

Appendix A: Permafrost and Sub-permafrost Groundwater Monitoring
Annual report

**Red Dog Mine
Long-Term Permafrost and
Groundwater Monitoring Program for
the Tailing Impoundment
2017
Annual Report**

March 2018

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Introduction

The Long-term Permafrost and Groundwater Monitoring Program (the Monitoring Program) was established as an outcome of the Supplemental Environmental Project (SEP) and the Consent Decree between Cominco Alaska, Inc. (now Teck Alaska Incorporated) and the United States Environmental Protection Agency (EPA), entered on November 25, 1997 (US v. Cominco Alaska Incorporated, Civil Action A97-267CV). The Monitoring Program was developed to monitor and predict potential effects of the Tailings Impoundment on permafrost and groundwater in the areas of the tailings Main Dam, Overburden Stockpile, and background locations downgradient of the Tailings Impoundment within the Red Dog Creek and Bons Creek drainages. A specific contract deliverable is the submission of an annual report which includes a data collection summary, a quality assurance and quality control (QA/QC) summary, and a description of the status of the monitoring program.

Background

The Red Dog Mine is a lead-zinc mine located in northwestern Alaska approximately 50 miles northeast of Kotzebue, Alaska and 107 miles north of the Arctic Circle within the DeLong Mountains. The mine is owned by NANA Regional Corporation and operated by Teck Alaska (TAK). Figures 1 and 2 illustrate the regional setting and layout of the mine and its support facilities. As illustrated on Figure 2, the mine consists of two open pits and support facilities. The open pits are used for the extraction of zinc and lead bearing ore. The support facilities include an ore milling and a concentration facility, an employee housing area, a construction camp, an asphalt paved runway, a power generation facility, and a tailings area. There are approximately 300 acres of waste rock piles and a tailings pond behind two earthen dams. The pond receives drainage from the open pit areas, natural surface run-off, and process waters from the milling operation.

The tailings pond has the potential to affect both permafrost and groundwater in one or more adjacent drainages. To document this, a ground temperature/groundwater level monitoring program began in the mid-1990s as part of the Groundwater Monitoring Supplemental Environmental Project. Results from this project are documented in Water Management Consultants, Inc. (WMCI 2001) report and form the basis for the Long-Term Permafrost and Groundwater Monitoring Plan.

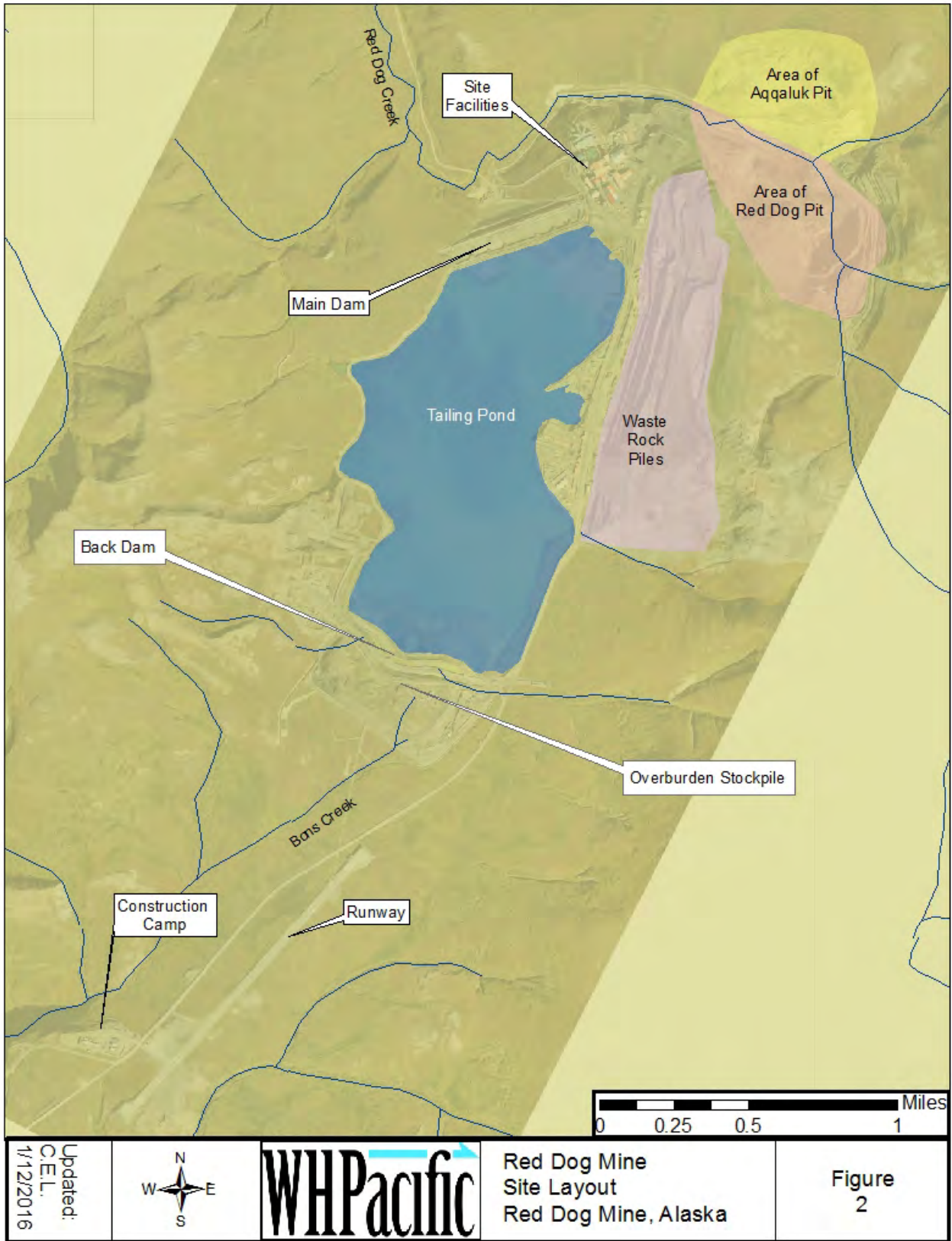
The key elements of the Monitoring Program are:

- The quarterly monitoring of fifteen thermistors at background sites, overburden stockpile, and main dam area;
- The quarterly monitoring of ten piezometers at background sites and main dam area;
- Data reduction, presentation, and management;
- Annual data reporting; and,
- Assessment of data trends on a five year basis.

Figure 1 Red Dog Mine and Vicinity



Figure 2 Red Dog Mine Site Layout



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2017 Data Collection

TAK emailed WHPacific the 2017 project thermistor and piezometer data for data reduction, presentation, and management. The raw data is presented in Appendix A.

Ground temperatures and water levels were monitored beneath the main dam and overburden stockpile for graphical comparison to the background sites.

Thermistor Data

WHPacific plotted the ground temperature measurements collected from the 15 thermistor monitoring locations. The Red Dog Mine thermistor monitoring locations are illustrated on Figure 3 (northern portion), Figure 4 (central portion), and Figure 5 (southern portion).

The ground temperature monitoring data is depicted using two types of graphical plots which are presented in Appendix B, and summarized below:

- Temperature trumpet plot of data for all years (separate color for each year); and
- Temperature trumpet plot of data for 2017.

For each graphic plot, the measurements are presented as auto range and scale limited. The auto range plots represents all measurements which have passed the database QA/QC process described in the Data Management section of this report. For visual clarity, scale limited plots only include data within a limited range and excludes most outliers.

Table 1 Summary of the 2017 Quarterly Thermistor Data Collection

Thermistors	Associated Figure	General Location	Sampling Dates			
			1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
T-96-015	Figure 3	Red Dog Creek	2/5/2017	4/23/2017	8/13/2017	11/26/2017
T-95-005	Figure 3	Dam Area	2/5/2017	4/23/2017	8/13/2017	11/26/2017
T-96-010	Figure 3	Dam Area	2/5/2017 2 of 24	4/23/2017 1 of 24	8/13/2017 4 of 24	11/26/2017 2 of 24
T-97-028	Figure 3	Dam Area	2/5/2017 2 of 24	4/23/2017 14 of 24	8/13/2017 13 of 24	11/26/2017 15 of 24
T-97-029	Figure 3	Dam Area	2/5/2017 4 of 24	4/23/2017 4 of 24	8/13/2017 6 of 24	11/26/2017 7 of 24
T-97-030	Figure 3	Dam Area	2/5/2017 13 of 24	4/23/2017 2 of 24	8/13/2017 2 of 24	11/26/2017 2 of 24
T-14-110	Figure 4	Tailing Impoundment	2/5/2017	4/23/2017	8/13/2017	11/26/2017
T-95-004	Figure 4	Dam area	2/5/2017 2 of 24	4/23/2017 2 of 24	8/13/2017 24 of 24	11/26/2017 23 of 24
T-05-061	Figure 4	Dam area	2/5/2017	4/23/2017	8/13/2017	11/26/2017
T-95-008 #2	Figure 5	Overburden Stockpile	2/5/2017	4/23/2017	8/13/2017	11/26/2017
T-96-013	Figure 5	Overburden Stockpile	2/5/2017	4/23/2017	8/13/2017	11/26/2017
T-96-021	Figure 5	Overburden Stockpile	2/5/2017	4/23/2017	8/13/2017	11/26/2017
T-96-022	Figure 5	Overburden Stockpile	2/5/2017 2 of 24	4/23/2017 2 of 24	8/13/2017	11/26/2017 2 of 24
T-96-023	Figure 5	Overburden Stockpile	2/5/2017 8 of 24	4/23/2017 8 of 24	8/13/2017 8 of 24	11/26/2017 9 of 24
T-96-012	Figure 5	Bons Creek	2/5/2017	4/23/2017 1 of 24	8/13/2017	11/26/2017 1 of 24
T-96-012s	Figure 5	Bons Creek	2/5/2017	4/23/2017	8/13/2017	11/26/2017

Note: Dates listed for date of collection, second line, if present, indicates number of nodes out of total number of nodes that were missing. For example first quarter thermistor T-96-010, two of twenty four nodes had no results reported.

Figure 3 Red Dog Mine Long-Term Thermistor and Piezometer Monitoring Locations
(Northern portion)

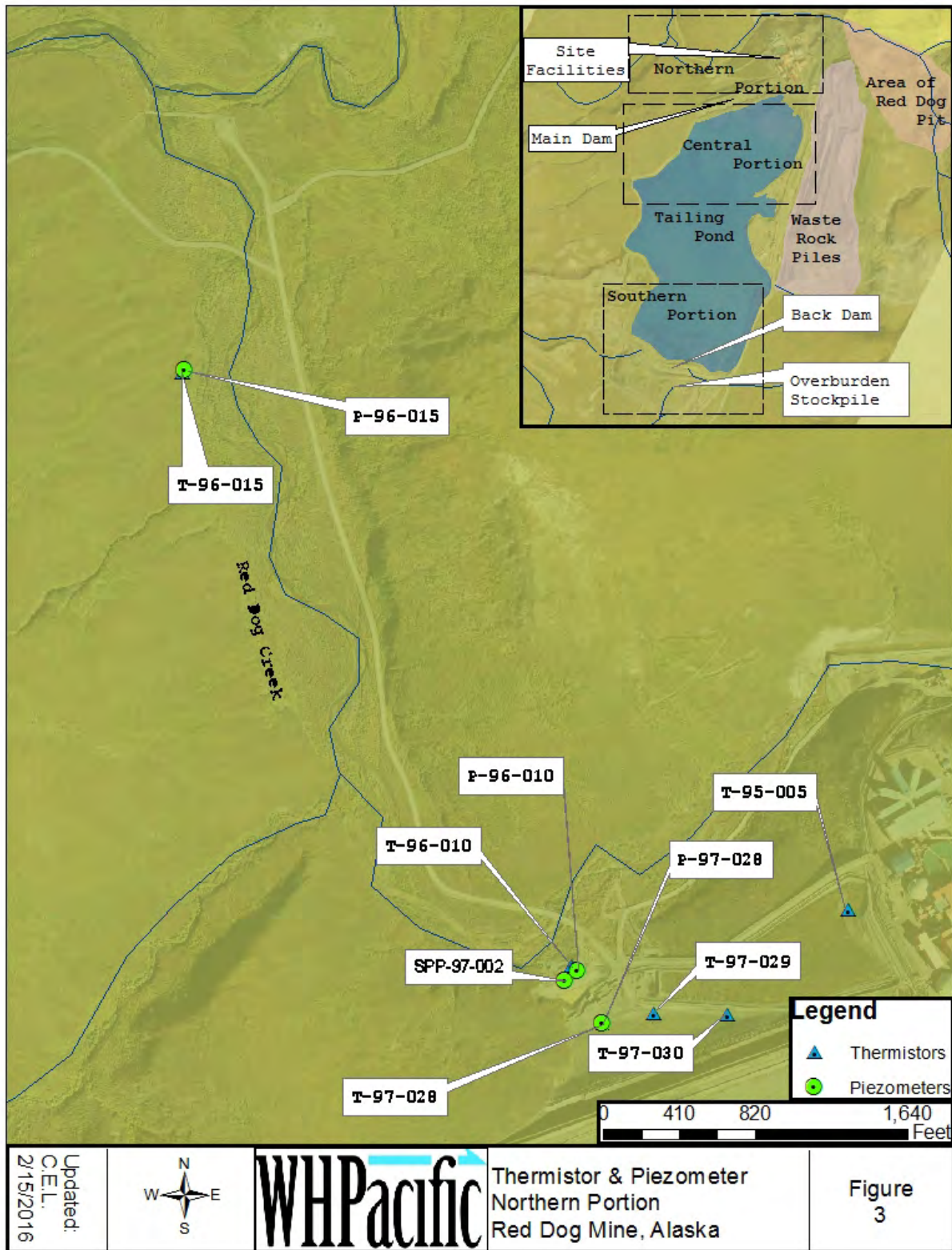


Figure 4 Red Dog Mine Long-Term Thermistor and Piezometer Monitoring Locations (Central portion)

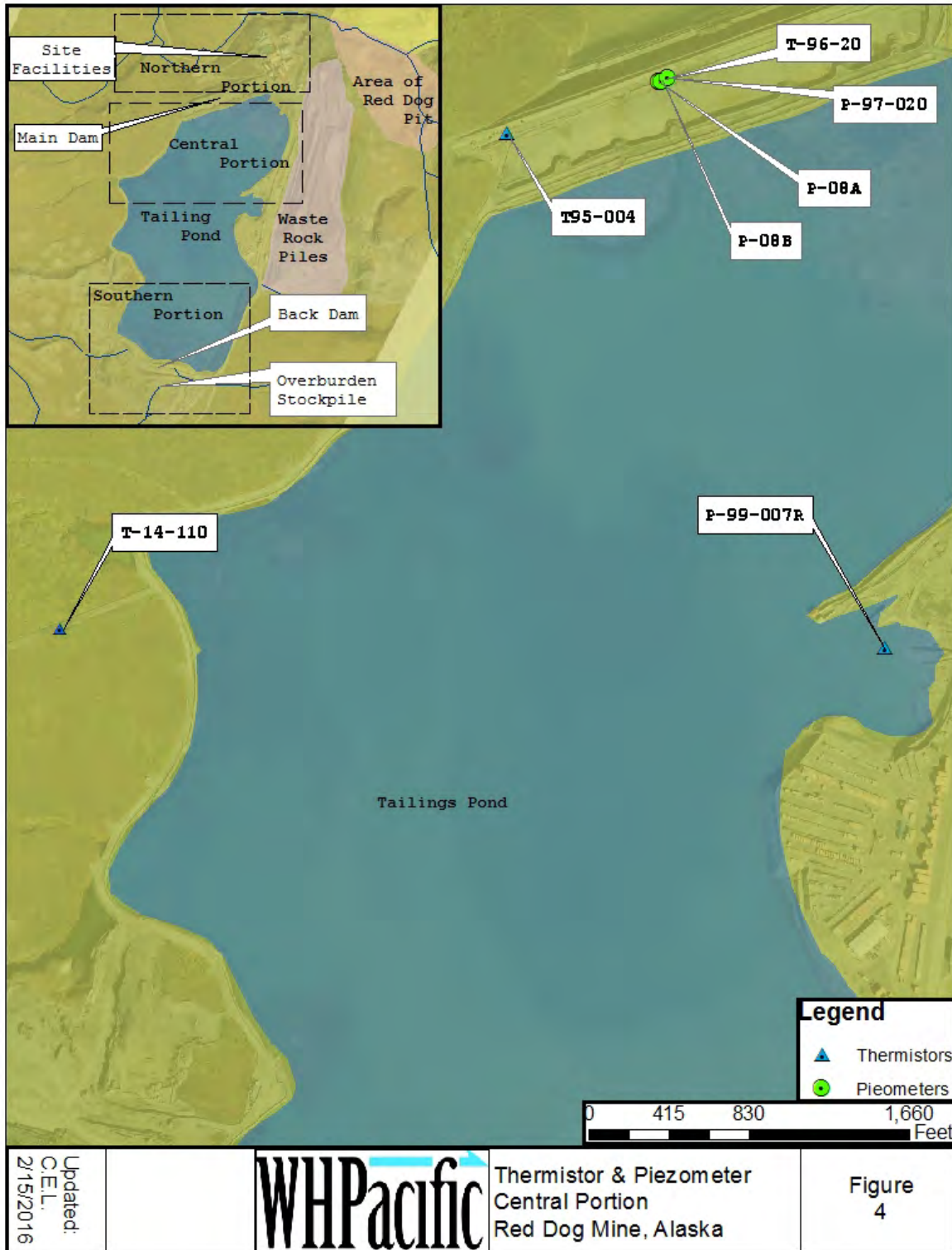
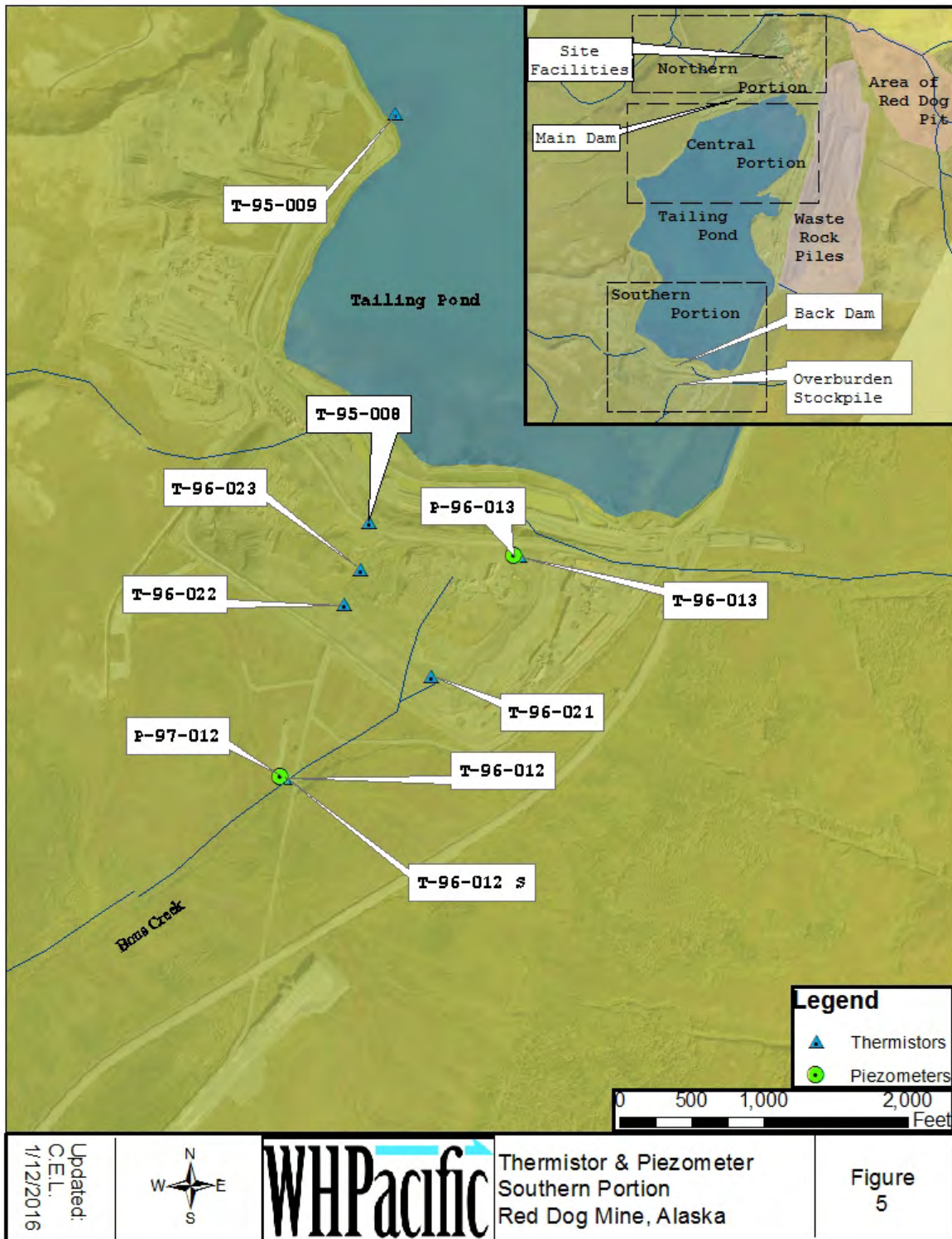


Figure 5 Red Dog Mine Long-Term Thermistor and Piezometer Monitoring Locations (Southern portion)



Piezometer Data

The Red Dog Mine piezometers are illustrated on Figure 3 (northern portion), Figure 4 (central portion), and Figure 5 (southern portion). The 2017 quarterly piezometer data was collected by TAK and submitted to WHPacific which prepared a graphical time series plots of groundwater elevation. This data is presented in Appendix C.

Table 2 Summary of the 2017 Quarterly Piezometer Data Collection

Piezometer	Associated Figure	General Location	Sampling Dates			
			1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
P-96-015	Figure 3	Red Dog Creek	2/5/2017	4/23/2017	8/13/2017	11/26/2017
P-96-010	Figure 3	Dam Area	-	4/23/2017	8/13/2017	11/26/2017
P-97-028	Figure 3	Dam Area	2/5/2017	4/23/2017	8/13/2017	11/26/2017
SPP-97-002	Figure 3	Dam Area	2/5/2017	4/23/2017	8/13/2017	11/26/2017
P-08A	Figure 4	Dam Area	2/5/2017	4/23/2017	8/13/2017	11/26/2017
P-08B	Figure 4	Dam Area	2/5/2017	4/23/2017	8/13/2017	11/26/2017
P-97-020	Figure 4	Dam Area	2/5/2017	4/23/2017	8/13/2017	11/26/2017
P-96-013	Figure 5	Overburden Stockpile	2/5/2017	4/23/2017	8/13/2017	11/26/2017
P-97-012	Figure 5	Bons Creek	2/5/2017	4/23/2017	8/13/2017	11/26/2017

Note:

- Hyphen (-) denotes data was not collected

Data Management

The 2017 thermistors and piezometers data collection was performed by TAK personnel in accordance with the Red Dog Mine Long Term Groundwater Monitoring Plan's standard operating procedure (WMCI 2001). This data was provided to WHPacific to update the TAK Red Dog Mine Database. Microsoft Access™ and Excel™ software were used to generate graphical plots of the data.

Data collected from the thermistor cables was measured in resistance as kilo-ohms (kohms) using a Dryden Instrumentation T5KMUK Automated Thermistor String Reader. The measured resistance values were converted to temperature using calibration coefficients for each thermistor sensor. A calibrated digital temperature acquisition cable was used to measure ground temperature at replacement site T-14-110. Data was reviewed for errors and omission, and then uploaded to the Red Dog Mine Database.

Ground temperature measurements that were not representative of true measurements (i.e., less than zero (0) kohms or greater than 300 kohms) were deleted before uploading to the Red Dog Mine Database. The deleted values are shaded red in the raw data table presented in Appendix A.

TAK provided WHPacific the piezometer's vibrating wire measurements and barometric pressure measurements collected on-site. The vibrating wire transducer measurements were converted to groundwater elevation using the calibration coefficients, site elevation, and barometric pressure. Calibration of the vibrating wire transducers was determined during installation. The 2017 data was reviewed for errors and omissions and then uploaded to the Red Dog Mine Database.

Summary of Data QA/QC and System OM

Starting in 2017 WHPacific developed and began using a "Quarterly Report Data Checklist", copies of which are included in Appendix D. The Checklist was developed to do a first order review of the data received from TAK. The completed checklists were transmitted to TAK to allow them to make corrections or if possible re-collect missing data. Standard operating procedures developed for the monitoring program included taking duplicate measurements to ensure different operators and or equipment would not impact representativeness of the data. QA/QC measurements for quarterly thermistors and piezometers data are attached in Appendix D.

Thermistor QA/QC

Duplicate measurements were collected from the Dryden Instrumentation T5KMUK data logger and the Dryden Switchbox Fluke multimeter system to ensure repeatability and concurrence with the automated data logger system. Variations in the thermistor measurements were also compared to previously collected data and trends. Thermistor QA/QC data is presented in Table 3.

Table 3 Summary of 2017, QA/QC Thermistors Data Collection

Quarter	Date	Thermistor	Multi-meter Start Time
1 st Quarter	2/5/2017	T-96-013	1610 hours
2 nd Quarter	4/23/2017	T-95-05	1535 hours
3 rd Quarter	8/13/2017	T-96-022	1054 hours
4 th Quarter	11/26/2017	T-96-023	1437 hours

Piezometer QA/QC

No piezometer QA/QC reports were received in 2017.

Thermistor System Maintenance

Thermistor measurements indicate that several are malfunctioning and require replacement. Replacement surface connectors have been ordered and are scheduled to be installed in 2018.

Piezometer System Maintenance

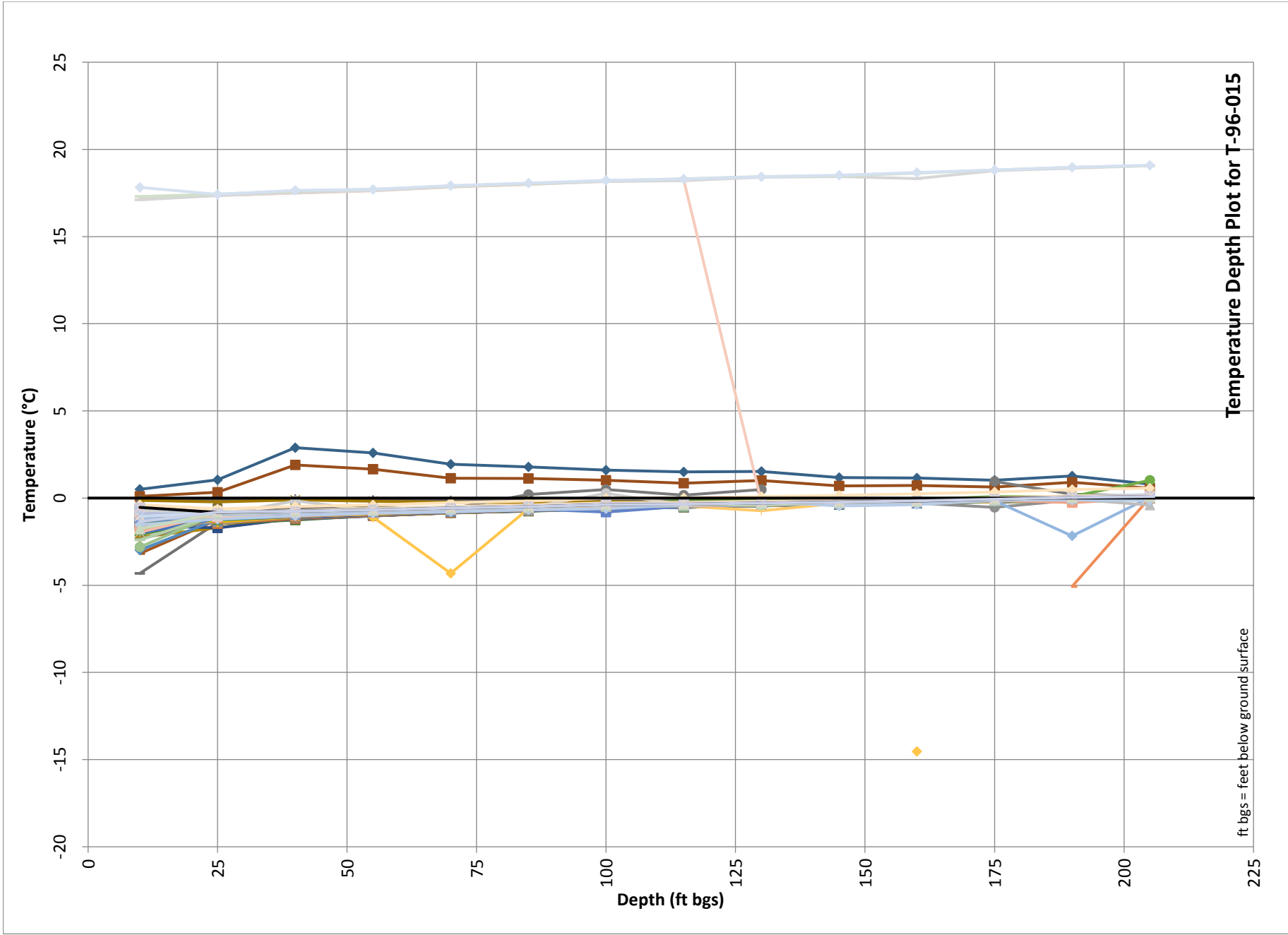
Vibrating wire transducers are functioning with few erroneous measurements collected from the sensors. Some of the piezometer wells have pneumatic packers installed in them to separate shallow from deep groundwater zones. It was noted in 2017, the pressure readings in some of these packers were very low so they were re-pressurized with nitrogen.

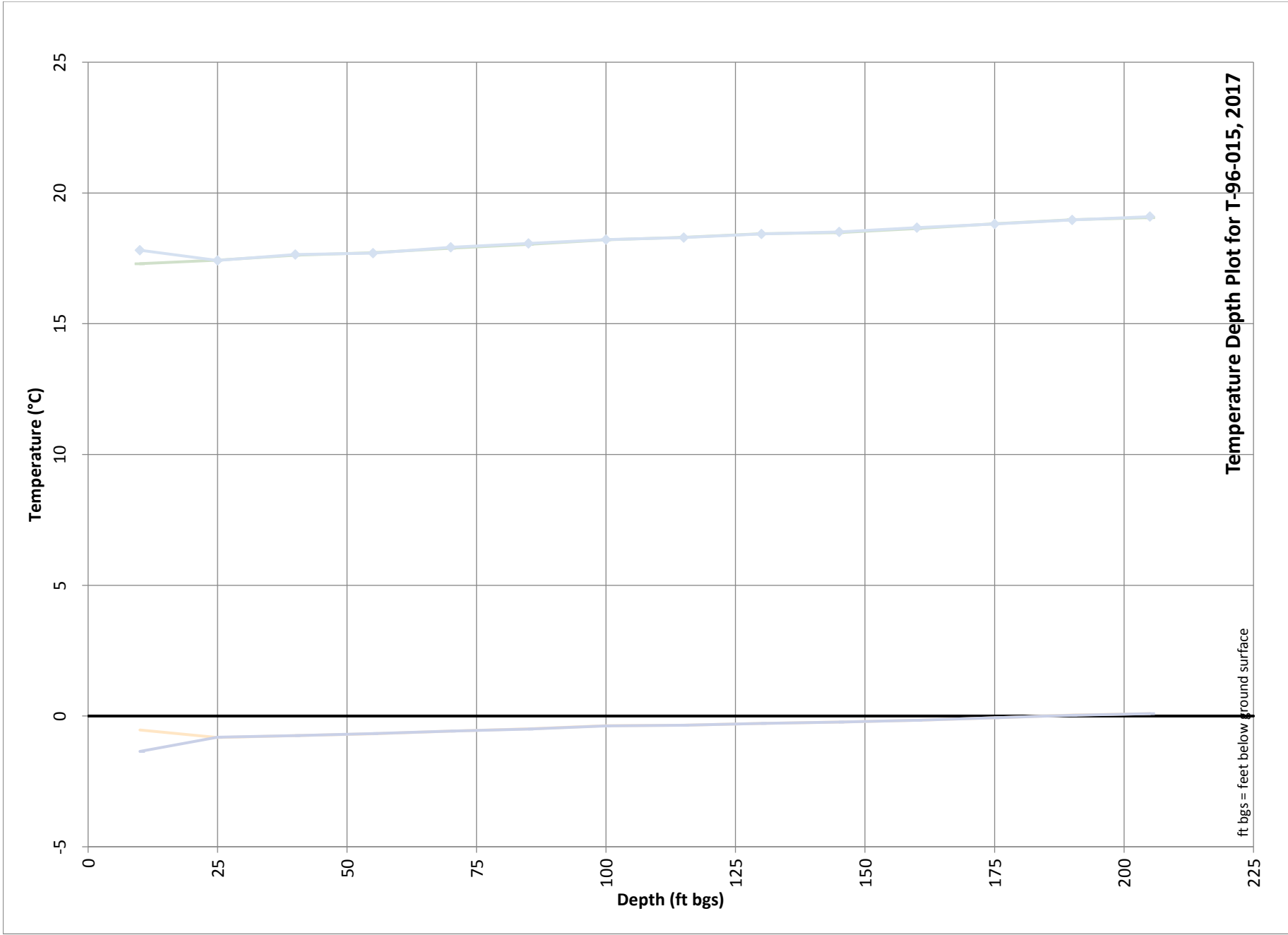
References

Water Management Consultants, Inc. (WMCI), 2001, Red Dog Mine – Long-Term Permafrost and Groundwater Monitoring Plan for the Tailing Impoundment, March, 2001.

Appendix A Raw Data

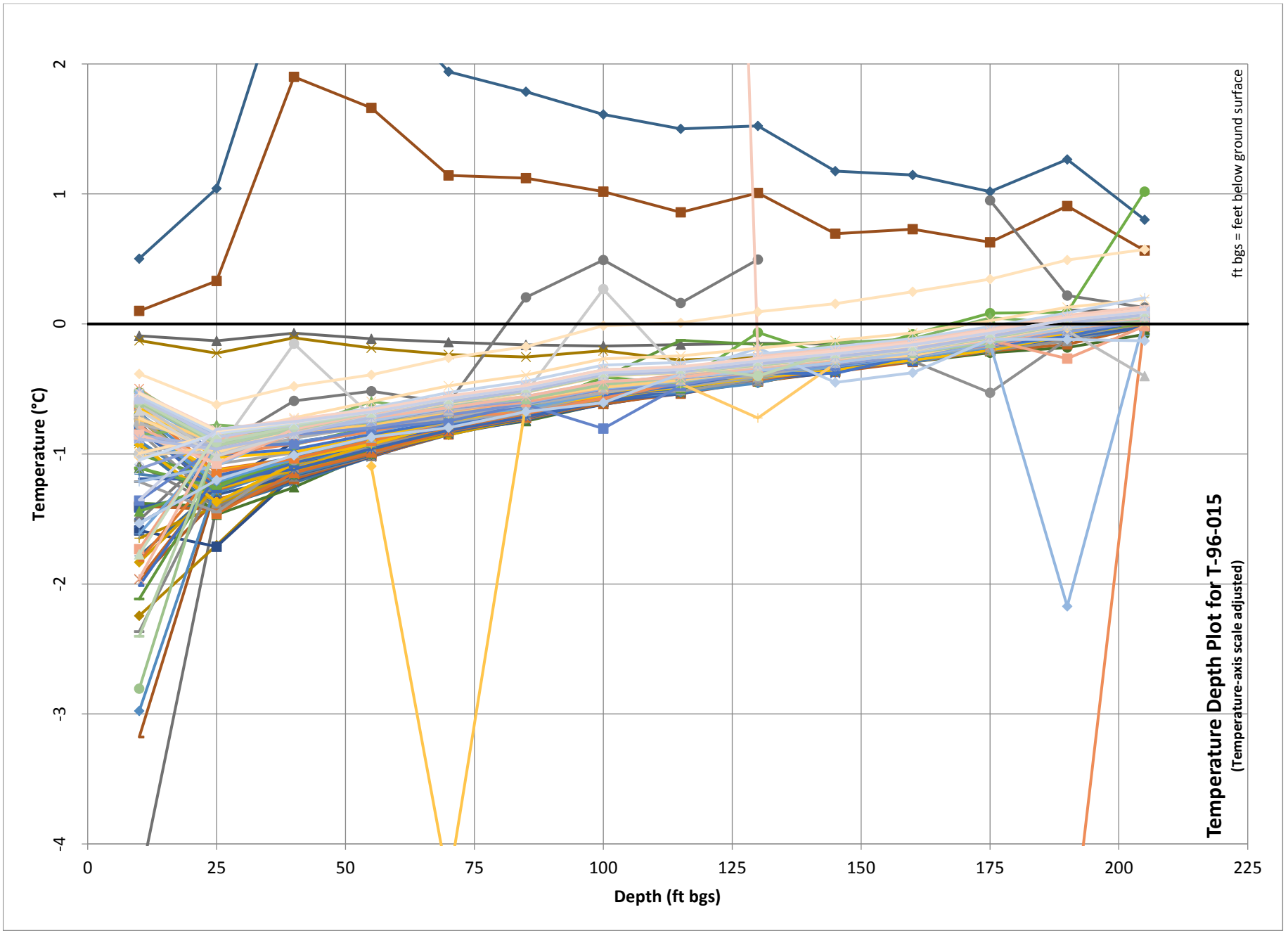
Appendix B Thermistor Plots

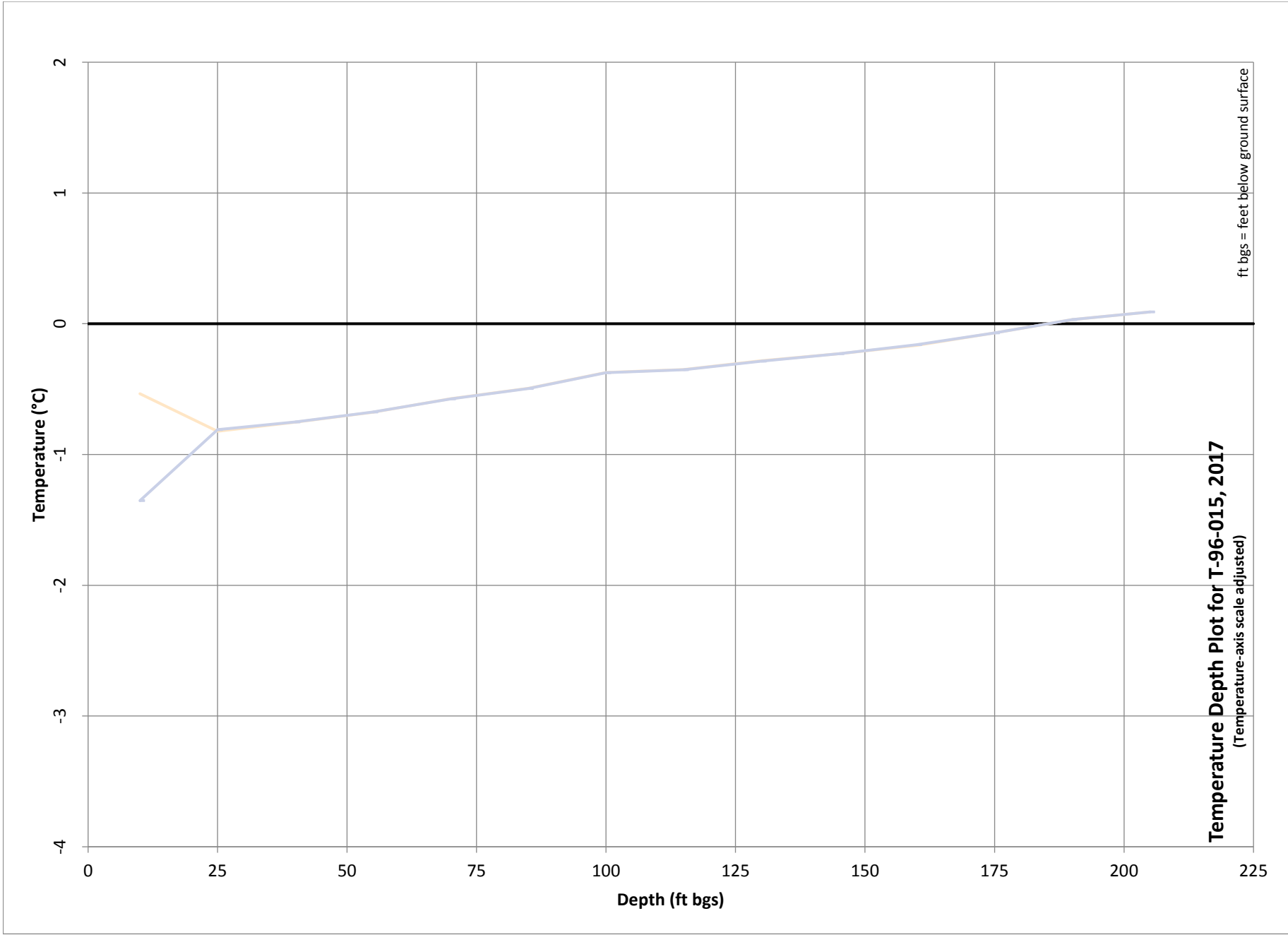


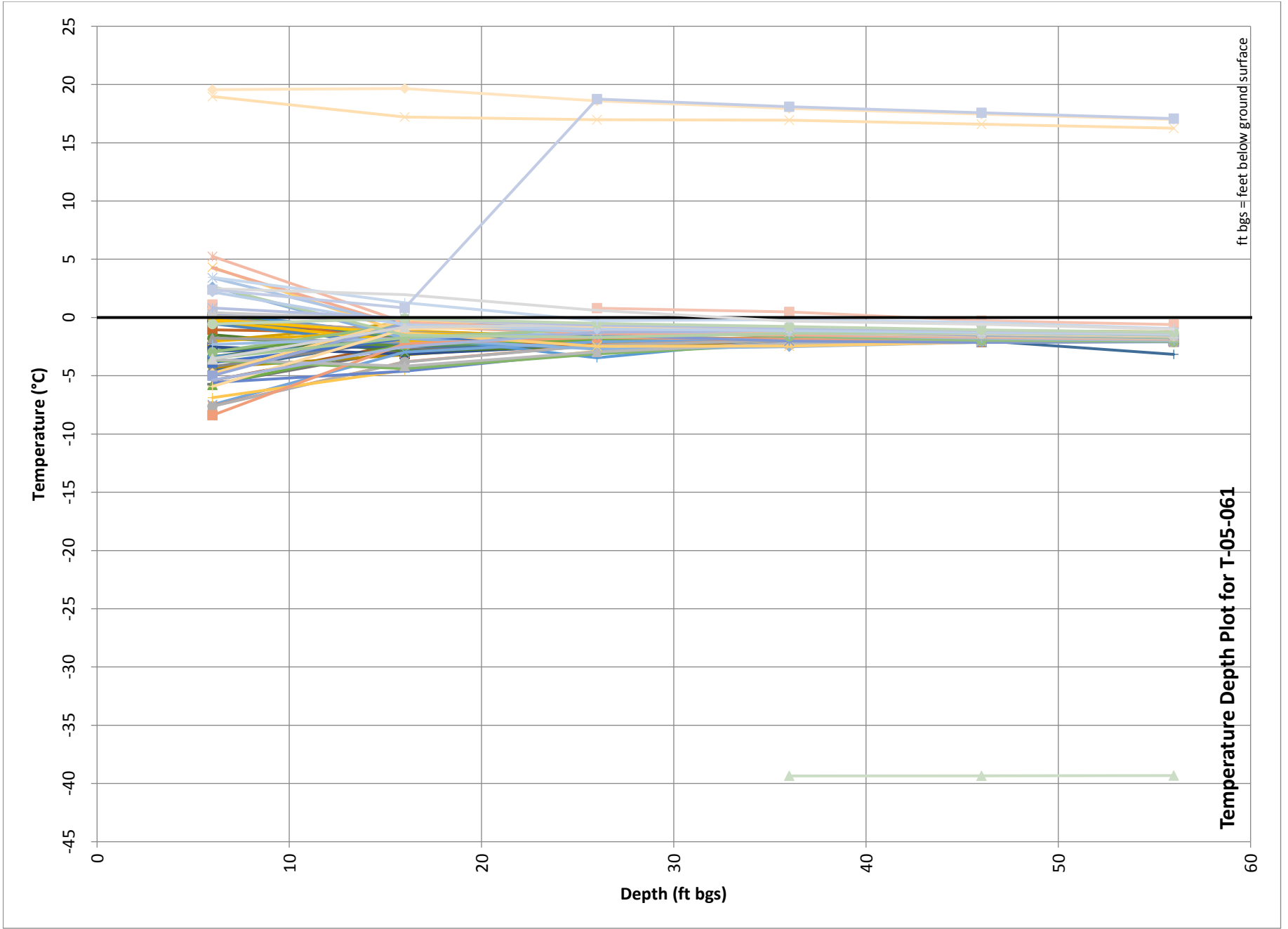


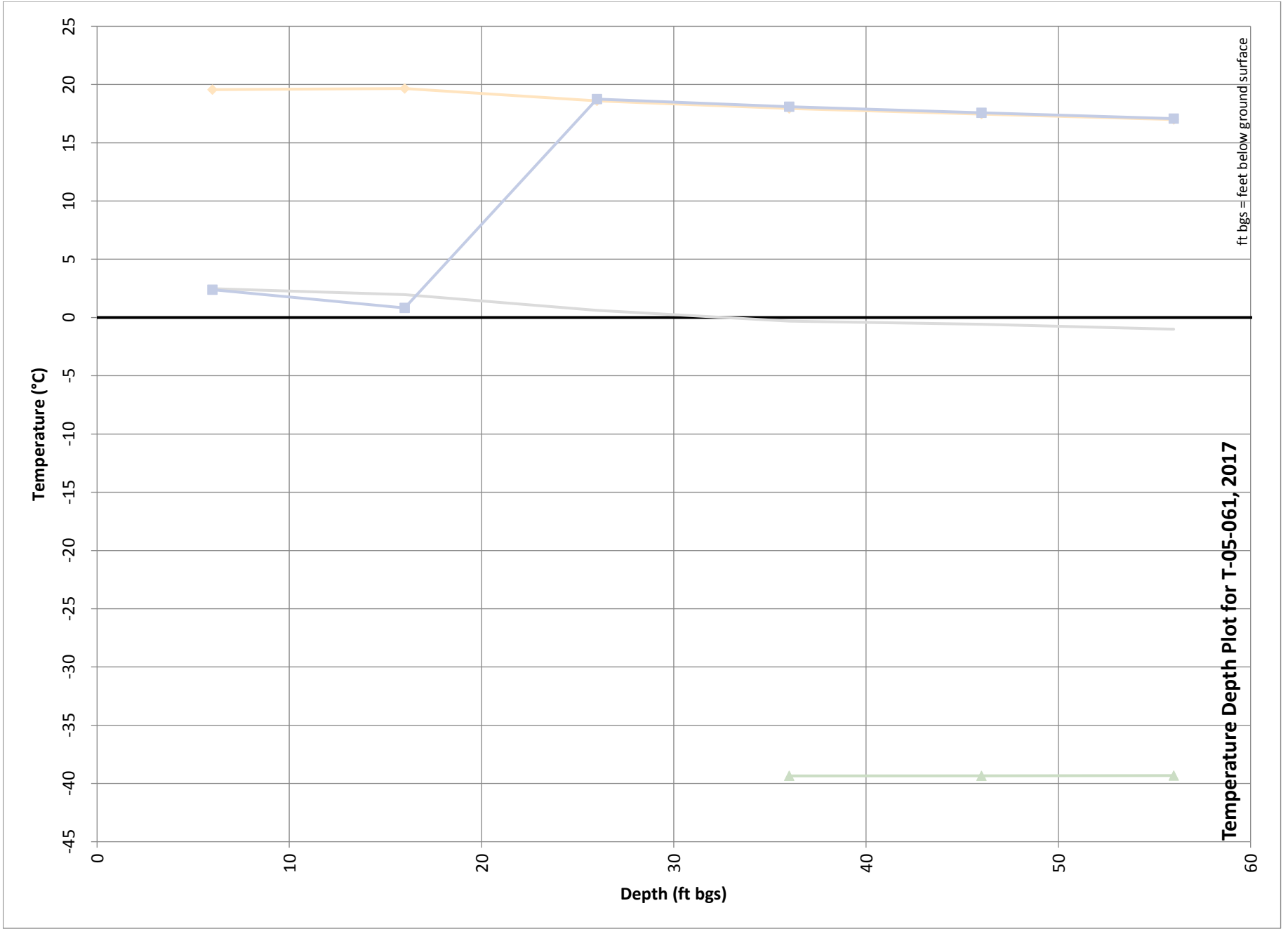
Temperature Depth Plot for T-96-015, 2017

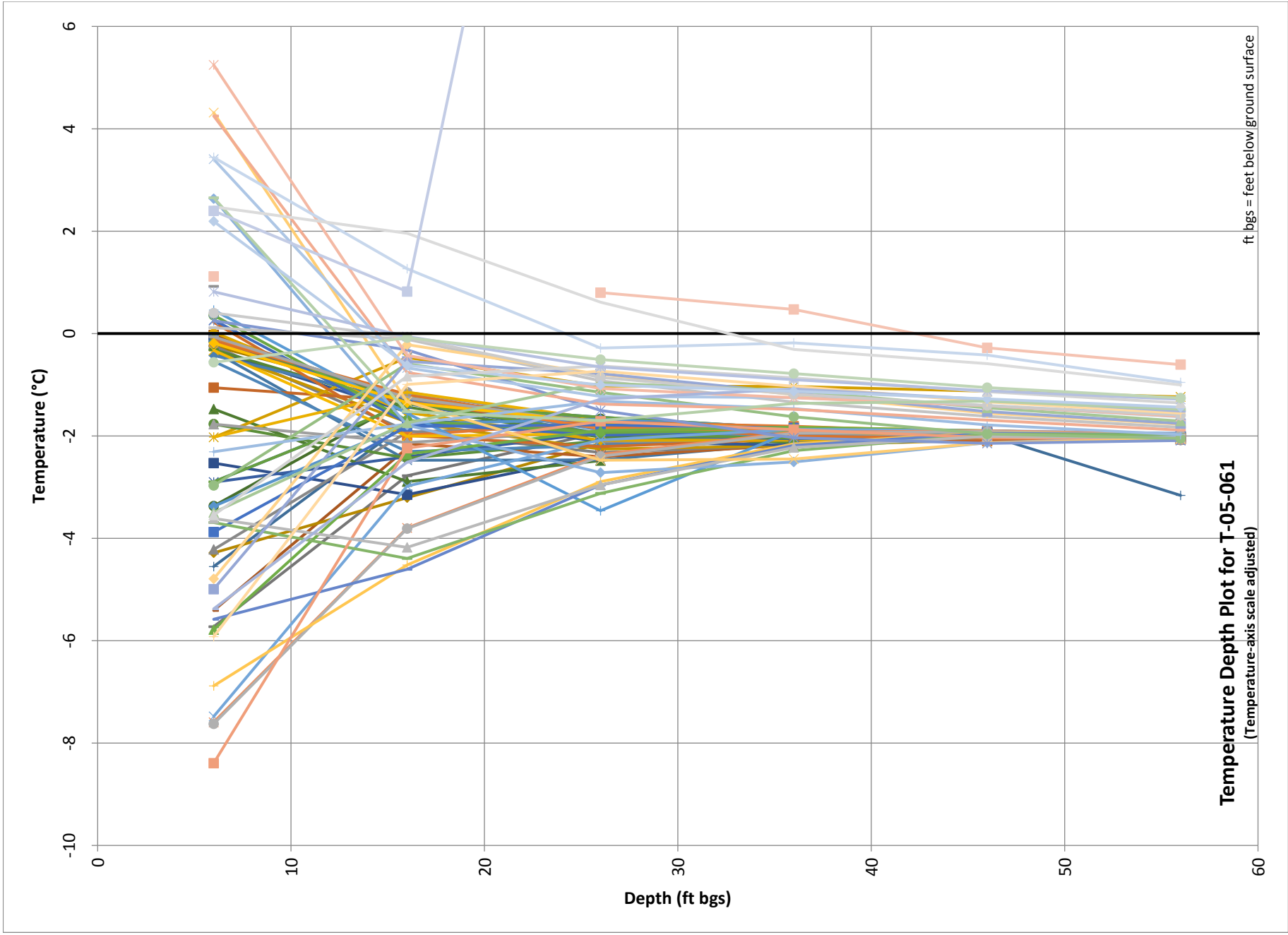
ft bgs = feet below ground surface

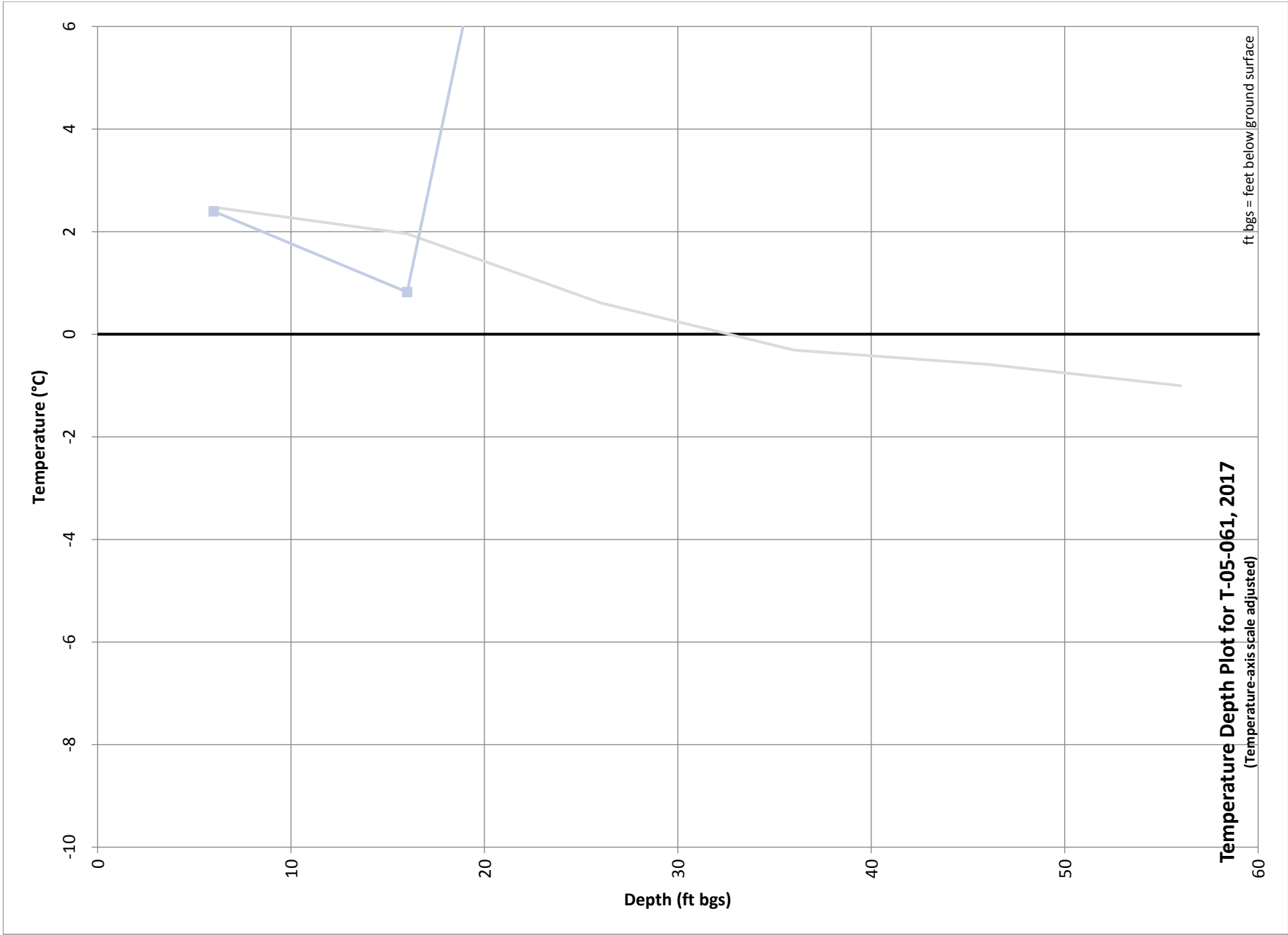


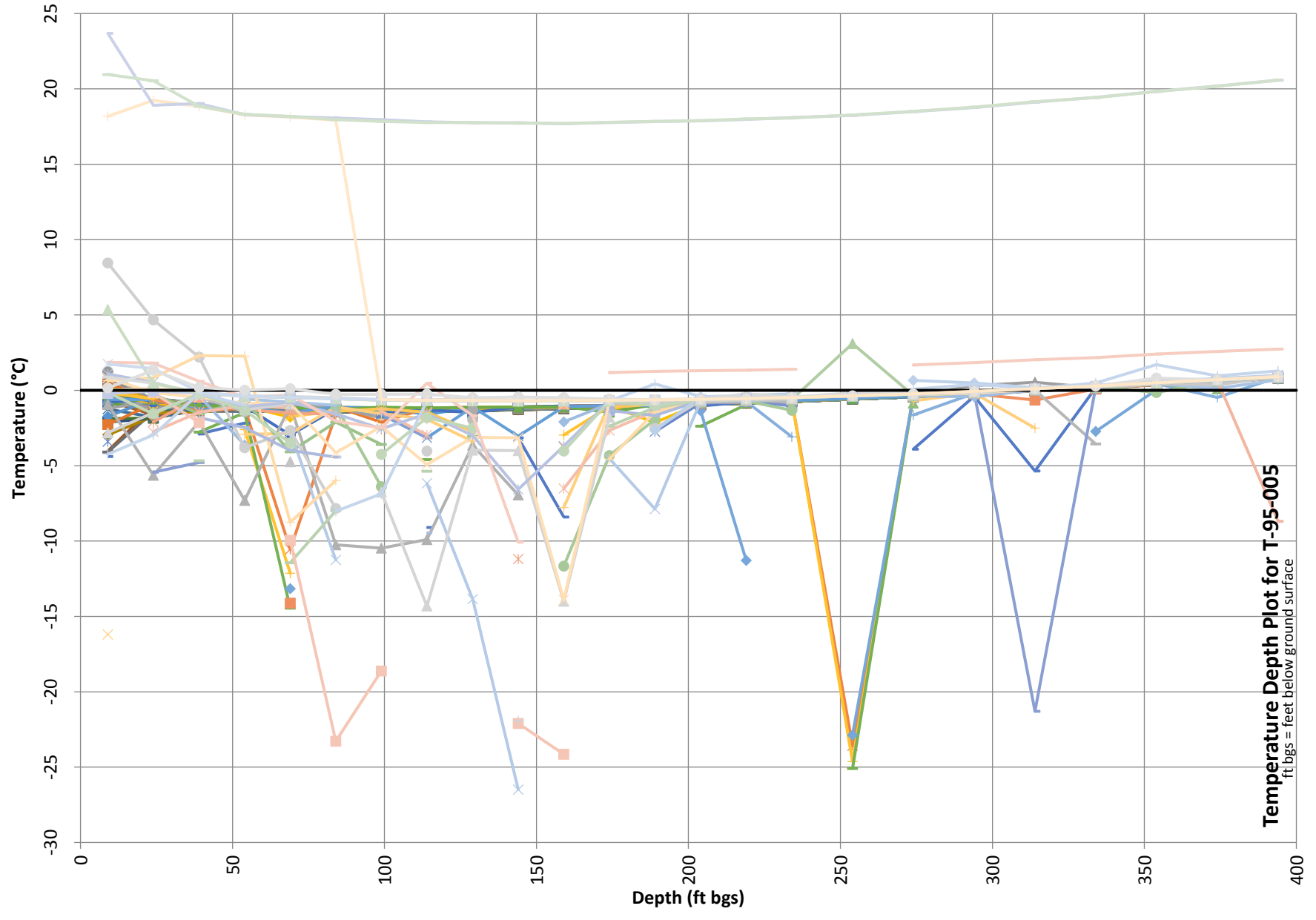


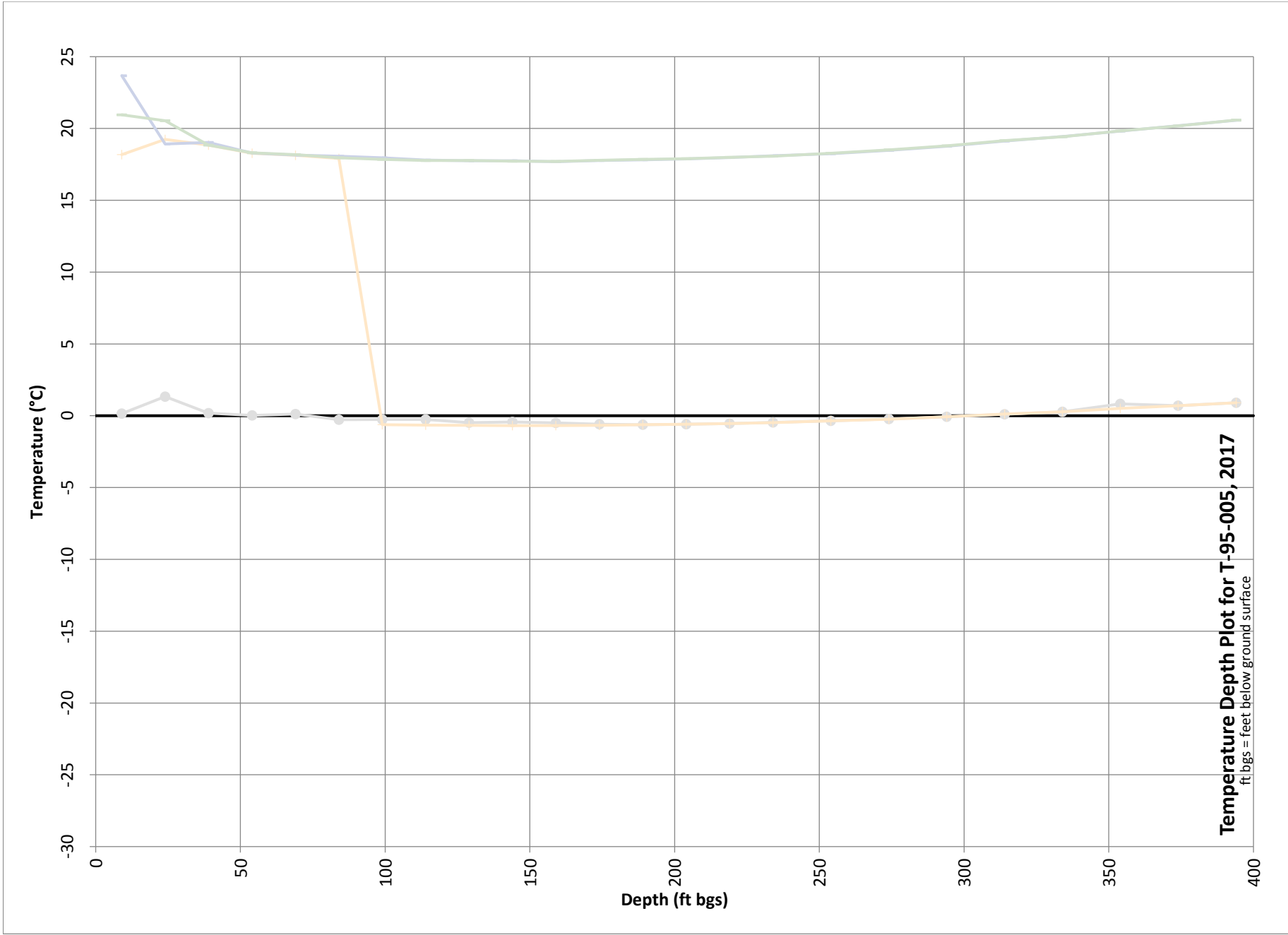


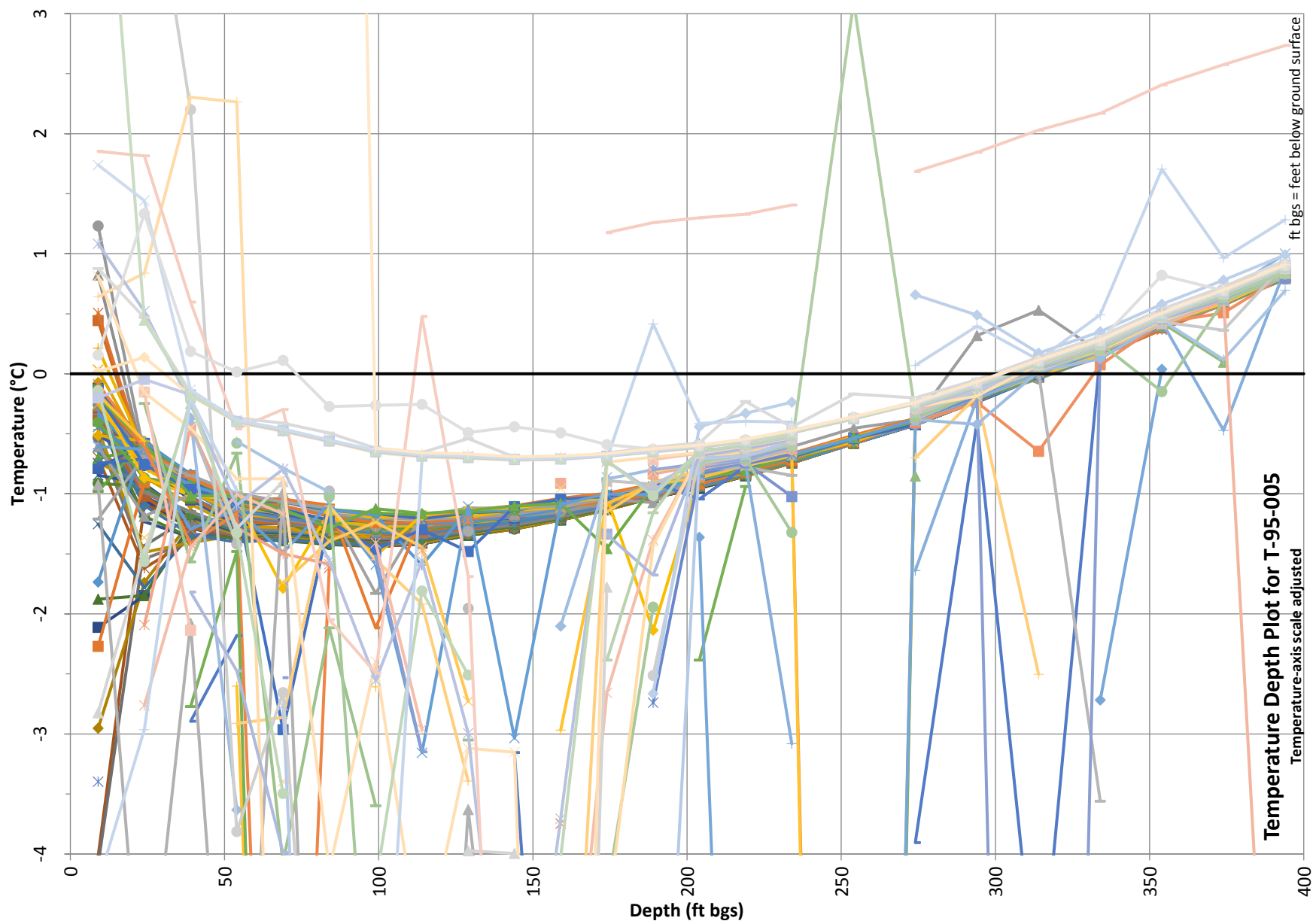






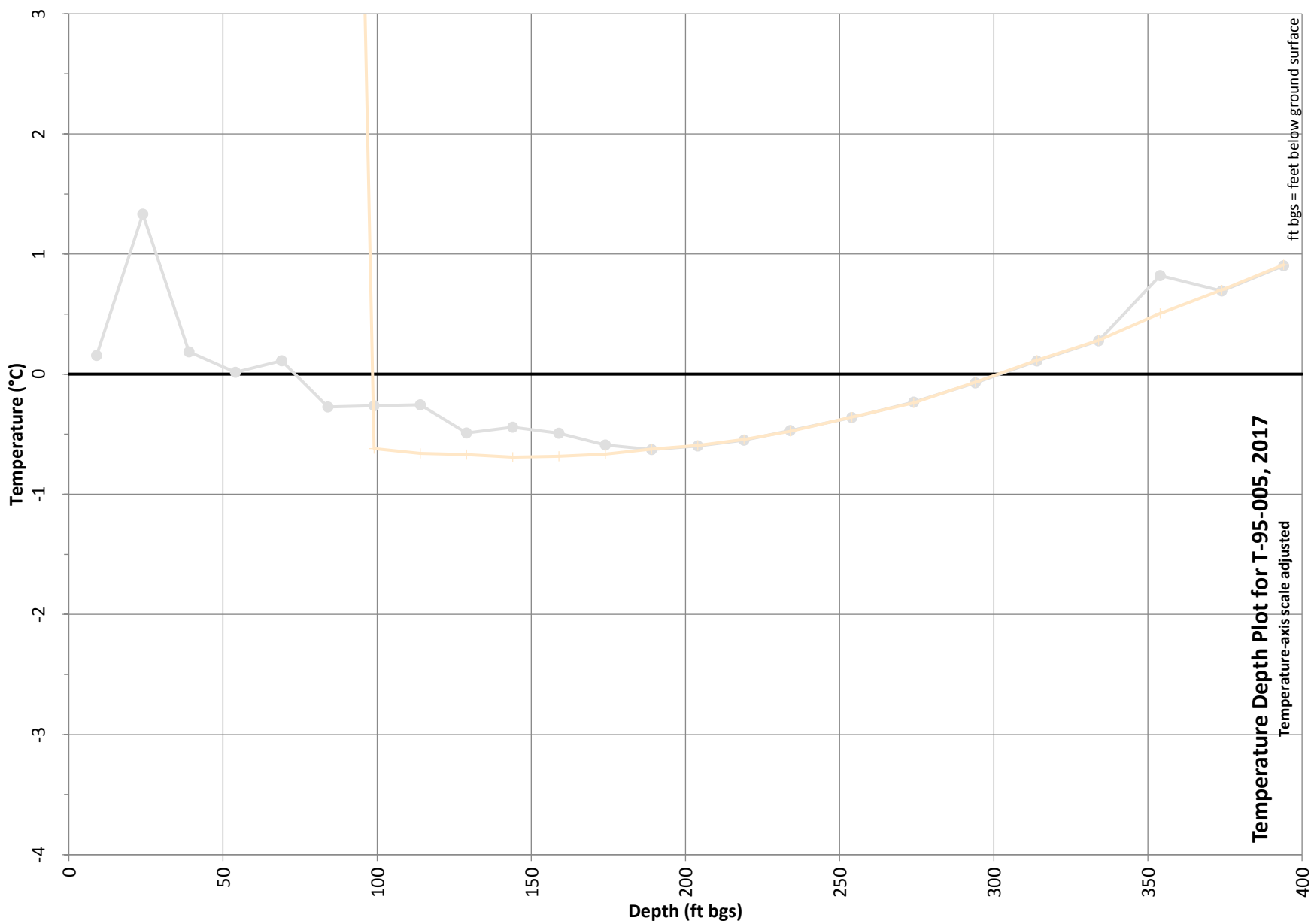


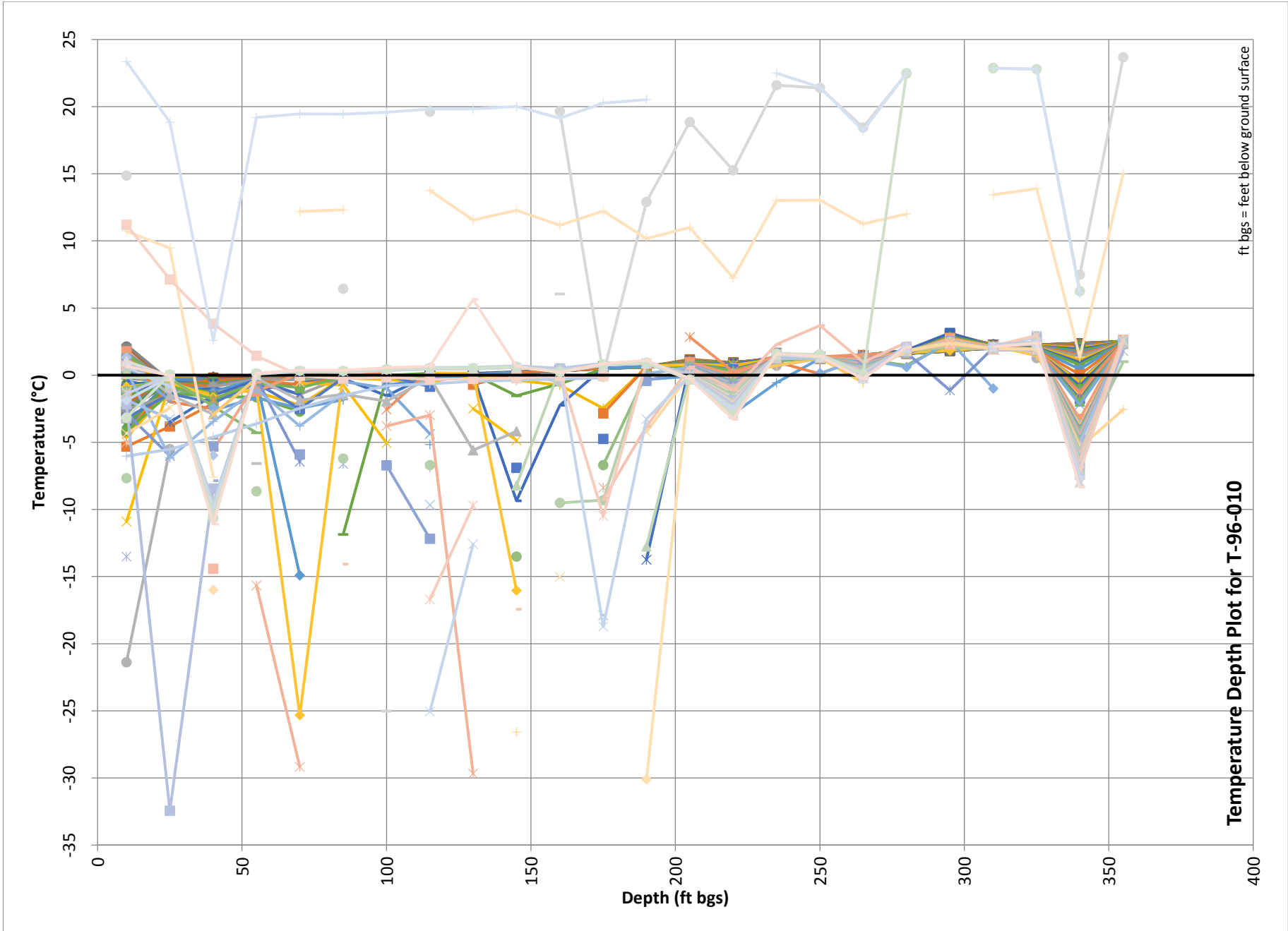


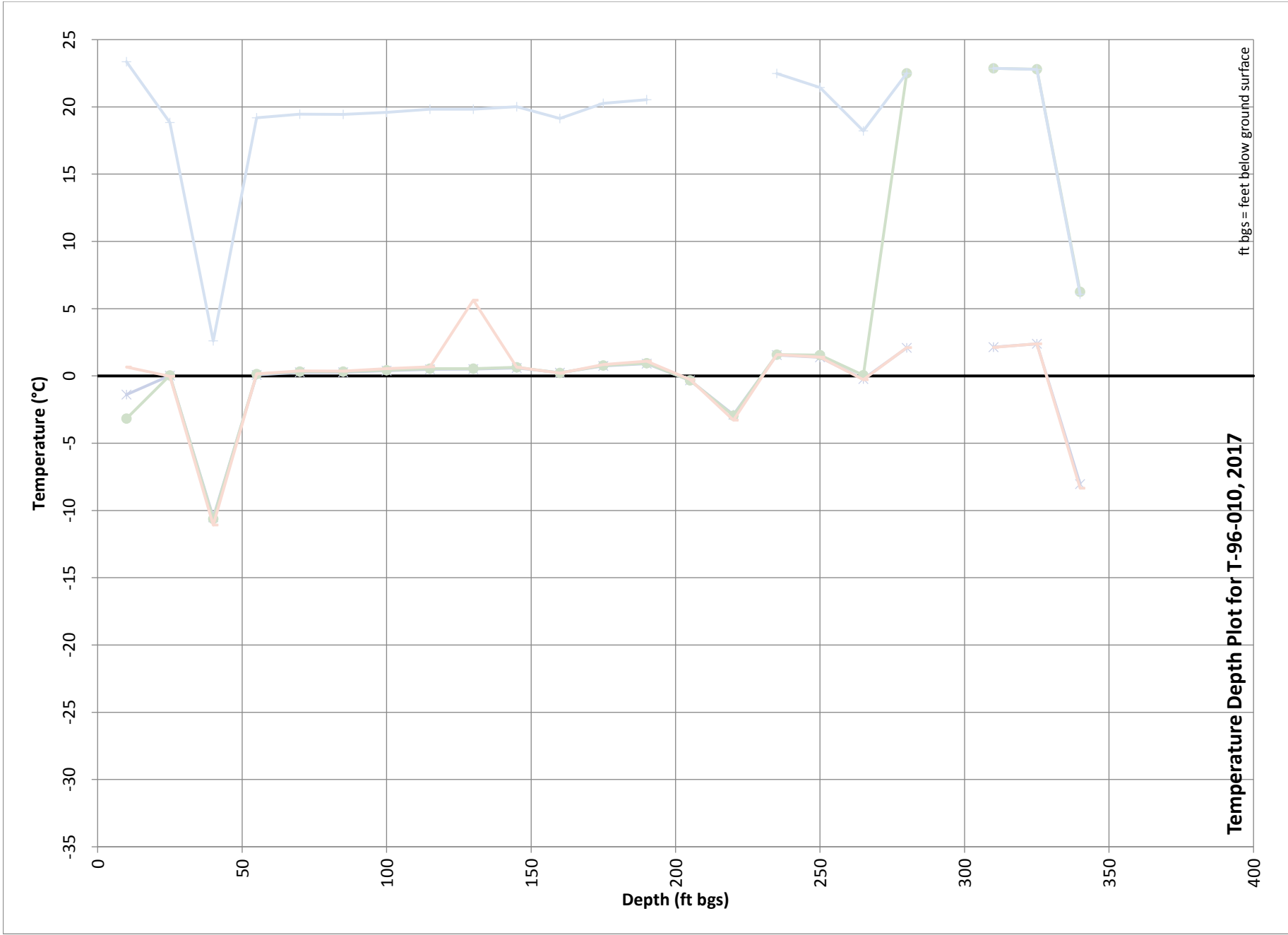


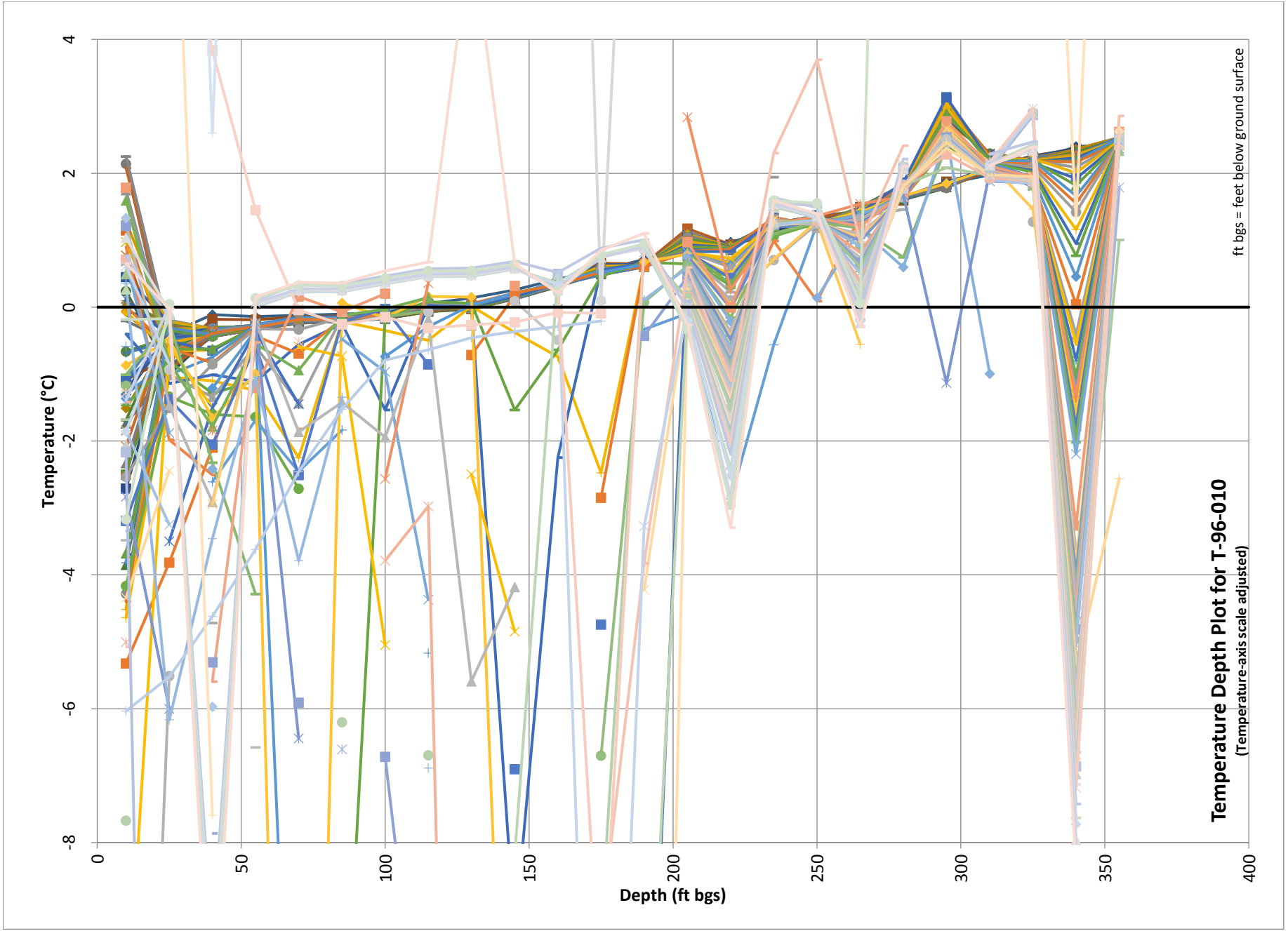
Temperature Depth Plot for T-95-005
Temperature-axis scale adjusted

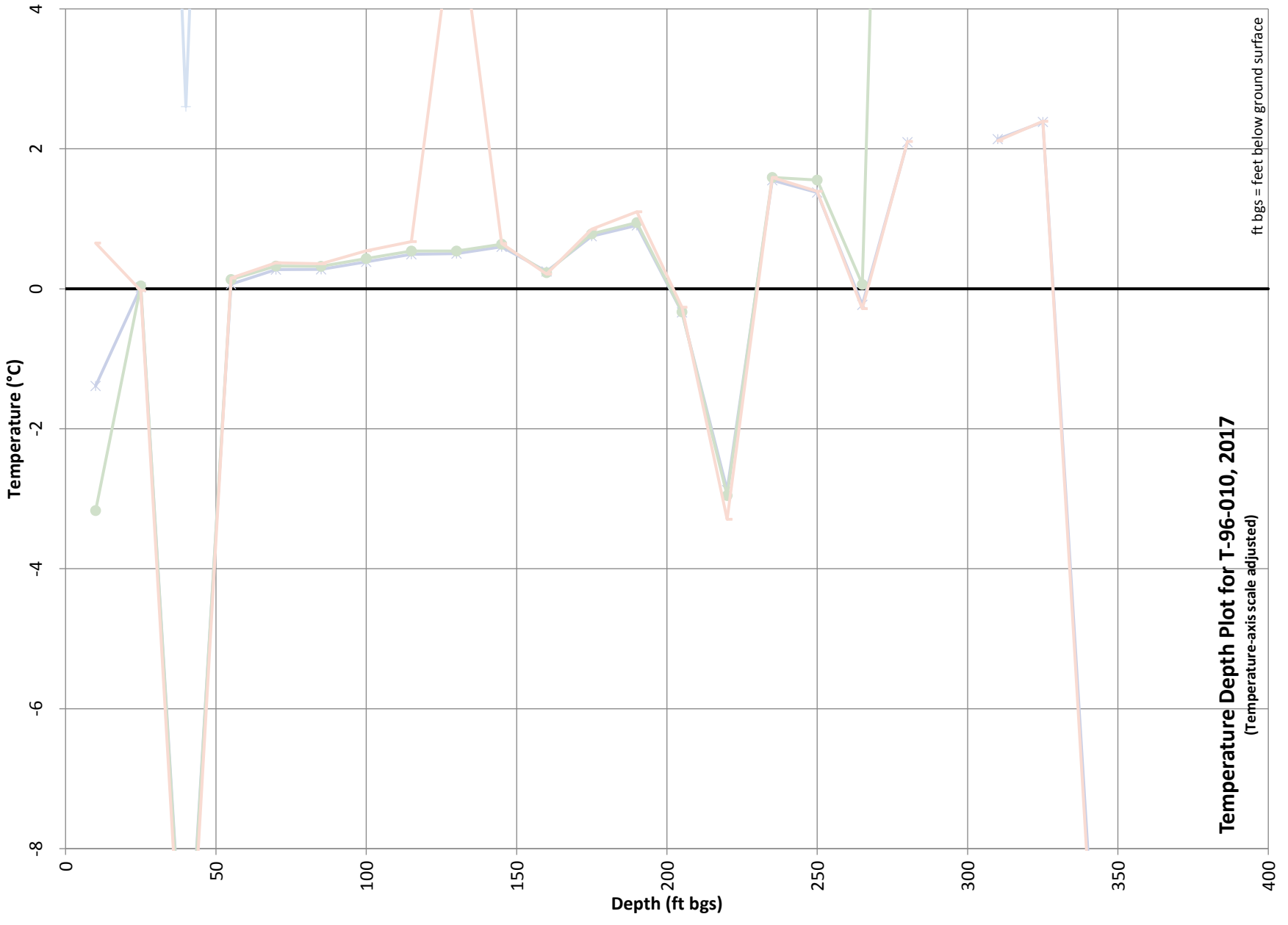
ft. bgs = feet below ground surface



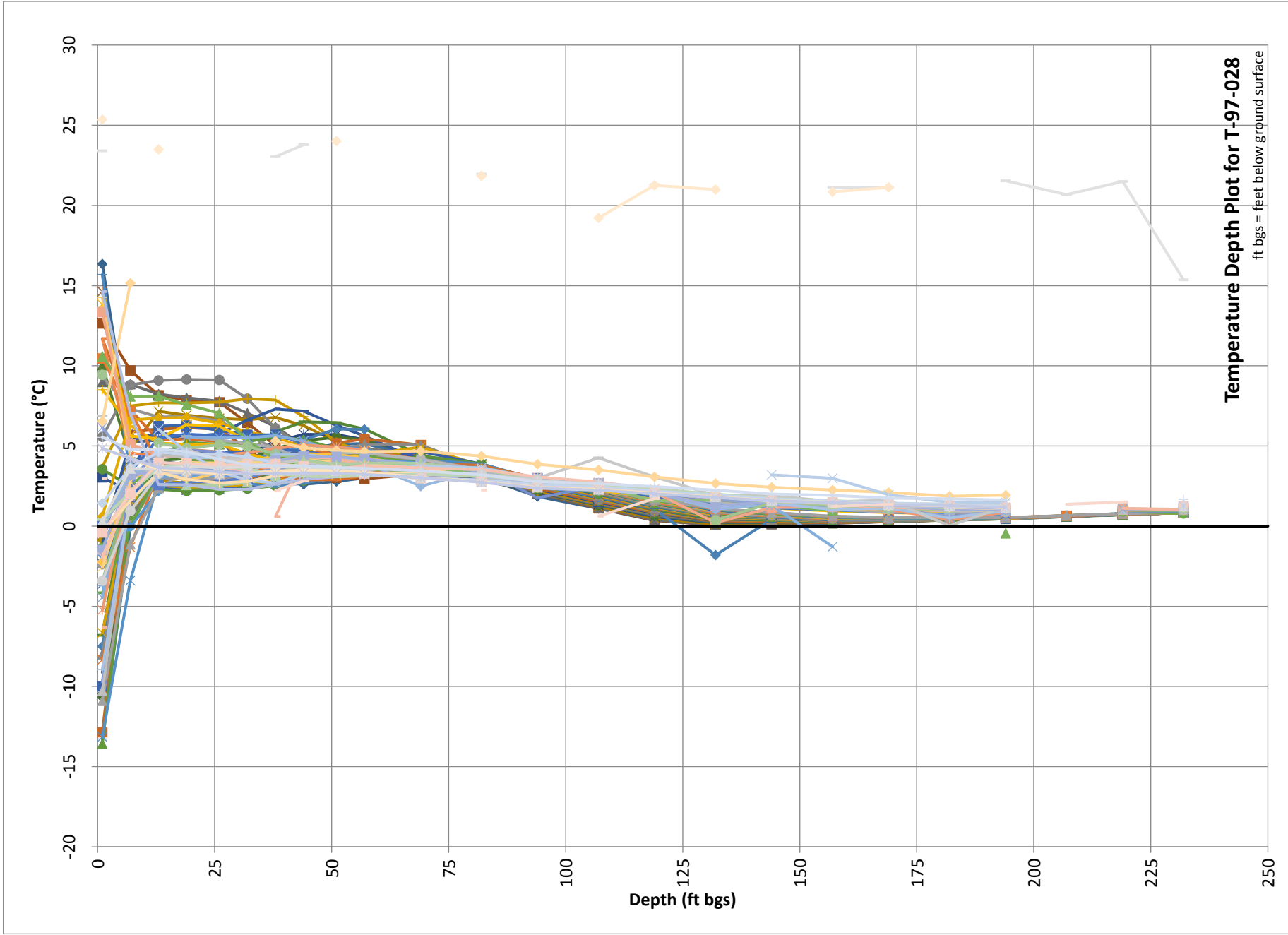


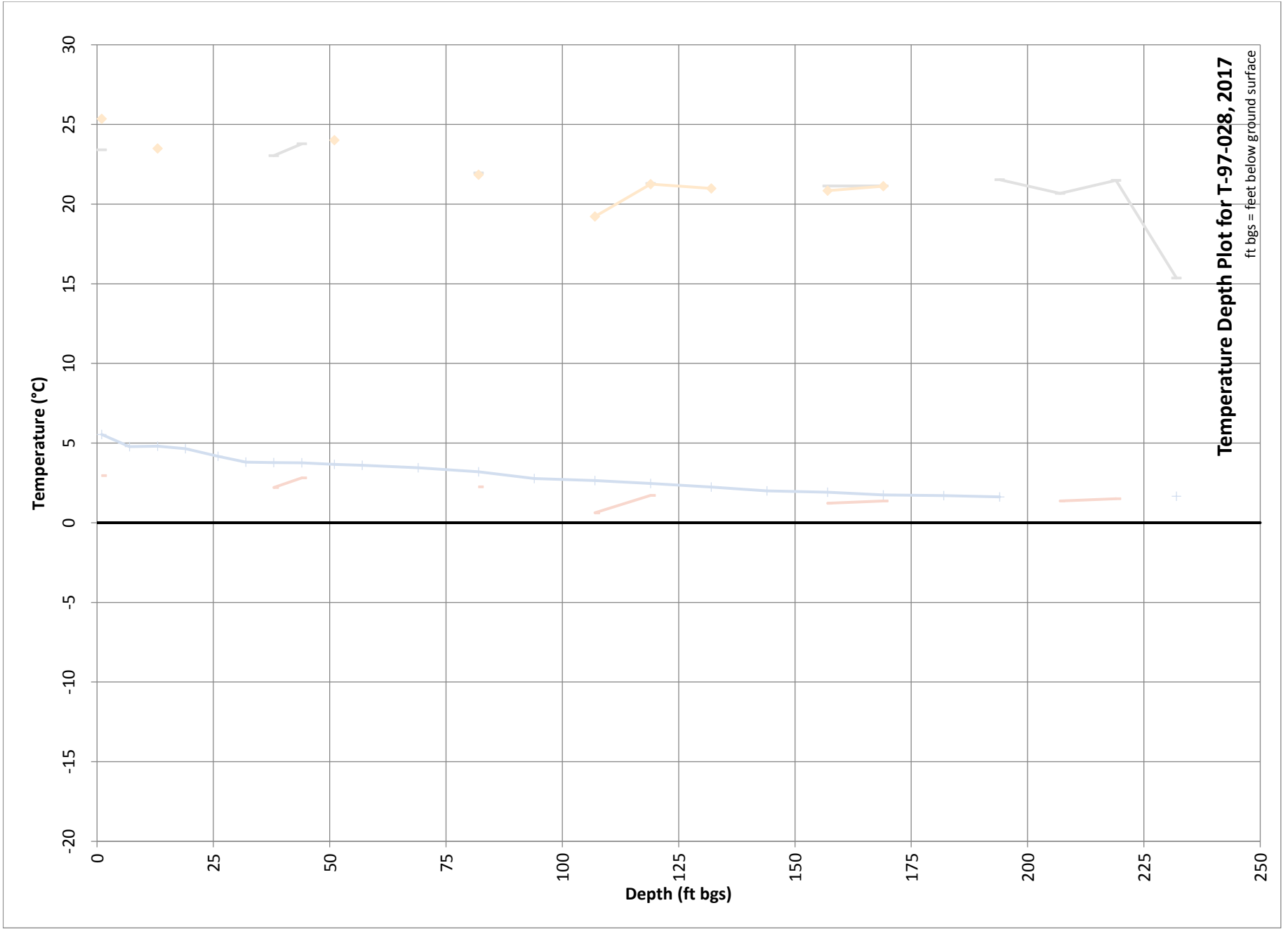


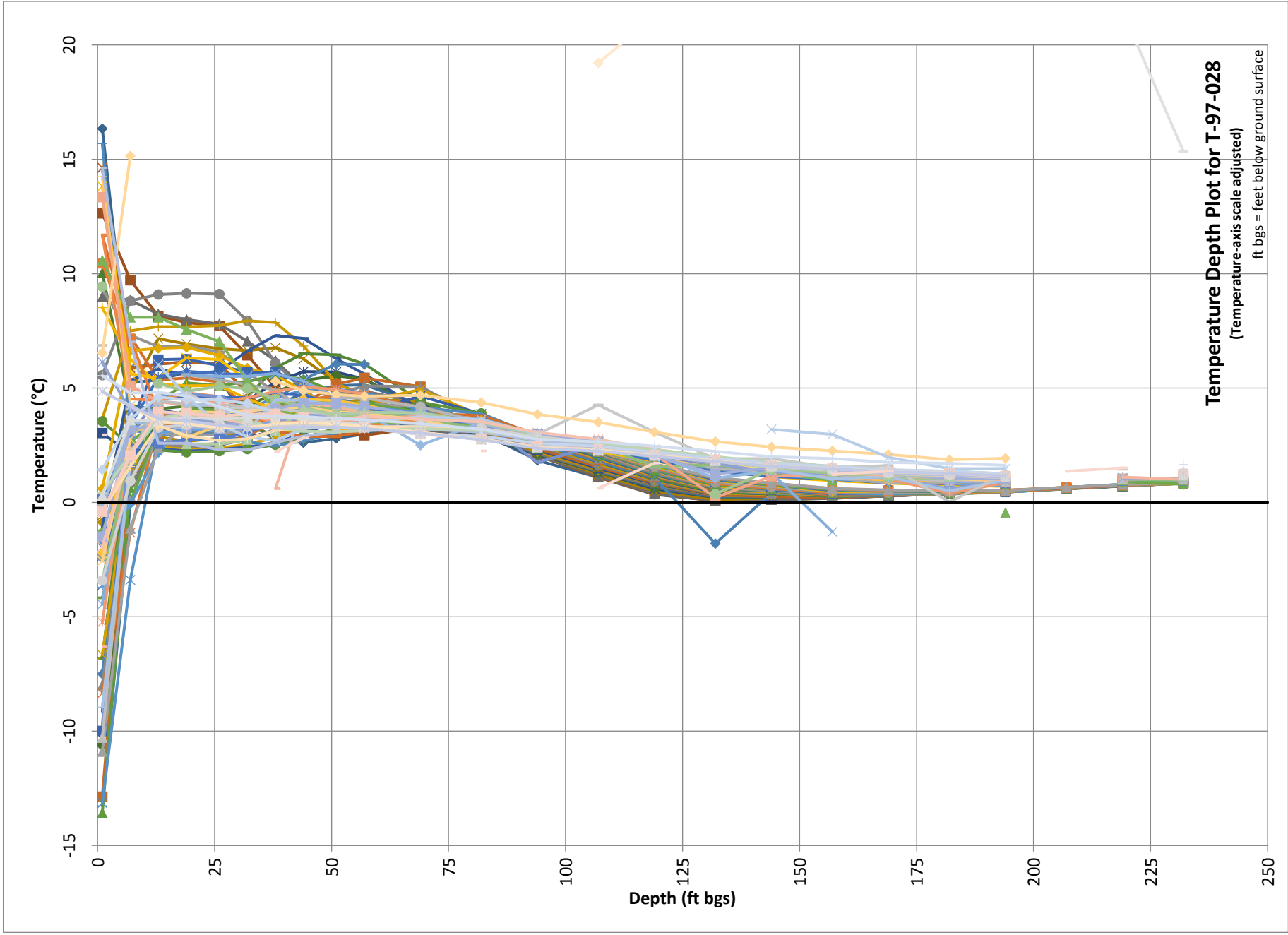


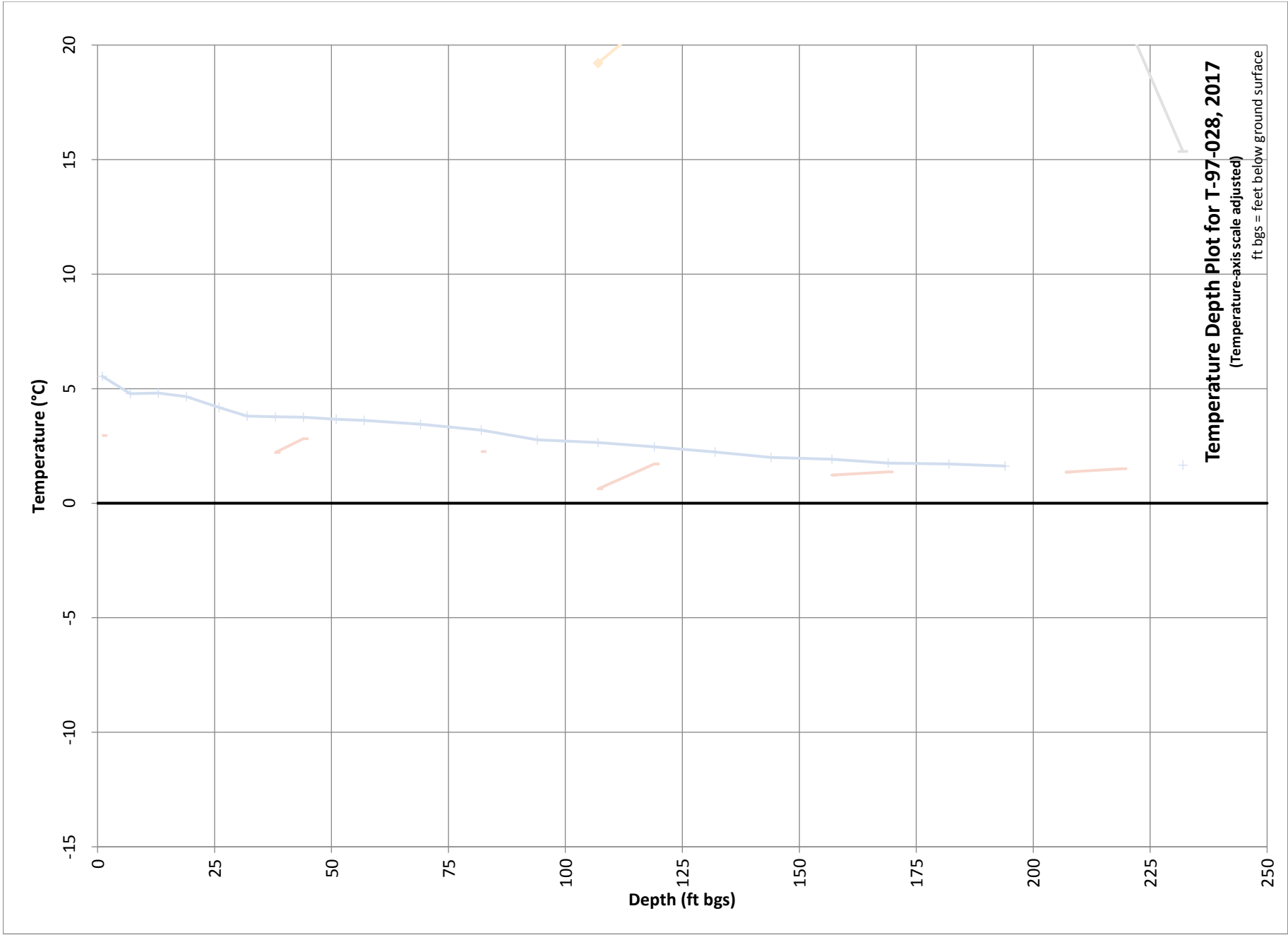


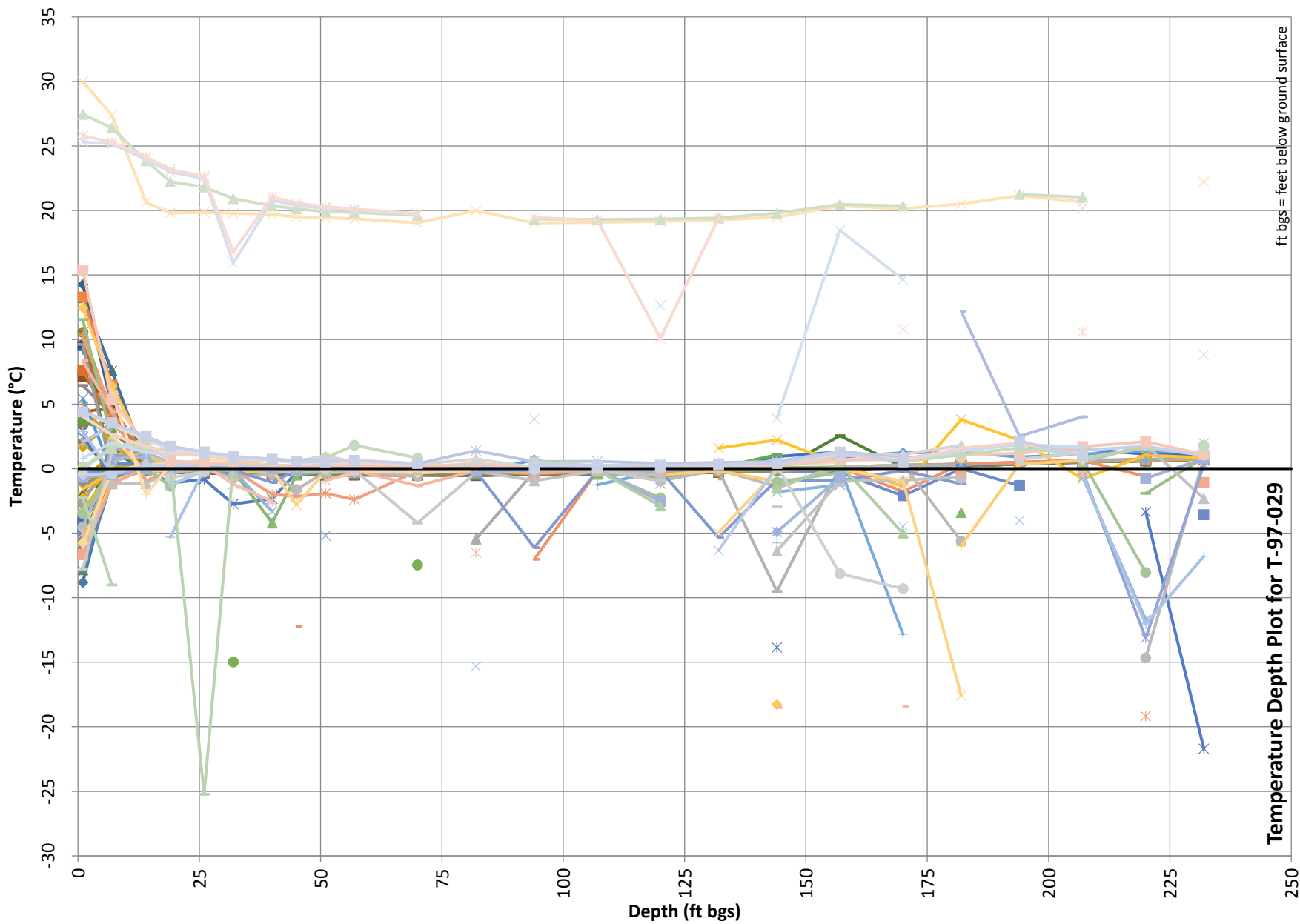
Temperature Depth Plot for T-96-010, 2017
(Temperature-axis scale adjusted)

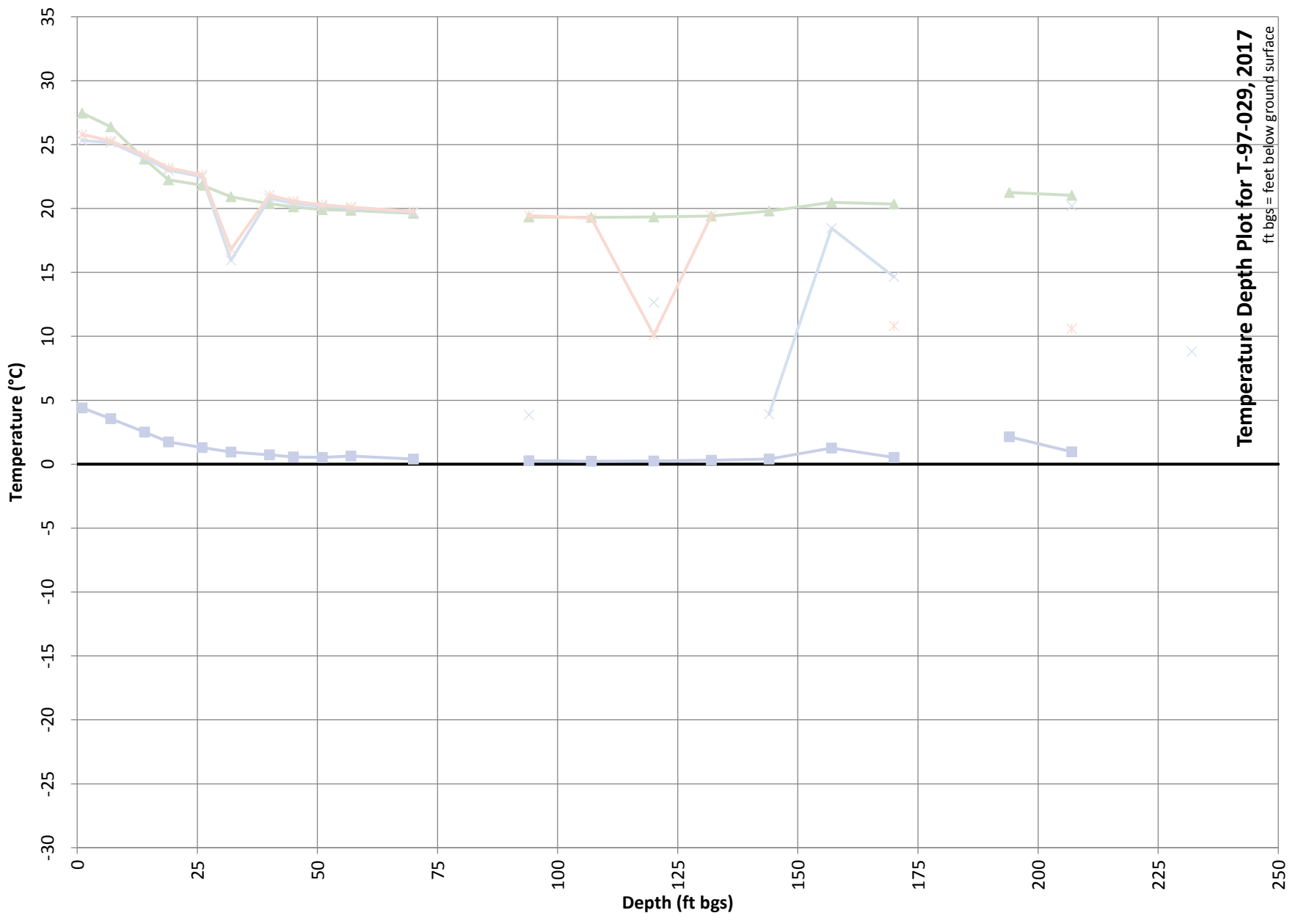




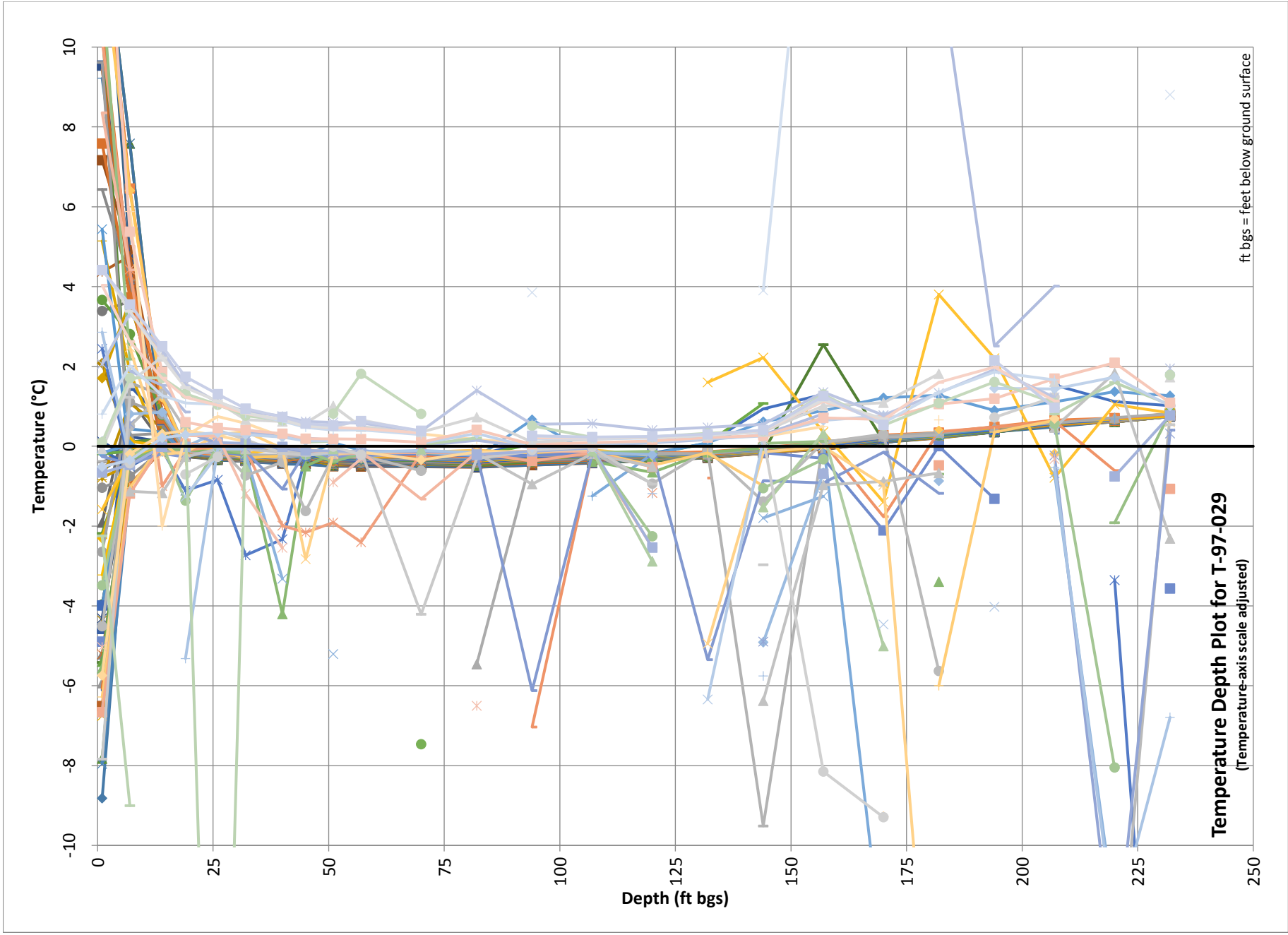


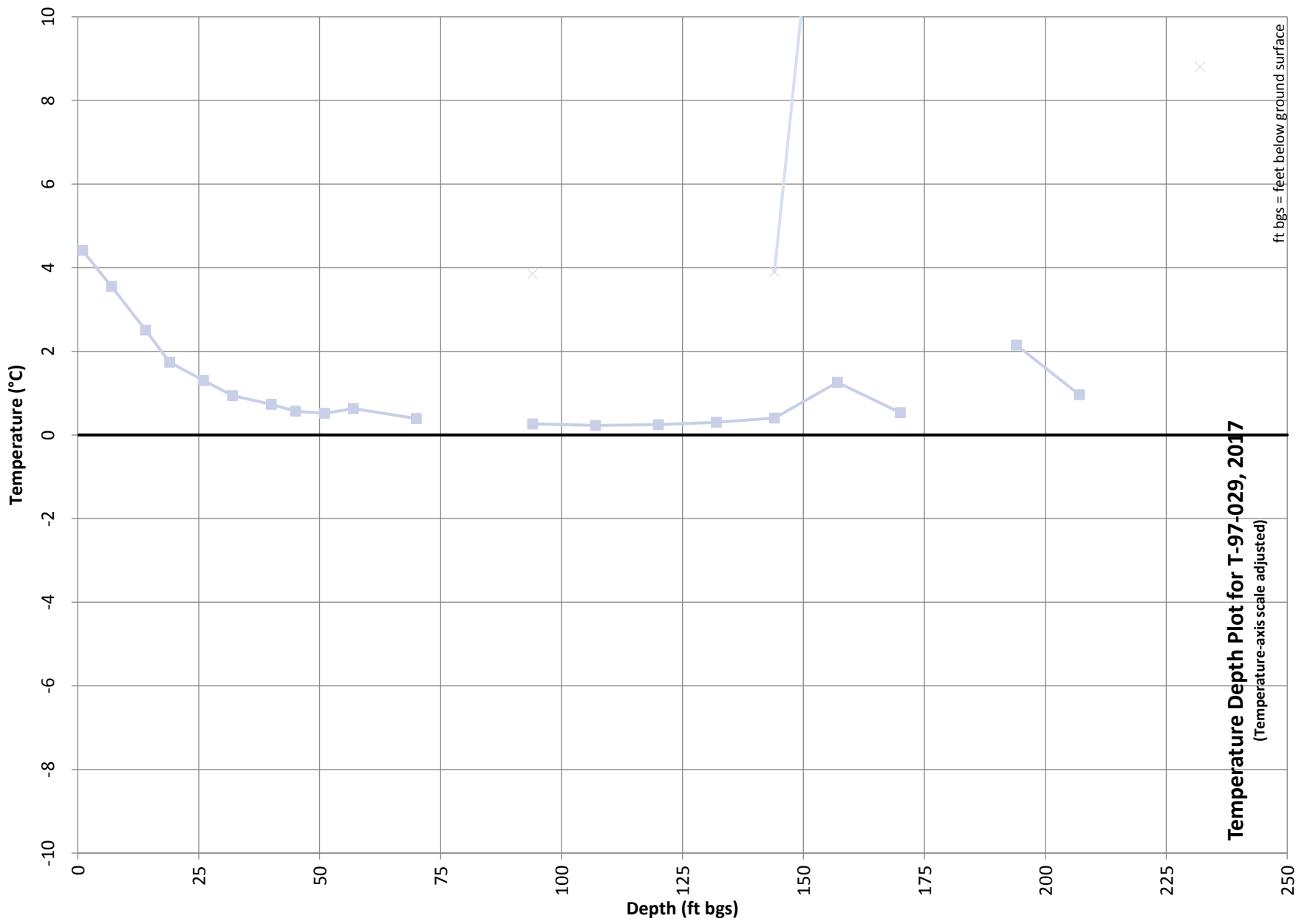






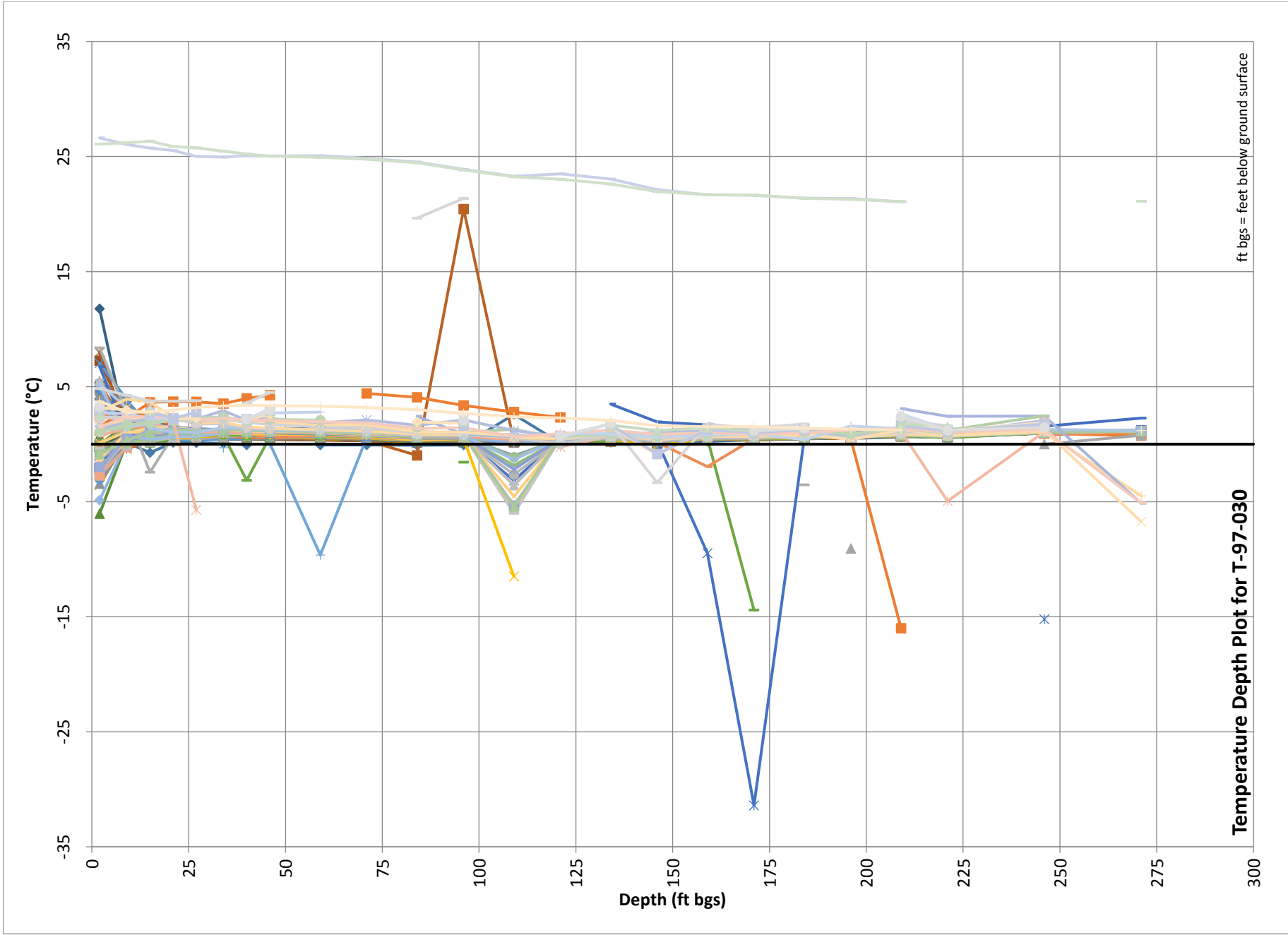
Temperature Depth Plot for T-97-029, 2017

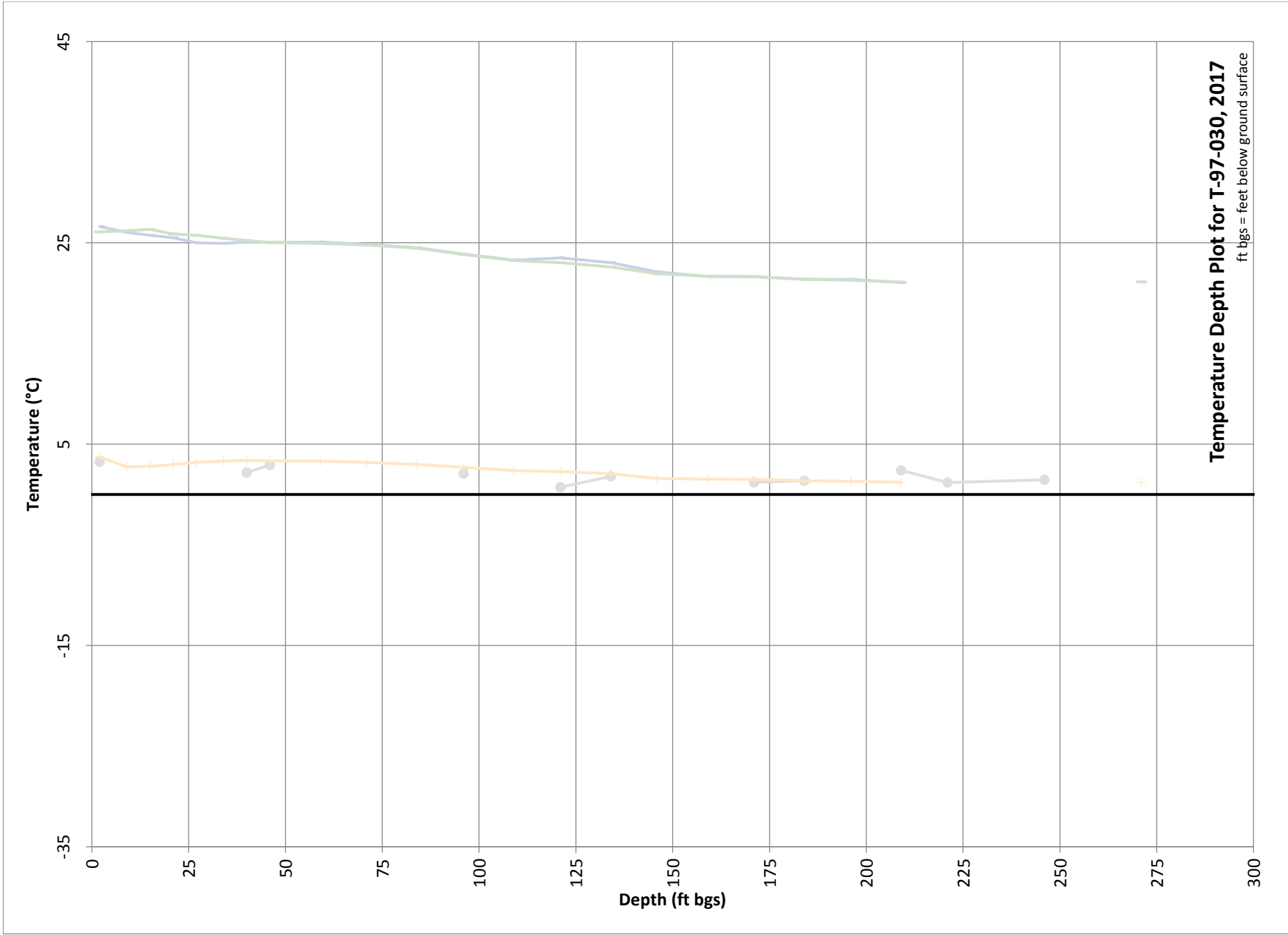


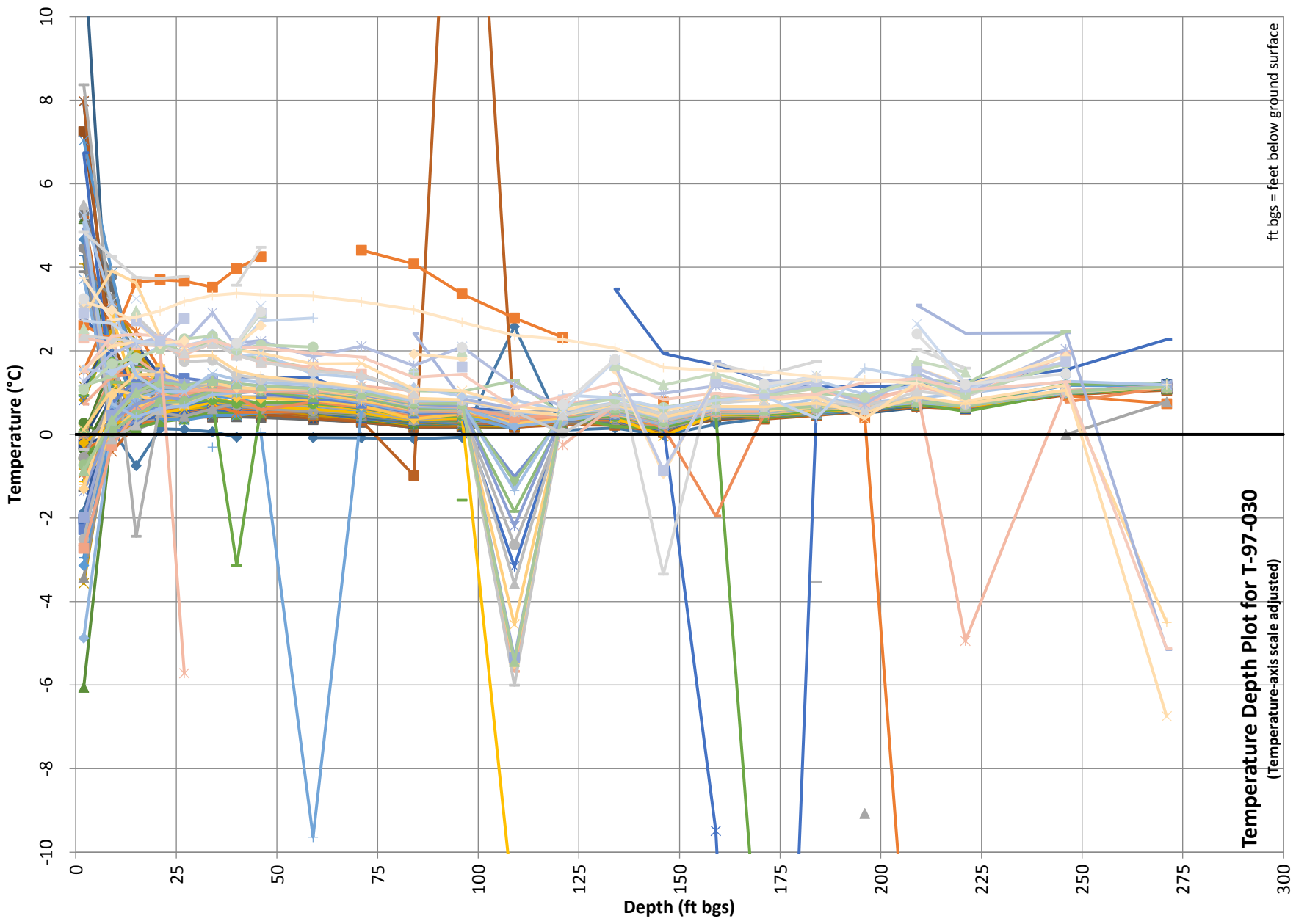


Temperature Depth Plot for T-97-029, 2017
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ft bgs = feet below ground surface

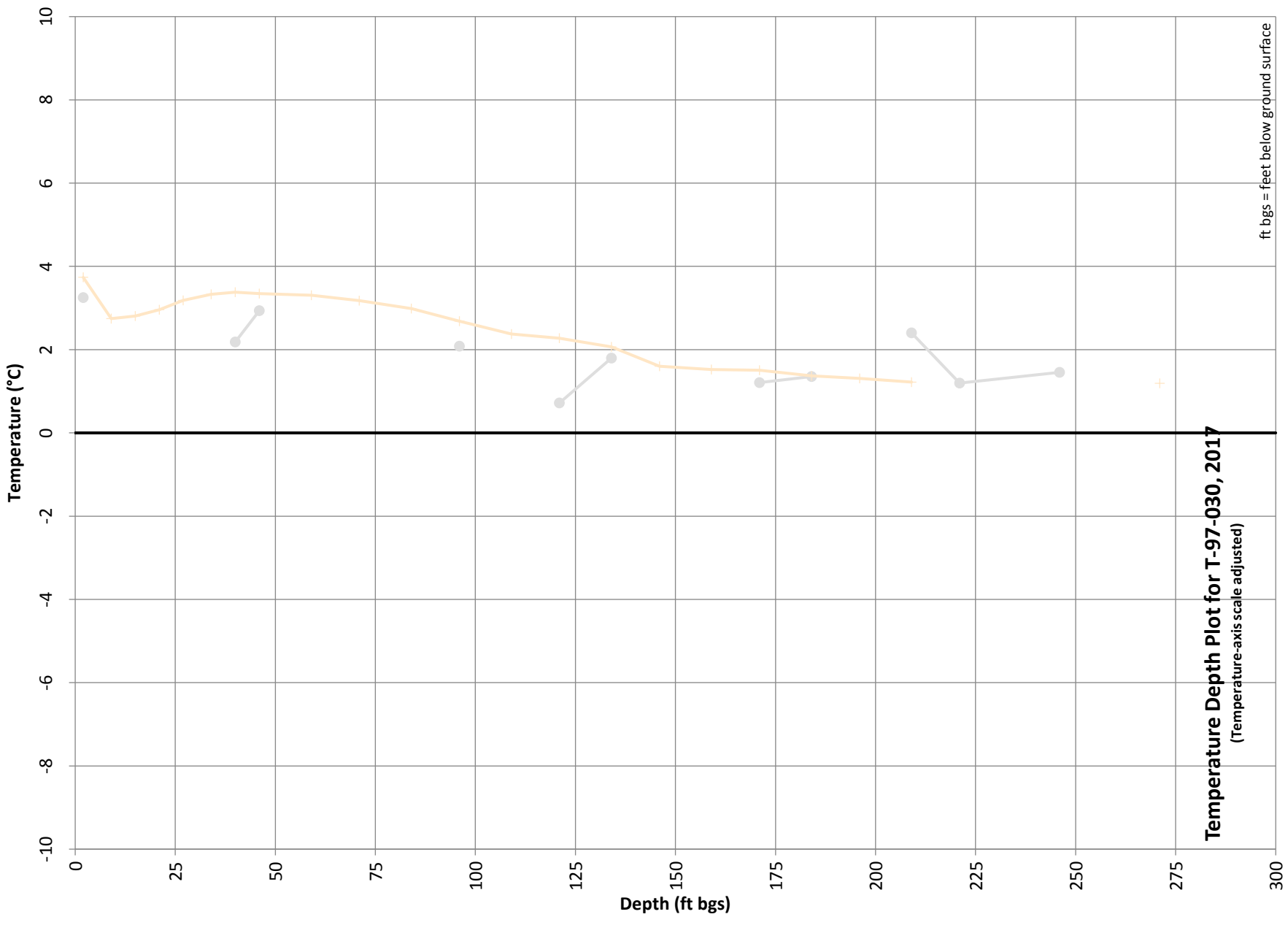




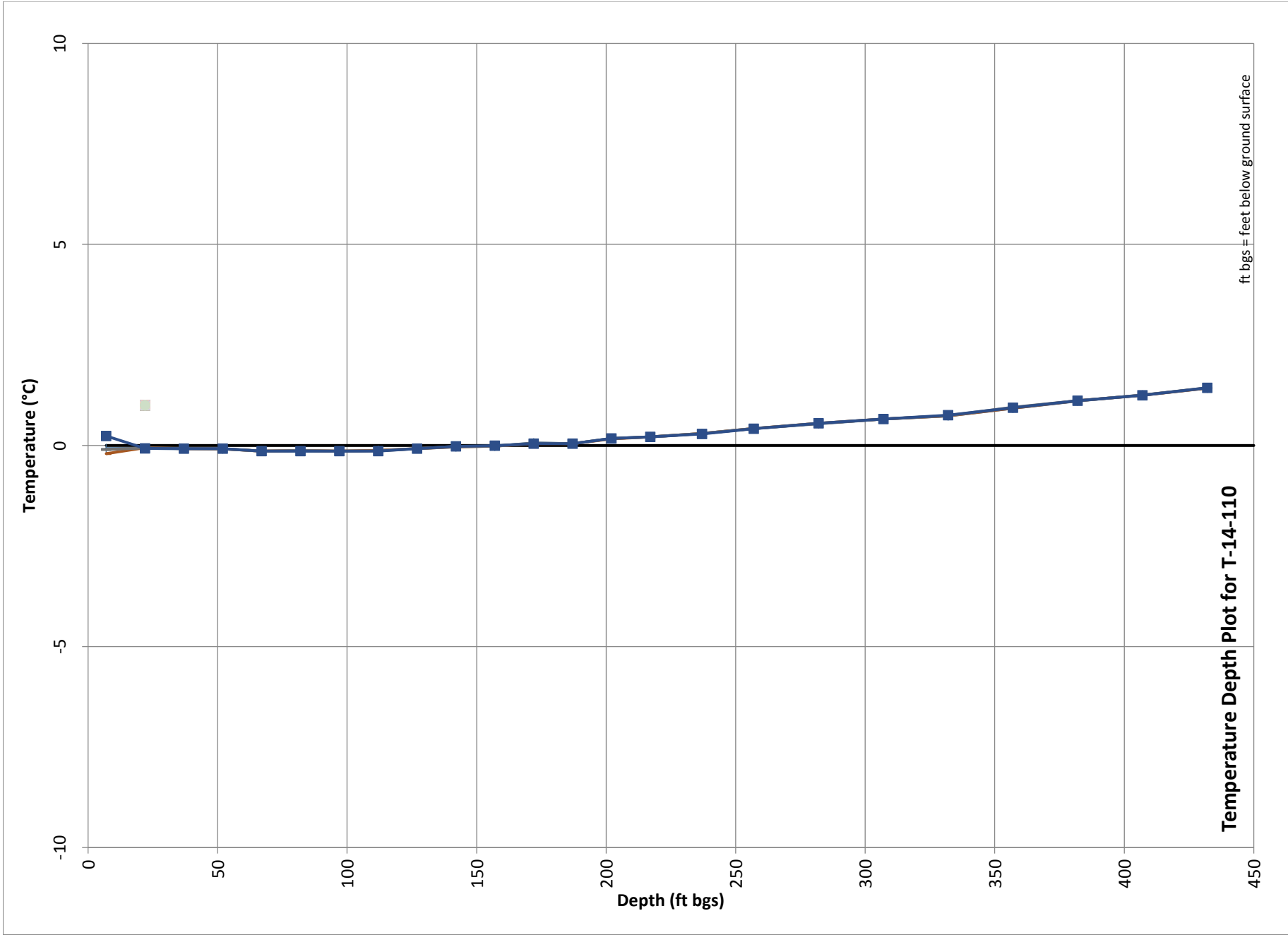


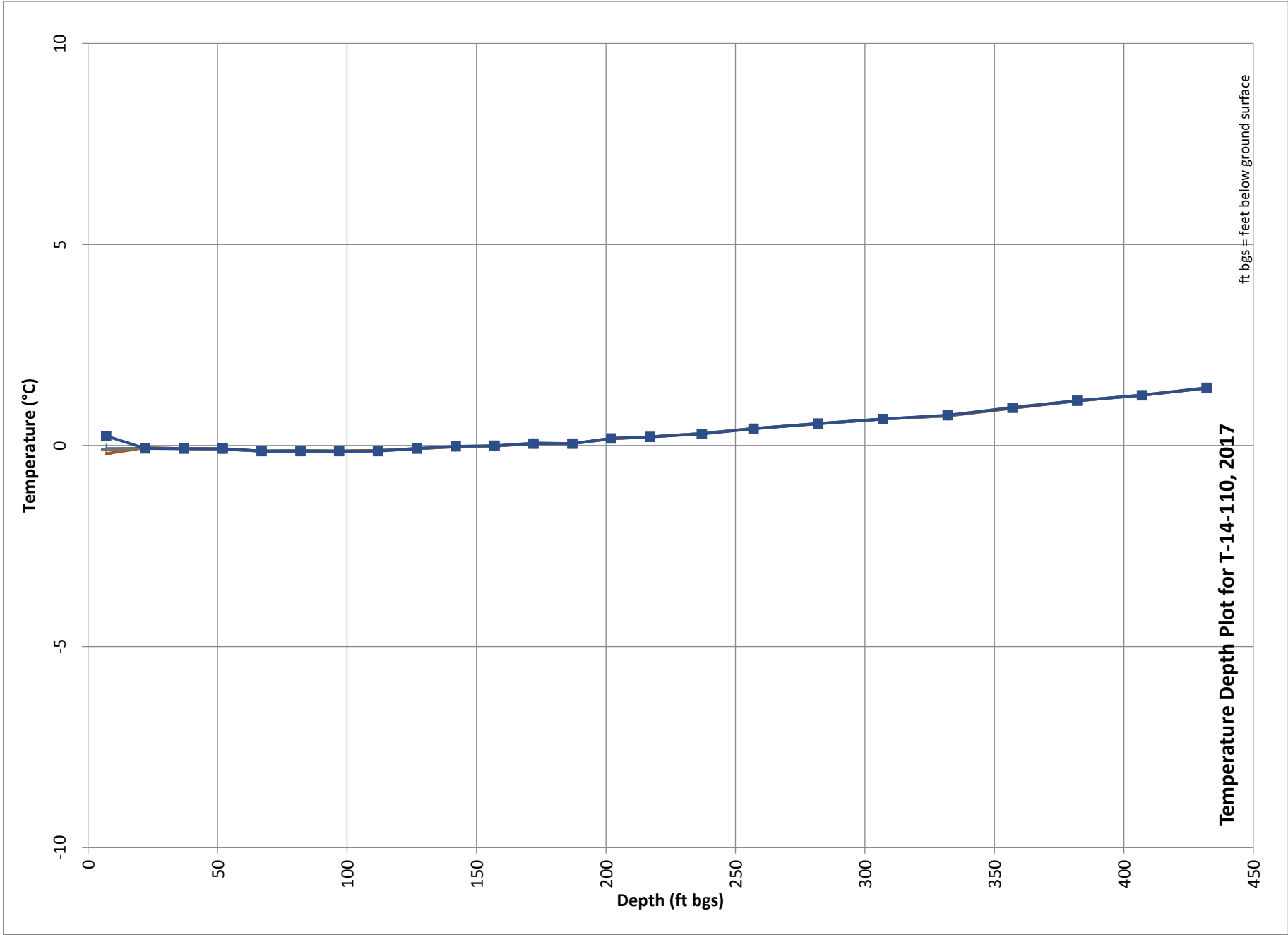
Temperature Depth Plot for T-97-030
(Temperature-axis scale adjusted)

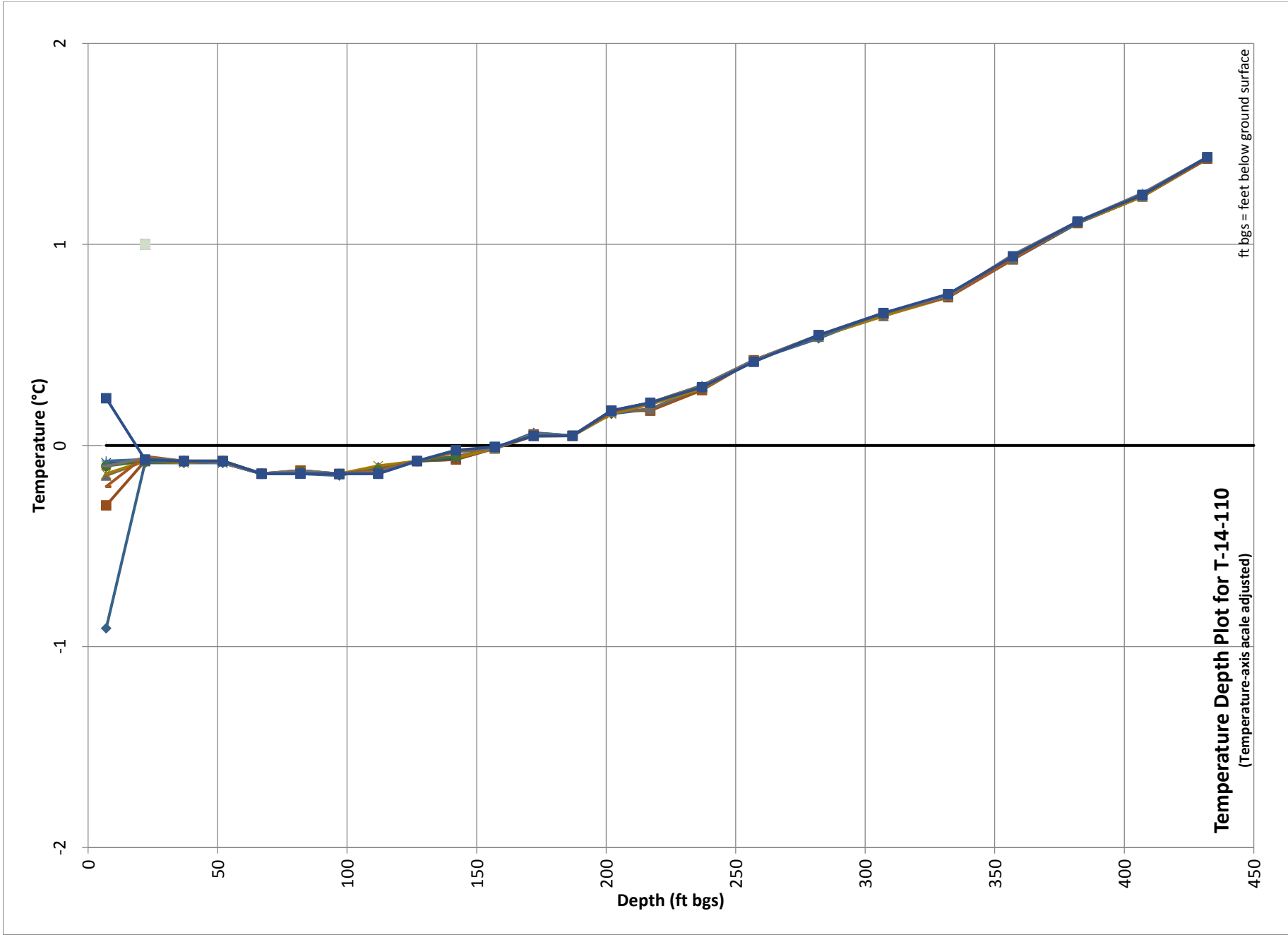
ft bgs = feet below ground surface

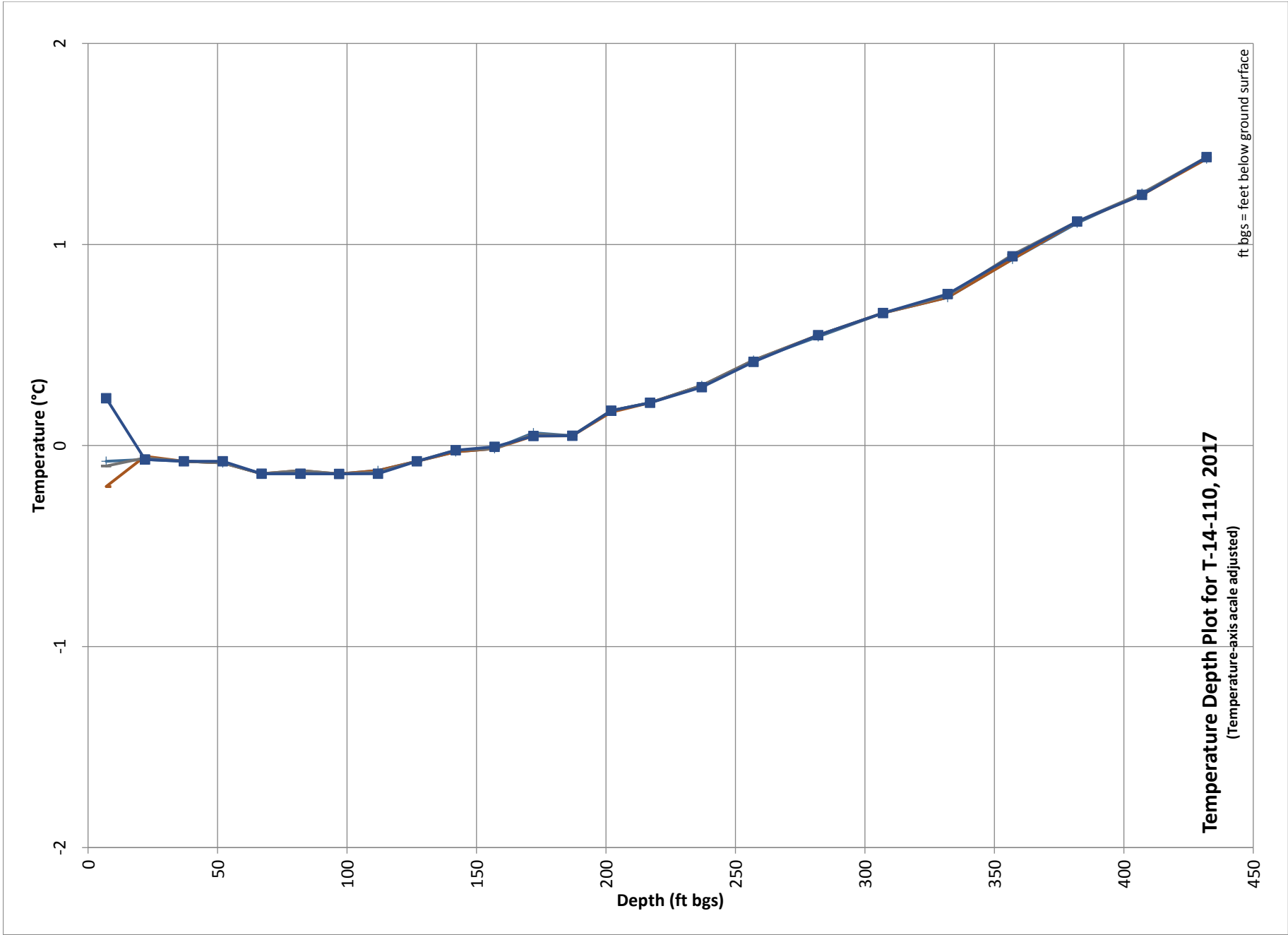


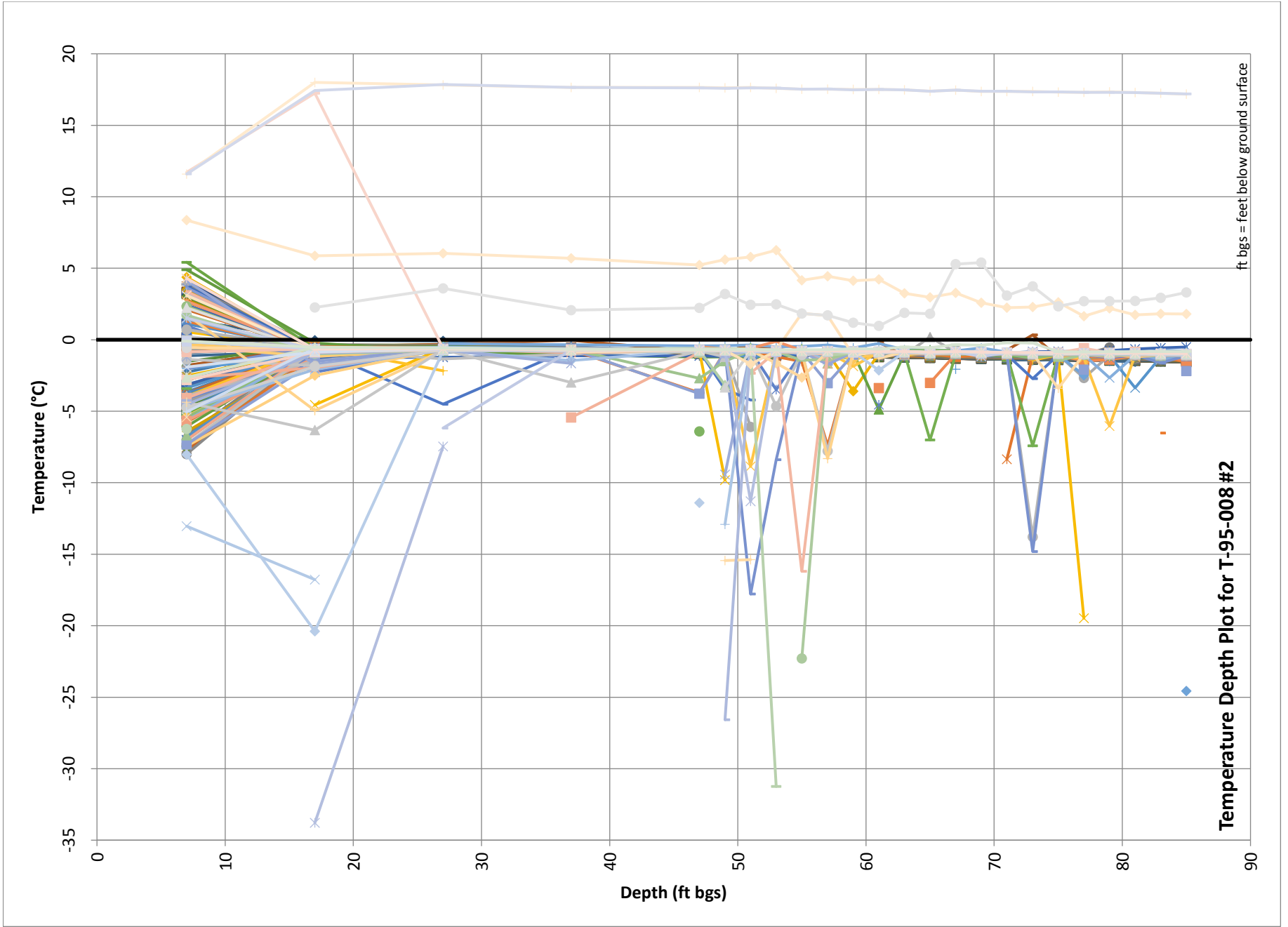
Temperature Depth Plot for T-97-030, 2017
(Temperature-axis scale adjusted)

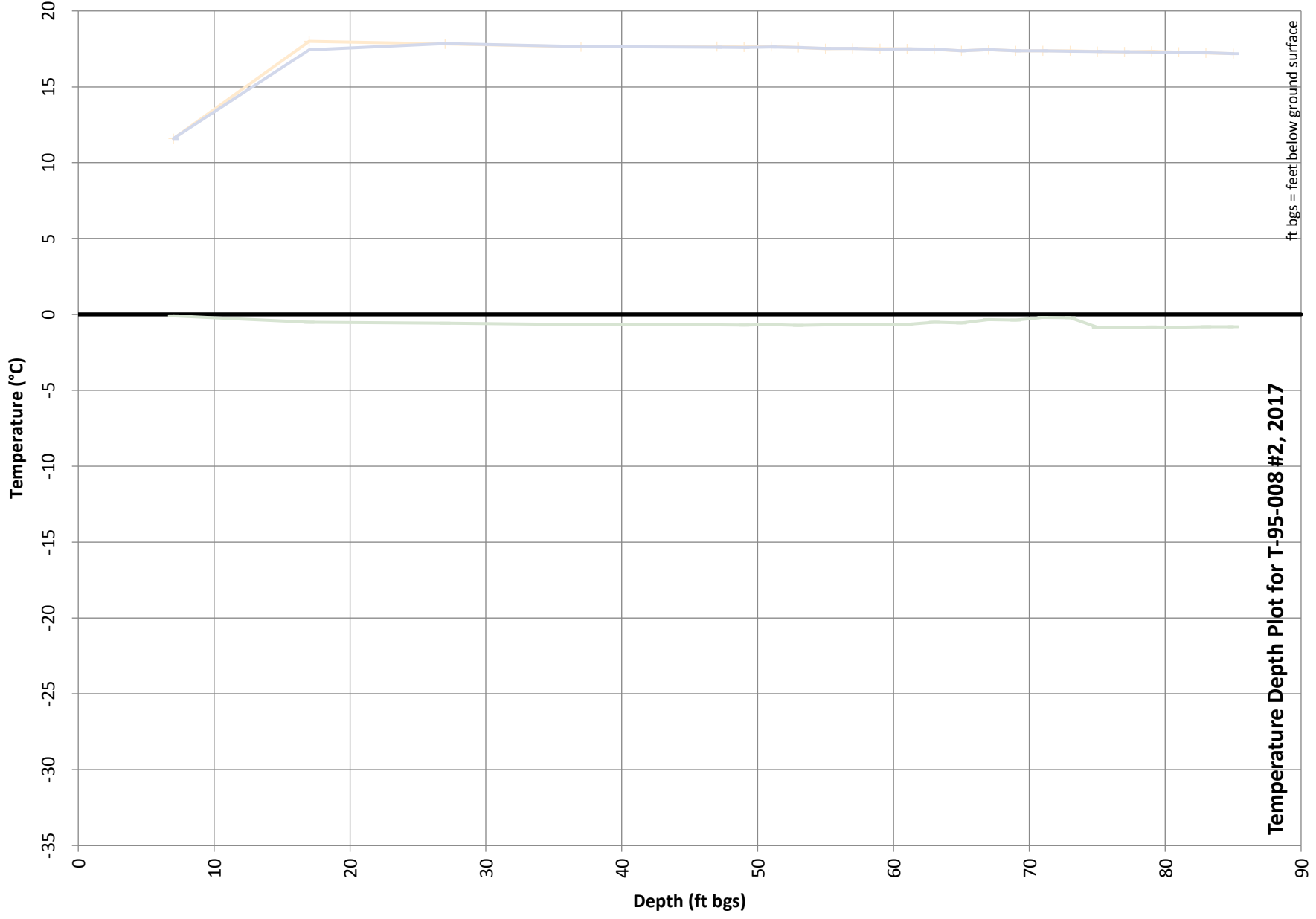


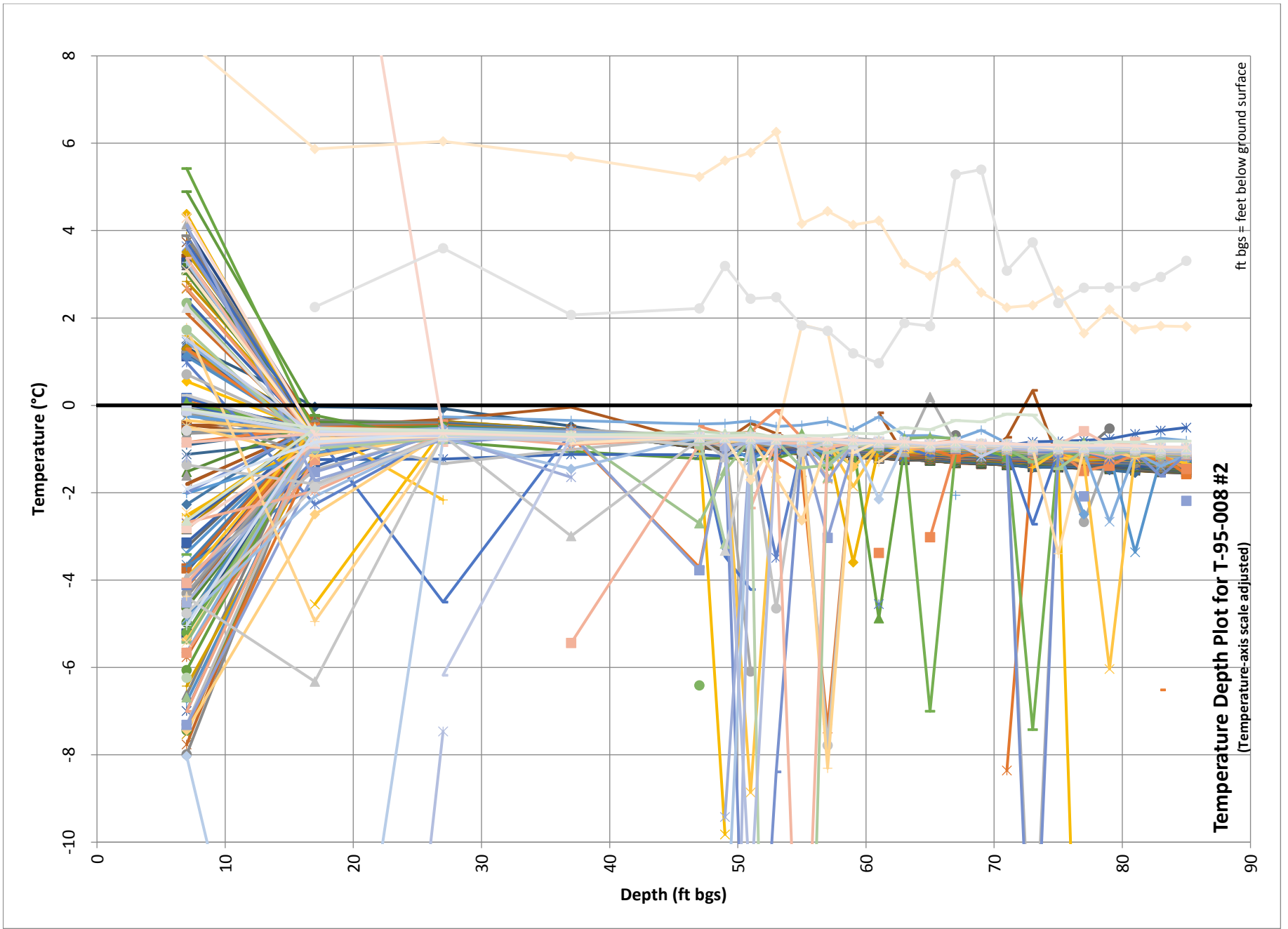


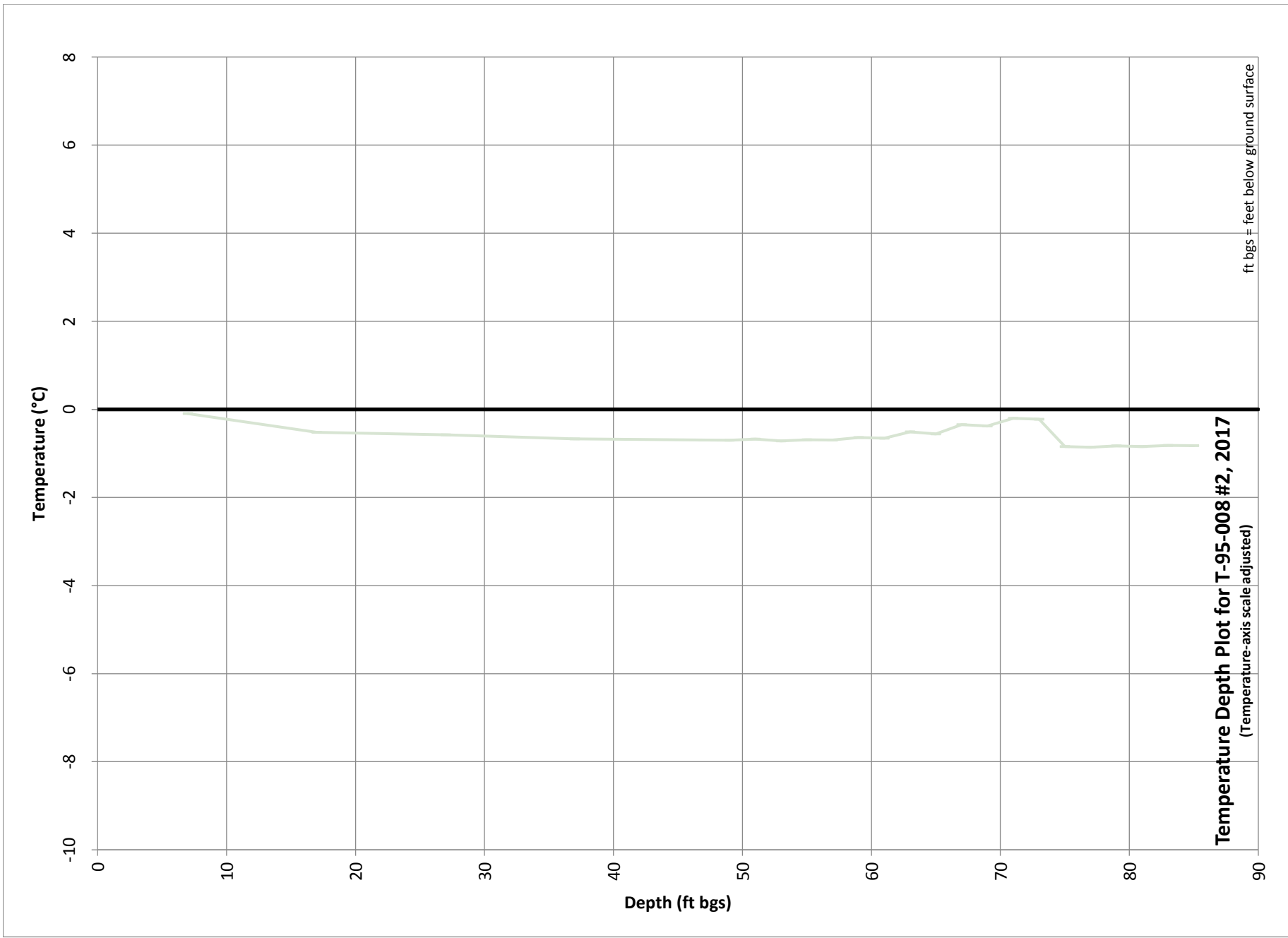


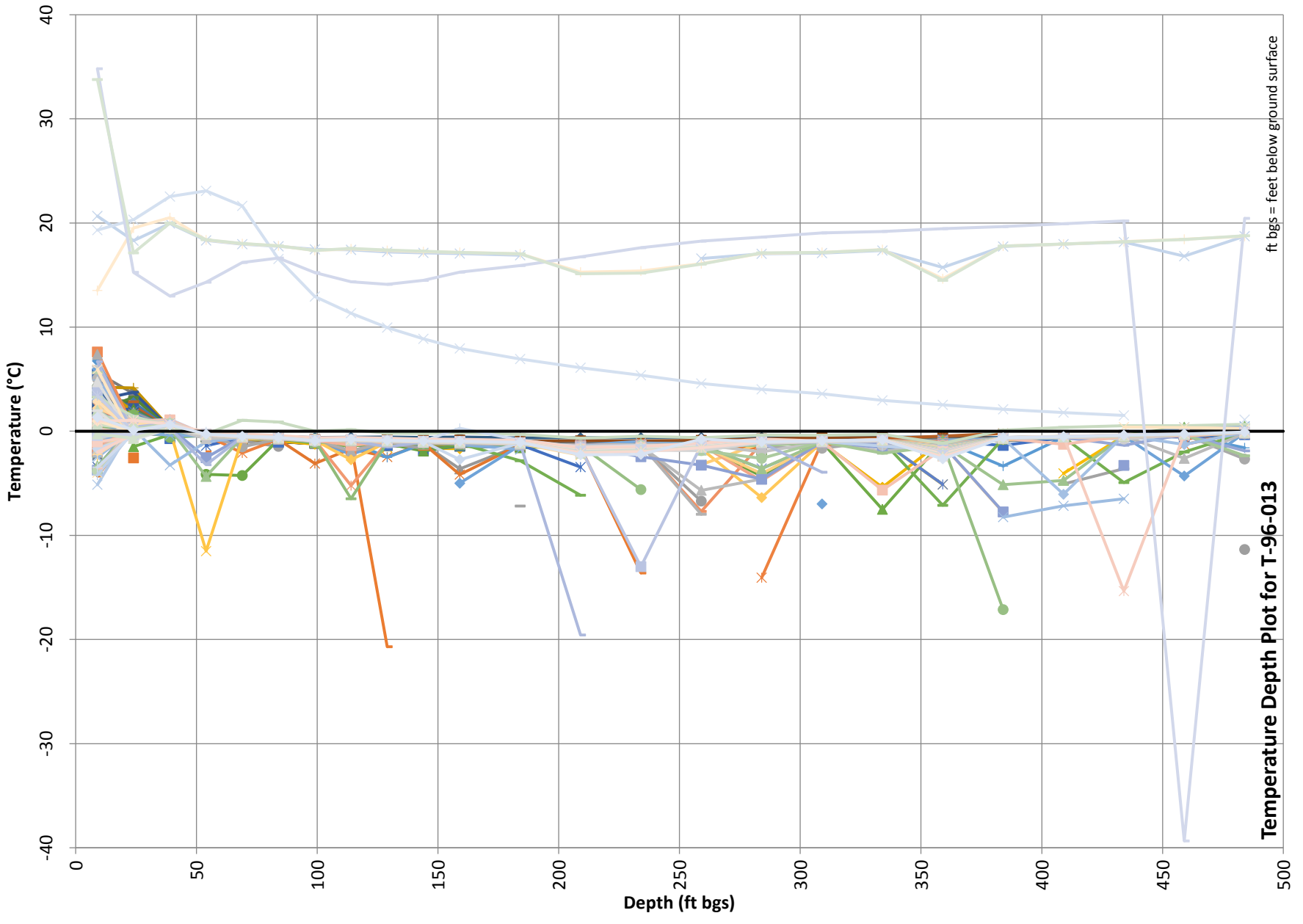




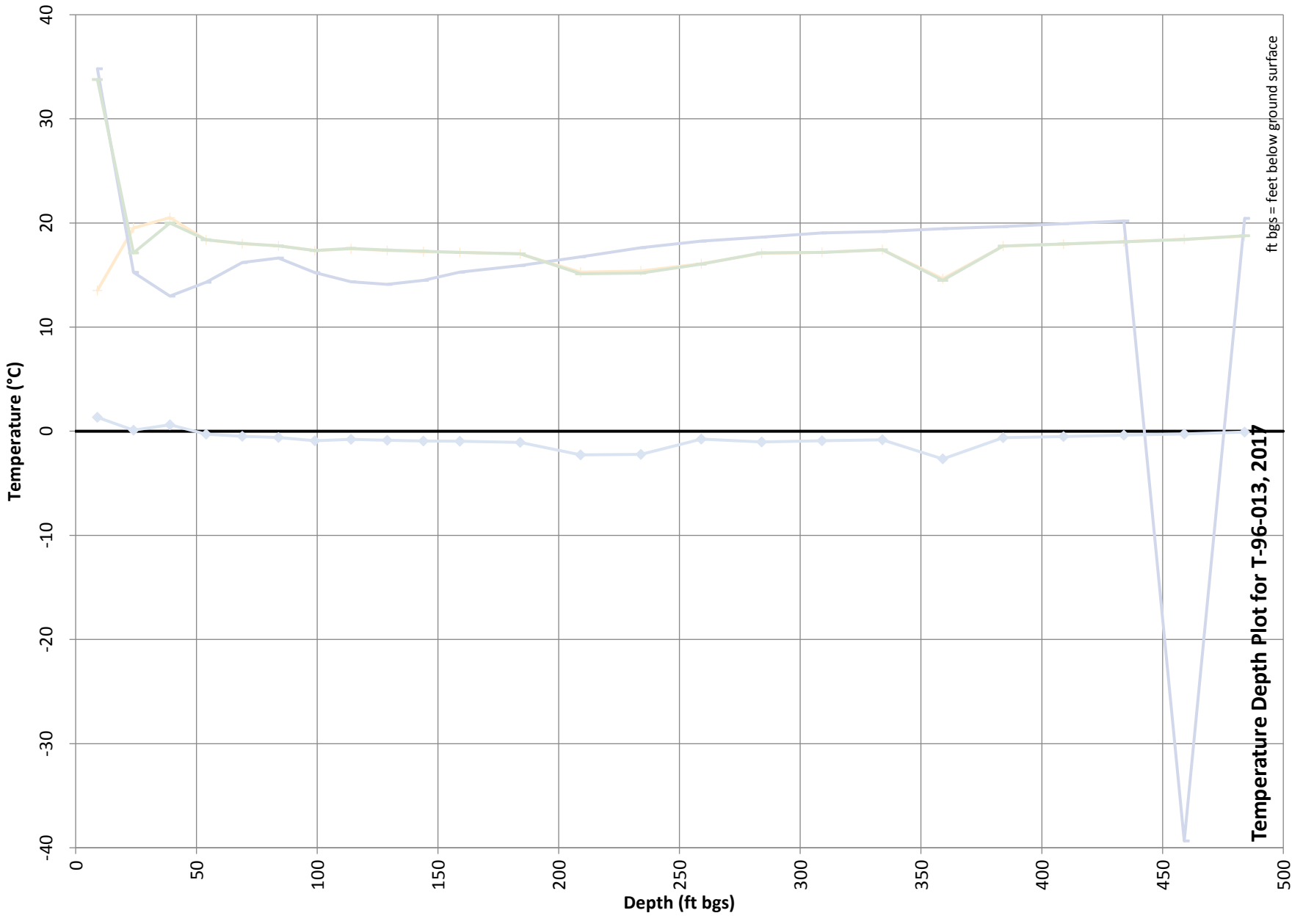


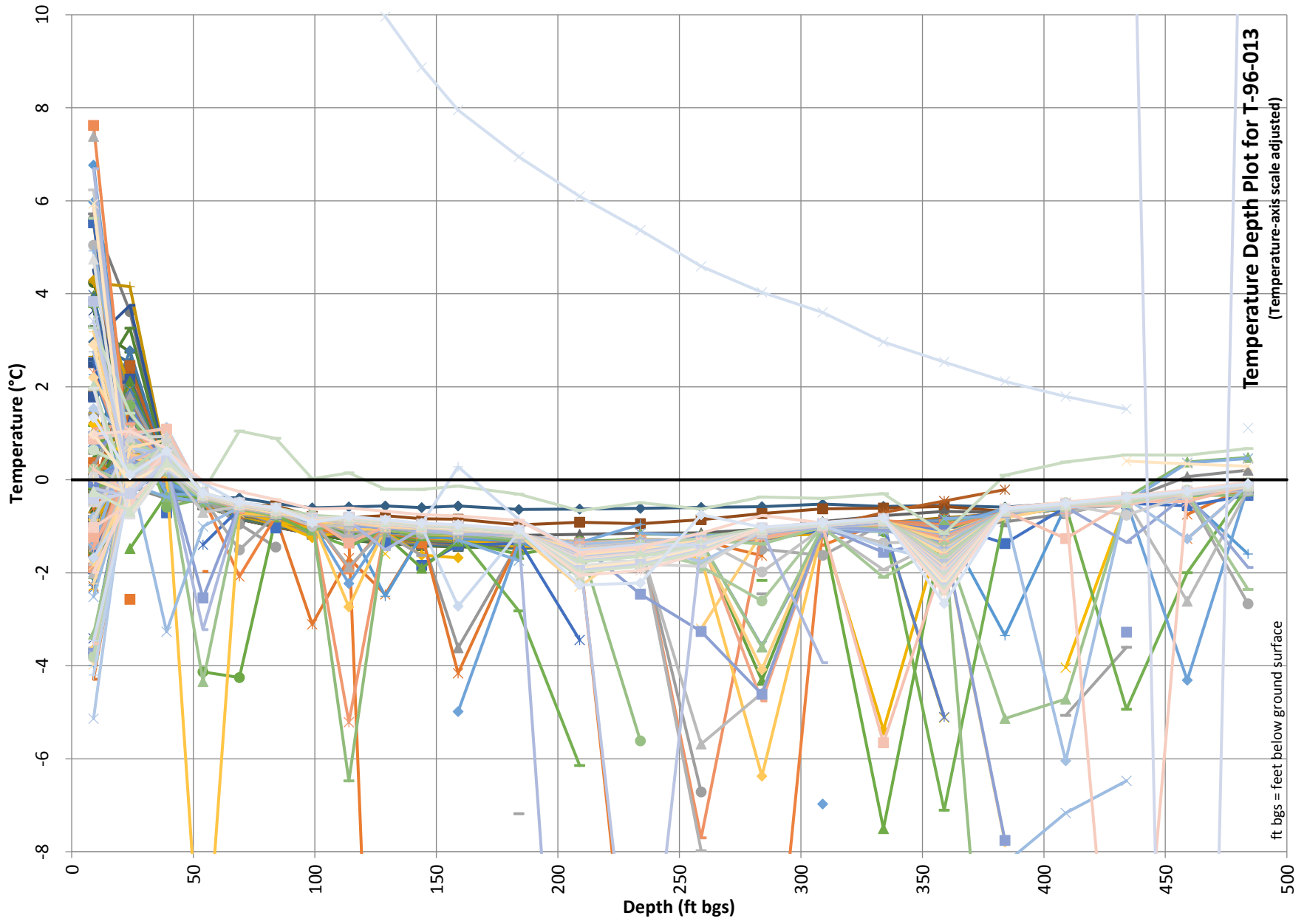


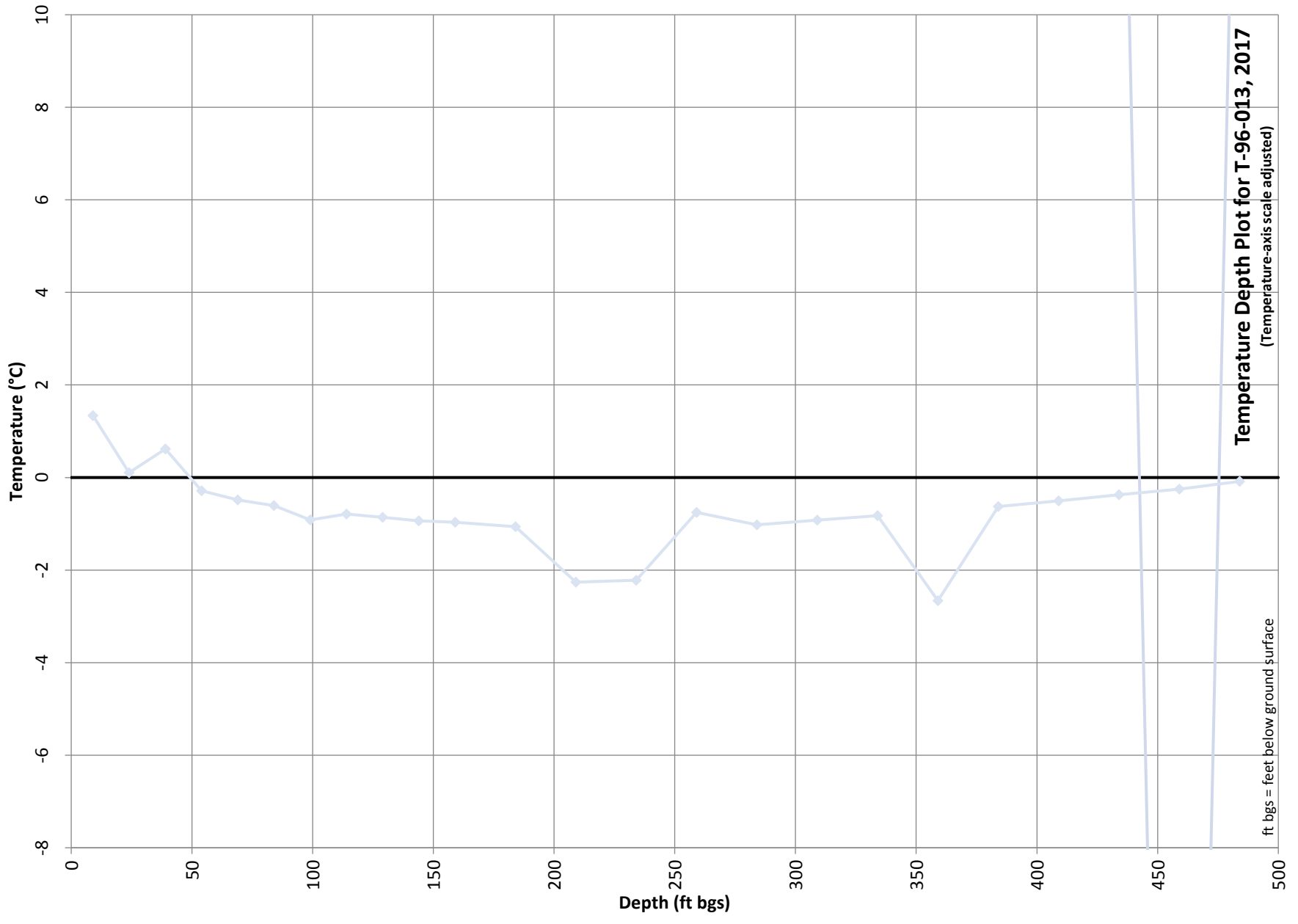




Temperature Depth Plot for T-96-013

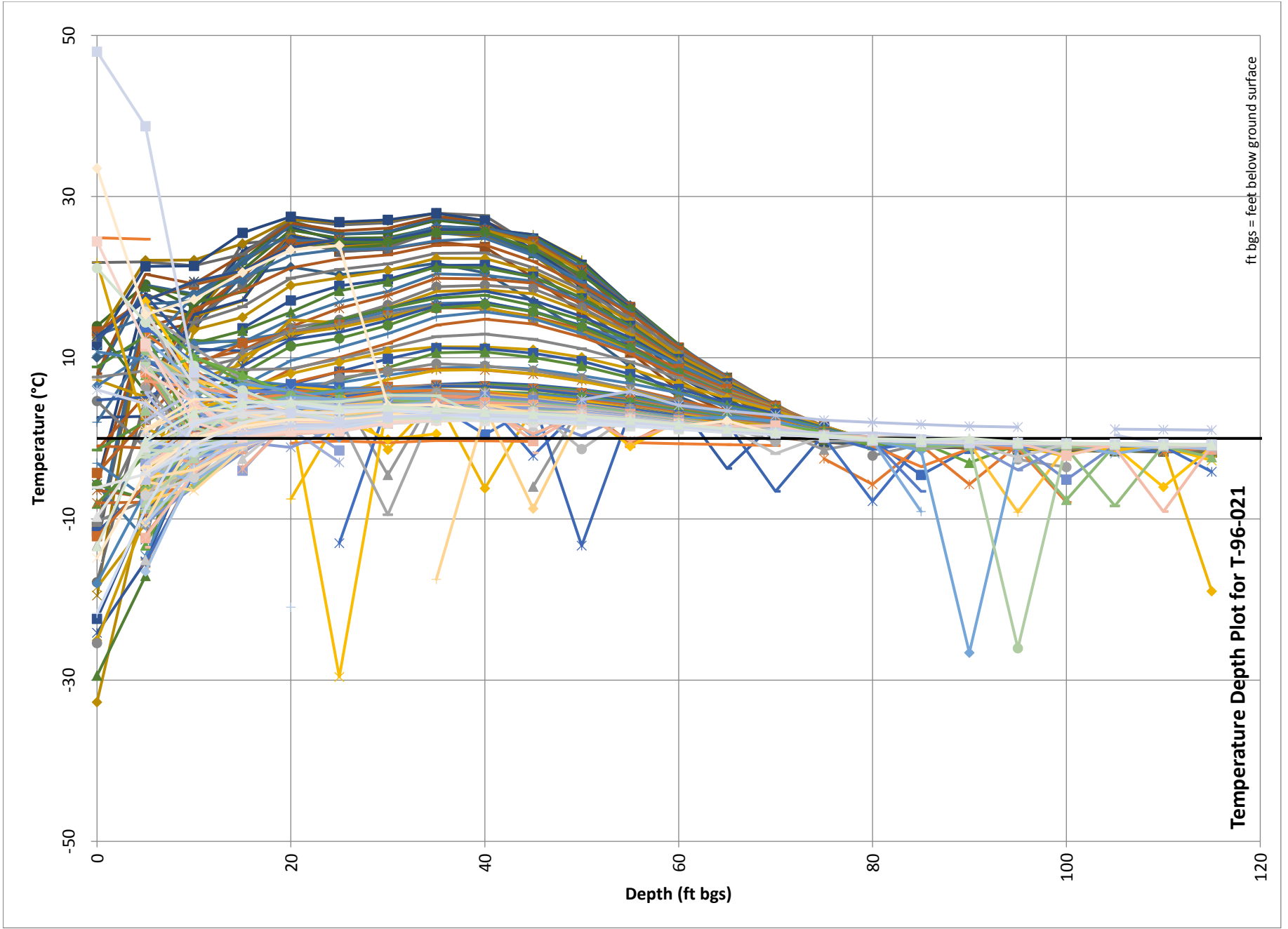


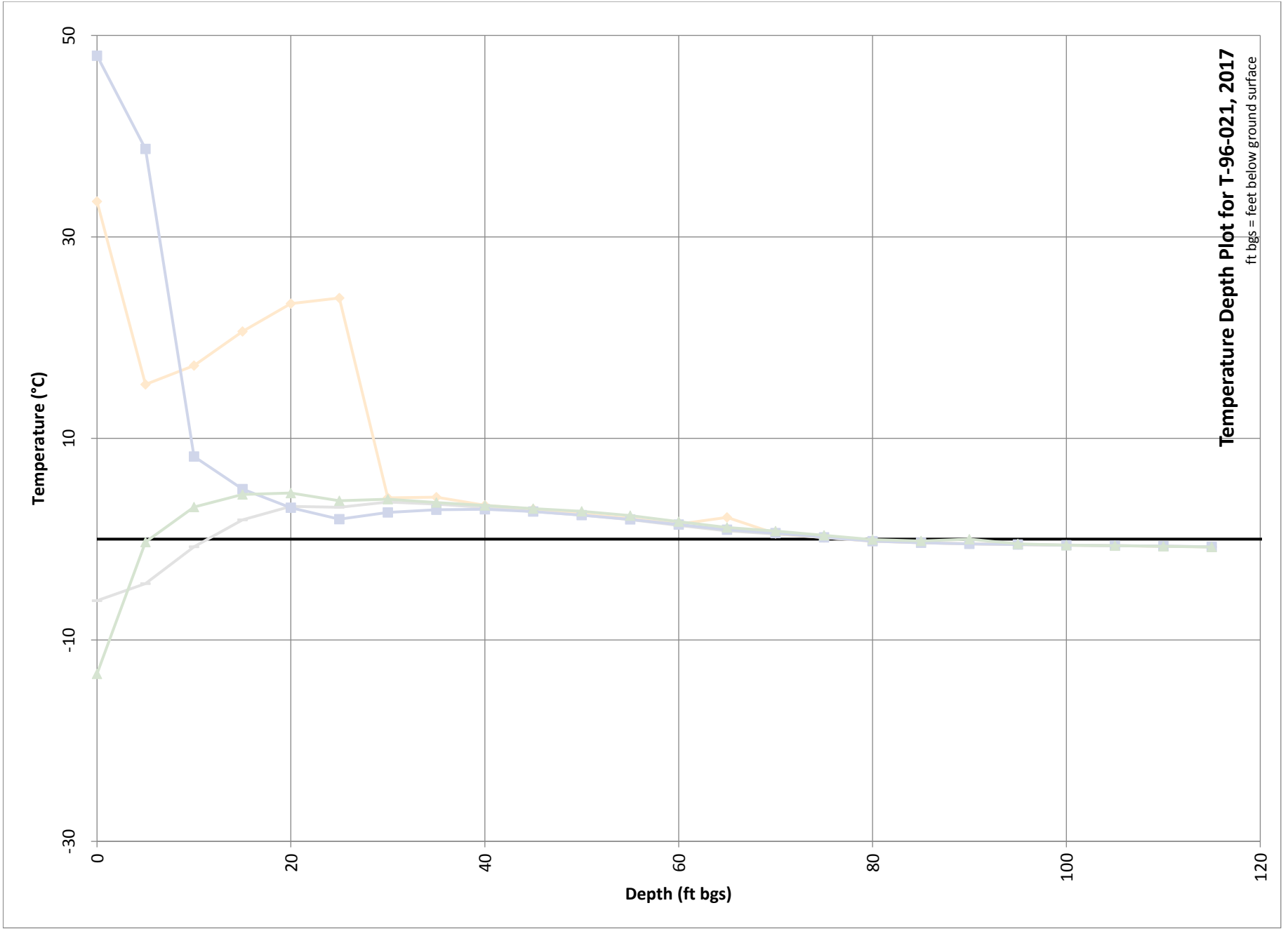


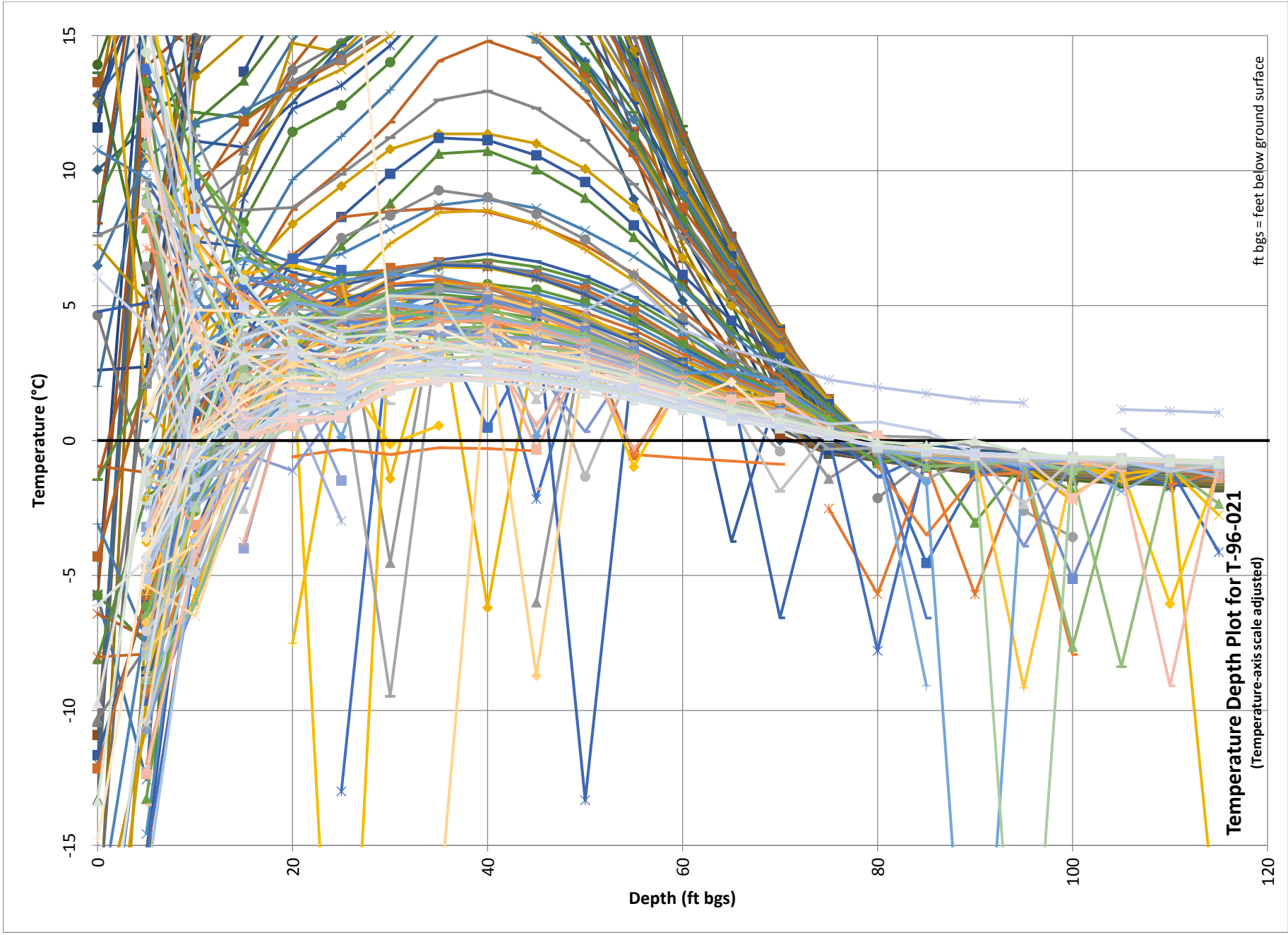


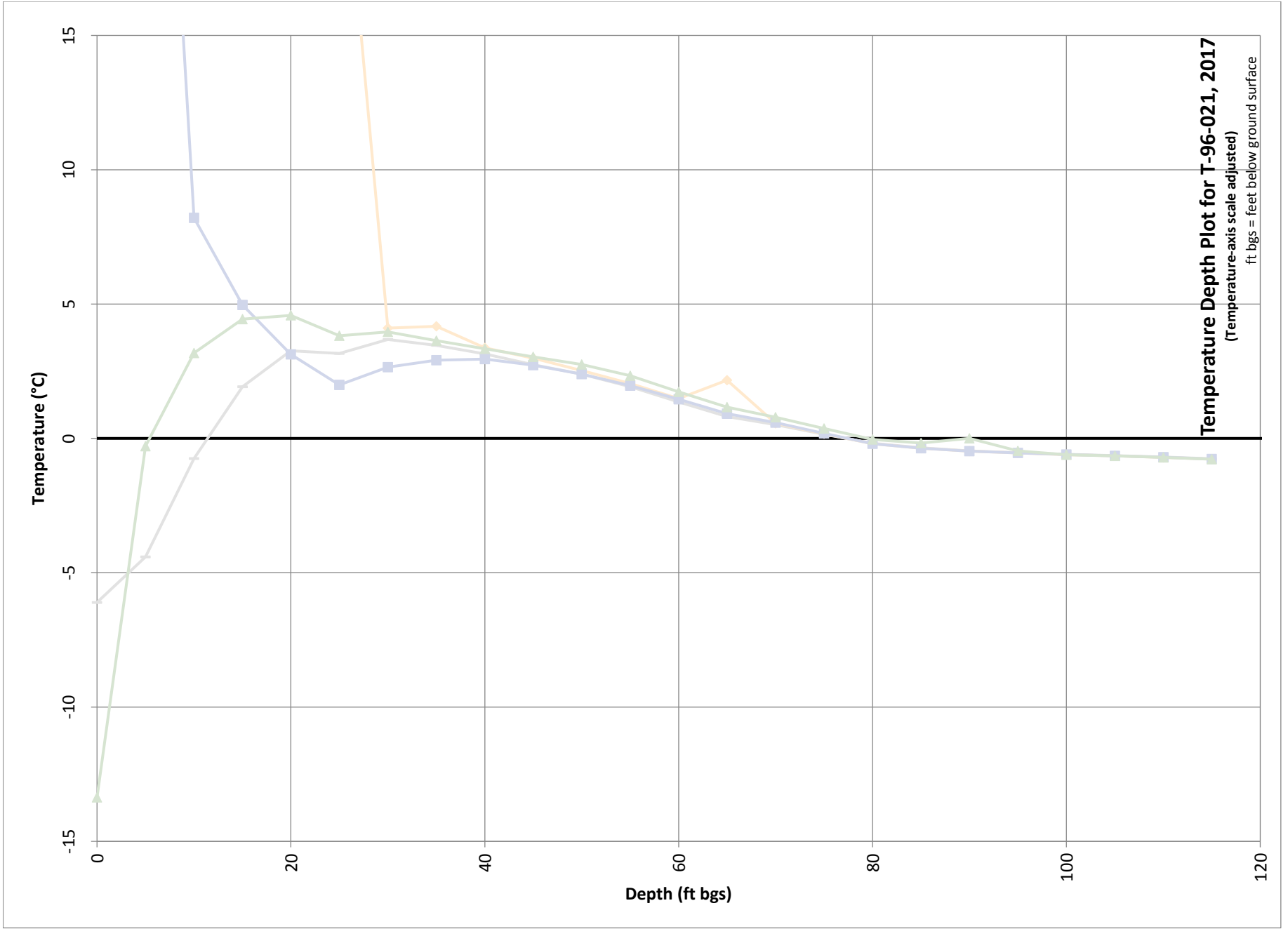
Temperature Depth Plot for T-96-013, 2017
(Temperature-axis scale adjusted)

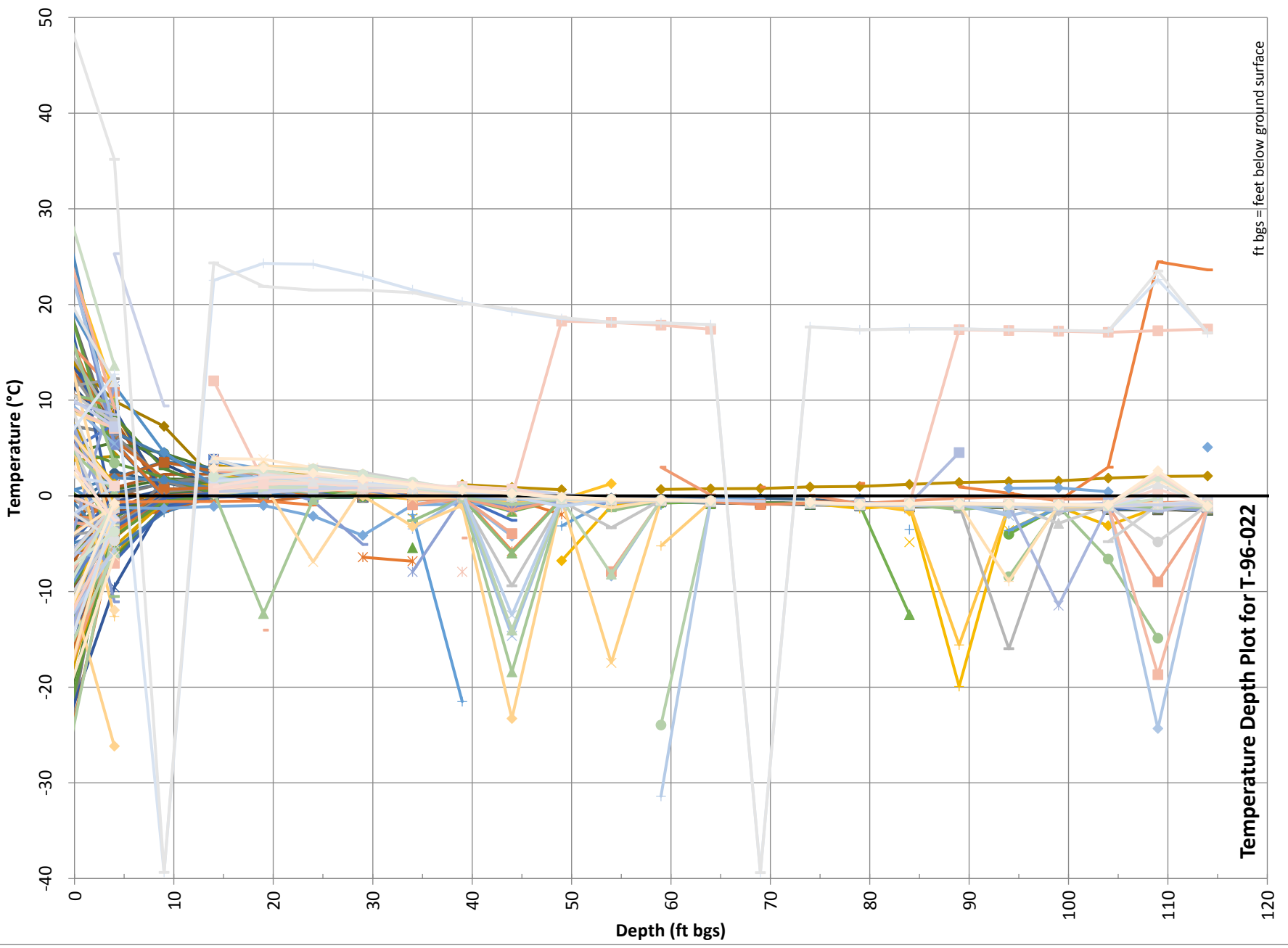
ft bgs = feet below ground surface

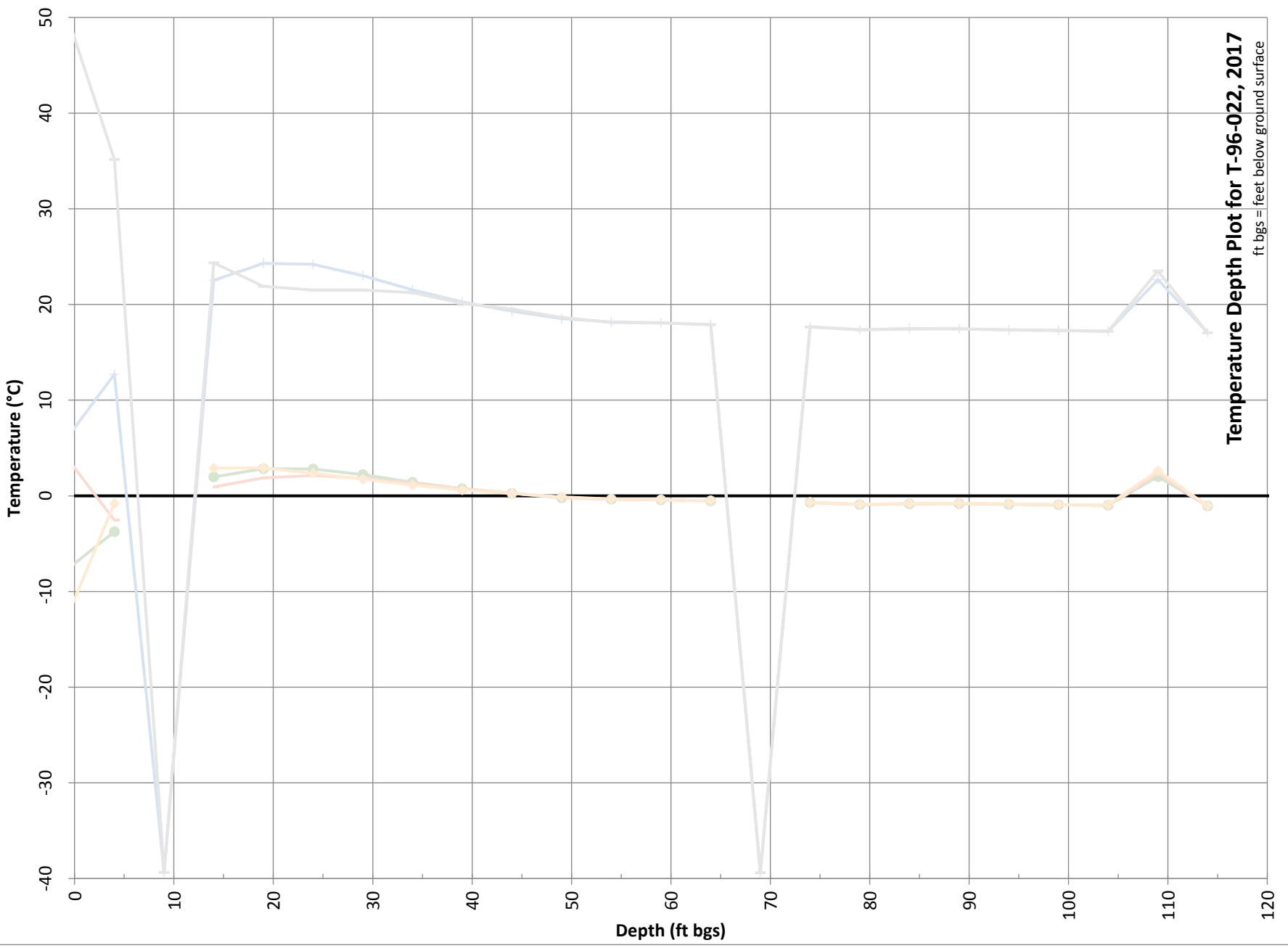




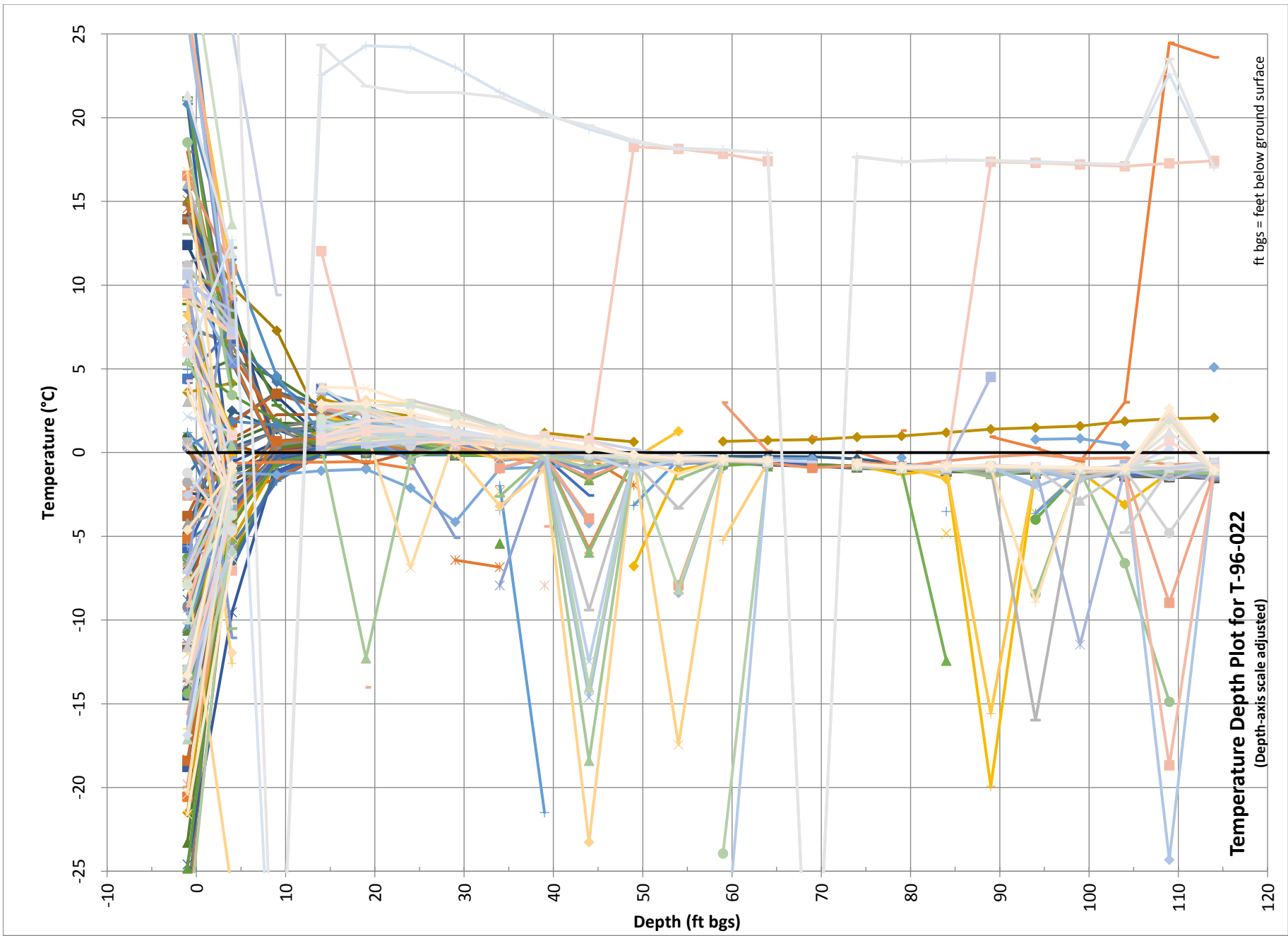


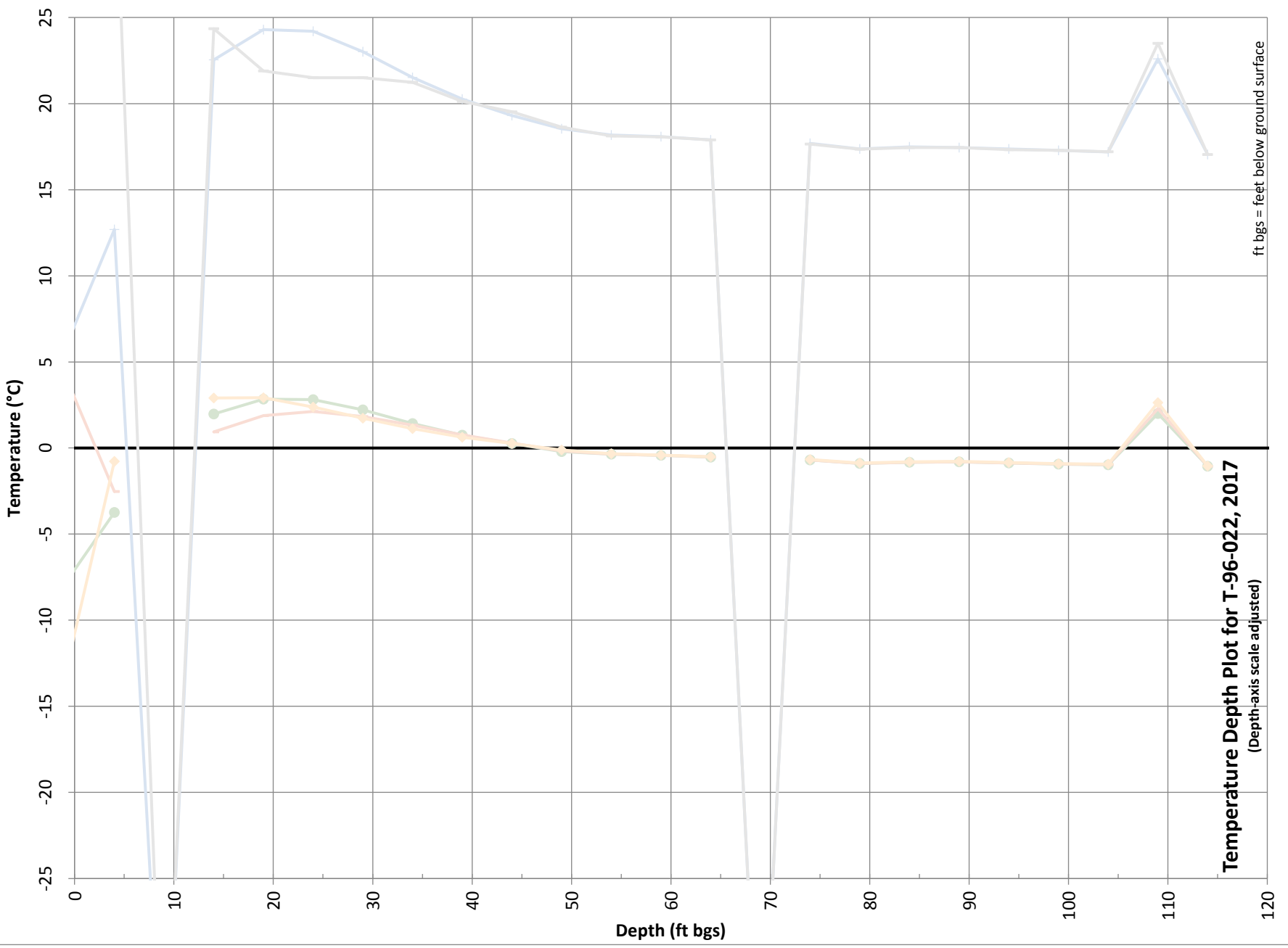


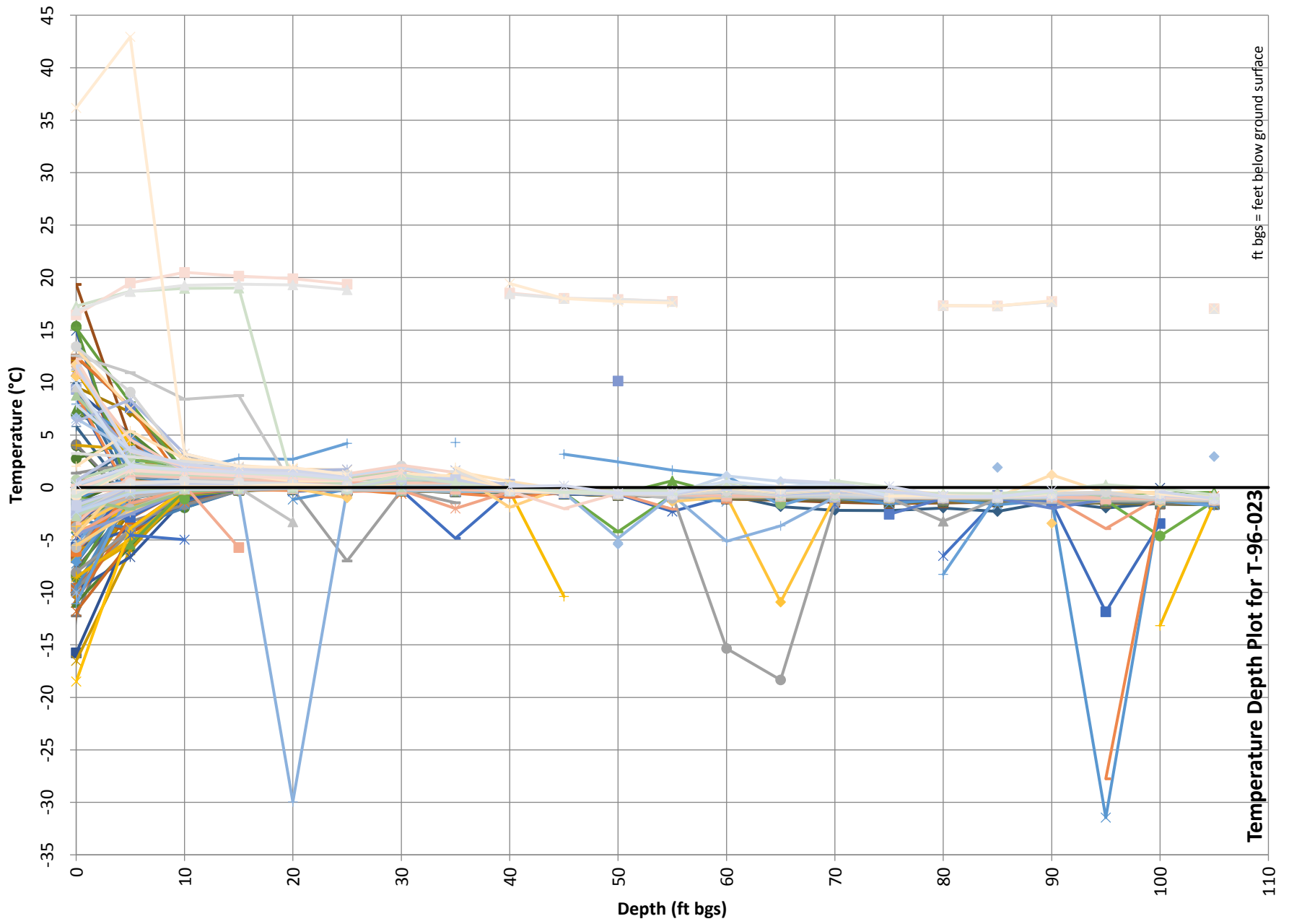


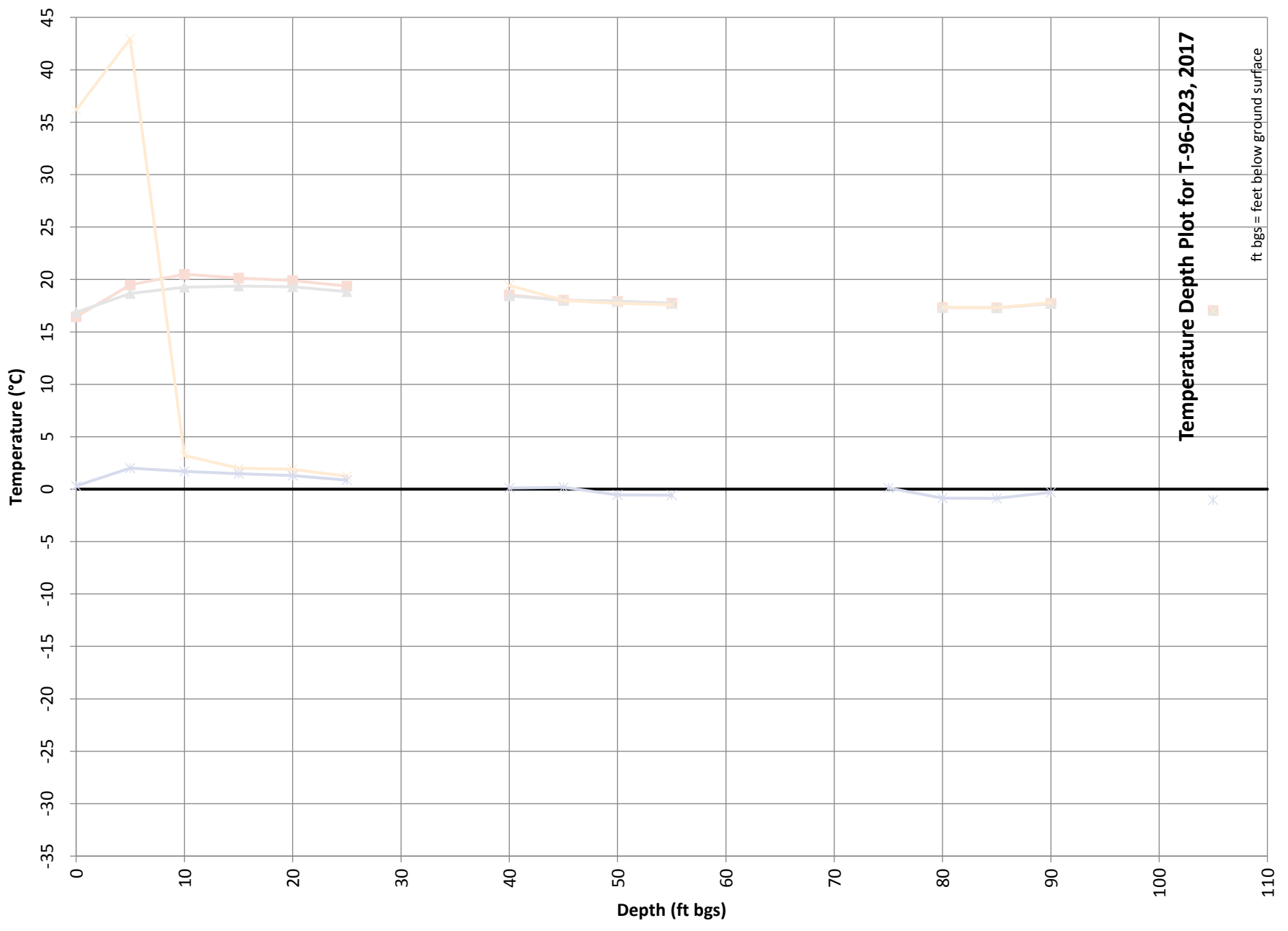


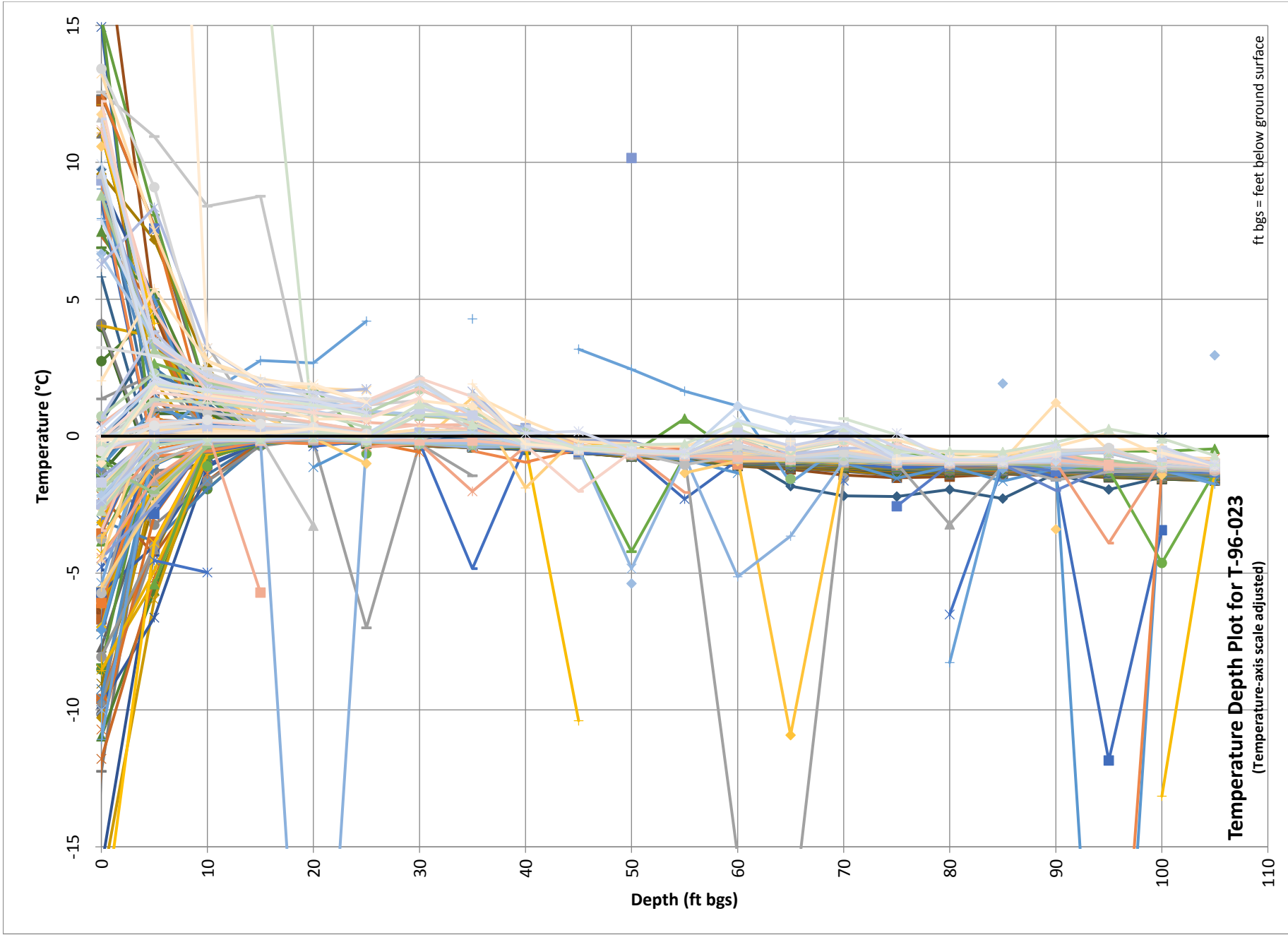
Temperature Depth Plot for T-96-022, 2017

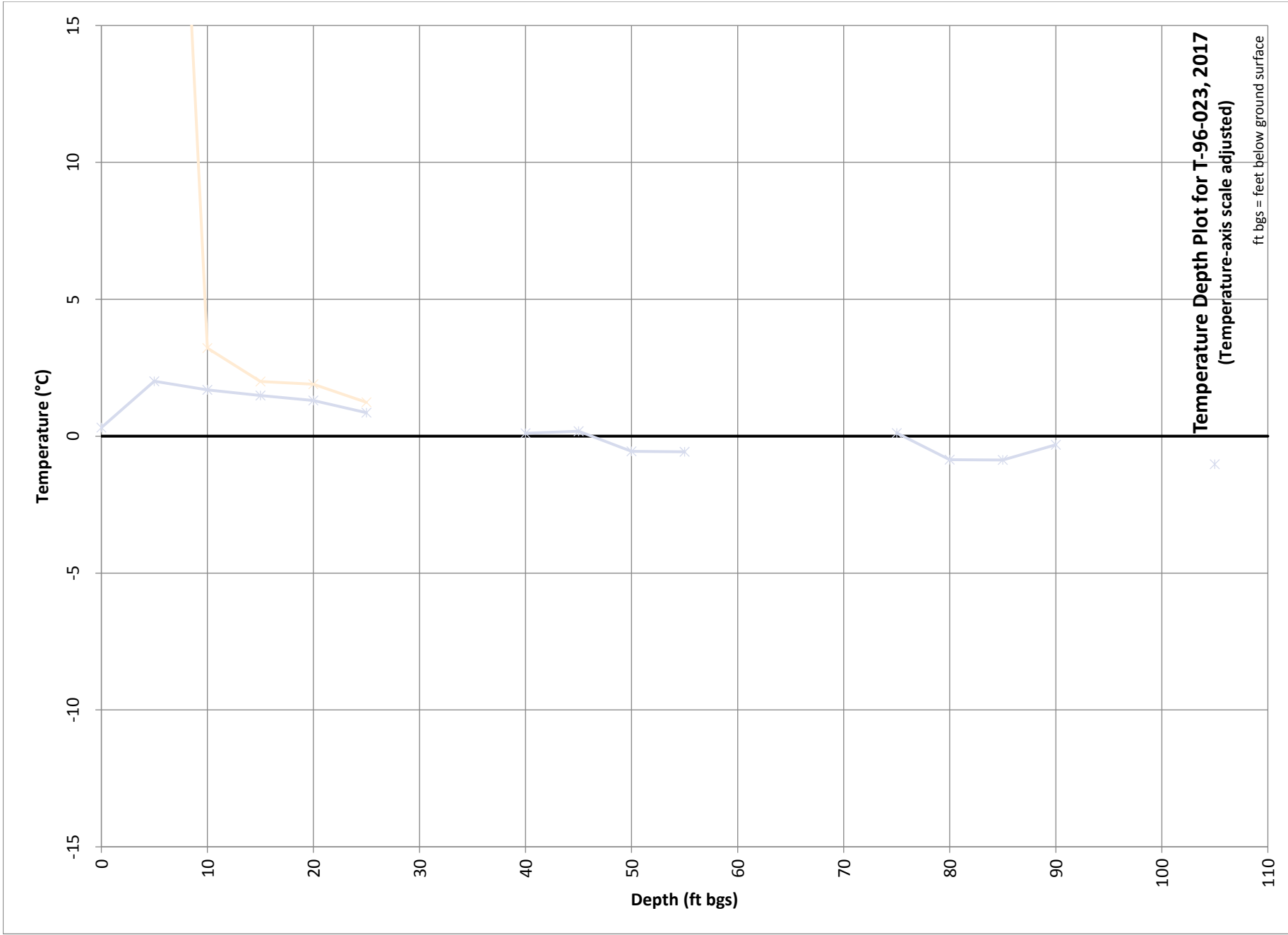


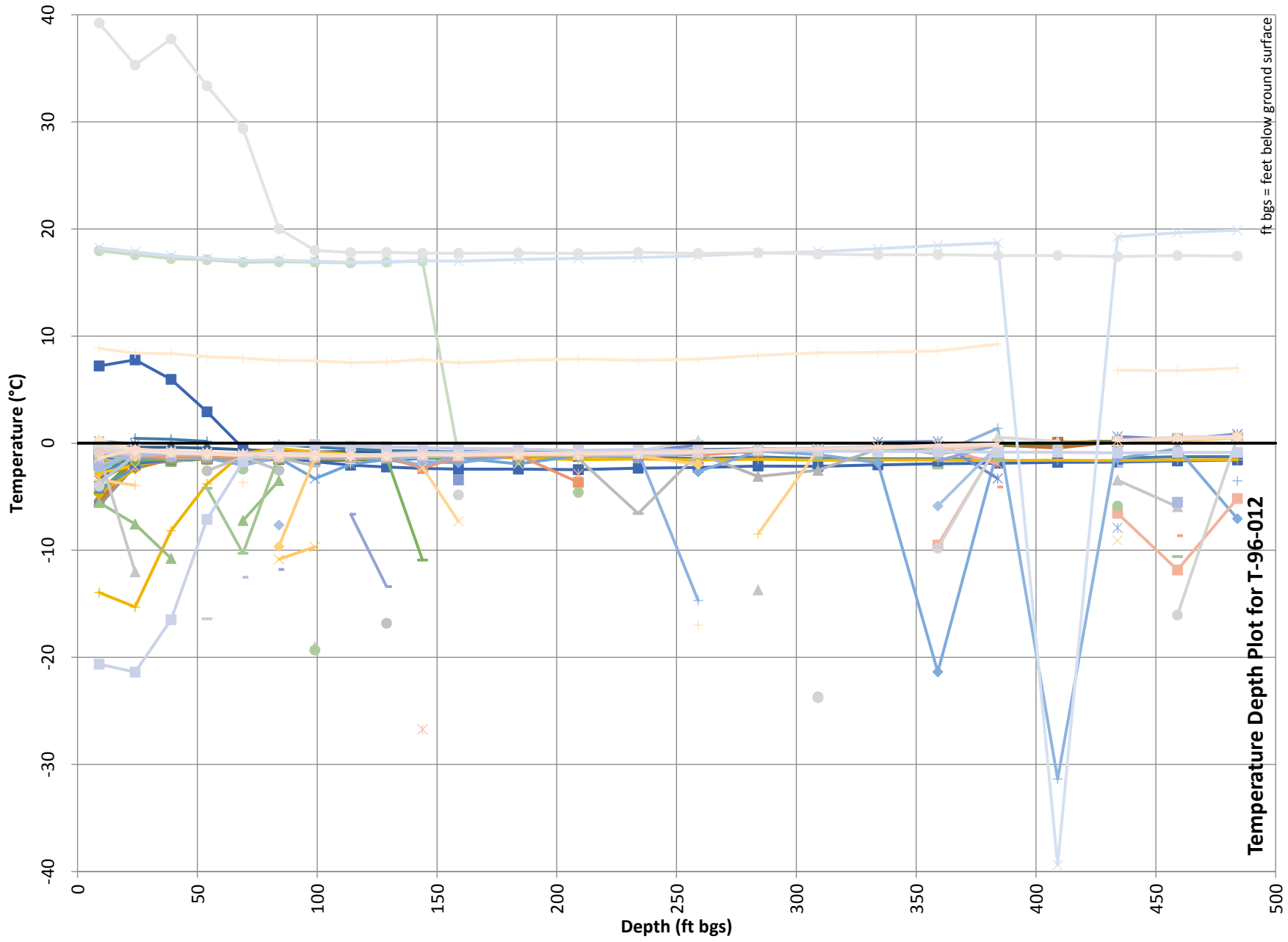




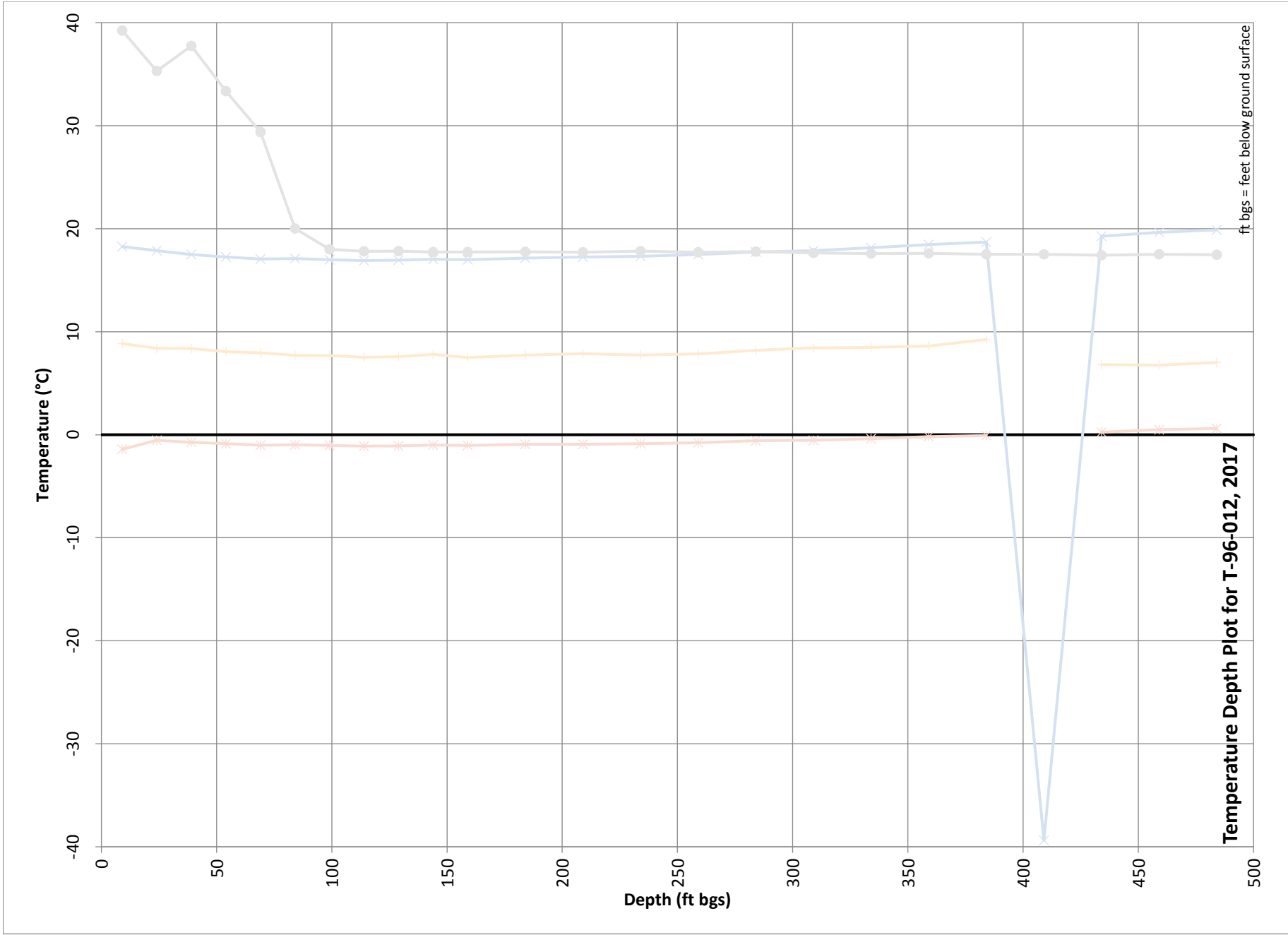


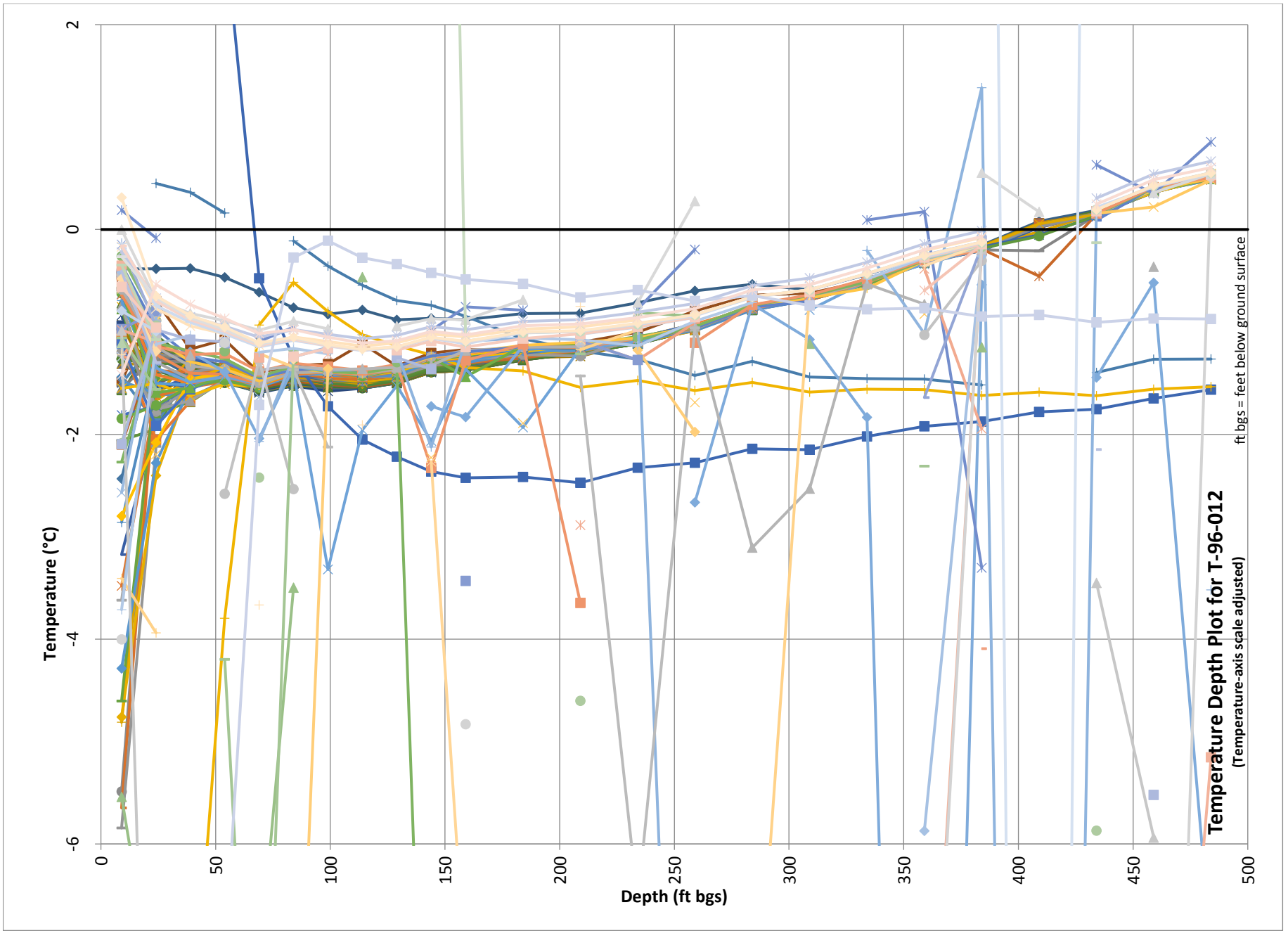


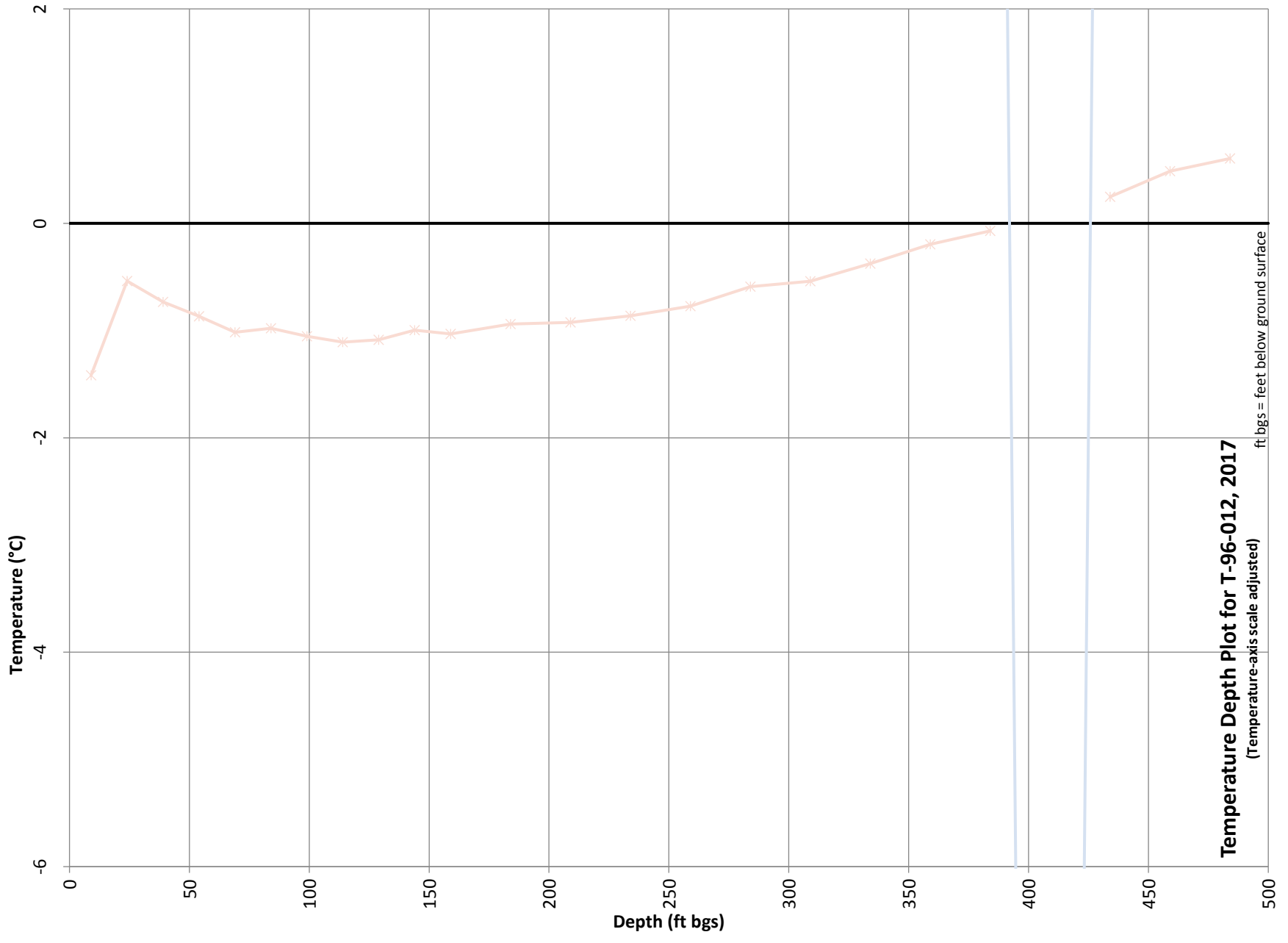




Temperature Depth Plot for T-96-012

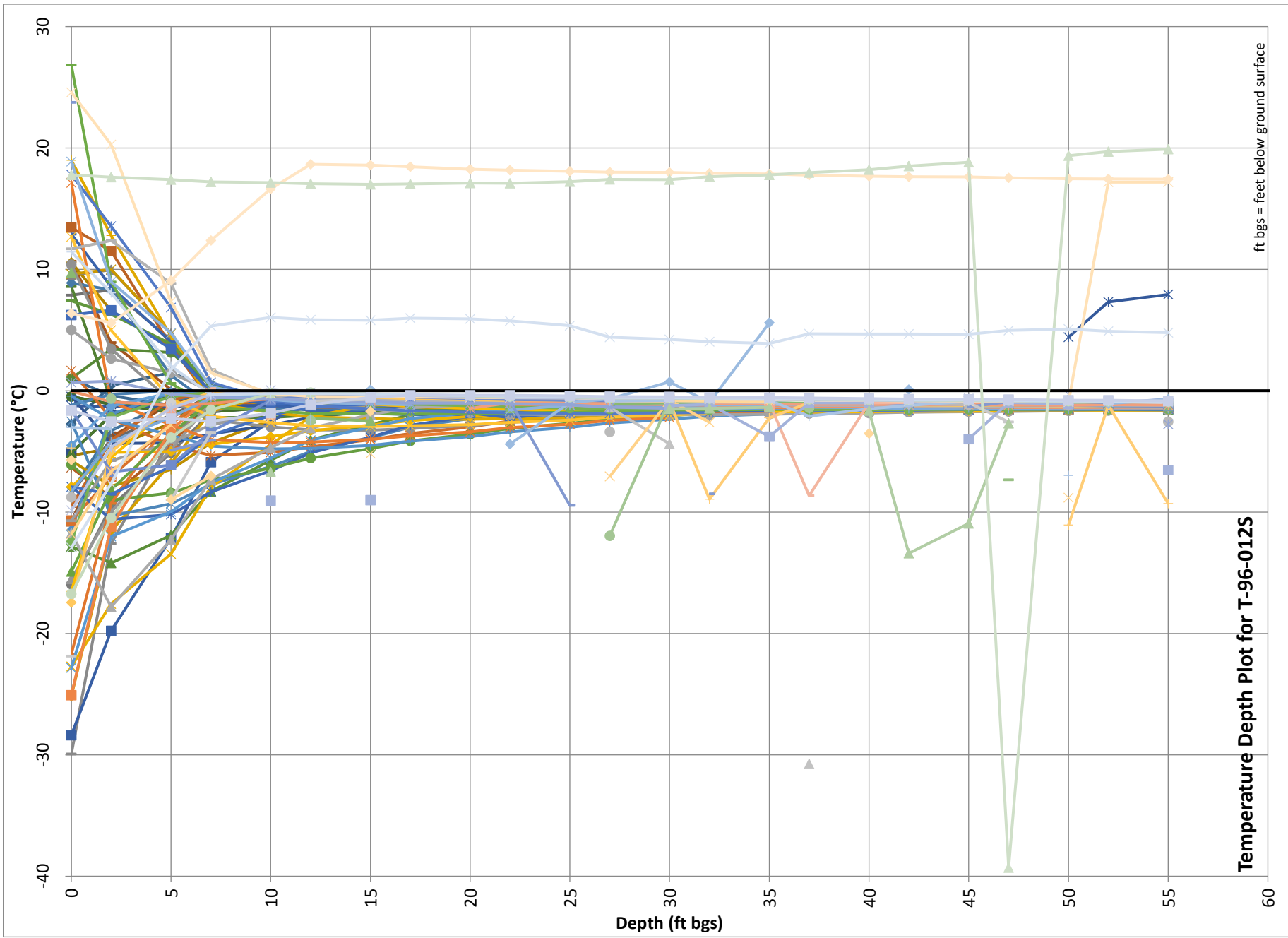


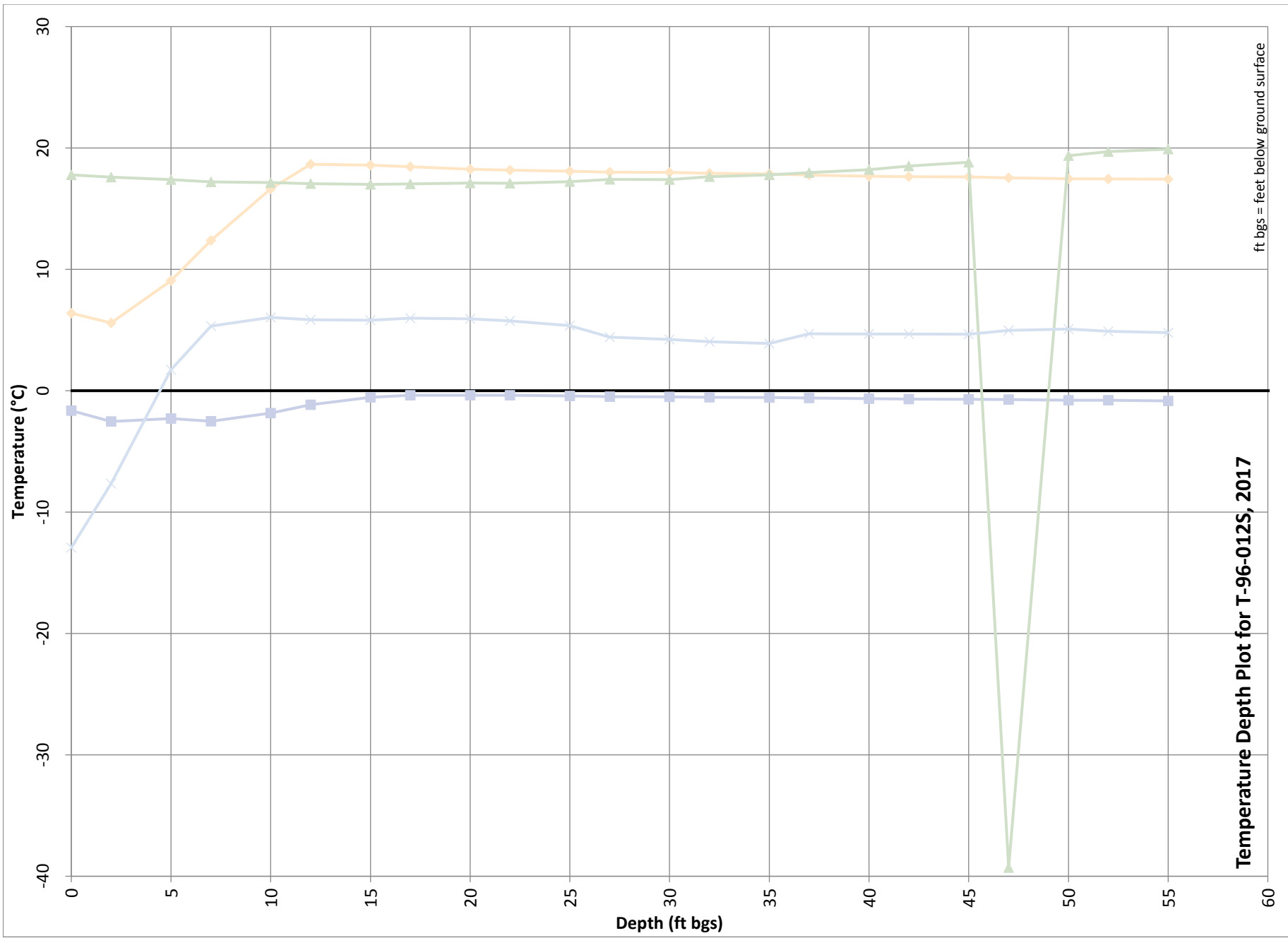


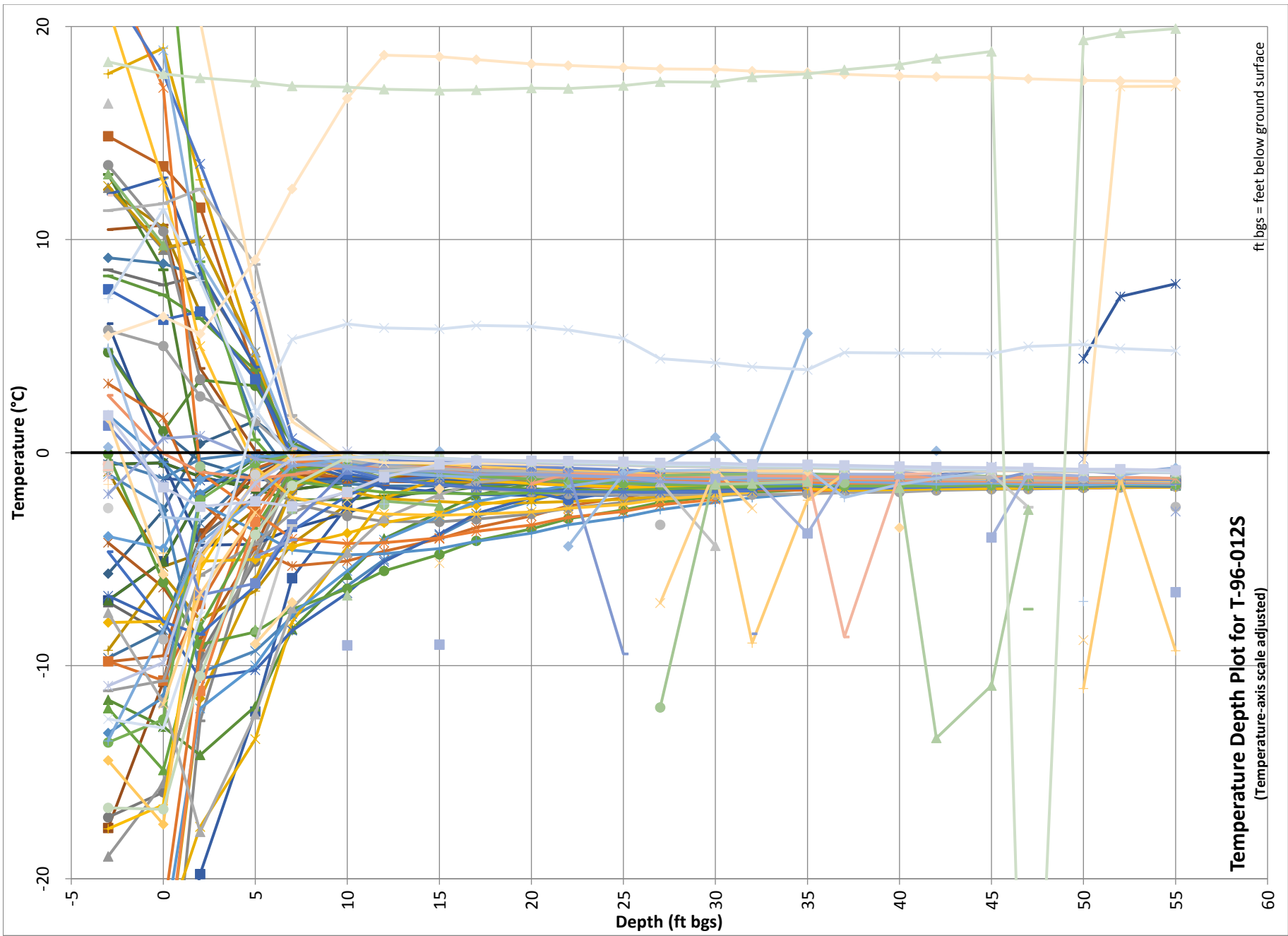


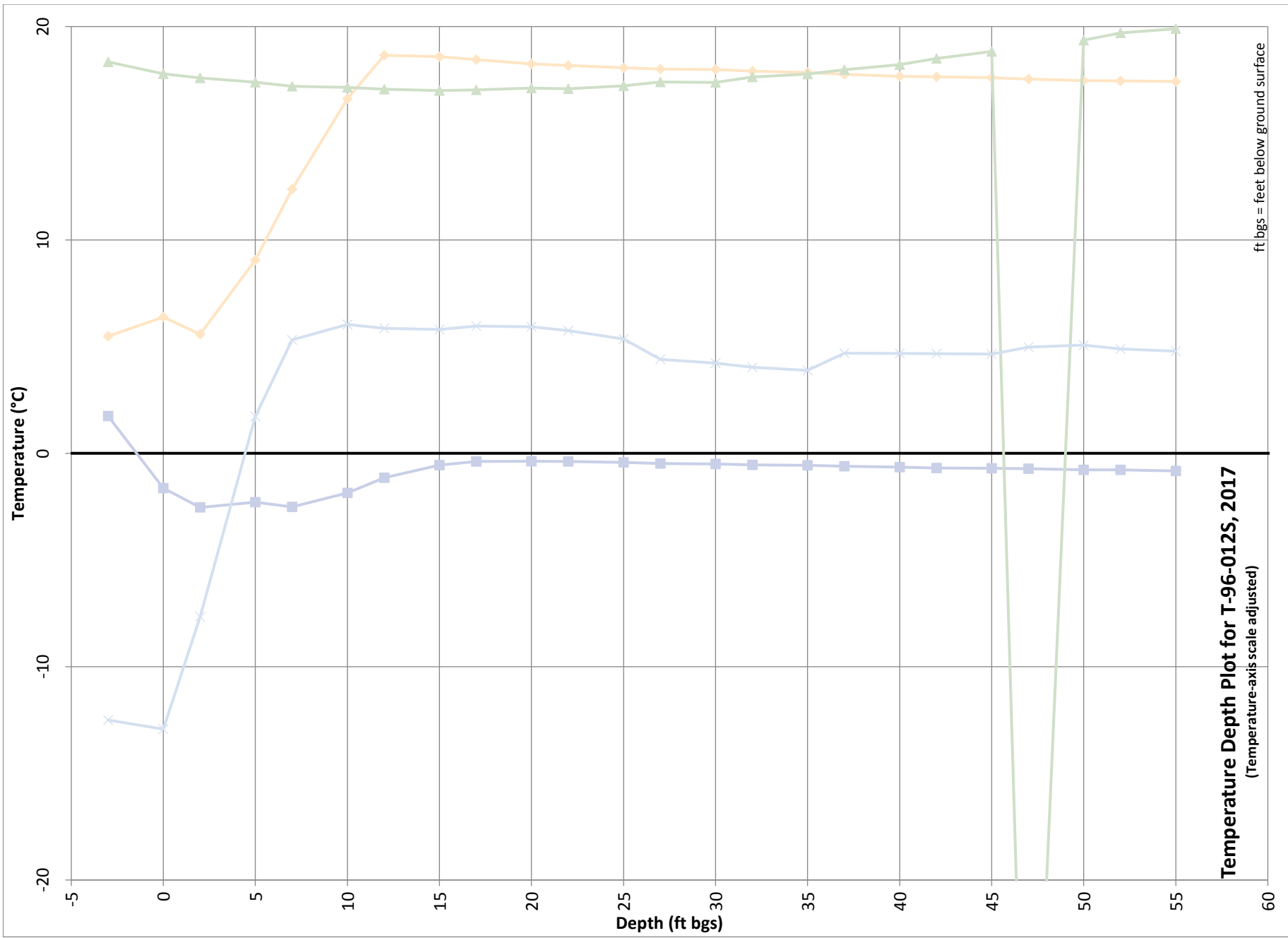
Temperature Depth Plot for T-96-012, 2017
(Temperature-axis scale adjusted)

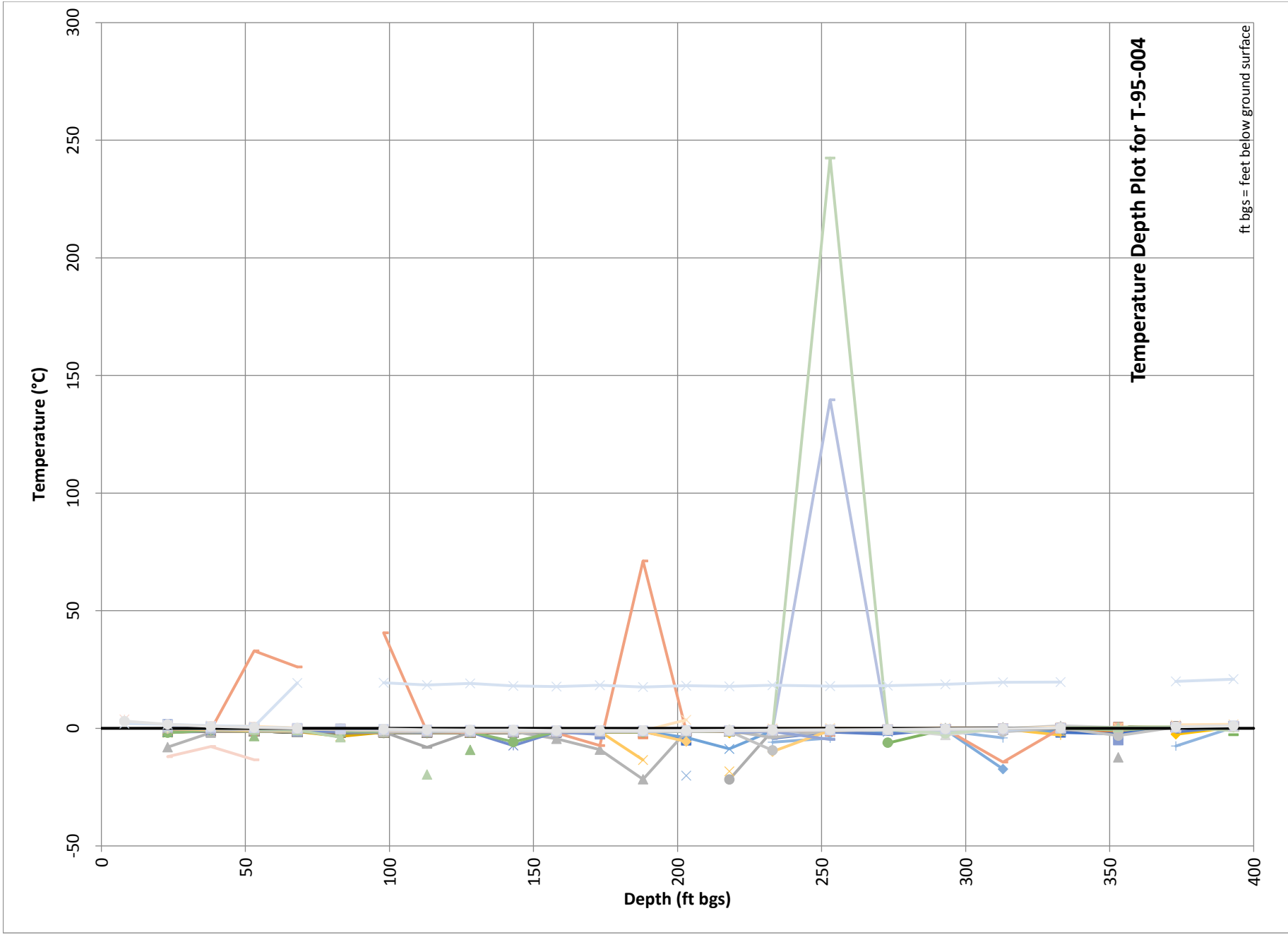
ft bgs = feet below ground surface

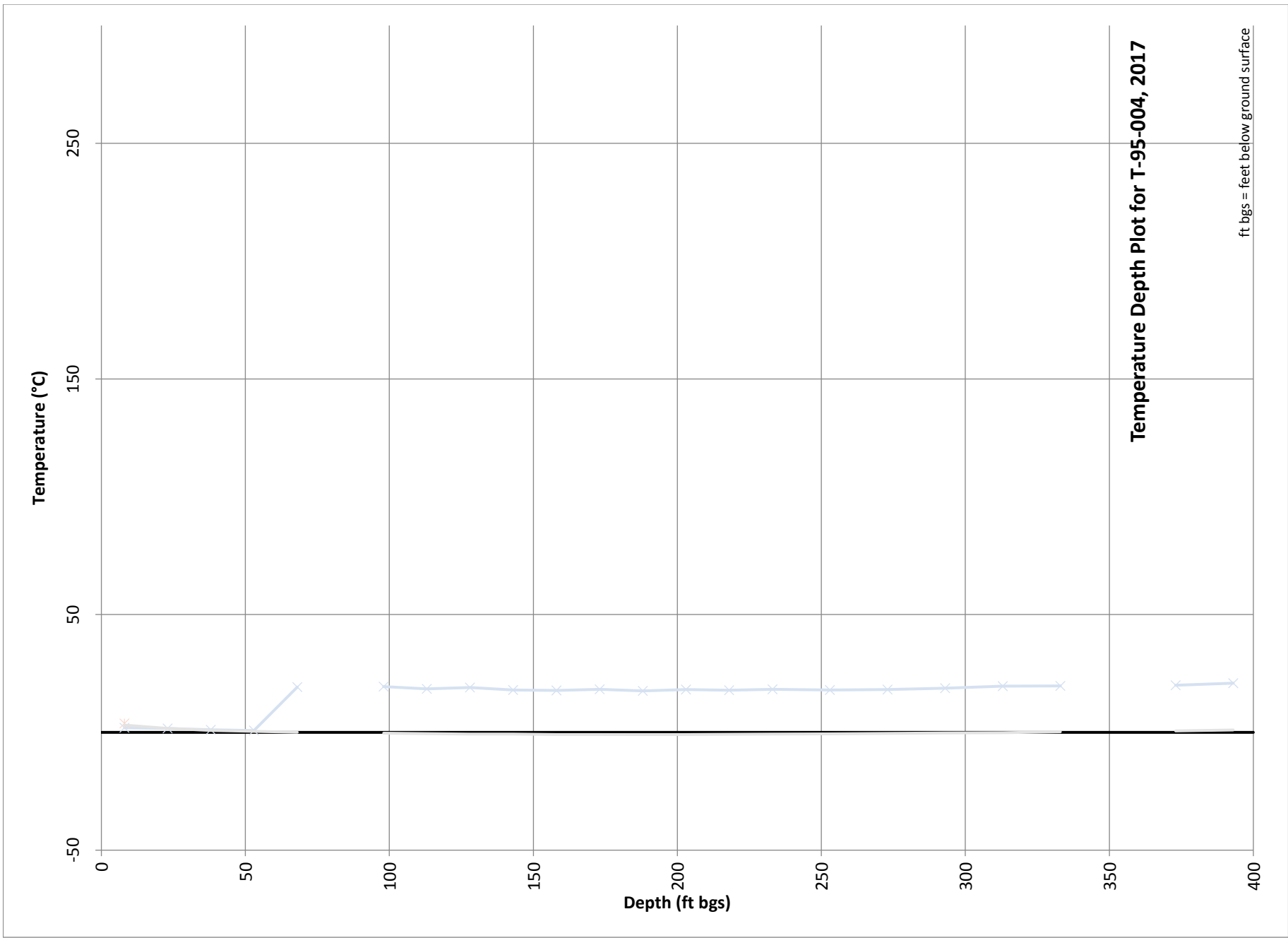


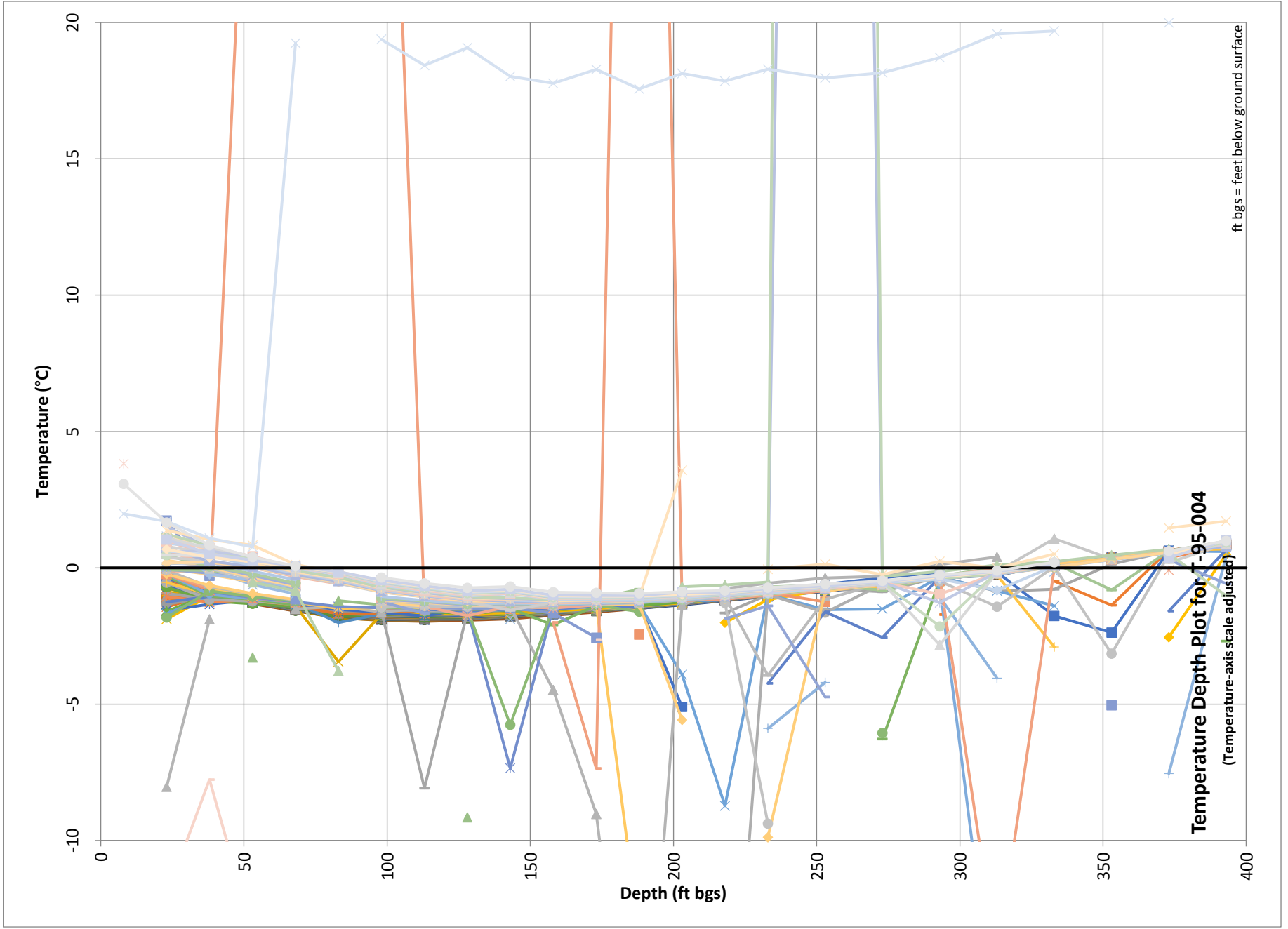


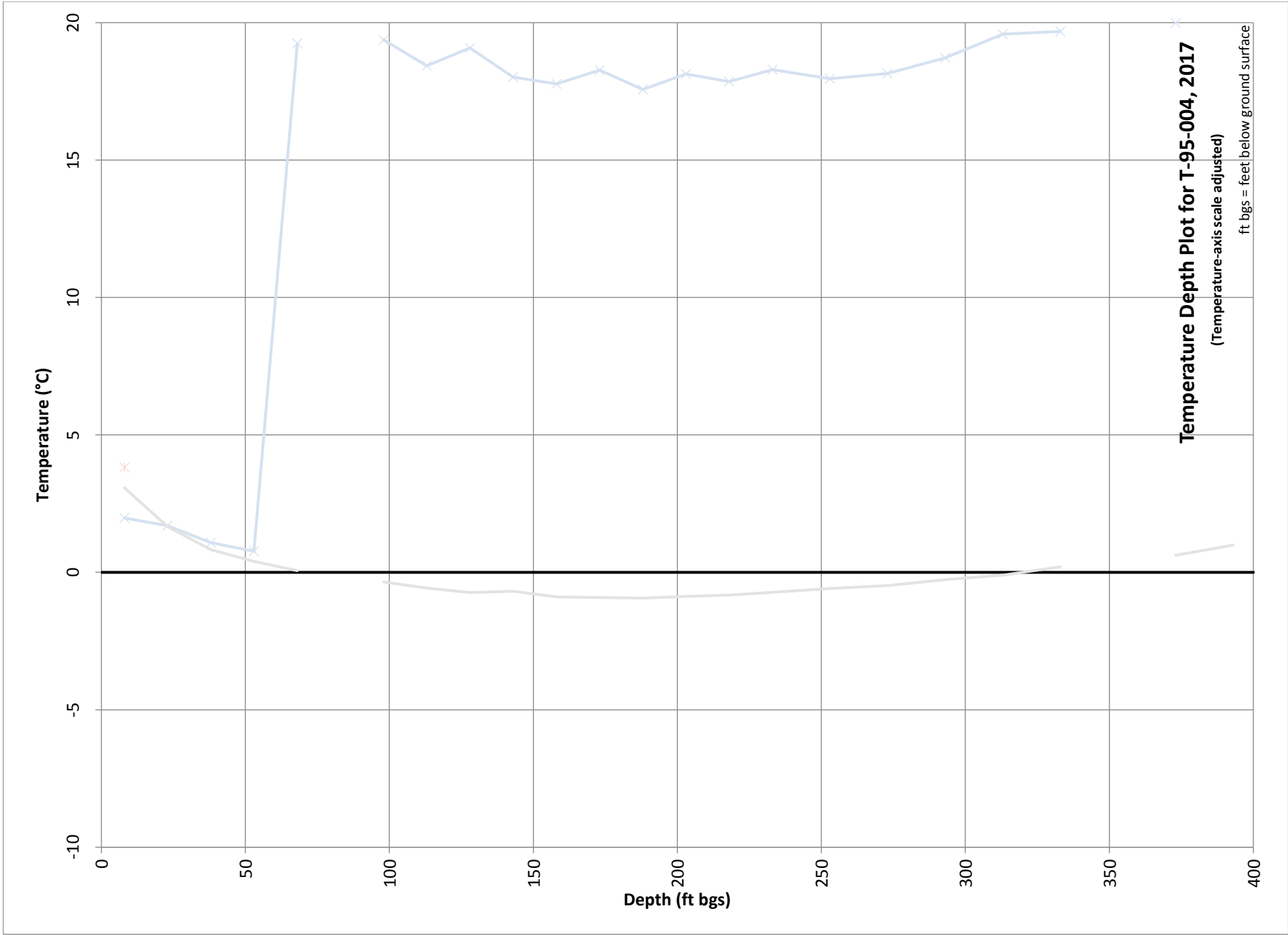






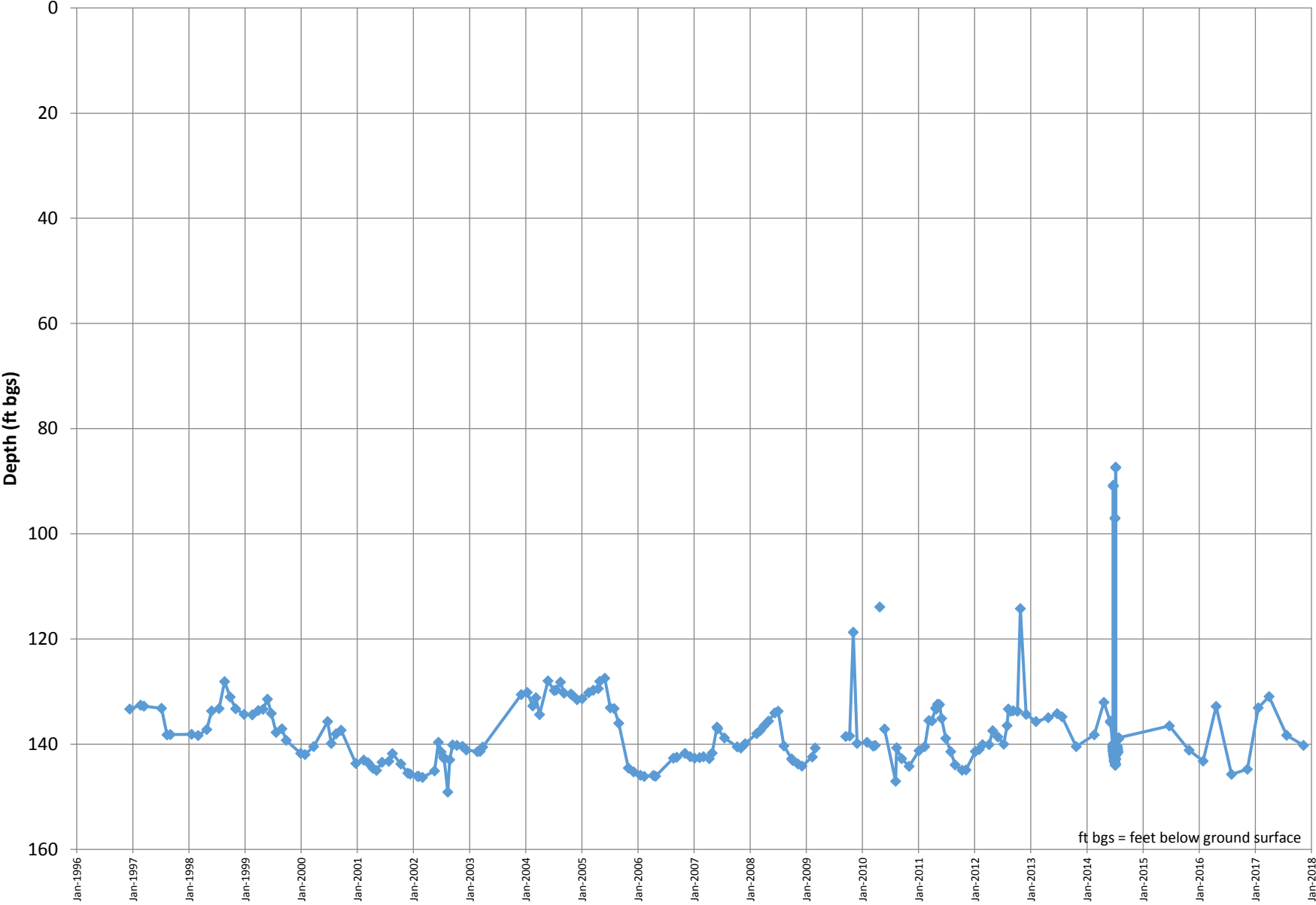




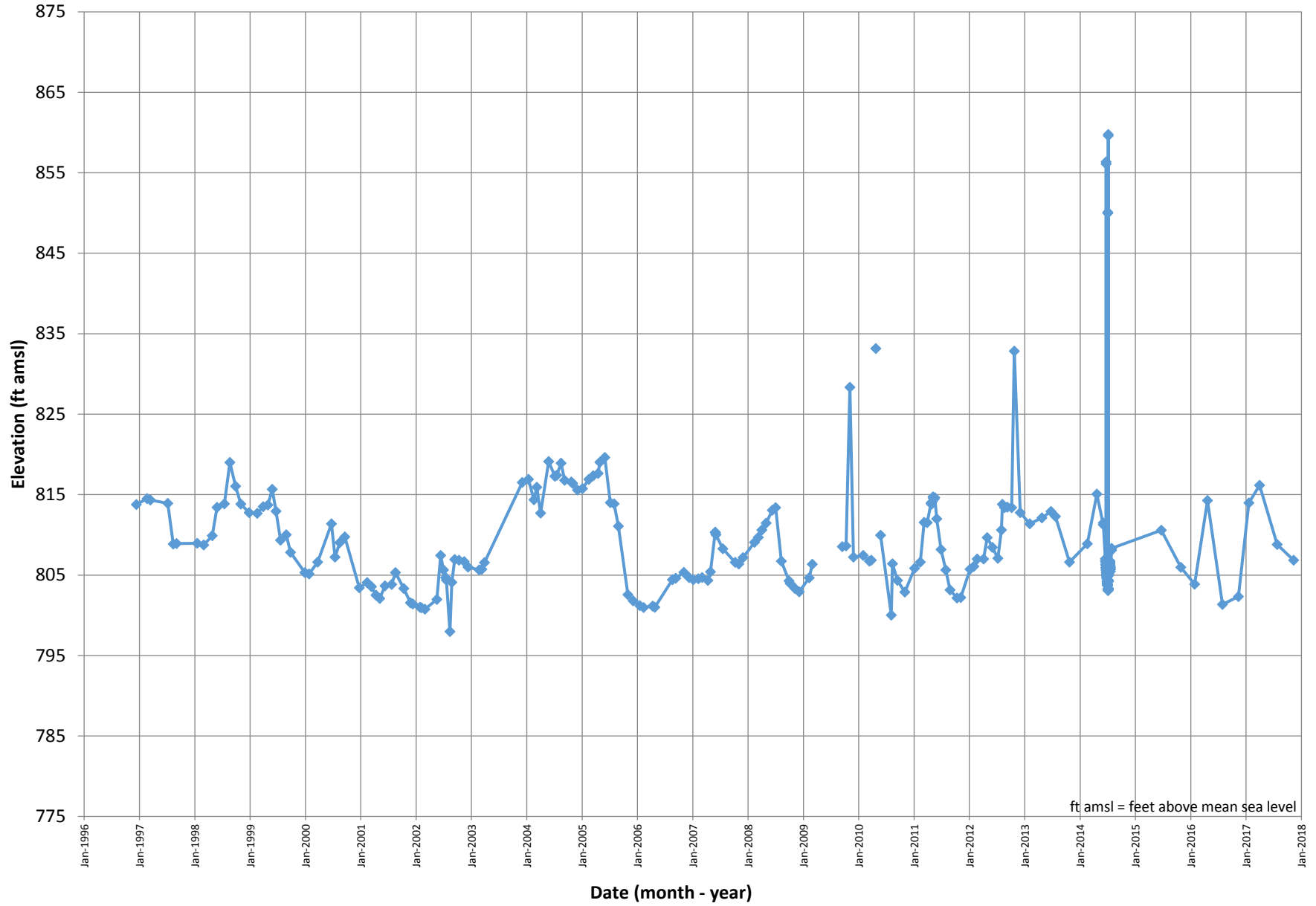


Appendix C Piezometer Plots

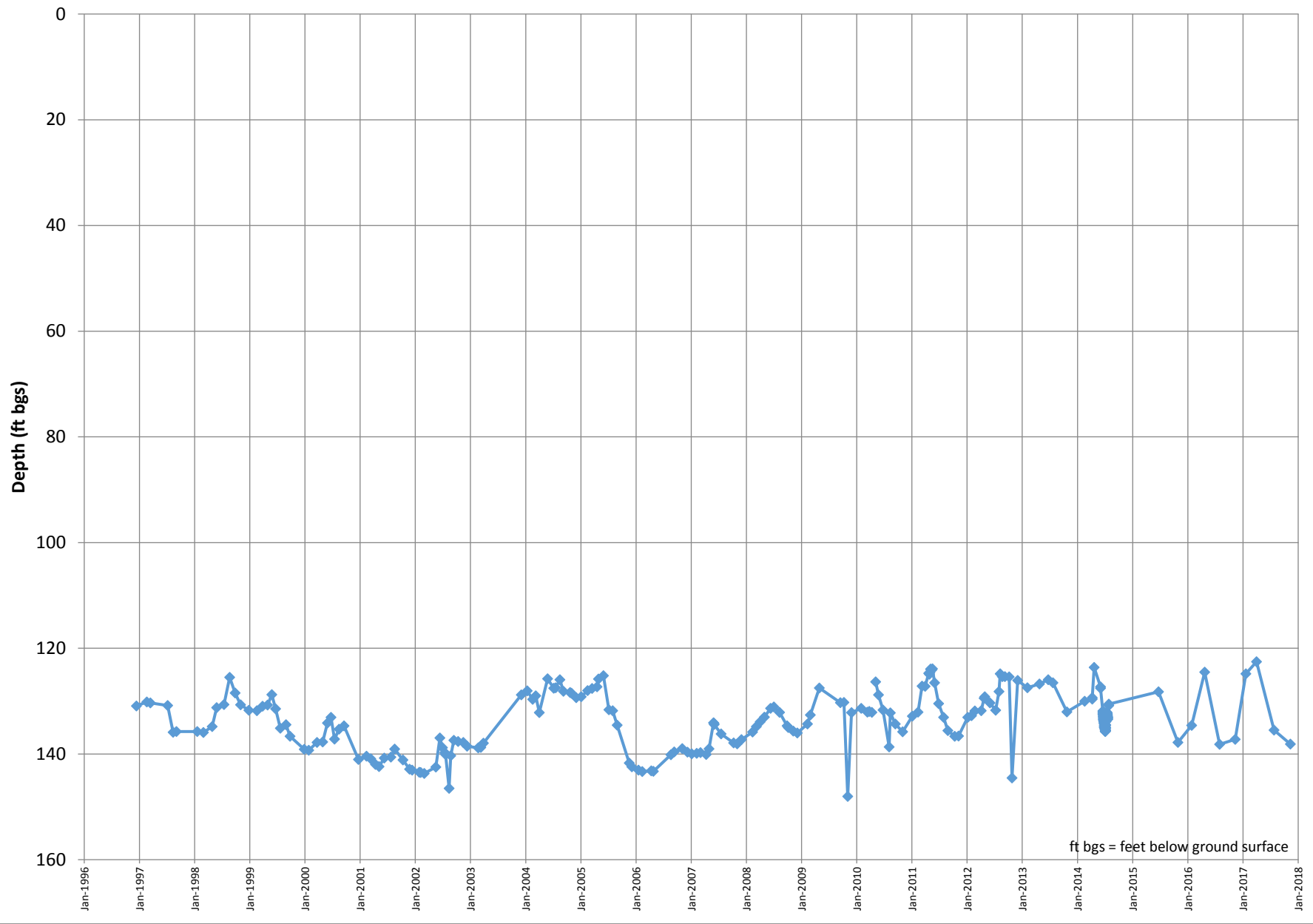
Depth Hydrograph for P-08A



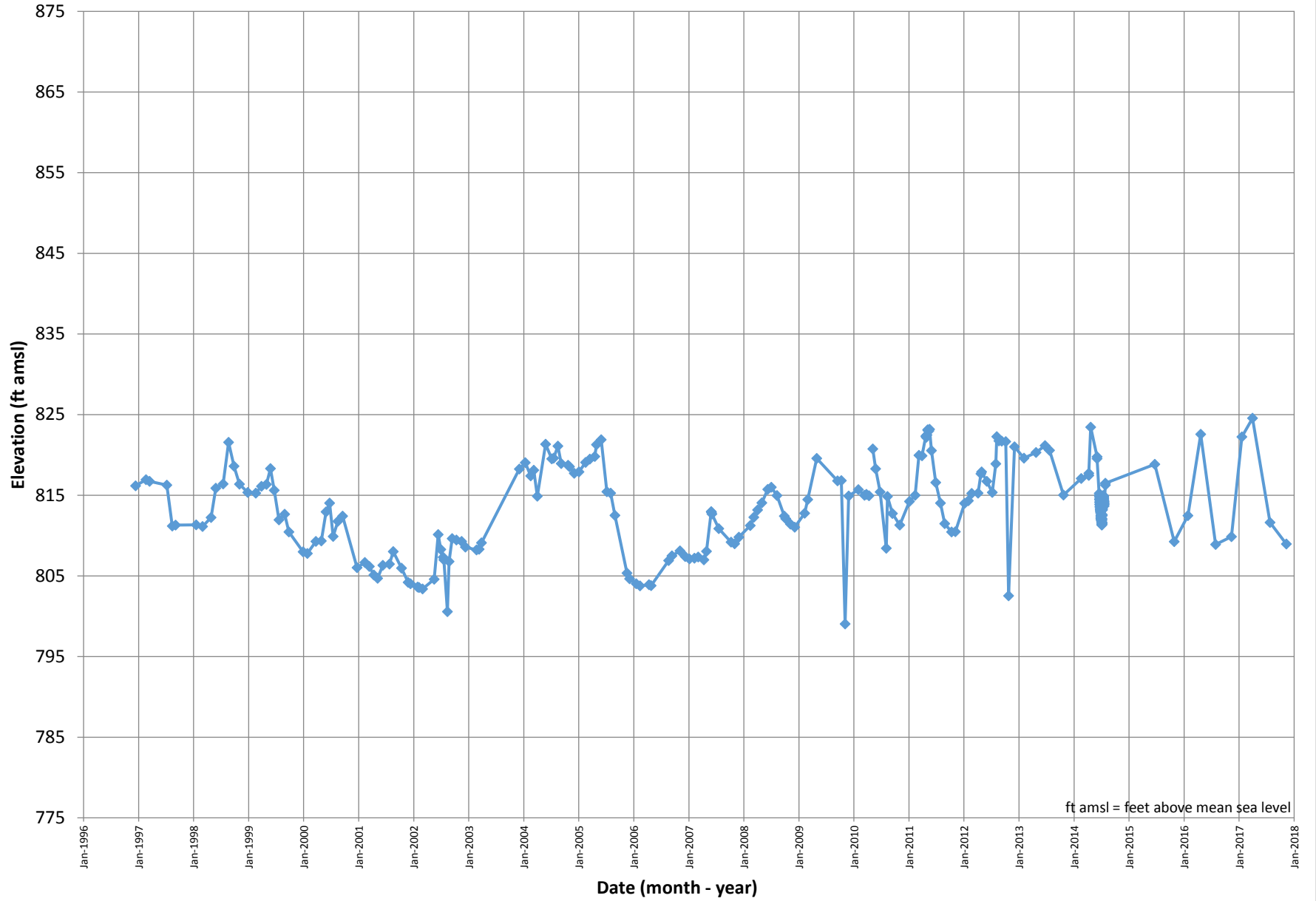
Elevation Hydrograph for P-08A



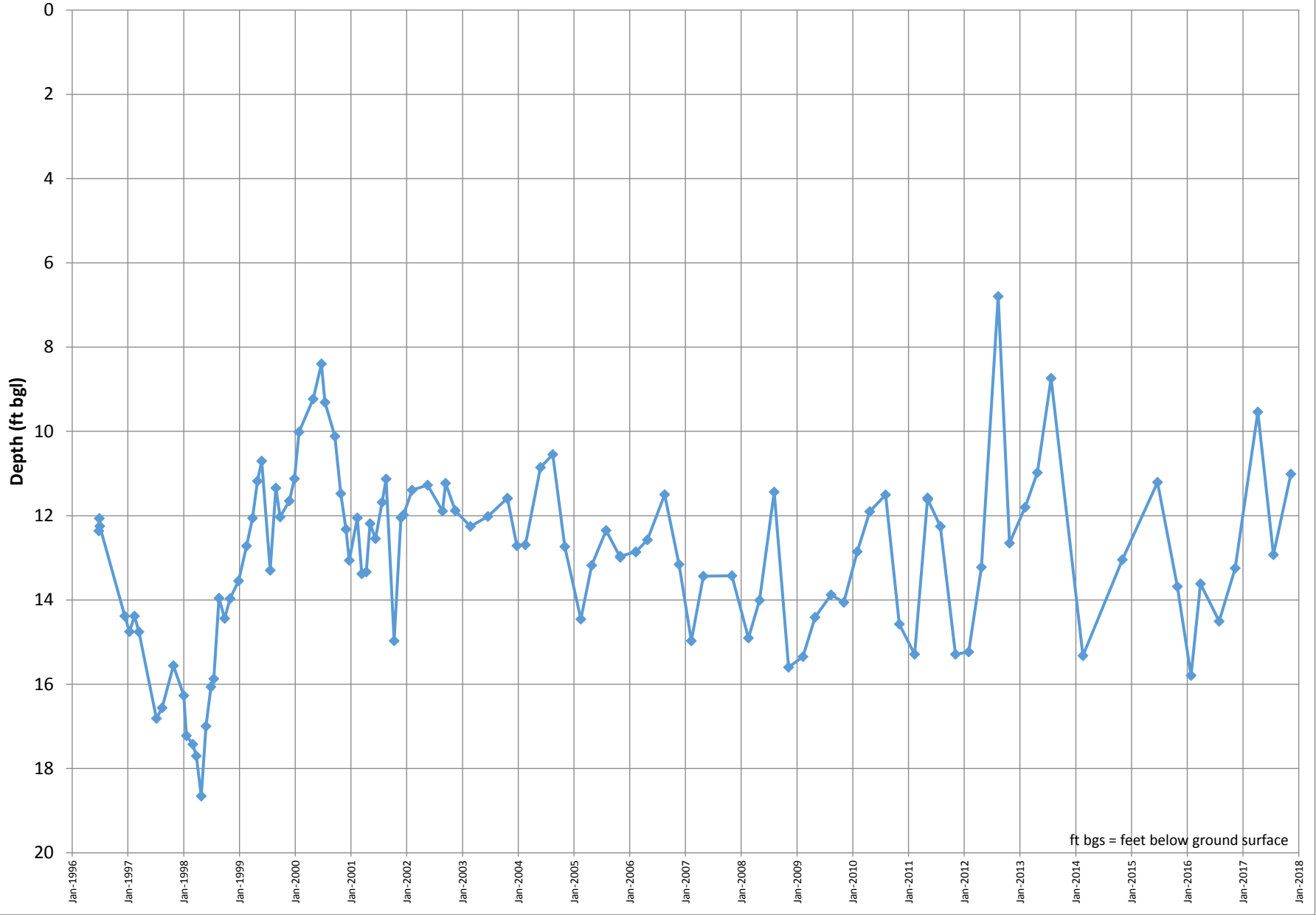
Depth Hydrograph for P-08B



Elevation Hydrograph for P-08B

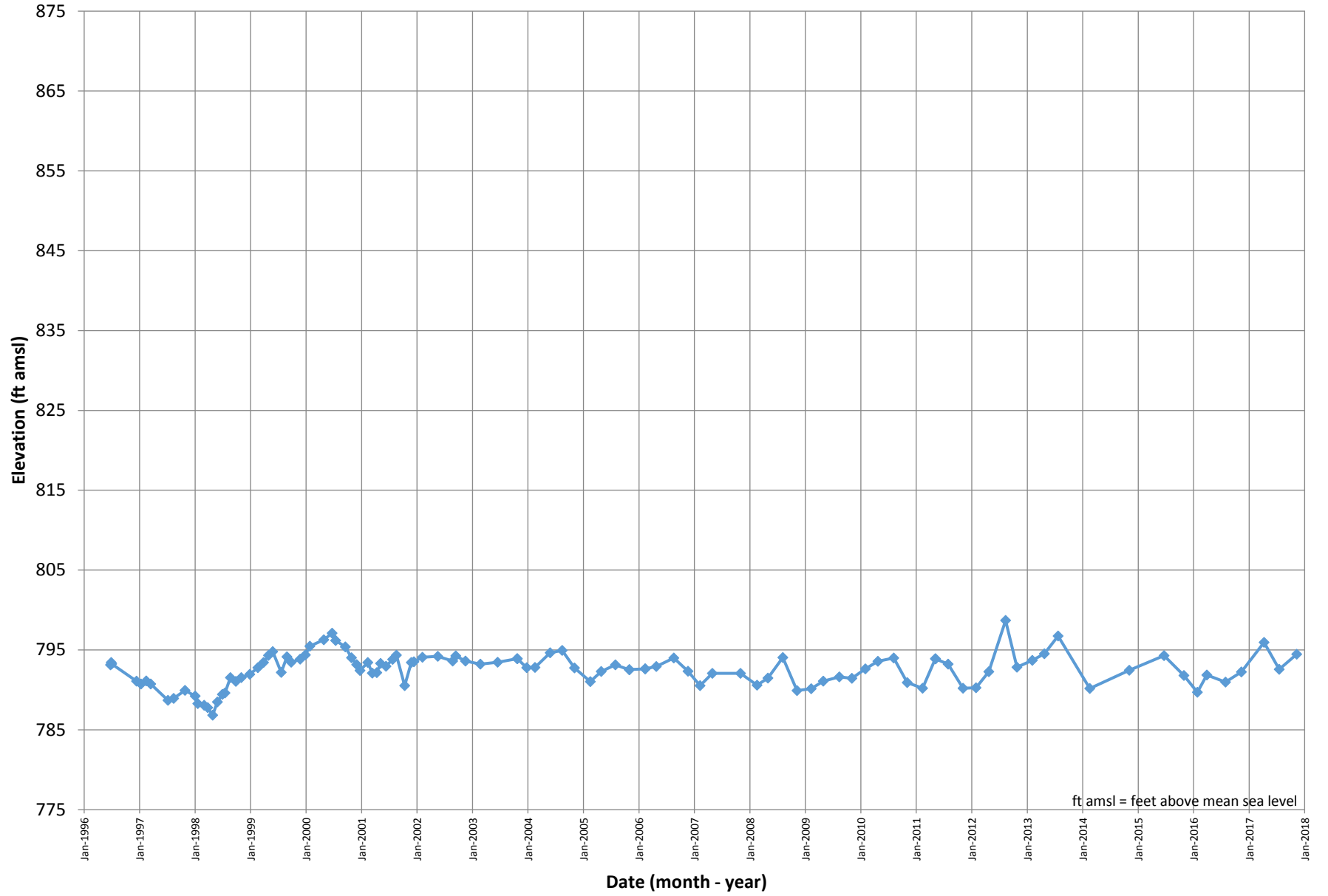


Depth Hydrograph for P-96-010

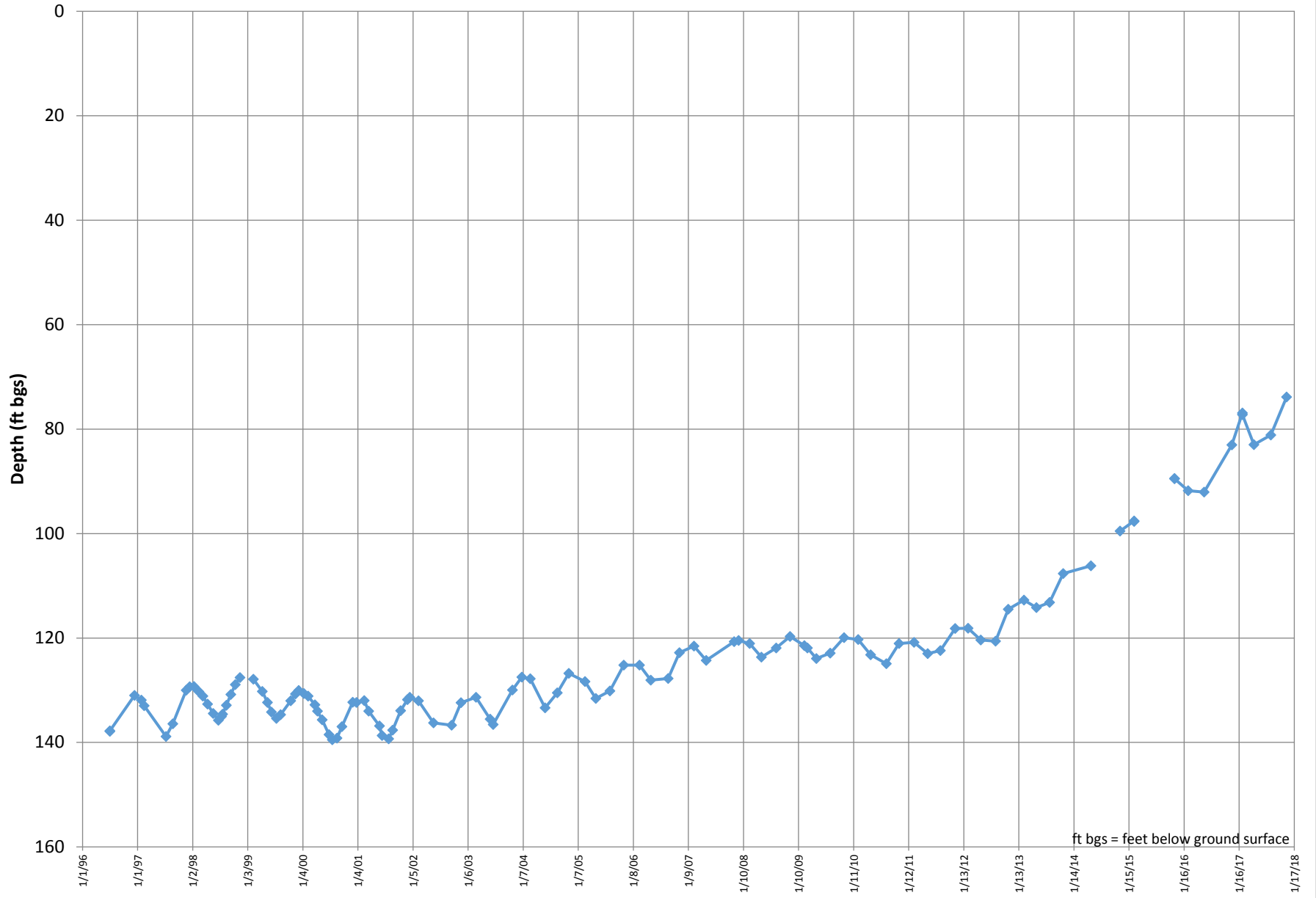


ft bgs = feet below ground surface

Elevation Hydrograph for P-96-010

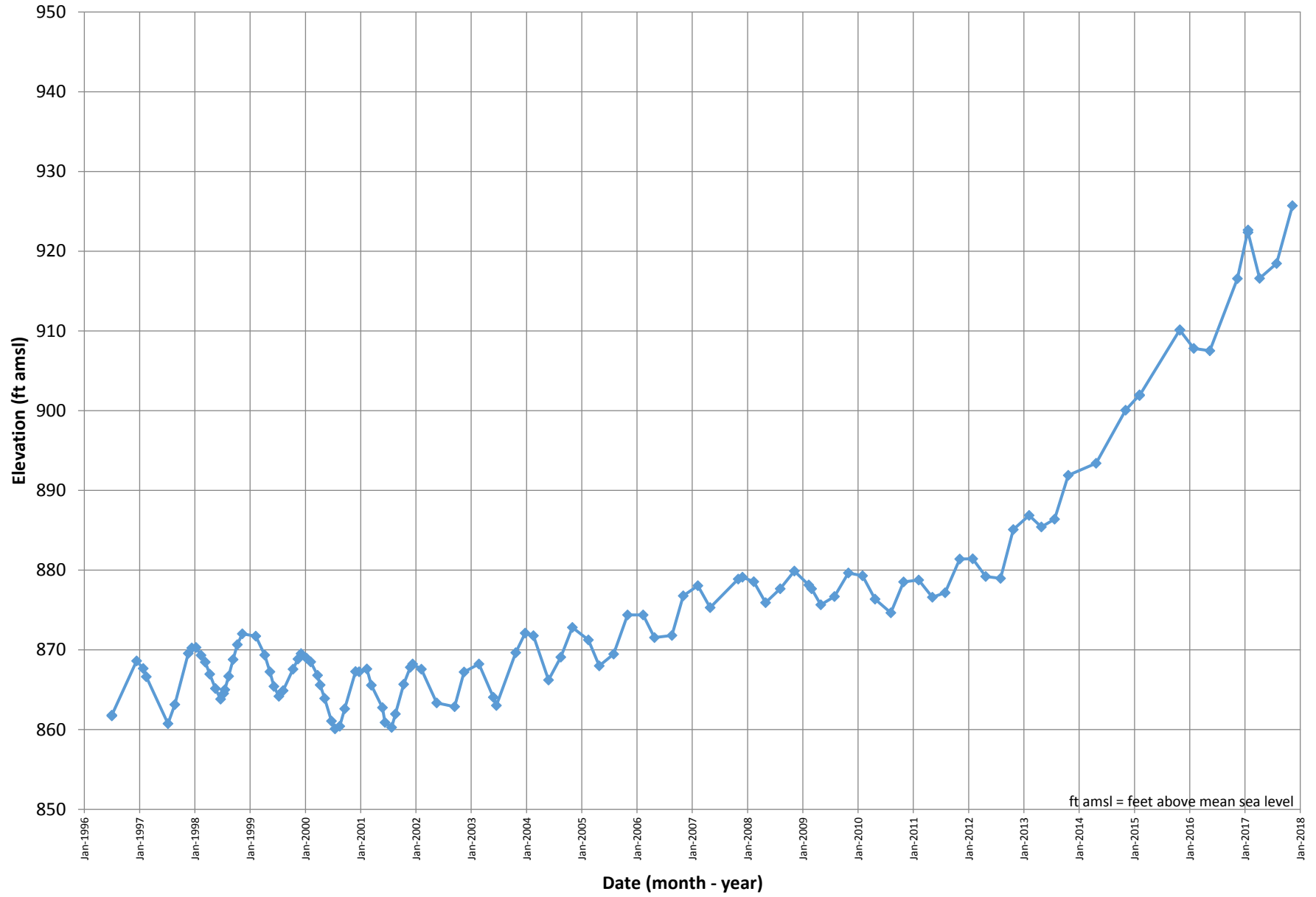


Depth Hydrograph for P-96-013



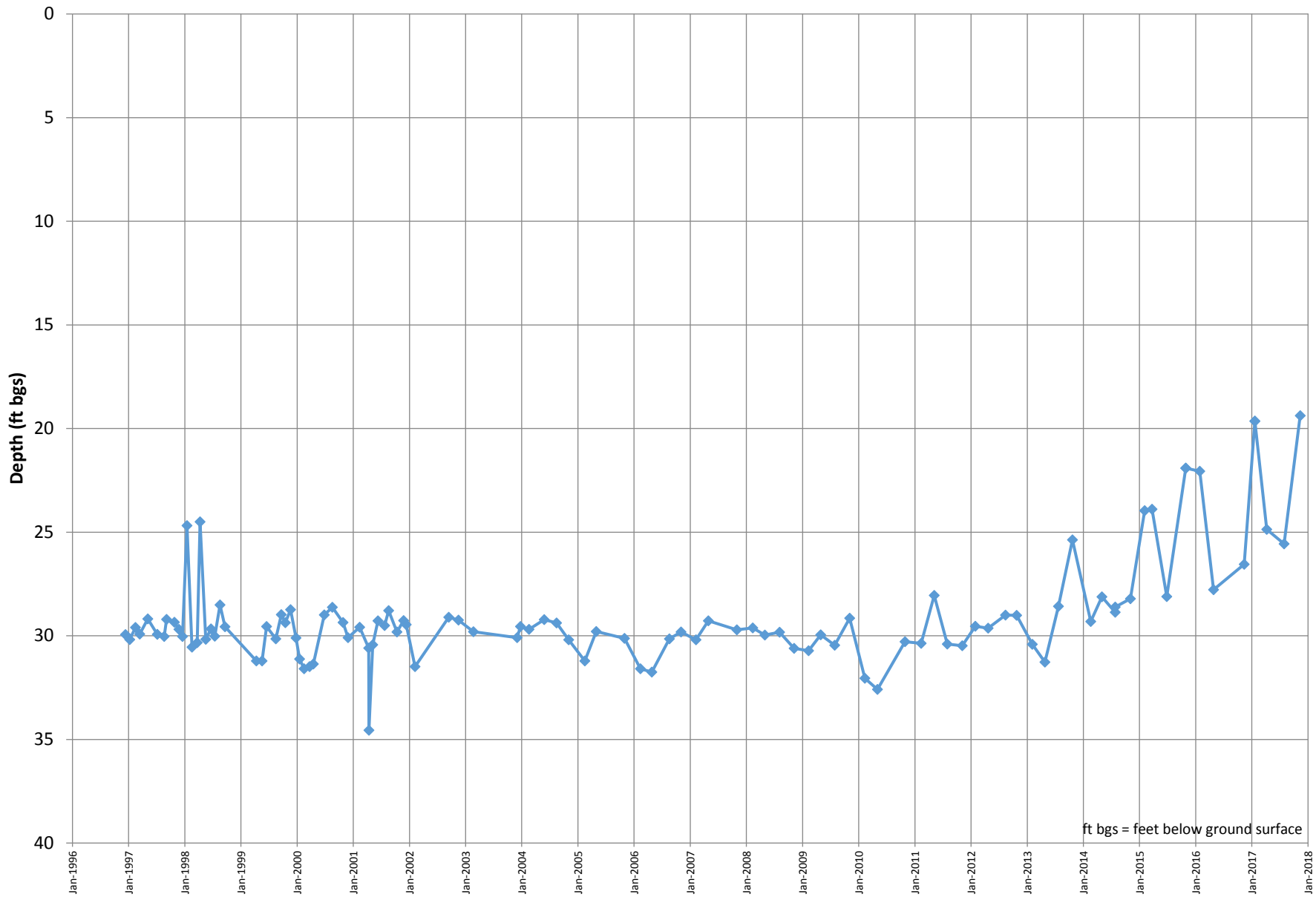
ft bgs = feet below ground surface

Elevation Hydrograph for P-96-013

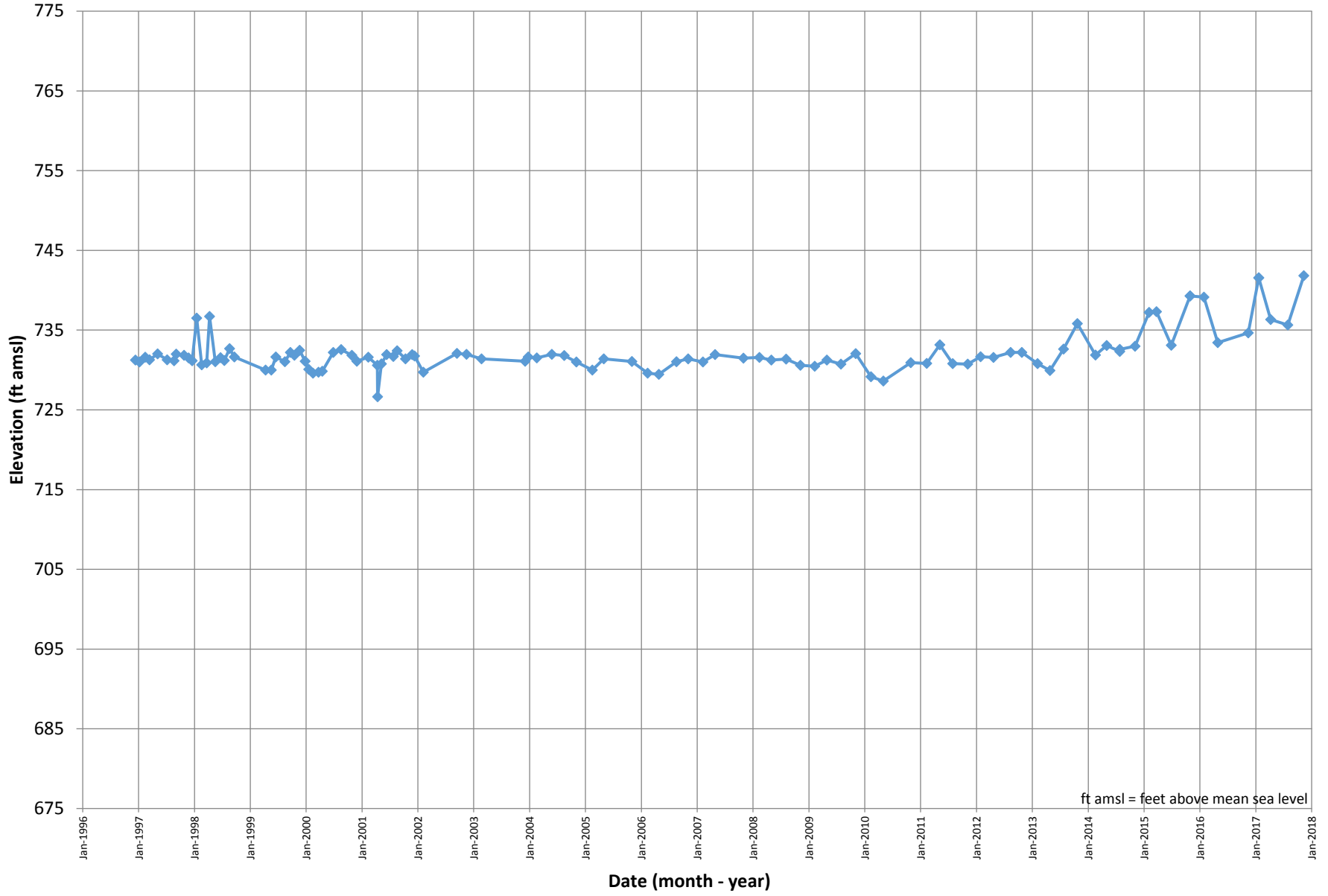


ft amsl = feet above mean sea level

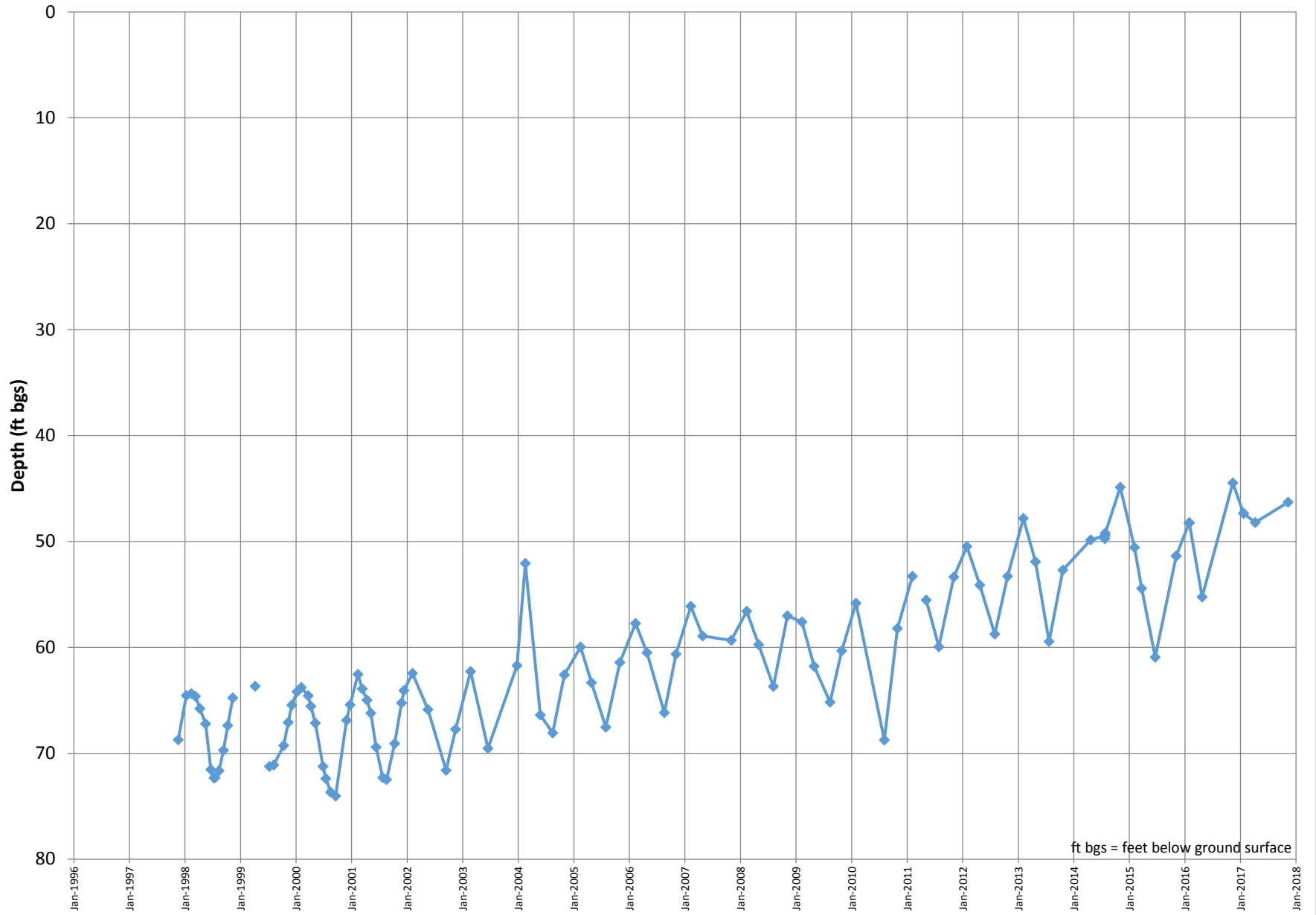
Depth Hydrograph for P-96-015



Elevation Hydrograph for P-96-015

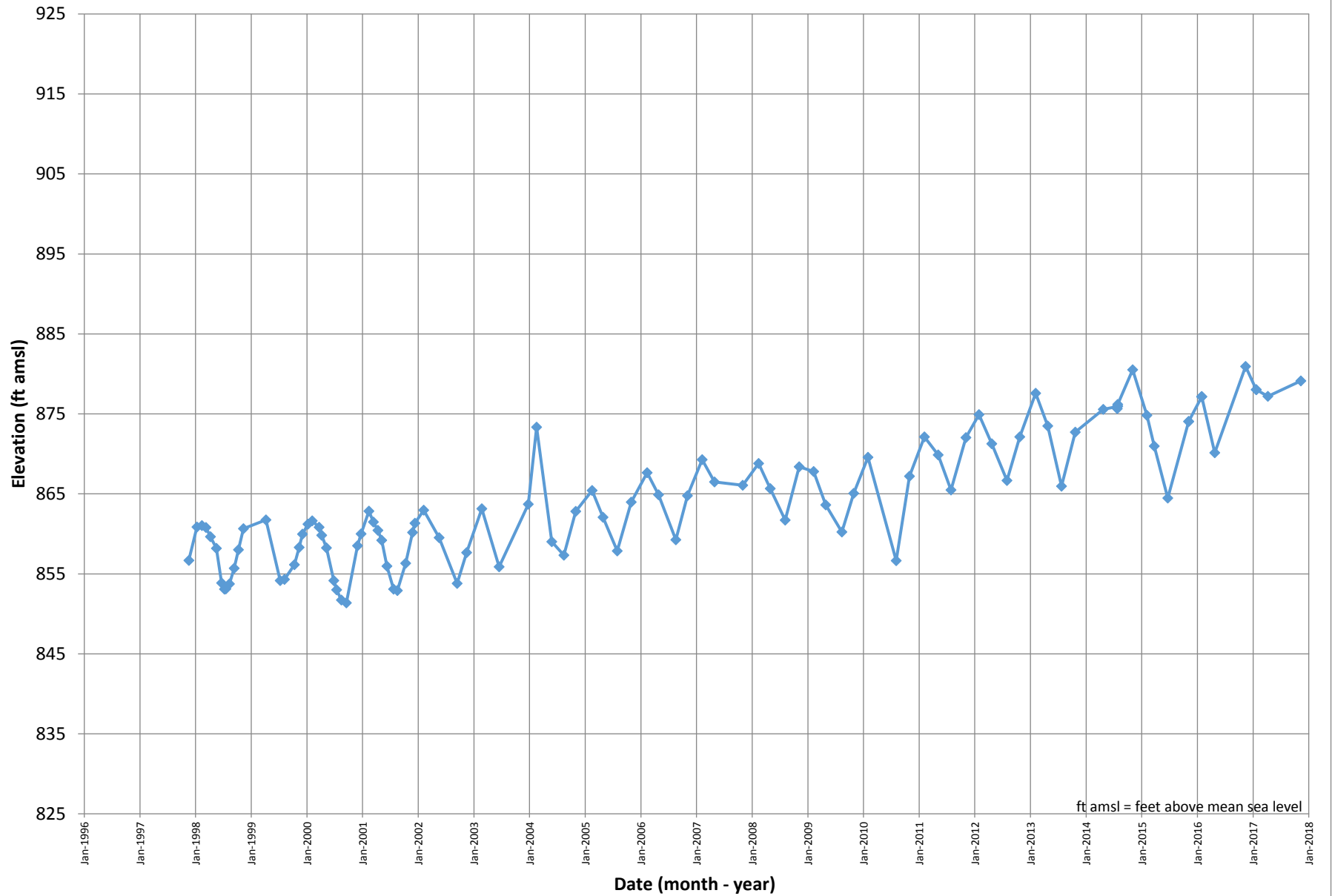


Depth Hydrograph for P-97-012

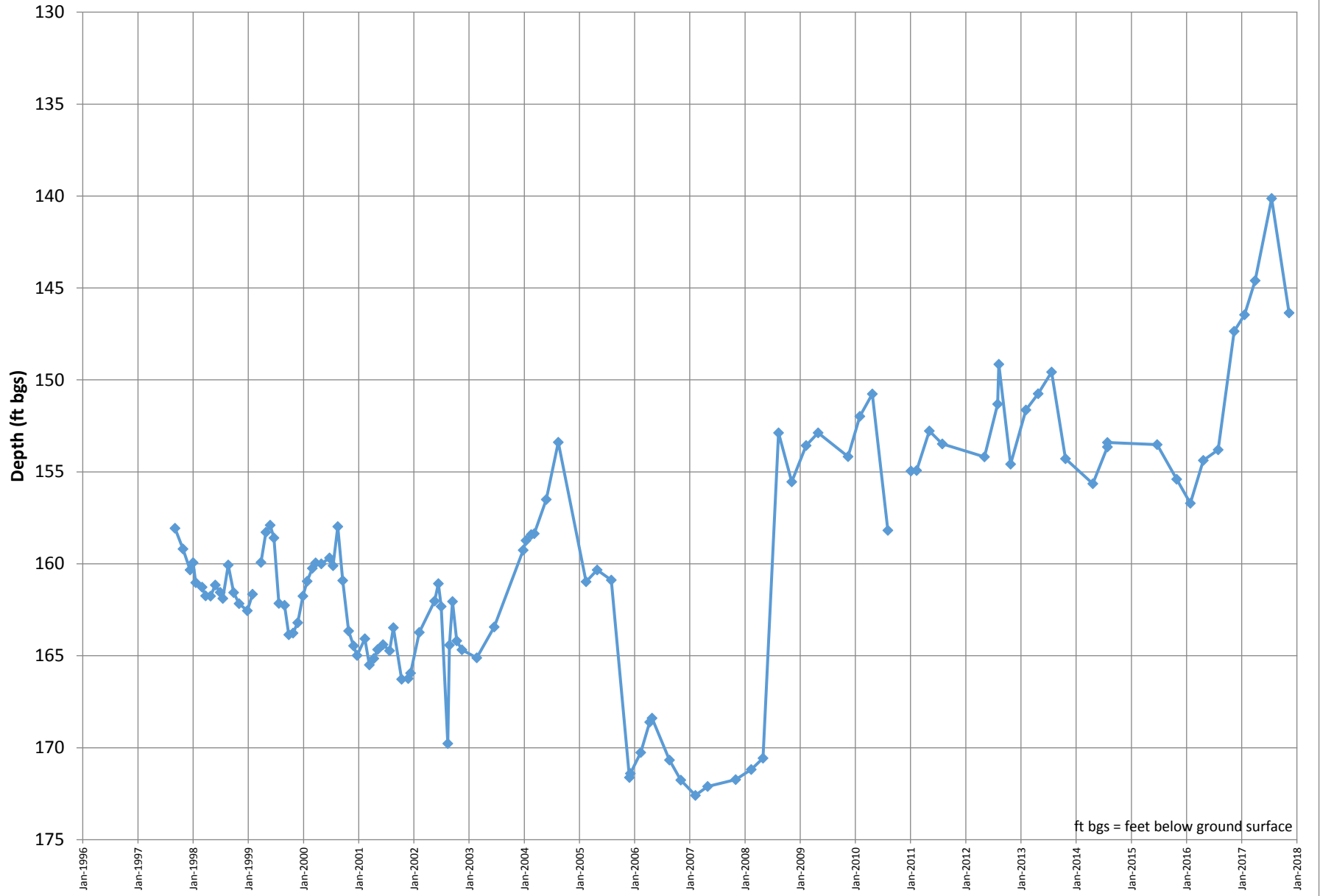


ft bgs = feet below ground surface

Elevation Hydrograph for P-97-012

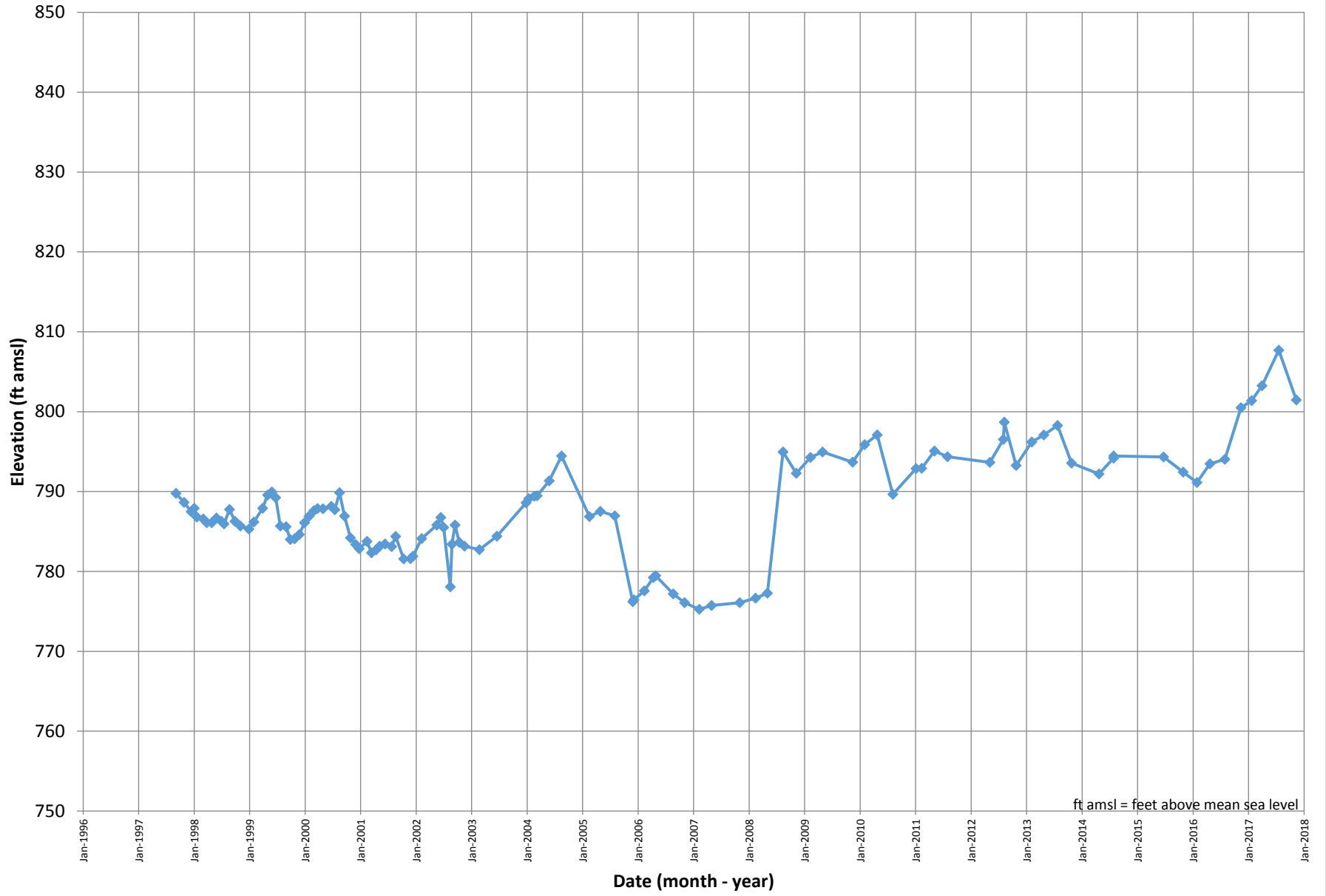


Depth Hydrograph for P-97-020



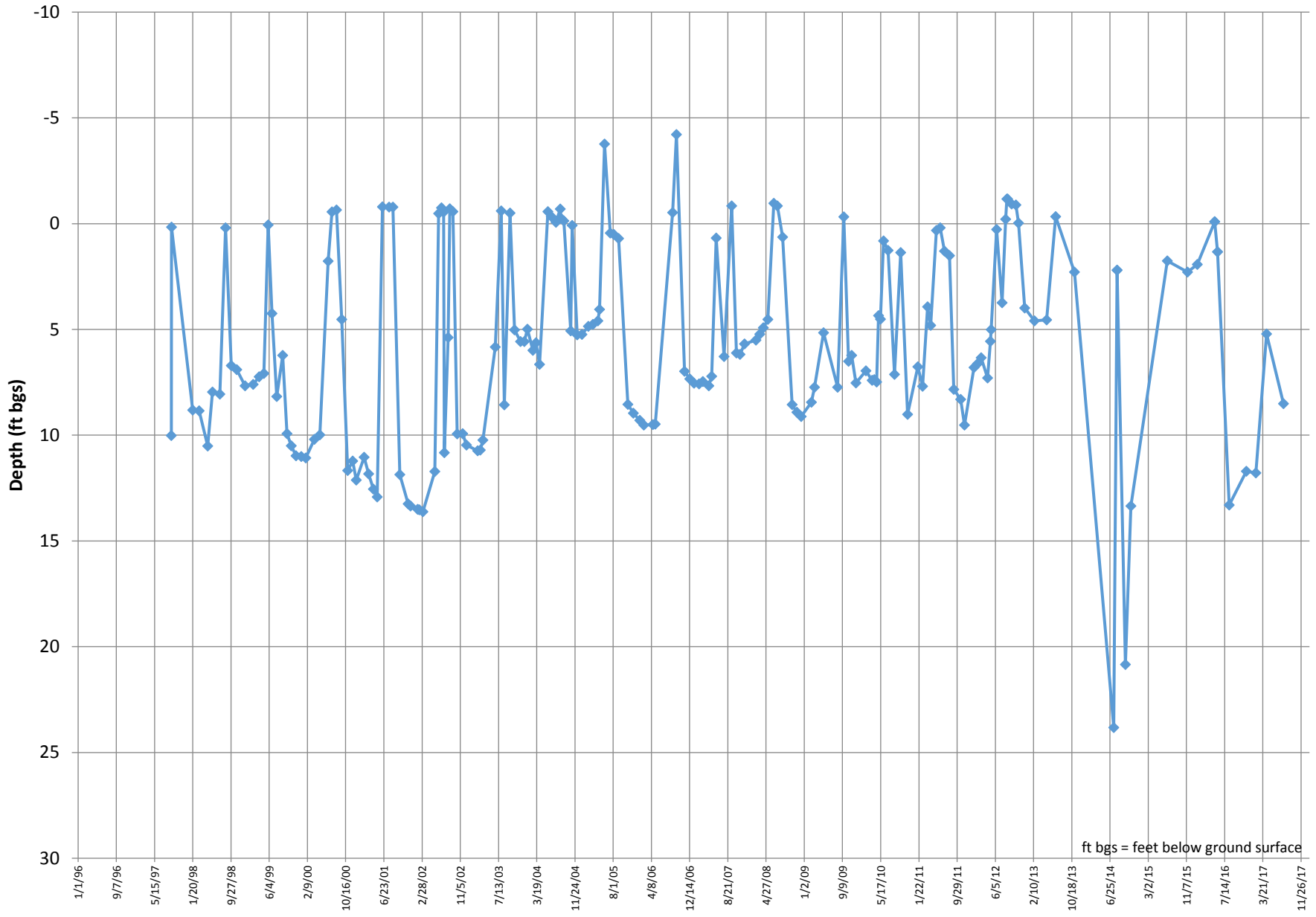
ft bgs = feet below ground surface

Elevation Hydrograph for P-97-020

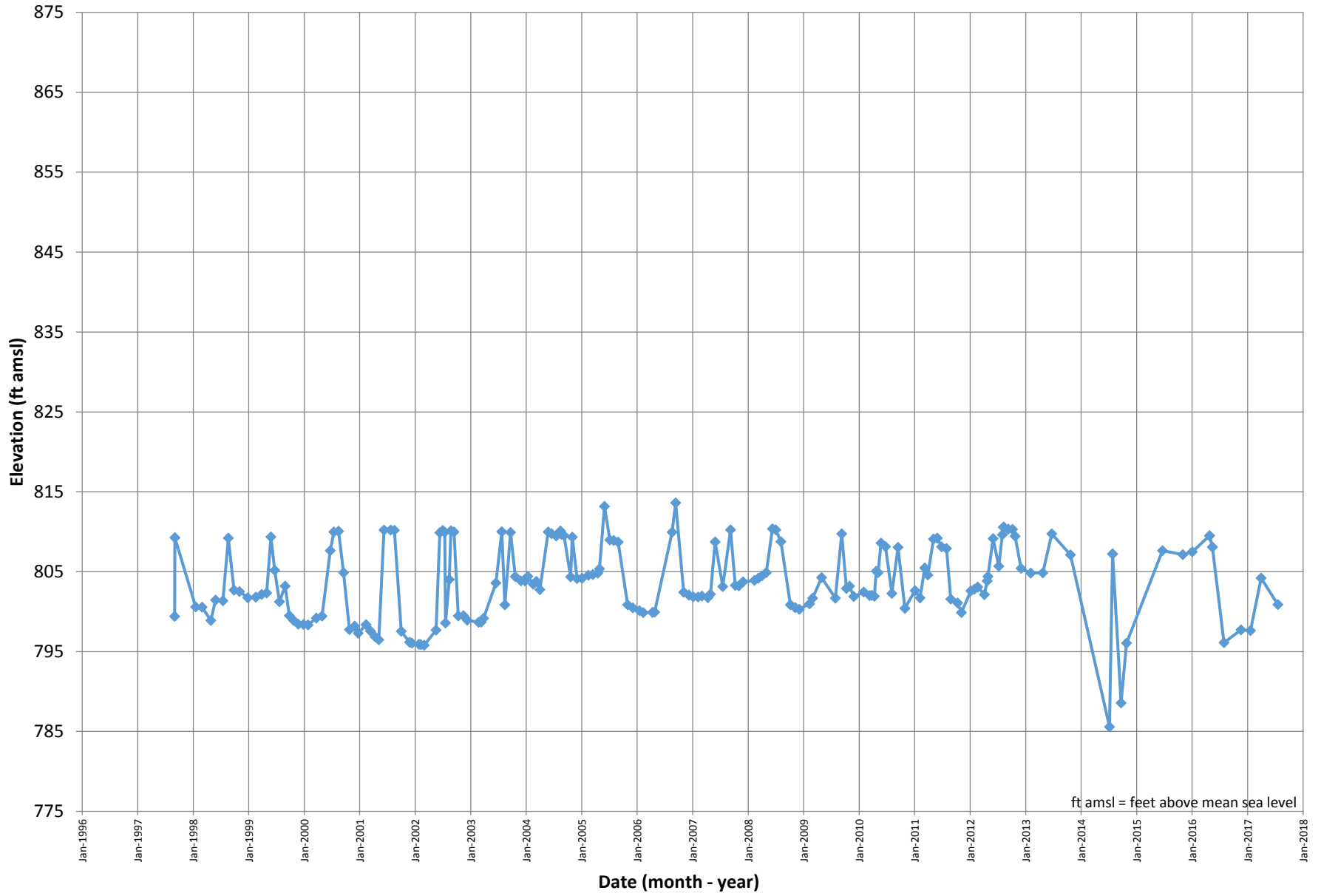


ft amsl = feet above mean sea level

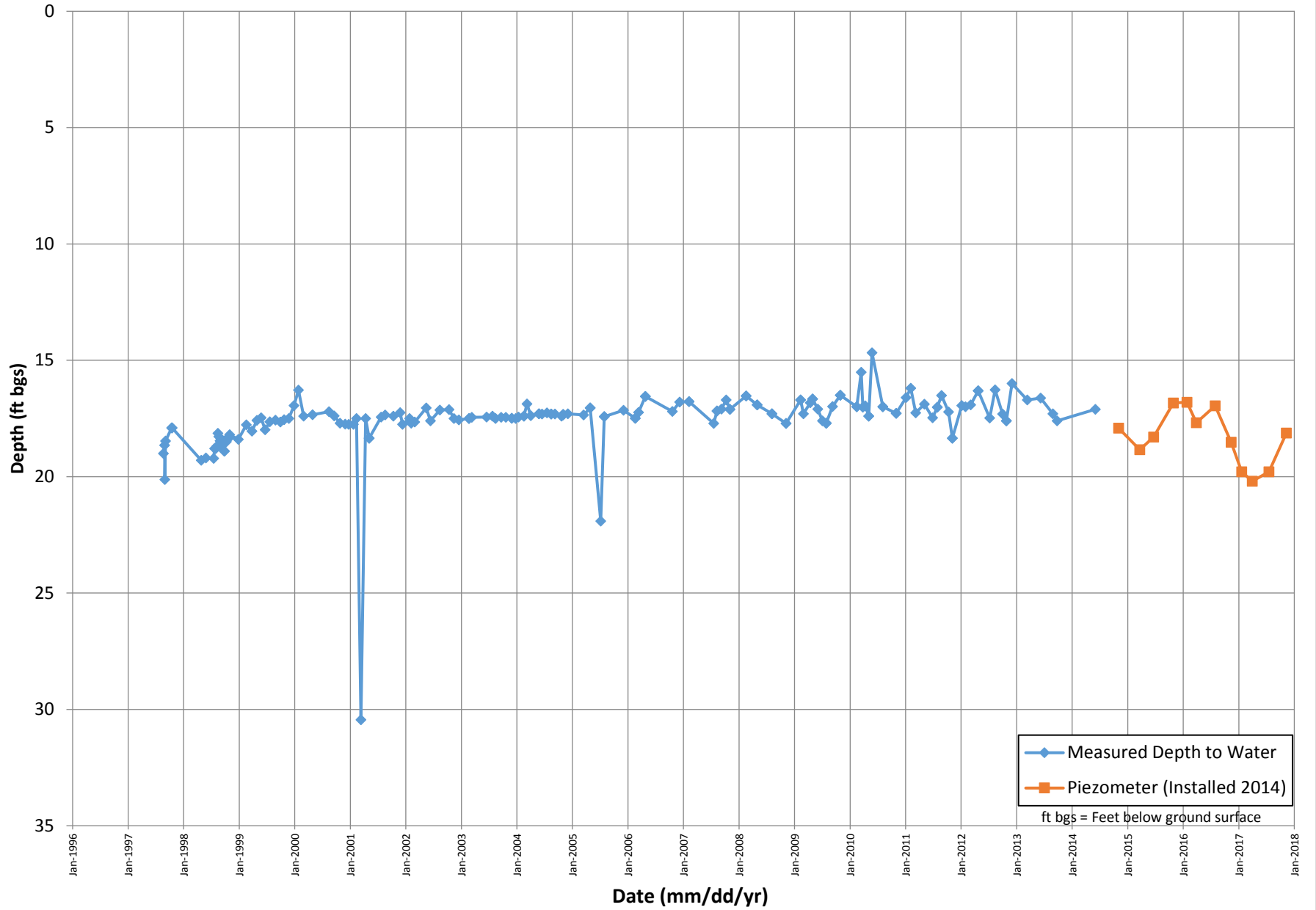
Depth Hydrograph for P-97-028



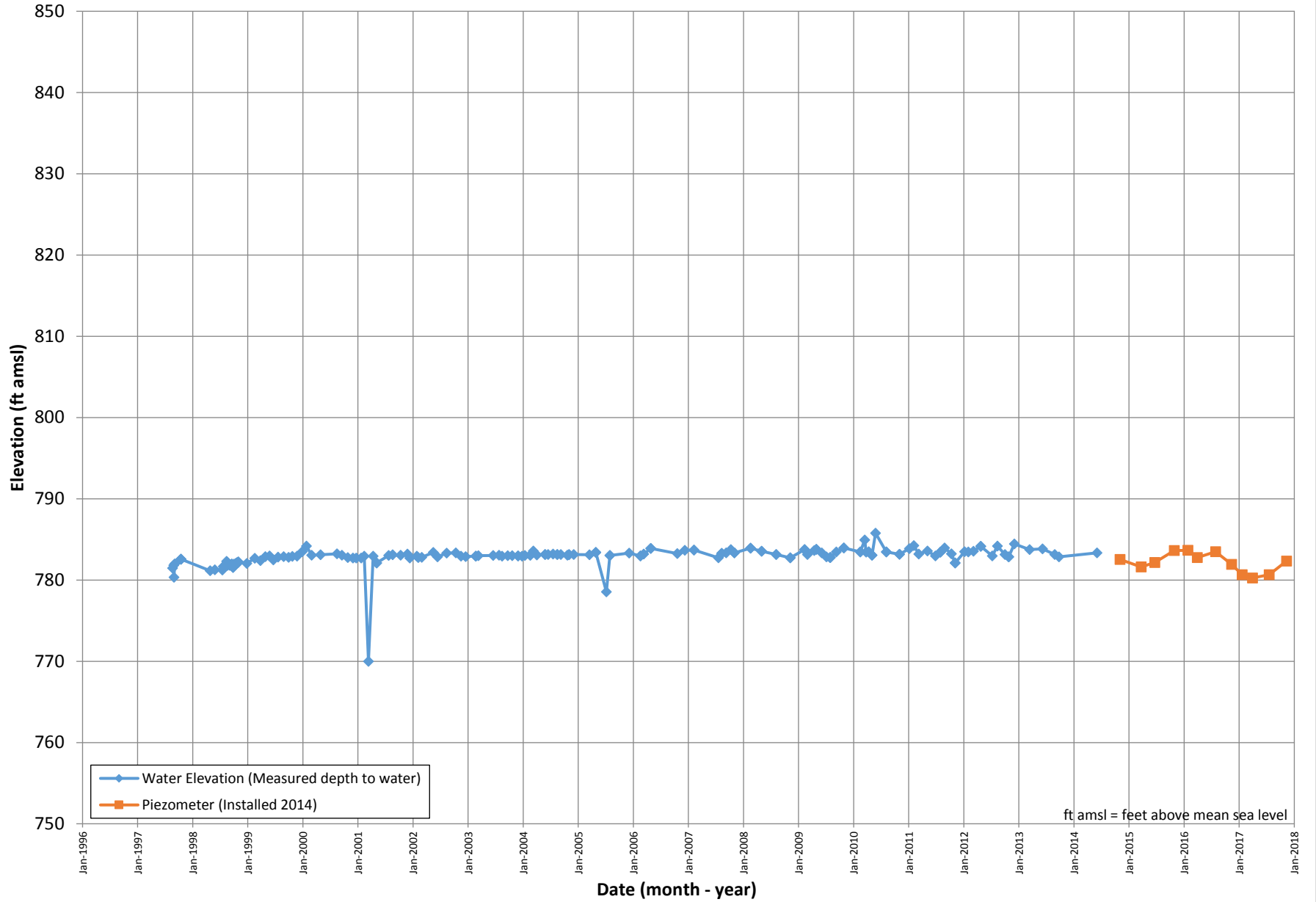
Elevation Hydrograph for P-97-028



Depth Hydrograph for SPP-97-002



Elevation Hydrograph for SPP-97-002



Appendix D
Quality Control / Quality Assurance

Quarterly Thermistor QA / QC

Location: T-96-13

Date: 2-5-17

Technician: NMS DJS Start Time: 16:10

Stop Time: 16:13

Node	Ohms	Comments
Test	16.35	
1	19.33	
2	16.08	
3	15.63	
4	16.60	
5	16.79	
6	16.90	
7	17.10	
8	17.01	
9	17.12	
10	17.16	
11	17.24	
12	17.27	
13	18.27	
14	18.21	
15	17.79	
16	17.25	
17	17.27	
18	17.08	
19	18.60	
20	16.90	
21	16.81	
22	16.70	
23	16.59	
24	16.42	
Test	16.35	

Node	Temperature
Test	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
Test	

Read these locations on noted month.

Month	Location
Feb-14	T 95-04
May-14	T 96-21
Aug-14	T 96-22
Nov-14	T 96-23
Feb-15	T 96-12
May-15	T 95-15
Aug-15	T 96-05
Nov-15	T 96-10
Feb-16	T 97-28
May-16	T 97-29
Aug-16	T 97-30
Nov-16	T 95-8
Feb-17 *	T 96-13
May-17	T 96-21
Aug-17	T 96-22

Make a comment if reading jumps around and takes a long time to stabilize.
QA / QC readings to be done on 5% of SEP required thermistors - see above schedule.
Record test readings before and after other readings.
CR850 & multimeter readings are to be taken within 5 minutes of each other.

Quarterly Thermister & Piezometer

Row:

Technician: *VMS DIS*

Well	Location	Col. Row #Ports	Collection Method Instrument	(Nodes) Time	Date	Well	Location	Col. Row #Ports	Collection Method Instrument	(Nodes) Time	Date
Backdam Piezo	Backdam	16	Nautiz Geokon logger		2-5-17	P16-148AB	Powerhouse	2	Nautiz Geokon logger		
T15-135	Backdam	1	Archer Beaded Stream		2-5-17	P16-149AB	S. of Powerhouse	2	Nautiz Geokon logger		
T15-136	Backdam	1	Archer Beaded Stream		2-5-17	P16-150	S. of Powerhouse	1	Nautiz Geokon logger		
T15-138	Backdam	1	Archer Beaded Stream		2-5-17	P05-63	Zn Thickener	1	Nautiz Geokon logger		2-4-17
T15-139	Backdam	1	Archer Beaded Stream		2-5-17	T05-63	Zn Thickener	129	Yellow box Thermister (8)		2-4-17
T15-140	Backdam	1	Archer Beaded Stream		2-5-17	T05-64	By CSB	130	Yellow box Thermister (7)		2-4-17
T15-141	Backdam	1	Archer Beaded Stream		2-5-17	T05-66	South of CSB	132	Yellow box Thermister (8)		
T15-143	Backdam	1	Archer Beaded Stream		2-5-17	*T95-05	By sandfilter	70	Yellow box Thermister (24)		2-5-17
T15-144	Backdam	1	Archer Beaded Stream		2-5-17	*T05-61	TDAM (end)	127	Yellow box Thermister (8)		2-5-17
T12-106	Backdam	1	Archer Beaded Stream		2-5-17	*T95-04	TDAM (end)	69	Yellow box Thermister (24)		2-5-17
T12-107	Backdam	1	Archer Beaded Stream		2-5-17	*T14-110	W. Tails Pond	1	Archer Beaded Stream (24)		2-5-17
T12-108	Backdam	1	Archer Beaded Stream		2-5-17	Piglet & 12A	TDAM	4	Nautiz Geokon logger		2-5-17
T12-109	Backdam	1	Archer Beaded Stream		2-5-17	TailingsCPT	TDAM	16	Nautiz Geokon logger		2-5-17
*T95-08	Over Burden	26	Yellow box Thermister (24)		2-5-17	P14-134	TDAM	1	Nautiz Geokon logger		2-5-17
*P96-13	Over Burden	25	Geokon Piezometer		2-5-17	P06-74	TDAM	1	Nautiz Geokon logger		2-5-17
*T96-13	Over Burden	29	Yellow box Thermister (24)		2-5-17	The Hog	TDAM	4	Nautiz Geokon logger		2-5-17
T96-13S	Over Burden	30	Yellow box Thermister (24)		2-5-17	Warthog	TDAM	16	Nautiz Geokon logger		2-4-17
*T96-21	Over Burden	31	Yellow box Thermister (24)		2-5-17	*SS-16 prt	TDAM	16	Nautiz Geokon logger		2-5-17
*T96-22	Over Burden	32	Yellow box Thermister (24)		2-5-17	P16-151AB	TDAM Slope	1	Nautiz Geokon logger	Bored	
*T96-23	Over Burden	33	Yellow box Thermister (24)		2-5-17	P14-131	TDAM Slope	1	Nautiz Geokon logger		2-4-17
T96-24	Over Burden	34	Yellow box Thermister (24)		2-5-17	P05-62B	Buttress	1	Nautiz Geokon logger		2-4-17
*P97-12	Blast Road	24	Geokon Piezometer		2-5-17	P14-132B	Buttress	1	Nautiz Geokon logger		2-4-17
*T96-12	Blast Road	27	Yellow box Thermister (24)		2-5-17	P05-69B	Buttress	1	Nautiz Geokon logger	89WMS	2-4-17
*T96-12S	Blast Road	28	Yellow box Thermister (24)		2-5-17	*T97-28	Buttress	76	Yellow box Thermister (24)		2-4-17
T98-33	Cold Storage	12	Yellow box Thermister (10)		2-5-17	*T97-29	Buttress	77	Yellow box Thermister (24)		2-4-17
T98-34	Cold Storage	13	Yellow box Thermister (11)		2-5-17	*T97-30	Buttress	78	Yellow box Thermister (24)		2-4-17
T98-35	Cold Storage	14	Yellow box Thermister (11)		2-5-17	*P96-10	Seepage Dam	1	Nautiz Geokon logger		2-4-17
T11-91	ARD Toe	145	Yellow box Thermister (12)		2-5-17	*T96-10	Seepage Dam	71	Yellow box Thermister (24)		2-4-17
T11-92	ARD Toe	146	Yellow box Thermister (11)		2-5-17	TDAM T7	Seepage Dam	65	Yellow box Thermister		2-4-17
T11-93	ARD Toe	147	Yellow box Thermister (9)		2-6-17	*SPP97-2	Seepage Dam	1	Nautiz Geokon logger		2-4-17
T11-94	ARD Toe	148	Yellow box Thermister (12)		2-6-17	*P96-15	Lower RDC	23	Geokon Piezometer	17:10	2-4-17
T11-95	ARD Toe	149	Yellow box Thermister (12) Bored		2-6-17	*T96-15	Lower RDC	44	Yellow box Thermister (14)	17:10	2-4-17
P05-67	By "3 Way"	1	Nautiz Geokon logger		2-5-17	DODO	By OF_001	1	Nautiz Geokon logger		2-4-17
T05-67	By "3 Way"	133	Yellow box Thermister (8)		2-5-17	P16-147	By OF_001	1	Nautiz Geokon logger	LB	2-4-17
WingWall	Power House	4	Nautiz Geokon logger		2-4-17	RDD Piezo	RDC Dam	16	Nautiz Geokon logger	LS	2-4-17

Comments: P97-30 2-4-17, 110A 2-4-17

~~P16-151AB~~
T05-65 Piezo Nest

*SEP Piezometer. QC: Duplicate Reading with Geokon to be taken within 5 min. of each other, Quarterly.

*SEP Thermister. QC: CR650 & Multimeter readings to be taken within 5 min. of each other, Quarterly.

WHP QUARTERLY REPORT DATA CHECKLIST

Quarter Q1

Date 4/24/2017

For Teck/Red Dog Long term Groundwater and Permafrost monitoring

- YES / NO** Quarterly data received from Teck. Date received: 02/08/2017
- YES / NO** Data received for 16 Thermistors
- YES / NO** Data received for 9 Piezometers
- YES / NO** QA/QC Forms received for both Thermistors and Piezometers No Piezometer QA/QC
- YES / NO** Is data complete for all Thermistors? If "No" make note of data gaps:
7 thermistors had issues with at least 2 nodes
- YES / NO** Is data complete for all Piezometers? If "No" make note of data gaps:
Readings for P-96-10 were 0.0
- YES / NO** Field Notes for the Quarter. Are data gaps/irregularities addressed?

Additional Comments: _____

Checklist Completed by: NB

QUARTER Q1 DATE 4/24/2017

Thermistor	Data Received? Y / N	Comments
T-96-015	Y	
T-05-061	Y	
T-95-005	Y	
T-96-010	Y	Two (of 24) nodes reported resistance readings < 0
T-97-028	Y	Two (of 24) nodes had problematic readings
T-97-029	Y	Four (of 24) nodes had resistance readings < 0
T-97-030	Y	Thirteen (of 24) nodes had resistance readings < 0
T-14-110	Y	
T-95-008 #2 <small>(manually add "#2")</small>	Y	
T-96-013	Y	
T-96-021	Y	
T-96-022	Y	No data from two (of 24) nodes.
T-96-023	Y	Eight (of 24) nodes had resistance readings < 0
T-96-012	Y	
T-96-012s	Y	
T-95-004	Y	Two (of 24) nodes had problematic readings

Piezometer	Data Received? Y / N	Comments
P-96-015	Y	Two readings reported
P-08A	Y	
P-08B	Y	
P-96-010	N	Piezo and temp readings both reported as 0.0
P-97-020	Y	
P-97-028	Y	
SPP-97-002	Y	
P-96-013	Y	Four readings reported
P-97-012	Y	Two readings reported

Quarterly Thermister & Piezometer

Row:

Technician: *Nicole Shellberg*

Well	Location	Col. Row #Ports	Collection Method Instrument	(Nodes)	Time	Date	Well	Location	Col. Row #Ports	Collection Method Instrument	(Nodes)	Time	Date
Backdam Piezo	Backdam	16	Nautiz Geokon logger			4-23-17	P16-148AB	Powerhouse	2	Nautiz Geokon logger		15:24	4-23-17
T15-135	Backdam	1	Archer Beaded Stream				P16-149AB	S. of Powerhouse	2	Nautiz Geokon logger		15:35	4-23-17
T15-136	Backdam	1	Archer Beaded Stream				P16-150	S. of Powerhouse	1	Nautiz Geokon logger		15:40	4-23-17
T15-138	Backdam	1	Archer Beaded Stream				P05-63	Zn Thickener	1	Nautiz Geokon logger		15:11	4-23-17
T15-139	Backdam	1	Archer Beaded Stream				T05-63	Zn Thickener	129	Yellow box Thermister (8)		15:11	4-23-17
T15-140	Backdam	1	Archer Beaded Stream				T05-64	By CSB	130	Yellow box Thermister (7)		15:08	4-23-17
T15-141	Backdam	1	Archer Beaded Stream				T05-66	South of CSB	132	Yellow box Thermister (8)		15:06	4-23-17
T15-143	Backdam	1	Archer Beaded Stream				*T95-05	By sandfilter	70	Yellow box Thermister (24)		15:33	4-23-17
T15-144	Backdam	1	Archer Beaded Stream				*T05-61	TDAM (end)	127	Yellow box Thermister (8)		15:05	4-25-17
T12-106	Backdam	1	Archer Beaded Stream			4-24-17	*T95-04	TDAM (end)	69	Yellow box Thermister (24)		15:00	4-25-17
T12-107	Backdam	1	Archer Beaded Stream			4-24-17	*T14-110	W. Tails Pond	1	Archer Beaded Stream (24)			
T12-108	Backdam	1	Archer Beaded Stream			4-24-17	Piglet & 12A	TDAM	4	Nautiz Geokon logger		14:44	4-25-17
T12-109	Backdam	1	Archer Beaded Stream			4-24-17	TailingsCPT	TDAM	16	Nautiz Geokon logger			4-25-17
*T95-08	Over Burden	26	Yellow box Thermister (24)			4-23-17	P14-134	TDAM	1	Nautiz Geokon logger			4-25-17
*P96-13	Over Burden	25	Geokon Piezometer			4-23-17	P06-74	TDAM	1	Nautiz Geokon logger			4-25-17
*T96-13	Over Burden	29	Yellow box Thermister (24)			4-23-17	The Hog	TDAM	4	Nautiz Geokon logger			4-25-17
T96-13S	Over Burden	30	Yellow box Thermister (24)			4-23-17	Warthog	TDAM	16	Nautiz Geokon logger			4-25-17
*T96-21	Over Burden	31	Yellow box Thermister (24)			4-24-17	*SS-16 prt	TDAM	16	Nautiz Geokon logger			4-25-17
*T96-22	Over Burden	32	Yellow box Thermister (24)			4-24-17	P16-151AB	TDAM Slope	1	Nautiz Geokon logger		16:10	4-23-17
*T96-23	Over Burden	33	Yellow box Thermister (24)			4-24-17	P14-131	TDAM Slope	1	Nautiz Geokon logger			4-23-17
T96-24	Over Burden	34	Yellow box Thermister (24)			4-24-17	P05-62	Buttress	1	Nautiz Geokon logger		16:20	4-23-17
*P97-12	Blast Road	24	Geokon Piezometer			4-23-17	P14-132	Buttress	1	Nautiz Geokon logger		16:24	4-23-17
*T96-12	Blast Road	27	Yellow box Thermister (24)			4-23-17	P05-69	Buttress	1	Nautiz Geokon logger		16:02	4-23-17
*T96-12S	Blast Road	28	Yellow box Thermister (24)			4-23-17	*T97-28	Buttress	76	Yellow box Thermister (24)		15:58	4-23-17
T98-33	Cold Storage	12	Yellow box Thermister (10)		13:40	4-23	*T97-29	Buttress	77	Yellow box Thermister (24)		16:26	4-23-17
T98-34	Cold Storage	13	Yellow box Thermister (11)		13:43	4-23	*T97-30	Buttress	78	Yellow box Thermister (24)		16:20	4-23-17
T98-35	Cold Storage	14	Yellow box Thermister (11)		13:48	4-23	*P96-10	Seepage Dam	1	Nautiz Geokon logger			4-23-17
T11-91	ARD Toe	145	Yellow box Thermister (12)		14:26	4-23-17	*T96-10	Seepage Dam	71	Yellow box Thermister (24)			4-23-17
T11-92	ARD Toe	146	Yellow box Thermister (11)		14:23	4-23-17	TDAM T7	Seepage Dam	65	Yellow box Thermister			4-23-17
T11-93	ARD Toe	147	Yellow box Thermister (9)		14:14	4-23-17	*SPP97-2	Seepage Dam	1	Nautiz Geokon logger			4-23-17
T11-94	ARD Toe	148	Yellow box Thermister (12)		13:56	4-23-17	*P96-15	Lower RDC	23	Geokon Piezometer		17:00	4-23-17
T11-95	ARD Toe	149	Yellow box Thermister (12)		14:08	4-23-17	*T96-15	Lower RDC	44	Yellow box Thermister (14)		17:00	4-23-17
P05-67	By "3 Way"	1	Nautiz Geokon logger		14:30	4-23-17	DODO	By OF_001	1	Nautiz Geokon logger		17:23	4-23-17
T05-67	By "3 Way"	133	Yellow box Thermister (8)		14:30	4-23-17	P16-147	By OF_001	1	Nautiz Geokon logger			4-23-17
WingWall	Power House	4	Nautiz Geokon logger				RDD Piezo	RDC Dam	16	Nautiz Geokon logger			4-23-17

Comments:

ADD TDAM TOE, Old Archer Dred

*SEP Piezometer. QC: Duplicate Reading with Geokon to be taken within 5 min. of each other, Quarterly.

*SEP Thermister. QC: CR850 & Multimeter readings to be taken within 5 min. of each other, Quarterly.

Quarterly Thermistor QA / QC

Location T95-05

Date:___ 4/23/2017

Technician:_____ NMS

Start Tim 15:35

Stop Tim 15:42

Node	Ohms	Comments	Node	Temperature	Read these locations on noted month.	
Test	16.34		Test		Month	Location
1	16.69		1		Feb-14	T 95-04
2	16.19		2		May-14	T 96-21
3	16.41		3		Aug-14	T96-22
4	16.64		4		Nov-14	T 96-23
5	16.71		5		Feb-15	T 96-12
6	16.82		6		May-15	T 95-15
7	16.87		7		Aug-15	T 96-05
8	16.92		8		Nov-15	T 96-10
9	16.92		9		Feb-16	T 97-28
10	19.93		10		May-16	T 97-29
11	19.94		11		Aug-16	T 97-30
12	16.89		12		Nov-16	T 95-8
13	16.87		13		Feb-17	T 96-13
14	16.85		14		May-17	T 96-21
15	16.79		15		Aug-17	T 96-22
16	16.72		16			
17	16.68		17			
18	16.55		18			
19	16.42		19			
20	16.23		20			
21	16.12		21			
22	15.93		22			
23	15.78		23			
24	15.6		24			
Test	16.34		Test			

Make a comment if reading jumps around and takes a long time to stabilize.

QA / QC readings to be done on 5% of SEP required thermistors - see above schedule.

Record test readings before and after other readings.

CR850 & multimeter readings are to be taken within 5 minutes of each other.

Teck

WHP QUARTERLY REPORT DATA CHECKLIST

Quarter Q2 2017

Date 20 June, 2017

For Teck/RedDog Longterm Groundwater and Permafrost monitoring

- YES / NO** Quarterly data received from Teck. Date received: 12 June, 2017

- YES / NO** Data received for 16 Thermistors

- YES / NO** Data received for 9 Piezometers

- YES / NO** QA/QC Forms received for both Thermistors and Piezos: No Piezometer QA/QC

- YES / NO** Is data complete for all Thermistors? If "No" make note of data gaps:
No data reported for T-14-110, noted by NS from Teck

- YES / NO** Is data complete for all Piezometers? If "No" make note of data gaps:
Data received for all Piezometers, no Piezo QA/QC received

- YES / NO** Field Notes for the Quarter. Are data gaps/irregularities addressed?

Additional Comments: _____

Did not receive a copy of the Field Form for Q2 2017

QUARTER Q2 2017

DATE 20 June, 2017

Thermistor	Data Received? Y / N	Comments
T-96-015	Y	
T-05-061	Y	
T-95-005	Y	
T-96-010	Y	Error at 1 of 24 nodes
T-97-028	Y	Error at 14 of 24 nodes
T-97-029	Y	Error at 4 of 24 nodes
T-97-030	Y	Error at 2 of 24 nodes
T-14-110	N	Data not recieved. Per Teck data was downloaded, but not sent.
T-95-008 #2 <small>(manually add "#2")</small>	Y	
T-96-013	Y	
T-96-021	Y	
T-96-022	Y	Error at 2 of 24 nodes
T-96-023	Y	Error at 8 of 24 nodes
T-96-012	Y	Error at 1 of 24 nodes
T-96-012s	Y	
T-95-004	Y	Error at 2 of 24 nodes

Piezometer	Data Received? Y / N	Comments
P-96-015	Y	
P-08A	Y	
P-08B	Y	
P-96-010	Y	
P-97-020	Y	
P-97-028	Y	
SPP-97-002	Y	
P-96-013	Y	
P-97-012	Y	

Quarterly Thermister & Piezometer

Technician: *NMS KGS JWM*

8-13-17

Row:

Well	Location	Col. Row #Ports	Collection Method Instrument	(Nodes)	Time	Date	Well	Location	Col. Row #Ports	Collection Method Instrument	(Nodes)	Time	Date
Backdam Piezo	Backdam	16	Nautiz Geokon logger		11:05	8-13-17	P16-148AB	Powerhouse	2	Nautiz Geokon logger		10:09	8-14-17
T15-135	Backdam	1	Archer Beaded Stream		11:40	8-14-17	P16-149AB	S. of Powerhouse	2	Nautiz Geokon logger		10:34	8-13-17
T15-136	Backdam	1	Archer Beaded Stream		11:03		P16-150	S. of Powerhouse	1	Nautiz Geokon logger		10:53	
T15-138	Backdam	1	Archer Beaded Stream		11:10		P05-63	Zn Thickener	1	Nautiz Geokon logger		10:50	
T15-139	Backdam	1	Archer Beaded Stream		11:15		T05-63	Zn Thickener	129	Yellow box Thermister	(8)	09:55	8-14-17
T15-140	Backdam	1	Archer Beaded Stream		11:18		T05-64	By CSB	130	Yellow box Thermister	(7)	10:39	8-13-17
T15-141	Backdam	1	Archer Beaded Stream		11:23		T05-66	South of CSB	132	Yellow box Thermister	(8)	09:49	8-14-17
T15-143	Backdam	1	Archer Beaded Stream		11:27		*T95-05	By sandfilter	70	Yellow box Thermister	(24)	09:42	8-14-17
T15-144	Backdam	1	Archer Beaded Stream		0:55		*T05-61	TDAM (end)	127	Yellow box Thermister	(6)	17:13	8-13-17
T12-106	Backdam	1	Archer Beaded Stream		11:20	8-13-17	*T95-04	TDAM (end)	69	Yellow box Thermister	(24)	11:42	8-13-17
T12-107	Backdam	1	Archer Beaded Stream		11:31	8-13-17	*T14-110	W. Tails Pond	1	Archer Beaded Stream	(24)		
T12-108	Backdam	1	Archer Beaded Stream		11:33	8-13-17	Piglet & 12	London	4	Nautiz Geokon logger			
T12-109	Backdam	1	Archer Beaded Stream		11:32	8-13-17	TailingsCPT	TDAM	16	Nautiz Geokon logger			
*T95-08	Over Burden	26	Yellow box Thermister	(24)	10:36	8-13-17	LR14-134	TDAM	1	Nautiz Geokon logger			
*P96-13	Over Burden	25	Geokon Piezometer		10:35		P06-74	TDAM	1	Nautiz Geokon logger			
*T96-13	Over Burden	29	Yellow box Thermister	(24)	10:37			TDAM	4	Nautiz Geokon logger			
T96-13S	Over Burden	30	Yellow box Thermister	(24)	10:44		Warthog	TDAM	16	Nautiz Geokon logger			
*T96-21	Over Burden	31	Yellow box Thermister	(24)				TDAM	16	Nautiz Geokon logger			
*T96-22	Over Burden	32	Yellow box Thermister	(24)		8-13-17		TDAM Slope	1	Nautiz Geokon logger			
*T96-23	Over Burden	33	Yellow box Thermister	(24)		8-13-17		TDAM Slope	1	Nautiz Geokon logger			
T96-24	Over Burden	34	Yellow box Thermister	(24)	11:03	8-13-17		Buttress	1	Nautiz Geokon logger			
*P97-12	Blast Road	24	Geokon Piezometer		10:12	8-13-17		Buttress	1	Nautiz Geokon logger			
*T96-12	Blast Road	27	Yellow box Thermister	(24)	10:05	8-13-17		Buttress	1	Nautiz Geokon logger			
*T96-12S	Blast Road	28	Yellow box Thermister	(24)	10:06	8-13-17	*T97-28	Buttress	76	Yellow box Thermister	(24)	15:10	8-13-17
T98-33	Cold Storage	12	Yellow box Thermister	(10)	13:26		*T97-29	Buttress	77	Yellow box Thermister	(24)	15:00	8-13-17
T98-34	Cold Storage	13	Yellow box Thermister	(11)	13:31		*T97-30	Buttress	78	Yellow box Thermister	(24)	15:05	8-13-17
T98-35	Cold Storage	14	Yellow box Thermister	(11)	13:35		*P96-10	Seepage Dam	1	Nautiz Geokon logger		15:00	8-13-17
T11-91	ARD Toe	145	Yellow box Thermister	(12)	13:40	8-13-17	*T96-10	Seepage Dam	71	Yellow box Thermister	(24)	15:00	
T11-92	ARD Toe	146	Yellow box Thermister	(11)	13:40	8-13-17	TDAM T7	Seepage Dam	65	Yellow box Thermister		15:00	
T11-93	ARD Toe	147	Yellow box Thermister	(9)	13:44	8-13-17	*SPP97-2	Seepage Dam	1	Nautiz Geokon logger		14:20	8-13-17
T11-94	ARD Toe	148	Yellow box Thermister	(12)	13:43	8-13-17	*T96-15	Lower RDC	23	Geokon Piezometer		14:20	8-13-17
T11-95	ARD Toe	149	Yellow box Thermister	(12)	13:50	8-13-17	*T96-15	Lower RDC	44	Yellow box Thermister	(14)	14:20	8-13-17
P05-67	By "3 Way"	1	Nautiz Geokon logger		13:40	8-13-17	DODO	By OF_001	1	Nautiz Geokon logger		14:35	8-13-17
T05-67	By "3 Way"	133	Yellow box Thermister	(8)	13:59	8-13-17	P16-147	By OF_001	1	Nautiz Geokon logger		14:40	8-13-17
WingWall	Power House	4	Nautiz Geokon logger		10:00	8-14-17	RDD Piezo	RDC Dam	16	Nautiz Geokon logger		14:45	8-13-17

Comments:

Pharmigan 14:33

Quarterly Thermistor QA / QC

Location: T96-22

Date: 8-13-17

Technician: JWM

Start Time: 10:54

Stop Time: 10:59

Node	Ohms	Comments
Test	16.34	
1	9.06	
2	11.29	
3	OL	
4	14.17	
5	15.06	
6	15.22	
7	15.24	
8	15.33	
9	15.79	
10	OL	
11	16.47	
12	16.75	
13	16.81	
14	16.87	
15	OL	
16	16.96	
17	17.10	
18	17.03	
19	17.10	
20	17.12	
21	17.14	
22	17.21	
23	14.58	
24	17.31	
Test	16.35	

Node	Temperature
Test	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
Test	

Read these locations on noted month.

Month	Location
Feb-17	T 95-04
May-17	T 96-21
Aug-17	T96-22
Nov-17	T 96-23
Feb-18	T 96-12
May-18	T 95-15
Aug-18	T 96-05
Nov-18	T 96-10
Feb-19	T 97-28
May-19	T 97-29
Aug-19	T 97-30
Nov-19	T 95-8
Feb-20	T 96-13
May-20	T 96-21
Aug-20	T 96-22

Make a comment if reading jumps around and takes a long time to stabilize.
QA / QC readings to be done on 5% of SEP required thermistors - see above schedule.
Record test readings before and after other readings.
CR850 & multimeter readings are to be taken within 5 minutes of each other.

Teck

WHP QUARTERLY REPORT DATA CHECKLIST

Quarter Q3 2017

Date 6 Sept, 2017

For Teck/RedDog Longterm Groundwater and Permafrost monitoring

- YES / NO** Quarterly data received from Teck. Date received: 6 Sept, 2017

- YES / NO** Data received for 16 Thermistors

- YES / NO** Data received for 9 Piezometers

- YES / NO** QA/QC Forms received for both Thermistors and Piezos: No Piezometer QA/QC

- YES / NO** Is data complete for all Thermistors? If "No" make note of data gaps:
T-95-04 data had error (below 0) readings for all 24 thermistors.

- YES / NO** Is data complete for all Piezometers? If "No" make note of data gaps:
Data received for all Piezometers, no Piezo QA/QC received.

- YES / NO** Field Notes for the Quarter. Are data gaps/irregularities addressed?

Additional Comments: _____

QUARTER Q3 2017

DATE 6 Sept, 2017

Thermistor	Data Received? Y / N	Comments
T-96-015	Y	
T-05-061	Y	
T-95-005	Y	
T-96-010	Y	Error at 4 of 24 nodes
T-97-028	Y	Error at 13 of 24 nodes
T-97-029	Y	Error at 6 of 24 nodes
T-97-030	Y	Error at 2 of 24 nodes
T-14-110	Y	
T-95-008 #2 <small>(manually add "#2")</small>	Y	
T-96-013	Y	
T-96-021	Y	
T-96-022	Y	
T-96-023	Y	Error at 8 of 24 nodes
T-96-012	Y	
T-96-012s	Y	
T-95-004	Y	Error at ALL 24 of 24 nodes (All readings below 0)

Piezometer	Data Received? Y / N	Comments
P-96-015	Y	
P-08A	Y	
P-08B	Y	
P-96-010	Y	
P-97-020	Y	
P-97-028	Y	
SPP-97-002	Y	
P-96-013	Y	
P-97-012	Y	Pressure reading received, error in temperature value

Quarterly Thermister & Piezometer

DJ Sheldon / JW Mills

Row:

Thermrdr:

Date: 11-26-17

Well	Location	Collection Method Instrument	Nodes	Date	Piezo PSI Therm Error	Comments
16	Backdam Piezo	Backdam	Nautiz Geokon logger	11-26-17		
26	*T95-08	Over Burden	Yellow box Thermister	11-26-17		
25	*P96-13	Over Burden	Geokon Piezometer			Damage to Cable - break
29	*T96-13	Over Burden	Yellow box Thermister			11-25
30	T96-13S	Over Burden	Yellow box Thermister			11-22
31	*T96-21	Over Burden	Yellow box Thermister			11-23
32	*T96-22	Over Burden	Yellow box Thermister			14:28, No Cap for Therm Connector
33	*T96-23	Over Burden	Yellow box Thermister			14:30, No Cap for Therm Connector, damage to cable shield
34	T96-24	Over Burden	Yellow box Thermister			14:33, No Cap on connector QA/QC
24	*P97-12	Blast Road	Geokon Piezometer	11-26-17		Damage to Cable - break
27	*T96-12	Blast Road	Yellow box Thermister			
28	*T96-12S	Blast Road	Yellow box Thermister			
12	T98-33	Cold Storage	Yellow box Thermister			Could not find Thermistor
13	T98-34	Cold Storage	Yellow box Thermister	11-29-17		Exposed Wires, Broken
14	T98-35	Cold Storage	Yellow box Thermister			Exposed & Broken Wires
145	T11-91	ARD Toe	Yellow box Thermister			
146	T11-92	ARD Toe	Yellow box Thermister			
147	T11-93	ARD Toe	Yellow box Thermister			
148	T11-94	ARD Toe	Yellow box Thermister			Exposed & Broken Wires
149	T11-95	ARD Toe	Yellow box Thermister			ic DJ5
1	P05-67	By "3 Way"	Nautiz Geokon logger	11-26-17		
133	T05-67	By "3 Way"	Yellow box Thermister	11-29-17		
4	WingWall	Power House	Nautiz Geokon logger			
1	P16-150	s. of Powerhouse	Nautiz Geokon logger			
1	P05-63	Zn Thickener	Nautiz Geokon logger	11-26-17		
129	T05-63	Zn Thickener	Yellow box Thermister	11-29-17		
130	T05-64	By CSB	Yellow box Thermister			
132	T05-66	South of CSB	Yellow box Thermister			
70	*T95-05	By sandfilter	Yellow box Thermister	11-26-17		
127	*T05-61	TDAM (end)	Yellow box Thermister	11-26-17		
69	*T95-04	TDAM (end)	Yellow box Thermister	11-29-17		Mostly Negative Readings
1	*T14-110	W. Tails Pond	Archer Beaded Stream	11-26-17		
76	*T97-28	Buttress	Yellow box Thermister	11-29-17		
77	*T97-29	Buttress	Yellow box Thermister	11-29-17		
78	*T97-30	Buttress	Yellow box Thermister	11-26-17		
1	*P96-10	Seepage Dam	Nautiz Geokon logger	11-26-17		
71	*T96-10	Seepage Dam	Yellow box Thermister	11-29-17		
65	TDAM T7	Seepage Dam	Yellow box Thermister	11-29-17		
1	*SPP97-2	Seepage Dam	Nautiz Geokon logger	11-26-17		
23	*P96-15	Lower RDC	Geokon Piezometer	11-26-17		
44	*T96-15	Lower RDC	Yellow box Thermister	11-26-17		
1	P16-147	By OF_001	Nautiz Geokon logger			Logger in Ice
16	RDD Piezo	RDC Dam	Nautiz Geokon logger	11-26-17		

*SEP Thermister. QC: CR850 Multimeter readings to be taken within 5 min. of each other, Quarterly.

*SEP Piezometer. QC: Duplicate Reading with Geokon to be taken within 5 min. of each.

Quarterly Thermistor QA / QC

Location: P 96-23

Date: 11/26/17

Technician: Jwn/DOS Start Time: 14:37

Stop Time: 14:42

Node	Ohms	Comments
Test	16.35	
1	open	
2	17.31	
3	17.24	
4	17.05 17.05	
5	17.20	
6	16.91	
7	17.15	
8	17.08	
9	17.08	
10	16.95	
11	16.92	
12	16.88	
13	16.86	
14	16.34	
15	16.41	
16	15.8	
17	15.83	
18	15.72	
19	15.44	
20	15.32	
21	15.05	
22	14.88	
23	16.05	
24	open	
Test	16.35	

Node	Temperature	Read these locations on noted month.	
Test		Month	Location
1			
2		Feb-17	T 95-04
3		May-17	T 96-21
4		Aug-17	T 96-22
5		Nov-17	T 96-23
6		Feb-18	T 96-12
7		May-18	T 95-15
8		Aug-18	T 96-05
9		Nov-18	T 96-10
10		Feb-19	T 97-28
11		May-19	T 97-29
12		Aug-19	T 97-30
13		Nov-19	T 95-8
14		Feb-20	T 96-13
15		May-20	T 96-21
16		Aug-20	T 96-22
17			
18			
19			
20			
21			
22			
23			
24			
Test			

Make a comment if reading jumps around and takes a long time to stabilize.
QA / QC readings to be done on 5% of SEP required thermistors - see above schedule.
Record test readings before and after other readings.
CR850 & multimeter readings are to be taken within 5 minutes of each other.

Teck

WHP QUARTERLY REPORT DATA CHECKLIST

Quarter Q4

Date 20 Dec 2017

For Teck/RedDog Longterm Groundwater and Permafrost monitoring

- YES / NO** Quarterly data received from Teck. Date received: 13 December, 2017

- YES / NO** Data received for 16 Thermistors

- YES / NO** Data received for 9 Piezometers

- YES / NO** QA/QC Forms received for both Thermistors and Piezos

- YES / NO** Is data complete for all Thermistors? If "No" make note of data gaps:
Significant data gaps at 4 thermistors

- YES / NO** Is data complete for all Piezometers? If "No" make note of data gaps:
Need barometric pressure readings for day(s)/time of piezometer readings.

- YES / NO** Field Notes for the Quarter. Are data gaps/irregularities addressed?

Additional Comments: No field notes received for Q4.

QUARTER Q4

DATE 20 Dec 2017

Thermistor	Data Received? Y / N	Comments
T-96-015	Y	
T-05-061	Y	
T-95-005	Y	
T-96-010	Y	Error at 2 of 24 nodes
T-97-028	Y	Errors (negative readings) at 15 of 24 nodes
T-97-029	Y	Errors (negative readings) at 7 of 24 nodes
T-97-030	Y	Errors at 2 of 24 nodes
T-14-110	Y	
T-95-008 #2 <small>(manually add "#2")</small>	Y	
T-96-013	Y	
T-96-021	Y	
T-96-022	Y	No reading at 2 of 24 nodes
T-96-023	Y	Errors at 9 of 24 nodes
T-96-012	Y	Error at 1 of 24 nodes
T-96-012s	Y	
T-95-004	Y	Error at 23 of 24 nodes

Piezometer	Data Received? Y / N	Comments
P-96-015	Y	BAROMETER READINGS??
P-08A	Y	
P-08B	Y	
P-96-010	Y	
P-97-020	Y	
P-97-028	Y	
SPP-97-002	Y	
P-96-013	Y	
P-97-012	Y	