

**WASHOE COUNTY ARTIFICIAL  
RECHARGE PROJECT  
GOLDEN VALLEY,  
WASHOE COUNTY, NEVADA**

**ANNUAL REPORT  
2021**

**PERMIT #UNEV91008**

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## TABLE OF CONTENTS

	Page
Summary of Activities	1
Injection Volumes	2
Injection Rates	3
Injection Pressures	4
Injection Water Quality Laboratory Analyses	5
Monitoring Well GV4 Water Quality Laboratory Analyses	13
Monitoring Well GV3 Water Quality Laboratory Analyses	21
Domestic Well Pendill (Puryear) Water Quality Laboratory Analyses	29
Field Water Quality Analyses	37
Monitoring Well Water Levels	38
Conclusions	45
Appendix 1. Laboratory Data Sheets	46
Appendix 2. UIC Form U230 – Field Sampling & Monitoring Summary	47
Attachment 1. Compounds analyzed for Routine Domestic Analyses	48

## LIST OF TABLES

1. Monthly Injection Volumes	2
2. Injection Rates (Q)	3
3. Pressure Readings (P)	4
4. Laboratory Analyses for Injection Water 2018	6
5. Laboratory Analyses for Monitoring Well GV4 2018	14
6. Laboratory Analyses for Monitoring Well GV3 2018	22
7. Laboratory Analyses for Pendill (Puryear) Domestic Well 2018	30
8. Field Water Quality Analyses	37
9. Water Level Data for Monitoring Well GV4 2018	38
10. Water Level Data for Monitoring Well GV3 2018	39
11. Water Level Data for Domestic Well Pendill (Puryear) 2018	39
12. Water Level Data for Monitoring Well GV5 2018	40
13. Water Level Data for Domestic Well Duncan 2018	40

## LIST OF FIGURES

1. Water Quality Data for Injection Water	
a. Total Dissolved Solids	7
b. pH	8
c. Nitrate	9
d. Sulfate	10
e. Chloride	11
f. Barium, Boron, Copper, Flouride, and Iron	12
2. Water Quality Data for Monitoring Well GV4	
a. Total Dissolved Solids	15
b. pH	16
c. Nitrate	17
d. Sulfate	18
e. Chloride	19
f. Barium, Boron, Copper, Flouride, and Iron	20
3. Water Quality Data for Monitoring Well GV3	
a. Total Dissolved Solids	23
b. pH	24
c. Nitrate	25
d. Sulfate	26
e. Chloride	27
f. Barium, Boron, Copper, Flouride, and Iron	28
4. Water Quality Data for Pendill (Puryear) Domestic Well	
a. Total Dissolved Solids	31
b. pH	32
c. Nitrate	33
d. Sulfate	34
e. Chloride	35
f. Barium, Boron, Copper, Flouride, and Iron	35
5. Ground Water Levels Monitoring Well GV4	41
6. Ground Water Levels for Monitoring Well GV3	42
7. Ground Water Levels for Pendill (Puryear) Domestic Well	43
8. Ground Water Levels for Monitoring Well GV5	44

GLOSSARY, ABBREVIATIONS, ACRONYMS, AND UNITS

Definition	Abbreviation	Unit
Alkalinity		ppm
Arsenic		ppm
Barium		ppm
Bicarbonate		ppm
Boron		ppm
Calcium		ppm
Carbonate		ppm
Chloride		ppm
Chlorine (free, total, combined)	Cl	ppm
Color		standard units
Copper		ppm
Degrees Celsius	°C	C
Degrees Fahrenheit	°F	F
Electrical Conductivity (laboratory)	EC	microsiemens per centimeter (µS/cm)
Fluoride		ppm
Hardness		ppm
Iron		ppm
Magnesium		ppm
Manganese		ppm
milligrams per liter	mg/L	-
Nitrate as N		ppm
parts per million	ppm	-
pH**		standard units
Potassium		ppm
Salinity	sal.	percent (%)
Silica***	SI	ppm
Sodium		ppm
Specific Conductivity (field)	SC	millisiemens per centimeter (mS/cm)
Sulfate		ppm
Temperature (sample & air)	temp.	°C, °F
Total Dissolved Solids* (Laboratory)	TDS	ppm
Total Dissolved Solids (Field)	TDS	grams/liter (g/L)
Total Trihalomethanes	TTHMs	ppm
Turbidity	turb.	nephelometric turbidity units (NTU)
Zinc		ppm
*at 180 °C		
**at 21.1 °C		
***at 20 °C		

## **SUMMARY OF ACTIVITIES**

The Washoe County Community Services Department – Division of Water Resources (WCDWR) operated an artificial recharge pilot system in Golden Valley, Washoe County, Nevada, from December 1992 through March 1998. The pilot system was returned to service on October 3, 2002, after new funding sources were established. On April 7, 2016, the injection system was shut down. Shallow domestic wells in the southwestern region of the valley experienced high and increasing water levels. In response, flow to all injection wells was temporarily ceased to allow for a monitoring period of aquifer and water level response. The injection system has remained out of service since 2016.

In September 2018, a backflow RP device was installed per Truckee Meadows Water Authority standards and request for compliance. The backflow was installed directly after the TMWA meter at the service line point of connection. The system was turned on momentarily and routed to the backflow branched line to pass inspection and was turned off immediately after the inspection of the RP device passed. The downstream valve remained closed to ensure no water was sent into the recharge system.

Standard permit monitoring remains in effect; additionally, Washoe County has increased the number of domestic wells monitored. This annual report includes information from January 1, 2021 through December 31, 2021.

Activities performed during the reporting period were completed according to requirements outlined in the Nevada Division of Environmental Protection (NDEP) Permit No. UNEV91008 when possible. These activities include: 1) collecting and analyzing groundwater samples; and 2) measuring water levels in five (5) designated monitoring wells and approximately thirty (30) additional domestic wells. No artificial recharge was performed during the reporting period.

Groundwater from the three (3) monitoring wells was collected and analyzed quarterly when possible. Field analyses were completed using a YSI multi probe system, and laboratory analyses were performed by the Western Environmental Testing Laboratory. Quarterly laboratory analyses include chloride, total dissolved solids (TDS), electric conductivity (EC), pH, routine domestics and total trihalomethanes (TTHM) according to NDEP permit requirements. Field analyses include pH, specific conductivity, sample temperature, dissolved oxygen, oxygen reduction potential, free chlorine, and total residual chlorine. Compounds included in the routine domestic analyses are summarized in Attachment 1.

Water levels were measured in the designated monitoring wells on a monthly basis when possible. Water levels are referenced to mean sea level (msl) in this report.

Washoe County injected 0 gallons/acre-feet (AF) of water between January 1, 2021 and December 31, 20. Because no injection was conducted for the reporting period, all injection quantities, flow rates, and pressures are reported as zeros in this report. Tables and figures have been retained in this report as placeholders, and to demonstrate that no water was injected.

A total of 288,898,463 gallons, or approximately 886.41 AF, were injected in the period between October 2002 and April 2016.

**Injection Volumes**

No artificial recharge was performed during the reporting period. The amount of water injected from January 1, 2021 through December 31, 20 was 0 gallons/acre-feet (AF.) Table 1 summarizes the monthly injection volumes for 1.

On April 7, 2016, the injection system was temporarily shut down. Shallow domestic wells in the southwestern region of the valley experienced high and increasing water levels. In response, flow to all injection wells was temporarily ceased to allow for a monitoring period of aquifer and water level response. Due to the significant precipitation events Northern Nevada has experienced since early 2017, Washoe County has not resumed artificial injection; the injection system has remained out of service since 2016.

Table 1: Monthly Injection Volumes

Month-YY	Amount of Water Injected Monthly (gallons)			
	GVI1	GVI3	GVI4	GVI5
January-21	0	0	0	0
February-21	0	0	0	0
March-21	0	0	0	0
April-21	0	0	0	0
May-21	0	0	0	0
June-21	0	0	0	0
July-21	0	0	0	0
August-21	0	0	0	0
September-21	0	0	0	0
October-21	0	0	0	0
November-21	0	0	0	0
December-21	0	0	0	0
Totals (gallons):	0	0	0	0
Totals (acre feet):	0.	0.	0.	0
Total Gallons Injected During Reporting Period:				<b>0</b>
Total Acre Feet Injected During Reporting Period:				<b>0</b>

**Injection Rates**

No artificial recharge was performed during the reporting period. Injection rates (Q) are calculated by dividing the volume of water injected between each meter reading by the time elapsed between each meter reading. Injection rates were measured in gallons per minute (gpm). Table 2 summarizes the monthly, maximum, minimum, and average injection rates for 2021.

Table 2: Summary of Injection Rates (Q)

Month-YY	Date	Q (GPM)			
		GVI1	GVI3	GVI4	GVI5
January-21	1/1/2021	0.00	0.00	0.00	0.00
February-21	2/1/2021	0.00	0.00	0.00	0.00
March-21	3/1/2021	0.00	0.00	0.00	0.00
April-21	4/1/2021	0.00	0.00	0.00	0.00
May-21	5/1/2021	0.00	0.00	0.00	0.00
June-21	6/1/2021	0.00	0.00	0.00	0.00
July-21	7/1/2021	0.00	0.00	0.00	0.00
August-21	8/1/2021	0.00	0.00	0.00	0.00
September-21	9/1/2021	0.00	0.00	0.00	0.00
October-21	10/1/2021	0.00	0.00	0.00	0.00
November-21	11/1/2021	0.00	0.00	0.00	0.00
December-21	12/1/2021	0.00	0.00	0.00	0.00
<b>Maximum Q:</b>		0.00	0.00	0.00	0.00
<b>Minimum Q:</b>		0.00	0.00	0.00	0.00
<b>Average Q:</b>		0.00	0.00	0.00	0.00

**Injection Pressures**

No artificial recharge was performed during the reporting period. Injection pressures (P) are monitored to prevent development of problems with the injection system. Maximum allowable pressure at the wellheads was never reached. Table 3 summarizes the monthly, maximum, minimum, and average pressure readings for 2021 in pounds per square inch (psi).

Table 3: Summary of Pressure Readings (P)

Month-YY	Date	P (PSI)			
		GVI1	GVI3	GVI4	GVI5
January-21	1/1/2021	0	0	0	0
February-21	2/1/2021	0	0	0	0
March-21	3/1/2021	0	0	0	0
April-21	4/1/2021	0	0	0	0
May-21	5/1/2021	0	0	0	0
June-21	6/1/2021	0	0	0	0
July-21	7/1/2021	0	0	0	0
August-21	8/1/2021	0	0	0	0
September-21	9/1/2021	0	0	0	0
October-21	10/1/2021	0	0	0	0
November-21	11/1/2021	0	0	0	0
December-21	12/1/2021	0	0	0	0
<b>Maximum P:</b>		0	0	0	0
<b>Minimum P:</b>		0	0	0	0
<b>Average P:</b>		0	0	0	0



### **Injection Water Quality Laboratory Analyses**

No artificial recharge was performed during the reporting period. When the system is in operation, injection water is sampled and analyzed in a laboratory on a semi-annual basis according to permit requirements. Laboratory analyses includes total dissolved solids (TDS), electric conductivity (EC), and pH; as well as routine domestic compounds (see Attachment 1) and total trihalomethanes (TTHM). Samples are collected from a spigot located on the outlet pipe of the activated carbon filter. The filter decreases the concentration of suspended solids, chlorine, and TTHM in the injection water before injection. The injection tank was back-washed once per month when the injection wells are in service. The activated carbon in the injection tank was last replaced in September 2005.

Table 4 summarizes the injection water quality laboratory analyses. Figures 1a through 1f illustrate fluctuations of the concentrations of various constituents in the injection water analyzed throughout the year. Because the system was off for 2021, there was no sampling performed on the injection water; therefore, Table 4 contains no data. Figures 1a through 1f show historical data prior to the injection system being temporarily halted.

WASHOE COUNTY COMMUNITY SERVICES DEPARTMENT  
 2021 ANNUAL REPORT FOR GOLDEN VALLEY ARTIFICIAL RECHARGE

Table 4: Summary of Laboratory Analyses for Injection Water 20

Because the system was off for 2021, there was no sampling performed on the injection water; therefore, Table 4 contains no data.

Sample Date	Turbidity NTUs	pH pH Units	EC umhos/cm	Total Trihalomethanes			Total ug/L
				Chloroform ug/L	Bromodichloromethane ug/L	Dibromochloromethane ug/L	
1	-	-	-	-	-	-	-

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 1a. TOTAL DISSOLVED SOLIDS (TDS) DATA FOR  
INJECTION WATER/INJECTATE**

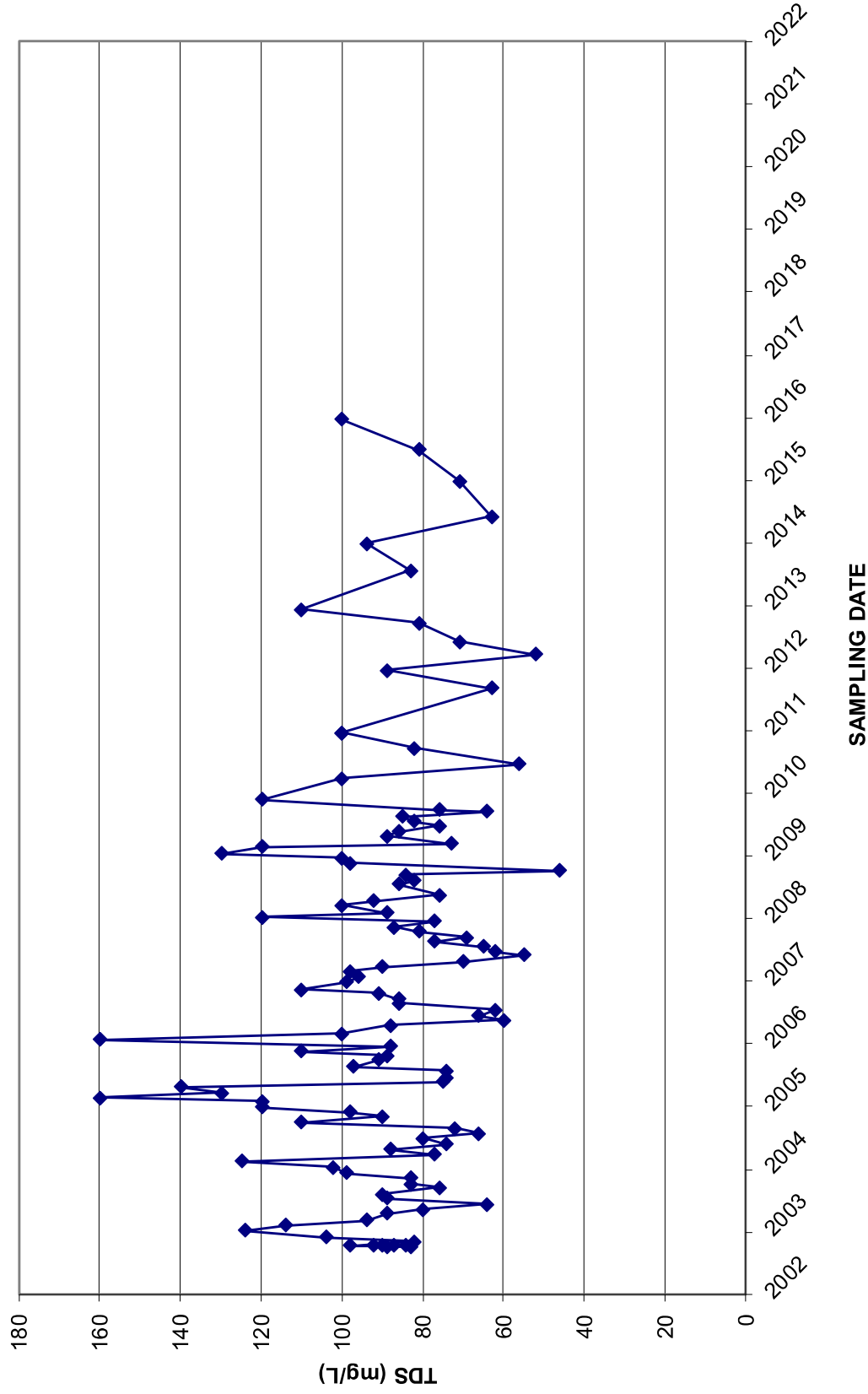
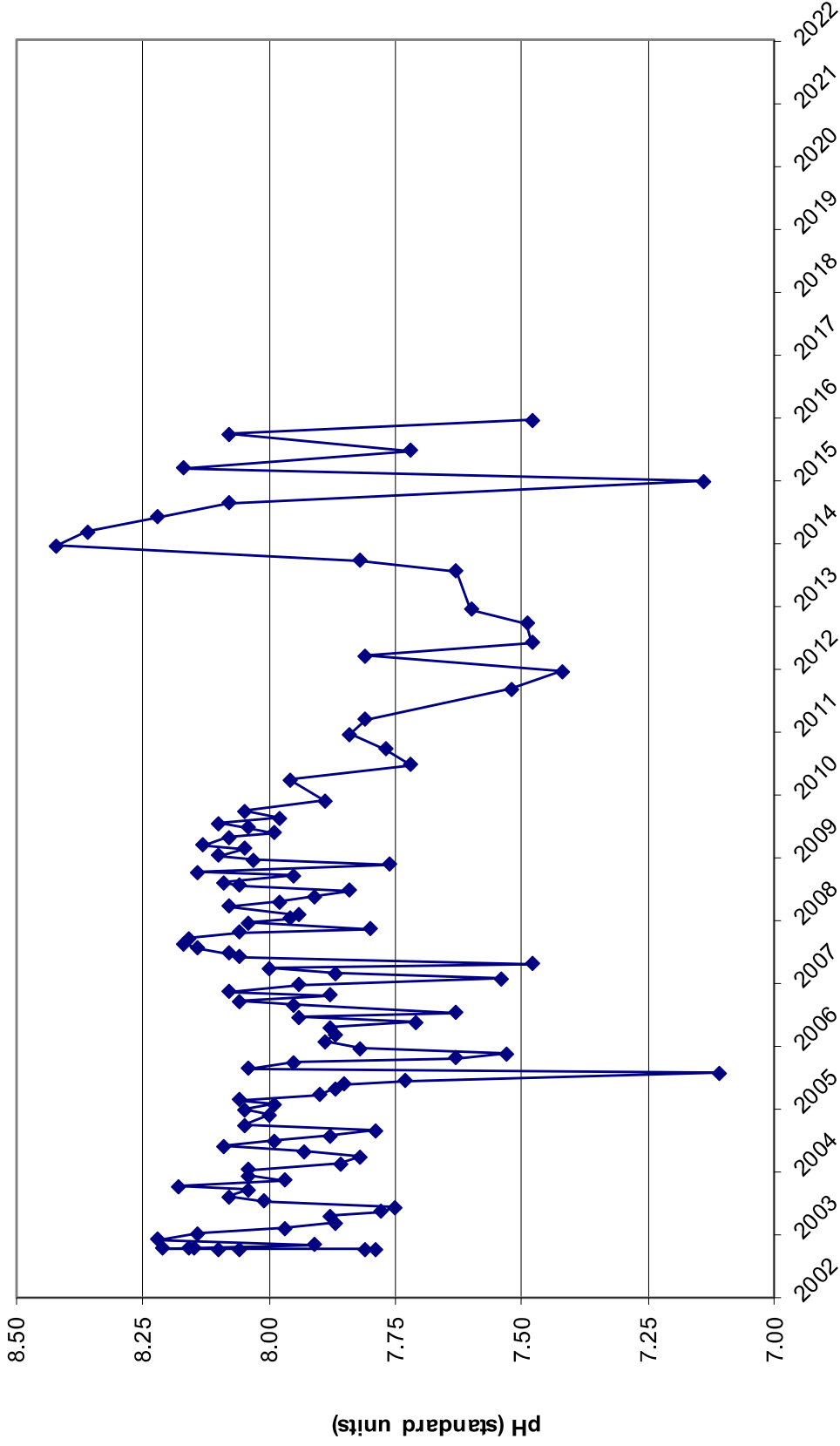


Fig. 1a: Concentration of Total Dissolved Solids (TDS) in injected water.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 1b. pH DATA FOR  
INJECTION WATER/INJECTATE**



**SAMPLING DATE**  
Fig. 1b: pH of injected water.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 1c. NITRATE AS N DATA FOR  
INJECTION WATER/INJECTATE**

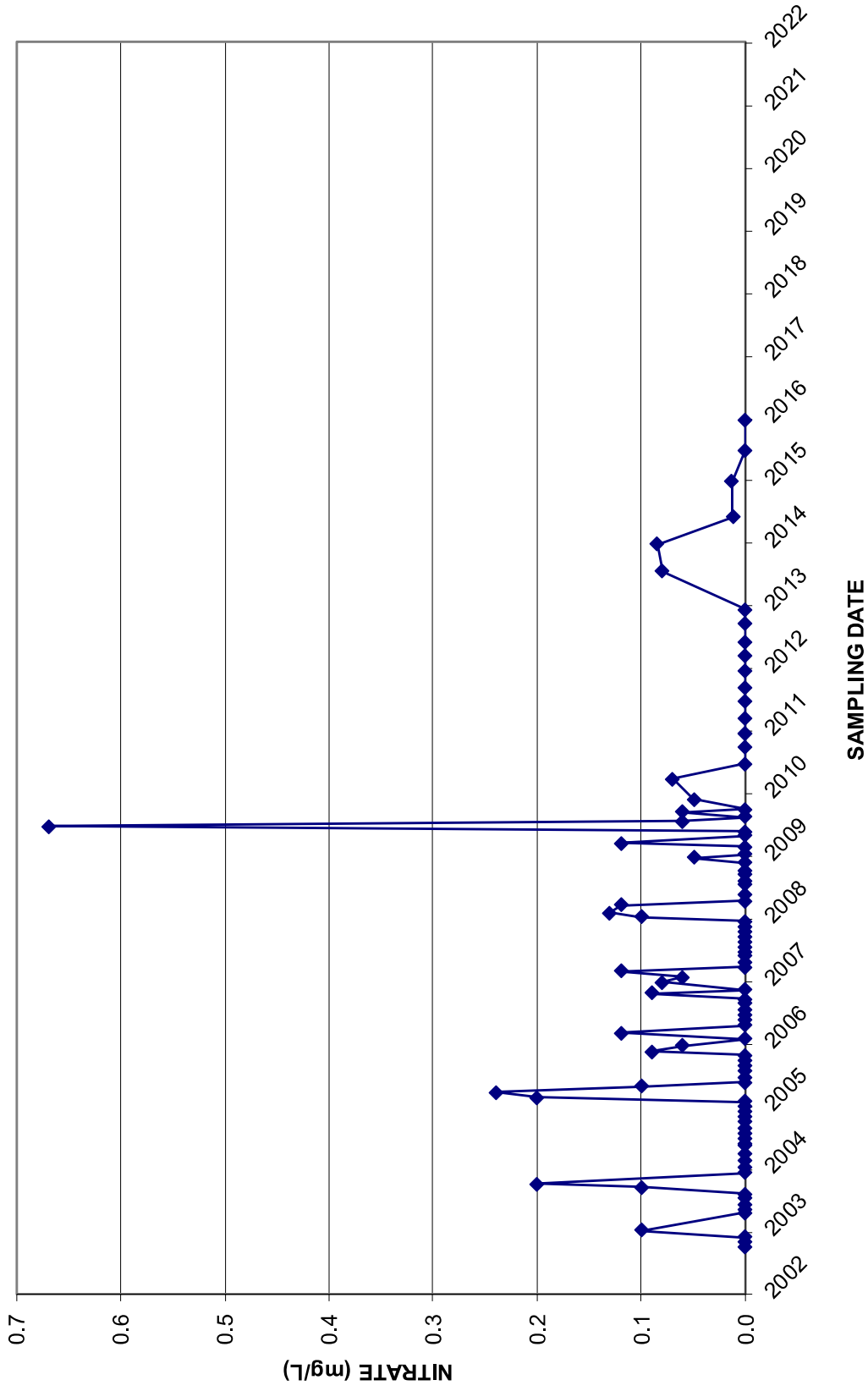
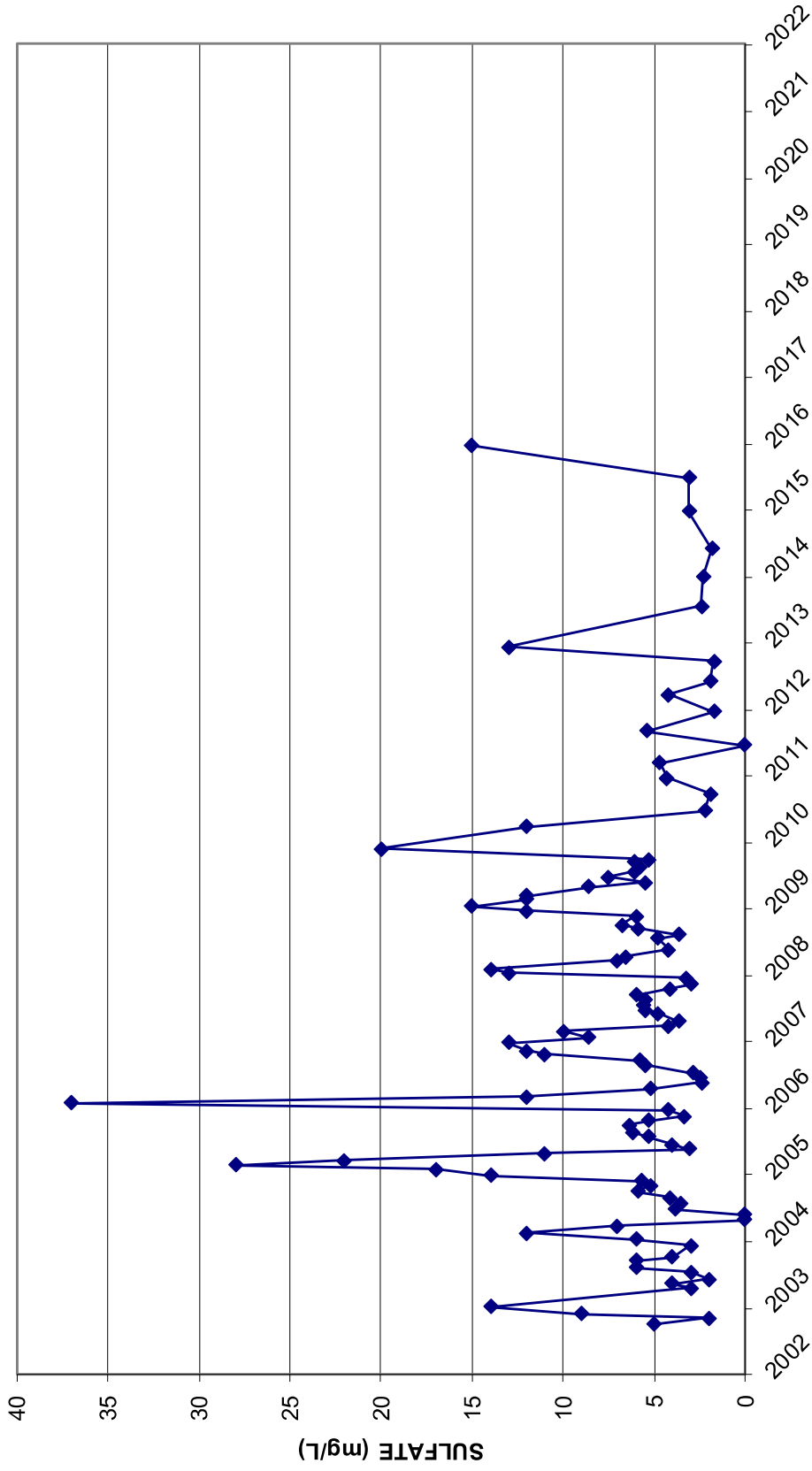


Fig. 1c: Concentration of nitrate in injected water.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 1d. SULFATE DATA FOR  
INJECTION WATER/INJECTATE**



**SAMPLING DATE**  
Fig. 1d: Concentration of sulfate in injected water.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 1e. CHLORIDE DATA FOR  
INJECTION WATER/INJECTATE**

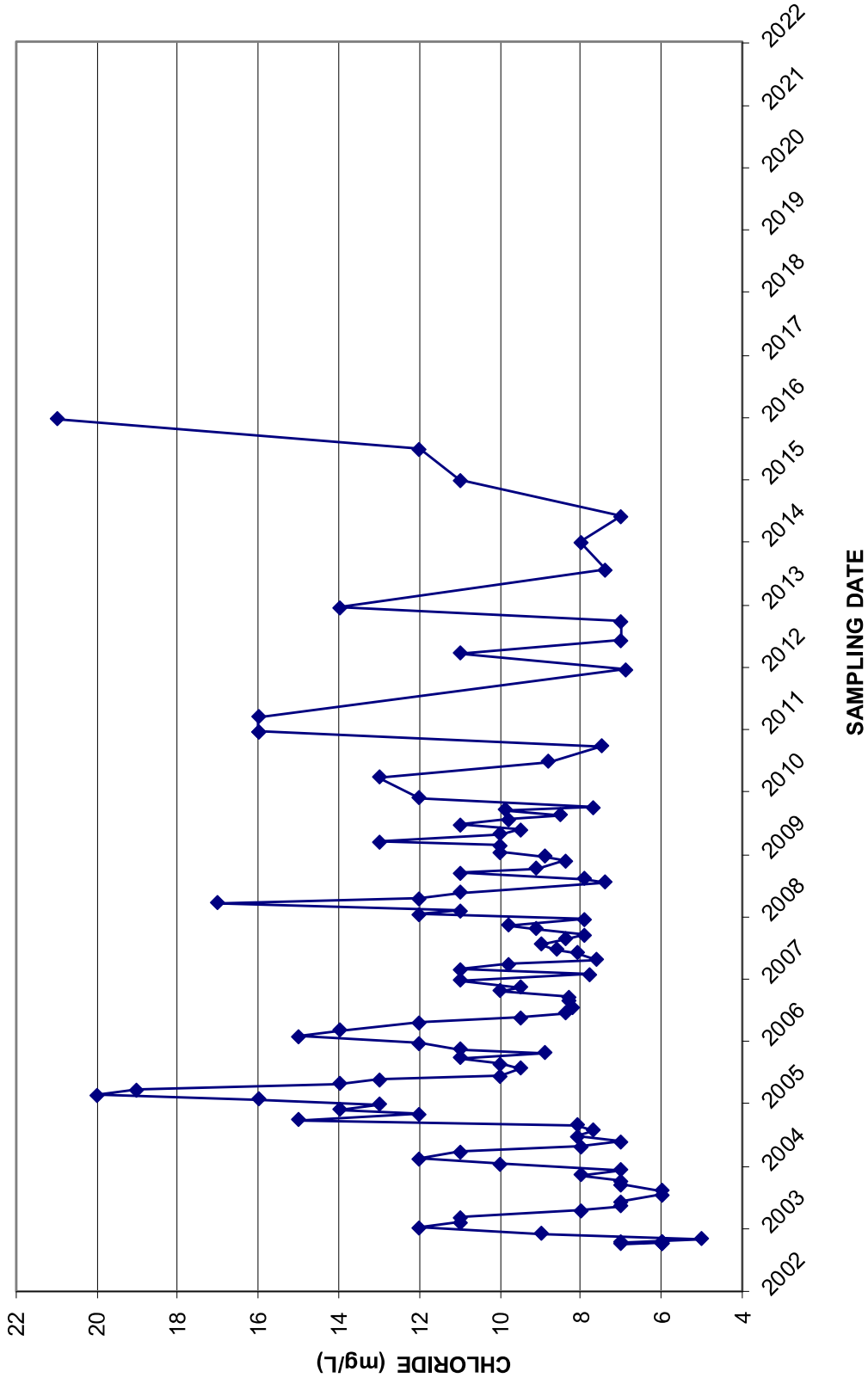
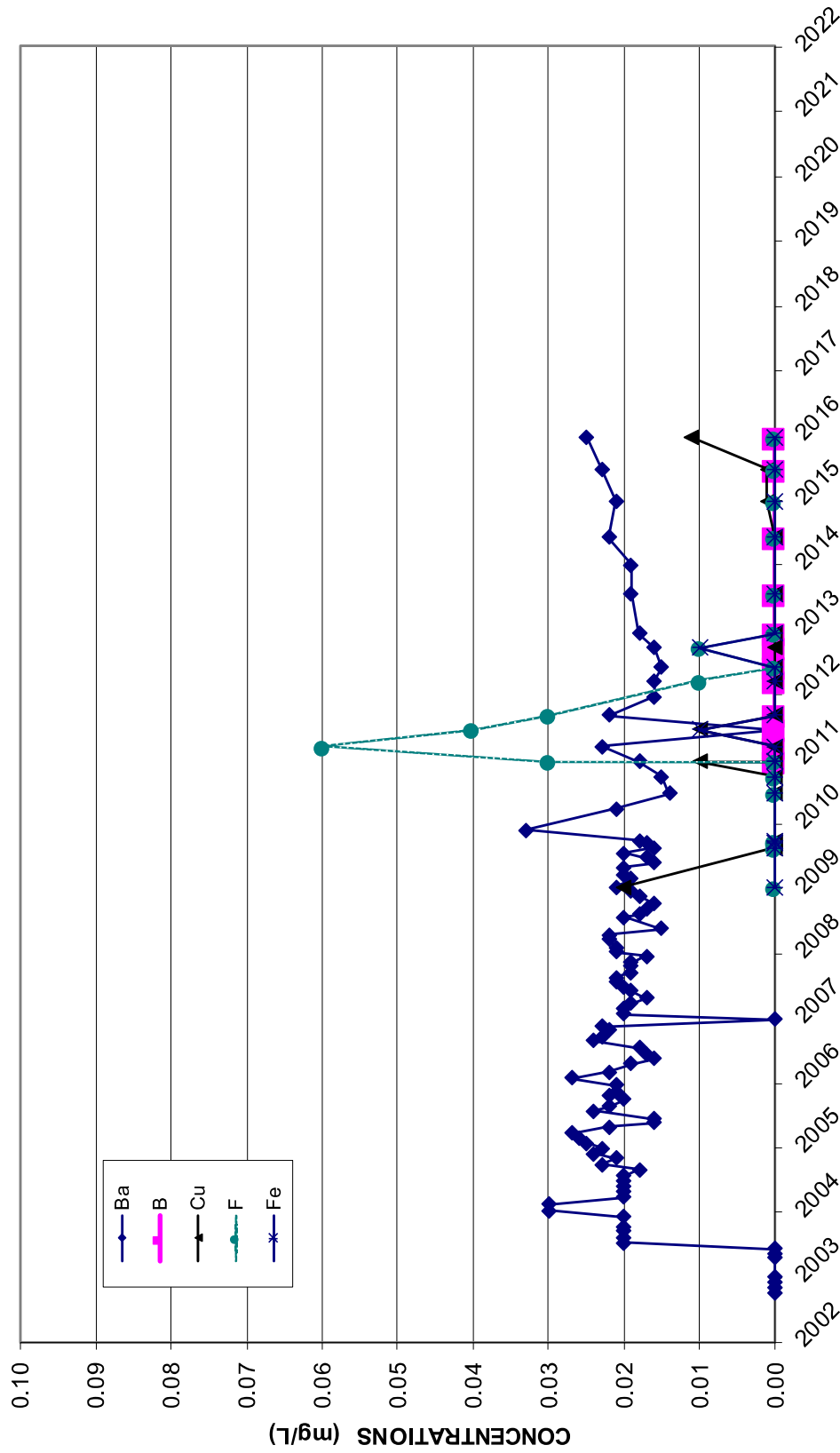


Fig. 1e: Concentration of chloride in the injected water.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 1f. BARIUM, BORON, COPPER, FLUORIDE, AND IRON DATA FOR  
INJECTION WATER/INJECTATE**



**SAMPLING DATE**

Fig. 1f: Concentration of barium, boron, copper, fluoride, and iron in the injected water.



**Monitoring Well GV4 Water Quality Laboratory Analysis**

Groundwater from monitoring well GV4 was sampled and analyzed in a laboratory on a quarterly basis according to permit requirements. Laboratory analyses include total dissolved solids (TDS), electric conductivity (EC), and pH; as well as routine domestic compounds (see Attachment 1) and total trihalomethanes (TTHM). Laboratory results can be found in Appendix 1. Samples were collected from the well with a portable submersible pump. The total volume of water pumped from the well was monitored during this process. Table 5 summarizes the laboratory analyses for monitoring well GV4 during the 2021 period. Figures 2a through 2f illustrate the concentrations of various constituents in the groundwater analyzed throughout the year.

Table 5: Summary of Laboratory Analyses for Monitoring Well GV4 2021

Sample Date	HCO <sub>3</sub>	CO <sub>3</sub>	Alka-linity	TDS	Cl	F	SO <sub>4</sub>	NO <sub>3</sub> -N	Si	Ba	B	Ca	Cu	Fe	Mg	Mn	K	Na	Zn	As
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
01/21/21	130	<1.0	130	310	44	<.30	27	14	4	0.03	<0.10	31	<0.040	<0.10	27	<0.010	6	25	2.2	<0.002
05/27/21	220	<1.0	220	500	47	<.30	29	26	32	0.064	<0.10	74	<0.040	<0.10	35	<0.010	6.2	27	0.77	<0.002
07/28/21	120	<1.0	120	300	46	<.30	26	24	3	0.025	<0.10	32	<0.040	<0.10	34	<0.010	5.9	24	0.41	<0.002
11/8/21	210	<2.0	210	550	52	<0.1	29	27	31	0.07	<0.05	80	<0.002	<0.05	37	0.003	5.9	27	0.71	<0.002

Sample Date	Turbidity	pH	EC	Total Trihalomethanes			
				Chloroform	Bromodichloromethane	Dibromochloromethane	Bromoform
	NTUs	pHUnits	umhos/cm	ug/L	ug/L	ug/L	ug/L
01/21/21	2.90	7.88	600	<0.500	<0.500	<0.500	<0.500
05/27/21	1.20	7.77	800	<0.500	<0.500	<0.500	<0.500
07/28/21	0.90	8.06	640	<0.500	<0.500	<0.500	<0.500
11/8/21	1.2	7.87	820	<1	<1	<0.500	<1

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 2a. TOTAL DISSOLVED SOLIDS (TDS) DATA FOR  
MONITORING WELL GV4**

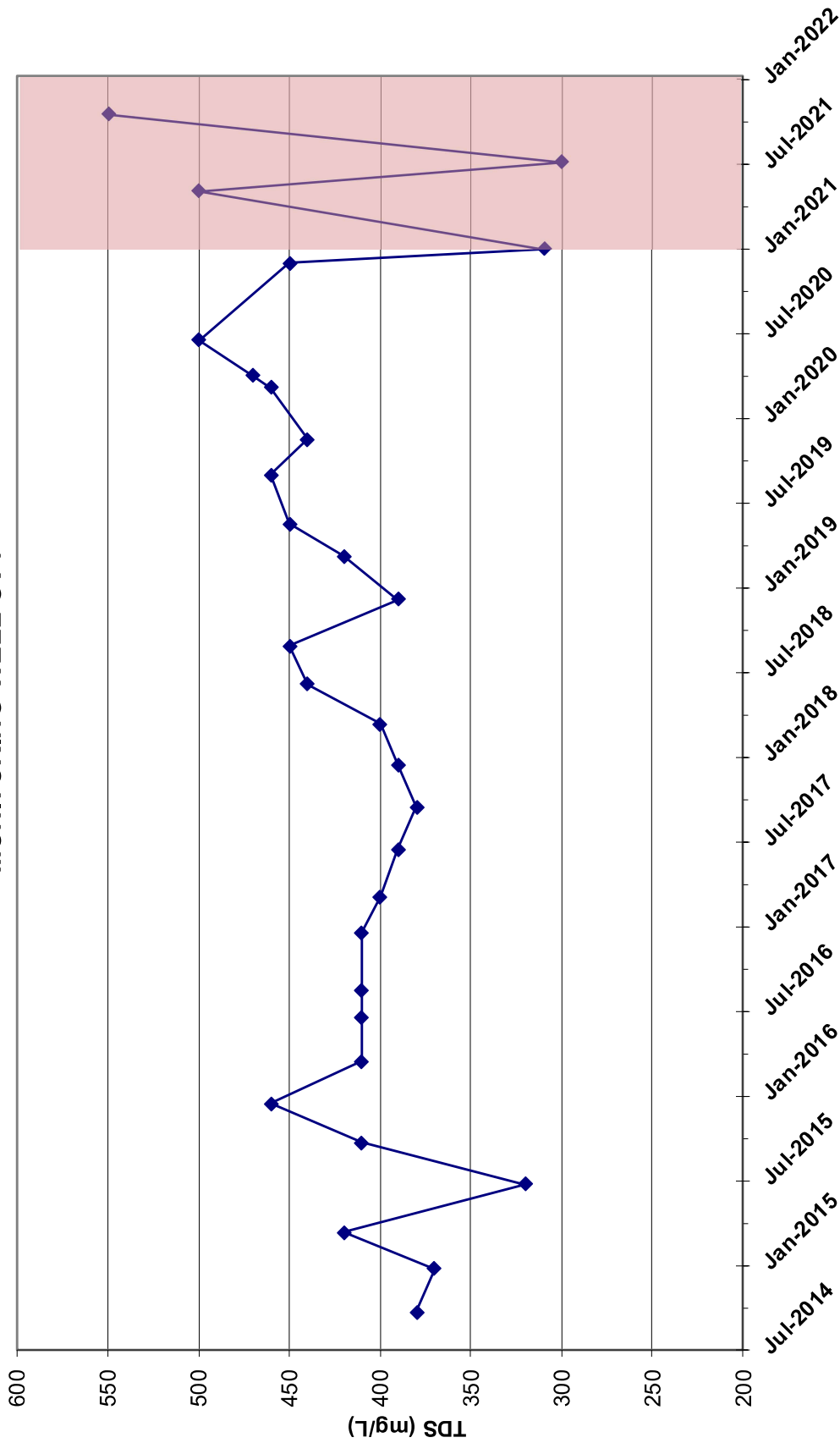


Fig. 2a: Concentration of Total Dissolved Solids (TDS) in groundwater from monitoring well GV4.  
Shaded area represents the 2021 monitoring period.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 2b. pH DATA FOR  
MONITORING WELL GV4**

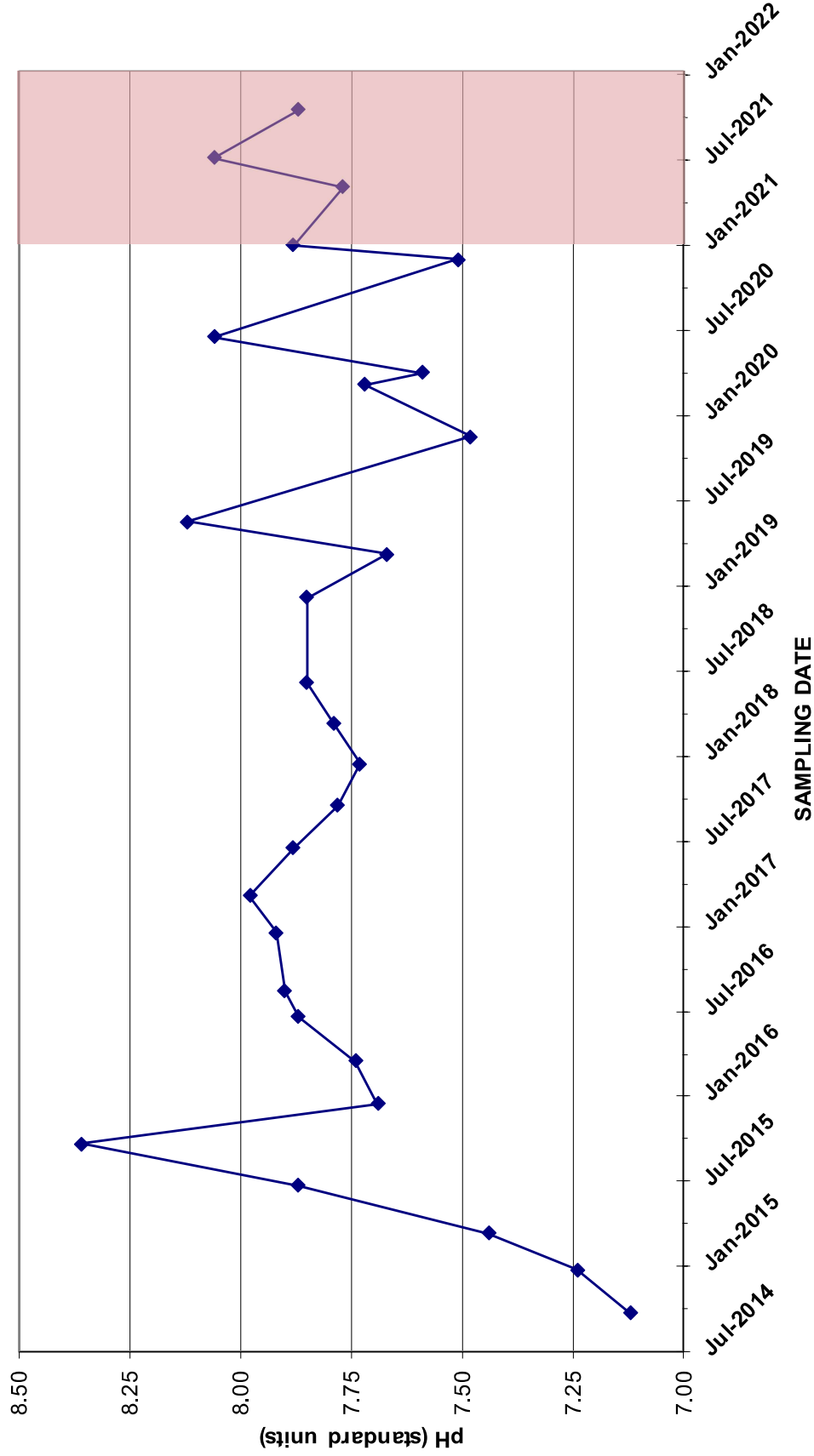


Fig. 2b: pH of groundwater from monitoring well GV4.  
Shaded area represents the 2021 monitoring period.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 2c. NITRATE AS N DATA FOR  
MONITORING WELL GV4**

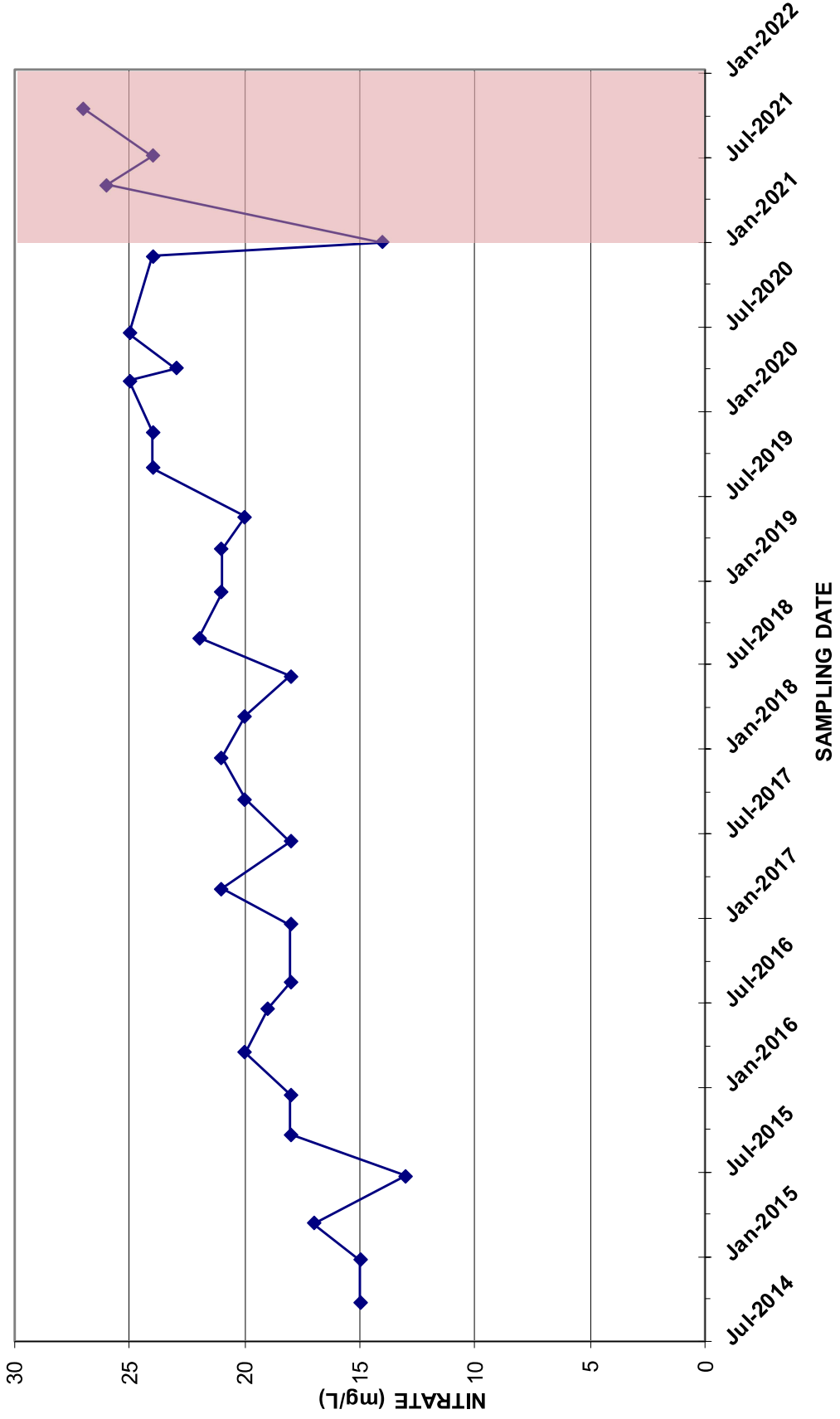


Fig. 2c: Concentration of nitrate in groundwater from monitoring well GV4.  
Shaded area represents the 2021 monitoring period.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 2d. SULFATE DATA FOR  
MONITORING WELL GV4**

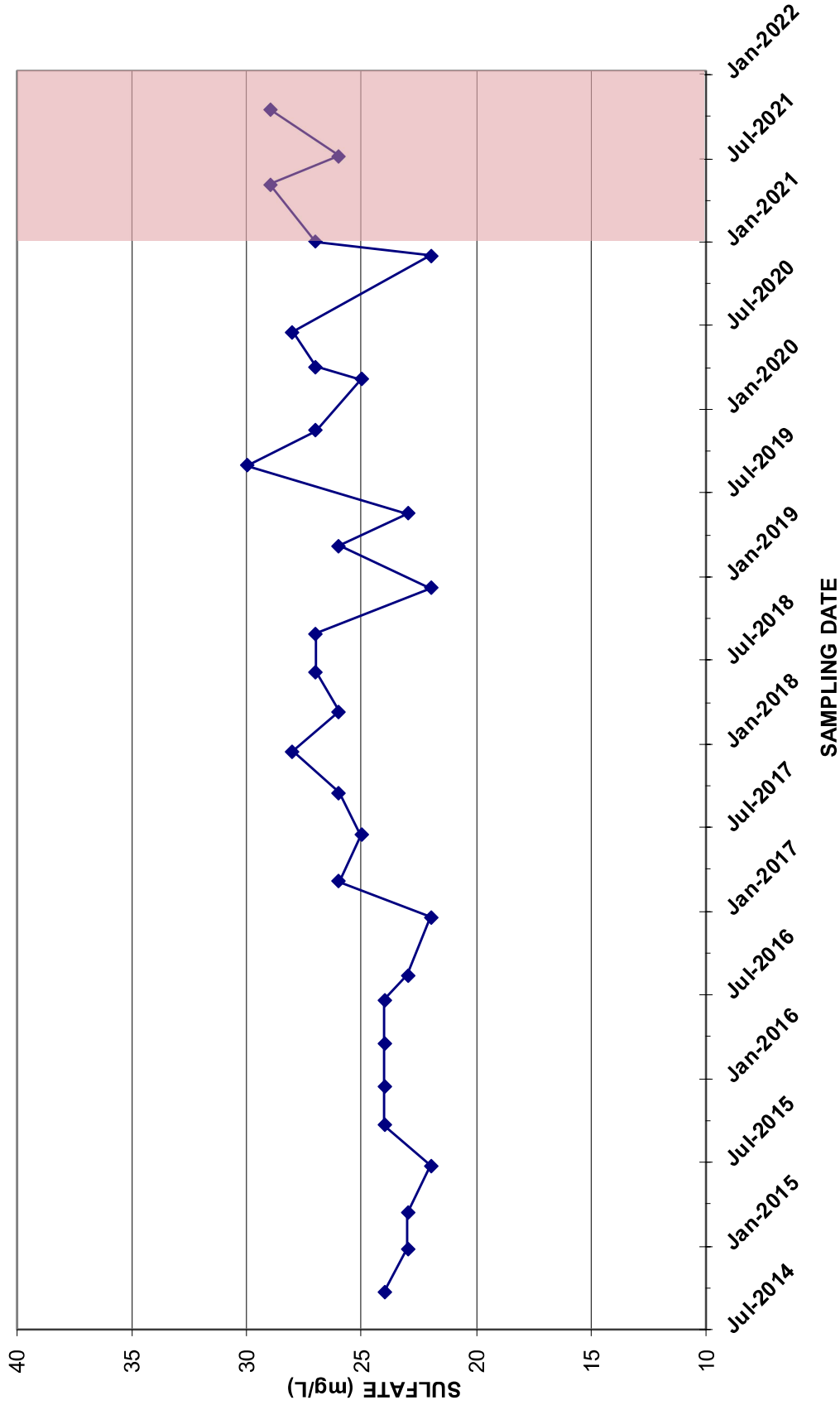


Fig. 2d: Concentration of sulfate in groundwater from monitoring well GV4.  
Shaded area represents the 2021 monitoring period.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 2e. CHLORIDE DATA FOR  
MONITORING WELL GV4**

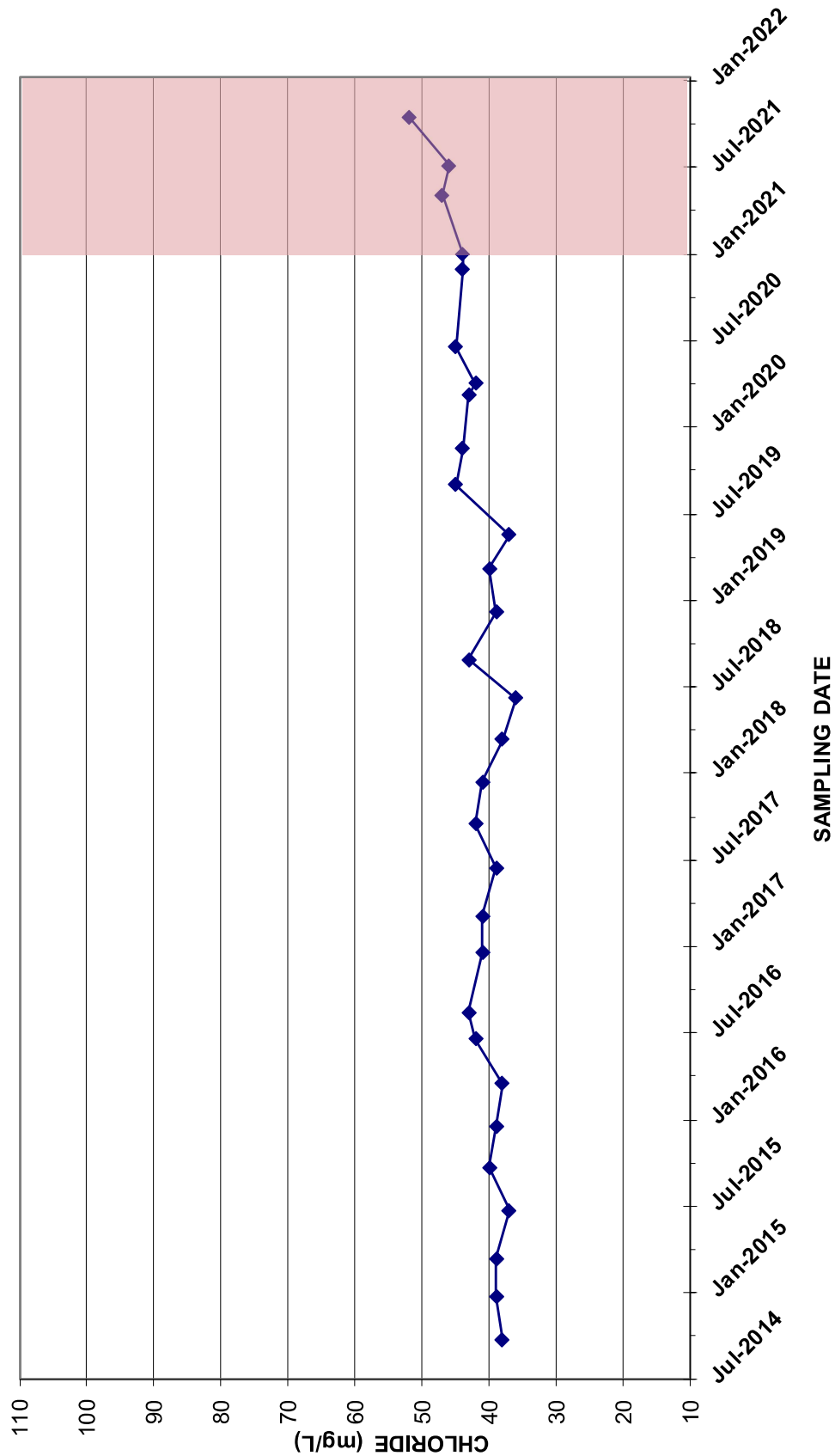
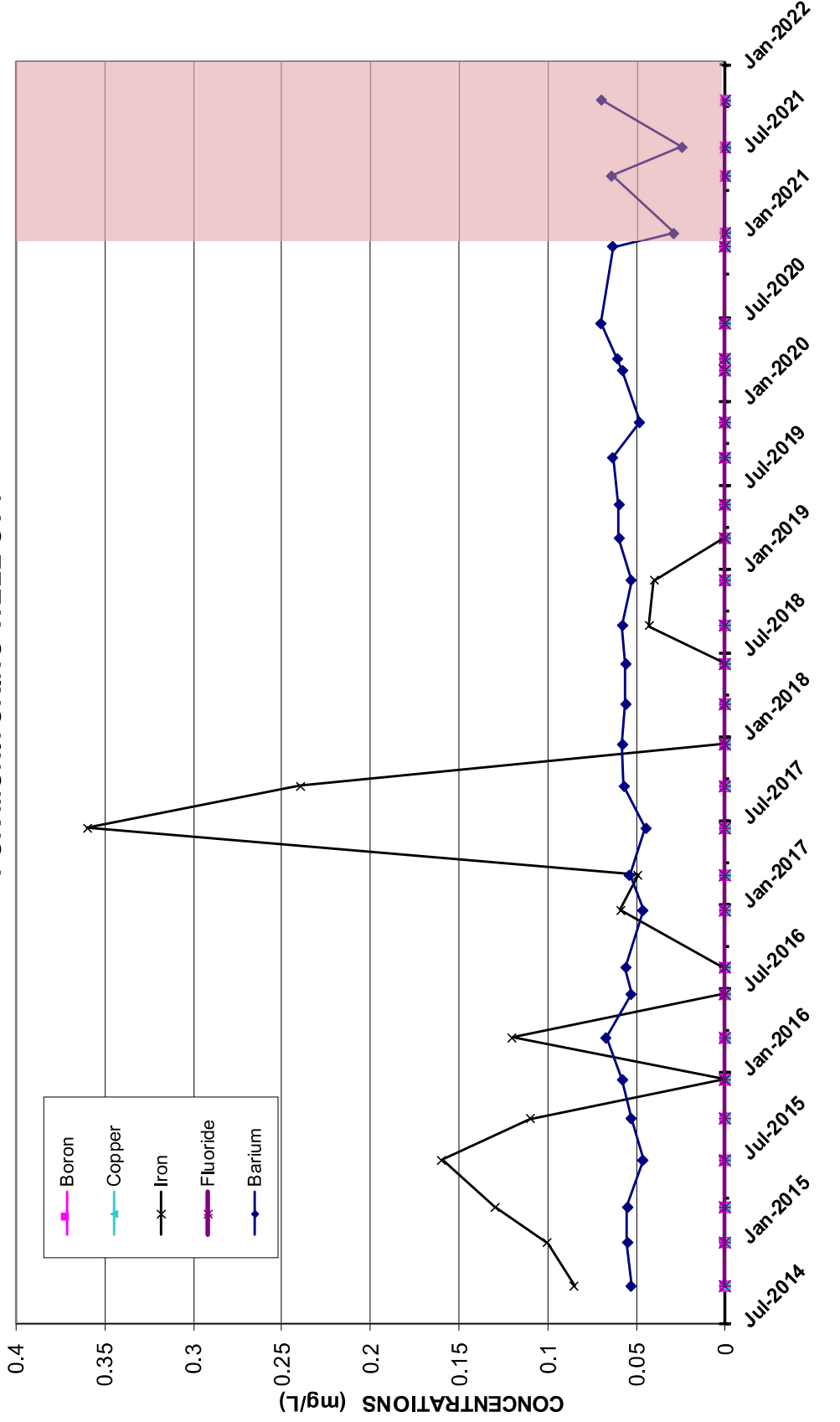


Fig. 2e: Concentration of chloride in groundwater from monitoring well GV4.  
Shaded area represents the 2021 monitoring period.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 2f. BARIUM, BORON, COPPER, FLUORIDE, AND IRON DATA FOR MONITORING WELL GV4**



**Fig. 2f:** Concentration of barium, boron, copper, fluorine, and iron in groundwater from monitoring well GV4. Shaded area represents the 2021 monitoring period.



### **Monitoring Well GV3 Water Quality Laboratory Analysis**

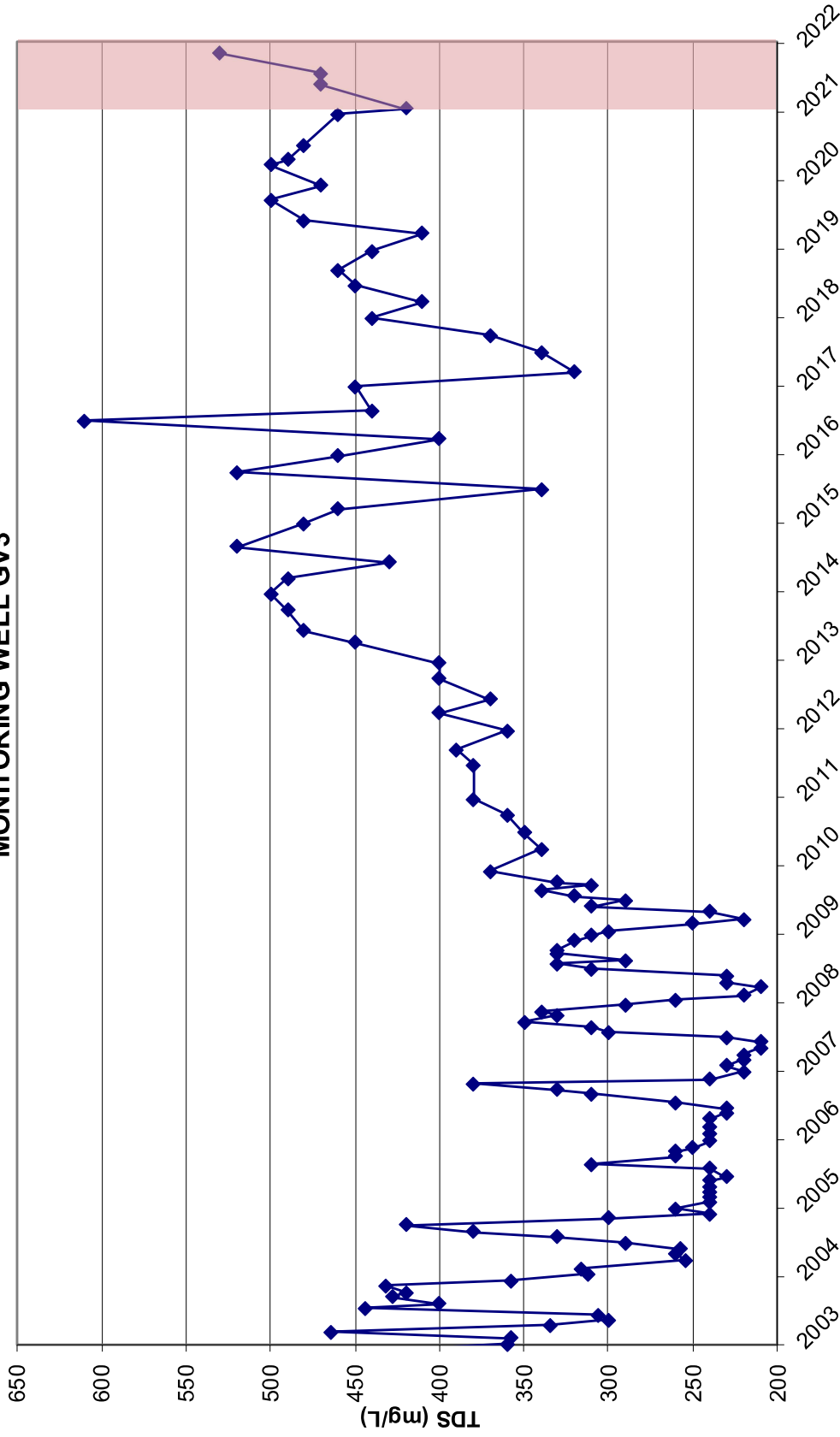
Groundwater from monitoring well GV3 was sampled and analyzed in a laboratory on a quarterly basis according to permit requirements. Laboratory analyses include total dissolved solids (TDS), electric conductivity (EC), and pH; as well as routine domestic compounds (see Attachment 1) and total trihalomethanes (TTHM). Laboratory results can be found in Appendix 1. Samples were collected from the well with a portable submersible pump. The total volume of water pumped from the well was monitored during this process. Table 6 summarizes the laboratory analyses for monitoring well GV3 during the 2021 monitoring period. Figures 3a through 3f illustrate the concentrations of various constituents in the groundwater analyzed throughout the year.

Table 6: Summary of Laboratory Analyses for Monitoring Well GV3 20

Sample Date	HCO <sub>3</sub> <sup>-</sup>	CO <sub>3</sub> <sup>-</sup>	Alka- linity	TDS	Cl	F	SO <sub>4</sub>	NO <sub>3</sub> <sup>-</sup>	N	Si	Ba	B	Ca	Cu	Fe	Mg	Mn	K	Na	Zn	As
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
01/21/21	130	<1.0	130	420	92	<.30	38	10	45.3	0.16	<0.10	66	66	<0.040	<0.10	27	<0.010	3.5	22	0.029	<0.005
05/27/21	140	<1.0	140	470	90	<.30	39	11	44	0.160	<0.10	67	67	<0.040	<0.10	25	<0.010	3.3	24	0.096	<0.005
07/28/21	150	<1.0	150	470	91	<.30	36	11	41.6	0.14	<0.10	70	70	<0.040	<0.10	30	<0.010	3.3	22	0.026	<0.005
11/08/21	160	<2.0	160	530	88	<0.1	41	14	42	0.140	<0.05	79	79	<0.002	<0.05	35	<0.002	3.8	24	0.020	0.002

Sample Date	Turbidity	pH	EC	Total Trihalomethanes				
				Chloroform	Bromodichloromethane	Dibromochloromethane	Bromoform	Total
	NTUs	pH Units	umhos/cm	ug/L	ug/L	ug/L	ug/L	ug/L
01/21/21	0.74	7.32	720	0.61	<0.500	<0.500	<0.500	0.61
05/27/21	2.10	7.35	700	0.84	<0.500	<0.500	<0.500	0.84
07/28/21	0.28	7.35	750	0.75	<0.500	<0.500	<0.500	0.75
11/08/21	0.50	7.68	780	12.2	2.43	<0.500	<1	14.6

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 3a. TOTAL DISSOLVED SOLIDS (TDS) DATA FOR  
MONITORING WELL GV3**



**SAMPLING DATE**  
Fig. 3a: Concentration of Total Dissolved Solids (TDS) in groundwater from monitoring well GV3.  
Shaded area represents the 2021 monitoring period.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 3b. pH DATA FOR  
MONITORING WELL GV3**

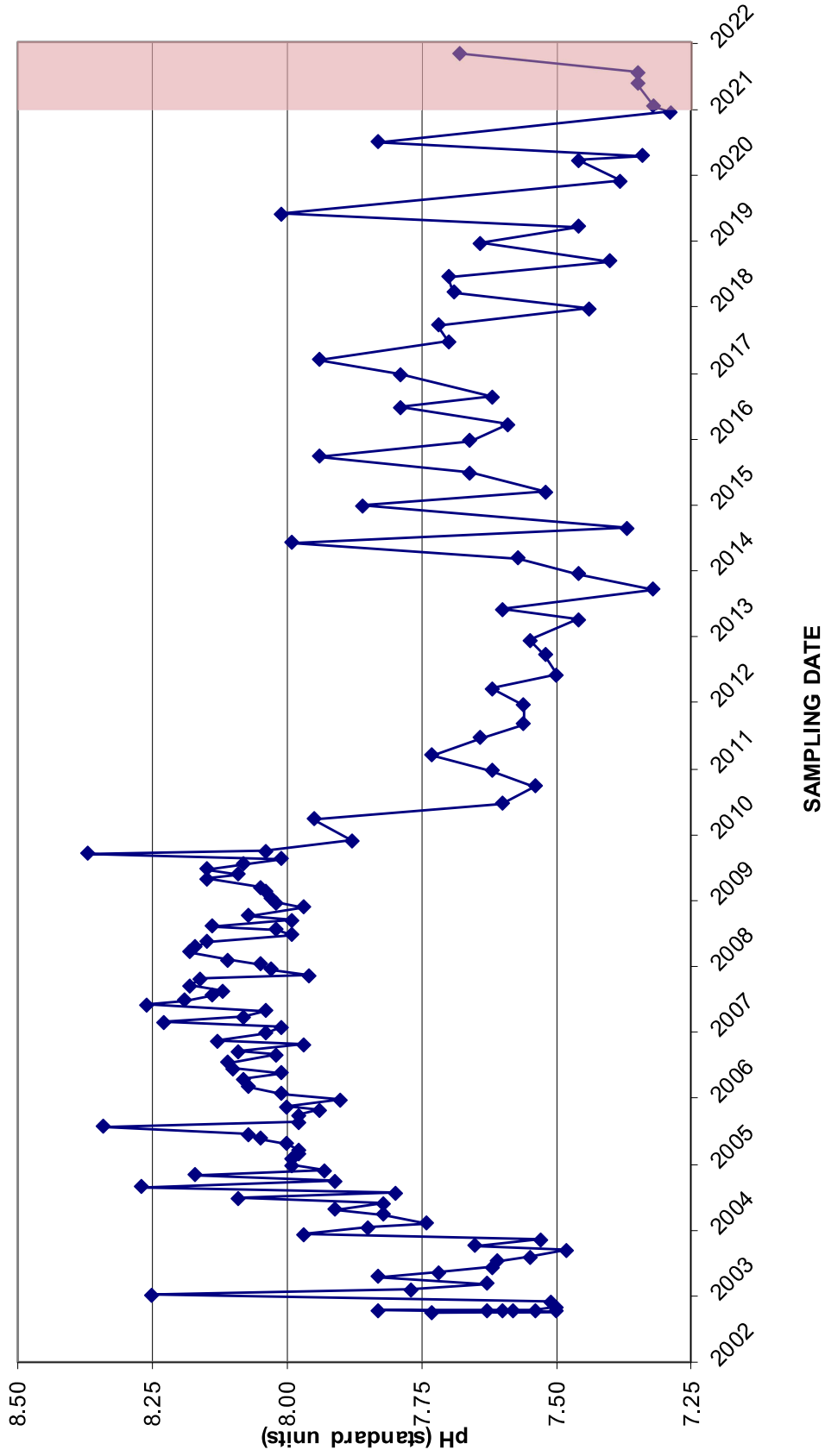


Fig. 3b: pH of groundwater from monitoring well GV3.  
Shaded area represents the 2021 monitoring period.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 3c. NITRATE AS N DATA FOR  
MONITORING WELL GV3**

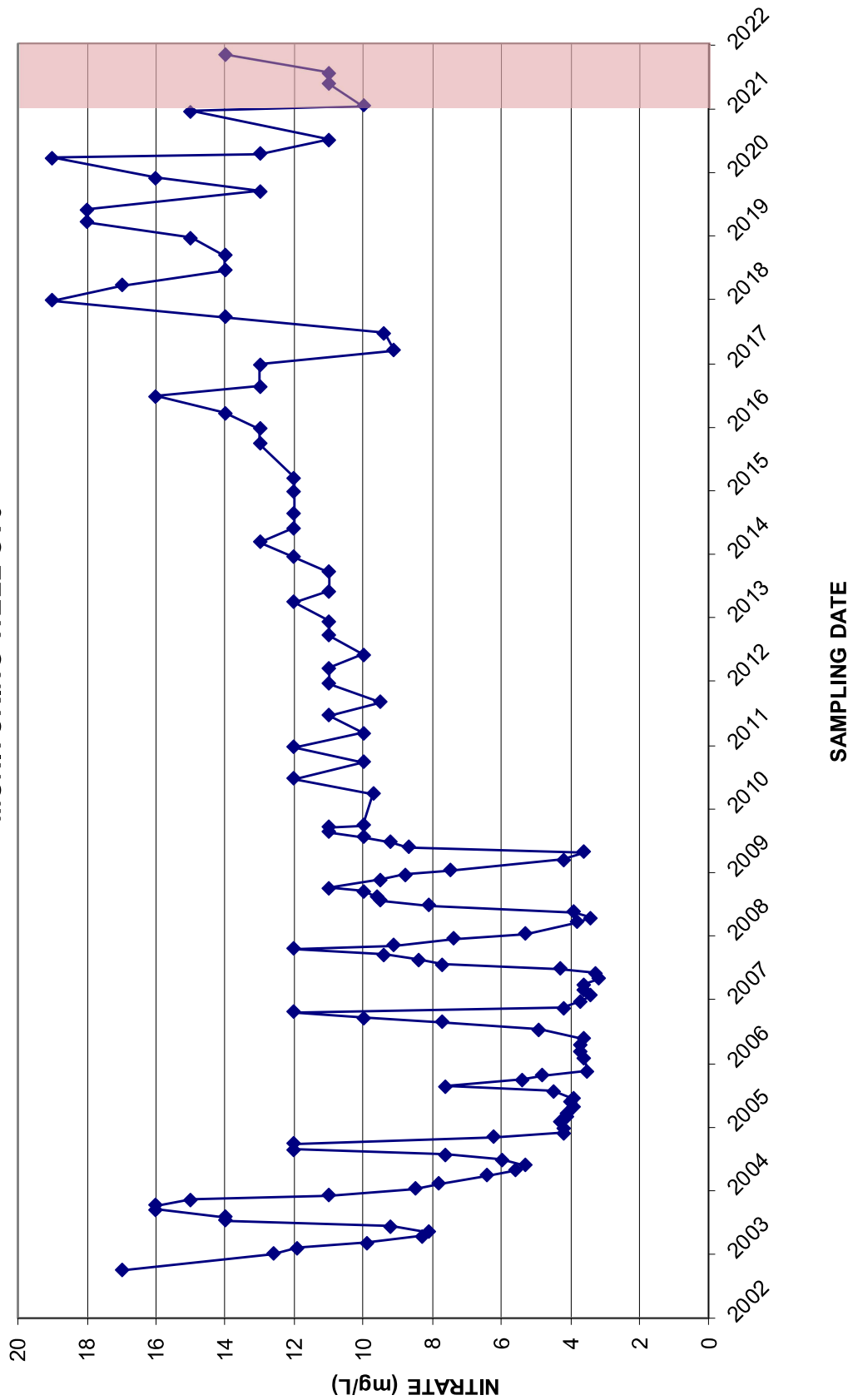


Fig. 3c: Concentration of nitrate in groundwater from monitoring well GV3.  
Shaded area represents the 2021 monitoring period.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 3d. SULFATE DATA FOR  
MONITORING WELL GV3**

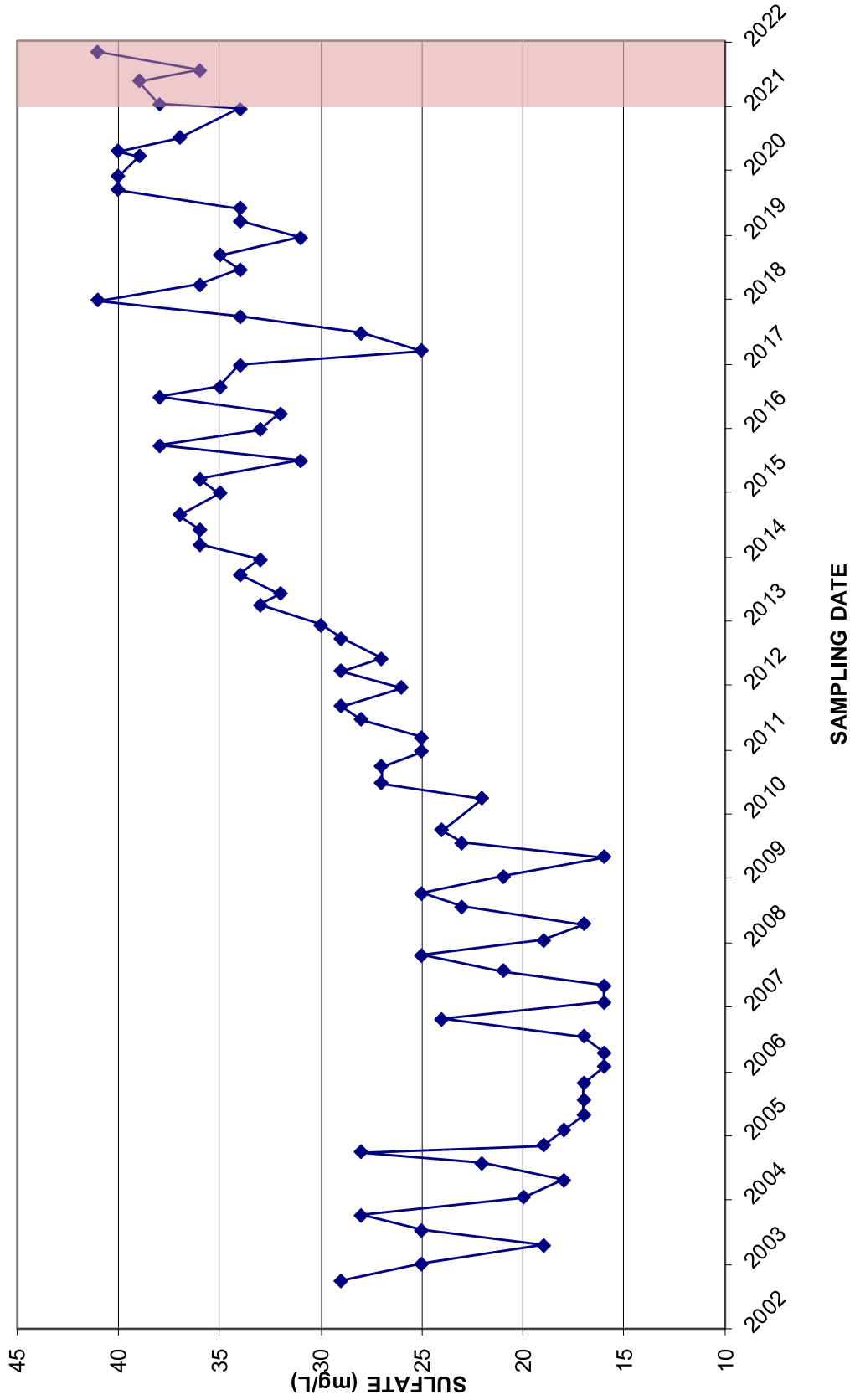


Fig. 3d: Concentration of sulfate in groundwater from monitoring well GV3.  
Shaded area represents the 2021 monitoring period.

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**FIGURE 3e. CHLORIDE DATA FOR  
MONITORING WELL GV3**

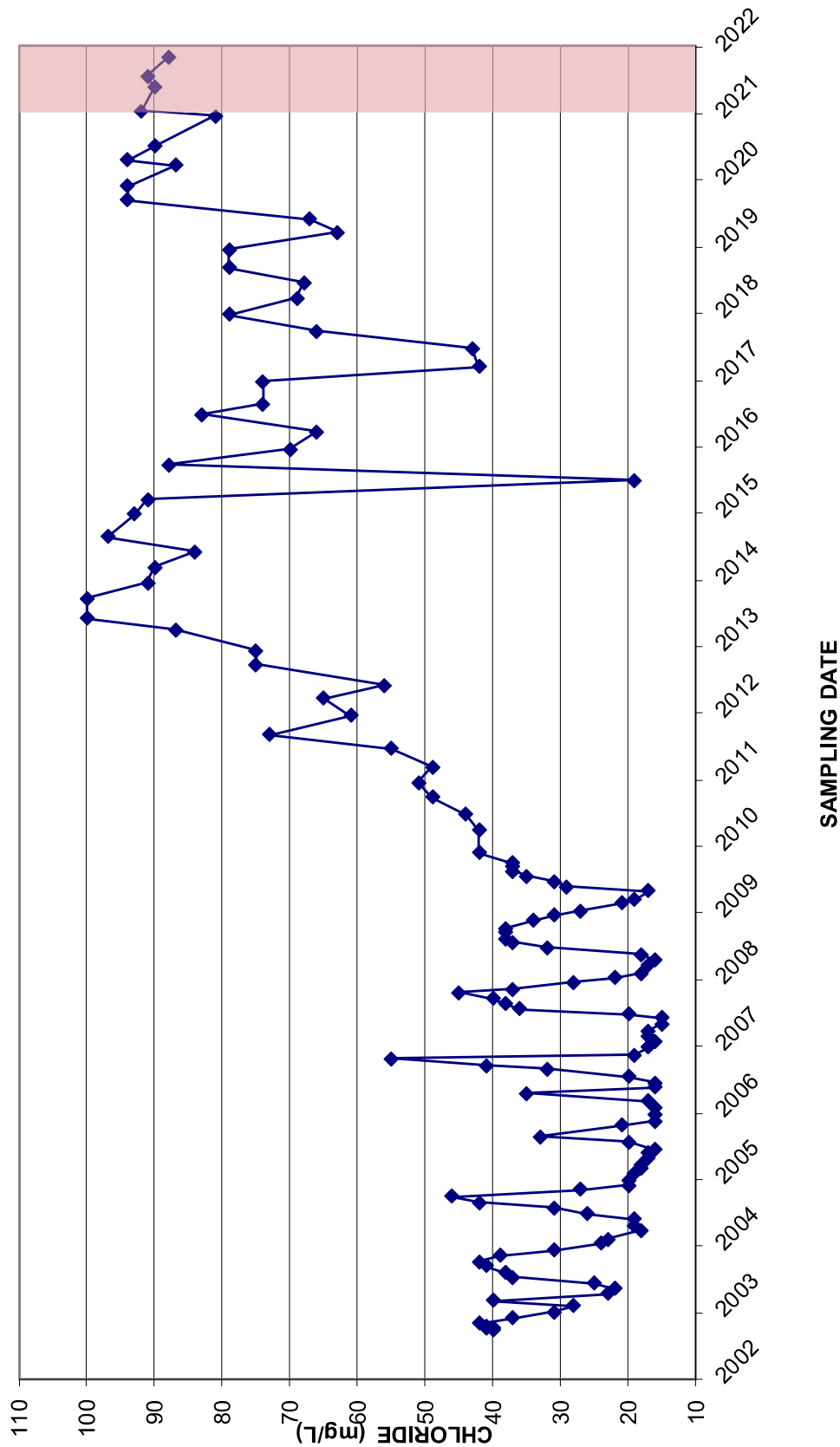


Fig. 3e: Concentration of chloride in groundwater from monitoring well GV3.  
Shaded area represents the 2021 monitoring period.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 3f. BARIUM, BORON, COPPER, FLUORIDE, AND IRON DATA  
FOR MONITORING WELL GV3**

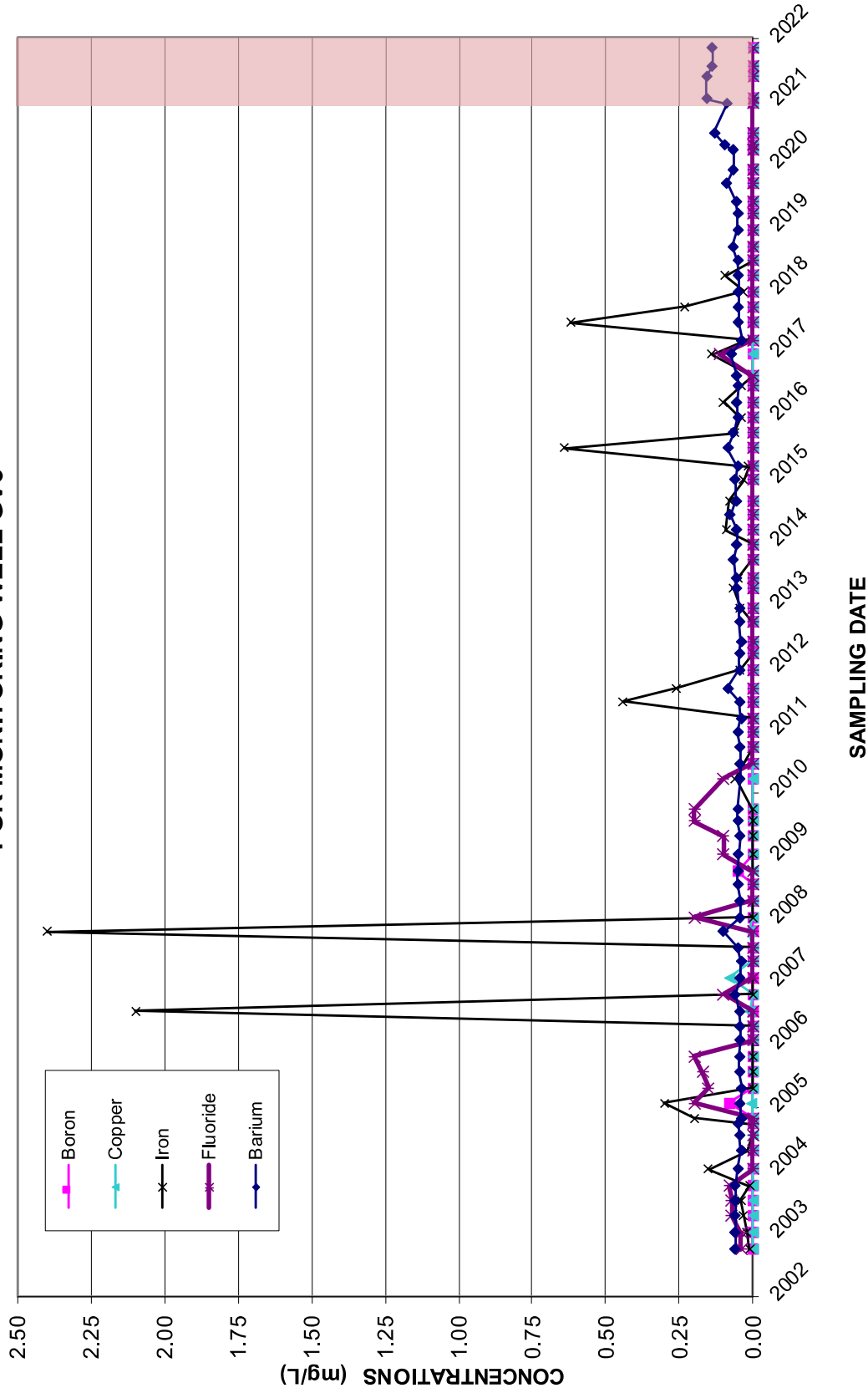


Fig. 3f: Concentration of barium, boron, copper, fluoride, and iron in groundwater from monitoring well GV3. Shaded area represents the 2021 monitoring period.



### **Domestic Well Pendill (Puryear) Water Quality Laboratory Analyses**

Groundwater from domestic well Pendill (Puryear) was sampled and analyzed in a laboratory on a quarterly basis according to permit requirements. Laboratory analyses include total dissolved solids (TDS), electric conductivity (EC), and pH; as well as routine domestic compounds (see Attachment 1) and total trihalomethanes (TTHM). Laboratory results can be found in Appendix 1. Water was collected from a spigot next to the well. Table 7 summarizes the laboratory analyses for domestic well Pendill (Puryear) during the 2021 monitoring period. Figures 4a through 4f illustrate fluctuations of the concentrations of various constituents in the groundwater analyzed throughout the year.

Table 7: Summary of Laboratory Analyses for Pendill (Puryear) Monitoring/Domestic Well 2020

Sample Date	HCO <sub>3</sub> <sup>-</sup> mg/L	CO <sub>3</sub> mg/L	Alka- linity mg/L	TDS mg/L	Cl mg/L	F mg/L	SO <sub>4</sub> mg/L	NO <sub>3</sub> - N mg/L	Si mg/L	Ba mg/L	B mg/L	Ca mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	K mg/L	Na mg/L	Zn mg/L	As mg/L
01/21/21	130	<1.0	130	350	58	<.30	27	7.0	34.7	0.19	<0.10	57	<0.040	0.81	19	<0.010	3.4	18	0.340	<0.005
05/27/21	140	<1.0	140	700	54	<.30	27	7.4	35	0.20	<0.10	56	<0.040	0.18	16	<0.010	3.5	19	0.320	<0.005
07/28/21	130	<1.0	130	200	21	<.30	14	2.2	33.9	0.11	<0.10	36	<0.040	0.10	11	<0.010	3.3	14	0.270	<0.005
11/08/21	120	<2.0	120	370	46	<0.1	23	6.4	35	0.18	<0.05	52	<0.002	0.37	17	0.007	3.3	17	0.150	<0.002

Sample Date	Turbidity NTUs	pH	EC umhos/cm	Total Trihalomethanes			Total ug/L
				Chloroform ug/L	Bromodichloromethane ug/L	Dibromochloromethane ug/L	
03/26/20	3.60	7.33	550	7.96	<0.500	<0.500	8.45
04/21/20	1.80	7.62	510	10.4	<0.500	<0.500	10.4
07/07/20	4.60	7.88	530	12.5	0.86	<0.500	13.4
12/21/20	2.00	7.27	520	16	0.54		16

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 4a. TOTAL DISSOLVED SOLIDS (TDS) DATA FOR  
PENDILL (PURYEAR) DOMESTIC WELL**

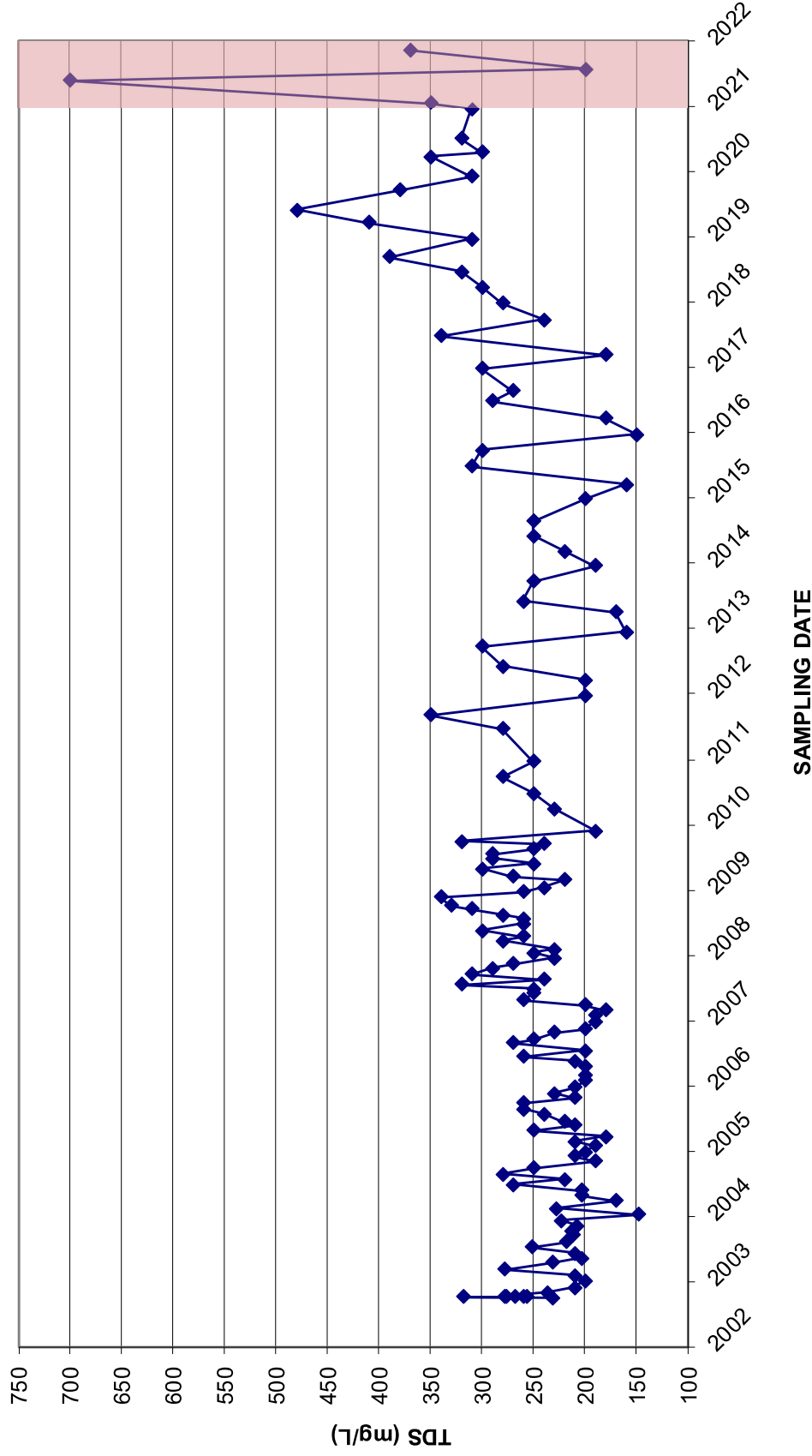
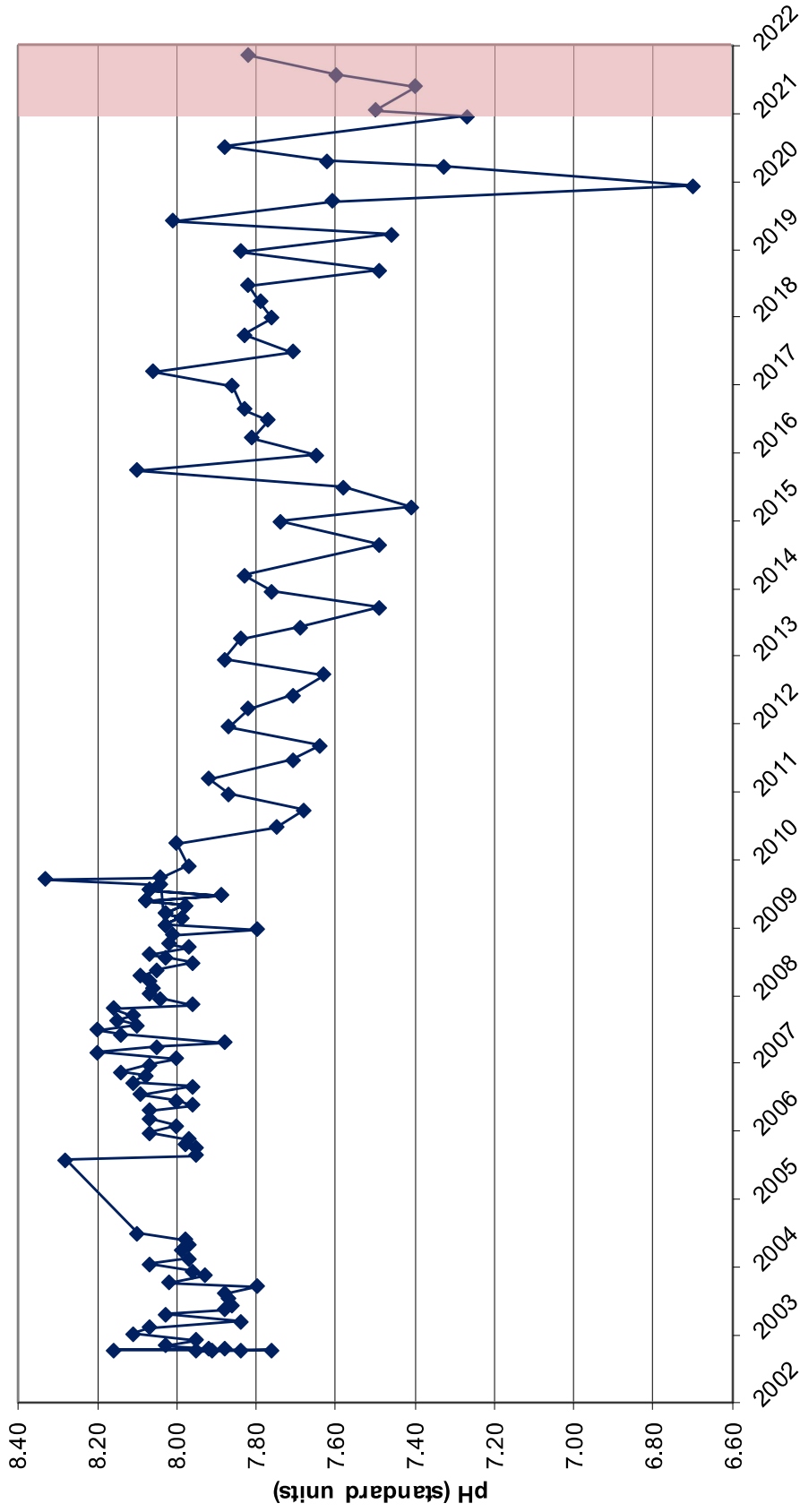


Fig. 4a: Concentration of Total Dissolved Solids (TDS) in groundwater from domestic well Pendill (Purveyar).  
Shaded area represents the 2021 monitoring period.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 4b. pH DATA FOR  
PENDILL (PURYEAR) DOMESTIC WELL**



**SAMPLING DATE**

Fig. 4b: pH of groundwater from domestic well Pendill (Puryear).  
Shaded area represents the 2021 monitoring period.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 4c. NITRATE DATA FOR  
PENDILL (PURYEAR) DOMESTIC WELL**

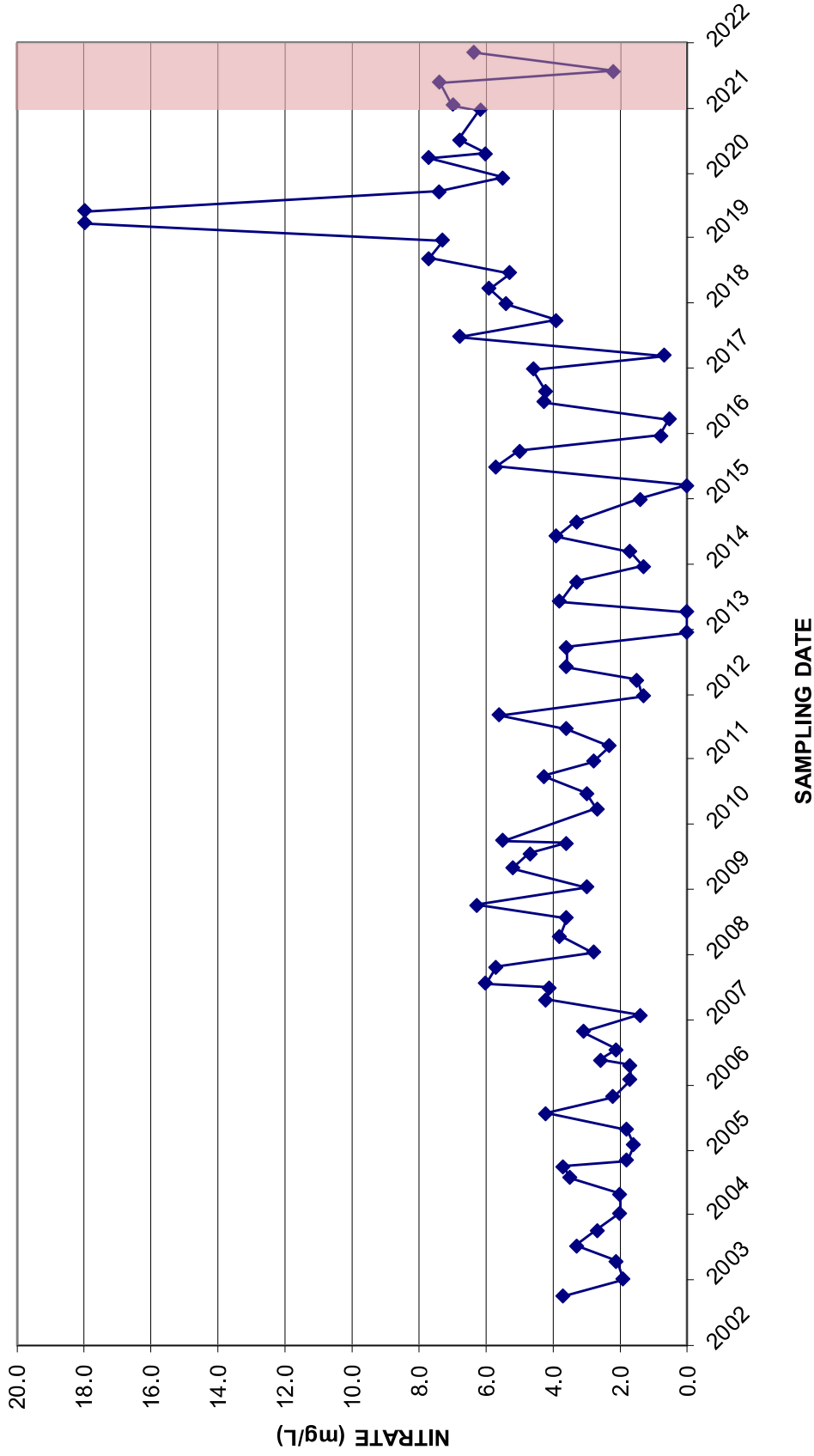


Fig. 4c: Concentration of nitrate in groundwater from domestic well Pendill (Puryear).  
Shaded area represents the 2021 monitoring period.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 4d. SULFATE DATA FOR  
PENDILL (PURYEAR) DOMESTIC WELL**

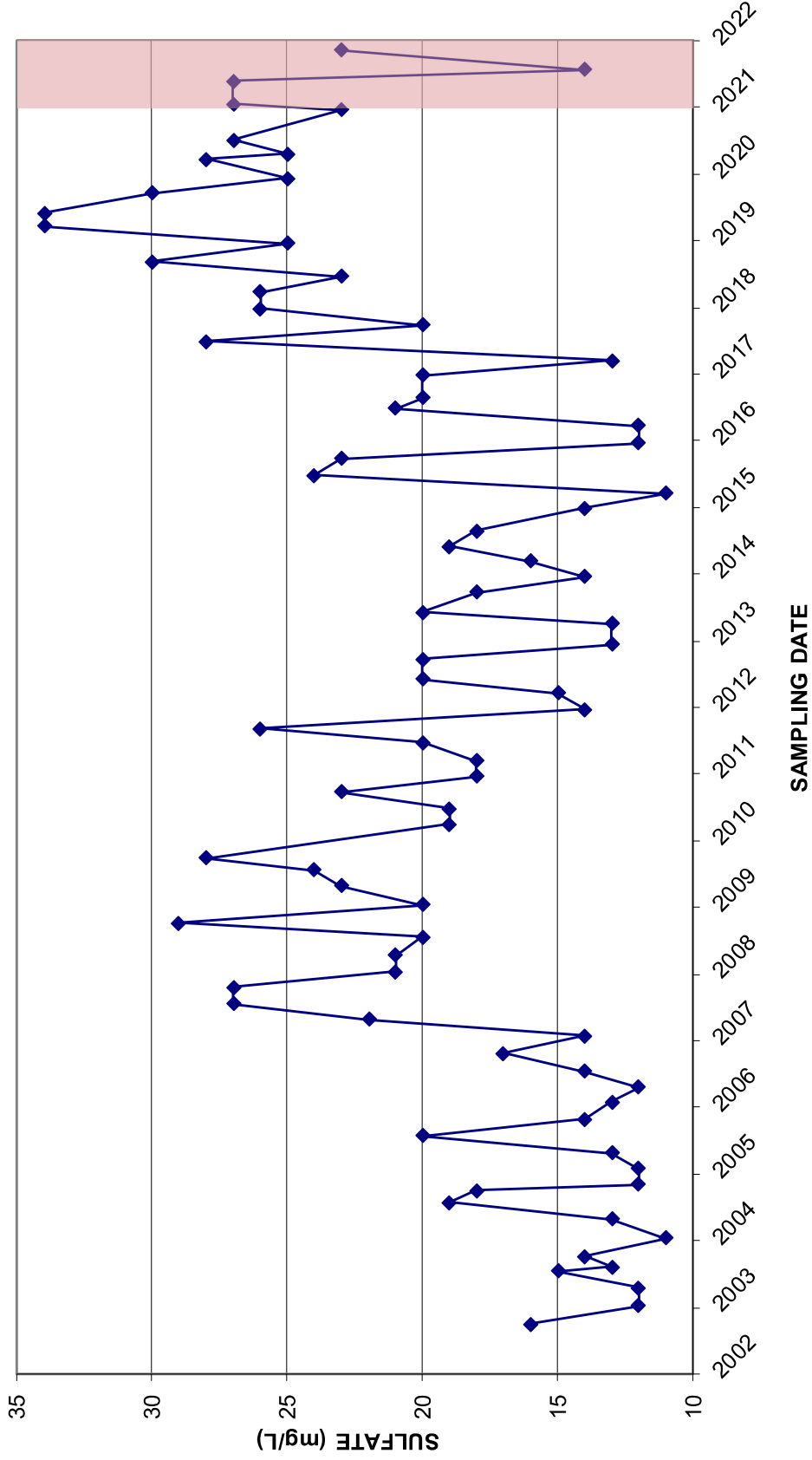
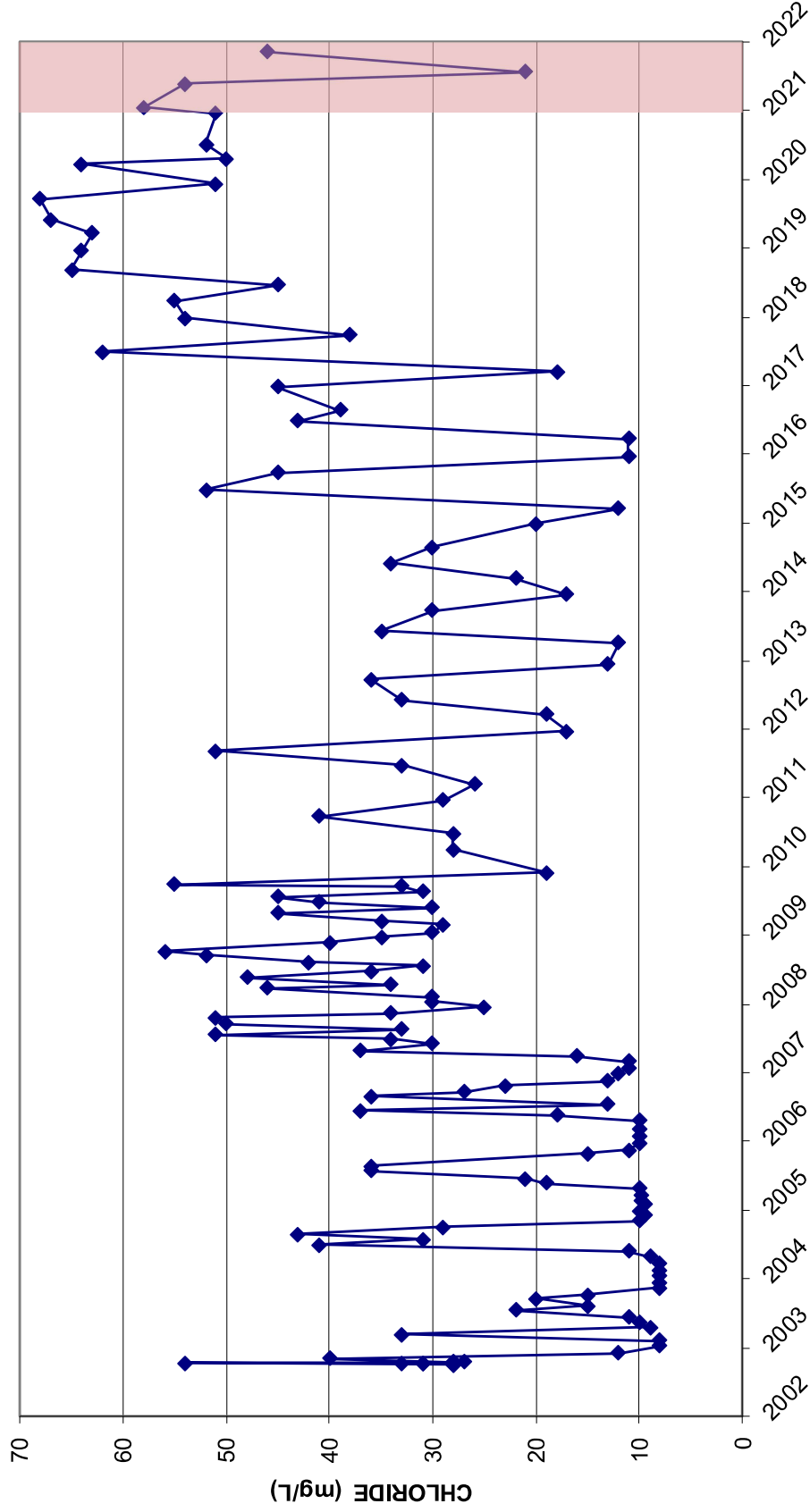


Fig. 4d: Concentration of sulfate in groundwater from domestic well Pendill (Puryear). Shaded area represents the 2021 monitoring period.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 4e. CHLORIDE DATA FOR  
PENDILL (PURYEAR) DOMESTIC WELL**



**Fig. 4e:** Concentration of chloride in groundwater from domestic well Pendill (Puryear).  
Shaded area represents the 2021 monitoring period.

WASHOE COUNTY ARTIFICIAL RECHARGE PROJECT  
**FIGURE 4f. BARIUM, FLUORIDE, IRON, COPPER, BORON DATA FOR  
 PENDILL (PURYEAR) DOMESTIC WELL**

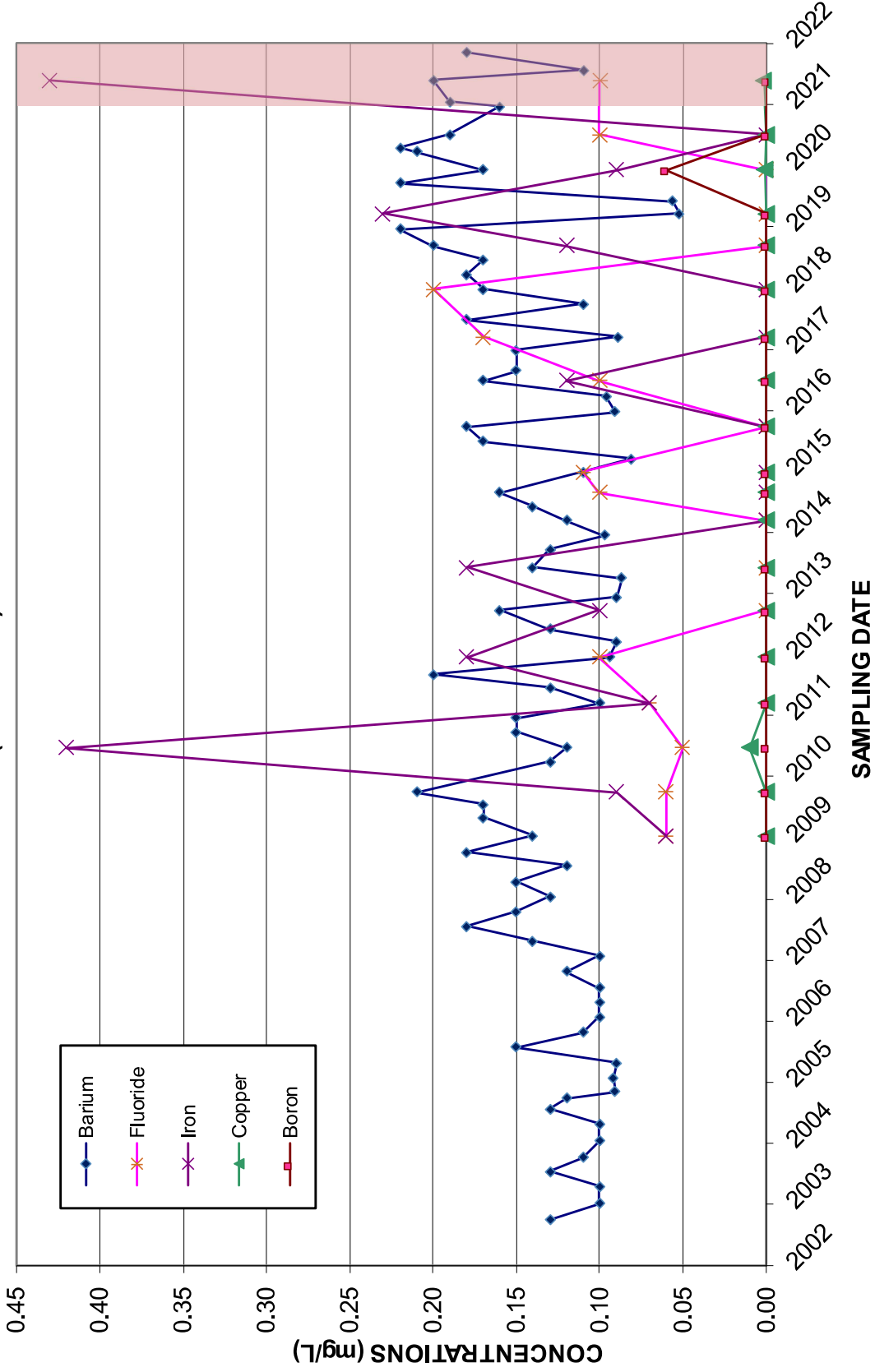


Fig. 4f: Concentration of barium, boron, copper, fluoride, and iron in groundwater from domestic well Pendill (Puryear). Shaded area represents the 2021 monitoring period.



**Field Water Quality Analyses**

Field analyses were completed quarterly when possible on the injection water and the GV4, GV3, and Pendill (Puryear) monitoring/domestic wells according to permit requirements. A YSI multi probe system was used to collect field data. The data collected during field analyses includes pH, specific conductivity, sample temperature, dissolved oxygen (DO), oxygen reduction potential (ORP), free chlorine, and total residual chlorine. Table 8 summarizes the field data collected from the four sites during the 2021 monitoring period.

Table 8: Summary of Field Water Quality Analyses

<b>Injection Water</b>						
Sample Date	pH	Specific Conductivity (µS/cm)	Sample Temp. (°C)	Dissolved Oxygen (mg/L)	Free Avail. Chlorine	Total Resid. Chlorine
-	-	-	-	-	-	-
<b>GV4 Monitoring Well</b>						
Sample Date	pH	Specific Conductivity (µS/cm)	Sample Temp. (°C)	Dissolved Oxygen (mg/L)	Free Avail. Chlorine	Total Resid. Chlorine
1/21/2021	10.08	372.4	14.3	0.28	0.09	0.09
5/26/2021	9.49	695.0	16.1	0.47	0.06	0.06
7/28/2021	9.76	578.00	16.60	0.80	0.07	0.09
11/8/2021	9.92	703.0	14.3	2.42	0.02	0.04
<b>GV3 Monitoring Well</b>						
Sample Date	pH	Specific Conductivity (µS/cm)	Sample Temp. (°C)	Dissolved Oxygen (mg/L)	Free Avail. Chlorine	Total Resid. Chlorine
1/21/2021	9.9	606.3	14.5	1.1	0.02	0.04
5/27/2021	9.66	647.0	16.4	0.96	0.02	0.03
7/28/2021	9.68	609.00	17.60	1.40	0.09	0.11
11/8/2021	10.31	618.0	15	4.06	0.02	0.03
<b>Pendill (Puryear) Domestic Well</b>						
Sample Date	pH	Specific Conductivity (µS/cm)	Sample Temp. (°C)	Dissolved Oxygen (mg/L)	Free Avail. Chlorine	Total Resid. Chlorine
1/21/2021	10.24	489.7	13.7	0.96	0.07	0.07
5/27/2021	9.87	515.1	17.4	1.51	0.03	0.04
7/28/2021	9.79	535.00	27.20	0.95	0.01	0.04
11/8/2021	10.93	463.6	15.6	3.08	0.05	0.06

**Monitoring Well Water Levels**

Water levels were measured on a monthly basis when possible in monitoring wells GV4, GV3, the Pendill (Puryear) domestic well, GV5 and the Duncan domestic well. Global Positioning System was used to determine ground elevation at each monitoring well. Water level data were converted to elevation above mean sea level (msl) using the GPS elevation data. Water levels measured during the 2021 monitoring period for monitoring wells GV4, GV3, domestic well Pendill (Puryear), GV5 and the Duncan domestic well are summarized in Tables 9, 10, 11, 12 and 13 respectively. Figures 5, 6, 7 and 8 illustrate the fluctuation of water levels in monitoring wells GV4, GV3, domestic well Pendill (Puryear) and GV5 during the 2021 monitoring period respectively.

Table 9: Summary of Water Level Data for Monitoring Well GV4 2021

Height to top of casing from ground level: 2.47 ft  
 Ground Level Elevation: 5128.93 ft

Date of Measurement	Reading (ft)	Water Level Below Ground (ft)	Water Elevation Below Ground (ft)
1/21/2021	36.46	33.99	5094.94
2/16/2021	36.27	33.80	5095.13
3/23/2021	36.22	33.75	5095.18
4/29/2021	38.39	35.92	5093.01
5/20/2021	38.16	35.69	5093.24
6/4/2021	39.36	36.89	5092.04
7/19/2021	41.73	39.26	5089.67
8/12/2021	42.16	39.69	5089.24
9/23/2021	43.25	40.78	5088.15
10/25/2021	41.5	39.03	5089.90
11/8/2021	41.66	39.19	5089.74
12/8/2021	41.56	39.09	5089.84

Table 10: Summary of Water Level Data for Monitoring Well GV3 2021

Height to top of casing from ground level: 1.35 ft  
 Ground Level Elevation: 5145.96 ft

Date of Measurement	Reading (ft)	Water Level Below Ground (ft)	Water Elevation Below Ground (ft)
1/21/2021	43.74	42.39	5102.87
2/16/2021	43.61	42.26	5103.00
3/23/2021	43.31	41.96	5103.30
4/29/2021	44.2	42.85	5102.41
5/20/2021	44.85	43.50	5101.76
6/4/2021	45.87	44.52	5100.74
7/19/2021	48.94	47.59	5097.67
8/12/2021	49.33	47.98	5097.28
9/23/2021	41.44	40.09	5105.17
10/25/2021	49.61	48.26	5097.00
11/8/2021	49.32	47.97	5097.29
12/8/2021	49.32	47.97	5097.29

Table 11: Summary of Water Level Data for Domestic Well Pendill (Puryear) 2021

Height to top of casing from ground level: 0.50 ft  
 Ground Level Elevation: 5228.78 ft

Date of Measurement	Reading (ft)	Water Level Below Ground (ft)	Water Elevation Below Ground (ft)
1/21/2021	115.62	115.12	5113.66
2/16/2021	118.07	117.57	5111.21
3/23/2021	105.13	104.63	5124.15
4/29/2021	125.4	124.9	5103.88
5/20/2021	111.23	110.73	5118.05
6/4/2021	157.18	156.68	5072.1
7/19/2021	146.39	145.89	5082.89
8/12/2021	151.08	150.58	5078.2
9/23/2021	121.12	120.62	5108.16
10/25/2021	117.21	116.71	5112.07
12/8/2021	117.82	117.32	5111.46
1/21/2021	115.62	115.12	5113.66

WASHOE COUNTY COMMUNITY SERVICES DEPARTMENT  
 2021 ANNUAL REPORT FOR GOLDEN VALLEY ARTIFICIAL RECHARGE

Table 12: Summary of Water Level Data for Monitoring Well GV5 2021

Height to top of casing from ground level: 2.22 ft  
 Ground Level Elevation: 5102.90 ft

Date of Measurement	Reading (ft)	Water Level Below Ground (ft)	Water Elevation Below Ground (ft)
1/28/2021	23.8	5081.318	21.58
2/16/2021	23.62	5081.498	21.4
3/23/2021	23.29	5081.828	21.07
4/29/2021	23.73	5081.388	21.51
5/20/2021	23.83	5081.288	21.61
6/4/2021	24.38	5080.738	22.16
7/19/2021	25.97	5079.148	23.75
8/12/2021	26.16	5078.958	23.94
9/23/2021	26.98	5078.138	24.76
10/25/2021	26.5	5078.618	24.28
12/1/2021	26.26	5078.858	24.04
1/28/2021	23.8	5081.318	21.58

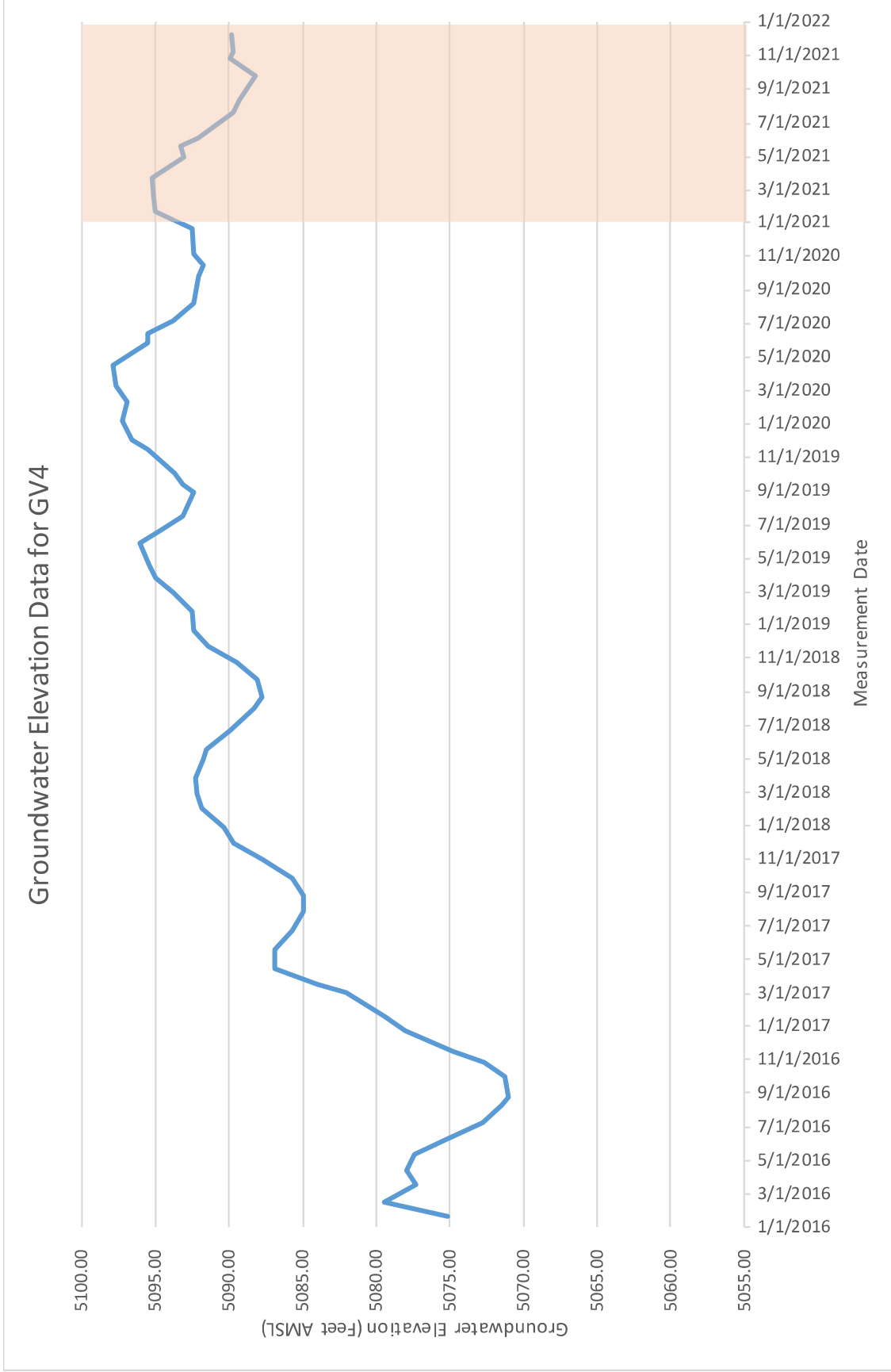


Fig. 5: Water levels in monitoring well GV4. Shaded area represents the 2021 monitoring period.

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2021 ANNUAL REPORT FOR GOLDEN VALLEY ARTIFICIAL RECHARGE

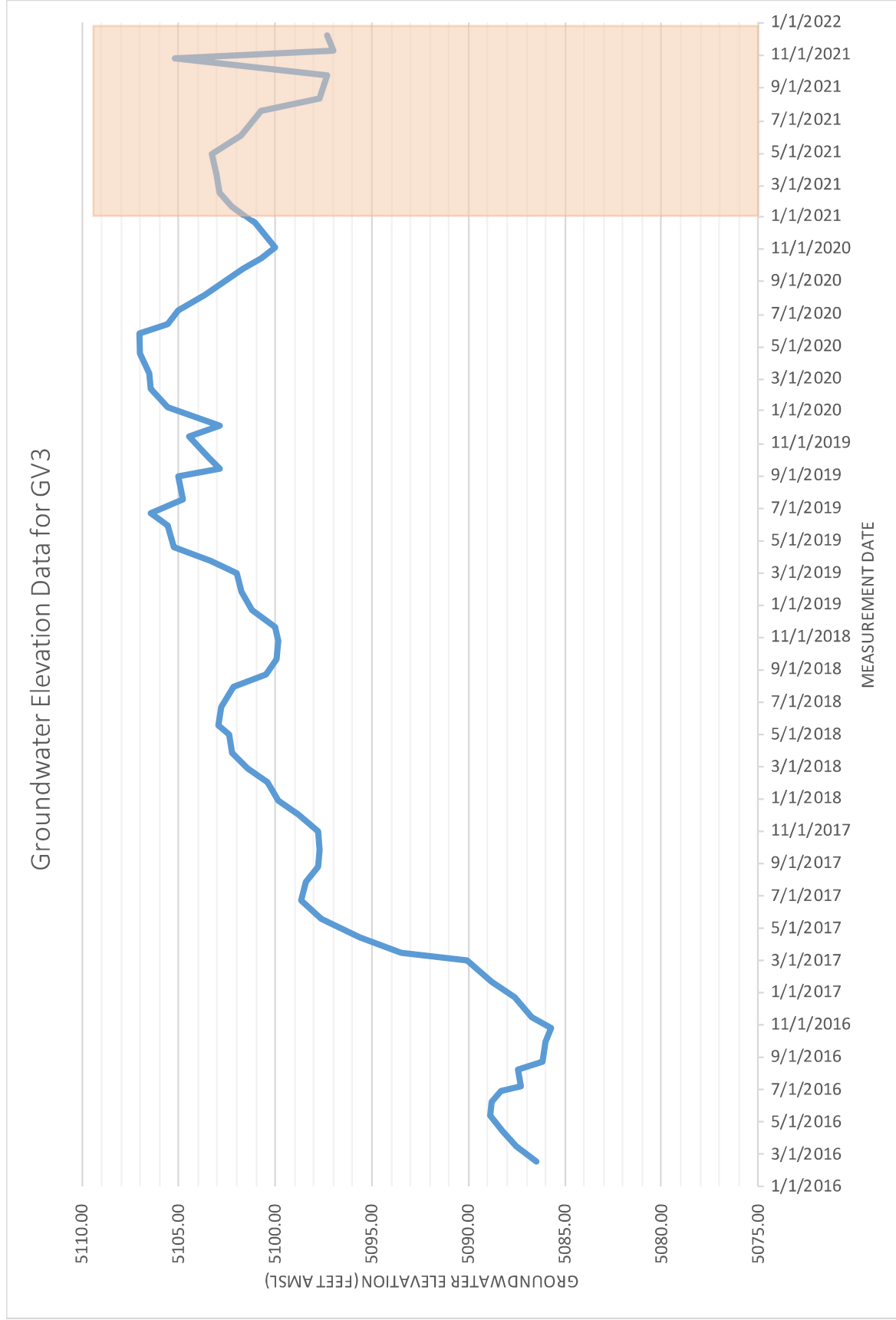


Fig. 6: Water levels in monitoring well GV3.  
Shaded area represents the 2021 monitoring period.

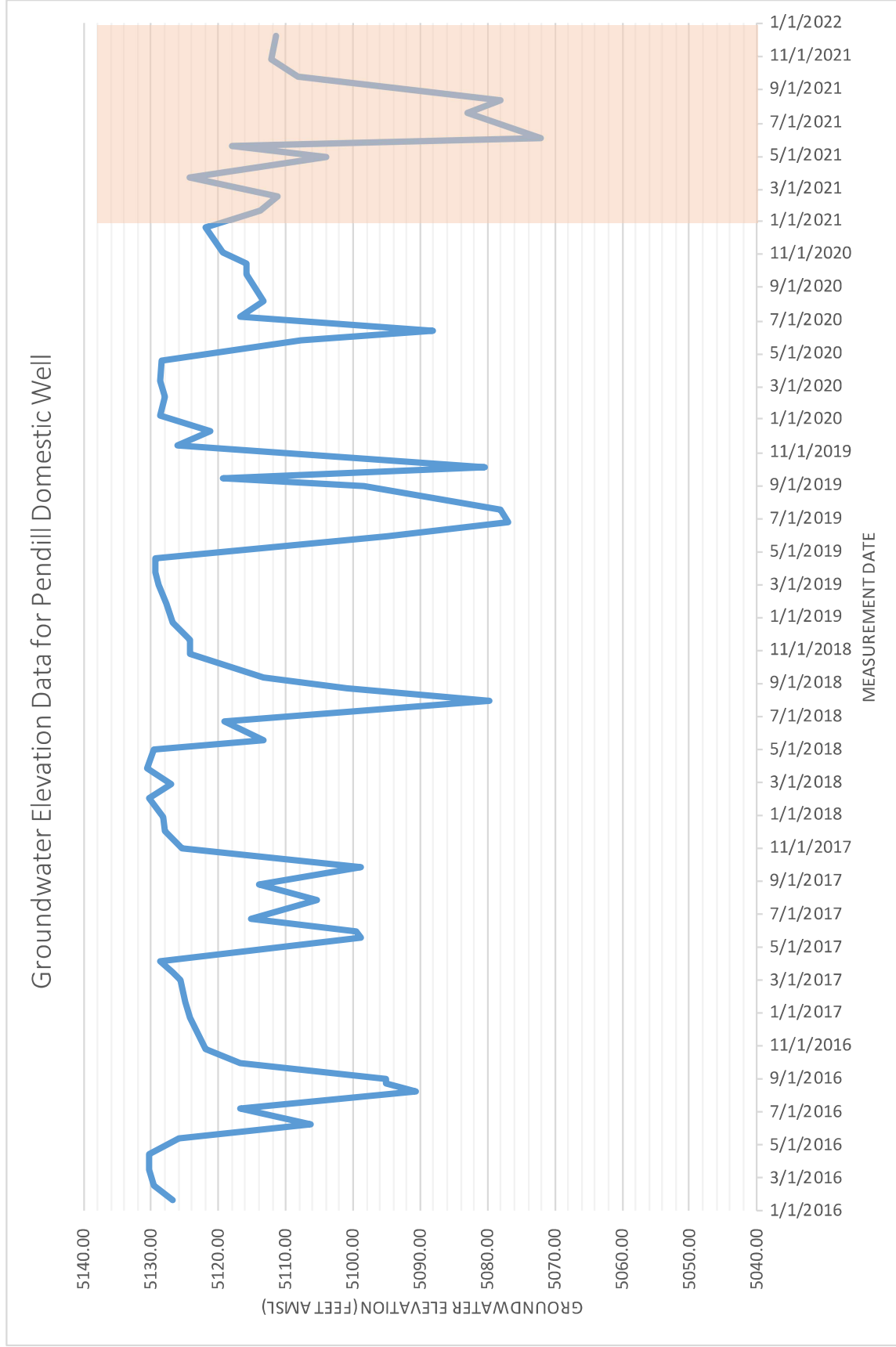


Fig. 7: Water levels in domestic well Pendill (Puryear).  
Shaded area represents the 2021 monitoring period.

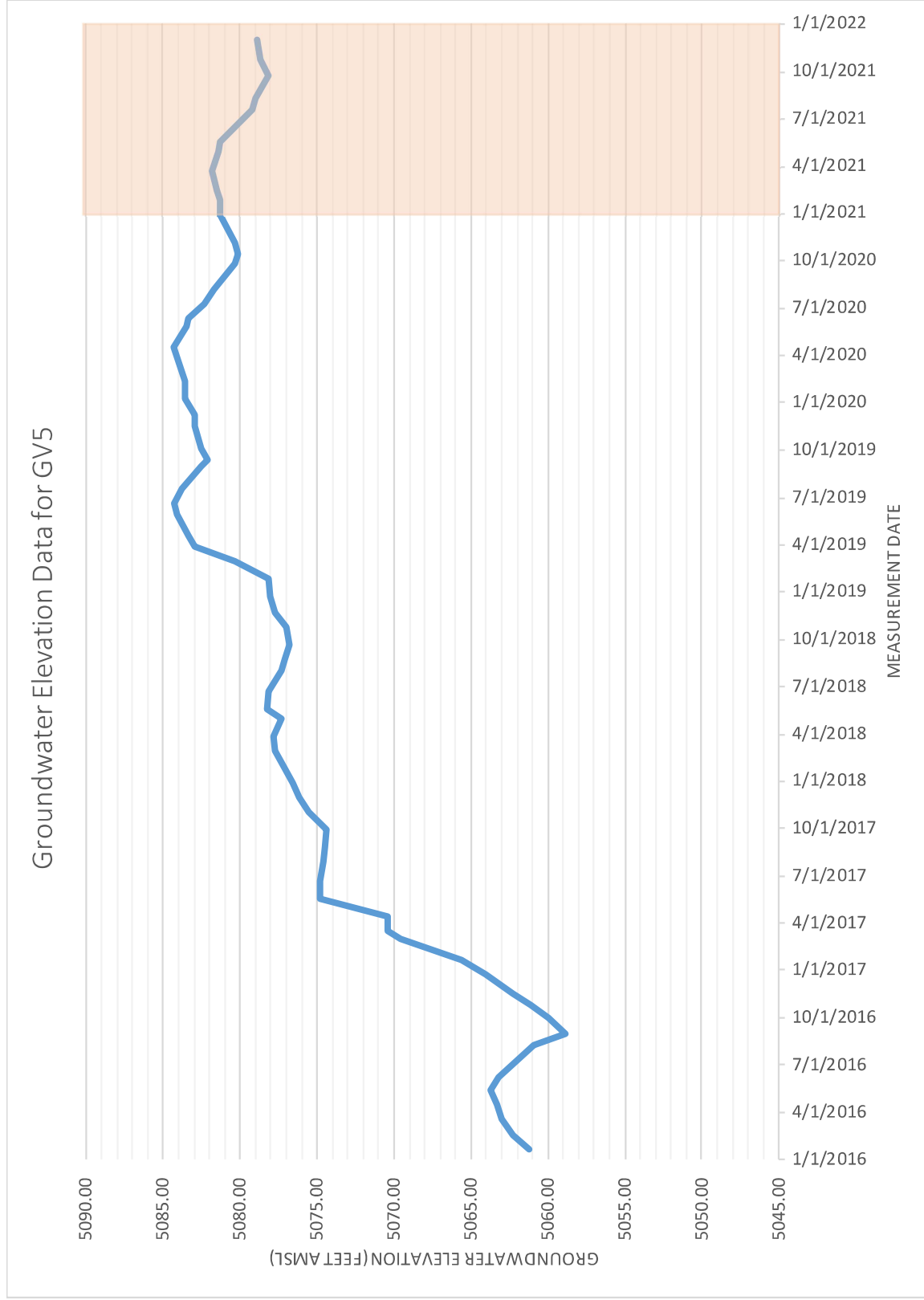


Fig. 8: Water levels in monitoring well GV5.  
Shaded area represents the 2021 monitoring period.



## **Conclusion**

Activities performed during the reporting period were completed according to requirements outlined in the Nevada Division of Environmental Protection (NDEP) Permit No. UNEV91008 when possible. These activities include: 1) collecting and analyzing groundwater samples; and 2) measuring water levels in five (5) designated monitoring wells and approximately thirty (30) additional domestic wells. No artificial recharge was performed during the reporting period. Washoe County injected 0 gallons/acre-feet (AF) of water between January 1, 201 and December 31, 201. A total of 288,898,463 gallons, or approximately 886.41 AF, were injected in the period between October 2002 and April 2016.

Tables 9, 10, 11, 12 and Figures 5, 6, 7, 8 show changes in water levels for the monitoring wells included in the injection permit (GV4, GV3, Pendill domestic, and GV5) between January 2021**20** and December 2021, with the 2021 monitoring period highlighted in red. Data indicates that water levels slightly declined during the spring and summer months which can be attributed to higher water demands during these seasons. Even with no recharge being conducted since April 2016, water levels have continued to rise. They appear to stabilize throughout 2018, but following another significant water year in 2021, water levels have continued to rise, albeit at a slower rate than before. Water levels dropped slightly in the wells in 2021.

No significant changes in water quality were observed during the reporting period. TDS levels seemed to drop slightly in all wells. All other chemical constituents remained relatively consistent with some decreasing trends in chloride, sulfate and nitrate.

The recharge system will remain off in 2022. Washoe County will coordinate with NDEP to cancel the injection permit (UNEV91008). If/when the recharge system is to be put back in service, Washoe County will work with permitting agencies prior to recharging water.

Water quality samples and water levels were collected by Washoe County staff. Data sheets from Western Environmental Testing Laboratory include initials of laboratory personnel analysts and are included as Appendix 1.

# **APPENDIX 1**

LABORATORY DATA SHEETS

## **APPENDIX 2**

UIC FORM U230 – FIELD SAMPLING & MONITORING SUMMARY

# **ATTACHMENT 1**

**COMPOUNDS ANALYZED FOR  
ROUTINE DOMESTIC ANALYSES**

Alkalinity, total  
Alkalinity/Bicarbonate  
Alkalinity/Carbonate  
Alkalinity/Hydroxide  
Arsenic  
Barium  
Boron  
Calcium  
Chloride  
Color Apparent  
Conductivity  
Copper  
Fluoride  
Hardness  
Iron  
Lead  
Magnesium  
Manganese  
MBAS Surfactants  
Nitrate  
pH  
pH-temperature  
Potassium  
Silica  
Sodium  
Sulfate  
Total Dissolved Solids  
Turbidity  
Zinc

Trihalomethanes:

Bromodichloromethane  
Bromoform  
Chloroform  
Dibromochloromethane