Red Dog Operations

4th Quarter Report & Annual
Waste Management Permit 2021DB0001
Reclamation Plan Approval F20219958

February 7th, 2024

Teck

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Introduction

This report has been prepared to fulfill the 4th quarter and annual reporting requirements for Teck Alaska Incorporated obligations under the State of Alaska Waste Management Permit No. 2021DB0001 and the Red Dog Mine Reclamation Plan Approval F20219958.

This report addresses Biomonitoring, Permafrost and Sub-permafrost Groundwater Monitoring around the Tailings Storage Facility, Mine Water Management, Waste Rock Management, Tailings Management, Class III Municipal Solid Waste Landfill, Mining and Milling Activities, Reclamation, Risk Management Plan, Financial Assurance, Amendments and Wildlife Interactions which addresses both 4th quarter and annual reporting as specified in the *Integrated Waste Management Plan – Monitoring Plan, (November 2021).*

Biomonitoring Program

Annual biomonitoring report

The 2023 annual *Biomonitoring Report* is being prepared by the Alaska Department of Fish & Game (ADF&G) this report is normally submitted by the 2nd quarter. The 2023 biomonitoring report will be incorporated as Appendix A within this report.

Annual summary of biomonitoring water quality sampling

Analytical results of samples collected for biomonitoring water quality is included as electronic file *Red Dog Analytical Data 2023.xls*.

Permafrost and Sub-permafrost Groundwater Monitoring

SEP permafrost and subsurface temperature monitoring (TSF)

Supplemental Environmental Project (SEP) piezometer and thermistor monitoring well measurements were completed quarterly for the 2023 year. The data collected in 2023 was consistent with the data from prior years with no significant changes noted with subpermafrost. The *2023 Annual Report - Long-Term Permafrost and Groundwater Monitoring Program* for the Tailings Storage Facility is included within Appendix B in this report.

Sporadic readings were noted for a few analog thermistor cables during the reporting year which led to further investigation with the analog type connectors at each cable end. A discovery of buildup of dirt/debris was interbedded in between the contacts which may be affecting resistance readings since each contact is a separate node reading. Maintenance and cleaning of each SEP thermistor connector and thermistors T-96-013 and T-95-08 will be re-spliced with new connector terminals and re-read to gauge viability of repair. The work is scheduled for 2024.

Significant activities in permafrost and sub-permafrost groundwater monitoring

No significant changes associated with the SEP permafrost monitoring program.

Non-SEP shallow active layer permafrost monitoring & water monitoring

As part of the minor modification to APDES permit AK0038652 Red Dog prepared and submitted a technical memorandum – *Ikalukrok Permafrost and Water Monitoring* to the Alaska Department of Environmental Conservation (ADEC) in January 2024. The memorandum summarizes work from 2020 through 2023 and includes the following:

- temperature cable and monitoring well installation,
- site permafrost conditions determined from monitoring of the temperature cables,
- water quality in shallow groundwater from summer 2022 sampling,
- water quality in the Ikalukrok and Red Dog Creeks and major tributaries, and
- water quality in seep areas adjacent to the Ikalukrok and in upper Red Dog Creek above the mine site.

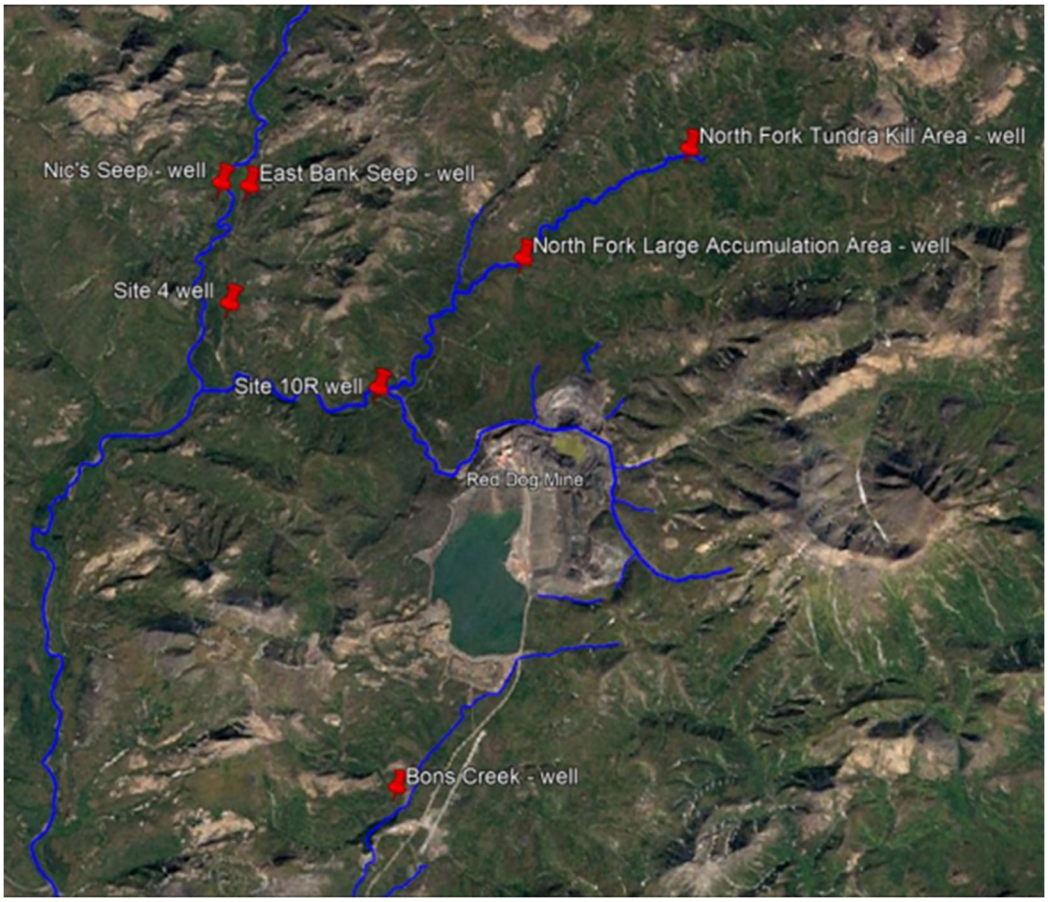


Figure 1 – Non-SEP Thermistor Well Locations

Mine Water Management

Mine water flows

Table 1 below provides a summary of mine water flows for mine water monitoring stations during the reporting period. Influent process water flows to Water Treatment Plant (WTP) #3 increased compared to the prior year due to the collection sumps being restarted after the road alignment project was completed along the toe of the Main Waste Dump (MWD). Water collection from the MWD sumps will continue to be monitored for flows and chemistry, Phase III of the MWD cover project is expected to be completed by fall of 2024.

Table 1 - Water Monitoring Volumes

	Volume in Gallons			
Mine Water Monitoring Stations	Oct	Nov	Dec	2023 Total
Bon's Creek Total Flow	9,032,000	10,360,000	12,420,000	124,141,000
Mine Water Sump Total Flow	54,400,000	56,150,000	29,520,000	781,666,000
Main Dam Seepage Pump back	33,450,000	28,110,000	28,650,000	417,880,000
Reclaim Flow to Mill	110,400,000	251,000	145,400,000	2,024,181,000
WTP #1 Influent from Reclaim	47,630,000	64,250,000	50,960,000	352,263,000
WTP #1 Influent from Mine Sump	0	0	0	93,920,000
WTP #1 Clarifier Sludge to Tails	0	0	0	0
WTP #2 Influent from Reclaim	0	0	0	1,960,490,760
WTP #2 Sludge to Tails	0	0	0	76,412,931
Discharge to Red Dog Creek	0	0	0	1,744,977,000
WTP #3 Influent from MWD	5,967,000	9,260,000	5,742	66,964,742
WTP #3 Influent from Mine Sump	0	0	11,090,000	11,090,000
WTP #3 Total Effluent	0	0	0	27,572,000
East Overburden Sump	383,600	251,900	191,000	7,286,691
West Overburden Sump	1,593,900	300,200	92,600	18,324,200
Main Waste ARD to Main Pit	0	0	0	0
Treated Water to Main Pit	0	0	0	0
Tailings Water Supernatant (calc.) to TSF *	191,753,600	238,935,000	242,190,600	2,014,121,800
Mill Pad Collection	***	***	***	***
Sand filter Effluent - Mine Road Dust Control	0	0	0	1,550,600
Kaviqsaaq Diversion **	0	0	0	4,221,600

* Includes Main Pit water pumped back to Tailings Storage Facility
** Monthly total flow averaged from all flow readings for month
*** Electronic data collection error, no values

Mine water quality

An electronic spreadsheet titled *Red Dog Analytical Data 2023.xlsx* is included with this report. The spreadsheet incorporates all analytical data used to generate the trend charts depicted in the Appendices of this report.

Mine water quality trend charts

Mine water quality trend charts are provided in Appendices C, D, E, F, G, H, I, J, K and L of this report. Water quality Profile I and II (*"Monitoring Plan, November 2021")* constituents for the Mine Water, Mine Drainage, Bons Creek, APDES stations, Mill Pad, Hilltop and the Kaviqsaaq Diversion are illustrated for a five-year period ending with the 4th quarter. No unusual trends were noted for the any of the monitored areas during 4th quarter period.

Visual monitoring of mine water management systems

Mine water collection systems were visually inspected during the quarter as required per the *Integrated Waste Management Plan – Monitoring Plan, (November 2021).* All systems operated as designed during the 4th quarter. The Kaviqsaaq diversion was winterized in late September.

Fish weir inspection

The fish weir fall inspection was completed on September 30th, 2023, no issues were identified and the system was operating as designed. A written report was submitted to the ADEC, ADF&G and the Environmental Protection Agency (EPA) Region 10.

Water balance

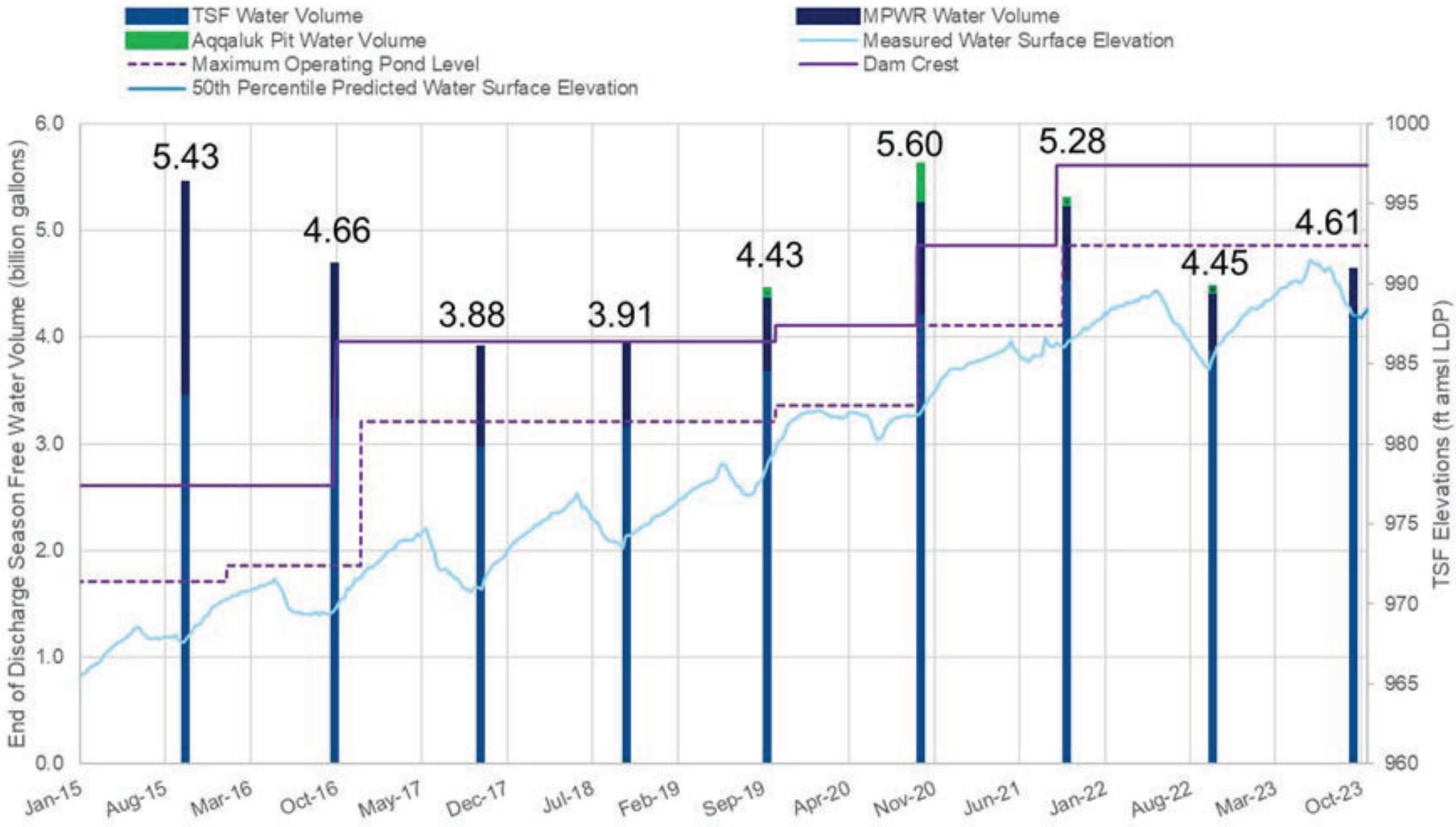
A mine water balance computer simulation program is maintained using GoldSim software. The GoldSim simulation generates a water elevation projection for Life of Mine (LOM) through multiple data sets entered into the model. Figure 2 depicts forecasted Tailings Storage Facility elevation based on current and expected operations. A free water inventory chart is provided in Figure 3 which represents historic trends through 2023 and includes water volumes for the Tailings Storage Facility, Main Pit Water Reservoir and Aqqaluk Pit.

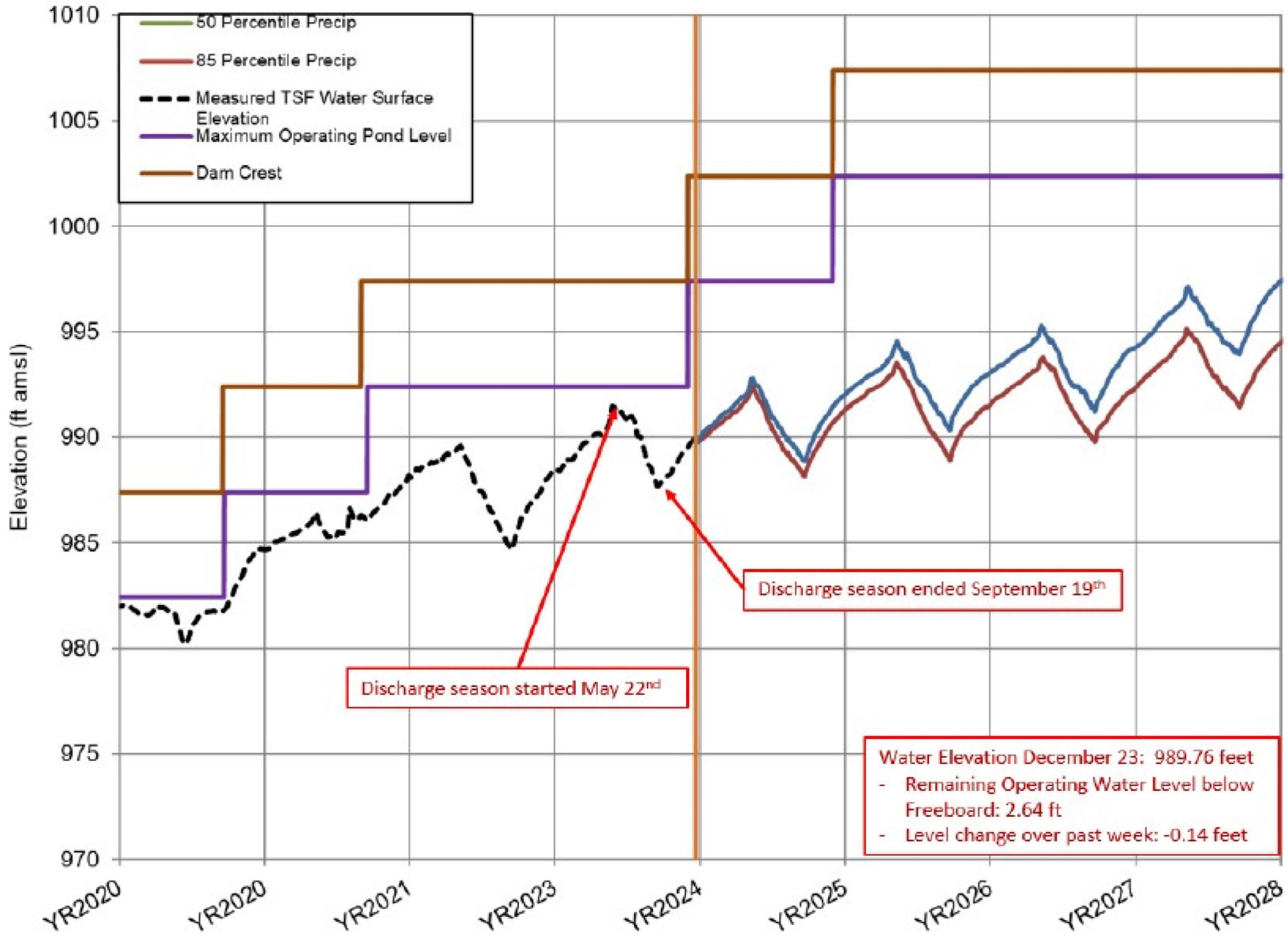
Waste water treatment reagent consumption

Significant reagents consumed for wastewater treatment during 2023 are listed below:

- Total quantity of flocculant used in Water Treatment Plant 2 (WTP2) and WTP1 was 121.8 metric tonnes, the majority being used in WTP2.
- Total quantity of lime used in WTP2 is not tracked individually, though the total lime used in WTP1, WTP2 and WTP3 was 11,566 metric dry tonnes.
- Total quantity of sodium sulfide used in WPT1 and WTP2 was 571 metric tonnes, utilized to precipitate cadmium.

- Total quantity of flocculants used in WTP3; - None
- Quantity of any other chemicals used in significant quantities in WTP2; - Gypsum 21,637 metric tonnes


TSF Water Volume
Aqqaluk Pit Water Volume
Maximum Operating Pond Level
50th Percentile Predicted Water Surface Elevation
MPWR Water Volume
Measured Water Surface Elevation
Dam Crest
End of Discharge Season Free Water Volume (billion gallons)
TSF Elevations (ft amsl LDP)
5.43
4.66
3.88
3.91
4.43
5.60
5.28
4.45
4.61
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1000
995
990
985
980
975
970
965
960
Jan-15
Aug-15
Mar-16
Oct-16
May-17
Dec-17
Jul-18
Feb-19
Sep-19
Apr-20
Nov-20
Jun-21
Jan-22
Aug-22
Mar-23
Oct-23


50 Percentile Precip
85 Percentile Precip
Measured TSF Water Surface Elevation
Maximum Operating Pond Level
Dam Crest
Elevation (ft amsl)
1010
1005
1000
995
990
985
980
975
970
YR2020
YR2020
YR2021
YR2023
YR2024
YR2025
YR2026
YR2027
YR2028
Discharge season started May 22nd
Discharge season ended September 19th
Water Elevation December 23: 989.76 feet
- Remaining Operating Water Level below Freeboard: 2.64 ft
- Level change over past week: -0.14 feet

Significant activities in mine water management

The Tailings Storage Facility contained an calculated 4.212 billion gallons of free water for December 2023 compared to 4.624 billion gallons during December 2022. The decrease in water volume was attributable to a successful discharge season. Total precipitation for the 2023 year was recorded at 30" almost double the normal average for the area.

The Main Pit The contained an estimated 131 million gallons of free water as of December 2023, a significant reduction compared to 500 million gallons measured the same time for the previous year.

A total of 1.78 billion gallons of water was discharged from outfall 001 during 2023 compared to 1.72 million gallons discharged in 2022. Red Dog commenced water discharge from Outfall 001 on May 22nd and ceased discharging on September 19th, 2023.

New Certificate of Authorizations (COA) were issued for the Water Supply Dam (WSD), Tailings Back Dam (TBD) and the Tailings Main Dam (TMD). The final construction raise was completed for the TMD. The current permitted elevation for the TBD dam is 1002.4 ft. which allows for a maximum surface water elevation of 997.4 ft. in the Tailings Storage Facility.

Waste Rock Management

Quantities, placement locations and analysis of waste rock

Dig face inspections of waste shots and weekly waste dump inspections were completed to confirm waste characteristics and suitability for stockpile locations. There were no exceptions to the Waste Rock Management Plan (Oct 2023) for this reporting period and all waste was managed in accordance with the plan.

During the quarter a total of 1,337,389 of Aqqaluk and 696,490 tonnes of Qanaiyaq waste rock was hauled as waste rock to various dump locations. The primary waste storage sites were:

- Main Pit Dump (MPD2, MPD3, MPD4 and MPD5)
- Oxide / Main Waste Dumps (COV3, CWD, LAN [Landfill], OXO, QPD1 and QPD2)
- Projects & Construction Areas (CPAD [Crusher Pad], NBANK [North Bank], PCP and ROADS.

Table 2 below provides a summation of waste rock lithology and placement, Appendix G - *Waste Rock Management Summary Reports* provide additional information for waste rock and cover material stockpiled. The *Waste Rock Production Report* provides geochemistry data and the *Cover Material Report* lists physical and chemical characteristics associated with the cover rock.

Table 2 - Summary of Waste Haulage, placement area and lithology

Tonnes			Type			
Dump Area	**Location**	**Lithology**	**Construction**	**Cover**	**Most Reactive**	**Other**
Main Pit Dump	COV2	Kivalina		33,390		
	COV2 Total			**33,390**		
	MPD2	Ikalukrok				474
		Kivalina				4,806
		Siksikpuk				228,318
	MPD2 Total					**233,598**
	MPD3	Ikalukrok				13,178
		Siksikpuk				7,453
	MPD3 Total					**20,631**
	MPD4	Ikalukrok			19,858	199,222
		Kivalina				92,970
		Mixed				378
		Siksikpuk				129,713
	MPD4 Total				**19,858**	**422,283**
	MPD5	Ikalukrok				42,561
		Kivalina				16,848
		Siksikpuk				258,486
	MPD5 Total					**317,895**
Main Pit Dump Total				**33,390**	**19,858**	**994,407**
Oxide/Main Waste Dump	COV3	Kivalina		3,712		
	COV3 Total			**3,712**		
	CWD	Ikalukrok			14,544	10,491
	CWD Total				**14,544**	**10,491**
	LAN	Ikalukrok				10,798
		Kivalina				1,703
		Siksikpuk				91
	LAN Total					**12,592**
	OXO	Ikalukrok				1,893
	OXO Total					**1,893**
	QPD1	Ikalukrok				294,217
		Kivalina				14,139
		Okpikruak				1,411
		Siksikpuk				262,008
	QPD1 Total					**571,775**
	QPD2	Ikalukrok				66,343
		Kivalina				9,606
		Siksikpuk				287,263
	QPD2 Total					**363,212**
Oxide/Main Waste Dump Total				**3,712**	**14,544**	**959,963**
Projects & Construction	CPAD	Siksikpuk	1,004			
	CPAD Total		**1,004**			
	NBANK	Siksikpuk	164			

	NBANK Total		**164**			
	PCP	Siksikpuk	6,677			
	PCP Total		**6,677**			
	ROADS	Ikalukrok	160			
	ROADS Total		**160**			
Projects & Construction Total			**8,005**			

Table 3 lists the volume of cover rock used to date for reclamation as well as the total cover material stockpiled and available for future closure requirements.

Table 3 - Cover Material Stockpiled

Cover Stockpile Location	Total Tonnes
Ramp to Nowhere (RNC)	1,271,891
North Oxide (COV)	3,229,929
South Oxide Top Soil (SOT)	81,094
Kivalina Overburden Top Soil (KOB)	70,913
North Oxide (COV2)	3,399,044
North Oxide (COV3)	214,909
Total collected to date	8,270,714
Cover utilized to date	400,955
Amount stockpiled	7,869,759

Results of waste rock geochemical monitoring

Other than blasthole analyses, no additional geochemical testing was conducted on waste rock during the reporting period. Geochemical waste rock test results are included in the *Waste Rock and Cover Rock Summary Report* listed in Appendix G of this report. The report addresses quantity, location placement and geochemical analysis for waste rock managed during this reporting period. All waste rock was managed in accordance with the *Integrated Waste Management Plan - Waste Rock Management (Oct 2023)*.

Visual monitoring of waste rock dumps

Weekly visual inspections of active waste rock dumps were conducted by the Senior Geotechnical Engineer or their designee if offsite. No significant waste rock dump incidents were observed during the inspections though Geotechnical Engineers were alerted when mine operators visually observed the failure zone during shift. This incident is further discussed in the next section.

Significant activities in waste rock management

A geotechnical incident was observed on November 25, 2023 which occurred within the Aqqaluk pit west wall at the 1,025’-900’ elevation. Five benches (25’ each) within the Kivalina shale unit were impacted, a minor amount of material sloughed down on the western side of the failure zone.

The fracture occurred along two unknown fault structures. Figure 4 depicts the failure area within the yellow highlight line. The area was barricaded until safe to access again. The failure was contained within the pit

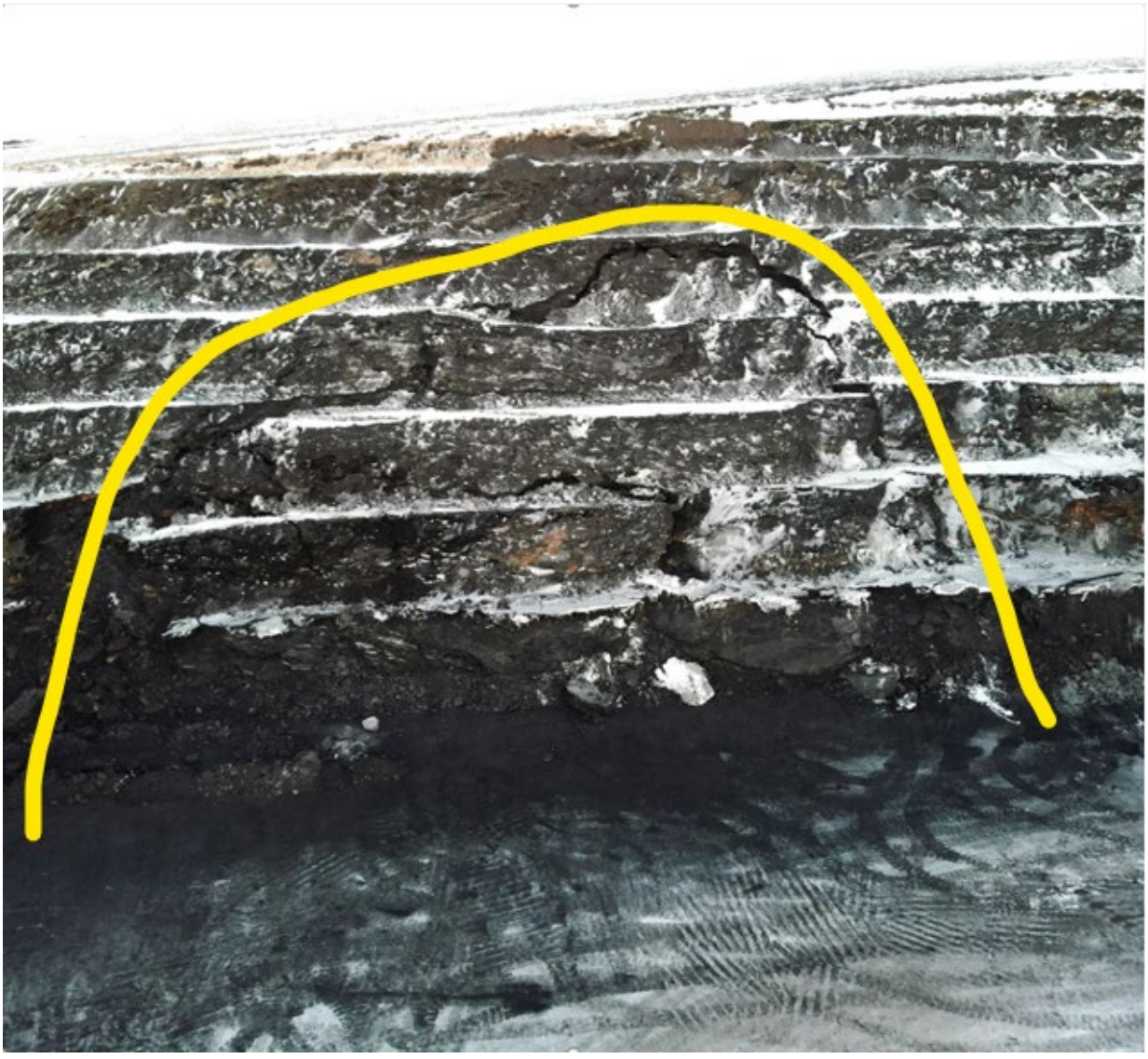
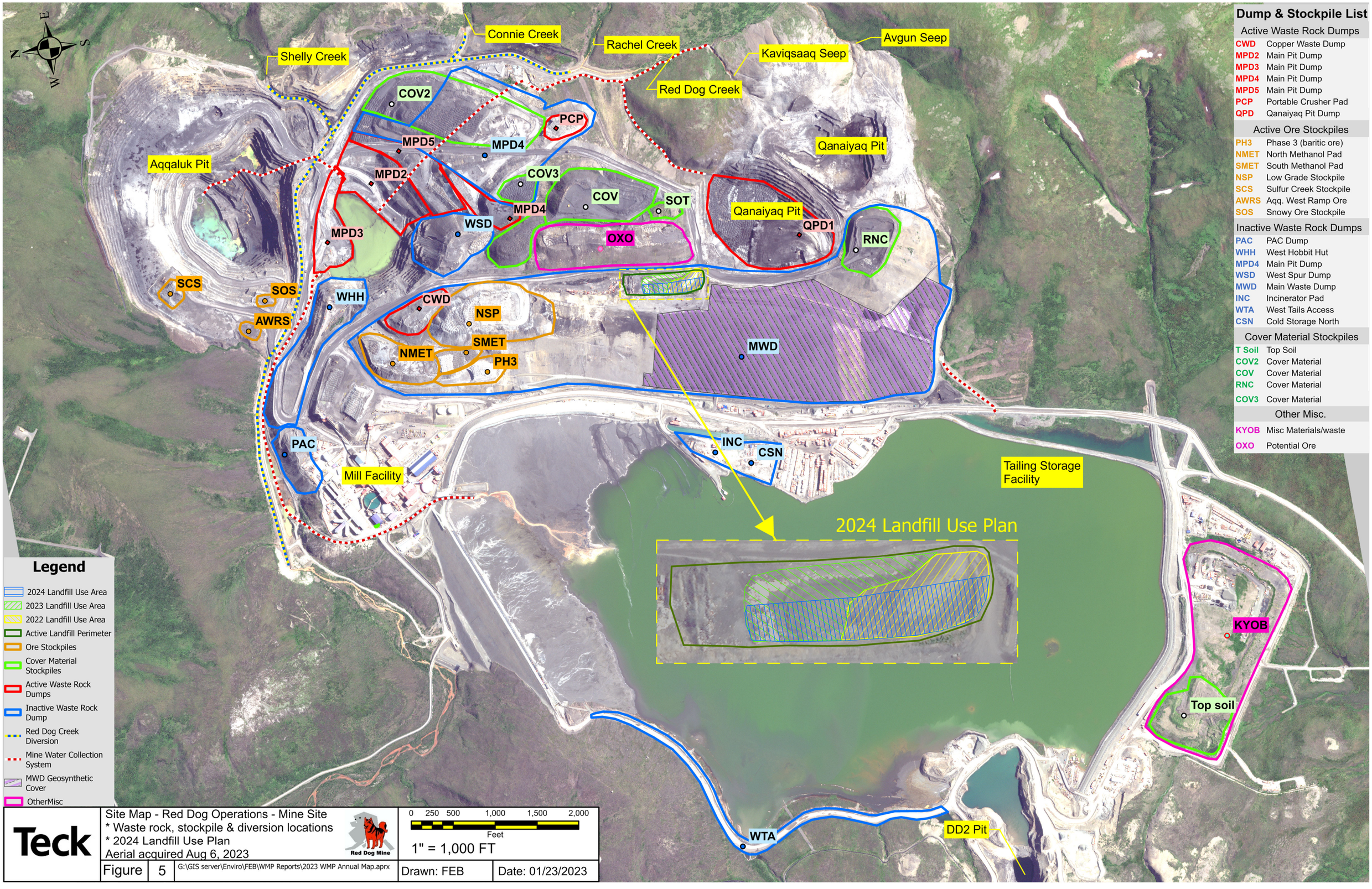


Figure 4 - Geotechnical Incident along pit wall



Dump & Stockpile List

Active Waste Rock Dumps

CWD	Copper Waste Dump
MPD2	Main Pit Dump
MPD3	Main Pit Dump
MPD4	Main Pit Dump
MPD5	Main Pit Dump
PCP	Portable Crusher Pad
QPD	Qanaiyaq Pit Dump

Active Ore Stockpiles

PH3	Phase 3 (baritic ore)
NMET	North Methanol Pad
SMET	South Methanol Pad
NSP	Low Grade Stockpile
SCS	Sulfur Creek Stockpile
AWRS	Aqq. West Ramp Ore
SOS	Snowy Ore Stockpile

Inactive Waste Rock Dumps

PAC	PAC Dump
WHH	West Hobbit Hut
MPD4	Main Pit Dump
WSD	West Spur Dump
MWD	Main Waste Dump
INC	Incinerator Pad
WTA	West Tails Access
CSN	Cold Storage North

Cover Material Stockpiles

T Soil	Top Soil
COV2	Cover Material
COV	Cover Material
RNC	Cover Material
COV3	Cover Material

Other Misc.

KYOB	Misc Materials/waste
OXO	Potential Ore

Legend

- 2024 Landfill Use Area
- 2023 Landfill Use Area
- 2022 Landfill Use Area
- Active Landfill Perimeter
- Ore Stockpiles
- Cover Material Stockpiles
- Active Waste Rock Dumps
- Inactive Waste Rock Dump
- Red Dog Creek Diversion
- Mine Water Collection System
- MWD Geosynthetic Cover
- OtherMisc

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Site Map - Red Dog Operations - Mine Site
* Waste rock, stockpile & diversion locations
* 2024 Landfill Use Plan
Aerial acquired Aug 6, 2023

Red Dog Mine

0 250 500 1,000 1,500 2,000
Feet
1" = 1,000 FT

Figure	5	G:\GIS server\Enviro\FEB\WMP Reports\2023 WMP Annual Map.aprx	Drawn: FEB	Date: 01/23/2023

Tailings Management

Quantities and analysis of tailings

Table 4 depicts the dry tonnes of tailings generated and the average lead, zinc and iron concentration in the tailing's solids discharged to the Tailings Storage Facility for the quarter. No tailings were placed into the former DD2 pit this quarter.

Table 4 - Tailings Produced

		Analysis		
Month	Dry Tonnes Tailings	% Pb	% Zn	% Fe
Oct	253,823	2.8	3.3	10.7
Nov	210,503	2.2	4.1	8.3
Dec	266,776	1.6	3.9	9.3

Tailings Storage Facility and Main Pit water elevations

Table 5 lists the surveyed Tailings Storage Facility water elevation levels recorded during the reporting period. The Tailings Storage Facility was maintained within the permitted level. The Main Pit was maintained below a water elevation of 850 feet amsl.

Table 5 - Tailings Storage Facility, Elevations

Survey Date	TSF
10/7/2023	988.105
10/13/2023	988.18
10/21/2023	988.289
10/27/2023	988.671
11/4/2023	988.788
11/10/2023	989.017
11/17/2023	989.249
11/24/2023	989.385
12/1/2023	989.48
12/23/2023	999.757
12/23/2023	989.757
12/29/23	989.828

Visual monitoring of tailings facilities

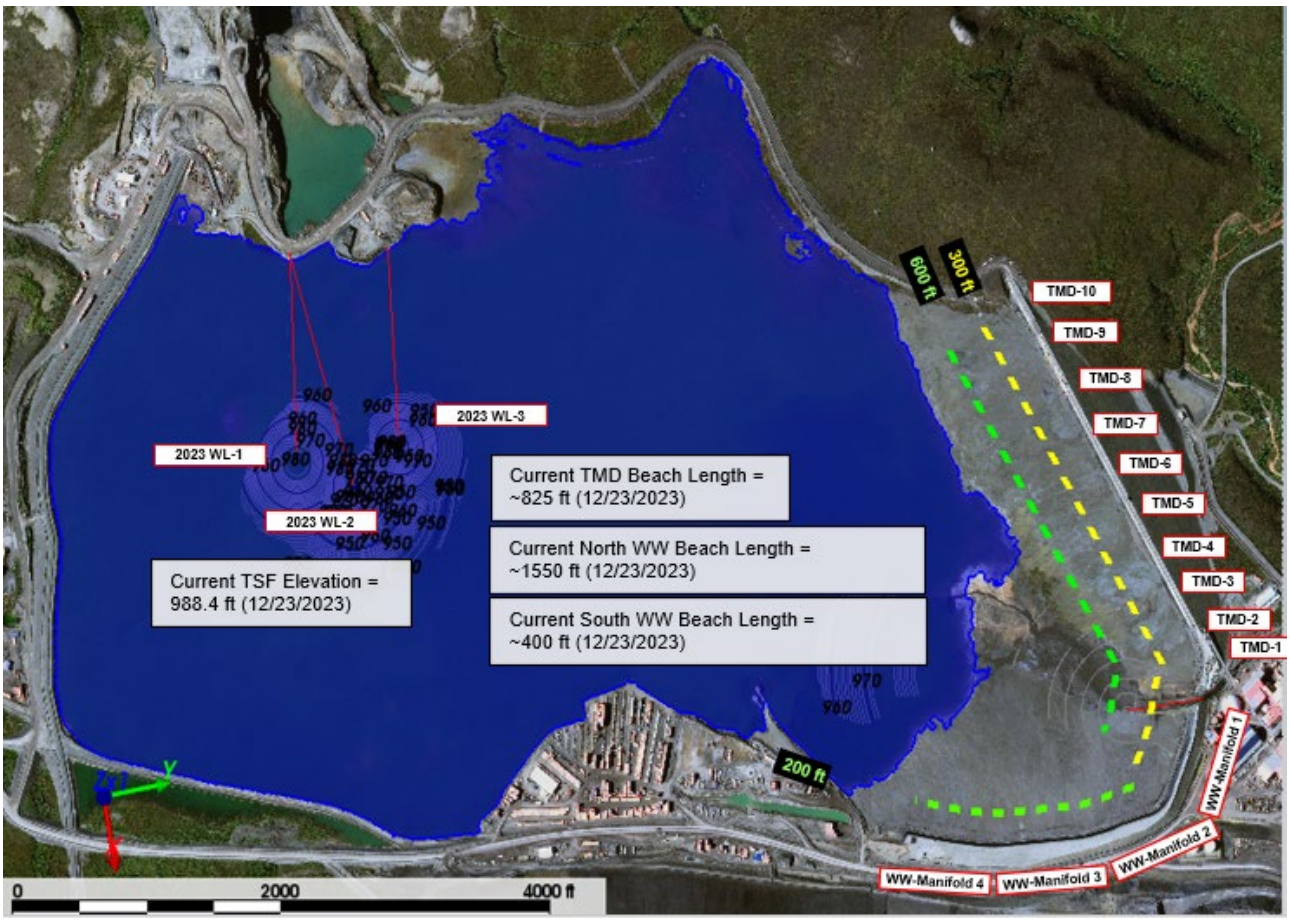
Visual monitoring inspections of the Tailings Storage Facility were completed as required. All systems operated as designed with no findings noted for the quarter. Monitoring of the dams per the requirements specified by each dams Operation and Maintenance Manual was completed for the period.

Significant activities in tailings management

A Tailings Storage Facility and the Main Pit bathymetry surveys were completed for the 2023-year, bathymetry maps are provided in figures 7 and 8 of this report.

Tailings continued to be deposited sub aqueously for the 4th quarter. Figure 6 denotes tailings deposition areas for the quarter.

Figure 6 - Tailing Deposition in TSF

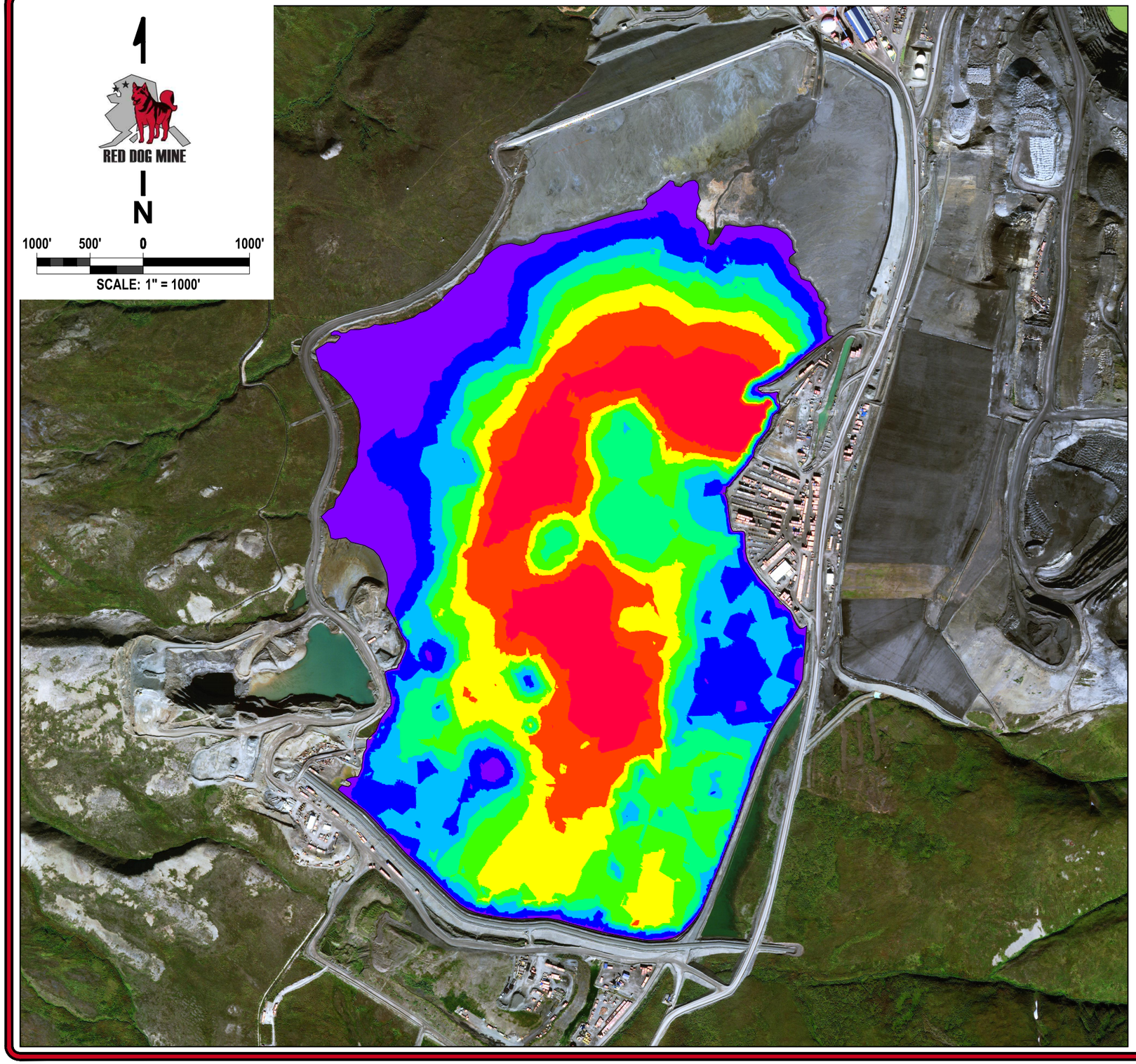


Location	Start Date	End Date	Durations (days)	Tailings Placed (Dry Tonnes)
Pipe corridor	8/25/2023	8/31/2023	6	62,974
2023 Winter Line 1	8/31/2023	9/16/2023	16	86,925
Pipe Corridor	9/16/2023	9/24/2023	8	80,388
2023 Winter Line 1	9/24/2023	10/21/2023	27	246,654
2023 Winter Line 2	10/21/2023	12/5/2023	45	325,9266
2023 Winter Line 3	12/5/2023	12/22/2023	17	140,215

Model Input Description	Version & Source	Notes
Image	8/24/2023 – PhotoSAT survey	
Base Surface	8/25/2023 Bathymetry & 8/24/2023 PhotoSAT survey	Updated with actual tailings placed
Water Elevations	12/23/2023 – GoldSim Water Balance	Water elevations are LDP
Tailings Production	December Mill Production Forecast	

Fig 6 Notes:

- TSF Beach lengths are measured from the Muk3D Model results. The beach lengths are verified from visual observations and CGG Survey.



Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	943	950	
2	950	955	
3	955	959	
4	959	964	
5	964	968	
6	968	974	
7	974	983	
8	983	987	

BATHYMETRY DATE:	AUGUST 26-29, 2023
IMAGERY DATE:	AUGUST 2023
TSF WATER ELEVATION:	987.3'
TSF AREA:	23,645,415.71 Sq. Ft. 542.824 Acres
FREE WATER VOLUME:	3,985.0296 M Gal
COORDINATE SYSTEM:	RED DOG MINE LDP

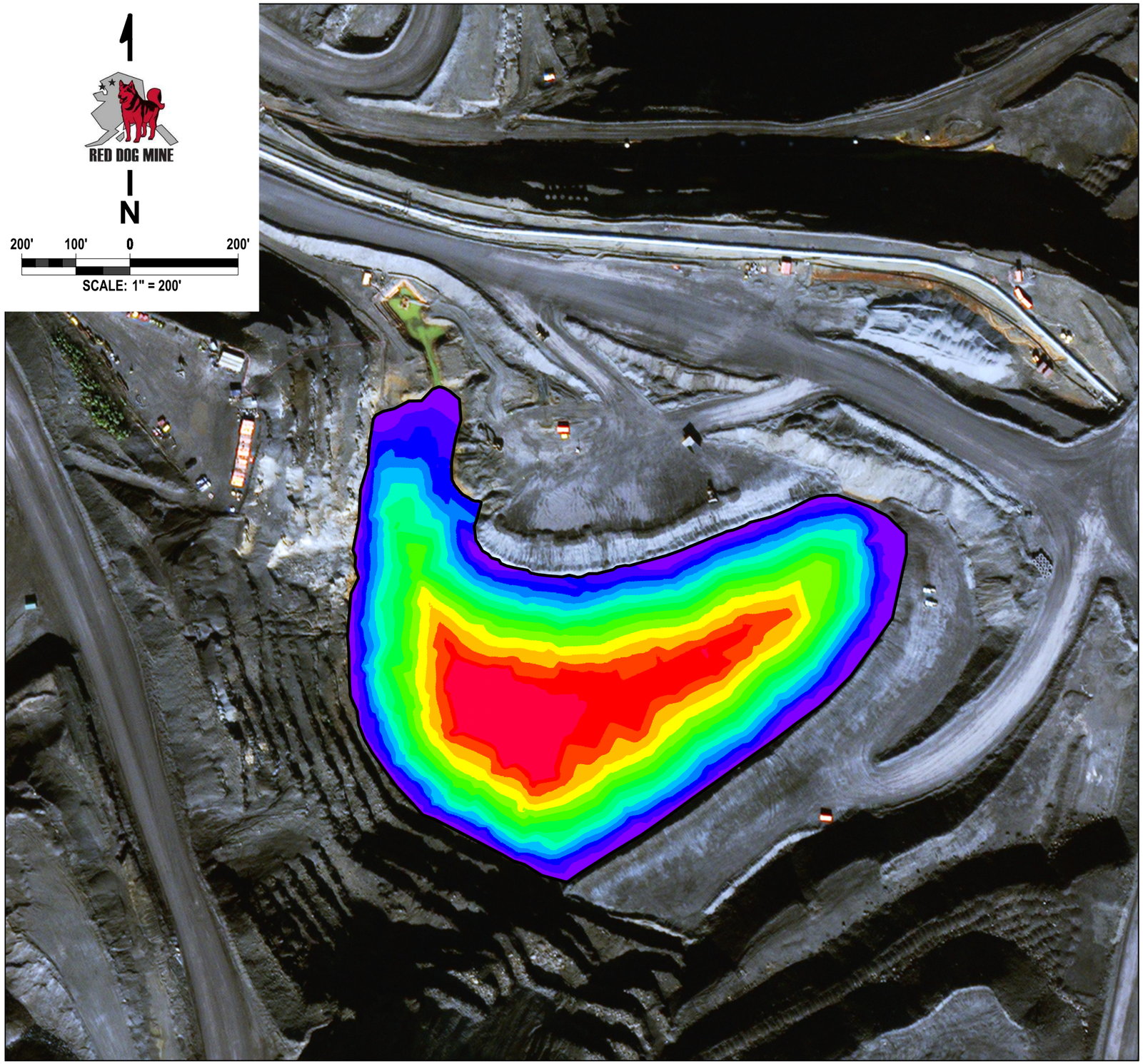
2023 TSF BATHYMETRIC MAP

PROJECT #	E7750
DRAWN BY:	JM
CHECKED BY:	TO
DATE:	10/16/2023
SCALE:	1"=1000'
SHEET:	1 OF 1

RED DOG MINE

Red Dog Operations

Teck



Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	717	720	
2	720	723	
3	723	734	
4	734	746	
5	746	758	
6	758	768	
7	768	778	
8	778	786	
9	786	795	
10	795	803	
11	803	811	
12	811	819	
13	819	825	
14	825	832	
15	832	840	

BATHYMETRY DATE: AUGUST 30, 2023
IMAGERY DATE: AUGUST 2023
TSF WATER ELEVATION: 839.6'
TSF AREA: 509,670.96 Sq. Ft. 11.700 Acres
FREE WATER VOLUME: 229.420 M Gal
COORDINATE SYSTEM: RED DOG MINE LDP

2023 MPWR BATHYMETRIC MAP

PROJECT # E7750
DRAWN BY: JM
CHECKED BY: TO
DATE: 10/16/2023
SCALE: 1"=200'
SHEET: 1 OF 1

RED DOG MINE

Red Dog Operations
Teck

Class III Municipal Solid Waste Landfill

Monthly visual landfill inspections were completed as required with no noted concerns. The annual mine incinerator composite (3-week) ash sample was collected during October and analyzed for metals using EPA method 1311 - Toxicity Characteristics Leaching Procedure (TCLP). TCLP results indicated the ash is non-hazardous waste under the EPA Resource Conservation Recovery Act (RCRA). A copy of the analytical lab report was previously submitted on November 15, 2023 to Neil Lehner with ADEC.

Quantities of inert solid waste

The Red Dog survey department performed a LiDAR scan of the landfill surface during October 2023 and calculated a volume of 23,902 cubic yards of combined refuse and waste rock placed for 2023. Approximately 10,021 cubic yards of waste rock was used as cover material, leaving a total amount of non-municipal refuse placed in the landfill of 13,881 cy for the 2023 reporting year.

Figure 9 – *Class III Landfill LiDAR image looking southwest* depicts the areas of use for the 2023. The difference was taken as a volumetric calculation between surfaces utilizing MineSight software.

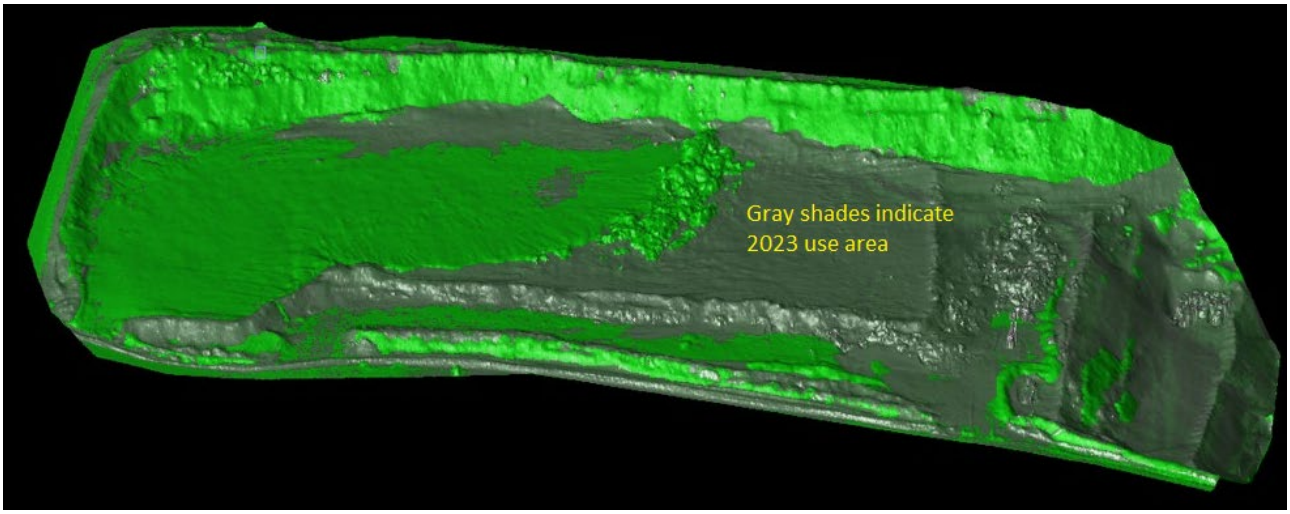


Figure 9 – Class III Landfill LiDAR image looking southwest

Significant activities in solid waste landfill and waste management

Red Dog Operations continued with recycling various items which could be sent offsite for reuse or recycling. Enhancements to the recycling program are ongoing with the ultimate goal of decreasing the amount of waste placed in the Class III landfill. Waste reduction can involve eliminating the waste though better management of how the materials are received the operations, continuously looking at new recycling options both onsite and off and though better management/segregation of waste generated onsite.

The bullet list below represents the amount of waste which was sent off site for recycling from all of Red Dog Operations (mine and port) for the 2023 reporting year.

- Recycled 146,890 lbs of cardboard
- Recycled 5,430 lbs. of plastic
- Recycled 5,470 lbs. paper
- Recycled 416,212 lbs. of scrap steel
- Recycled 300,423 lbs. of used tires
- Sent 300,423 lbs of tires for retreading
- Recycled 8,420 lbs. of electronic waste
- Recycled 858,510 lbs. of sag mill liners
- Recycled 206,115 wooden pallets
- Recycled 272,660 lbs of used oil for reprocessing offsite

Landfill Use Plan

For the 2024-year, non-municipal refuse will continue to be placed within the existing cell with refuse placement progressing to the north. *Figure 5 – Site Map* depicts the landfill use area planned for 2024.

Significant activities in Class III municipal solid waste landfill

A cleanup of an existing boneyard was completed during the summer, approximately thirty 20-cy boxes of various metals were collected and sent offsite in addition to the amounts reported in the bullet list above.

Mining and Milling Activities

Mining quantities

Table 6 lists the total tonnes of ore hauled to the mill stockpile each month during the reporting period. The total includes both Aqqaluk and Qanaiyaq ore and does not include any marginal ore placed within the Marginal Ore Stockpile.

Table 6 - Ore Mined and Stockpiled

Month	Ore Mined, tonnes
Oct	392,643
Nov	262,888
Dec	371,640

Milling Quantities

Table 7 lists the total tonnes of ore processed through the mill facilities each month during the reporting period.

Table 7 - Ore Processed through Mill

Month	Ore Milled, tonnes
Oct	372,092
Nov	292,271
Dec	402,774

Significant activities in mining and milling

Qanaiyaq ore continued to be mixed with Aqqaluk ore at a mill feed blend of approximately 20% to 30% for the 4th quarter.

Reclamation

Significant activities associated with reclamation

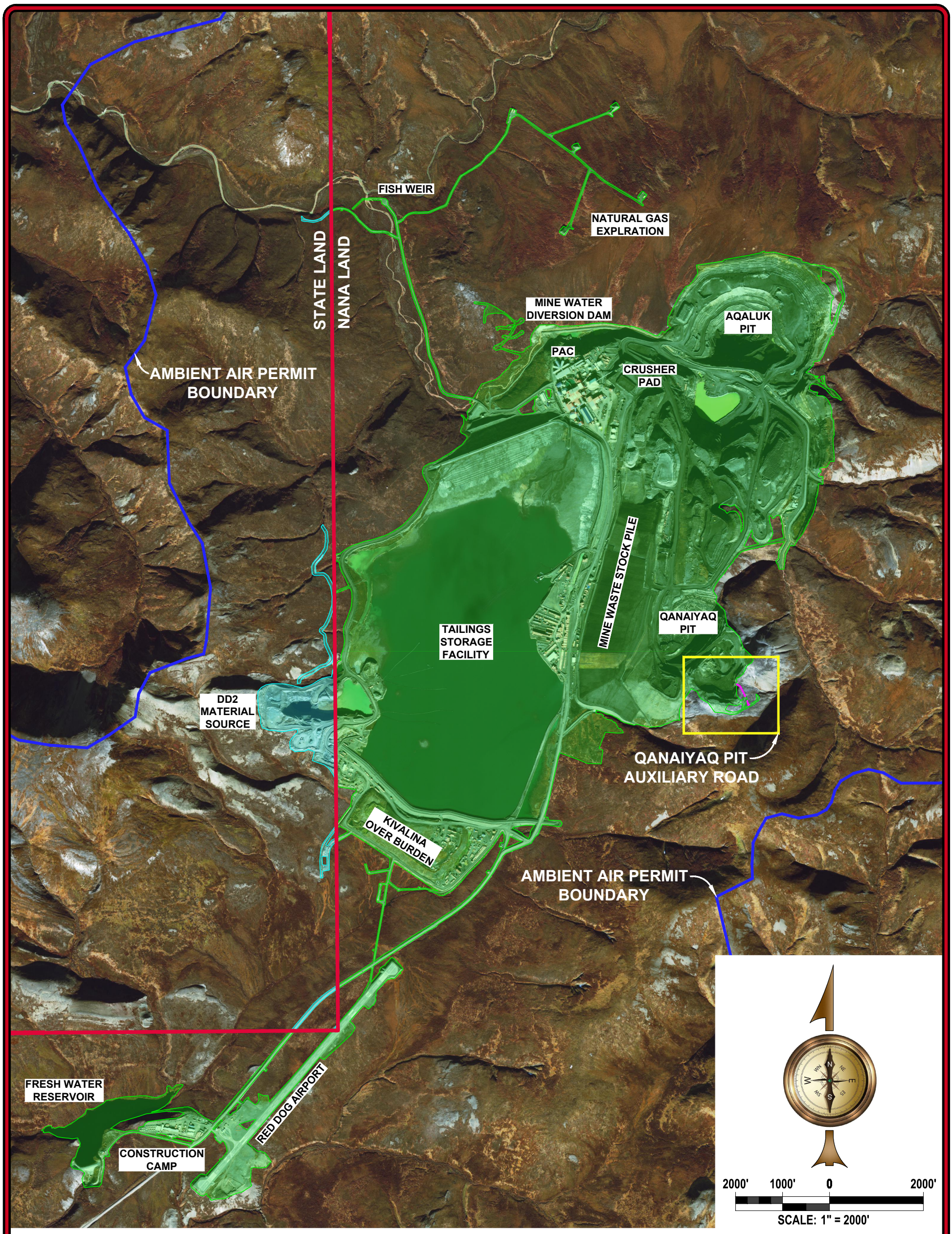
Reclamation activities for the Main Waste Dump (MWD) cover project were completed late September. Approximately 73% or 95.14 acres of the MWD has been covered to date, approximately 24.4 acres are planned to be completed for 2024 (Phase III area) leaving 9.5 acres (Phase V) to be completed in 2030-31 or once the low-grade ore stockpiled in the Phase V area is processed.

Disturbance

A map of the new land disturbance for the mine site for the year is shown in Figure 8 – *Red Dog Operations 2023 Land Disturbance Map*. Table 8 lists the areas or projects contributing to the disturbance for 2023.

Table 8 - Area Disturbed in 2022

2023 New Disturbance Area	Acres
Qanaiyaq Auxiliary Road	0.20
Total 2023 Disturbance	0.20



2023 LAND DISTURBANCE MAP

LAND DISTURBANCE AREA = 0.20 ACRES

LEGEND

- NANA LAND PREVIOUSLY DISTURBED
- NANA LAND NEWLY DISTURBED
- STATE LAND PREVIOUSLY DISTURBED

PROJECT #	
DRAWN BY:	JM
CHECKED BY:	CC
DATE:	01/11/24
SCALE:	1"=2000'
FIGURE	1

RED DOG MINE

Red Dog Operations

Teck

Reclamation research

No reclamation research was completed for the reporting year.

Reclamation monitoring

No reclamation monitoring was completed for the reporting year.

Amendments to the WMP and RPA

Red Dog Operations submitted an amendment for the Plan of Operations F20219958POOA and Reclamation Plan Approval F20219958RPA to complete a geotechnical evaluation in an undisturbed area just south of the DD2 quarry pit to gauge viability for a possible new storage pad location. Authorization was granted from ADNR on April 27, 2023.

ADEC reviewed three new trial dust suppressants proposed for use within the TSF, ADEC approved their use on May, 24th, 2023.

The Waste Rock Management Plan was amended and approved by ADEC on October 2, 2023, the amendment provided flexibility with managing highly reactive waste rock within the pits.

Risk Management Plan

The 2022 Risk Management Plan (RMP) Annual report was submitted to applicable state agencies during December 2023, no notable fugitive dust changes were noted in the report. The 2023 RMP report is expected be submitted to agencies sometime in 2024, will be included as Appendix H - *2023 Risk Management Plan Annual Report*.

Dust monitoring activities

Dust monitoring activities for the reporting year will be presented in the 2023 Risk Management Plan Annual Report anticipated to be submitted by the 2nd quarter 2024.

Financial Assurance

Financial assurance increased $31,450,050 based on the annual CPI adjustment. ADNR accepted the adjusted amount on September 5, 2023. The current mine reclamation bond amount after the adjustment is $660,451,050.

Wildlife

Wildlife interactions and casualties

There were seven recorded wildlife interactions recorded for this reporting period. Table 10 provides details for each recorded event.

Table 9 - Wildlife Interactions

SIR ID	Date	Incident Comments
13382	10/04/23	An environmental technician was traveling up the port road (mile 25) and noticed a dead fox. The dead fox was double bagged and transported to the mine. The cause of death is unknown.
13385	10/05/23	The Environmental team responded to a call from the Surface Crew reporting the presence of a bear and its two cubs in the vicinity between the Y and the airport. Under the guidance of the Environmental Technician Supervisor, a helicopter was deployed to safely relocate the bear and two cubs to a more suitable area.
13415	10/28/23	At about 15:10, a dead fox was seen on the Noatak side of the road just 10 yards north of Mile Post 13. A photo was taken and Environmental Technical Supervisor was notified. The carcass was not taken back due to lack of tools and trash bag to safely handle the dead fox. It will be retrieved later today and incinerated.
13458	11/21/23	received a call about caribou near the runway, aircraft were schedule to arrive within a few hour so it posed a threat to human health and safety. We attempted to haze without the use of cracker shells but the caribou were unfazed, so we fired off two cracker shells, of the (estimated) 40 Caribou about 30 of them reacted and ran across the road into the tundra away from the runway, 10 stuck around and seemed unwilling to cross the road, in total 4 more cracker shots were fired before we decided to attempt to haze them with a snow mobile, using the sound of the engine to scare them away while applying spacial pressure from the direction of the runway. it should be noted that the snow mobile used was not the typical 2 Stroke engine so the caribou seemed less bothered by the noise and more affected by the pressure of my presence. eventually with the use of two more cracker shells and some yelling from the snow mobile rider the remaining 10 caribou were encouraged enough to cross the road. they were then spotted lingering in nearby (1-2 miles) several hours later in a patch of tundra.
13462	11/28/23	Environmental Department received a call from airport tower that ptarmigan were spotted in close proximity to north end of runway with a plane landing in 30 minutes. Technician stopped on the road and shot off two cracker shells, moving the flock of ptarmigan ~800 feet east of the runway. Technician then entered the runway and hazed the remaining ptarmigan (~10) spotted between road and runway further away north. One cracker shell was shot off to ensure the remaining group joined the main flock east of runway. Plane landed with no issues.
13469	12/07/23	Port Road maintenance operator was tasked to help retrieve two dead caribou down the Port Road at 36 mile. After loading up the unsalvageable caribou into the back of 82-325 pickup, the pickup driver started heading north down back to the mine site. At 37 mile the driver ran into five caribou crossing the road and could not stop in time killing a caribou. Driver was traveling 40 MPH with poor visibility do to high winds with blowing snow. Driver did not see the caribou when traveling south bound to 36 mile.

13470	12/07/23	DML Concentrate Driver was southbound loaded descending the hill into Little Creek, at Mile 36 on the Port Road on a dark winter early morning. Running with low beams due to snow glare, he could see the illumination of over 10 delineators (1,000 ft.), with some ground blowing snow. As he approached the bridge, he observed movement at 200 ft. in the road and identified approx. a dozen caribou crossing from North to South. He attempted to slow and to go between animals. They then adjusted their movements and he was unable to avoid them, striking one with his front bumper. He continued to slow to a stop, and then radioed the DML Shop. As the Mechanics arrived, they, they observed a second dead caribou, which had apparently struck the trailers, unknown to the Driver.

Closing

Please accept this report as required under the State of Alaska Waste Management Permit No. 2021DB0001 and Reclamation Plan Approval F20219958. If there are any questions, please contact Frank Bendrick at (907) 754-5138 or myself at (907) 754-5700.

Based on information and belief formed after reasonable inquiry, I certify that the statements and information in and attached to this document are true, accurate and complete.

Sincerely,



Les Yesnik
General Manager
Red Dog Operations

cc: Tim Pilon, ADEC, Fairbanks
William Groom, ADNR, Fairbanks
Adam Daniels, ADNR, Fairbanks
DNR.Water.Reports
Audra Brase, ADF&G, Fairbanks
Lance Miller , NANA
Mike Gonzales, Red Dog Operations
Richard Hudson, Red Dog Operations

Appendix A: Biomonitoring Report (pending 2nd quarter)

Appendix B: Annual Long-Term Permafrost & Groundwater Monitoring for TSF

2023 ANNUAL REPORT

Long-Term Permafrost and Groundwater Monitoring Program

Red Dog Mine Tailings Storage Facility

December 2023

Prepared for:

Teck Alaska, Inc.
2525 C St., Suite 310
Anchorage, AK 99503
Teck PO #1409577-SVC

Prepared by:

4300 B Street, Suite 605
Anchorage, AK 99503

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Appendices

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Appendix B – Figures/Maps
Appendix C – 2022 Thermistor Measurements
Appendix D – Thermistor Plots
Appendix E – Piezometer Plots
Appendix F – Quality Assurance/Quality Control Data and Field Measurement Forms
Appendix G – Comparison Graphs, P/T-96-13 and P/T-21-13

Acronyms and Abbreviations

EPA	(US) Environmental Protection Agency
ft amsl	feet above mean sea level
ft bgs	feet below ground surface
Kohms	kilo-ohms
Kuna	Kuna Engineering, LLC
QA/QC	Quality Assurance and Quality Control
SEP	Supplemental Environmental Program
TAK	Teck Alaska, Inc.
WMCI	Water Management Consultants, Inc.
WRWP	Well Replacement Work Plan

1 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 into on November 25, 1997 (US v. Cominco Alaska Incorporated, Civil Action A97-267CV). The Monitoring Program was developed to monitor the potential effects of the Tailings Impoundment Facility (now called the Tailings Storage Facility, TSF) on permafrost and groundwater in the areas of the TSF Main Dam, the Overburden Stockpile, and background locations downgradient of the TSF within the Red Dog Creek and Bons Creek drainages. The Consent Decree requires the submission of an annual report to provide a data collection summary, a quality assurance and quality control (QA/QC) summary, and a description of the status of the monitoring program. This report follows a similar format and content as previously submitted reports, including the most recent annual report submitted in February 2023 for calendar year 2022 (Kuna 2023). This report also builds on the most recent 5-year report submitted in April 2022 for calendar years 2017 – 2021 (Kuna 2022a).

2 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). Figure 1 illustrates the regional setting and layout of the mine and its support facilities. The mine consists primarily of several open pits (ore bodies) and associated support facilities. Support facilities include an ore milling and concentration facility, an employee housing area, a construction camp, an asphalt paved runway, and a power generation facility. The site also includes approximately 300 acres of waste rock piles and a tailings storage facility (impoundment) behind two earthen dams (the main and back dams). The TSF is used for the storage of tailings (underwater) and receives drainage from the open pit areas, natural surface run-off, and process waters from the milling operation. Following treatment, water is discharged during summer months. The original Red Dog ore body (i.e., Main Pit) is no longer being actively mined and is instead receiving waste rock from the mining of the Aqqaluk and Qanaiyaq ore bodies. Waste rock will continue to be placed in the former pit area until the pit has been completely backfilled.

The TSF has the potential to affect both permafrost and groundwater in one or more adjacent watersheds/drainages. To document these potential effects, a ground temperature and groundwater level monitoring program began in the mid-1990s as part of the Groundwater Monitoring Supplemental Environmental Project (SEP). Results from this project are documented in the project's report (Water Management Consultants, Inc. 2001b) and form the basis for the Long-Term Permafrost and Groundwater Monitoring Plan (WMCI 2001a). Long-term monitoring is intended to demonstrate the continuity of the permafrost and the minimal flow of groundwater beneath and from (outside of) the TSF. The continuity of subsurface frozen conditions is critical to ensuring that any impacts from dissolved metals in the TSF do not affect the adjacent watersheds.

The key elements of the SEP monitoring program are:

- The quarterly monitoring of sixteen thermistors at background sites, the overburden stockpile, and within and downgradient from main dam area;
- The quarterly monitoring of nine piezometers at background sites and the main dam area;
- Data reduction, presentation, and management;
- Annual data reporting; and,
- Assessment of pertinent data trends on a five-year basis.

3 2023 Data Collection

TAK personnel collect the data from the project thermistors and piezometers (see listing in Appendix A). This data is then submitted to Kuna Engineering (Kuna). Appendix B contains a table of the raw data. Kuna is then responsible for the data reduction, presentation, and management.

The RDM thermistor and piezometer monitoring locations are illustrated on Figure 3 (northern portion), Figure 4 (central portion), and Figure 5 (southern portion).

Table 1 provides a summary of the quarterly data collection dates for the active thermistor strings, and Table 2 provides a summary of the quarterly data collection dates for the active piezometers.

Table 1. Summary of the 2023 Quarterly Thermistor Data Collection

Thermistors	Associated Figure	General Location	Monitoring Dates			
			1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
T-96-015	Figure 2	Red Dog Creek	1/9/23	4/24/23	8/29/23	10/18/23
T-95-005	Figure 2	Dam Area	1/7/23	6/28/23	8/29/23*	10/18/23
T-96-010	Figure 2	Dam Area	-	-	-	-
T-97-028	Figure 2	Dam Area	1/8/23	4/29/23	8/29/23	10/18/23
T-97-029	Figure 2	Dam Area	1/8/23	5/1/23	8/29/23	10/18/23
T-97-030	Figure 2	Dam Area	1/8/23	4/29/23	8/29/23	10/18/23
T-14-110	Figure 2	Tailing Impoundment	1/7/23	4/24/23	8/29/23	10/18/23
T-95-004	Figure 2	Dam area	-	-	-	-
T-05-061	Figure 2	Dam area	-	6/28/23*	8/29/23*	-
T-95-008 #2	Figure 3	Overburden Stockpile	1/7/23	4/24/23	8/29/23	10/18/23
T-96-013	Figure 3	Overburden Stockpile	1/7/23	4/24/23	8/29/23*	10/18/23
T-96-021	Figure 3	Overburden Stockpile	1/7/23	4/24/23	8/29/23	10/18/23
T-96-022	Figure 3	Overburden Stockpile	1/7/23	4/24/23	8/29/23	10/18/23
T-96-023	Figure 3	Overburden Stockpile	-	6/28/23	8/29/23	10/18/23
T-96-012	Figure 3	Bons Creek	1/7/23	4/29/23	8/29/23	10/18/23
T-96-012s	Figure 3	Bons Creek	1/7/23	4/29/23	8/29/23	10/18/23
T-21-013	Figure 3	Overburden Stockpile	-	-	9/3/23	10/30/23

Note: Hyphens (-) indicate that data was not collected. * Indicates inaccurate readings.

Table 2. Summary of the 2023 Quarterly Piezometer Data Collection

Piezometer	Associated Figure	General Location	Monitoring Dates			
			1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
P-96-015	Figure 2	Red Dog Creek	1/7/23	5/4/23	-	10/20/23
P-96-010	Figure 2	Dam Area	1/7/23	5/4/23	8/29/23	10/18/23
P-97-028	Figure 2	Dam Area	1/7/23	5/4/23	-	10/18/23
SPP-97-002	Figure 2	Dam Area	1/7/23	5/4/23	8/29/23	10/18/23
P-08A	Figure 2	Dam Area	1/7/23	5/4/23	8/29/23	10/18/23
P-08B	Figure 2	Dam Area	1/7/23	5/4/23	8/29/23	10/18/23
P-97-020	Figure 2	Dam Area	1/7/23	5/4/23	-	10/18/23
P-96-013	Figure 3	Overburden Stockpile	1/7/23	4/24/23	8/29/23	10/20/23
P-97-012	Figure 3	Bons Creek	1/7/23	4/24/23	8/29/23	10/20/23
P-21-013	Figure 3	Overburden Stockpile	7/25/23	4/24/23	8/29/23	10/18/23

Note: Hyphens (-) indicate that data was not collected.

Wells T-96-010 and T-95-004 have missing data throughout 2023 due to the inadvertent burial of the extension cables during the 2021 Main Dam raise and the development of a new seepage pond below the Main Dam. Both thermistor cables will be cut and spliced in spring/summer 2024 and data retrieval will resume. Well T-21-013 has missing data from Q1 and Q2 due to severe weather hampering data collection. Other thermistors have no readings during winter months due to the complete burial of the well in snow. While periodic data quality and collection issues continue to exist, these do not impact the overall long-term monitoring objective for the program.

4 Data Management and Reporting

As previously described, the reading and collection of the data from the thermistors and piezometers was performed by TAK personnel in 2023. This data was periodically provided to Kuna to upload to the Red Dog Mine groundwater monitoring database. Microsoft Access™ and Excel™ software are used to generate the tables and graphical plots of the data.

4.1 Thermistor Data Collection

Data collected from the thermistor cables is measured as a resistance value, in kilo-ohms (kohms) using a Dryden Instrumentation T5KMUK Automated Thermistor String Reader. The measured resistance values are subsequently converted to temperatures 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; similar to the T-21-013 thermistor string, the temperature data is logged and available for download on a periodic basis as necessary. Measured values are reviewed for completeness and the data is subsequently uploaded to the database. Where possible and if time permits, erroneous readings (such as negative values or those marked as “9999”) are re-read during the quarter.

Some thermistor measurements are not representative of true/valid measurements (i.e., where the measurements are less than zero (0) kohms or greater than 300 kohms). These measurements may also represent issues with the sensors or cable breaks/shorts. Thermistor data considered as “outliers” are

more than 3 standard deviations from the average values for the sensor; these values are excluded from the analysis data set and the graphs included in Appendix D. The out-of-range values are shaded red in the raw data table presented in Appendix C.

4.2 Piezometer Data Collection

As with the thermistor readings, TAK personnel are responsible for providing the measurements from the vibrating wire piezometers (VWPs) and the associated barometric pressure readings from the mine meteorological station. The VWP measurements (via pressure transducers) are then converted by Kuna to groundwater elevations using the individual transducer calibration coefficients, site elevations, and the barometric pressure readings. The calibration coefficients for each of the VWPs was determined during installation. Following conversion and a quality control review, the 2023 data was uploaded to the database.

Some piezometer measurements are not representative of true/valid measurements (i.e., where the barometric pressure readings are outside of 3,000-5,000). These measurements may also represent issues with the sensors or cable breaks/shorts. These measurements are not uploaded to the database. Piezometer data that is considered as “outliers” are those that are more than 3 standard deviations from average values for the sensor; these values are excluded from the analysis data set and the graphs included in Appendix E.

4.3 Data Analyses

The ground temperature measurements collected from the sixteen thermistor monitoring locations are graphed using three types of graphs/plots as presented in Appendix D (separate plots for each thermistor string):

- Temperature trumpet plots of data for all years (separate color for each year/quarter);
- Temperature plots of data for the 2023 data according to depth (for each quarter of measurements); and
- Average temperature plots of the 2023 data according to depth.

The piezometer data are presented in Appendix D as time series graphs of groundwater elevation and depth.

For each graph, the measurements are presented as auto range and scale limited. The auto range plots represent the validated measurements (i.e., those not eliminated as described previously). For visual clarity, scale limited plots only include data within a limited range and excludes most outliers. Note the outliers are individual nodes that are likely caused by intermittent connections and therefore do not represent true changes in temperature or water elevation.

5 Summary of Data QA/QC and Data Considerations

Copies of the quarterly report data checklists are provided in Appendix E, with the quarterly data field reporting forms. The checklists are completed by Kuna following the receipt of the quarterly data and sent back to TAK personnel to enable the recollection of data as necessary. 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.

According to the 1997 consent decree, a full analysis and interpretation of the data will be provided in the next 5-year monitoring report to be submitted in 2026. A 5-year report covering the years 2017 – 2021 was submitted in Spring 2022 (Kuna 2022b).

5.1 Thermistor QA/QC

Duplicate measurements for at least 1 thermistor string from each quarter were collected from the Dryden Instruments T5KMUK data logger and the Dryden Switchbox Fluke multimeter system. Variations in the thermistor measurements were also compared to previously collected data and trends. The thermistor QA/QC data is presented in Table 3.

Table 3. Summary of 2023 Thermistor QA/QC Data

Quarter	Date	Thermistor	Multi-meter Start Time	Comments
1st Quarter	1/8/23	T-96-30	16:28	Nodes 22 and 22 have errors
2nd Quarter	5/1/23	T-97-29	14:52	Nodes 3, 4, and 12 have errors
3rd Quarter	8/29/23	T-97-30	17:41	Nodes 13, 14, 16, 17, and 22 have errors
4th Quarter	10/18/23	T-95-08	14:23	

5.2 Piezometer QA/QC

Piezometer QA/QC consists of a duplicate reading within five minutes of the first piezometer reading each quarter. Table 4 presents a summary of the QA/QC data for 2023.

Table 4. Summary of 2023 Piezometer QA/QC Data

Quarter	Date	Piezometer	Comments
1st Quarter	1/17/23	P-97-12	6173.0 m/m at 0.2°C
2nd Quarter	-	-	Not recorded.
3rd Quarter	8/29/23	P-97-12	6203 m/m at -0.1°C
4th Quarter	10/20/23	P-97-12	6174.1 m/m at 0.2°C

5.3 Thermistor System Maintenance

The thermistor measurements from 2023 indicate that several are malfunctioning (i.e., out of range readings, Appendix F) and require maintenance. Shorts or discontinuities may also exist in the cabling/wiring for each thermistor at the connect or exposed end, as mentioned under Section 3. Out-of-range readings may be indicative of these issues. An investigation into sporadic thermistor readings led to the discovery of resistance errors likely from buildup of dirt inside of the sealed connectors; Figure 1 depicts this buildup. All thermistors connections will be opened, inspected, cleaned with acid (20% HNO_3), rinsed with DI water and then resealed to prevent future corrosion and build-up. Thermistors T-96-013 and T-95-08 will be re-spliced with new connector terminals and re-read to gauge viability of repair.

Teck is improving the on-going program to improve the maintenance of the surface connector cables (a common point of failure), as needed. Additional efforts will be taken in 2024 to improve data collection

despite snow or other challenges. Snowshoes and/or snowmobiles will be utilized to access areas with deep snow. Locator flays or poles will be affixed to locations where deep snow has covered wells.

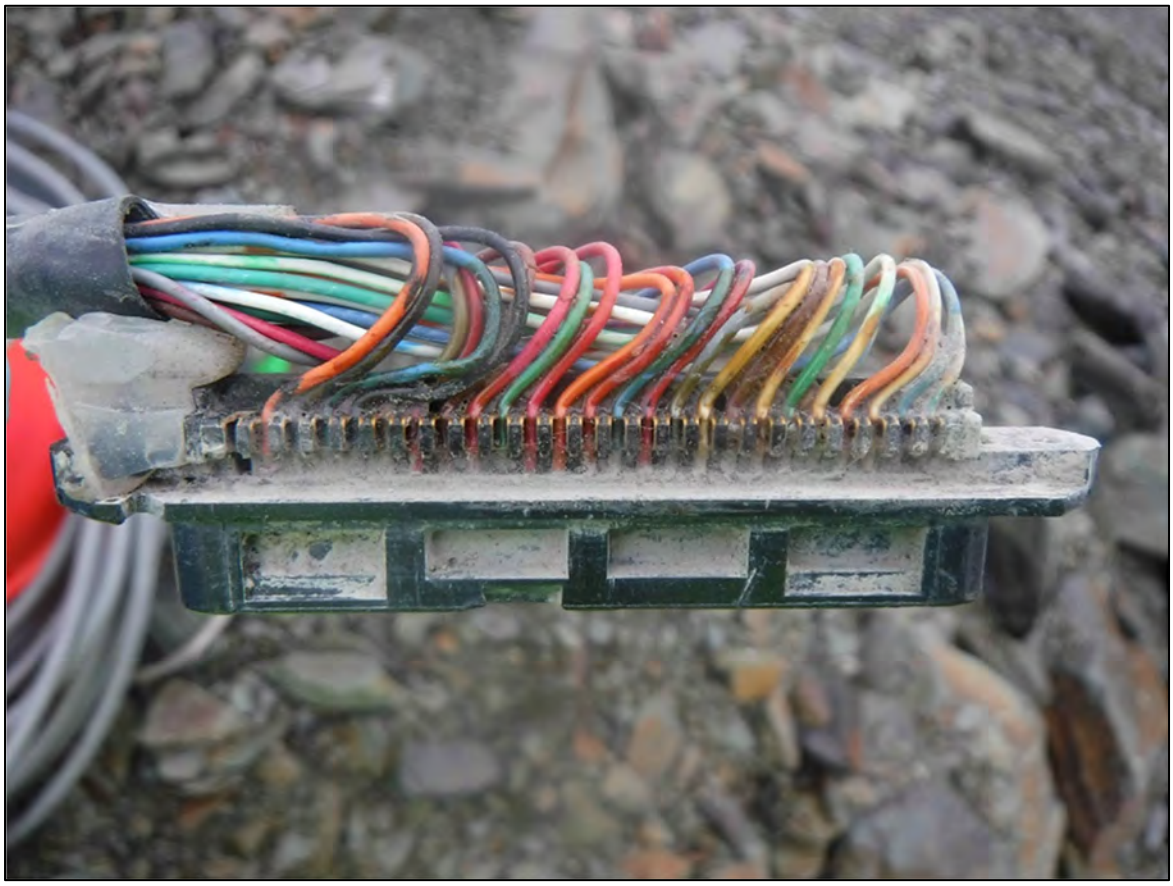


Figure 1. Thermistor connector with debris build up.

5.4 Piezometer System Maintenance

Most of the VWPs are functioning, with limited erroneous measurements in 2023. Piezometers P97-012 and P96-13 are identified as having outlier data during Q1 and Q4, respectively, with readings 3 standard deviations outside of normal distribution. These outliers were removed from datasets portrayed in the Appendix E plots.

5.5 New Thermistor/Piezometer Comparisons

The 2018 SEP Well Replacement Work Plan (2018 SEP WRWP, Golder 2018) describes the replacement details for the P/T 96-013 thermistor and piezometer, located just south of the back dam, within the Kivalina Overburden Stockpile (Figure 3). The original piezometer and thermistor wells were installed in 1996 as part of the SEP Phase I project. This site is replaced by the P/T-21-13 well, completed late in 2021. The piezometer is installed to a total depth of 610 feet bgs with dual VWPs located at this depth. The thermistor string is installed to a total depth of 490 feet bgs and has 24 sensors, identical to T-96-013. A memo was previously submitted to the USEPA providing documentation on these installations and the comparison of the P/T 21-13 and P/T 96-013 (Kuna 2022a).

A graph providing a comparison of the piezometer data for this location is provided in Appendix G. As shown in this graph, the water levels measured through P-21-013-1 are roughly 6 – 8 feet higher than those measured by P-21-013-2. The specific rationale for these differences is uncertain. However, the measurements for P-21-13-2 and P96-13 are close matches, often less than 2-3 feet different.

The comparison of the thermistor data (T-96-13 and T-21-13) is provided in Appendix G. As shown in this graph, the average data is very comparable, typically less than 1°C different (except for a few nodes).

These comparisons are used to recommend the future data collection and management activities as outlined in Section 7.

6 Summary and Conclusions

The data collected in 2023 for the SEP is generally consistent with the data from prior quarters and years. The Red Dog Mine area is characterized by a "warm" permafrost that exhibits temperatures of just a few degrees below freezing. Permafrost near the TSF area is continuous from roughly 40 – 80 feet bgs to 150 – 200 ft bgs, with unfrozen material below these depths. Permafrost is no longer present south of the dam for approximately a half of mile (Golder, 2020). Groundwater elevations are generally consistent with past years, with flows generally towards Red Dog Creek, except in the back dam area where a flow divide exists, around the south side of the overburden stockpile, separating the Bons Creek drainage from the Red Dog Creek drainage.

7 Future Data Monitoring and Management Recommendations

The comparisons of the water elevation and temperature data for the new and old piezometers and thermistors is described in Section 5.5 and through the graphs included in Appendix G. The following recommendations for future data management activities is recommended as a result of these comparisons:

- Teck recommends the cessation of data collection for piezometer P-96-013. This data is considered to be comparable and nearly duplicative of the data measured through P21-013-2. Going forward the readings from P96-13 would be collected on a periodic basis to provide a general confirmation of the P21-13-2 data.
- Teck recommends periodic data collection for piezometer P-21-13-1. This data will just be collected on an irregular, but periodic basis to provide a general confirmation of the P21-13-2 data.
- Teck recommends the cessation of data collection for thermistor T-96-013. Going forward this data would be collected just on a periodic basis to provide a general confirmation of the T21-13 data.

Teck will not move forward on these recommendations until an official approval is received from the USEPA.

8 References

Golder, 2018. Technical Memorandum – Work Plan for Proposed 2018 SEP Well Replacement, Red Dog Mine, Alaska.

Golder, 2020. Technical Report – Site Wide Permafrost Delineation, Red Dog Mine, Alaska

Kuna Engineering, 2021. 2020 Annual Report, Long-Term Permafrost and Groundwater Monitoring Program for the Tailings Impoundment Facility, February 2021.

Kuna Engineering, 2022a. Technical Memorandum, Comparison of PT96-13 and PT21-113.

Kuna Engineering, 2022b. Data Analysis Report, 2017 – 2021, Long-Term Permafrost and Groundwater Monitoring Program, April 2022.

Kuna Engineering, 2023. 2022 Annual Report, Long-Term Permafrost and Groundwater Monitoring Program for the Tailings Impoundment Facility, February 2023.

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

Water Management Consultants, Inc. (WMCI), 2001b, *Red Dog Mine – Phase III Hydrologic Characterization of the Tailings Impoundment*, March 2001.

Appendix A
Listing of SEP Thermistors and Piezometers

SEP GW Instrument Information

Station ID	Type	No. Nodes (thermistors only)	Location	Status	Instrument Depth	Notes
P-08A	piezometer		Dam Area	Active	153	
P-08B	piezometer		Dam Area	Active	178	
P-21-013	piezometer (1)		Overburden Stockpile	Active	610	Replaces P-96-013; 2 VWPs, both at 610 ft bgs
P-96-010	piezometer		Dam Area	Active	197.2	Cable severed, needs repair.
P-96-013	piezometer		Overburden Stockpile	Active	544.4	
P-96-015	piezometer		Bons Creek	Active	300	
P-97-012	piezometer		Bons Creek	Active	460.52	
P-97-020	piezometer		Dam Area	Active	410	
P-97-028	piezometer		Dam Area	Active	48.5	
P-99-007R	piezometer		Tailing Impoundment	Inactive	-	Flooded
SPP-97-002	piezometer		Dam Area	Active	unknown	
T-05-061	thermistor	6	Dam Area	Active	58	
T-14-110	thermistor (1)		Tailing Impoundment	Active	unknown	Replaced T-95-007
T-21-013	thermistor (1)	44	Overburden Stockpile	Active	490	Replaces T-96-013
T-95-004	thermistor		Dam Area	Active	400	Cable needs repair.
T-95-005	thermistor		Dam Area	Active	400	
T-95-007	thermistor		Tailing Impoundment	Inactive	400	
T-95-008	thermistor	24	Overburden Stockpile	Inactive	260	
T-95-008#2	thermistor	24	Overburden Stockpile	Active	260	Replaced T-95-008
T-96-010	thermistor		Dam Area	Active	360	
T-96-012	thermistor	24	Bons Creek	Active	490	
T-96-012S	thermistor	24	Bons Creek	Active	490	
T-96-013	thermistor	24	Overburden Stockpile	Active	490	
T-96-015	thermistor	14	Red Dog Creek	Active	210	
T-96-020	thermistor	24	Dam Area	Inactive	470	
T-96-021	thermistor	24	Overburden Stockpile	Active	122	
T-96-022	thermistor	24	Overburden Stockpile	Active	122	
T-96-023	thermistor	24	Overburden Stockpile	Active	112	
T-97-028	thermistor	24	Dam Area	Active	235	
T-97-029	thermistor	24	Dam Area	Active	235	
T-97-030	thermistor	24	Dam Area	Active	275	

Notes:

(1) Digital type instruments. T-21-13 is connected to a continuous data logger.

Appendix B
Figures/Maps

- Figure 1 – Mine Layout
- Figure 2 – Main Dam Area
- Figure 3 – Overburden Stockpile/Back Dam Area



Legend

Contour Line (50 Ft)

Streams

0 0.25 0.5 1 Miles

N

Notes:
1. Coordinate system is NAD83 Zone 7N, units are US feet.
2. Background imagery is from GINA, 2020, contour lines are from 2021 topography.

The information in this map is for planning purposes only and is not to be used as a legal document.

KUNA ENGINEERING

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Red Dog Mine Supplemental Environmental Program
Long Term Permafrost and Groundwater Monitoring Program

MINE LAYOUT

File Name: RDM_SEP_GW_TemplateLandscape1	Date: 12/5/2023	Job No. 165.030593	Approved: JCR/MLN	Figure: 1



Legend

- Ground Temperature (Thermistor)
- Groundwater (Piezometer)
- Inactive Groundwater (Piezometer)
- Stream
- Contour Line (50 Ft)

N

0 450 900 1,800 Feet

Notes:
1. Coordinate system is NAD83 Zone 7N, units are US feet.
2. Background imagery is from CGG Ortho, 2021, contour lines are from 2021 topography.

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Red Dog Long Term Permafrost and Groundwater Monitoring Program

MAIN DAM AREA

File Name: RDM_SEP_GW_TemplateLandscape2	Date: 12/5/2023	Job No. 165.030593	Approved: JCR/MLN	Figure: 2



Legend

- Inactive Groundwater (Piezometer)
- Ground Temperature (Thermistor)
- Groundwater (Piezometer)
- Stream
- Contour Line (50 Ft)

N

0 450 900 1,800 Feet

Notes:
1. Coordinate system is NAD83 Zone 7N, units are US feet.
2. Background imagery is from CGG Ortho, 2021, contour lines are from 2021 topography.

The information in this map is for planning purposes only and is not to be used as a legal document.

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OVERBURDEN STOCKPILE/ BACK DAM AREA

File Name: RDM_SEP_GW_TemplateLandscape3	Date: 12/5/2023	Job No. 165.030593	Approved: JCR/MLN	Figure: 3

Appendix C
Raw Thermistor Data

Appendix B - THERMISTOR DATA READINGS 2023 (SORTED BY DATE)

Site ID	Num Therm	Date/Time		pt-01	pt-02	pt-03	pt-04	pt-05	pt-06	pt-07	pt-08	pt-09	pt-10	pt-11	pt-12	pt-13	pt-14	pt-15	pt-16	pt-17	pt-18	pt-19	pt-20	pt-21	pt-22	pt-23	pt-24
T95-8	24	1/7/2023	14:13	16.308	16.252	16.044	-14.97	16.001	15.798	15.48	14.72	15.334	16.027	16.059	-69.31	16.682	16.604	16.111	15.191	15.389	15.46	16.261	15.24	14.97	16.321	16.091	16.624
T96-13	24	1/7/2023	14:26	-9999	16.018	-24.86	-21.06	-62.82	-22.98	18.163	-242.6	16.907	-17.15	-19.82	17.136	19.111	19.877	18.208	-9999	17.413	16.956	19.477	16.803	16.769	16.774	16.588	-1208
T96-21	24	1/7/2023	14:59	27.027	16.094	14.361	13.507	13.132	13.364	13.171	13.33	13.489	-18.74	14.079	14.448	14.925	15.398	15.698	9999.9	16.484	16.591	16.607	16.714	-18.41	16.805	16.805	16.905
T96-22	24	1/7/2023	15:09	-43.63	16.96	9999.9	14.435	14.118	14.229	14.655	-7286	-1472	-3827	-4864	-9999	-952.7	16.776	9999.9	9999.9	16.967	16.92	17	17.019	17.107	16.911	10.699	16.497
T96-12s	24	1/7/2023	15:46	28.98	28.632	26.199	20.113	17.618	16.605	16.369	16.417	16.452	16.585	16.639	16.661	16.706	16.667	16.698	9999.9	-9999	16.811	16.806	16.836	16.897	16.898	16.93	16.877
T96-12	24	1/7/2023	15:47	16.434	16.632	16.812	16.808	16.77	16.783	17.077	17.126	17.107	16.816	17.119	-1220	-1579	17.011	16.892	9999.9	16.754	16.446	16.409	16.331	-9123	13.99	15.967	15.878
T95-5	24	1/7/2023	16:27	15.081	14.86	15.481	16.139	16.161	16.43	16.578	16.589	16.613	16.669	16.661	16.701	-1424	16.67	16.546	9999.9	16.314	652.76	16.114	15.986	15.97	15.804	15.758	15.596
T97-28	24	1/8/2023	14:40	13.44	13.544	13.472	13.74	14.138	13.693	13.932	14.066	14.077	12.74	13.78	13.52	-92.56	9999.9	-14.24	9999.9	-259.6	15.133	15.007	0.0371	15.308	-387.2	19.742	-21.19
T97-29	24	1/8/2023	14:56	14.161	14.092	14.179	-2335	17.613	-1601	14.525	15.956	14.565	14.192	-140.3	-3908	-15.03	15.436	15.543	-9999	15.417	15.173	15.181	12.05	14.79	15.48	15.434	13.94
T97-30	24	1/8/2023	16:23	14.156	14.004	13.989	14.007	13.972	13.982	14.028	14.065	14.062	14.113	14.219	14.429	14.746	14.729	14.878	9999.9	15.184	15.149	15.252	15.265	15.416	-2814	5449	15.312
T96-15	14	1/9/2023	16:18	16.744	16.903	16.852	16.851	16.763	16.687	16.652	16.567	16.518	16.501	16.399	16.325	16.273	16.217										
T96-13	24	4/24/2023	8:15	-158.9	-158	-6658	-9999	21.159	-3486	-419.6	27.15	16.998	17.327	9999.9	17.145	19.396	19.996	18.265	-103.6	-141.5	21.32	-9999	16.831	16.829	16.751	16.608	16.44
T95-8	24	4/24/2023	8:23	19.902	16.755	16.818	16.943	16.943	16.957	16.941	16.928	17.005	17.004	17.01	22.04	17.02	17.051	16.996	17.041	17.036	17.019	17.043	17.068	17.064	17.05	17.106	17.134
T96-12	24	4/24/2023	8:33	16.546	16.662	16.857	16.929	17.018	17.054	17.094	17.155	17.158	17.139	17.191	9999.9	9999.9	17.028	16.915	16.894	16.783	16.658	16.53	16.374	9999.9	16.149	16.014	15.895
T96-21	24	4/24/2023	8:49	22.623	17.365	15.091	13.841	13.309	13.457	13.118	13.179	13.325	13.632	13.988	14.441	14.936	15.424	15.705	16.09	16.494	16.596	16.608	16.742	16.811	16.827	16.851	16.908
T96-22	24	4/24/2023	8:55	25.256	17.544	9999.9	15.159	14.723	14.684	14.886	9999.9	15.525	15.852	16.249	16.574	16.722	16.778	9999.9	9999.9	16.979	16.932	17.022	17.041	17.061	16.973	10.588	16.375
T96-15	14	4/24/2023	9:30	16.702	16.889	16.854	16.851	16.762	16.685	16.651	16.567	16.517	16.501	16.398	16.324	16.275	16.215										
T96-12s	24	4/29/2023	14:30	26.95	18.882	20.009	17.28	17.286	16.258	16.008	16.071	16.125	16.346	16.142	16.387	21.96	16.333	16.28	16.113	-722.8	16.63	16.602	16.141	16.759	16.818	16.724	16.661
T97-28	24	4/29/2023	15:16	28.38	13.509	13.43	13.724	14.103	13.599	13.923	14.037	13.976	12.6	13.66	13.16	-92.12	9999.9	14.59	-114.2	-256.4	15.017	14.965	0.0409	14.937	-370.8	19.042	20.64
T97-29	24	5/1/2023	13:48	-97.55	14.13	14.208	-7275	16.864	-2098	14.576	16.25	14.574	14.146	-193.5	-6851	14.31	15.405	15.522	15.64	15.386	15.234	15.143	12.55	14.17	15.172	14.925	13.57
T97-30	24	4/29/2023	15:20	22.18	14.079	14.061	14.093	13.894	13.916	13.997	14.047	14.019	14.122	14.165	14.274	14.677	14.729	14.878	-9999	15.182	15.081	15.239	15.248	15.441	-2260	-6130	15.269
T96-23	24	4/29/2023	2:42	9999.9	9999.9	8.5238	10.169	11.462	14.301	14.866	15.63	15.952	16.096	16.228	16.794	16.708	16.591	16.511	16.423	16.475	16.815	17.199	17.058	16.894	16.284	17.001	16.916
T05-61	6	4/29/2023	3:21	72.55	42.019	55.52	43.75	-804.6	27.99																		
T95-5	24	4/29/2023	3:41	14.718	15.753	15.863	16.271	16.476	16.626	16.695	16.744	16.768	16.785	16.825	16.771	16.753	16.742	16.681	16.637	16.607	9999.9	16.348	16.178	16.057	15.884	15.731	15.559
T96-21	24	8/29/2023	23:23	8.8395	11.016	10.658	11.825	12.936	13.777	13.567	13.55	13.612	13.852	14.15	14.511	14.914	15.373	15.696	16.094	16.495	16.597	16.615	16.734	16.814	16.828	16.846	16.908
T96-22	24	8/29/2023	23:32	8.8451	12.415	9999.9	12.947	14.326	15.029	15.402	-9999	15.873	16.094	16.3	16.566	16.724	16.751	9999.9	16.899	16.983	16.923	17.019	17.038	17.071	17.026	10.449	16.23
T96-23	24	8/29/2023	23:37	-9999	9999.9	11.126	11.246	13.035	14.582	-14.89	15.795	15.985	16.092	-15.99	16.786	16.68	16.436	16.561	16.559	16.551	16.777	17.002	17.045	-16.9	-16.26	17.013	16.911
T96-13	24	8/29/2023	23:53	-9999	9999.9	9999.9	13.15	13.98	-8469	18.002	-25.56	9999.9	-9999	9999.9	13.79	13.958	-7900	16.96	16.94	17.342	16.829	16.856	16.504	-1148	17.14	20.88	20.067
T96-15	14	8/29/2023	2:36	16.737	16.873	16.85	16.849	16.759	16.685	16.65	16.567	16.517	16.502	16.396	16.324	16.273	16.217										
T97-28	24	8/29/2023	3:08	14.691	14.186	14.145	14.223	14.024	13.968	14.005	14.061	14.069	14.155	14.247	14.437	14.676	14.728	14.88	15.02	15.186	15.148	15.251	15.264	15.377	-3138	-5921	15.282
T97-29	24	8/29/2023	3:15	-97.55	14.13	14.208	-7275	16.864	-2098	14.576	16.25	14.574	14.146	-193.5	-6851	14.31	15.405	15.522	15.64	15.386	15.234	15.143	12.55	14.17	15.172	14.925	13.57
T95-8	24	8/29/2023	3:43	13.67	16.788	16.791	16.896	16.911	16.922	16.894	16.782	16.772	16.881	16.962	16.976	-150	16.981	16.941	16.92	16.963	16.938	16.983	16.961	17.11	16.947	17.051	17.063
T96-12	24	8/29/2023	3:58	13.194	16.609	16.789	16.844	16.944	16.986	17.009	17.024	16.977	16.918	17.174	-0.001	9999.9	17.001	16.898	16.77	16.757	16.575	16.303	16.099	-641.4	15.98	16.006	15.893
T96-12s	24	8/29/2023	3:59	6.7741	6.0015	6.101	7.2316	11.618	12.354	13.924	15.916	16.072	16.46	16.599	16.571	16.654	16.639	16.668	16.731	-9999	16.736	16.739	16.783	16.872	16.874	16.884	16.81
T05-61	6	8/29/2023	4:38	-82.26	-28.97	-36.99	-6783	-356.9	-30.88																		
T97-30	24	8/29/2023	5:39	12.04	13.48	13.37	13.58	14.19	13.58	13.79	13.92	13.94	12.28	13.49	13.25	-80.03	9999.9	14.63	-115.3	-231.2	15.02	14.93	0.0358	14.9	-324.9	18.86	18.68
T95-5	24	8/29/2023	6:11	12.02	15.308	15.92	16.271	16.467	16.614	16.687	16.732	16.76	16.891	16.765	16.76	16.817	16.733	16.674	16.641	16.601	9999.9	16.343	16.171	16.078	15.879	15.73	15.506
T96-12	24	10/18/2023	10:42	16.097	16.611	16.813	16.839	16.946	16.976	17.012	17.082	17.068	16.895	17.041	0.003	7732.1	16.867	16.675	9999.9	16.723	16.528	16.376	16.234	-2195	16.057	15.935	15.831
T96-12s	24	10/18/2023	10:44	23.842	24.196	23.283	20.399	17.491	16.474	15.975	16.108	16.255	16.508	16.589	16.619	18.051	16.632	16.68	9999.9	-9999	16.78	16.779	16.815	16.892	16.883	16.906	16.857
T96-23	24	10/18/2023	23:38	-9999	-9999	15.944	13.253	13.286	14.137	14.4	15.575	15.95	16.154	16.13	16.785	16.711	16.425	16.55	16.75	16.64	16.783	16.904	17.046	16.888	16.78	17.12	17.07
T96-22	24	10/18/2023	23:42	23.34	18.225	9999.9	13.087	13.623	14.394	15.01	9999.9	15.834	16.079	16.307	16.559	16.735	16.772	9999.9	16.91	16.983	16.944	17.017	17.036	17.435	16.97	9999.9	-9999
T96-21	24	10/18/2023	23:49	23.577	16.042	12.808	12.214	12.459	13.224	13.303	13.513	13.665	13.91	14.181	14.519	14.961	15.39	15.686	16.02	16.486	16.571	16.597	16.726	16.84	16.868	16.83	16.87
T96-13	24	10/18/2023	23:57	13.859	12.732	36.8	9999.9	16.7	16.802	17.361	16.889	16.988	17.03	17.097	17.133	19.241	20.12	18.299	9999.9	21.04	16.995	19.847	16.827	17.92	17.79	17.62	17.43
T95-8	24	10/18/2023	2:30	15.791	16.788	16.806	16.919	16.912	16.913	16.862	16.836	16.938	16.983	16.99	16.966	18.128	17.068	17.232	17.06	16.999	16.975	16.951	17.015	17.002	17.005	17.103	17.671
T05-61	6	10/18/2023	3:03	-50.48	21.34	26.23	-58.21	-117.8	40.456																		
T96-15	14	10/18/2023	4:58	16.695	16.866	16.848	16.847	16.756	16.683	16.648	16.565	16.514	16.499	16.394	9999.9	16.292	16.214										
T97-28	24	10/18/2023	5:17	12.52	13.47	13.4	13.66	14.29	13.64	13.82	14.01	13.99	12.16	13.44	13.26	-81.9	-9999	14.38	-100.3	-231.4	15.02	14.94	0.0362	14.94	-371	19.02	18.78
T97-29	24	10/18/2023	5:21	14.132	13.968	9999.9	-3983	14.04	-1762	-2313	-47.65	-39.45	20.68	-9999	-9999	13.94	15.33	15.508	-658.4	15.28	-4613	27.111	13.37	14.22	14.29	15.02	43.723
T97-30	24	10/18/2023	5:24	14.264	14.149	14.057	14.062	13.904	13.932	13.954	14.056	14.064	14.147	14.243	14.433	14.748	14.722	14.868	15.05	15.167	15.11	15.231	15.228	15.357	-3097	-5934	15.274
T95-5	24	10/18/2023	5:36	13.377	14.334	15.53	15.793	16.143	16.257	16.313	16.251	16.19	16.4	16.396	16.18	16.05	16.488	16.346	16.25	16.139	-9999	16.071	15.663	15.758	15.125	15.498	15.355
T-14-110	24	1/7/2023	12:00	0.76	0.38	0.13	0	-0.13	-0.06	-0.13	-0.06	0	0	0.06	0.13	0.13	0.25	0.25	0.38	0.51	0.63	0.7	0.82	1.01	1.14	1.33	1.52
T-14-110	24	4/24/2023	12:00	0.5	0.32	0.13	0	-0.13	-0.06	-0.13	-0.13	0	0.06	0.06	0.13	0.13	0.25	0.25	0.32	0.51	0.57	0.7	0.82	1.01	1.14	1.33	1.52
T-14-110	24	8/29/2023	12:00	2.59	0.25	0.13	0	-0.13	-0.06	-0.13	-0.06	0	0	0.06	0.13	0.13	0.25	0.25	0.38	0.44	0.57	0.7	0.82	0.95	1.14	1.33	1.52
T-14-110	24	10/18/2023	12:00	2.65	0.57	0.13	0	-0.13	-0.06	-0.13	-0.06	-0.06	0.06	0.06	0.13	0.13	0.19	0.25	0.38	0.51	0.63	0.7	0.82	1.01	1.14	1.33	1.45
T-21-013	44	9/3/2023		13.121	13.354	8.437	8.375	8.749	8.32	6.95	4.551	2.382	2.296	2.249	2.305	1.686	1.489	1.513	1.177	1.098	1.058	1.082	1.043	0.596	-0.109	-0.266	-0.25
T-21-013	44	10/30/2023		1.51	1.32	-0.2	1.32	3.03	3.86	4.71	4.88	4.43	2.81	2.35	2.57	2.63	2.53	2.49	2.37	1.66	1.43	1.43	1.36	0.05	-0.24	-0.27	-0.27

Site ID	Num Therm	Date/Time		pt-25	pt-26	pt-27	pt-28	pt-29	pt-30	pt-31	pt-32	pt-33	pt-34	pt-35	pt-36	pt-37	pt-38	pt-39	pt-40	pt-41	pt-42	pt-43	pt-44				
T-21-013		9/3/2023	Continued	-0.431	-0.65	-0.831	-0.901	-0.964	-0.941	-0.996	-1.098	-1.018	-1.081	-1.019	-1.05	-0.893	-0.838	-0.728	-0.643	-0.524	-0.392	-0.328	-0.078				
T-21-013		10/30/2023	Continued	-0.45	-0.65	-0.83	-0.91	-0.96	-0.94	-1	-1.1	-1.04	-1.07	-1.02	-1.04	-0.89	-0.87	-0.74	-0.65	-0.53	-0.4	-0.33	-0.09				

Notes:

Num of Therms = total number of thermistor sensors at each site (string)

Date/Time = mm/dd/yy hh:mm

Measurements are shown in kohms. *T14-110 and T21-013 measurements are in Celsius

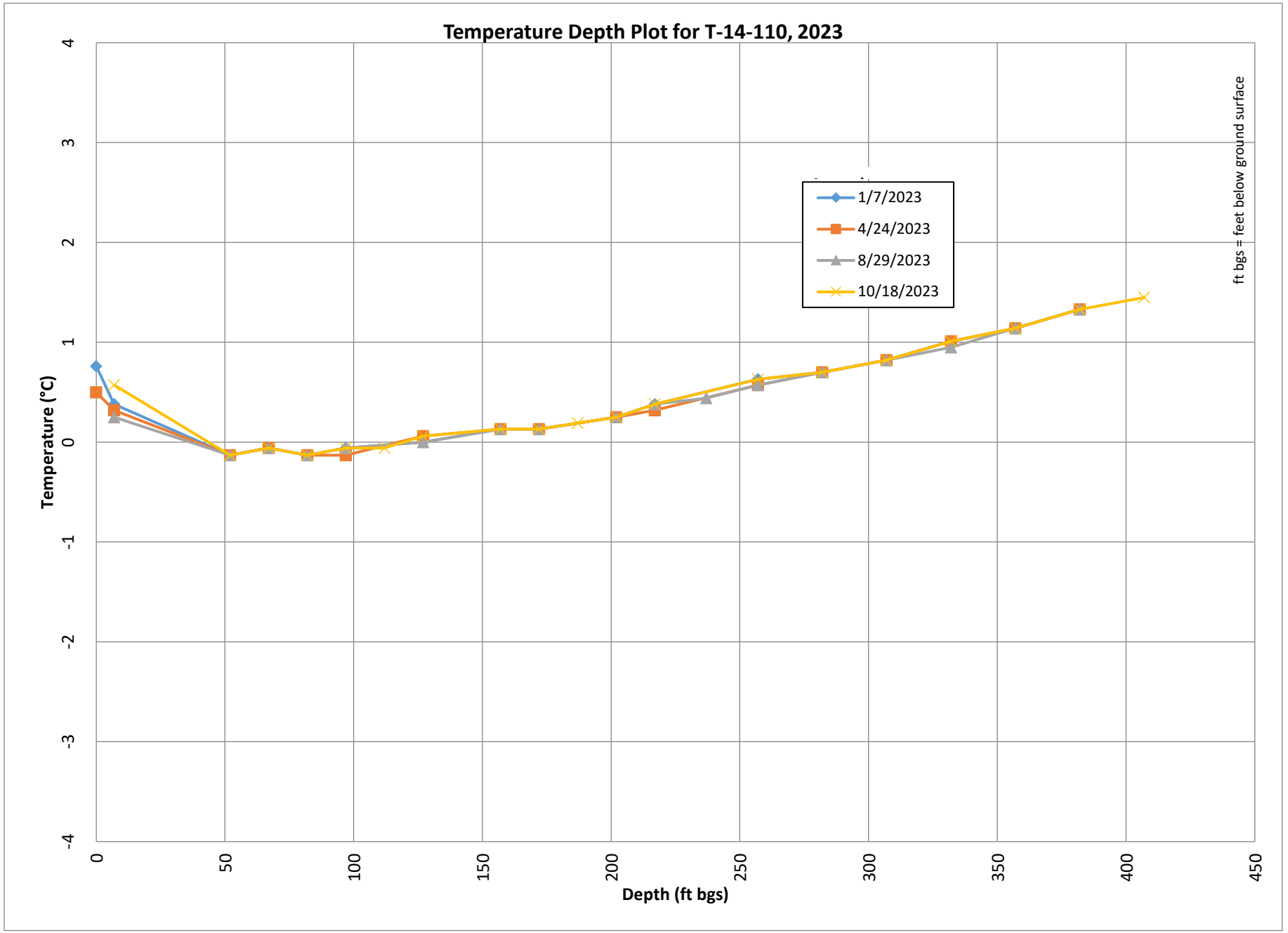
Red highlighted data represent measurements that are outside of database criteria and omitted from the database.

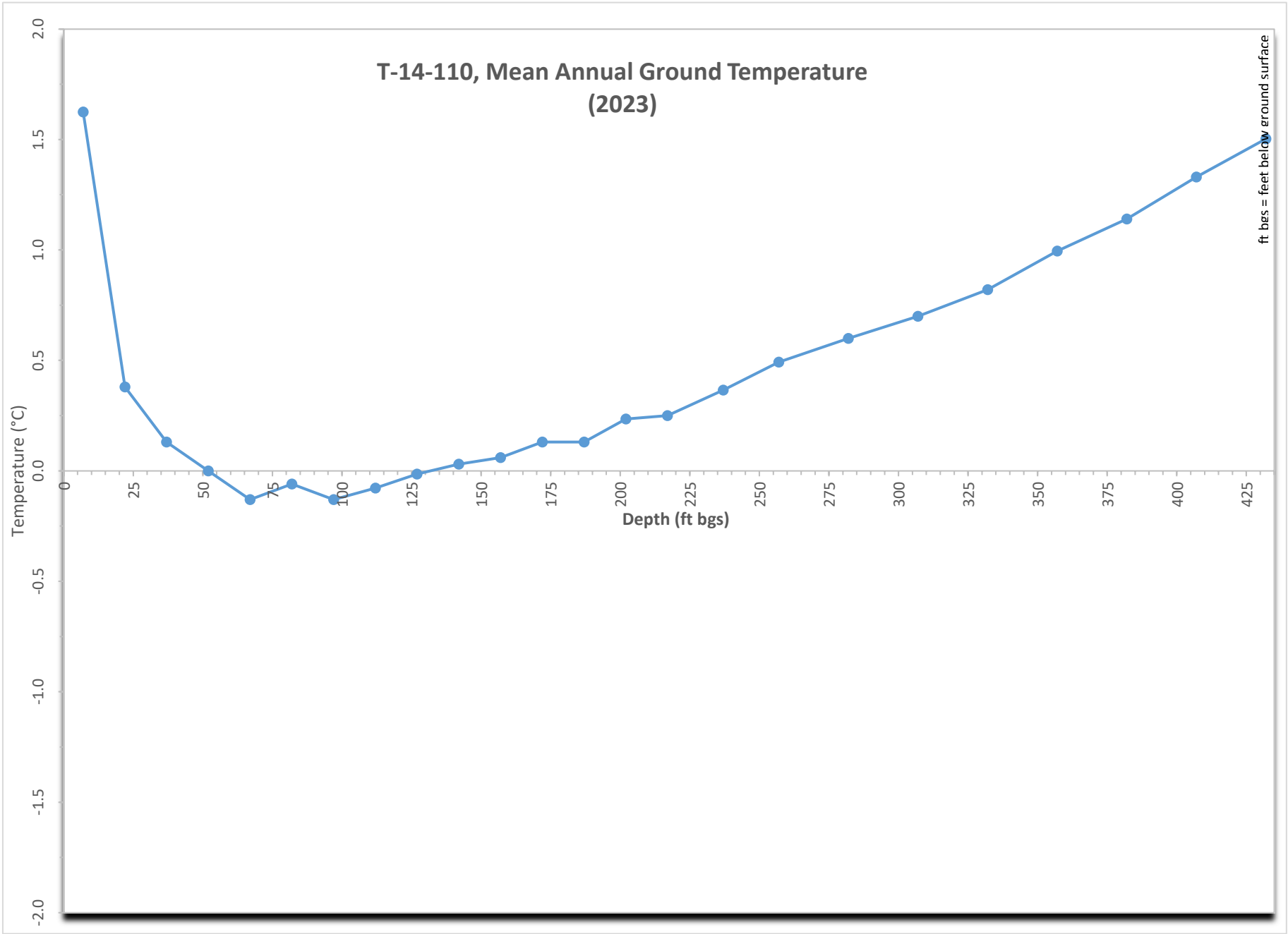
Appendix D
Thermistor Plots

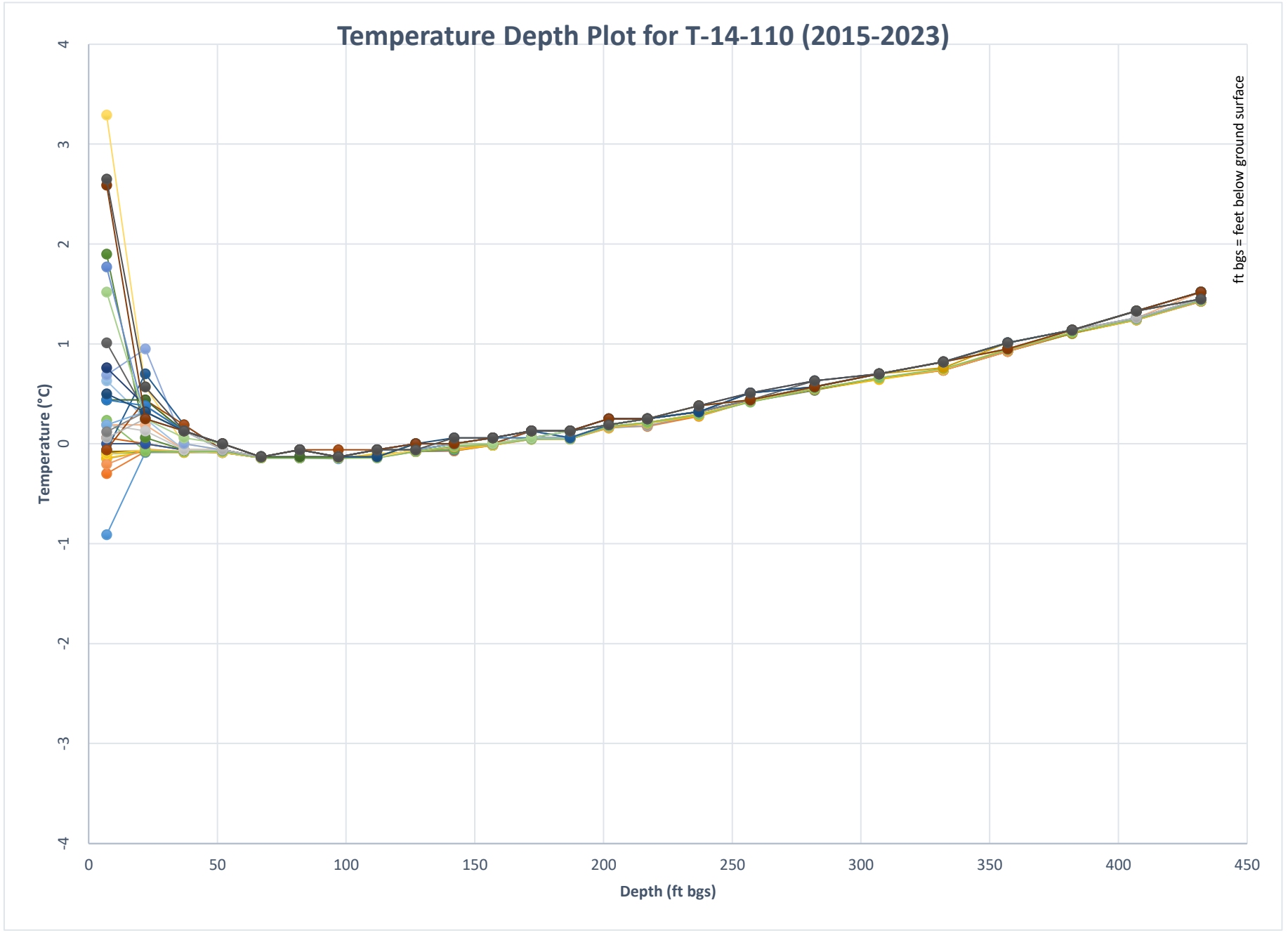
3 plots per thermistor:

- 2023 quarterly temperatures vs. depth
- 2023 average temperature vs. depth
- Cumulative temperature vs. depth (by quarter)

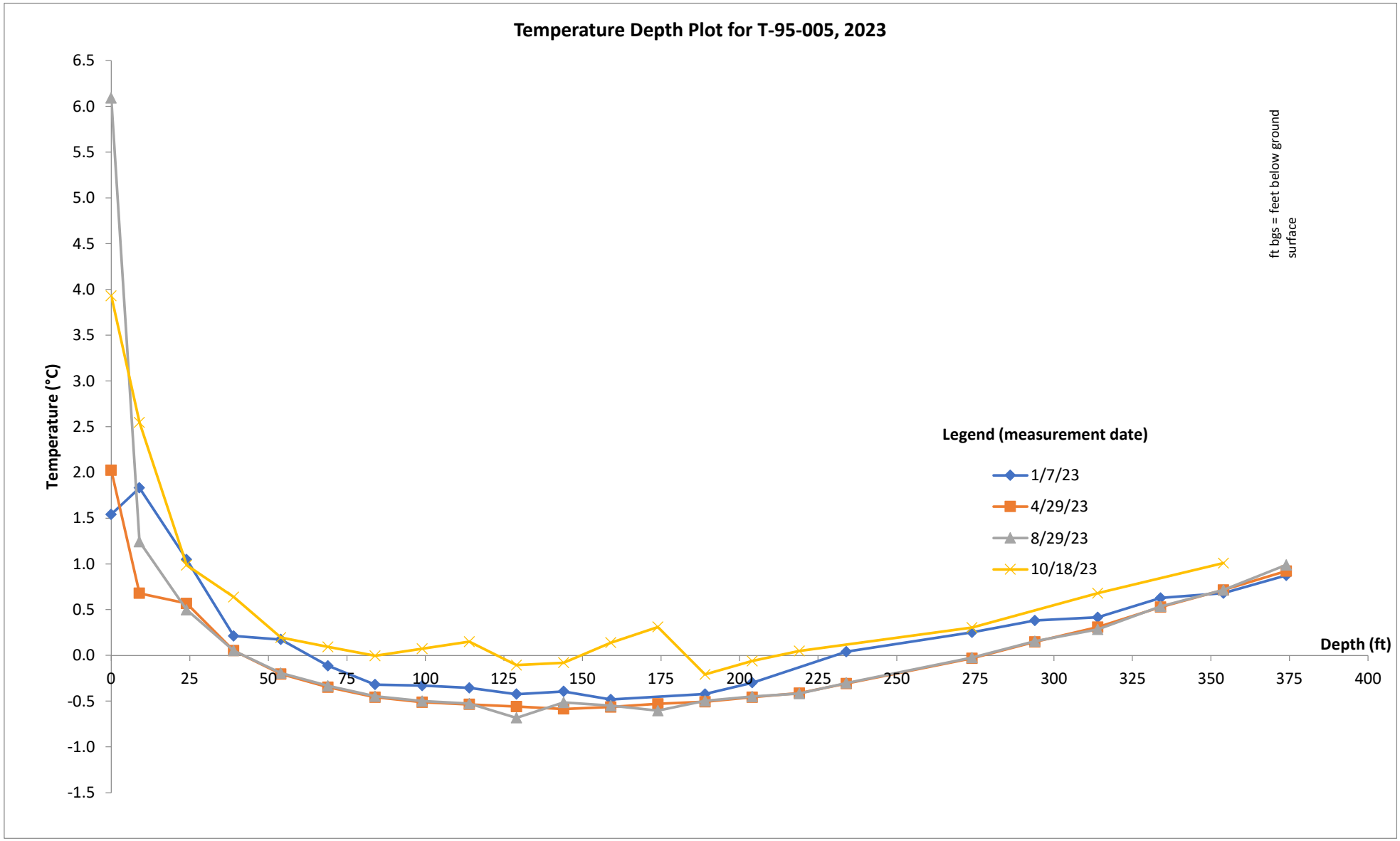
Thermistor T-14-110

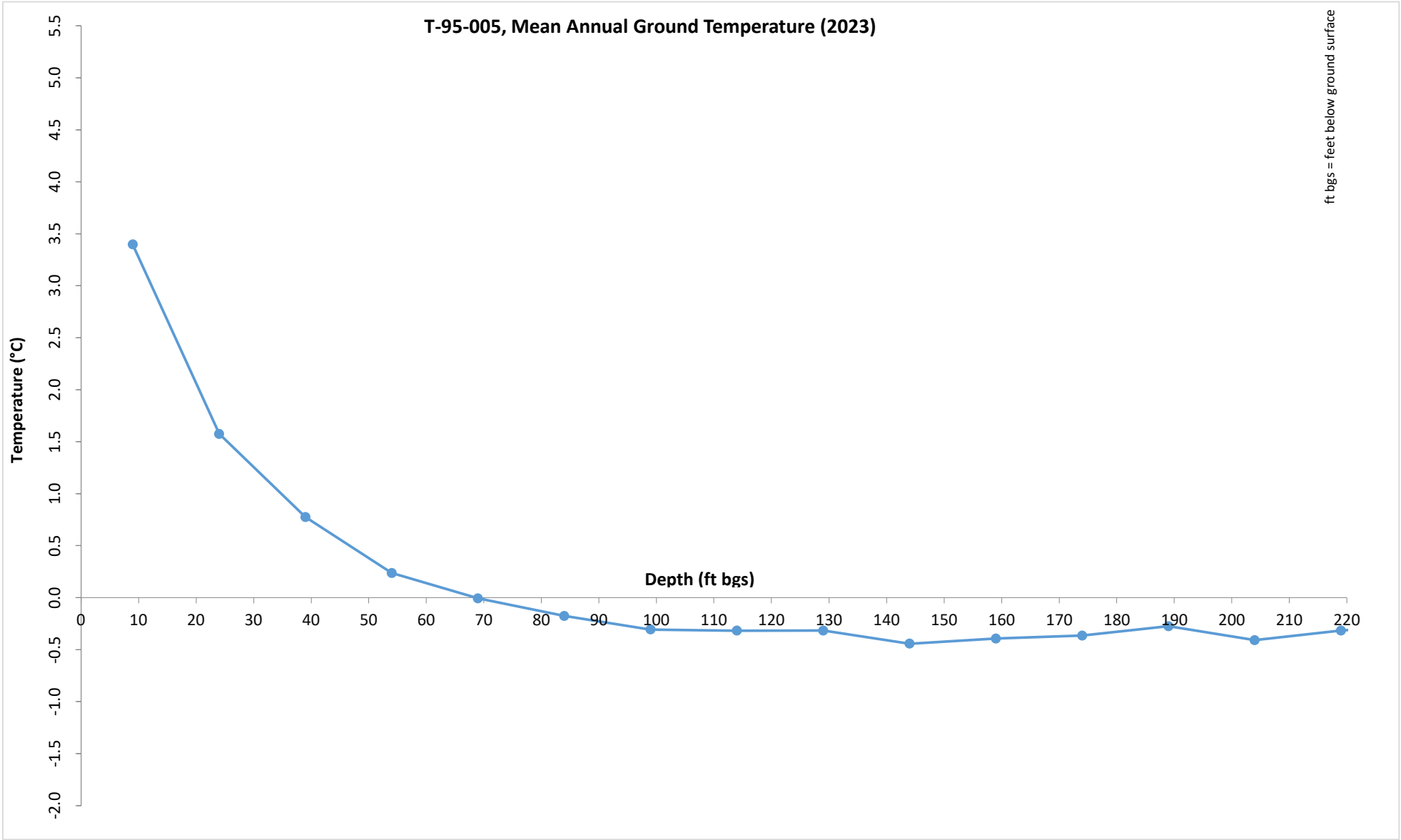

Temperature Depth Plot for T-14-110, 2023
Temperature (°C)
4
3
2
1
0
-1
-2
-3
-4
0
50
100
150
200
250
300
350
400
450
Depth (ft bgs)
1/7/2023
4/24/2023
8/29/2023
10/18/2023
ft bgs = feet below ground surface

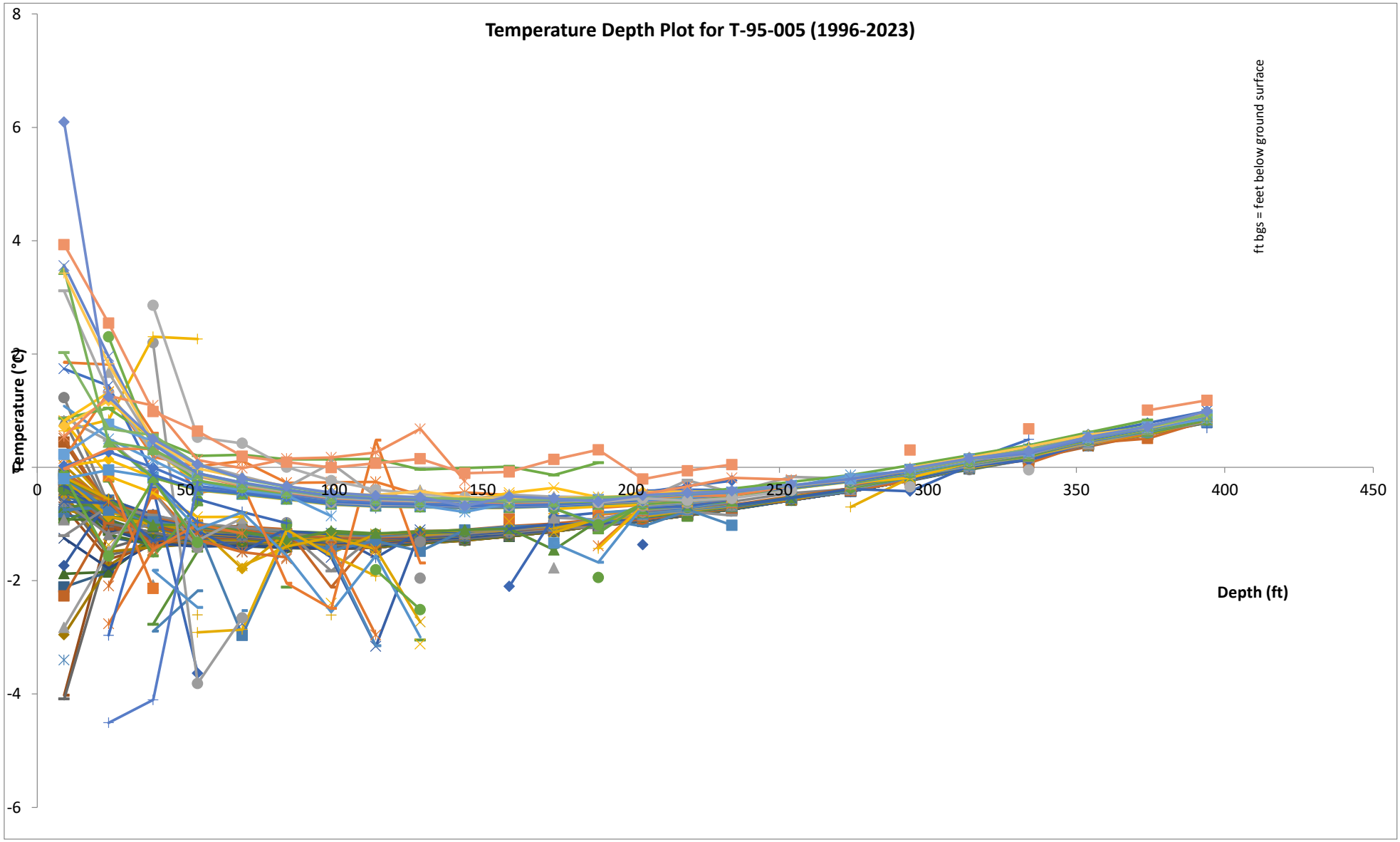

T-14-110, Mean Annual Ground Temperature
(2023)
Temperature (°C)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
425
Depth (ft bgs)
ft bgs = feet below ground surface


Temperature Depth Plot for T-14-110 (2015-2023)
Temperature (°C)
4
3
2
1
0
-1
-2
-3
-4
0
50
100
150
200
250
300
350
400
450
Depth (ft bgs)
ft bgs = feet below ground surface

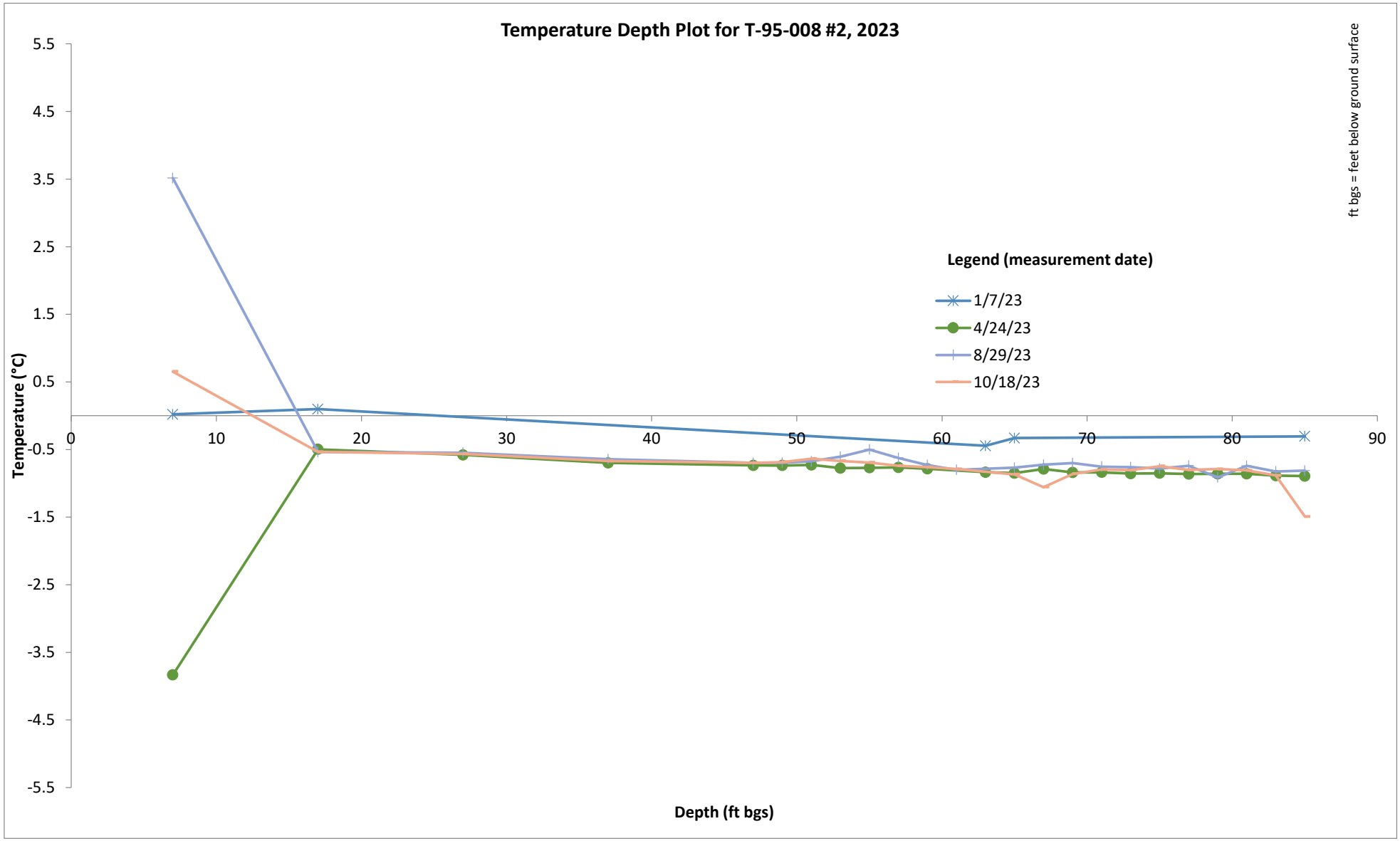
Thermistor T-95-05

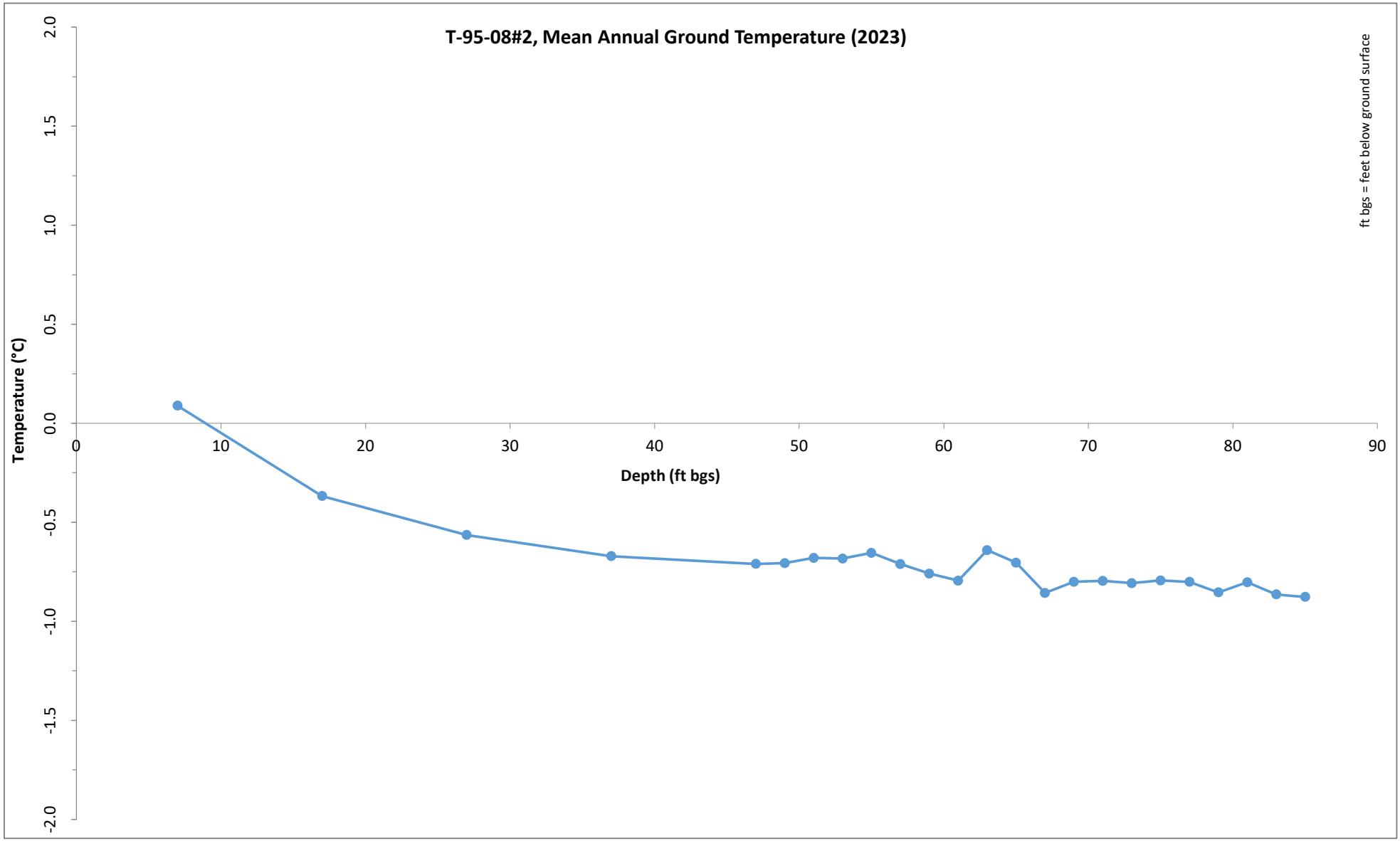

Temperature Depth Plot for T-95-005, 2023
Temperature (°C)
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
Depth (ft)
ft bgs = feet below ground surface
Legend (measurement date)
1/7/23
4/29/23
8/29/23
10/18/23

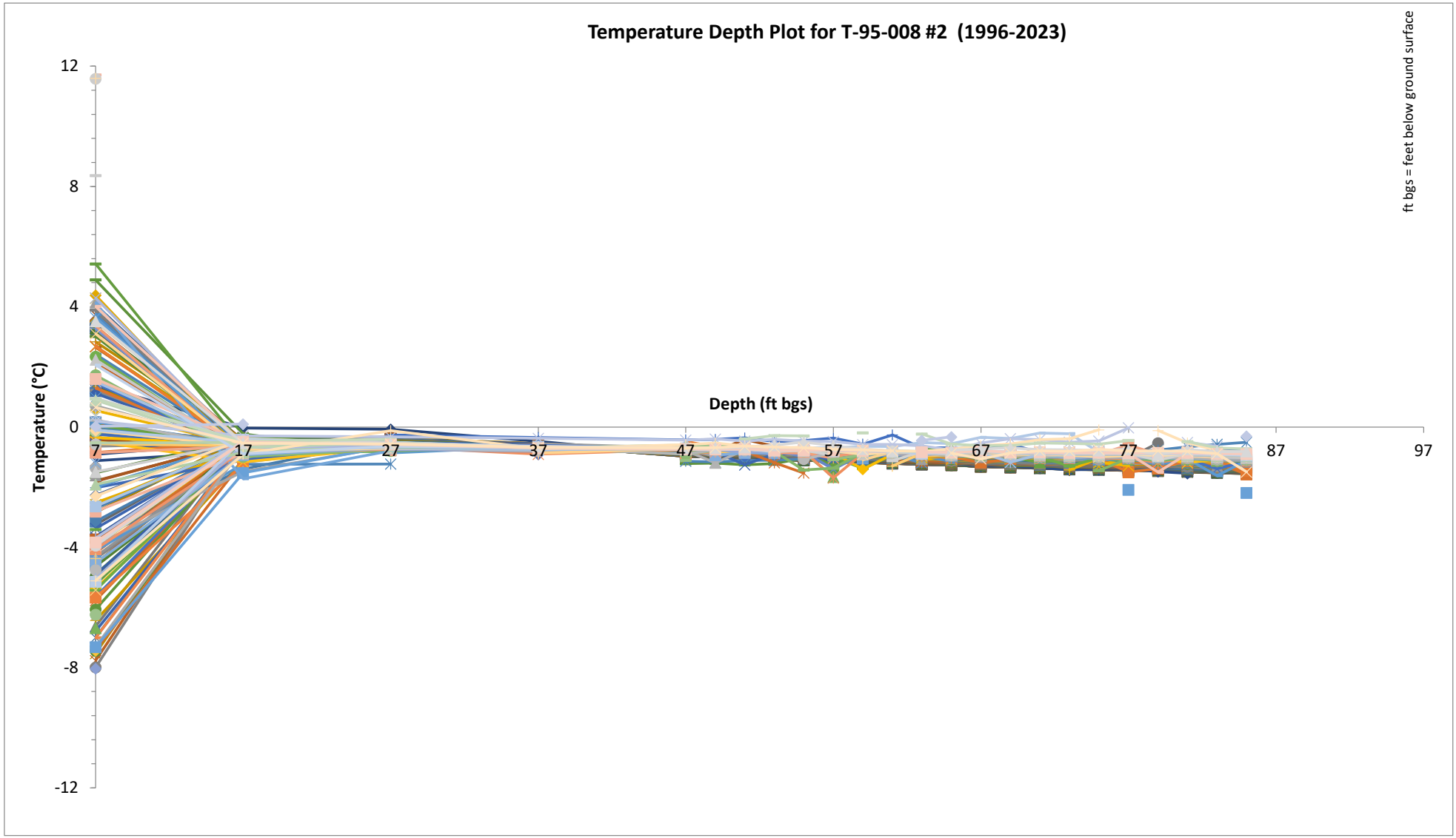

T-95-005, Mean Annual Ground Temperature (2023)
Temperature (°C)
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
Depth (ft bgs)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
ft bgs = feet below ground surface


Temperature Depth Plot for T-95-005 (1996-2023)
ft bgs = feet below ground surface
Temperature (°C)
Depth (ft)
8
6
4
-2
-4
-6
0
50
100
150
200
250
300
350
400
450

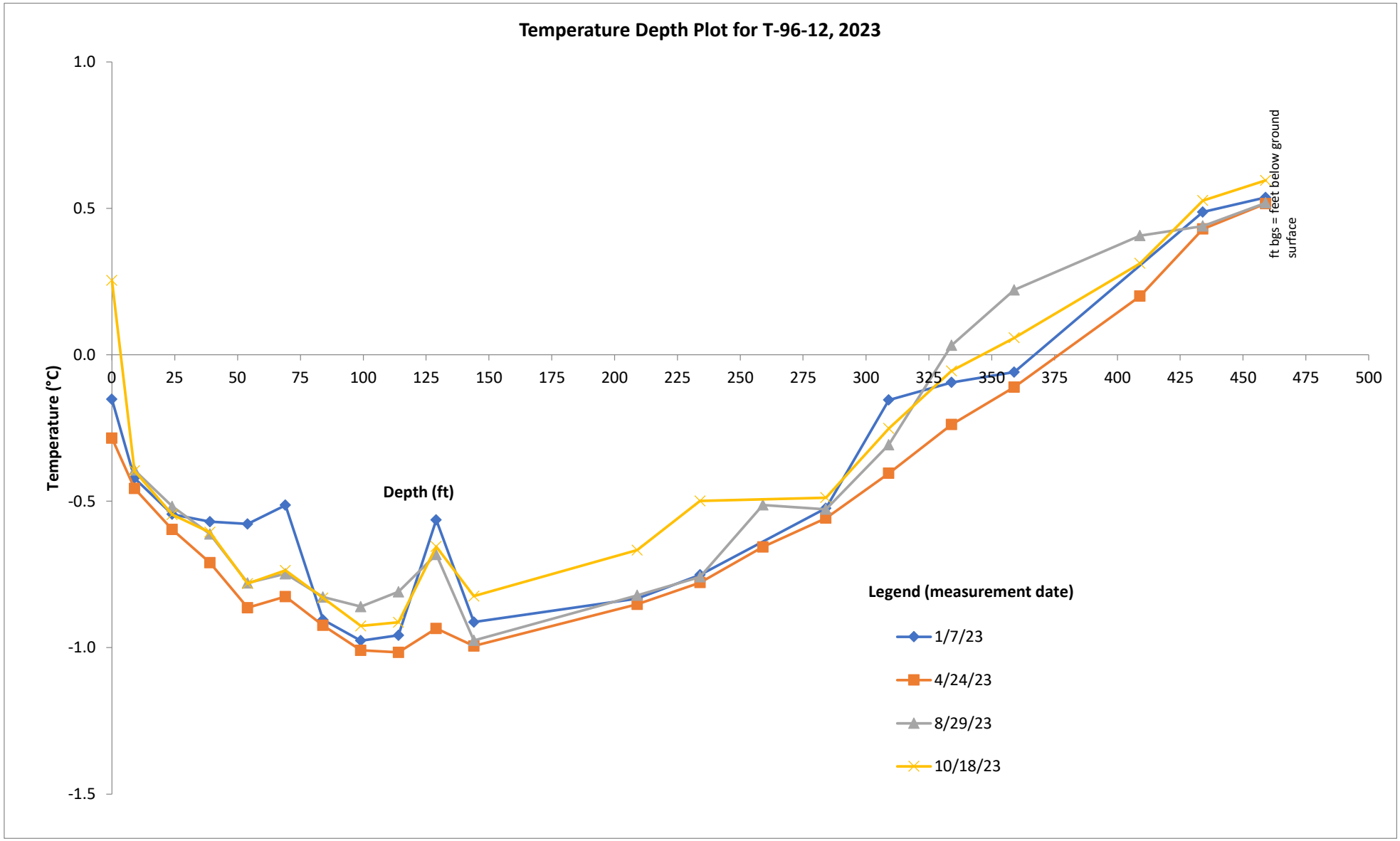
Thermistor T-95-08#2

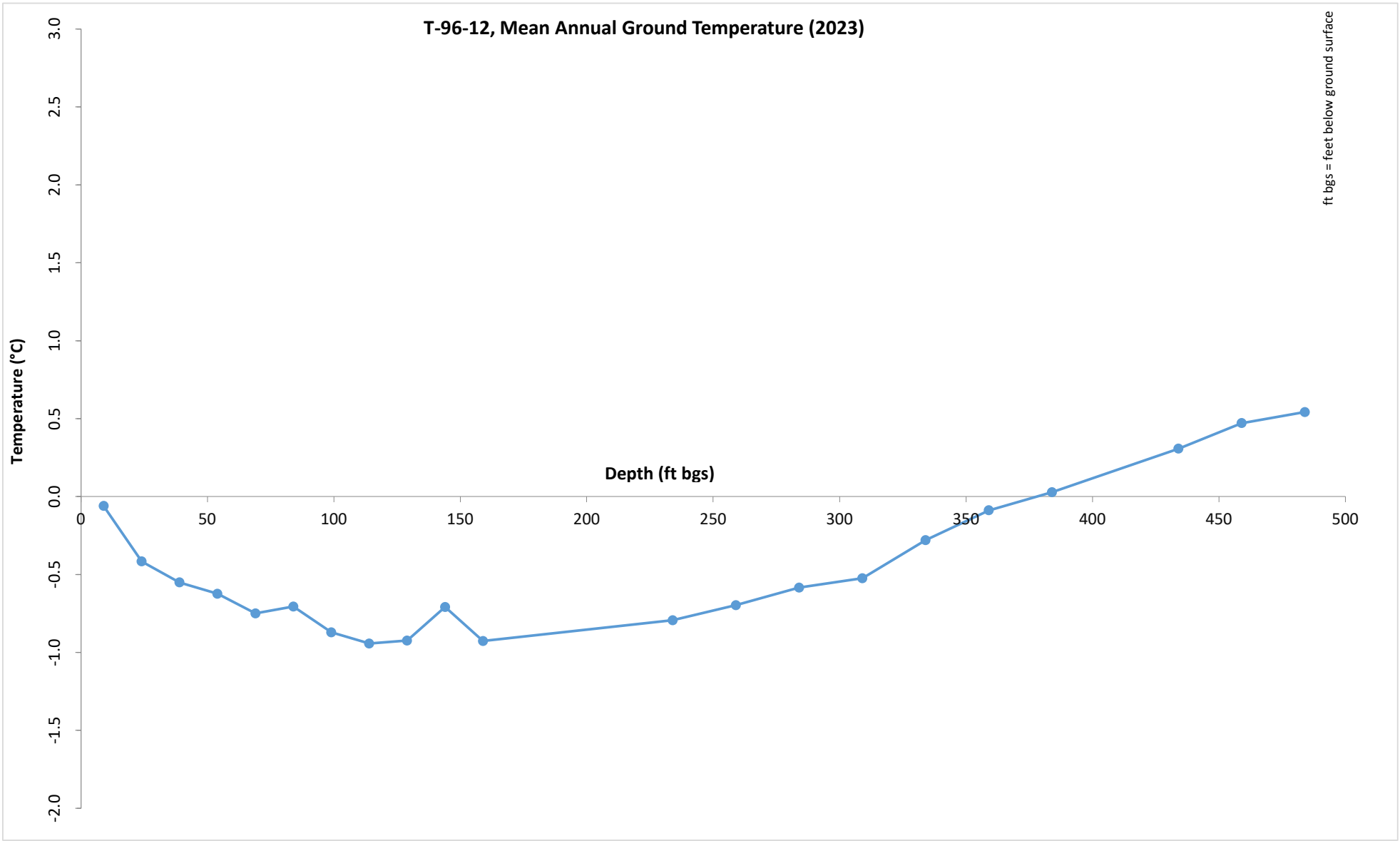

Temperature Depth Plot for T-95-008 #2, 2023
5.5
4.5
3.5
2.5
1.5
0.5
-0.5
-1.5
-2.5
-3.5
-4.5
-5.5
0
10
20
30
40
50
60
70
80
90
Temperature (°C)
Depth (ft bgs)
ft bgs = feet below ground surface
Legend (measurement date)
1/7/23
4/24/23
8/29/23
10/18/23

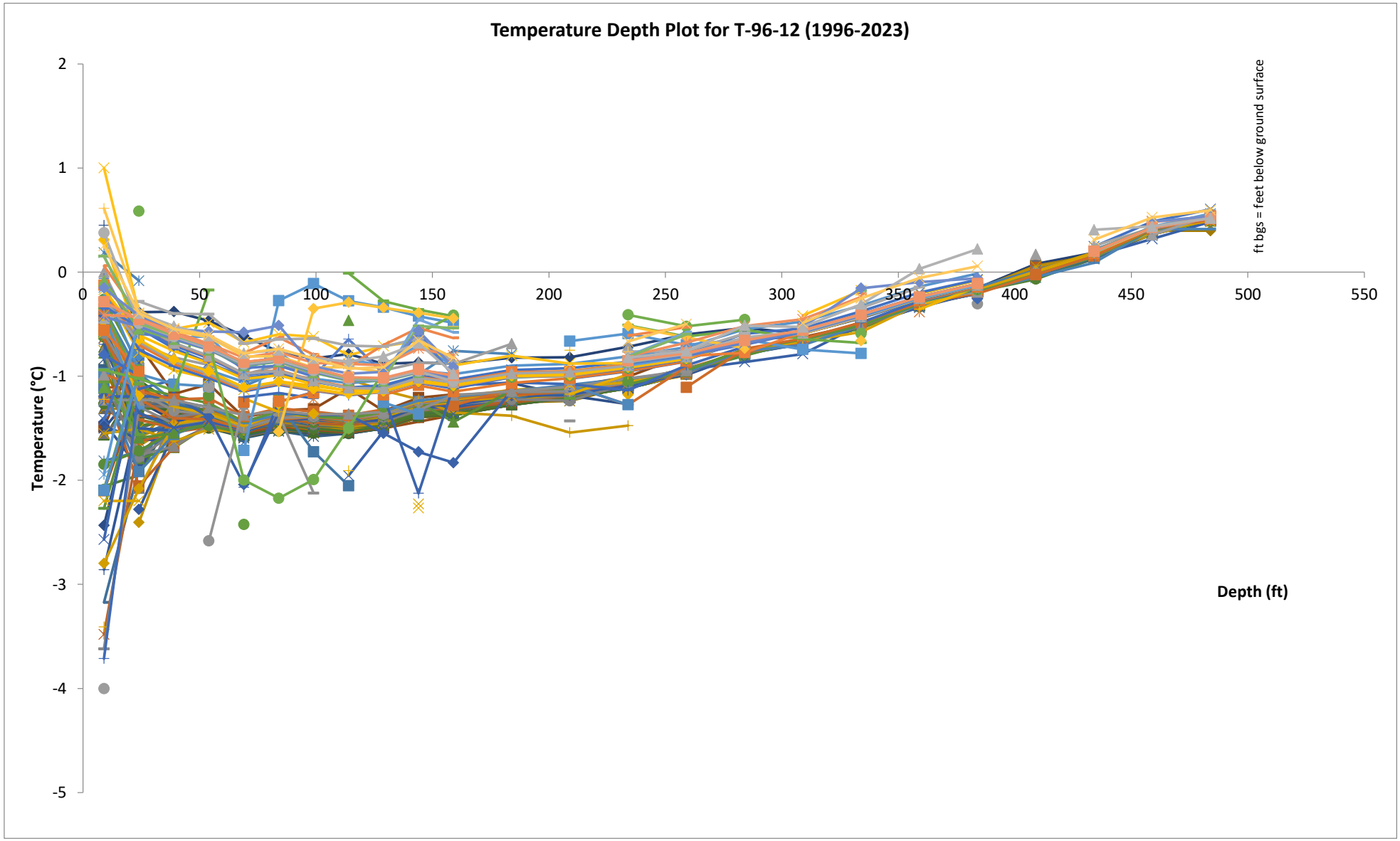

T-95-08#2, Mean Annual Ground Temperature (2023)
Temperature (°C)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
0
10
20
30
40
50
60
70
80
90
Depth (ft bgs)
ft bgs = feet below ground surface


Temperature Depth Plot for T-95-008 #2 (1996-2023)
Temperature (°C)
12
8
4
0
-4
-8
-12
Depth (ft bgs)
7
17
27
37
47
57
67
77
87
97
ft bgs = feet below ground surface

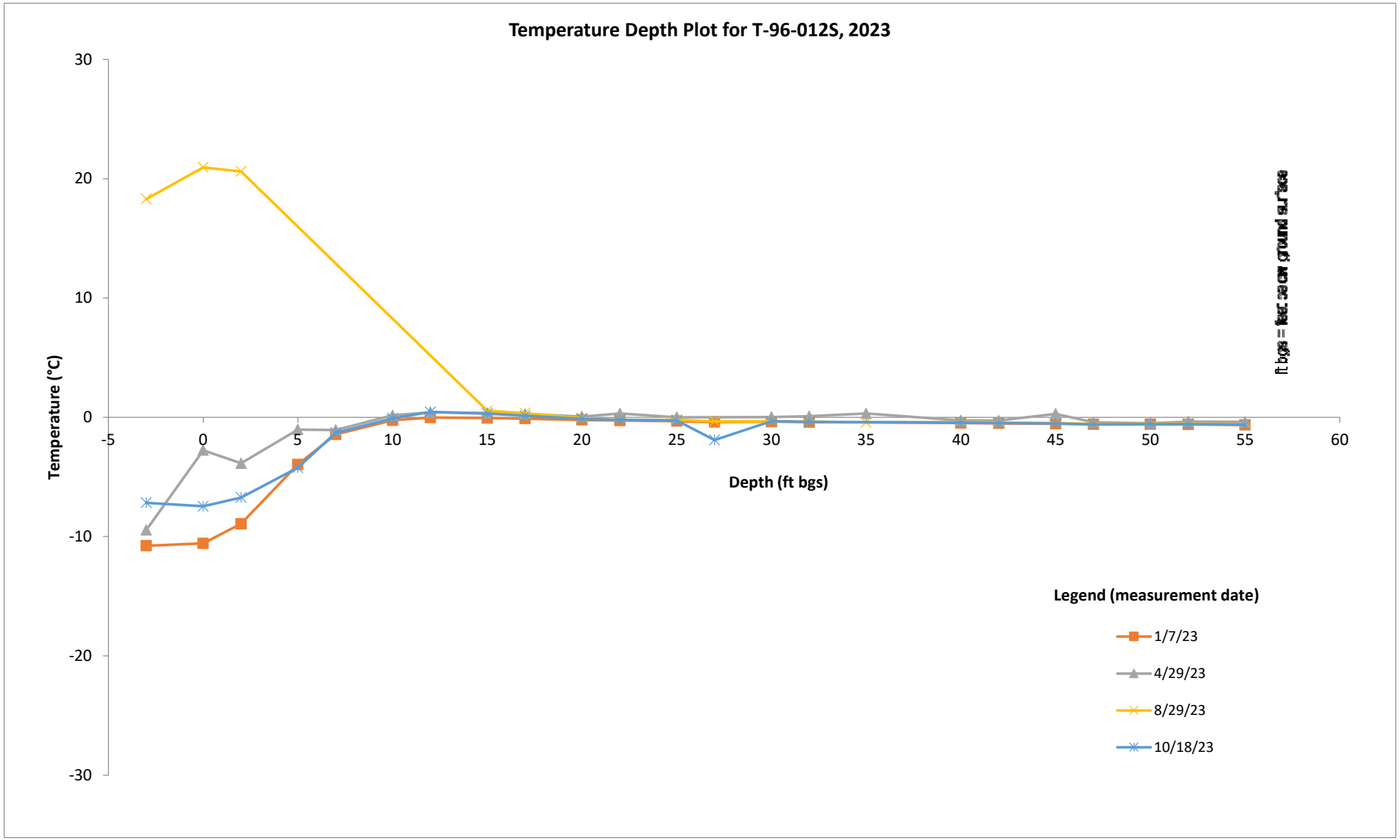
Thermistor T-96-12

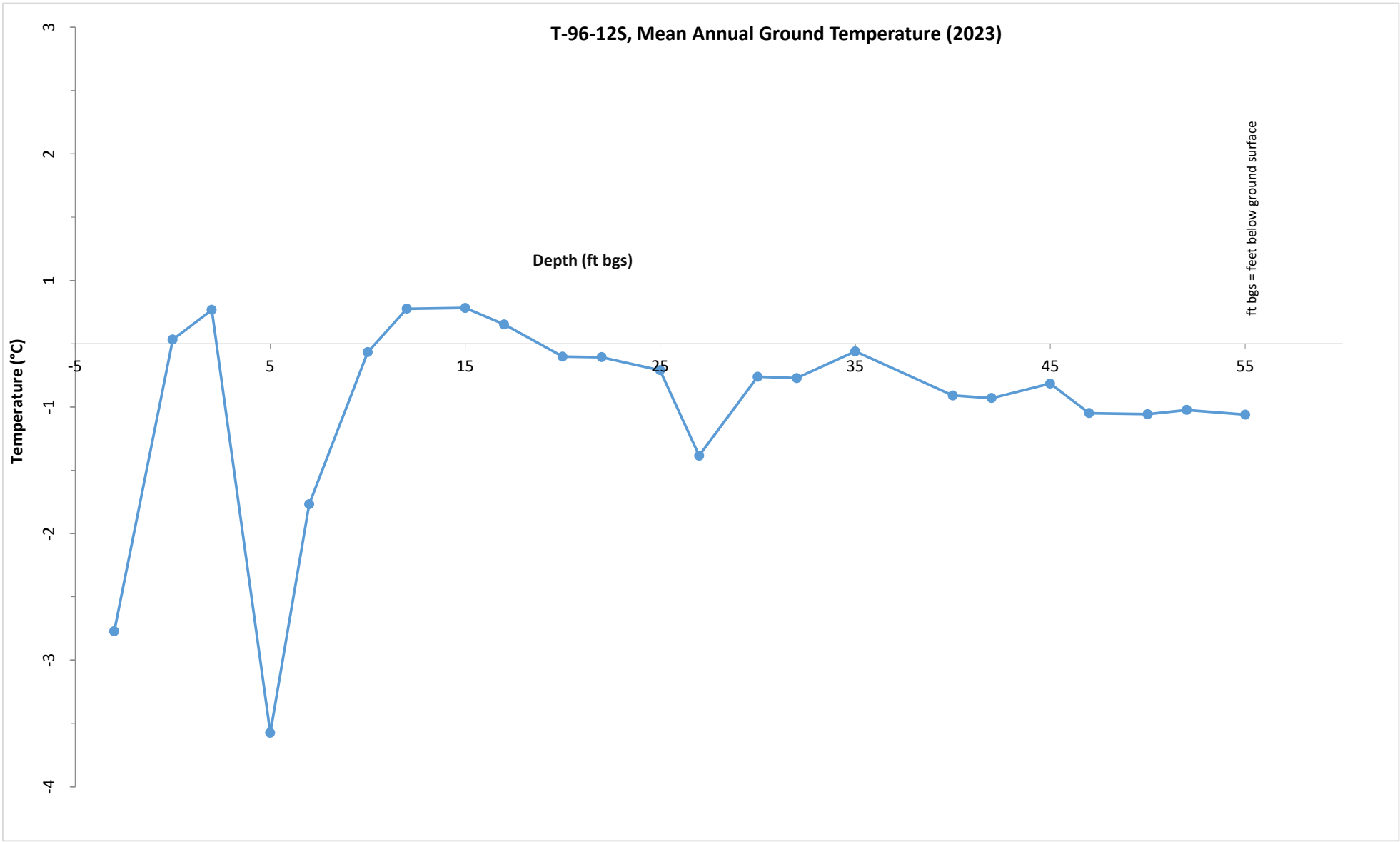

Temperature Depth Plot for T-96-12, 2023
Temperature (°C)
1.0
0.5
0.0
-0.5
-1.0
-1.5
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
425
450
475
500
Depth (ft)
ft bgs = feet below ground surface
Legend (measurement date)
1/7/23
4/24/23
8/29/23
10/18/23

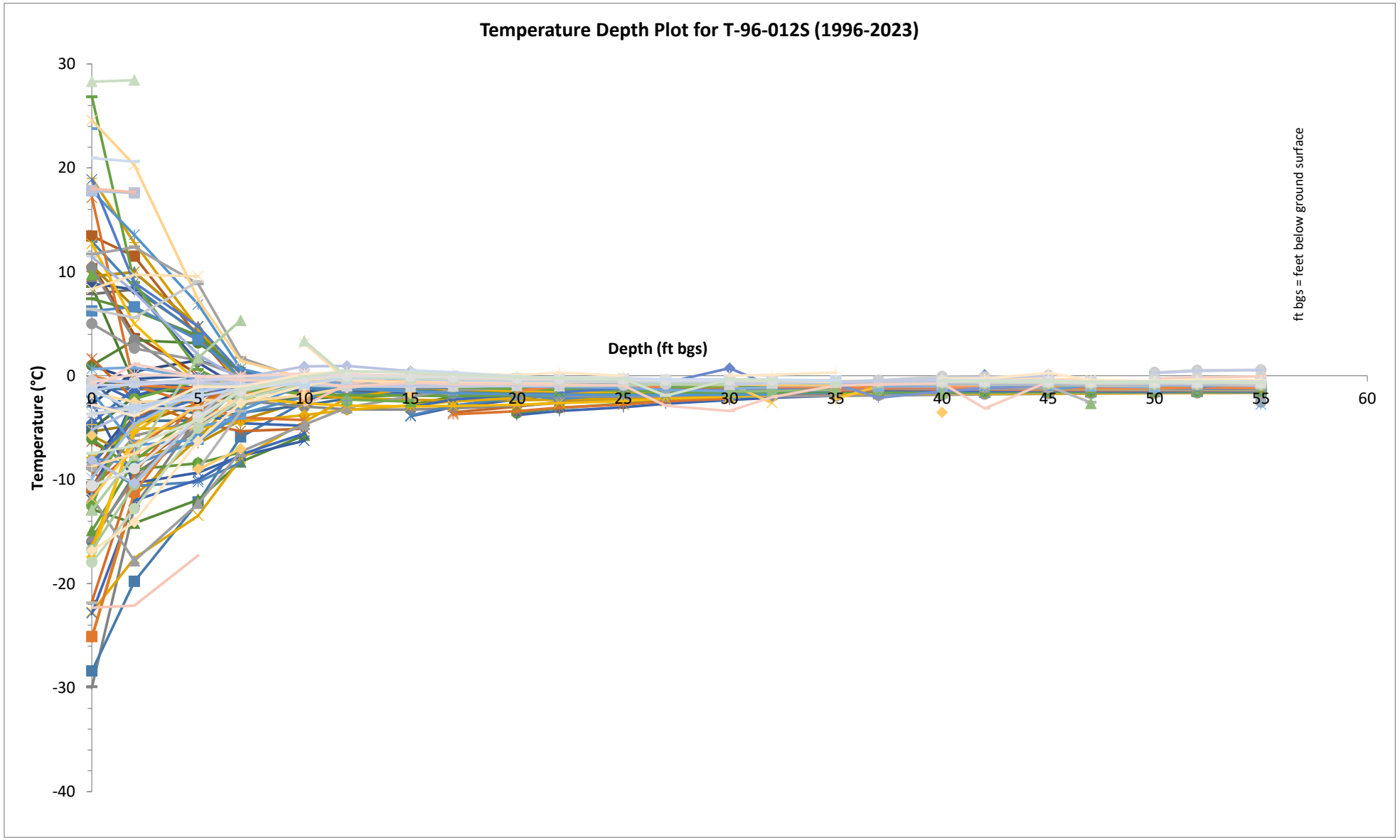

T-96-12, Mean Annual Ground Temperature (2023)
Temperature (°C)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
Depth (ft bgs)
0
50
100
150
200
250
300
350
400
450
500
ft bgs = feet below ground surface


Temperature Depth Plot for T-96-12 (1996-2023)
Temperature (°C)
2
1
0
-1
-2
-3
-4
-5
0
50
100
150
200
250
300
350
400
450
500
550
Depth (ft)
ft bgs = feet below ground surface

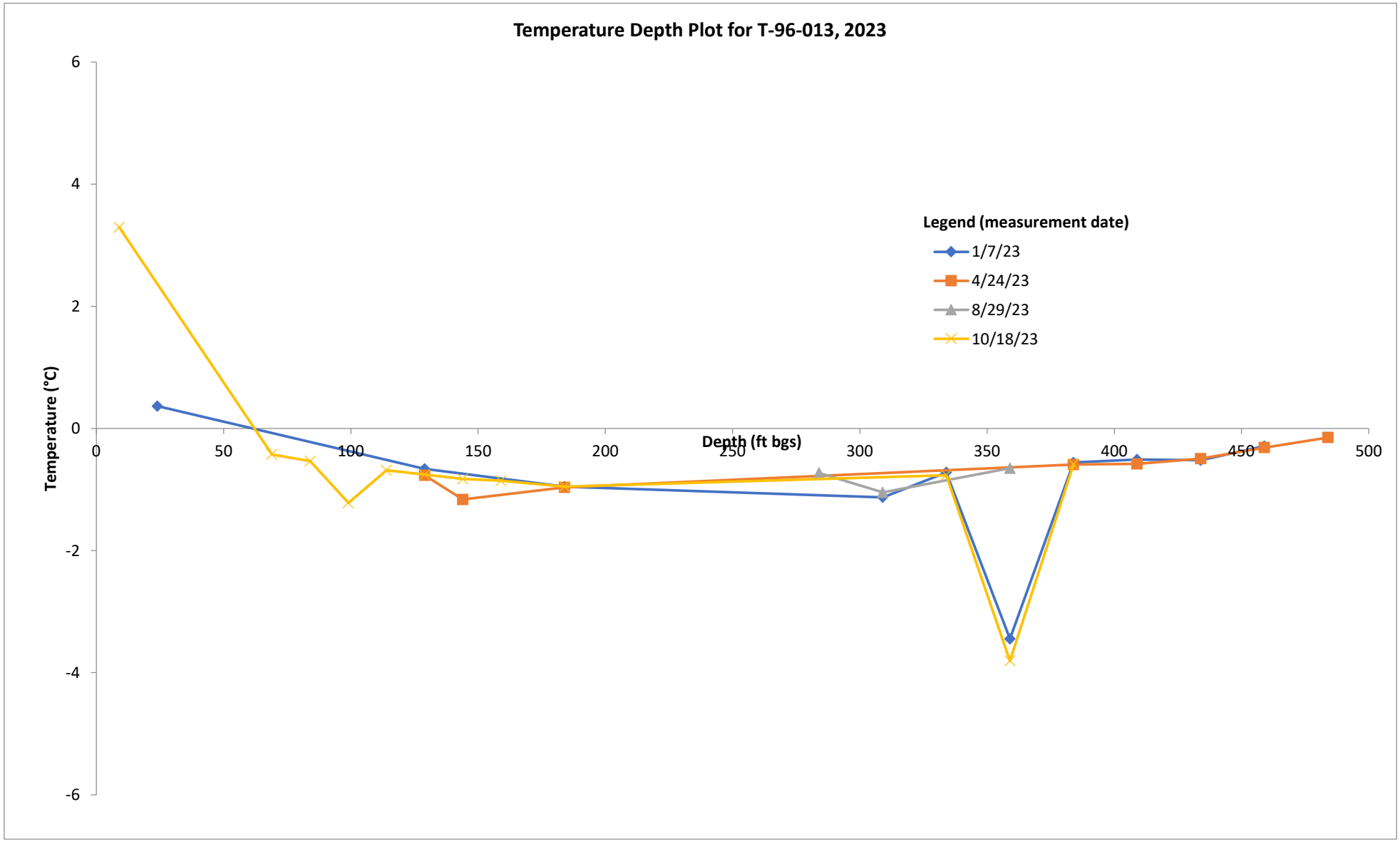
Thermistor T-96-12S

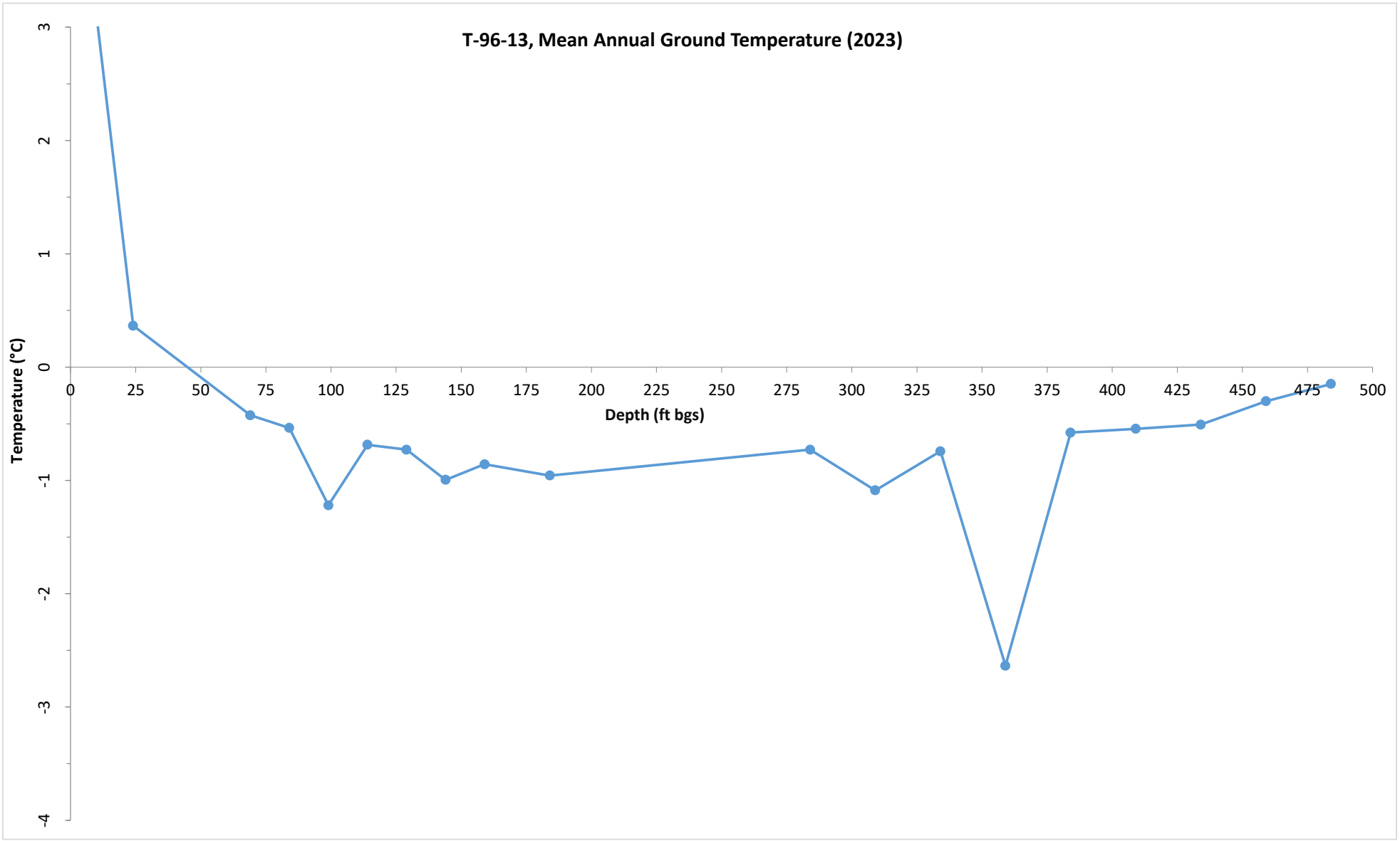

Temperature Depth Plot for T-96-012S, 2023
Temperature (°C)
30
20
10
0
-10
-20
-30
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
Depth (ft bgs)
ft bgs = feet below ground surface
Legend (measurement date)
1/7/23
4/29/23
8/29/23
10/18/23

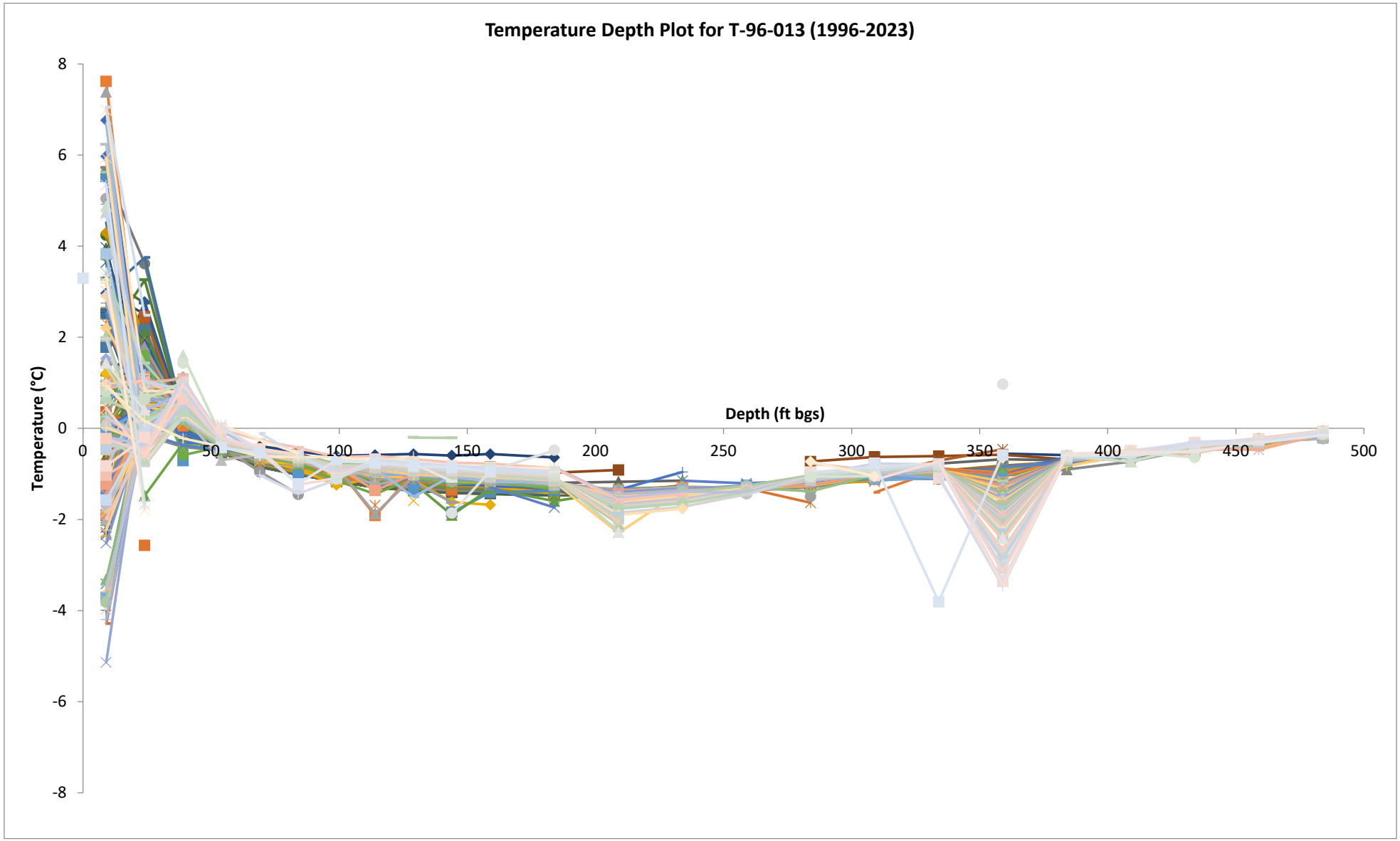

T-96-12S, Mean Annual Ground Temperature (2023)
Temperature (°C)
Depth (ft bgs)
ft bgs = feet below ground surface
3
2
1
-1
-2
-3
-4
-5
5
15
25
35
45
55


Temperature Depth Plot for T-96-012S (1996-2023)
Temperature (°C)
30
20
10
0
-10
-20
-30
-40
0
5
10
15
20
25
30
35
40
45
50
55
60
Depth (ft bgs)
ft bgs = feet below ground surface

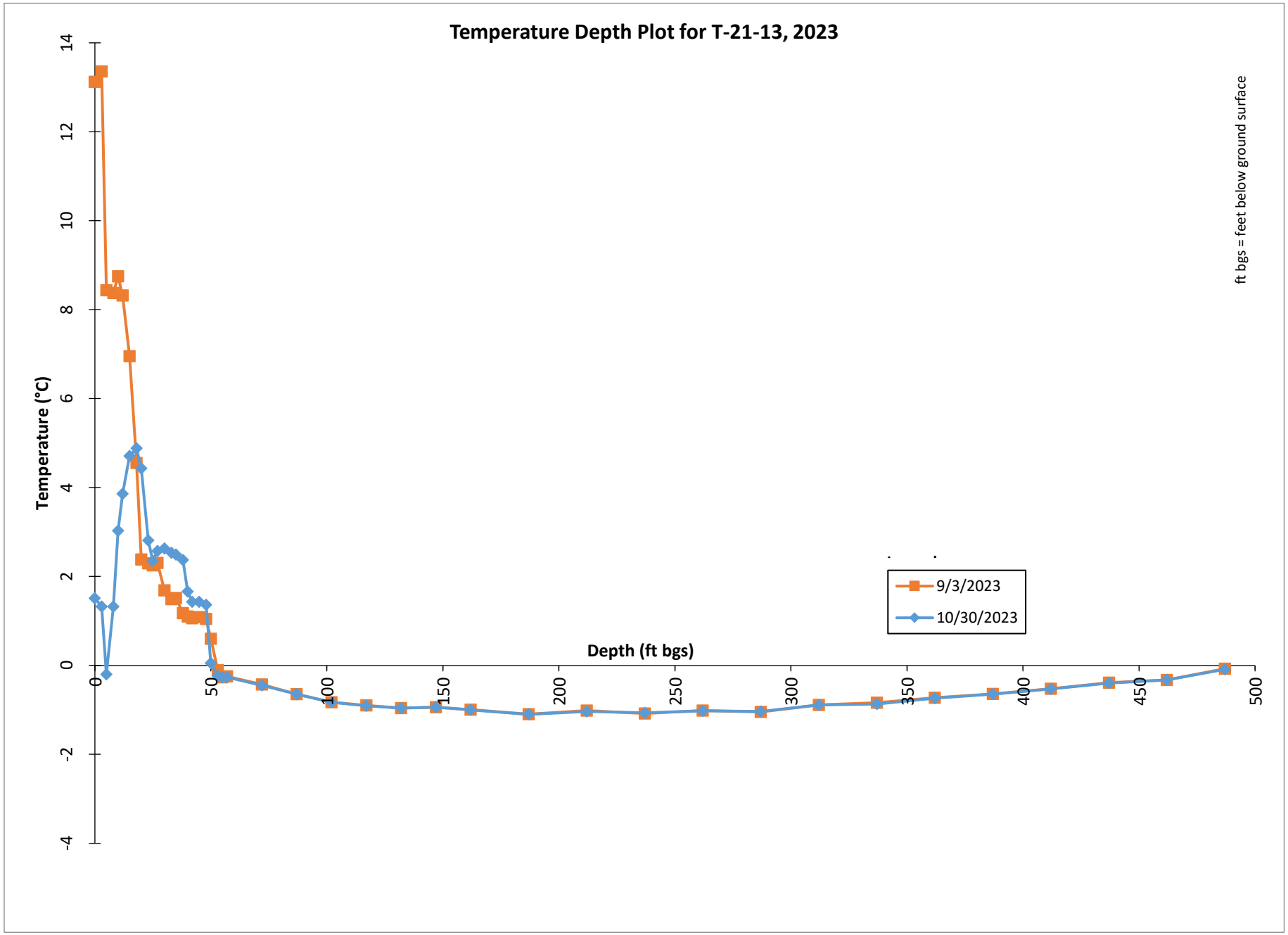
Thermistor T-96-13

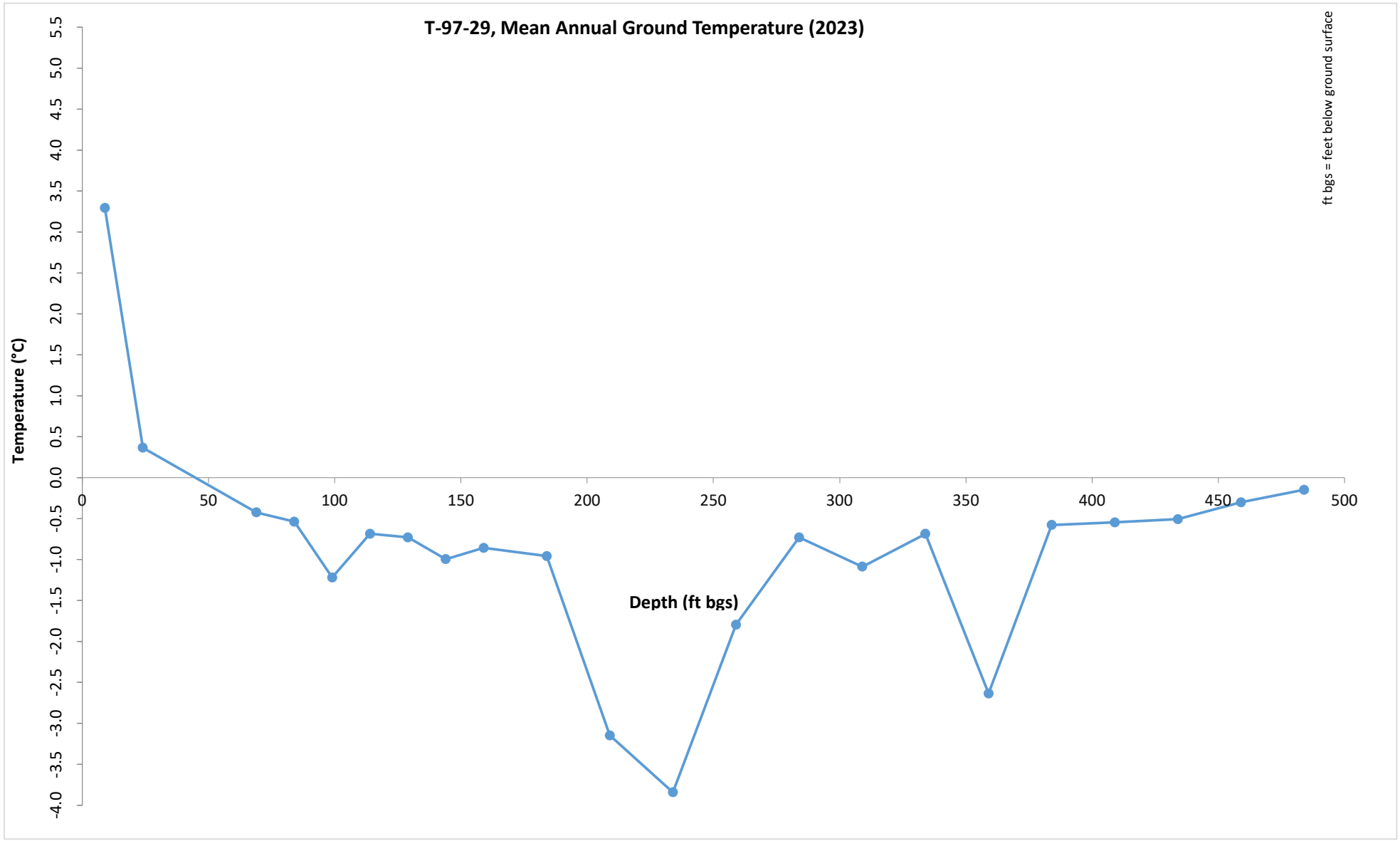

Temperature Depth Plot for T-96-013, 2023
Temperature (°C)
6
4
2
0
-2
-4
-6
0
50
100
150
200
250
300
350
400
450
500
Depth (ft bgs)
Legend (measurement date)
1/7/23
4/24/23
8/29/23
10/18/23


T-96-13, Mean Annual Ground Temperature (2023)
Temperature (°C)
3
2
1
0
-1
-2
-3
-4
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
425
450
475
500
Depth (ft bgs)

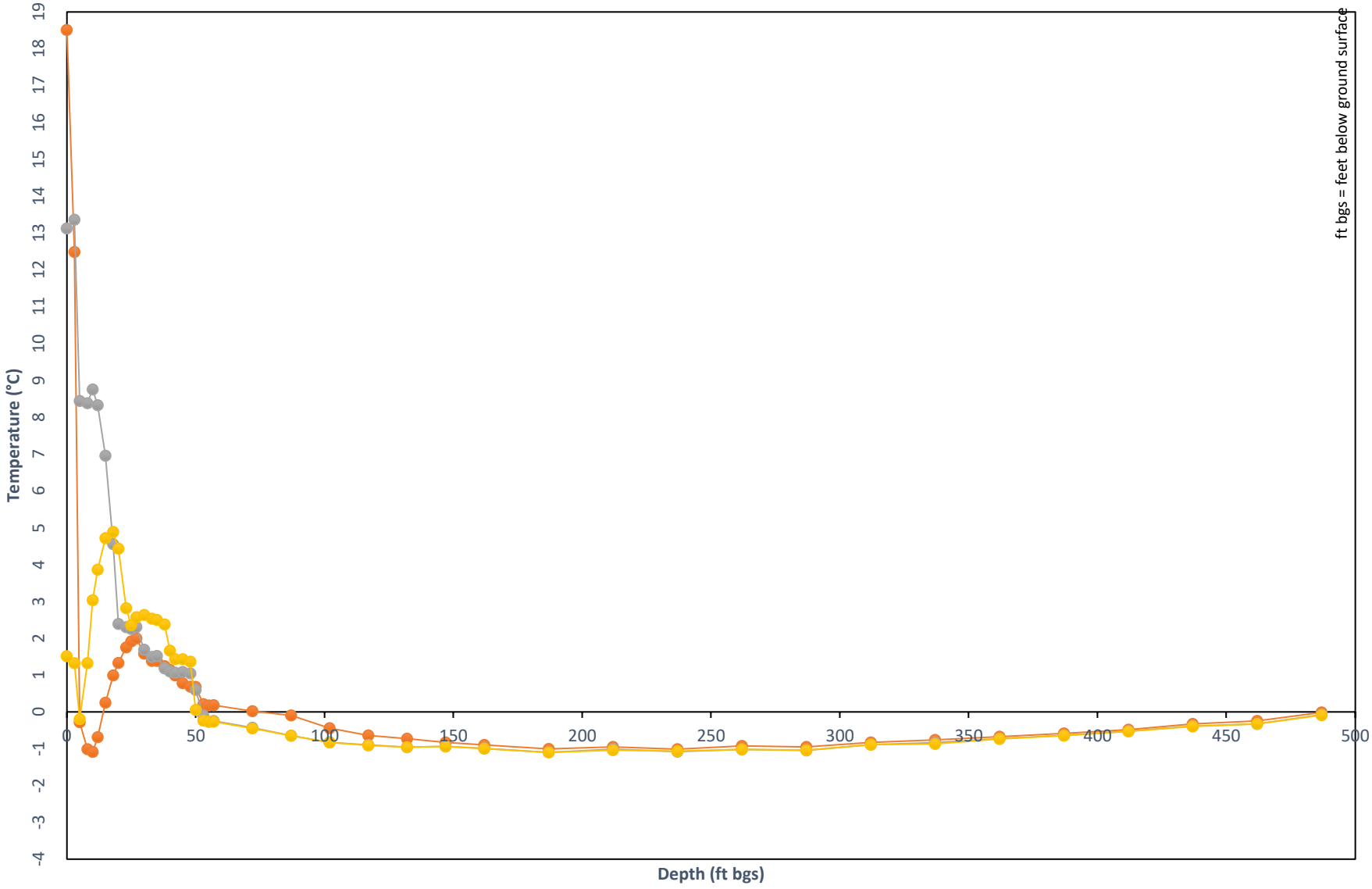

Temperature Depth Plot for T-96-013 (1996-2023)
Temperature (°C)
8
6
4
2
0
-2
-4
-6
-8
Depth (ft bgs)
0
50
100
150
200
250
300
350
400
450
500

Thermistor T-21-13

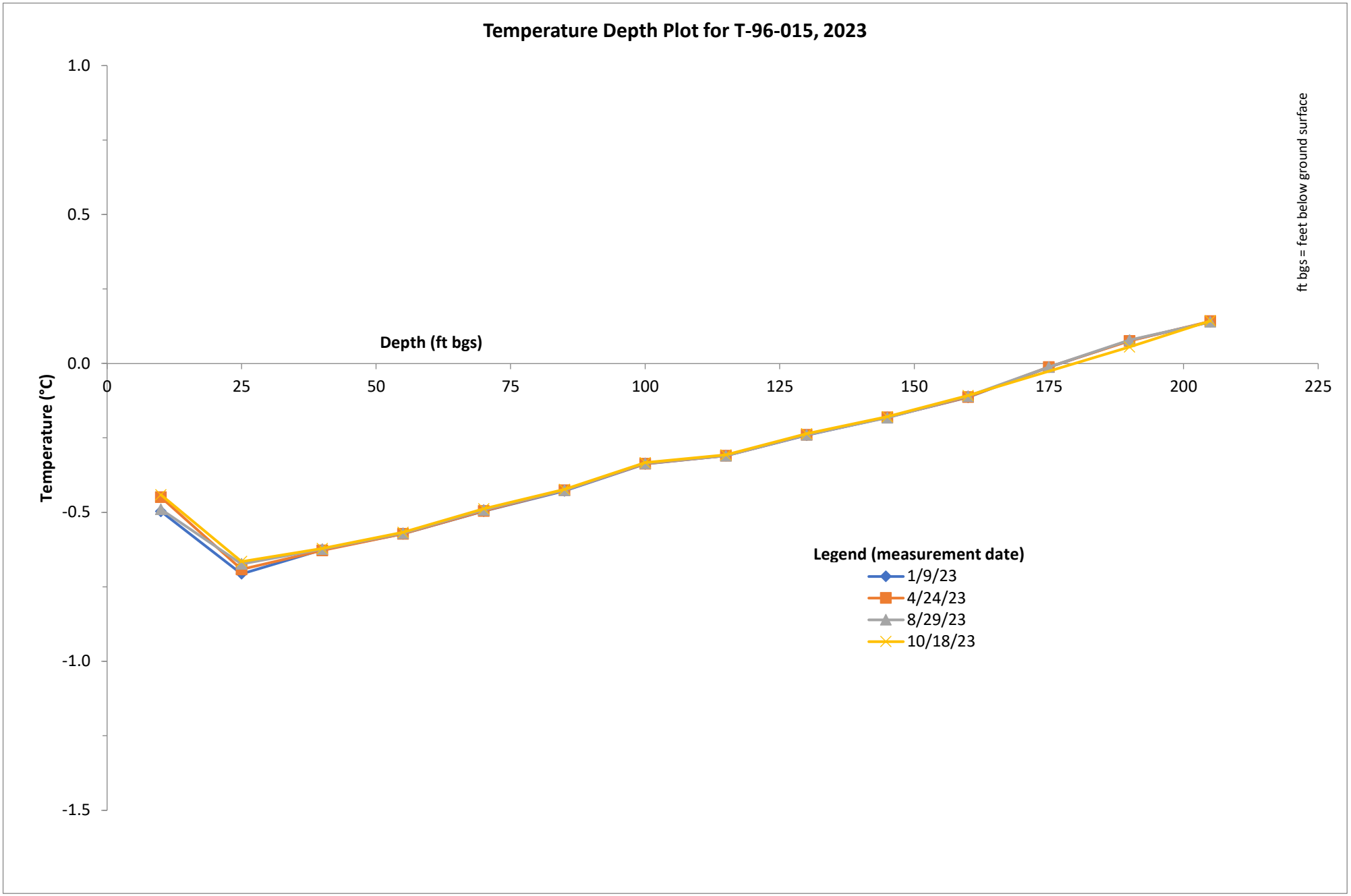

Temperature Depth Plot for T-21-13, 2023
Temperature (°C)
14
12
10
8
6
4
2
0
-2
-4
0
50
100
150
200
250
300
350
400
450
500
Depth (ft bgs)
9/3/2023
10/30/2023
ft bgs = feet below ground surface

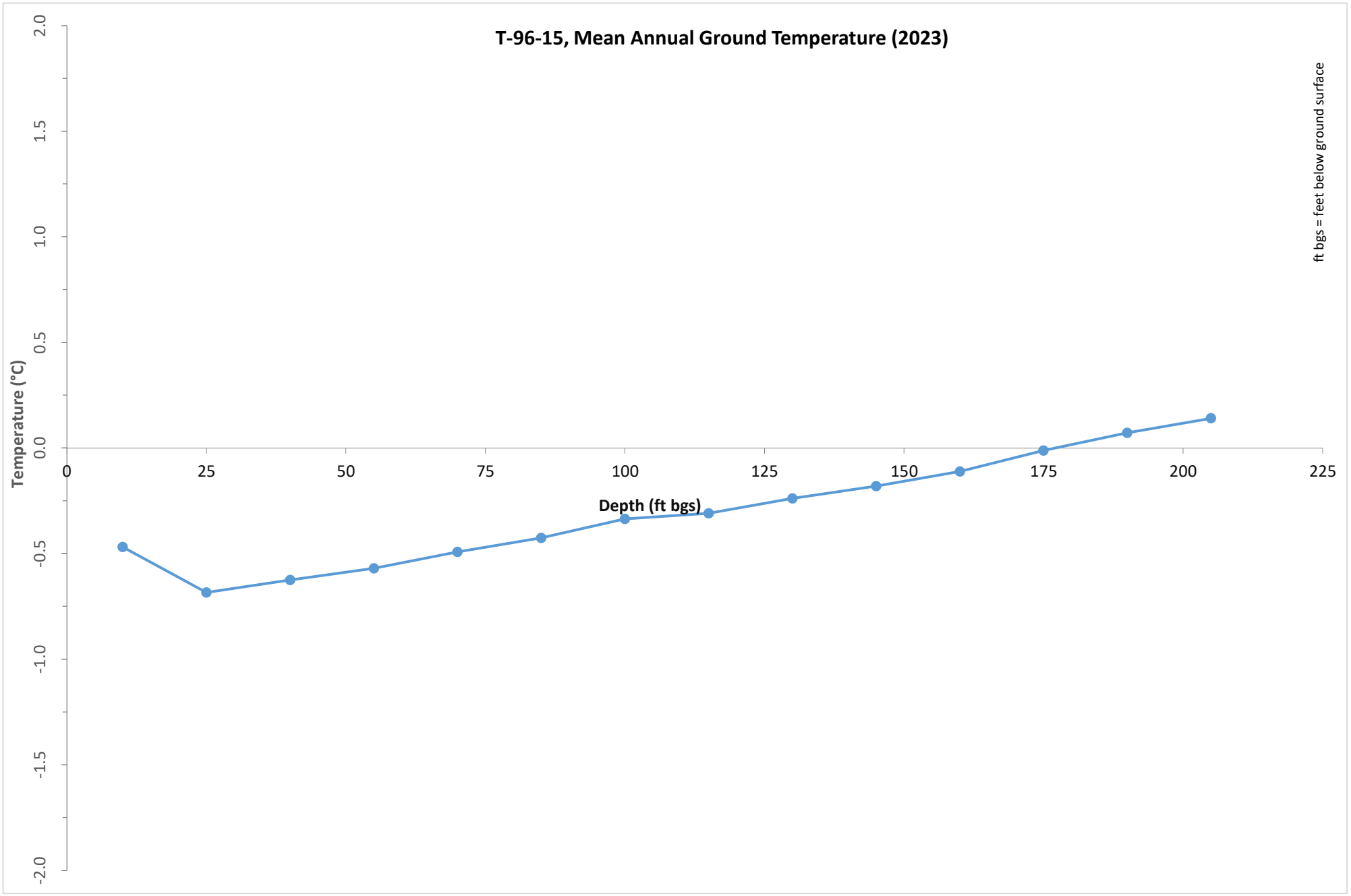

T-97-29, Mean Annual Ground Temperature (2023)
Temperature (°C)
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
0
50
100
150
200
250
300
350
400
450
500
Depth (ft bgs)
ft bgs = feet below ground surface

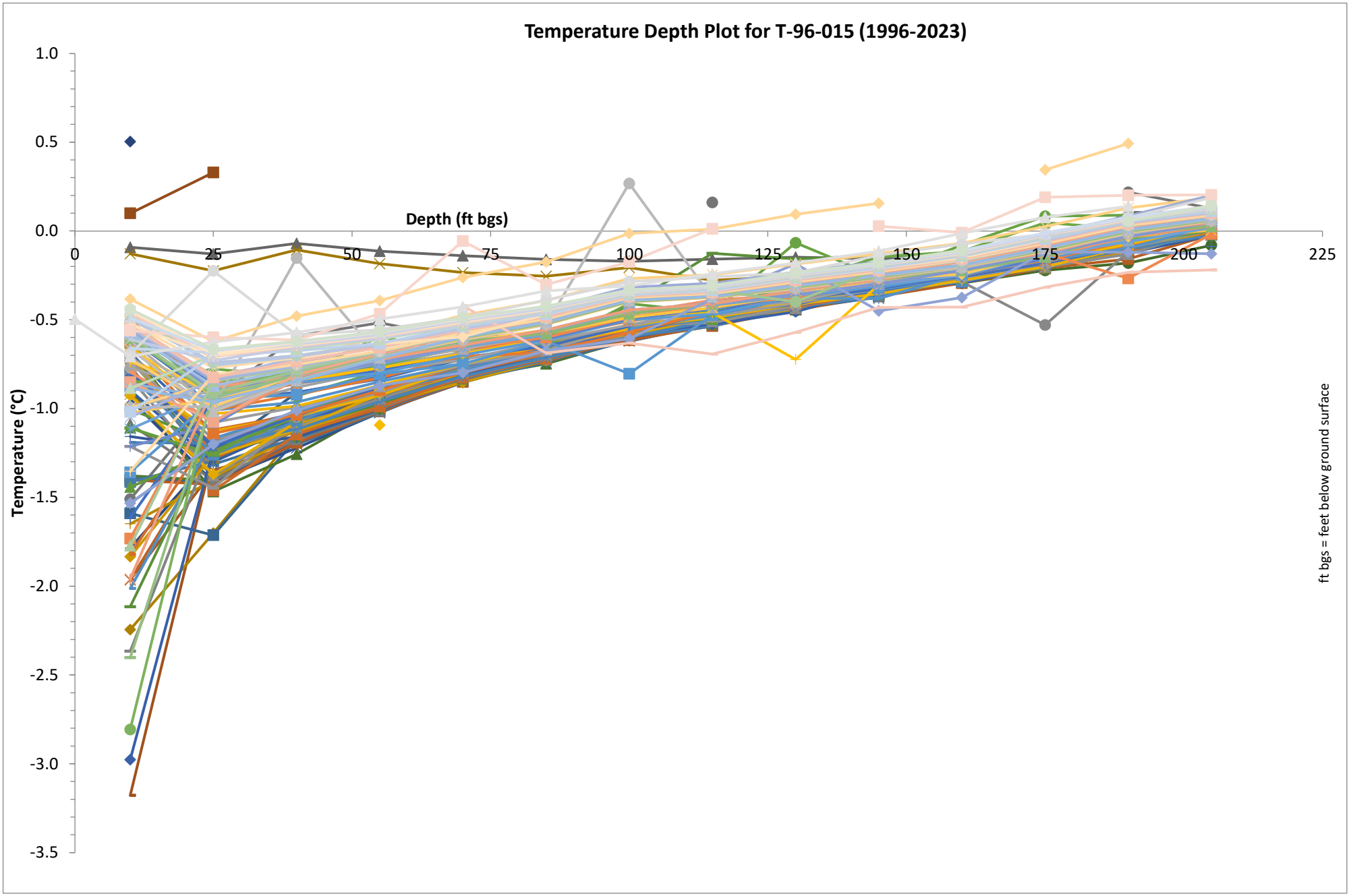
Temperature Depth Plot for T-21-13 (2015-2023)



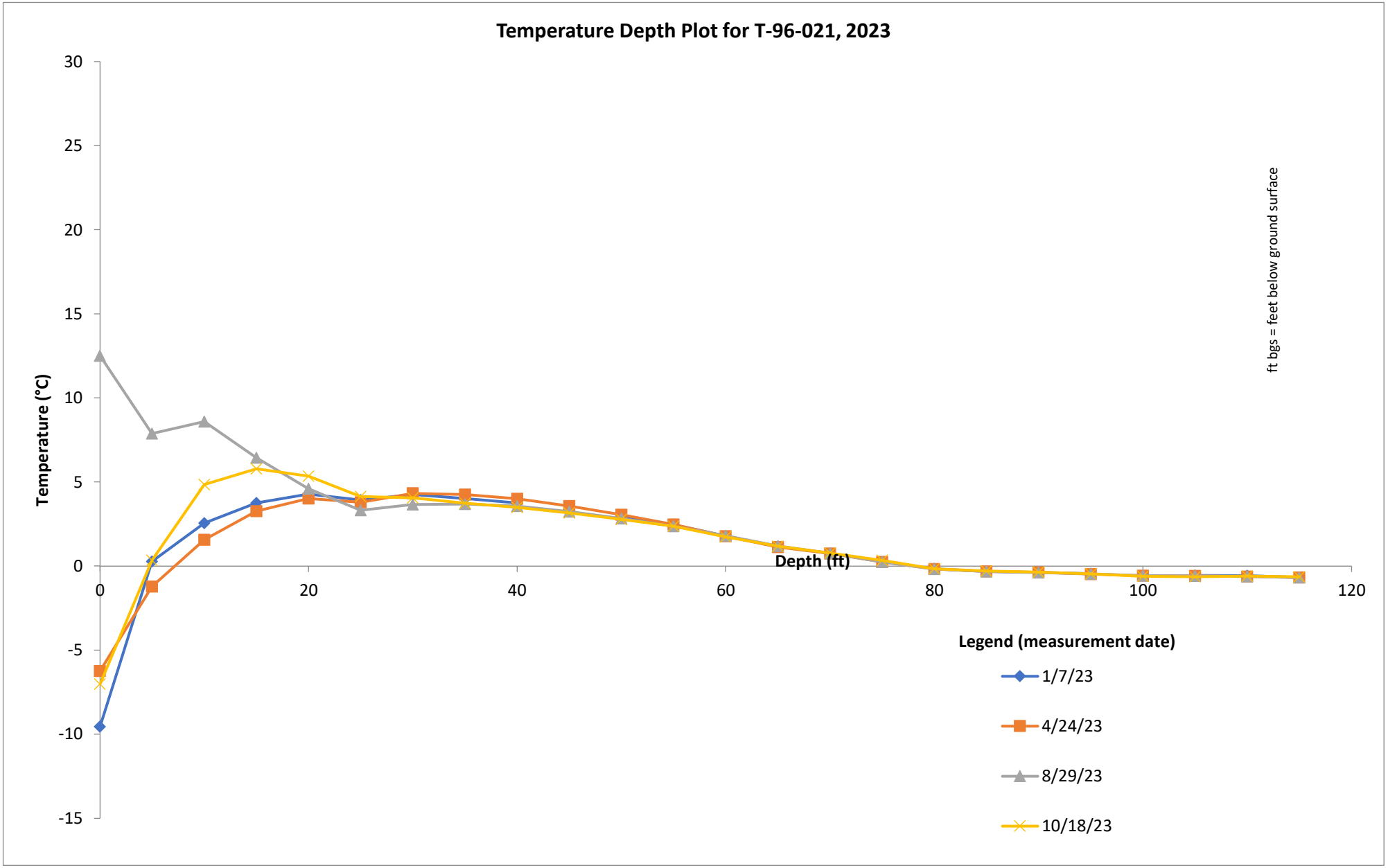
Thermistor T-96-15

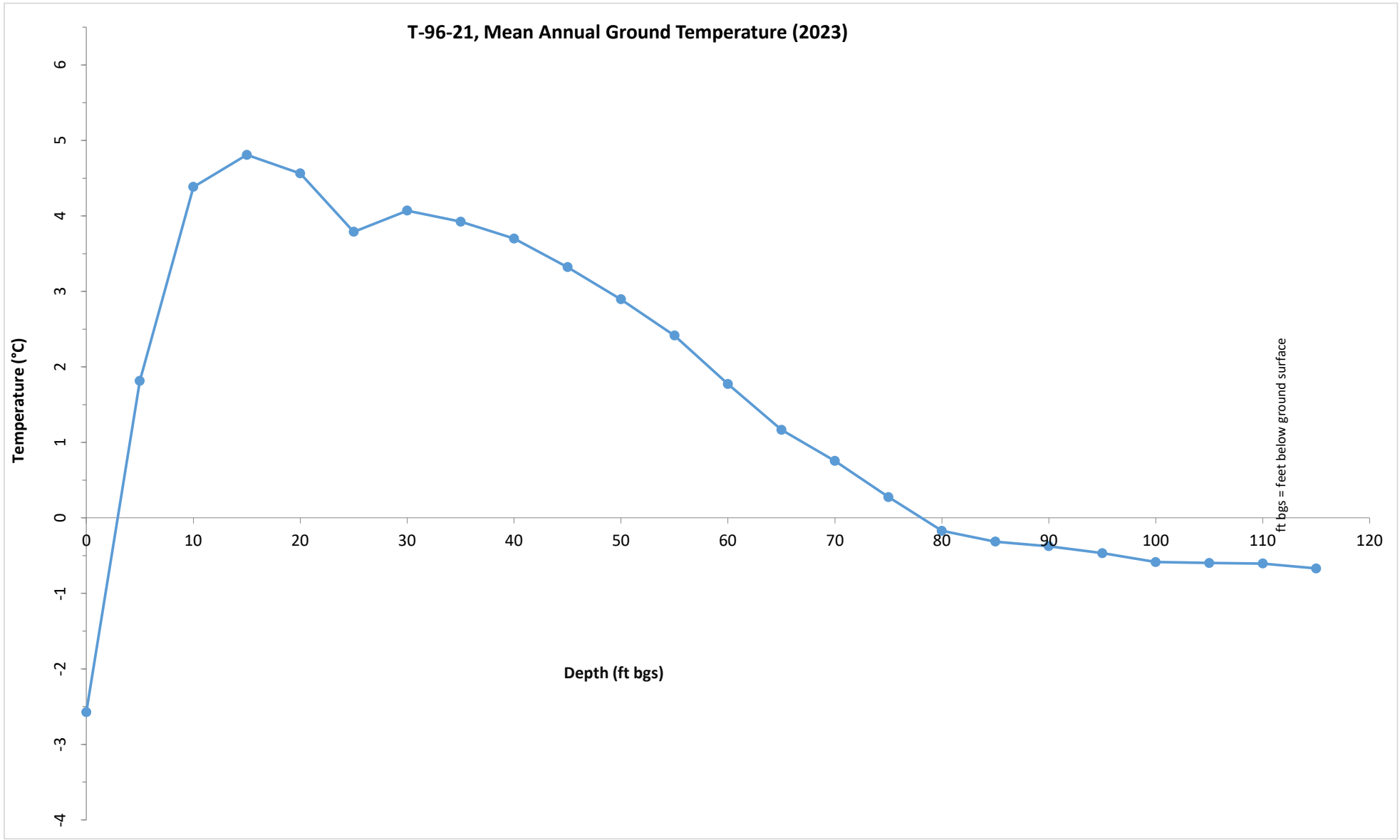

Temperature Depth Plot for T-96-015, 2023
1.0
0.5
0.0
-0.5
-1.0
-1.5
Temperature (°C)
0
25
50
75
100
125
150
175
200
225
Depth (ft bgs)
ft bgs = feet below ground surface
Legend (measurement date)
1/9/23
4/24/23
8/29/23
10/18/23

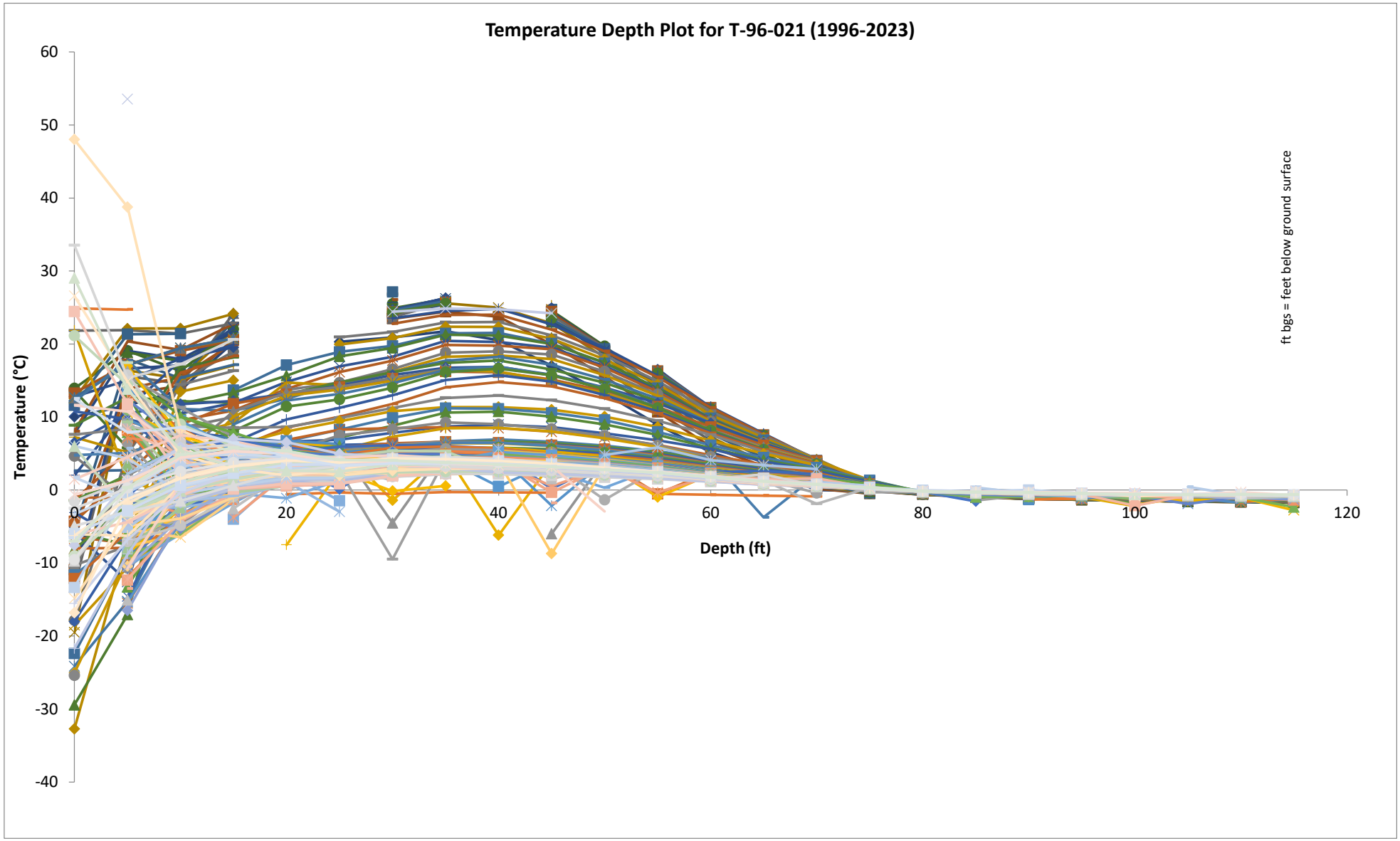

T-96-15, Mean Annual Ground Temperature (2023)
Temperature (°C)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
0
25
50
75
100
125
150
175
200
225
Depth (ft bgs)
ft bgs = feet below ground surface


Temperature Depth Plot for T-96-015 (1996-2023)
Depth (ft bgs)
Temperature (°C)
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
0
25
50
75
100
125
150
175
200
225
ft bgs = feet below ground surface

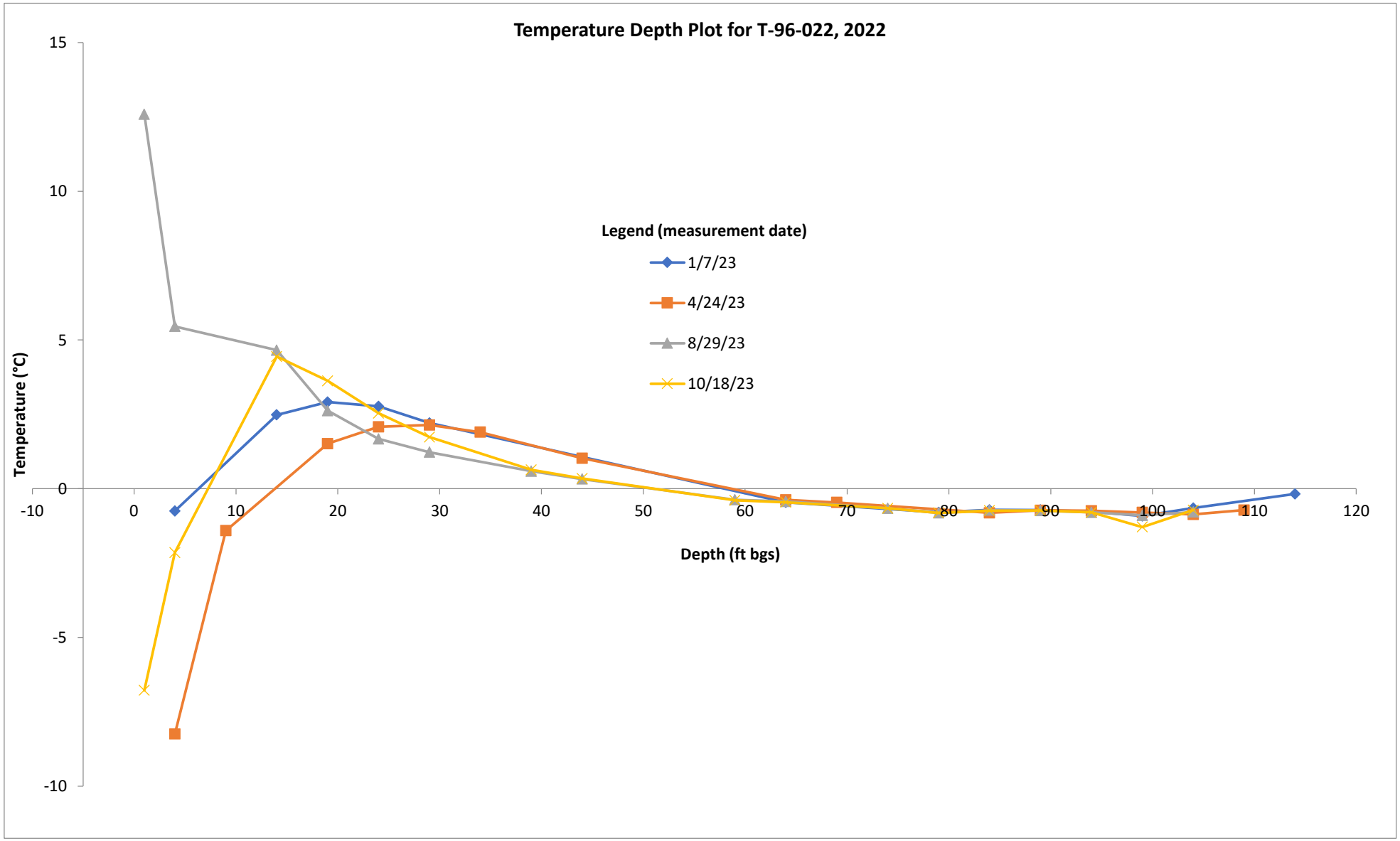
Thermistor T-96-21

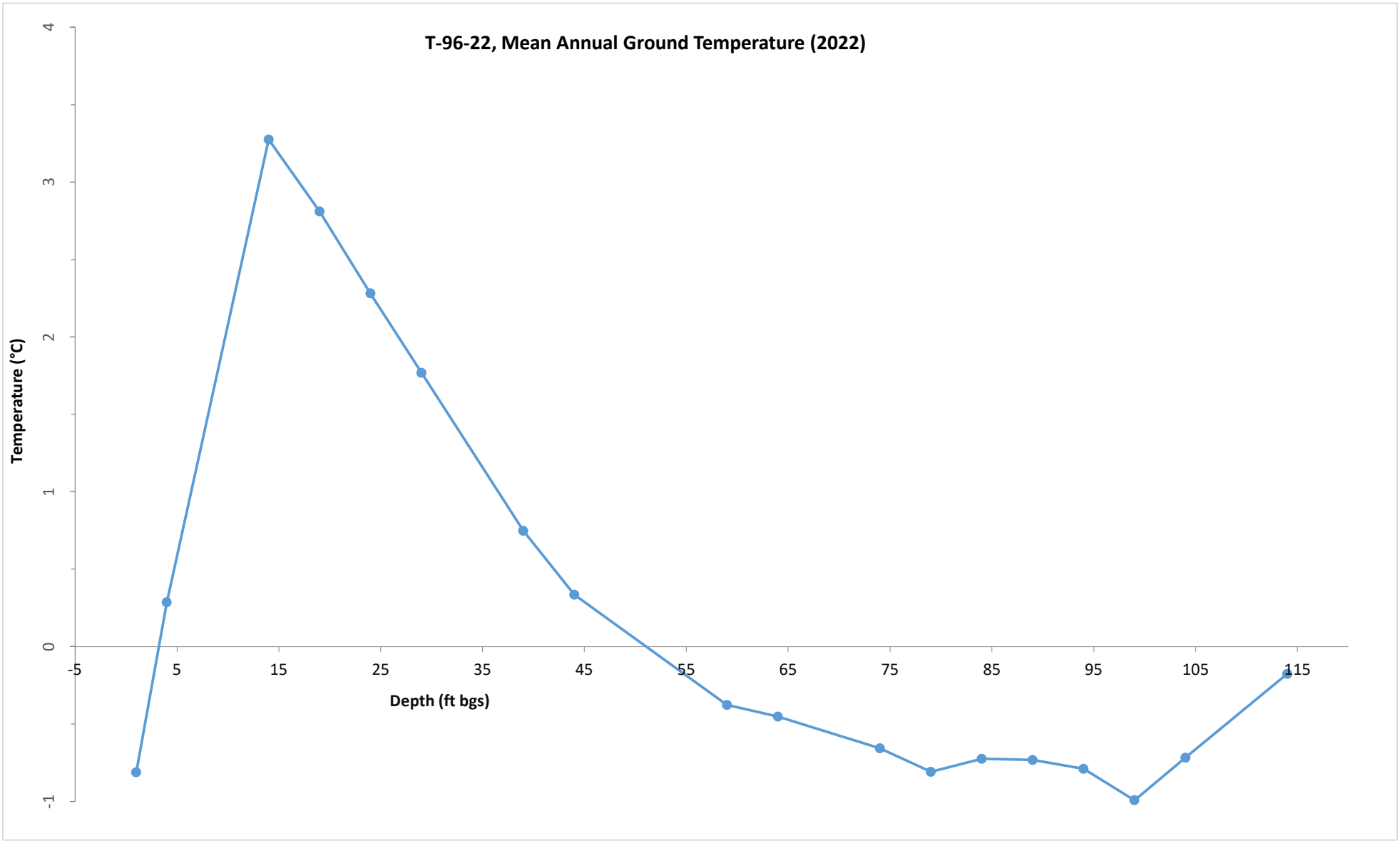

Temperature Depth Plot for T-96-021, 2023
Temperature (°C)
30
25
20
15
10
5
0
-5
-10
-15
0
20
40
60
80
100
120
Depth (ft)
ft bgs = feet below ground surface
Legend (measurement date)
1/7/23
4/24/23
8/29/23
10/18/23

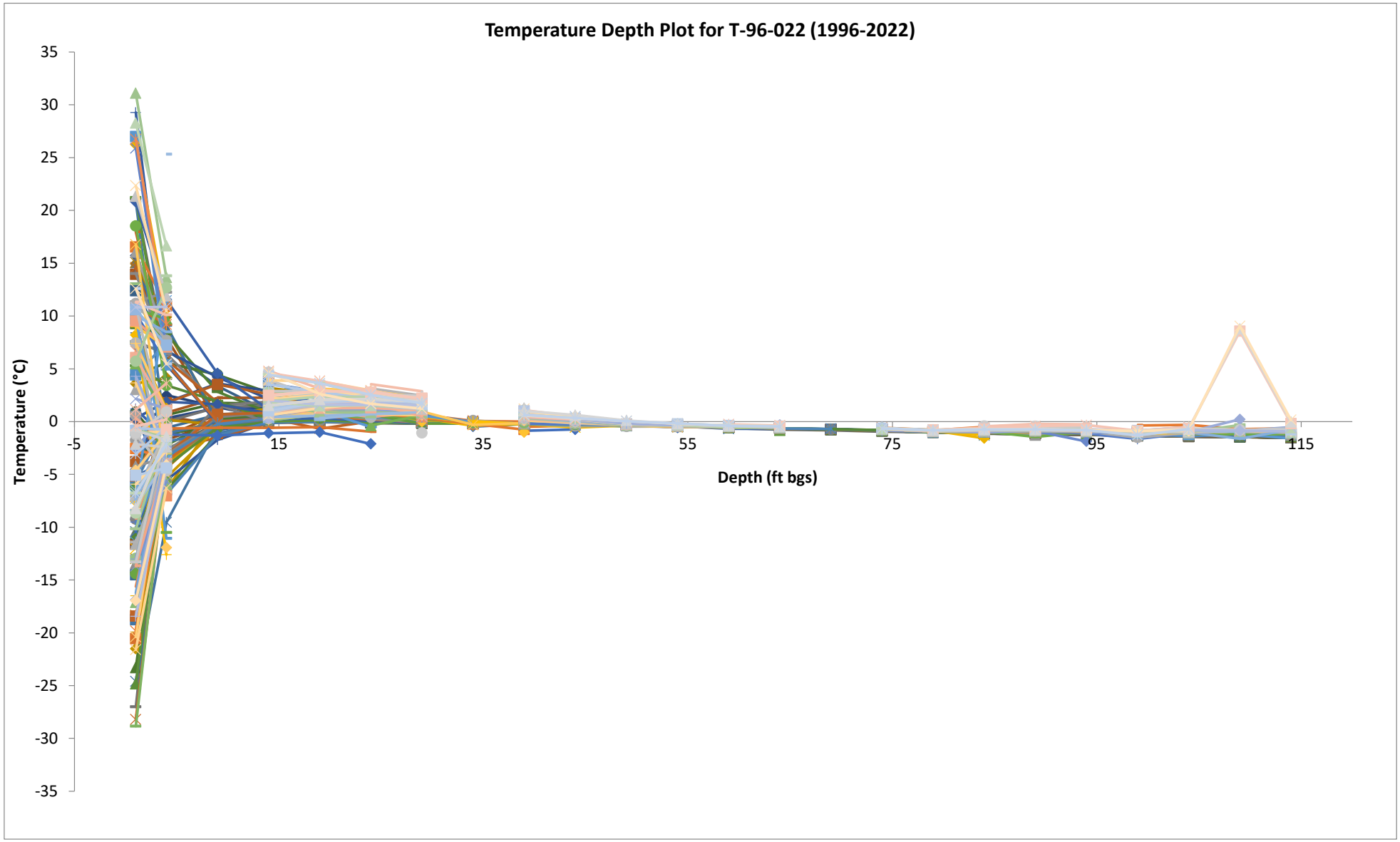

T-96-21, Mean Annual Ground Temperature (2023)
Temperature (°C)
6
5
4
3
2
1
0
-1
-2
-3
-4
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (ft bgs)
ft bgs = feet below ground surface


Temperature Depth Plot for T-96-021 (1996-2023)
Temperature (°C)
60
50
40
30
20
10
0
-10
-20
-30
-40
0
20
40
60
80
100
120
Depth (ft)
ft bgs = feet below ground surface

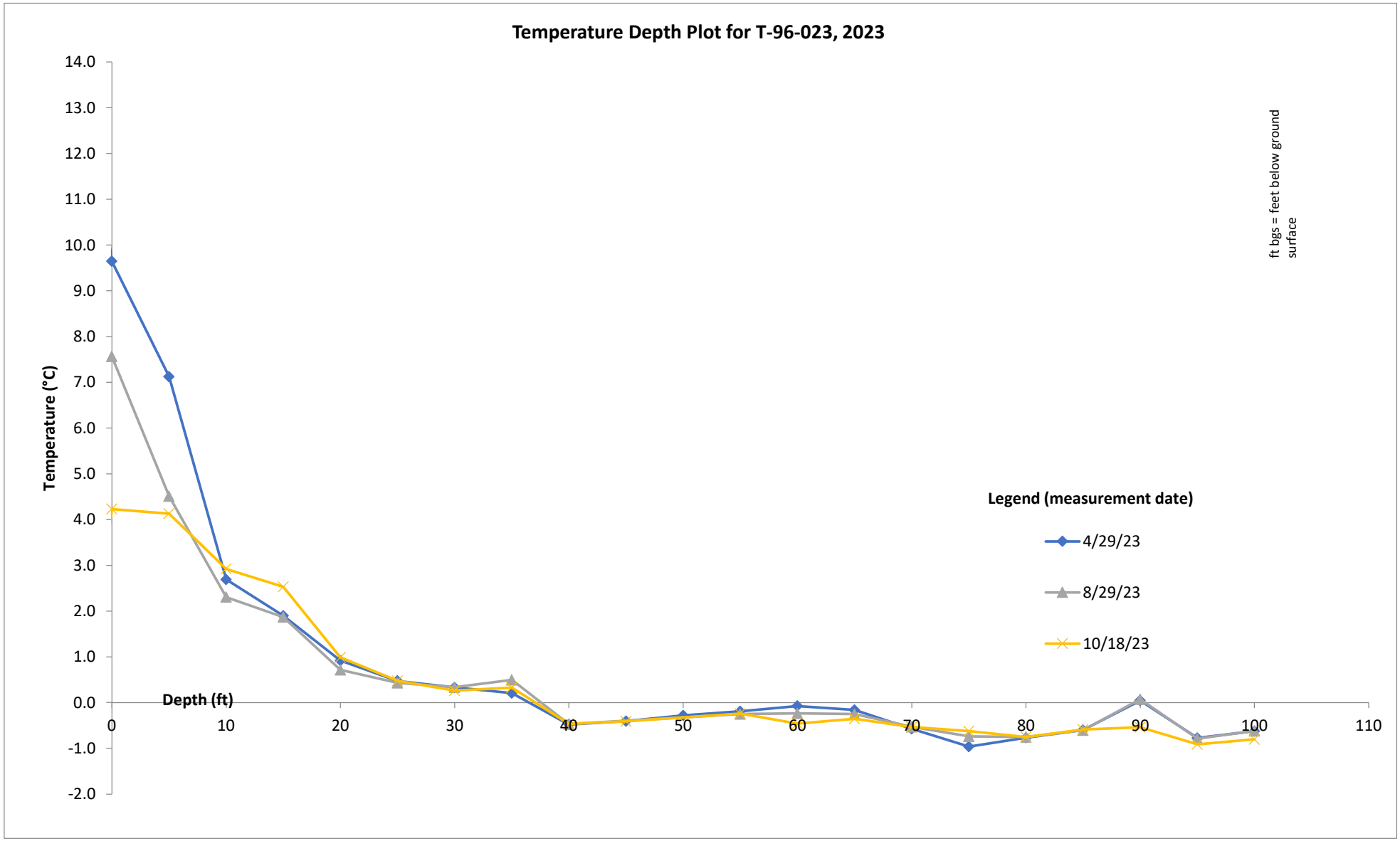
Thermistor T-96-22

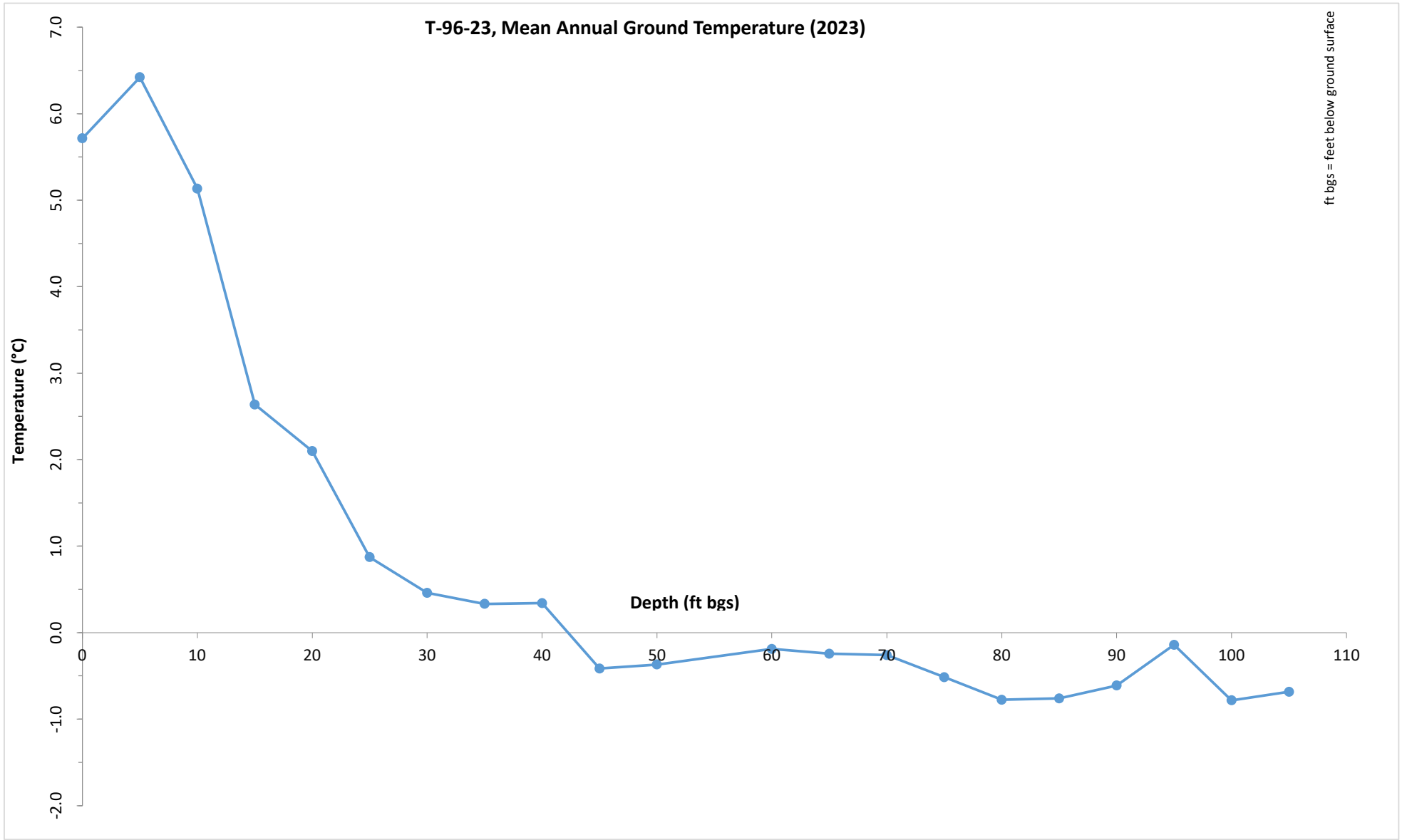

Temperature Depth Plot for T-96-022, 2022
Legend (measurement date)
1/7/23
4/24/23
8/29/23
10/18/23
Temperature (°C)
Depth (ft bgs)
15
10
5
0
-5
-10
-10
0
10
20
30
40
50
60
70
80
90
100
110
120

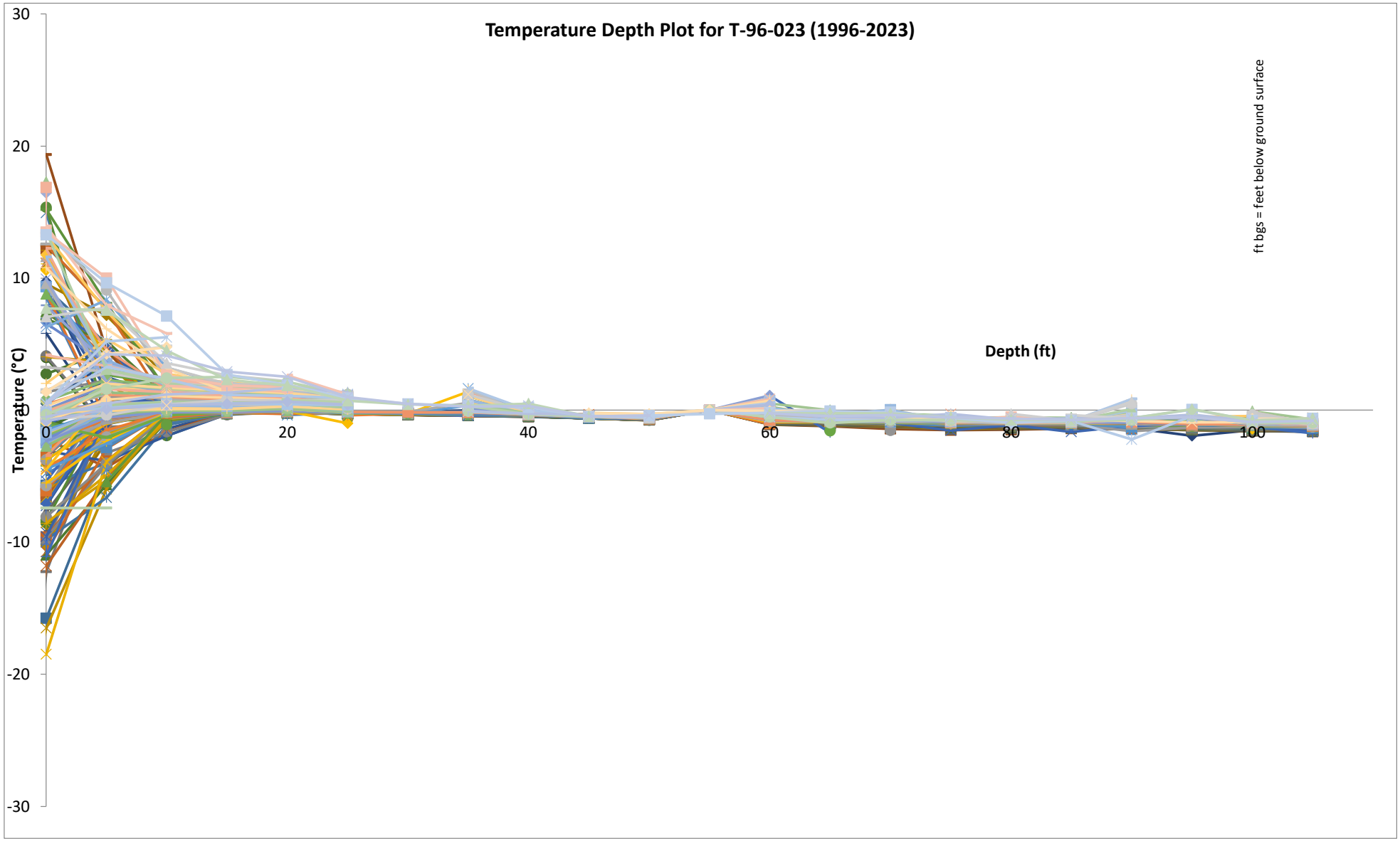

T-96-22, Mean Annual Ground Temperature (2022)
Temperature (°C)
4
3
2
1
0
-1
-5
5
15
25
35
45
55
65
75
85
95
105
115
Depth (ft bgs)


Temperature Depth Plot for T-96-022 (1996-2022)
Temperature (°C)
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-5
15
35
55
75
95
115
Depth (ft bgs)

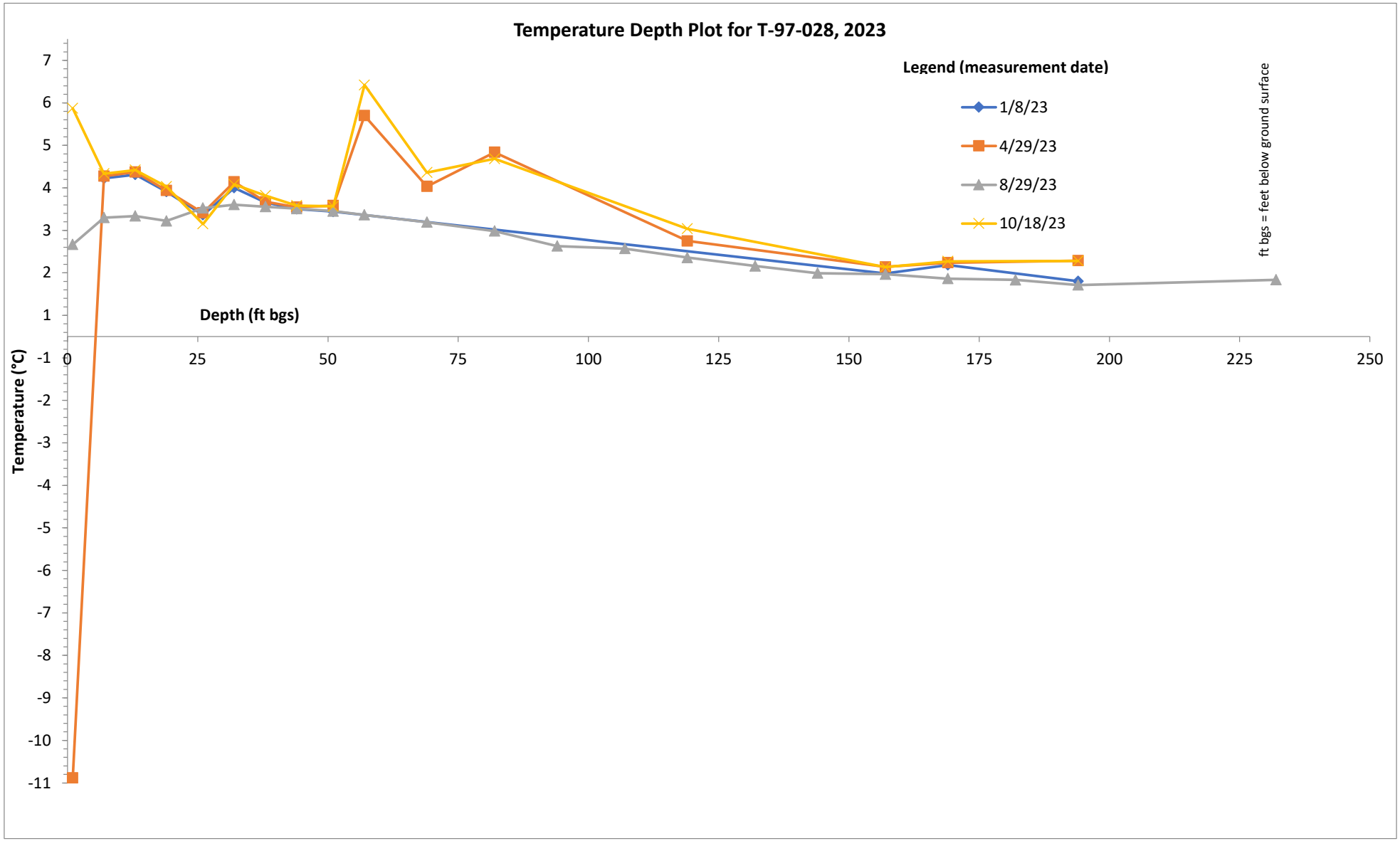
Thermistor T-96-23

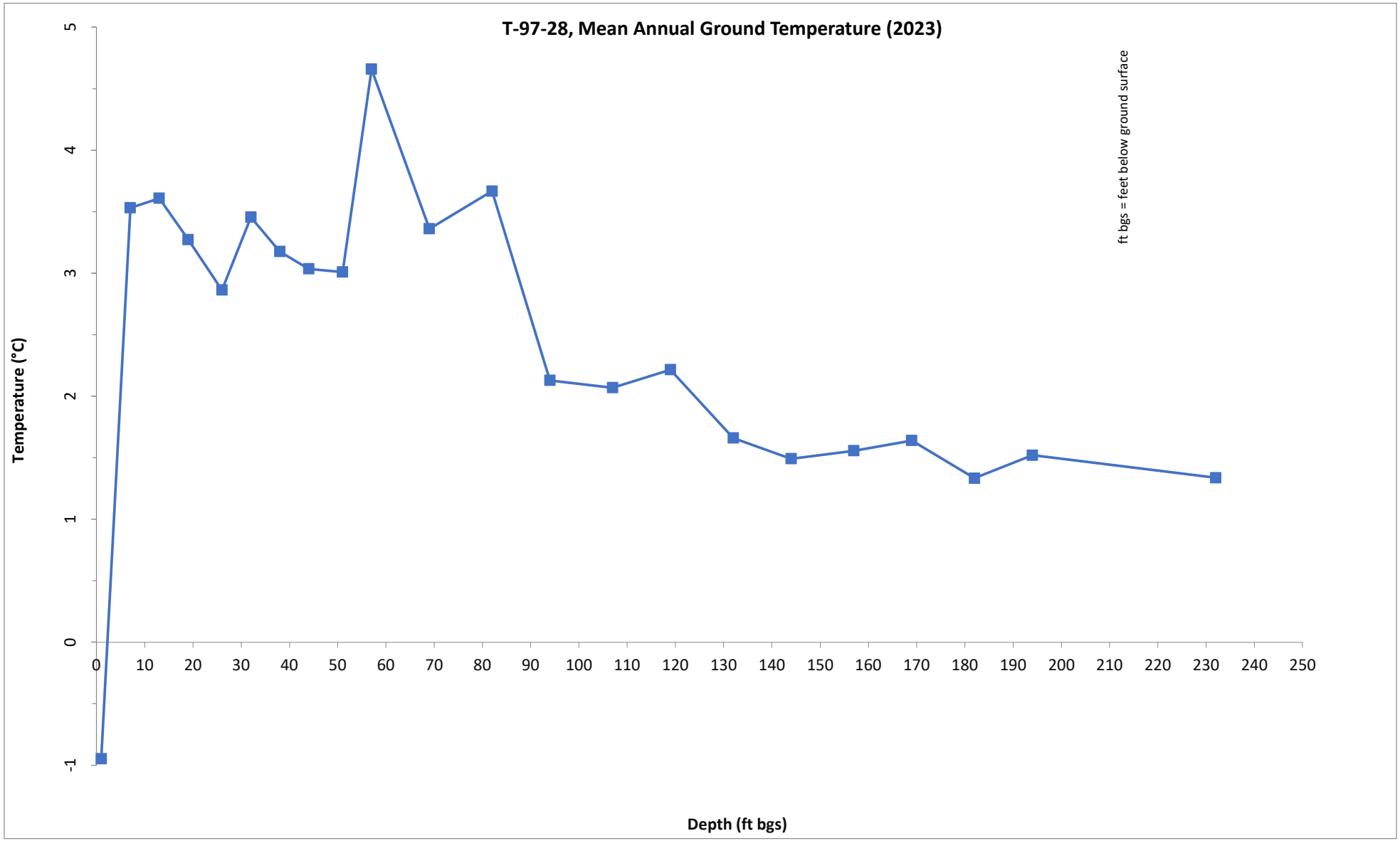

Temperature Depth Plot for T-96-023, 2023
Temperature (°C)
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
Depth (ft)
0
10
20
30
40
50
60
70
80
90
100
110
ft bgs = feet below ground surface
Legend (measurement date)
4/29/23
8/29/23
10/18/23

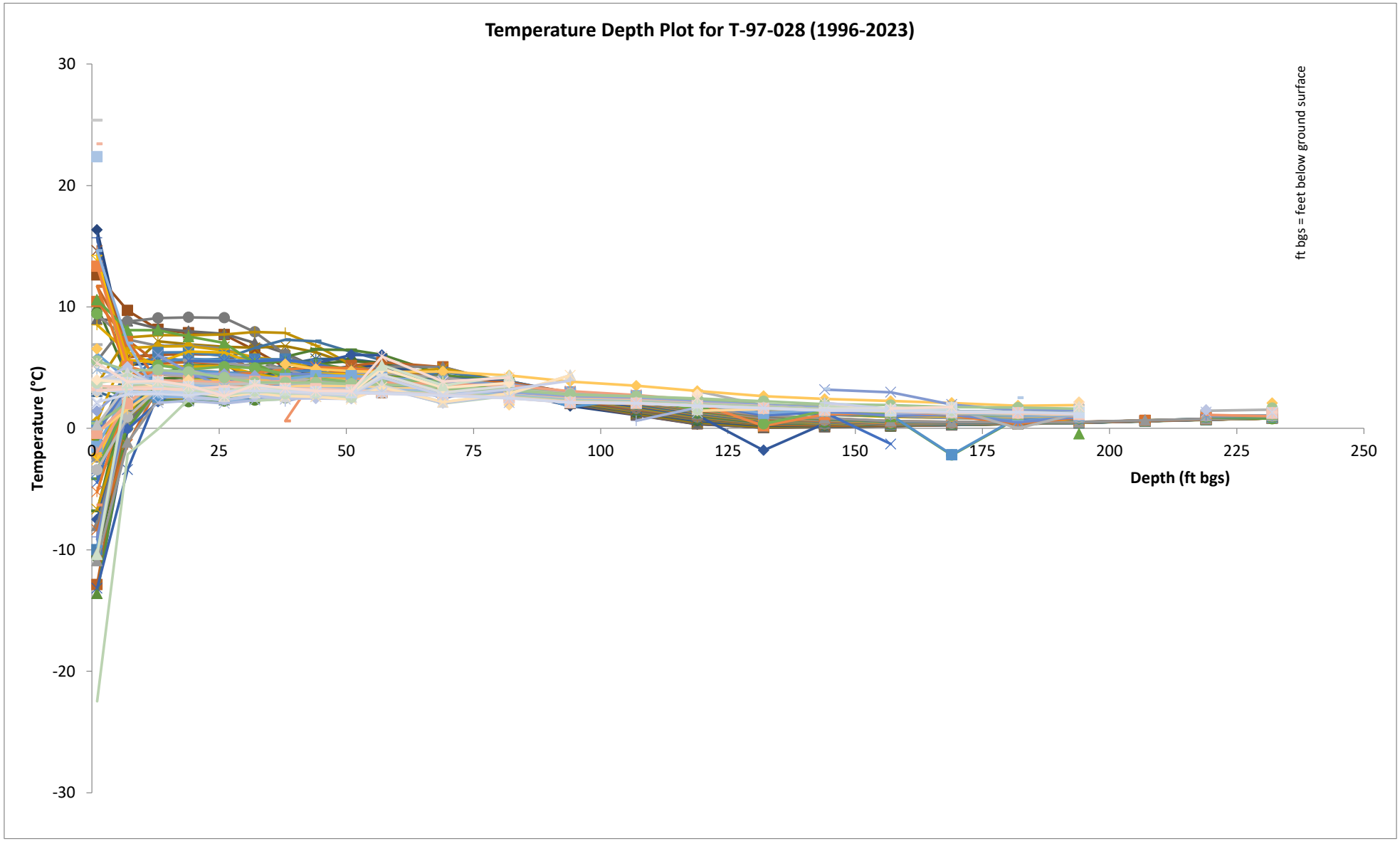

T-96-23, Mean Annual Ground Temperature (2023)
Temperature (°C)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
Depth (ft bgs)
0
10
20
30
40
50
60
70
80
90
100
110
ft bgs = feet below ground surface


Temperature Depth Plot for T-96-023 (1996-2023)
ft bgs = feet below ground surface
Temperature (°C)
Depth (ft)
30
20
10
0
-10
-20
-30
0
20
40
60
80
100

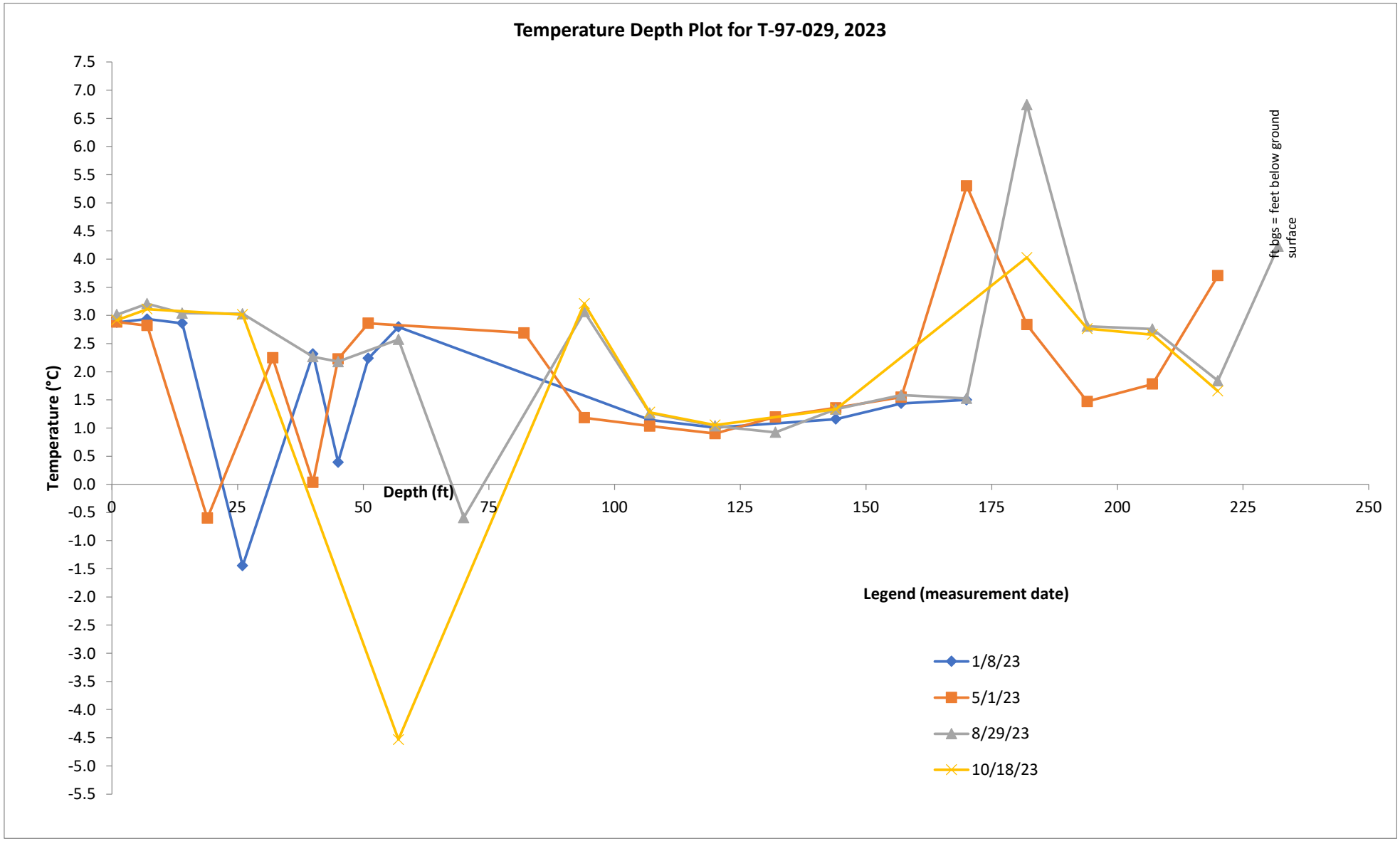
Thermistor T-97-28

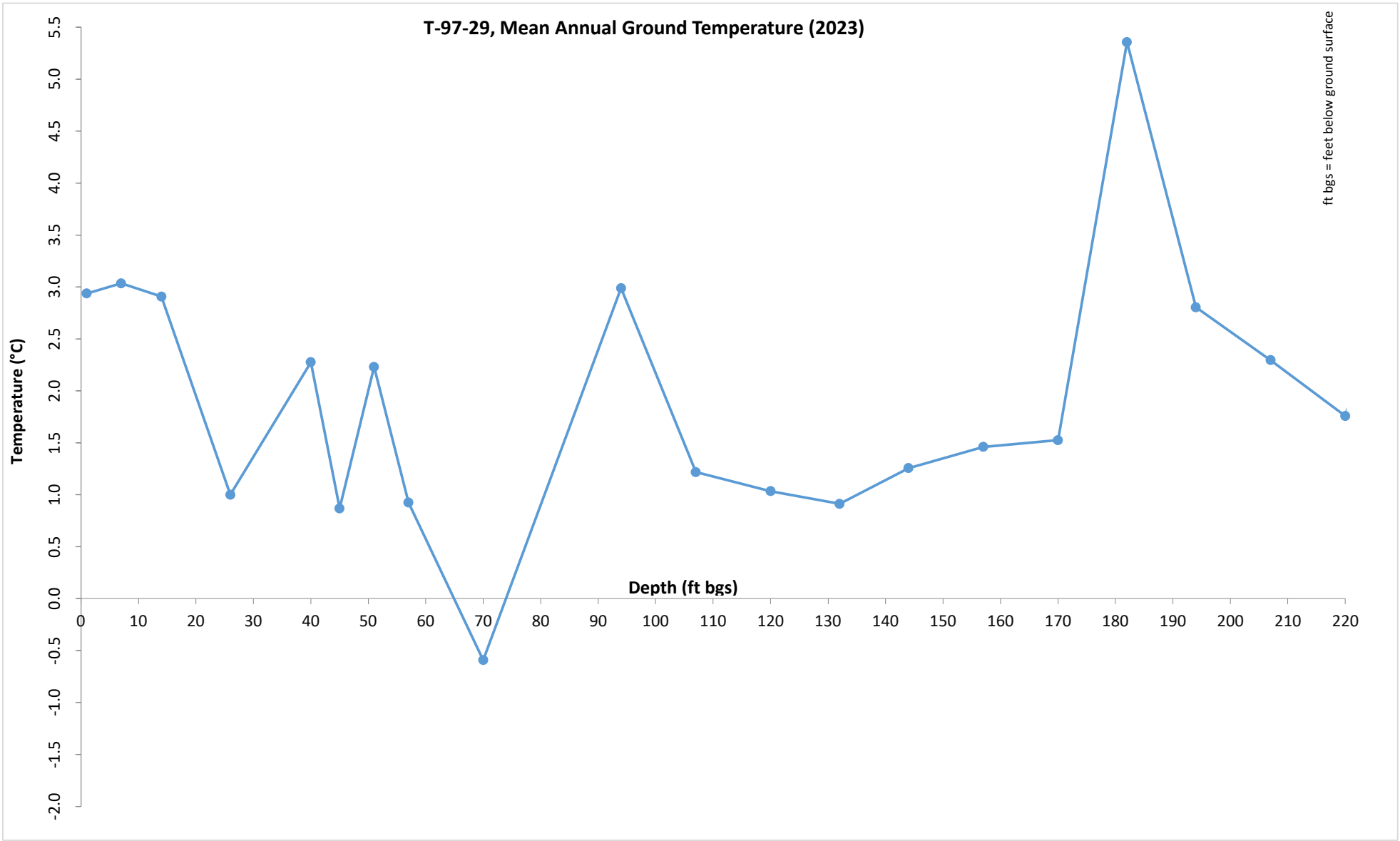

Temperature Depth Plot for T-97-028, 2023
Legend (measurement date)
1/8/23
4/29/23
8/29/23
10/18/23
ft bgs = feet below ground surface
Depth (ft bgs)
Temperature (°C)
0
25
50
75
100
125
150
175
200
225
250
7
6
5
4
3
2
1
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11

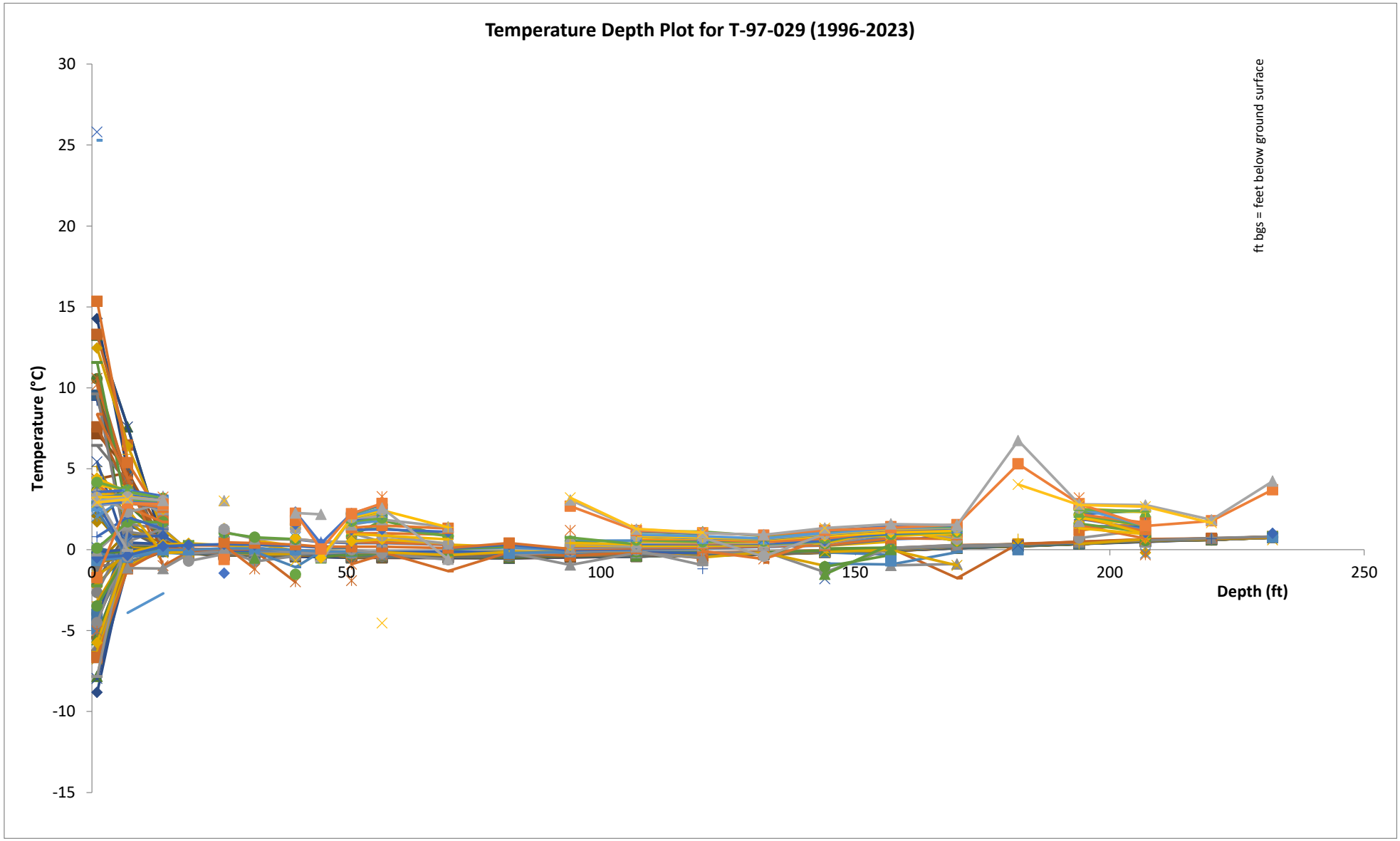

T-97-28, Mean Annual Ground Temperature (2023)
ft bgs = feet below ground surface
Temperature (°C)
5
4
3
2
1
0
-1
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
Depth (ft bgs)


Temperature Depth Plot for T-97-028 (1996-2023)
Temperature (°C)
30
20
10
0
-10
-20
-30
0
25
50
75
100
125
150
175
200
225
250
Depth (ft bgs)
ft bgs = feet below ground surface

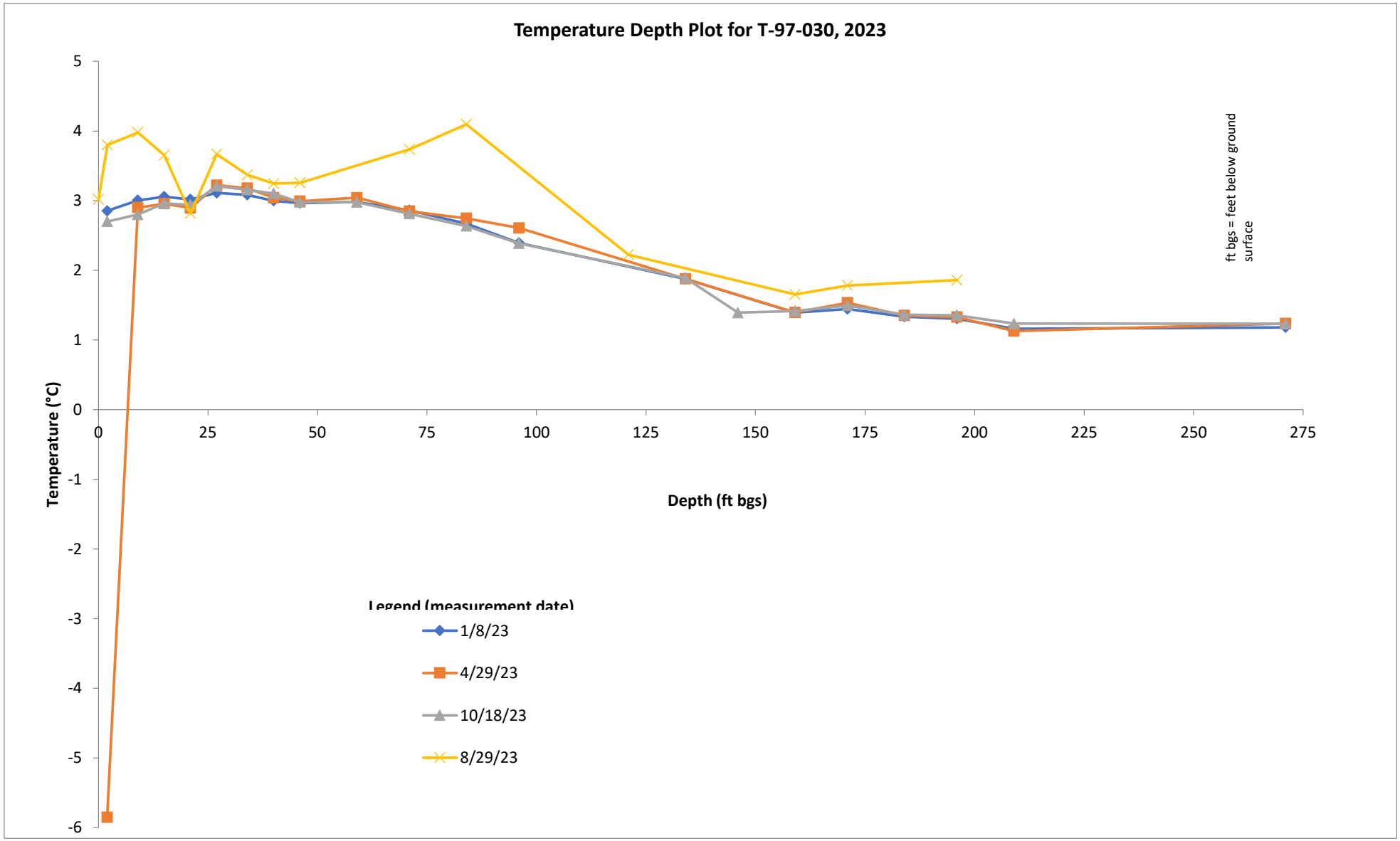
Thermistor T-97-29

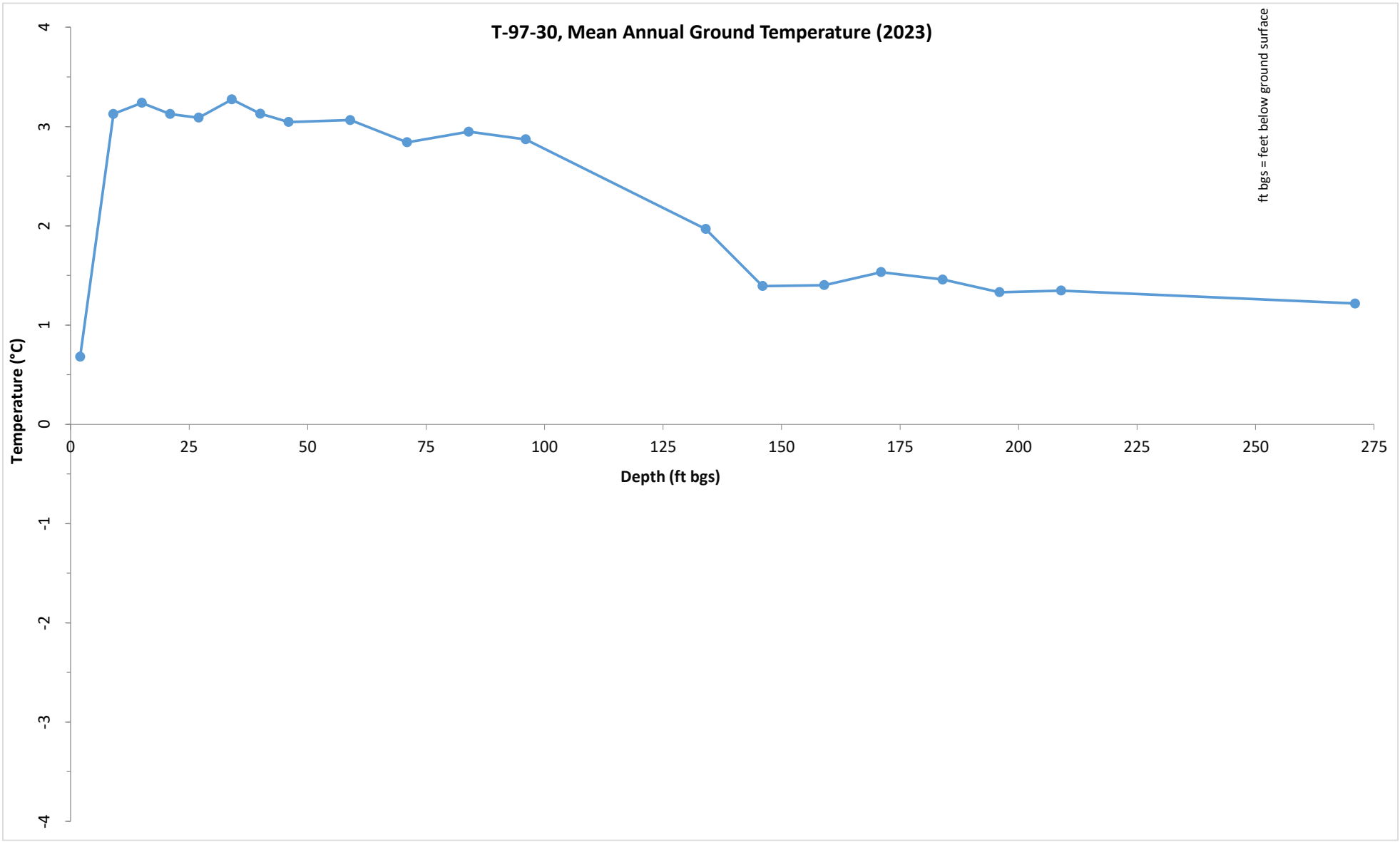

Temperature Depth Plot for T-97-029, 2023
Temperature (°C)
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-5.5
0
25
50
75
100
125
150
175
200
225
250
Depth (ft)
ft bgs = feet below ground surface
Legend (measurement date)
1/8/23
5/1/23
8/29/23
10/18/23

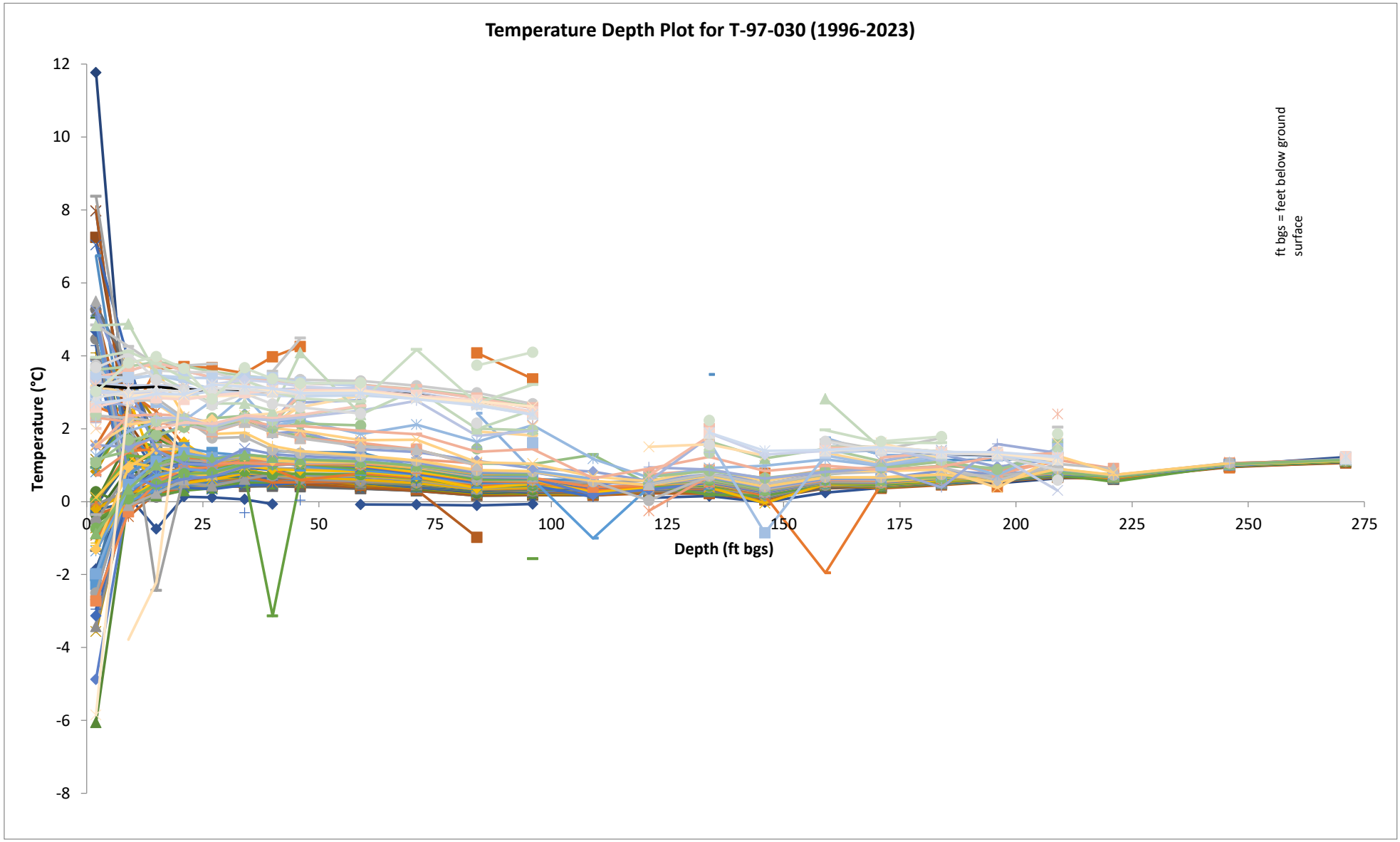

T-97-29, Mean Annual Ground Temperature (2023)
Temperature (°C)
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
Depth (ft bgs)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
ft bgs = feet below ground surface


Temperature Depth Plot for T-97-029 (1996-2023)
Temperature (°C)
30
25
20
15
10
5
0
-5
-10
-15
0
50
100
150
200
250
Depth (ft)
ft bgs = feet below ground surface

Thermistor T-97-30

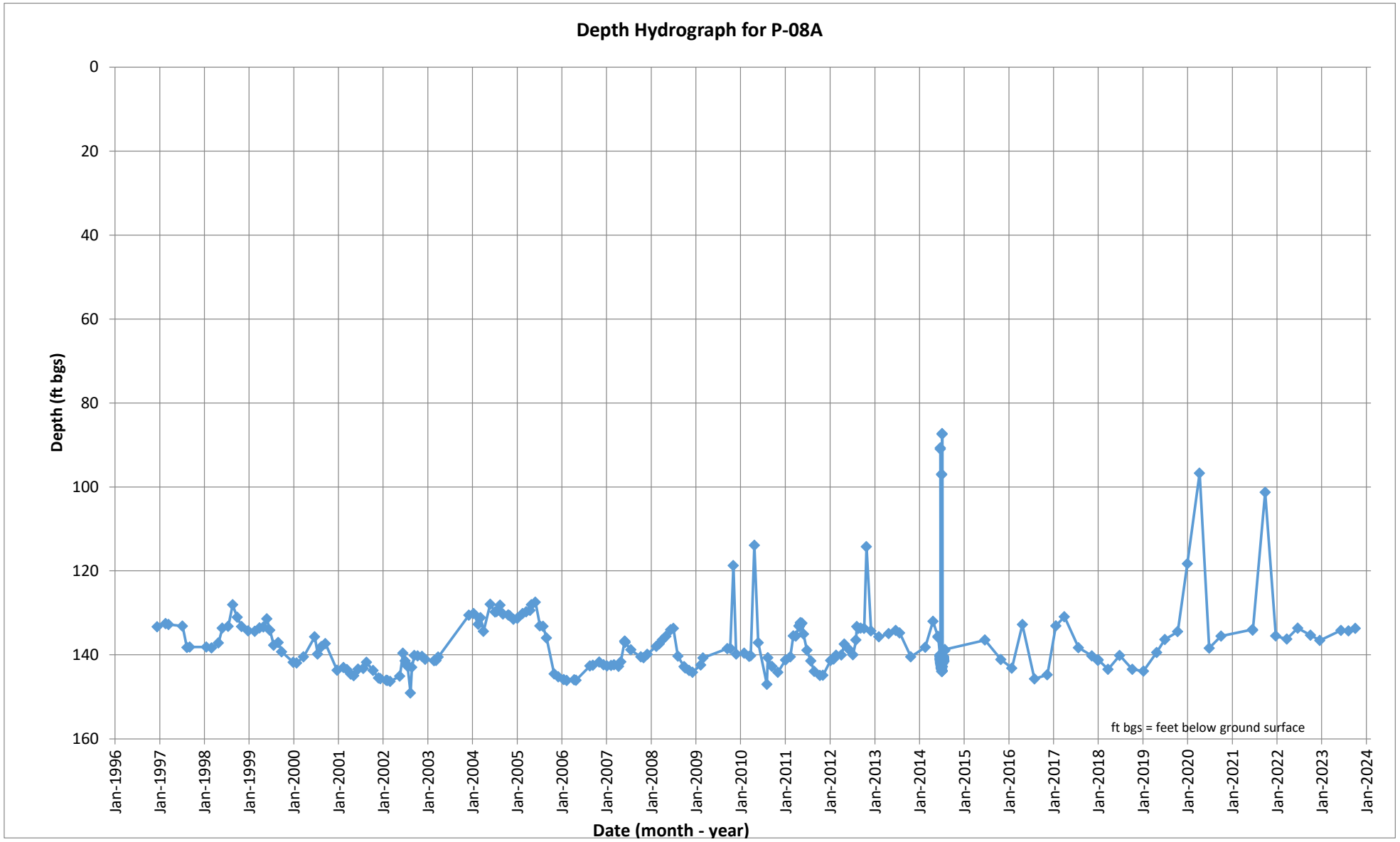

Temperature Depth Plot for T-97-030, 2023
Temperature (°C)
Depth (ft bgs)
ft bgs = feet below ground surface
Legend (measurement date)
1/8/23
4/29/23
10/18/23
8/29/23

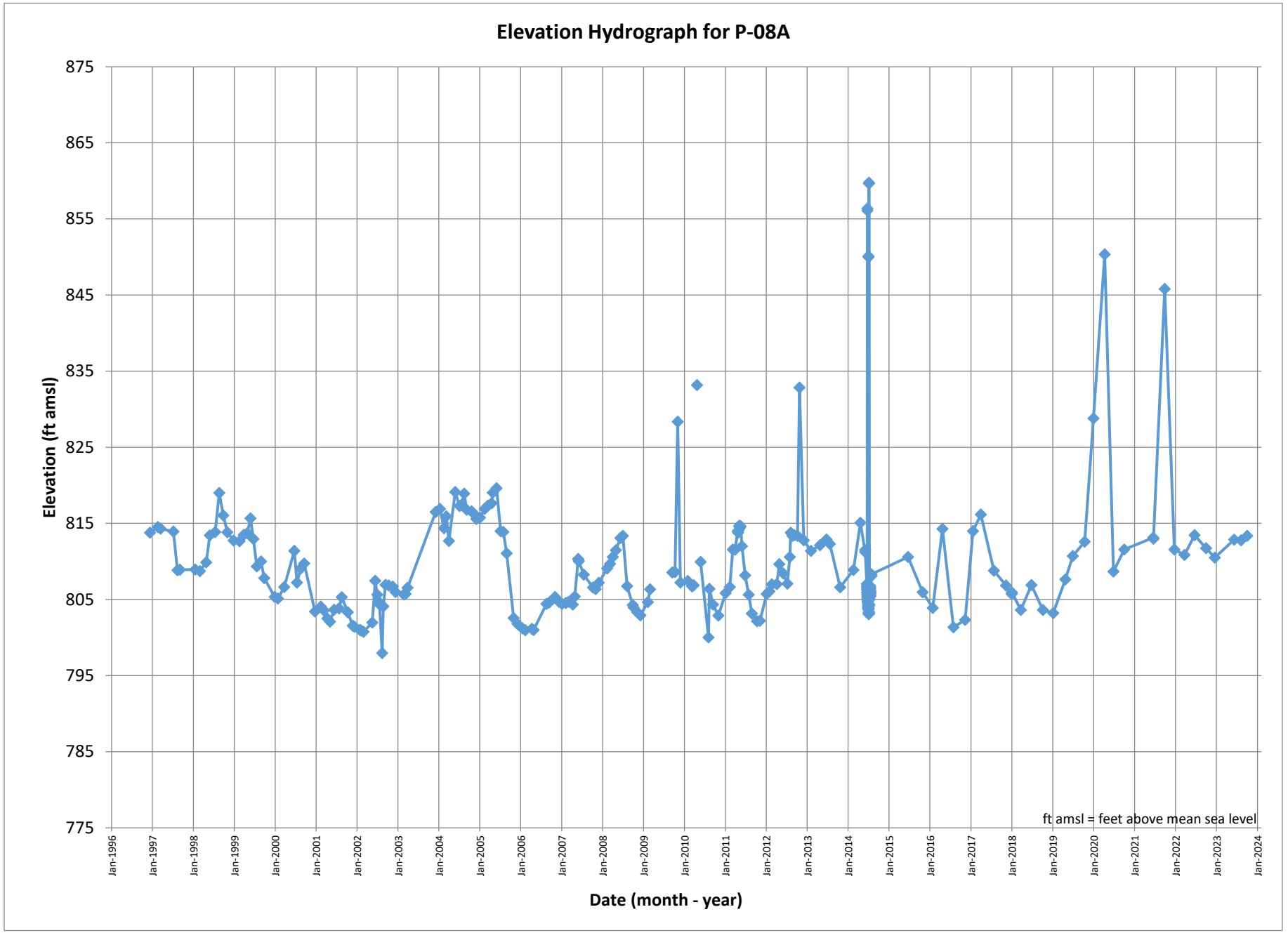

T-97-30, Mean Annual Ground Temperature (2023)
ft bgs = feet below ground surface
Temperature (°C)
4
3
2
1
0
-1
-2
-3
-4
0
25
50
75
100
125
150
175
200
225
250
275
Depth (ft bgs)


Temperature Depth Plot for T-97-030 (1996-2023)
Temperature (°C)
12
10
8
6
4
2
0
-2
-4
-6
-8
0
25
50
75
100
125
150
175
200
225
250
275
Depth (ft bgs)
ft bgs = feet below ground surface

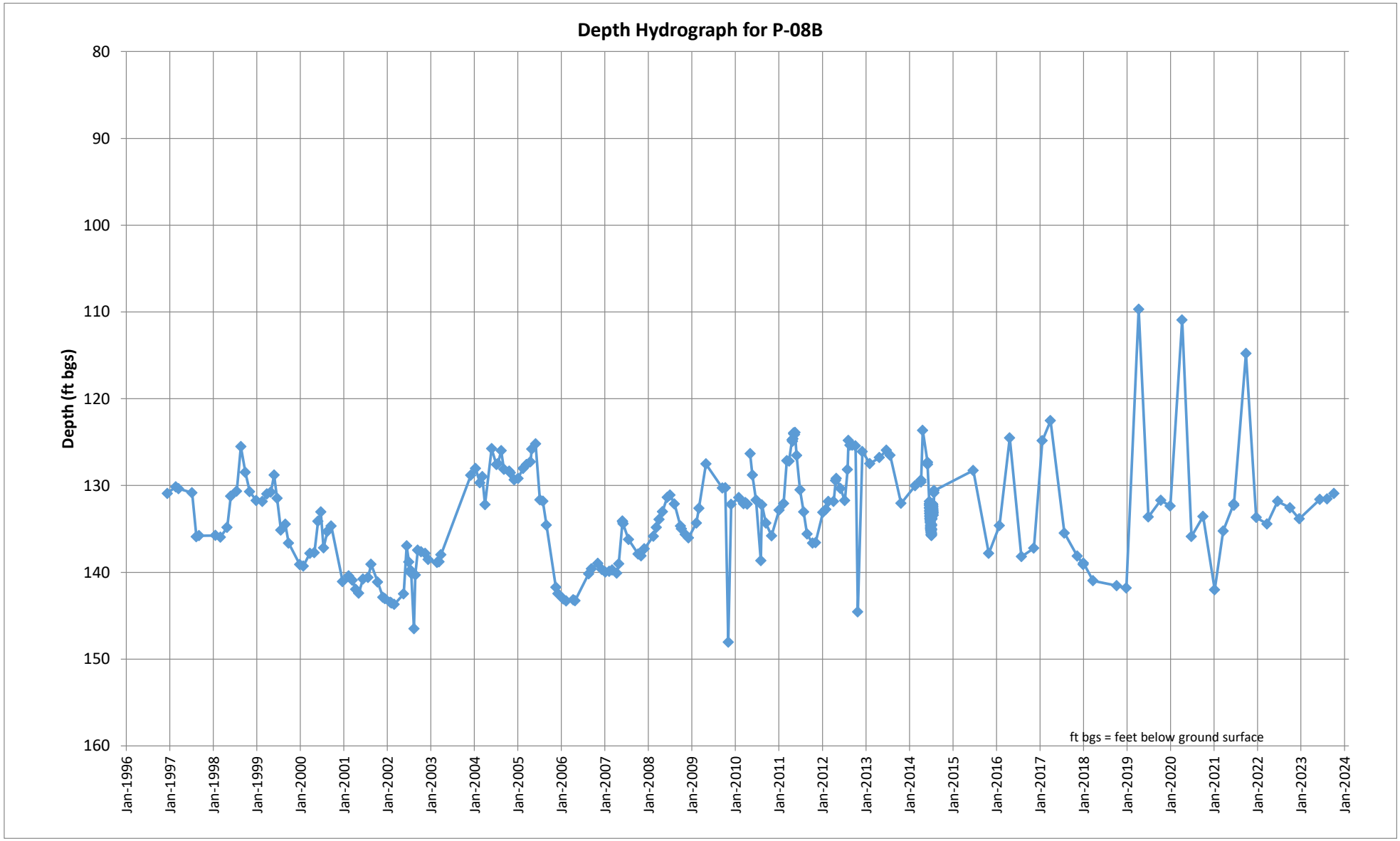
Appendix E
Piezometer Plots

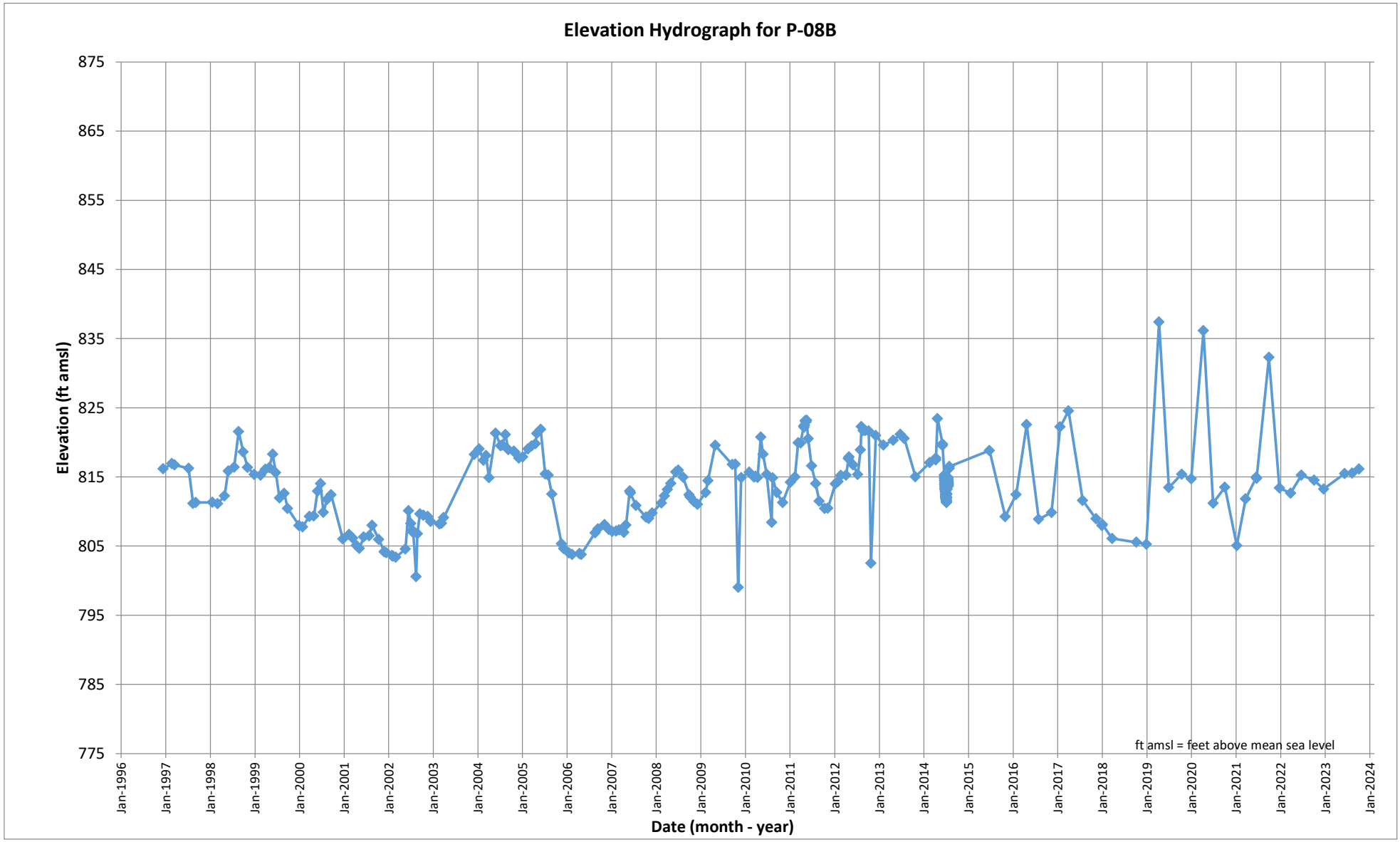
Piezometer P-08A


Depth Hydrograph for P-08A
Depth (ft bgs)
0
20
40
60
80
100
120
140
160
Jan-1996
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (month - year)
ft bgs = feet below ground surface

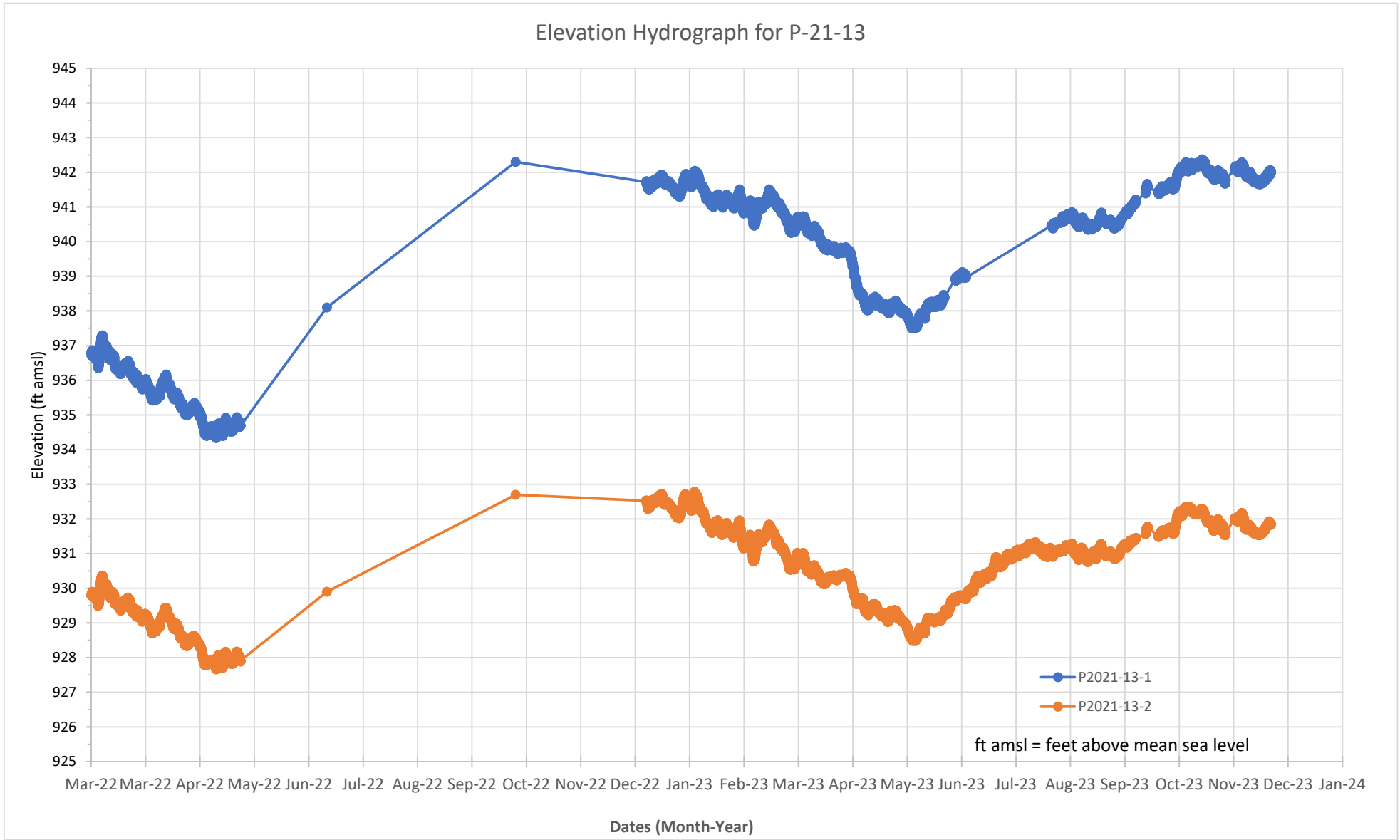

Elevation Hydrograph for P-08A
Elevation (ft amsl)
875
865
855
845
835
825
815
805
795
785
775
Jan-1996
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (month - year)
ft amsl = feet above mean sea level

Piezometer P-08B

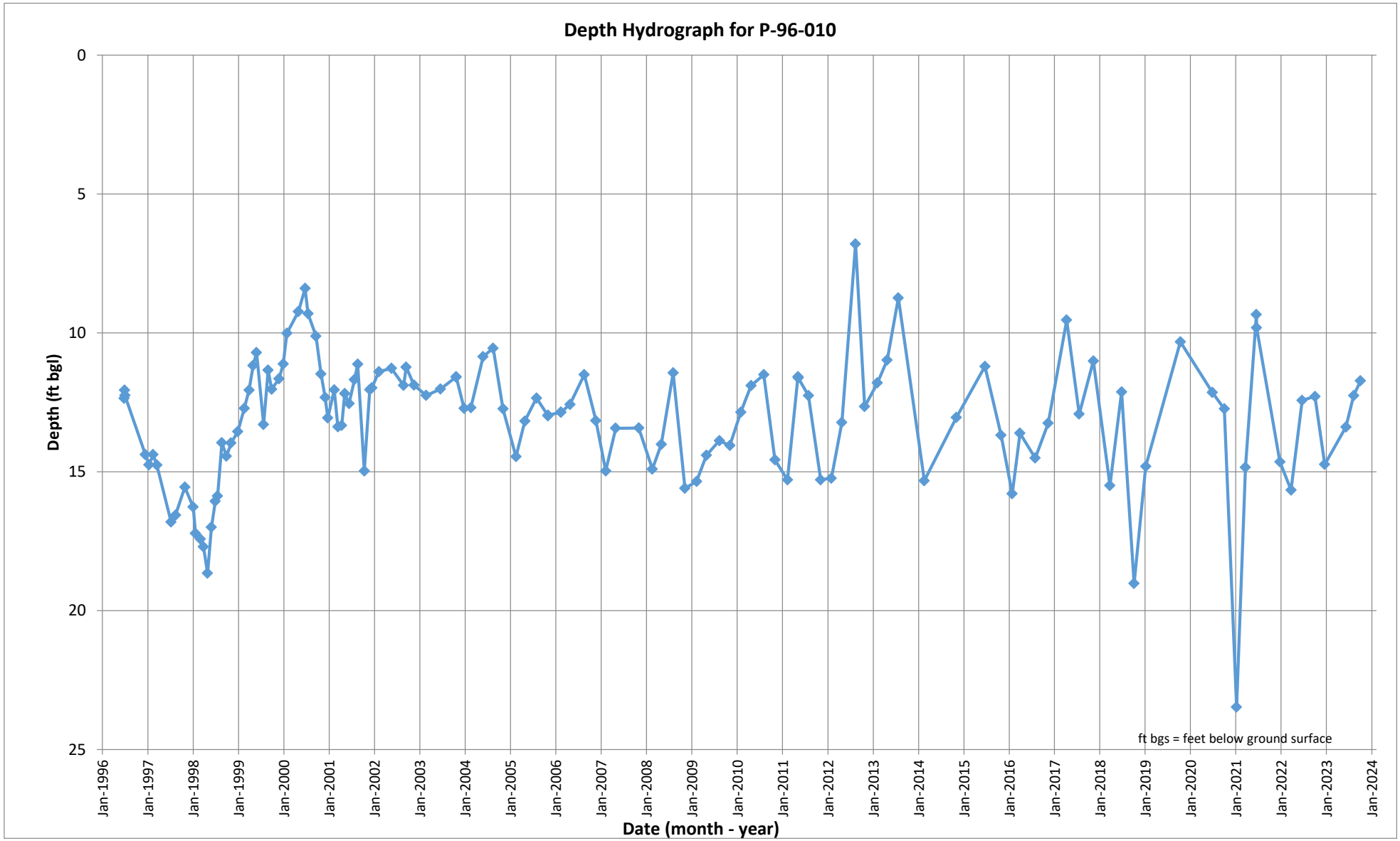

Depth Hydrograph for P-08B
Depth (ft bgs)
80
90
100
110
120
130
140
150
160
Jan-1996
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
ft bgs = feet below ground surface

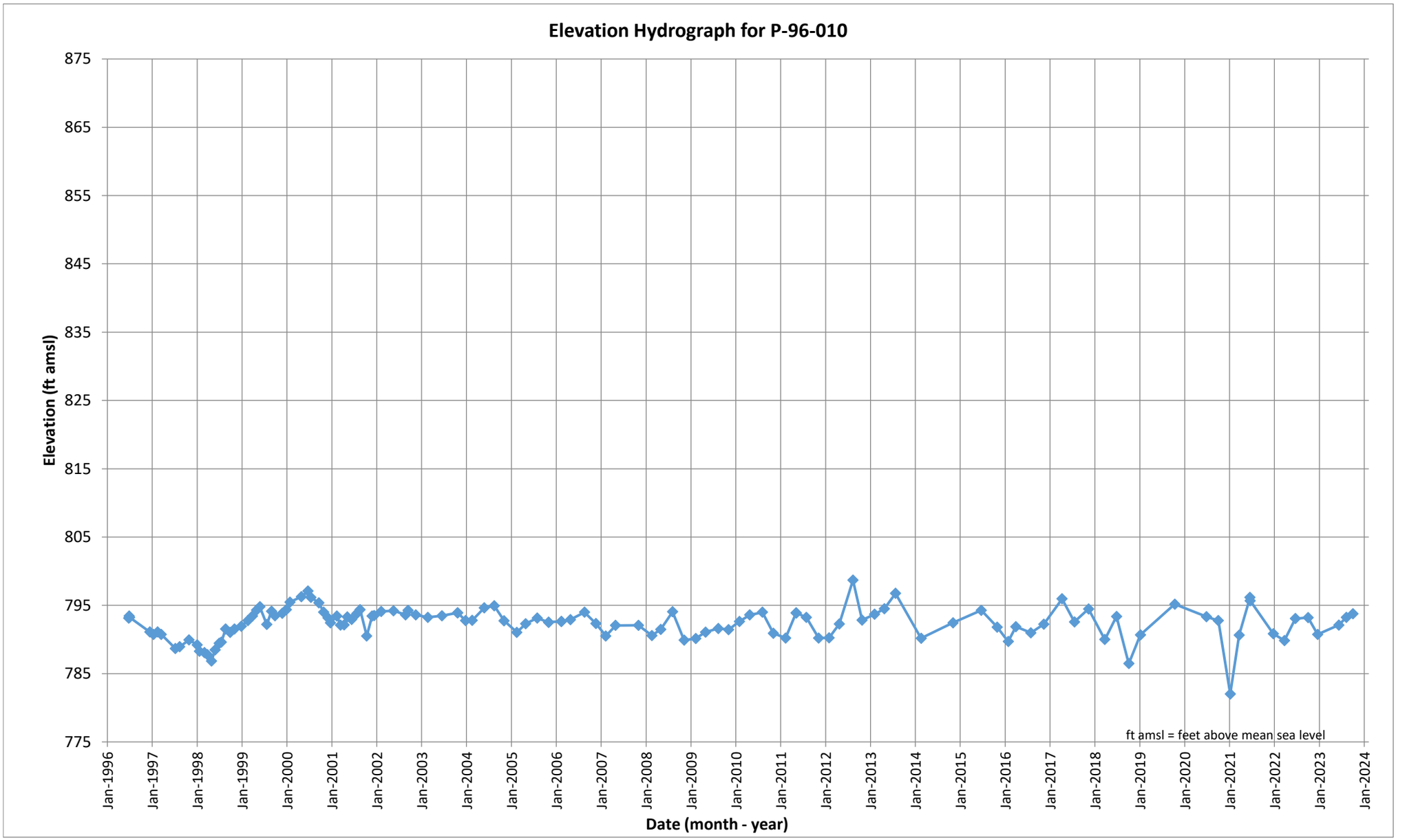

Elevation Hydrograph for P-08B
Elevation (ft amsl)
875
865
855
845
835
825
815
805
795
785
775
Jan-1996
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (month - year)
ft amsl = feet above mean sea level

Piezometer P-21-013

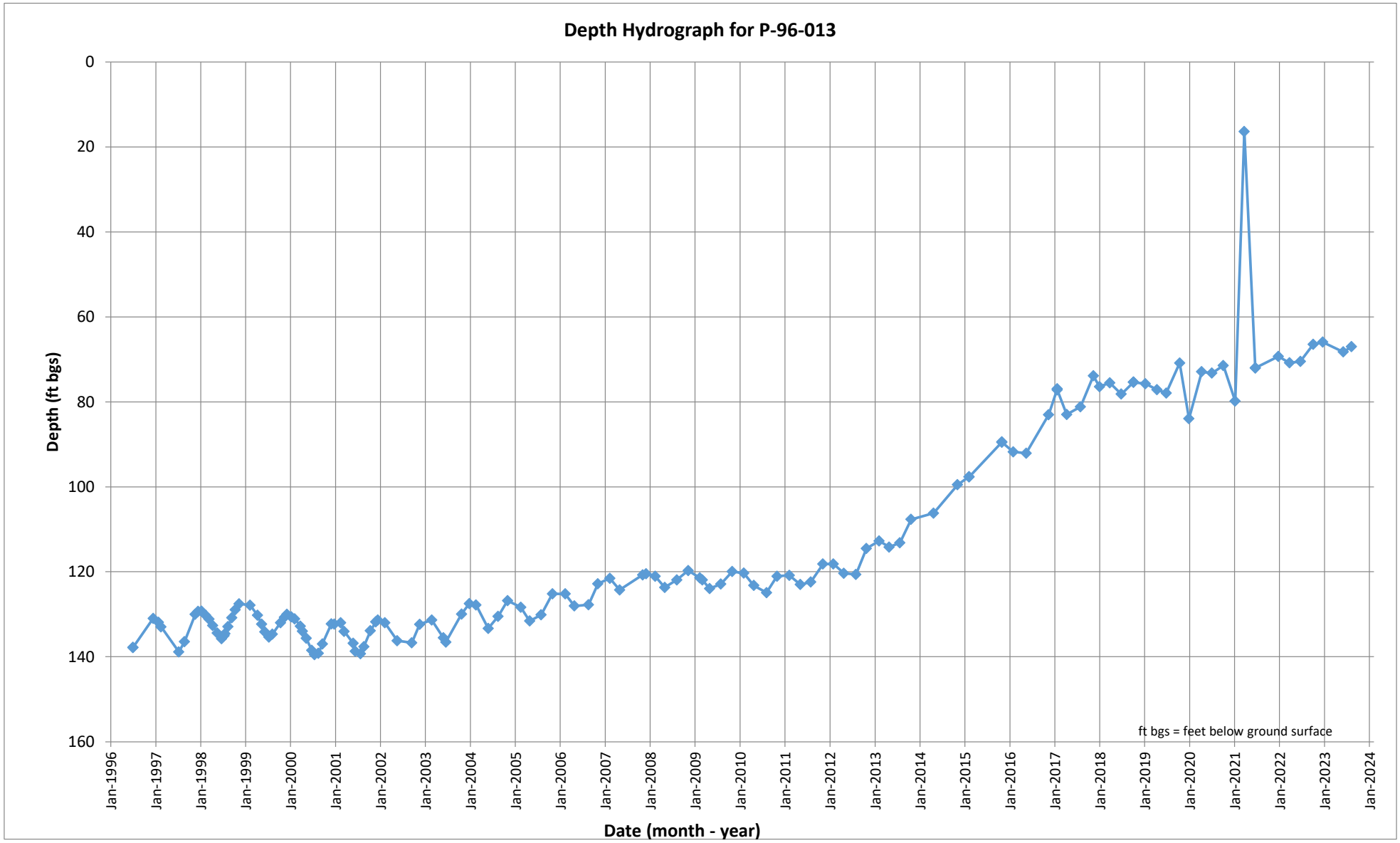

Elevation Hydrograph for P-21-13
Elevation (ft amsl)
945
944
943
942
941
940
939
938
937
936
935
934
933
932
931
930
929
928
927
926
925
Mar-22 Mar-22 Apr-22 May-22 Jun-22 Jul-22 Aug-22 Sep-22 Oct-22 Nov-22 Dec-22 Jan-23 Feb-23 Mar-23 Apr-23 May-23 Jun-23 Jul-23 Aug-23 Sep-23 Oct-23 Nov-23 Dec-23 Jan-24
Dates (Month-Year)
P2021-13-1
P2021-13-2
ft amsl = feet above mean sea level

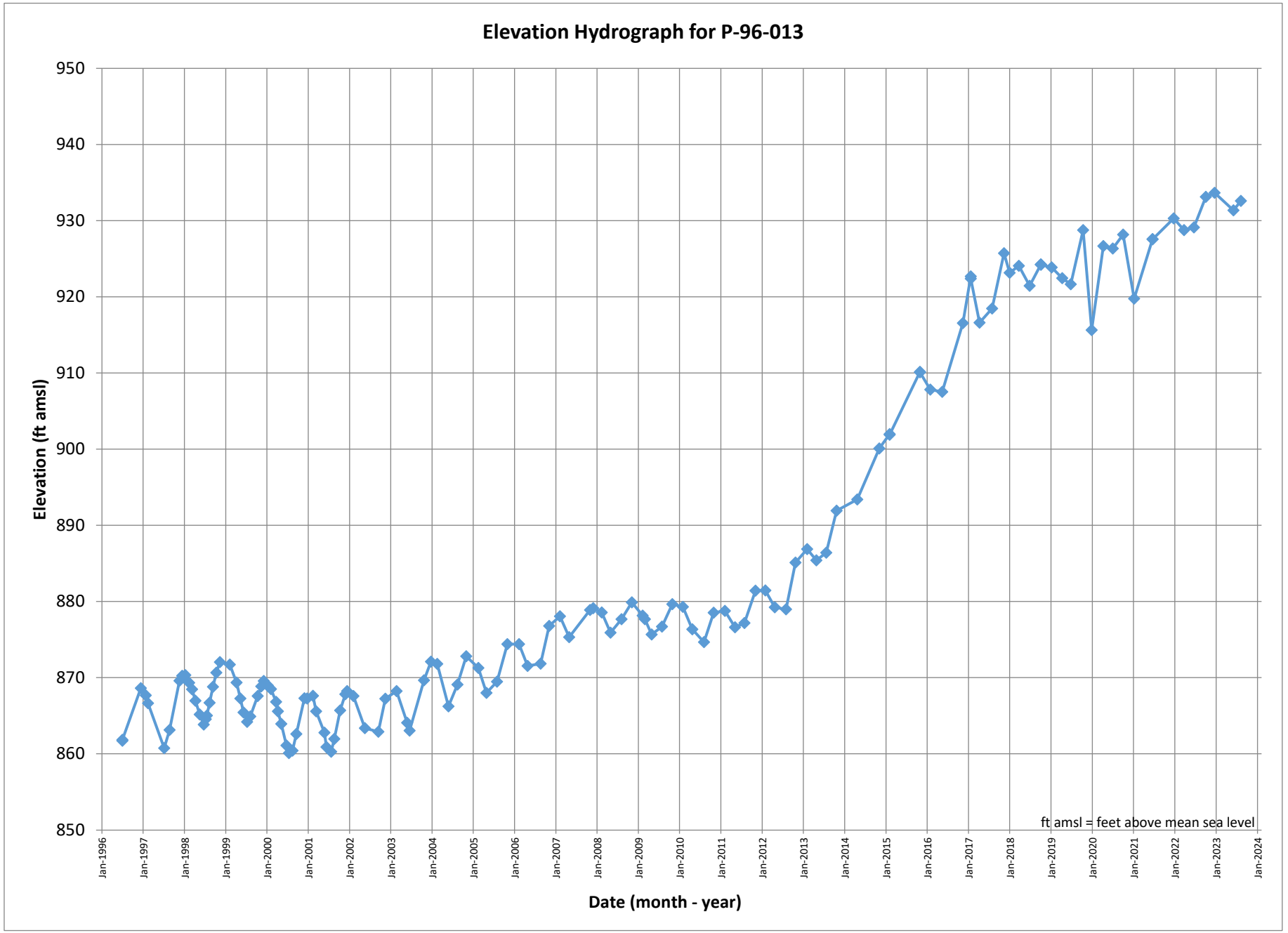
Piezometer P-96-10


Depth Hydrograph for P-96-010
Depth (ft bgl)
0
5
10
15
20
25
Jan-1996
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (month - year)
ft bgs = feet below ground surface

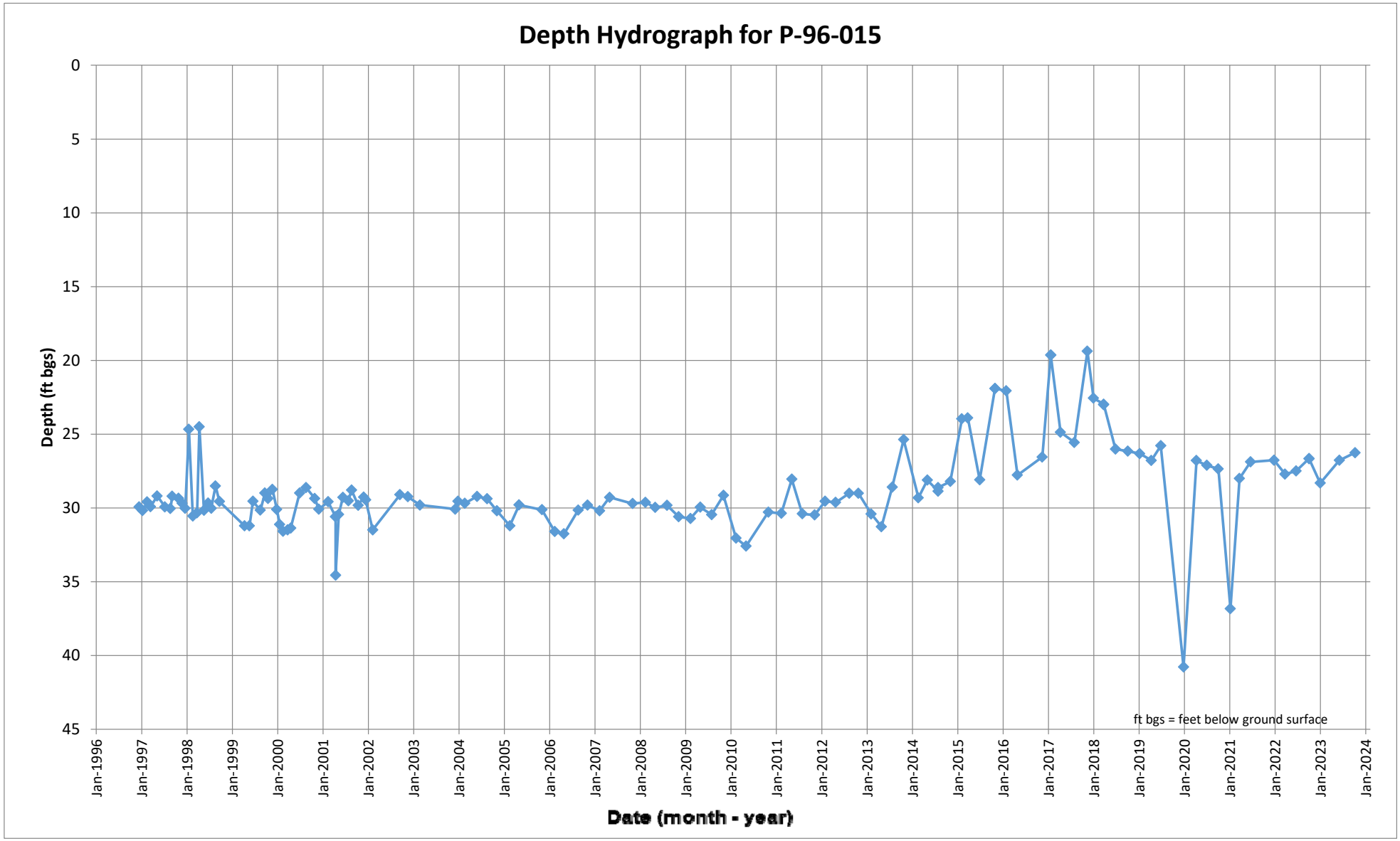

Elevation Hydrograph for P-96-010
875
865
855
845
835
825
815
805
795
785
775
Elevation (ft amsl)
Jan-1996
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (month - year)
ft amsl = feet above mean sea level

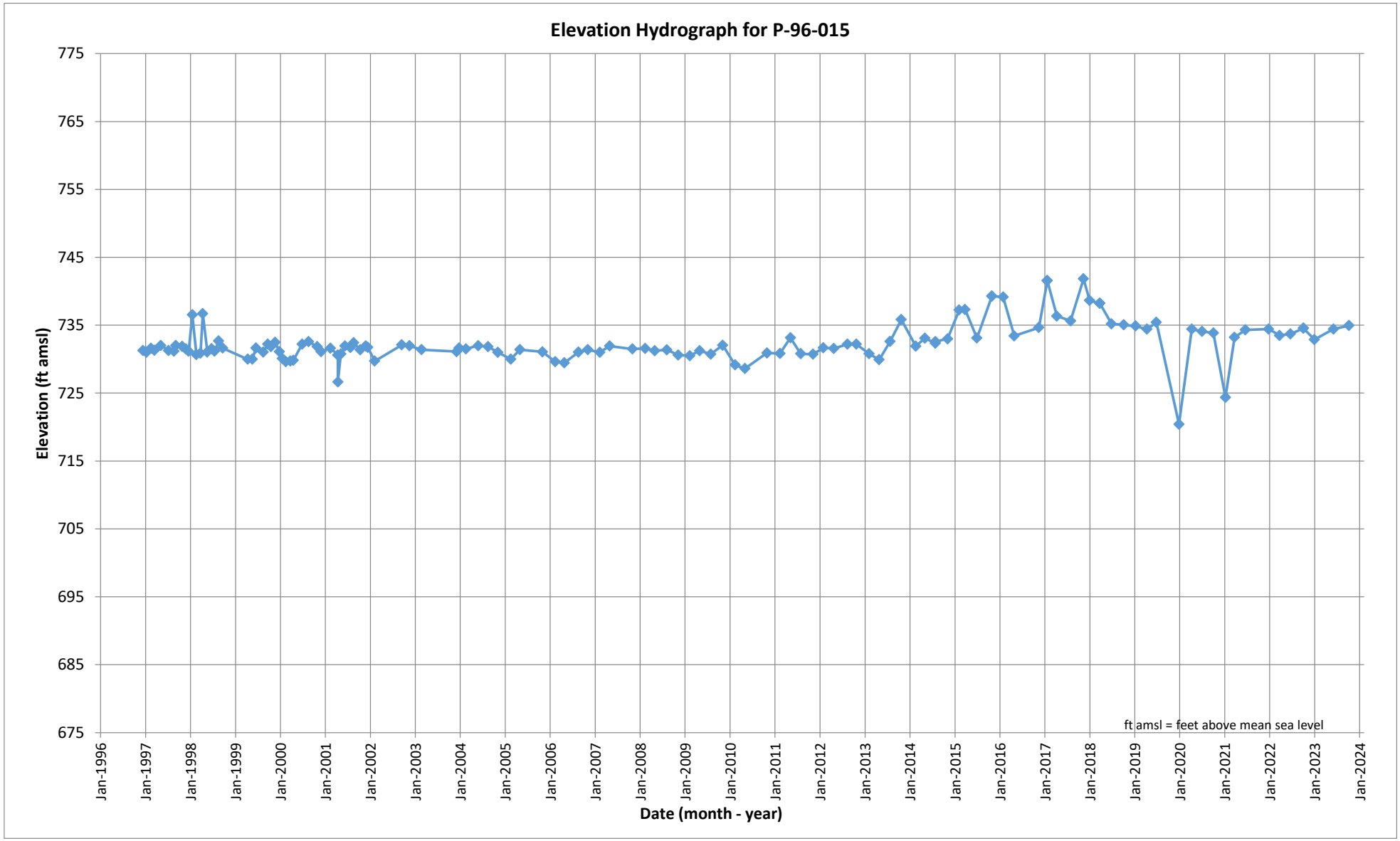
Piezometer P-96-13


Depth Hydrograph for P-96-013
Depth (ft bgs)
0
20
40
60
80
100
120
140
160
Jan-1996
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (month - year)
ft bgs = feet below ground surface

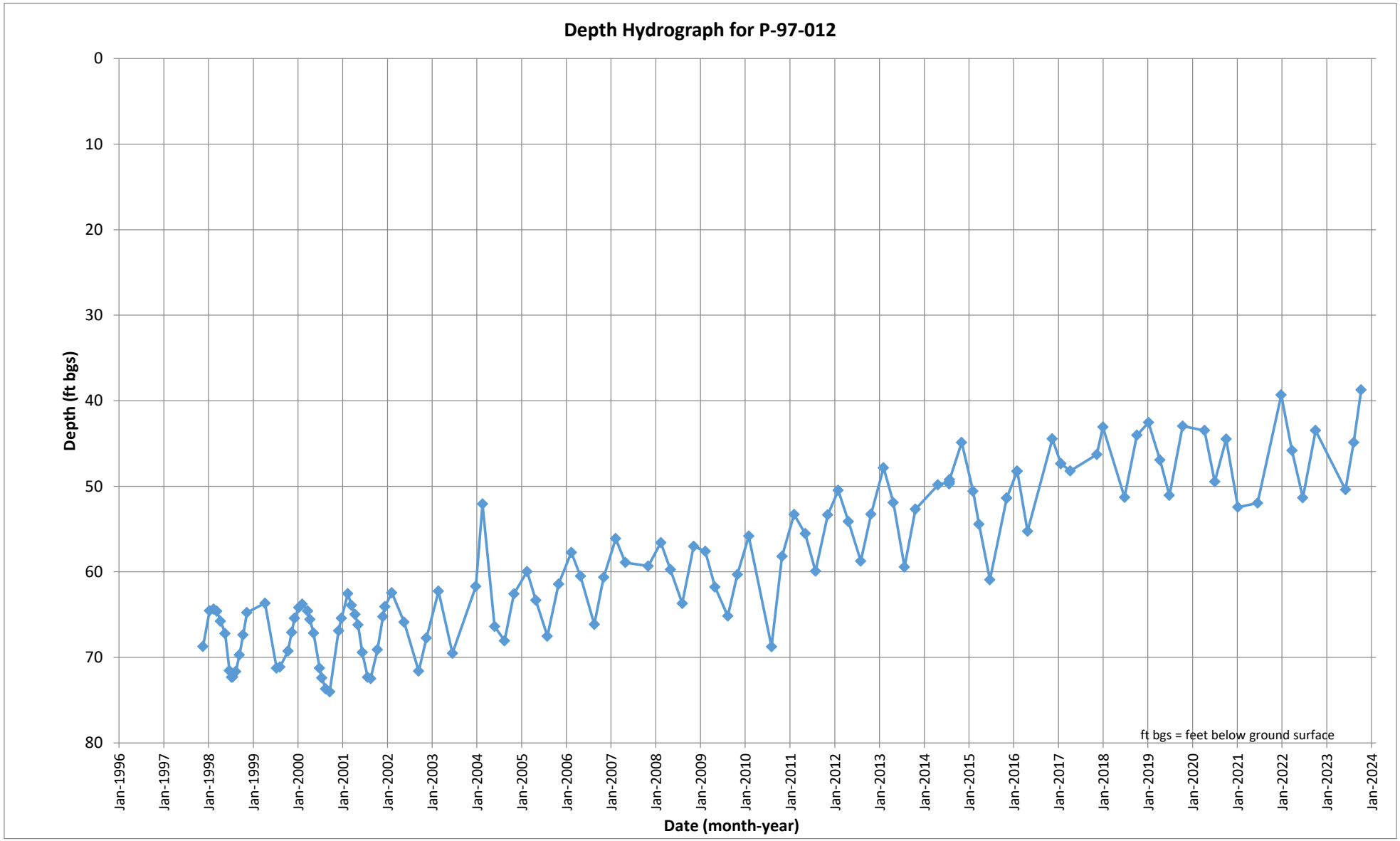

Elevation Hydrograph for P-96-013
950
940
930
920
910
900
890
880
870
860
850
Elevation (ft amsl)
Jan-1996
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (month - year)
ft amsl = feet above mean sea level

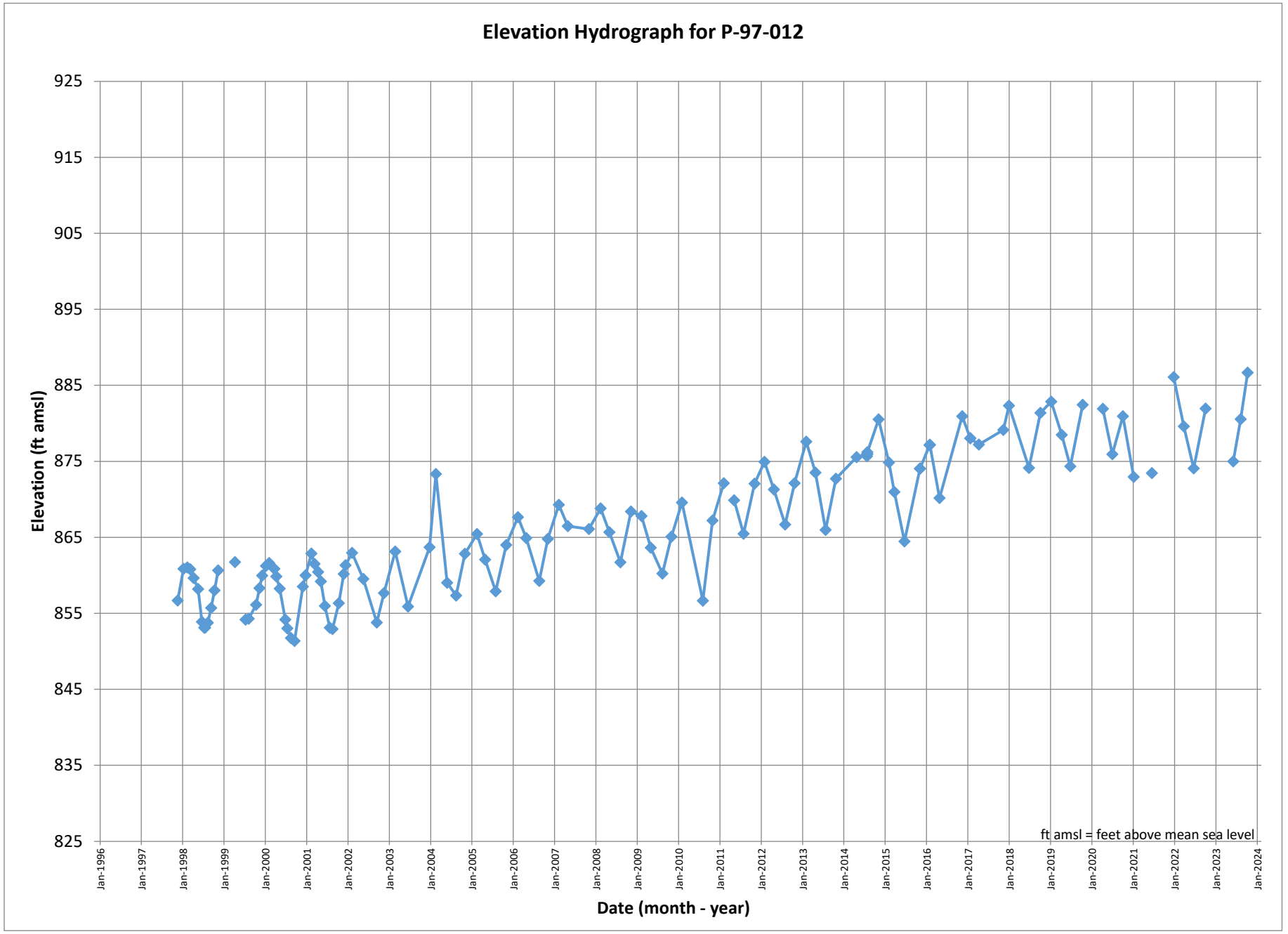
Piezometer P-96-15


Depth Hydrograph for P-96-015
Depth (ft bgs)
0
5
10
15
20
25
30
35
40
45
Jan-1996
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (month - year)
ft bgs = feet below ground surface

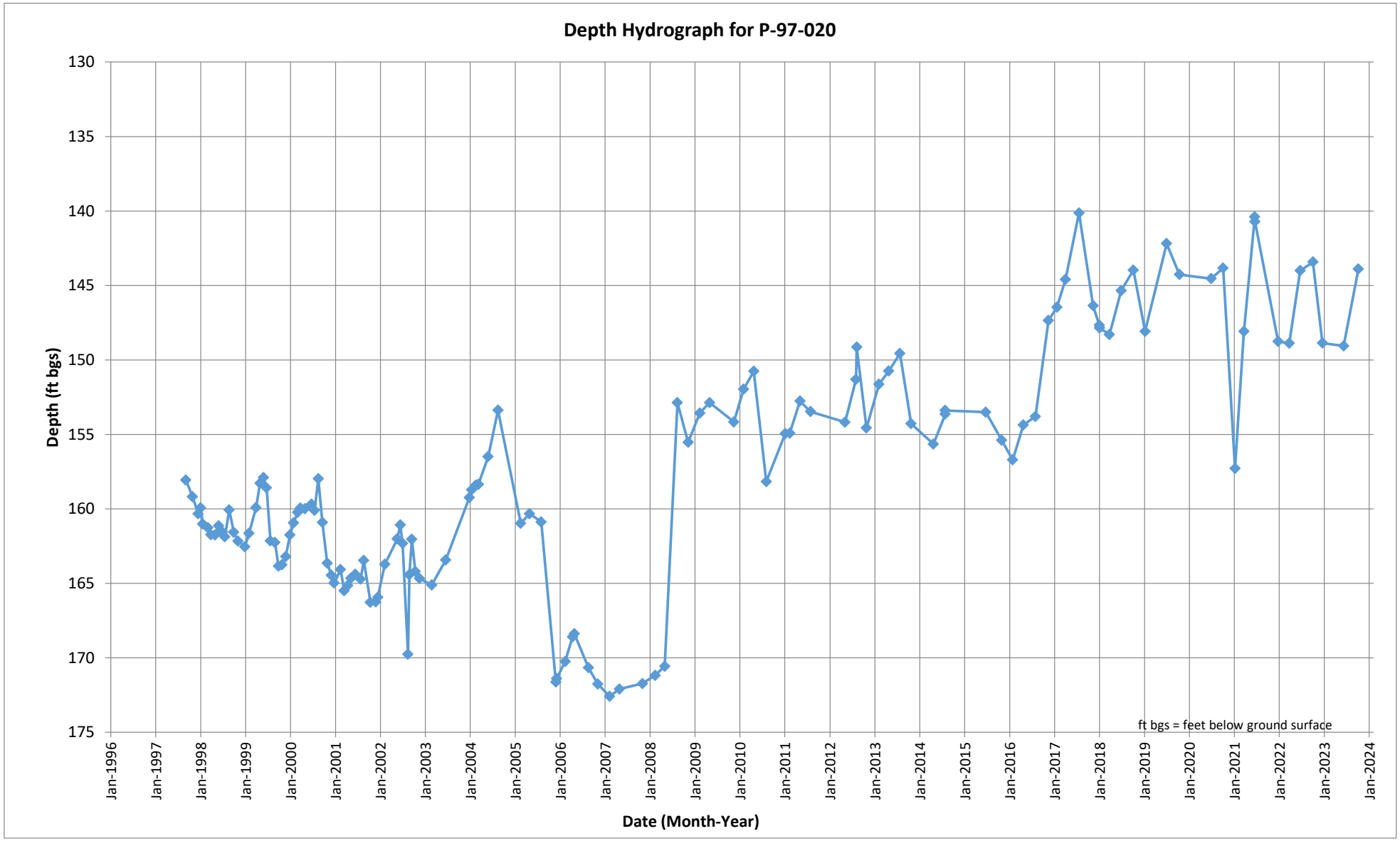

Elevation Hydrograph for P-96-015
775
765
755
745
735
725
715
705
695
685
675
Elevation (ft amsl)
Jan-1996
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (month - year)
ft amsl = feet above mean sea level

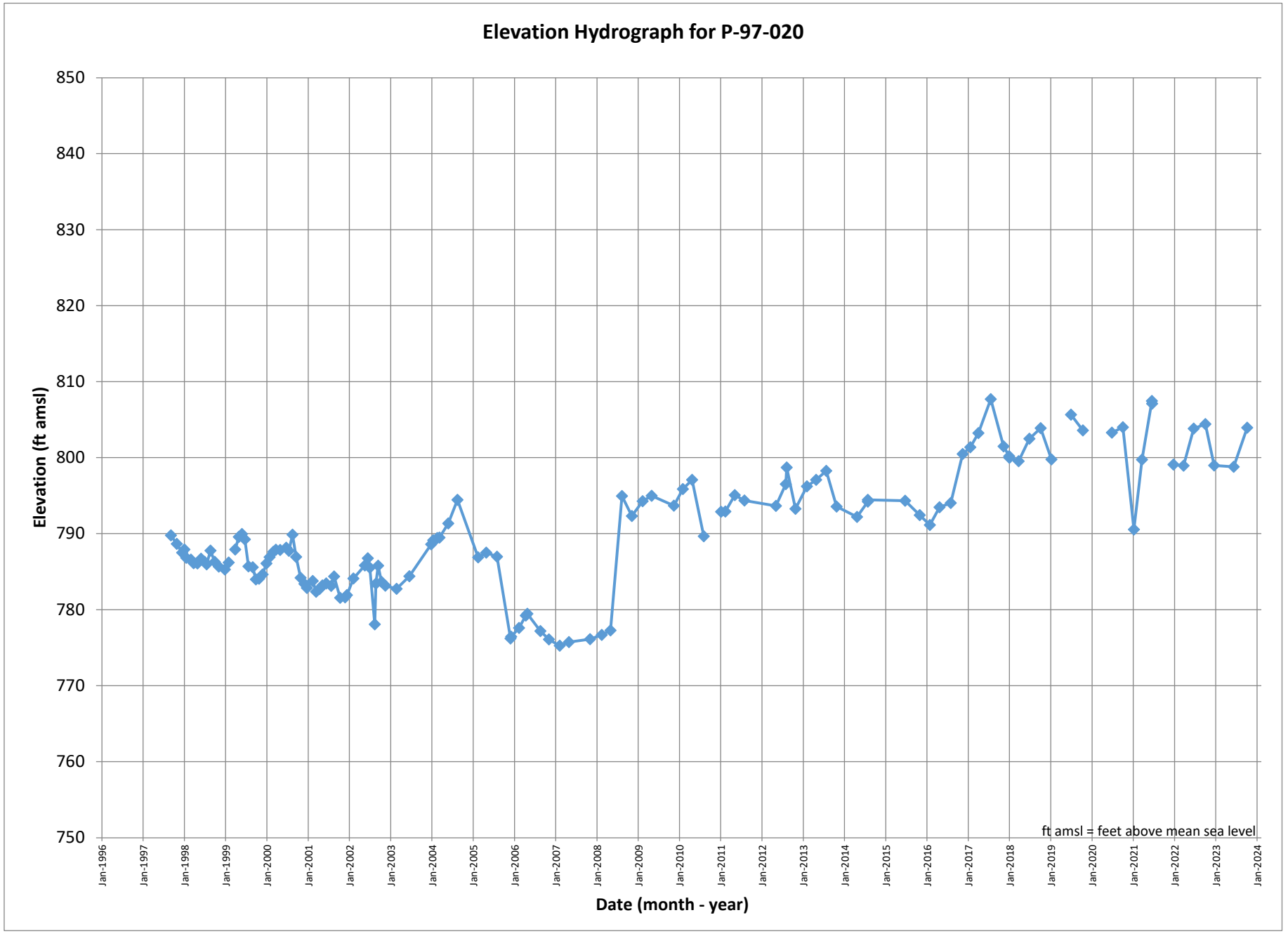
Piezometer P-97-12


Depth Hydrograph for P-97-012
Depth (ft bgs)
0
10
20
30
40
50
60
70
80
Jan-1996
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (month-year)
ft bgs = feet below ground surface

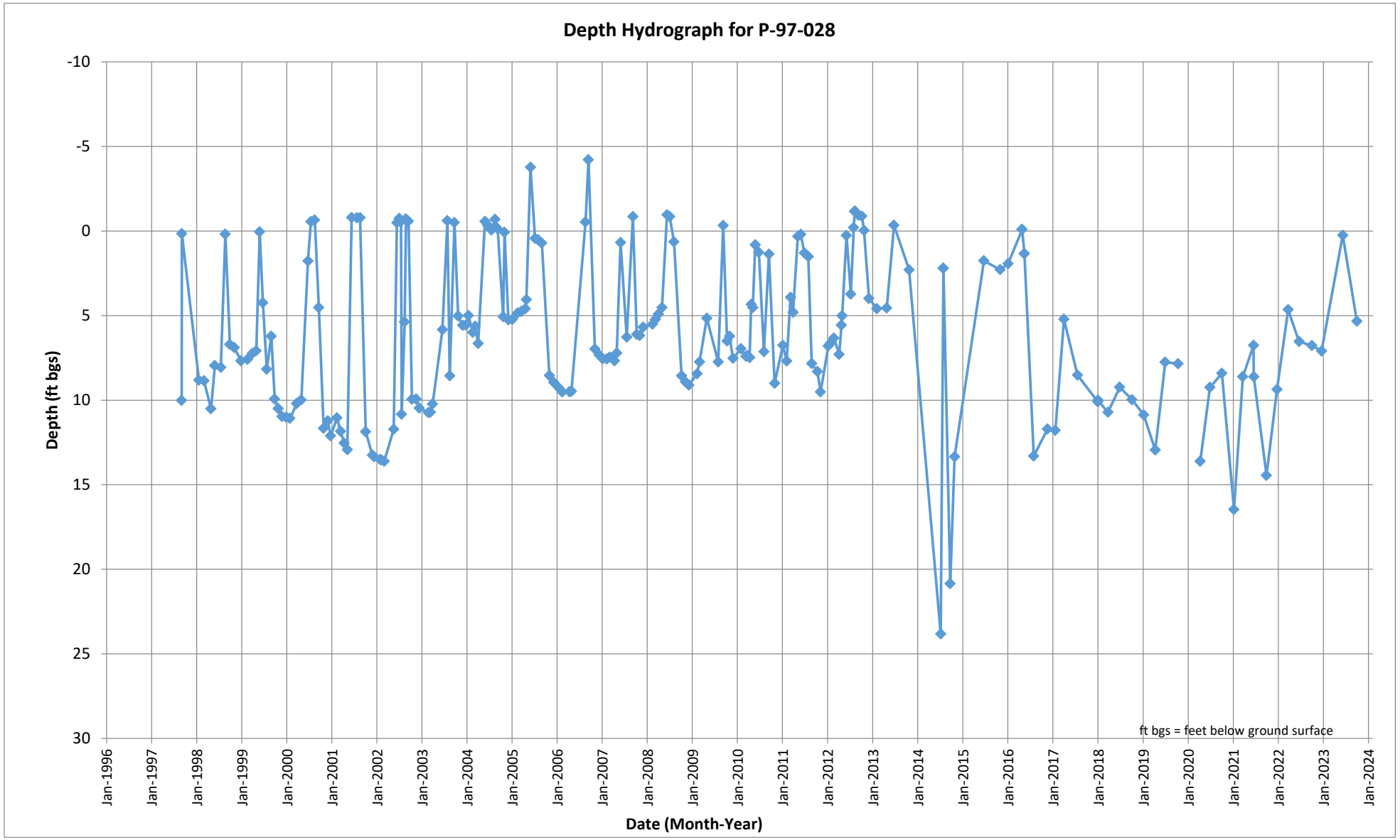

Elevation Hydrograph for P-97-012
925
915
905
895
885
875
865
855
845
835
825
Elevation (ft amsl)
Jan-1996
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (month - year)
ft amsl = feet above mean sea level

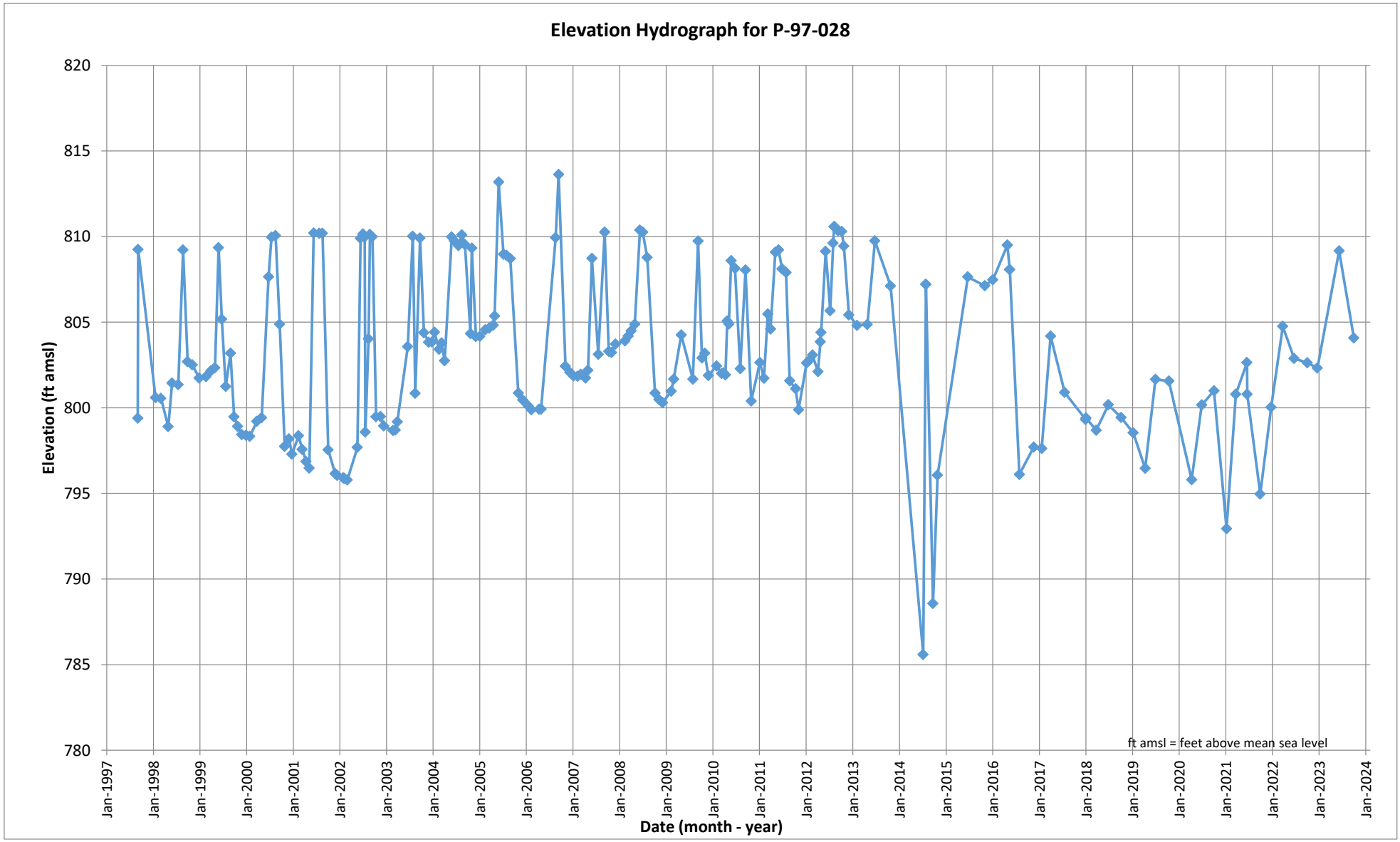
Piezometer P-97-20


Depth Hydrograph for P-97-020
Depth (ft bgs)
130
135
140
145
150
155
160
165
170
175
Jan-1996
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (Month-Year)
ft bgs = feet below ground surface

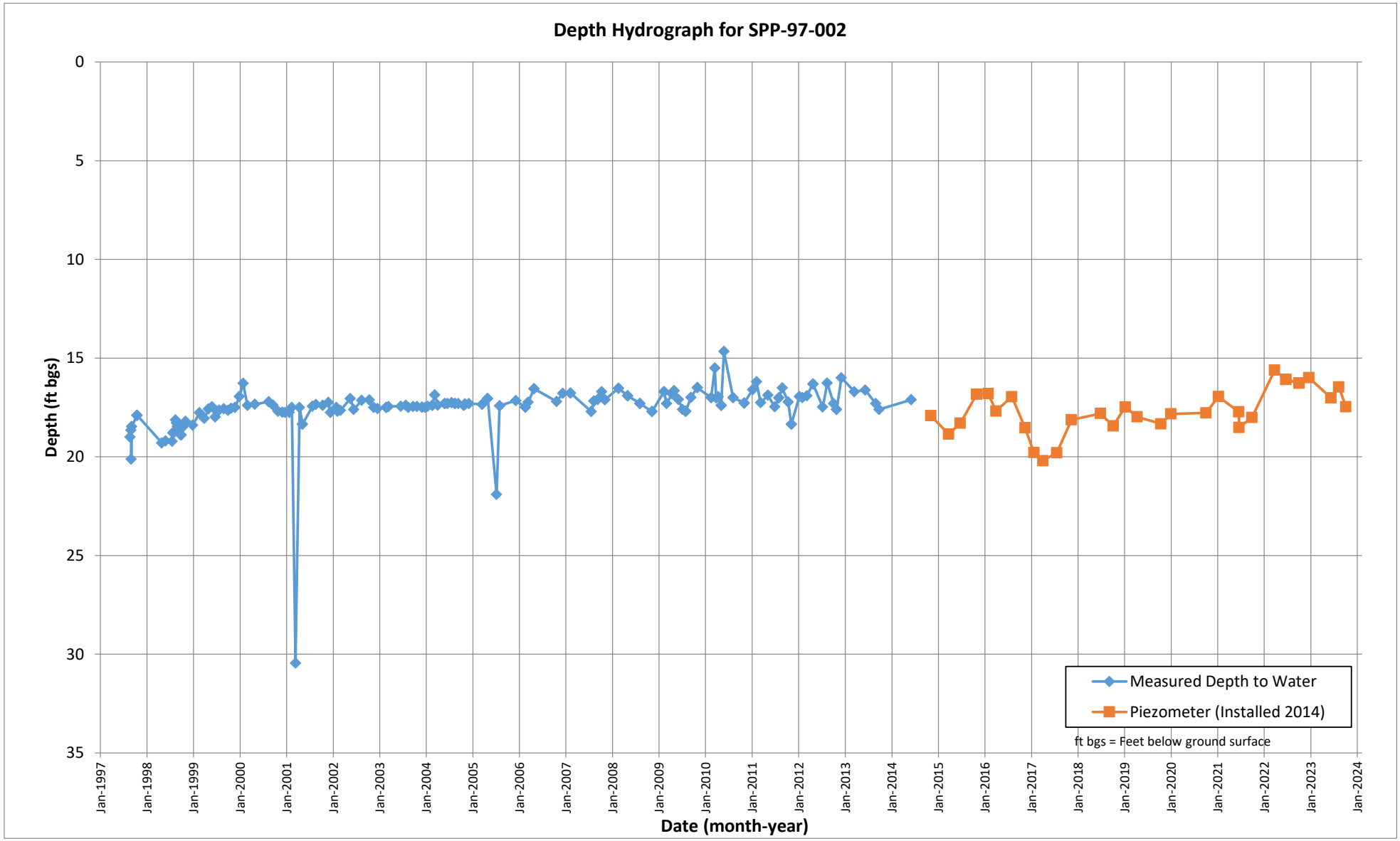

Elevation Hydrograph for P-97-020
Elevation (ft amsl)
850
840
830
820
810
800
790
780
770
760
750
Jan-1996
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (month - year)
ft amsl = feet above mean sea level

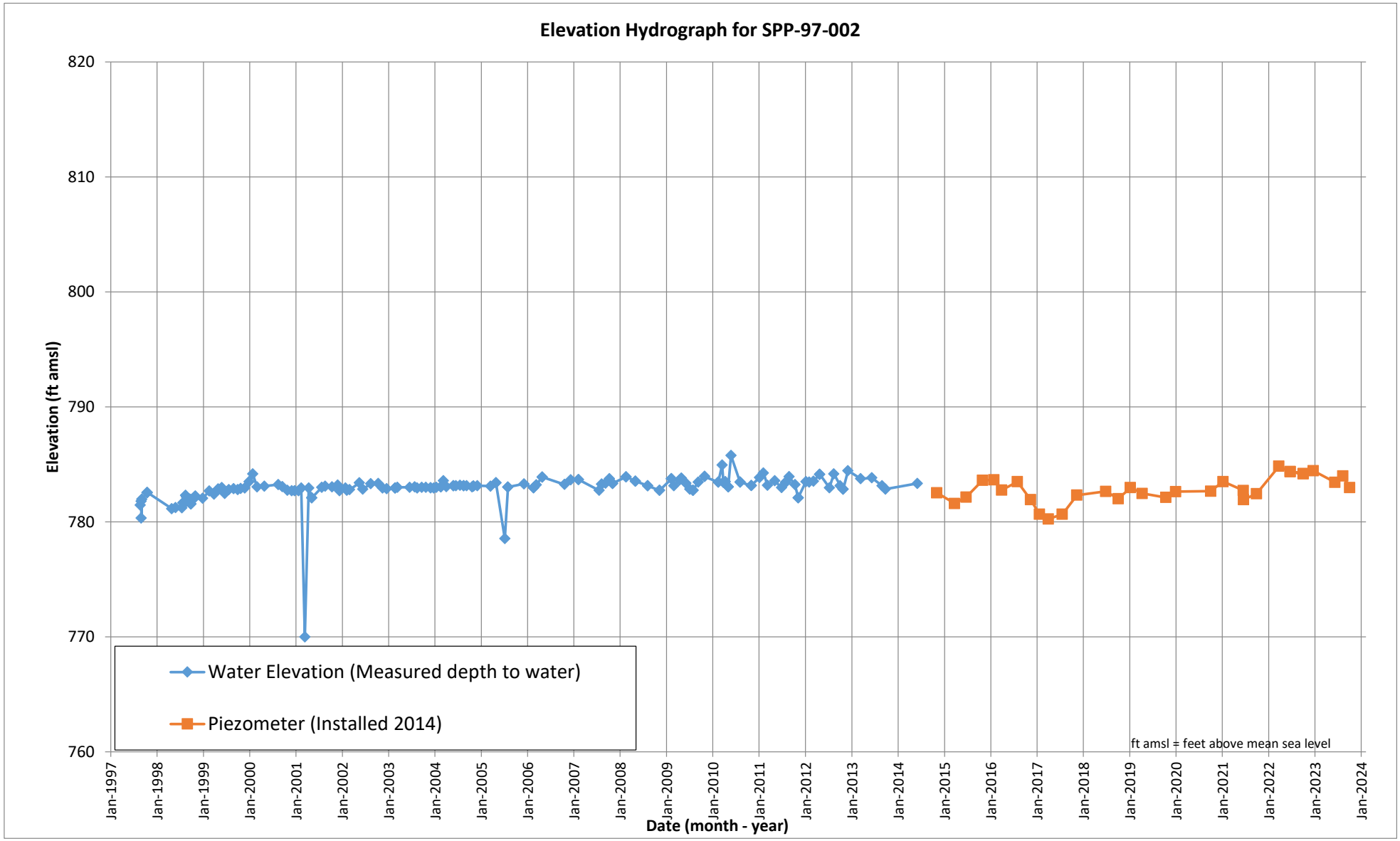
Piezometer P-97-28


Depth Hydrograph for P-97-028
Depth (ft bgs)
-10
-5
0
5
10
15
20
25
30
Jan-1996
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (Month-Year)
ft bgs = feet below ground surface


Elevation Hydrograph for P-97-028
820
815
810
805
800
795
790
785
780
Elevation (ft amsl)
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (month - year)
ft amsl = feet above mean sea level

Piezometer SPP-97-002


Depth Hydrograph for SPP-97-002
Depth (ft bgs)
0
5
10
15
20
25
30
35
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (month-year)
Measured Depth to Water
Piezometer (Installed 2014)
ft bgs = Feet below ground surface


Elevation Hydrograph for SPP-97-002
820
810
800
790
780
770
760
Elevation (ft amsl)
Water Elevation (Measured depth to water)
Piezometer (Installed 2014)
ft amsl = feet above mean sea level
Jan-1997
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
Jan-2021
Jan-2022
Jan-2023
Jan-2024
Date (month - year)

Appendix F
QA/QC Data and Field Forms

1st Quarter 2023

KUNA QUARTERLY REPORT DATA CHECKLIST **Quarter** Q1 2023 **Date** 3/9/2023

For Teck/RedDog Long-Term Groundwater and Permafrost Monitoring

Checklist Items

- ☐ **YES / NO** Quarterly data received from Teck. Date received: 1/13/2023
- ☐ **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:
- ☐ **YES / NO** Is data complete for all Piezometers? If "No" make note of data gaps:
  See notes in table on specific data values/readings.
- ☐ **YES / NO** Field Notes for the Quarter. Are data gaps/irregularities addressed?

Comments/Notes:

- None.

Thermistor Data

Thermistor	Data Received? Y / N	Comments
T-96-015	Y	
T-05-061	**N**	
T-95-005	Y	Several error reading
T-96-010	**N**	
T-97-028	Y	Several error readings
T-97-029	Y	Several error readings
T-97-030	Y	error readings
T-14-110	Y	
T-95-008 #2 (manually add "#2")	Y	Error readings
T-96-013	Y	Error readings
T-96-021	Y	Error readings
T-96-022	Y	Error readings
T-96-023	**N**	
T-96-012	Y	Error readings
T-96-012s	Y	Error readings
T-95-004	**N**	

Piezometer Data

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	
Barometer	Y	

Quarterly Thermistor/Piezometer Fieldsheet

Technician(s):	Geokon ID #:	Thermrdr ID #:	Date:	General Weather:
Kelson Phillips	392	19977	1/7/23	11.9°F, winds SW 1.4mph Overcast, Fog

Col. # Row	Well	Location	Collection Method Instrument	Nodes	Piezo PSI or Therm Error Code	Date	Comments
26	*T-95-008	Overburden	Yellow box Thermistor	24	3	1/7/23	
25	*P-96-013	Overburden	Geokon Piezometer		PSI Reading: 250	1/7/23	14:18 6536.6 0.3°C
29	*T-96-013	Overburden	Yellow box Thermistor	24	3	1/7/23	
30	T-96-013S	Overburden	Yellow box Thermistor	24		1/7/23	No attachment/unable to locate
31	*T-96-021	Overburden	Yellow box Thermistor	24	3	1/7/23	string 14.8
32	*T-96-022	Overburden	Yellow box Thermistor	24	3	1/7/23	-0.6
33	*T-96-023	Overburden	Yellow box Thermistor	24			Buried?
24	*P-97-012	Blast Road	Geokon Piezometer		PSI Reading: NA	1/7/23	No PSI gauge 16:41 6536.2 0.4°C
27	*T-96-012	Blast Road	Yellow box Thermistor	24	3	1/7/23	31.8
28	*T-96-012S	Blast Road	Yellow box Thermistor	24	3	1/7/23	12.5
1	*T-14-110	W. Tails Pond	Beaded Stream Datalogger	24	Collect Data via Internet	1/7/23	
70	*T-95-005	By sandfilter	Yellow box Thermistor	24	3	1/7/23	34.8
127	*T-05-061	TDAM (end)	Yellow box Thermistor	6			Buried
75	*T-97-028	Buttress	Yellow box Thermistor	24	3	1/8/23	38.9
76	*T-97-029	Buttress	Yellow box Thermistor	24	3	1/8/23	37.1
77	*T-97-030	Buttress	Yellow box Thermistor	24	3	1/8/23	37.1
71	*T-96-010	Seepage Dam	Yellow box Thermistor	24		1/8/23	▲ Severed connection/not spliced
	*P-96-010	Seepage Dam	Read PSI Only		PSI Reading:		Buried
23	*P-96-015	Lower RDC	Geokon Piezometer		PSI Reading: NA	1/9/23	No PSI Gauge 16:09 7541.2 0.6°C
44	*T-96-015	Lower RDC	Yellow box Thermistor	14	0	1/9/23	31.1 → Read twice
	P-97-012	Write-in QAQC Piezometer #	Geokon Piezometer		Duplicate reading within 5 minutes of first Piezo reading for QAQC		6173.0 0.2°C

Additional Comments:

Request Piezo data from T&W for Piezometer's P-97-028, P-96-010, SPP 97-002, P-08A, P-08B, P-97-020, Barometer (Baro needed for each day of data collectior

Quarterly Thermistor QAQC Schedule: **2021** Q1=T97-28, Q2=T96-21, Q3=T96-22, Q4=T96-23; **2022** Q1=T96-12, Q2=T95-15, Q3=T96-05, Q4=T96-10;

Quarterly Thermistor QAQC Schedule: **2023** Q1=T97-28, Q2=T97-29, Q3=97-30, Q4=T95-08; **2024** Q1=T96-13, Q2=T96-21, Q3=T96-22, Q4=T96-05

*SEP Thermistor. QAQC: Datalogger & Manual Switchbox w/Ohmmeter readings to be taken within 5 min. of each other

Remember to print QAQC form for Thermistor

Quarterly Thermistor QA / QC

Technician(s): KMP/JWM Date: 1/8/23

Location: 96-030 Start Time: 1625 Stop Time: 1628

Node Test	Ohms	Comments	Node Test	Temperature
	16.3			
1	14.19		1	
2	14.04		2	
3	14.02		3	
4	14.06		4	
5	14.01		5	
6	14.02		6	
7	14.07		7	
8	14.11		8	
9	14.1		9	
10	14.16		10	
11	14.26		11	
12	14.49		12	
13	14.71		13	
14	14.77		14	
15	14.91		15	
16	15.04		16	
17	15.22		17	
18	15.19		18	
19	15.29		19	
20	15.3		20	
21	15.41		21	
22		unstable	22	
23		unstable	23	
24	15.33		24	
Test	16.35		Test	

Read these l
noted q

Month
Q1-2021
Q2-2021
Q3-2021
Q4-2021
Q1-2022
Q2-2022
Q3-2022
Q4-2022
Q1-2023
Q2-2023
Q3-2023
Q4-2023
Q1-2024
Q2-2024
Q3-2024
Q4-2024

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.

2nd Quarter 2023

Quarterly Thermistor/Piezometer Fieldsheet

Technician(s): KMP / SEW	Geokon ID #:	Thermrdr ID #: 2	Date: 4/24/23 General Weather: Clear, sunny, light wind

Col. # Row	Well	Location	Collection Method Instrument	Nodes	Piezo PSI or Therm Error Code	Date	Comments
26	*T-95-008	Overburden	Yellow box Thermistor	24	Err 3	4/24/23	25.1
25	*P-96-013	Overburden	Geokon Piezometer		PSI Reading: 250	4/21/23	#26 12:48 6548.7 0.3°C
29	*T-96-013	Overburden	Yellow box Thermistor	24	ERR3	4/24/23	-38.4
30	T-96-013S	Overburden	Yellow box Thermistor	24		4/24/23	NO Pig tail/Not found
31	*T-96-021	Overburden	Yellow box Thermistor	24	ERR3	4/24/23	20.7
32	*T-96-022	Overburden	Yellow box Thermistor	24	ERR3	4/24/23	17.0
33	*T-96-023	Overburden	Yellow box Thermistor	24		4/24/23	Buried
24	*P-97-012	Blast Road	Geokon Piezometer		PSI Reading:		#27 13:07 6197.4 0.2°C
27	*T-96-012	Blast Road	Yellow box Thermistor	24	ERR3	4/24/23	31.5
28	*T-96-012S	Blast Road	Yellow box Thermistor	24	3/ERR3	4/24/23	T96-012S Buried Read 4/24/23 14.9
1	*T-14-110	W. Tails Pond	Beaded Stream Datalogger	24	Collect Data via Internet	4/24/23	
70	*T-95-005	By sandfilter	Yellow box Thermistor	24			Buried
127	*T-05-061	TDAM (end)	Yellow box Thermistor	6			Buried
75	*T-97-028	Buttress	Yellow box Thermistor	24	ERR3	4/29/23	13.2
76	*T-97-029	Buttress	Yellow box Thermistor	24	ERR3	~~4/24/23~~	13.3 Reread 5/1/23
77	*T-97-030	Buttress	Yellow box Thermistor	24	ERR3	4/29/23	21.4
71	*T-96-010	Seepage Dam	Yellow box Thermistor	24		4/24/23	Severed Connection / not spliced
	*P-96-010	Seepage Dam	Read PSI Only		PSI Reading:		Buried
23	*P-96-015	Lower RDC	Geokon Piezometer		PSI Reading:		#28 14:16 7539.6 0.6°C
44	*T-96-015	Lower RDC	Yellow box Thermistor	14	Err 0	4/24/23	
	T21-13	Overburden	Yellow box Thermistor	44			Get reading from Tailing & Water Dam Safety
	P21-13	Overburden	Geokon Piezometer		PSI Reading:		Get reading from Tailing & Water Dam Safety
		Write-in QAQC Piezometer #	Geokon Piezometer		Duplicate reading within 5 minutes of first Piezo reading for QAQC		

Additional Comments:

Request Piezo data from T&W for Piezometer's P-97-028, P-96-010, SPP 97-002, P-08A, P-08B, P-97-020, Barometer (Baro needed for each day of data collection

Quarterly Thermistor QAQC Schedule: **2021** Q1=T97-28, Q2=T96-21, Q3=T96-22, Q4=T96-23; **2022** Q1=T96-12, Q2=T95-15, Q3=T96-05, Q4=T96-10;

Quarterly Thermistor QAQC Schedule: **2023** Q1=T97-28, Q2=T97-29, Q3=97-30, Q4=T95-08; **2024** Q1=T96-13, Q2=T96-21, Q3=T96-22, Q4=T96-05

*SEP Thermistor. QAQC: Datalogger & Manual Switchbox w/Ohmmeter readings to be taken within 5 min. of each other

Quarterly Thermistor QA / QC

Technician(s): Kmp/ATB Date: 5/1/23

Location: T97-29 Start Time: 1448 Stop Time: 1452

Node	Ohms	Comments	Node	Temperature	Read these l noted q
Test	16.34		Test		
1	14.29		1		Month
2	14.19		2		Q1-2021
3	Ø	Unstable	3		Q2-2021
4	Ø	Bad	4		Q3-2021
5	17.56		5		Q4-2021
6	17.65		6		Q1-2022
7	14.62		7		Q2-2022
8	16.27		8		Q3-2022
9	14.63		9		Q4-2022
10	14.69		10		Q1-2023
11	Ø		11		Q2-2023
12	Ø	Unstable	12		Q3-2023
13	14.92		13		Q4-2023
14	15.44		14		Q1-2024
15	15.60		15		Q2-2024
16	15.67		16		Q3-2024
17	15.72		17		Q4-2024
18	15.59		18		
19	15.74		19		
20	13.37		20		
21	15.18		21		
22	15.35		22		
23	15.15		23		
24	15.24		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.

KUNA QUARTERLY REPORT DATA CHECKLIST **Quarter** Q2 2023 **Date** 6/1/2023

Checklist Items

- ☐ **YES / NO** Quarterly data received from Teck. Date received: 5/29/2023
- ☐ **YES / NO** Data received for 10 Thermistors; 6 missing (see below)
- ☐ **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: see below
- ☐ **YES / NO** Is data complete for all Piezometers? If "No" make note of data gaps:
  See notes in table on specific data values/readings.
- ☐ **YES / NO** Field Notes for the Quarter. Are data gaps/irregularities addressed?

Thermistor Data

Thermistor	Data Received? Y / N	Comments
T-95-008 #2	Y	
T-96-013	Y	
T-96-013S	**N**	No pig tail/not found
T-96-021	Y	
T-96-022	Y	
T-96-023	**N**	Buried?
T-96-012	Y	
T-96-012s	**N**	Buried
T-14-110	Y	
T-95-005	**N**	Buried
T-05-061	**N**	Buried
T-97-028	Y	
T-97-029	Y	
T-97-030	Y	
T-96-010	**N**	Buried
T-96-015	Y	

Piezometer Data

Piezometer	Data Received? Y / N	Comments
P-96-015	Y	
P-08A	Y	Temp is 24.1 C (75 F)
P-08B	Y	Temp is 24.1 C (75 F)
P-96-010	Y	
P-97-020	Y	
P-97-028	Y	
SPP-97-002	Y	
P-96-013	Y	
P-97-012	Y	
Barometer	Y	

3rd Quarter 2023

KUNA QUARTERLY REPORT DATA CHECKLIST **Quarter** Q3 2023 **Date** 10/4/2023

Checklist Items

☐ **YES / NO** Quarterly data received from Teck. Date received: 9/11/2023

☐ **YES / NO** Data received for 16 Thermistors: 3 missing (see below)

☐ **YES / NO** Data received for 9 Piezometers: 4 missing (see below)

☐ **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: see below

☐ **YES / NO** Is data complete for all Piezometers? If "No" make note of data gaps:

See notes in table on specific data values/readings.

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

Data irregularities are not identified/addressed

Thermistor Data

Thermistor	Data Received? Y / N	Comments
T-95-008 #2	Y	Few erroneous readings
T-96-013	Y	All readings are erroneous
T-96-013S	**N**	No pig tail/not found
T-96-021	Y	
T-96-022	Y	Few erroneous readings
T-96-023	Y	First two node readings are suspect
T-96-012	Y	Couple erroneous readings on deeper nodes
T-96-012s	Y	
T-14-110	Y	
T-95-005	Y	All readings are erroneous
T-05-061	**N**	Buried
T-97-028	Y	
T-97-029	Y	Few erroneous readings
T-97-030	Y	
T-96-010	**N**	Therm connection severed
T-96-015	Y	

Piezometer Data

Piezometer	Data Received? Y / N	Comments
P-96-015	**N**	
P-08A	Y	Temp is 25.9 C (78 F)
P-08B	Y	Temp is 25.9 C (78 F)
P-96-010	Y	
P-97-020	**N**	**Comms Issue**
P-97-028	**N**	**Comms Issue**
SPP-97-002	Y	
P-96-013	Y	
P-97-012	Y	
Barometer	Y	Multiple readings

Quarterly Thermistor QA / QC

Technician(s): Trevor Phillips Date: 8/29/23

Location: T-97-30 Start Time: 17:26 Stop Time: 17:41

Node Test	Ohms	Comments
1	16.33	
2	13.84	
3	14.08	
4	14.10	
5	14.13	
6	14.60	
7	14.22	
8	14.27	
9	14.47	
10	14.50	
11	14.56	
12	14.87	
13	14.87	
14	~~15.0~~	error 1000Ω 100k
15	—	error
16	15.07	
17	—	error 6500Ω 10k
18	—	error 960Ω 10k
19	15.31	
20	15.34	
21	0.02	
22	15.30	
23	—	error, 19.07Ω 1k
24	14.77	
Test	27.8	
	16.33	

Node Test	Temperature
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 l
noted q

Month
Q1-2021
Q2-2021
Q3-2021
Q4-2021
Q1-2022
Q2-2022
Q3-2022
Q4-2022
Q1-2023
Q2-2023
Q3-2023
Q4-2023
Q1-2024
Q2-2024
Q3-2024
Q4-2024

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 Thermistor/Piezometer Fieldsheet

Technician(s):	Geokon ID #:	Thermrdr ID #:	Date: General Weather:
Trevor Phillips Alden Ballot	392	19977	8/29/23: 86°F, 5.14 mph SW wind, overcast then sunny to. 8/30/23: 51°F, 3.9 mph E wind, mostly cloudy 8/31/23: 55°F, 8.4 mph W winds, partly cloudy

Col. # Row	Well	Location	Collection Method Instrument	Nodes	Piezo PSI or Therm Error Code	Date	Comments
26	*T-95-008	Overburden	Yellow box Thermistor	24	3	8/29/23	
25	*P-96-013	Overburden	Geokon Piezometer		PSI Reading: 245	8/30/23	6543.0 @ 0.3°C
29	*T-96-013	Overburden	Yellow box Thermistor	24	—	8/29/23	Read manually (on sheet) due to yellowbox errors
30	T-96-013S	Overburden	Yellow box Thermistor	24	—	—	
31	*T-96-021	Overburden	Yellow box Thermistor	24	0	8/29/23	
32	*T-96-022	Overburden	Yellow box Thermistor	24	3	8/29/23	
33	*T-96-023	Overburden	Yellow box Thermistor	24	3	8/29/23	
24	*P-97-012	Blast Road	Geokon Piezometer		PSI Reading: NA	8/31/23	6203.4 @ 0.1°C
27	*T-96-012	Blast Road	Yellow box Thermistor	24	3	8/29/23	Manual read/check: Node #12: 0.00, #13: error, #21: error
28	*T-96-012S	Blast Road	Yellow box Thermistor	24	3	8/29/23	Manual read/check: Node #17: error, #24: error
1	*T-14-110	W. Tails Pond	Beaded Stream Datalogger	24	Collect Data via Internet	8/29/23	
70	*T-95-005	By sandfilter	Yellow box Thermistor	24	3	8/29/23	
127	*T-05-061	TDAM (end)	Yellow box Thermistor	6	3	8/29/23	
75	*T-97-028	Buttress	Yellow box Thermistor	24	3	8/29/23	Read Manually/check: Node #22: error, #23: error
76	*T-97-029	Buttress	Yellow box Thermistor	24	3	8/29/23	Read Manually (on sheet) due to yellow box errors
77	*T-97-030	Buttress	Yellow box Thermistor	24	3	8/29/23	QAQC
71	*T-96-010	Seepage Dam	Yellow box Thermistor	24	—	—	Therm connection severed
	*P-96-010	Seepage Dam	Read PSI Only		PSI Reading: —	—	collected from Tailings & Water 8468.682 @ 0.13°C
23	*P-96-015	Lower RDC	Geokon Piezometer		PSI Reading:	8/29/23	
44	*T-96-015	Lower RDC	Yellow box Thermistor	14	0	8/29/23	
	T21-13	Overburden	Yellow box Thermistor	44		9/3/23	Get reading from Tailing & Water Dam Safety
	P21-13	Overburden	Geokon Piezometer		PSI Reading: —	8/29/23	Get reading from Tailing & Water Dam Safety P-21-13-1 (Deep) 6946.38 @ 0.78°C P-21-13-2 (shallow) 0974.98 @ 1.34°C
	P-97-012	Write-in QAQC Piezometer #	Geokon Piezometer		Duplicate reading within 5 minutes of first Piezo reading for QAQC		6203 @ -0.1°C

Additional Comments:

Request Piezo data from T&W for Piezometer's P-97-028, P-96-010, SPP 97-002, P-08A, P-08B, P-97-020, Barometer (Baro needed for each day of data collection

Quarterly Thermistor QAQC Schedule: **2021** Q1=T97-28, Q2=T96-21, Q3=T96-22, Q4=T96-23; **2022** Q1=T96-12, Q2=T95-15, Q3=T96-05, Q4=T96-10;

Quarterly Thermistor QAQC Schedule: **2023** Q1=T97-28, Q2=T97-29, Q3=97-30, Q4=T95-08; **2024** Q1=T96-13, Q2=T96-21, Q3=T96-22, Q4=T96-05

*SEP Thermistor. QAQC: Datalogger & Manual Switchbox w/Ohmmeter readings to be taken within 5 min. of each other

4th Quarter 2023

KUNA QUARTERLY REPORT DATA CHECKLIST **Quarter** Q4 2023 **Date** 11/17/2023

Checklist Items

☐ **YES / NO** Quarterly data received from Teck. Date received: 11/17/2023

☐ **YES / NO** Data received for 16 Thermistors: 2 missing (see below)

☐ **YES / NO** Data received for 9 Piezometers: 4 missing (see below)

☐ **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: see below

☐ **YES / NO** Is data complete for all Piezometers? If "No" make note of data gaps:

See notes in table on specific data values/readings.

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

Data irregularities are not identified/addressed

Thermistor Data

Thermistor	Data Received? Y / N	Comments
T-95-008 #2	Y	
T-96-013	Y	1 error reading
T-95-04	**N**	
T-96-021	Y	
T-96-022	Y	3 error readings
T-96-023	Y	2 error readings
T-96-012	Y	1 error reading
T-96-012s	Y	2 error readings
T-14-110	Y	
T-95-005	Y	
T-05-061	**y**	4 error readings
T-97-028	Y	1 error reading
T-97-029	Y	10 error readings
T-97-030	Y	2 error readings
T-96-010	**N**	
T-96-015	Y	1 error reading

Piezometer Data

Piezometer	Data Received? Y / N	Comments
P-96-015	Y	
P-08A	Y	Temp is 25.9 C (78 F)
P-08B	Y	Temp is 25.9 C (78 F)
P-96-010	Y	
P-97-020	Y	
P-97-028	Y	
SPP-97-002	Y	
P-96-013	Y	
P-97-012	Y	
Barometer	Y	

Quarterly Thermistor QA / QC

Technician(s): James Mills, Shannon Wasuli Date: 10/18/23

Multimeter model: Craftsman 82141

Location: T95-008 Start Time: 14:21 Stop Time: 14:23

Node	Ohms	Comments	Node	Temperature
Test	16.33		Test	
1	SEM ~~16.33~~ 15.79		1	
2	16.82		2	
3	16.9		3	
4	16.96		4	
5	16.97		5	
6	16.99		6	
7	16.96		7	
8	16.95		8	
9	17.03		9	
10	17.04		10	
11	17.04		11	
12	17.02		12	
13	17.11		13	
14	17.08		14	
15	17.05		15	
16	17.06		16	
17	17.06		17	
18	17.05		18	
19	17.06		19	
20	17.09		20	
21	17.06		21	
22	17.08		22	
23	17.14		23	
24	open		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.

Quarterly Thermistor/Piezometer Fieldsheet

Technician(s):	Geokon ID #:	Thermrdr ID #:	Date:	General Weather:
James Mills Shannon Wasuli	392	19977	10/18/23	19°F, 3.4 mph ENE, overcast

Col. # Row	Well	Location	Collection Method Instrument	Nodes	Piezo PSI or Therm Error Code	Date	Comments
26	*T-95-008	Overburden	Yellow box Thermistor	24	Err 3	10/18/23	Cleaned and reread-error3. DAQC.
25	*P-96-013	Overburden	Geokon Piezometer		PSI Reading: ID 30	10/18/23	PSI: 245
29	*T-96-013	Overburden	Yellow box Thermistor	24	Err 3	10/18/23	Cleaned and reread-error3.
30	T-96-013S	Overburden	Yellow box Thermistor	24	—	—	Wire has been cut.
31	*T-96-021	Overburden	Yellow box Thermistor	24	Err 3	10/18/23	Cleaned and reread-error3. Cable might be damaged. SEW
32	*T-96-022	Overburden	Yellow box Thermistor	24	Err 3	10/18/23	cleaned and reread-error3.
33	*T-96-023	Overburden	Yellow box Thermistor	24	Err 3	10/18/23	Cleaned and reread-error3.
24	*P-97-012	Blast Road	Geokon Piezometer		PSI Reading: ID 29	10/18/23	PSI: No PSI Gauge. QAQC
27	*T-96-012	Blast Road	Yellow box Thermistor	24	Err 3	10/18/23	Cleaned and reread-error3.
28	*T-96-012S	Blast Road	Yellow box Thermistor	24	Err 3	10/18/23	Cleaned and reread-error3.
1	*T-14-110	W. Tails Pond	Beaded Stream Datalogger	24	Collect Data via Internet	10/18/23	
70	*T-95-005	By sandfilter	Yellow box Thermistor	24	Err3	10/18/23	Two pins missing.
127	*T-05-061	TDAM (end)	Yellow box Thermistor	6	Err3	10/18/23	saved as T96-010
75	*T-97-028	Buttress	Yellow box Thermistor	24	Err3	10/18/23	Cleaned and reread-error3.
76	*T-97-029	Buttress	Yellow box Thermistor	24	Err3	10/18/23	one pin missing.
77	*T-97-030	Buttress	Yellow box Thermistor	24	Err3	10/18/23	Cleaned and reread-error3.
71	*T-96-010	Seepage Dam	Yellow box Thermistor	24			collect from Tailings and Water Wi Fi
	*P-96-010	Seepage Dam	Read PSI Only		PSI Reading:		
23	*P-96-015	Lower RDC	Geokon Piezometer		PSI Reading: 0	10/18/23	~~QAQC SEW~~
44	*T-96-015	Lower RDC	Yellow box Thermistor	14	Err 3	10/18/23	
	T21-13	Overburden	Yellow box Thermistor	44		TOP 10/30/23	Get reading from Tailing & Water Dam Safety
	P21-13	Overburden	Geokon Piezometer		PSI Reading:		Get reading from Tailing & Water Dam Safety
	~~P-96-015~~ SEW T97-012	Write-in QAQC Piezometer #	Geokon Piezometer		Duplicate reading within 5 minutes of first Piezo reading for QAQC		

Additional Comments: *Node 16 on Yellow box faulty, replaced with manual readings

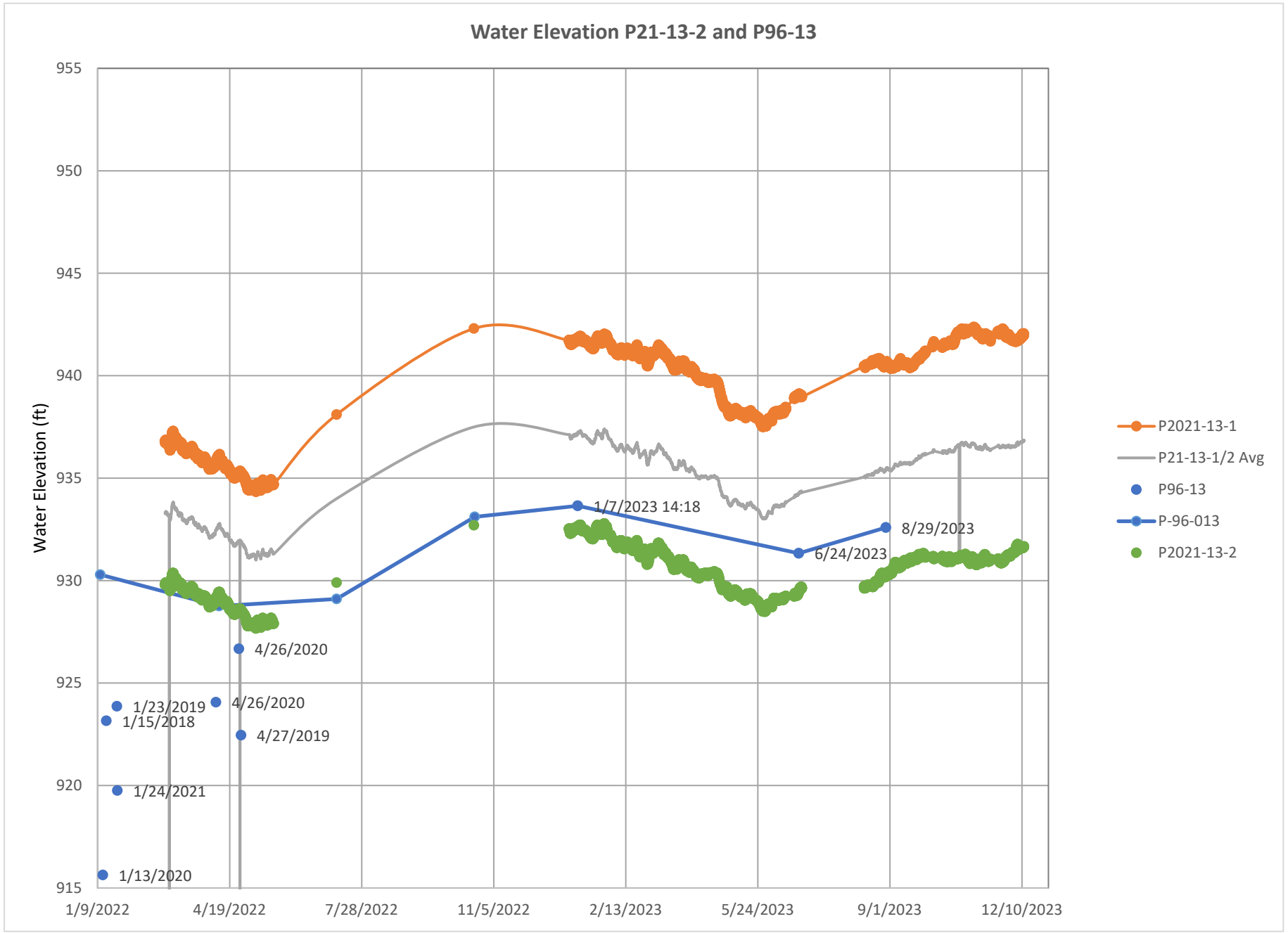
Request Piezo data from T&W for Piezometer's P-97-028, P-96-010, SPP 97-002, P-08A, P-08B, P-97-020, Barometer (Baro needed for each day of data collectior

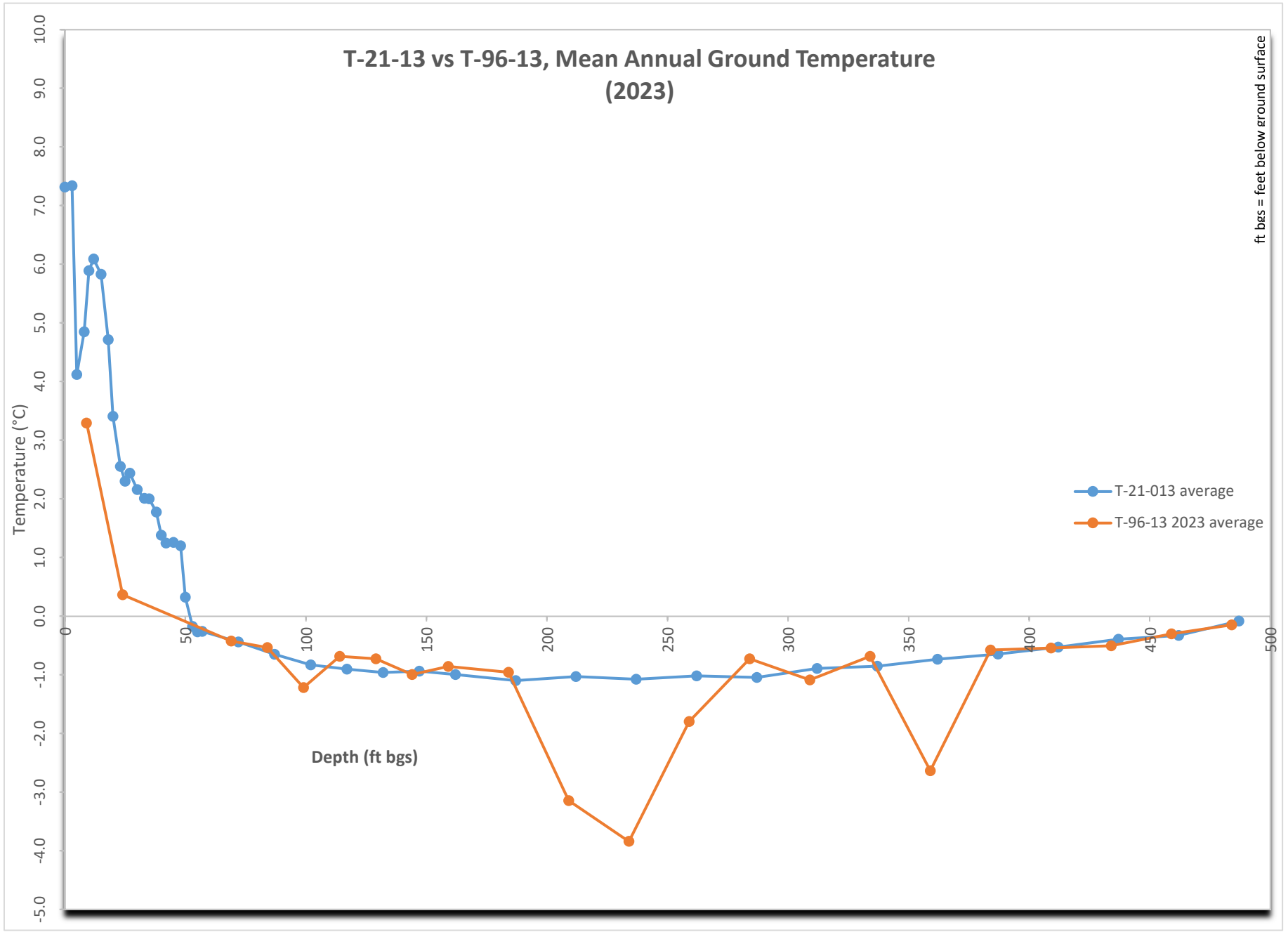
Quarterly Thermistor QAQC Schedule: **2021** Q1=T97-28, Q2=T96-21, Q3=T96-22, Q4=T96-23; **2022** Q1=T96-12, Q2=T95-15, Q3=T96-05, Q4=T96-10;

Quarterly Thermistor QAQC Schedule: **2023** Q1=T97-28, Q2=T97-29, Q3=97-30, Q4=T95-08; **2024** Q1=T96-13, Q2=T96-21, Q3=T96-22, Q4=T96-05

*SEP Thermistor. QAQC: Datalogger & Manual Switchbox w/Ohmmeter readings to be taken within 5 min. of each other

Appendix G
P/T-96-13 and P/T-21-13 Comparison Graphs


Water Elevation P21-13-2 and P96-13
Water Elevation (ft)
955
950
945
940
935
930
925
920
915
1/9/2022
4/19/2022
7/28/2022
11/5/2022
2/13/2023
5/24/2023
9/1/2023
12/10/2023
1/7/2023 14:18
8/29/2023
6/24/2023
4/26/2020
1/23/2019
4/26/2020
1/15/2018
4/27/2019
1/24/2021
1/13/2020
P2021-13-1
P21-13-1/2 Avg
P96-13
P-96-013
P2021-13-2

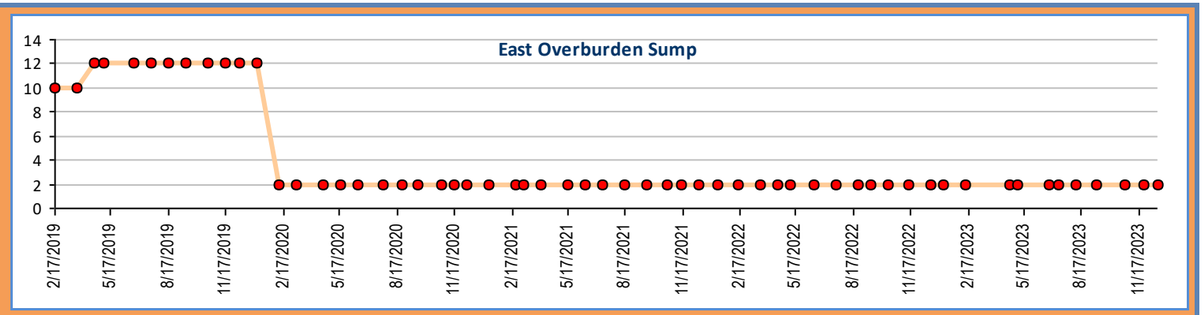

T-21-13 vs T-96-13, Mean Annual Ground Temperature
(2023)
Temperature (°C)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
0
50
100
150
200
250
300
350
400
450
500
Depth (ft bgs)
ft bgs = feet below ground surface
T-21-013 average
T-96-13 2023 average

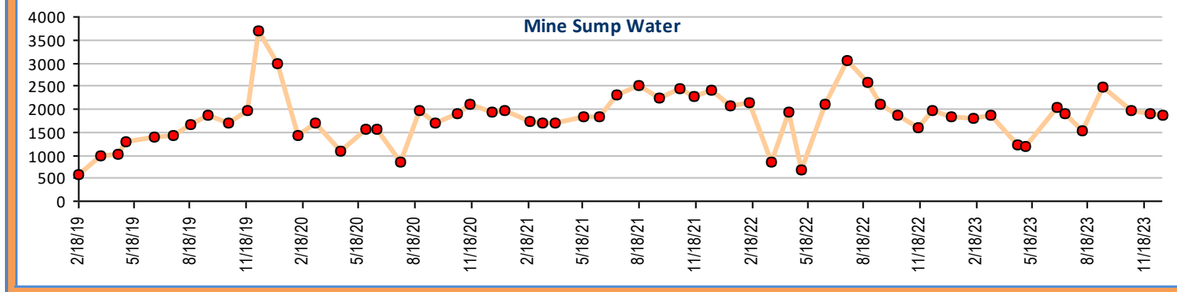
Appendix C: Water Quality Profile II Charts – Mine Water Monitoring Stations

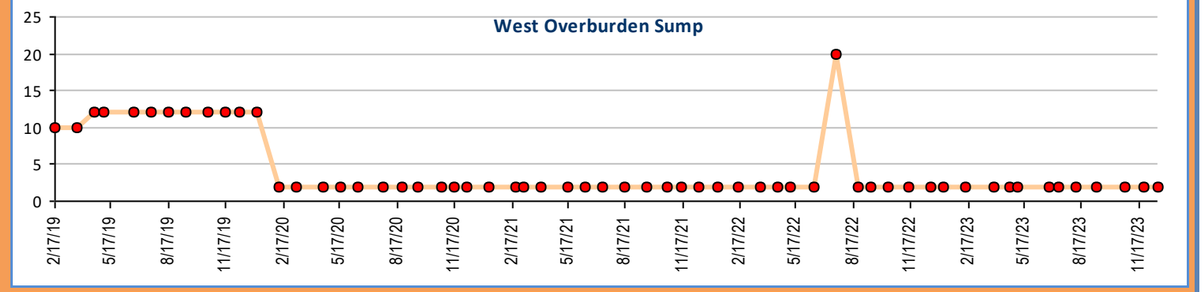
RED DOG MINE

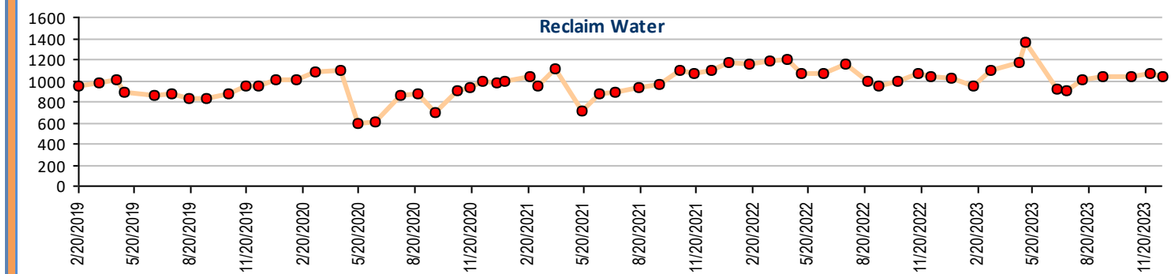
Mine Water Monitoring - Water Quality Profile II, Trend Charts

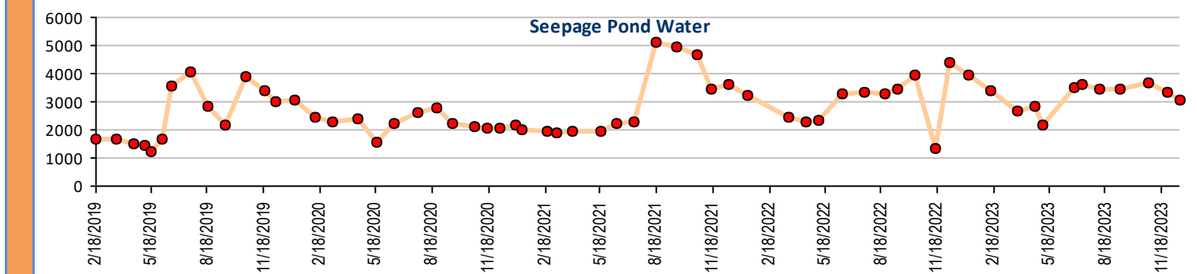
Acidity as CaCO3, units mg/L

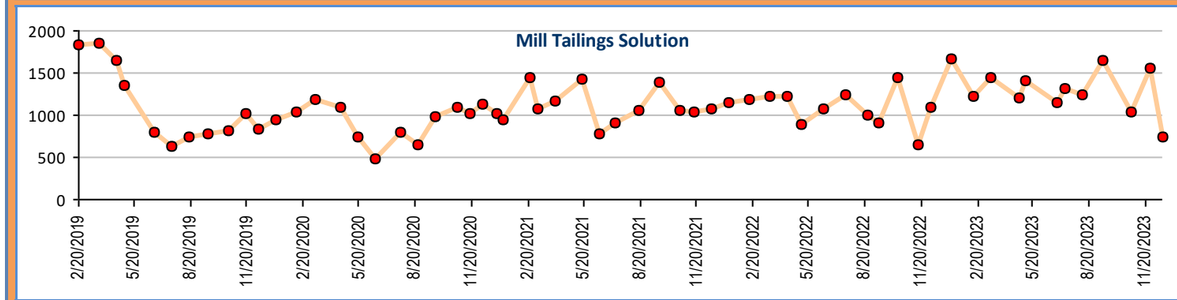


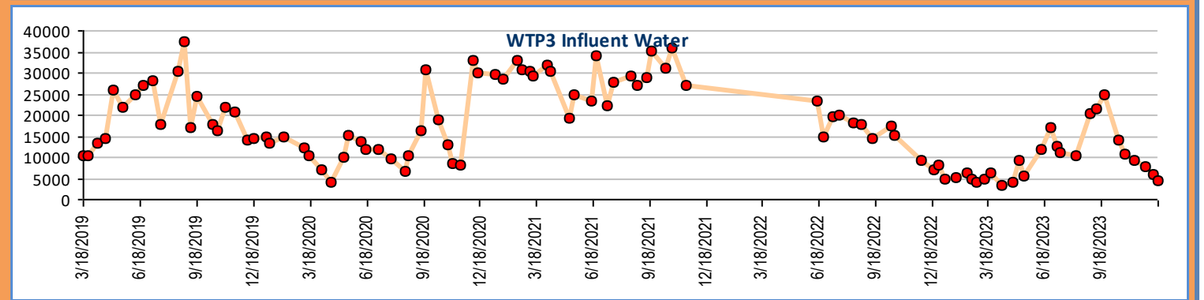


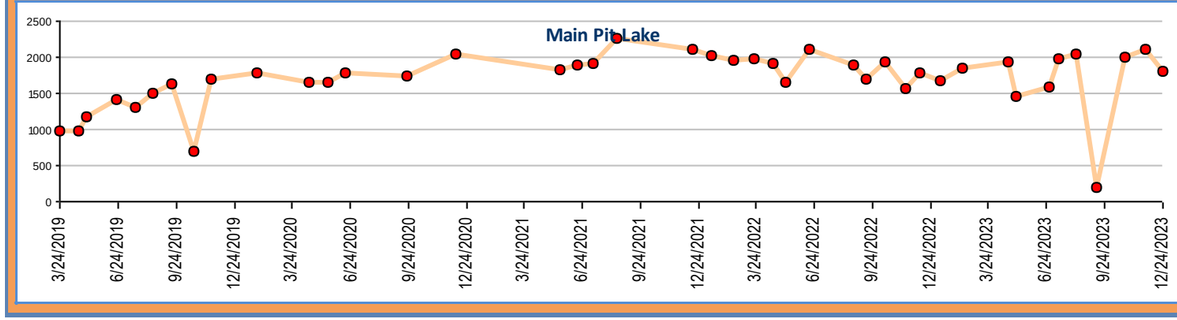


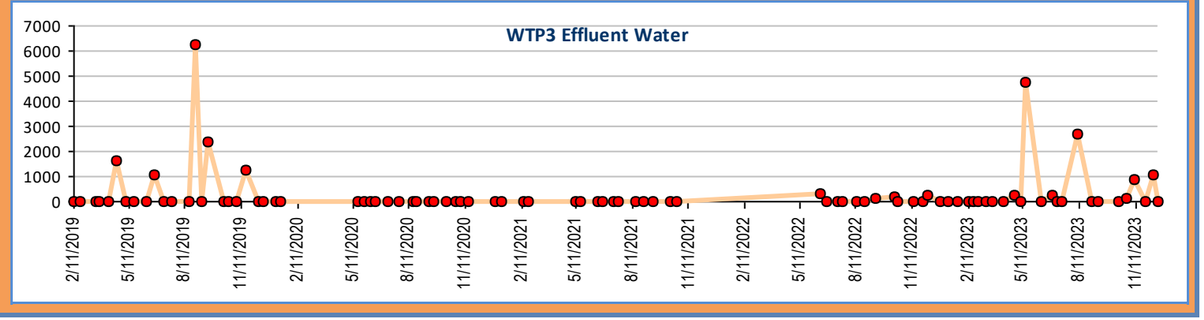








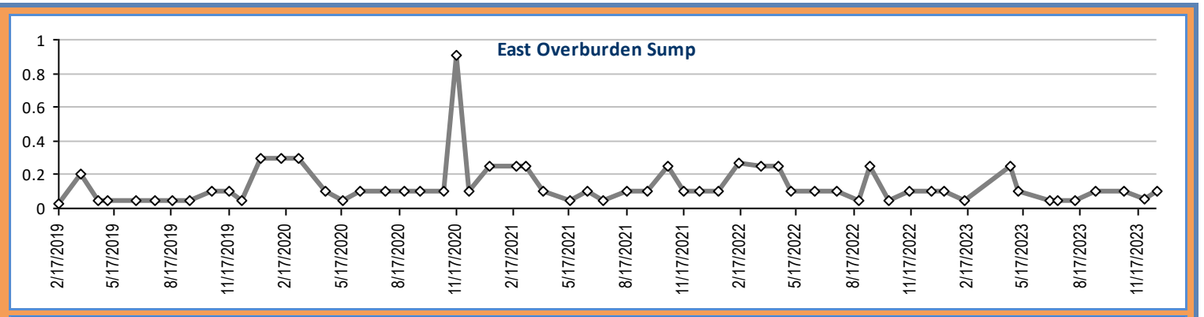


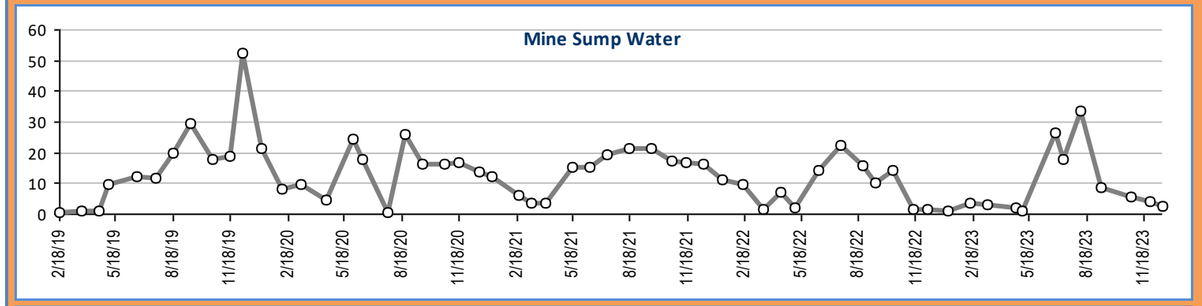


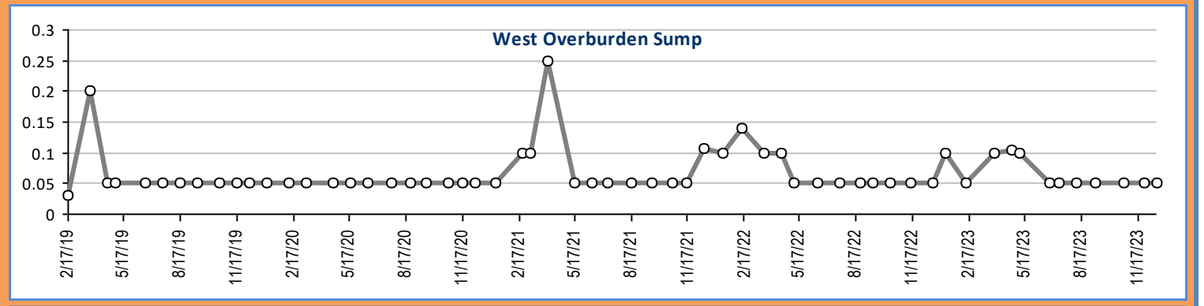
RED DOG MINE

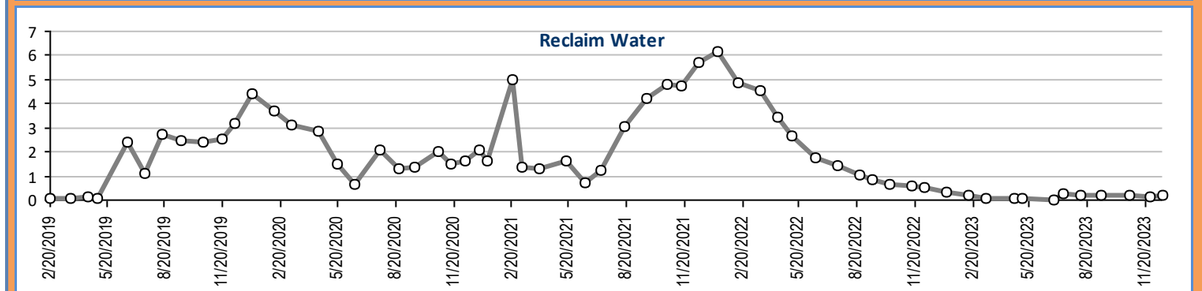
Mine Water Monitoring - Water Quality Profile II, Trend Charts

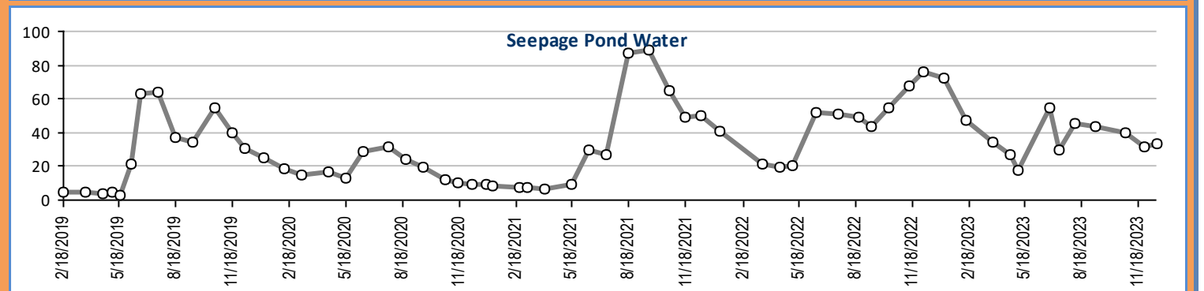
Aluminum, dissolved, units mg/L

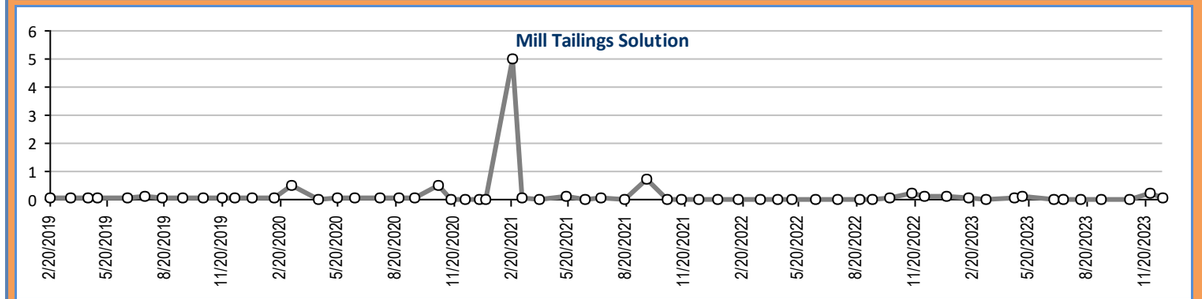


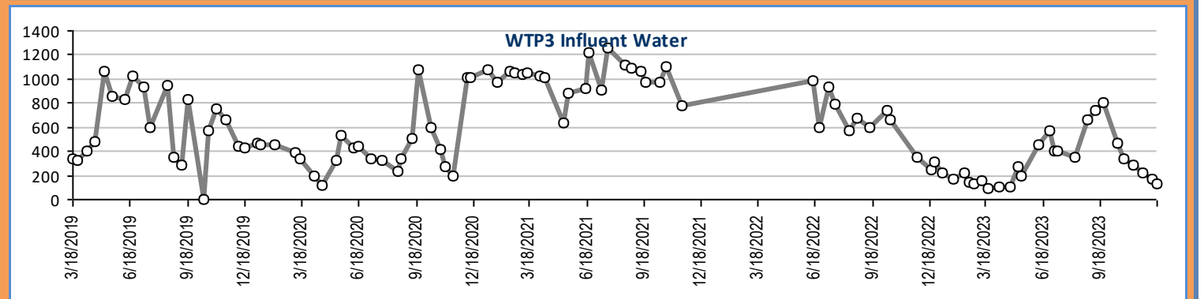


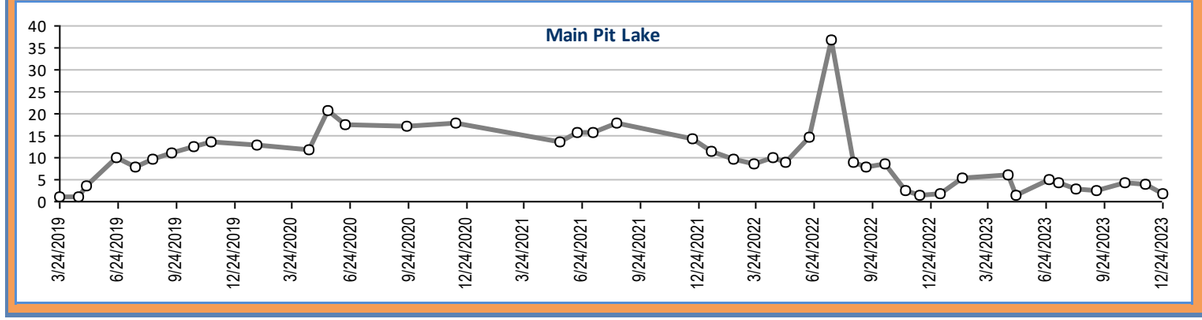


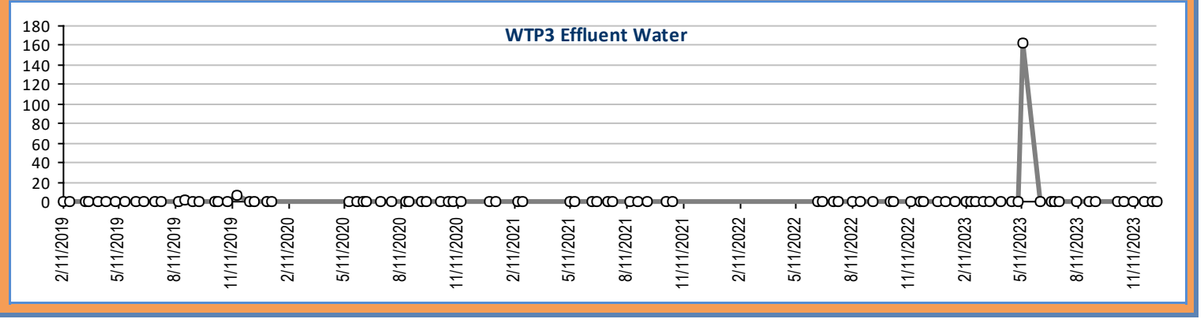








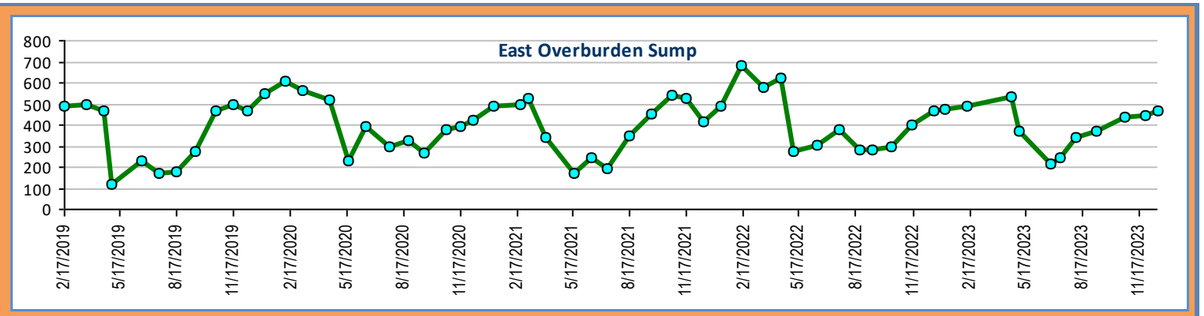


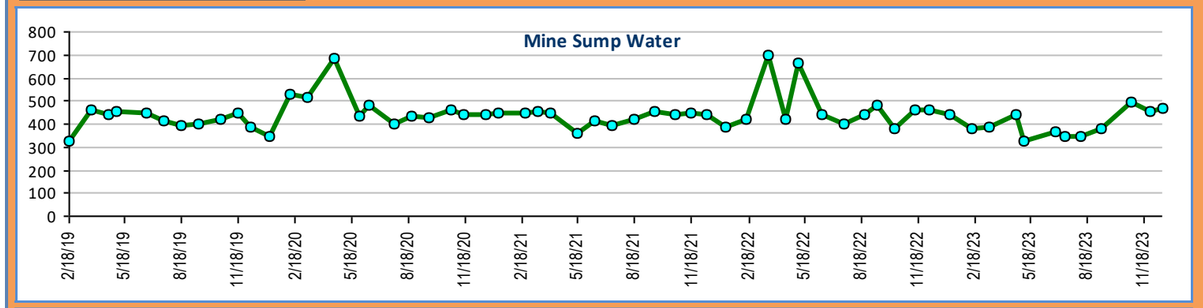


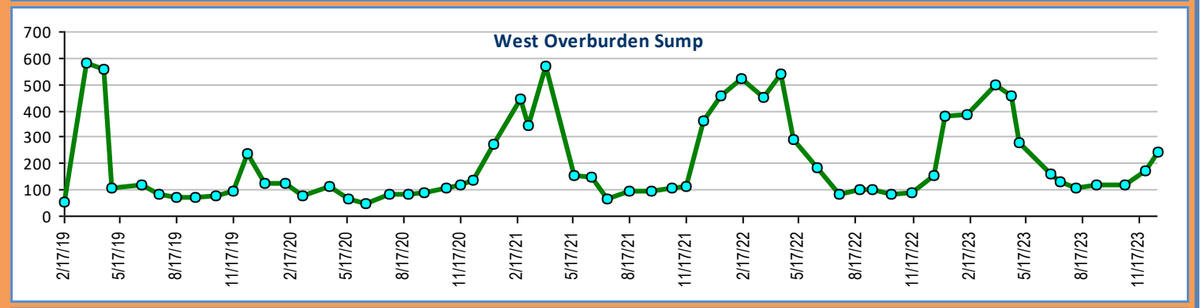
RED DOG MINE

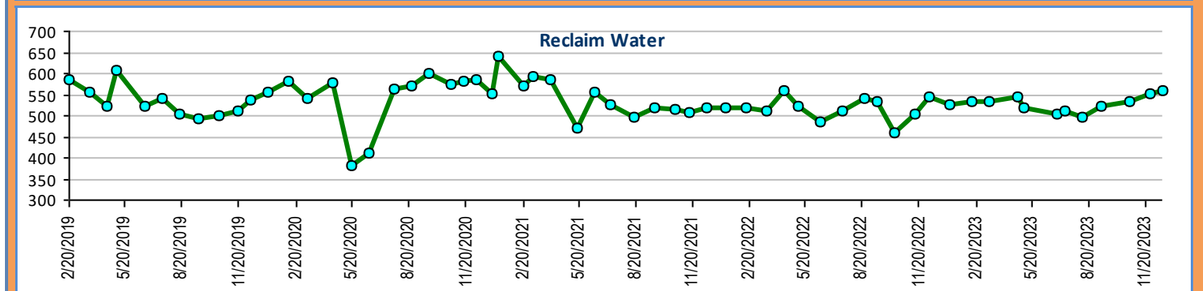
Mine Water Monitoring - Water Quality Profile II, Trend Charts

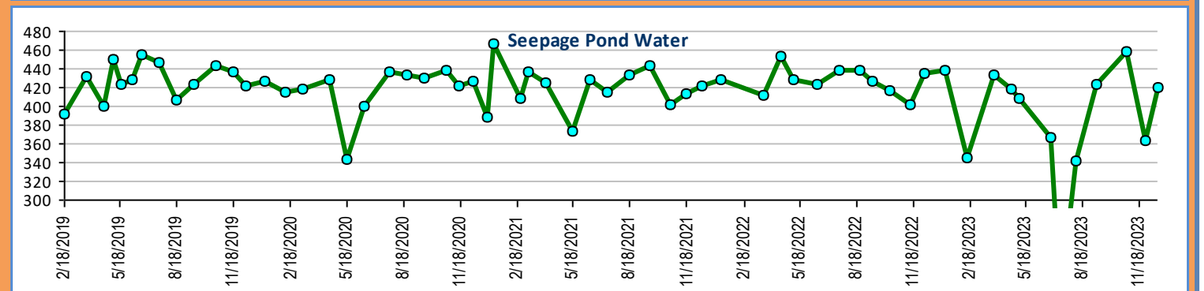
Calcium, dissolved, units mg/L

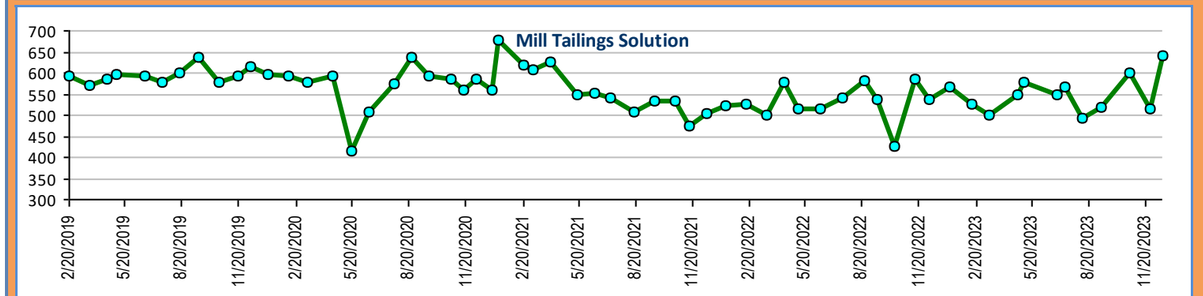


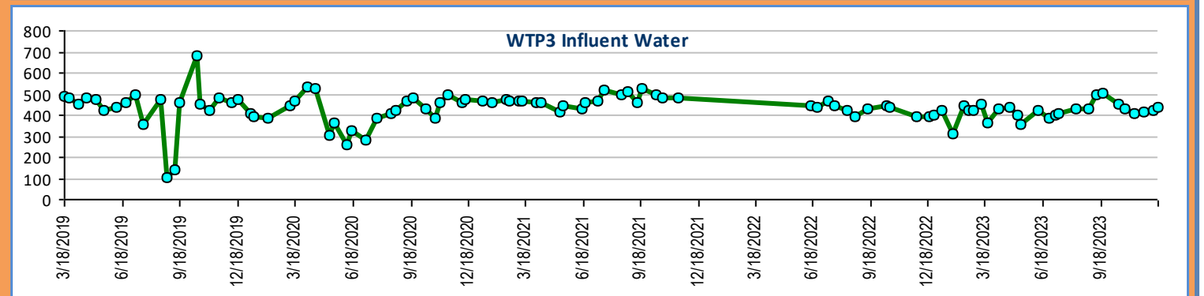


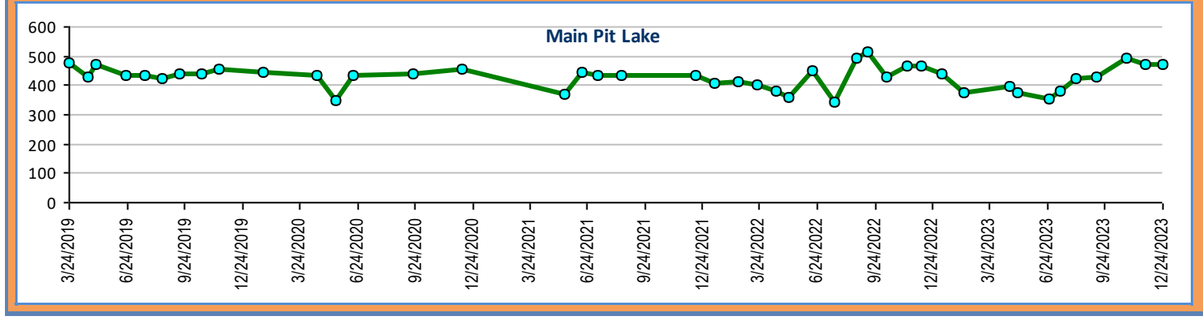


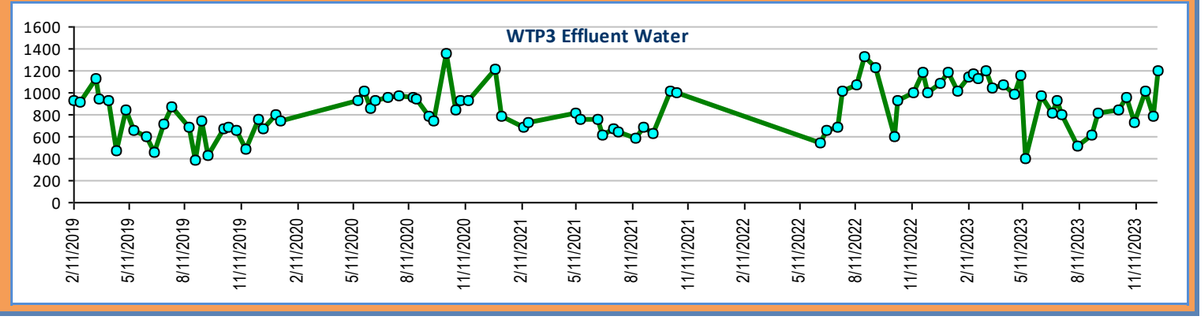








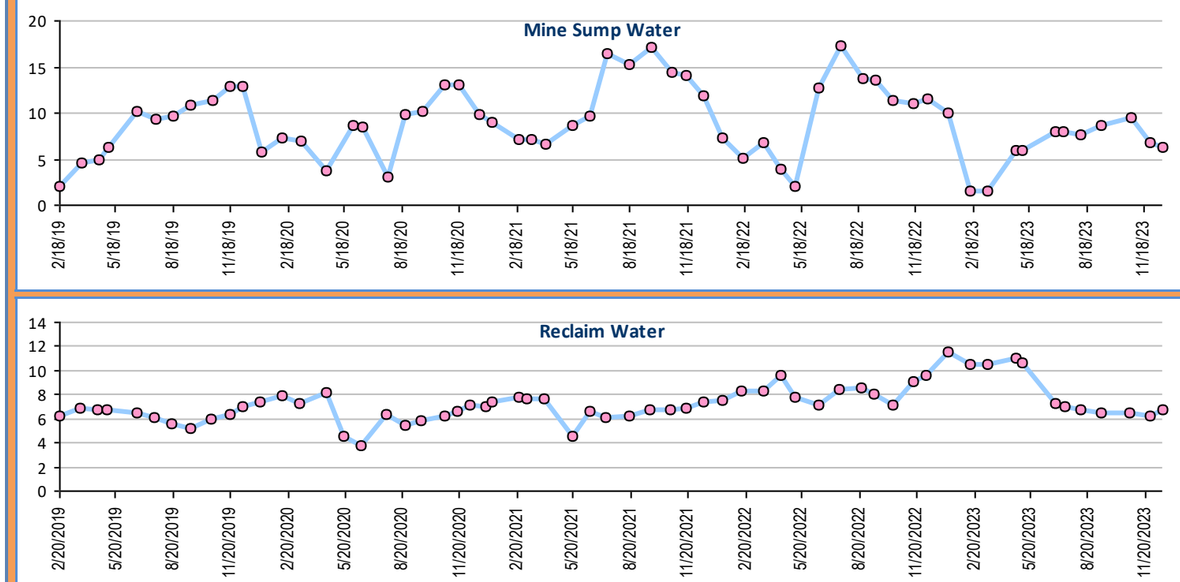


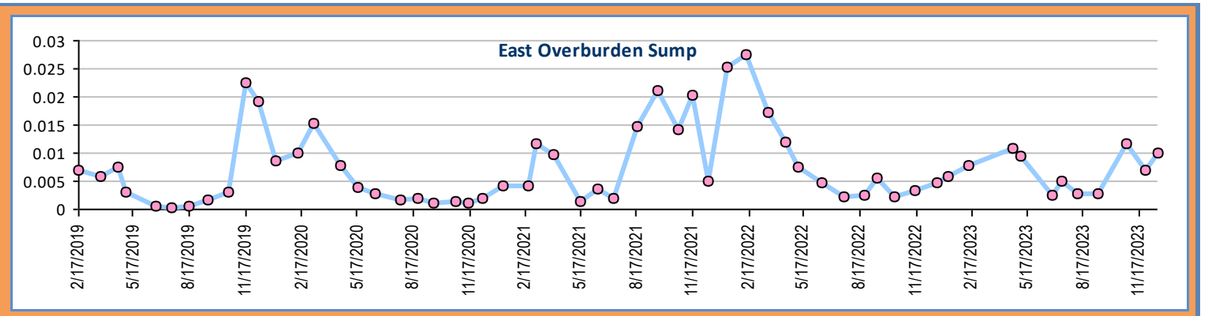


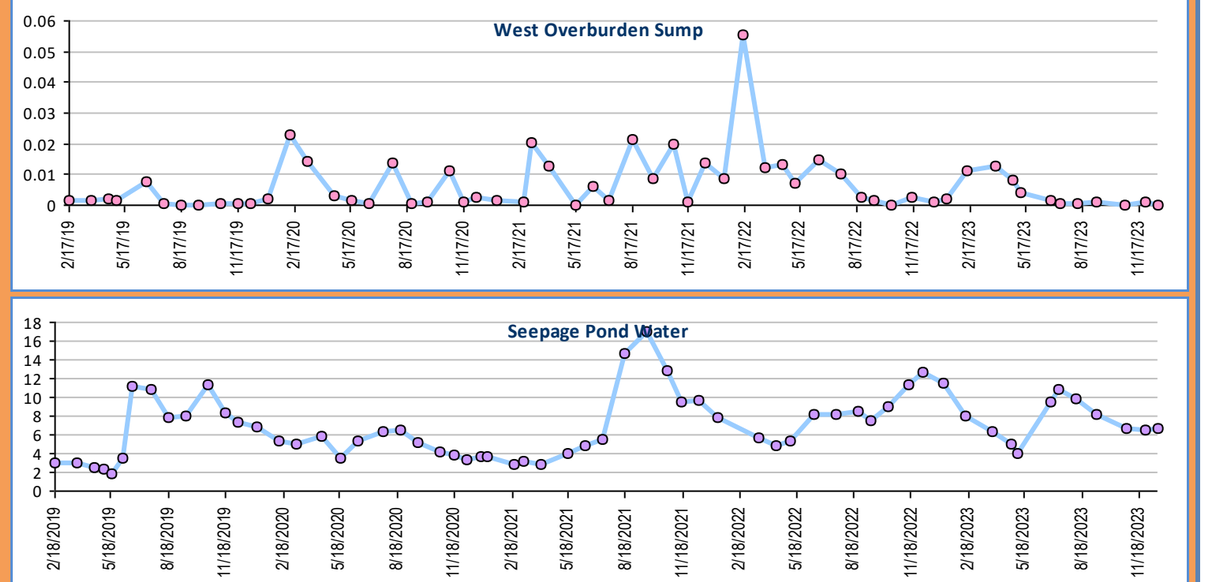
RED DOG MINE

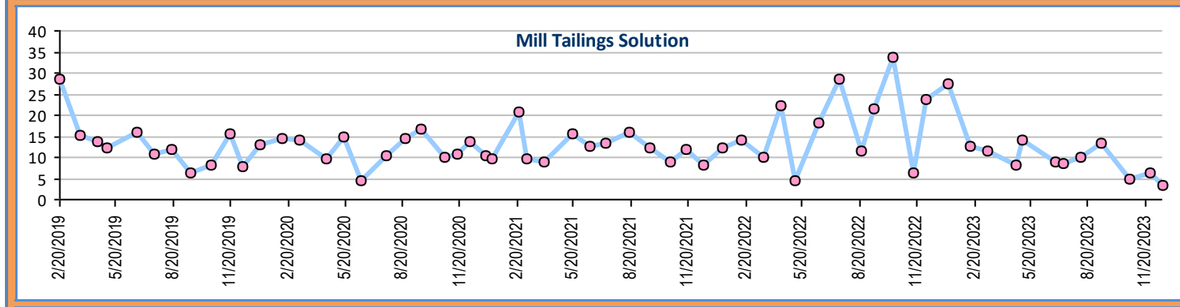
Mine Water Monitoring - Water Quality Profile II, Trend Charts

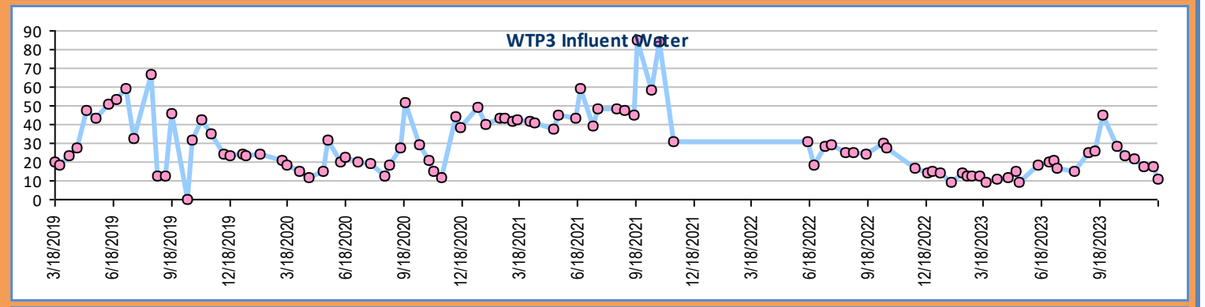
Cadmium, dissolved, units mg/L

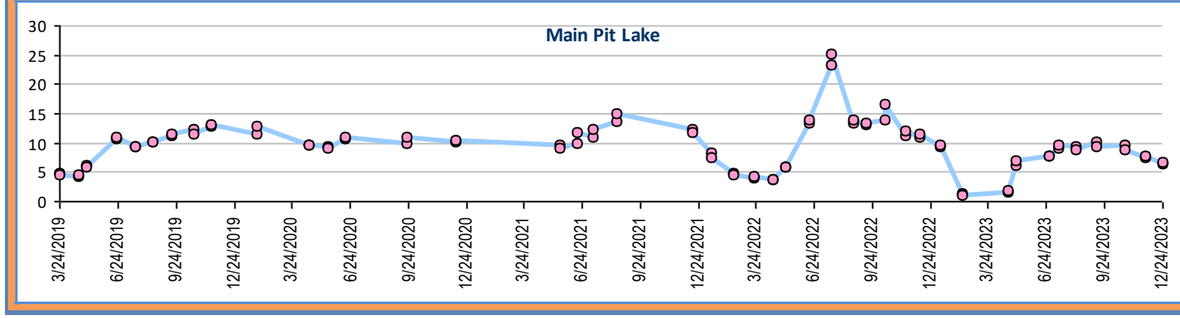


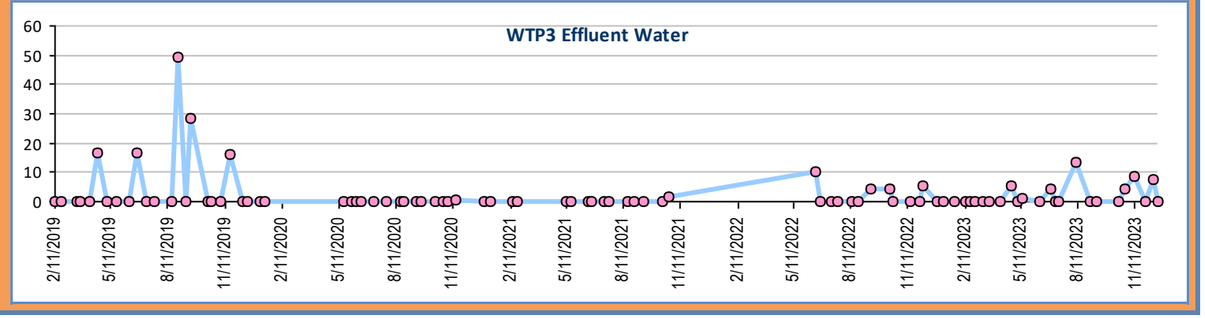








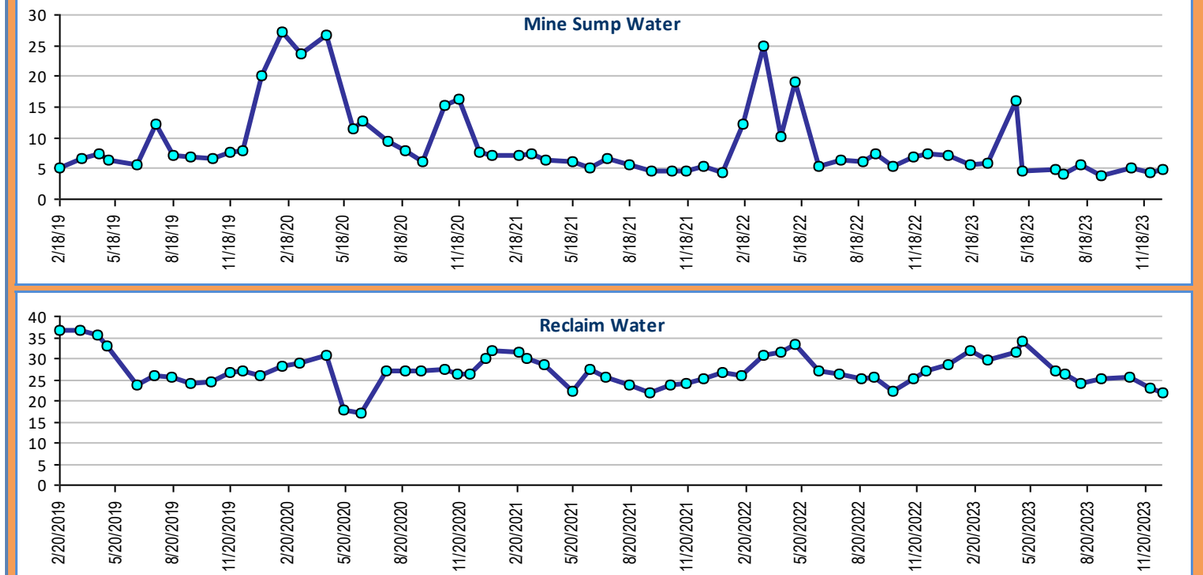


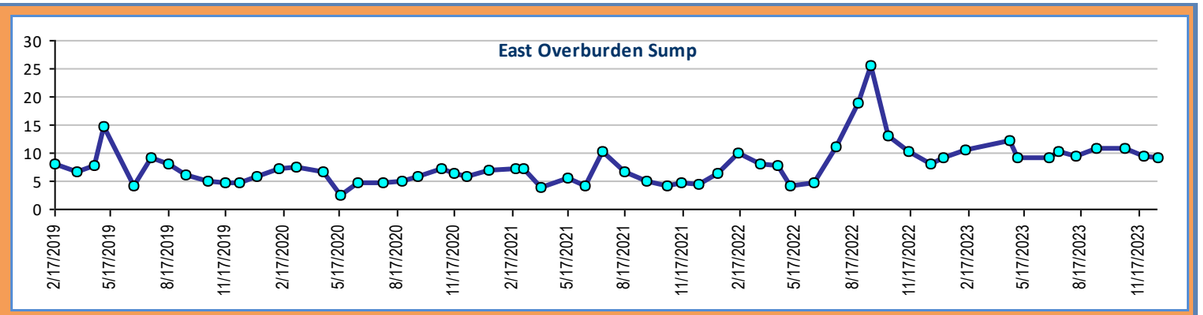


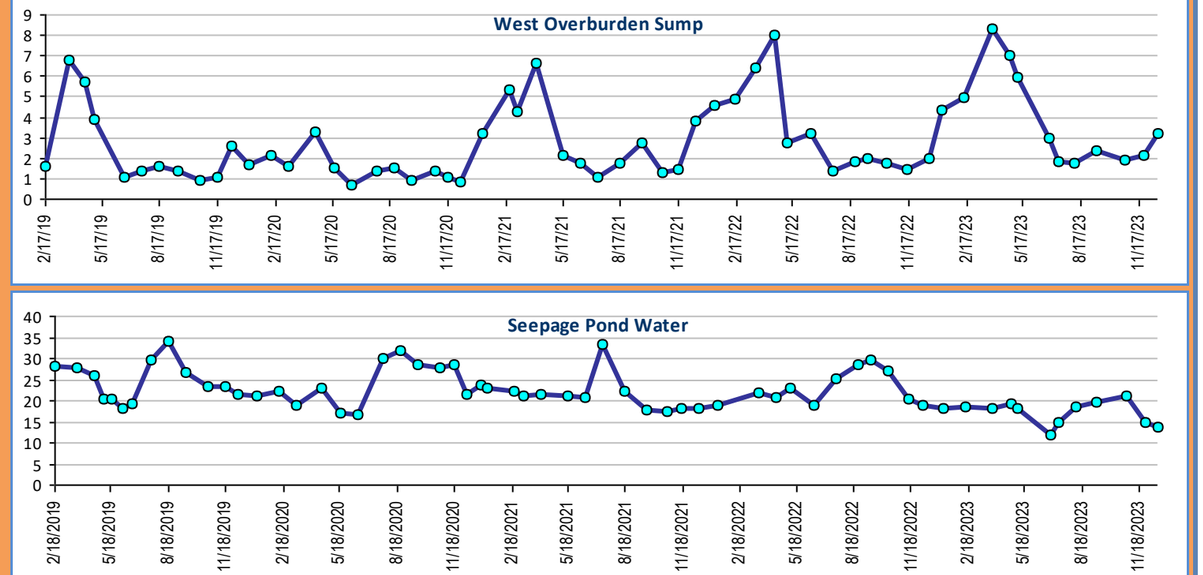
RED DOG MINE

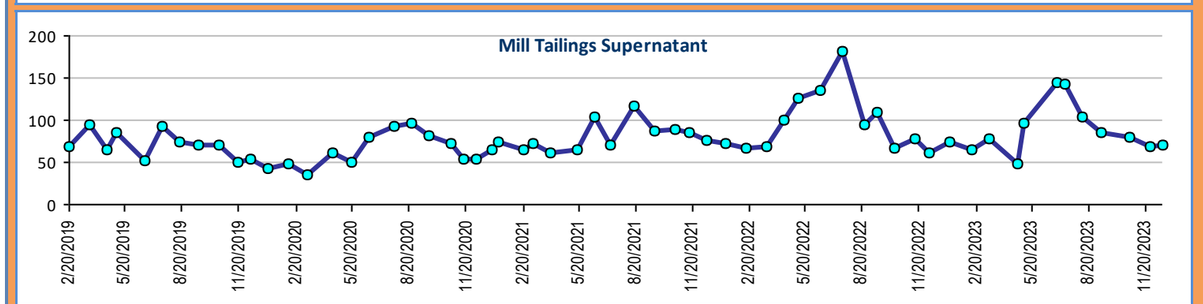
Mine Water Monitoring - Water Quality Profile II, Trend Charts

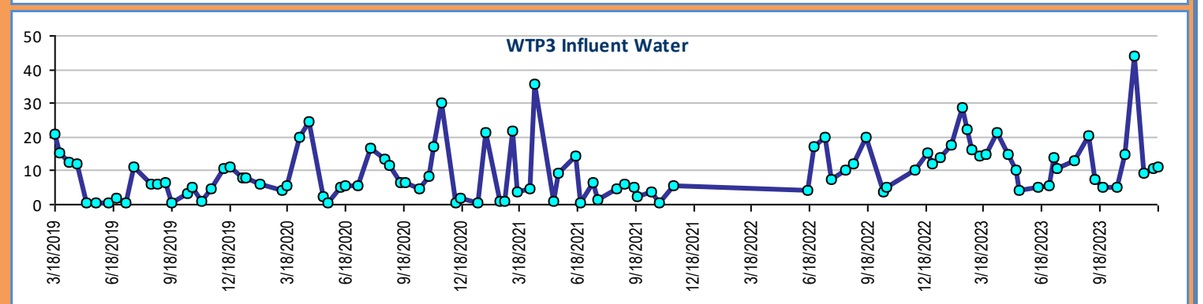
Chloride, dissolved, units mg/L

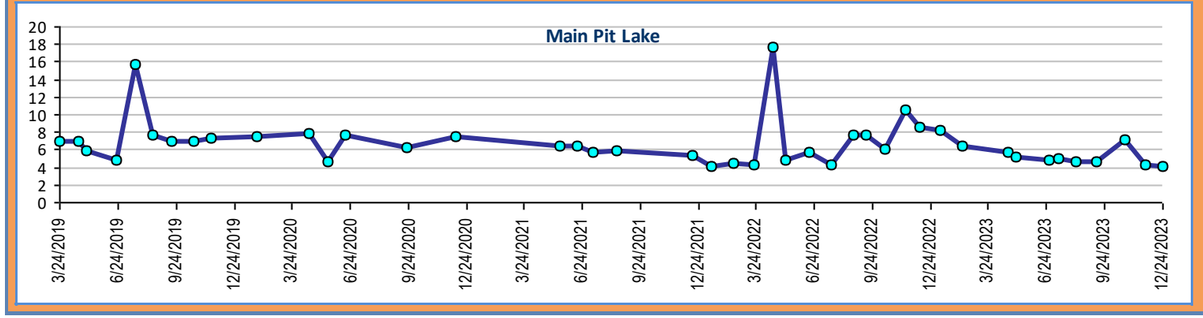


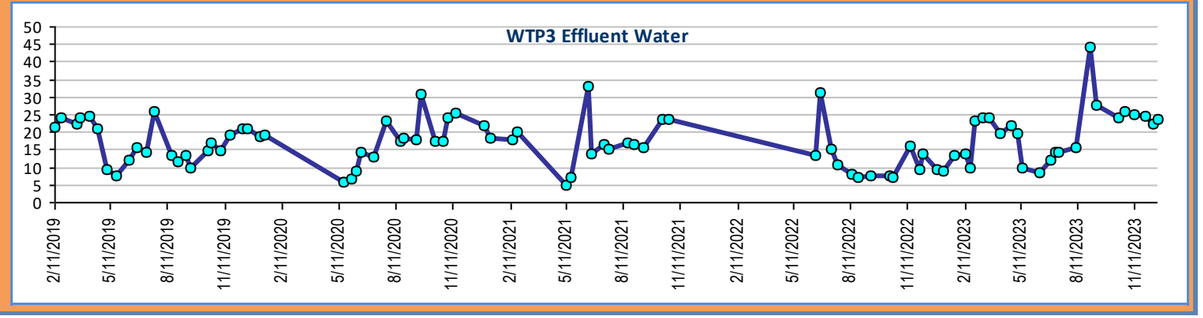








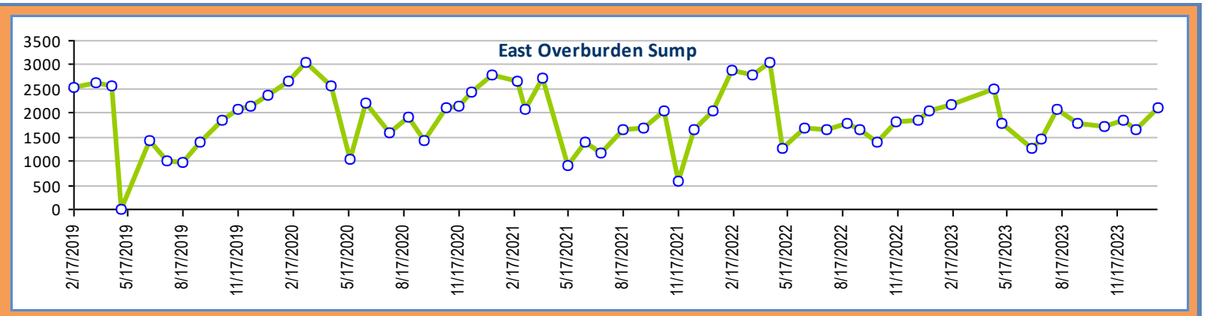


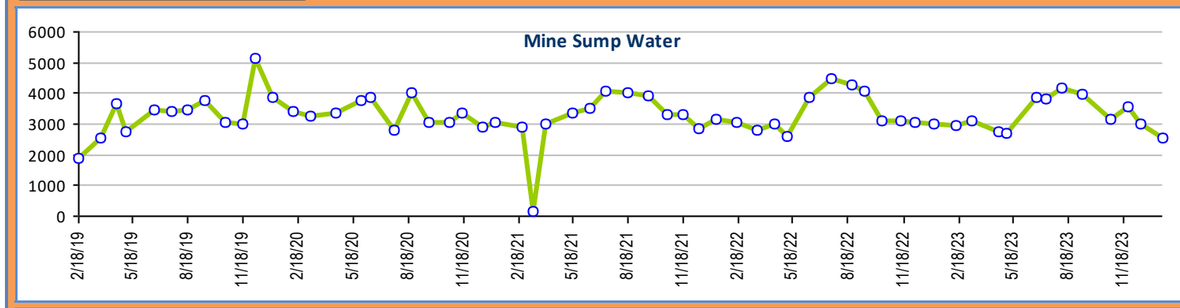


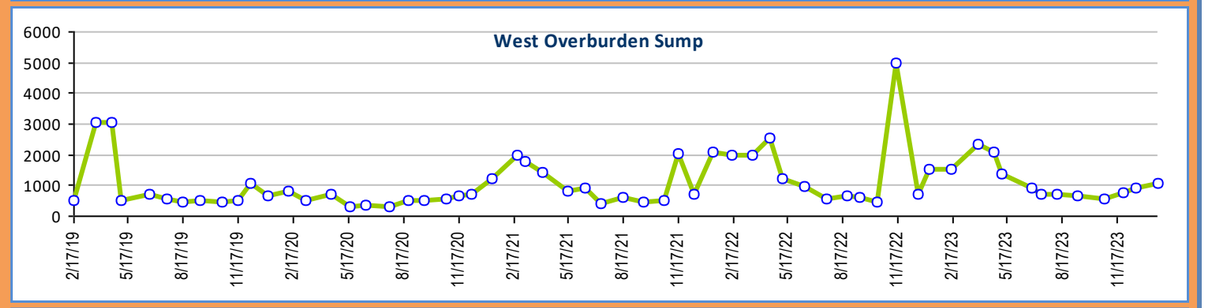
RED DOG MINE

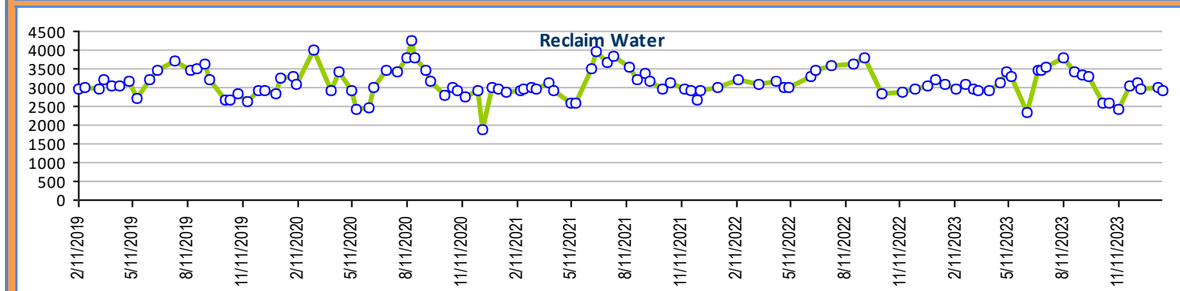
Mine Water Monitoring - Water Quality Profile II, Trend Charts

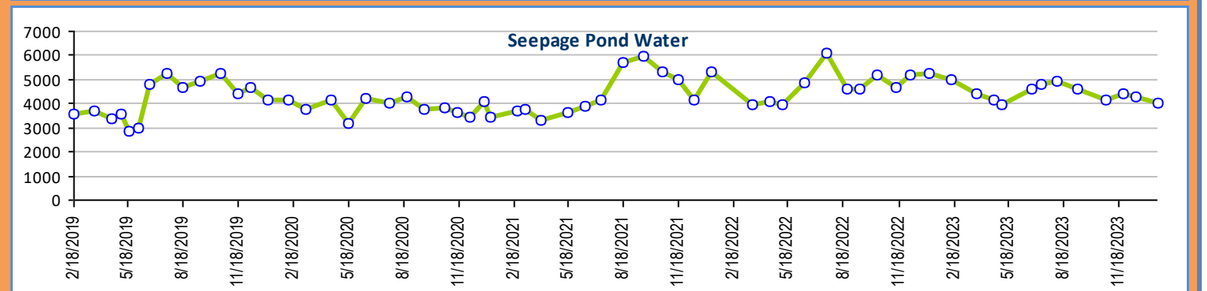
Conductivity, units uS/cm

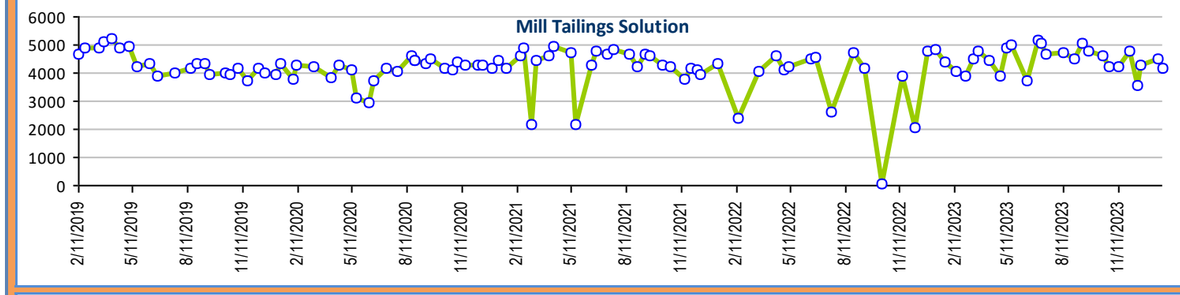


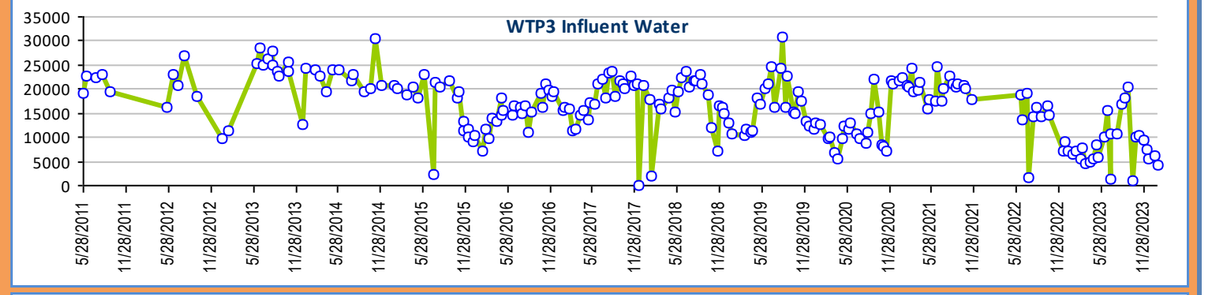


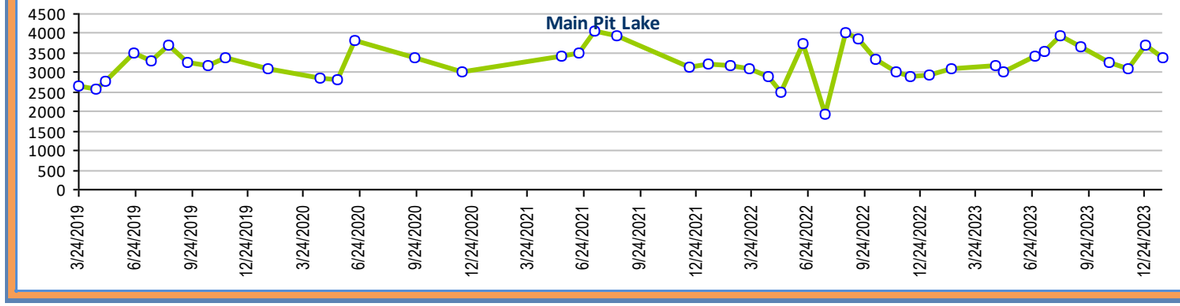


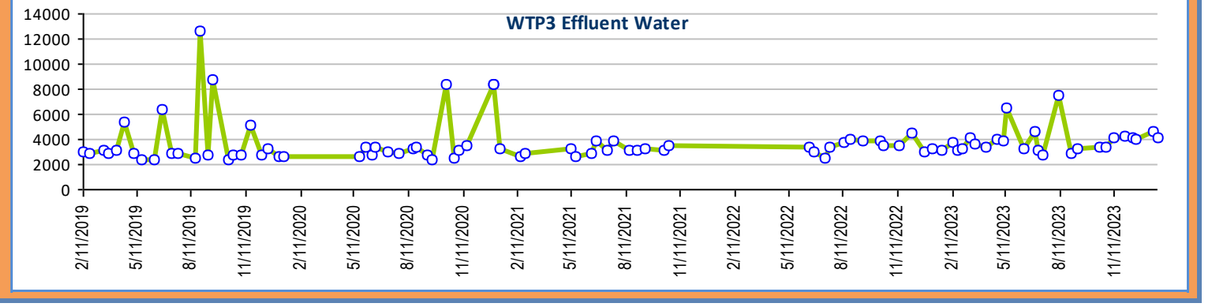








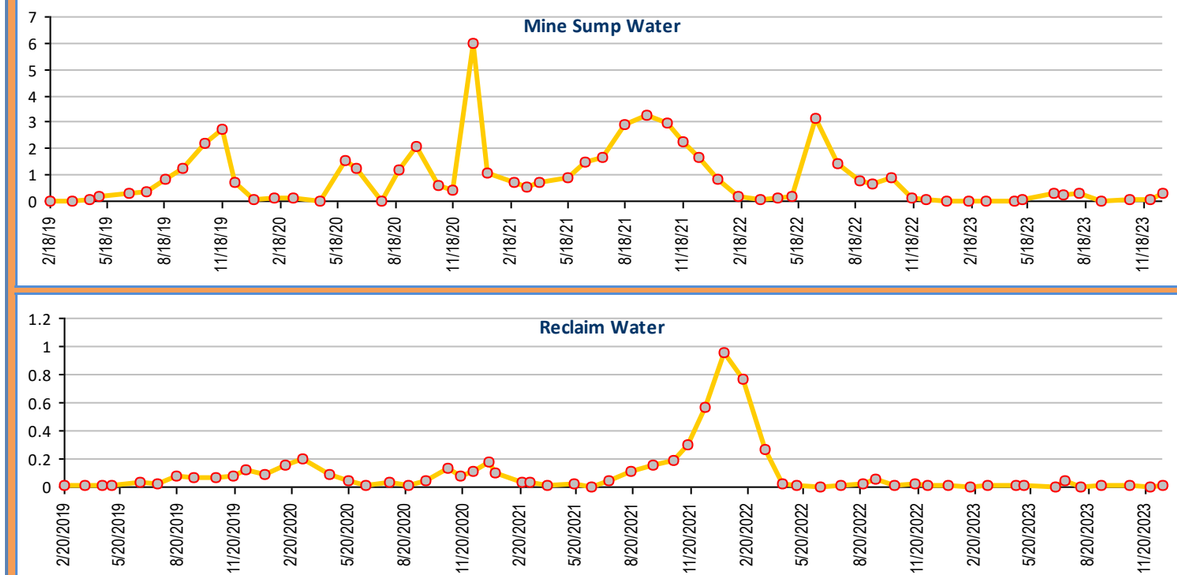


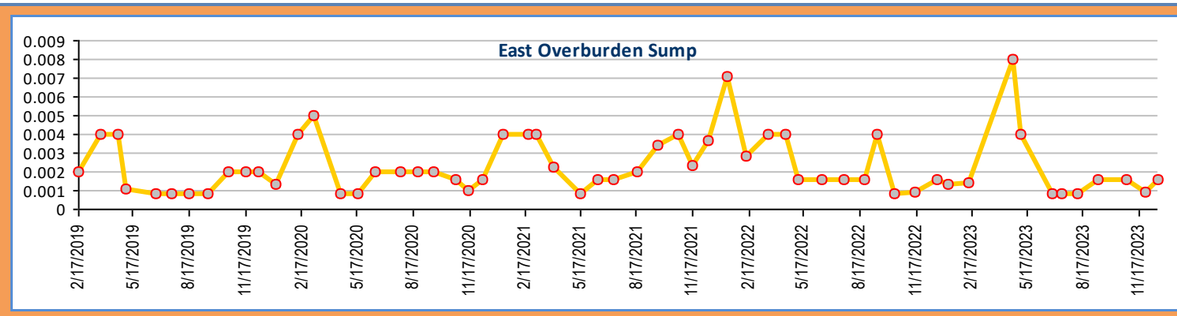


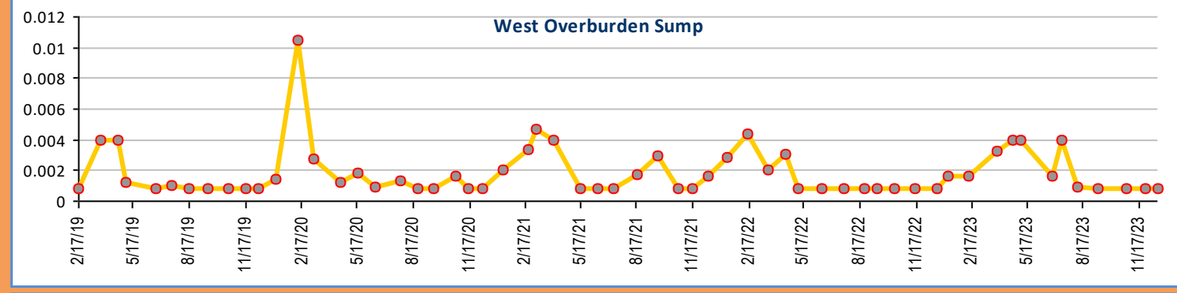
RED DOG MINE

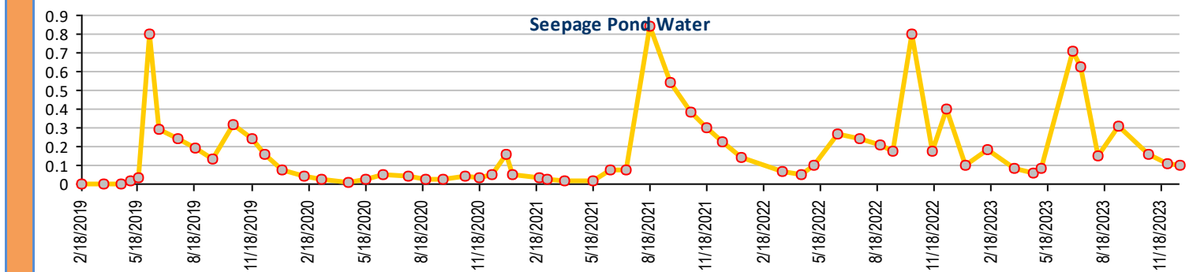
Mine Water Monitoring - Water Quality Profile II, Trend Charts

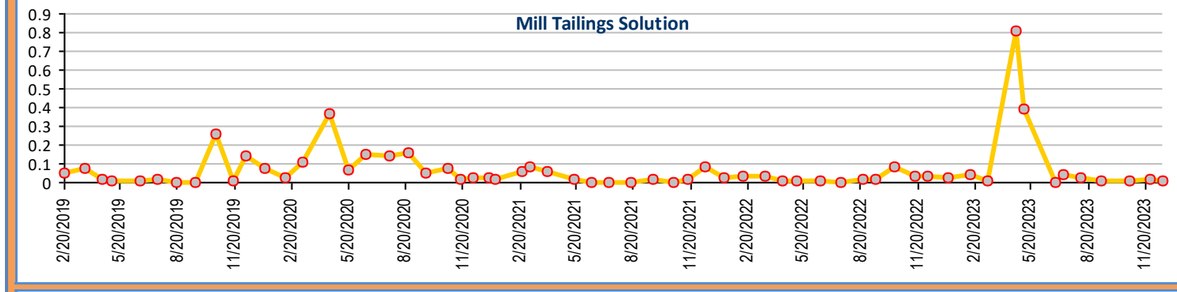
Copper, dissolved, units mg/L

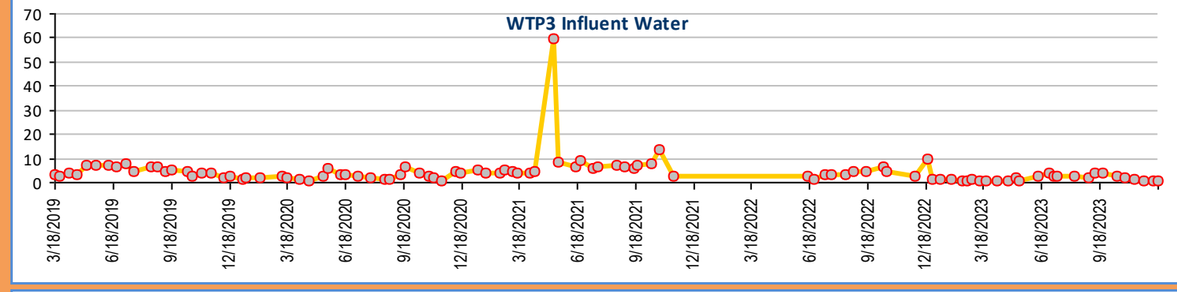


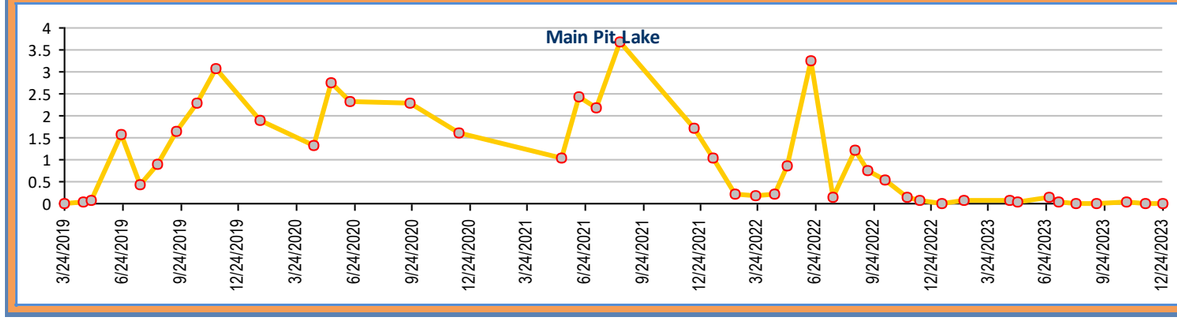


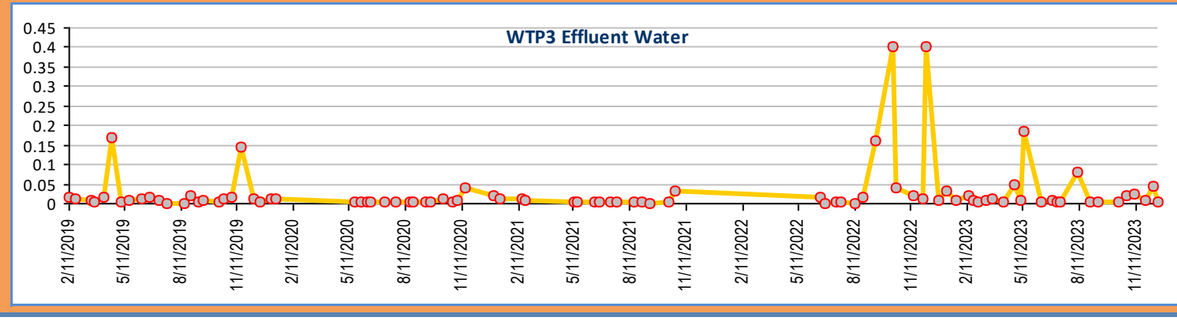








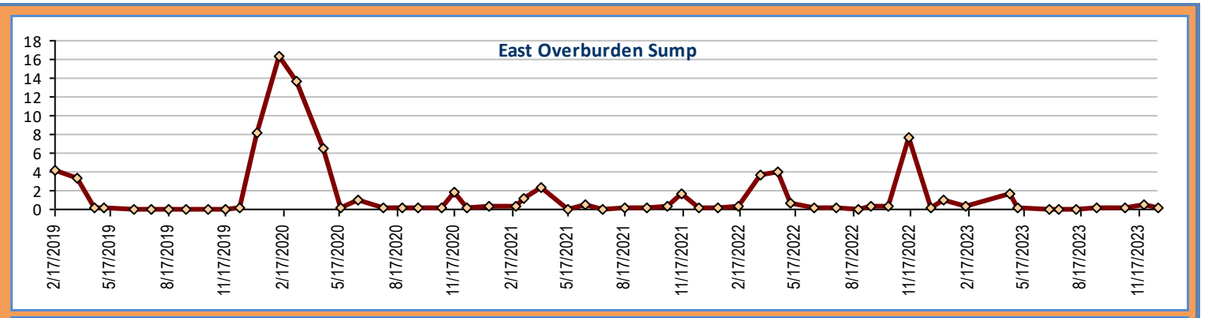


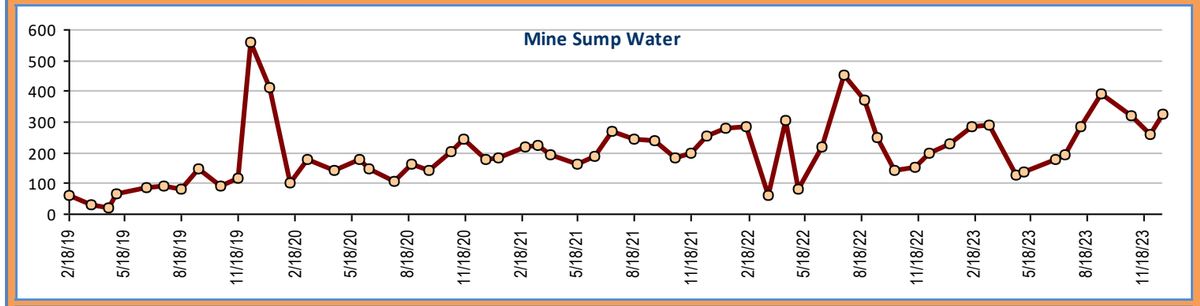


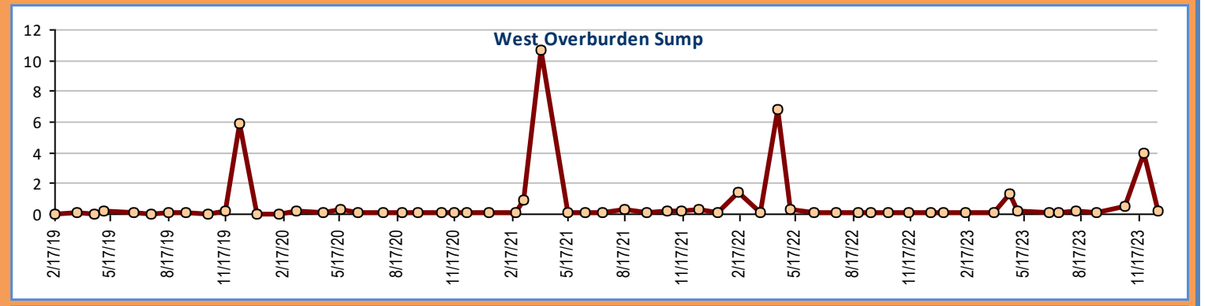
RED DOG MINE

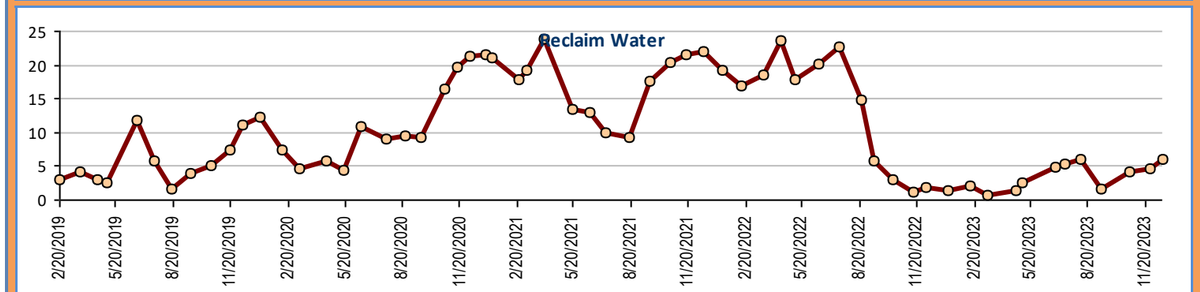
Mine Water Monitoring - Water Quality Profile II, Trend Charts

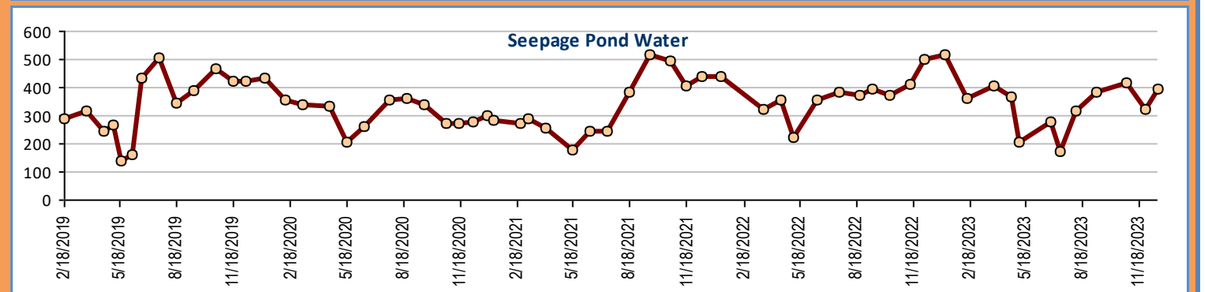
Iron, dissolved, units mg/L

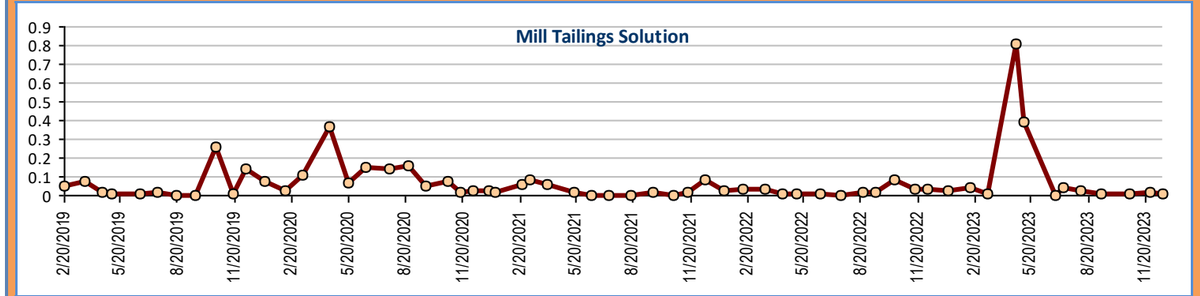


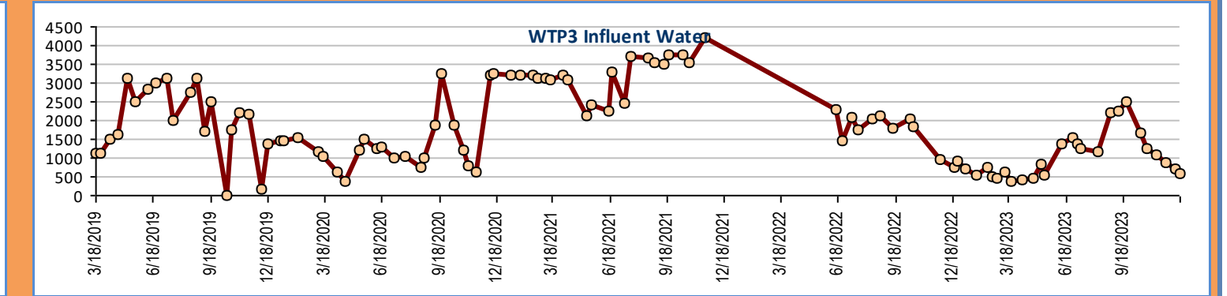


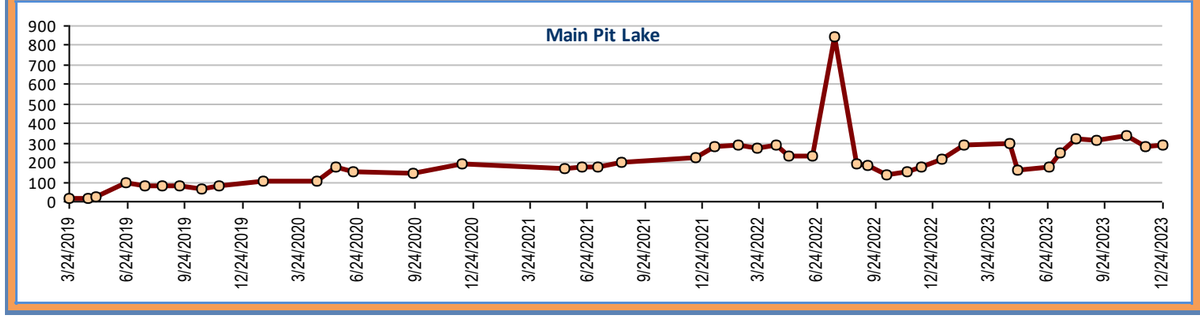


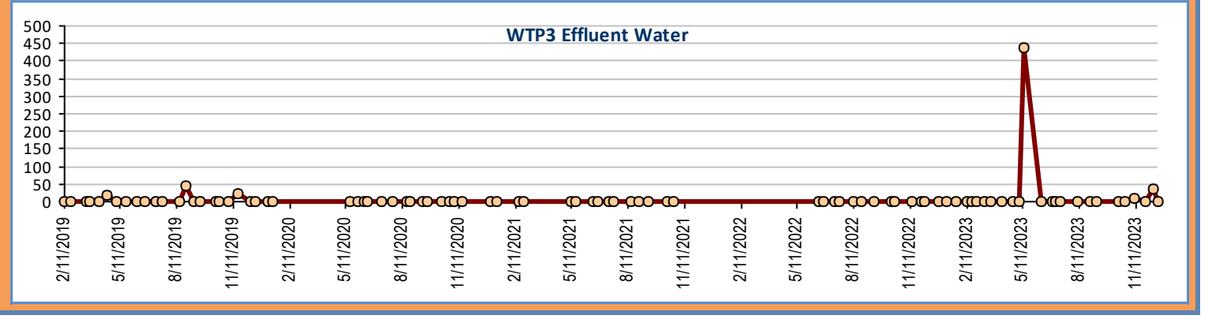








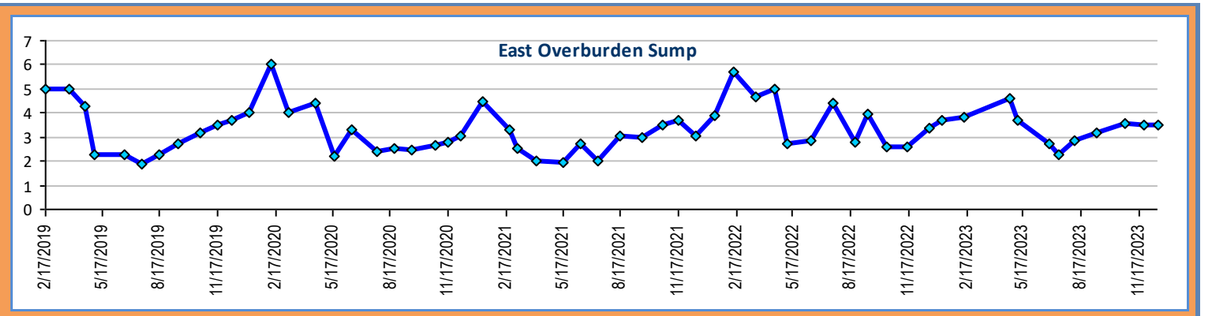


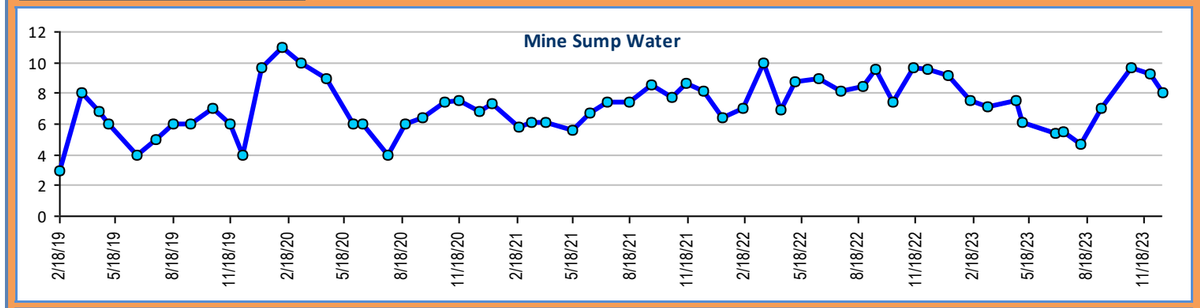


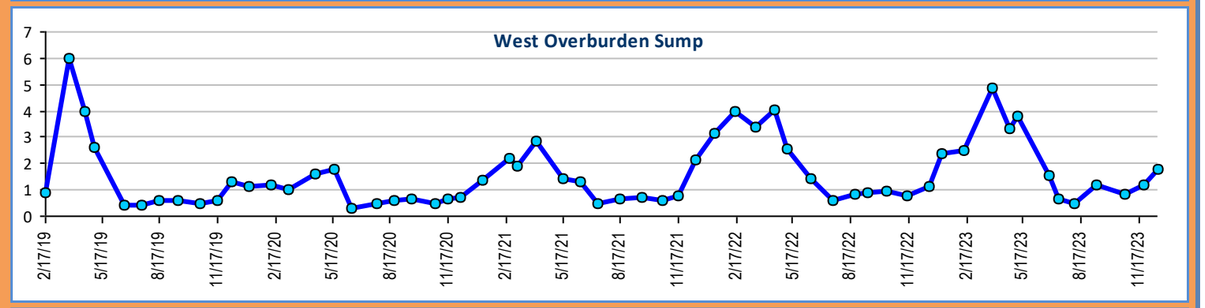
RED DOG MINE

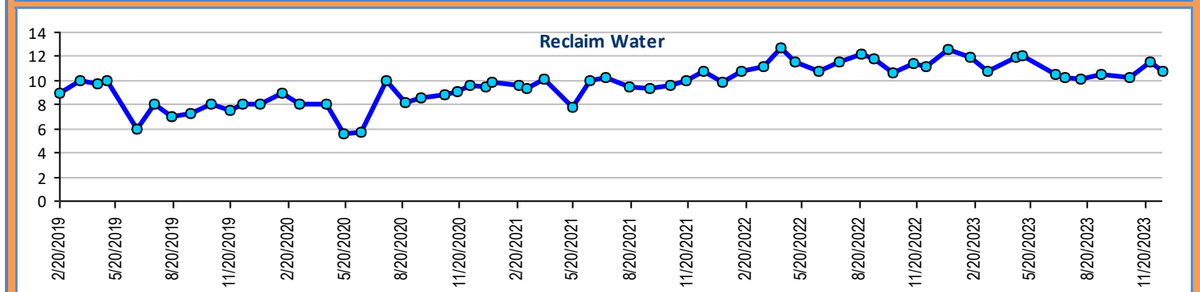
Mine Water Monitoring - Water Quality Profile II, Trend Charts

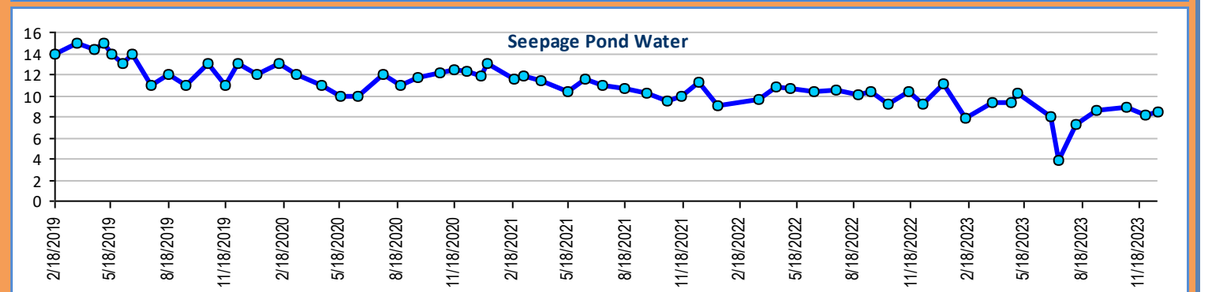
Potassium, dissolved, units mg/L

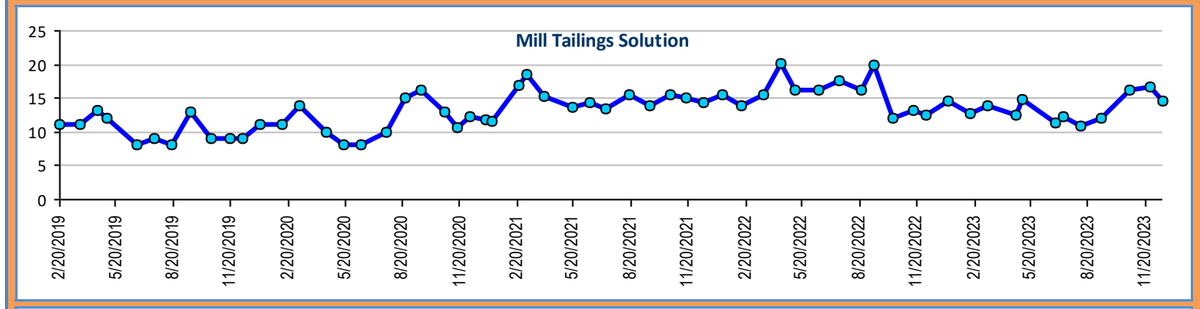


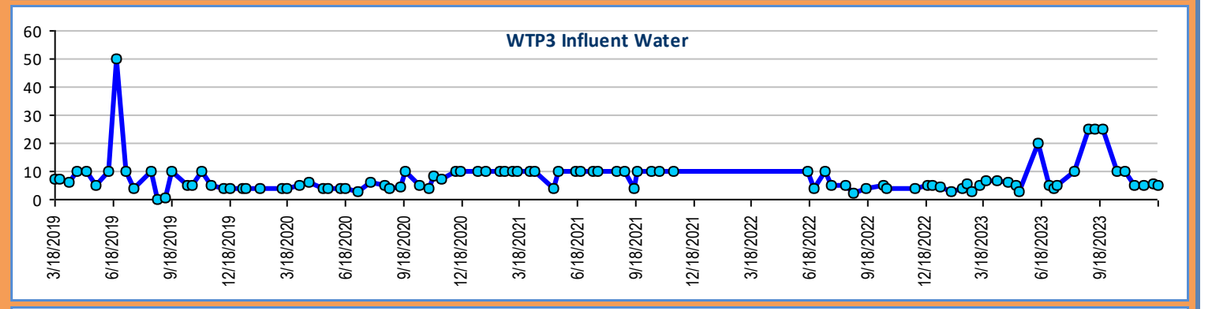


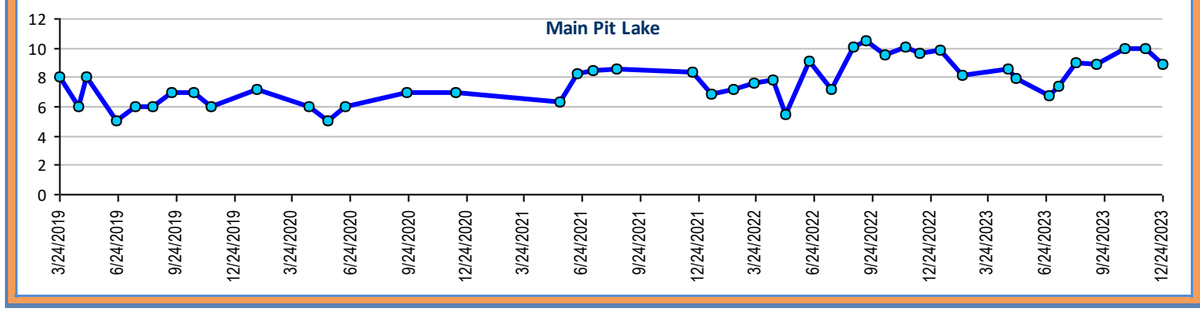


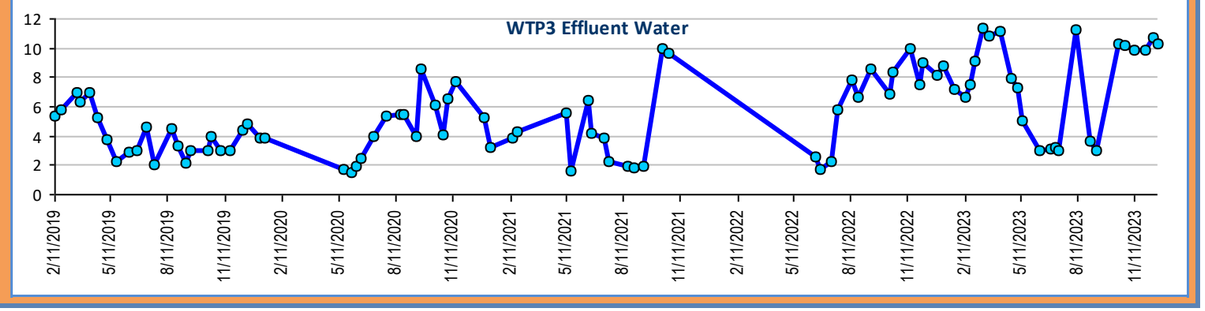








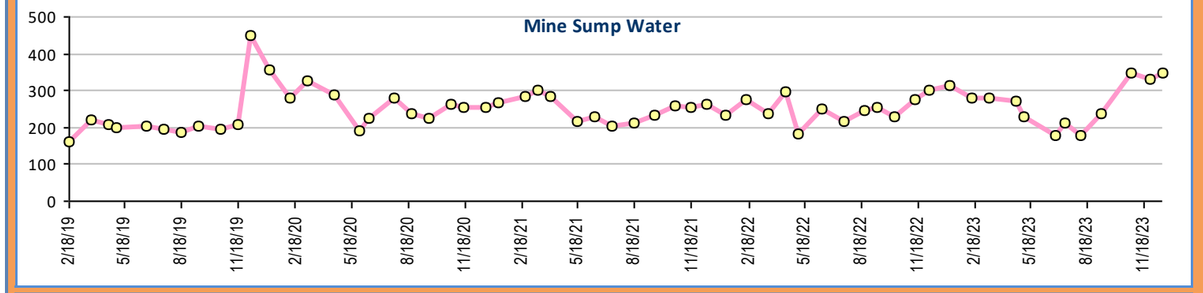


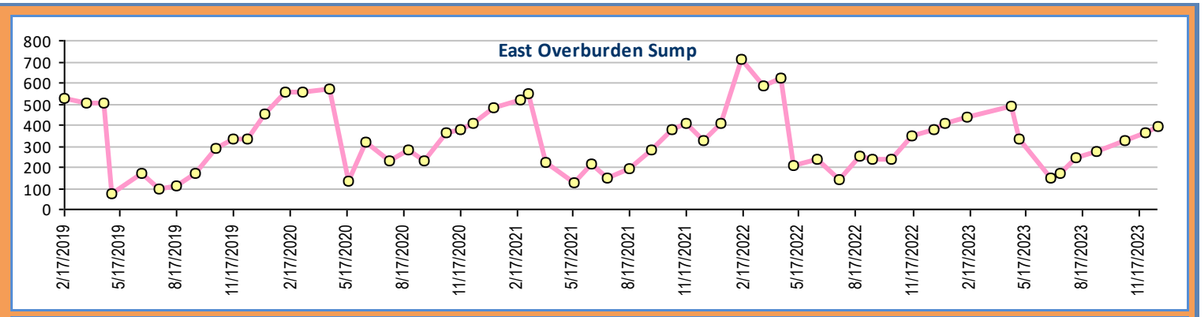


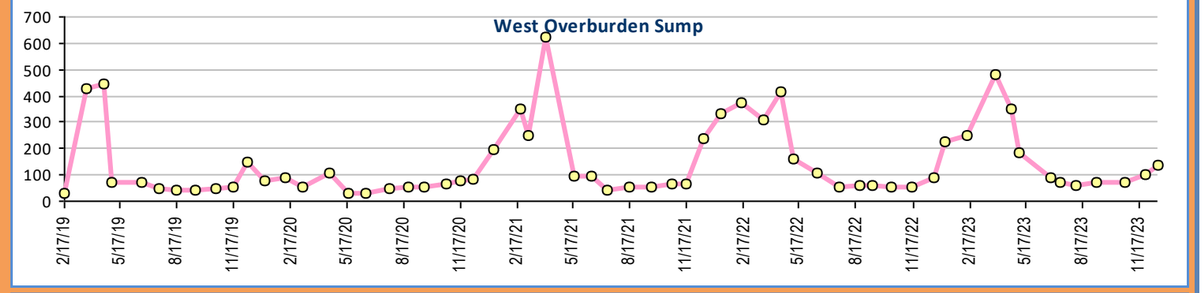
RED DOG MINE

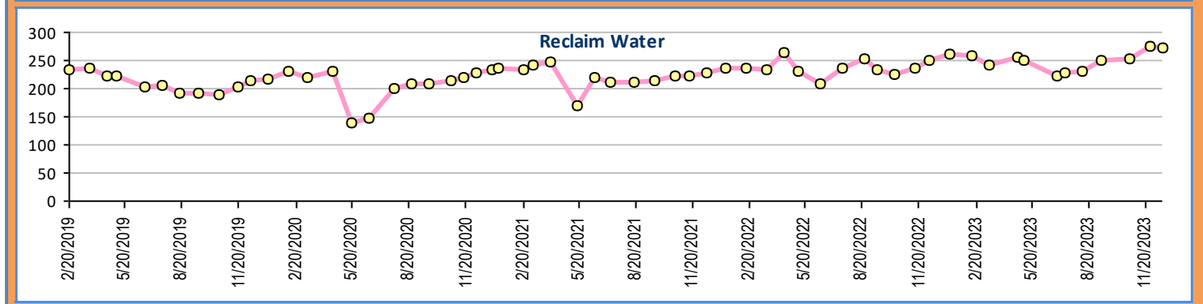
Mine Water Monitoring - Water Quality Profile II, Trend Charts

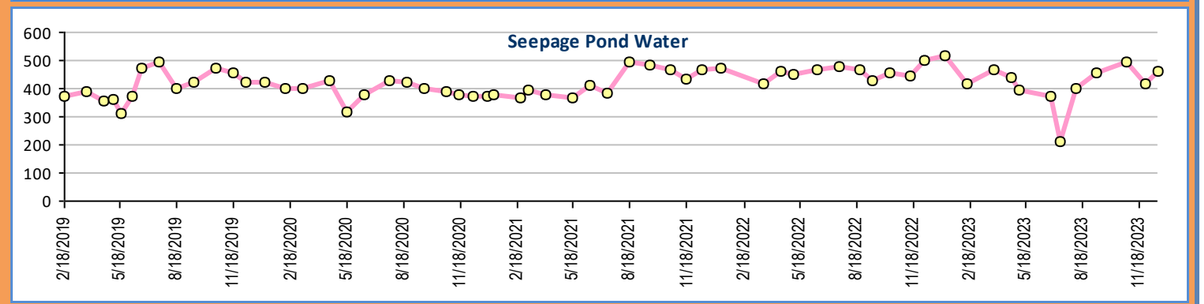
Magnesium, dissolved, units mg/L

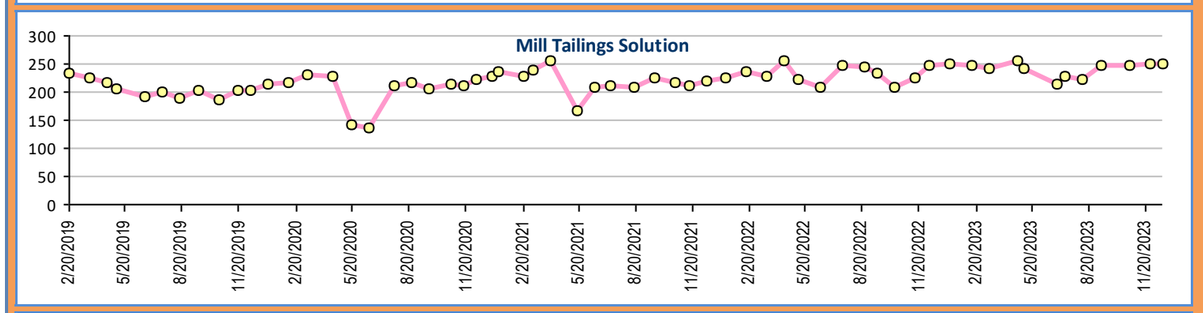


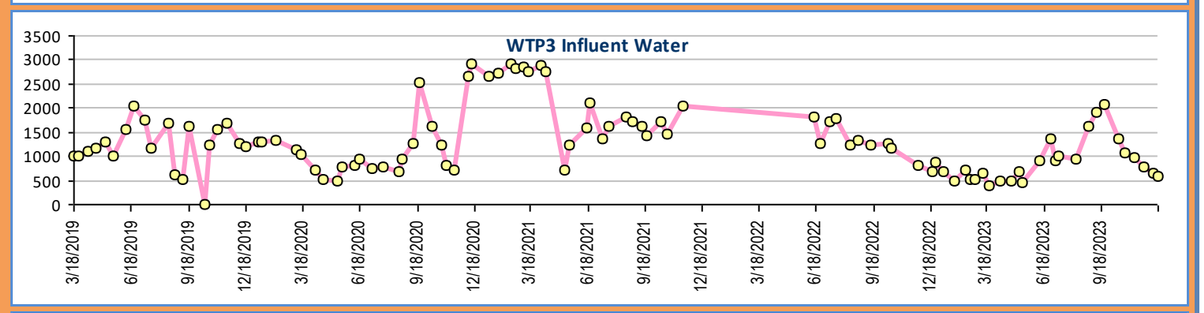


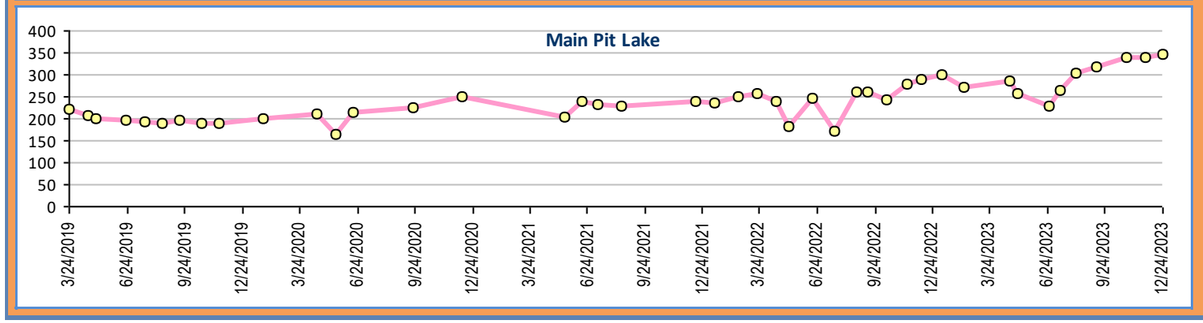


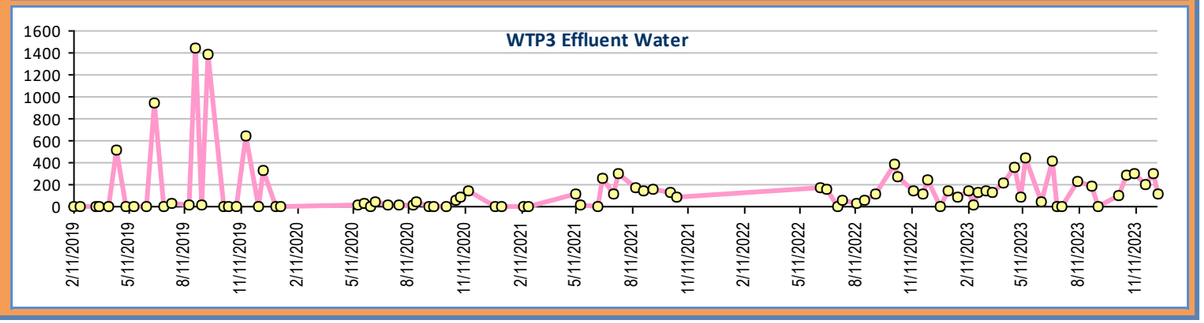








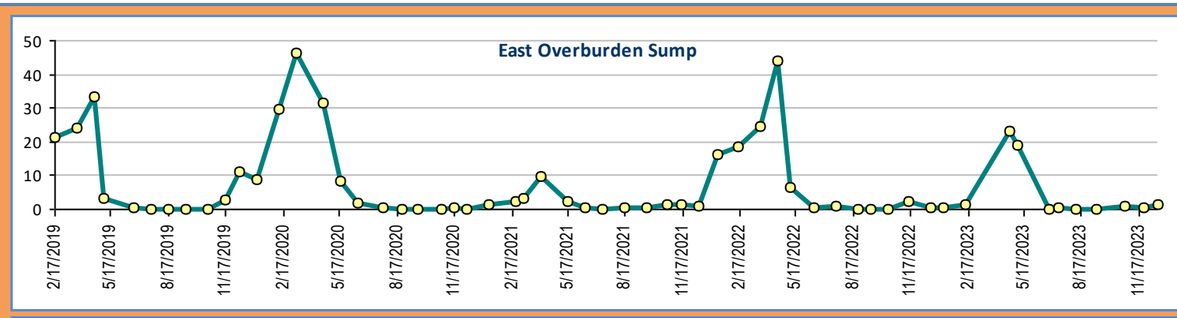


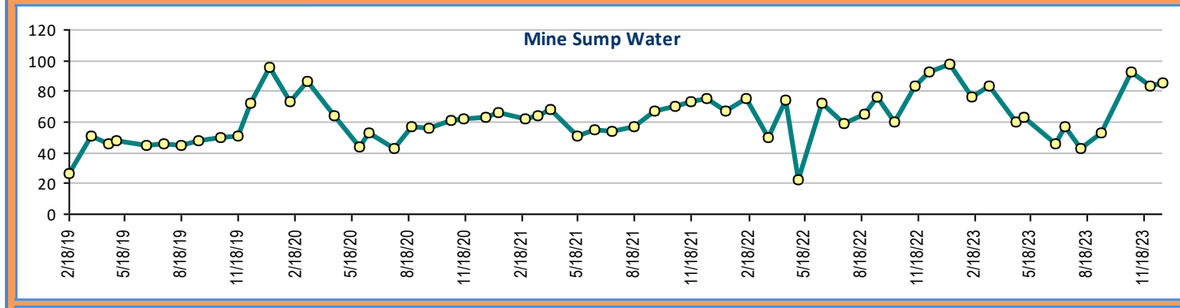


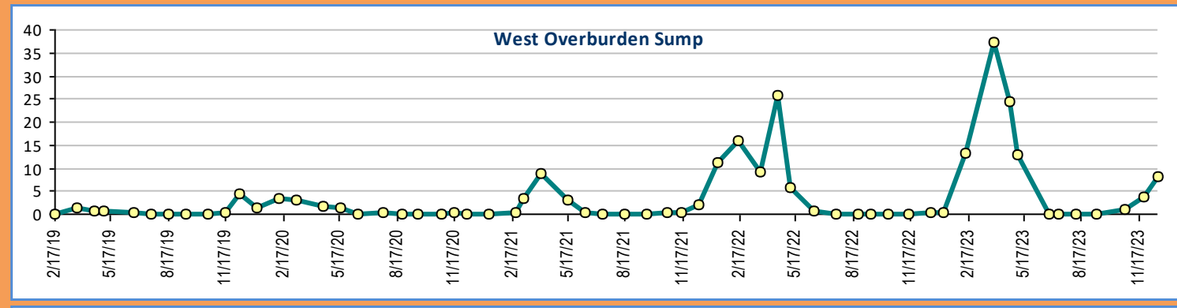
RED DOG MINE

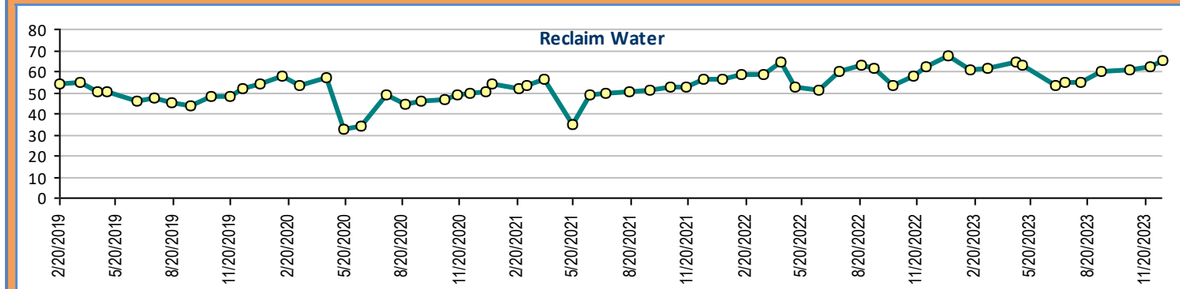
Mine Water Monitoring - Water Quality Profile II, Trend Charts

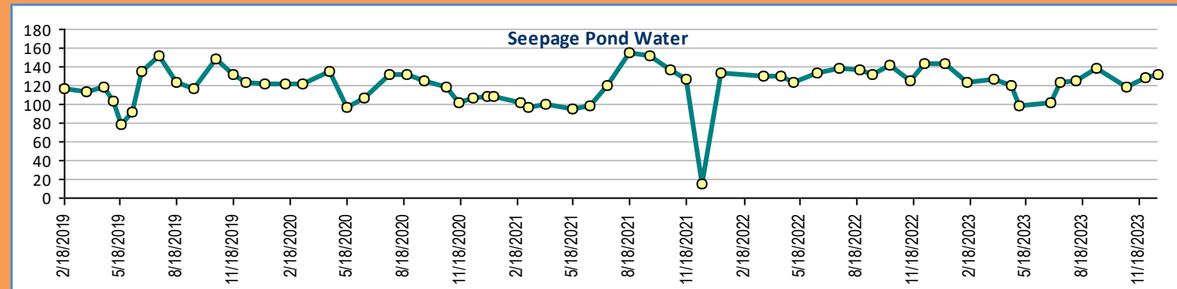
Manganese, dissolved, units mg/L

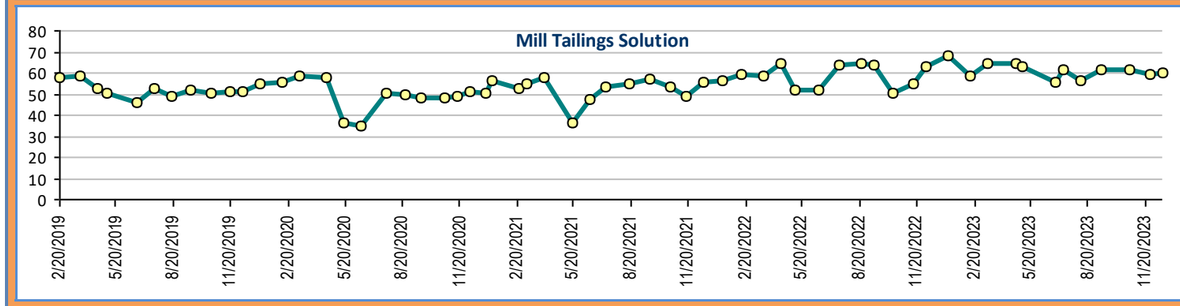


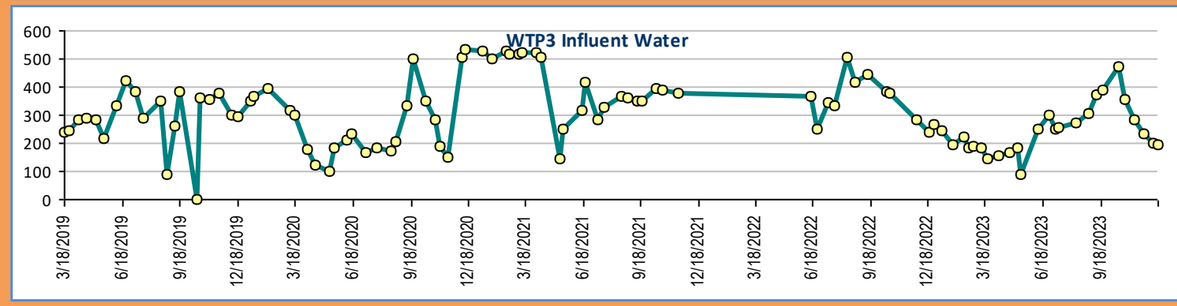


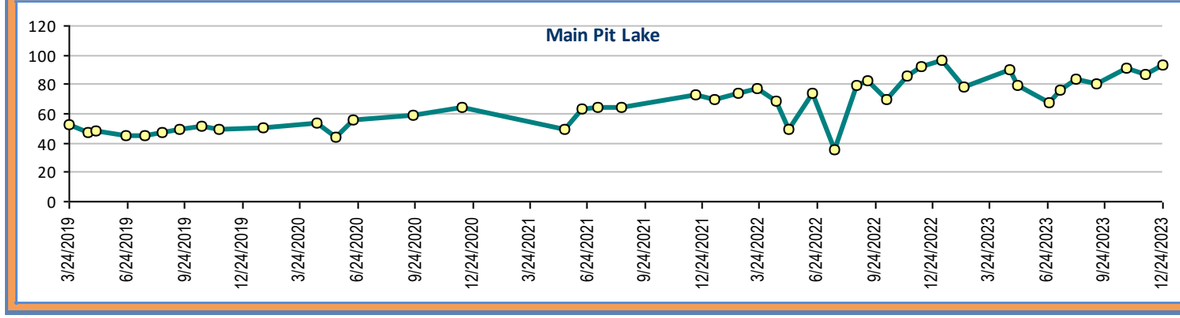


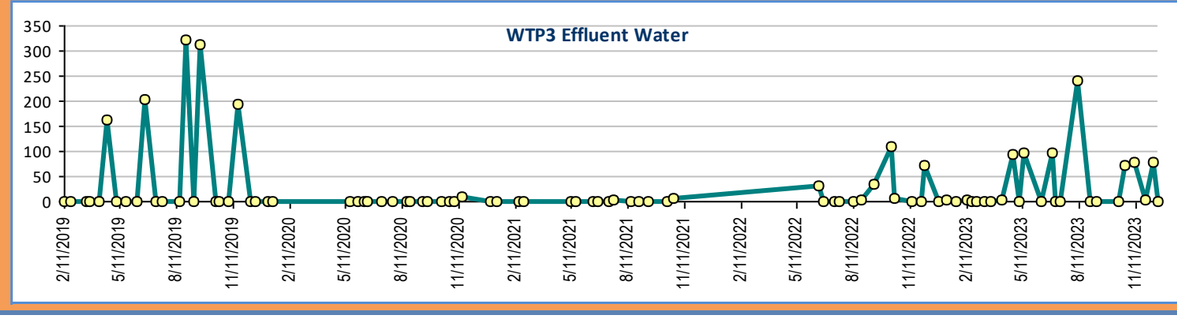








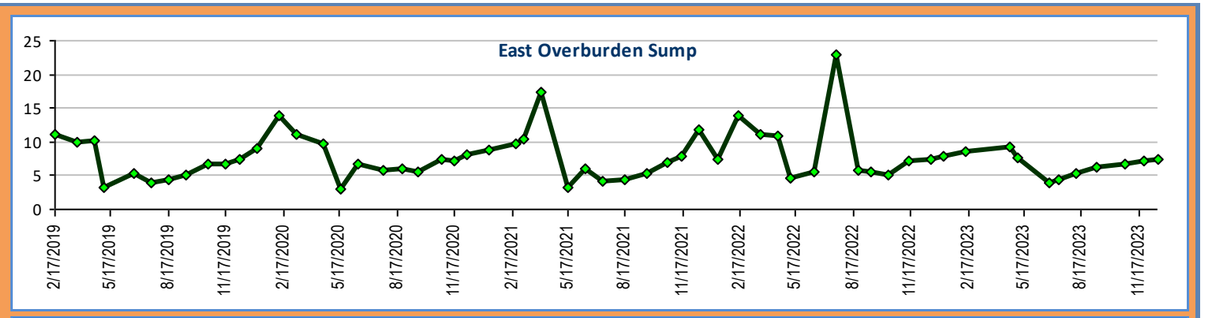


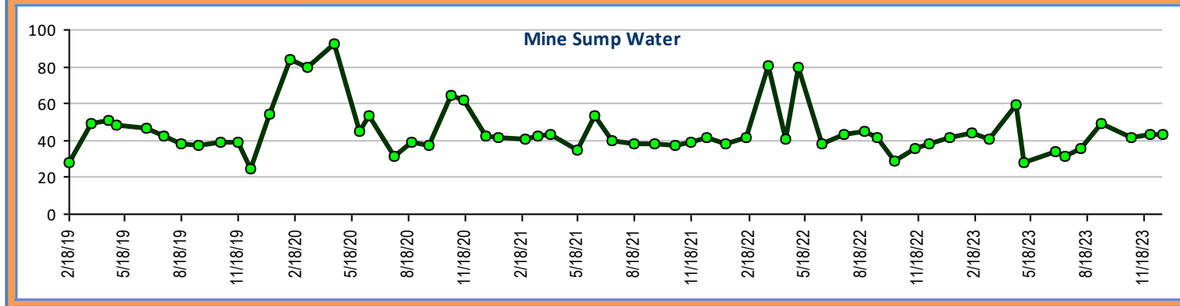


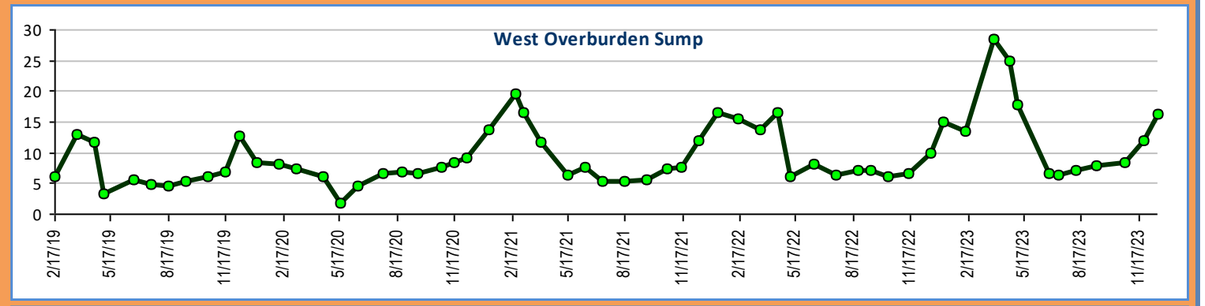
RED DOG MINE

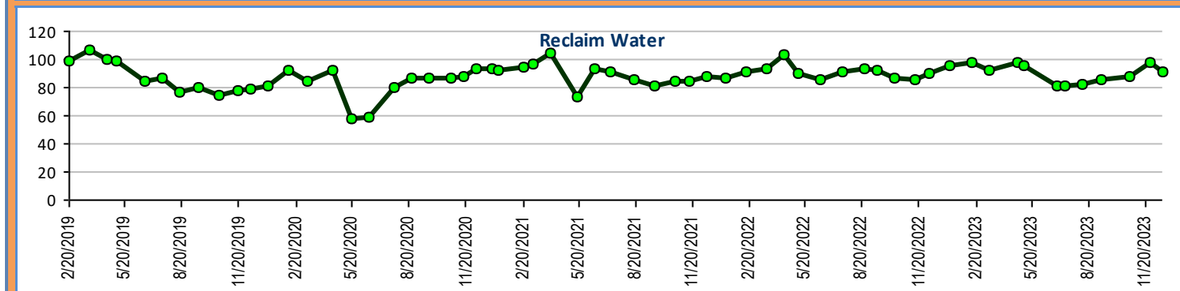
Mine Water Monitoring - Water Quality Profile II, Trend Charts

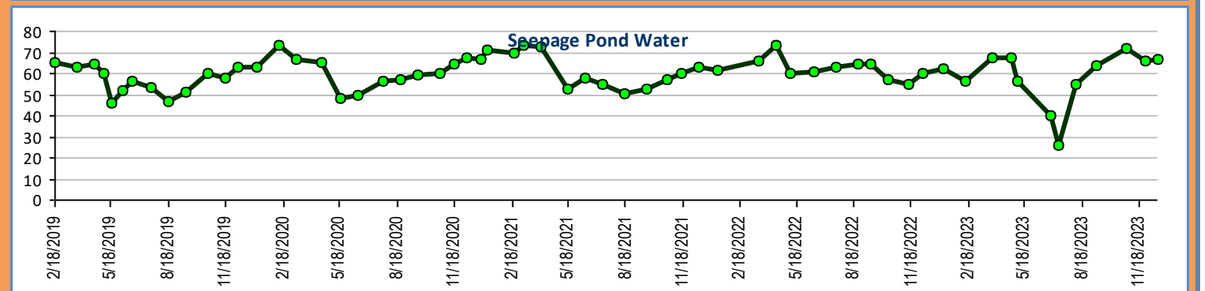
Sodium, dissolved, units mg/L

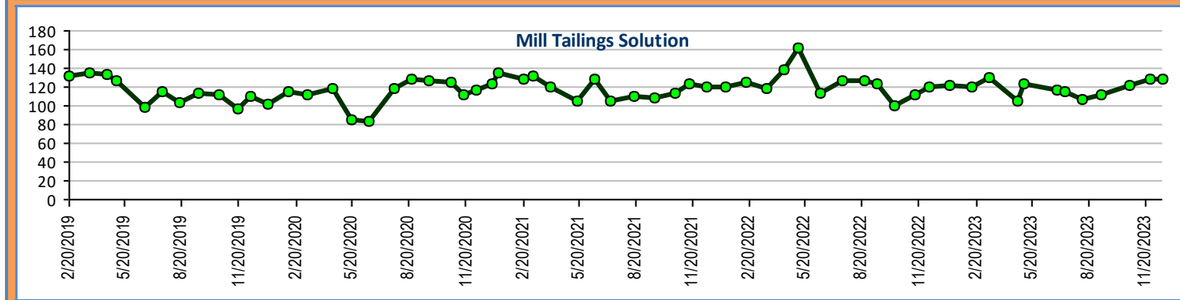


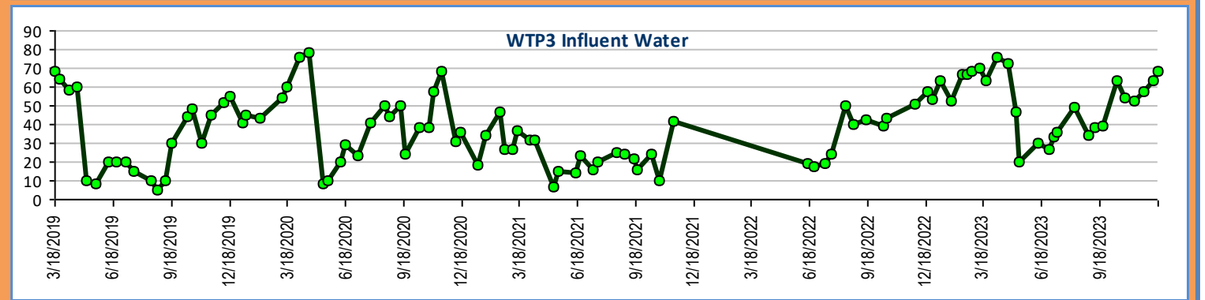


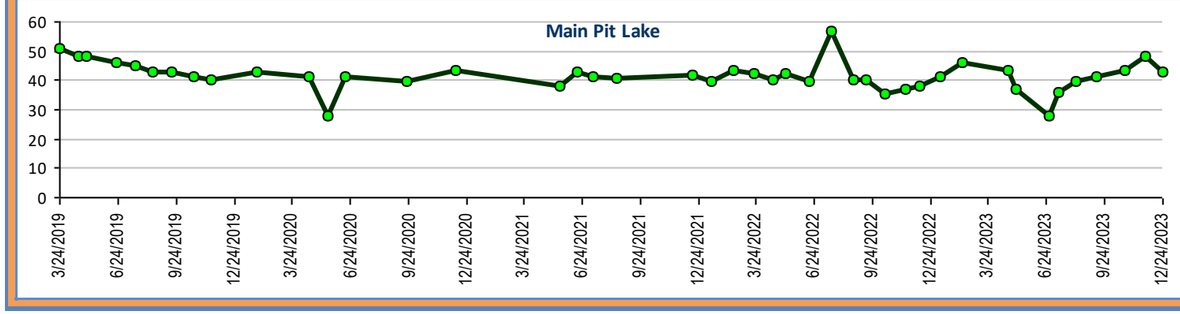


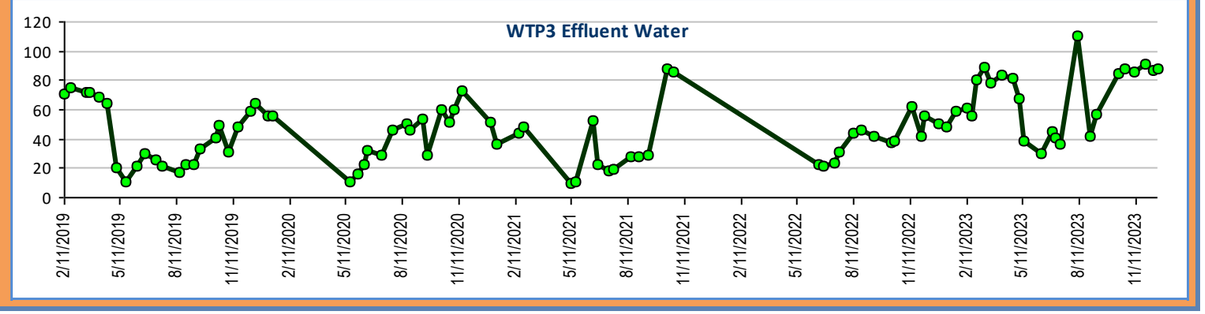








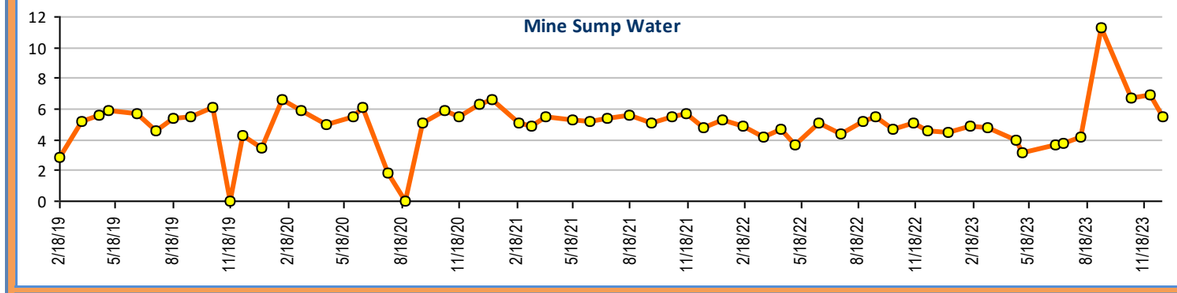


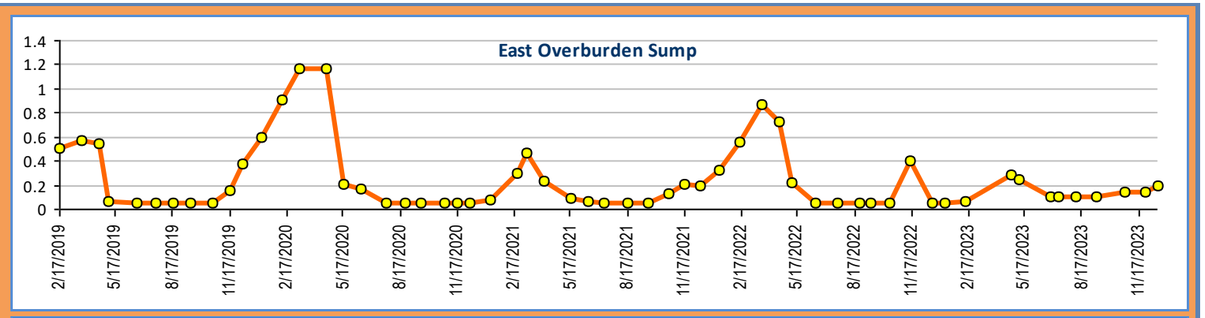


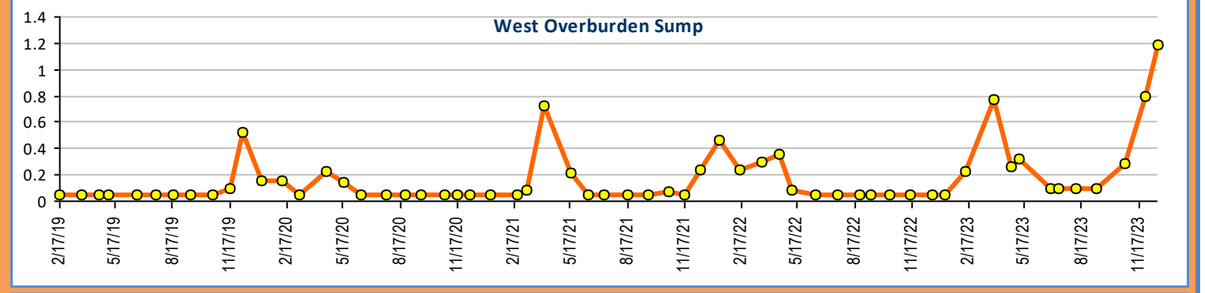
RED DOG MINE

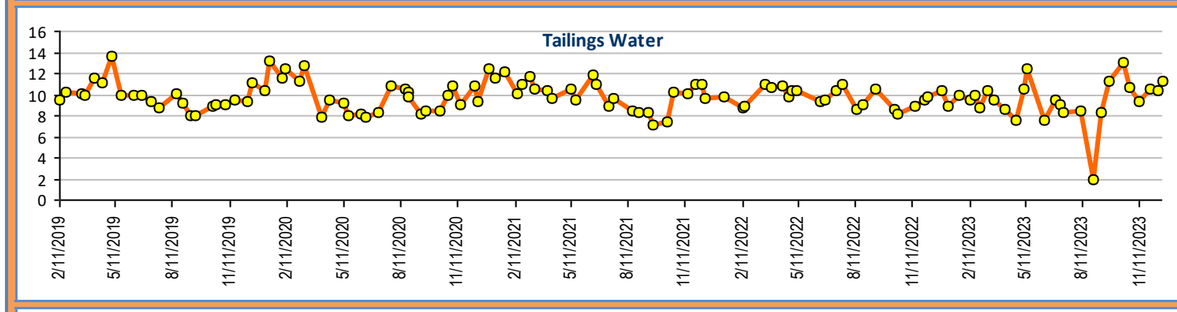
Mine Water Monitoring - Water Quality Profile II, Trend Charts

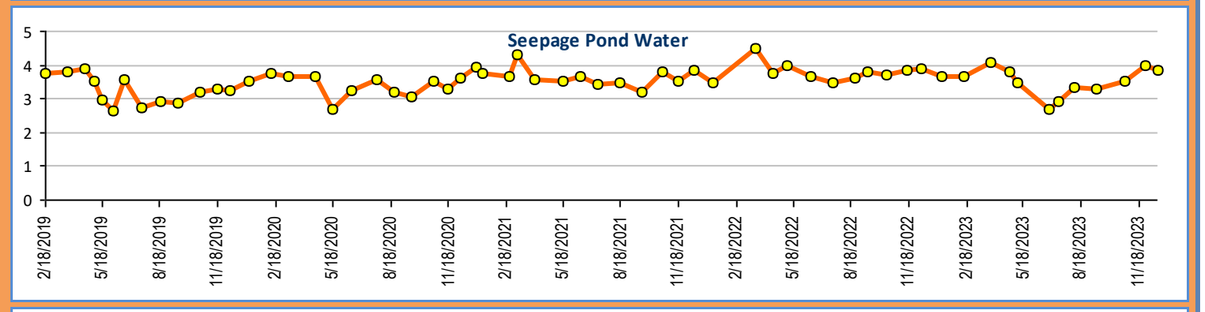
Ammonia as N, units mg/L

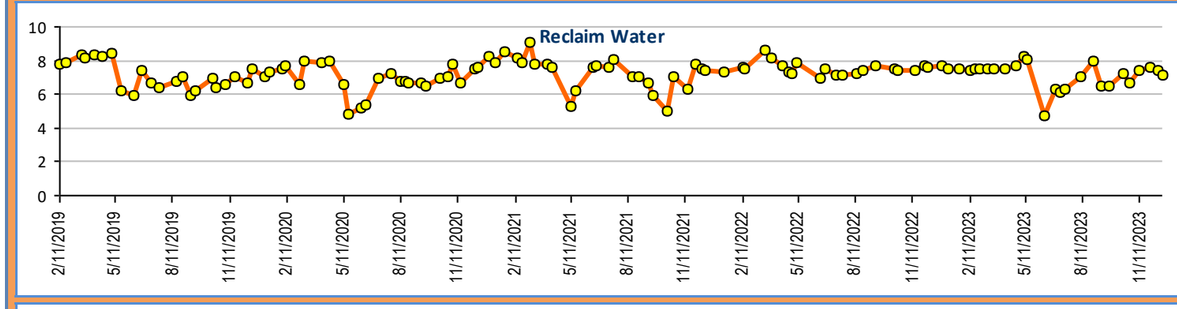


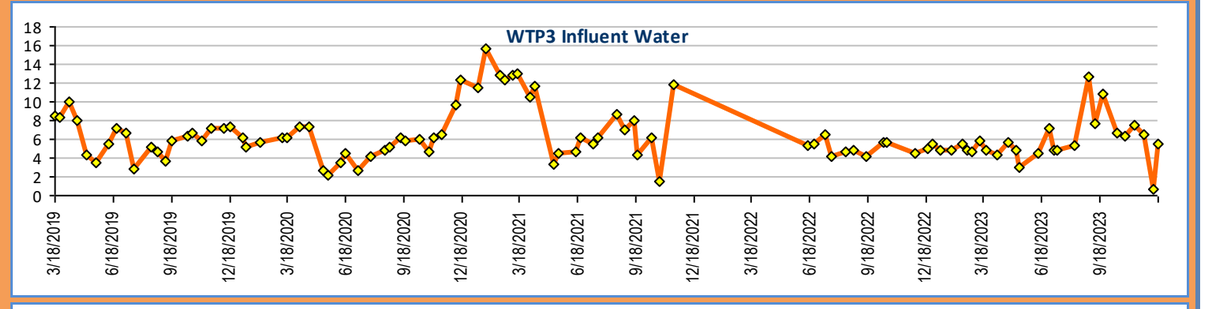


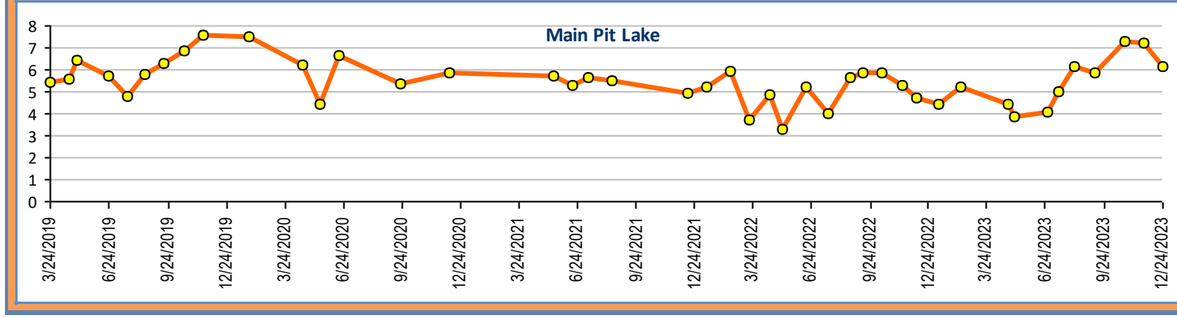


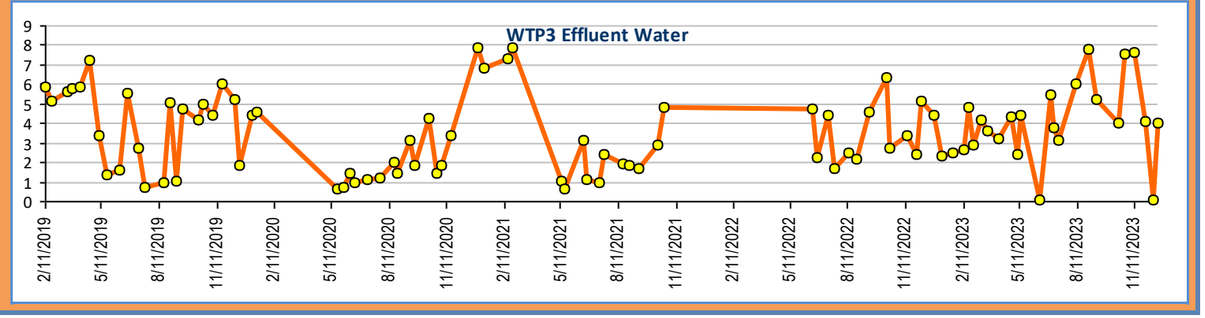








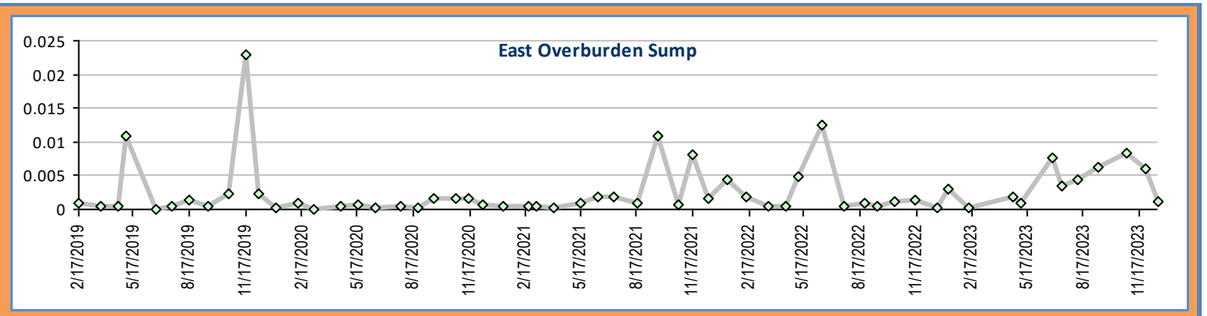


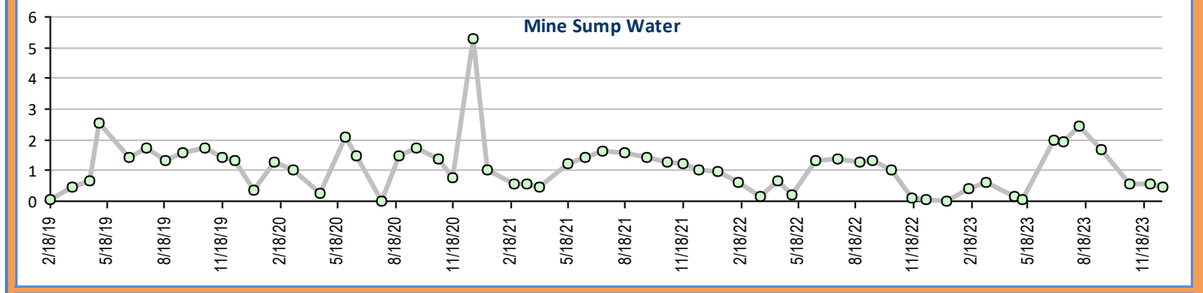


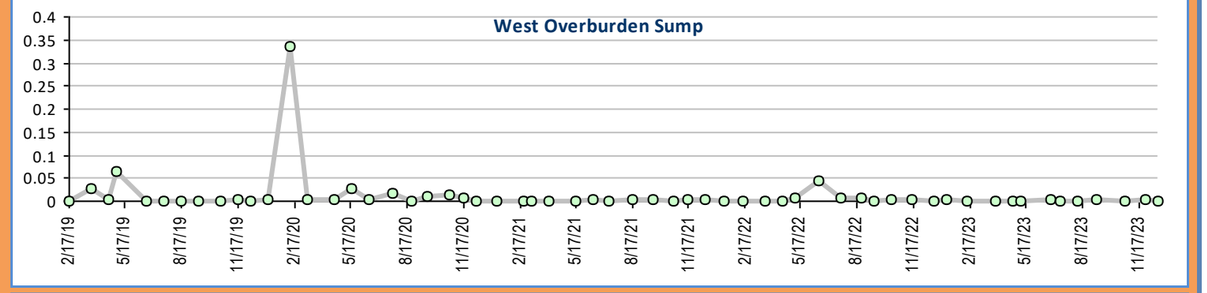
RED DOG MINE

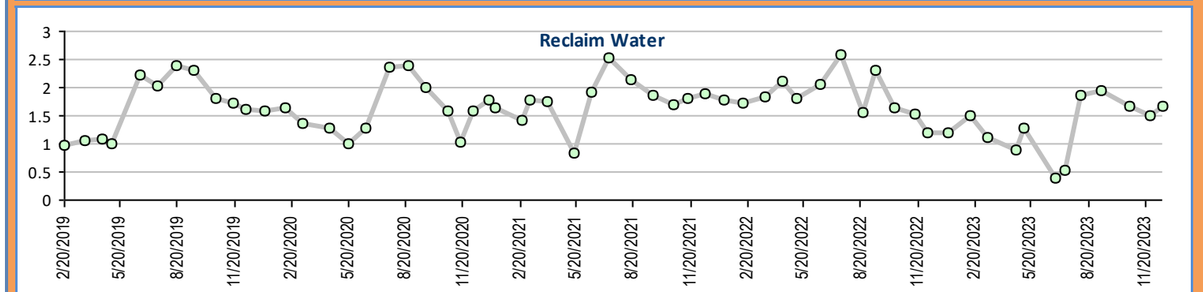
Mine Water Monitoring - Water Quality Profile II, Trend Charts

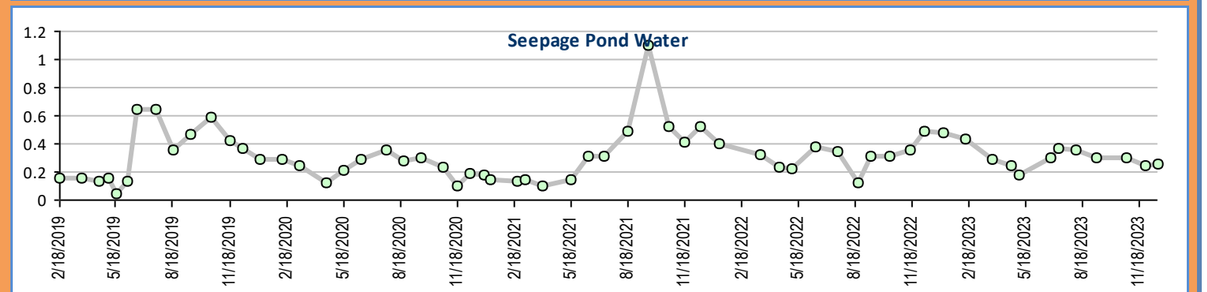
Lead, dissolved, units mg/L

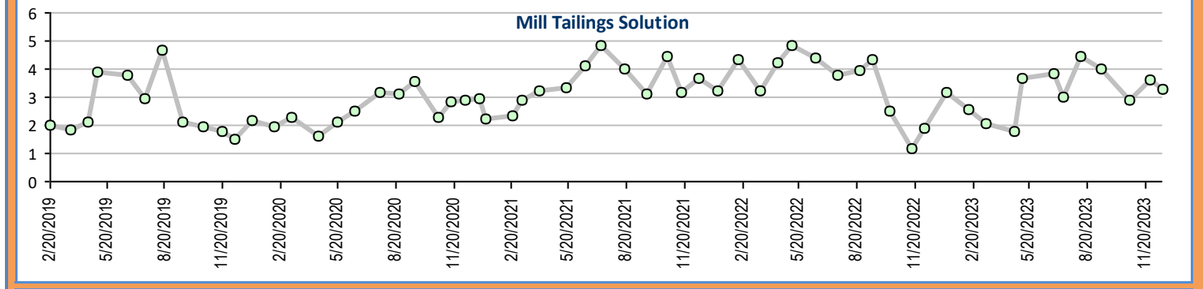


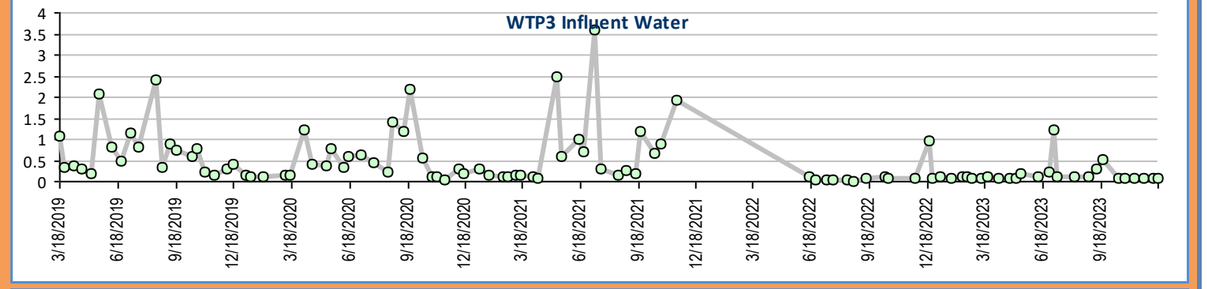


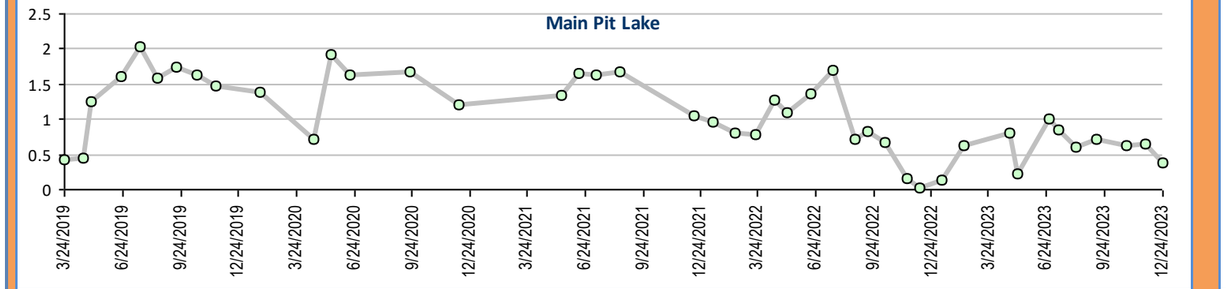


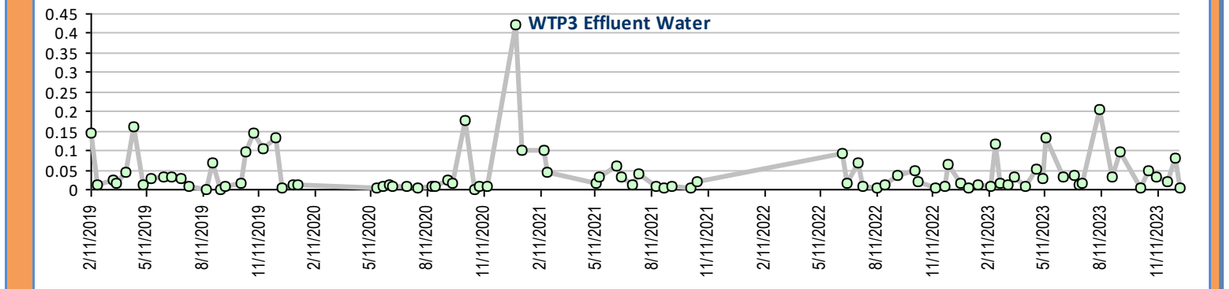








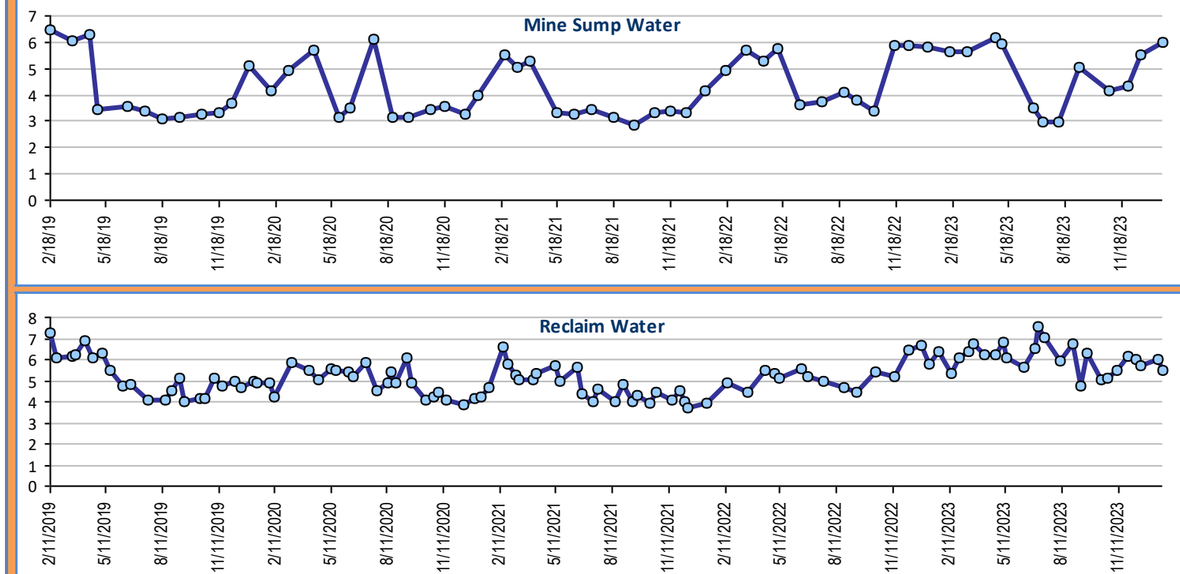


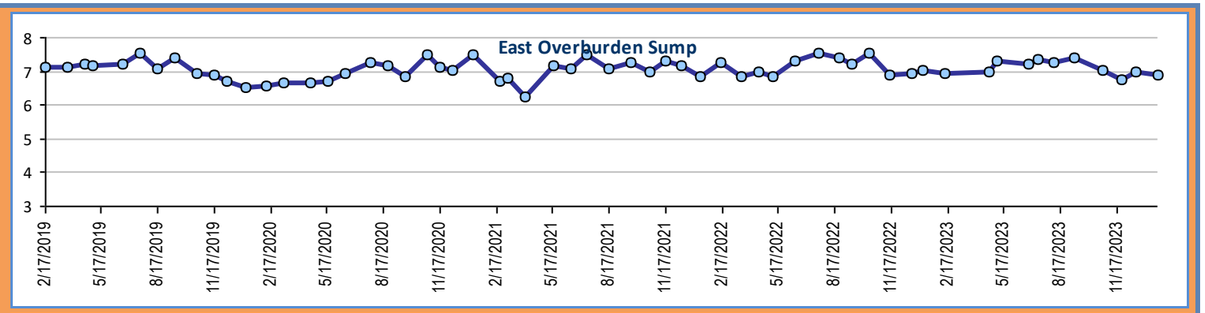


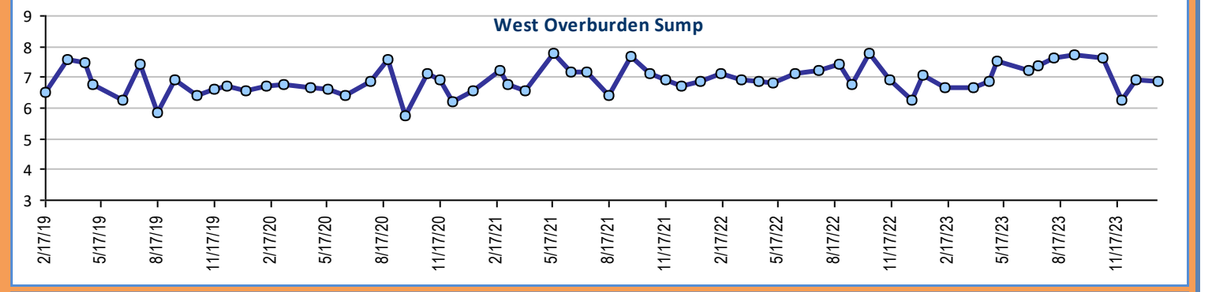
RED DOG MINE

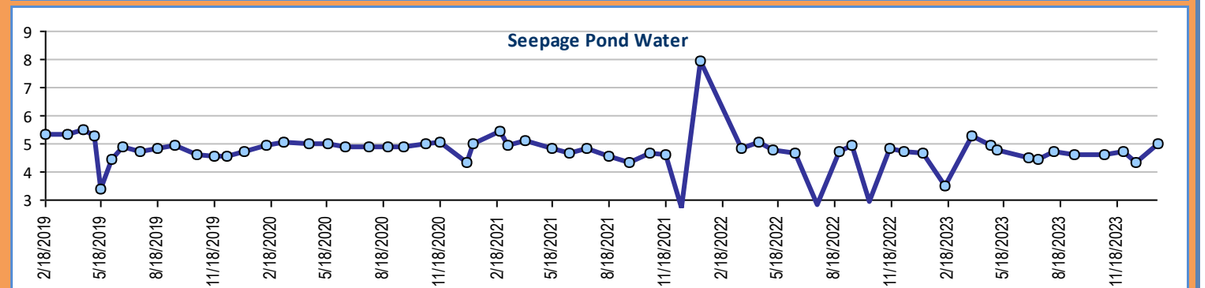
Mine Water Monitoring - Water Quality Profile II, Trend Charts

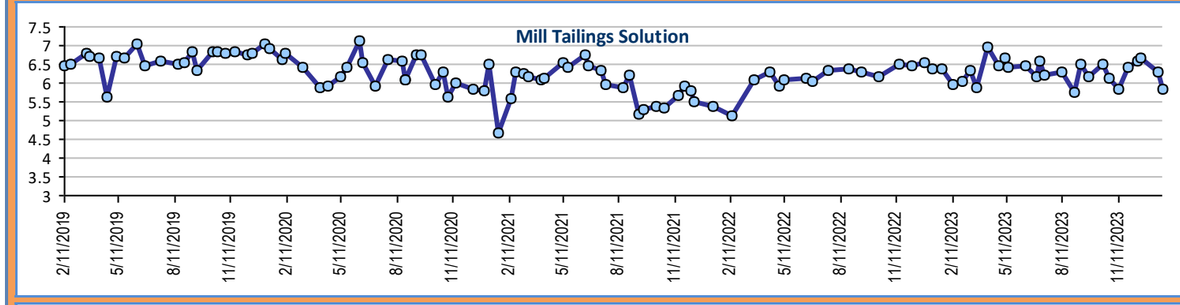
pH, units

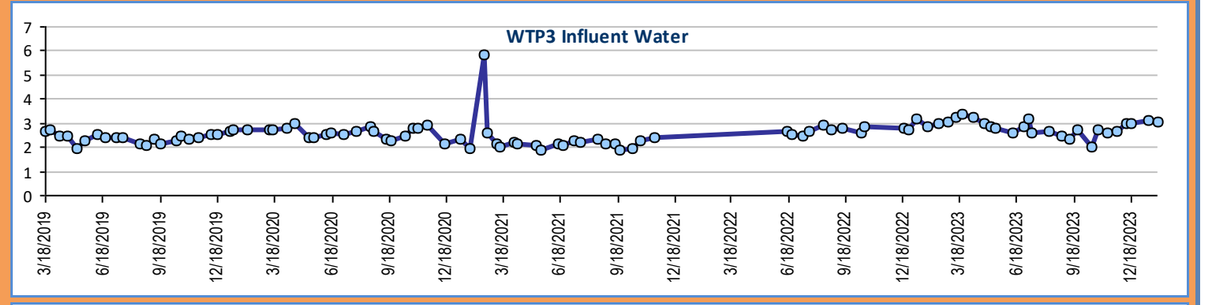


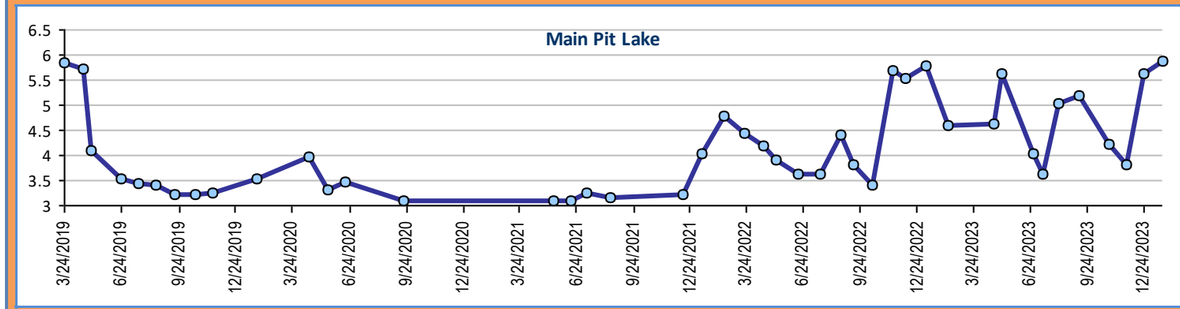


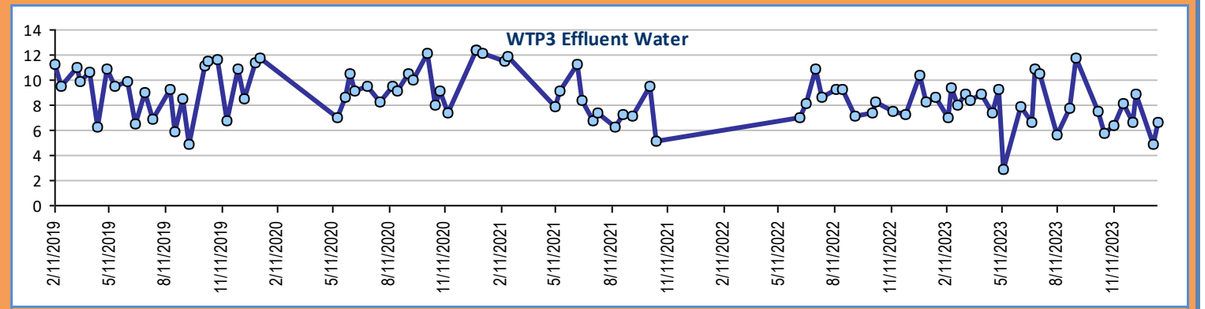








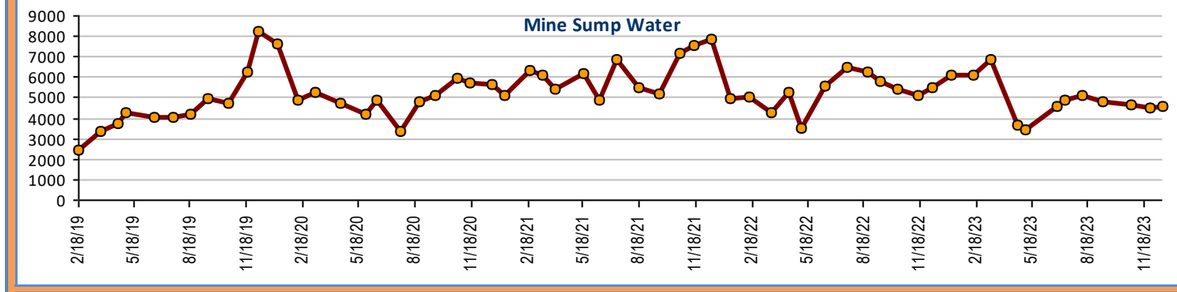


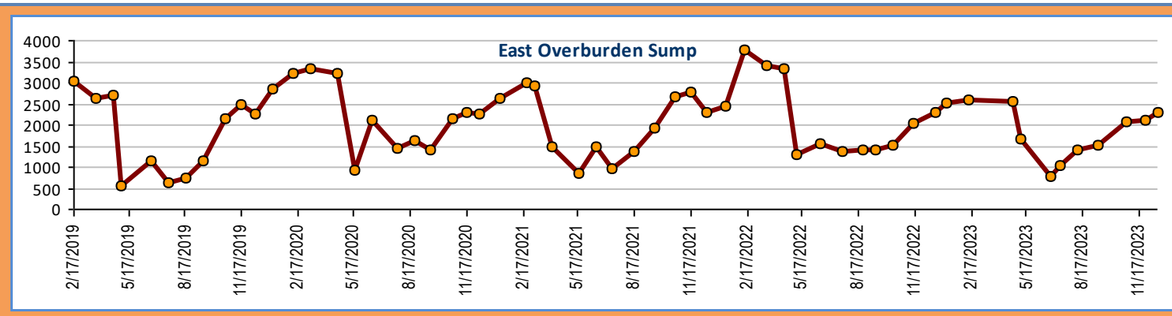


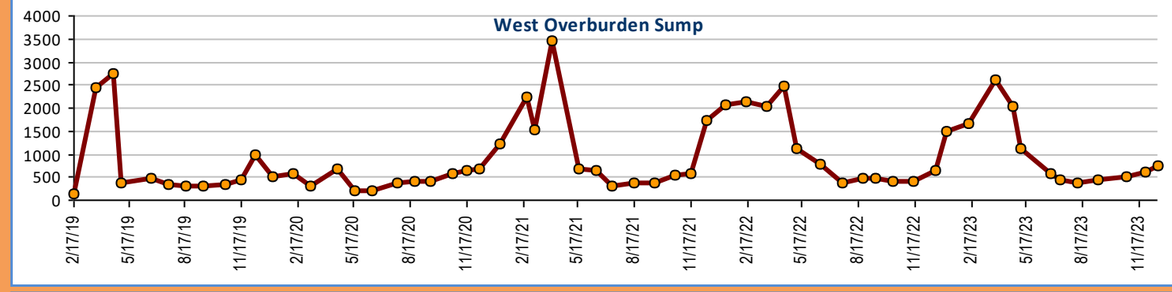
RED DOG MINE

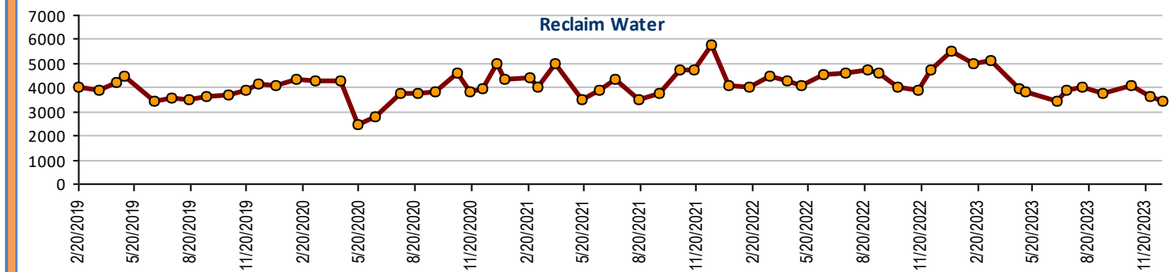
Mine Water Monitoring - Water Quality Profile II, Trend Charts

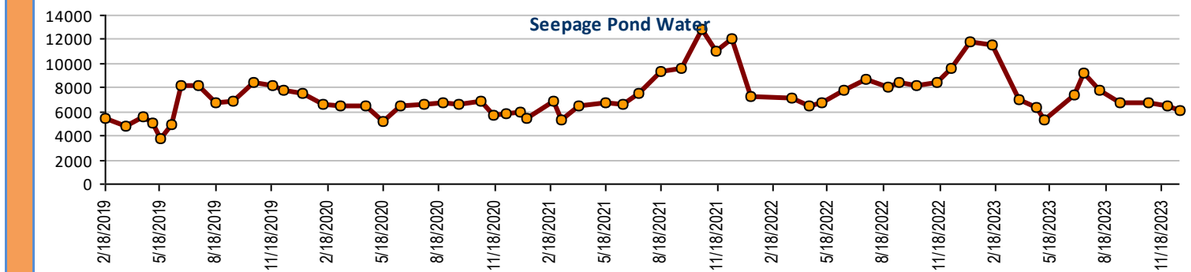
Sulfate, units mg/L

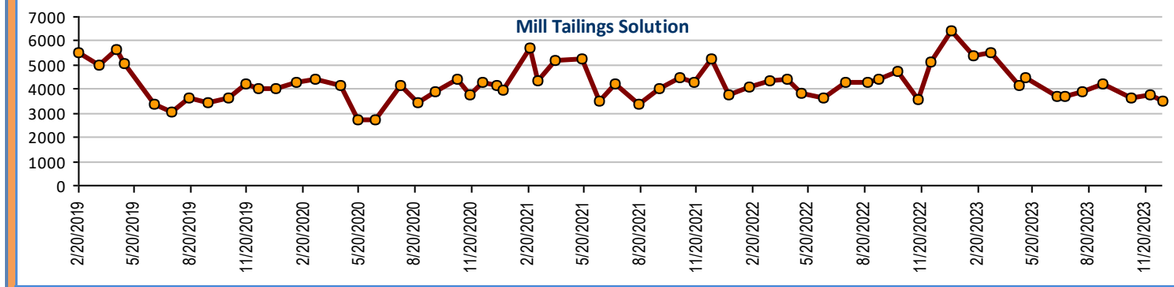


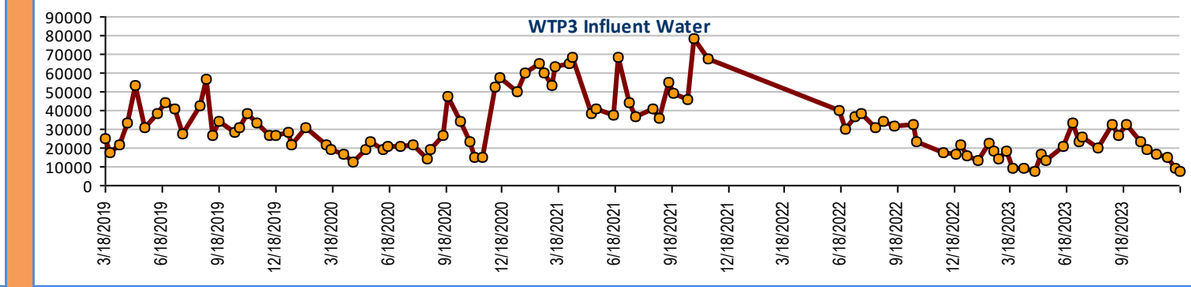


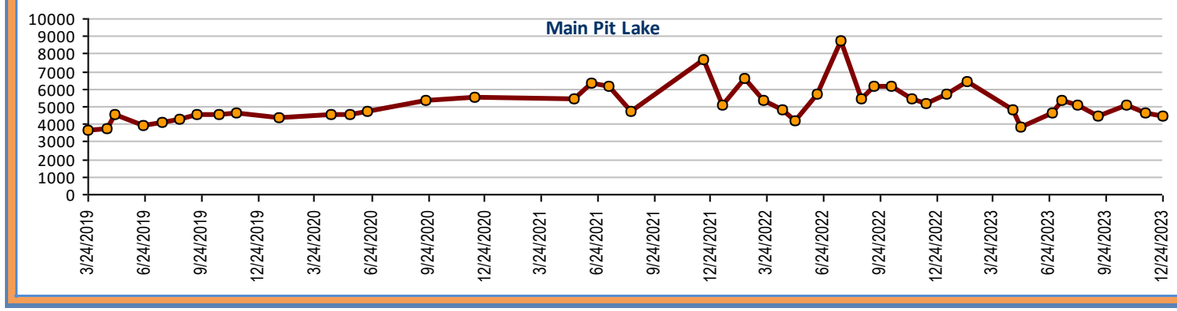


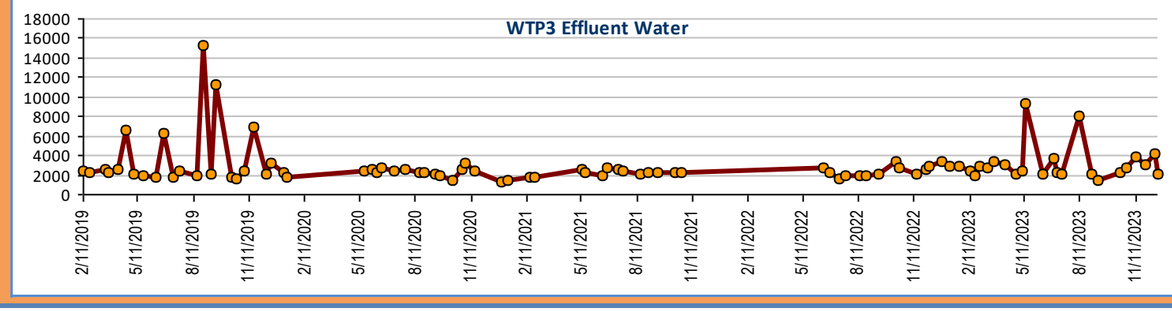








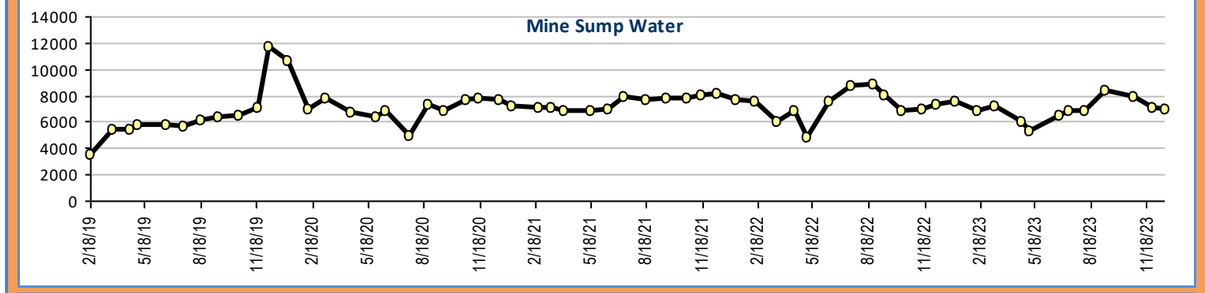


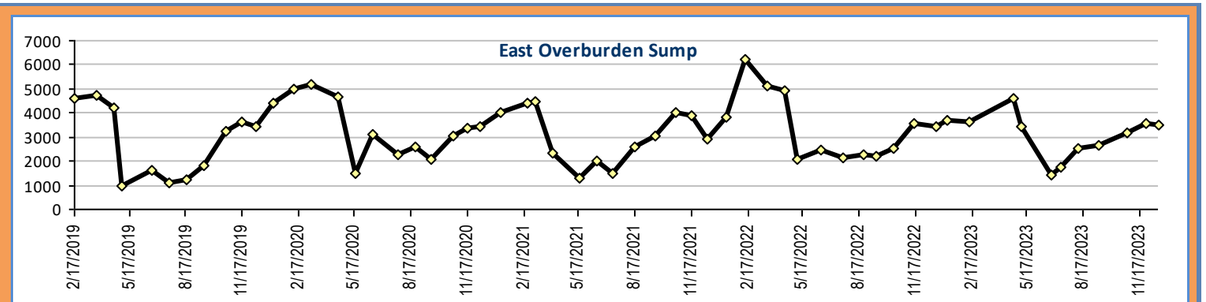


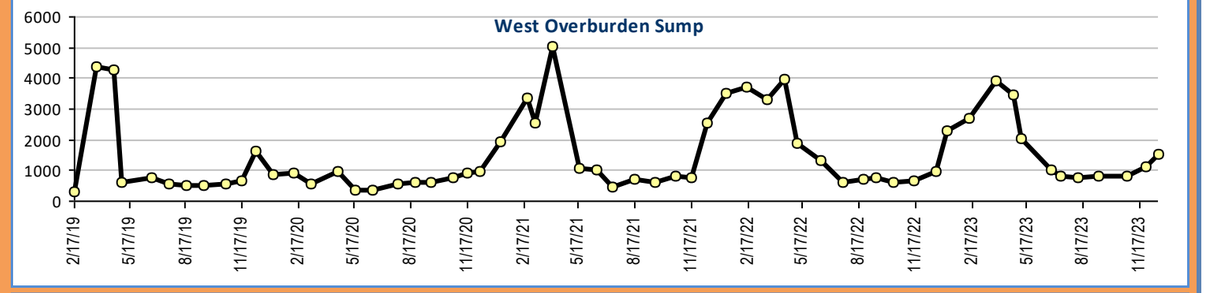
RED DOG MINE

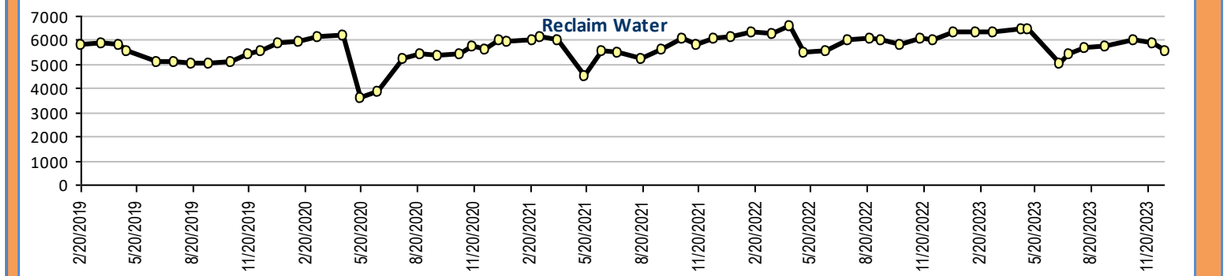
Mine Water Monitoring - Water Quality Profile II, Trend Charts

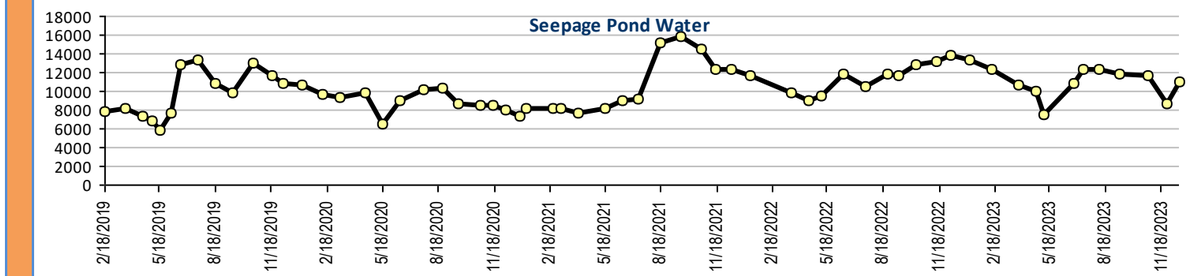
Total Dissolved Solids, units, mg/L

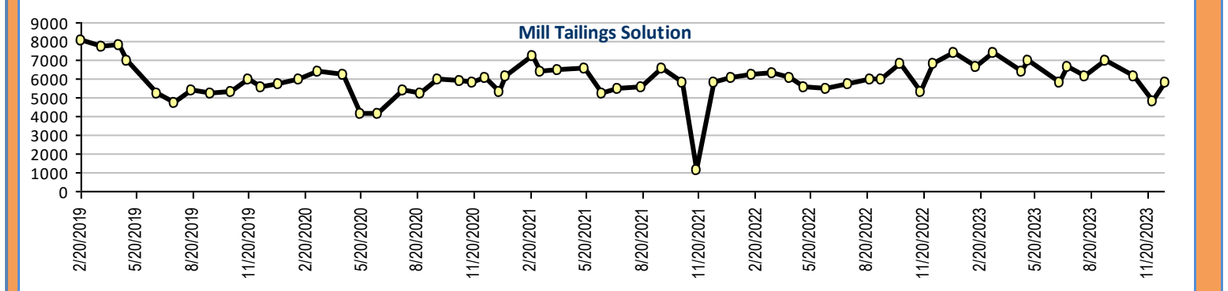


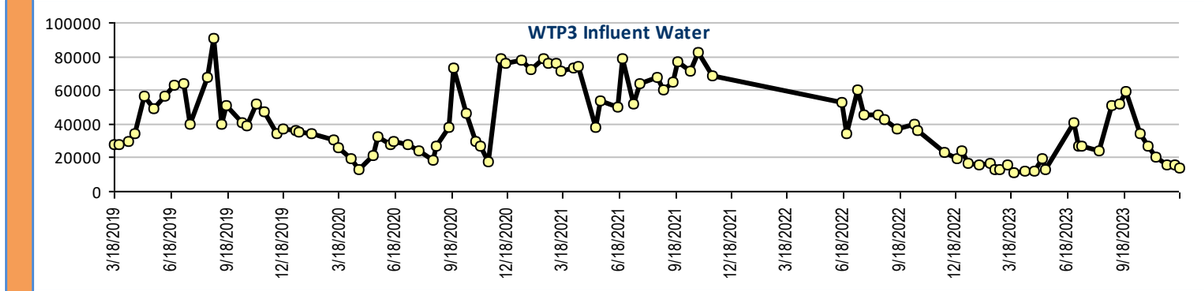


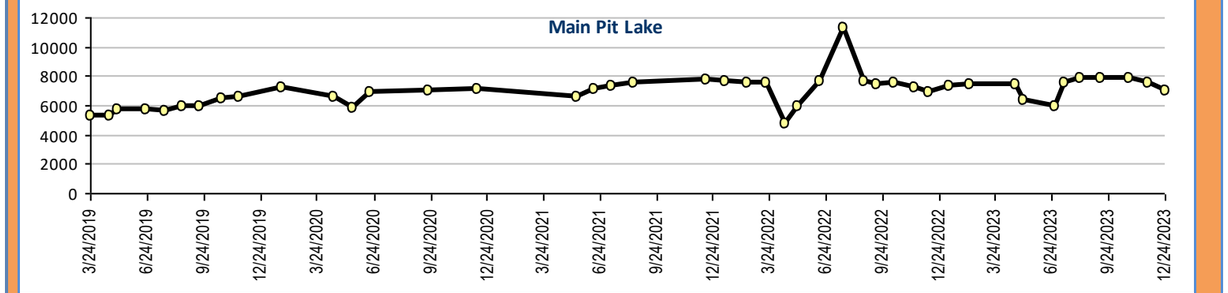


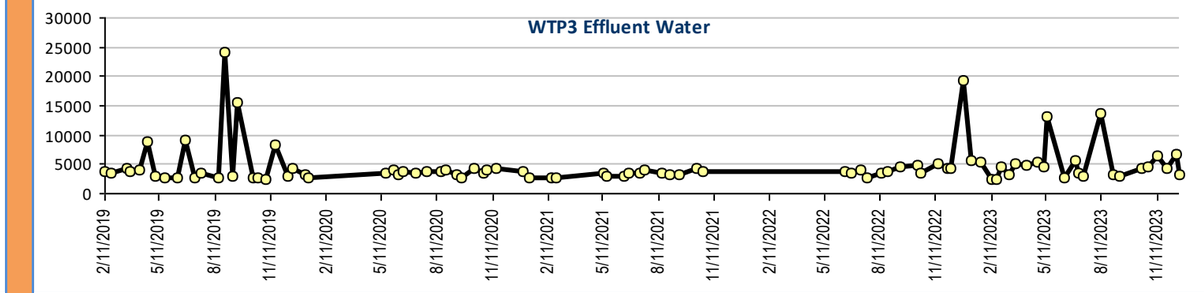








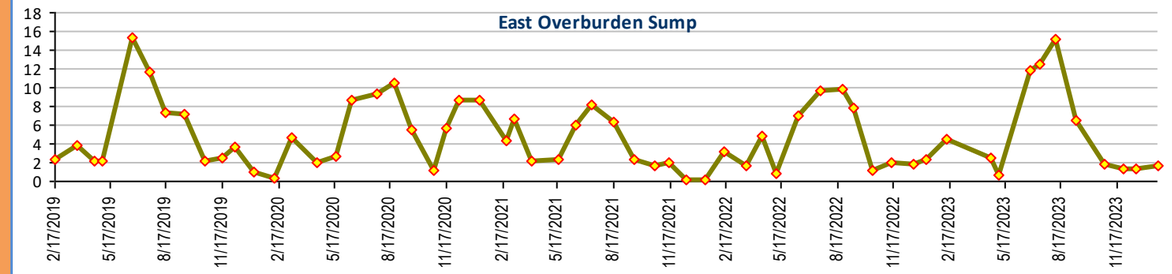


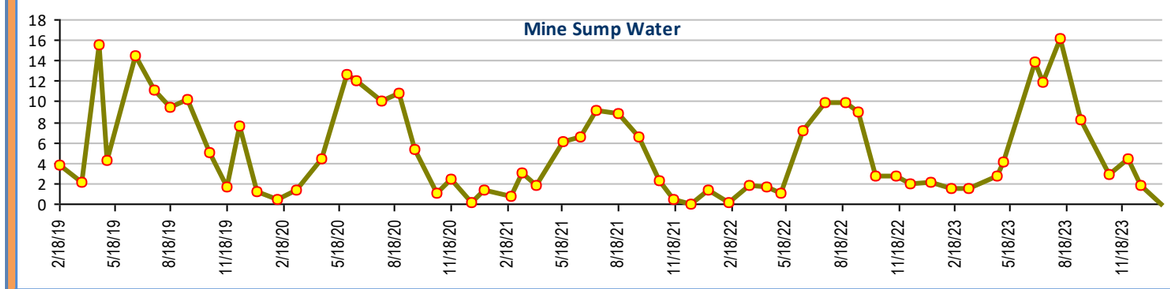


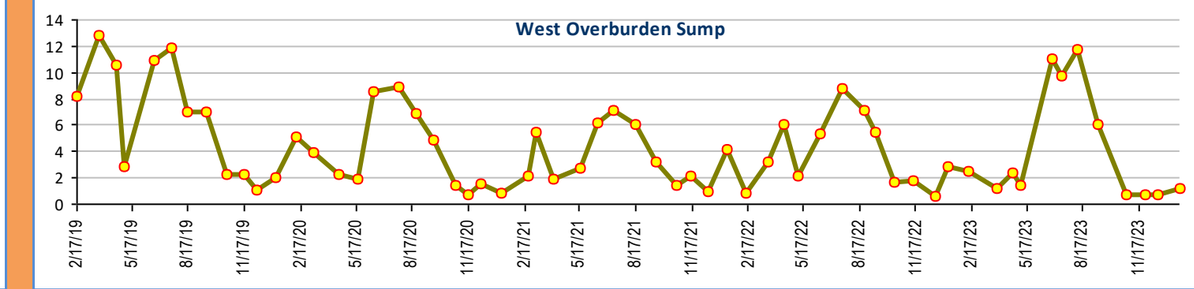
RED DOG MINE

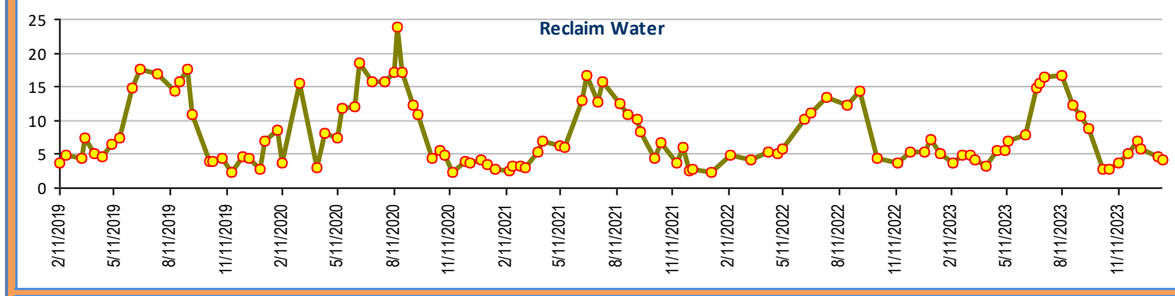
Mine Water Monitoring - Water Quality Profile II, Trend Charts

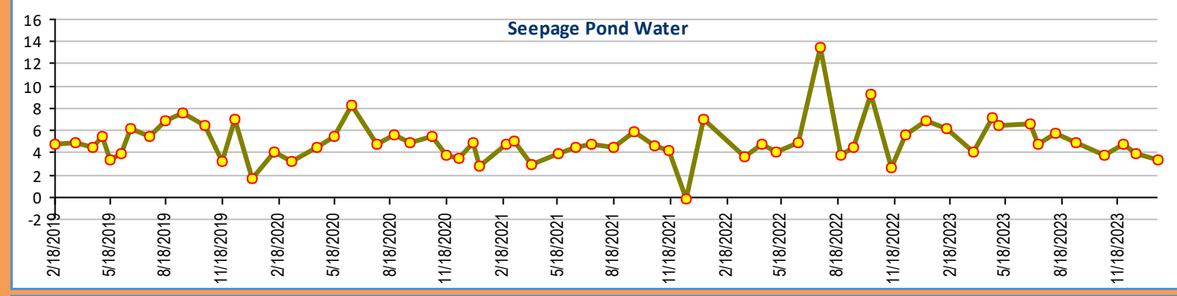
Temperature, Celsius

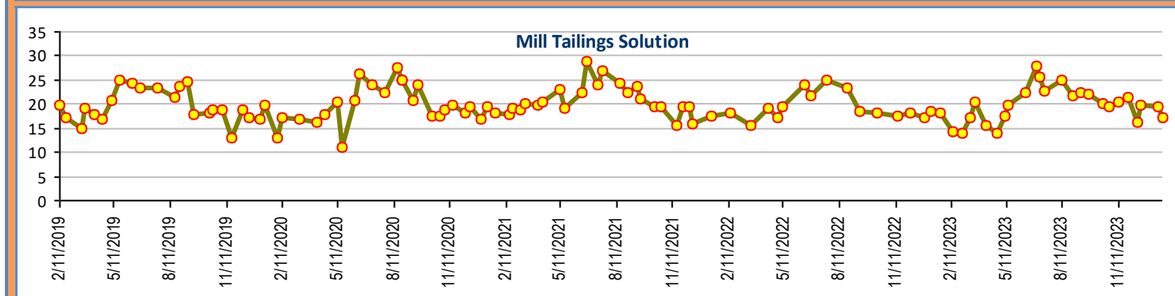


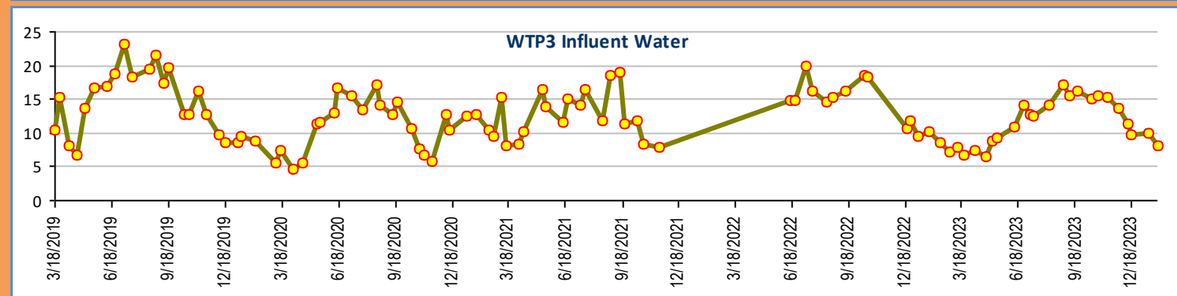


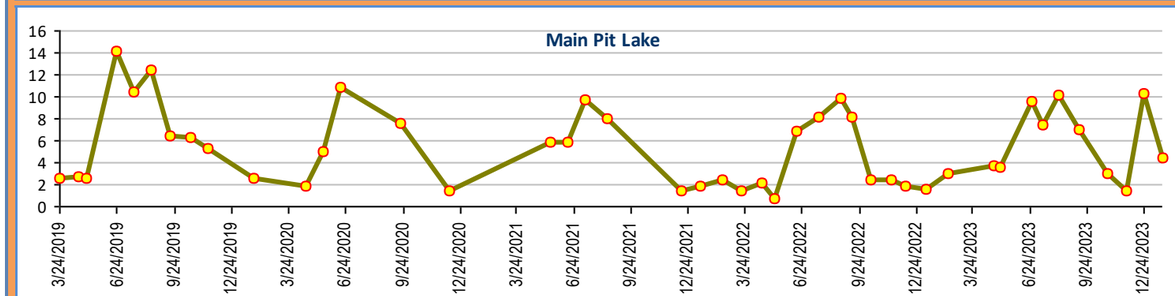


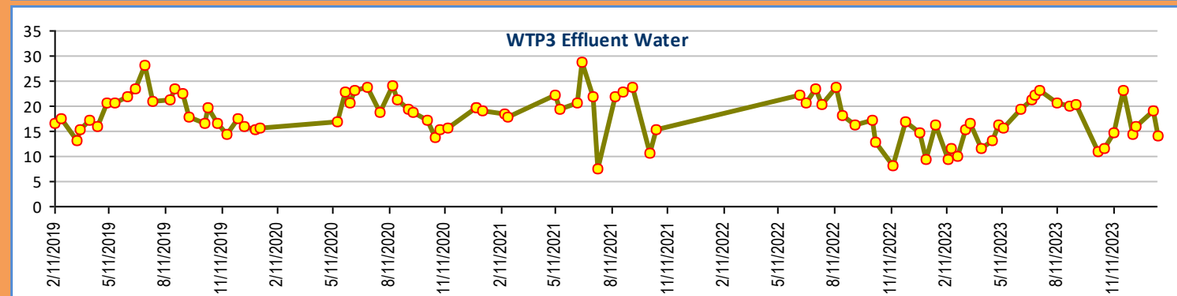








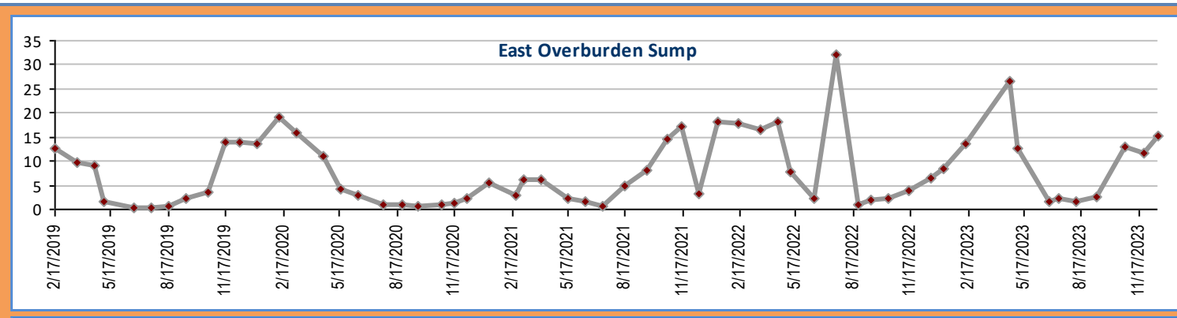


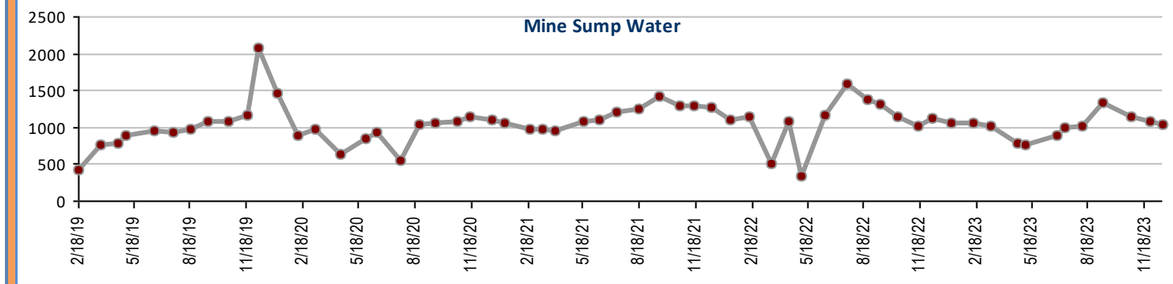


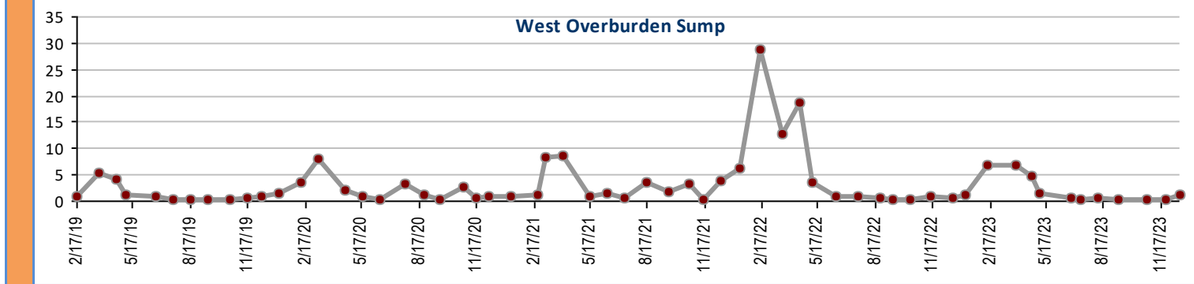
RED DOG MINE

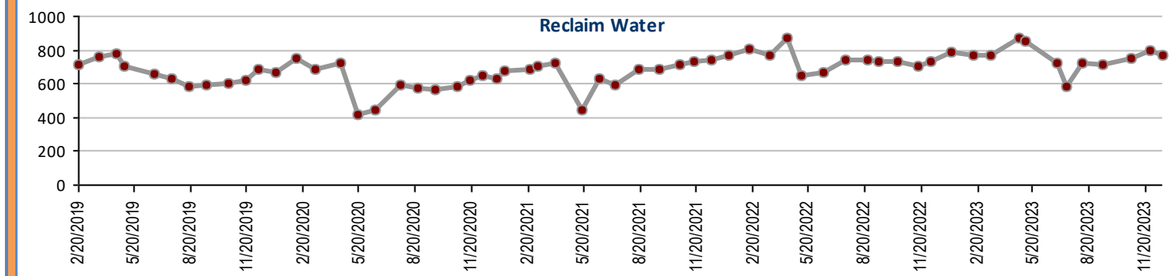
Mine Water Monitoring - Water Quality Profile II, Trend Charts

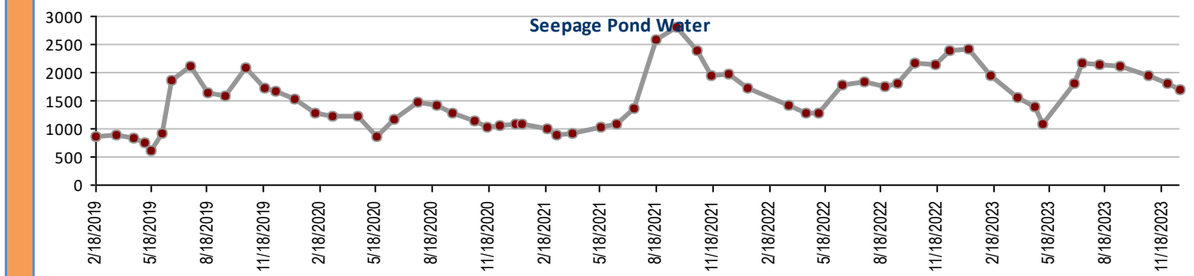
Zinc, dissolved, units, mg/L

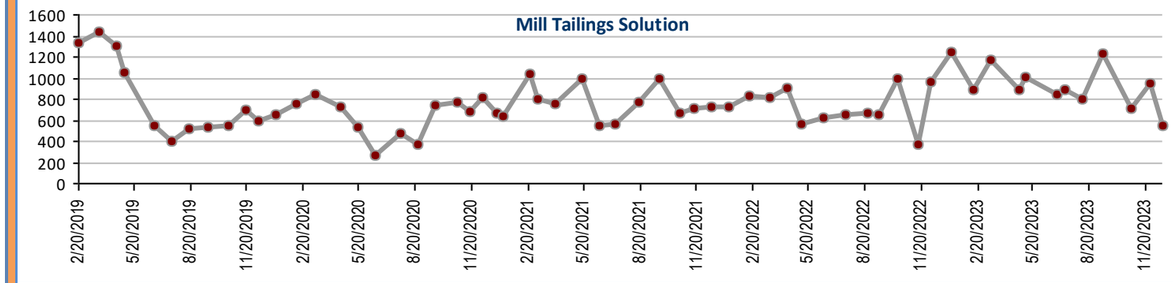


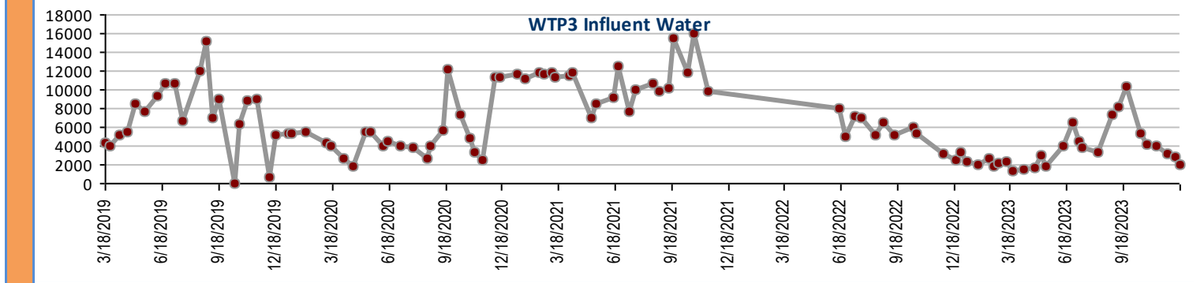


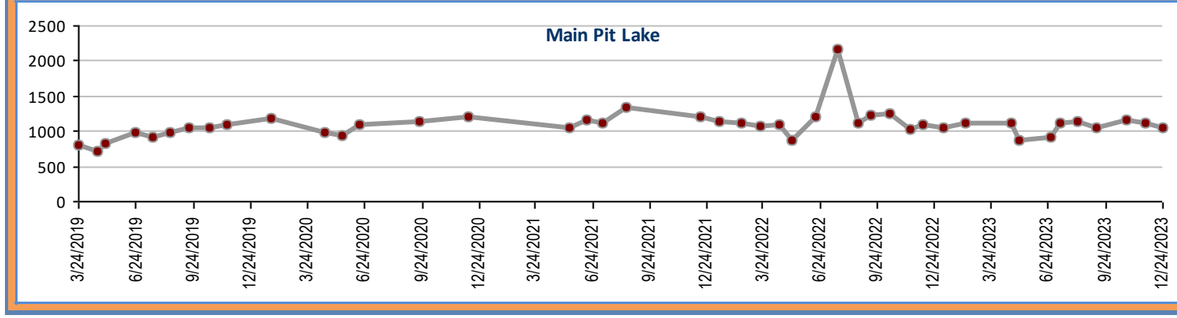


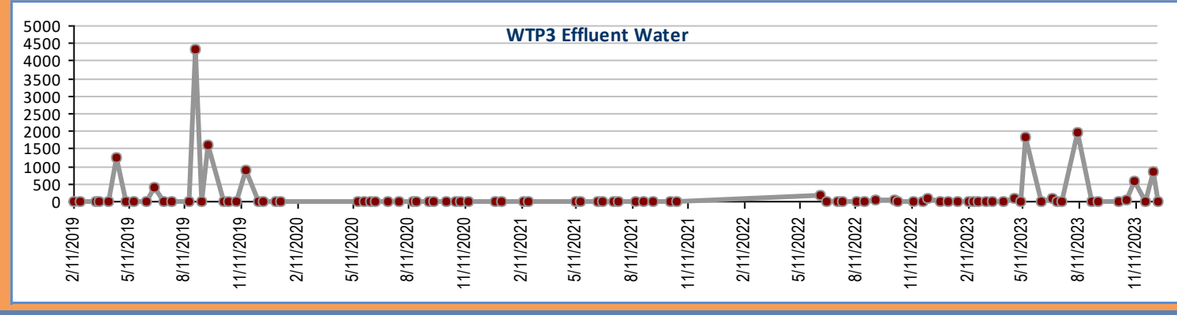












Appendix D: Water Quality Profile I Charts – Mine Drainage Monitoring Stations

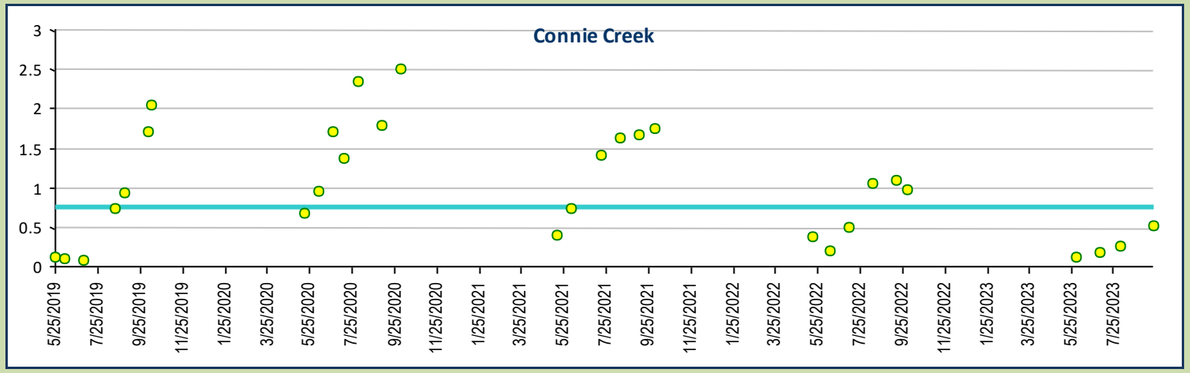
RED DOG MINE

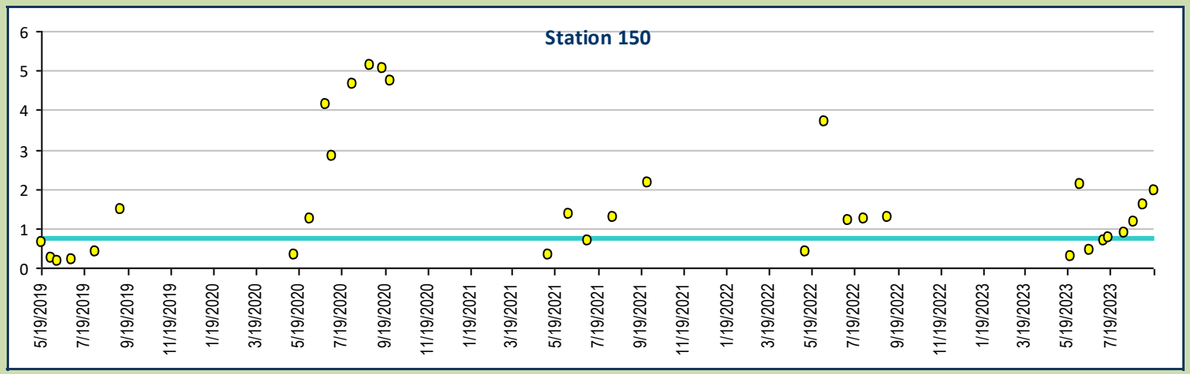
Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

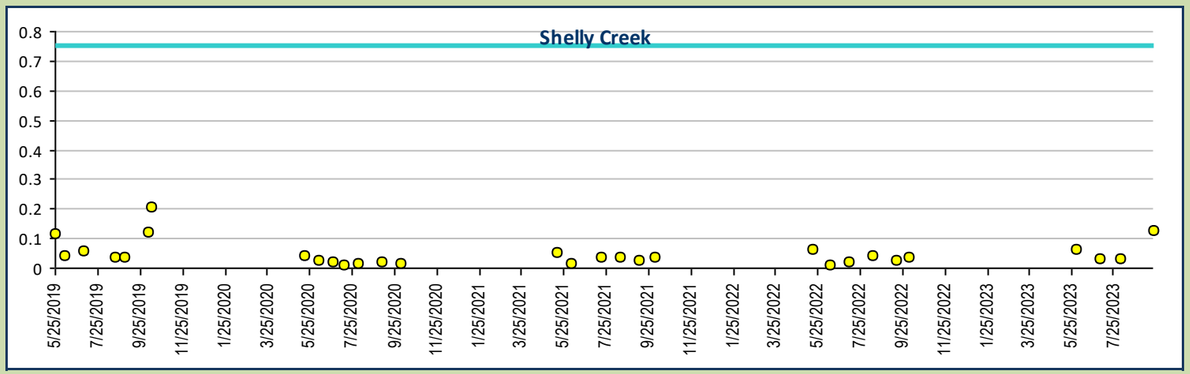
Aluminum, Total recoverable, units mg/L

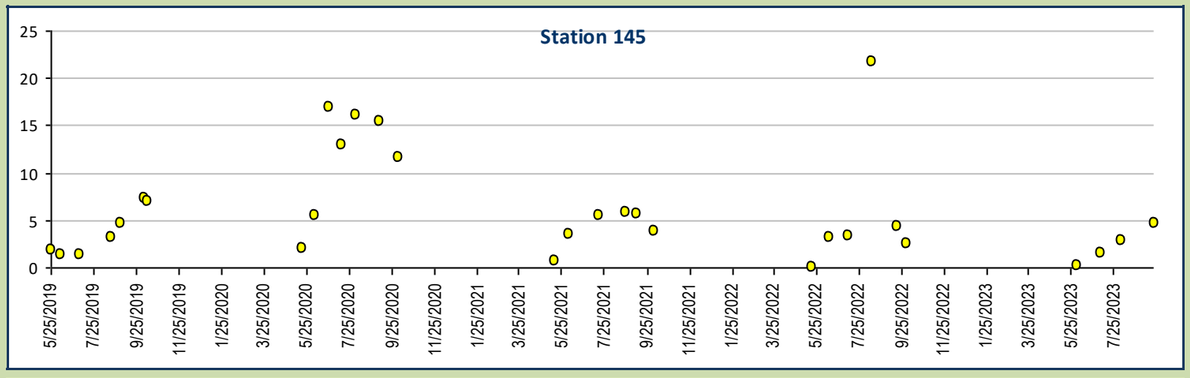
Aquatic Life - Fresh Water Chronic WQS mg/L

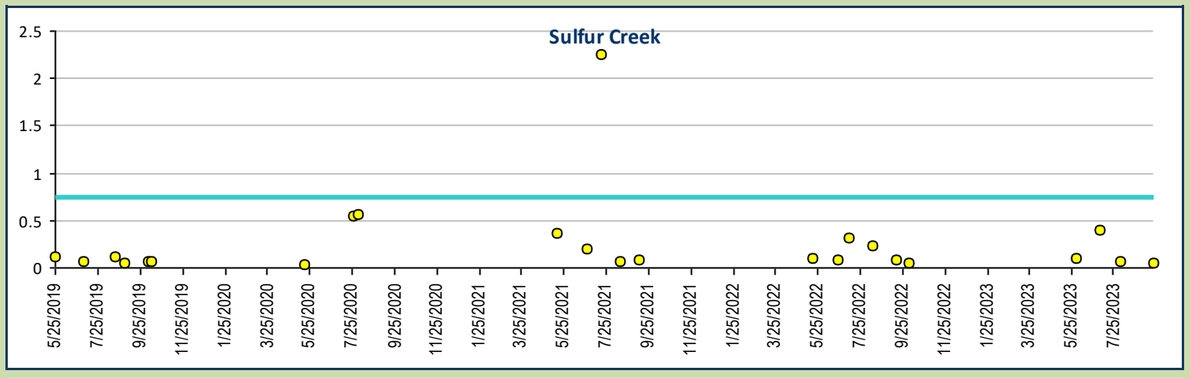
If pH > 7 and hardness > 50. then WQS = 0.75mg/l

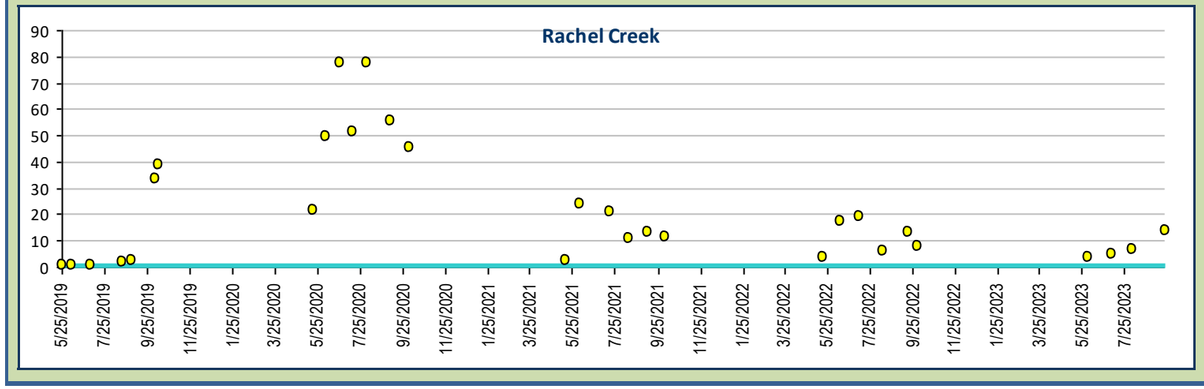


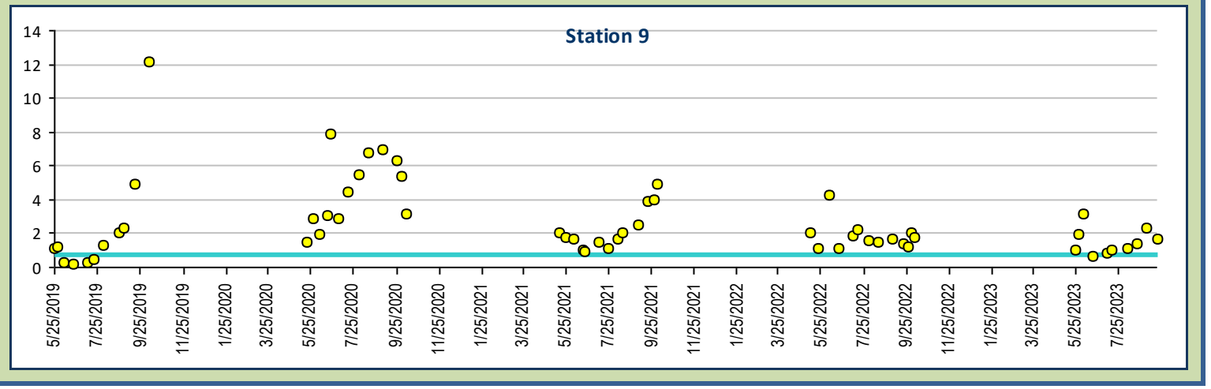












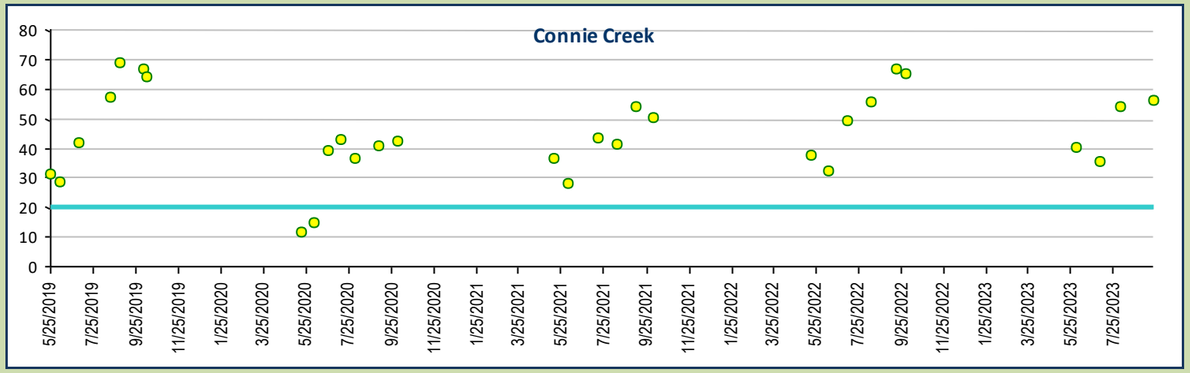
RED DOG MINE

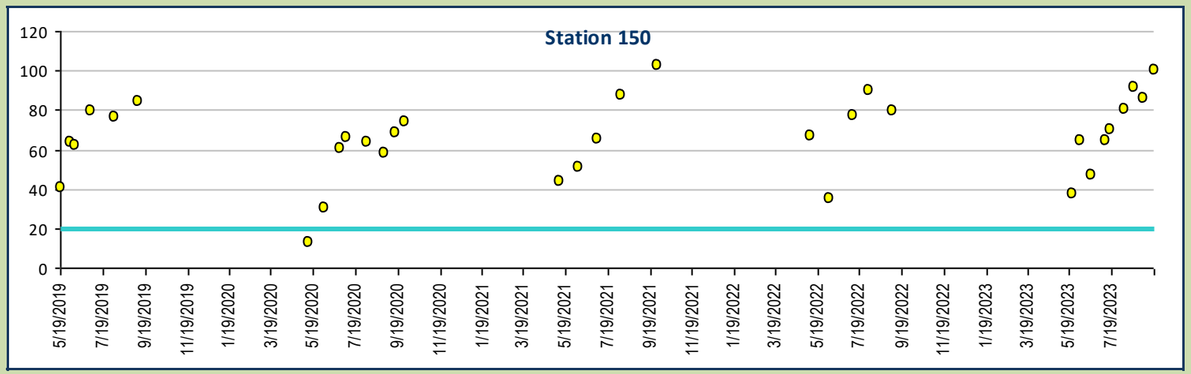
Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

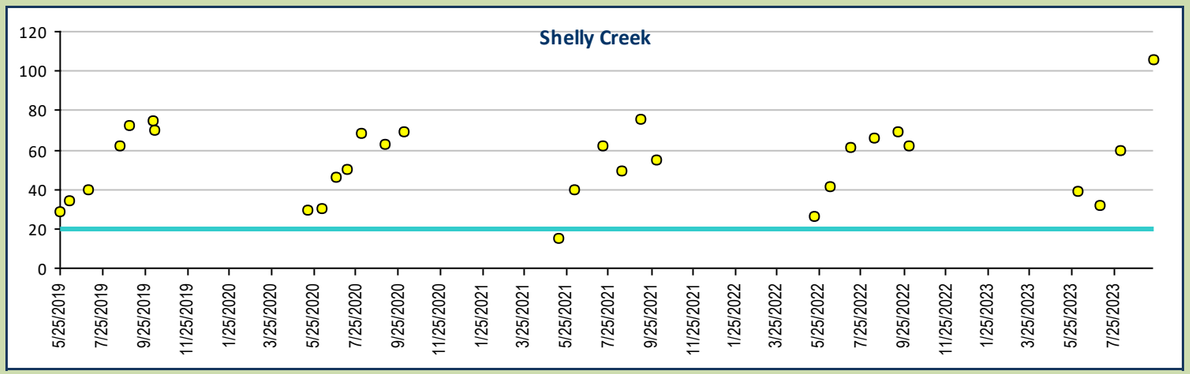
Alkalinity as CaCO3, units mg/L

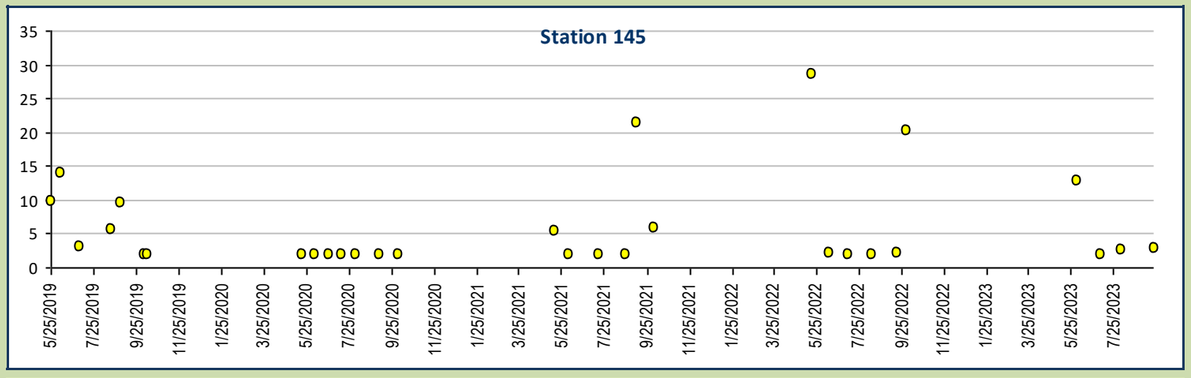
Aquatic Life - Fresh Water Chronic WQS mg/L

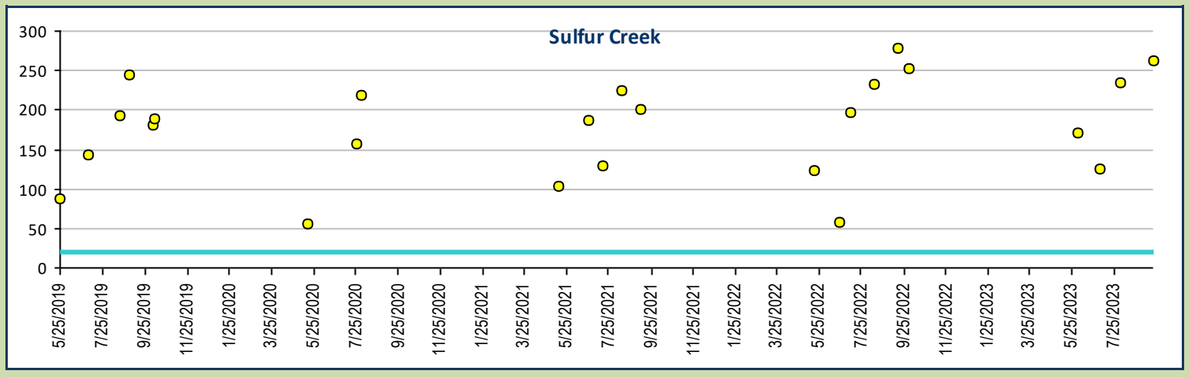
20 mg/L minimum

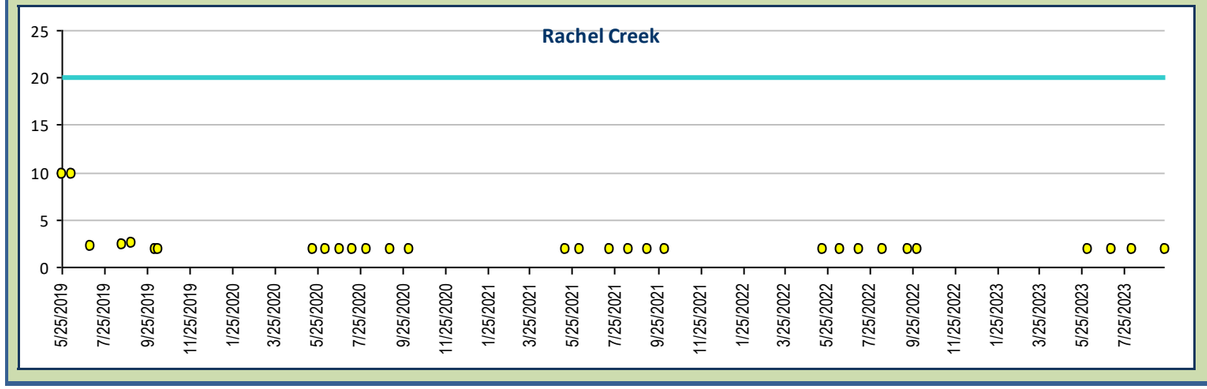


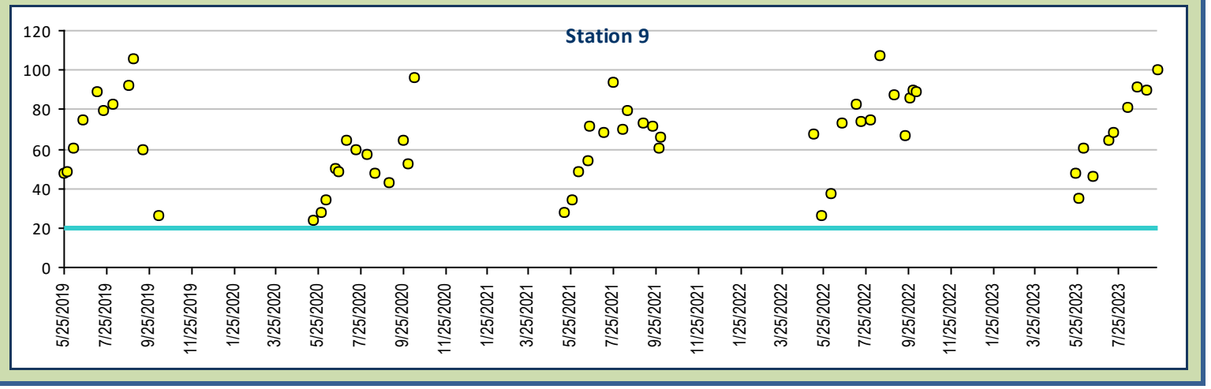








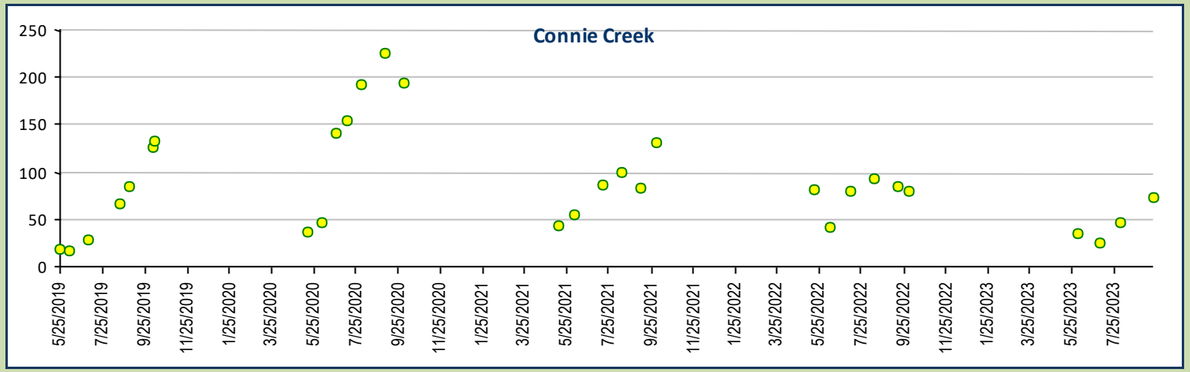


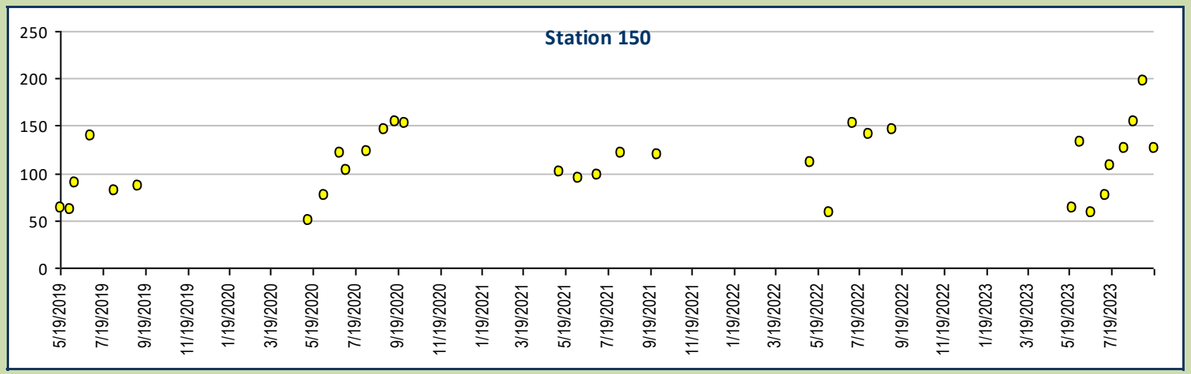


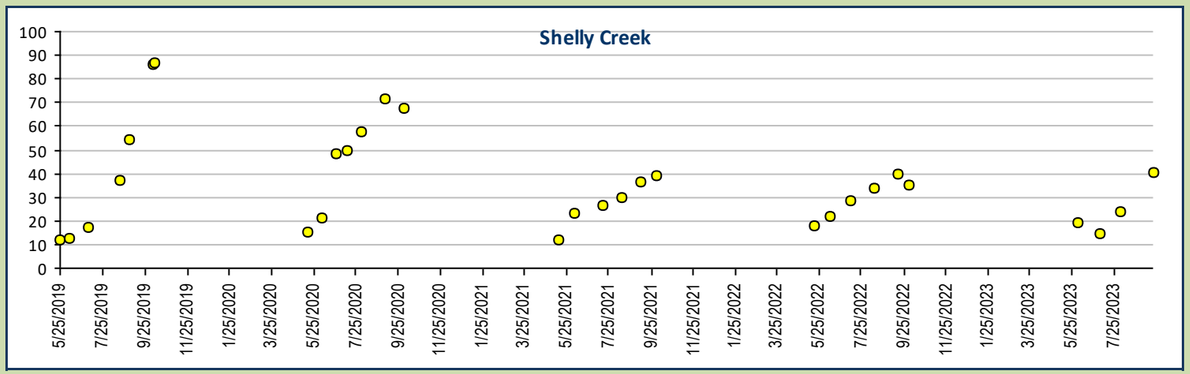
RED DOG MINE

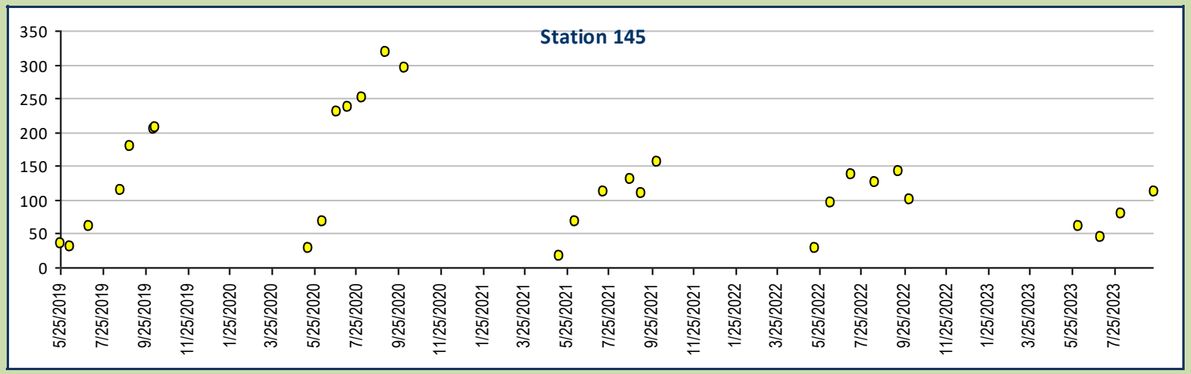
Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

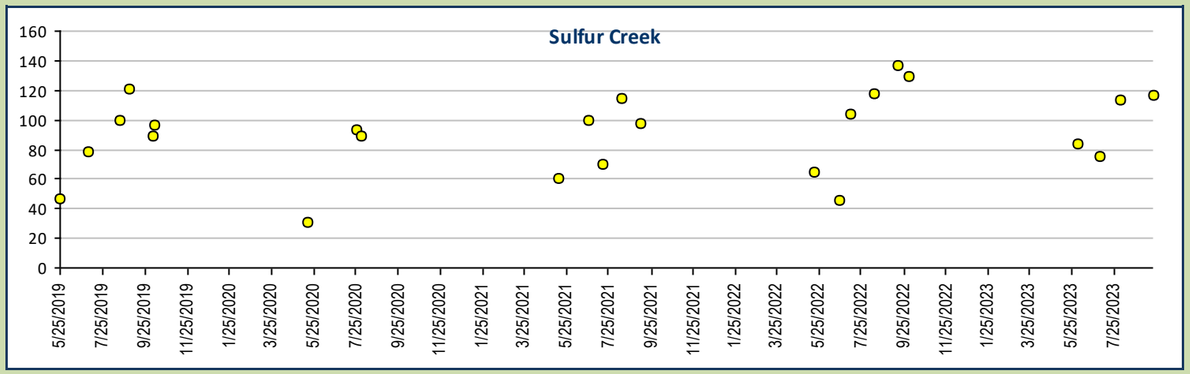
Calcium, Total recoverable, units mg/L

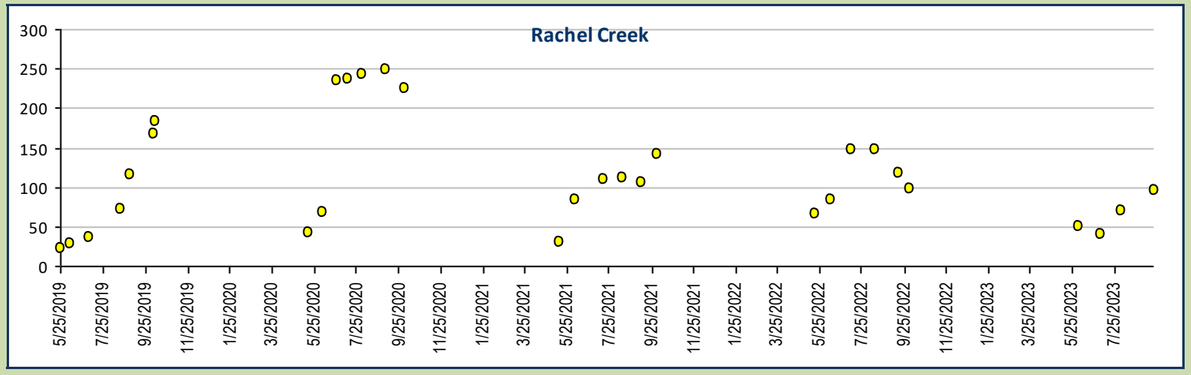


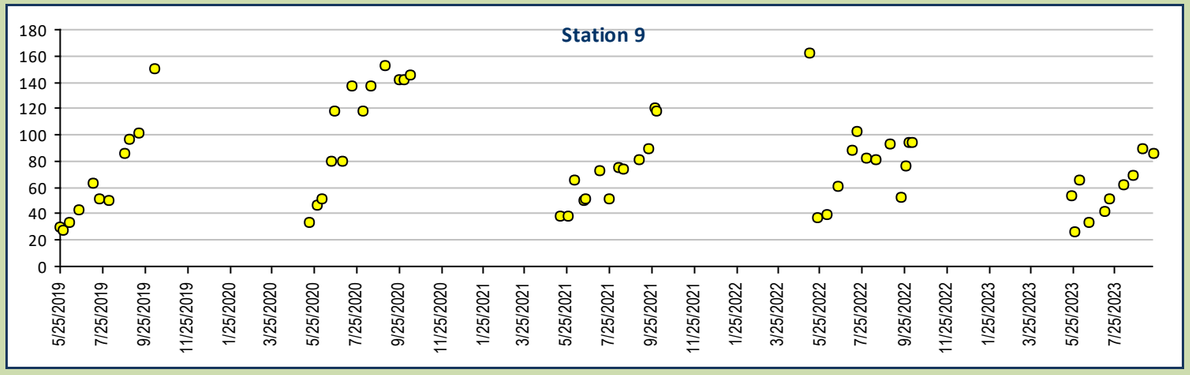












RED DOG MINE

Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

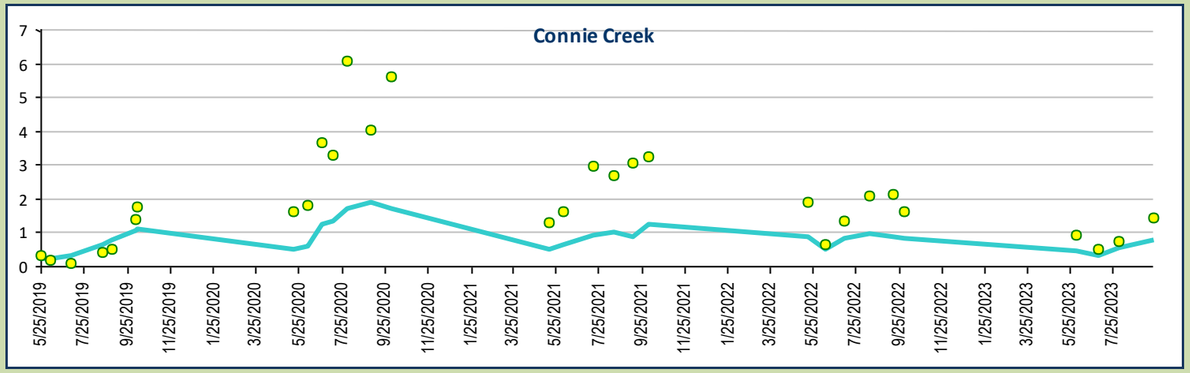
Cadmium, Total Recoverable, units ug/L

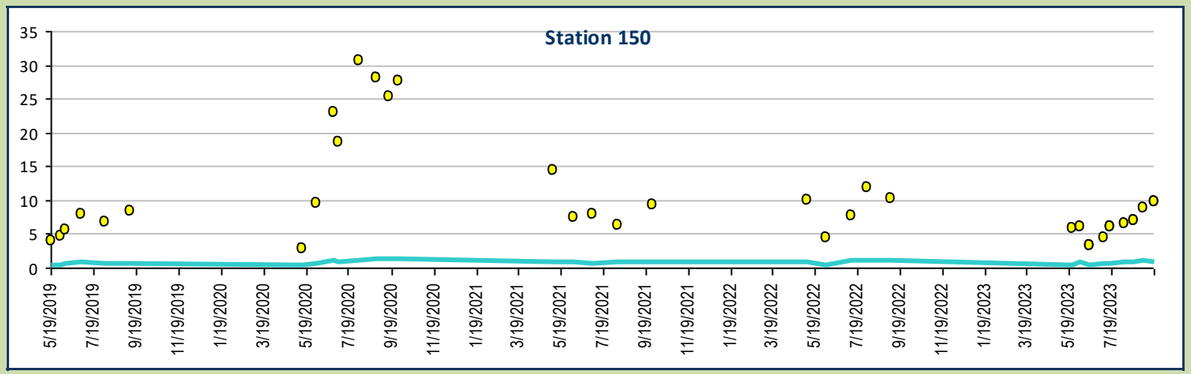
Aquatic Life - Fresh Water Chronic WQS ug/L

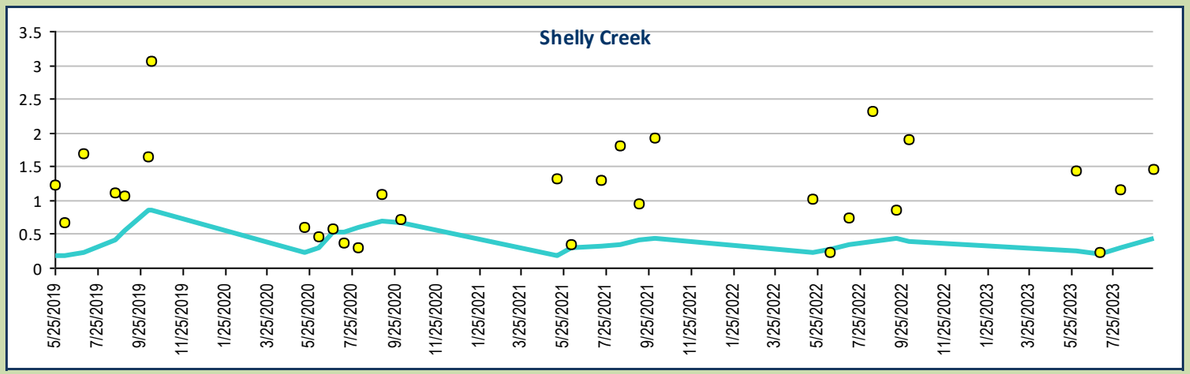
Hardness Dependent Calculation

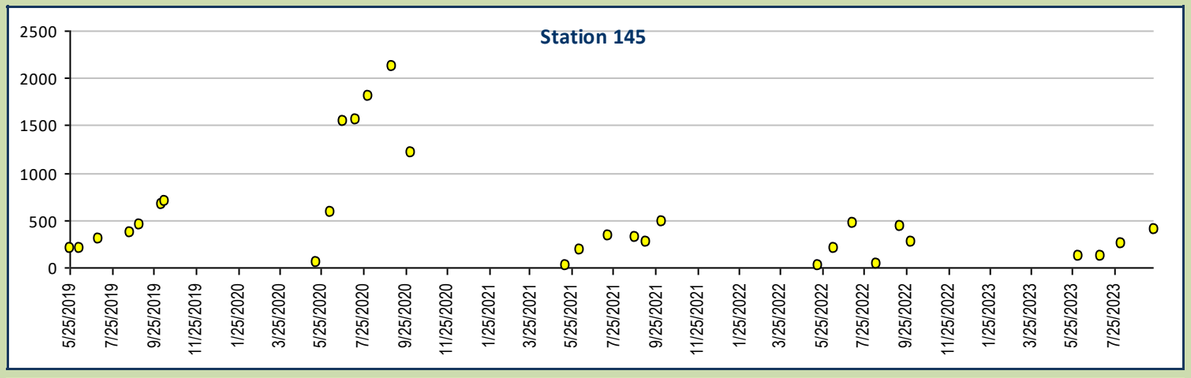
=EXP(0.7409*(LN(calc *hardness))-4.719)

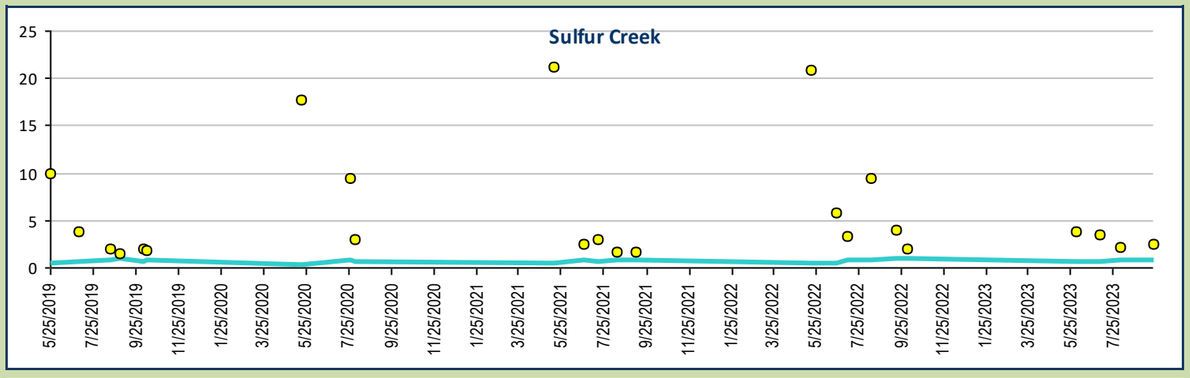
* Calculated using Standard Methods 2340B

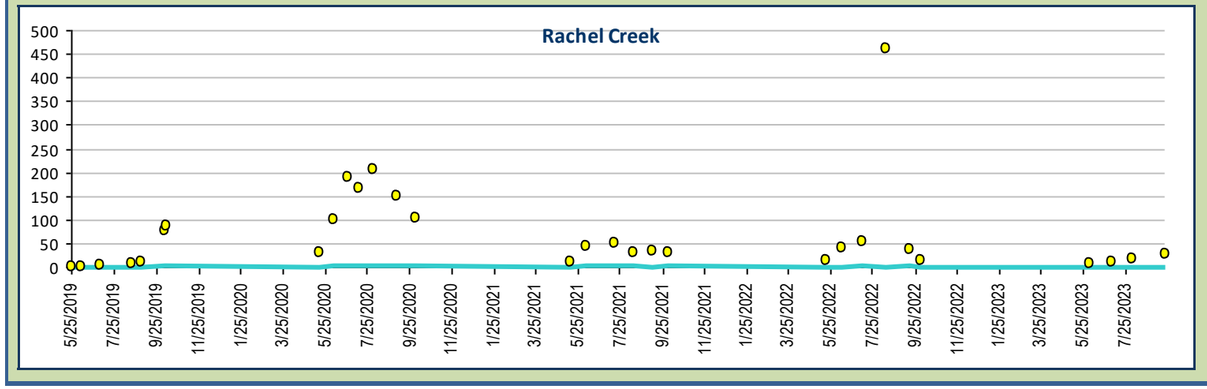


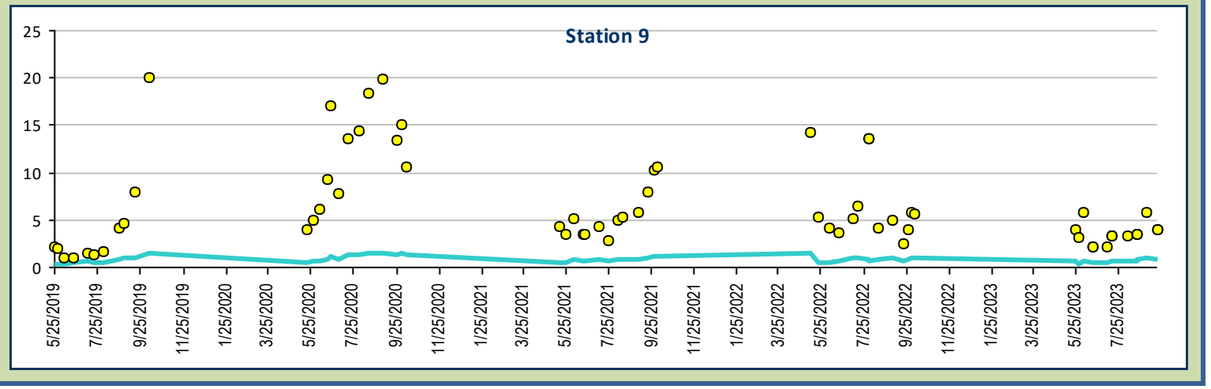












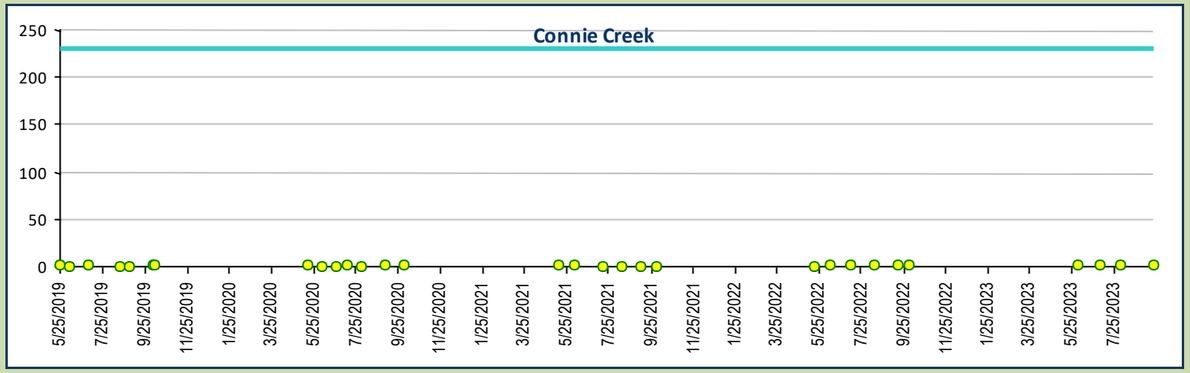
RED DOG MINE

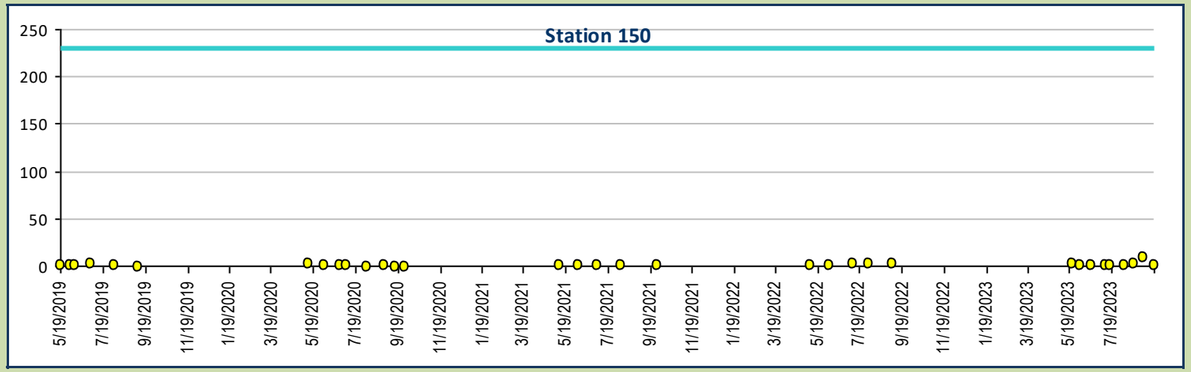
Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

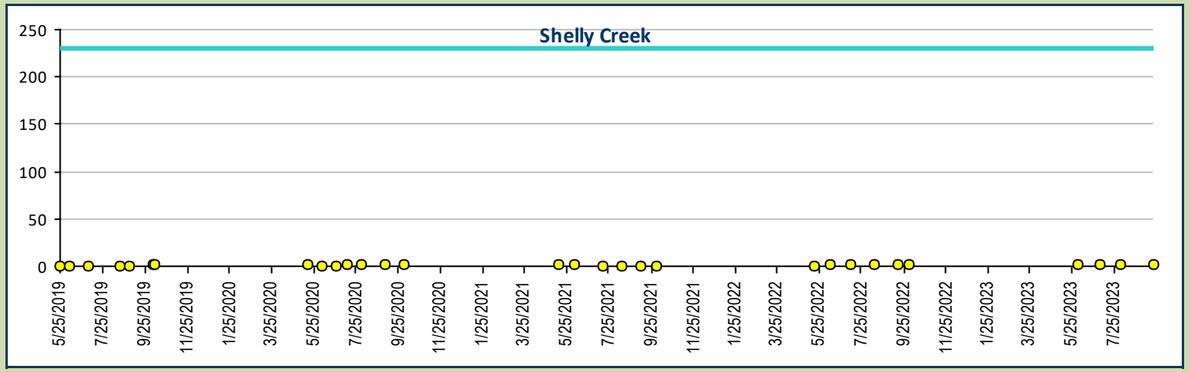
Chloride, Total Recoverable, units mg/L

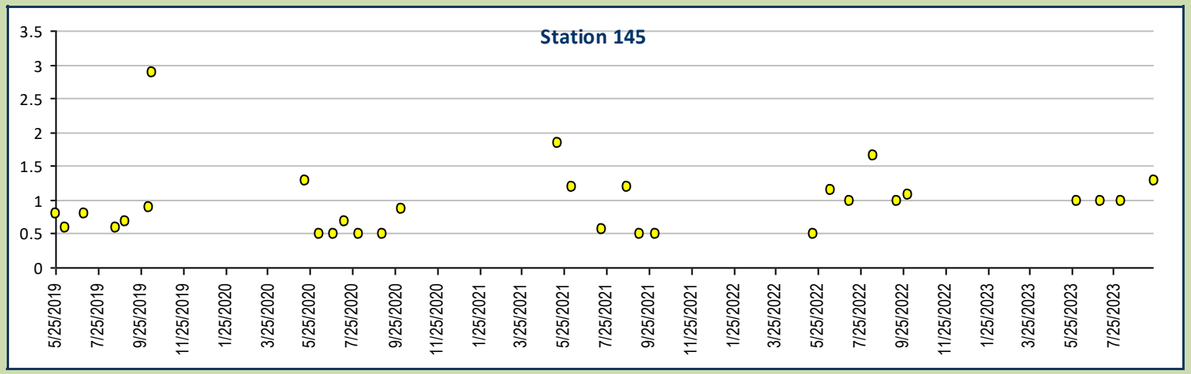
Aquatic Life - Fresh Water Chronic WQS mg/L

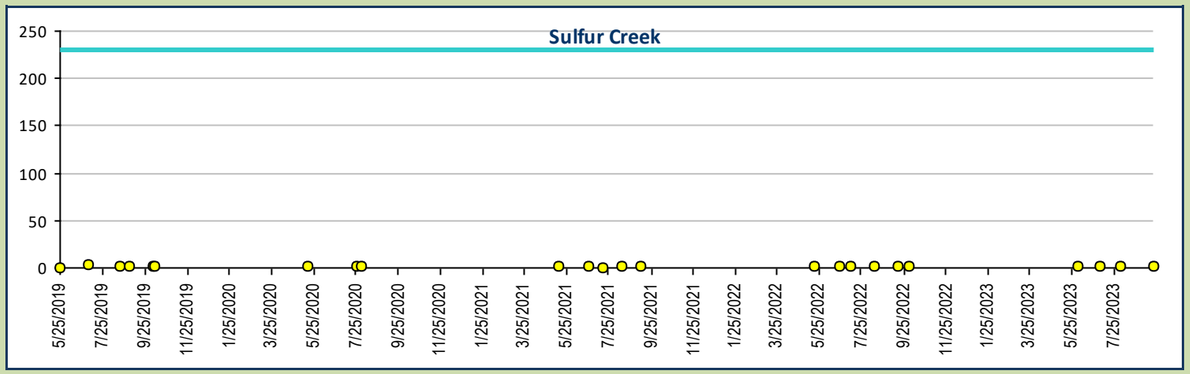
230 mg/L

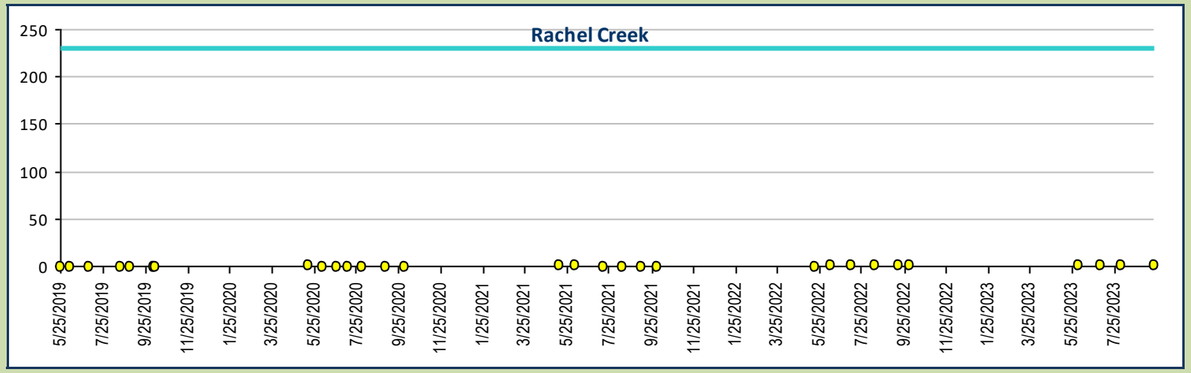


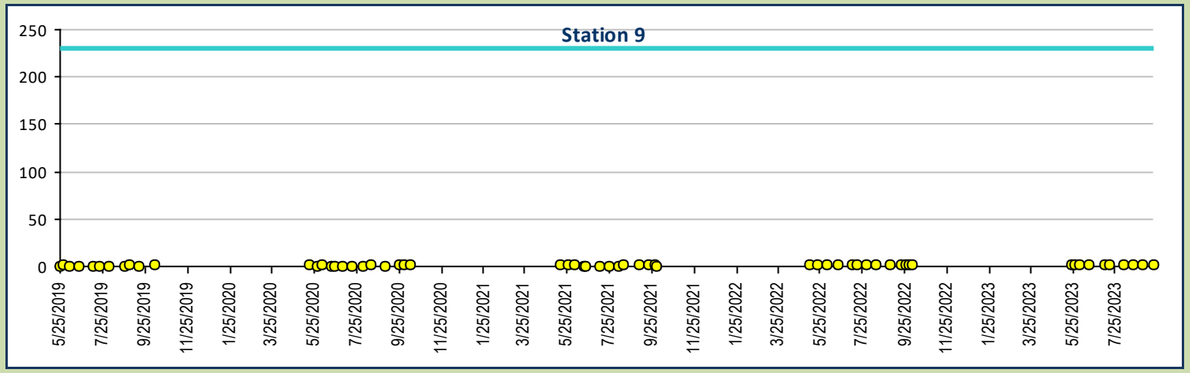








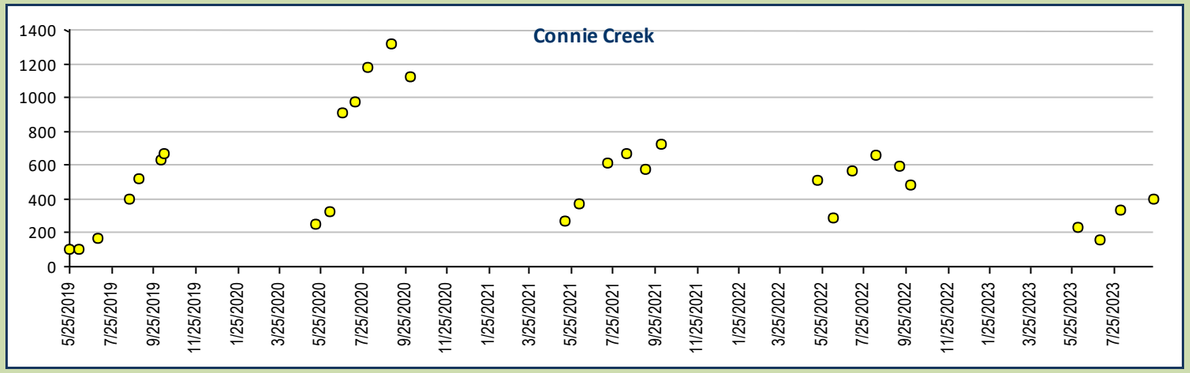


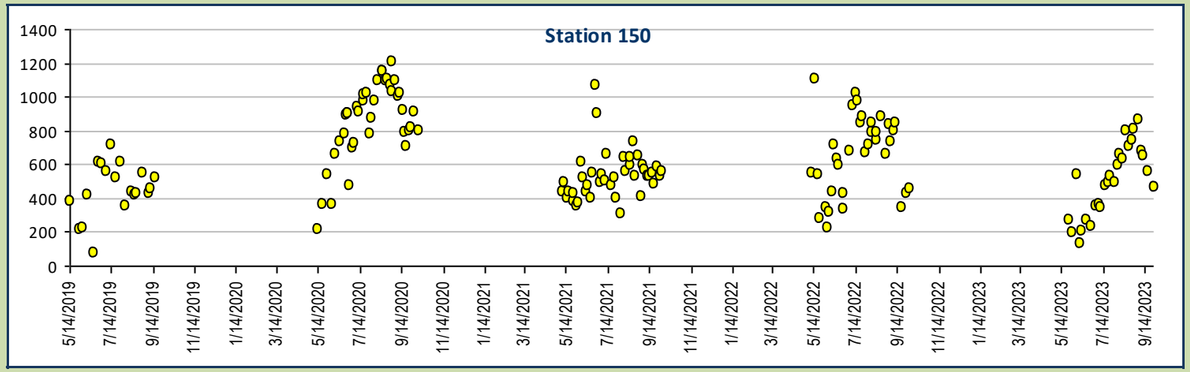


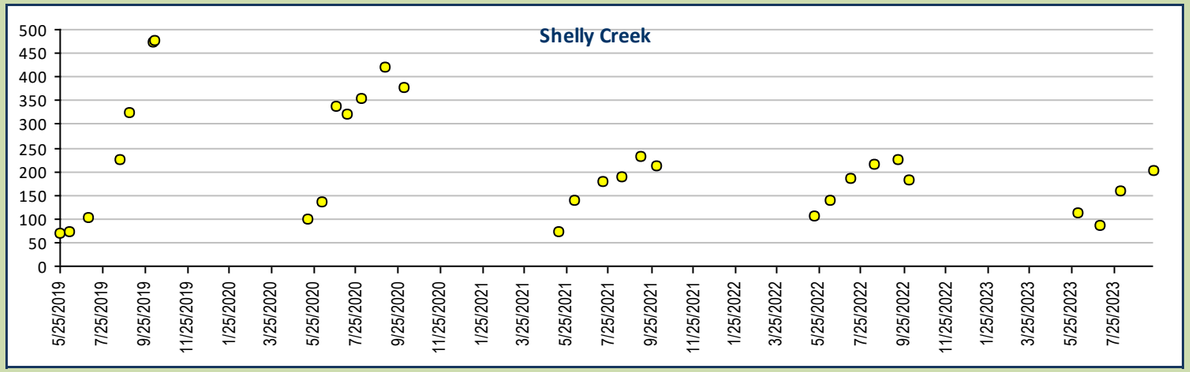
RED DOG MINE

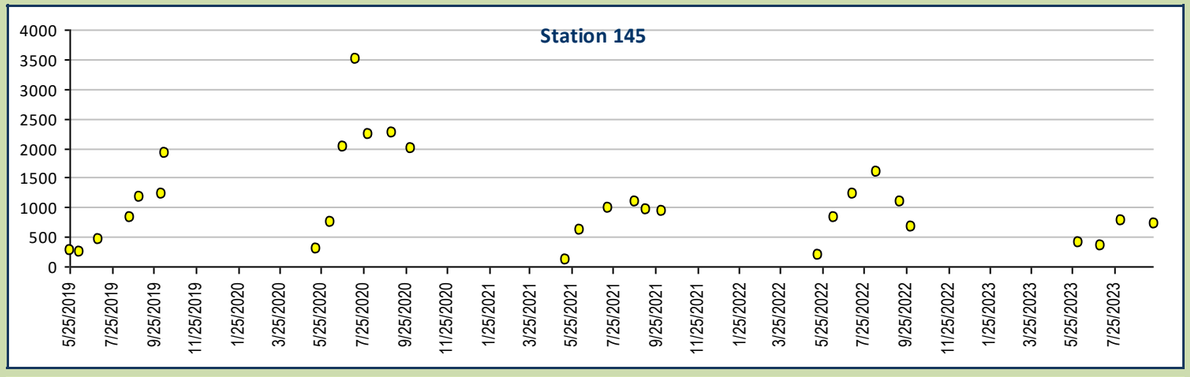
Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

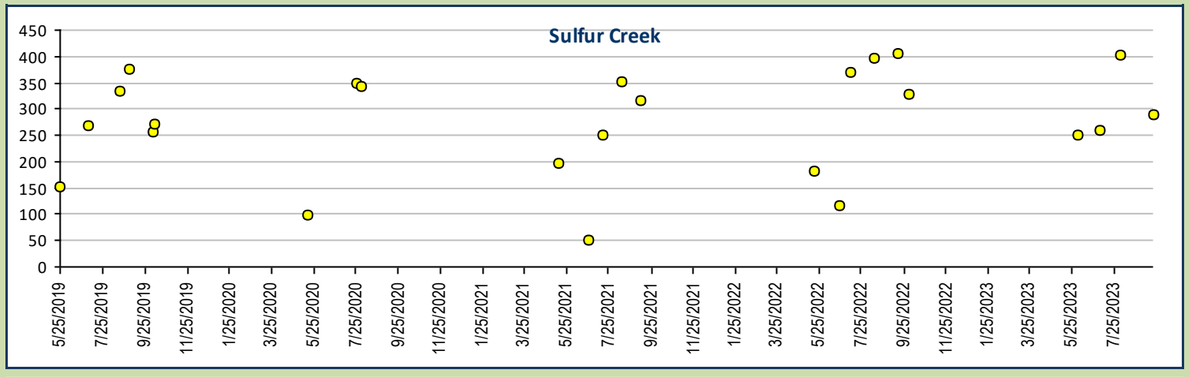
Conductivity, units uS/cm

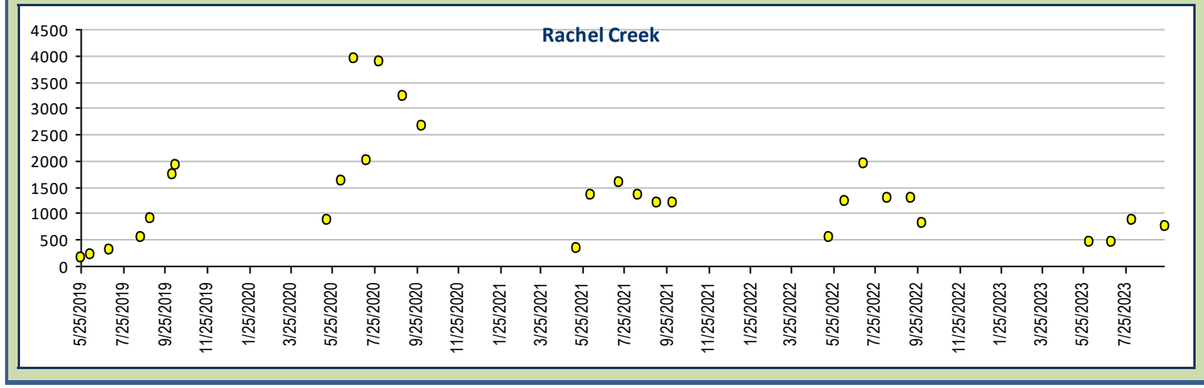


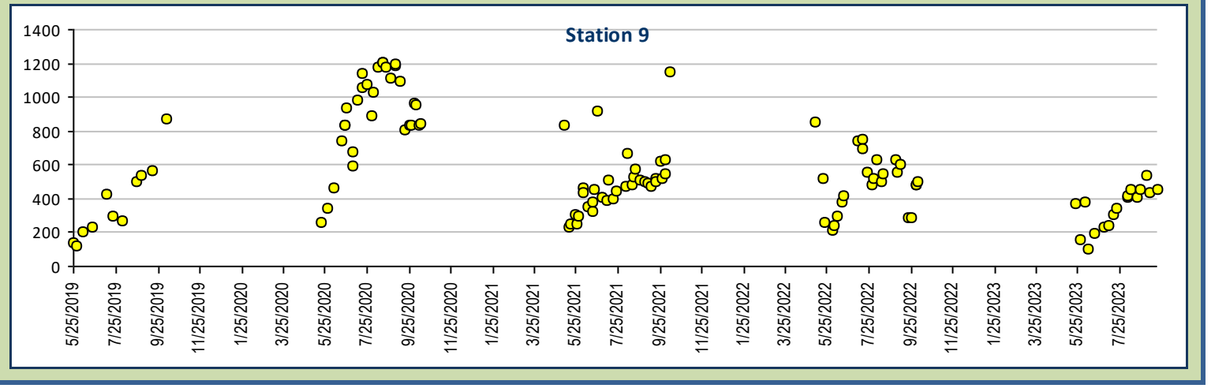












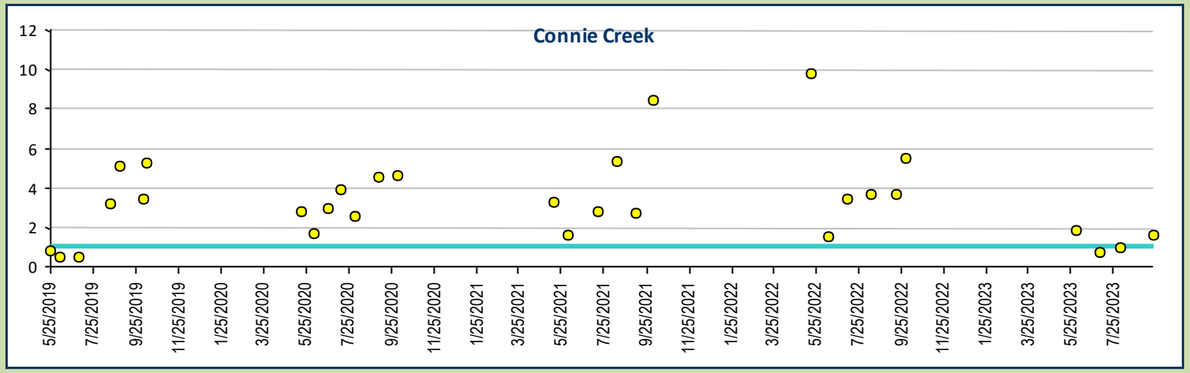
RED DOG MINE

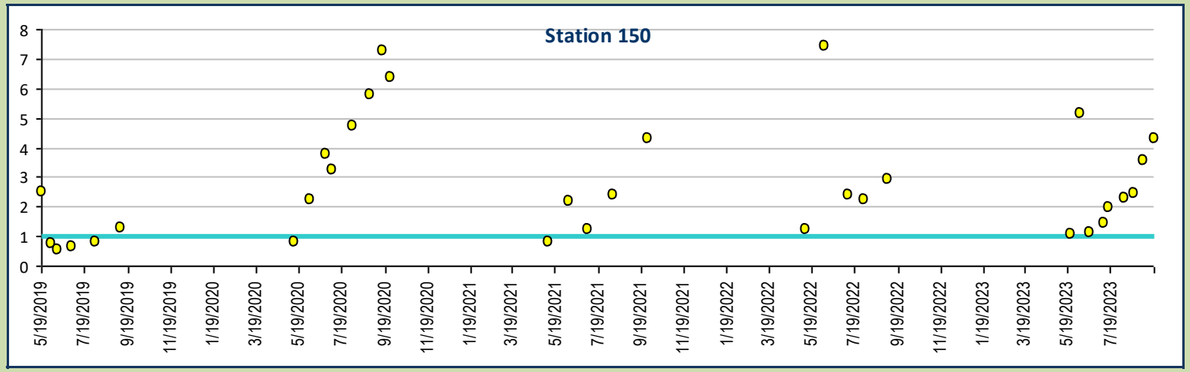
Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

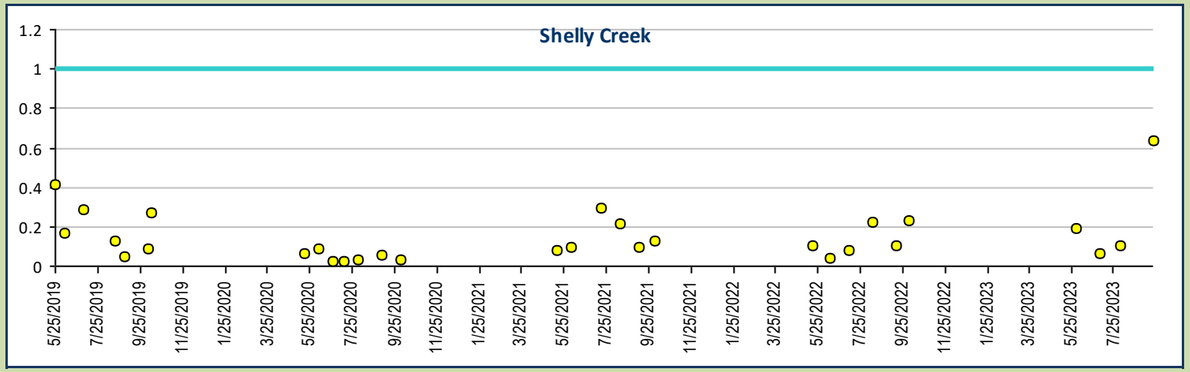
Iron, Total Recoverable, units mg/L

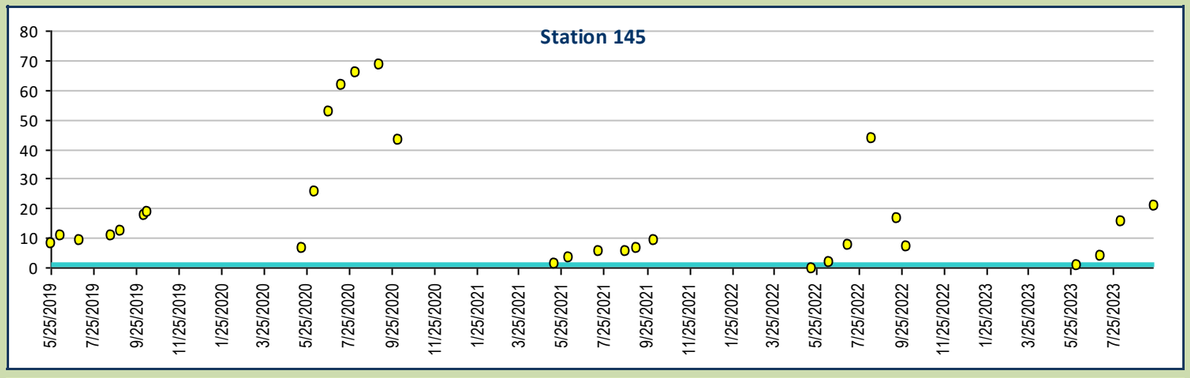
Aquatic Life - Fresh Water Chronic WQS mg/L

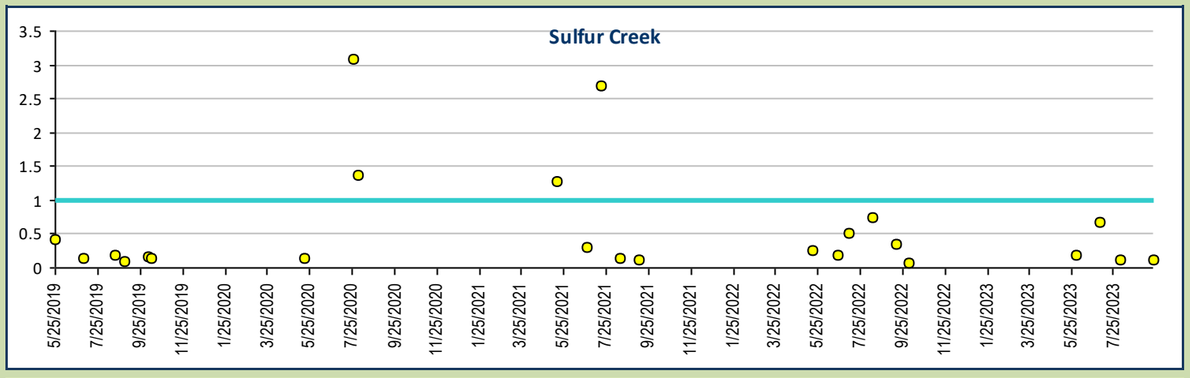
1.0 mg/L

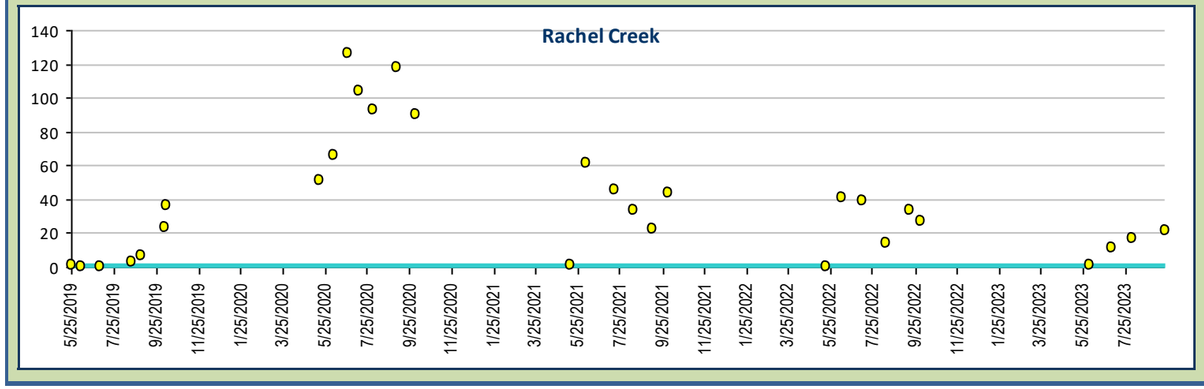


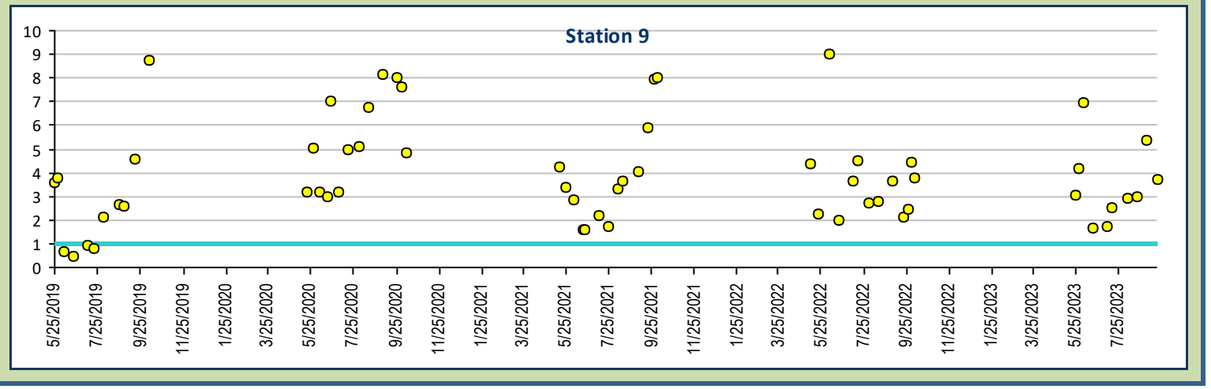








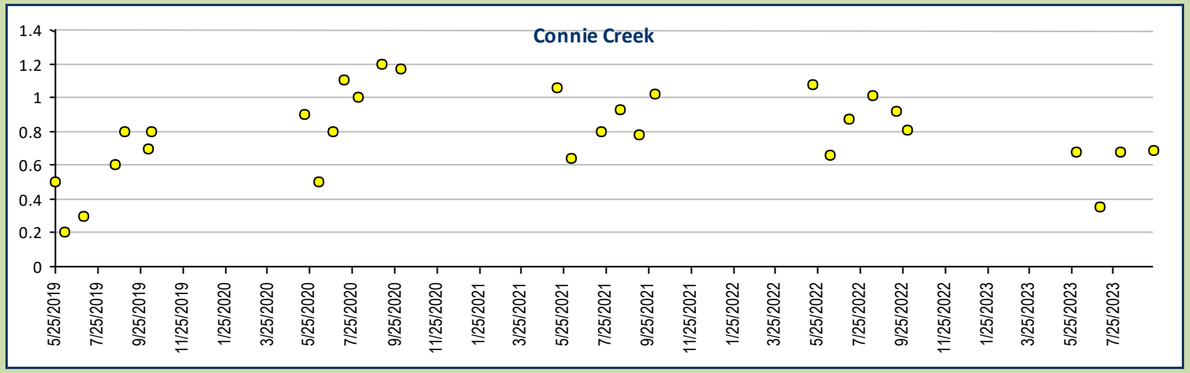


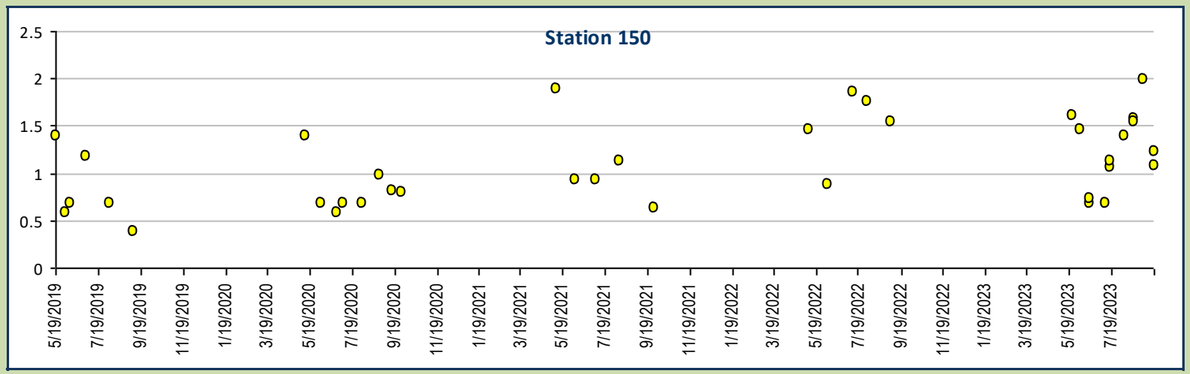


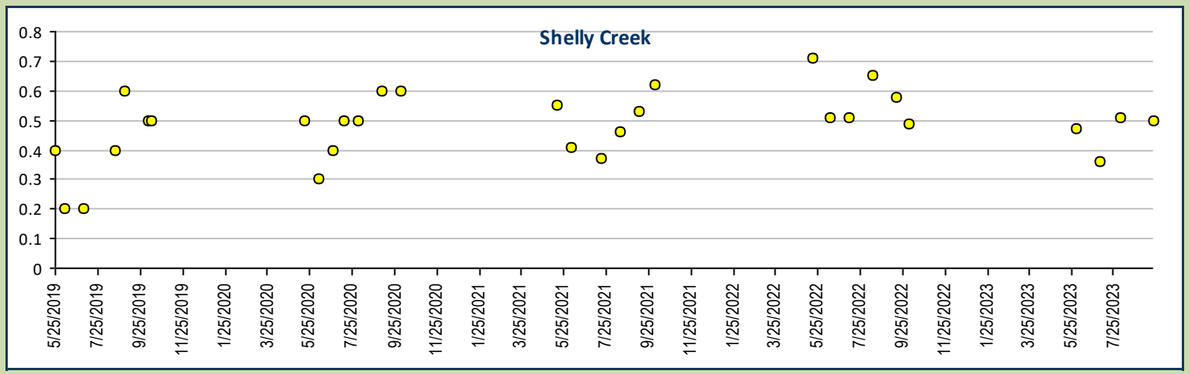
RED DOG MINE

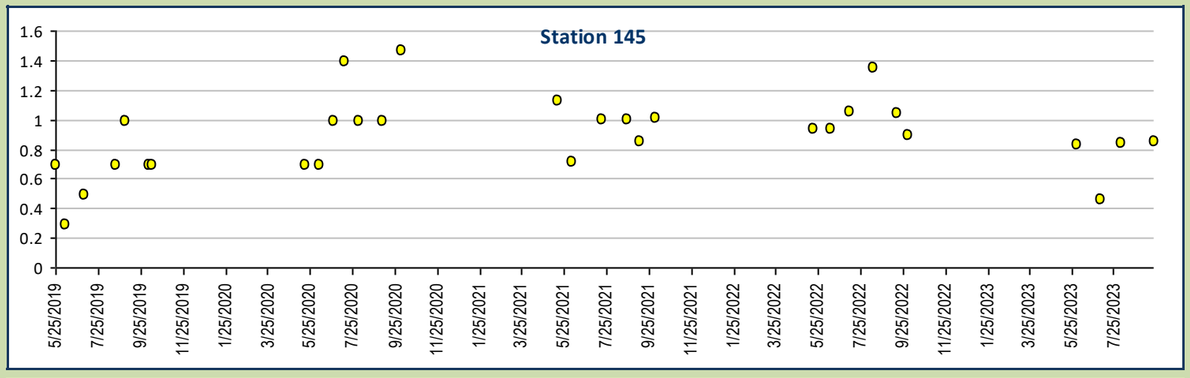
Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

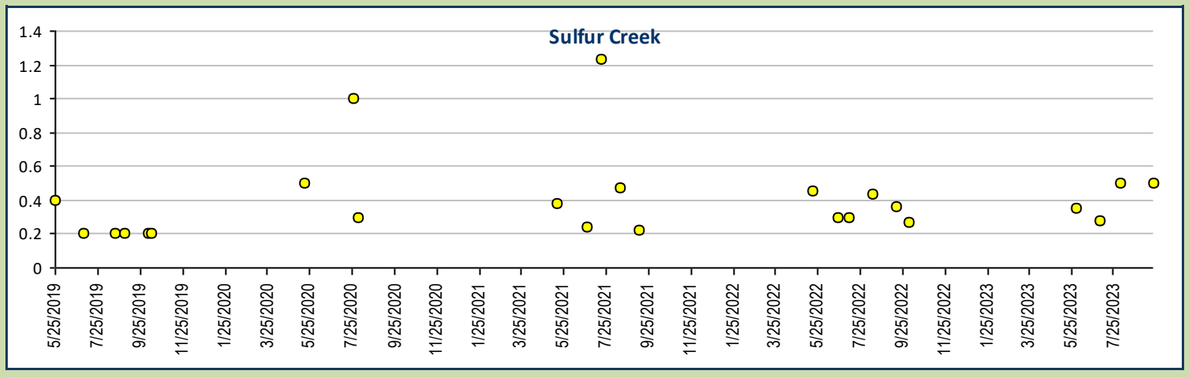
Potassium, Total Recoverable, units mg/L

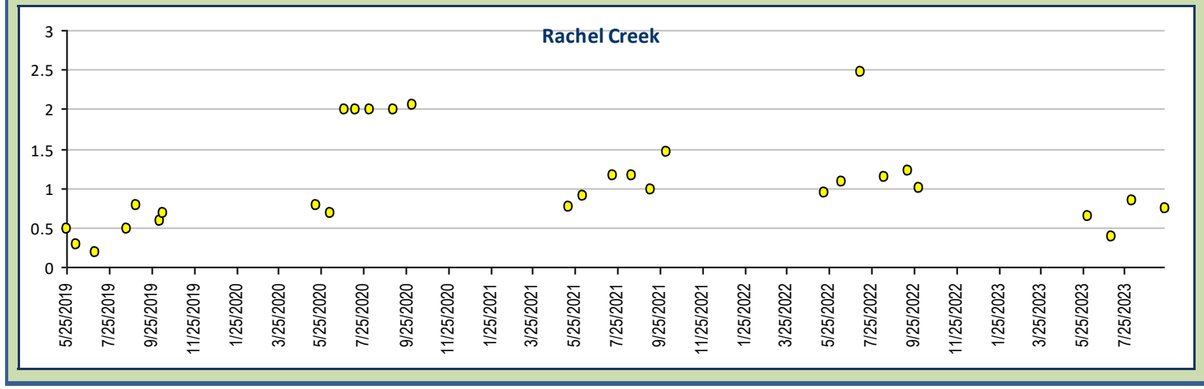


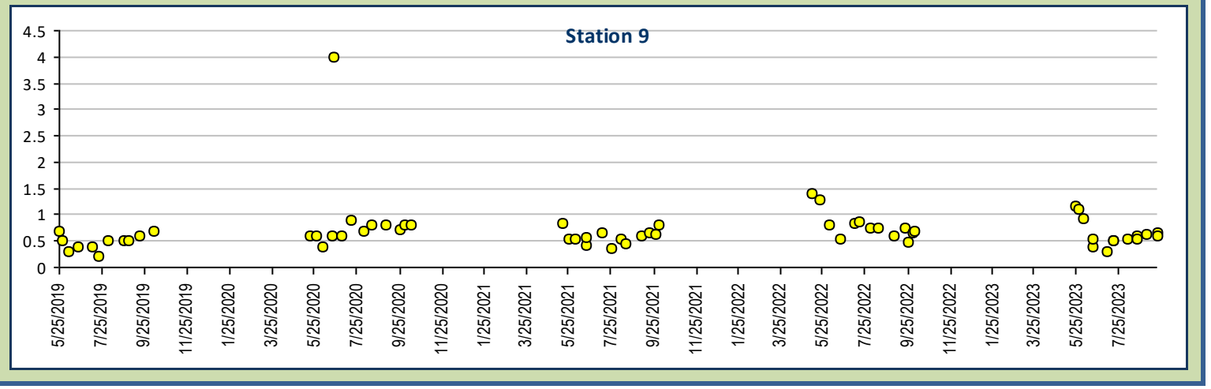








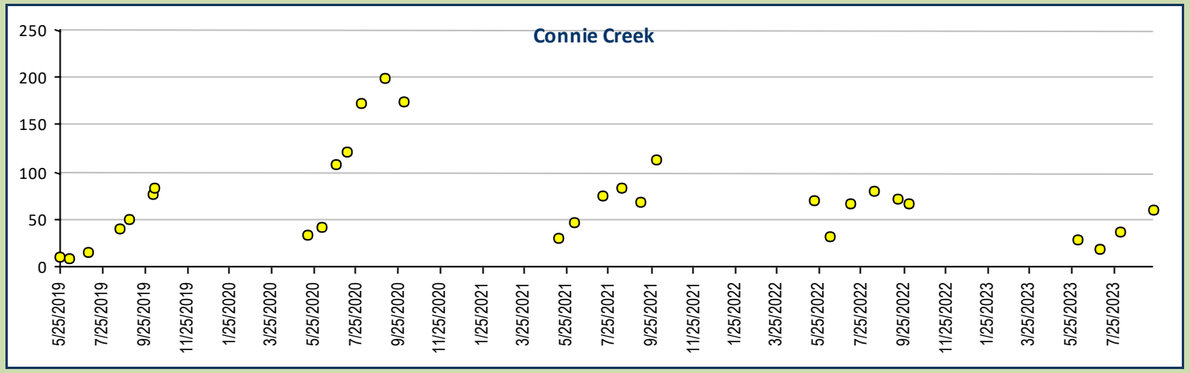


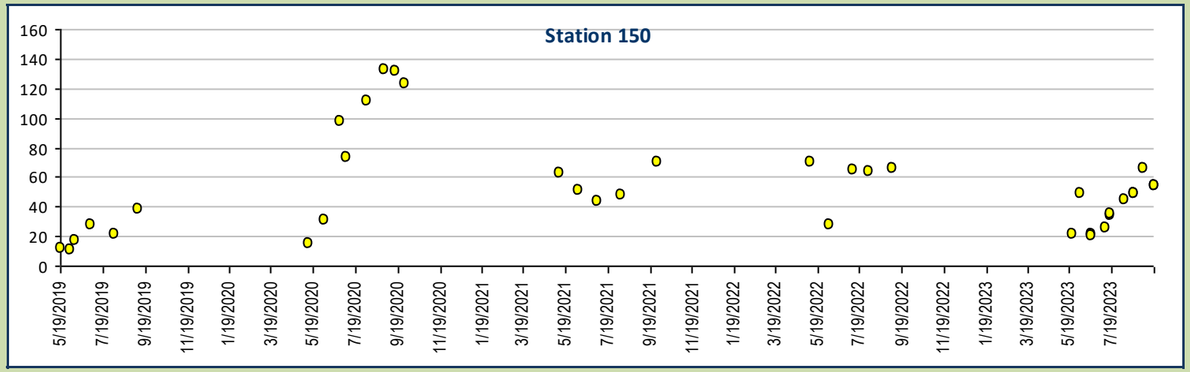


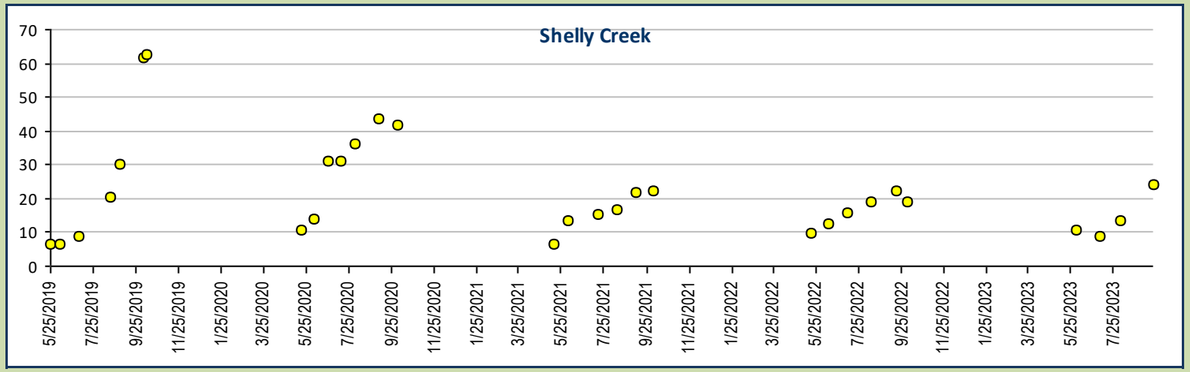
RED DOG MINE

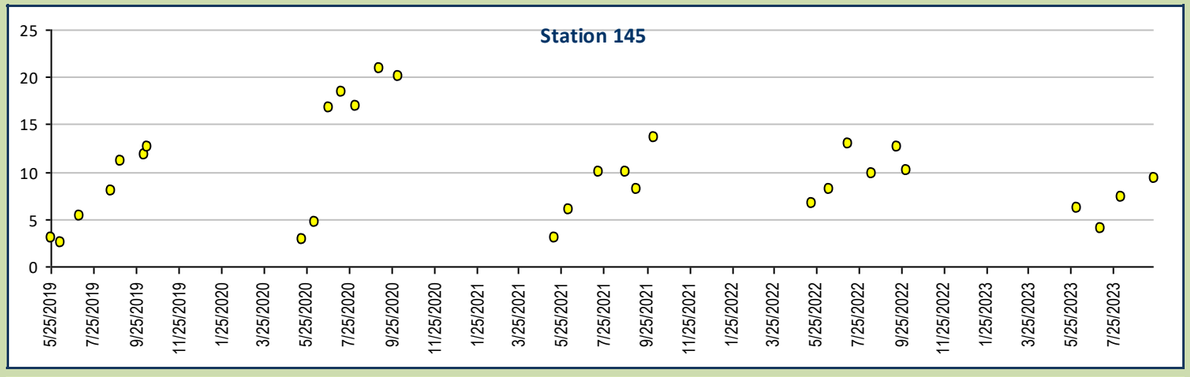
Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

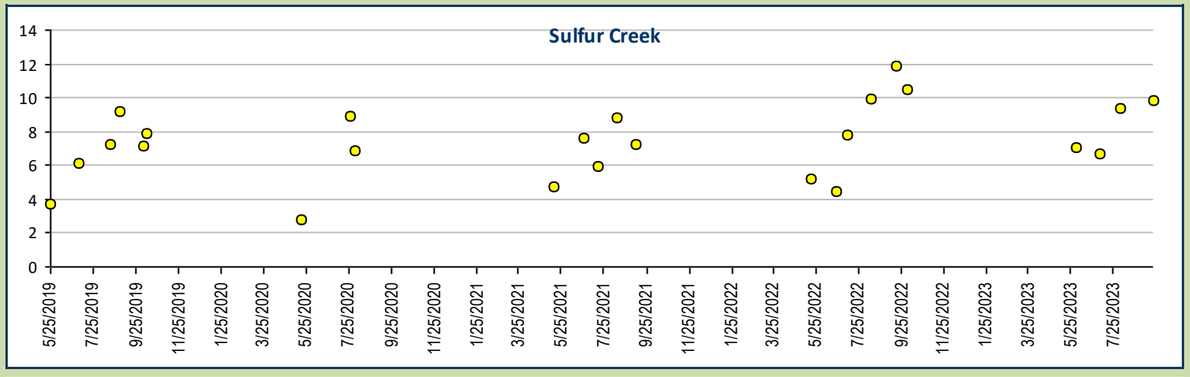
Magnesium, Total Recoverable, units mg/L

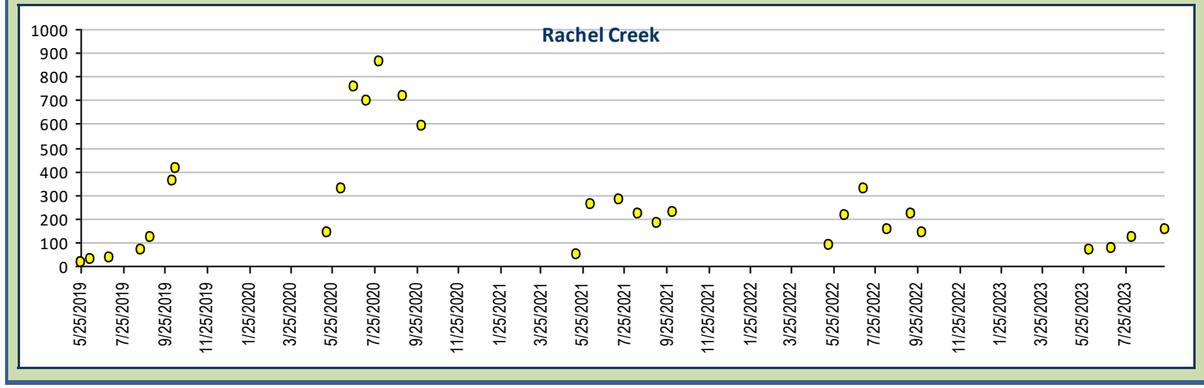


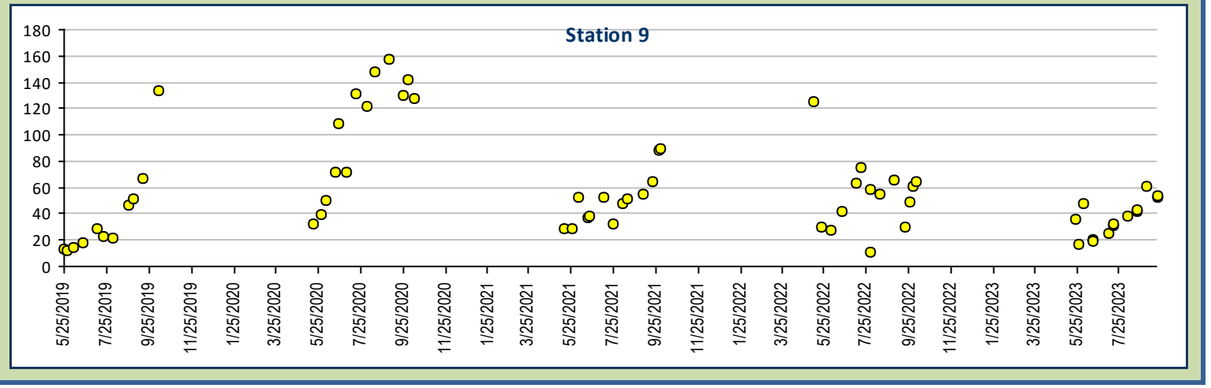








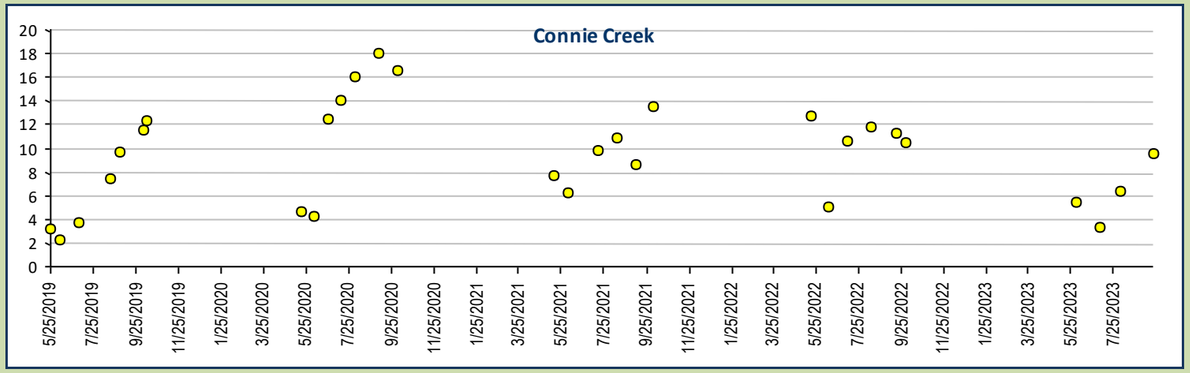


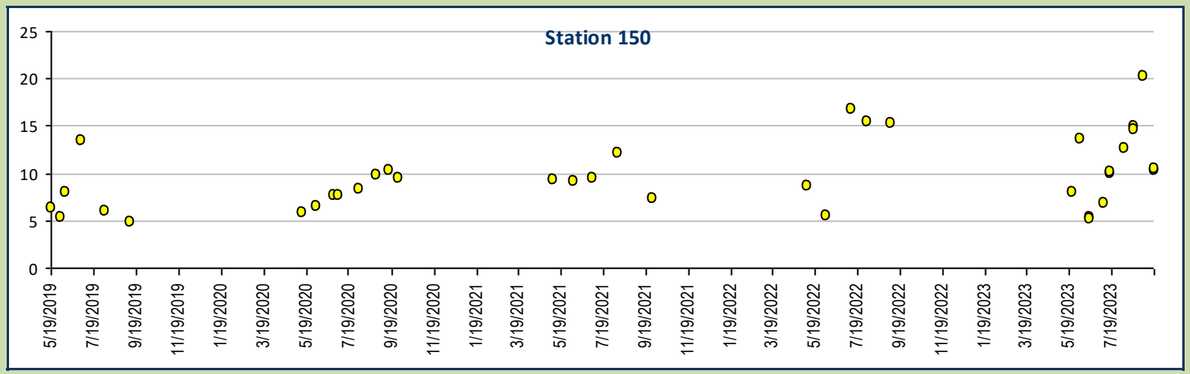


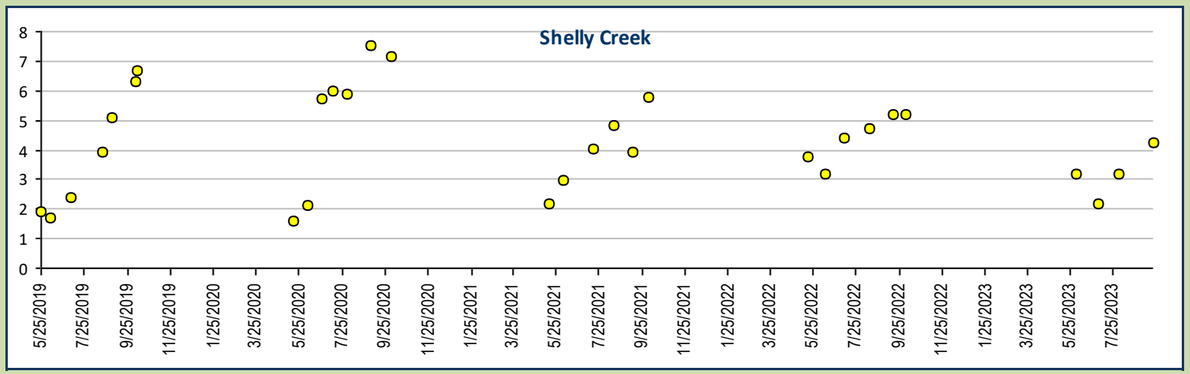
RED DOG MINE

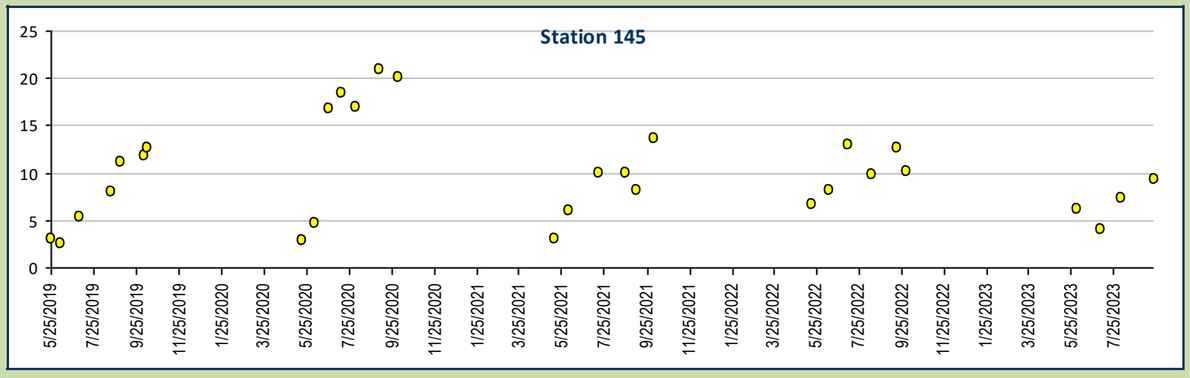
Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

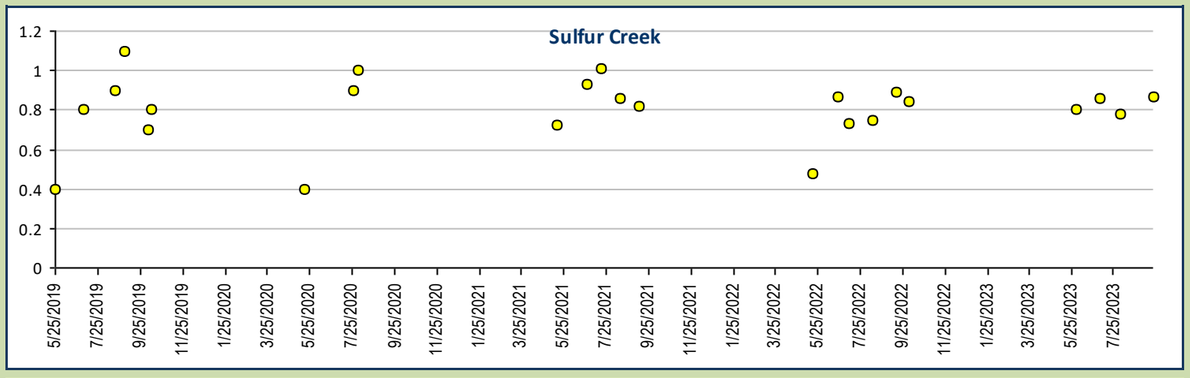
Sodium, Total Recoverable, units mg/L

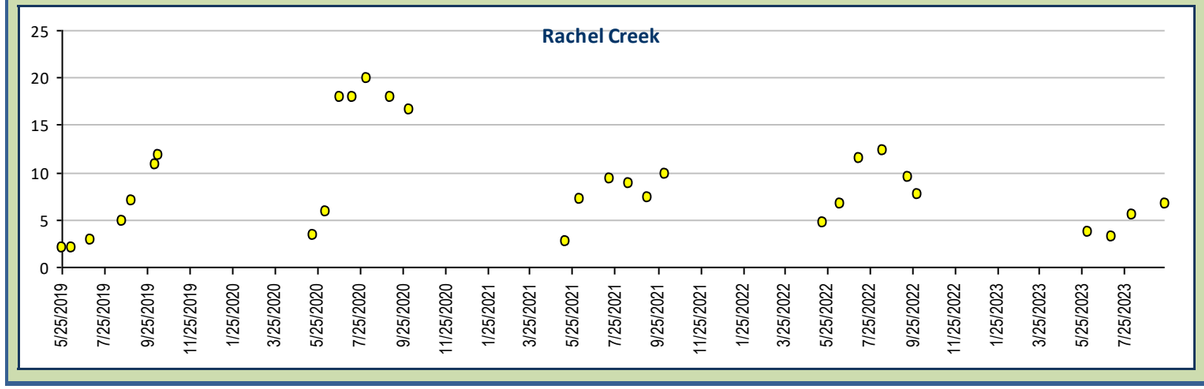


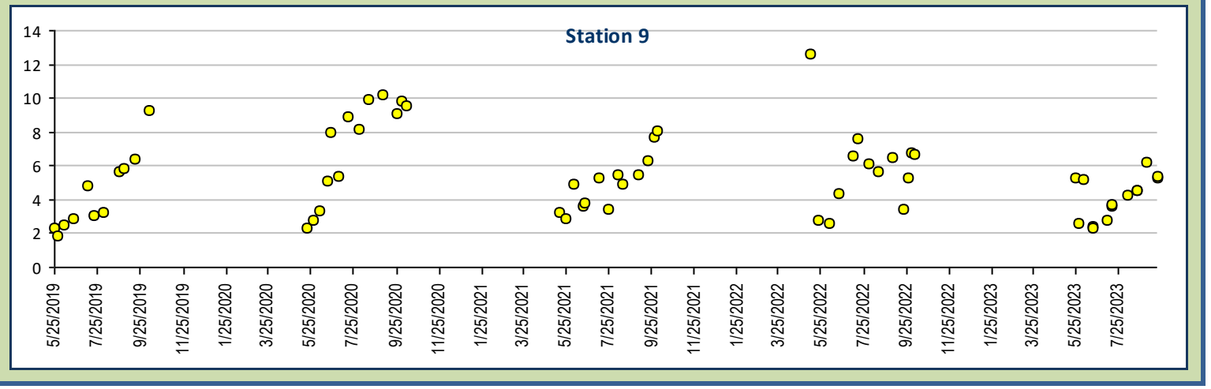












RED DOG MINE

Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

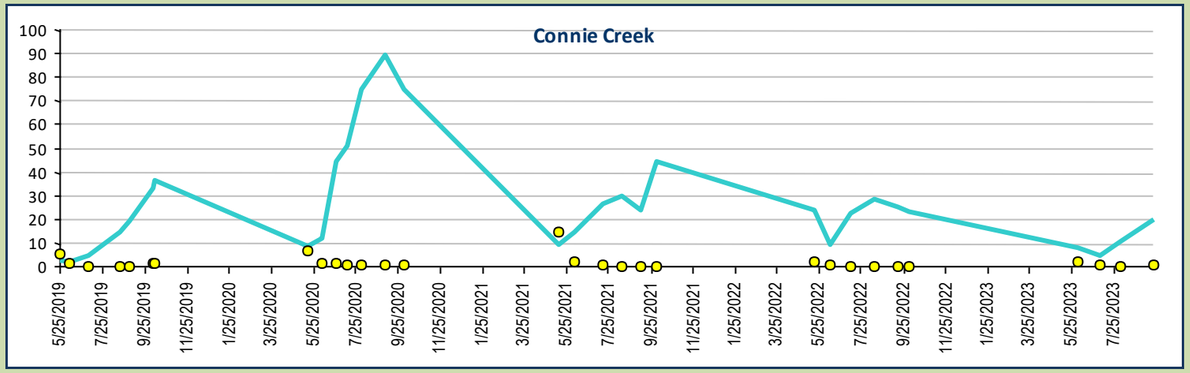
Lead, Total Recoverable, units ug/L

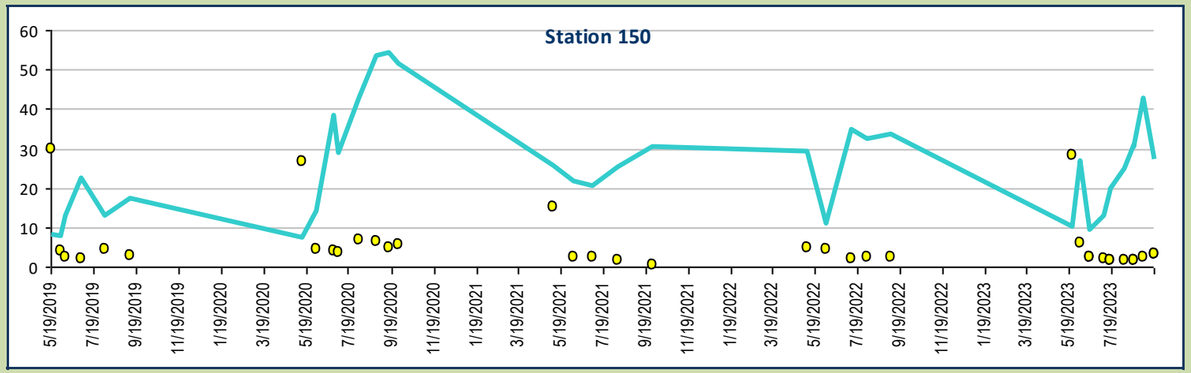
Aquatic Life - Fresh Water Chronic WQS ug/L

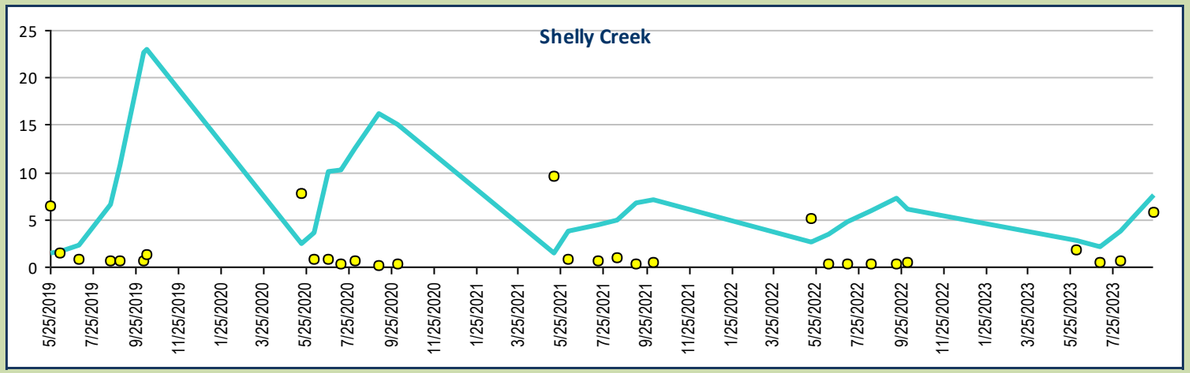
Hardness Dependent Calculation

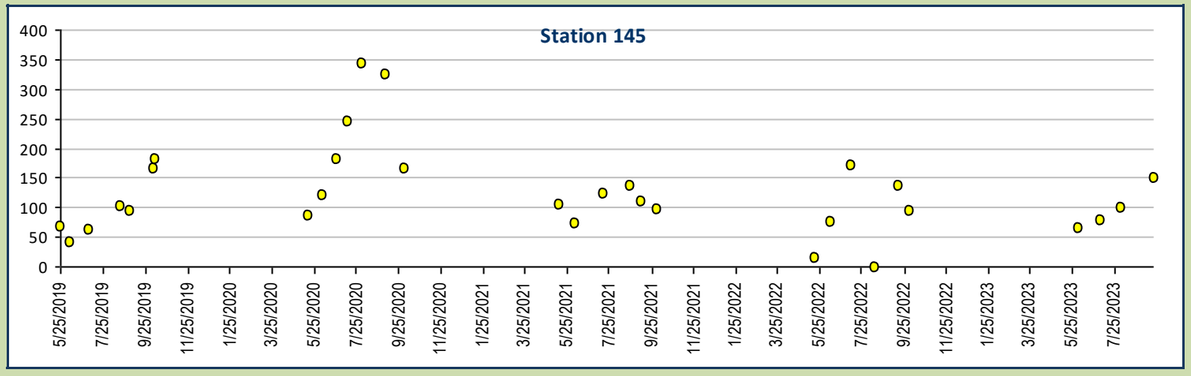
=EXP(1.273*(LN(calc *hardness))-4.705)

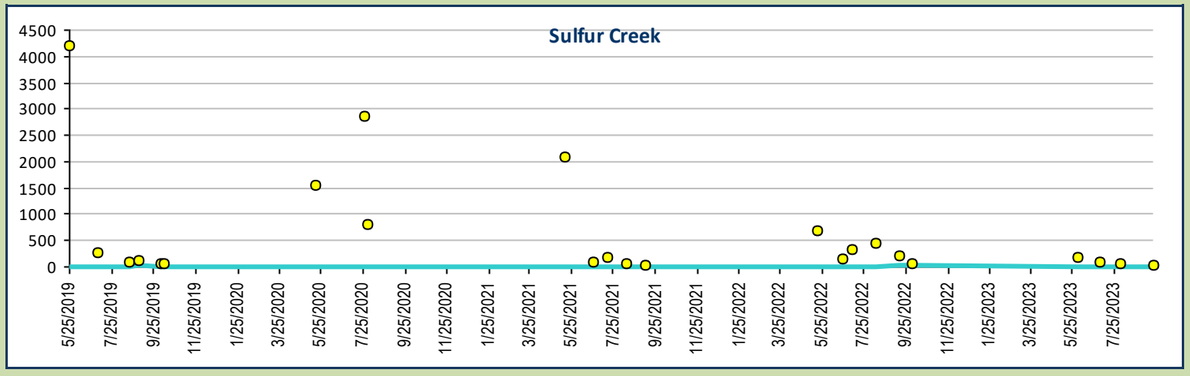
* Calculated using Standard Methods 2340B

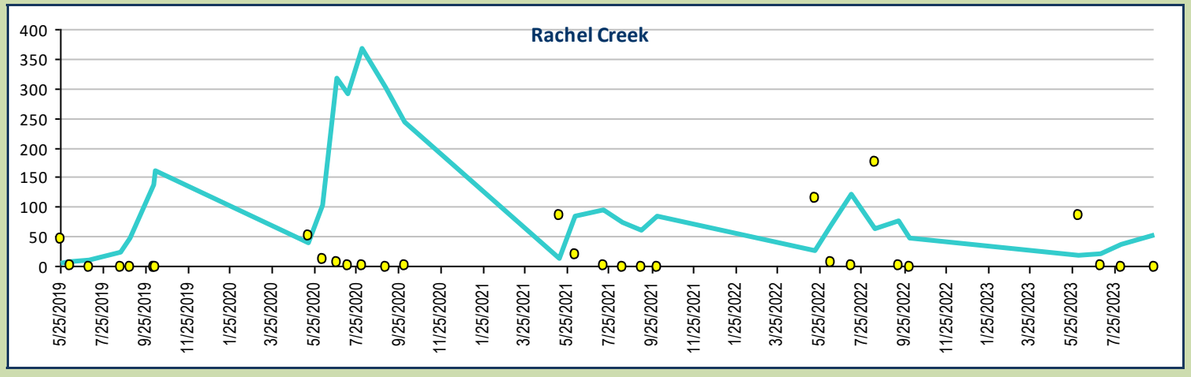


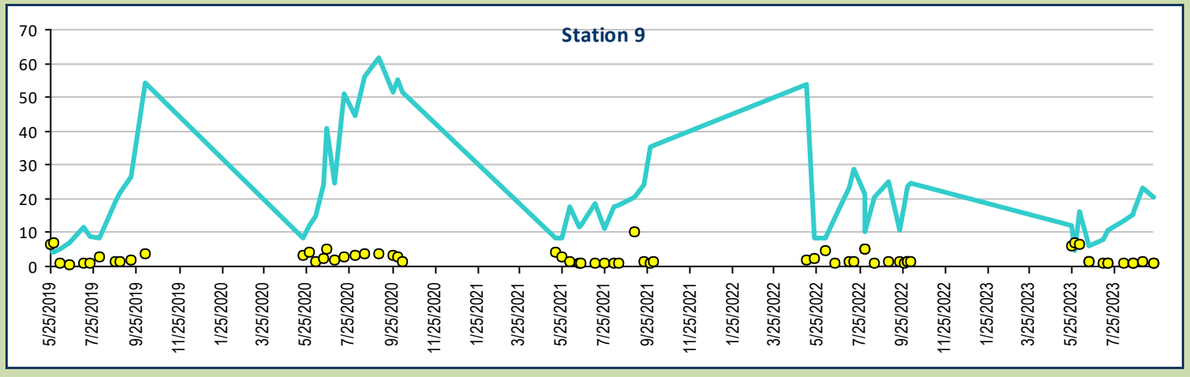










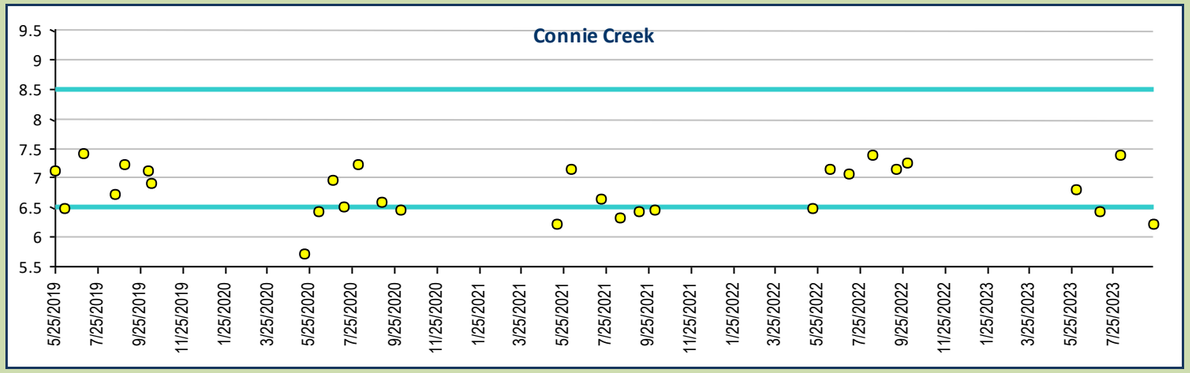


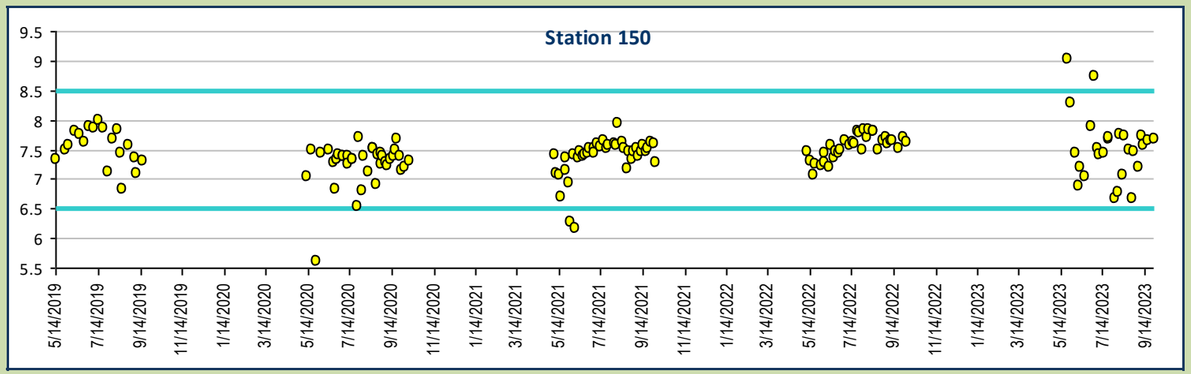
RED DOG MINE

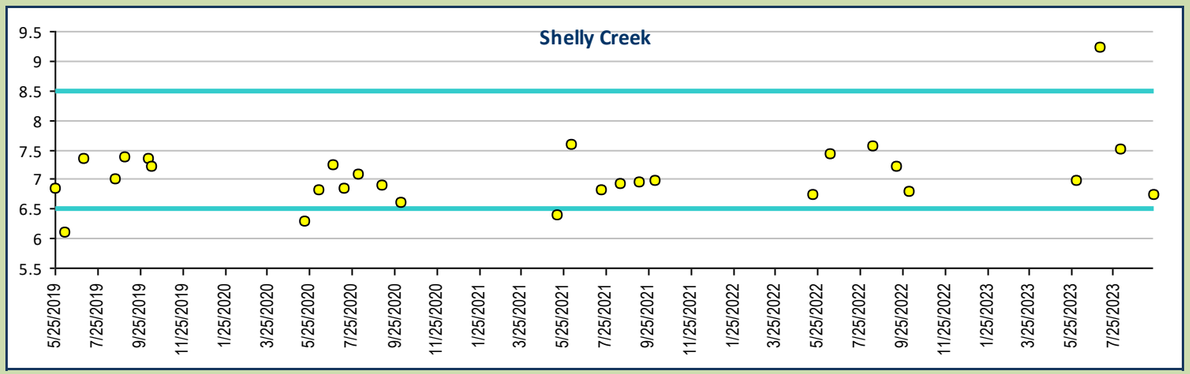
Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

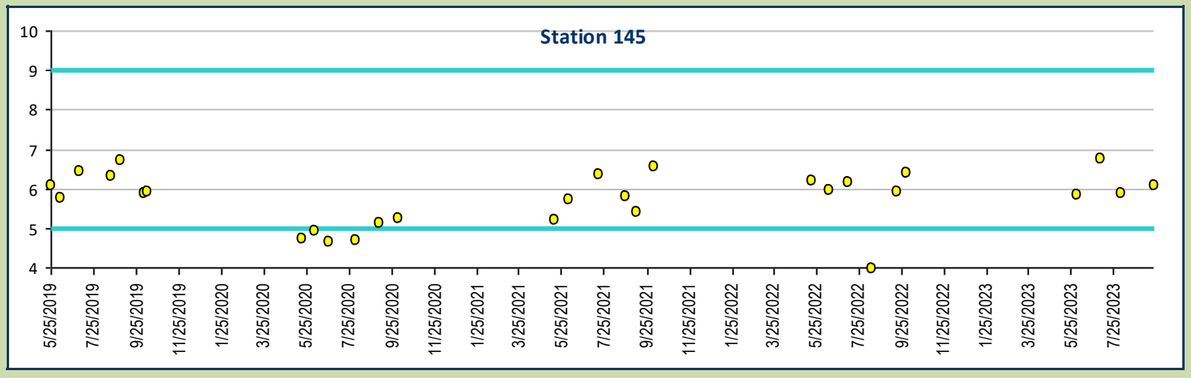
pH

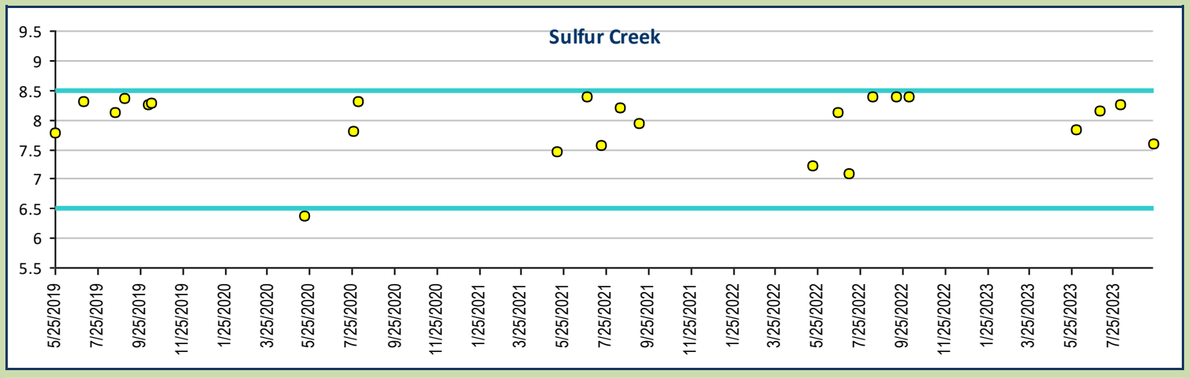
Site Specific WQS pH units

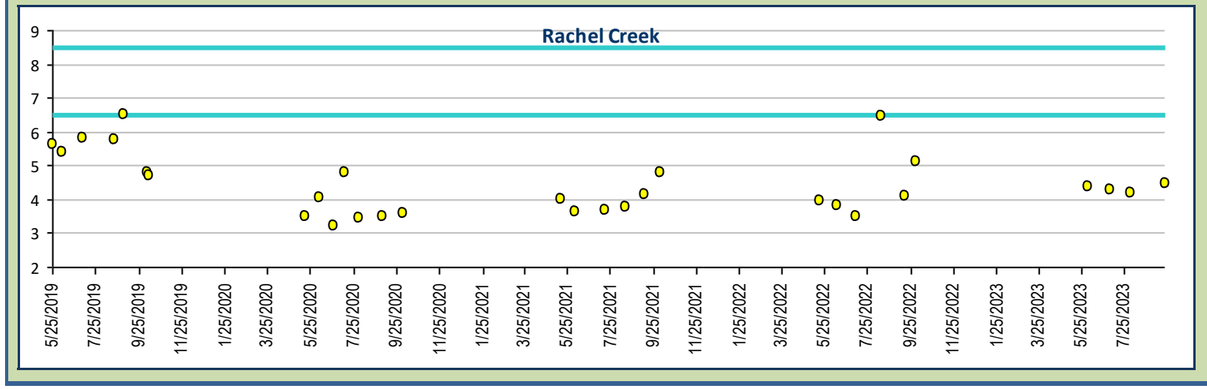


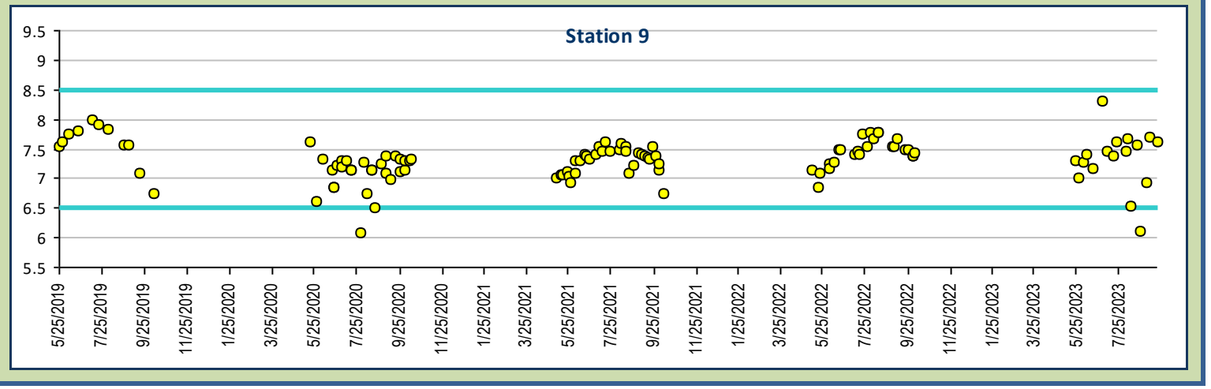












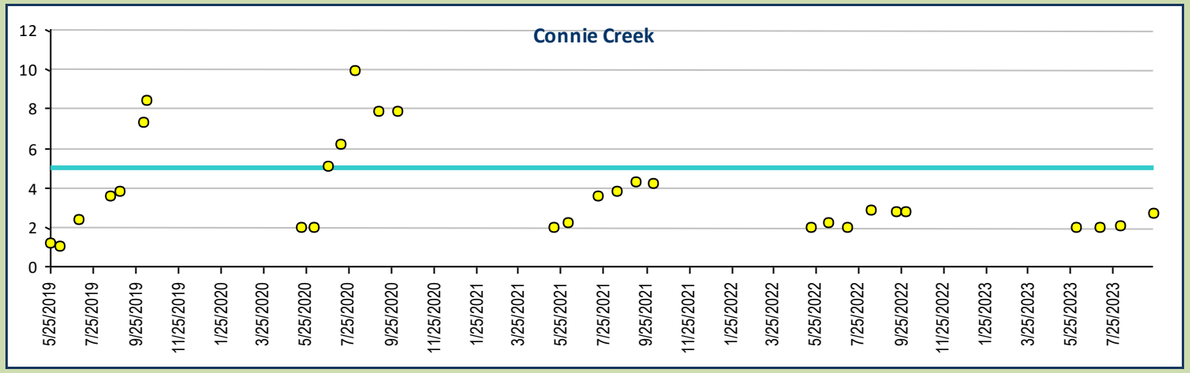
RED DOG MINE

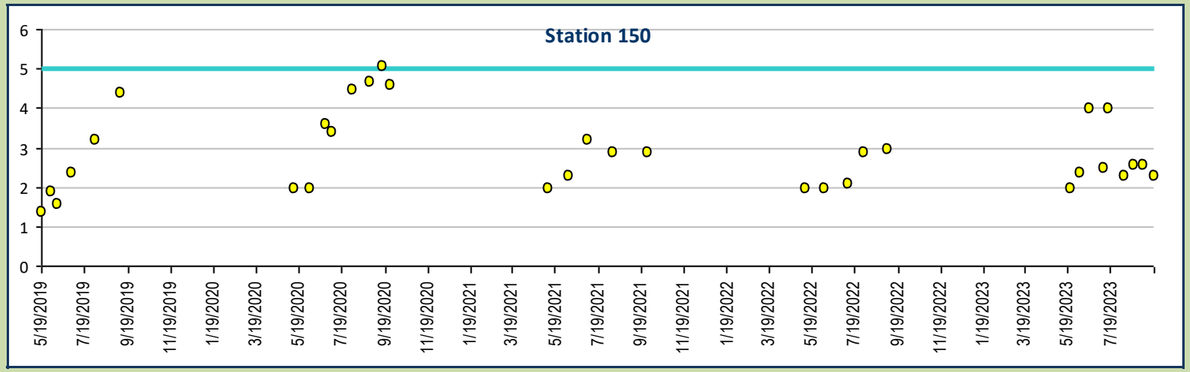
Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

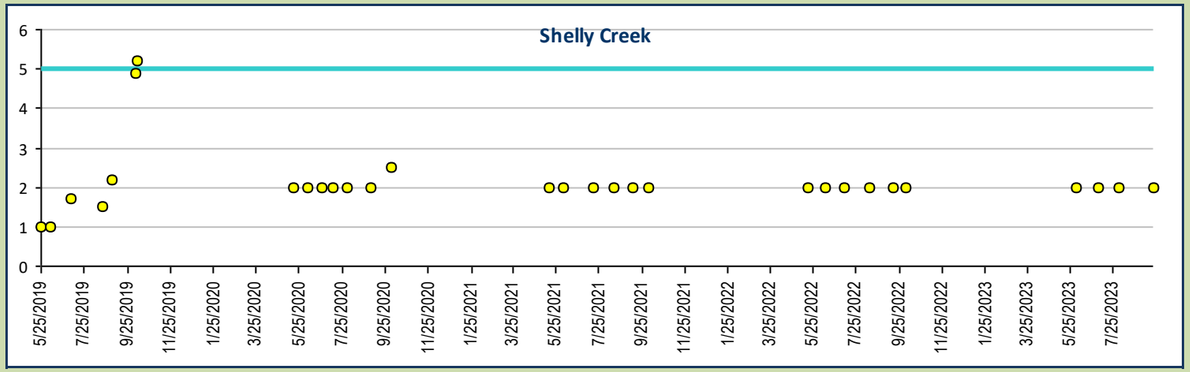
Selenium, Total Recoverable, units ug/L

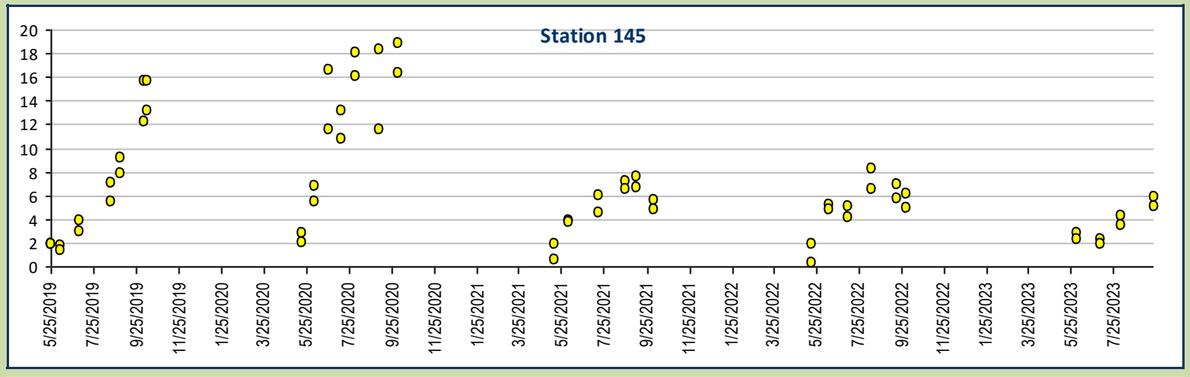
Aquatic Life - Fresh Water Chronic WQS ug/L

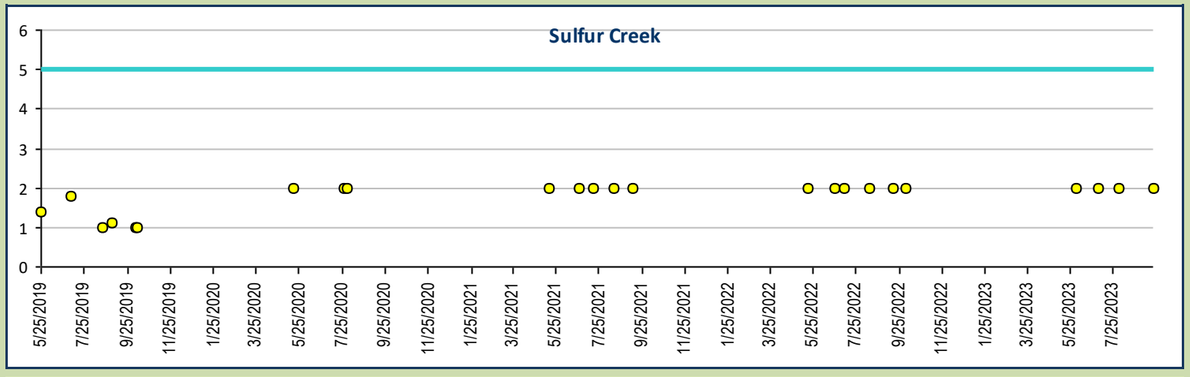
5 ug/L

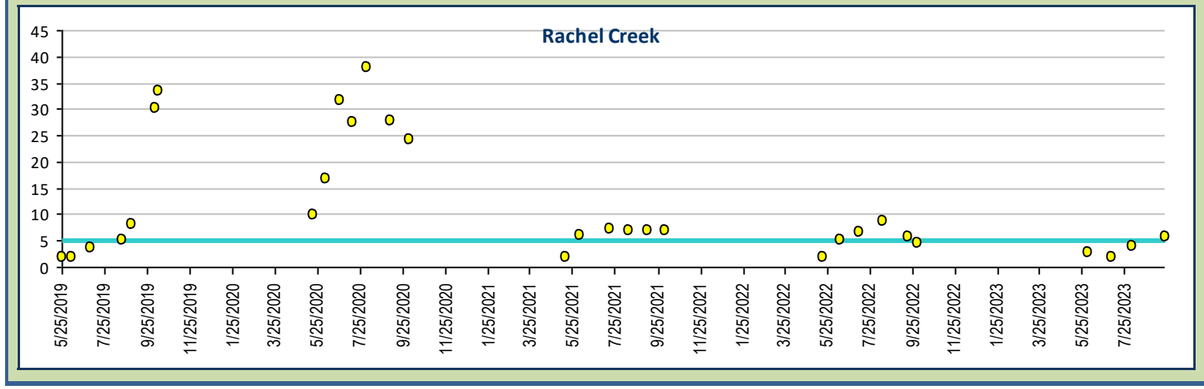


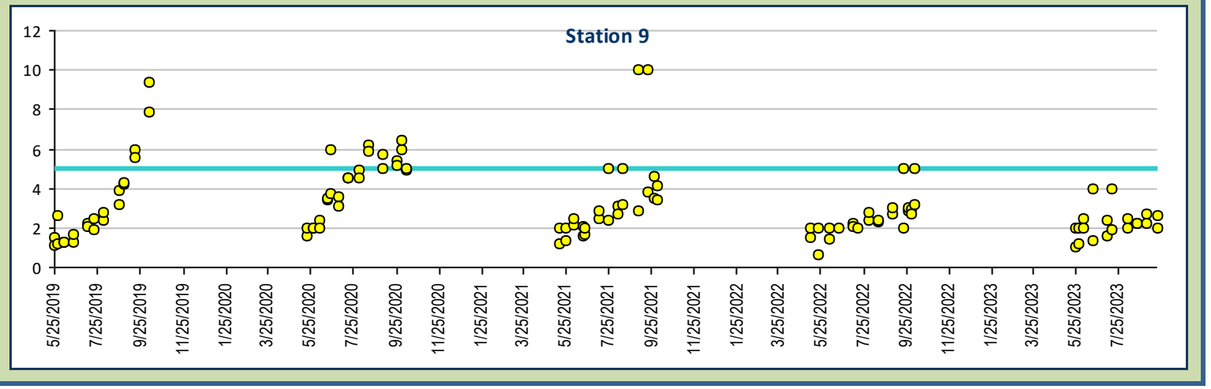








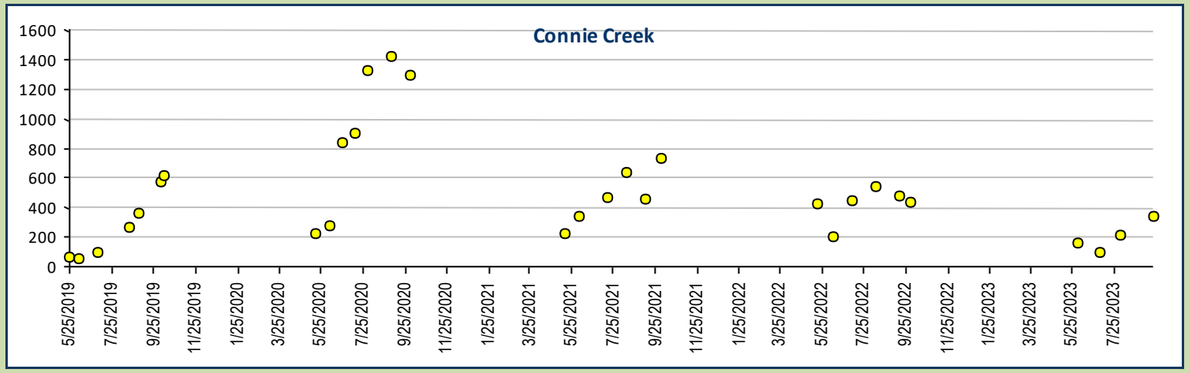


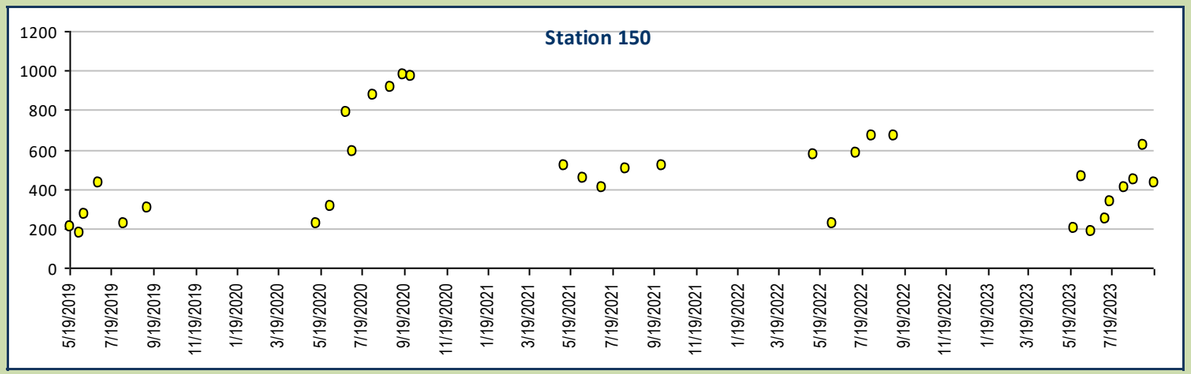


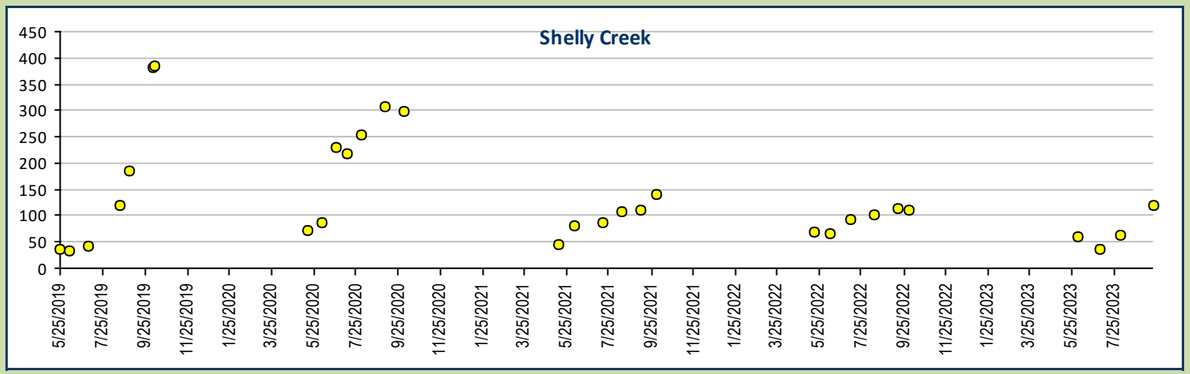
RED DOG MINE

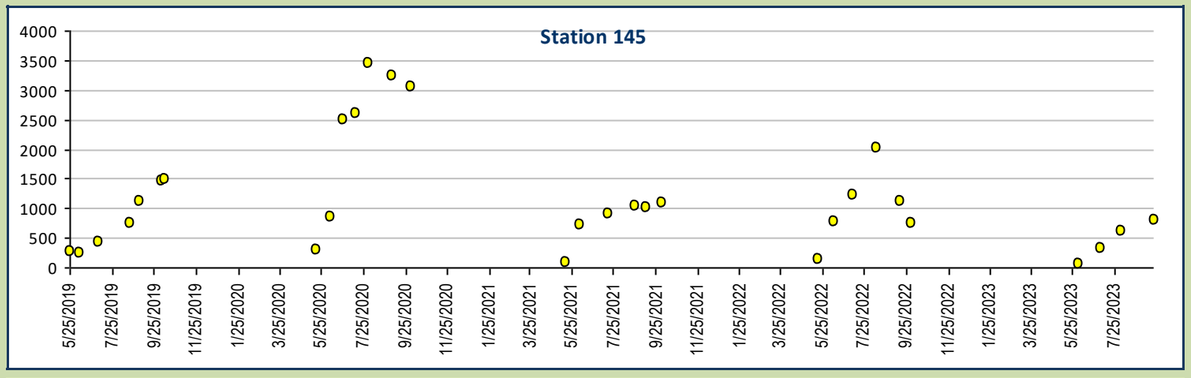
Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

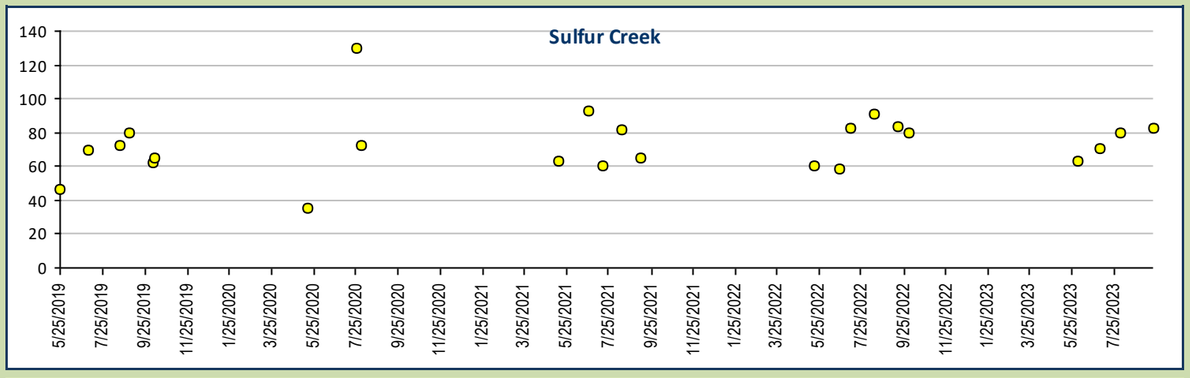
Sulfate, units mg/L

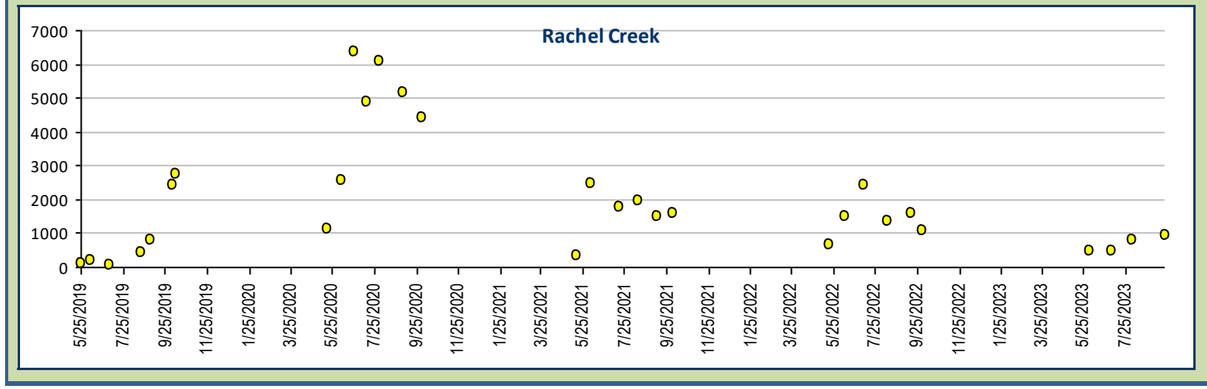


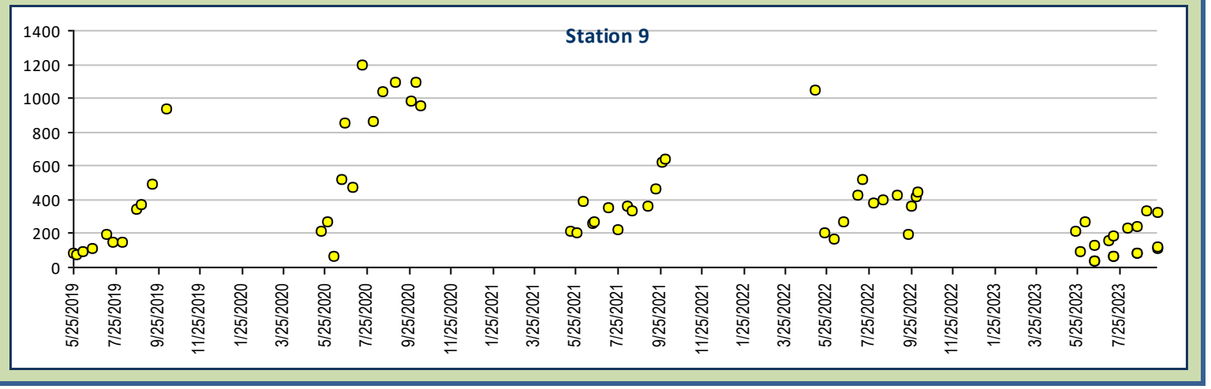












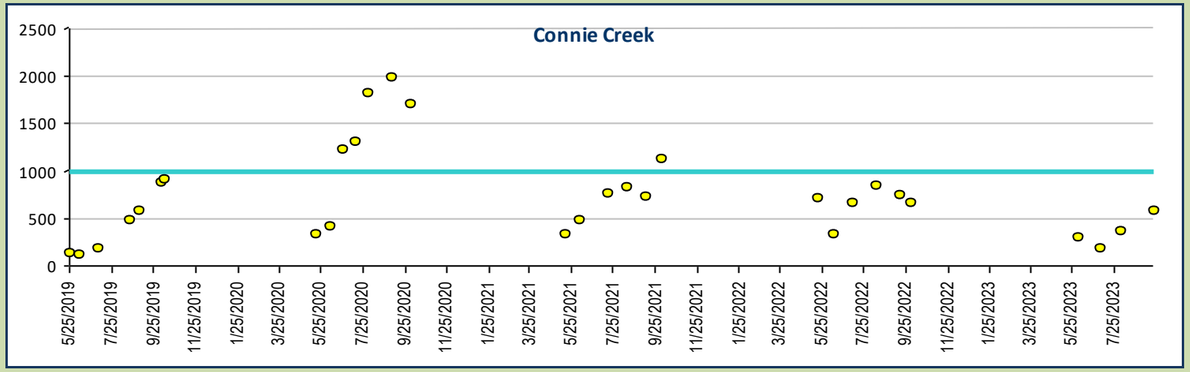
RED DOG MINE

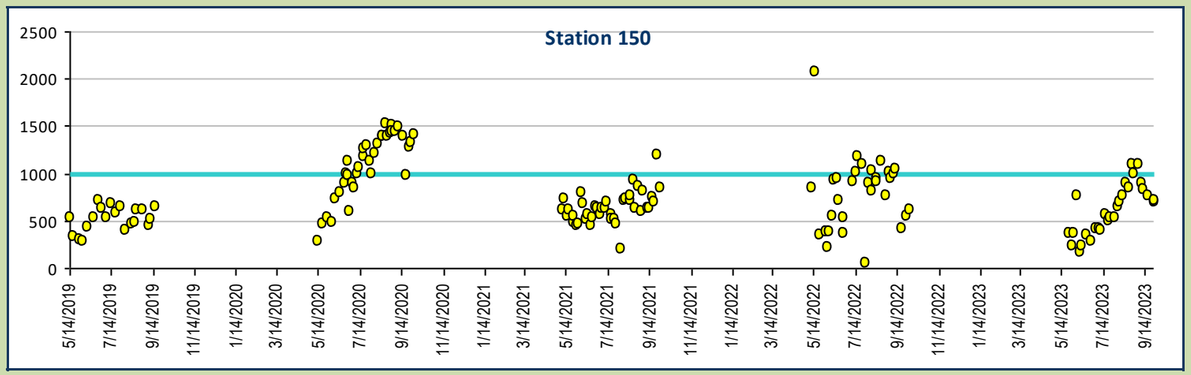
Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

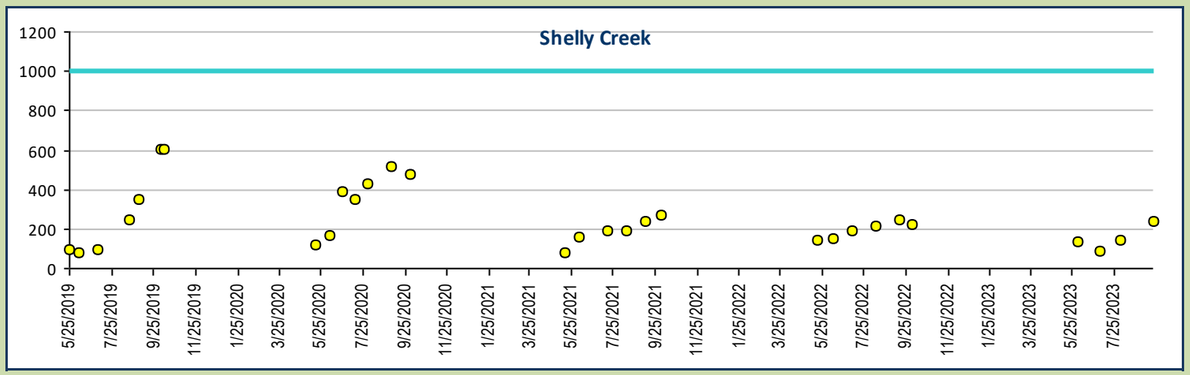
Total Dissolved Solids, units mg/L

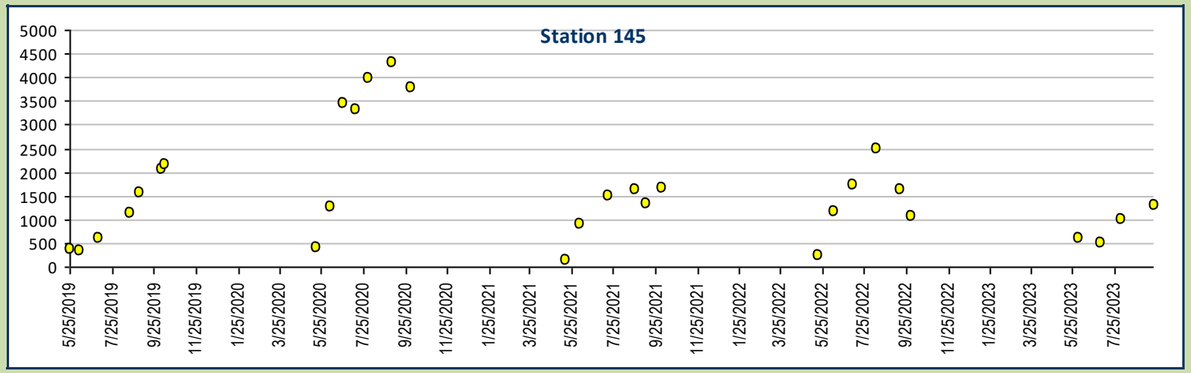
Site Specific WQS mg/L

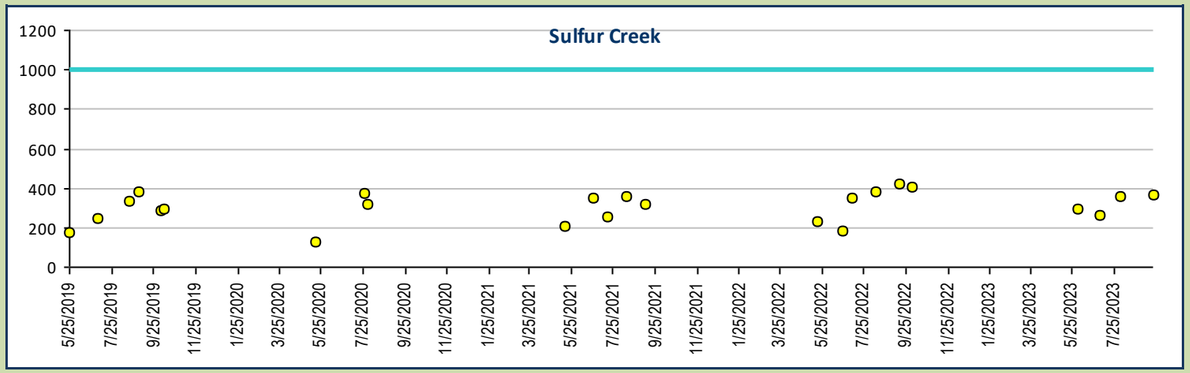
1000 mg/L

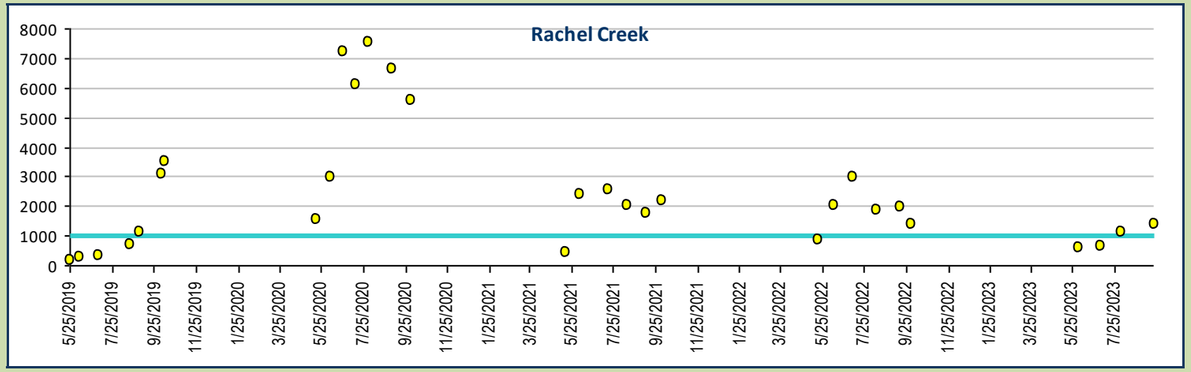


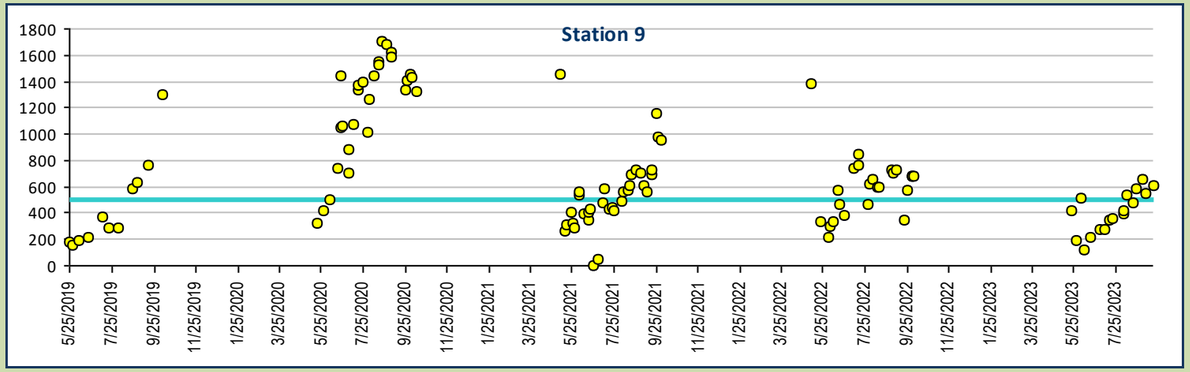












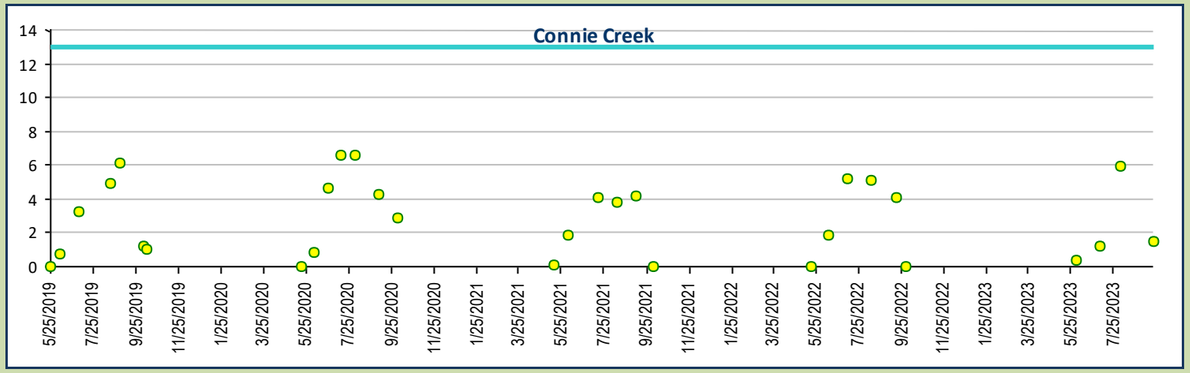
RED DOG MINE

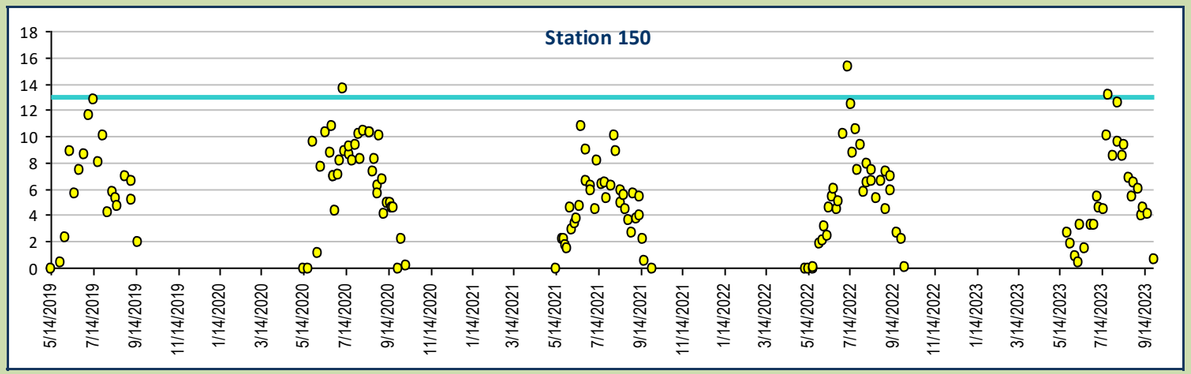
Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

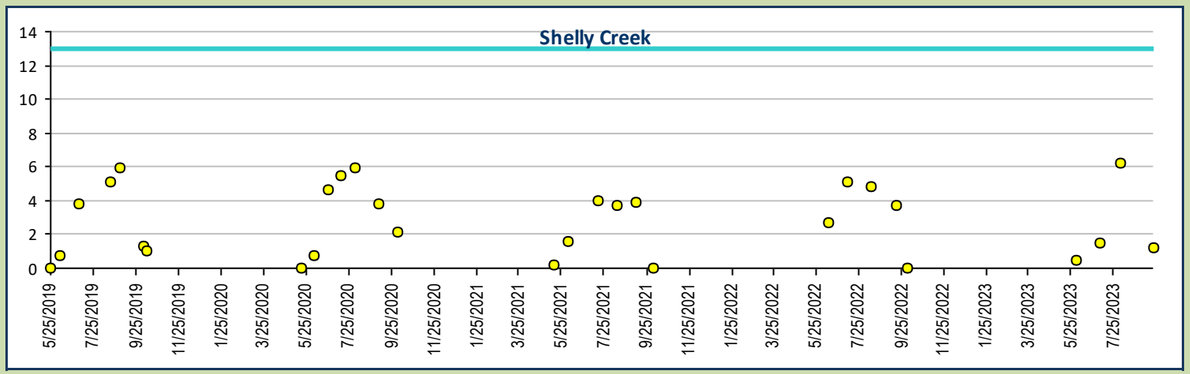
Temperature Field, Celsius

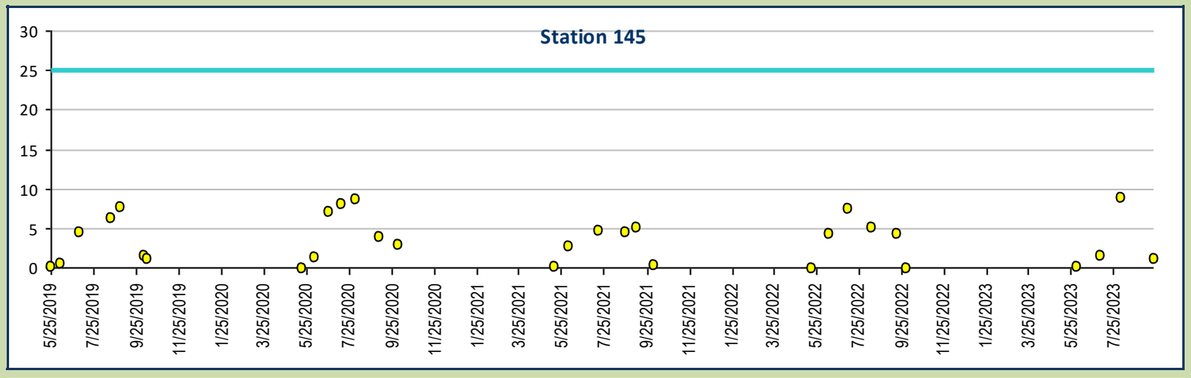
Site Specific WQS mg/L

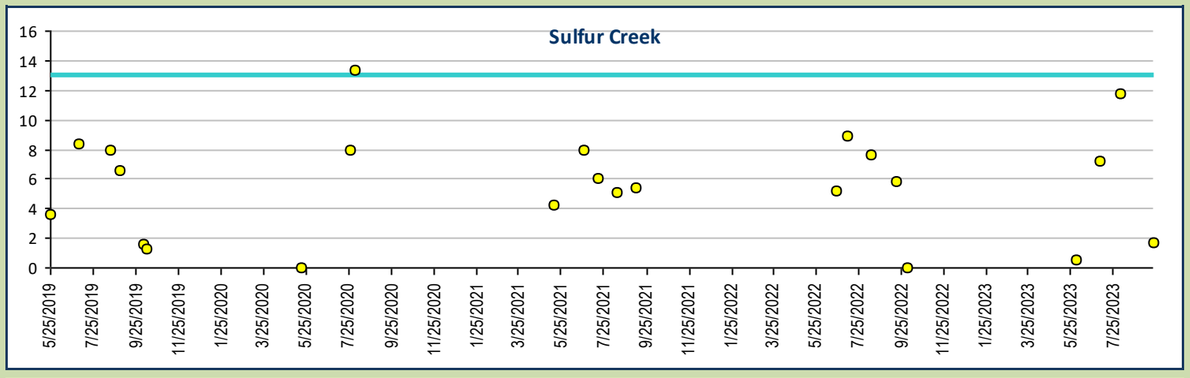
13 Celsius

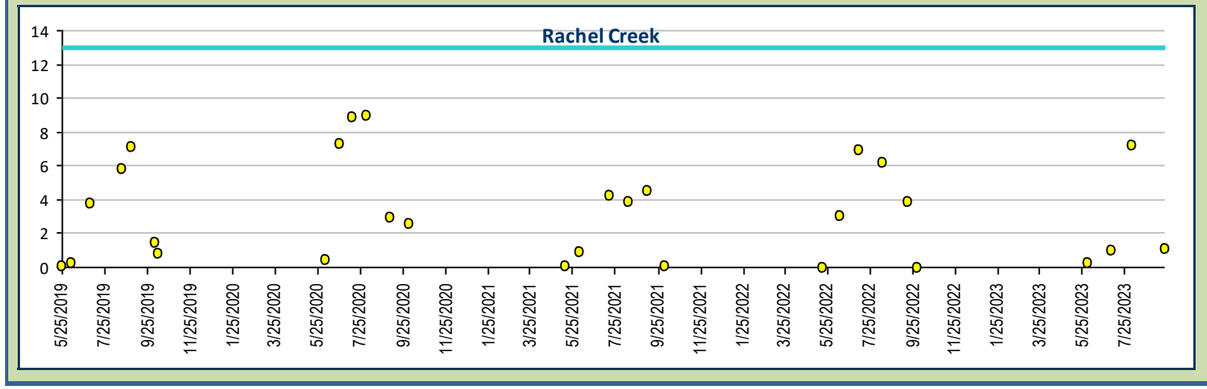


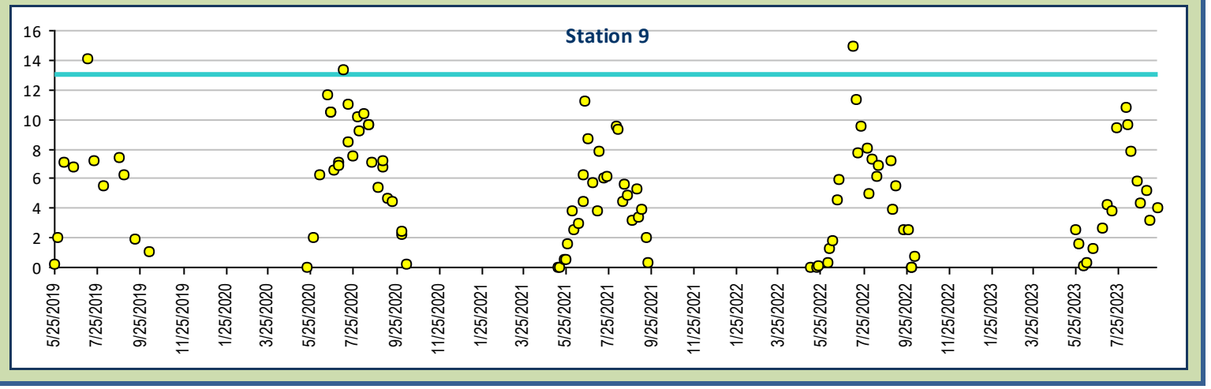








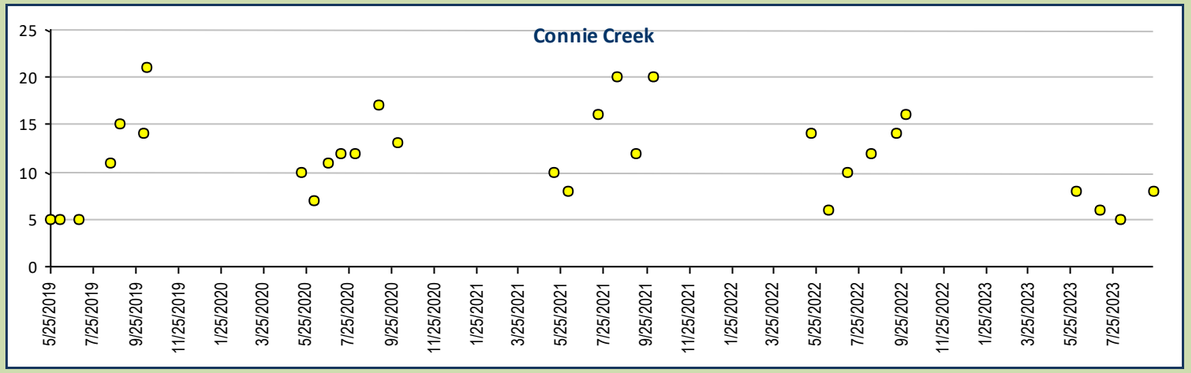


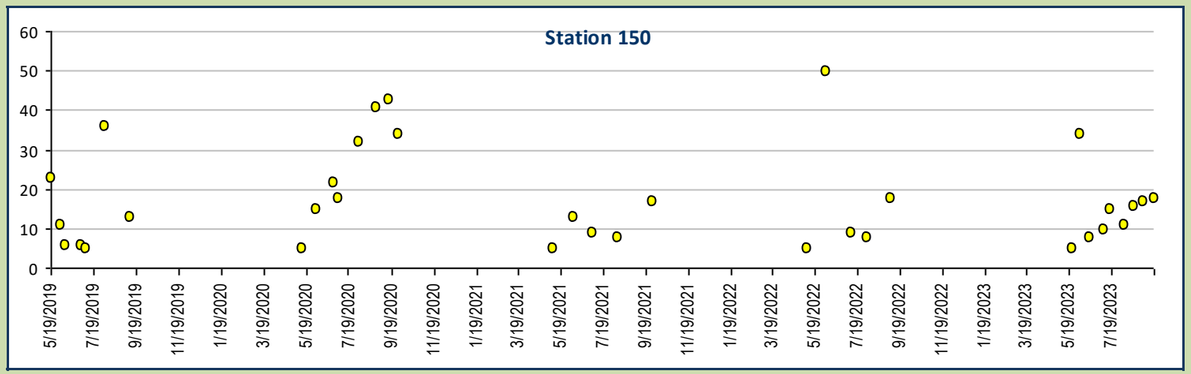


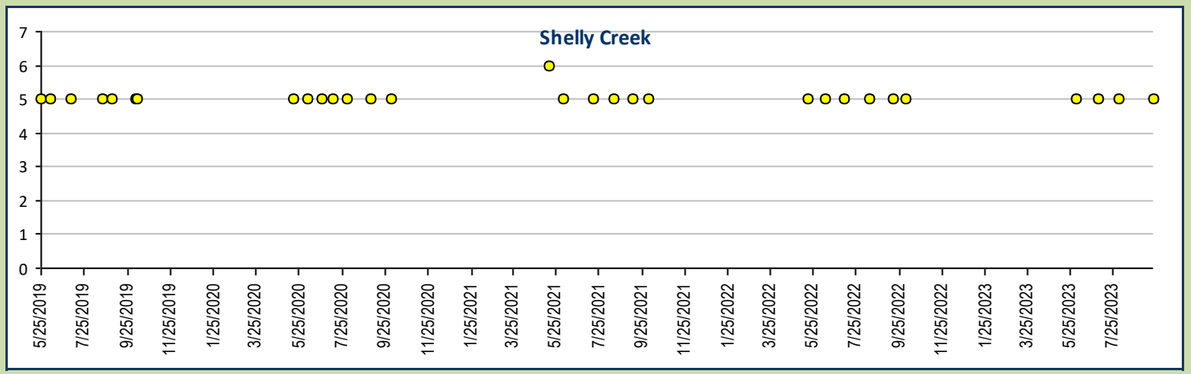
RED DOG MINE

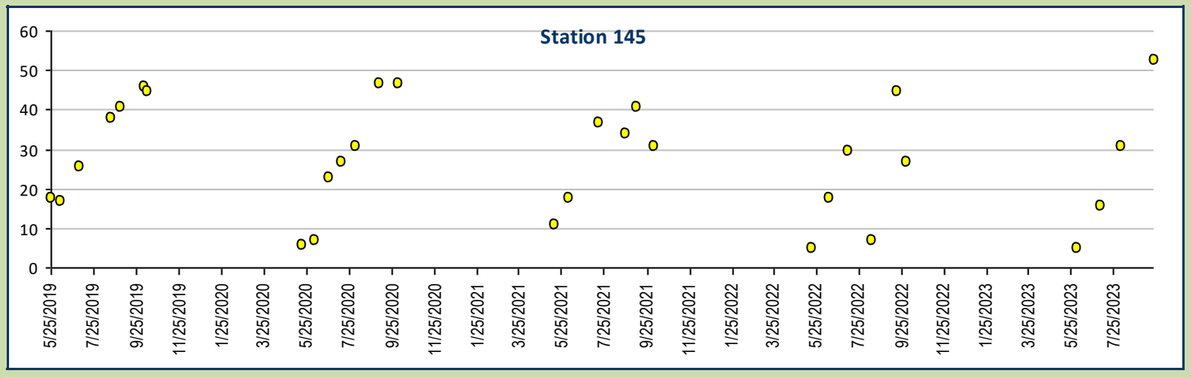
Water Monitoring Mine Drainage
Water Quality Profile I , 5-Year Trend Charts

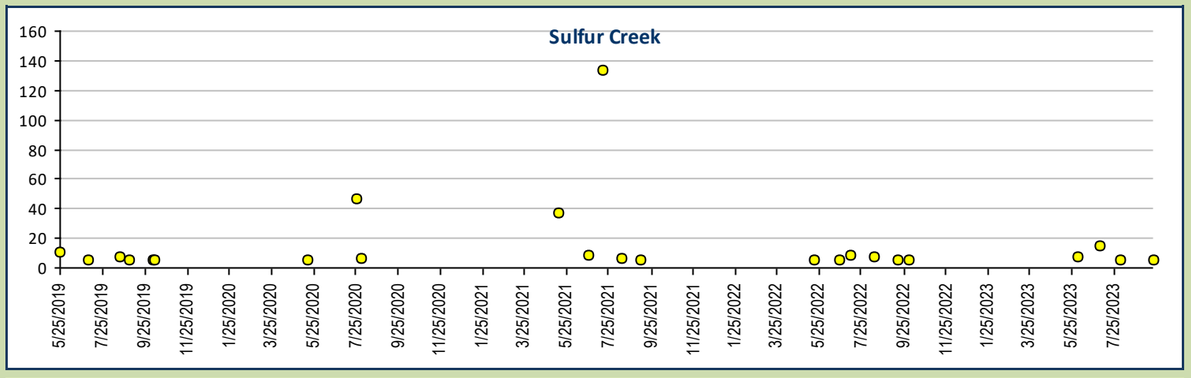
Total Suspended Solids, units mg/L

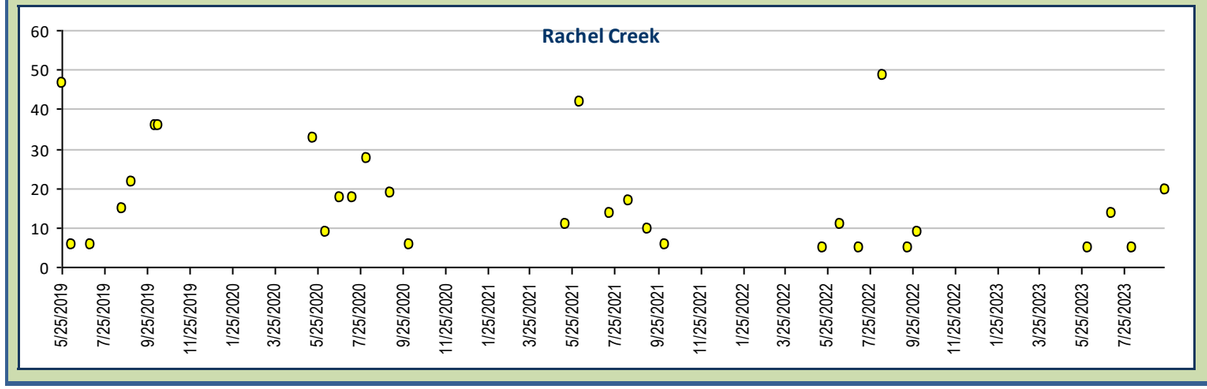


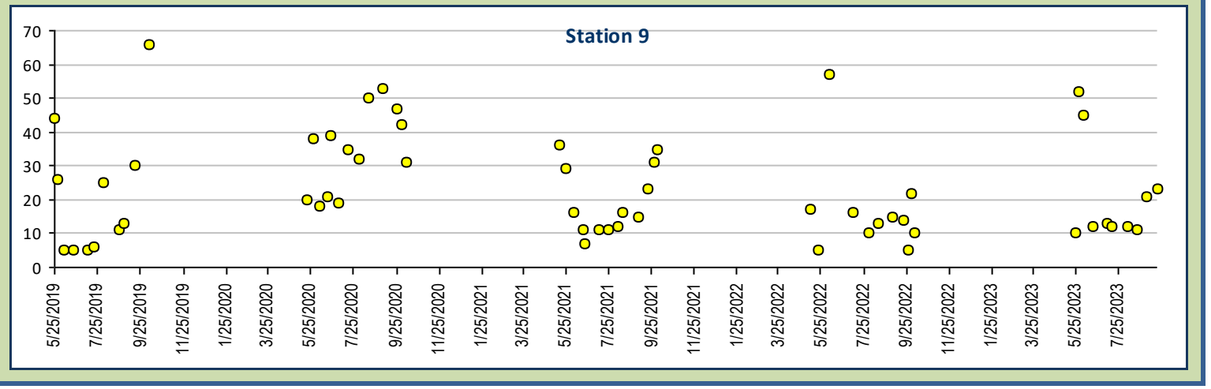












RED DOG MINE

Water Monitoring Drainage
Water Quality Profile I , 5-Year Trend Charts

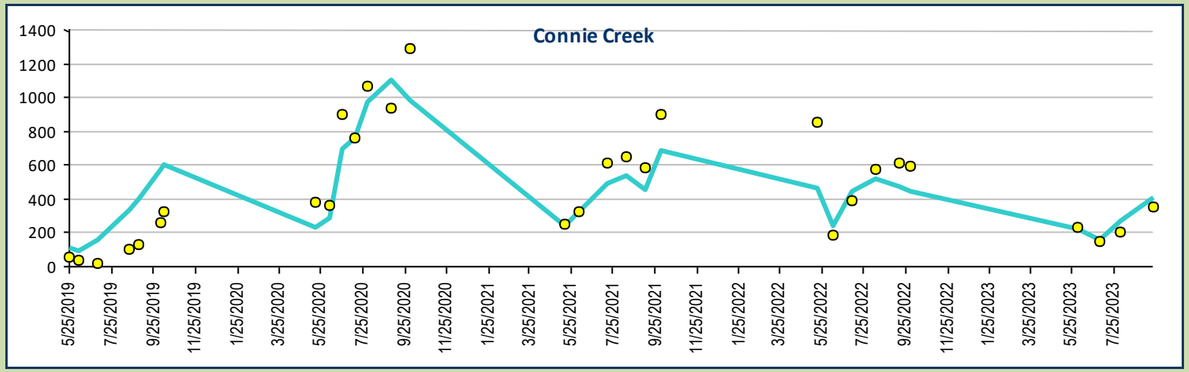
Zinc, Total Recoverable, units ug/L

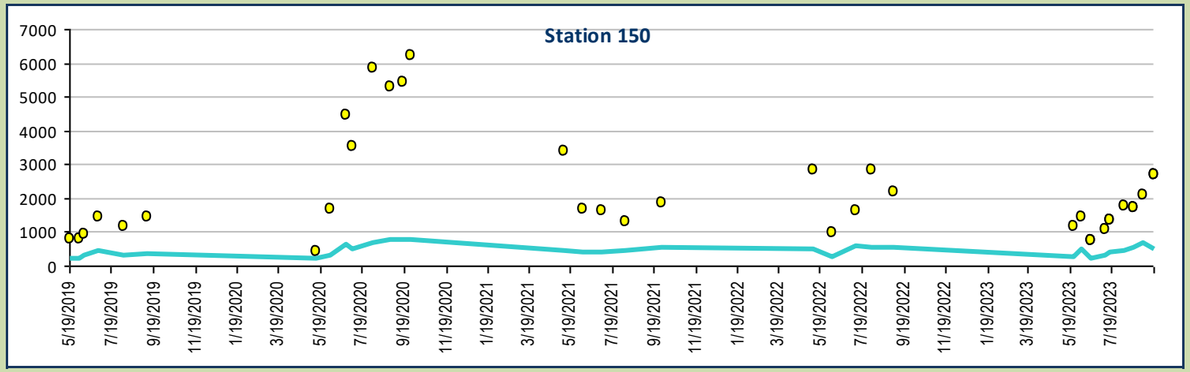
Aquatic Life - Fresh Water Acute WQS ug/L

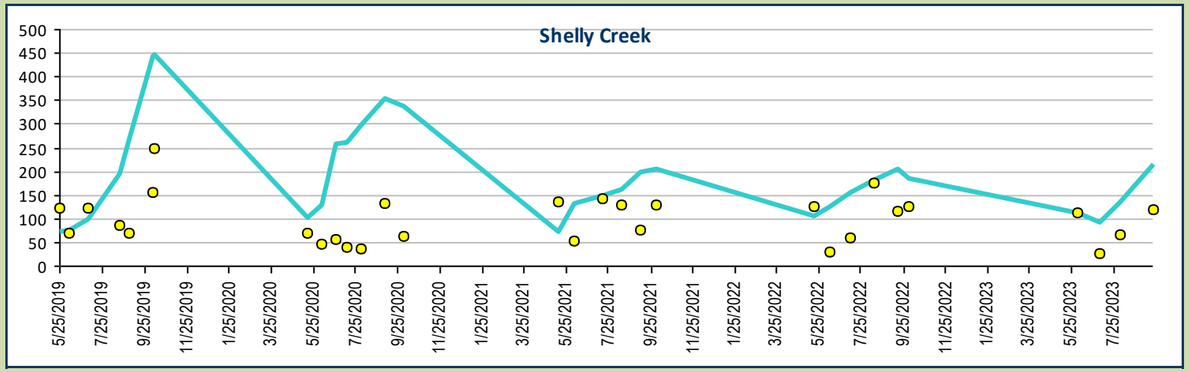
Hardness Dependent Calculation

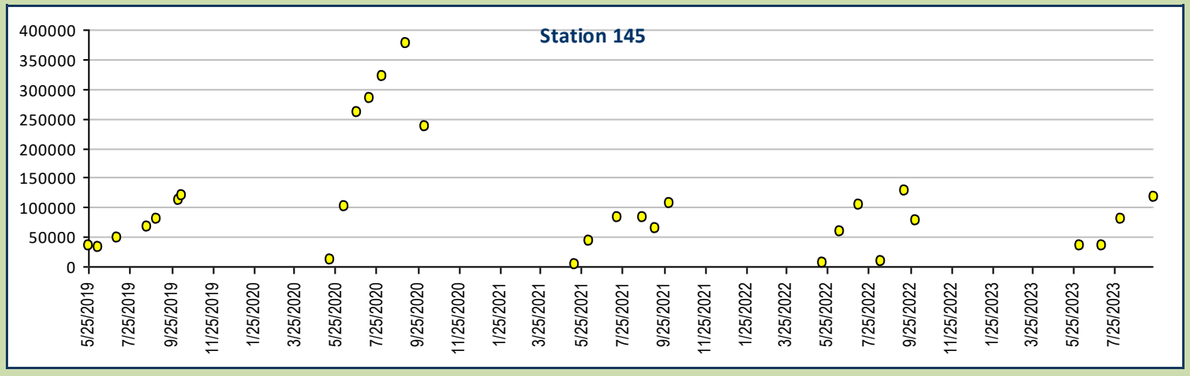
=EXP(0.8473*(LN(*hardness))+0.884)

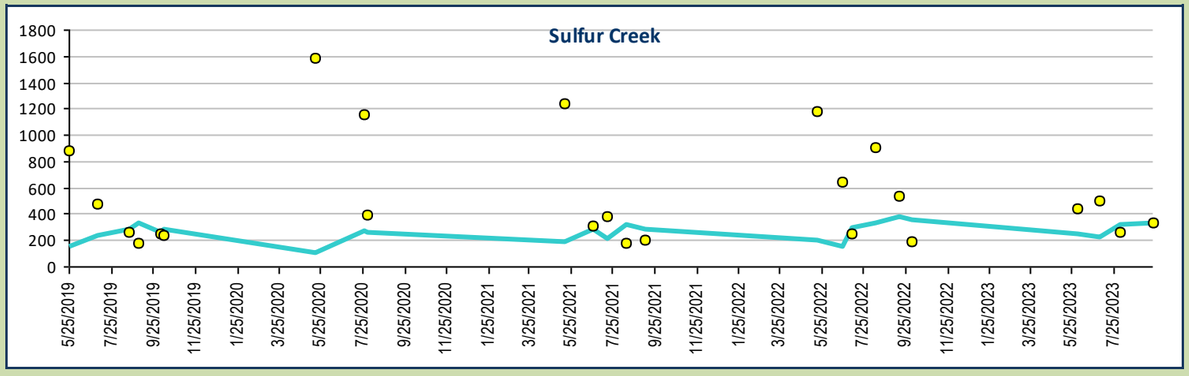
* Calculated using Standard Methods 2340B

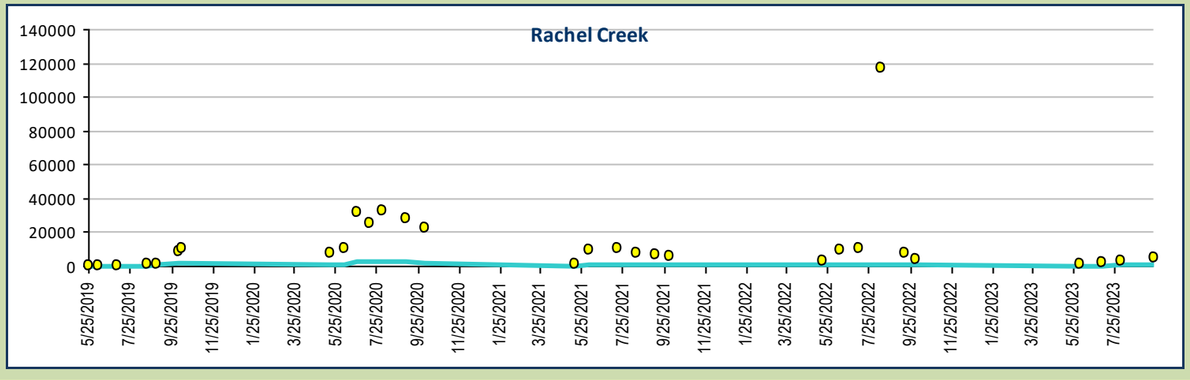


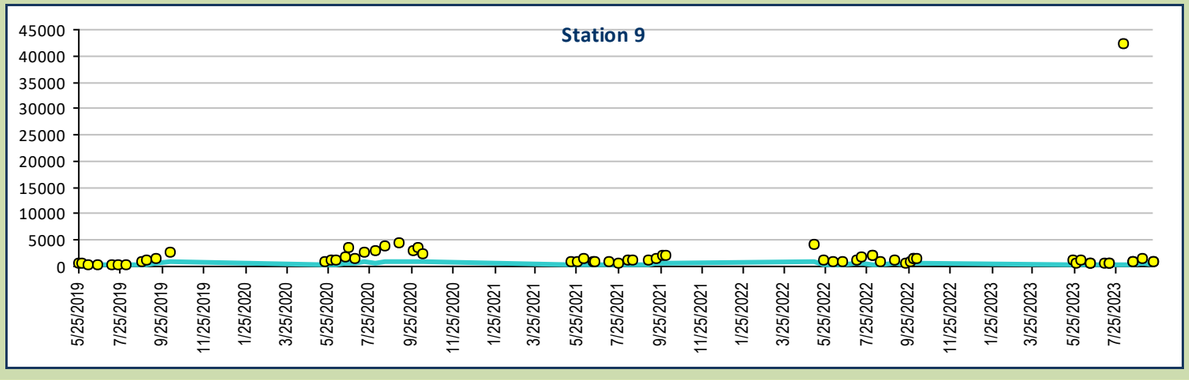












Appendix E: Water Quality Profile I Charts – Bons Creek Monitoring Stations

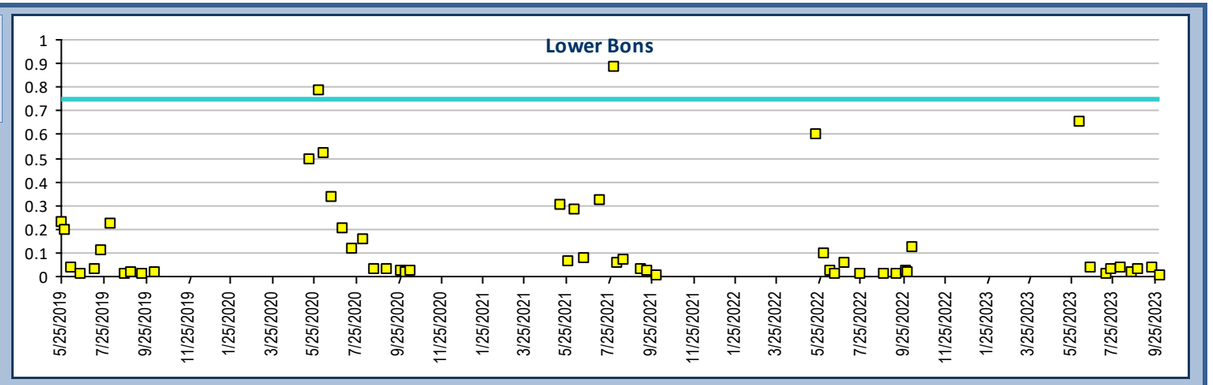
RED DOG MINE

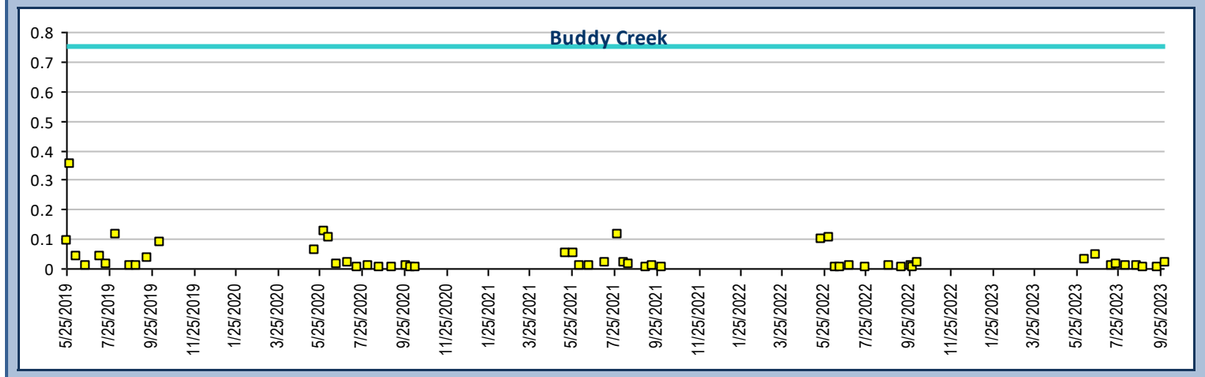
Water Monitoring Bons Creek Drainage
Water Quality Profile I , 5-Year Trend Charts

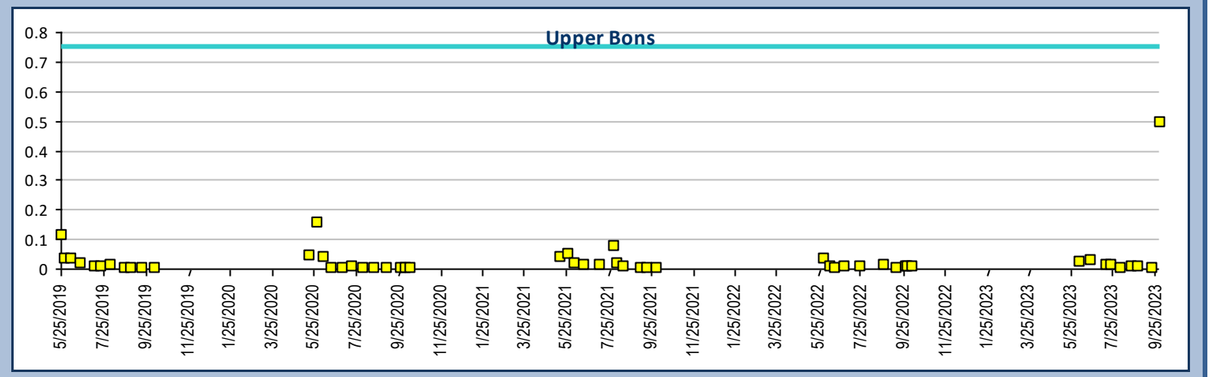
Aluminum, Total Recoverable, units mg/L

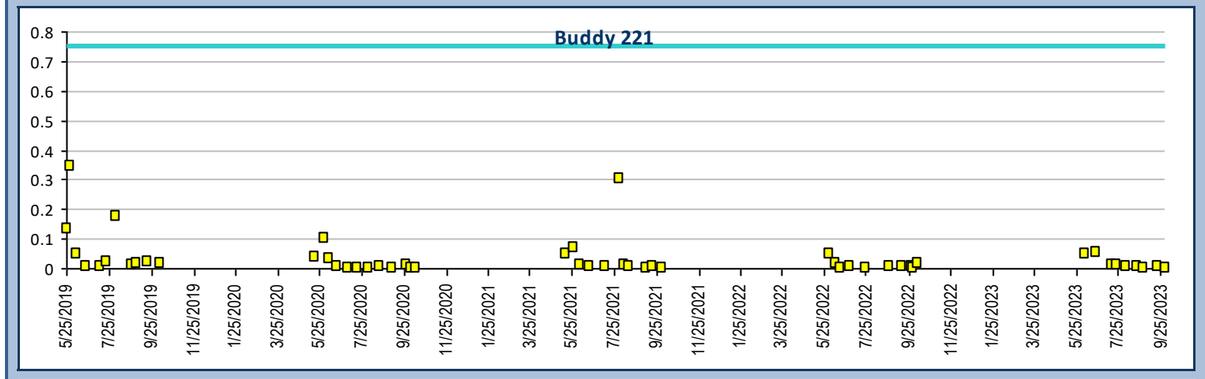
Aquatic Life - Fresh Water Chronic WQS mg/L

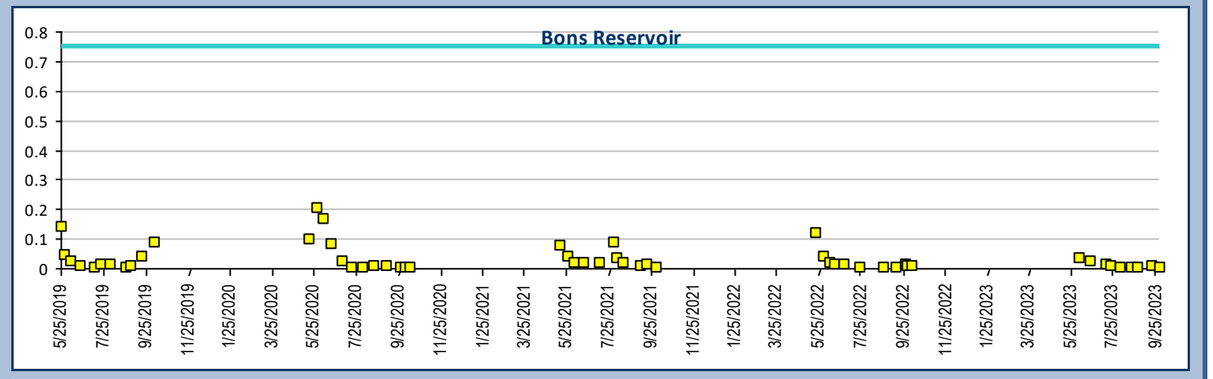
If pH > 7 and hardness > 50. then WQS = 0.75mg/l

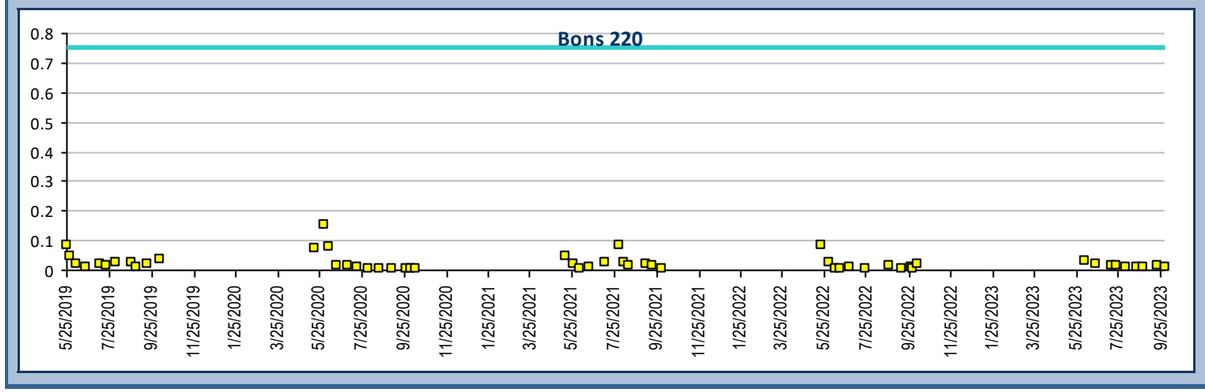


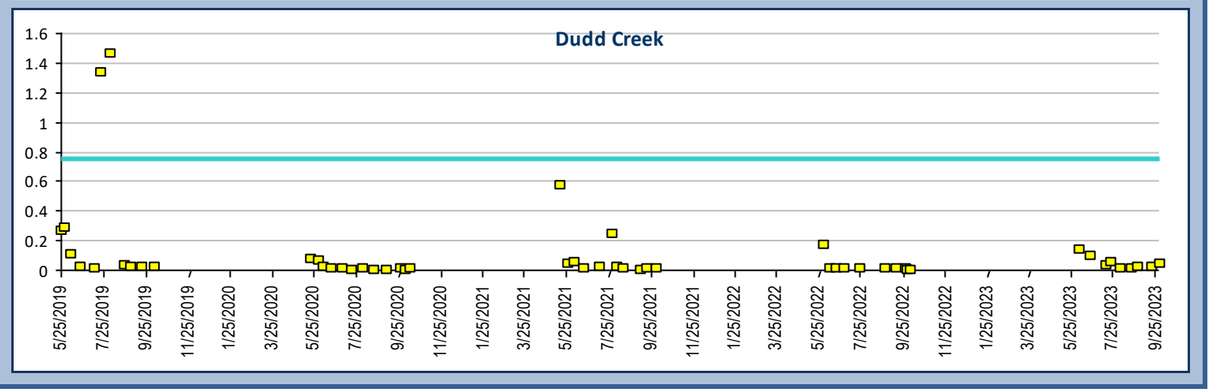












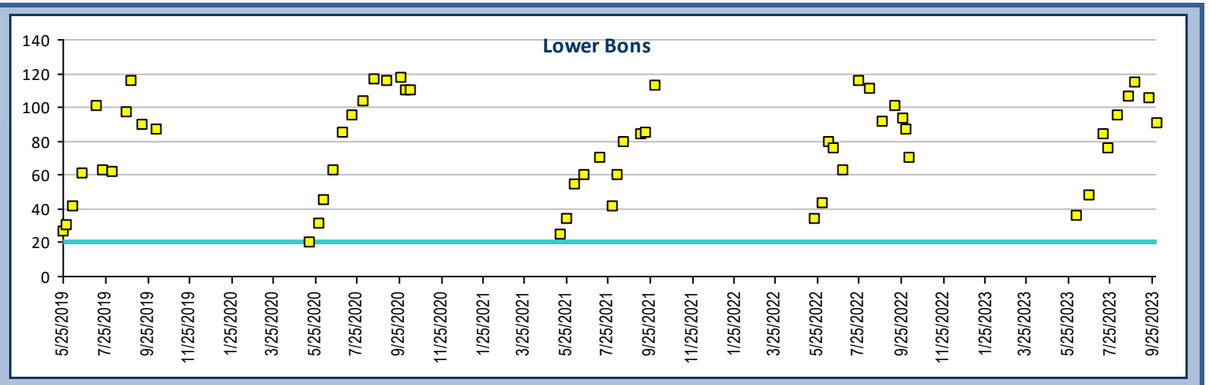
RED DOG MINE

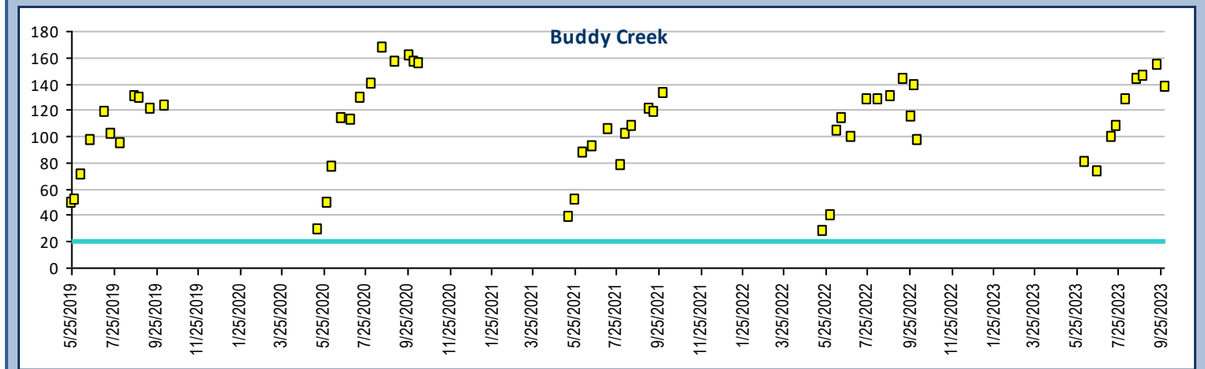
Water Monitoring Bons Creek Drainage
Water Quality Profile I , 5-Year Trend Charts

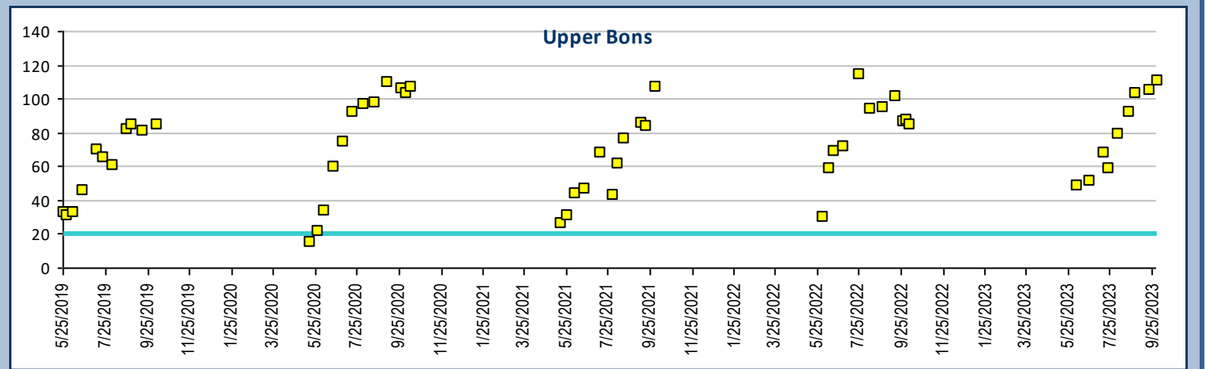
Alkalinity (as CaCO3), units mg/L

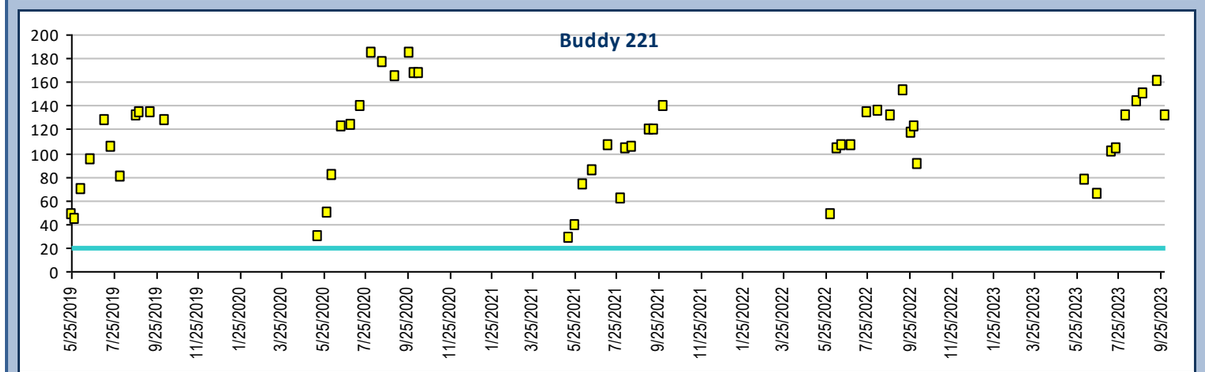
Aquatic Life - Fresh Water Chronic WQS mg/L

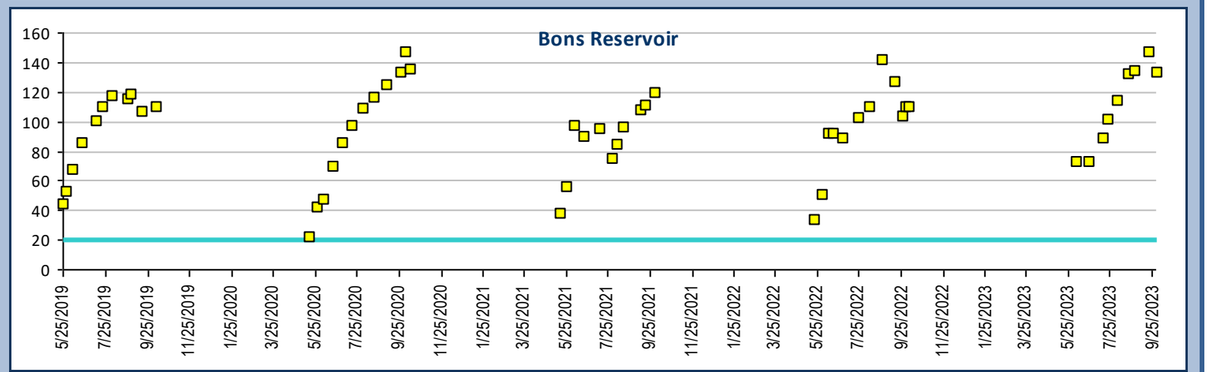
20 mg/L minimum

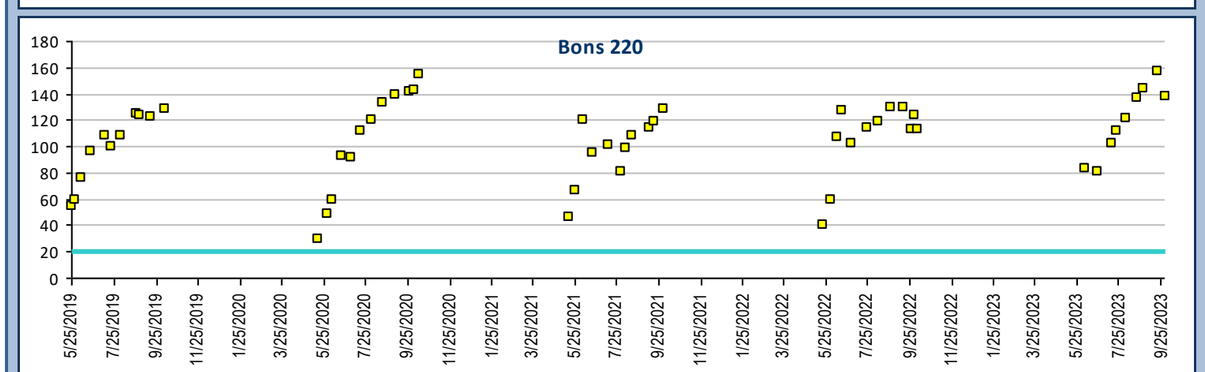


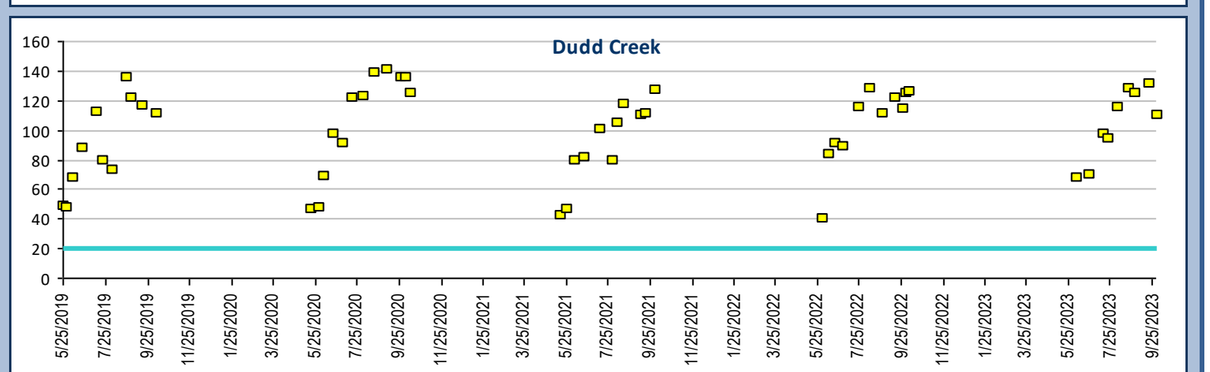








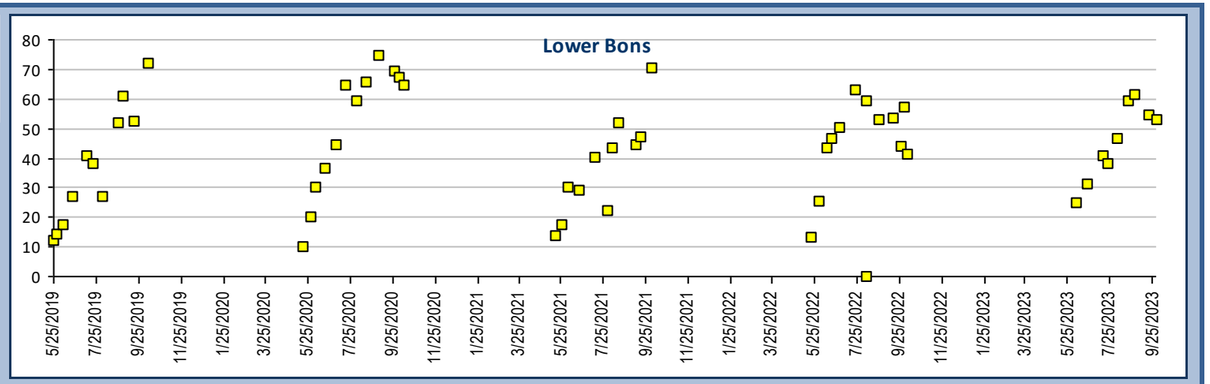


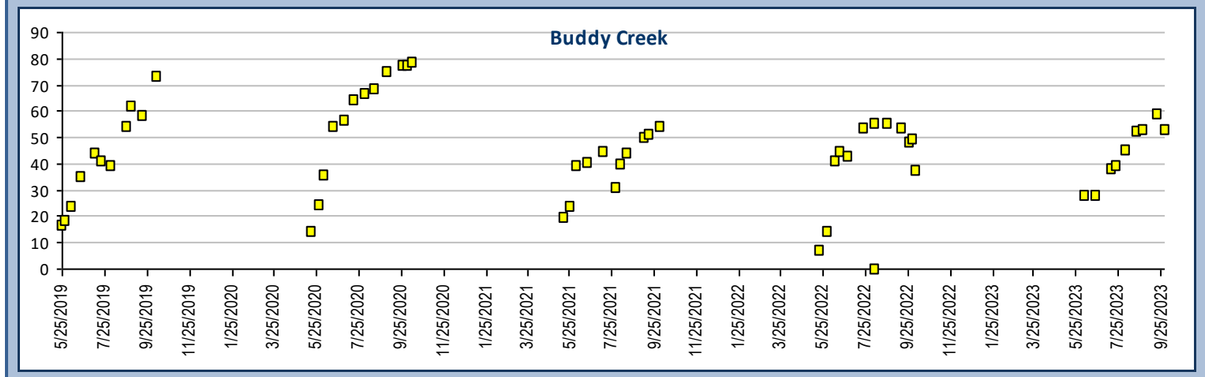


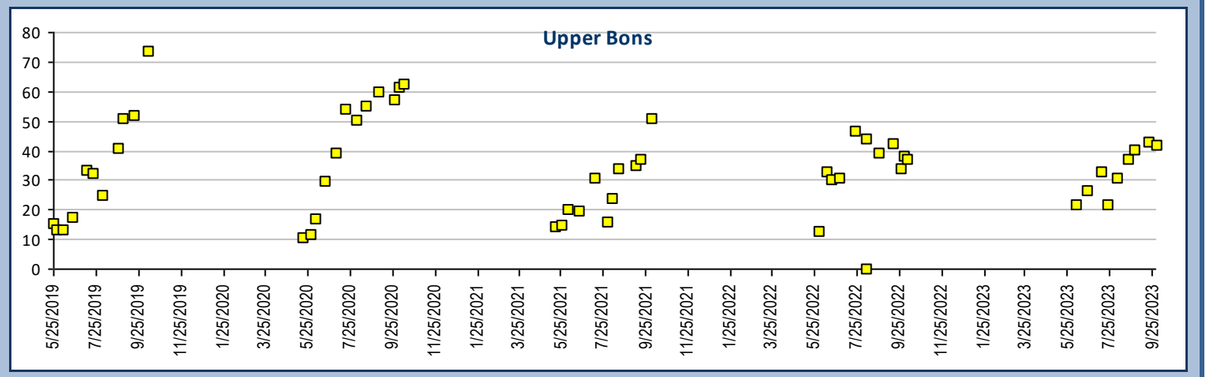
RED DOG MINE

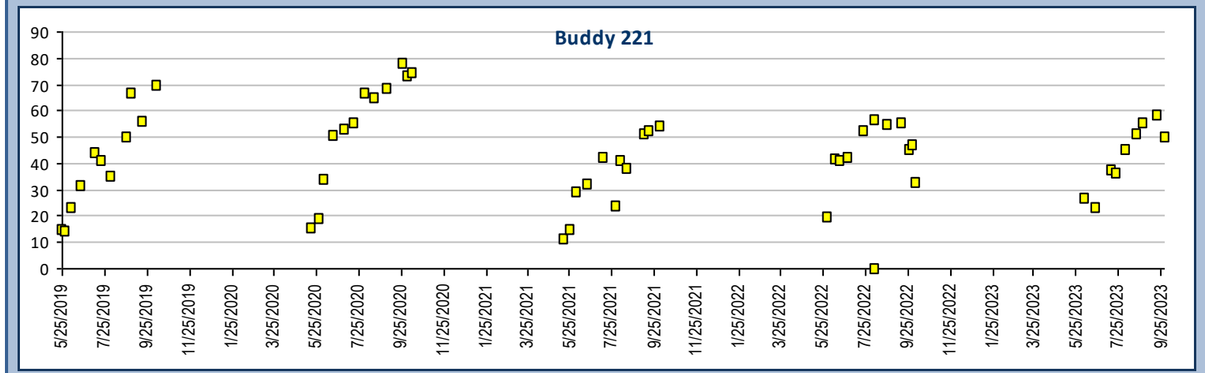
Water Monitoring Bons Creek Drainage
Water Quality Profile I , 5-Year Trend Charts

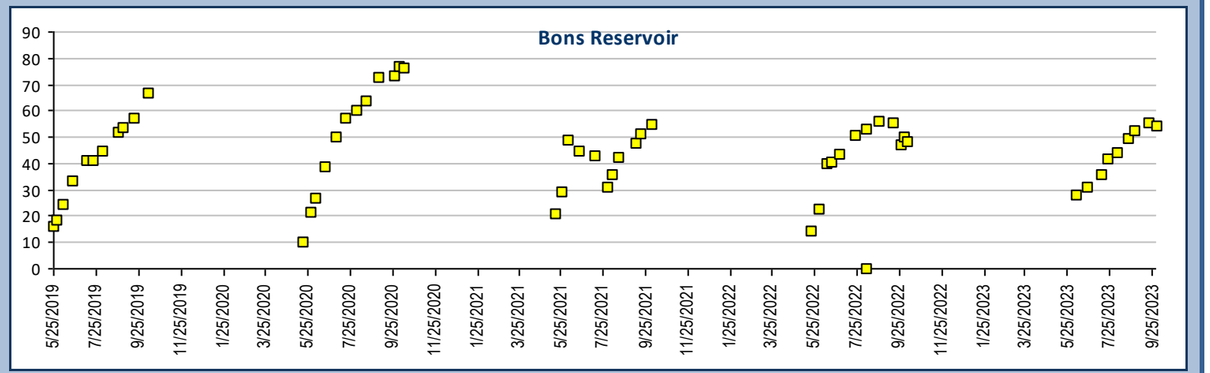
Calcium, Total Recoverable, units mg/L

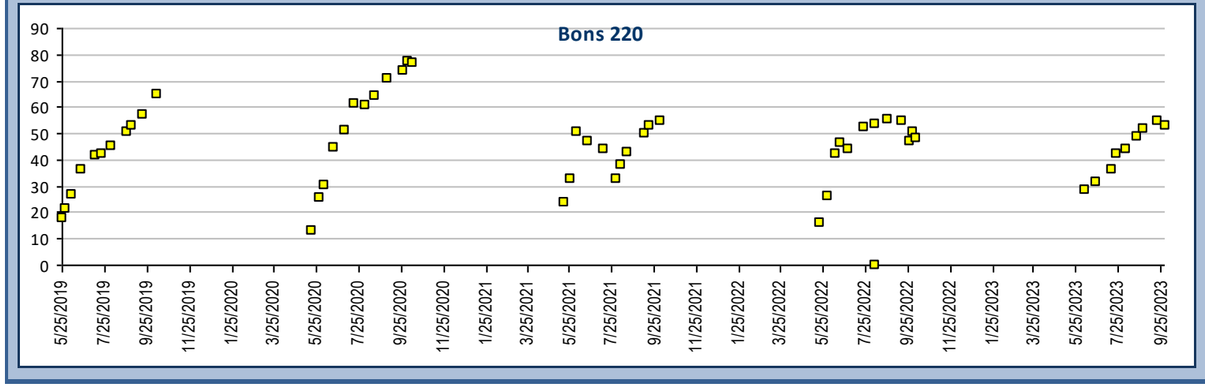


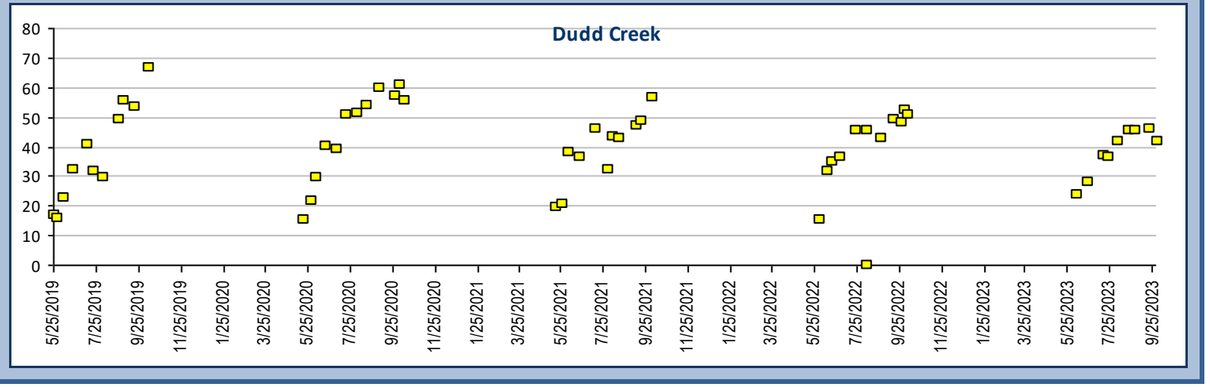












RED DOG MINE

Water Monitoring Bons Creek Drainage
Water Quality Profile I , 5-Year Trend Charts

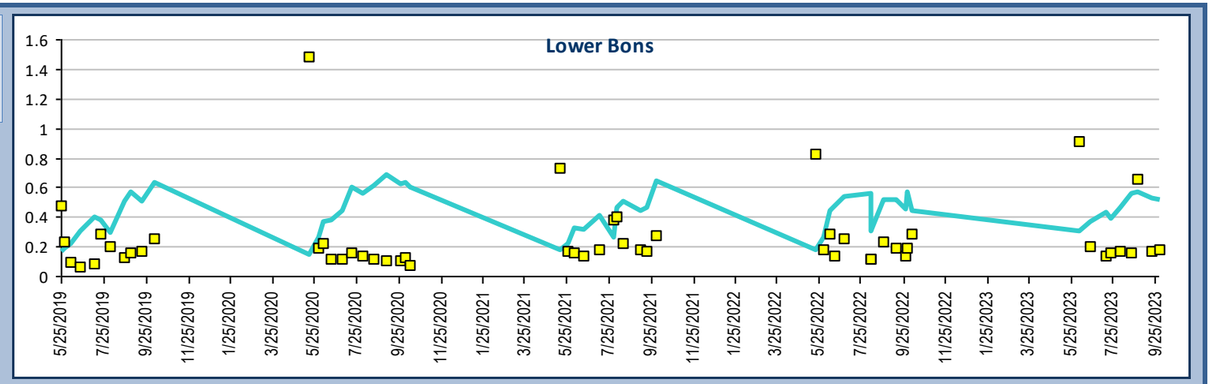
Cadmium, Total Recoverable, units ug/L

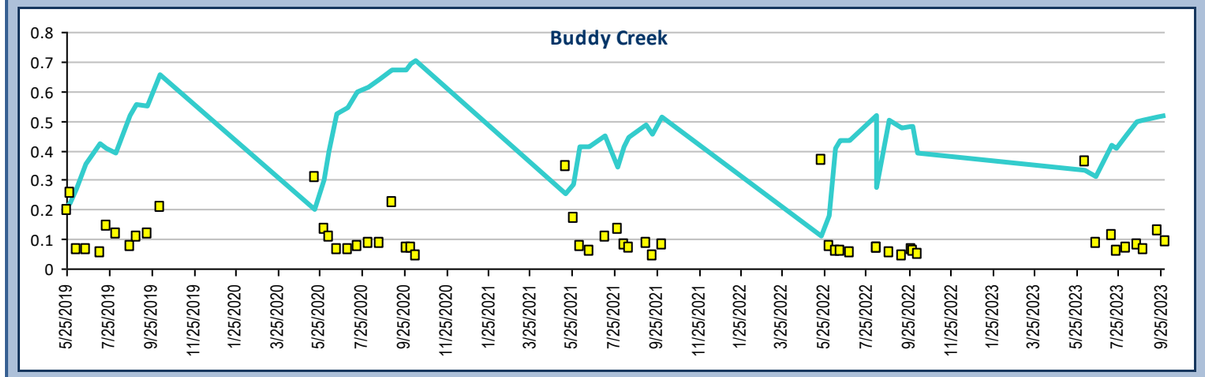
Aquatic Life - Fresh Water Chronic WQS ug/L

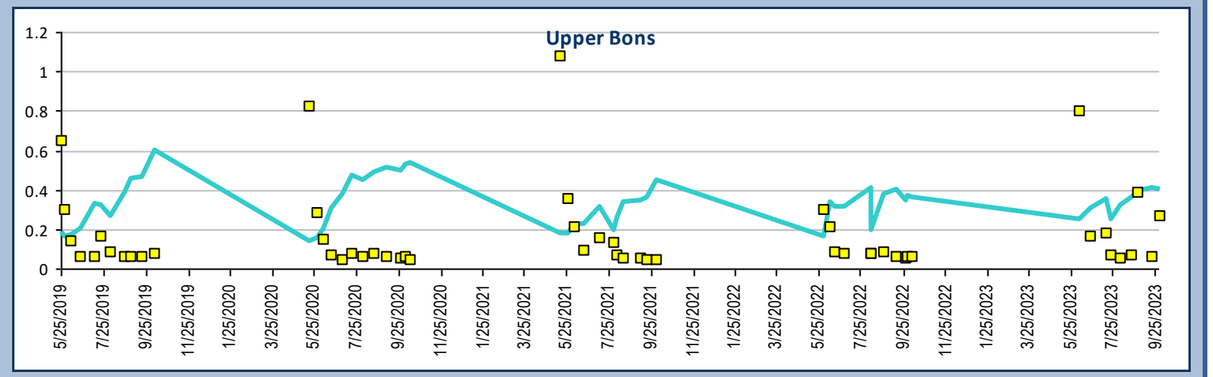
Hardness Dependent Calculation

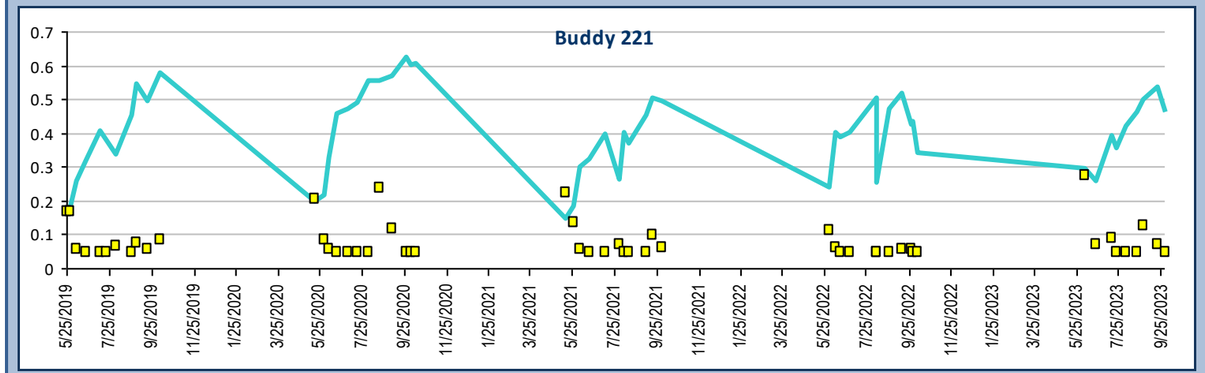
=EXP(0.7409*(LN(calc *hardness))-4.719)

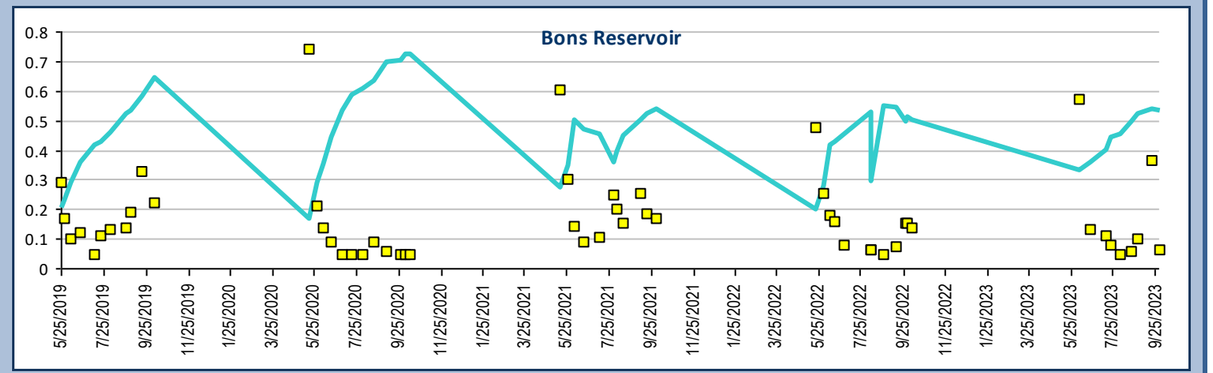
* Calculated using Standard Methods 2340B

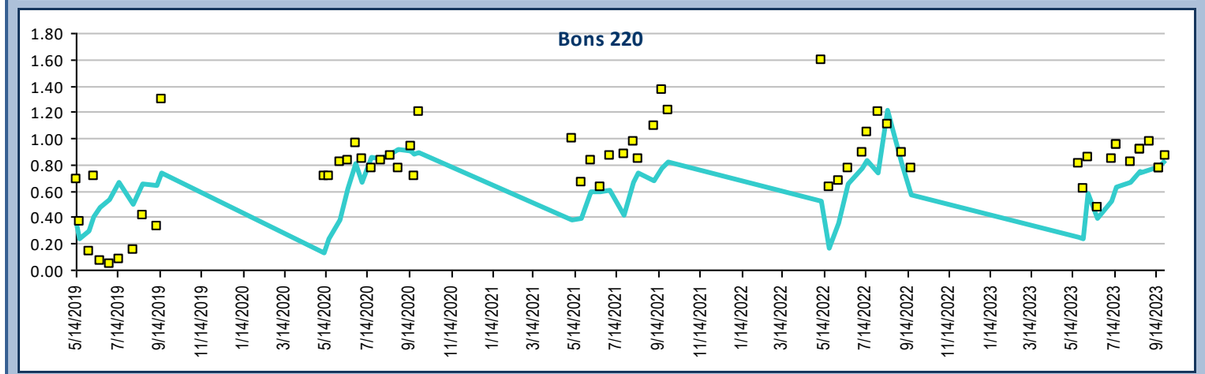


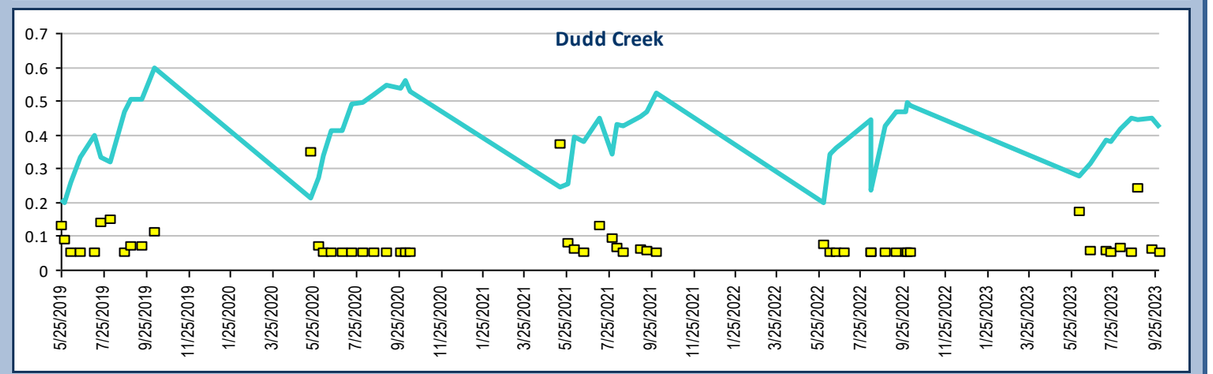








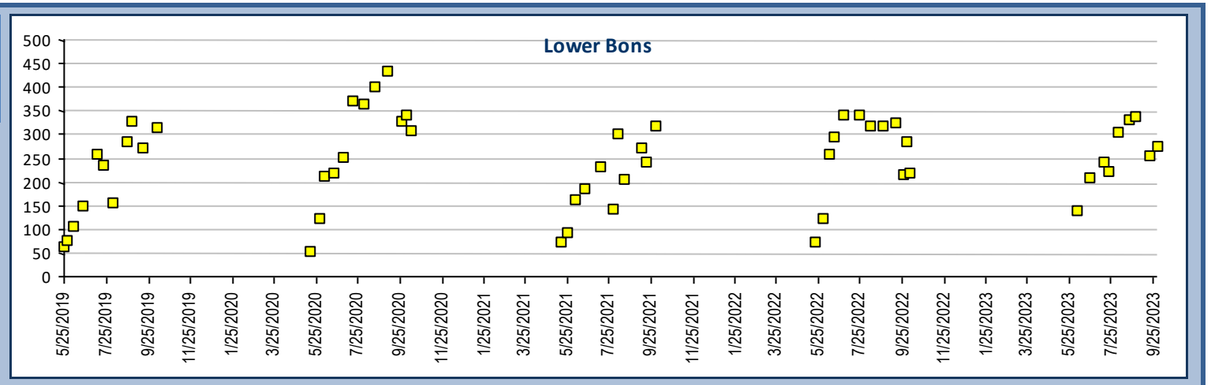


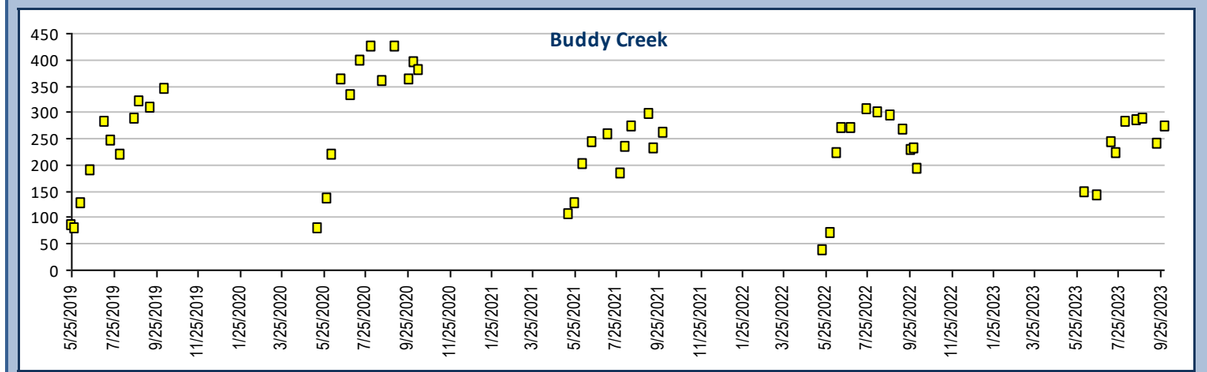


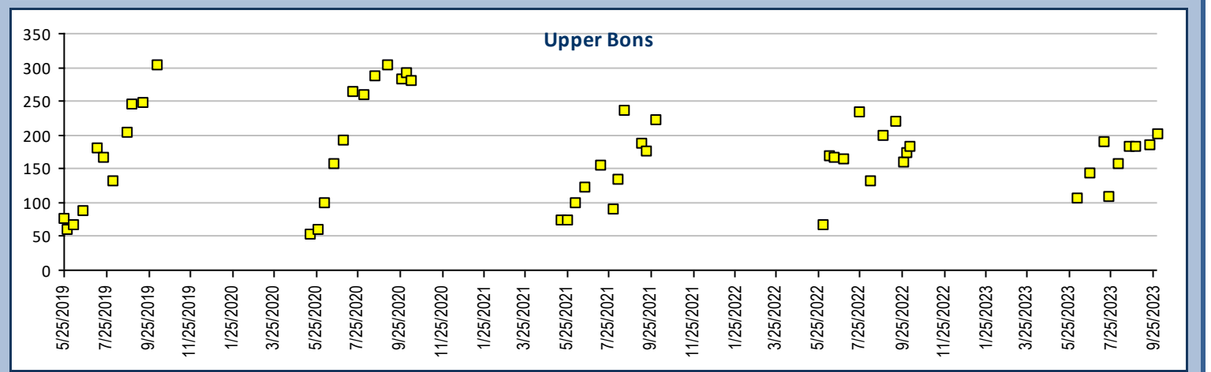
RED DOG MINE

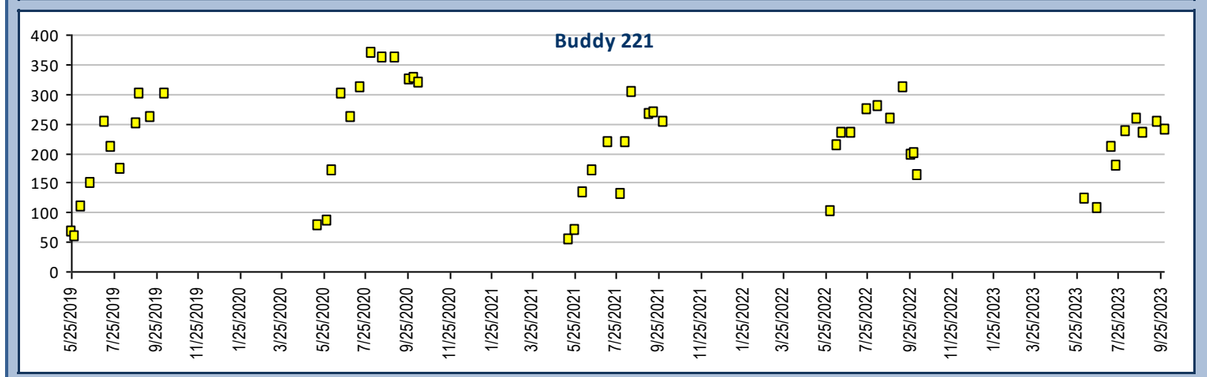
Water Monitoring Bons Creek Drainage
Water Quality Profile I , 5-Year Trend Charts

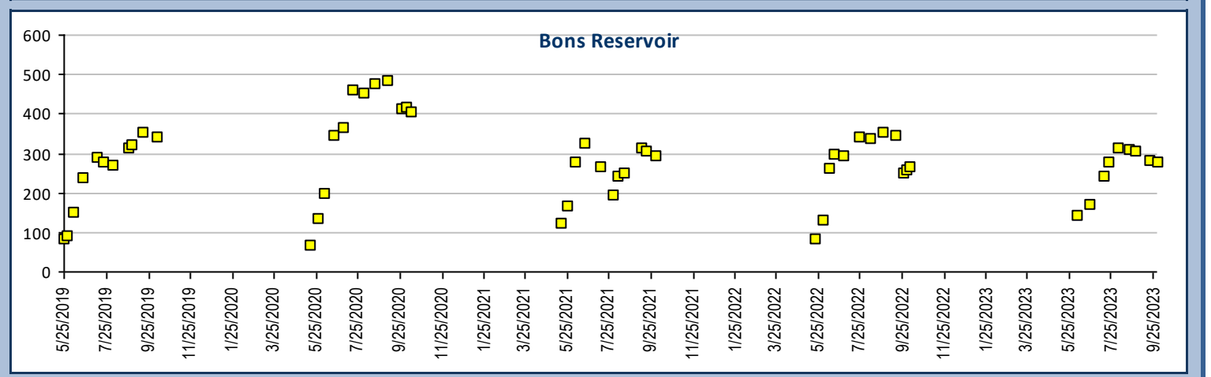
Conductivity, units uS/cm

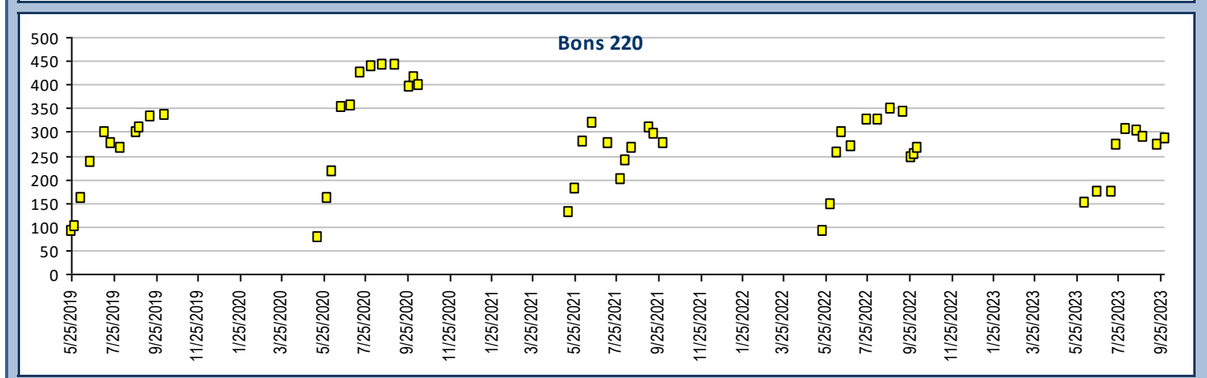


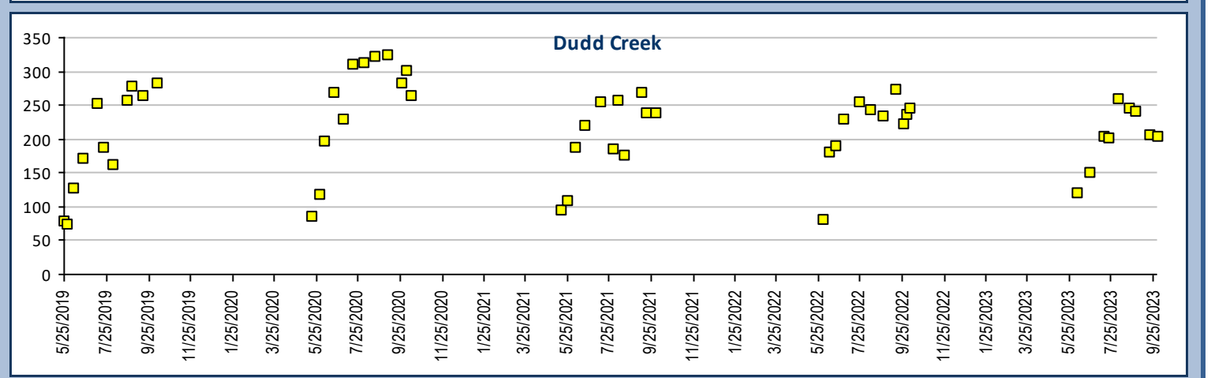








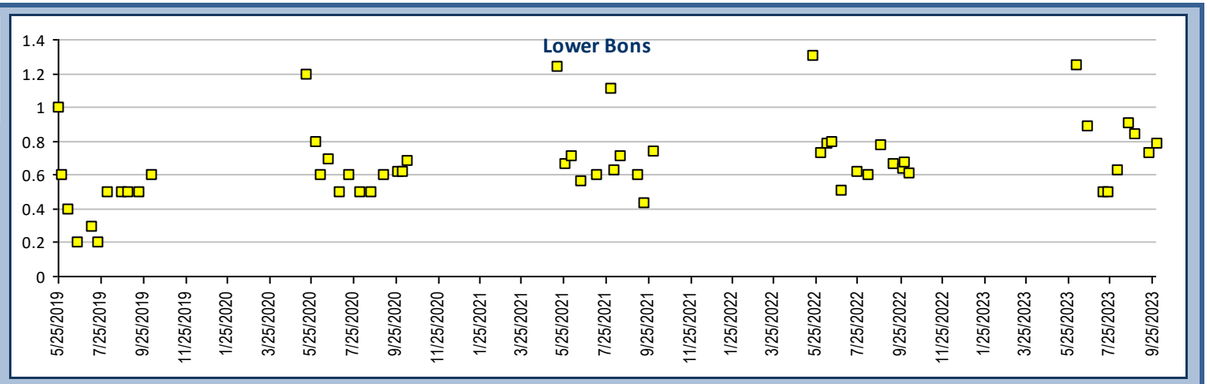


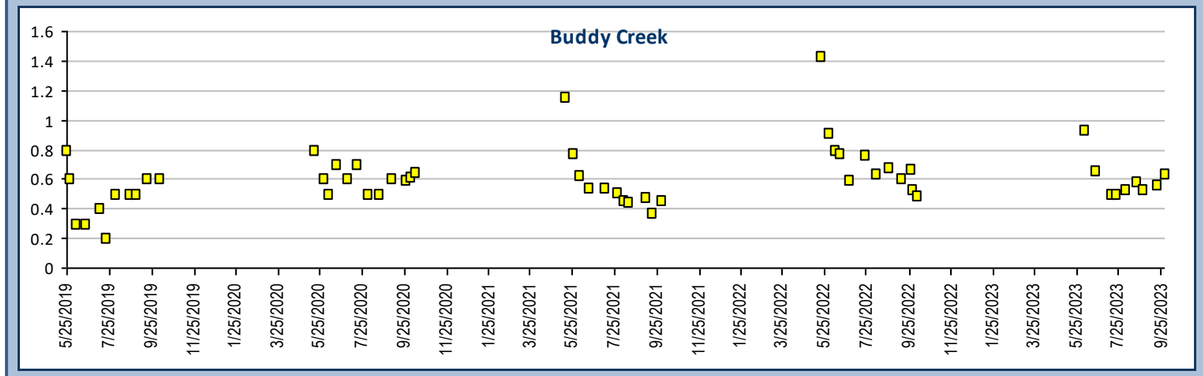


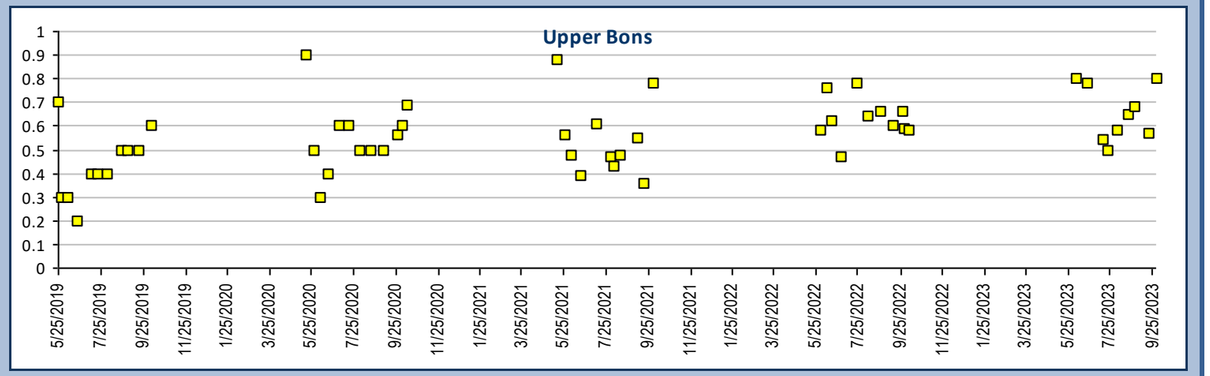
RED DOG MINE

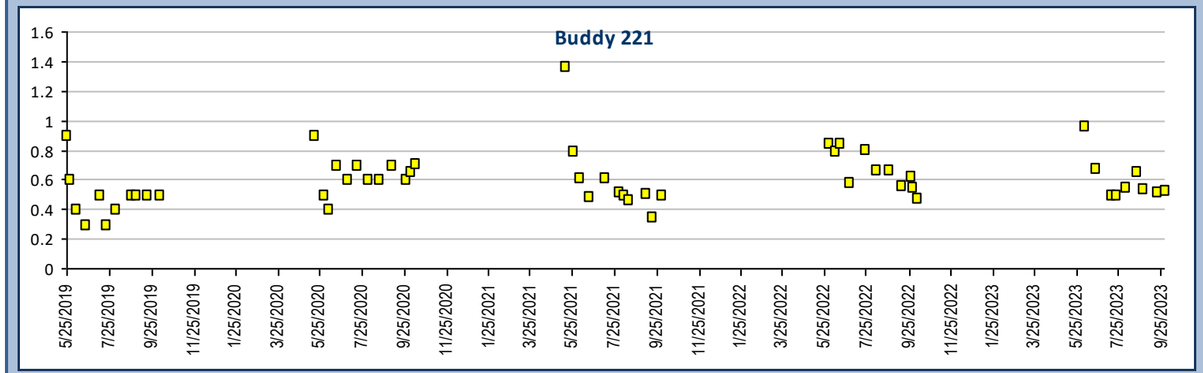
Water Monitoring Bons Creek Drainage
Water Quality Profile I , 5-Year Trend Charts

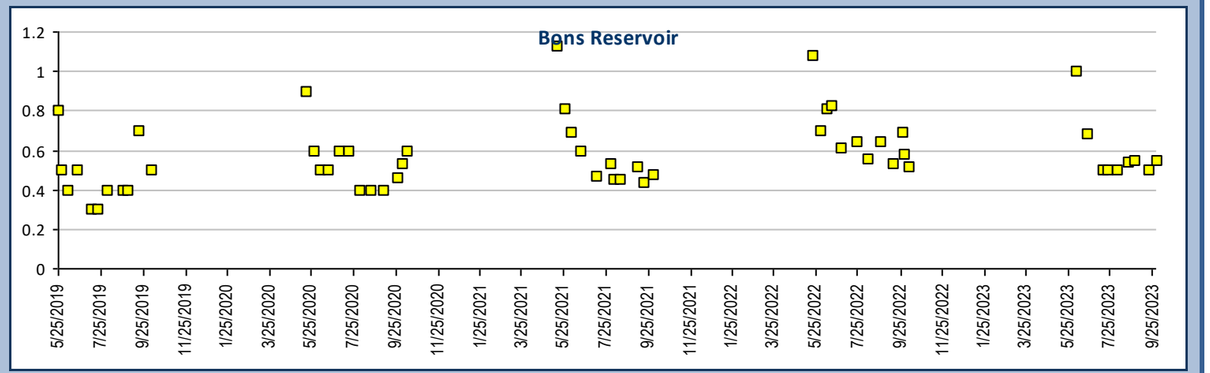
Potassium, Total Recoverable, units mg/L

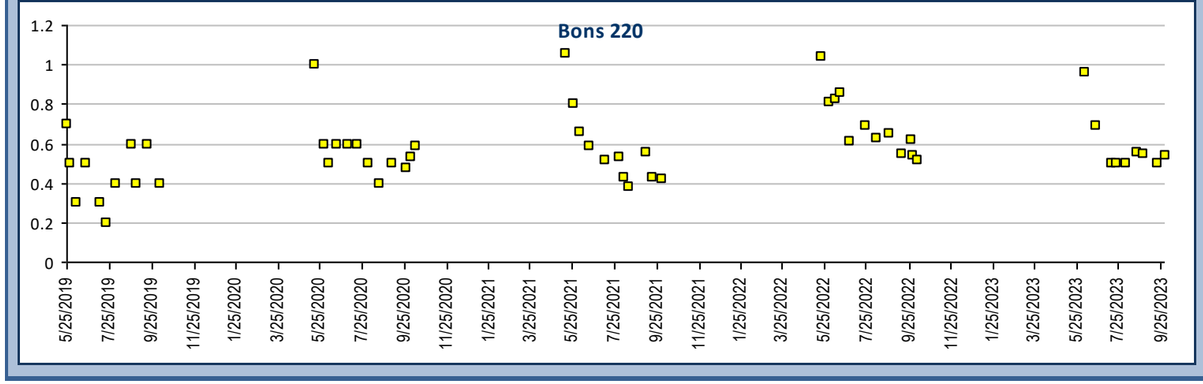


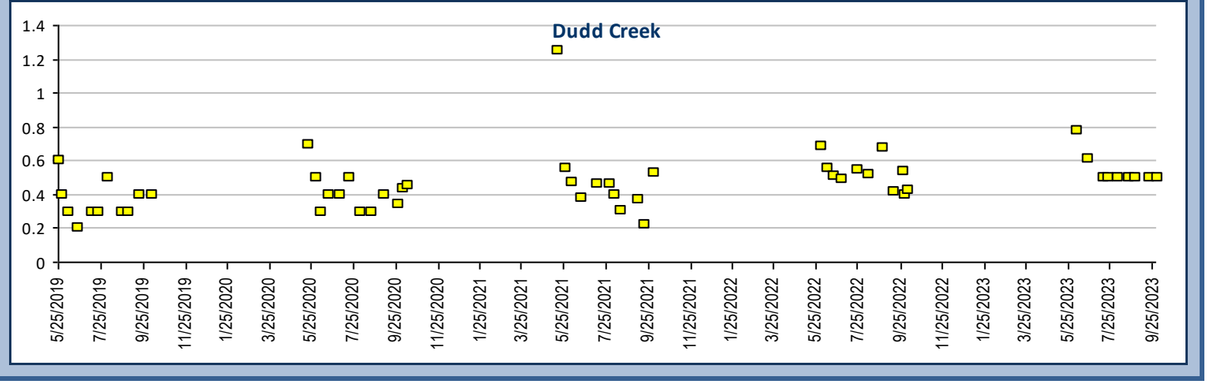








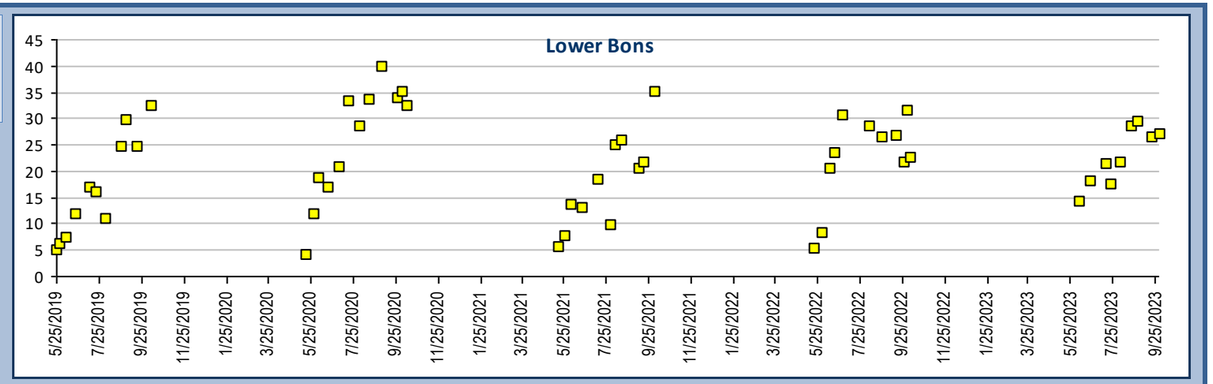


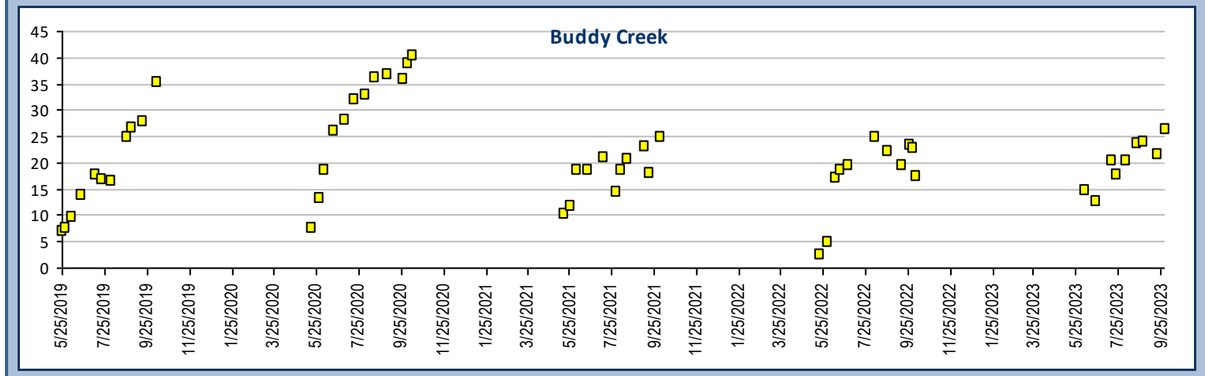


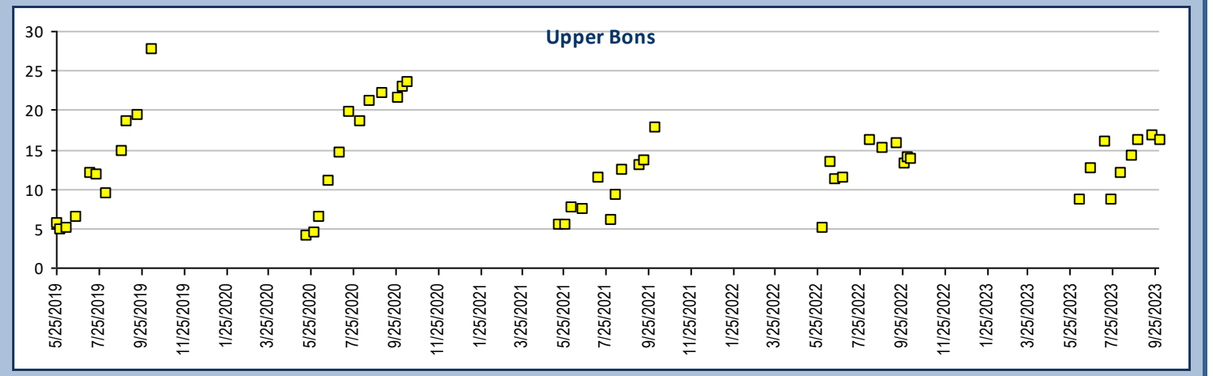
RED DOG MINE

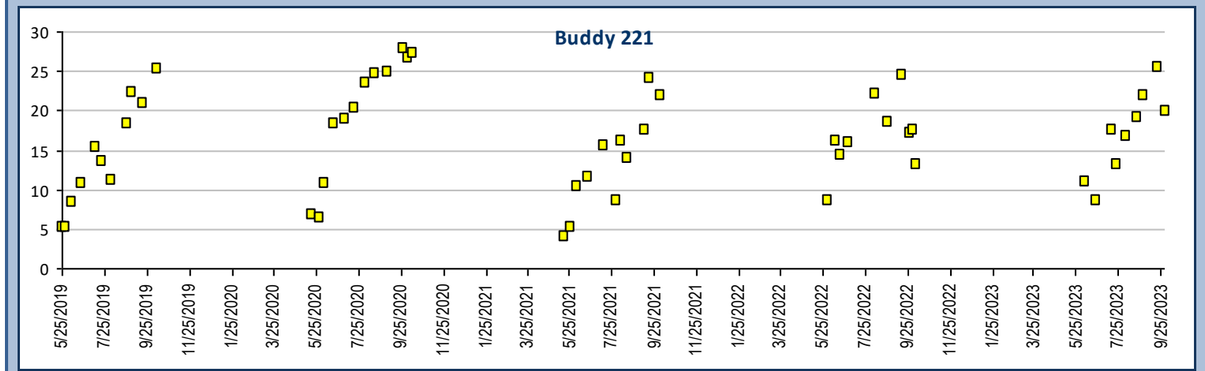
Water Monitoring Bons Creek Drainage
Water Quality Profile I , 5-Year Trend Charts

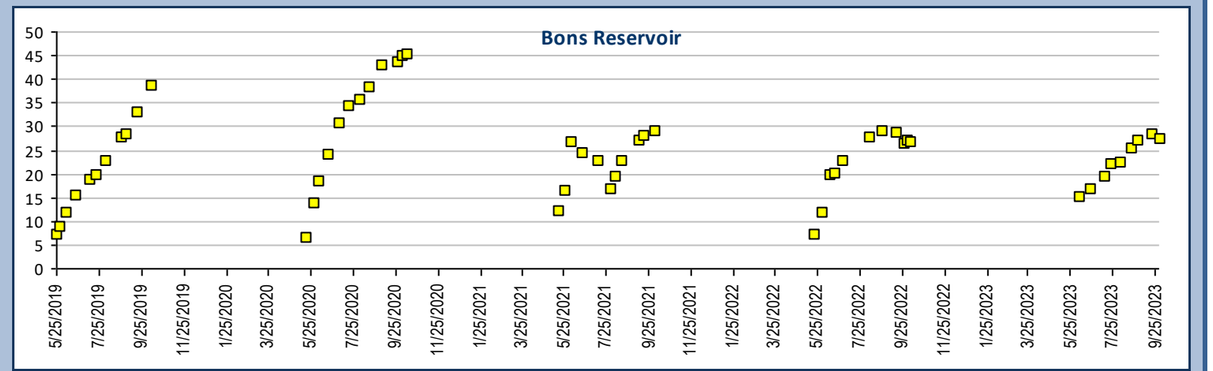
Magnesium, Total Recoverable, units mg/L

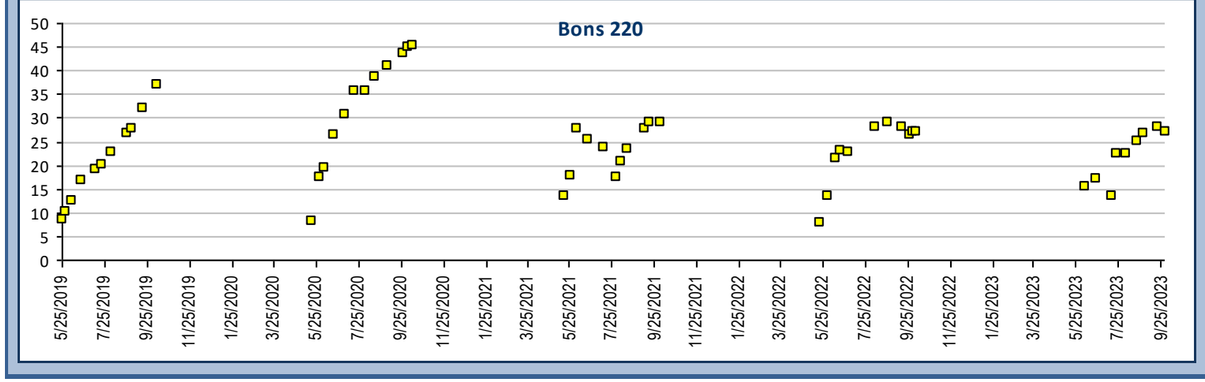


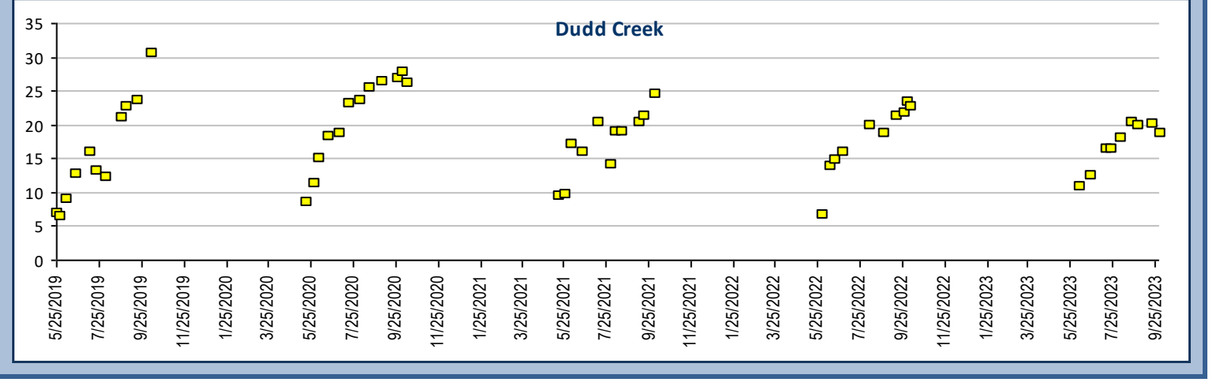








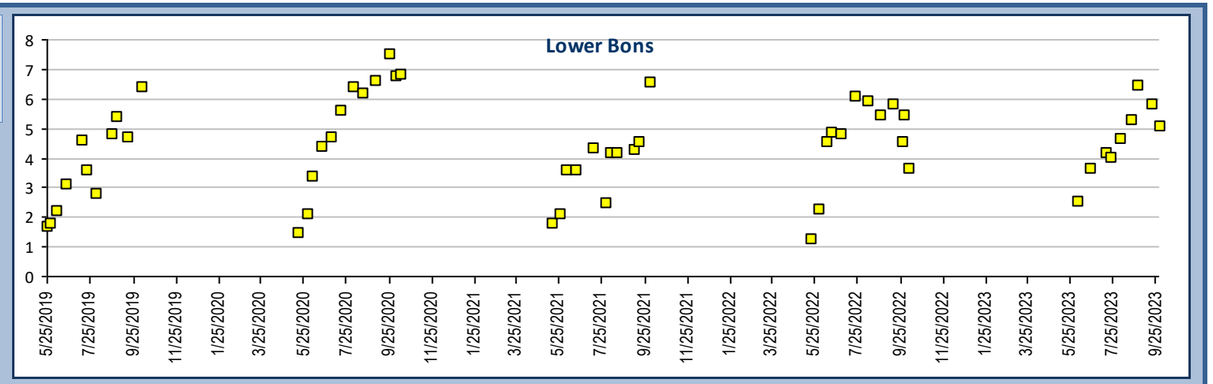


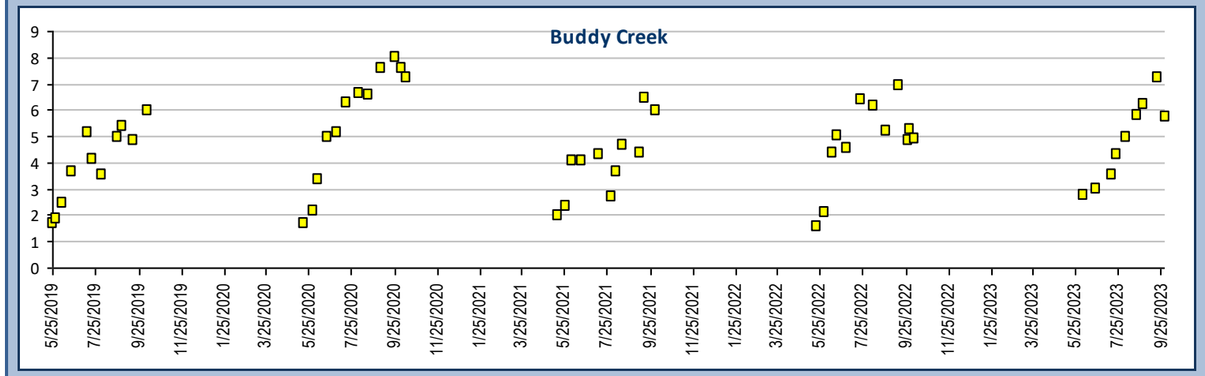


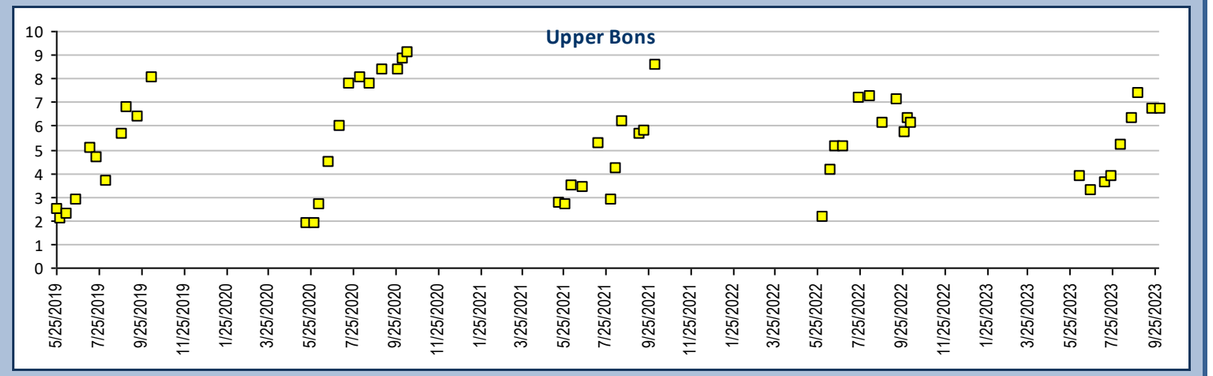
RED DOG MINE

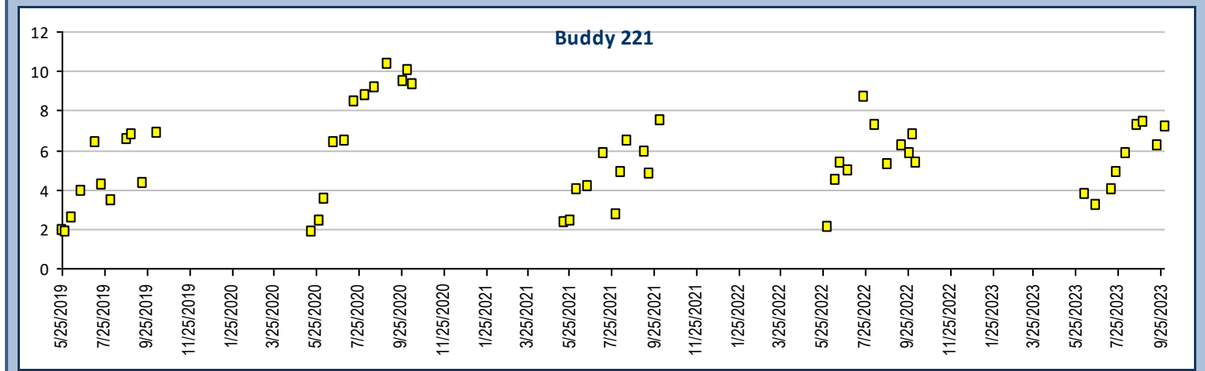
Water Monitoring Bons Creek Drainage
Water Quality Profile I , 5-Year Trend Charts

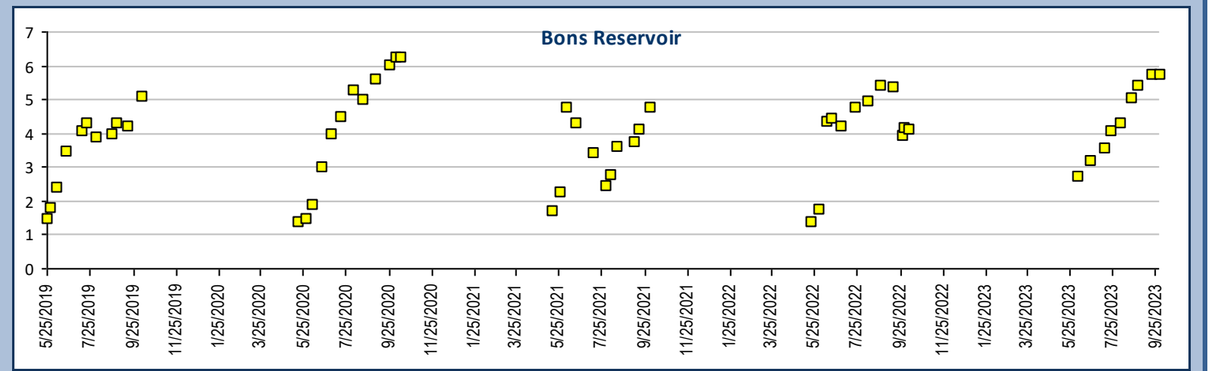
Sodium, Total Recoverable, units mg/L

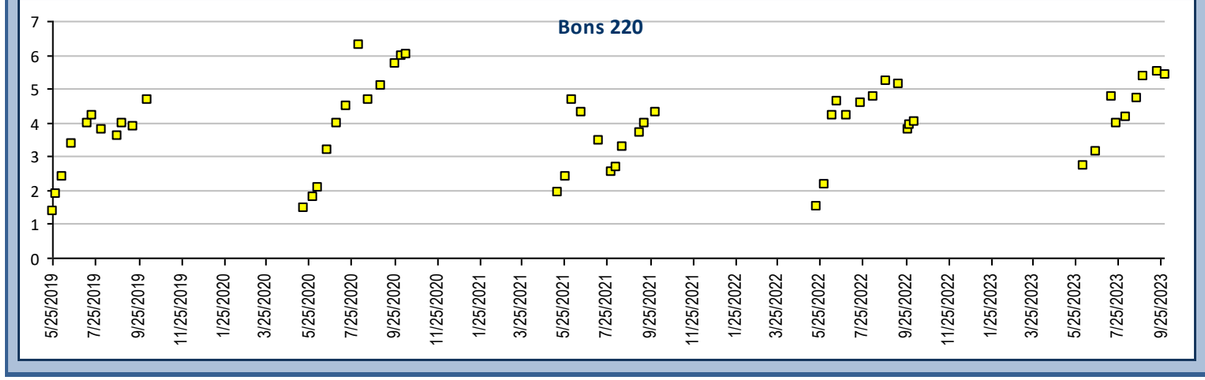


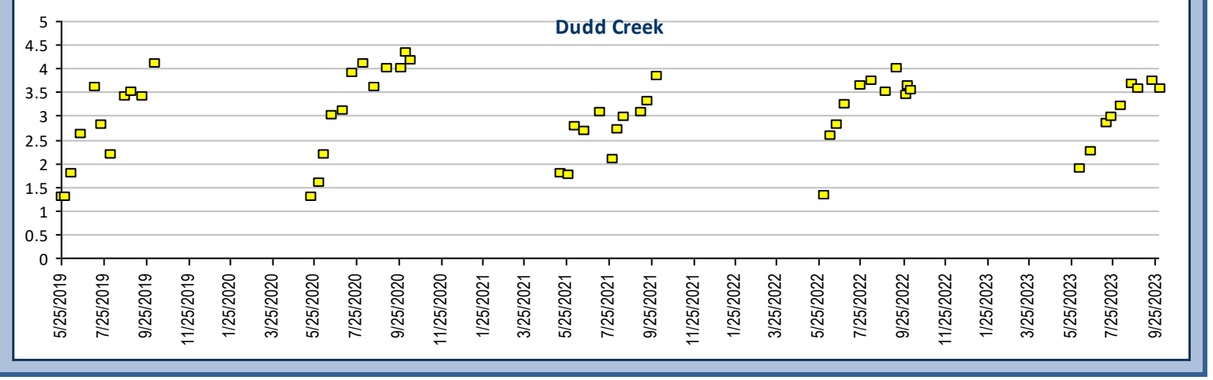












RED DOG MINE

Water Monitoring Bons Creek Drainage
Water Quality Profile I , 5-Year Trend Charts

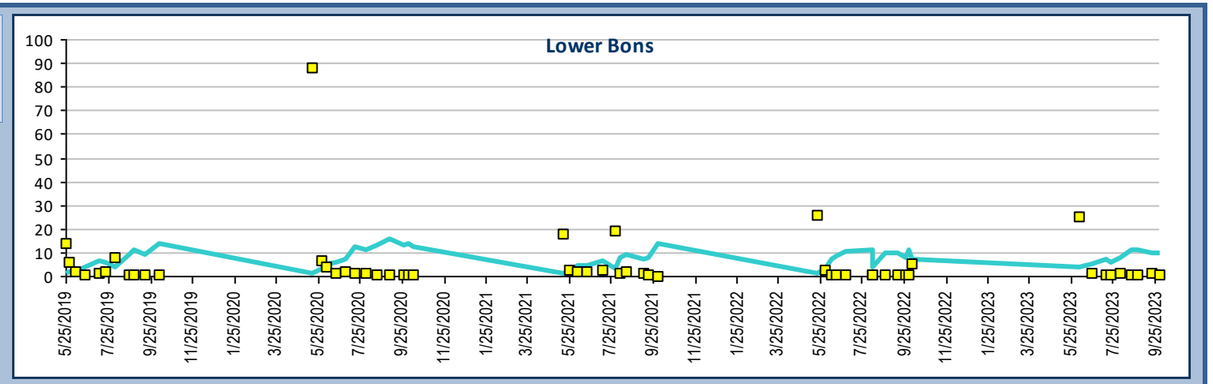
Lead, Total recoverable, units ug/L

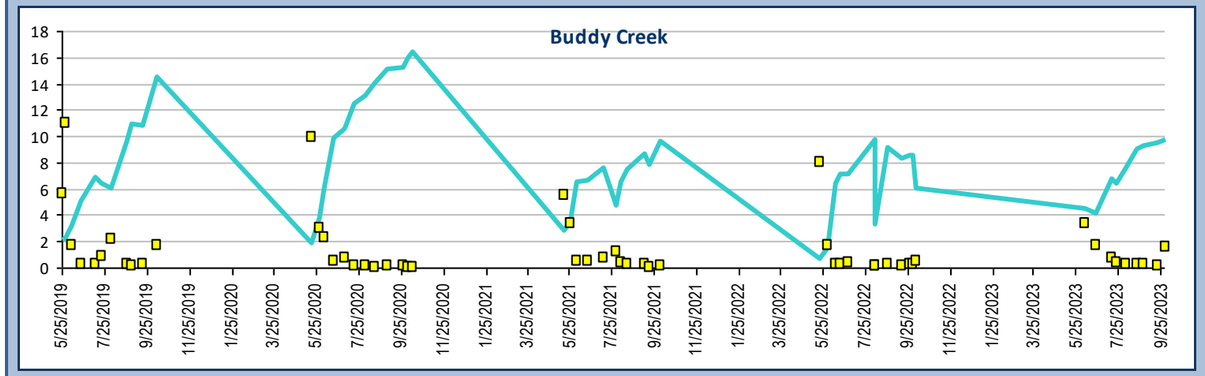
Aquatic Life - Fresh Water Chronic WQS ug/L

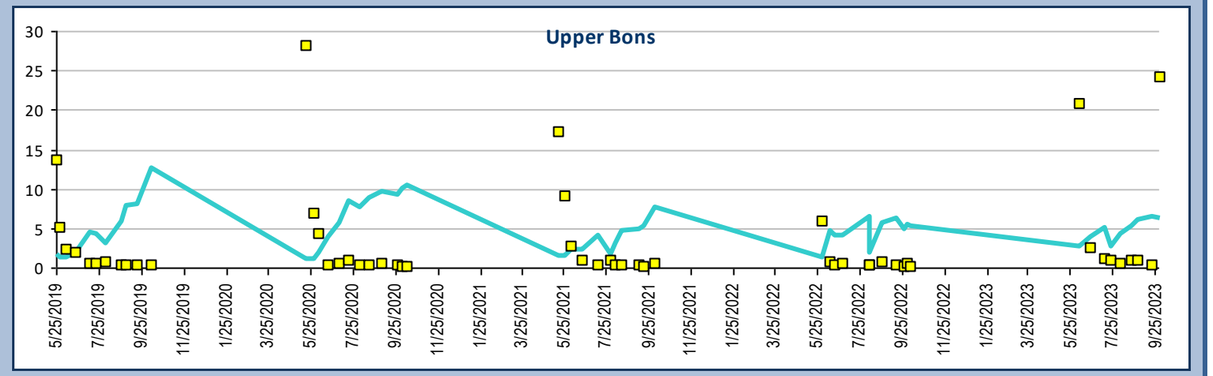
Hardness Dependent Calculation

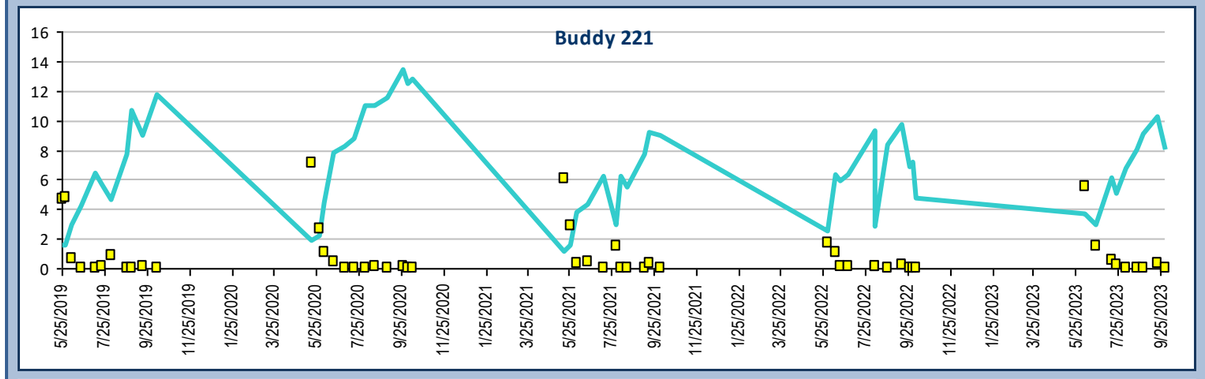
=EXP(1.273*(LN(calc *hardness))-4.705)

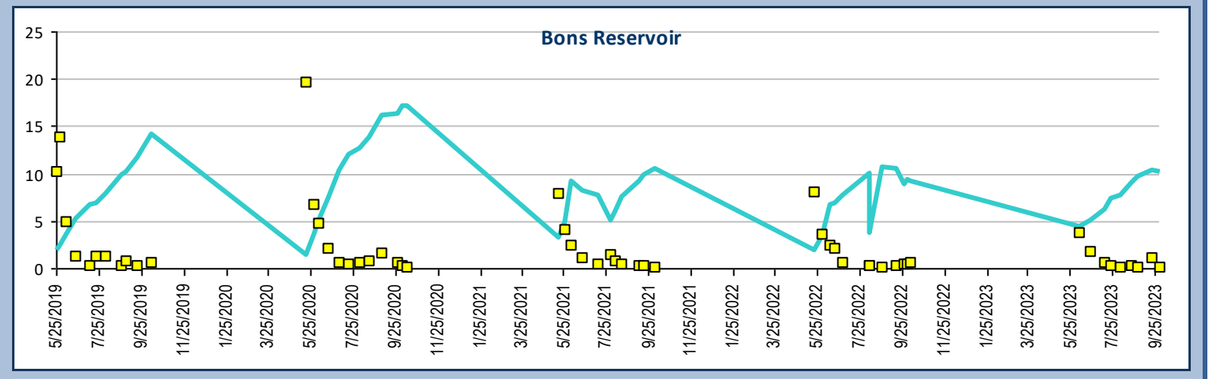
* Calculated using Standard Methods 2340B

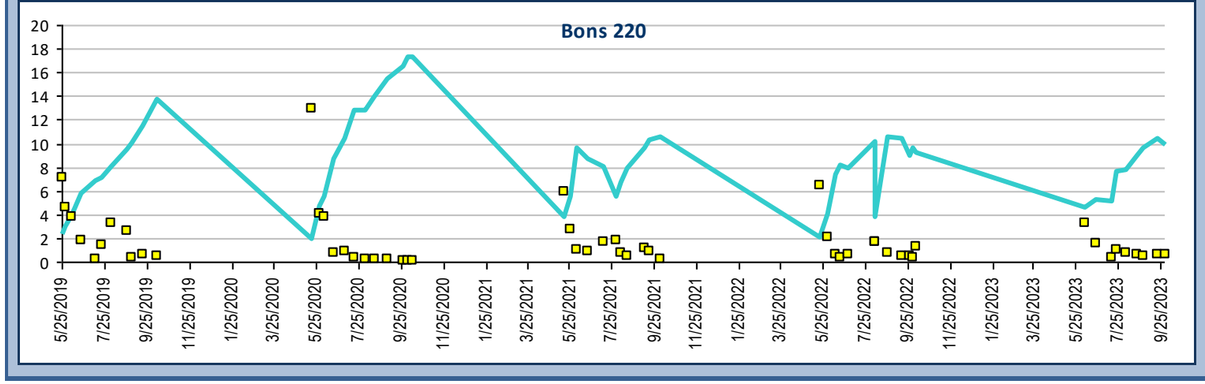


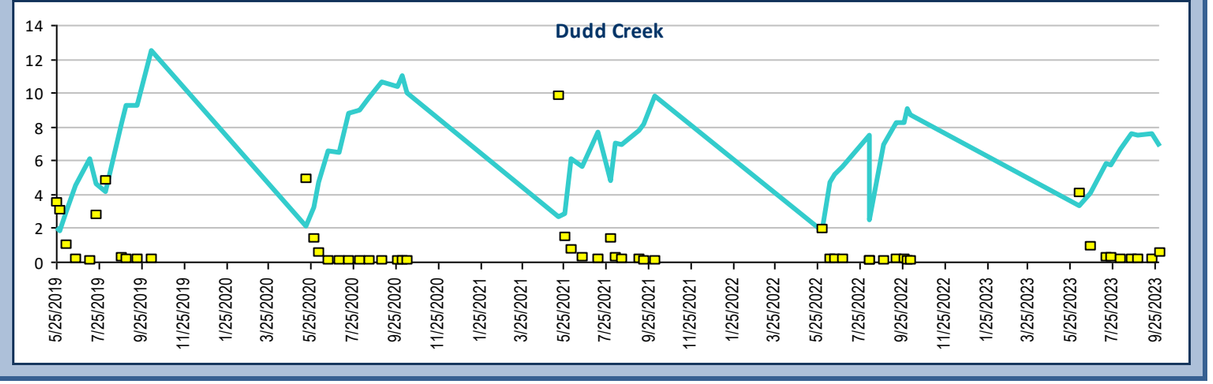










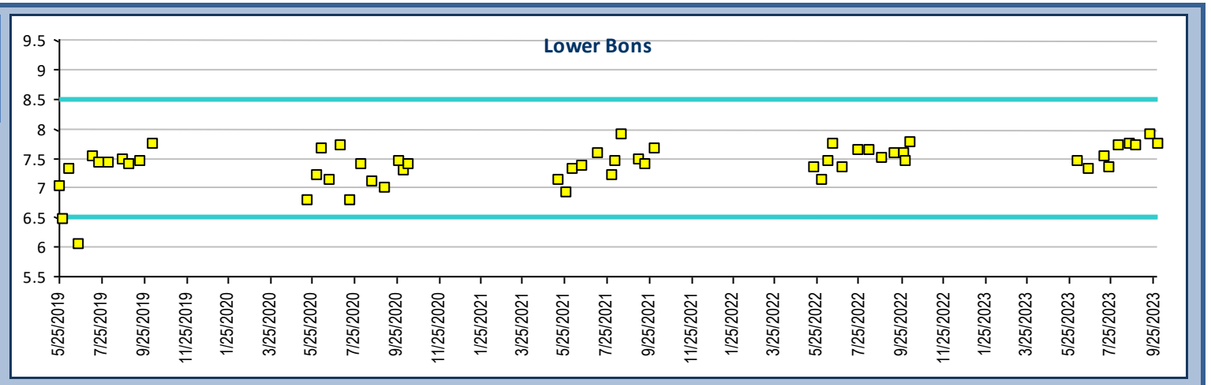


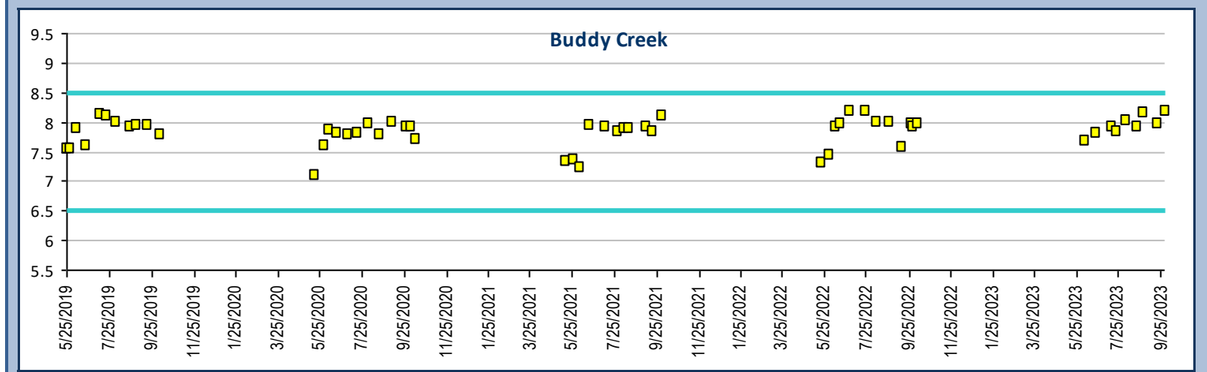
RED DOG MINE

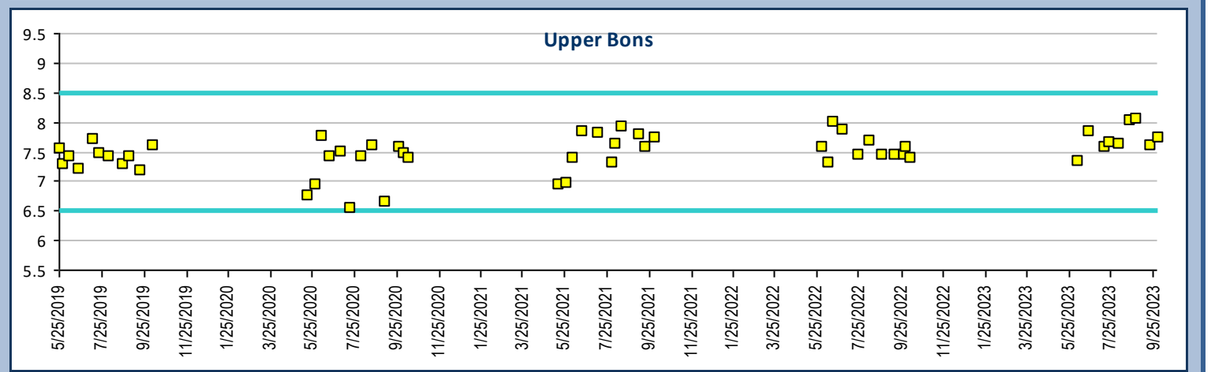
Water Monitoring Bons Creek Drainage
Water Quality Profile I , 5-Year Trend Charts

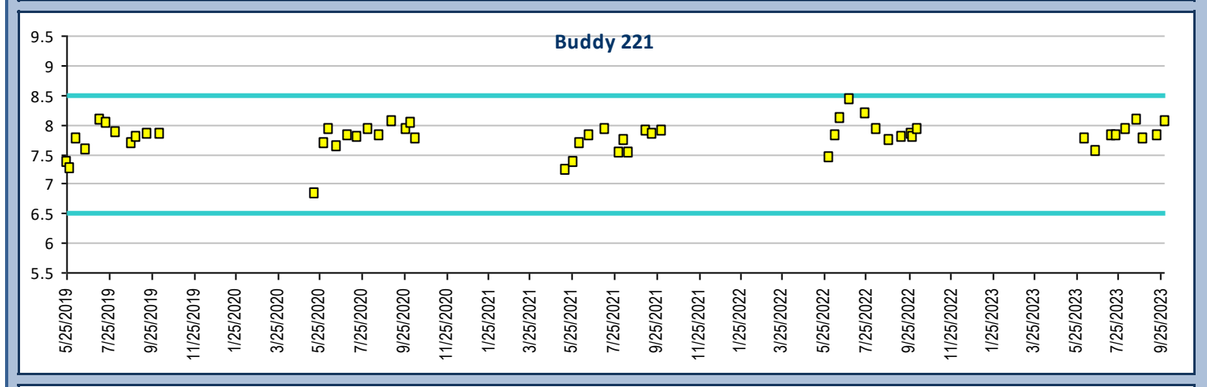
pH

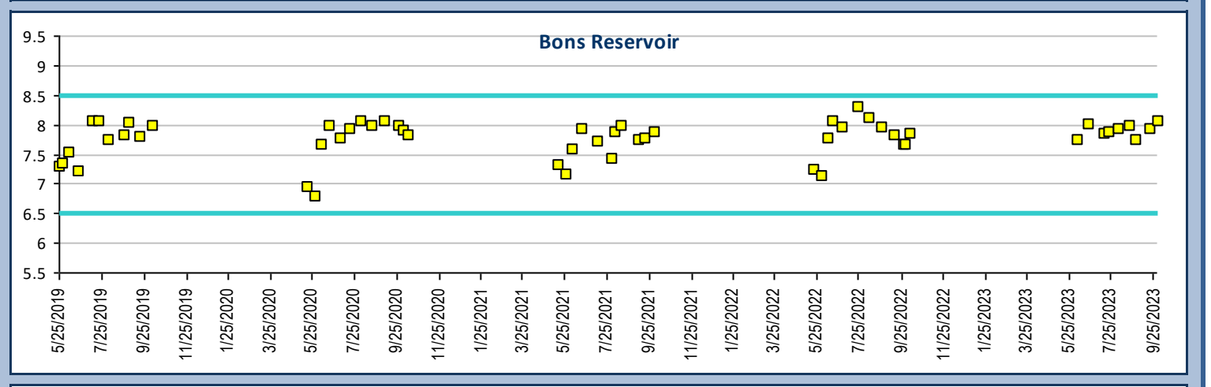
Site Specific WQS between 6.5 and 8.5

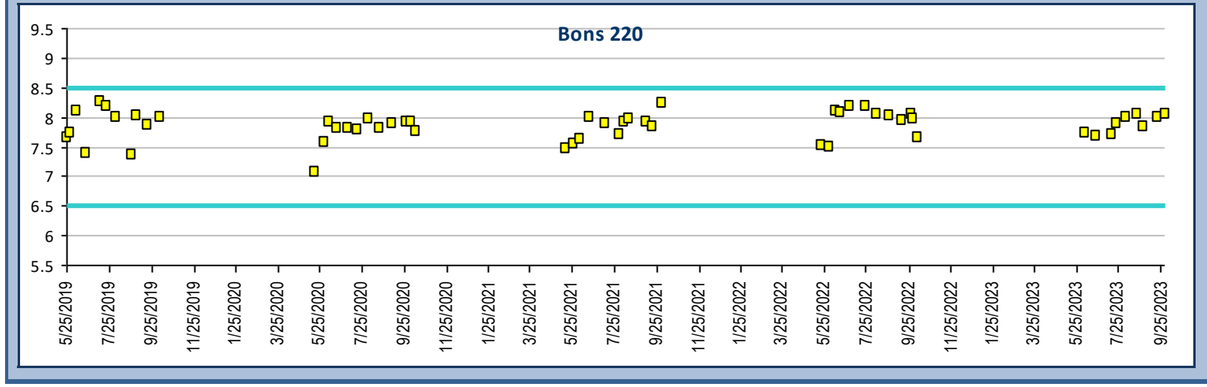


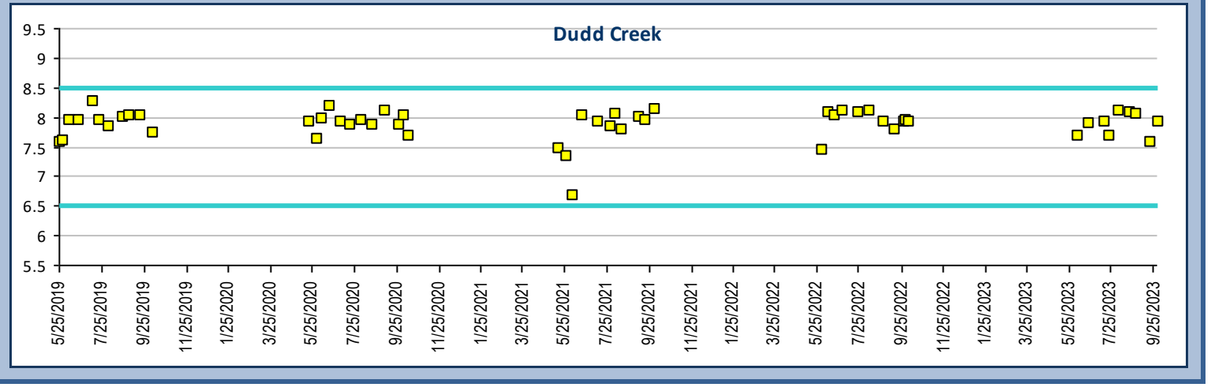












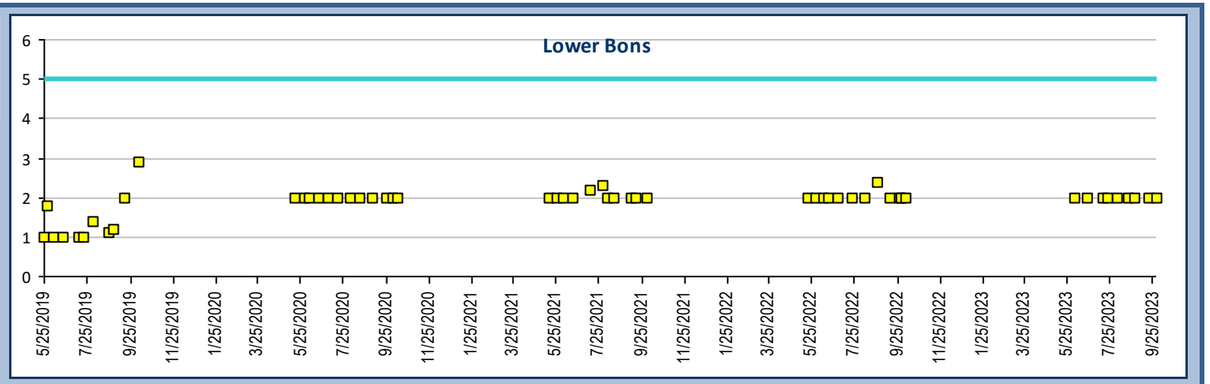
RED DOG MINE

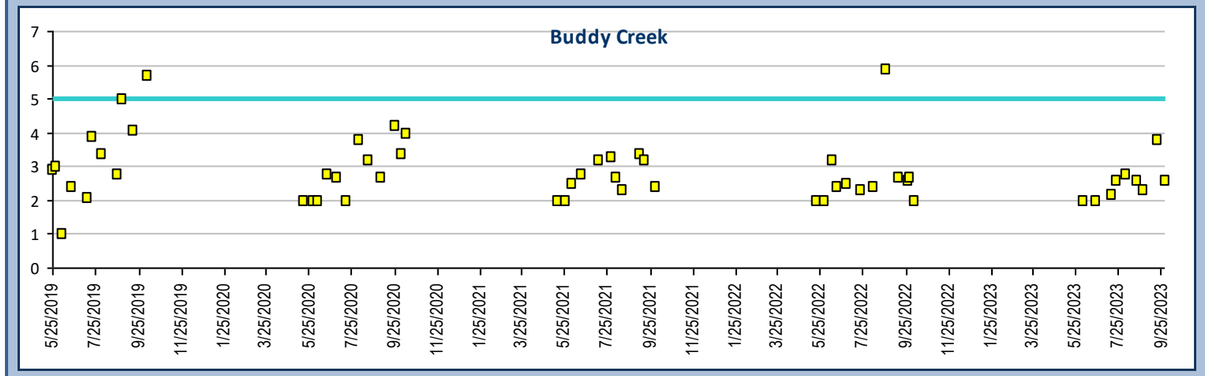
Water Monitoring Bons Creek Drainage
Water Quality Profile I , 5-Year Trend Charts

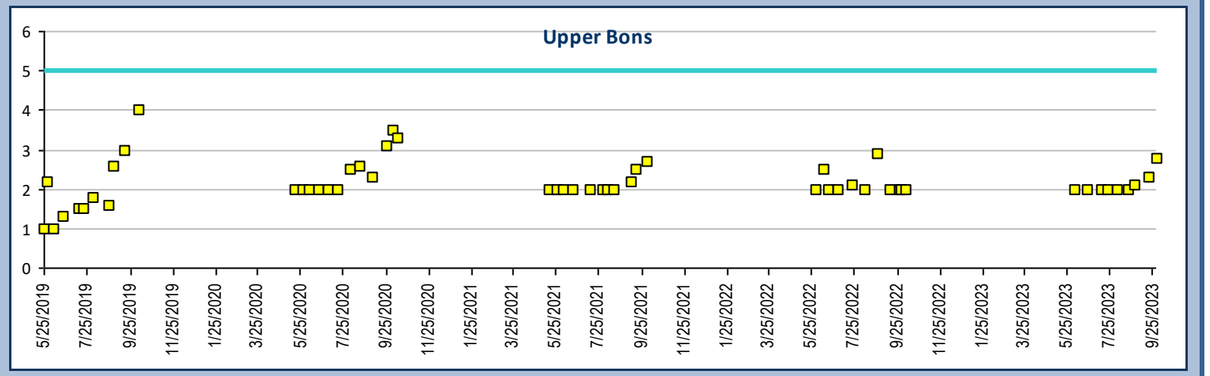
Selenium, Total Recoverable, units ug/L

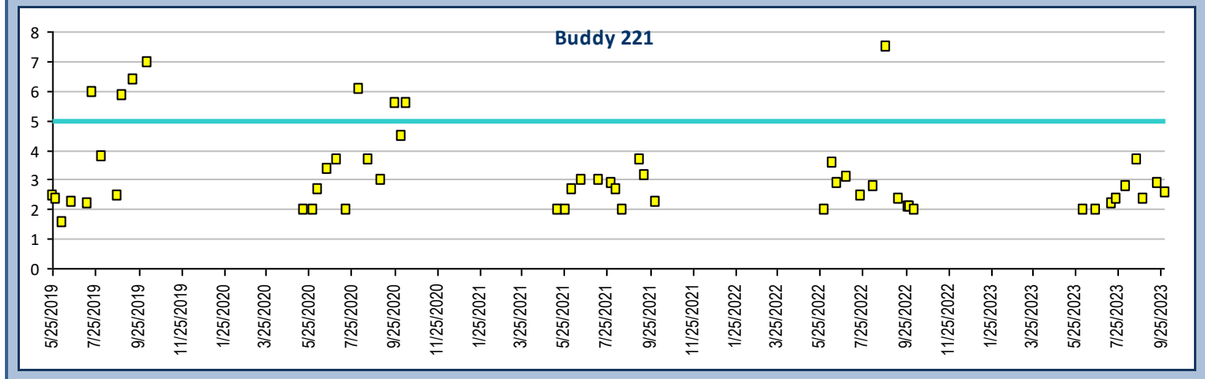
Aquatic Life - Fresh Water Chronic WQS ug/L

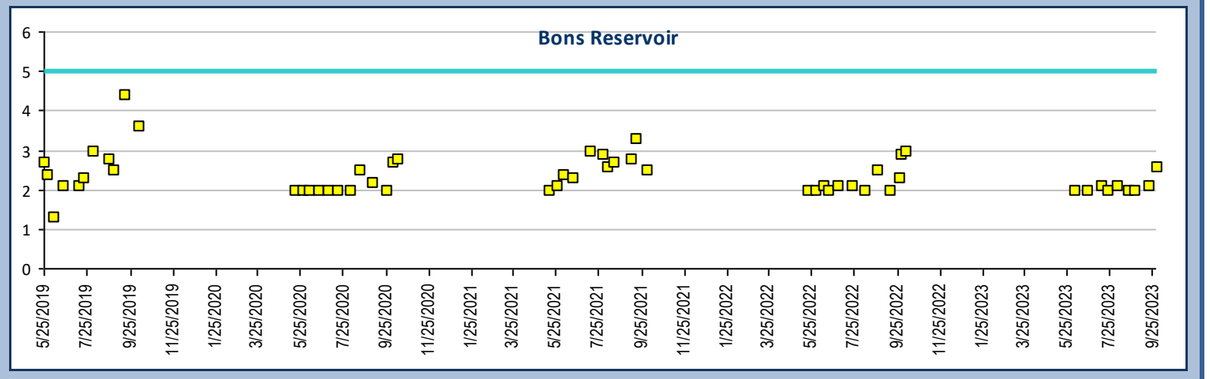
5 ug/L

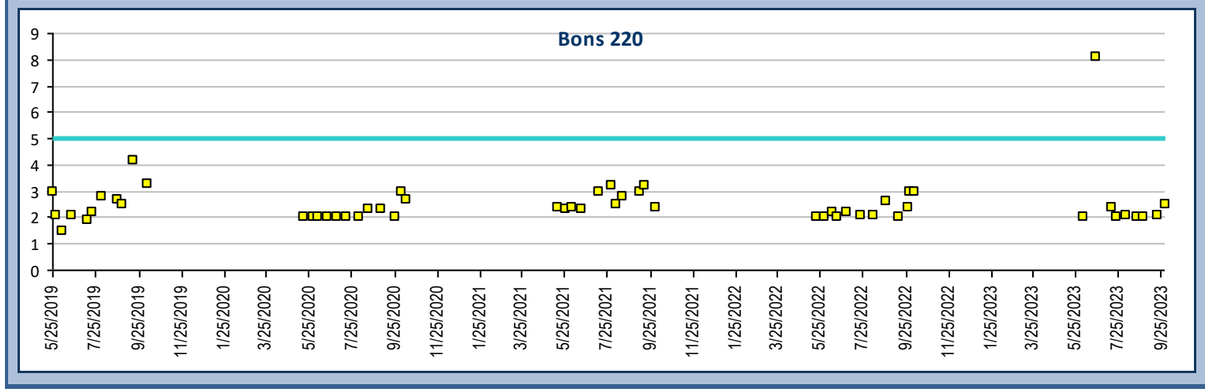


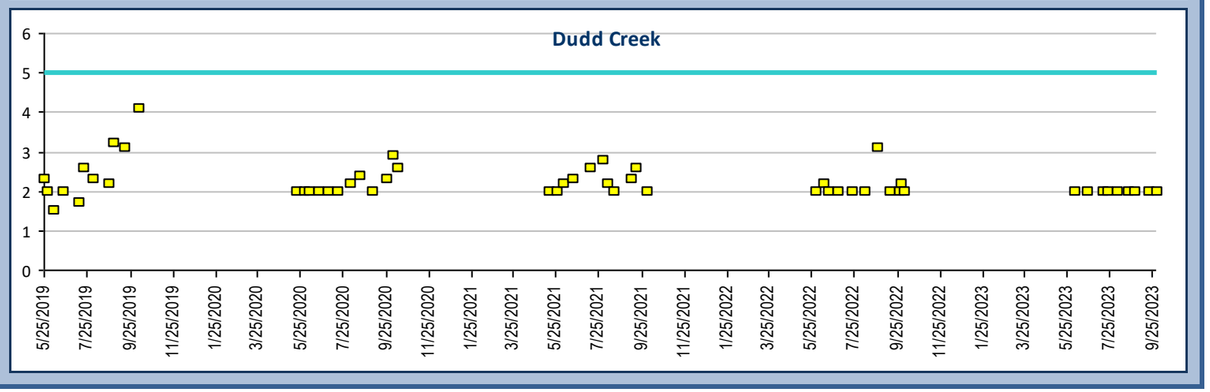








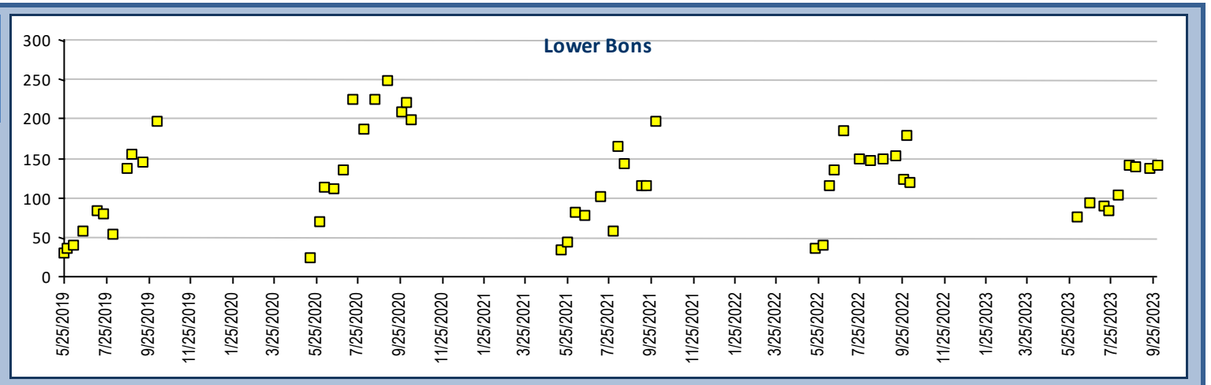


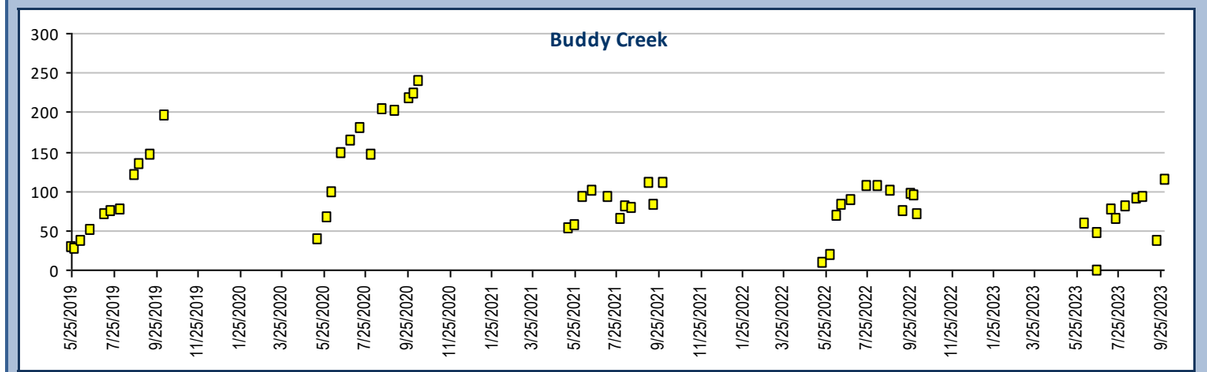


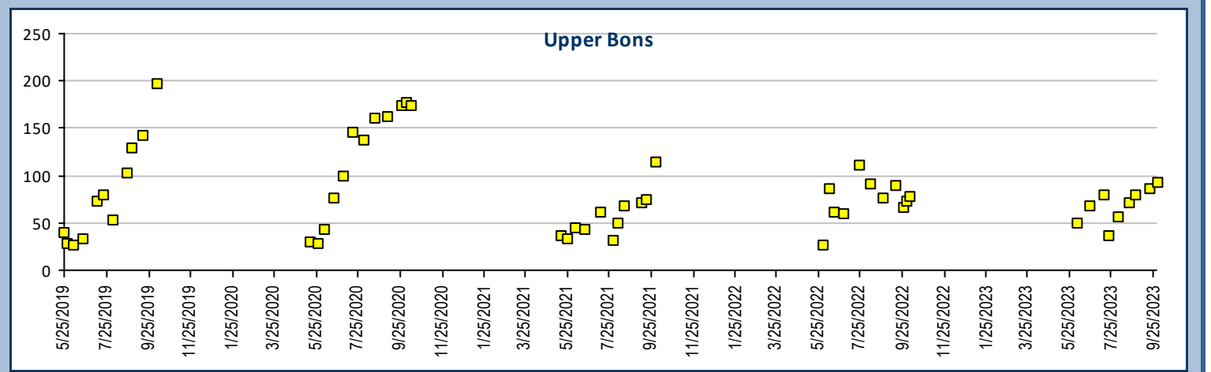
RED DOG MINE

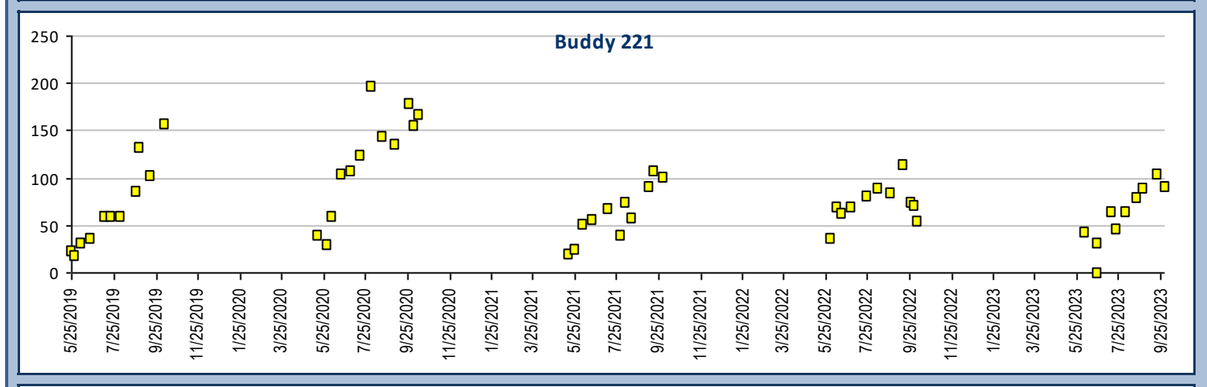
Water Monitoring Bons Creek Drainage
Water Quality Profile I , 5-Year Trend Charts

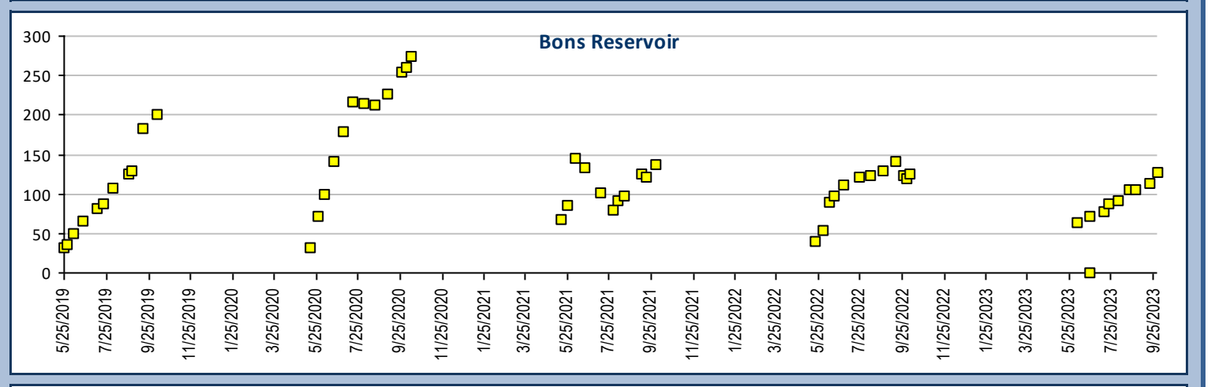
Sulfate, Total recoverable, units mg/L

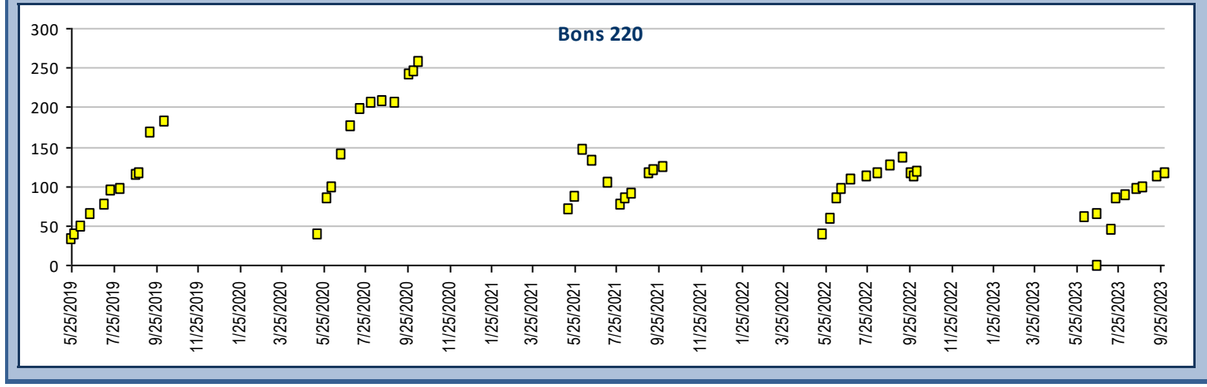


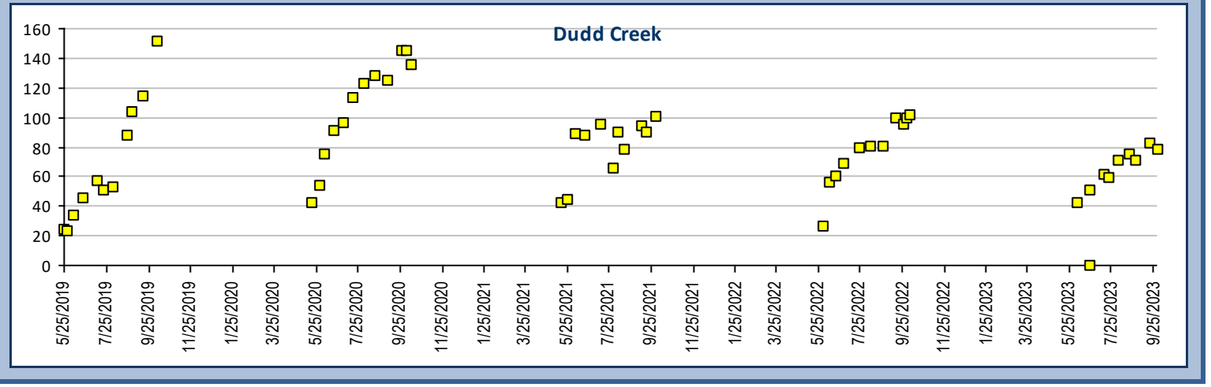












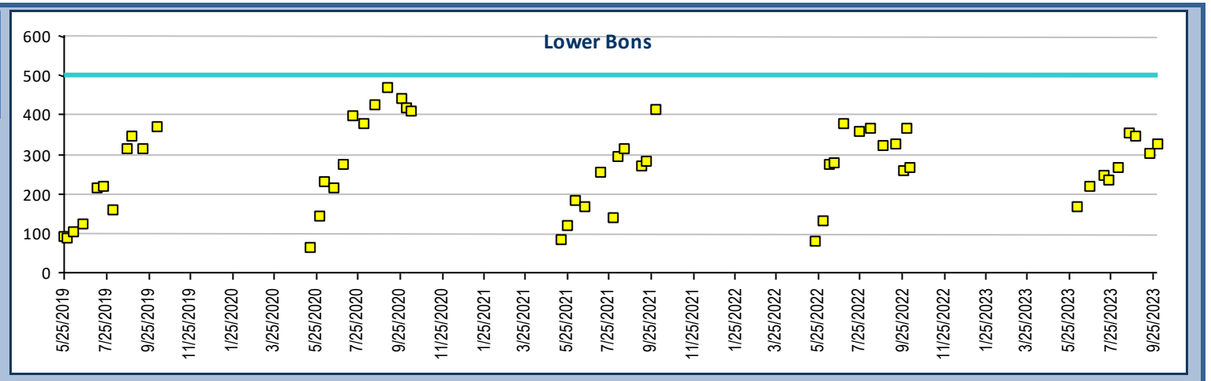
RED DOG MINE

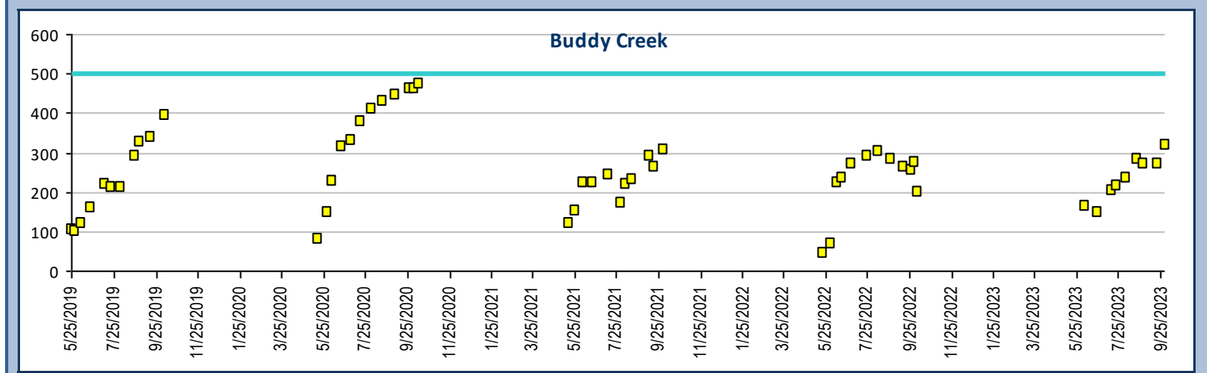
Water Monitoring Bons Creek Drainage
Water Quality Profile I , 5-Year Trend Charts

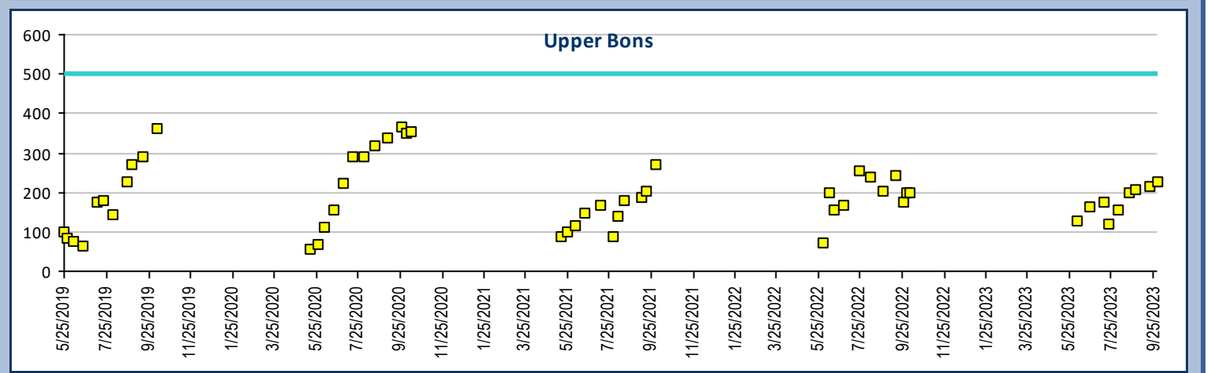
Total Dissolved Solids, units mg/L

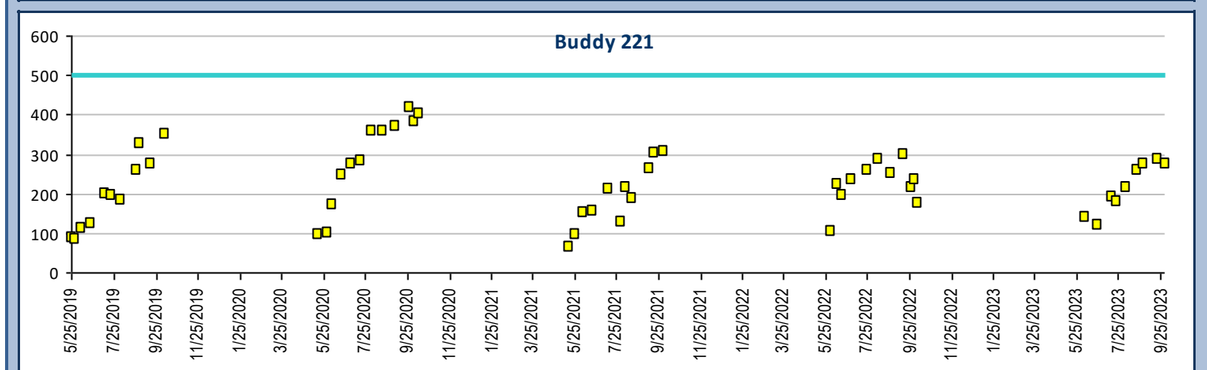
Site Specific WQS mg/L

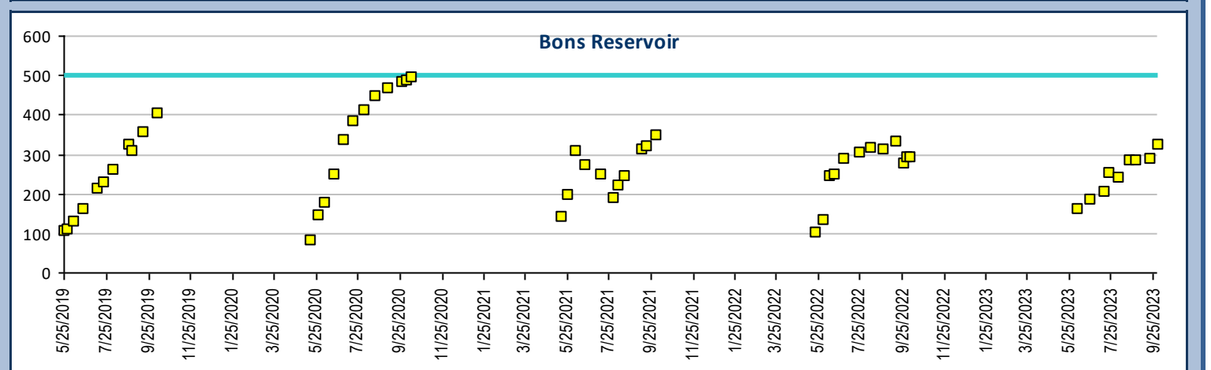
500 mg/L

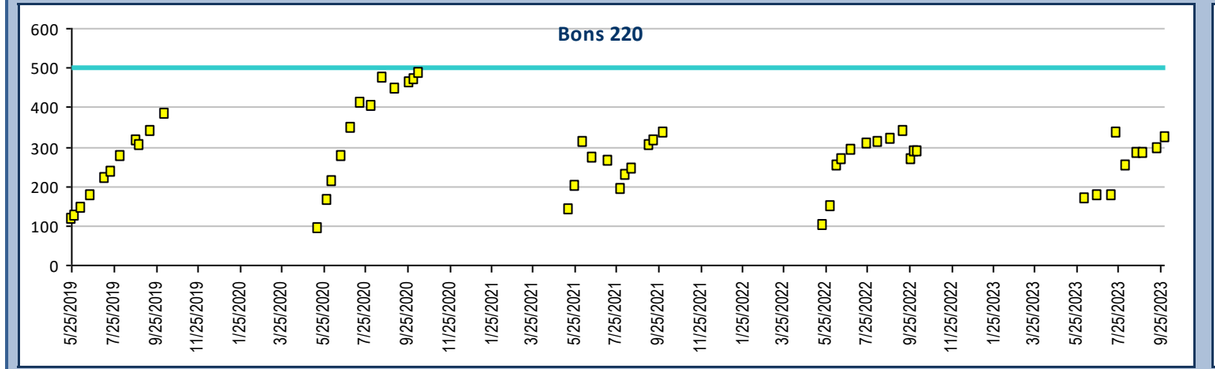


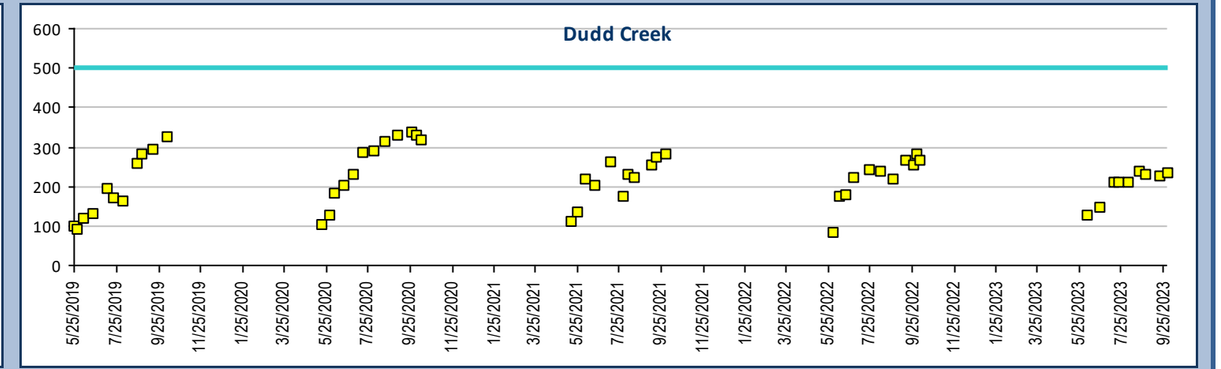












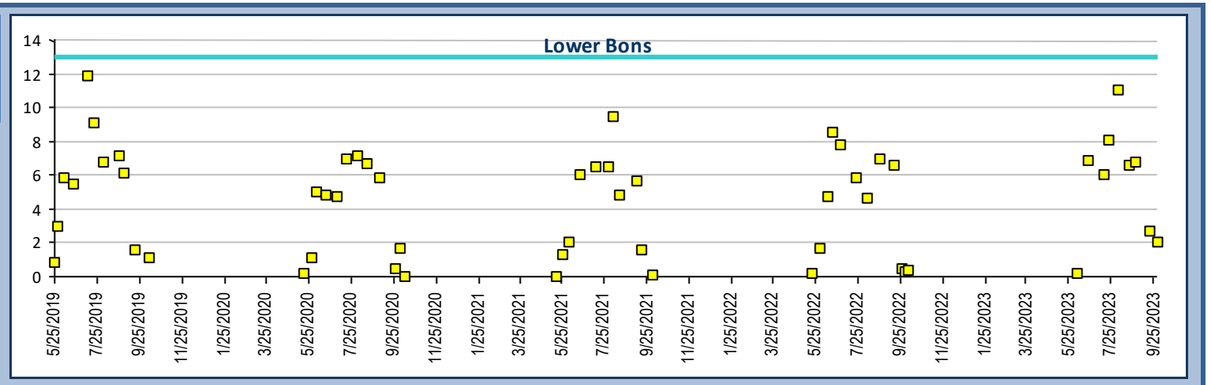
RED DOG MINE

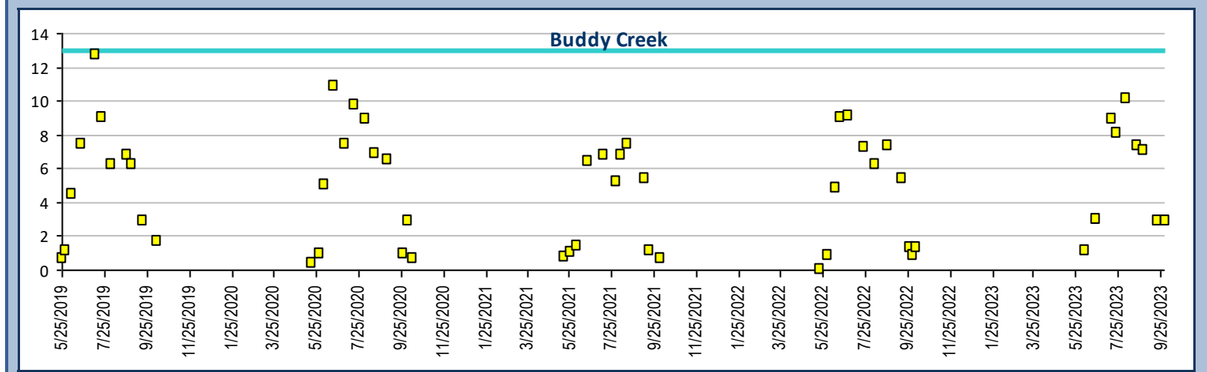
Water Monitoring Bons Creek Drainage
Water Quality Profile I , 5-Year Trend Charts

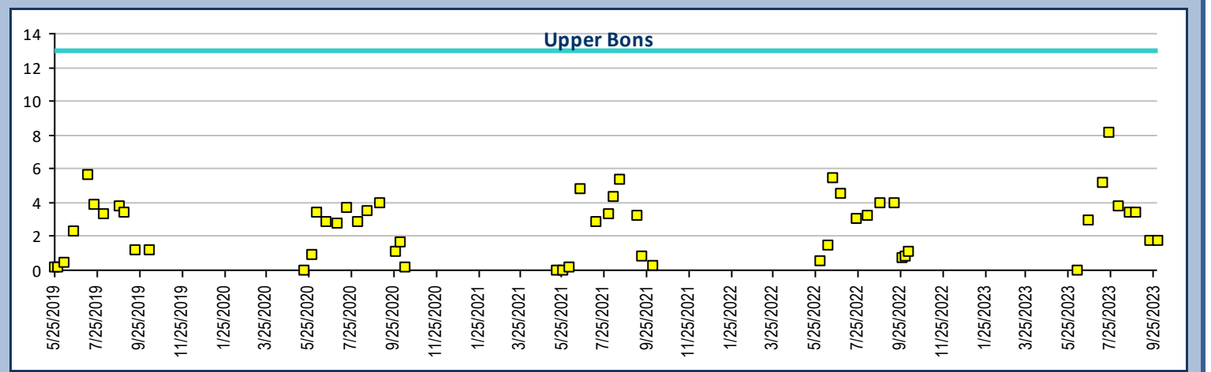
Temperature Field, units Celsius

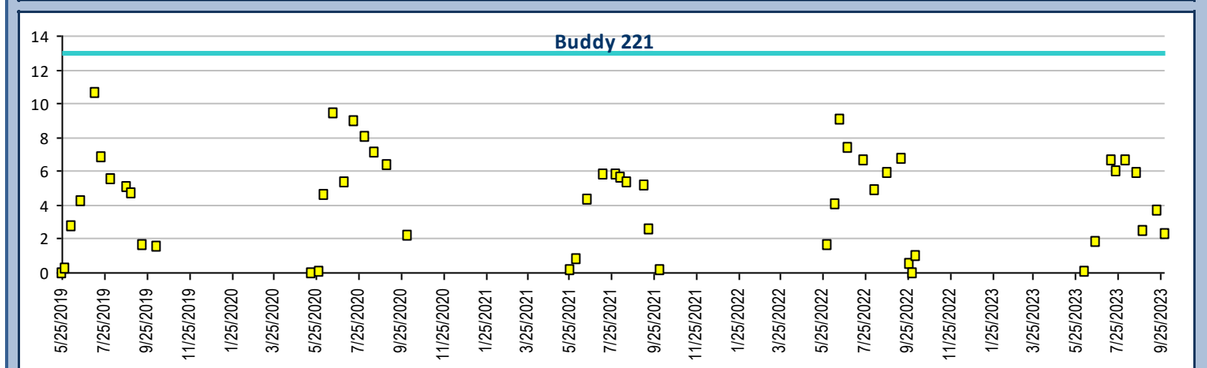
Site Specific WQS mg/L

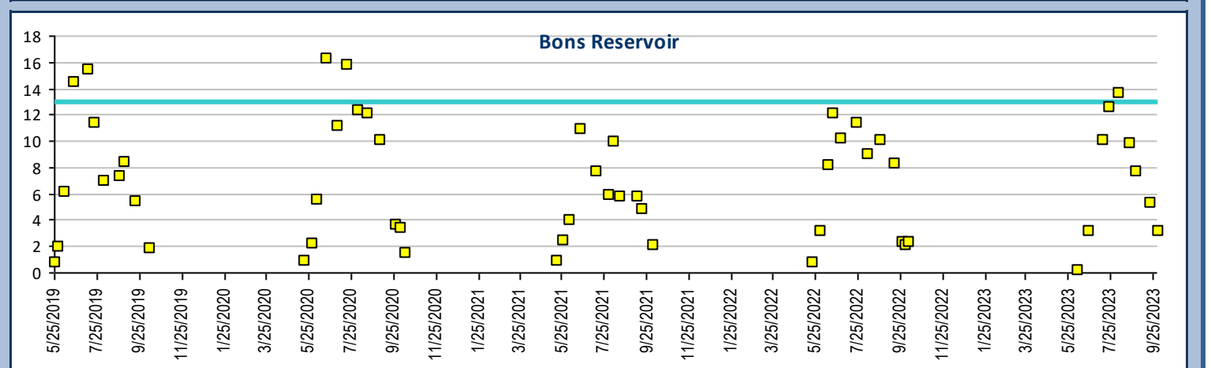
13 Celsius

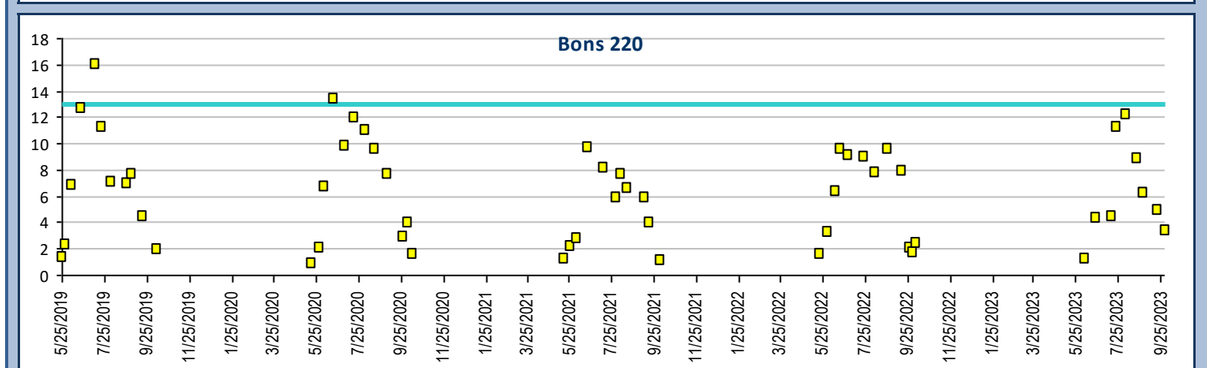


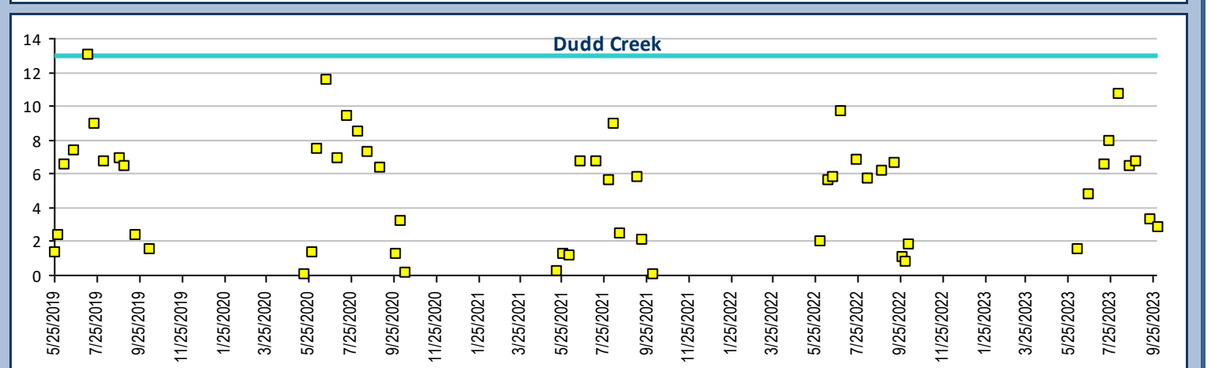






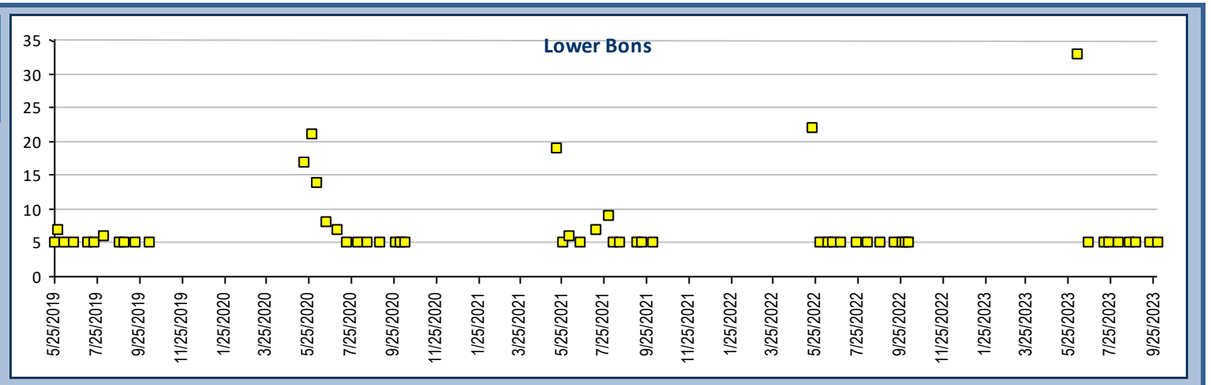


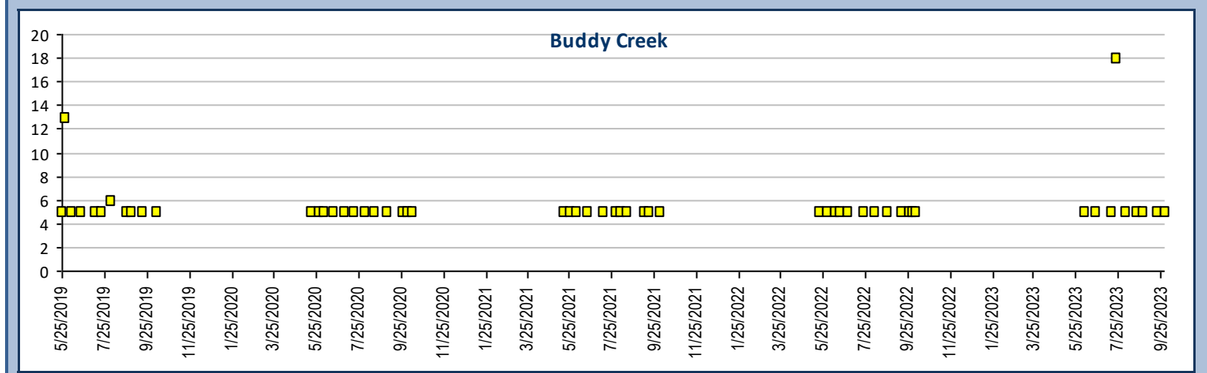


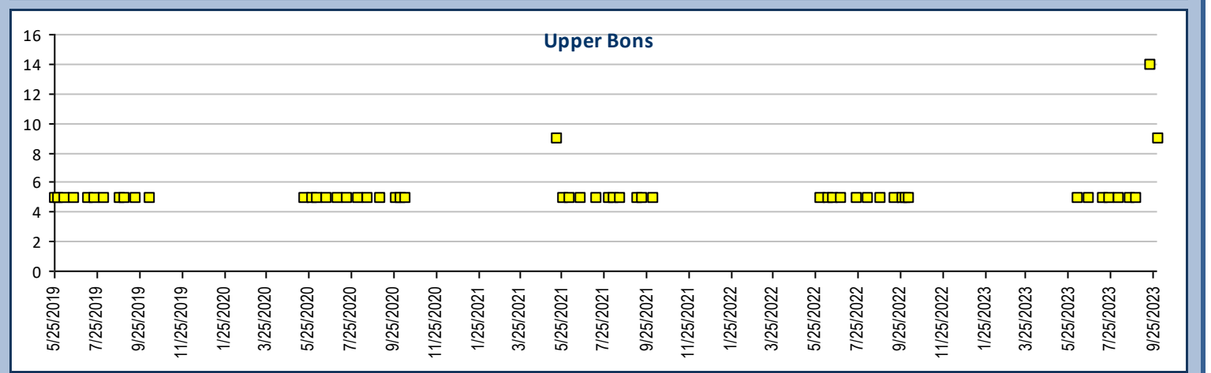


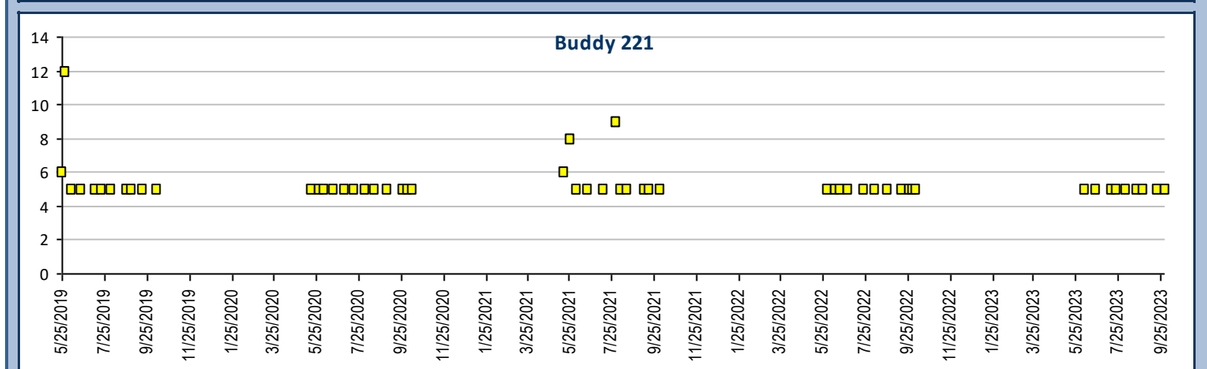
Water Monitoring Bons Creek Drainage
Water Quality Profile I , 5-Year Trend Charts

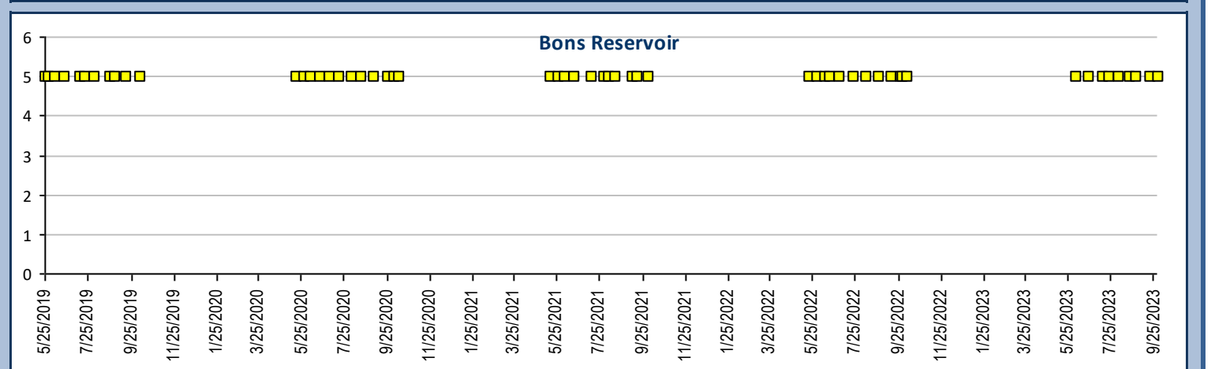
Total Suspended Solids, units mg/L

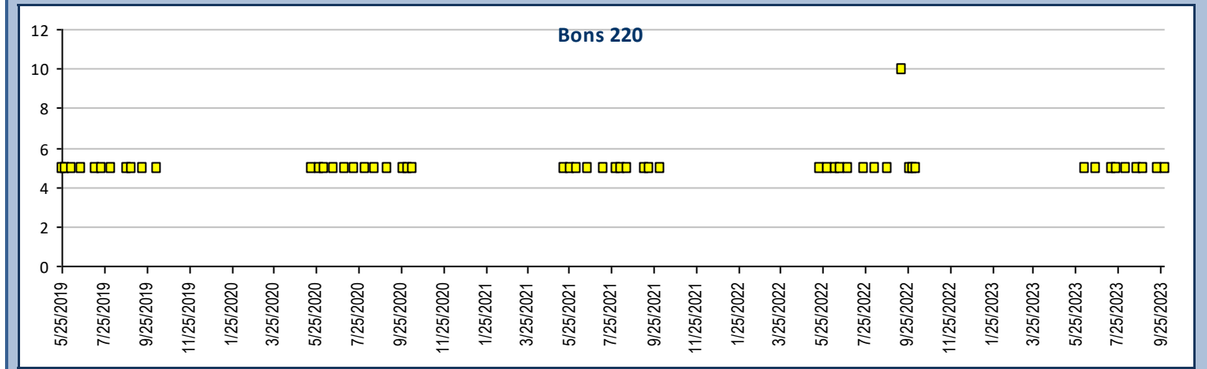


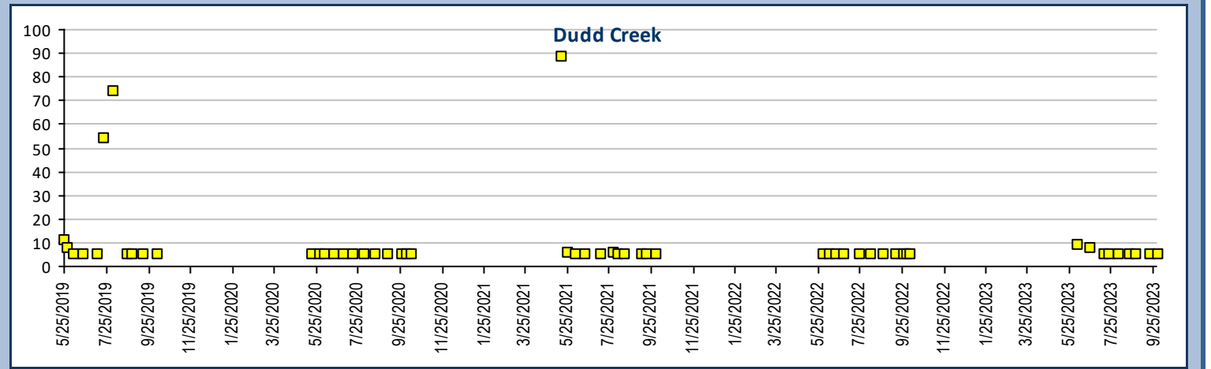












RED DOG MINE

Water Monitoring Bons Creek Drainage
Water Quality Profile I , 5-Year Trend Charts

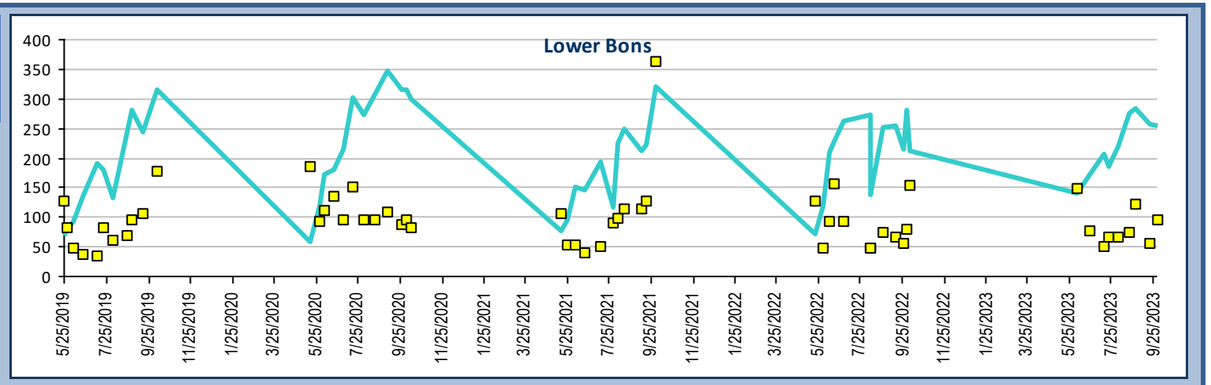
Zinc, Total Recoverable, units ug/L

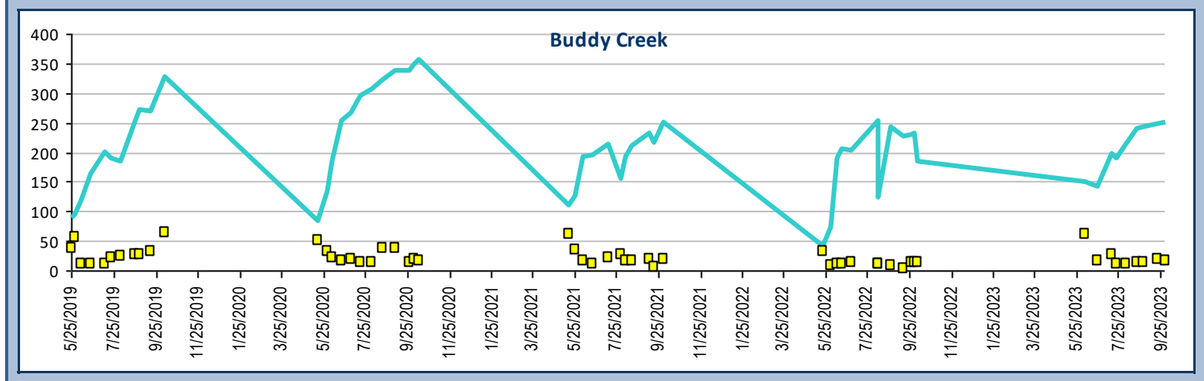
Aquatic Life - Fresh Water Acute WQS ug/L

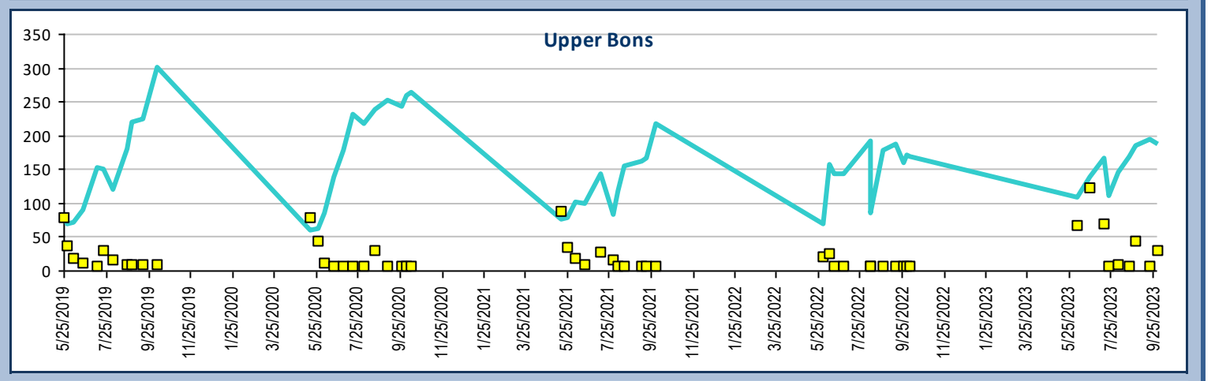
Hardness Dependent Calculation

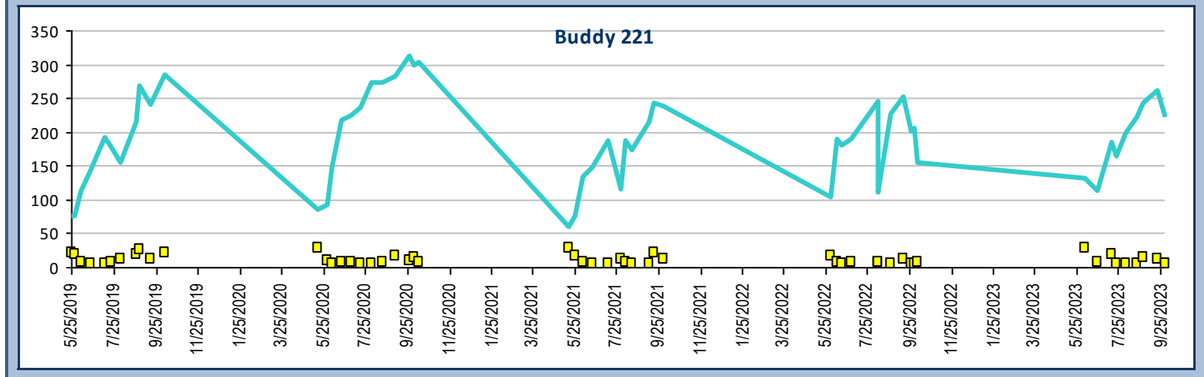
=EXP(0.8473*(LN(*hardness))+0.884)

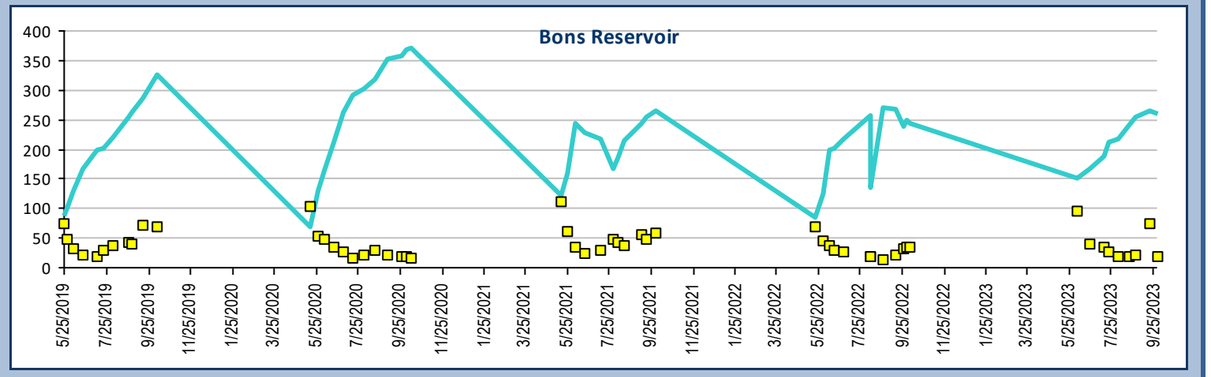
* Calculated using Standard Methods 2340B

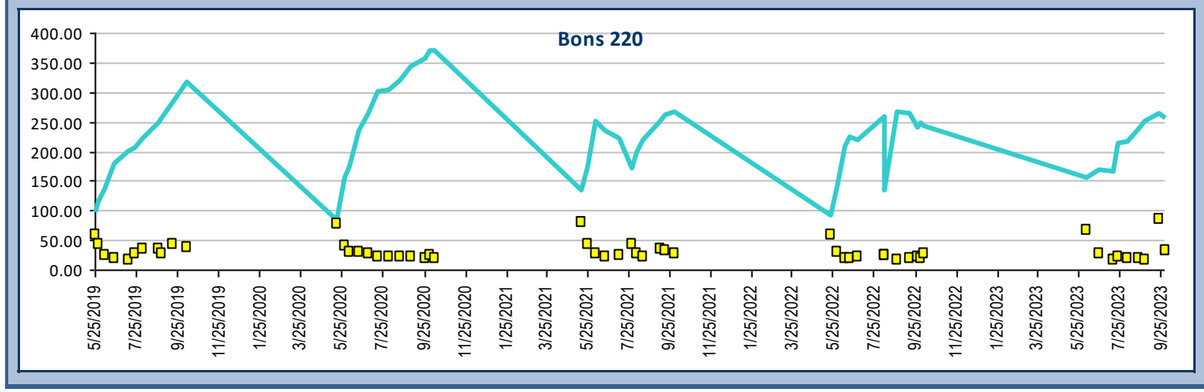


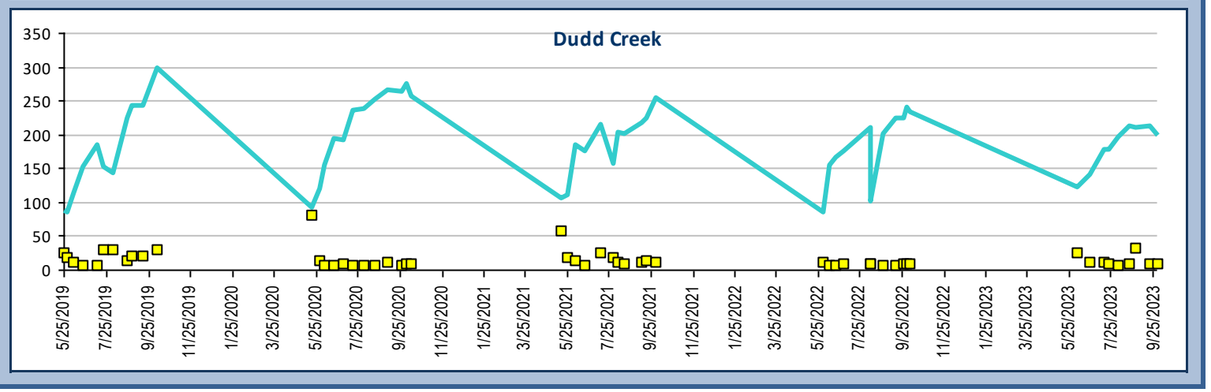






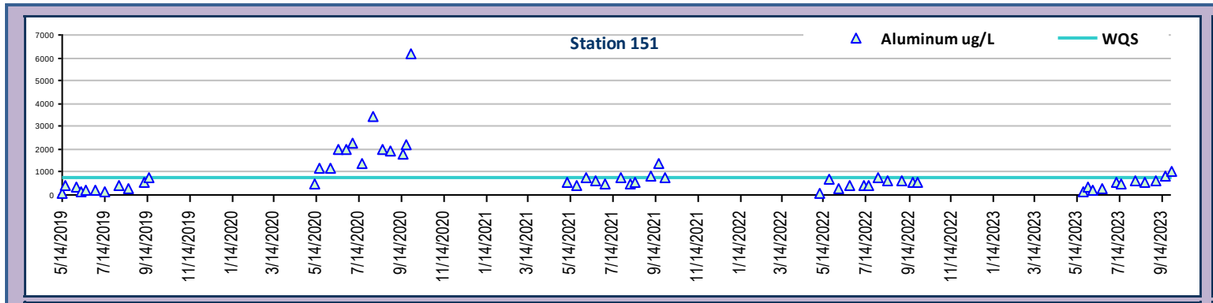


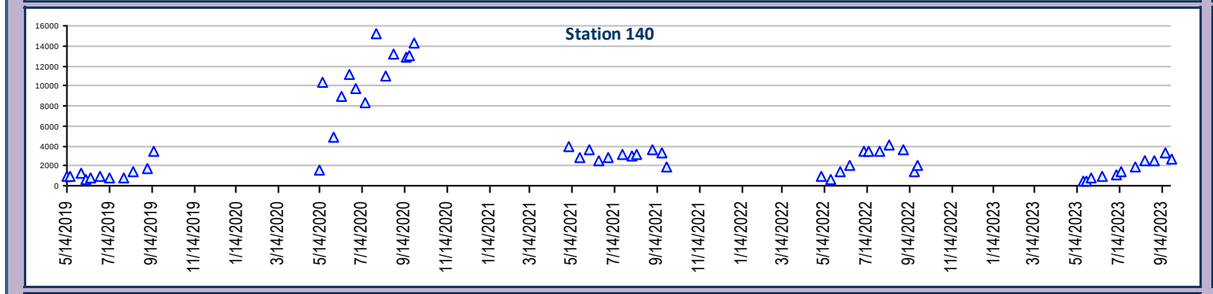


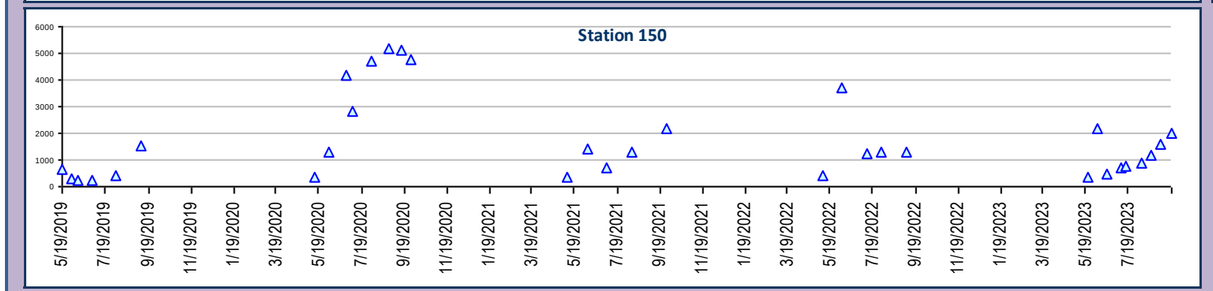


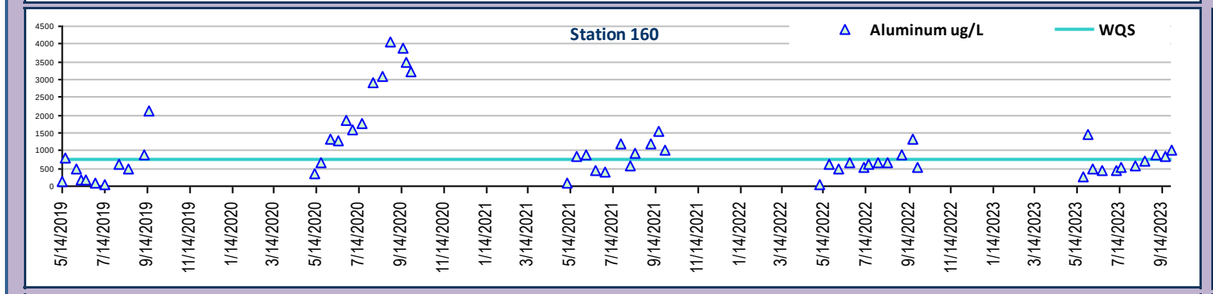
Appendix F: APDES Monitoring Station Trend Charts

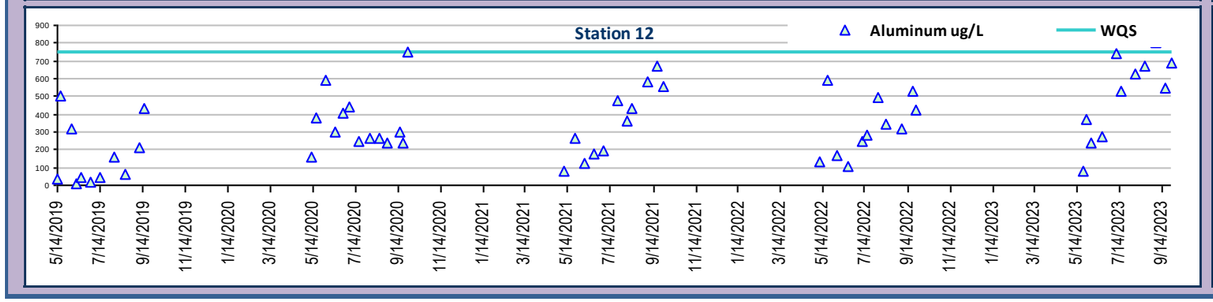
APDES Stations : Aluminum, Total, units ug/L - 5 Year Trend



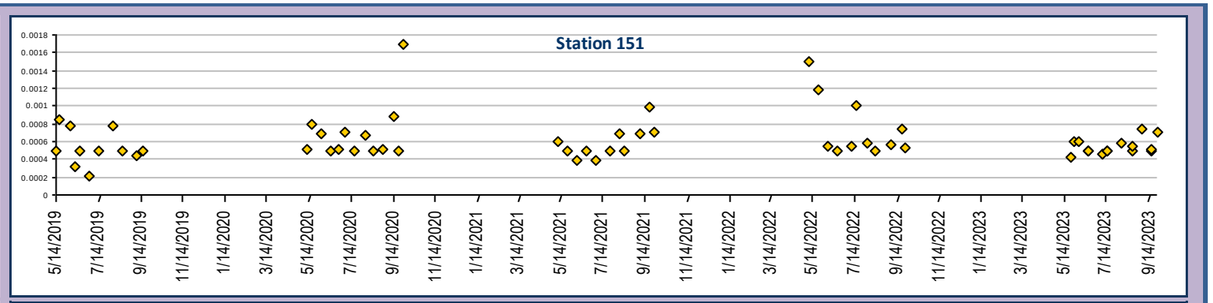


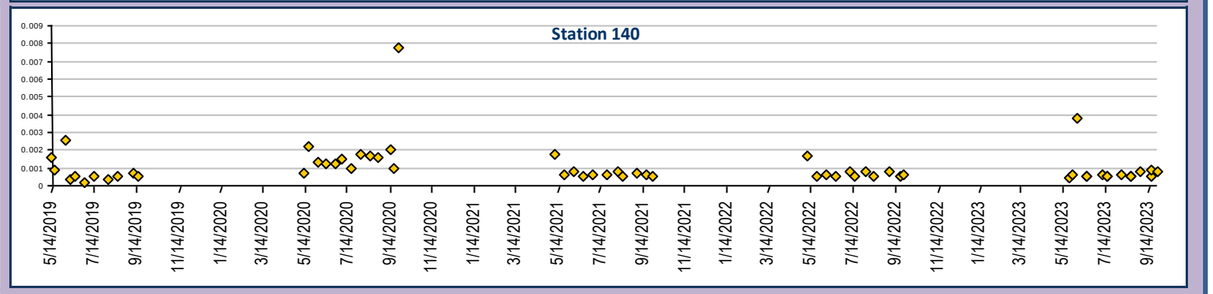


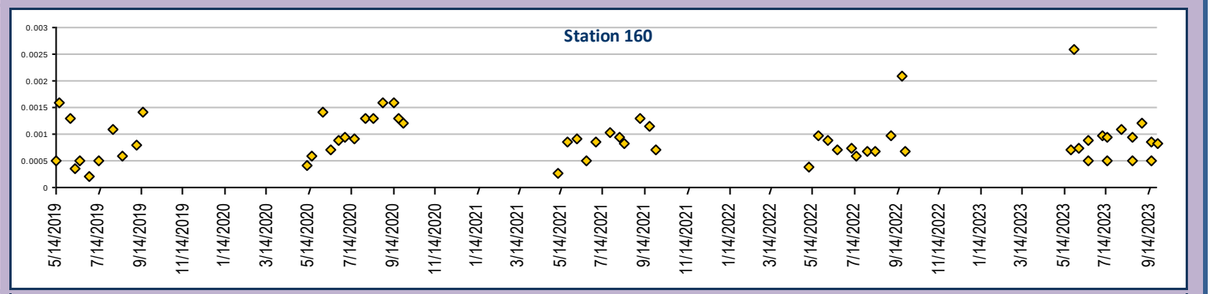


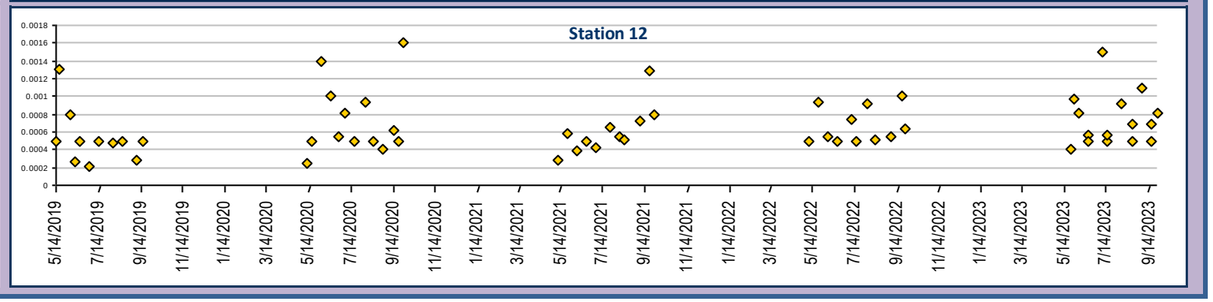


APDES Stations : Chromium, Total, units mg/L - 5 Year Trend

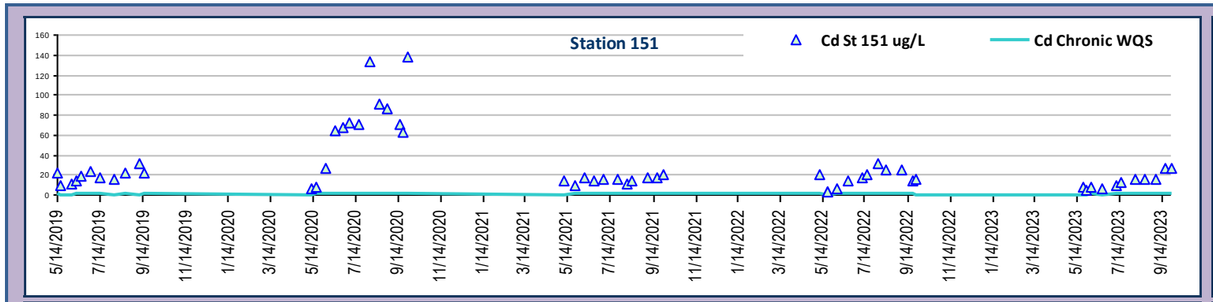


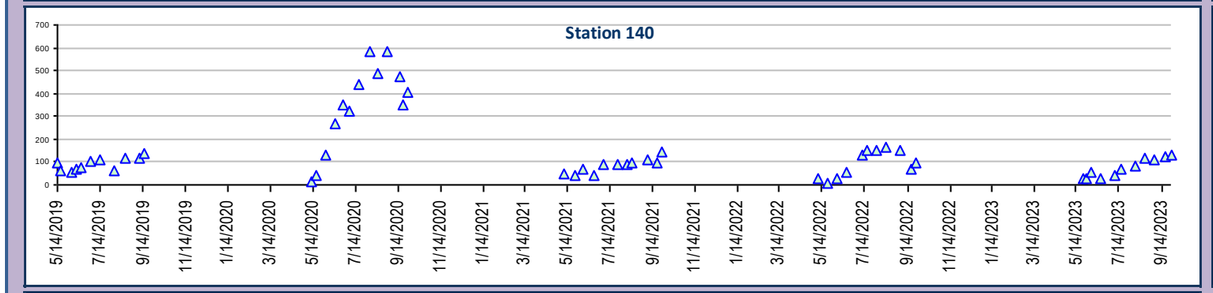


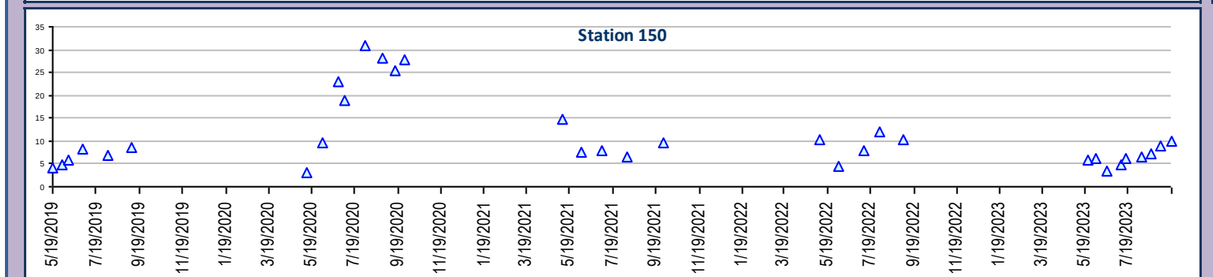


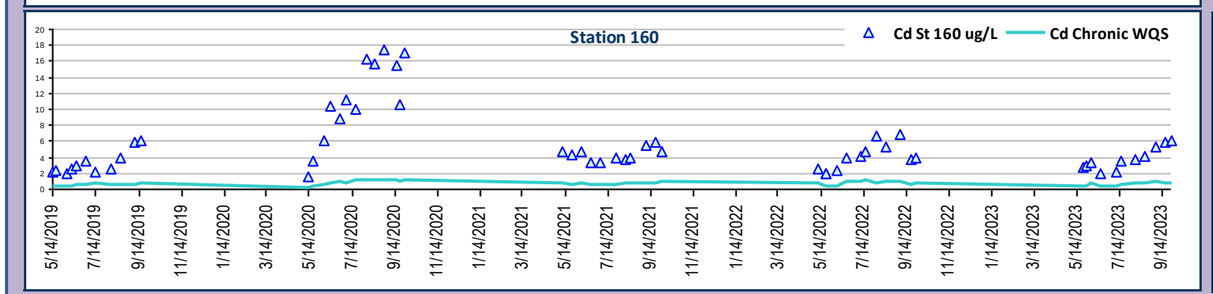


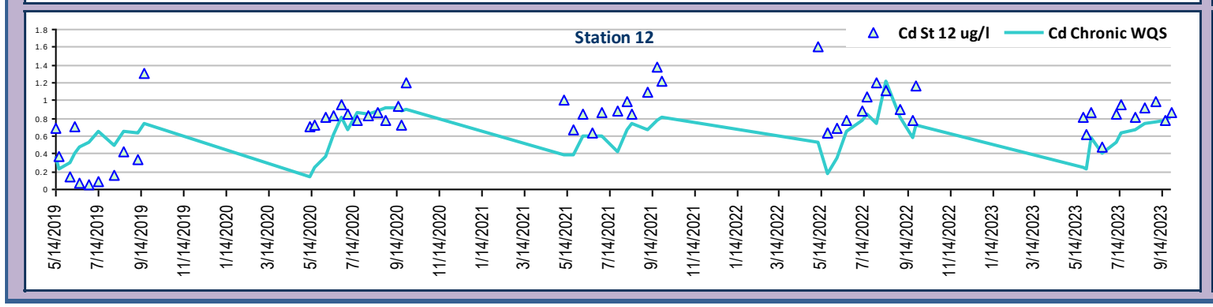
APDES Stations : Cadmium, Total, units ug/L - 5 Year Trend



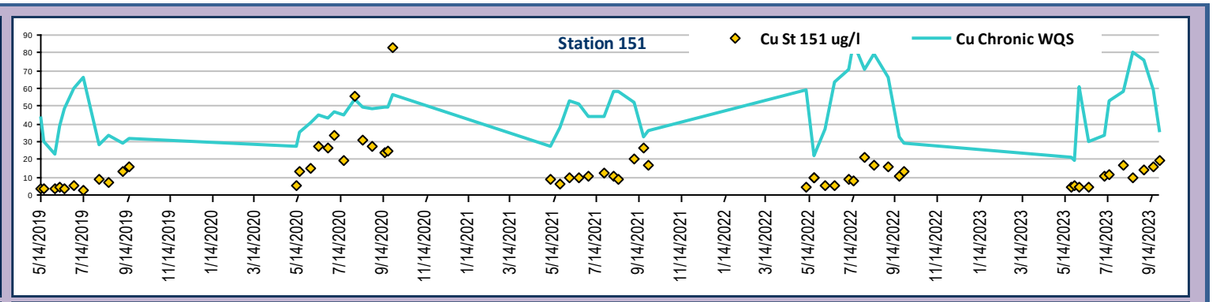


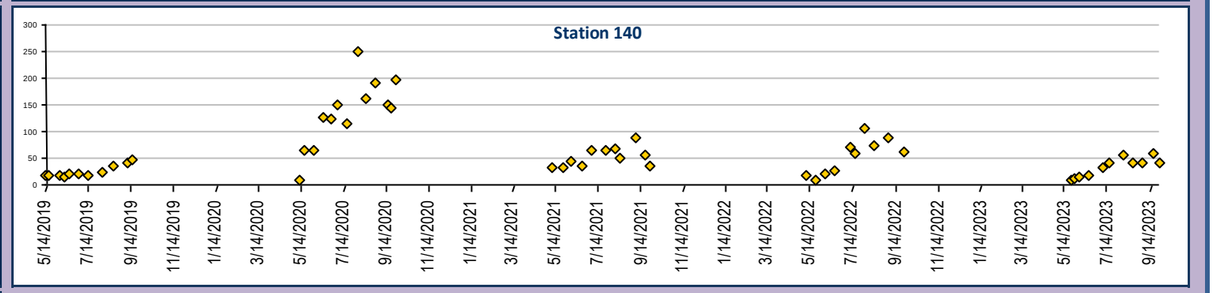


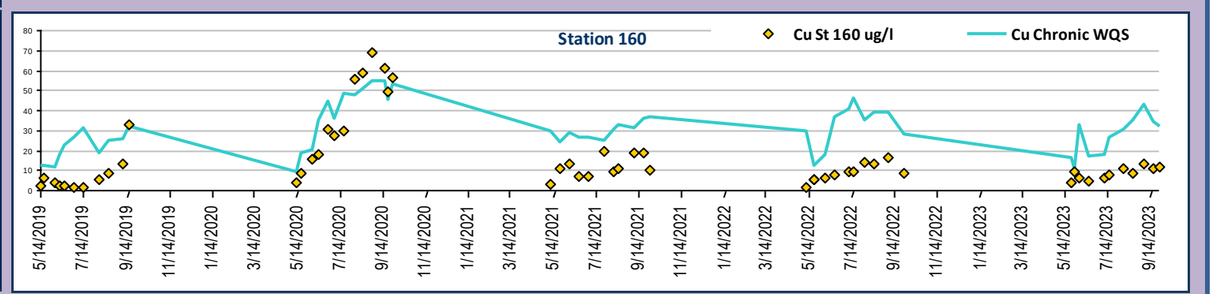


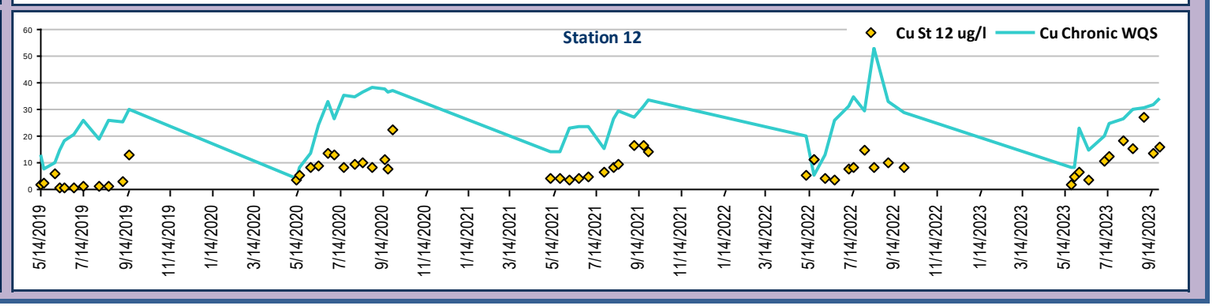


APDES Stations : Copper, Total, units, ug/L - 5 Year Trend

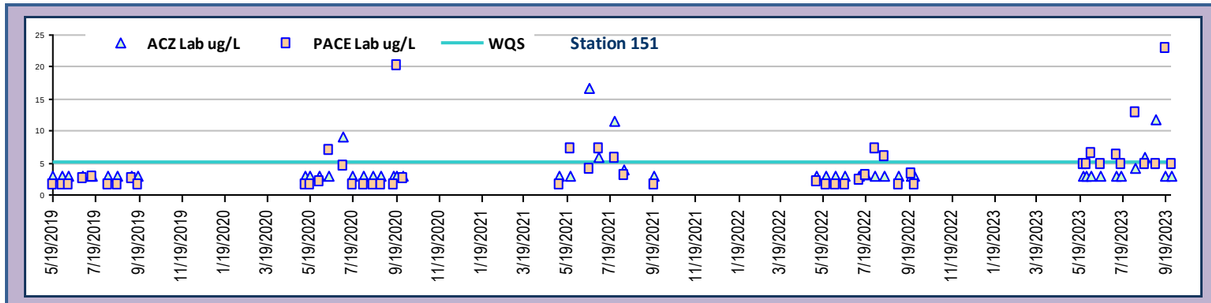




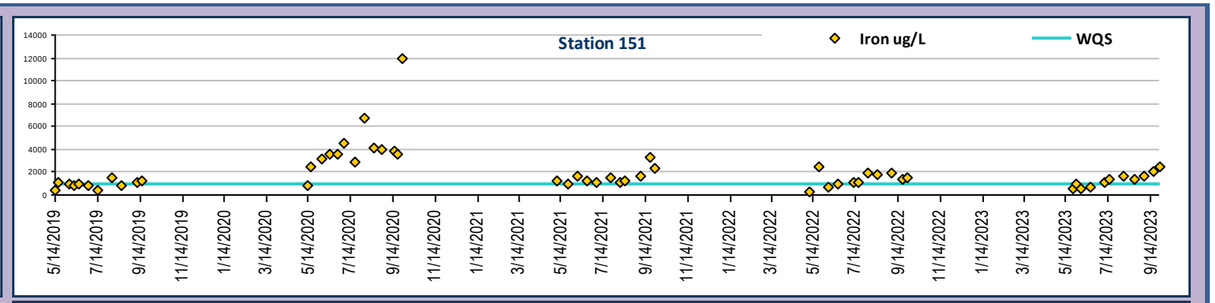


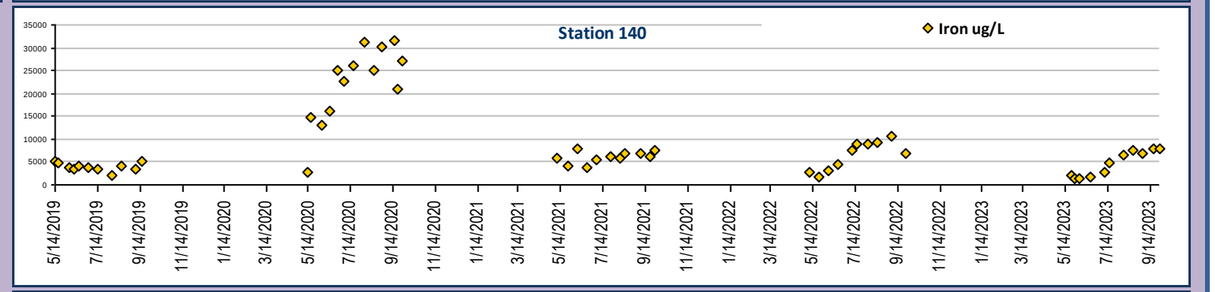


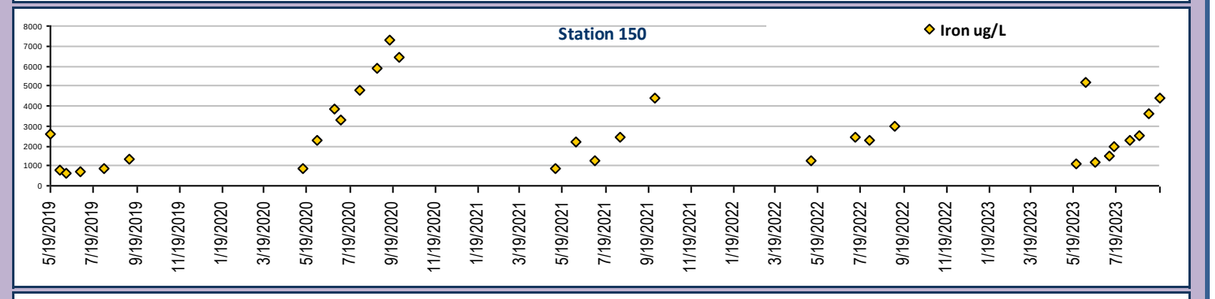
APDES Stations : Cyanide, WAD, units ug/L - 5 Year Trend

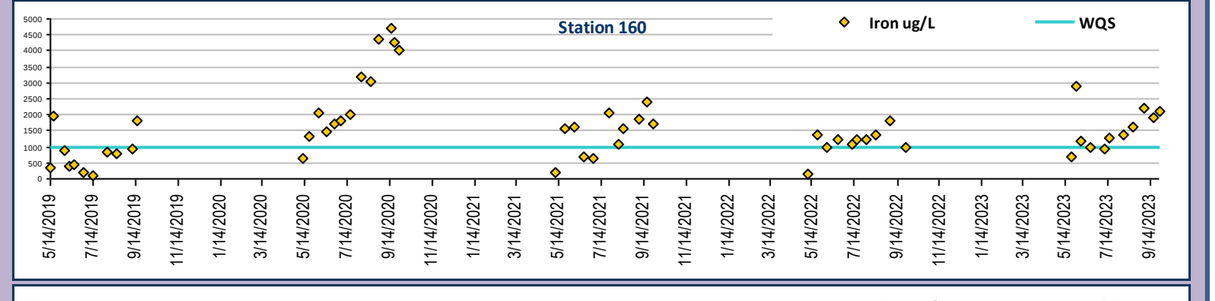


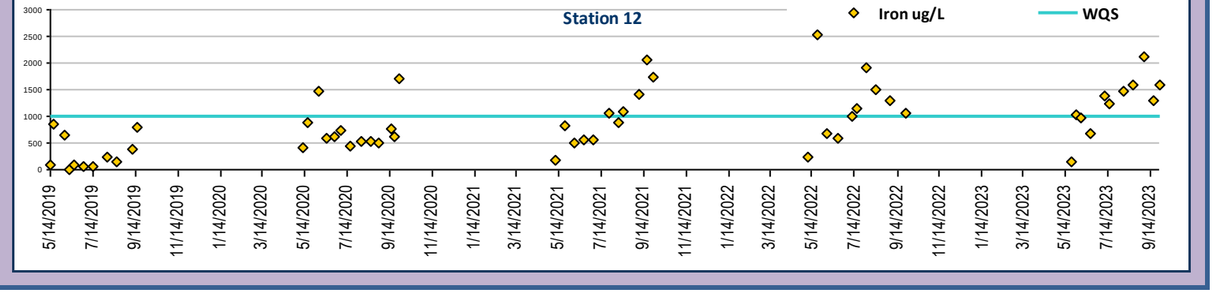
APDES Stations : Iron, Total, units, ug/L - 5 Year Trend



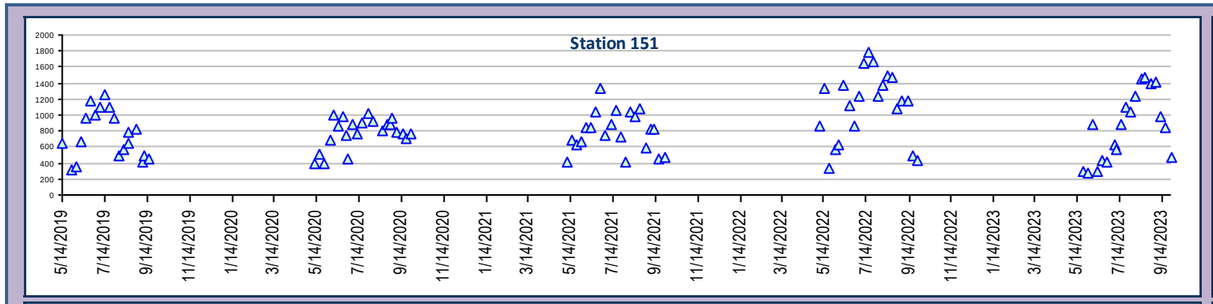


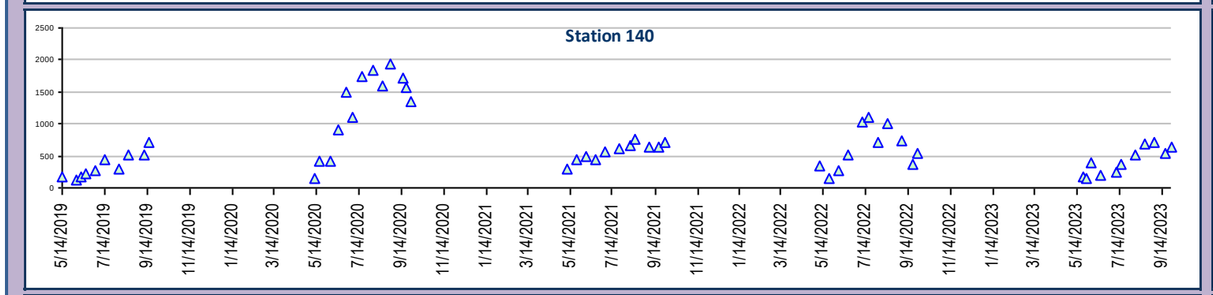


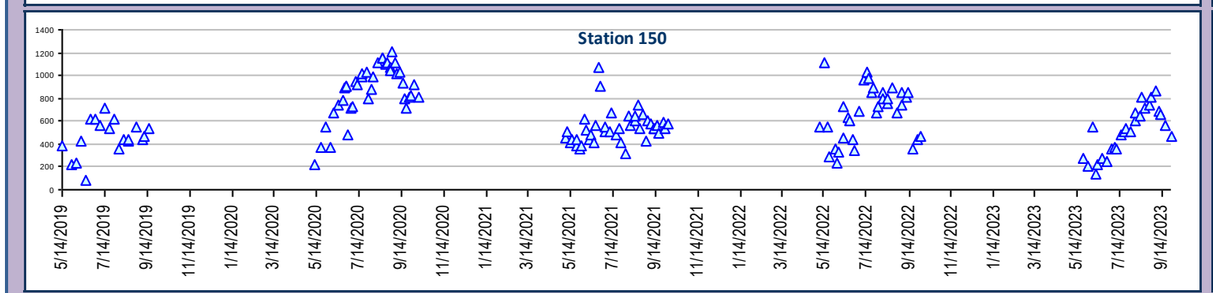


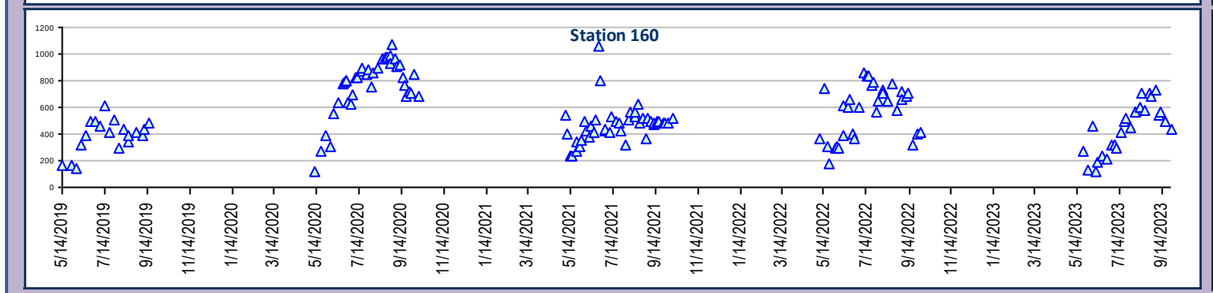


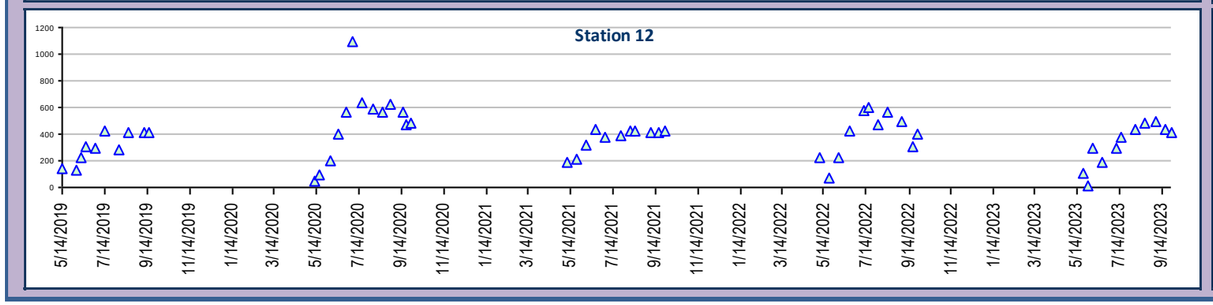
APDES Stations : Conductivity, Total, units uS/cm - 5 Year Trend



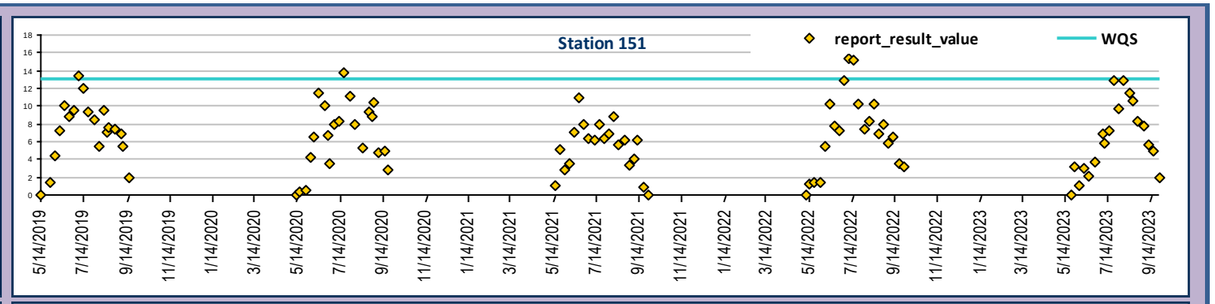


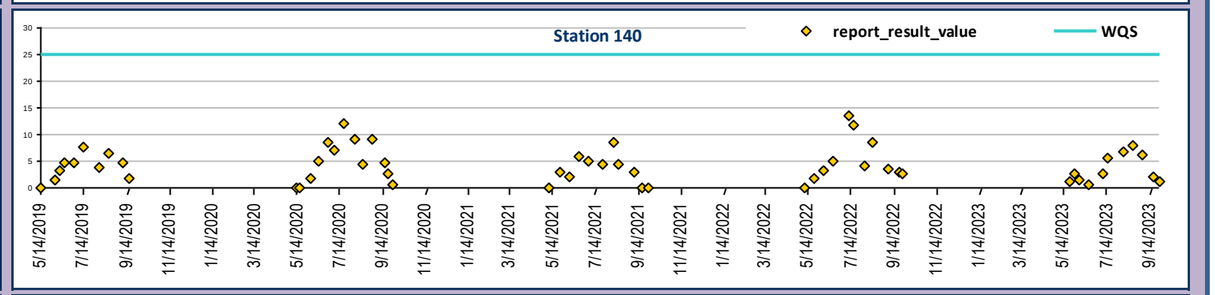


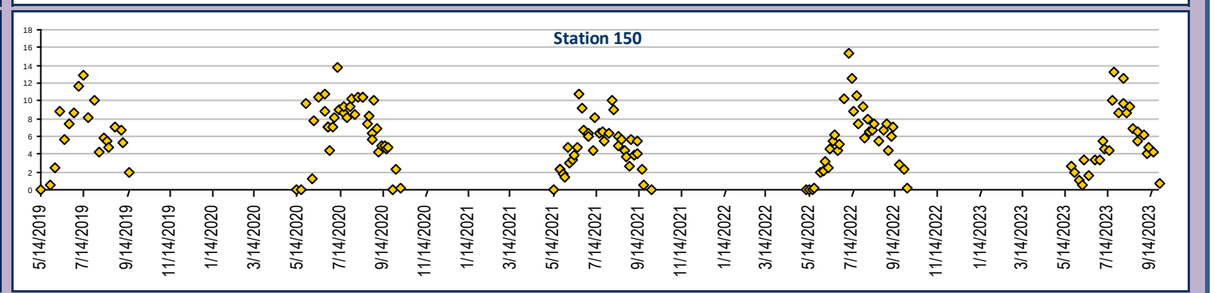


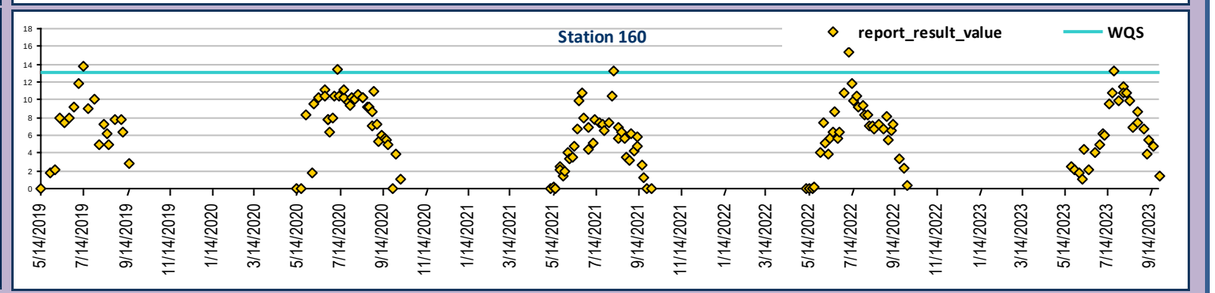


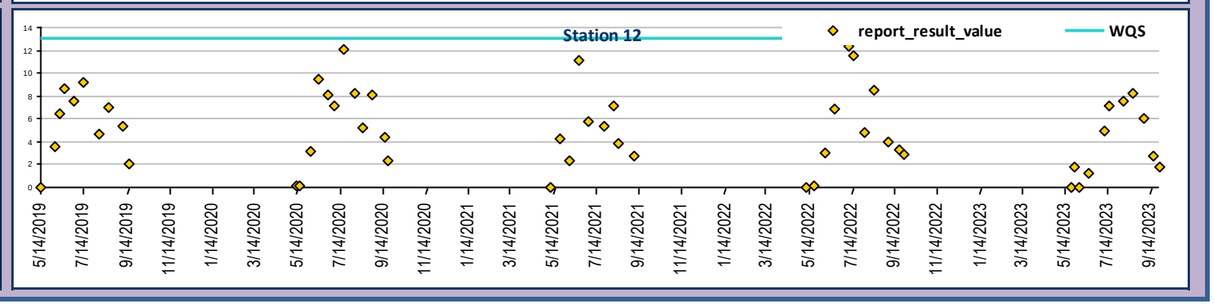
APDES Stations : Temperature, units Celsius - 5 Year Trend



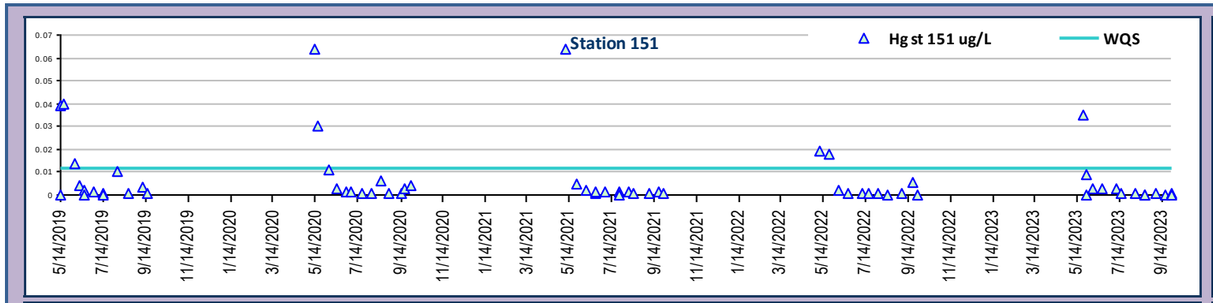


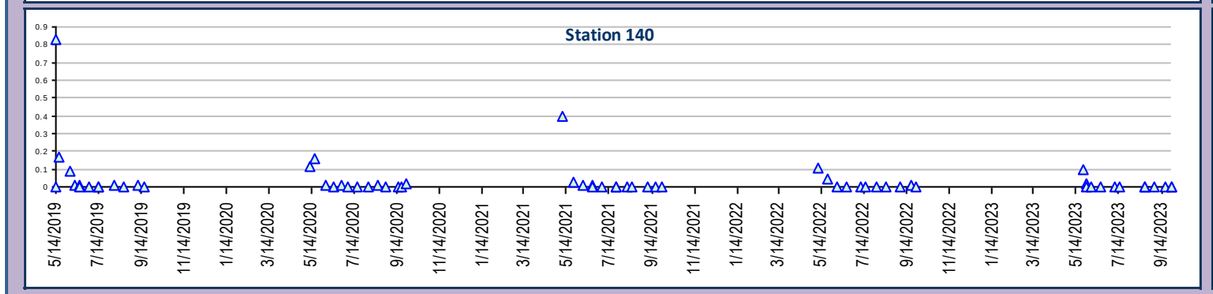




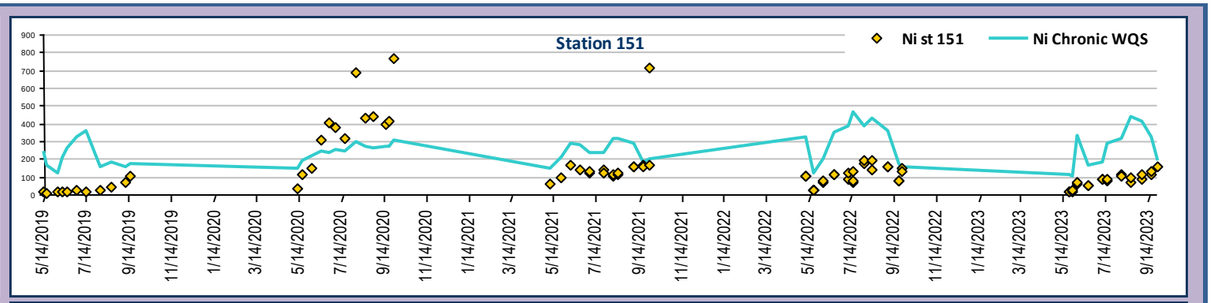


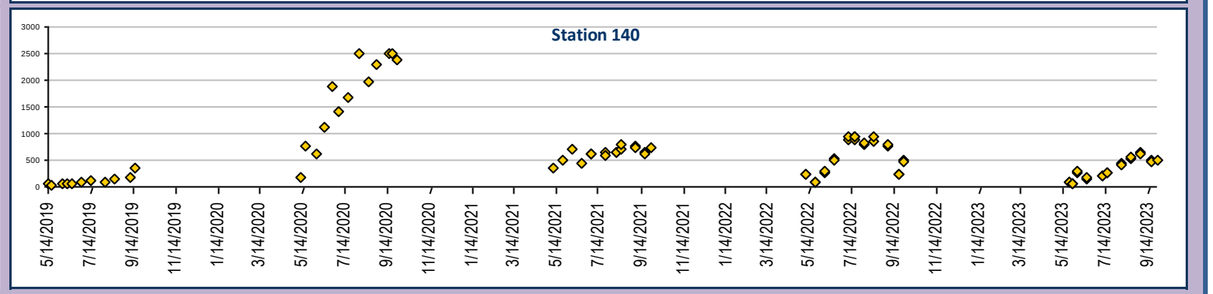
APDES Stations : Mercury, Total, units ug/L - 5 Year Trend

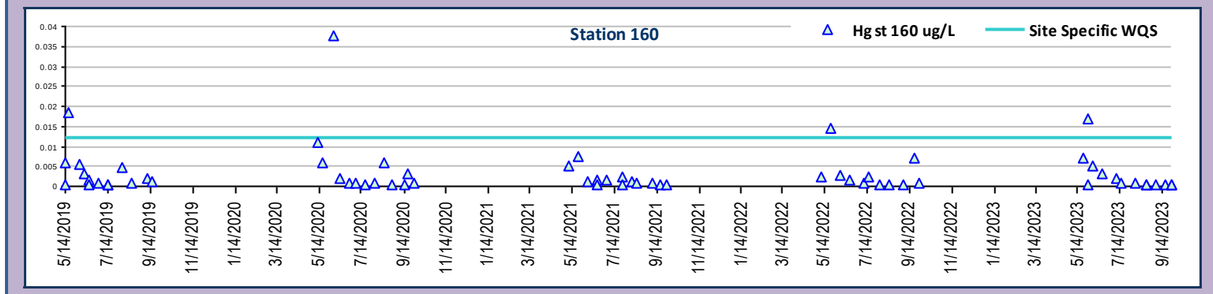


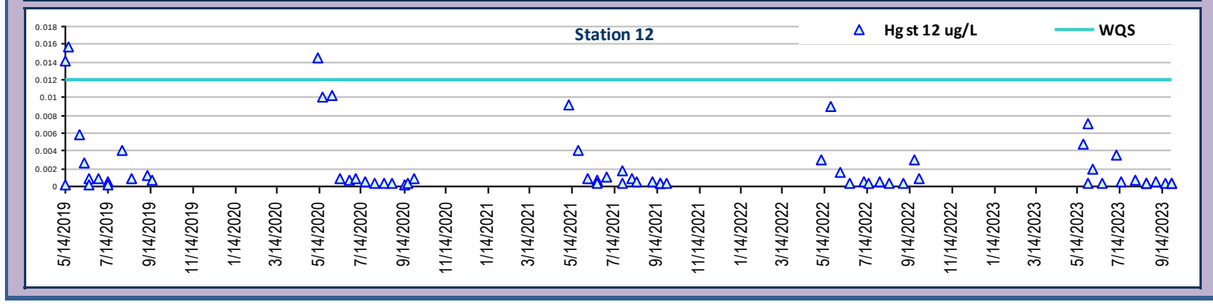


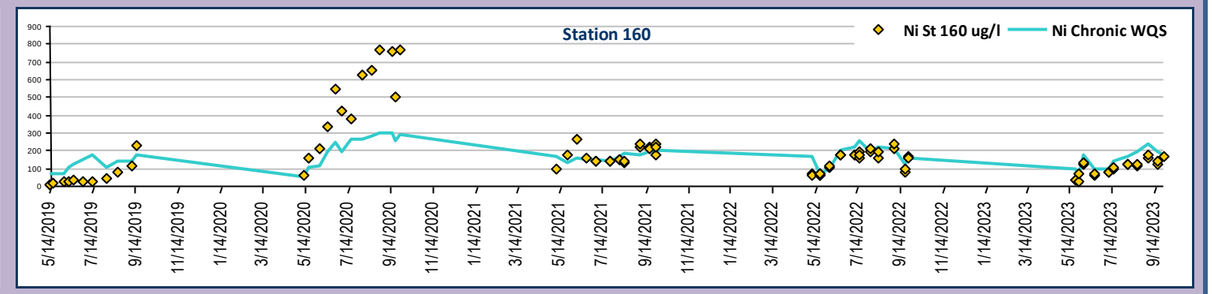
APDES Stations : Nickel, Total, units, ug/L - 5 Year Trend

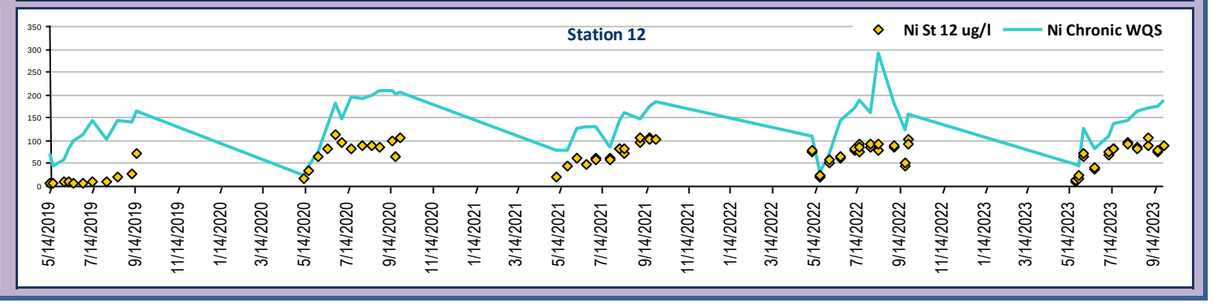




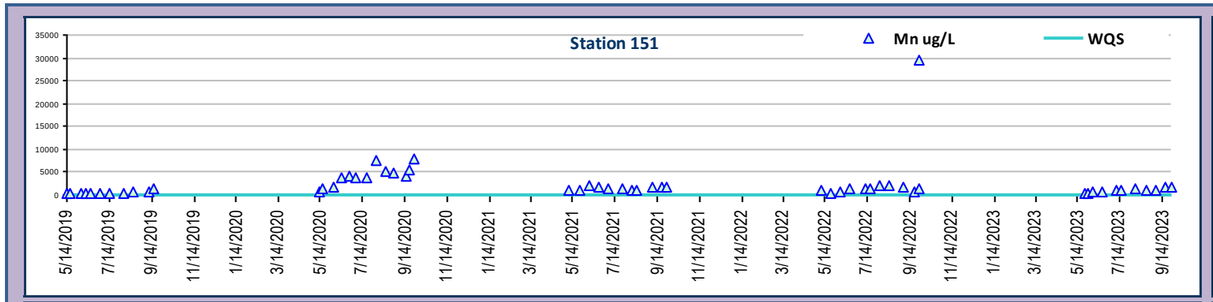


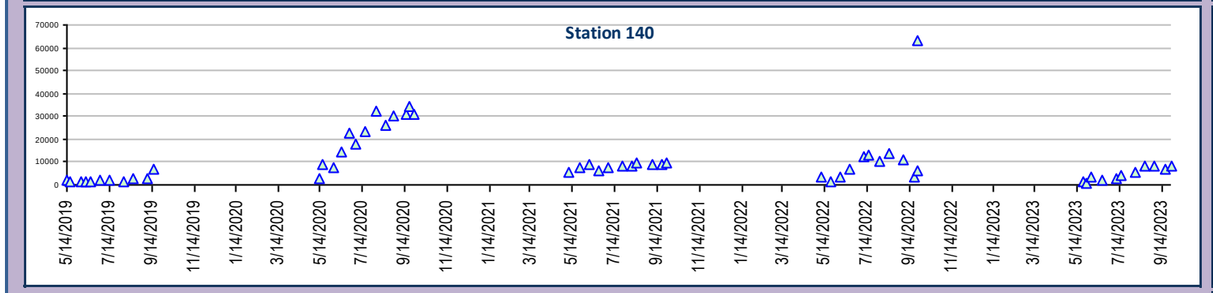


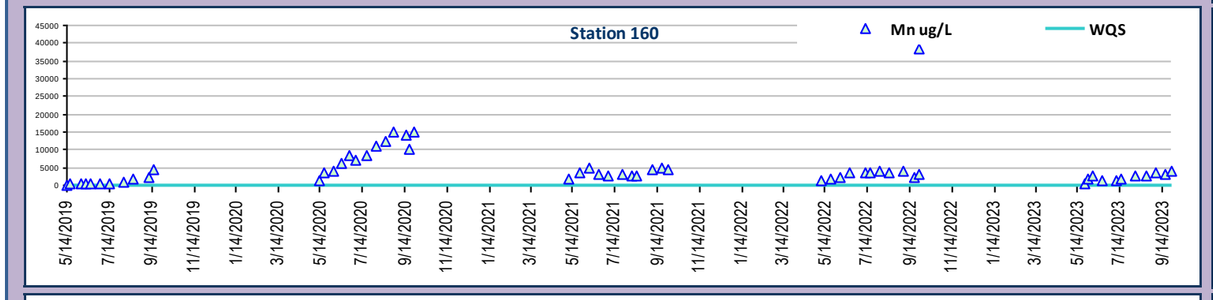


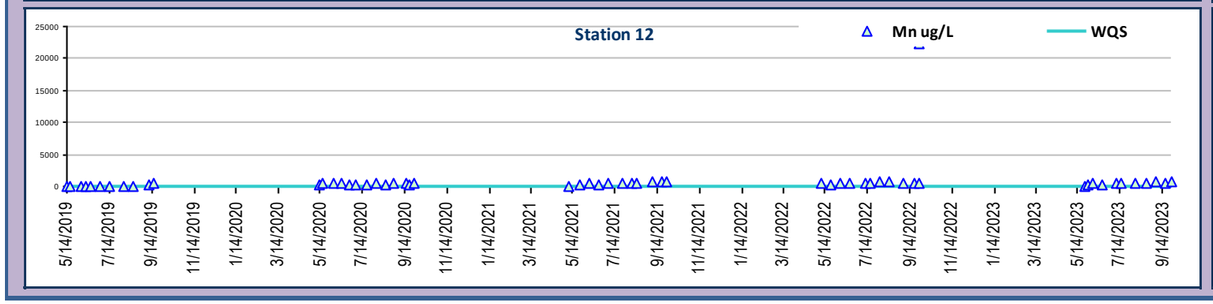


APDES Stations : Manganese, Total, units ug/L - 5 Year Trend

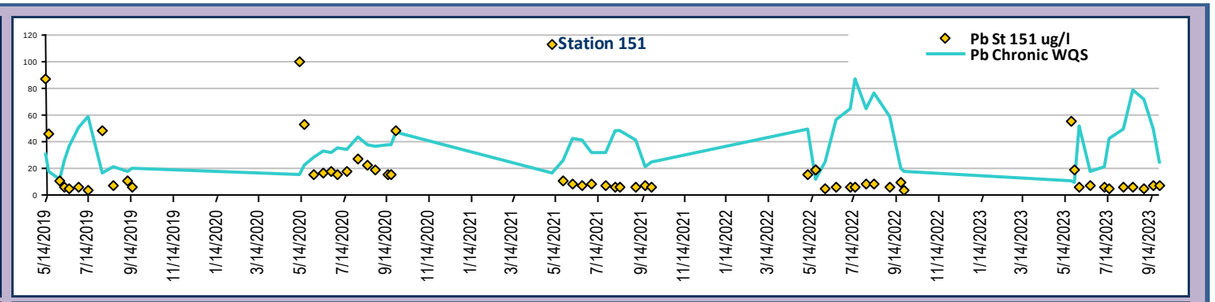


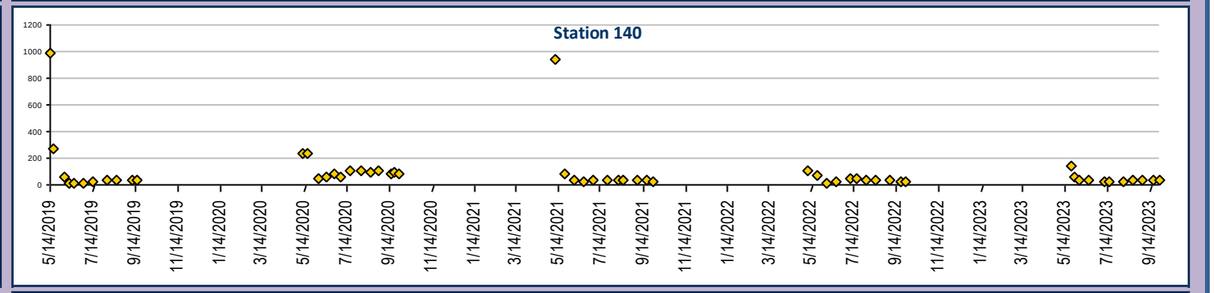


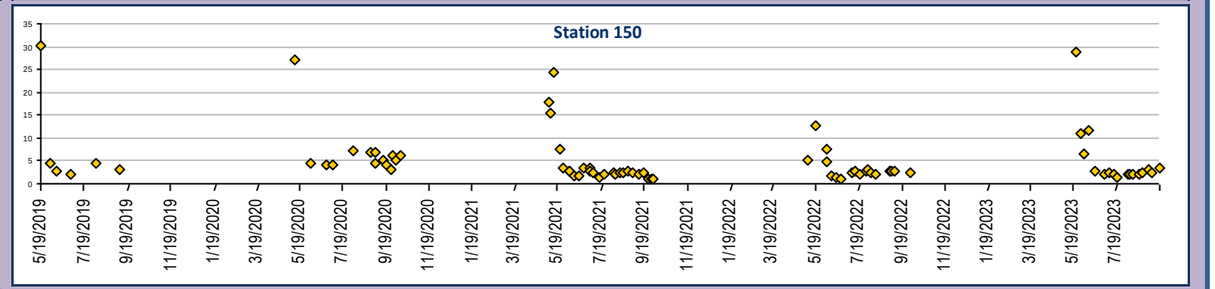


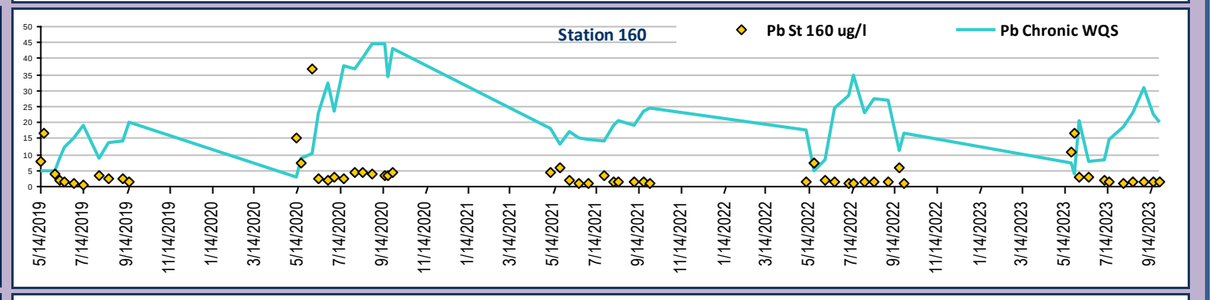


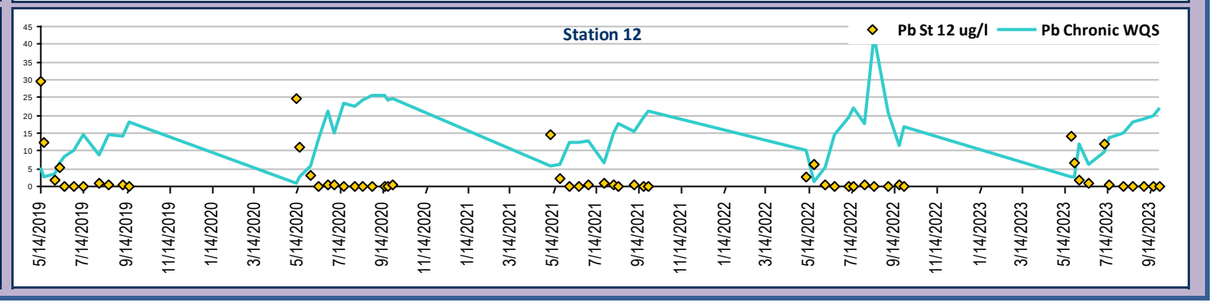
APDES Stations : Lead, Total, units, ug/L - 5 Year Trend



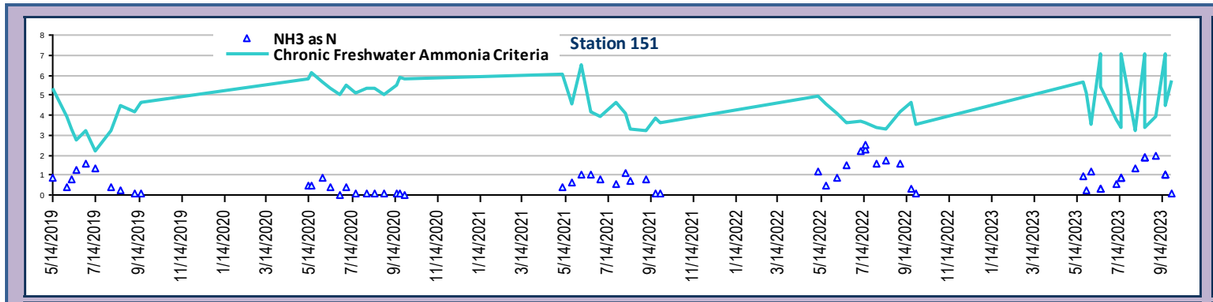


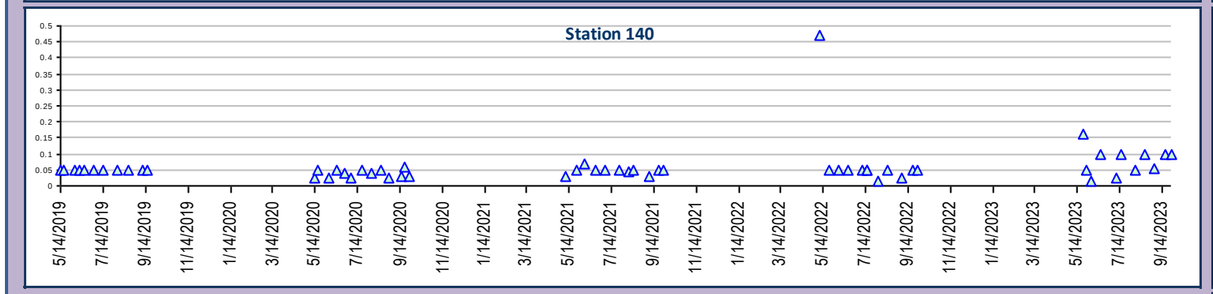


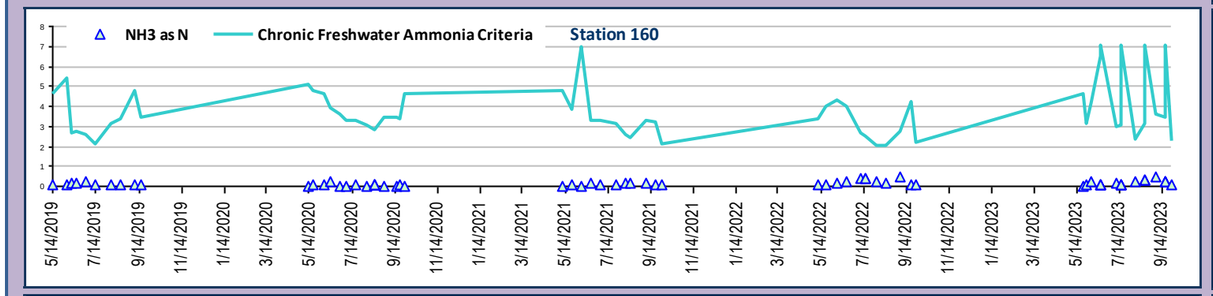


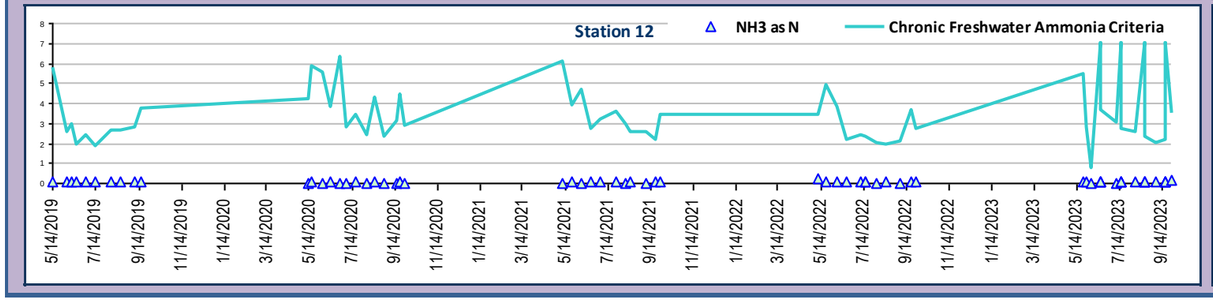


APDES Stations : NH3-N, Total, units mg/l - 5 Year Trend

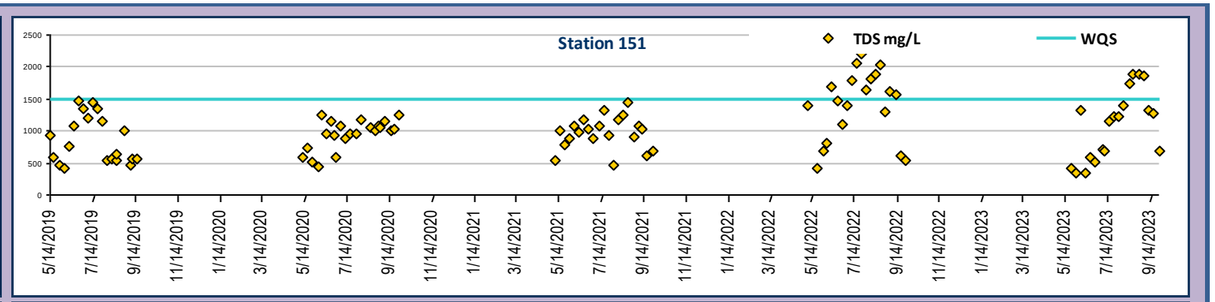


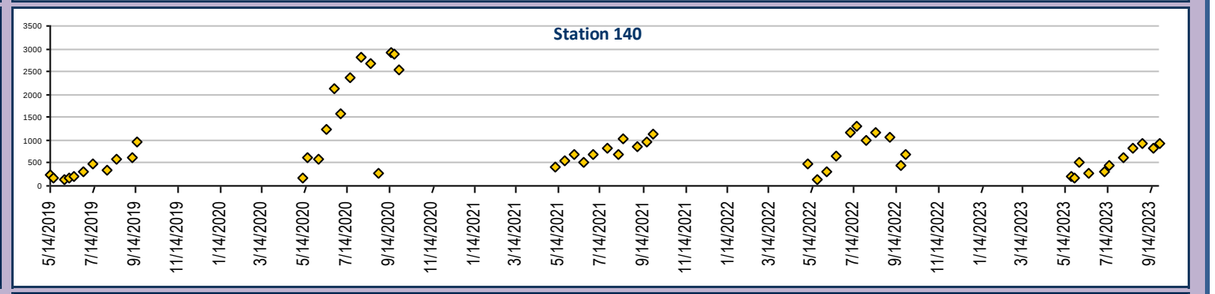


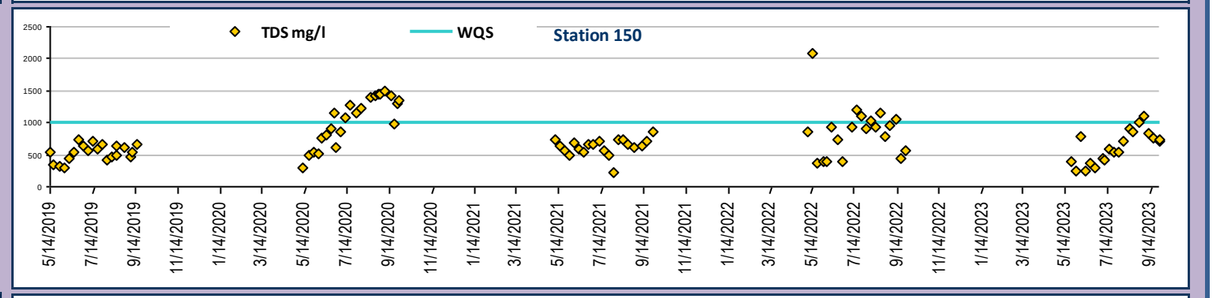


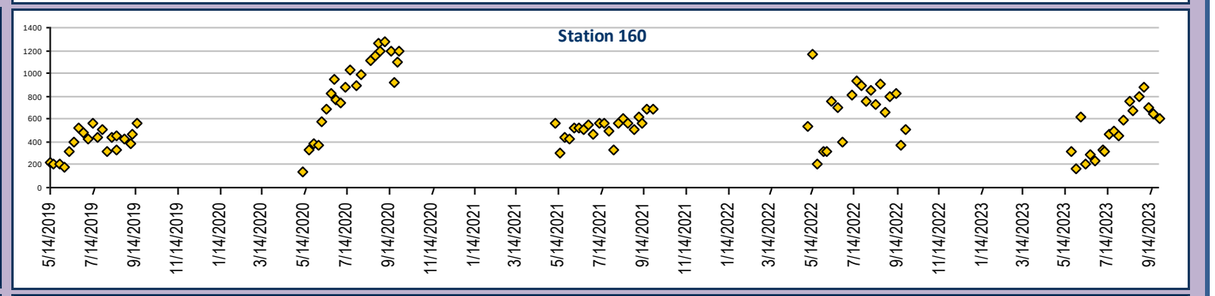


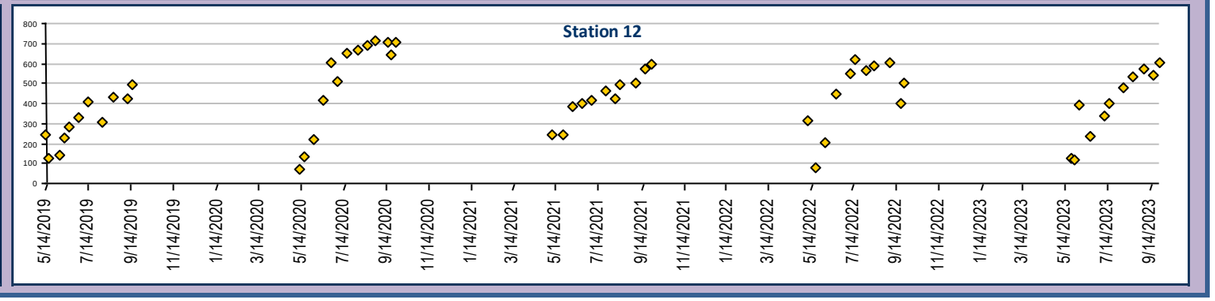
APDES Stations : TDS, units mg/l - 5 Year Trend



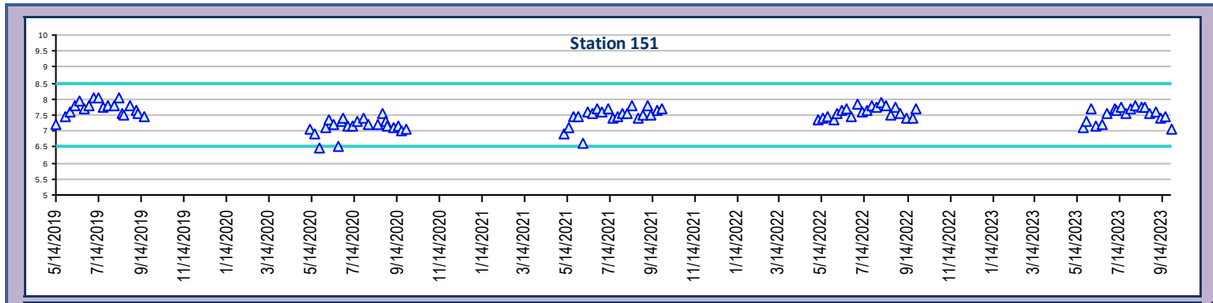


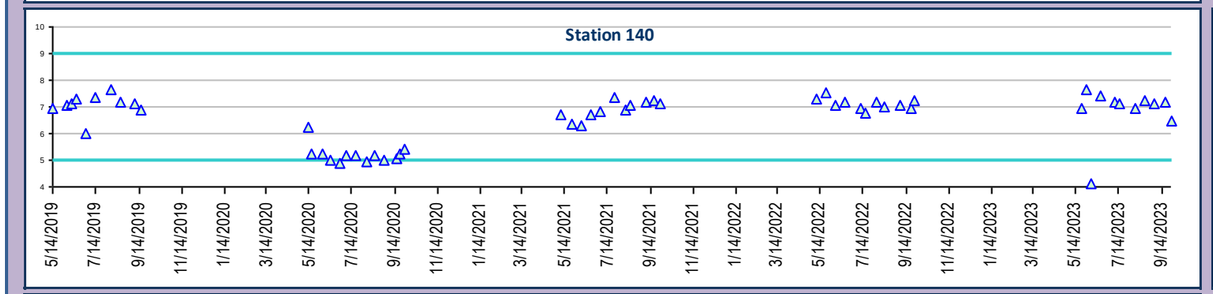


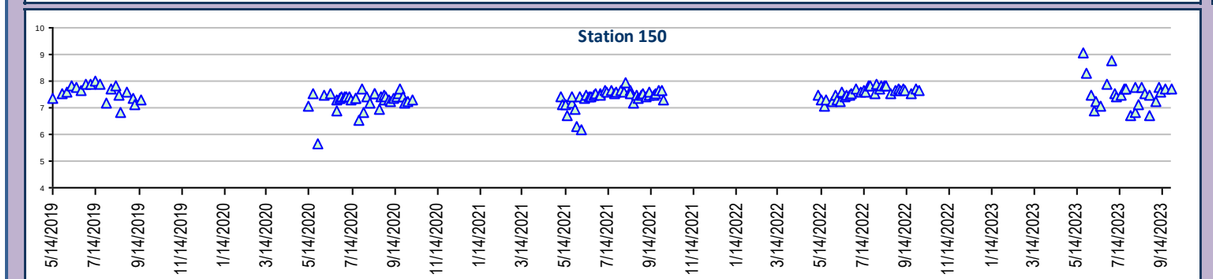


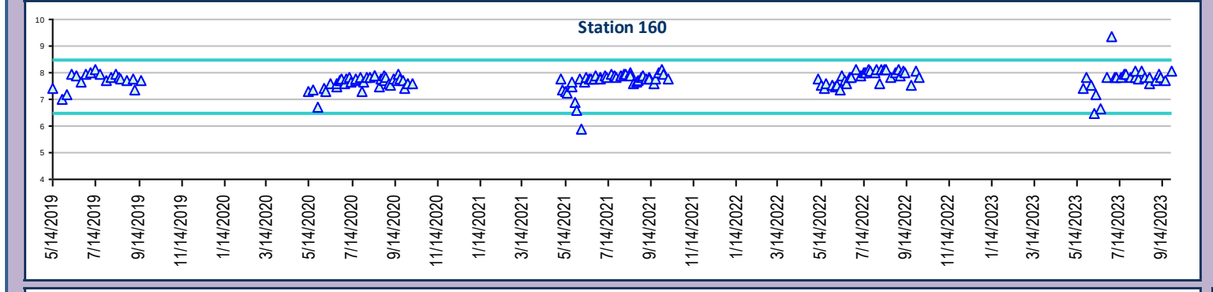


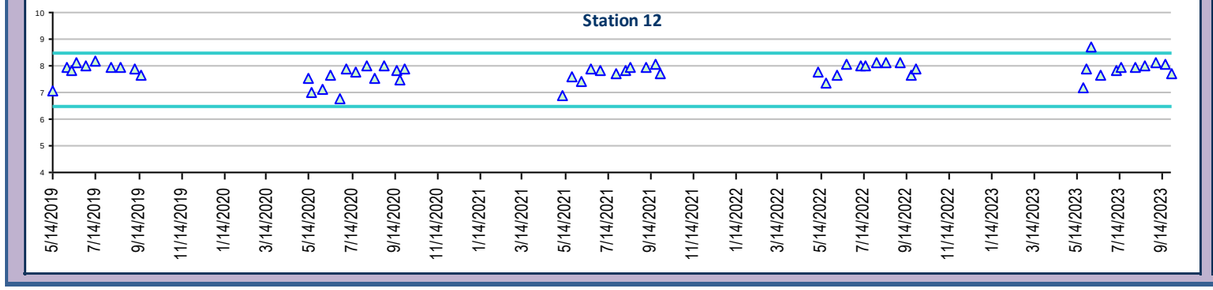
APDES Stations : pH, units - 5 Year Trend



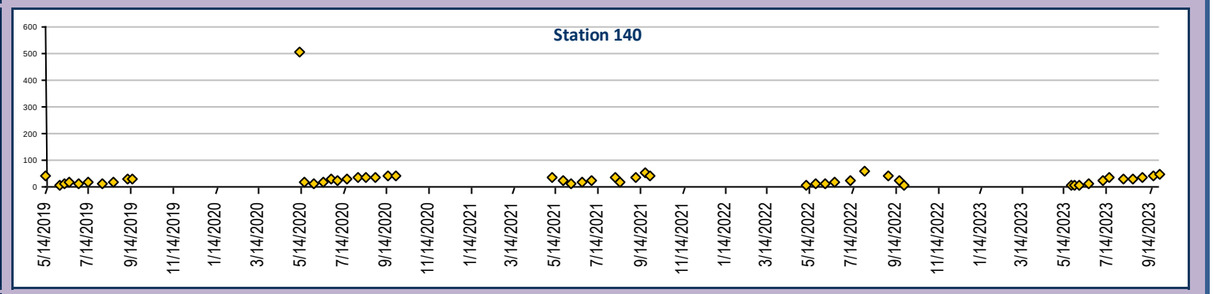


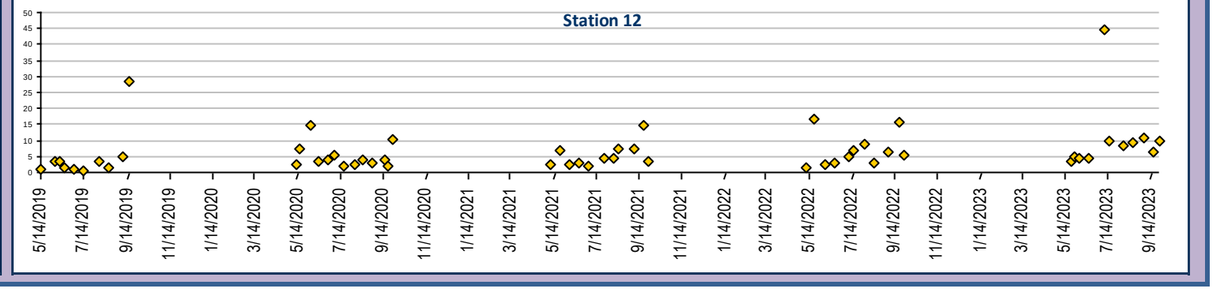






APDES Stations : Turbidity, Total, units NTU - 5 Year Trend

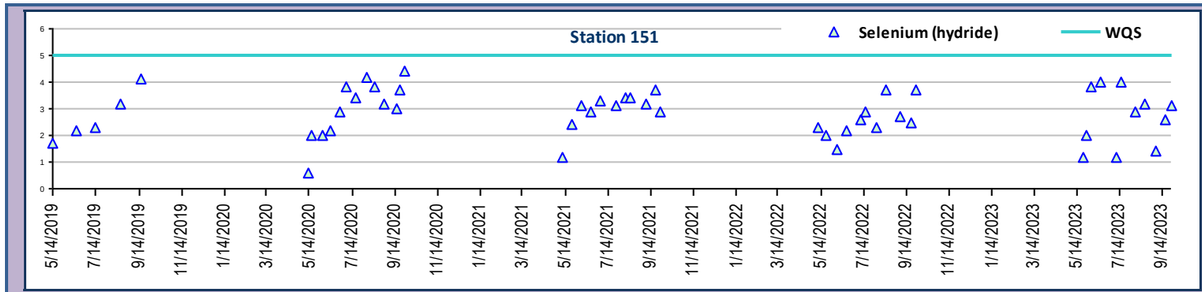


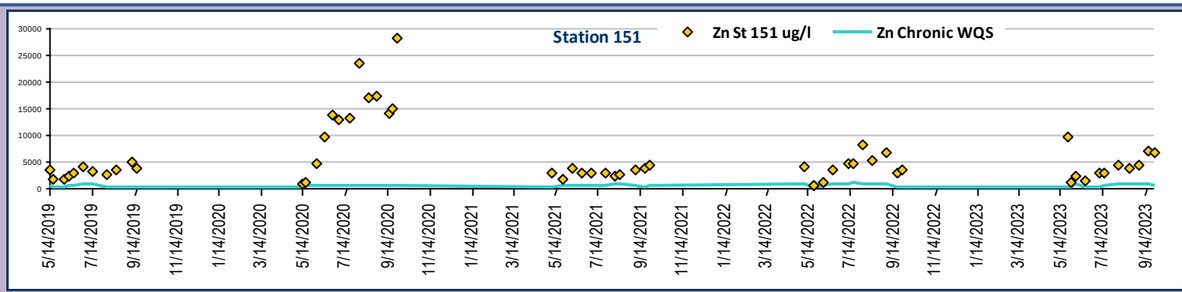


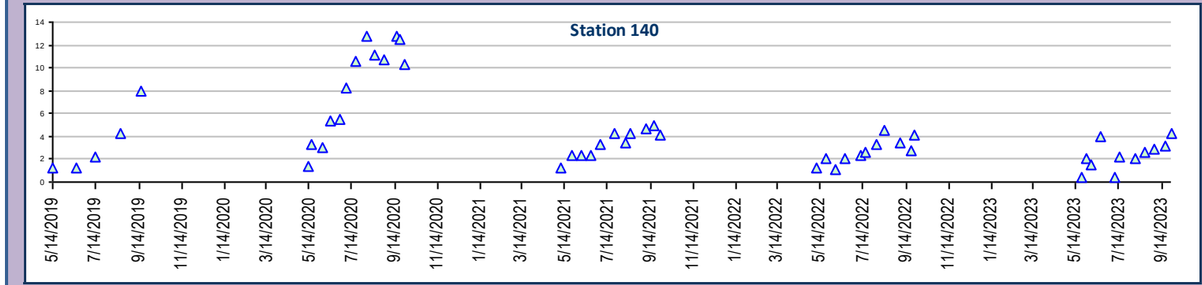
APDES Stations : Selenium, units, ug/l - 5 Year Trend

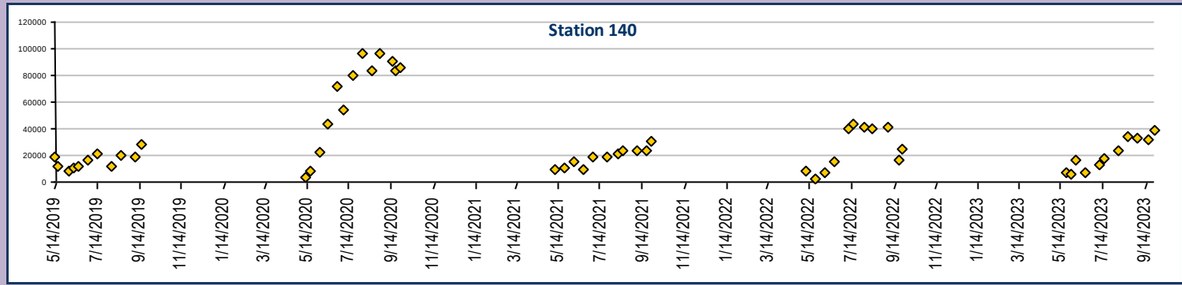
APDES Stations : Zinc, Total, units ug/l - 5 Year Trend

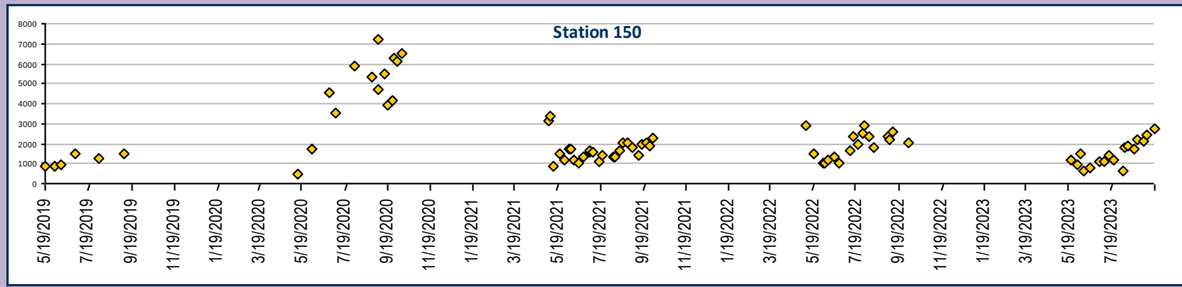
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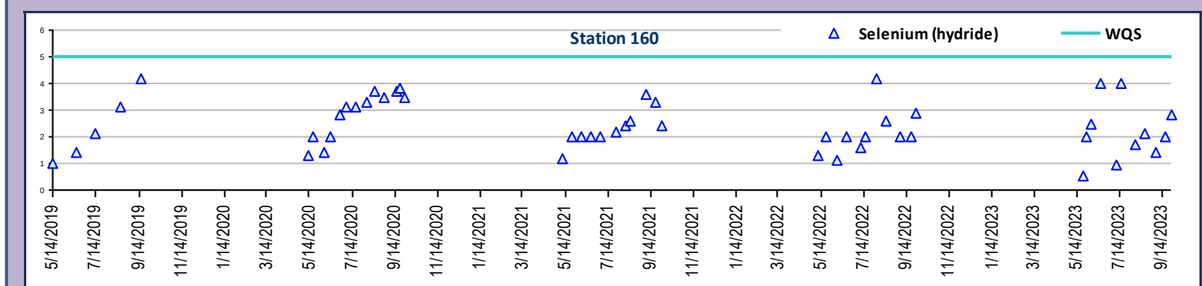


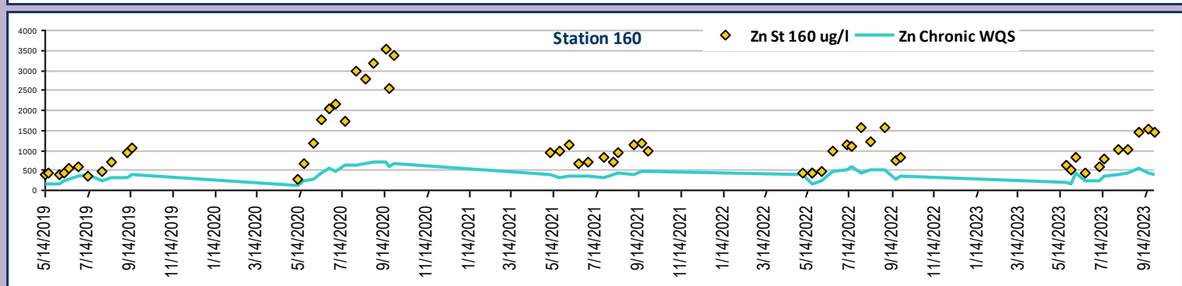


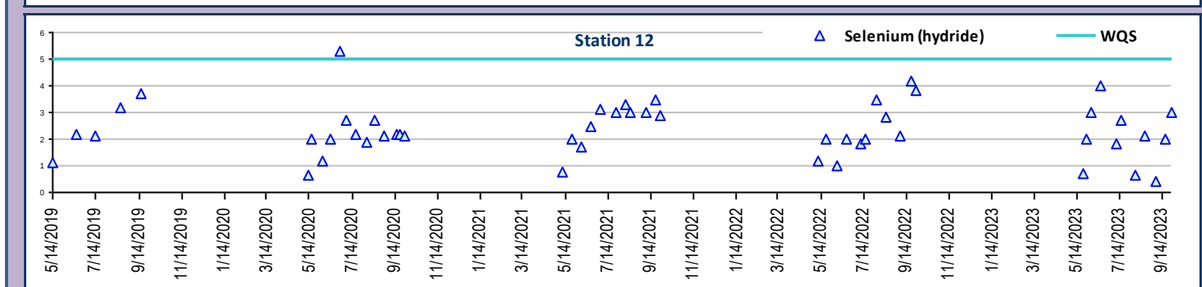


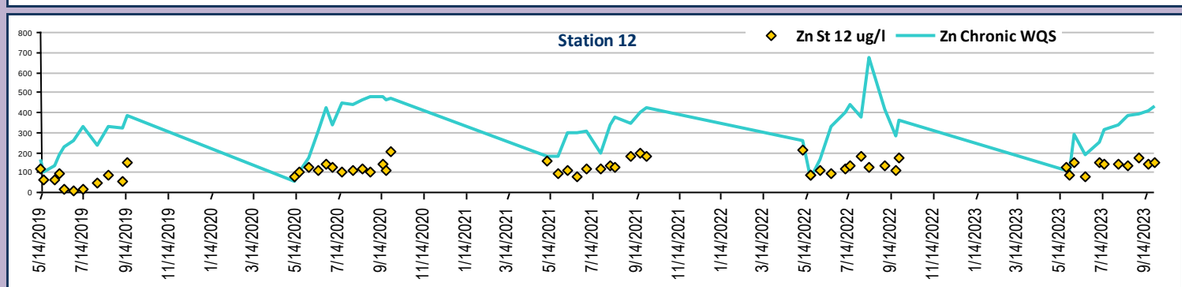












Appendix G: Waste Rock Management Summary Reports

Quarterly Waste Rock Production Report

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Production Month **October 2023**

Waste Type: Construction Waste	**Tonnes**	**Avg Zn%**	**Avg Fe%**	**Avg Pb%**
Formation: Ikalukrok				
Placed Location				
Haul Road Maintenance	160	0.17%	0.59%	2.18%
Formation: Siksikpuk				
Placed Location				
Crusher Pad	1,004	0.86%	1.30%	2.02%
Placed Location				
Portable crusher Pad	6,677	0.22%	1.81%	0.13%
Waste Type Subtotal	**7,841**			
Waste Type: Most Reactive Waste	**Tonnes**	**Avg Zn%**	**Avg Fe%**	**Avg Pb%**
Formation: Ikalukrok				
Placed Location				
CWD	3,377	14.30%	7.17%	11.83%
Waste Type Subtotal	**3,377**			
Waste Type: Other Waste	**Tonnes**	**Avg Zn%**	**Avg Fe%**	**Avg Pb%**
Formation: Ikalukrok				
Placed Location				
CWD	3,305	17.92%	2.25%	8.22%
Placed Location				
Landfill @MWD	10,798	0.25%	3.45%	0.09%
Placed Location				
Main Pit Dump 2	474	1.13%	4.44%	0.36%
Placed Location				
Main Pit Dump 3	13,178	0.47%	6.07%	0.20%
Placed Location				
Main Pit Dump 5	40,457	0.30%	6.08%	0.13%
Placed Location				
Oxide Ore Stockpile	1,476	7.48%	3.23%	12.83%
Placed Location				
Qanaiyaq Pit Dump 1	234,380	1.27%	2.59%	1.99%
Placed Location				
Qanaiyaq Pit Dump 2 (North)	170	0.17%	0.59%	2.18%
Formation: Kivalina				
Placed Location				
Qanaiyaq Pit Dump 1	12,719	1.49%	5.48%	0.58%
Formation: Okpikruak				
Placed Location				
Qanaiyaq Pit Dump 1	1,411	0.14%	5.67%	0.13%
Formation: Siksikpuk				
Placed Location				
Main Pit Dump 3	7,453	0.61%	4.29%	1.21%
Placed Location				
Main Pit Dump 5	164,034	0.33%	3.66%	0.47%
Placed Location				
Qanaiyaq Pit Dump 1	138,162	1.18%	1.61%	2.75%
Placed Location				
Qanaiyaq Pit Dump 2 (North)	3,736	0.86%	1.30%	2.02%
Placed Location				
Main Pit Dump 2	169,201	0.26%	4.46%	0.30%

	Waste Type Subtotal	**800,954**			
	Total tonnes for month	**812,172**			

Production Month **November 2023**

Waste Type: Cover Material	**Tonnes**	**Avg Zn%**	**Avg Fe%**	**Avg Pb%**
Formation: Kivalina				
Placed Location				
COV3 on MPD4 north of COV (2023)	3,712	0.09%	1.70%	0.08%
Placed Location				
Cover Dump 2	11,353	0.09%	1.70%	0.08%
Waste Type Subtotal	**15,065**			

Waste Type: Other Waste	**Tonnes**	**Avg Zn%**	**Avg Fe%**	**Avg Pb%**
Formation: Ikalukrok				
Placed Location				
Qanaiyaq Pit Dump 2 (North)	147	4.58%	2.69%	4.05%
Placed Location				
CWD	7,186	10.81%	2.25%	5.66%
Placed Location				
Main pit dump 4	36,622	1.65%	5.05%	0.57%
Placed Location				
Main Pit Dump 5	2,104	1.47%	5.82%	0.94%
Placed Location				
Qanaiyaq Pit Dump 1	53,475	1.77%	4.52%	1.76%
Formation: Kivalina				
Placed Location				
Landfill @MWD	1,703	0.70%	3.02%	0.11%
Placed Location				
Main pit dump 4	89,345	0.70%	3.01%	0.11%
Placed Location				
Main Pit Dump 5	16,848	0.53%	2.62%	0.25%
Placed Location				
Qanaiyaq Pit Dump 1	1,420	0.66%	3.04%	0.25%
Placed Location				
Qanaiyaq Pit Dump 2 (North)	9,606	0.61%	2.81%	0.18%
Placed Location				
Main Pit Dump 2	4,806	0.53%	2.62%	0.25%
Formation: Siksikpuk				
Placed Location				
Main Pit Dump 2	53,123	0.30%	2.69%	0.16%
Placed Location				
Main pit dump 4	9,674	0.11%	3.54%	0.09%
Placed Location				
Main Pit Dump 5	64,736	0.37%	2.59%	0.19%
Placed Location				
Qanaiyaq Pit Dump 1	112,444	1.32%	2.71%	0.88%
Placed Location				
Qanaiyaq Pit Dump 2 (North)	167,224	1.61%	1.22%	2.15%
Waste Type Subtotal	**630,463**			
Total tonnes for month	**645,528**			

Production Month **December 2023**

Waste Type: Construction Waste	**Tonnes**	**Avg Zn%**	**Avg Fe%**	**Avg Pb%**
Formation: Siksikpuk				
Placed Location				
North Bank	164	0.09%	3.84%	0.08%
Waste Type Subtotal	**164**			
Waste Type: Cover Material	**Tonnes**	**Avg Zn%**	**Avg Fe%**	**Avg Pb%**
Formation: Kivalina				
Placed Location				
Cover Dump 2	22,037	0.10%	2.08%	0.08%
Waste Type Subtotal	**22,037**			
Waste Type: Most Reactive Waste	**Tonnes**	**Avg Zn%**	**Avg Fe%**	**Avg Pb%**
Formation: Ikalukrok				
Placed Location				
CWD	11,167	10.83%	4.32%	4.00%
Placed Location				
Main pit dump 4	19,858	3.98%	19.22%	1.92%
Waste Type Subtotal	**31,025**			
Waste Type: Other Waste	**Tonnes**	**Avg Zn%**	**Avg Fe%**	**Avg Pb%**
Formation: Ikalukrok				
Placed Location				
Main pit dump 4	162,600	1.61%	5.67%	1.87%
Placed Location				
Oxide Ore Stockpile	417	0.76%	1.38%	10.94%
Placed Location				
Qanaiyaq Pit Dump 1	6,362	5.84%	3.70%	3.49%
Placed Location				
Qanaiyaq Pit Dump 2 (North)	66,026	3.05%	3.23%	2.15%
Formation: Kivalina				
Placed Location				
Main pit dump 4	3,625	0.09%	2.02%	0.08%
Formation: Mixed				
Placed Location				
Main pit dump 4	378	1.00%	4.00%	1.00%
Formation: Siksikpuk				
Placed Location				
Qanaiyaq Pit Dump 2 (North)	116,303	1.15%	1.60%	1.77%
Placed Location				
Landfill @MWD	91	0.09%	3.84%	0.08%
Placed Location				
Main Pit Dump 2	5,994	0.09%	3.84%	0.08%
Placed Location				
Main pit dump 4	120,039	0.20%	3.44%	0.15%
Placed Location				
Main Pit Dump 5	29,716	0.09%	3.84%	0.08%
Placed Location				
Qanaiyaq Pit Dump 1	11,402	0.31%	0.69%	1.67%
Waste Type Subtotal	**522,953**			
Total tonnes for month	**576,179**			

Total Waste Rock tonnes for period **2,033,879**

Cover Material Monitoring Report

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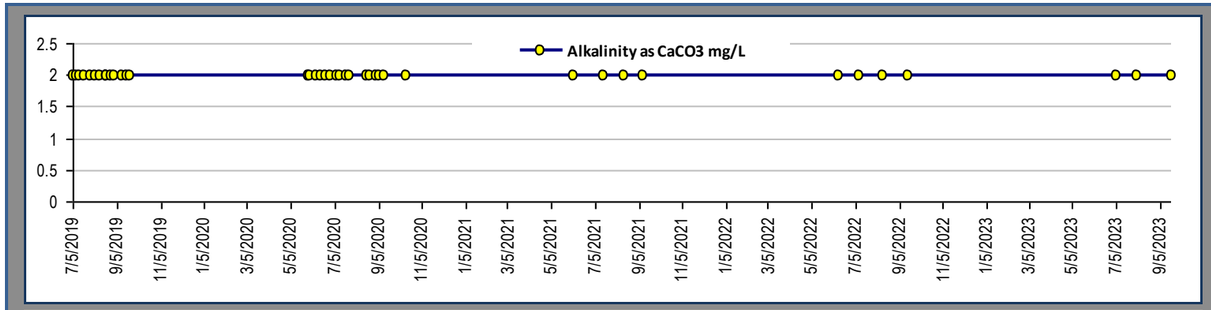
	Date Stockpiled	Waste Rock Type	Tonnes	Formation	Zinc_%	Stockpile Code
November 2023						
	11/11/2023	Cover Material	3,712	Kivalina	0.09	COV3
	11/11/2023	Cover Material	7,441	Kivalina	0.09	COV2
	11/12/2023	Cover Material	694	Kivalina	0.09	COV2
	11/12/2023	Cover Material	3,218	Kivalina	0.09	COV2
December 2023						
	12/6/2023	Cover Material	899	Kivalina	0.09	COV2
	12/6/2023	Cover Material	9,993	Kivalina	0.10	COV2
	12/7/2023	Cover Material	2,464	Kivalina	0.10	COV2
	12/7/2023	Cover Material	1,346	Kivalina	0.09	COV2
	12/13/2023	Cover Material	4,803	Kivalina	0.09	COV2
	12/17/2023	Cover Material	2,532	Kivalina	0.09	COV2
		Total	**37,102**			

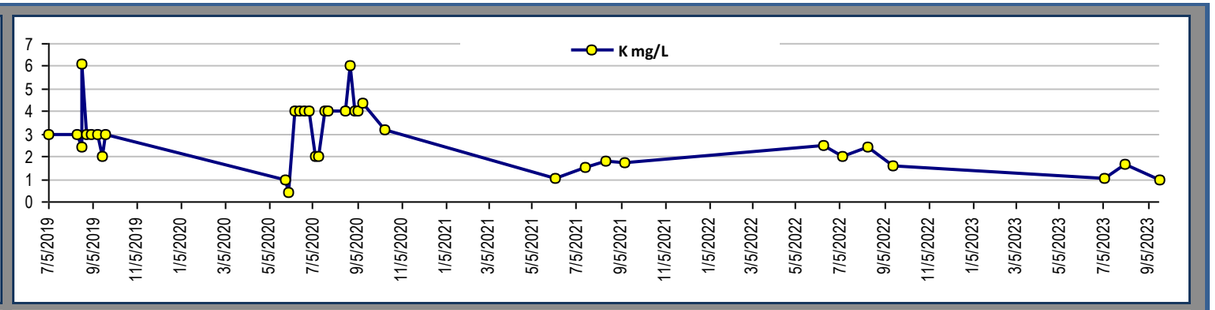
Appendix H: Risk Management Plan (pending sometime in 2024)

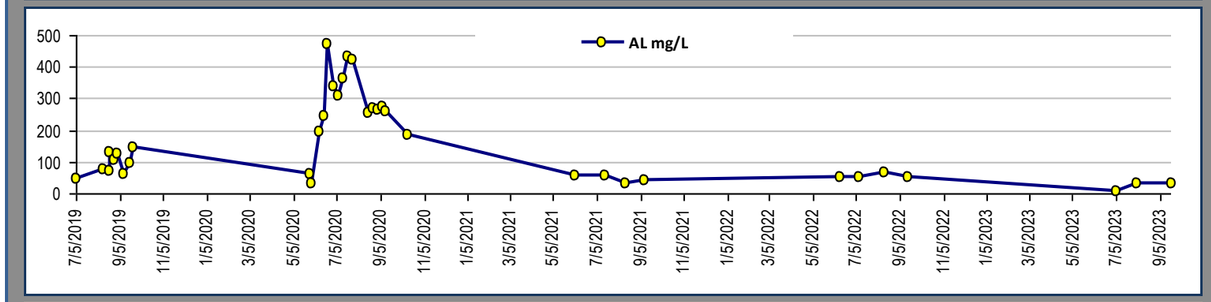
Appendix I: Kaviqsaaq Diversion – Profile I Trend Charts

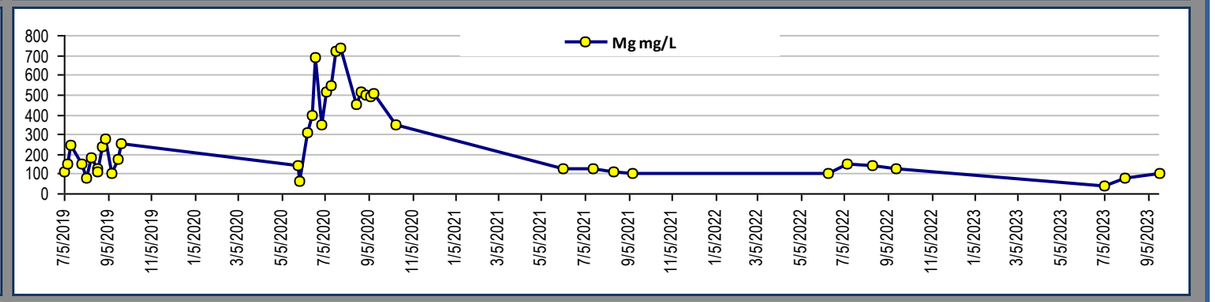
Kaviqsaaq Diversion - Profile I: Total

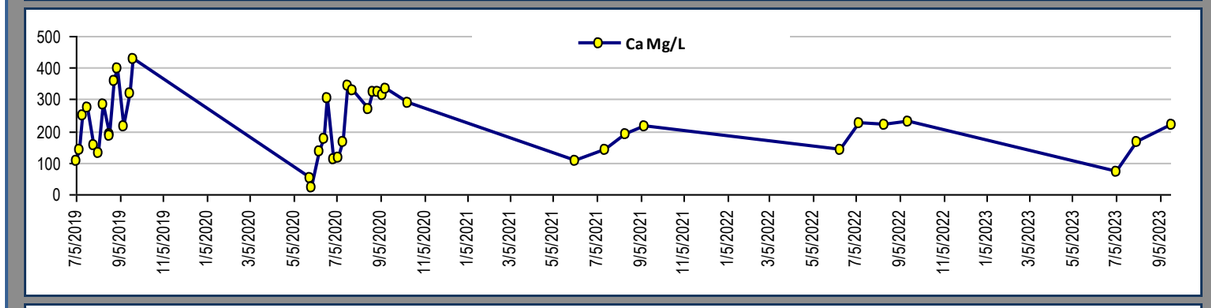
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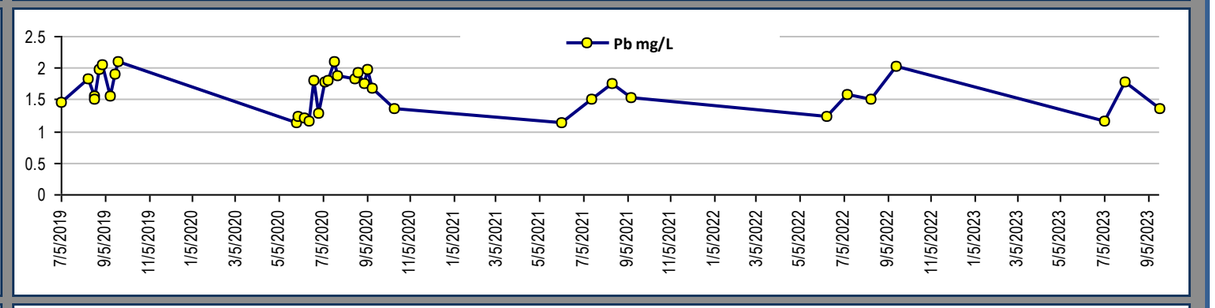


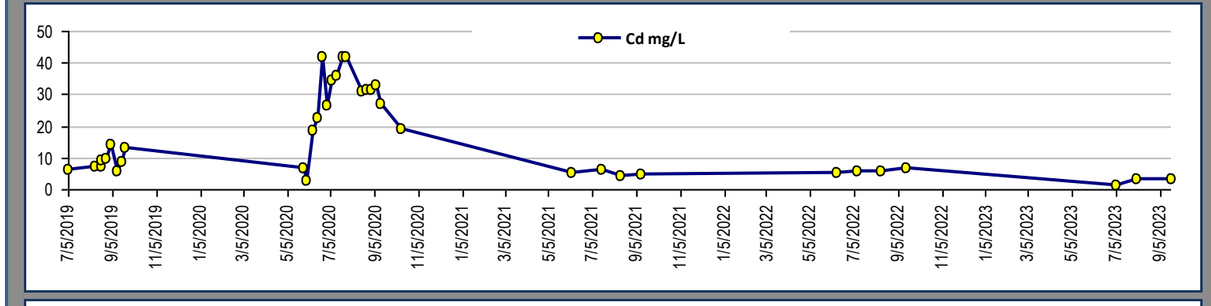


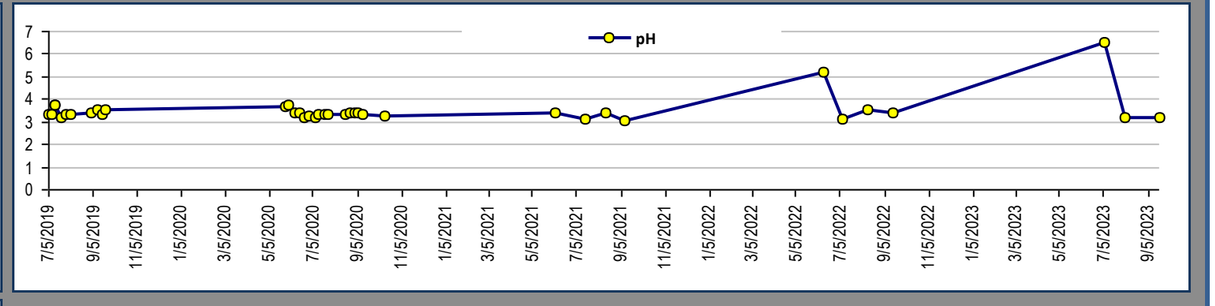


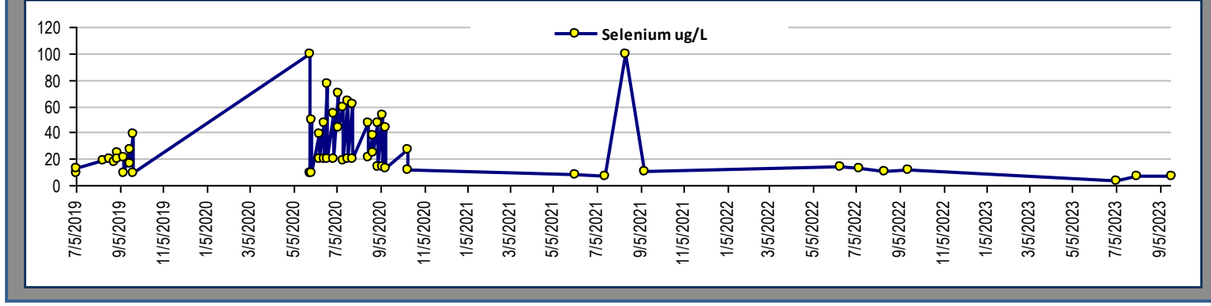






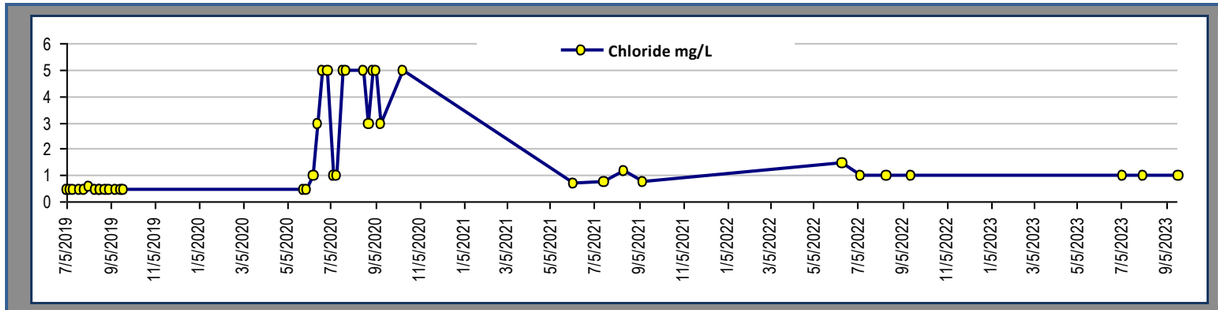


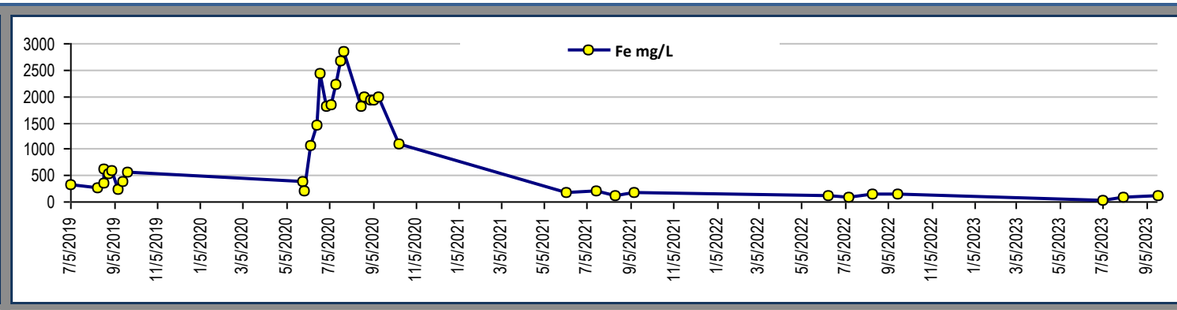


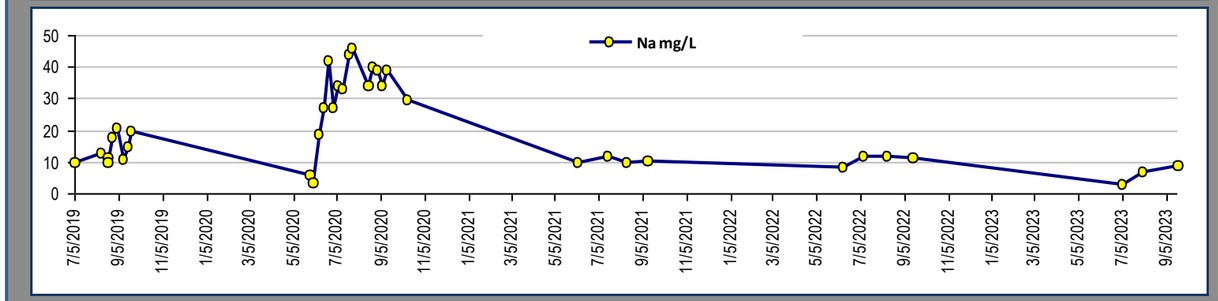


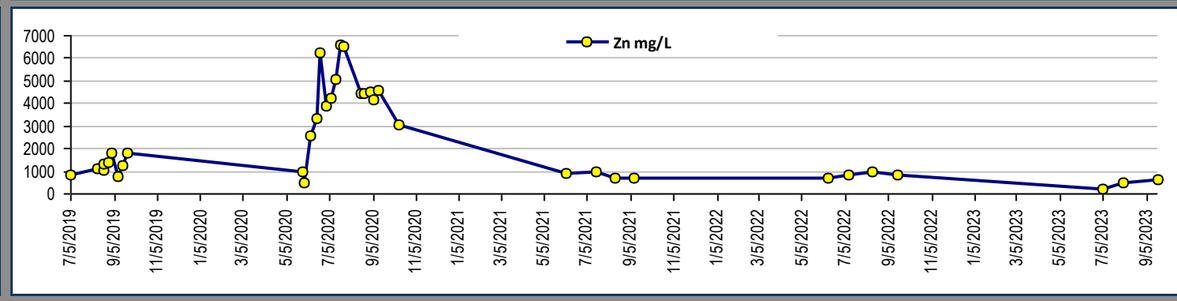
Kaviqsaaq Diversion - Profile I: Total

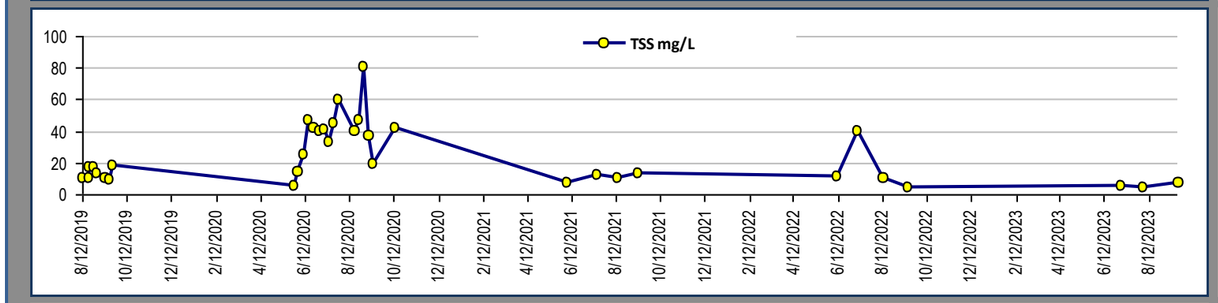
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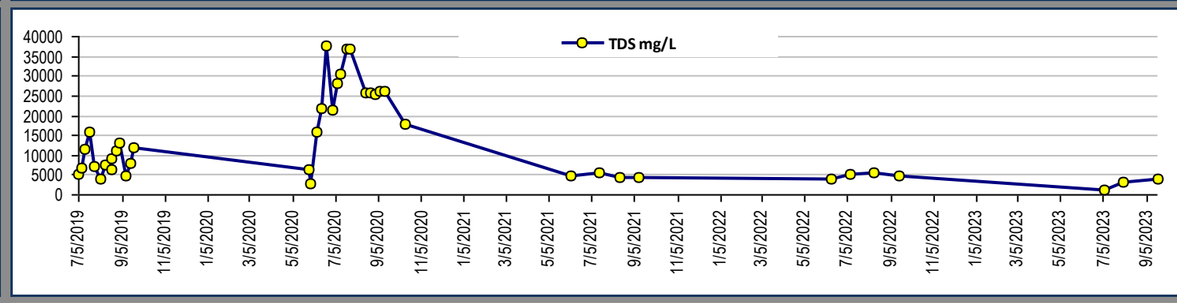


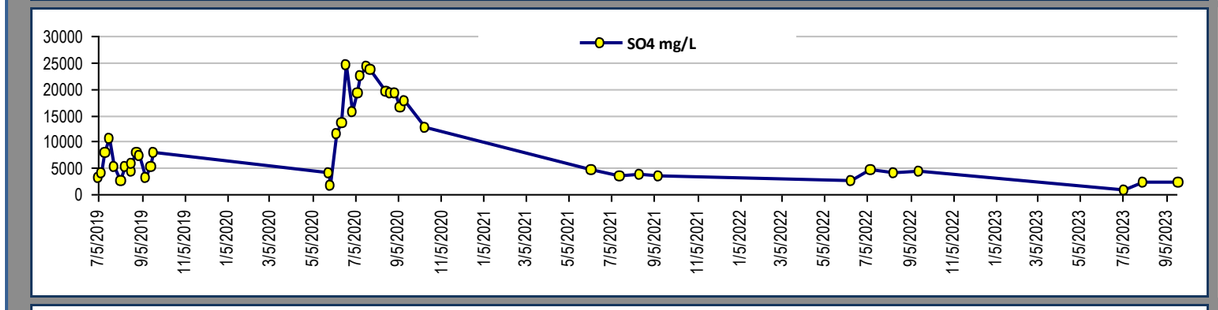


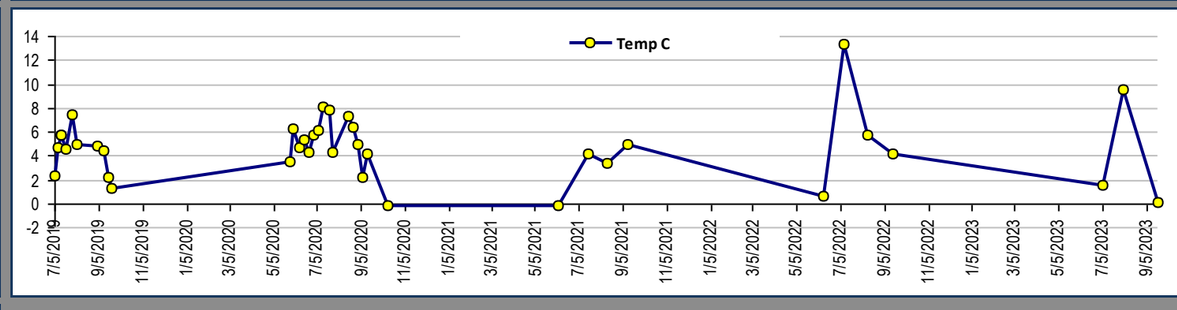


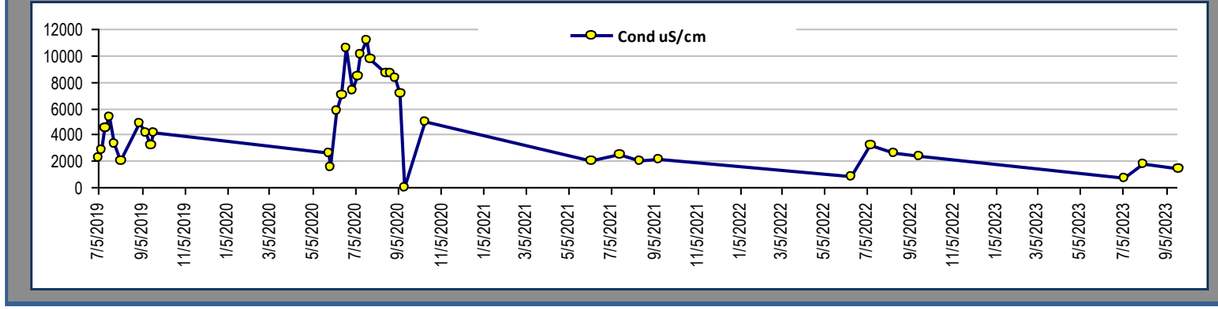






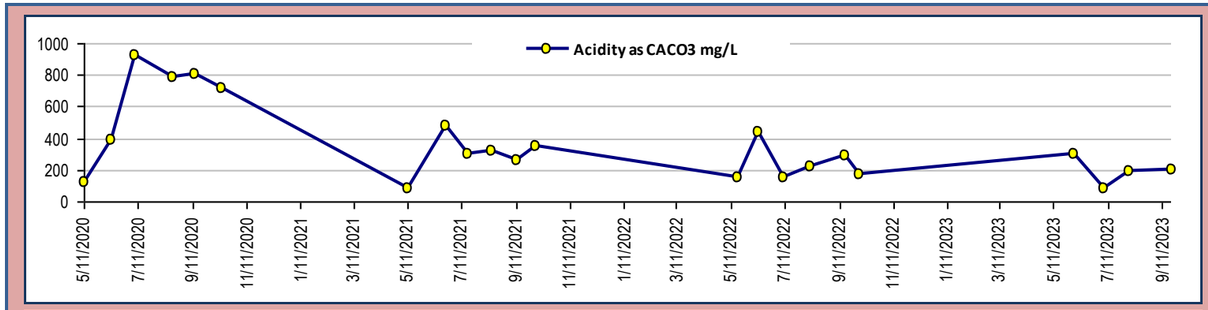


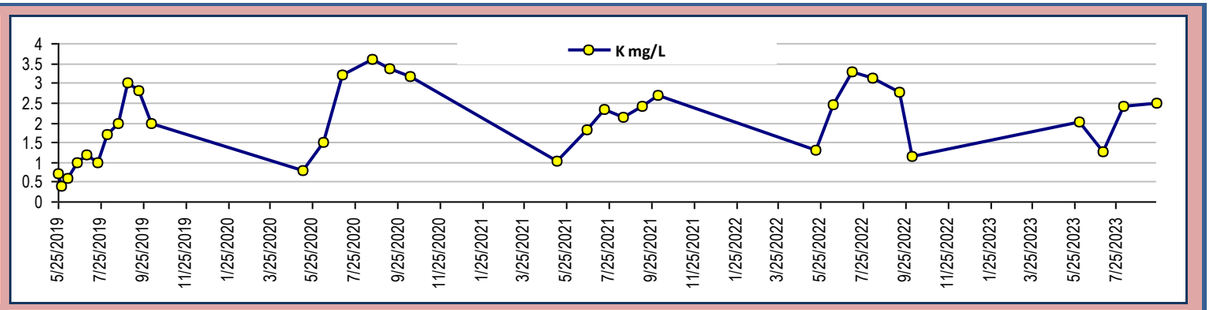


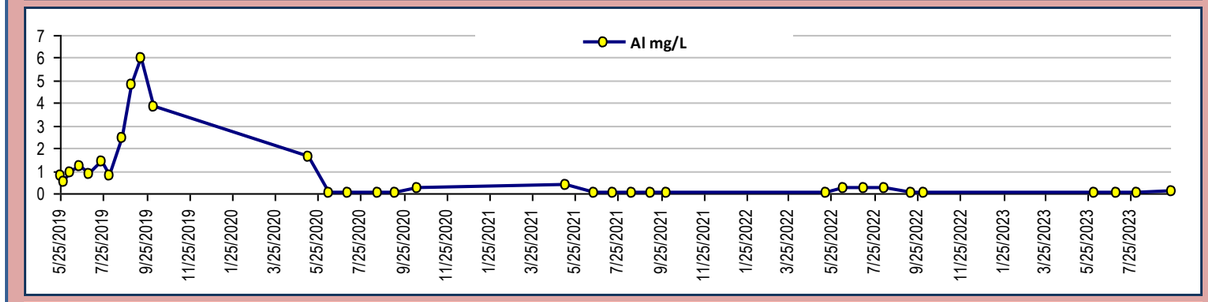


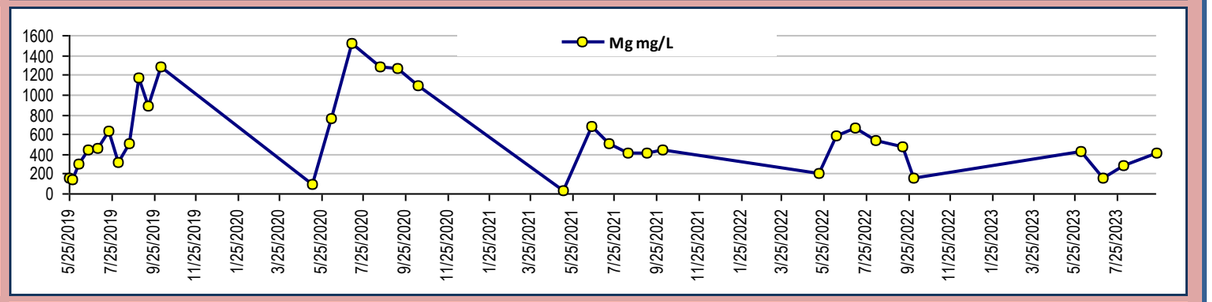
Appendix J: Hill top Diversion Profile II Trend Charts

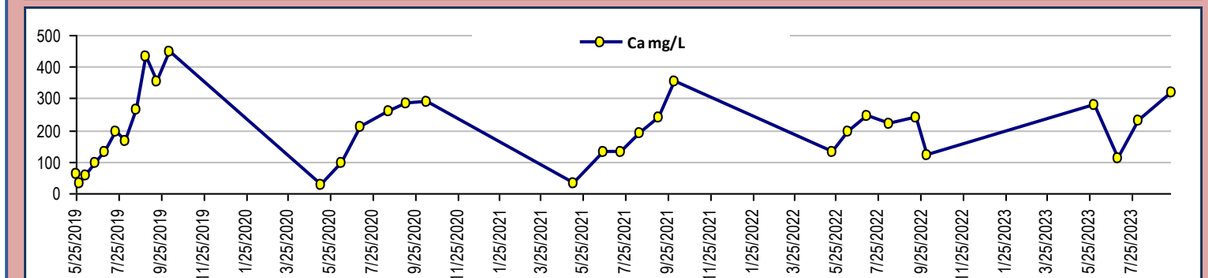
Hill Top Diversion - Profile II: Dissolved

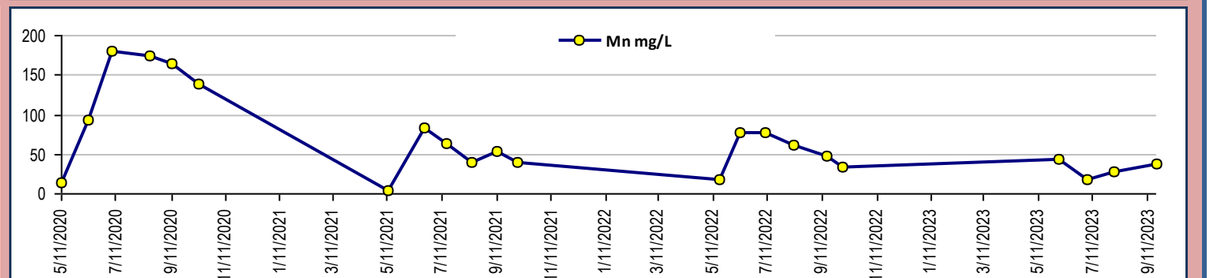


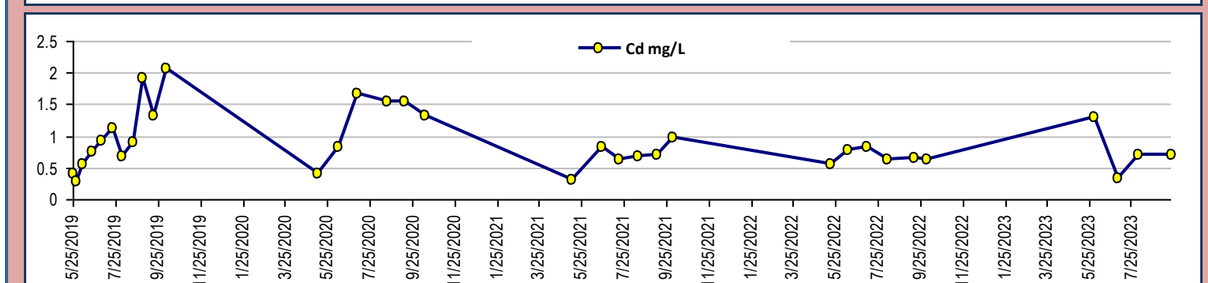


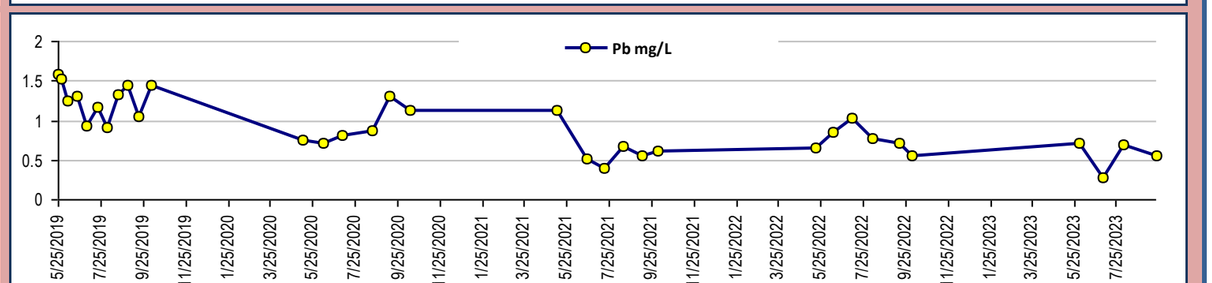


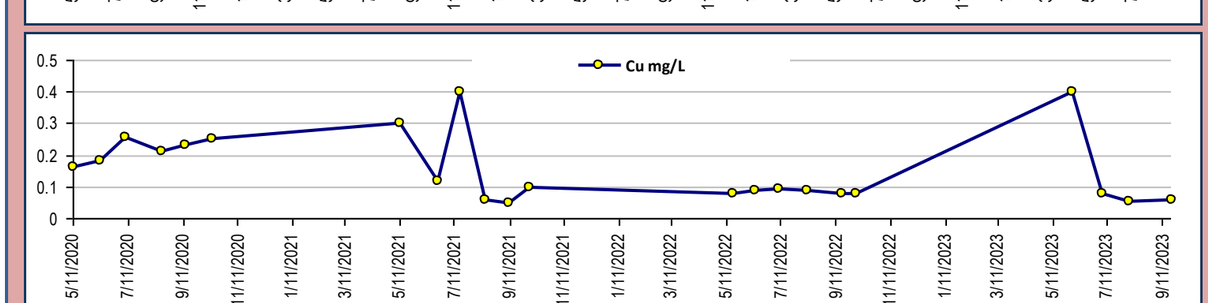


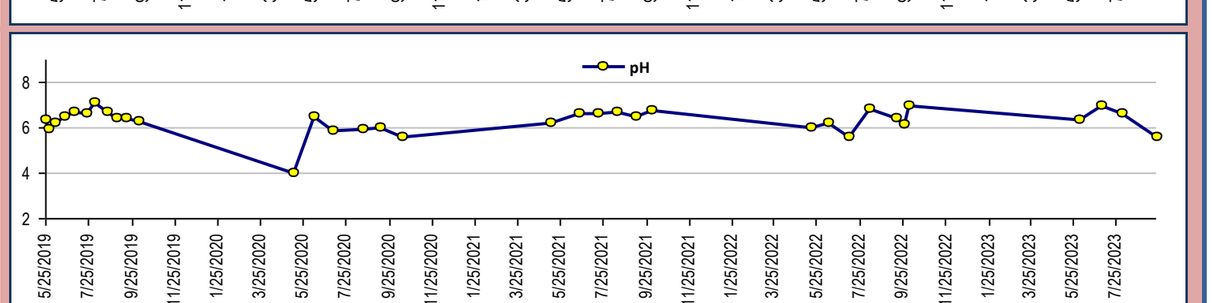






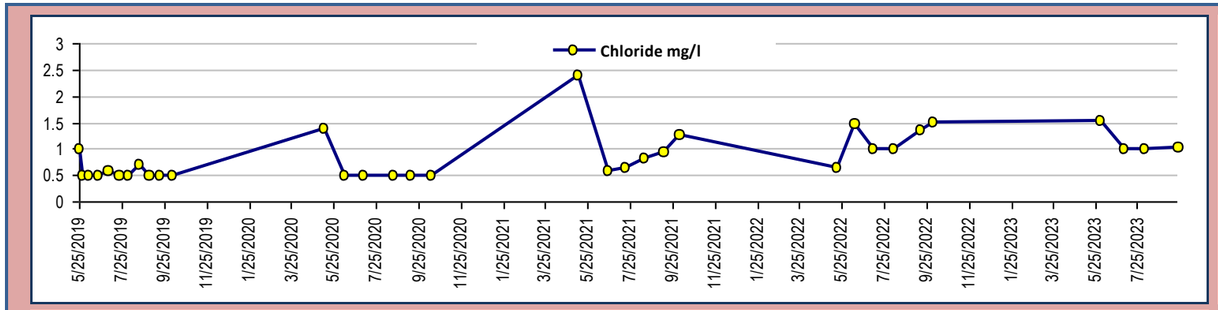


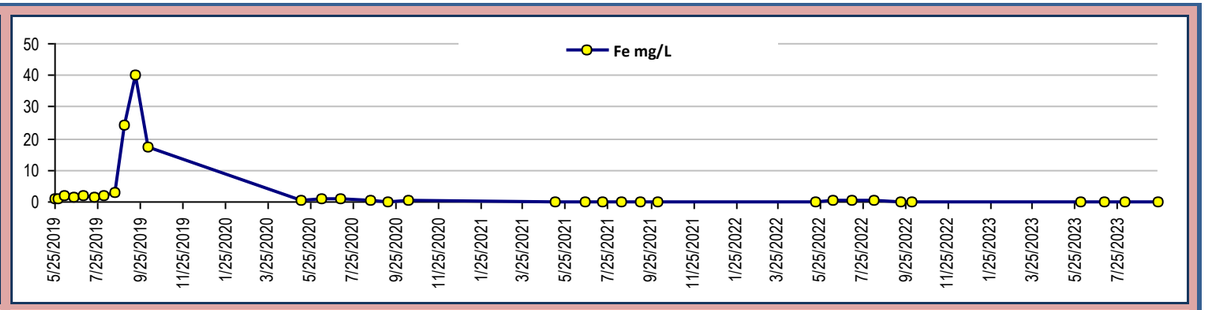


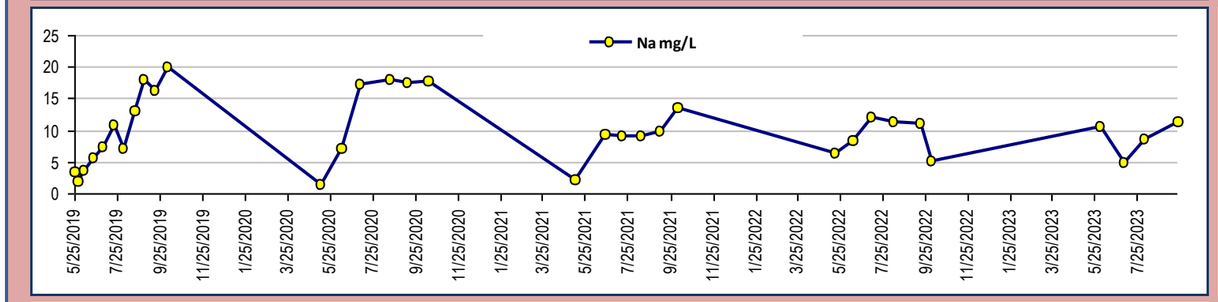


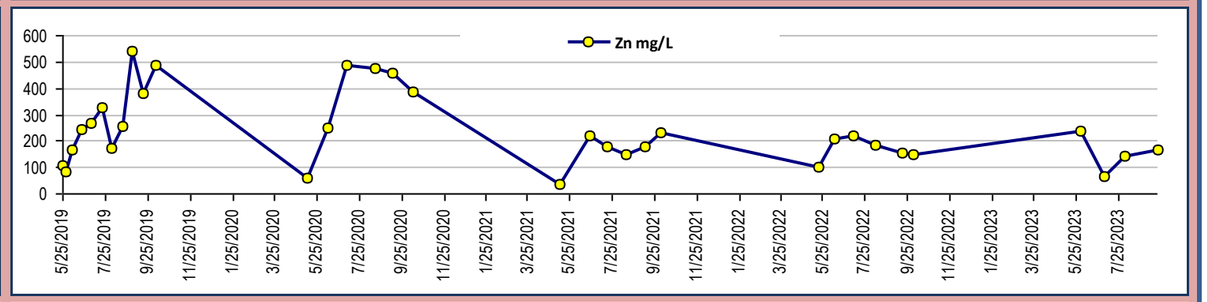
Hill Top Diversion - Prifile II: Dissolved

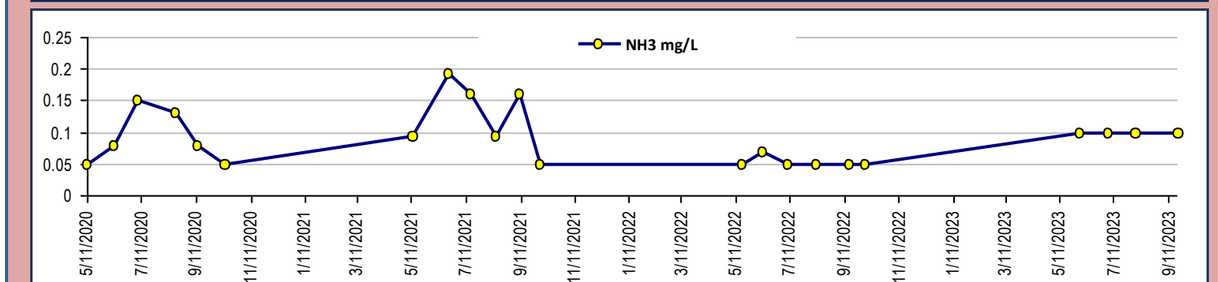
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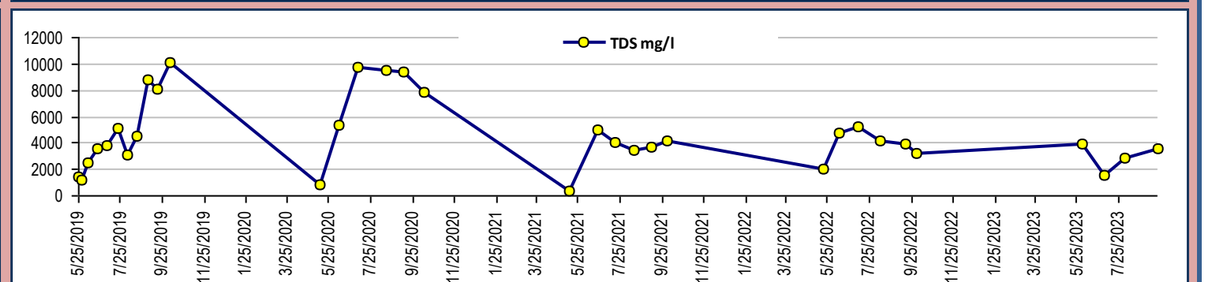


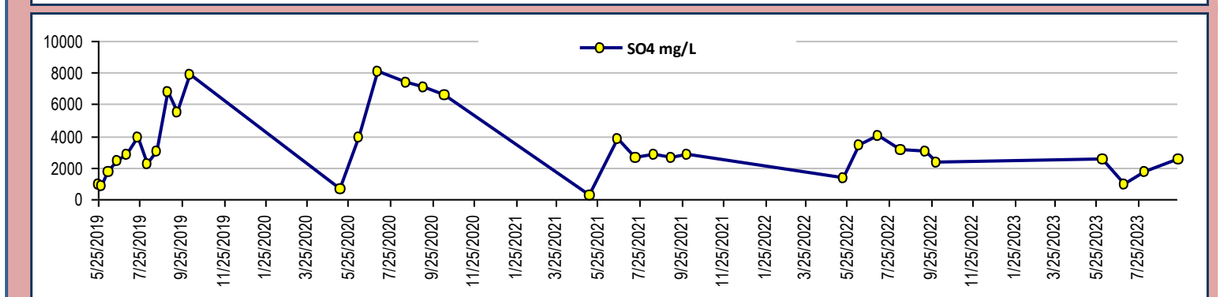


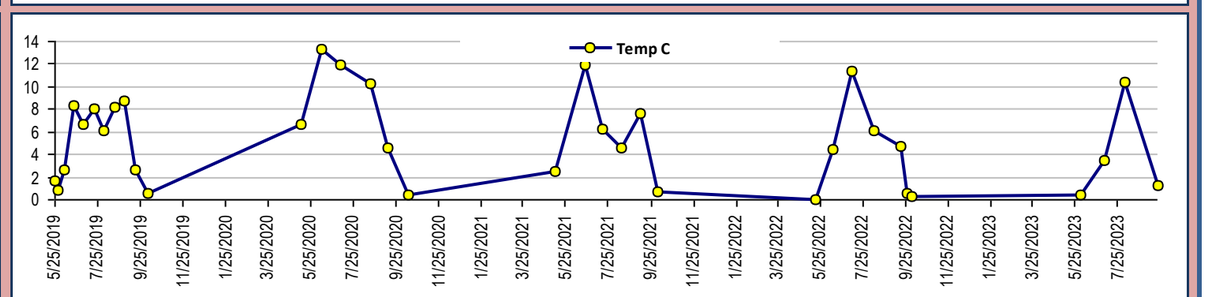


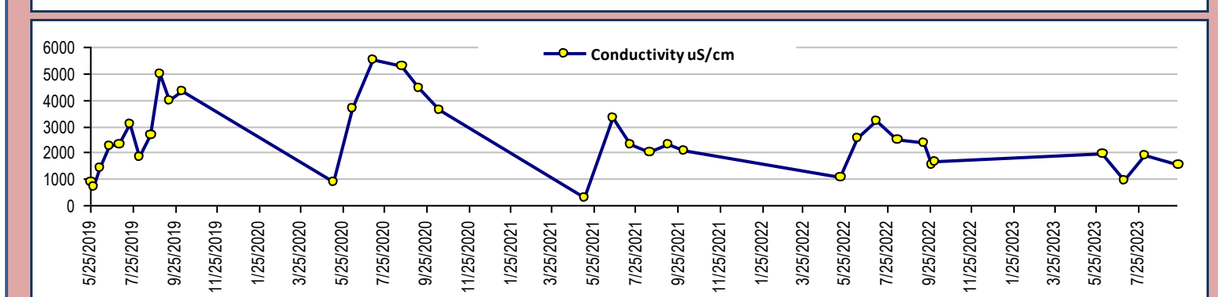








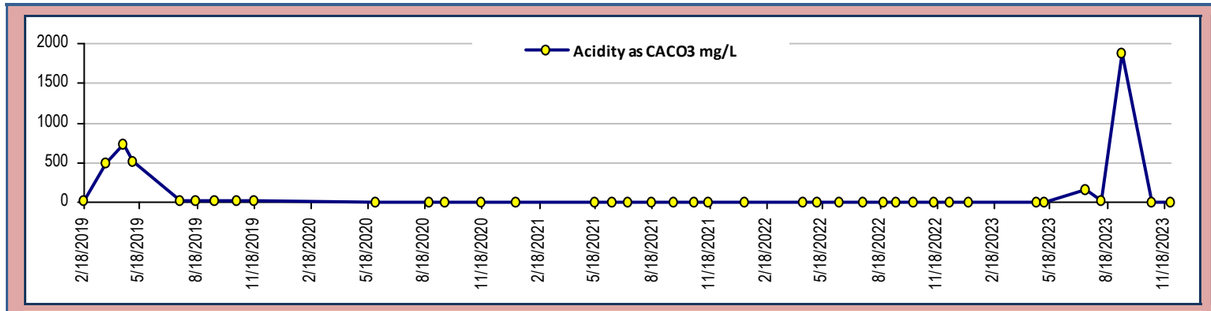


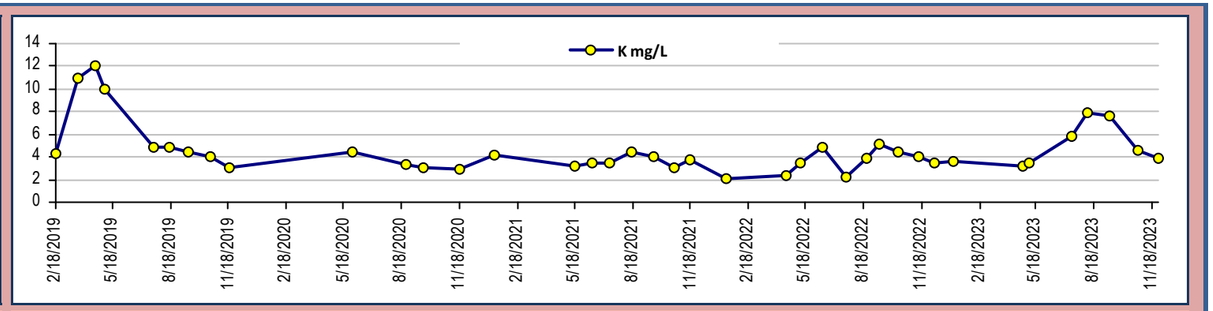


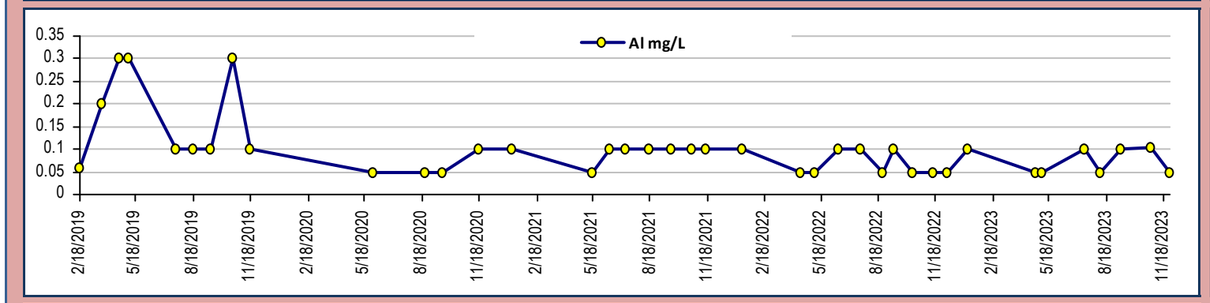
Appendix K: Mill Pad Collection Profile II Trend Charts

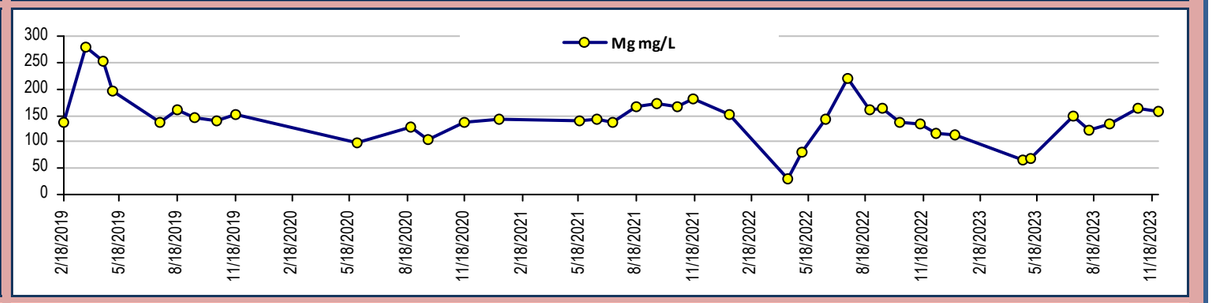
Mill Pad Runoff - Profile II: Dissolved

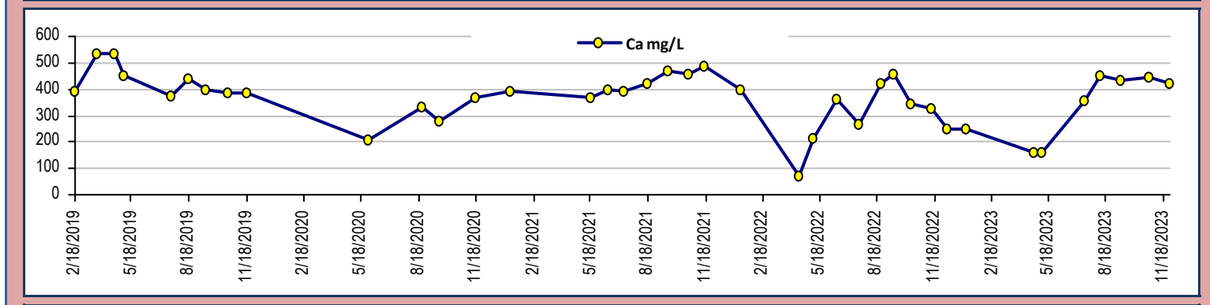
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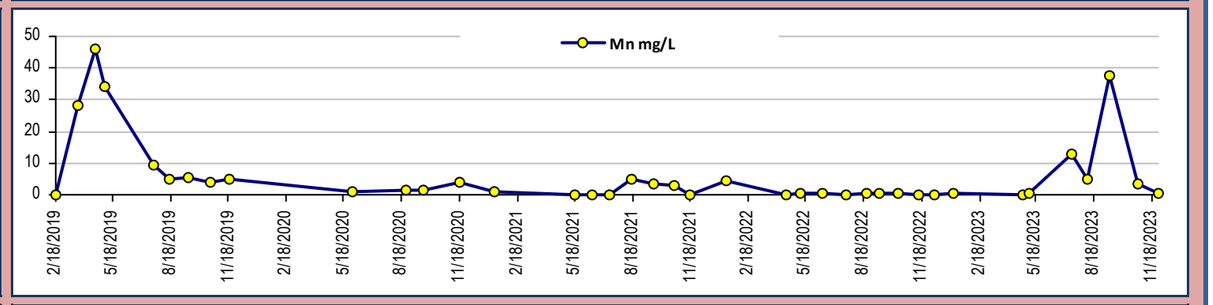


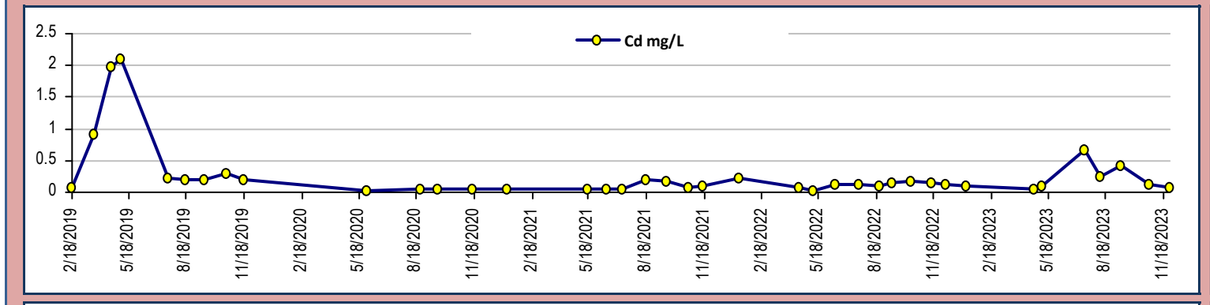


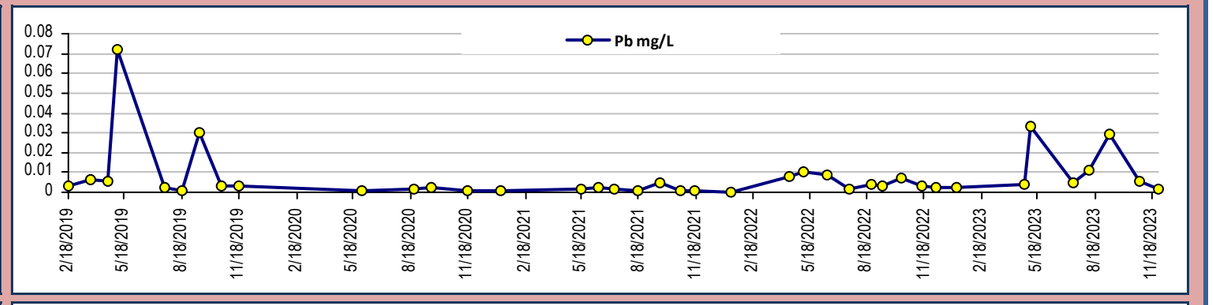


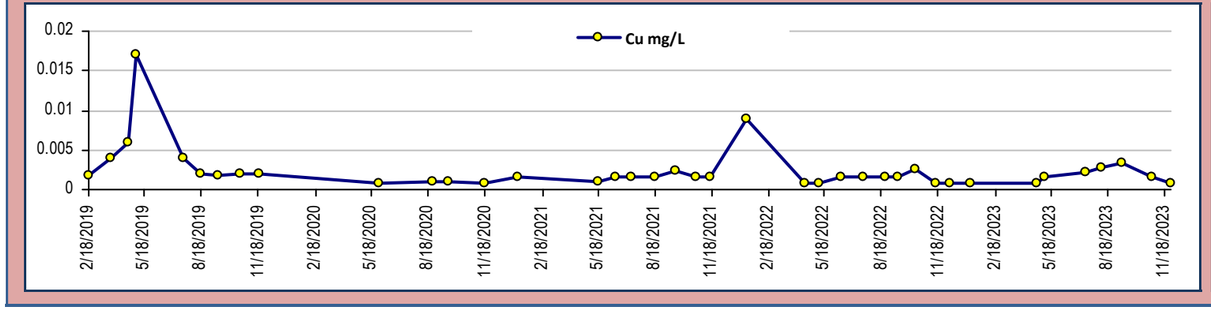


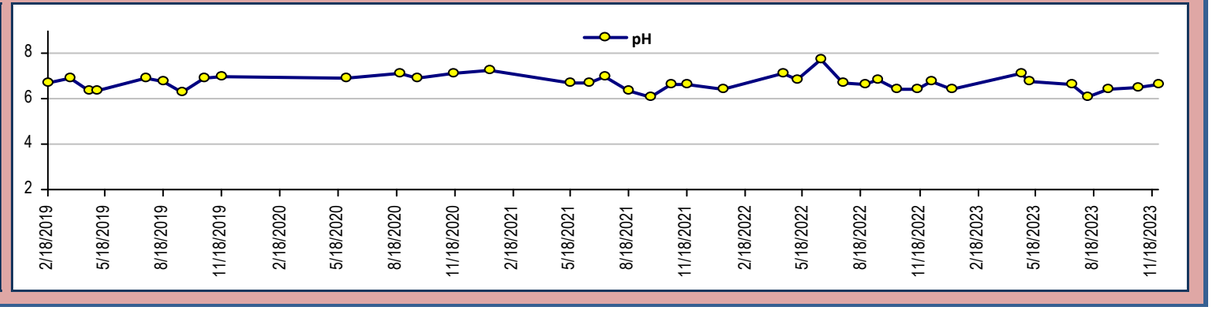






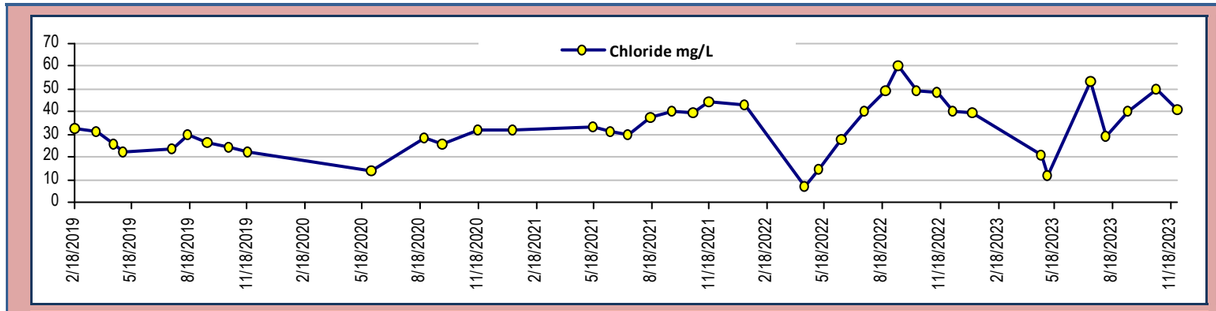


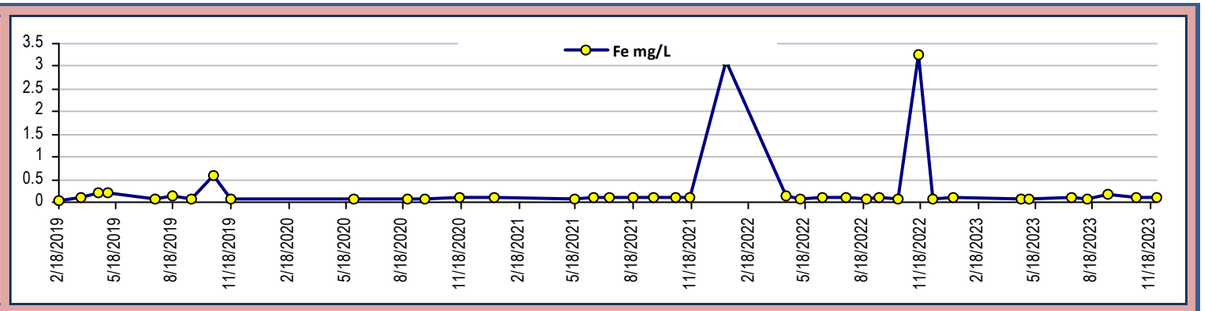


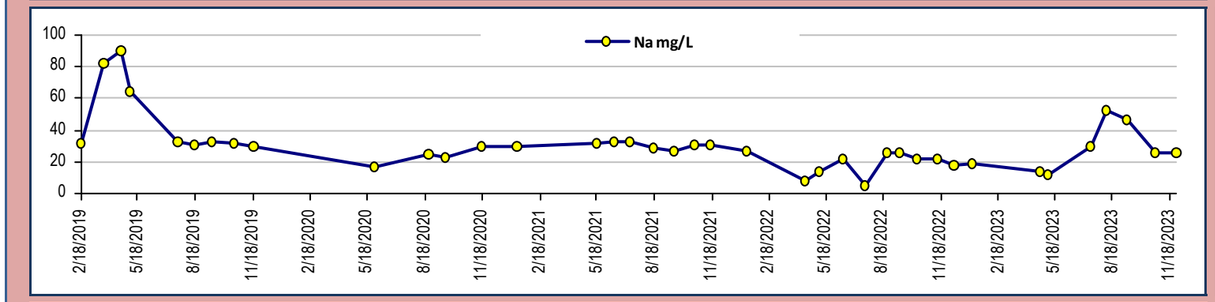


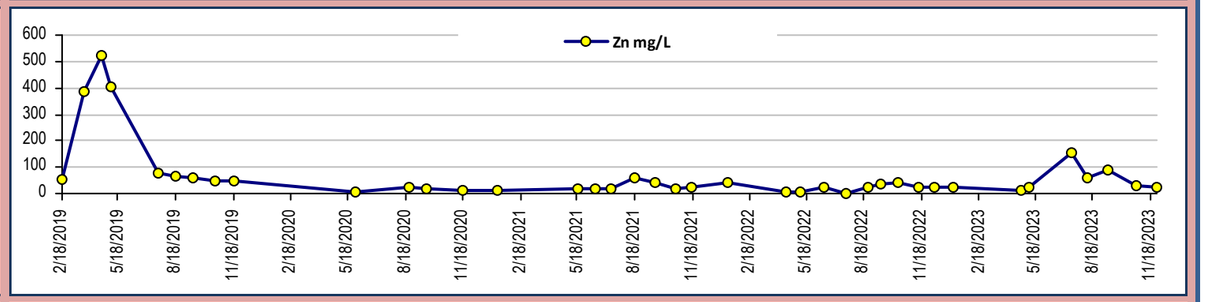
Mill Pad Runoff - Profile II: Dissolved

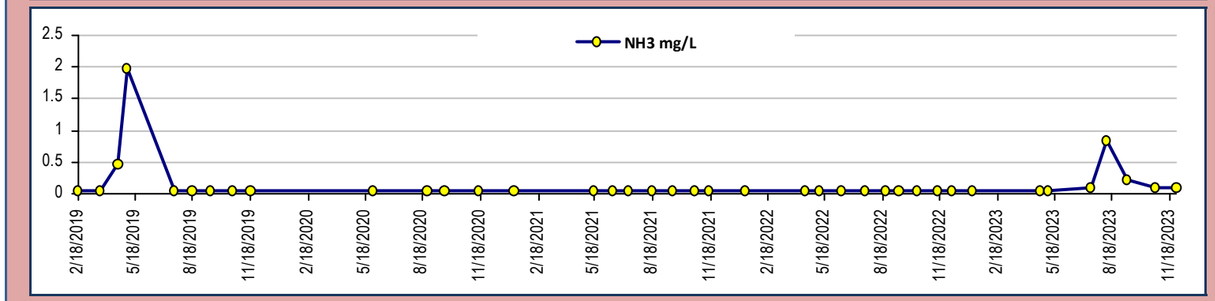
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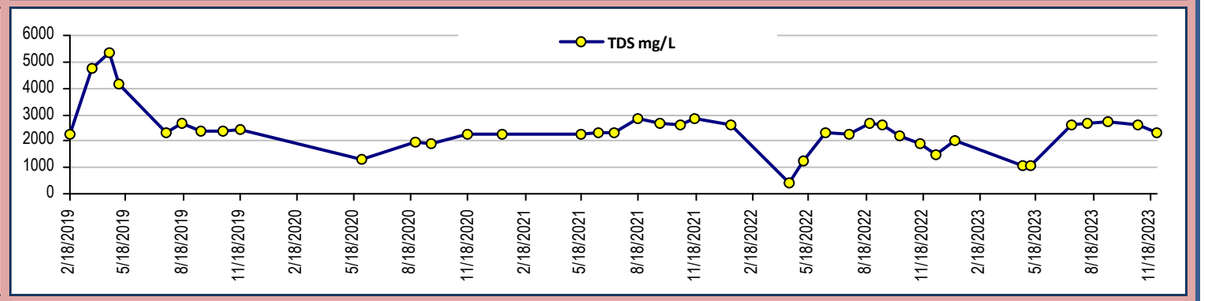


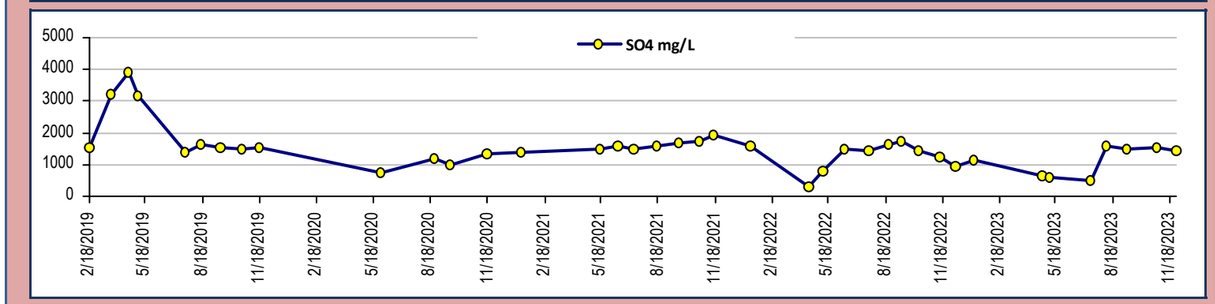


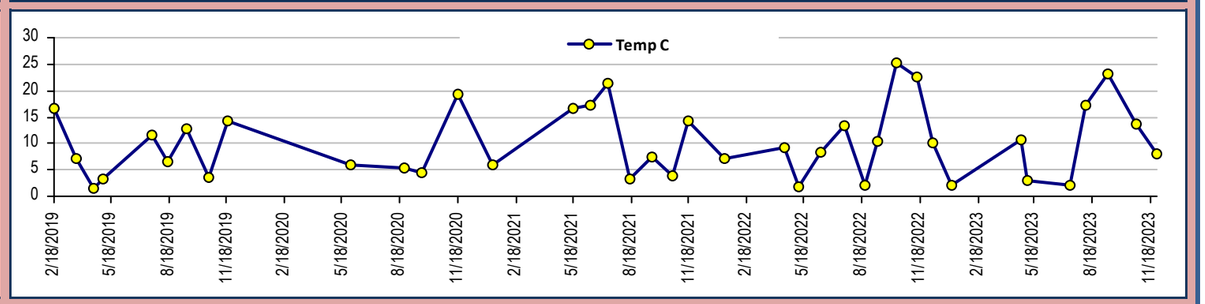


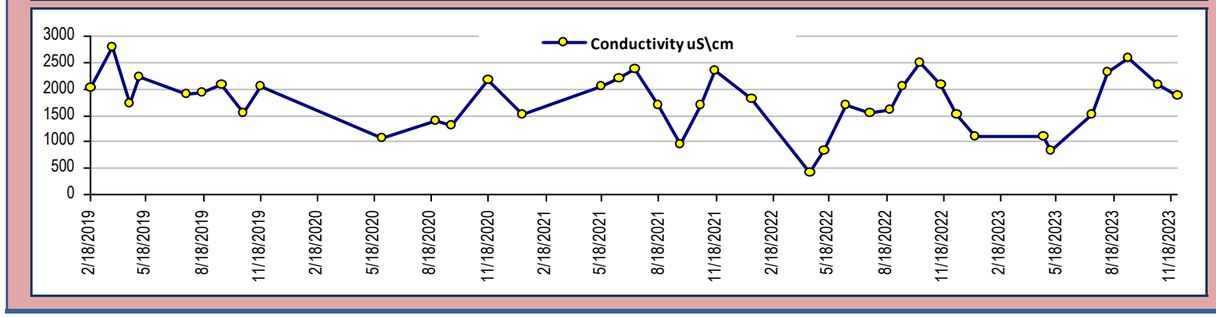








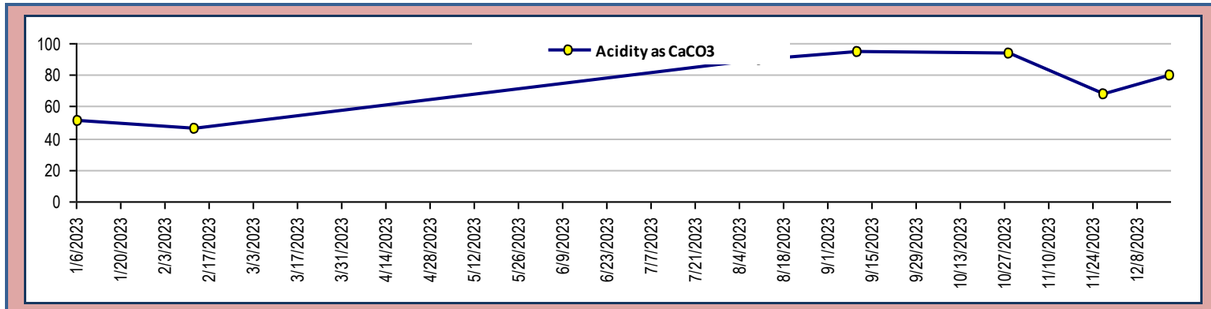


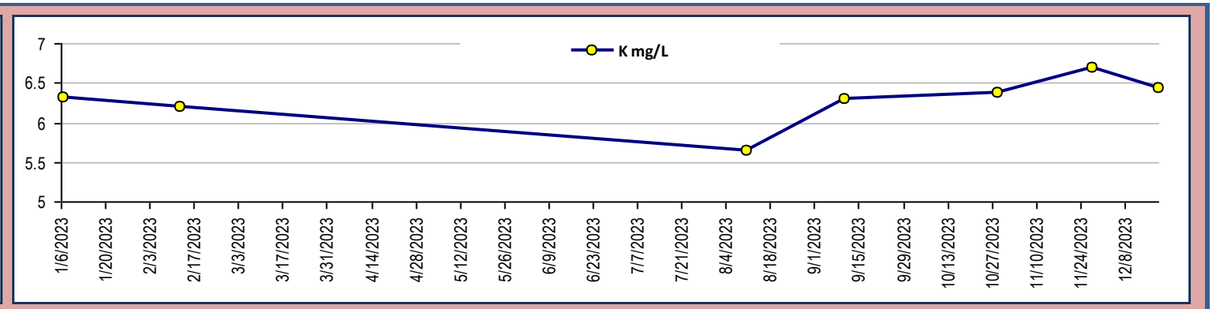


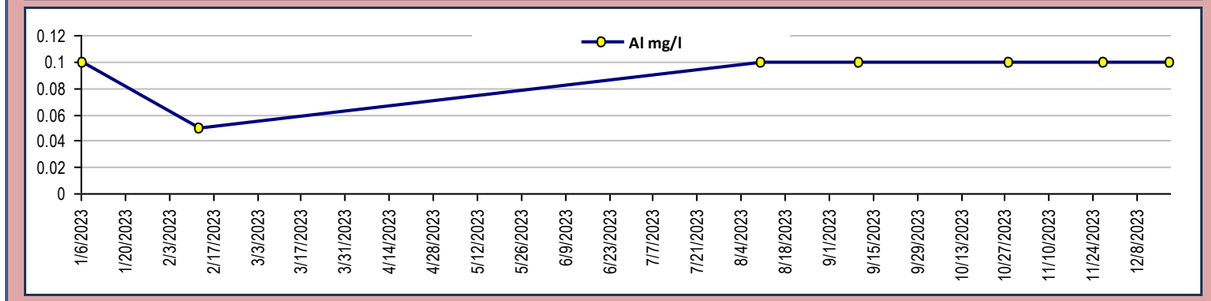
Appendix L: TMD Seepage Monitoring Well Trend Charets Trend Charts

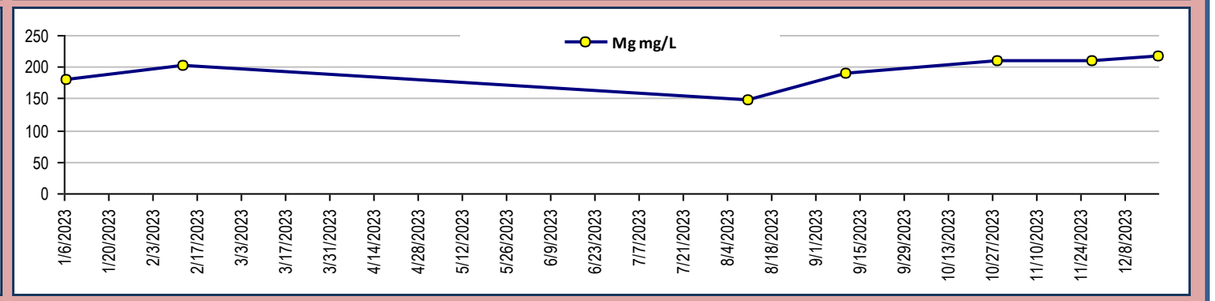
TMD Seepage Monitoring Well - Profile II: Dissolved

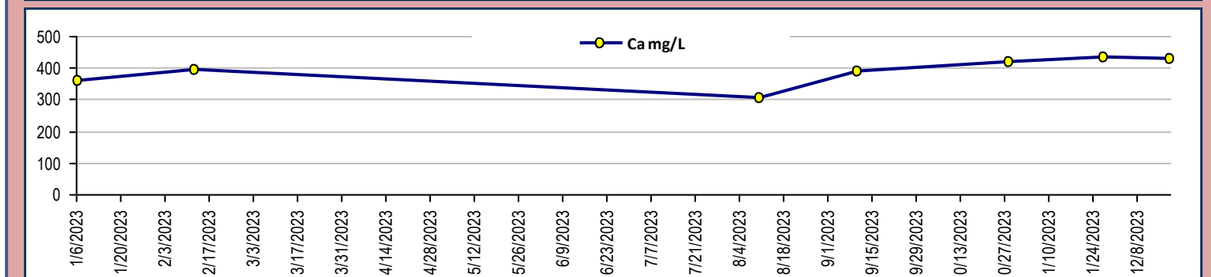
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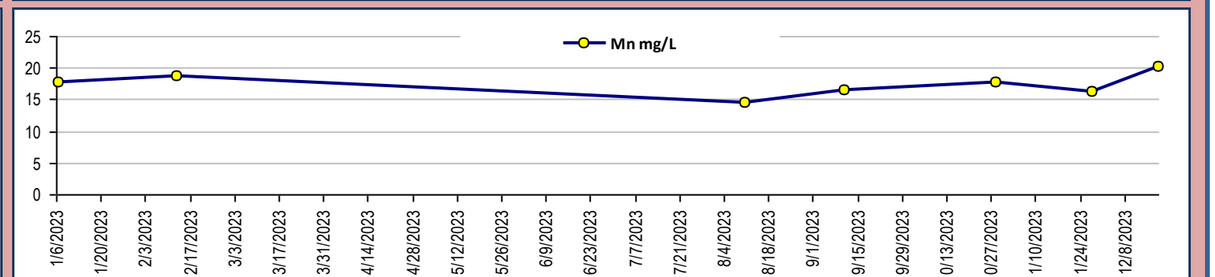


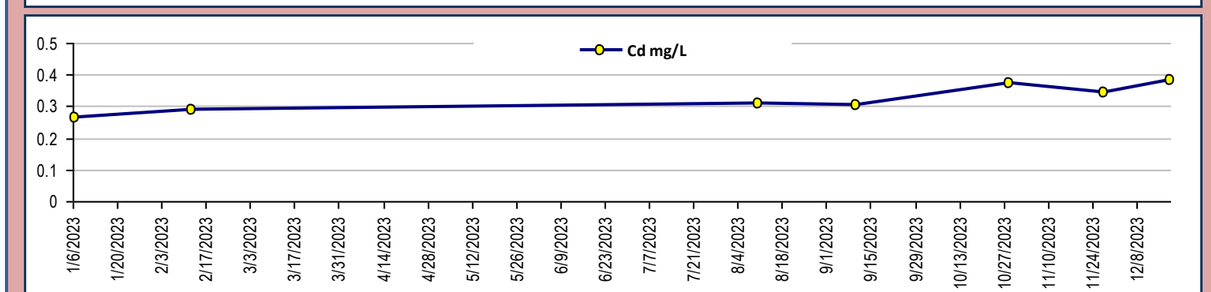


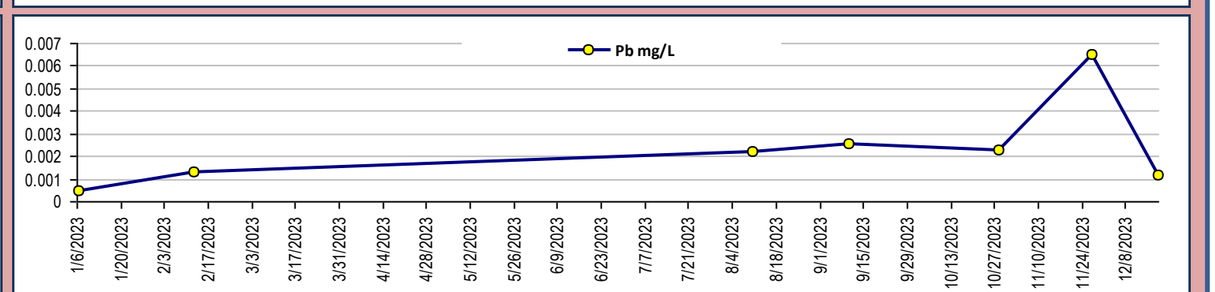


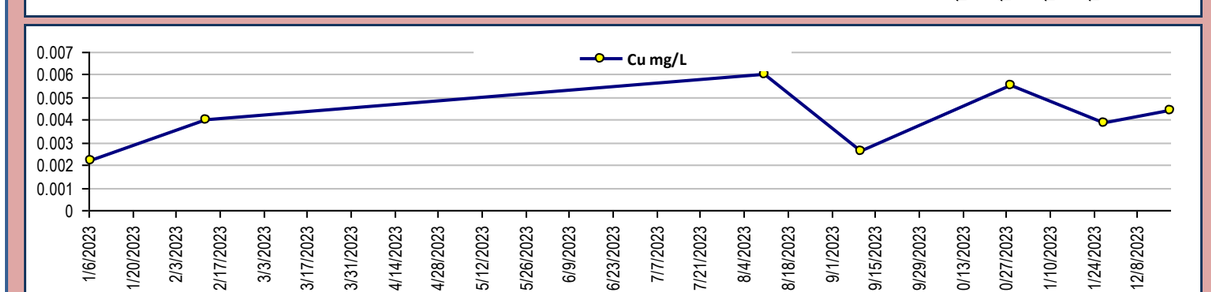


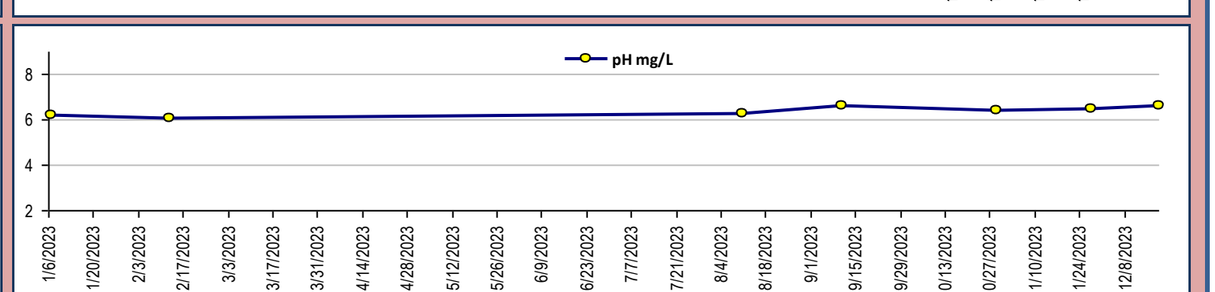












TMD Seepage Monitoring Well - Prifile II: Dissolved

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