



GROUNDWATER MONITORING DATA RELEASE FALL 2018 SAMPLING EVENT LUCKEY FUSRAP SITE

**U.S. Army Corps of Engineers
Buffalo District**

Building Strong®

May 2019

Formerly Utilized Sites Remedial Action Program (FUSRAP)

FUSRAP was initiated in 1974 to identify, investigate and, if necessary, clean up or control sites throughout the United States that were contaminated as the result of Manhattan Engineer District or early Atomic Energy Commission (AEC) activities. When implementing FUSRAP, the Corps of Engineers follows the investigation and response framework of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan.

Site Description

The Luckey Site is located at 21200 Luckey Road near the Village of Luckey, Ohio, 22 miles southeast of Toledo. It is bordered by Luckey Road to the west, Gilbert Road to the south, abandoned railroad tracks to the east, and privately-owned farm fields to the north. The site is zoned industrial but is currently not being used. It covers approximately 40 acres and includes open areas as well as unused buildings, some of which are partially demolished. Several of these open areas were previously used to store byproducts from beryllium ore processing.

Site History

In 1942 the federal government built a magnesium processing facility at the site, which was operated by National Lead for the federal government from 1942 to 1945. In 1949 Brush Beryllium Company (later Brush Wellman) began production of beryllium oxide, beryllium hydroxide, and beryllium pebbles at the site under contract to the AEC. Brush Beryllium Company operated the facility for the AEC until 1958 when beryllium production ceased. In 1959, AEC contracted with Brush Beryllium Company to close the facility. Closing operations consisted of constructing a two-acre diked disposal area in the northeast corner of the property where sludge from three on-site lagoons was placed. The General Services Administration sold the facility in 1961 and the site has had various owners since then.

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Purpose

Groundwater monitoring is being performed to obtain additional information and to establish a baseline of groundwater data prior to implementing monitored natural attenuation of groundwater, as documented in the February 2008 *Record of Decision, Groundwater Operable Unit, Luckey Site*.

Hydrogeologic conditions and the nature and extent of groundwater contamination at the site are presented in the record of decision. Groundwater occurs in three primary water-bearing zones: shallow, intermediate, and deep bedrock. It is present under unconfined and semi-confined conditions. The horizontal flow of groundwater within these zones in the vicinity of the site is northerly and northwesterly. Constituents of concern (COCs) and associated U.S. Environmental Protection Agency (USEPA) Maximum Contaminant Levels (MCLs) for protection of drinking water include beryllium (4 micrograms per liter [$\mu\text{g/L}$]), lead (15 $\mu\text{g/L}$), and total uranium (30 $\mu\text{g/L}$). A contiguous plume of COC-contaminated groundwater is not present.

Results and Interpretation

During September 18 through October 2, 2018, 22 groundwater monitoring wells (illustrated on Figure 1) and one residential well (GW0002) were sampled for beryllium, lead, isotopic uranium (uranium-234 [U-234], U-235, U-238), and total uranium. Groundwater surface elevations measured during this event are presented in Table 1.

Analytical results are presented in Table 2. Samples with concentrations above the USEPA MCLs are highlighted and listed below.

- Beryllium (MW-01(I), MW-02(S), MW-22R(I), and MW-26(S))
- Lead (MW-21(I) and PW(W))
- Total uranium (MW-21(I))

These exceedances are consistent with previous results. The wells are located on-site and are not used for water supply. Residential well GW0002 did not contain COCs at concentrations above the MCLs.

Beryllium

Plots of beryllium concentrations against time are presented on Figure 2 (unfiltered samples) and Figure 3 (filtered samples) for wells that exceeded the MCL and for residential well GW0002. The Mann-Kendall test was used to determine if the data exhibit statistically significant upward trends or downward trends. Results are summarized in Tables 3 and 4. The following conclusions are made from the data plots and trend analysis:

- Downward trends are observed for wells MW-01(I) (unfiltered samples) and MW-02(S) (filtered and unfiltered samples).
- No trends are observed for wells MW-01(I) (filtered samples), MW-26(S) (filtered and unfiltered samples), and GW0002 (unfiltered and filtered samples).

Lead

Plots of lead concentrations against time are presented on Figure 4 (unfiltered samples) and Figure 5 (filtered samples) for wells MW-21(I), GW0002, and PW(E) (former water supply well for the Luckey Site). Trend analysis results are summarized in Tables 3 and 4. The following conclusions are made from the data plots and trend analysis:

- Downward trends are observed for wells GW0002 (filtered samples), MW-24(S) (unfiltered samples), and PW(E) (filtered and unfiltered samples).
- No trends are observed for wells GW0002 (unfiltered samples), MW-21(I) (unfiltered and filtered samples), MW-24(S) (filtered samples), and PW(E) (filtered and unfiltered samples).

Total Uranium

Plots of total uranium concentrations against time are presented on Figure 6 (unfiltered samples) and Figure 7 (filtered samples) for wells MW-21(I) and GW0002. Trend analysis results are summarized in Tables 3 and 4. The following conclusions are made from the data plots and trend analysis:

- An upward trend is observed for well MW-21(I) (unfiltered samples).
- No trends are observed for well MW-21(I) (unfiltered samples), MW-24(S) (unfiltered samples), and GW0002 (filtered and unfiltered samples).

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TABLES

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Fall 2018 Sampling Results

Table 1: Groundwater Elevations (September 2018)

Well	Geologic Zone	Depth to Water (ft)	Measuring Point Elevation (ft amsl)	Groundwater Elevation (ft amsl)
Shallow Monitoring Wells				
MW-02(S)	SH	7.81	650.27	642.46
MW-26(S)	SH	8.02	650.44	642.42
MW-51(S)	SH	8.64	650.09	641.45
MW-54(S)	SH	7.73	650.27	642.54
PZ-01	SH	9.62	651.10	641.48
Intermediate Monitoring Wells				
MW-01(I)	IN	8.02	650.52	642.50
MW-05(I)	IN	8.50	653.26	644.76
MW-18(I)	IN	4.95	647.54	642.59
MW-19(I)	IN	8.56	651.03	642.47
MW-21(I)	IN	9.00	651.45	642.45
MW-22R(I)	IN	7.46	649.98	642.52
MW-25(I)	IN	8.38	649.31	640.93
OMW-27(I)	IN	7.61	649.97	642.36
OMW-31(I)	IN	6.25	648.68	642.43
MW-50(I)	IN	10.36	652.92	642.56
MW-52(I)	IN	7.71	650.21	642.50
MW-53(I)	IN	7.21	649.69	642.48
MW-55(I)	IN	9.73	650.19	640.46
Deep Monitoring Wells				
OMW-32(B)	BR	6.27	648.74	642.47
PW(E)	BR	NM	NA	NA
PW(W)	BR	NM	NA	NA
Hybrid Monitoring Wells				
MW-52A(I)	HY	7.35	649.31	641.96

Notes:

amsl Above mean sea level
 NM Not measured
 NA Not available
 ft Foot (Feet)

Geologic Zones:

SH Shallow water bearing zone (overburden)
 IN Intermediate water bearing zone (shallow bedrock)
 BR Deep water bearing zone (deep bedrock)
 HY Multiple zones (hybrid well)

Luckey FUSRAP Site
 Fall 2018 Sampling Results

Table 2: Analytical Results

Well	Year	Beryllium	Lead	Total Uranium (KPA) ¹
Units		µg/L	µg/L	µg/L
<i>USEPA MCL</i>		4	15	30 ²
GW0001	2002	0.0 U	2.0 U	0.48
	2004	0.158 U	1.7 J	0.561
GW0001 (Filtered)	2002	0.0 U	2.0 U	
	2004	0.158 U	1.72 U	
GW0002	2002	0.0 U	2.0 U	0.18
	2004	0.158 U	1.72 U	0.371
	2005	0.13 U	0.8 J	0.044 U
	2006	0.088 U	0.6 J	0.85 J
	2007	0.51 U	2.4 U	
	2008	1.0 U	2.5 U	0.35 U
	2009	0.17 J	0.96	0.088 U
	2010	0.056 U	0.58	1 U
	2011	0.1 U	1.2	0.146 J
	2012	0.25 U	0.38 J	0.191 J
	2013	0.36 J	0.48 J	0.202
	2014	0.5 U	1.0	0.306
	2017	0.1 U	0.36	0.18
	2018 (April)	0.1 U	0.238 J	0.126 J
	2018 (October)	0.0412 UJ	2.19 J	0.303 J
GW0002 (Filtered)	2002	0.0 U	2.0 U	
	2004	0.158 U	1.72 U	
	2005	0.13 U	1.0 J	
	2006	0.088 U	0.49 U	
	2007	0.51 U	2.4 U	
	2008	1.0 U	3.8 B	
	2009	0.076 J	0.14 J	
	2010	0.056 U	0.094 J	
	2011	0.1 U	0.12 J	0.153 J
	2012	0.25 U	0.24 U	0.205 J
	2013	0.25 U	0.24 U	0.215
	2014	0.5 U	0.59 J	0.292
	2017	0.1 U	0.16	0.19
	2018 (April)	0.1 U	0.1 U	0.133 J
	2018 (October)	0.0412 UJ	0.641 J	0.292 J

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Table 2: Analytical Results

Well	Year	Beryllium	Lead	Total Uranium (KPA) ¹
Units		µg/L	µg/L	µg/L
<i>USEPA MCL</i>		4	15	30 ²
MW-01(I)	2002	34	2.0 U	3.19
	2004	31.1	1.72 U	3.16
	2005	41.2	2.8 U	3.32
	2006	31.8	0.49 U	2.85
	2007	32.5	4.8 U	
	2008	31.1	2.5 U	2.63
	2009	39	0.57	2.39
	2010	25	0.74	2.91
	2011	28	0.45	2.99
	2013	35	2.3	2.90
	2014	24	1.5	3.08
	2017	31.6	0.82	3.08
	2018 (April)	30.3	0.52 J	2.96
	2018 (September)	25.7 J	0.328 UJ	5.77 J
MW-01(I) (Filtered)	2002	11	3.0	
	2004	32.7	1.72 U	
	2005	33.8	0.57 U	
	2006	33.2	0.62 J	
	2007	30.9	4.8 U	
	2008	31.5	2.5 U	
	2009	34	0.46	
	2010	20	0.35 J	
	2011	28	0.36 J	2.88
	2013	29	0.41 J	2.87
	2014	24	0.46 J	3.09
	2017	31	0.39	3.1
	2018 (April)	28.7	0.18 J	2.92
	2018 (September)	28.4 J	0.328 UJ	5.73 J
MW-02(S)	2002	60	6.0	6.97
	2004	77.8	1.7 J	6.24
	2005	44.2	1.5 J	5.23
	2006	14.8	1.8	4.13
	2007	14.2	4.8 U	
	2008	13.2	2.5 U	3.93
	2009	14	1.3	3.64
	2010	11	1.3	4.17
	2011	13	1.1	4.36
	2013	15	1.1	4.07
	2014	13	0.75 J	4.43
	2017	13.7	0.77	4.71
	2018 (April)	13.5	0.81 J	4.62
	2018 (September)	10.7 J	0.612 J	9.35 J

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Table 2: Analytical Results

Well	Year	Beryllium	Lead	Total Uranium (KPA) ¹
Units		µg/L	µg/L	µg/L
<i>USEPA MCL</i>		4	15	30 ²
MW-02(S) (Filtered)	2002	62	2.0 U	
	2004	79.6	1.72 U	
	2005	43	2.3 J	
	2006	13.7	1.4	
	2007	13.2	4.8 U	
	2008	12.4	2.5 U	
	2009	22	1.3	
	2010	3.1	0.72	
	2011	14	0.87	4.20
	2013	13	0.72 J	3.90
	2014	13	0.58 J	4.22
	2017	13.4	0.73	4.58
	2018 (April)	13.2	0.474 J	4.50
	2018 (September)	11.9 J	0.677 J	9.29 J
MW-03(I)	2017	0.1 U	3.49	0.89
MW-03(I) (Filtered)	2017	0.1 U	0.12	0.82
MW-04(S)	2017	0.1 U	0.39	0.73
MW-04(S) (Filtered)	2017	0.1 U	0.11	0.72
MW-05(I)	2002	0.0 U	4.0	3.58
	2004	0.158 U	1.72 U	2.79
	2005	0.13 U	2.6 J	3.23
	2006	0.088 U	1.5	3.82
	2007	1.0 U	4.8 U	
	2008	1.0 U	3.5 B	2.96
	2009	0.056 U	3.3	2.77
	2010	0.52	3.3	3.36
	2011	0.21 J	3.4	3.16
	2013	0.25 U	4.3	3.33
	2014	0.5 U	3.5	3.27
	2017	0.1 U	5.3	3.40
	2018 (April)	0.223 J	7.65	3.26
	2018 (September)	0.0412 UJ	3.26 J	6.62 J

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Table 2: Analytical Results

Well	Year	Beryllium	Lead	Total Uranium (KPA) ¹
Units		µg/L	µg/L	µg/L
<i>USEPA MCL</i>		4	15	30 ²
MW-05(I) (Filtered)	2002	0.0 U	4.0	
	2004	0.158 U	1.72 U	
	2005	0.13 U	3.4	
	2006	0.088 U	1.2	
	2007	0.51 U	2.4 U	
	2008	1.0 U	3.4 B	
	2009	0.028 U	2.7	
	2010	0.084 J	2.6	
	2011	0.16 J	1.9	3.0
	2013	0.25 U	2.9	3.26
	2014	0.5 U	2.7	3.51
	2017	0.1 U	4.05	3.49
	2018 (April)	0.1 U	3.87	3.24
2018 (September)	0.0412 UJ	4.17 J	6.79 J	
MW-06(S)	2017	0.1 U	1.19	1.21
MW-06(S) (Filtered)	2017	0.1 U	0.76	1.23
MW-07(I)	2002	0.0 U	2.0 U	2.48
	2004	0.158 U	1.72 U	2.47
	2005	0.13 U	0.57 U	2.53
	2006	0.088 U	0.49 U	2.73
	2007	1.0 U	4.8 U	
	2008	1.0 U	2.5 U	2.36
	2009	0.056 U	0.067 J	2.17
	2017	0.1 U	0.77	2.71
MW-07(I) (Filtered)	2002	0.0 U	2.0 U	
	2004	0.158 U	1.72 U	
	2005	0.13 U	0.57 U	
	2006	0.088 U	0.49 U	
	2007	1.0 U	4.8 U	
	2008	1.0 U	2.5 U	
	2009	0.028 U	0.21	
	2017	0.1 U	0.55	2.74
MW-08(S)	2017	0.1 U	0.7	1.66
MW-08(S) (Filtered)	2017	0.1 U	0.36	1.62
MW-13(S)	2017	0.1 U	0.47	5.1
MW-13(S) (Filtered)	2017	0.1 U	0.57	4.97
MW-14(S)	2017	82.4	2.68	15.6
MW-14(S) (Filtered)	2017	64.6	0.56	15.5
MW-17(S)	2017	226	0.36	1.54
MW-17(S) (Filtered)	2017	238	0.16	1.40

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Table 2: Analytical Results

Well	Year	Beryllium	Lead	Total Uranium (KPA) ¹
Units		µg/L	µg/L	µg/L
<i>USEPA MCL</i>		4	15	30 ²
MW-18(I)	2017	0.1 U	1.01	1.34
	2018 (April)	0.1 U	0.704 J	2.42
	2018 (September)	0.0412 UJ	0.647 J	4.61 JJ
MW-18(I) (Filtered)	2017	0.1 U	0.89	1.38
	2018 (April)	0.1 U	2.23	2.38
	2018 (September)	0.0412 UJ	0.548 J	4.23 J
MW-19(I)	2002	0.0 U	2.0 U	0.43
	2004	2.8 J	1.72 U	0.554
	2005	3.1 J	0.57 U	0.492 J
	2006	2.8	0.49 U	0.473 U
	2007	2.2 J	4.8 U	
	2008	2.9 B	2.5 U	0.685 U
	2009	3.9	0.25 J	0.550 U
	2010	3.0	0.55	1.0 U
	2011	3.2	0.54	0.559
	2013	3.7	3.2	0.532
	2014	4.7	0.36 J	0.852
	2017	3.47	1.0	1.92
	2018 (April)	3.61	0.122 J	0.636
	2018 (September)	3.59 J	0.328 UJ	1.07 J
MW-19(I) (Filtered)	2002	0.0 U	2.0 U	
	2004	6.0	1.72 U	
	2005	2.9 J	0.57 U	
	2006	3.5	0.49 U	
	2007	2.1 J	4.8 U	
	2008	2.4 B	2.5 U	
	2009	4.6	0.16 J	
	2010	2.2	0.25 J	
	2011	4.3	0.34 J	0.813
	2013	2.3	3.1	0.507
	2014	5.3	0.48 J	1.04
	2017	3.28	0.79	1.95
	2018 (April)	2.31	0.234 J	0.765
	2018 (September)	2.05 J	0.328 UJ	1.16 J
MW-20(S)	2017	0.18	3.93	139
MW-20(S) (Filtered)	2017	0.13	1.06	152

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Table 2: Analytical Results

Well	Year	Beryllium	Lead	Total Uranium (KPA) ¹
Units		µg/L	µg/L	µg/L
<i>USEPA MCL</i>		4	15	30 ²
MW-21(I)	2002	0.0 U	34	27.60
	2004	0.158 U	32.5	13.57
	2005	0.63 U	25.5	14.90
	2006	0.088 U	32.7	35.0
	2007	1.0 U	27.1	
	2008	1.0 U	39.6	37.7
	2009	0.056 U	84	
	2009			34.1
	2010	2.6	62	44.4
	2011	0.5 U	38	37.7
	2013	0.25 U	66	34.7
	2014	1.0 U	24	43.2
	2017	0.1 U	32.7	37.2
	2018 (April)	0.1 U	23.5	38.2
2018 (September)	0.049 J	20.7 J	42.7 J	
MW-21(I) (Filtered)	2002	0.0 U	29	
	2004	0.158 U	37.5	
	2005	0.63 U	25.7	
	2006	0.088 U	31.7	
	2007	1.0 U	25.7	
	2008	1.0 U	32.9	
	2009	0.028 U	58	
	2010	0.28 U	53	
	2011	0.5 U	36	37.2
	2013	0.25 U	54	41
	2014	0.5 U	23	45
	2017	0.1 U	31.3	37.8
	2018 (April)	0.1 U	22.9	38
	2018 (September)	0.067 J	18.1 J	44.5 J
MW-22(I)	2008	1.0 U	2.5 U	1.11
	2009	0.056 U	1.3	0.771 U
MW-22(I) (Filtered)	2008	1.0 U	3.1 B	
	2009	0.088 J	1.7	
MW-22R(I)	2013	75	2.2	5.07
	2014	52	2.4	6.85
	2017	13.7	4.85	10.2
	2018 (April)	66.7	1.5	5.08
	2018 (September)	76.8 J	1.43 J	9.16 J
MW-22R(I) (Filtered)	2013	71	1.7	5.02
	2014	51	2.4	6.76
	2017	42.6	4.66	10.5
	2018 (April)	64.2	1.44	5.05
	2018 (September)	69.6 J	1.38 J	9.32 J

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Table 2: Analytical Results

Well	Year	Beryllium	Lead	Total Uranium (KPA) ¹
Units		µg/L	µg/L	µg/L
<i>USEPA MCL</i>		4	15	30 ²
MW-23(S)	2008	1.0 U	2.5 U	4.44
	2009	0.1 J	0.6	2.64
	2017	0.1 U	0.49	4.38
MW-23(S) (Filtered)	2008	1.0 U	4.8 B	
	2009	0.034 J	1.1	
	2017	0.1 U	0.12	4.14
MW-24(S) ³	2002	0.0 U	13	333
	2004	0.158 U	9.4	273
	2005	0.63 U	2.8 U	161
	2006	0.38 J	6.8	184
	2007	0.51 U	6.1 J	
	2008	1.0 U	4.3 B	163
	2009	0.79	5.9	197
MW-24(S) ³ (Filtered)	2002	0.0 U	12	
	2004	0.66 U	9.5	
	2005	0.63 U	4.2 J	
	2006	0.17 J	6.1	
	2007	0.51 U	7.1 J	
	2008	1 U	9.8 B	
	2009	0.61	6.7	
MW-24A(S)	2013	0.5 U	2.5	130
	2014	1.0 U	2.4	119
	2017	0.11	3.58	123
MW-24A(S) (Filtered)	2013	0.25 U	2.6	129
	2014	1.0 U	1.9	122
	2017	0.1 U	2.31	123
MW-24R(S)	2010	0.88 J	2.4	21.3
	2011	0.1 U	2.3	0.987
	2013	0.25 U	1.4	15.1
	2014	0.5 U	1.1	14
	2017	0.19	1.44	19.7
MW-24R(S) (Filtered)	2010	0.28 U	3.0	
	2011	0.1 U	1.1	6.83
	2013	0.25 U	0.68 J	15.5
	2014	1.0 U	1.3	17.1
	2017	0.12	0.71	19.7

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Table 2: Analytical Results

Well	Year	Beryllium	Lead	Total Uranium (KPA) ¹
Units		µg/L	µg/L	µg/L
<i>USEPA MCL</i>		4	15	30 ²
MW-25(I)	2008	1.0 U	2.5 U	1.28
	2009	0.2 J	0.59	
	2009			0.700 U
	2010	0.056 J	0.42	3.30
	2011	0.1 U	0.53	2.68
	2013	1.2	0.47 J	2.32
	2014	0.5 U	0.5 U	1.15
	2017	0.1 U	0.17 J	0.65
	2018 (April)	0.1 U	0.1 U	0.725
	2018 (September)	0.083 J	0.328 UJ	1.35 J
MW-25(I) (Filtered)	2008	1.0 U	5.9 B	
	2009	0.21	0.11 J	
	2010	0.056 U	0.072 J	
	2011	0.1 U	0.32 J	2.64
	2013	1.4	0.24 U	2.29
	2014	0.5 U	0.5 U	1.23
	2017	0.1 U	0.11 J	0.67
	2018 (April)	0.1 U	0.1 U	0.691
	2018 (September)	0.0412 UJ	0.328 UJ	1.28 J
MW-26(S)	2002	119	10	13.8
	2008	8.9	5 B	6.72
	2009	15	5.3	9.53
	2010	9.2	2.1	8.18
	2011	20	1.8	7.77
	2013	12	0.86 J	5.72
	2014	11	0.7 J	6.25
	2017	28.7	1.49	8.42
	2018 (April)	28.3	0.55 J	6.04
	2018 (September)	16.4 J	0.339 J	10.5 J
MW-26(S) (Filtered)	2002	103	2.0 U	
	2008	9.1	2.5 U	
	2009	18	6.2	
	2010	8.4	1.2	
	2011	22	1.9	8.55
	2013	13	0.76 J	6.07
	2014	12	0.92 J	6.89
	2017	29.7	1.64	9.10
	2018 (April)	28.9	0.517 J	6.41
	2018 (September)	13.9 J	0.328 UJ	10.2 J
MW-27(I)	2018 (April)	0.1 U	0.378 J	1.89
	2018 (September)	0.0412 UJ	0.375 J	3.87 J
MW-27(I) (Filtered)	2018 (April)	0.1 U	0.375 J	1.85
	2018 (September)	0.0412 UJ	0.484 J	3.97 J

Luckey FUSRAP Site
 Fall 2018 Sampling Results

Table 2: Analytical Results

Well	Year	Beryllium	Lead	Total Uranium (KPA) ¹
Units		µg/L	µg/L	µg/L
<i>USEPA MCL</i>		4	15	30 ²
MW-31(I)	2018 (April)	0.1 U	0.1 U	0.493
	2018 (September)	0.0412 UJ	0.328 UJ	0.8 J
MW-31(I) (Filtered)	2018 (April)	0.1 U	0.1 U	0.563
	2018 (September)	0.0412 UJ	0.328 UJ	0.892 J
MW-40(B)	2002	0.0 U	4.0	1.03
	2004	0.158 U	1.72 U	1.1
	2005	0.13 U	0.57 U	0.484 J
	2006	0.088 U	0.49 U	0.366 U
	2007	1 U	4.8 U	
	2017	0.1 U	1.66	0.36
MW-40(B) (Filtered)	2002	0 U	3.0	
	2004	0.158 U	3.1 J	
	2005	0.13 U	0.57 U	
	2006	0.088 U	0.49 J	
	2007	1.0 U	4.8 U	
	2017	0.1 U	1.47	0.42
MW-41(B)	2017	0.1 U	0.21	0.41
MW-41(B) (Filtered)	2017	0.1 U	0.13	0.42
MW-50(I)	2010	0.082 J	0.72	2.17
	2011	0.1 U	1.6	1.16
	2013	0.25 U	0.25 J	1.17
	2014	0.5 U	0.45 J	0.929
	2017	0.1 U	0.63	1.31
	2018 (April)	0.1 U	0.338 J	1.22
	2018 (September)	0.060 UJ	0.328 UJ	2.55 J
MW-50(I) (Filtered)	2010	0.06 J	0.15 J	
	2011	0.1 U	0.62	1.16
	2013	0.25 U	0.24 U	1.06
	2014	0.5 U	0.32 J	1.19
	2017	0.1 U	0.62	1.47
	2018 (April)	0.1 U	0.410 J	1.28
	2018 (September)	0.0412 UJ	0.368 J	2.67 J
MW-51(S)	2010	0.35 U	1.4 J	
	2011	0.1 U	0.13 J	4.73
	2012	0.25 U	0.24 U	9.36
	2013	0.25 U	0.24 U	9.32
	2014	0.5 U	0.5 U	5.3
	2017	0.1 U	0.13	6.5
	2018 (April)	0.1 U	0.1 U	8.04
	2018 (September)	0.0412 UJ	0.328 UJ	17.6 J

Luckey FUSRAP Site
 Fall 2018 Sampling Results

Table 2: Analytical Results

Well	Year	Beryllium	Lead	Total Uranium (KPA) ¹
Units		µg/L	µg/L	µg/L
<i>USEPA MCL</i>		4	15	30 ²
MW-51(S) (Filtered)	2010	0.35 U	0.17 U	
	2011	0.1 U	0.15 J	0.94
	2012	0.25 U	0.24 U	7.53
	2013	0.25 U	0.24 U	8.37
	2014	0.5 U	0.5 U	2.05
	2017	0.1 U	0.1	6.8
	2018 (April)	0.1 U	0.1 U	8.4
	2018 (September)	0.0412 UJ	0.328 UJ	15.3 J
MW-52(I)	2010	0.35 U	6.8	
	2011	0.37 J	0.74	2.76
	2012	0.25 U	0.5 J	2.76
	2013	0.25 U	0.76 J	2.6
	2014	0.5 U	0.94 J	2.71
	2017	0.1 U	0.85	2.76
	2018 (April)	0.1 U	0.786 J	2.45
	2018 (September)	0.0412 UJ	0.87 J	4.95 J
MW-52(I) (Filtered)	2010	0.35 U	7.3	
	2011	0.1 U	0.4	2.68
	2012	0.25 U	0.35 J	2.69
	2013	0.25 U	0.46 J	2.66
	2014	0.5 U	0.47 J	2.56
	2017	0.1 U	0.68	2.70
	2018 (April)	0.1 U	0.676 J	2.50
	2018 (September)	0.0412 UJ	0.683 J	4.90 J
MW-52A(I)	2012	0.64 J	11	15.2
	2013	0.75 J	10	15.4
	2014	0.6 J	9.4	14.9
	2017	1.23	10.4	15.2
	2018 (April)	1.3	9.05	16.1
	2018 (September)	0.735 J	6.39 J	18.9 J
MW-52A(I) (Filtered)	2012	0.67 J	10	15.4
	2013	0.8 J	9.4	16.0
	2014	0.5 U	9.4	15.2
	2017	1.51	10.3	16.2
	2018 (April)	1.43	9.32	16.3
	2018 (September)	1.01 J	11 J	19.3 J
MW-53(I)	2010	0.056 U	0.17 J	1.00 U
	2011	0.1 U	0.87	0.408
	2012	0.25 U	0.66 J	0.432
	2013	3.7	8.7	0.458
	2014	0.5 U	0.5 U	0.452
	2017	0.1 U	0.49	0.380
	2018 (April)	0.1 U	0.544 J	0.362
	2018 (September)	0.412 UJ	0.328 UJ	0.756 J

Luckey FUSRAP Site
Fall 2018 Sampling Results

Table 2: Analytical Results

Well	Year	Beryllium	Lead	Total Uranium (KPA) ¹
Units		µg/L	µg/L	µg/L
<i>USEPA MCL</i>		4	15	30 ²
MW-53(I) (Filtered)	2010	0.056 U	0.07 J	
	2011	0.1 U	0.096 U	0.404
	2012	0.25 U	0.24 U	0.398
	2013	3.4	0.24 U	0.451
	2014	0.5 U	0.5 U	0.560
	2017	0.1 U	0.63	0.370
	2018 (April)	0.1 U	0.1 U	0.362
	2018 (September)	0.412 UJ	0.328 UJ	0.718 J
MW-54(S)	2010	0.11 J	0.21 J	4.98
	2011	0.1 U	0.096 U	7.0
	2012	0.25 U	0.24 U	4.39
	2013	0.25 U	0.77 J	5.21
	2014	0.5 U	0.54 J	5.67
	2017	0.1 U	0.1 U	5.72
	2018 (April)	0.1 U	0.1 U	4.73
	2018 (September)	0.412 UJ	0.328 UJ	8.88 J
MW-54(S) (Filtered)	2010	0.056 U	0.072 J	
	2011	0.1 U	0.096 U	8.14
	2012	0.25 U	0.24 U	4.57
	2013	0.25 U	0.24 U	4.42
	2014	0.5 U	0.5 U	4.65
	2017	0.1 U	0.1 U	5.34
	2018 (April)	0.1 U	0.1 U	4.21
	2018 (September)	0.412 UJ	0.328 UJ	9.86 J
MW-55(I)	2010	0.056 U	0.06 J	1.00 U
	2011	0.1 U	0.096 U	0.684
	2012	0.25 U	0.24 U	0.437
	2013	0.25 U	1.0	0.442
	2014	0.5 U	0.5 U	0.486
	2017	0.1 U	0.1 U	0.43
	2018 (April)	0.1 U	0.1 U	0.415
	2018 (September)	0.412 UJ	0.328 UJ	0.820 J
MW-55(I) (Filtered)	2010	0.056 U	0.064 J	
	2011	0.1 U	0.096 U	0.391
	2012	0.25 U	0.24 U	0.436
	2013	0.25 U	0.24 U	0.438
	2014	0.5 U	0.5 U	0.502
	2017	0.1 U	0.1 U	0.42
	2018 (April)	0.1 U	0.1 U	0.425
	2018 (September)	0.412 UJ	0.328 UJ	0.802 J
MW-56(I)	2010	0.25 J	0.48	3.45
	2011	0.62	0.12 J	1.35
	2013	0.25 U	0.24 U	1.23
	2014	0.5 U	0.5 U	0.963
	2017	0.1 U	0.34 J	0.94

Luckey FUSRAP Site
 Fall 2018 Sampling Results

Table 2: Analytical Results

Well	Year	Beryllium	Lead	Total Uranium (KPA) ¹
Units		µg/L	µg/L	µg/L
<i>USEPA MCL</i>		4	15	30 ²
MW-56(I) (Filtered)	2010	0.08 J	0.3 J	
	2011	0.1 U	0.16 J	1.54
	2013	0.25 U	0.24 U	0.812
	2014	0.5 U	0.5 U	1.01
	2017	0.1 U	0.1 U	0.85
OMW-27(I)	2008	1.0 U	2.5 U	1.89
	2009	0.056 U	0.73	1.41
	2010	0.056 U	1.20	2.09
	2011	0.1 U	1.20	1.88
	2012	0.25 U	0.32 J	2.02
	2013	0.25 U	0.9 J	2.03
	2014	0.62 J	0.94 J	2.14
	2017	0.1 U	1.18	1.91
OMW-27(I) (Filtered)	2008	1.0 U	2.5 U	
	2009	0.028 U	0.54	
	2010	0.056 U	0.55	
	2011	0.1 U	0.49	1.73
	2012	0.25 U	0.24 U	1.98
	2013	0.25 U	1.10	2.06
	2014	0.5 U	0.5 J	2.07
	2017	0.1 U	2.27	1.99
OMW-28(B)	2017	0.1 U	0.32	0.24
OMW-28(B) (Filtered)	2017	0.1 U	0.19	0.23
OMW-29(I)	2002	0.0 U	2.0 U	0.21
	2004	0.158 U	1.72 U	0.299
	2005	0.13 U	0.57 U	4.45
	2006	0.088 U	0.49 U	2.5
	2007	0.51 U	2.4 U	
OMW-29(I) (Filtered)	2002	0.0 U	2.0 U	
	2004	0.158 U	1.72 U	
	2005	0.13 U	0.57 U	
	2006	0.088 U	0.89 J	
	2007	0.51 U	2.4 U	

Luckey FUSRAP Site
 Fall 2018 Sampling Results

Table 2: Analytical Results

Well	Year	Beryllium	Lead	Total Uranium (KPA) ¹
Units		µg/L	µg/L	µg/L
<i>USEPA MCL</i>		4	15	30 ²
OMW-31(I)	2002	0.0 U	2.0 U	0.67
	2004	0.158 U	1.72 U	0.982
	2005	0.13 U	0.57 U	1.42
	2006	0.088 U	0.49 U	1.81 J
	2007	1.0 U	4.8 U	
	2008	1.0 U	2.5 U	0.525 U
	2009	0.056 U	0.27 J	0.469 U
	2010	0.056 U	0.66	1.00 U
	2011	0.1 U	1.2	1.25
	2012	0.25 U	0.3 J	0.423
	2013	0.25 U	0.24 U	0.335
	2014	1.8	1.9	0.159 J
	2017	0.1 U	0.13	0.61
OMW-31(I) (Filtered)	2002	0.0 U	2.0 U	
	2004	0.158 U	1.72 U	
	2005	0.13 U	0.57 U	
	2006	0.088 U	0.49 U	
	2007	1.0 U	4.8 U	
	2008	1.0 U	2.5 U	
	2009	0.035 J	0.35	
	2010	0.056 U	0.22 J	
	2011	0.1 U	0.25 J	0.59
	2012	0.25 U	0.24 U	0.517
	2013	0.25 U	0.24 U	0.392
	2014	0.5 U	0.32 J	0.453
	2017	0.1 U	0.1 U	0.59
OMW-32(B)	2008	1.0 U	2.5 U	0.258 U
	2009	0.056 U	0.13 J	0.016 U
	2010	0.056 U	0.18 J	1.00 U
	2011	0.36 J	0.57	0.178 J
	2012	0.25 U	0.48 J	0.145 J
	2013	0.25 U	0.29 J	0.089 J
	2014	0.5 U	0.64 J	0.113 J
	2017	0.1 U	0.5	0.04
	2018 (April)	0.1 U	0.1 U	0.047 J
	2018 (September)	0.412 UJ	0.328 UJ	0.086 J

Luckey FUSRAP Site
 Fall 2018 Sampling Results

Table 2: Analytical Results

Well	Year	Beryllium	Lead	Total Uranium (KPA) ¹
Units		µg/L	µg/L	µg/L
<i>USEPA MCL</i>		4	15	30 ²
OMW-32(B) (Filtered)	2008	1.0 U	2.5 U	
	2009	0.028 U	0.28	
	2010	0.056 U	0.18 J	
	2011	0.1 U	0.18 J	0.085 J
	2012	0.25 U	0.24 U	0.146 J
	2013	0.25 U	0.25 J	0.086 J
	2014	0.5 U	0.5 U	0.179 J
	2017	0.1 U	0.65	0.04
	2018 (April)	0.1 U	0.1 U	0.044 J
	2018 (September)	0.412 UJ	0.328 UJ	0.107 J
OMW-35(I)	2002	0.0 U	2.0 U	0.72
	2004	0.158 U	1.72 U	0.763
	2005	0.13 U	0.57 U	0.528 J
	2006	0.088 U	1.6	1.91 J
	2007	1.0 U	4.8 U	
OMW-35(I) (Filtered)	2002	0.0 U	2.0 U	
	2004	0.158 U	1.72 U	
	2005	0.13 U	0.57 U	
	2006	0.088 U	1.5	
	2007	1.0 U	4.8 U	
PW(E)	2002	0.0 U	2.0 U	0.52
	2004	0.158 U	1.72 U	0.502
	2008	1.0 U	26.2	0.249 U
	2009	0.17 J	26	0.103 U
	2010	0.098 J	16	1.00 U
	2011	0.1 U	0.54	0.157 J
	2013	0.25 U	6.9	0.273
	2014	0.5 U	10	0.268
	2017	0.1 U	2.82	0.14
	2018 (April)	0.1 U	1.65	0.031 U
	2018 (September)	0.412 UJ	0.328 UJ	0.0521 UJ
PW(E) (Filtered)	2002	0.0 U	2.0 U	
	2004	0.158 U	3.2 J	
	2008	1.0 U	4.0 B	
	2009	0.028 J	0.56	
	2010	0.056 U	0.18 J	
	2011	0.1 U	0.12 J	0.332
	2013	0.25 U	0.24 U	0.266
	2014	0.5 U	0.5 U	0.28
	2017	0.1 U	0.24	0.14
	2018 (April)	0.1 U	0.1 U	0.032 J
	2018 (September)	0.412 UJ	0.328 UJ	0.0521 UJ

Luckey FUSRAP Site
Fall 2018 Sampling Results

Table 2: Analytical Results

Well	Year	Beryllium	Lead	Total Uranium (KPA) ¹
Units		µg/L	µg/L	µg/L
<i>USEPA MCL</i>		4	15	30 ²
PW(W)	2004	4.1 J	1.72 U	8.04
	2008	11.3	2.5 U	4.14
	2009	13	2.20	3.74
	2010	7.5	1.30	3.73
	2011	6.8	0.91	3.64
	2013	7.5	1.20	2.90
	2014	4.6	0.55 J	2.60
	2017	1.18	2.69	6.60
	2018 (April)	0.1 U	8.85	0.416
	2018 (September)	0.052 UJ	22 J	0.734 J
PW(W) (Filtered)	2004	4.4 J	6.50	
	2008	11	2.5 U	
	2009	18	1.60	
	2010	8.7	0.85	
	2011	6.6	0.71	3.58
	2013	7.1	0.42 J	2.89
	2014	5.3	0.38 J	3.01
	2017	0.74	0.60 J	6.50
	2018 (April)	0.1 U	1.04	0.449
	2018 (September)	0.412 UJ	2.10 J	0.683 J
PZ-01	2017	2.87	77.6	13.1
	2018 (April)	1.22	28.5	8.51
	2018 (September)	0.10 J	2.28 J	14.3 J
PZ-01 (Filtered)	2017	0.1 U	0.59 J	5.71
	2018 (April)	0.1 U	0.10 U	5.60
	2018 (September)	0.412 UJ	3.28 UJ	13.2 J
PZ-03	2017	3.65	23.8	8.63
PZ-03 (Filtered)	2017	0.1 U	0.16 J	8.64
PZ-04	2017	0.53	23.5	3.95
PZ-04 (Filtered)	2017	0.1 U	0.14 J	1.59
PZ-05	2017	0.86	18.7	4.36
PZ-05 (Filtered)	2017	0.1 U	0.24	2.21
PZ-06	2017	4.63	18.2	17.3
PZ-06 (Filtered)	2017	0.2	0.19	14.8
TW-42(S)	2017	0.1 U	0.26	3.16
TW-42(S) (Filtered)	2017	0.1 U	0.23	3.58
TW-43(S)	2017	0.1 U	0.32	6.0
TW-43(S) (Filtered)	2017	0.1 U	0.10 U	5.58

Luckey FUSRAP Site
 Fall 2018 Sampling Results

Table 2: Analytical Results

Well	Year	Beryllium	Lead	Total Uranium (KPA) ¹
Units		µg/L	µg/L	µg/L
<i>USEPA MCL</i>		4	15	30 ²

Notes:

- U Undetected above quantitation limit
- R Result was rejected because of quality issues
- J Result is estimated
- B Constituent also detected in laboratory blank
- blank cells Not Analyzed

- bold entries highlighted blue** Result exceeds USEPA Maximum Contaminant Levels (MCL) for protection of drinking water
- µg/L micrograms per liter
- pCi/L pico Curies per liter
- 1 Kinetic Phosphorescence Analysis (KPA) and Alpha Spec are the analytical methods used to measure Total Uranium and Uranium Isotopes, respectively
- 2 This MCL refers to the sum of Uranium Isotopes (MCL=27pCi/L or 30 µg/L)
- 3 MW-24(S) was abandoned and replaced by MW-24A(S)

Luckey FUSRAP Site
Fall 2018 Sampling Results

Table 3: Summary of Mann-Kendall Test Results for Large Sample Size

Well	Constituent	Sample Size (n)	Test Statistic (z)	Critical Value ($Z_{1-\alpha}$) ¹	Conclusion	Notes
GW0002	total beryllium	15	test not performed		No discernable trend	13 of 15 results < detection limit; detected results < MCL
GW0002	filtered beryllium	15	test not performed		No discernable trend	14 of 15 results < detection limit; detected result < MCL
GW0002	total lead	15	-0.99	-1.28	No trend	All results < MCL; four of 15 results < detection limit
GW0002	filtered lead	15	-1.73	-1.28	Downward trend	All results < MCL; seven of 15 results < detection limit
GW0002	total uranium	14	0.05	1.28	No trend	All results < MCL
MW-01(I)	total beryllium	14	-1.81	-1.28	Downward trend	All results > MCL
MW-01(I)	filtered beryllium	14	-0.99	-1.28	No trend	All results > MCL
MW-02(S)	total beryllium	14	-2.91	-1.28	Downward trend	All results > MCL
MW-02(S)	filtered beryllium	14	-2.41	-1.28	Downward trend	All results > MCL
MW-21(I)	total lead	14	-0.22	-1.28	No trend	All results > MCL
MW-21(I)	filtered lead	14	-0.93	-1.28	No trend	All results > MCL
MW-21(I)	total uranium	13	2.44	1.28	Upward trend	10 of 13 results > MCL
MW-26(S)	total beryllium	10	0.54	1.28	No trend	All results > MCL
MW-26(S)	filtered beryllium	10	0.18	1.28	No trend	All results > MCL
PW(E)	total lead	11	-1.32	-1.28	Downward trend	Three of 11 results > MCL
PW(E)	filtered lead	11	-2.34	-1.28	Downward trend	All results < MCL

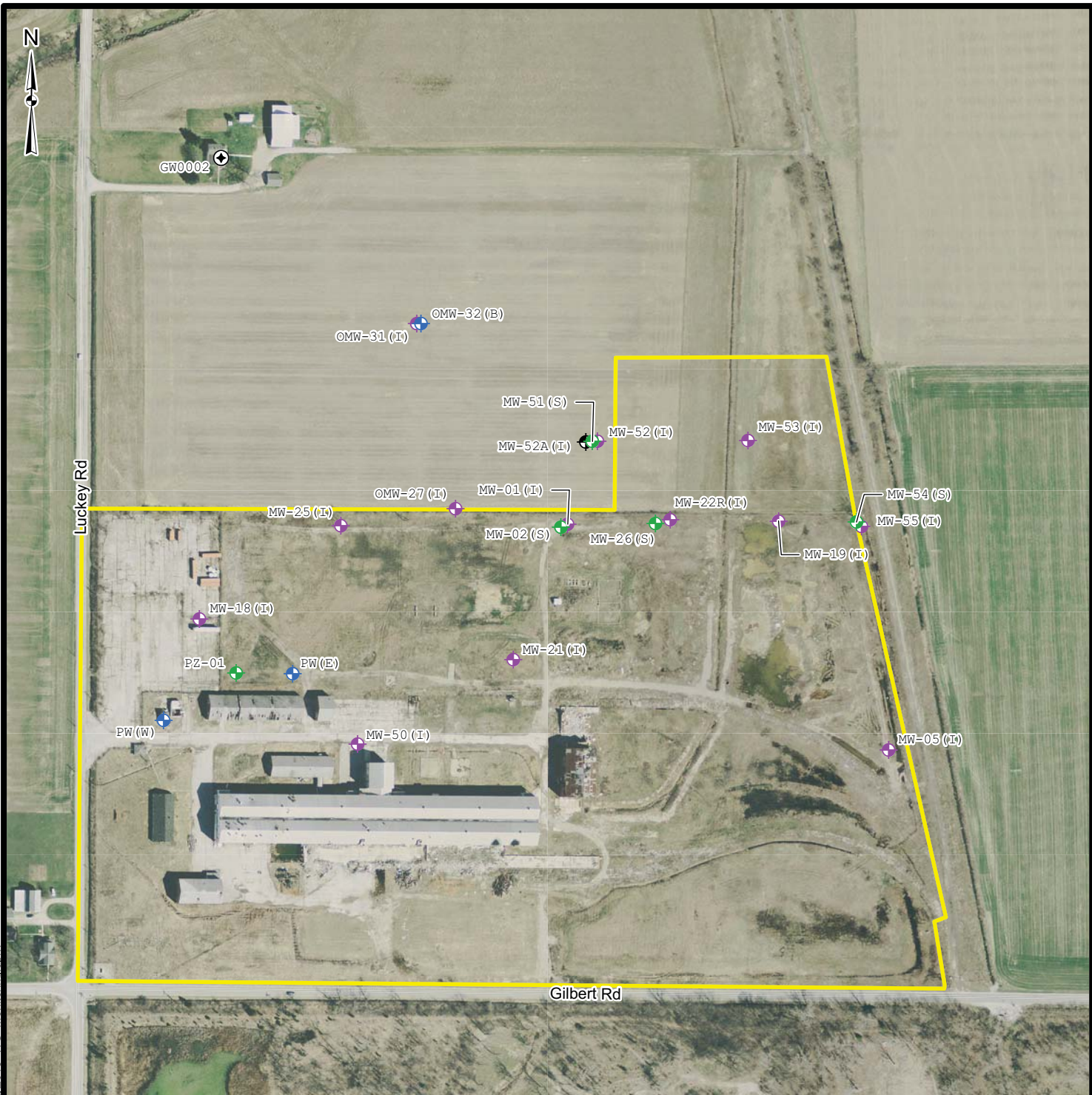
1 Critical values at 90% level of confidence

Table 4: Summary of Mann-Kendall Test Results for Small Sample Size

Well	Constituent	Sample Size (n)	Test Probability (ρ)	Level of Confidence (%)	Conclusion	Notes
GW0002	filtered uranium	7	0.329	90	No trend	All results < MCL
MW-21(I)	filtered uranium	6	0.235	90	No trend	All results > MCL
MW-24(S)	total lead	7	0.097	90	Downward trend	All results < MCL
MW-24(S)	filtered lead	7	0.386	90	No trend	All results < MCL
MW-24(S)	total uranium	6	0.235	90	No trend	All results > MCL

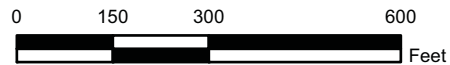
FIGURES

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Legend

-  Hybrid Monitoring Well (Installed 2012)
-  Residential Well
-  Shallow Monitoring Well
-  Intermediate Monitoring Well
-  Deep Monitoring Well
-  Site Boundary



U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

**2018 MONITORING PROGRAM
GROUNDWATER SAMPLE LOCATIONS**

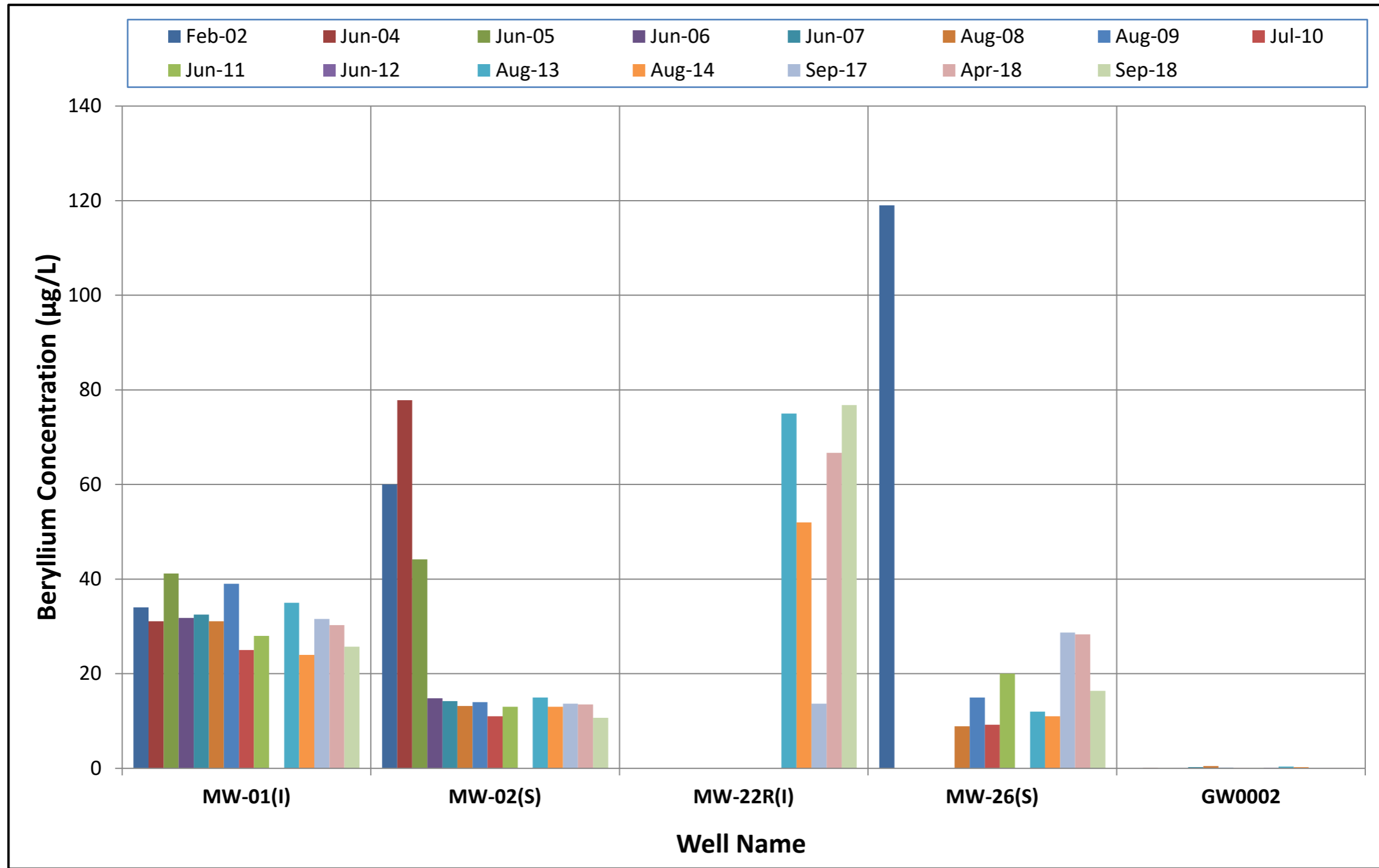
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Drawn By: H5TDESPM
Date Saved: 1/2/2019
Time Saved: 0937

**LUCKEY FUSRAP SITE
LUCKEY, OHIO**

FIGURE 1

Document Path: K:\LUCKEY\GIS\ArcGISPro\2018\2018_WG_Monitoring.aprx

Figure 2: Beryllium Concentrations in Unfiltered Groundwater

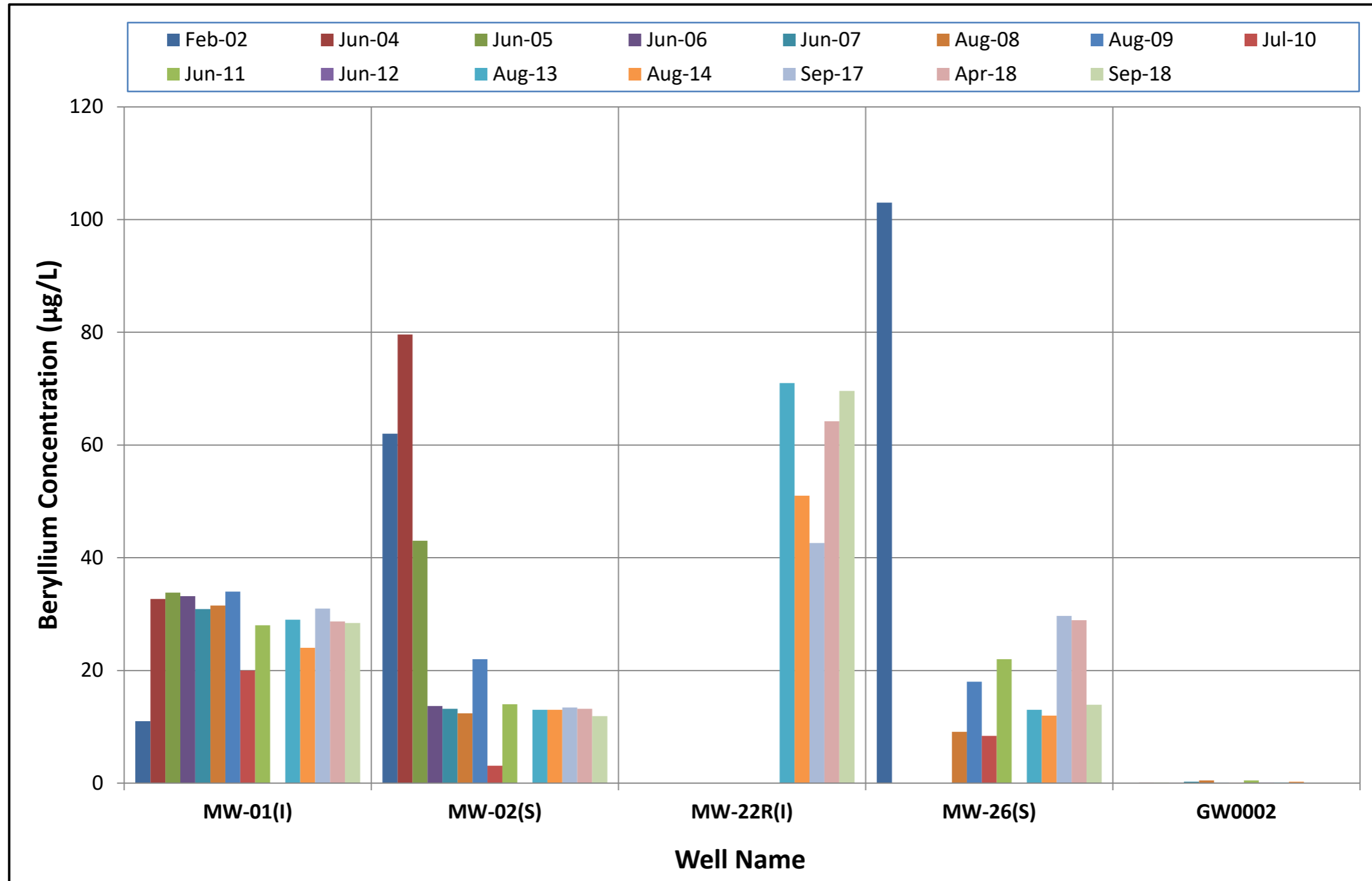


Legend

(S) - shallow monitoring well
 (I) - intermediate monitoring well

GW0002 - residential well
 µg/L - micrograms per liter

Figure 3: Beryllium Concentrations in Filtered Groundwater

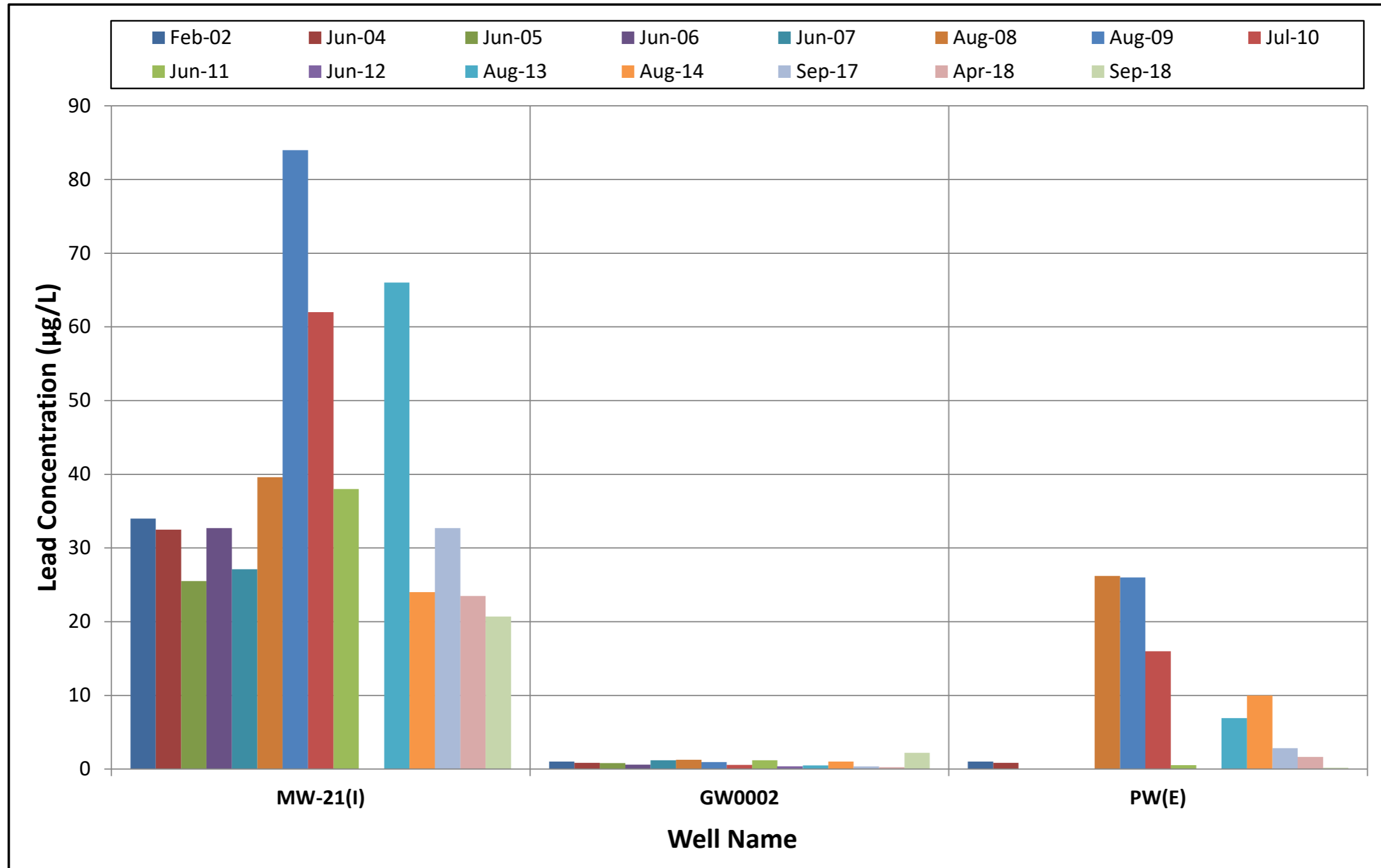


Legend

(S) - shallow monitoring well
 (I) - intermediate monitoring well

GW0002 - residential well
 µg/L - micrograms per liter

Figure 4: Lead Concentrations in Unfiltered Groundwater

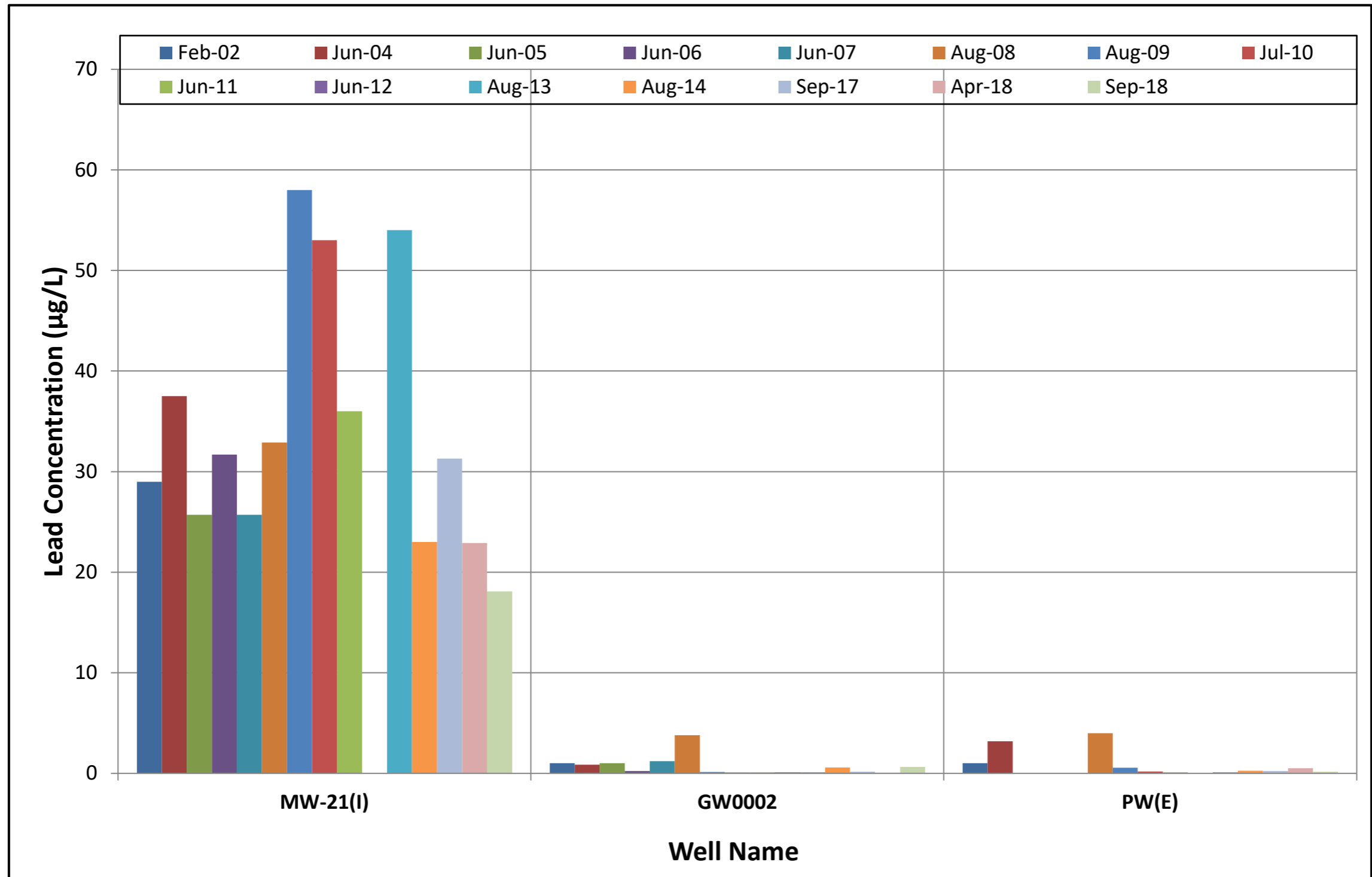


Legend

(I) - intermediate monitoring well
 GW0002 - residential well

PW(E) - former water supply well for the Luckey Site (east)
 µg/L - micrograms per liter

Figure 5: Lead Concentrations in Filtered Groundwater

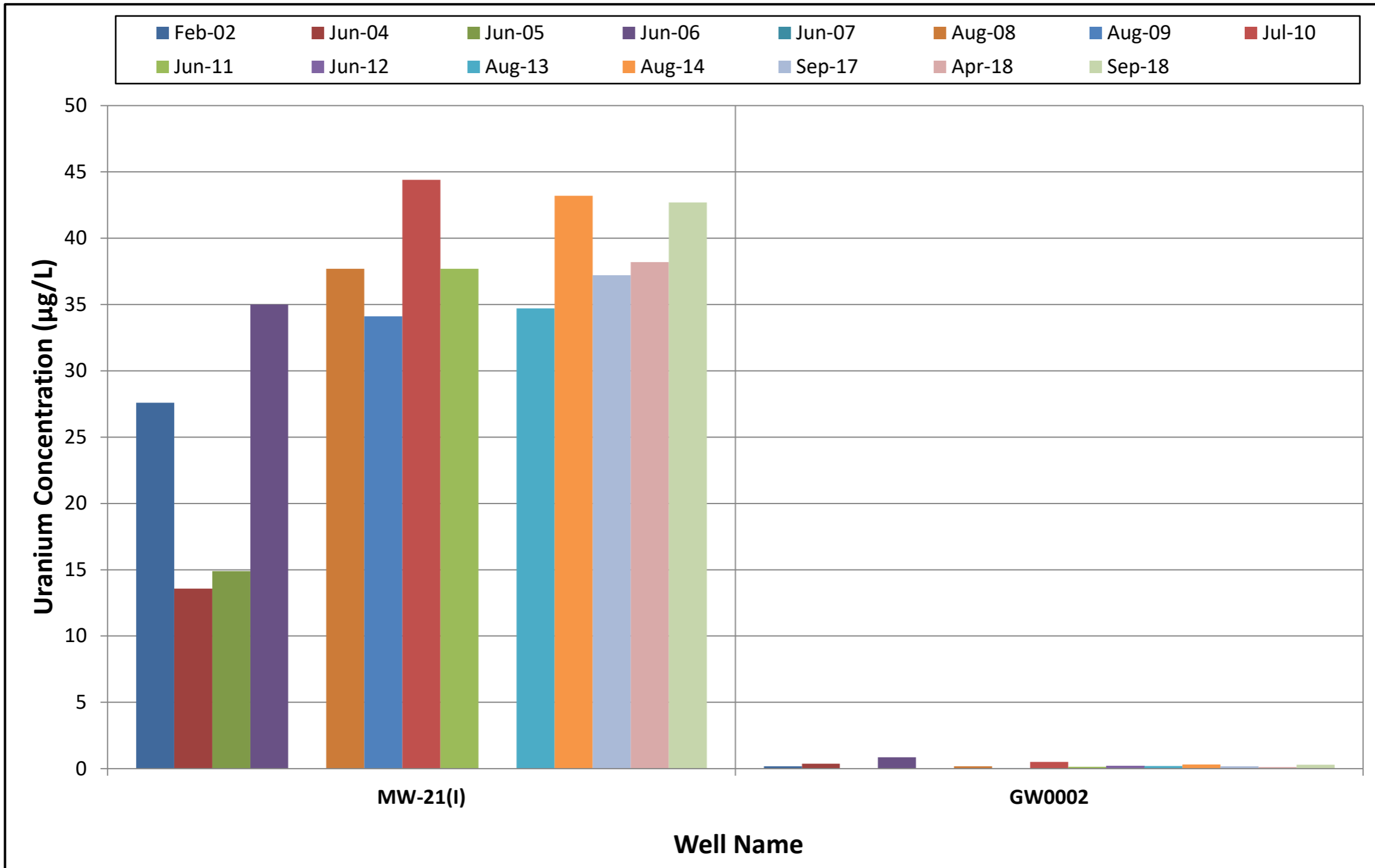


Legend

(I) - intermediate monitoring well
 GW0002 - residential well

PW(E) - former water supply well for the Luckey Site (east)
 µg/L - micrograms per liter

Figure 6: Uranium Concentrations in Unfiltered Groundwater

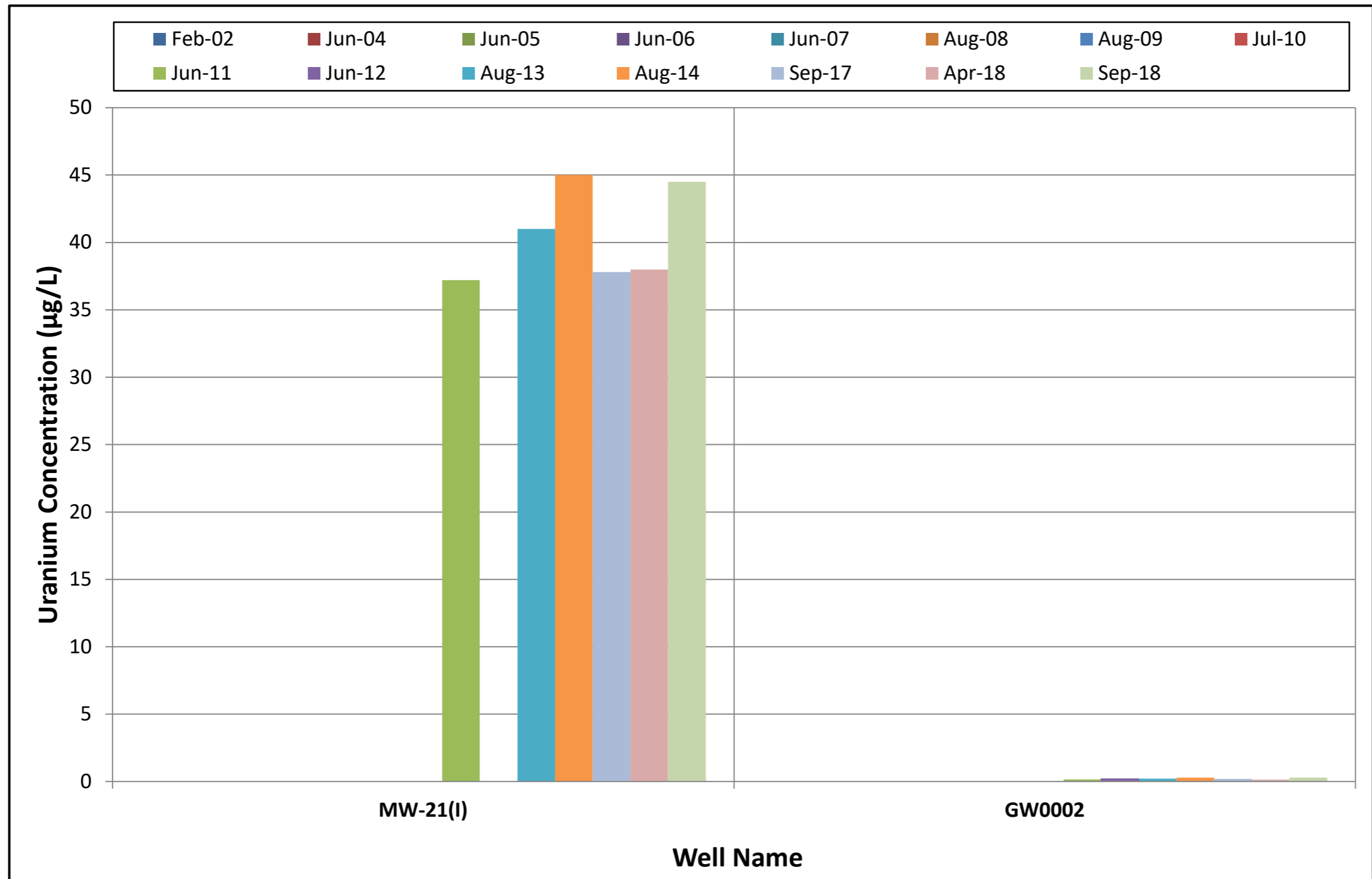


Legend

(I) - intermediate monitoring well
 GW0002 - residential well

µg/L - micrograms per liter

Figure 7: Uranium Concentrations in Filtered Groundwater



Legend

(I) - intermediate monitoring well
GW0002 - residential well

µg/L - micrograms per liter