

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

2021 ANNUAL REPORT

PERMIT #R-009

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January 2022

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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	Deg. C	C
Degrees Fahrenheit	deg. F	F
Electrical Conductivity (laboratory)	EC	microsiemens per centimeter ($\mu\text{S}/\text{cm}$)
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.	Deg. C, deg. F
Total Dissolved Solids*	TDS	grams/liter (g/L)
Total Trihalomethanes	TTHMs	ppm
Turbidity	turb.	Nephelometric turbidity units (NTU)
Zinc		ppm

*at 180 deg.C

**at 21.1 deg. C

***at 20 deg. 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. Figure 1 shows the injection line and the location of the injection wells.

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 followed the requirements outlined in the Nevada Division of Water Resources (NDWR) Permit No. R-009. These activities include: 1) collecting and analyzing ground water; and 2) measuring water levels in designated monitoring wells and additional wells located throughout the valley. No artificial recharge was performed during the reporting period.

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.

Ground water samples were collected from three designated monitoring wells on a quarterly basis. Water analyses were performed by Western Environmental Testing Laboratory, and in the field. Laboratory analyses include chloride (Cl⁻), total dissolved solids (TDS), electric conductivity (EC), and total trihalomethanes (TTHMs). Field analyses include pH, specific conductivity, sample temperature, oxidation–reduction potential, dissolved oxygen, free available chlorine, total residual chlorine, and combined chlorine. Results from water analyses are shown in Tables 2a through 2d and Table 3. Compounds included in the routine domestic analyses are identified in Attachment 1.

Water levels were measured on a monthly and quarterly basis per the requirements of NDWR Permit #R-009. Water levels are referenced to feet above mean sea level (msl) in this report. Ground water elevation data are included in Table 4, and Figures 2, 3, 4 and 5.

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Injection Amounts

No artificial recharge was performed during the reporting period. The total amount of water injected from January 1, 2021 through December 31, 2021 was 0 gallons/acre feet (Table 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.

Injection Water Quality

No artificial recharge was performed during the reporting period. Injection water quality data are shown in Table 2d and Table 3. In addition to laboratory analyses, field measurements were performed using a YSI Water Quality Monitor. Because the system was off for **Error! Reference source not found.**, there was no sampling performed on the injection water; therefore, these entries contain no data.

Monitoring Well Water Quality

Monitoring well water quality data are included in Tables 2a-c and Table 3. Water samples were collected and analyzed from GV-MW3, GV-MW4 and the Pendill/Puryear domestic well on a quarterly basis, following permit requirements. Field measurements also were collected using a YSI Water Quality Monitor for all sampling events.

Monitoring Well Water Levels

Water levels were measured on a monthly basis when possible in monitoring wells GV-MW3, GV-MW4, GV-MW5 and the Pendill/Puryear domestic well. Each well was previously surveyed with a Global Positioning System (GPS) to estimate ground elevation at the wellhead. Water level data were converted to elevations above mean sea level (msl) using the GPS reference elevation. Water level elevations are reported in Table 4. Graphs of the changes in water elevations over time are shown in Figures 2, 3, 4 and 5.

Conclusion

Activities performed during the reporting period followed the requirements outlined in the Nevada Division of Water Resources (NDWR) Permit No. R-009. These activities include: 1) collecting and analyzing ground water; and 2) measuring water levels in designated monitoring wells and additional wells located throughout the valley. No artificial recharge was performed during the reporting period. Washoe County injected 0 gallons/acre-feet (AF) of water between January 1, 2021 and December 31, 2021. A total of 288,898,463 gallons, or approximately 886.41 AF, were injected in the period between October 2002 and April 2016.

Following another significant water year in 2021, most domestic wells in Golden Valley continued to experience increasing water levels during the year, even with the injection system not in operation. A number of domestic wells near drainages experienced higher increases in water levels during this period after large rainfall events.

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. No significant changes in water quality were observed during the reporting period. Nitrate levels in monitoring well Pendill spiked to 18 mg/L before returning to its typical value of less than 8 mg/L. All other chemical constituents remained relatively consistent with some increasing trends in TDS, chloride, sulfate and nitrate.

The recharge system will remain off in 2021. Washoe County will communicate with NDWR to review the recharge permit (R-009). If/when the recharge system is to be put back in service, Washoe County will work with permitting agencies prior to recharging water.

Injection Volumes

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

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 amount of water injected

Month-YY	Date	Amount of Water Injected Monthly (gallons)			
		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
Totals (gallons):		0	0	0	0
Totals (acre feet):		0	0	0	0
Total Gallons Injected During Reporting Period:					0
Total Acre Feet Injected During Reporting Period:					0

Water Quality Analysis

TABLE 2a.

Summary of Laboratory Analyses for Monitoring Well GV-MW3

Sample Date	HCO ₃	CO ₃	Alka- linity	TDS	Cl	F	SO ₄	NO ₃ ⁻ 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	420	92	<.30	38	10	45.3	0.16	<0.10	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	<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	<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	<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

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TABLE 2b.

Summary of Laboratory Analyses for Pendill Monitoring Well

Sample Date	HCO ₃	CO ₃	Alka- linity	TDS	Cl	F	SO ₄	NO ₃ - 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	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	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	7.80	7.50	570	13	<0.500	<0.500	<0.500	13
05/27/21	1.8	7.40	560	9.5	<0.500	<0.500	<0.500	9.5
07/28/21	0.3	7.60	370	18.0	0.590	<0.500	<0.500	18.0
11/08/21	2.0	7.82	480	1.36	<0.500	<0.500	<0.500	1.36

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TABLE 2c.

Summary of Laboratory Analyses for GV-MW4

Sample Date	HCO ₃	CO ₃	Alka-linity	TDS	Cl	F	SO ₄	NO ₃ -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	Total
	NTUs	pH Units	umhos/cm	ug/L	ug/L	ug/L	ug/L	ug/L
01/21/21	2.90	7.88	600	<0.500	<0.500	<0.500	<0.500	<2.00
05/27/21	1.20	7.77	800	<0.500	<0.500	<0.500	<0.500	<2.00
07/28/21	0.90	8.06	640	<0.500	<0.500	<0.500	<0.500	<2.00
11/8/21	1.2	7.87	820	<1	<1	<0.500	<1	<2.00

TABLE 2d.

Summary of Laboratory Analyses for Injection Well

The injection system was shut down in April 2016 and has remained off since then. Because the system was off, there is no injection data available during this period.

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
-	-	-	-	-	-	-	-	-

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TABLE 3: Summary of Field Water Quality Analyses

Injection Water							
Sample Date	pH	Specific Conductivity (µS/cm)	Sample Temp. (°C)	Dissolved Oxygen (mg/L)	Free Avail. Chlorine	Total Resid. Chlorine	Comments
-	-	-	-	-	-	-	Injection Off
GV4 Monitoring Well							
Sample Date	pH	Specific Conductivity (µS/cm)	Sample Temp. (°C)	Dissolved Oxygen (mg/L)	Free Avail. Chlorine	Total Resid. Chlorine	Comments
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	
GV3 Monitoring Well							
Sample Date	pH	Specific Conductivity (µS/cm)	Sample Temp. (°C)	Dissolved Oxygen (mg/L)	Free Avail. Chlorine	Total Resid. Chlorine	Comments
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	
Pendill (Puryear) Domestic Well							
Sample Date	pH	Specific Conductivity (µS/cm)	Sample Temp. (°C)	Dissolved Oxygen (mg/L)	Free Avail. Chlorine	Total Resid. Chlorine	Comments
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	

TABLE 4: Summary of Water Level Data

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

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

Summary of Water Level Data for Monitoring Well GV4 Error! Reference source not found.

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

Summary of Water Level Data for Monitoring Well GV5 Error! Reference source not found.

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

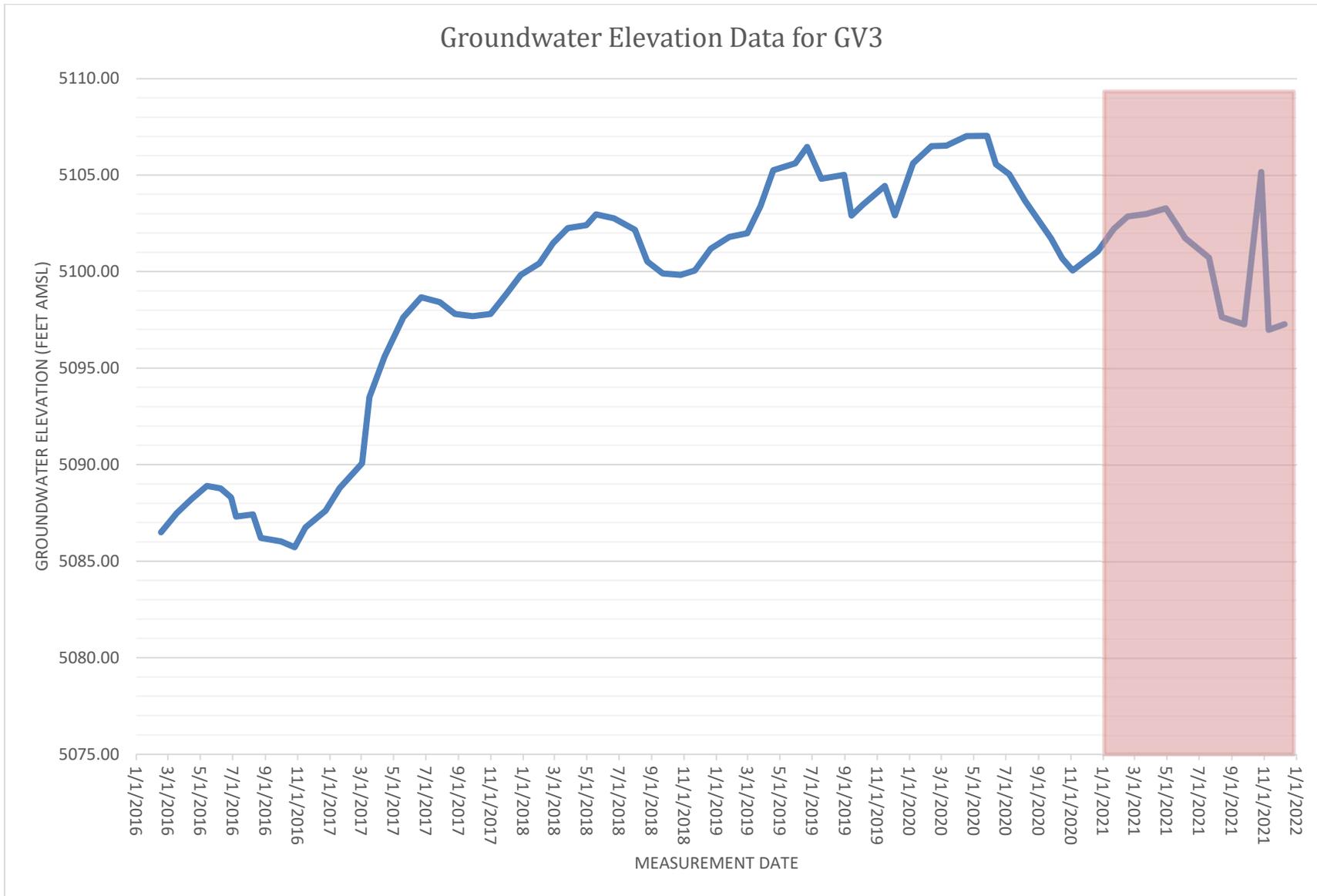


Fig. 2: Water elevations in monitoring well GV3.
 Shaded area represents the 2021 monitoring period.

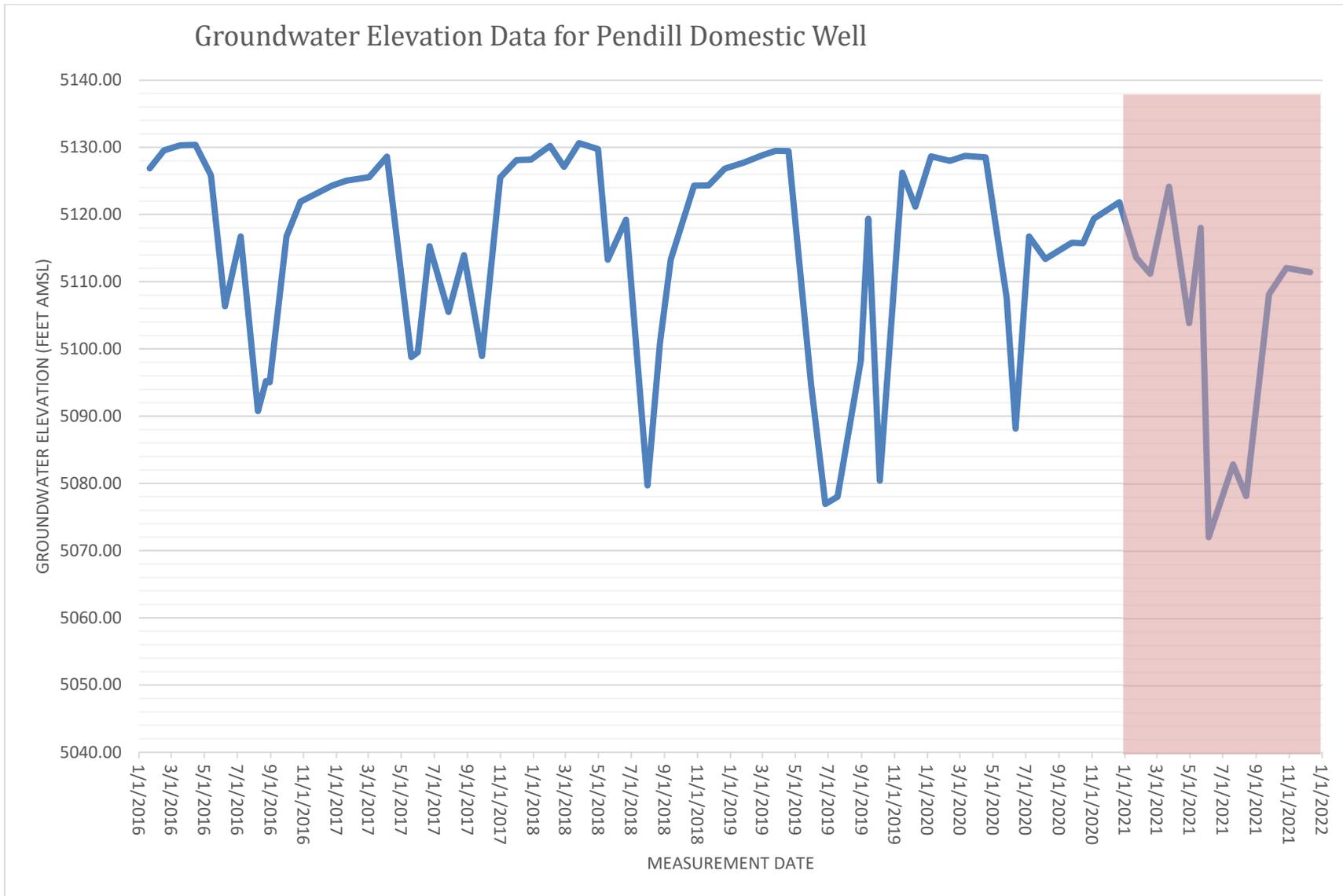


Fig. 3: Water elevations in domestic well Pendill (Puryear).
 Shaded area represents the 2021 monitoring period.

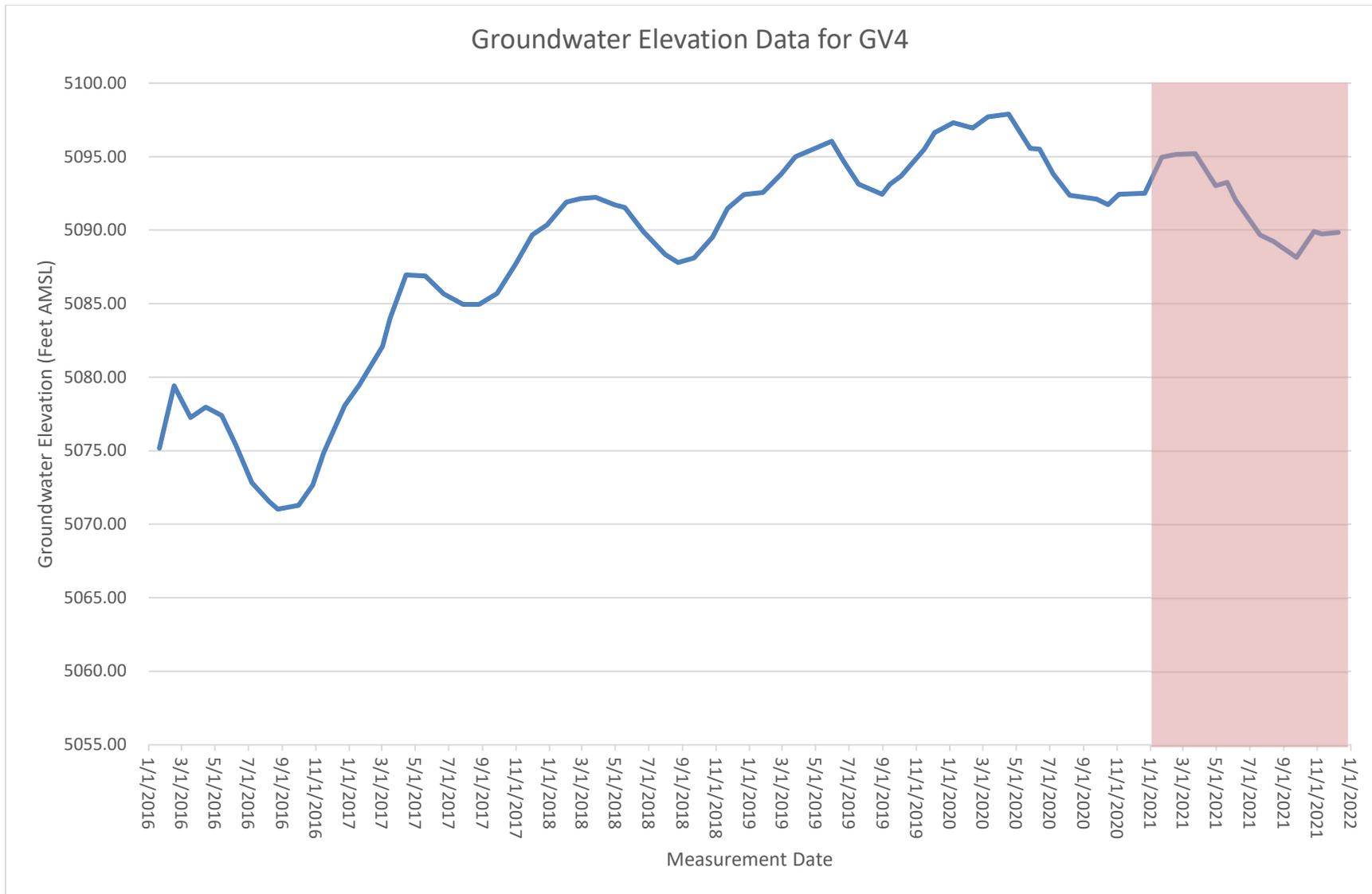


Fig. 4: Water elevations in monitoring well GV4. Shaded area represents the 1 monitoring period.

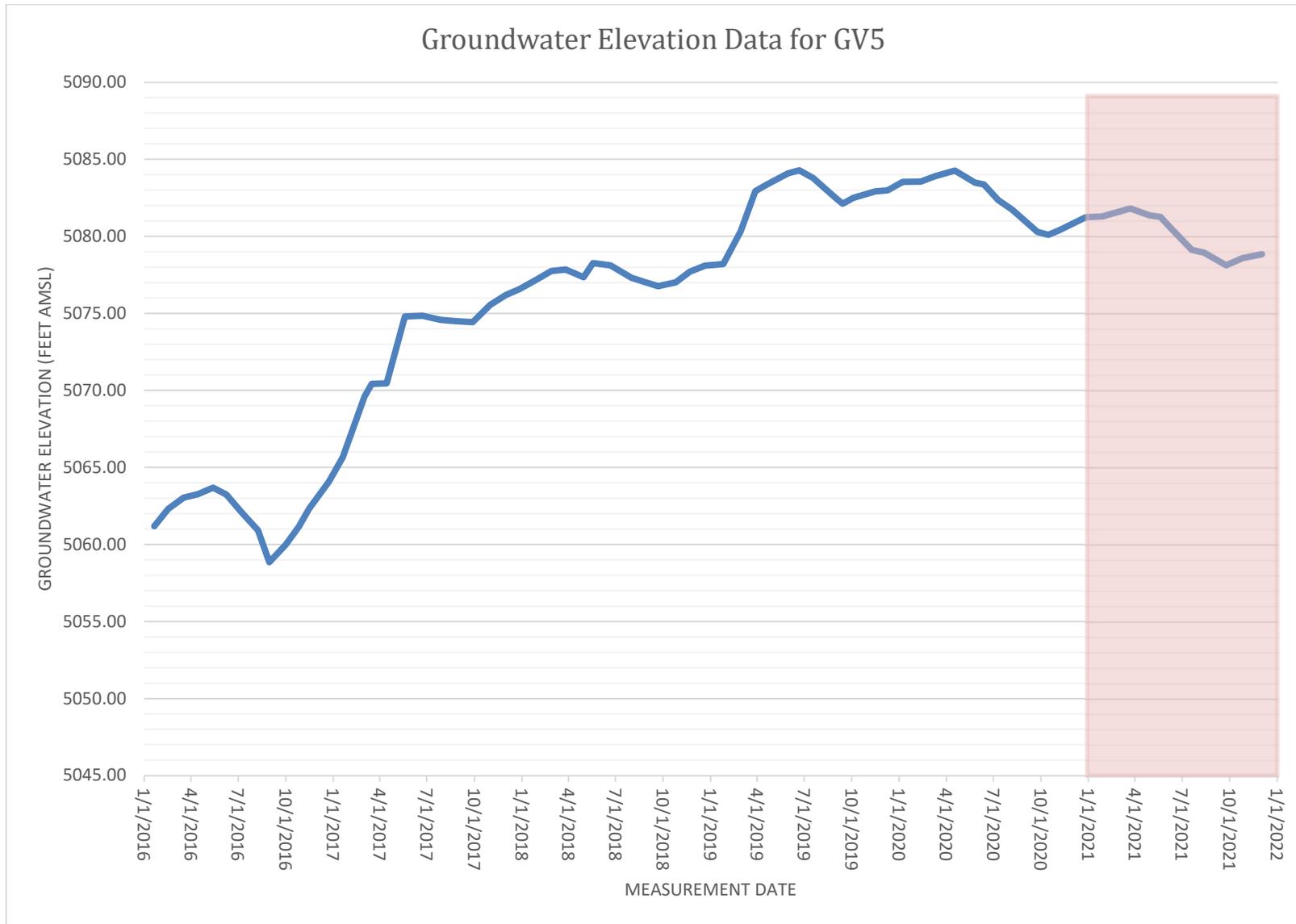


Fig. 5: Water elevations in monitoring well GV5.
Shaded area represents the 2021 monitoring period.

ATTACHMENT 1

Compounds in the Routine Domestic Analyses

Alkalinity, total
Alkalinity/Bicarbonate
Alkalinity/Carbonate
Alkalinity/Hydroxide
Arsenic
Barium
Boron
Calcium
Chloride
Color Apparent
Conductivity
Copper/acre-feet (AF)
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