

## Upper Prediction Limits for Monitoring Constituents in the Alluvial Aquifer

Code	Type	Constituent	Unit	n	No. Below MDL	% Below MDL	No. of Distinct Obs.	Lognormal (Full)		Lognormal (with BDLs)			Gamma (Full)		k star for detected data <sup>1,2</sup>					Normal (Full)	Normal (with BDLs)	Nonparametric		Maximum	ProUCL's Best Fit <sup>3</sup>	HDR's Recommended Fit	HDR's Recommendations			Notes	
								sd	(1- $\alpha$ )th UPL	sd	LROS(1- $\alpha$ )th UPL	s	WH (1- $\alpha$ )th UPL	HW (1- $\alpha$ )th UPL	k star for detected data <sup>1</sup>	GROS-WH (1- $\alpha$ )th UPL	GROS-HW (1- $\alpha$ )th UPL	KM-WH (1- $\alpha$ )th UPL	KM-HW (1- $\alpha$ )th UPL	(1- $\alpha$ )th UPL	KM (1- $\alpha$ )th UPL	(1- $\alpha$ )th UPL	Chebyshev (1- $\alpha$ )th UPL								
1_1_102	Dissolved Metals	aluminum (dissolved)	mg/L	15	10	67%	9			1.42	26.6	17.4		0.310	2.04	2.66	1.82	2.33		0.987	0.730	18.5	0.730		Gamma; Lognormal	Nonparametric	0.0001	4	0.730 ***		
1_1_104	Dissolved Metals	antimony (dissolved)	mg/L	15	13	87%	6			0.125	0.000848	0.000833		N/A			0.000794	0.000803		0.000741	0.00250	0.00629	0.000530		Nonparametric	Nonparametric	0.0001	4	0.000530 **>		
1_1_106	Dissolved Metals	arsenic (dissolved)	mg/L	15	1	7%	12			0.175	0.00125	0.00124			24.1	0.00591	0.00570	0.00123	0.00124		0.00122	0.00130	0.00213	0.00130		Lognormal	Lognormal	0.0156	2	0.00125	
1_1_108	Dissolved Metals	barium (dissolved)	mg/L	15	0	0%	8	0.165	0.0259				0.0257	0.0257						0.0253		0.0260	0.0434	0.0260	Gamma; Lognormal	Gamma	0.0156	2	0.0257		
1_1_110	Dissolved Metals	beryllium (dissolved)	mg/L	15	15	100%	4																	N/A			na	na	0.00100 *		
1_1_112	Dissolved Metals	cadmium (dissolved)	mg/L	15	15	100%	4																	N/A			na	na	0.00100 *		
1_1_114	Dissolved Metals	calcium (dissolved)	mg/L	15	0	0%	12	0.150	65.5				64.6	64.8						63.1		58.6	104	58.6	Gamma; Lognormal; Normal	Gamma	0.0156	2	64.7		
1_1_116	Dissolved Metals	chromium (dissolved)	mg/L	15	13	87%	5			0.460	0.0110	0.00446		N/A			0.00410	0.00418		0.00371	0.00300	0.0534	0.00300		Nonparametric	Nonparametric	0.0001	4	0.00300 **		
1_1_118	Dissolved Metals	cobalt (dissolved)	mg/L	15	2	13%	13			0.496	0.00109	0.000973			3.47	0.0105	0.0107	0.000939	0.000945		0.000927	0.00110	0.00221	0.00110		Lognormal	Lognormal	0.0156	2	0.00103	
1_1_120	Dissolved Metals	copper (dissolved)	mg/L	15	6	40%	10			0.957	0.187	0.133			0.617	0.114	0.168	0.0406	0.0485		0.0214	0.0140	0.385	0.0140		Nonparametric	Nonparametric	0.0001	4	0.0140	
1_1_122	Dissolved Metals	iron (dissolved)	mg/L	15	8	53%	10			0.865	3.18	2.33			0.506	1.51	1.91	1.11	1.24		0.750	0.560	13.8	0.560		Nonparametric	Nonparametric	0.0001	4	0.560 ***	
1_1_124	Dissolved Metals	lead (dissolved)	mg/L	15	12	80%	5			0.271	0.00133	0.00103		N/A	0.119	0.187	0.000922	0.000944		0.000807	0.000700	0.00970	0.000584		Lognormal; Normal	Nonparametric	0.0001	4	0.000584 **>		
1_1_126	Dissolved Metals	magnesium (dissolved)	mg/L	15	0	0%	8	0.106	32.5				32.3	32.3					32.0		32.2	48.1	32.2	Gamma; Lognormal	Gamma	0.0156	2	32.3			
1_1_128	Dissolved Metals	manganese (dissolved)	mg/L	15	0	0%	9	0.200	0.313				0.309	0.310					0.306		0.330	0.563	0.330	Gamma; Lognormal; Normal	Gamma	0.0156	2	0.310			
1_1_130	Dissolved Metals	mercury (dissolved)	mg/L	15	15	100%	3																N/A			na	na	0.000100 *			
1_1_132	Dissolved Metals	nickel (dissolved)	mg/L	15	1	7%	13			0.442	0.00538	0.00523			3.42	0.00885	0.00896	0.00508	0.00510		0.00510	0.00630	0.0123	0.00630		Lognormal	Lognormal	0.0156	2	0.00531	
1_1_136	Dissolved Metals	potassium (dissolved)	mg/L	15	2	13%	13			0.497	2.40	2.32			3.12	2.25	2.30	2.13	2.17		2.02	2.40	4.84	2.40		Gamma; Lognormal	Gamma	0.0156	2	2.21	
1_1_138	Dissolved Metals	selenium (dissolved)	mg/L	15	14	93%	3																0.00300			0.0001	4	0.00300 **			
1_1_140	Dissolved Metals	silver (dissolved)	mg/L	15	12	80%	6			1.01	0.00940	0.00191		N/A	0.155	0.286	0.00107	0.00118		0.000753	0.00100	0.0136	0.000550		Lognormal; Normal	Nonparametric	0.0001	4	0.000550 **>		
1_1_142	Dissolved Metals	sodium (dissolved)	mg/L	15	0	0%	11	0.136	1,127				1,094	1,102					1,048			920	1,599	920	Normal	Normal	0.0156	2	1,048		
1_1_144	Dissolved Metals	thallium (dissolved)	mg/L	15	15	100%	4																N/A			na	na	0.00100 *			
1_1_146	Dissolved Metals	vanadium (dissolved)	mg/L	15	1	7%	13			0.486	0.00669	0.00647			3.40	0.00942	0.00965	0.00584	0.00596		0.00531	0.00554	0.0124	0.00554		Gamma; Lognormal; Normal	Gamma	0.0156	2	0.00772	
1_1_148	Dissolved Metals	zinc (dissolved)	mg/L	15	10	67%	8			0.579	0.0657	0.0531			0.945	0.0527	0.0627	0.0303	0.0335		0.0201	0.0500	0.327	0.0140		Gamma; Lognormal; Normal	Nonparametric	0.0001	4	0.0500 ***>	
1_2_133	Nitrate	nitrate	mg/L	15	11	73%	6			1.09	27.9	6.93			0.376	6.45	9.44	3.66	4.05		2.54	1.90	46.4	1.90		Gamma; Lognormal	Nonparametric	0.0001	4	1.90 **	
1_3_134	Perchlorate	perchlorate	mg/L	15	15	100%	4																N/A			na	na	0.000100 *			
1_4_101	Total Metals	aluminum	mg/L	15	2	13%	15			1.58	5.86	4.79			0.400	3.68	3.91	3.38	3.49		3.38	4.20	9.9								

<sup>5</sup> To optimize the process for estimating a reference background concentration when there are multiple forms of the UPL equations for data sets with assumed distributional properties, the averaging of the results over the multiple methods or equations under the recommended distribution assumption is done. The equations are comparable and each one offers advantages and also has inherent errors in their methods. The action of averaging the estimates from the equations produces a pooled estimate closest to the unknown common truth based on how this error is perceived.

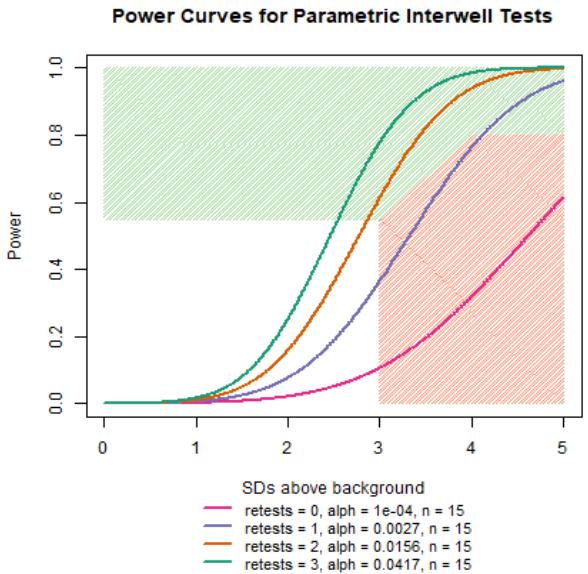
The first step in this process is to select one parametric distribution or failing results from the goodness of fit tests (or having 50% or more NDs), selecting nonparametric methods. The ProUCL authors have recognized that the GOF tests at a given significance level can indicate multiple distributions as the best or discernable fit. We see examples of all three parametric distributions passing the GOF tests, two of the three passing or just one. The very small datasets are unreliable to have confirmation as to the best fit, though results are indicative of a distribution from a type of parametric distribution. For this reason, the latest version of ProUCL no longer recommends a best fit. When multiple distributions are noted as fitting a distribution, we prioritize the selection of the ‘recommended’ distribution in this order: Gamma, lognormal (provided the standard deviation of the log-transformed data is less than 1), and normal. The ProUCL authors highly recommend gamma over lognormal even if both pass GOF tests as the lognormal can have extremely long tails and may produce unrealistic BTVs. (e.g., page 38 of ProUCL Version 5.1 Technical Guide).

Once a parametric distribution has been assigned, and depending on the censorship level of the sample, one or multiple equations are available to estimate the UPL. If there is more than one equation, we average the outputs. The averaging of multiple equations is a method drawn from both meta-analysis (combining outputs from the experts) and machine learning (combining outputs from different algorithms trying to predict the same value).

The work contained in the Unified Guidance and ProUCL are based on information as of the late nineties or early 2000’s. Nuances as to how to interpret UPL results using very small datasets are not addressed in depth (e.g., the issue of overfitting a dataset due to small sample size), leaving the ambiguity to be resolved by the practitioner. We have resolved such ambiguity by averaging the different equations within a distribution class as supported by state of the practice for statistical and machine learning analyses. The averaging or pooling is a means to negate the biases from the different equations under very small sample conditions to produce a UPL that is more representative than any one estimate produced by a particular equation. It is noted that the averaging approach in this study will have minimal impact on the recommended UPLs as the approach specific methods within a parametric class produce very similar UPL estimates.

#### Notes:

- \* Constituent is 100% Non-Detect (ND) so the maximum detection limit is chosen as the BTV. Recommend using the DQR process to determine if an exceedance has occurred.
- \*\* Data set is too small to compute reliable and meaningful statistics and estimates! Recommend maximum value as the upper background limit until more samples can be calculated.
- \*\*\* Nonparametric methods were used since percent BDL is greater than half.
- > Sample contains MDLs that are greater than the maximum detect value.



Upper Prediction Limits for Monitoring Constituents in the Bedrock Aquifer

Code	Type	Constituent	Unit	n	No. Below MDL	% Below MDL	No. of Distinct Obs.	Lognormal (Full)		Lognormal (with BDLs)			Gamma (Full)		Gamma (with BDLs) <sup>2</sup>				Normal (Full)	Normal (with BDLs)	Nonparametric		Maximum	ProUCL's Best Fit <sup>3</sup>	HDR's Recommended Fit	HDR's Recommendations			Notes
								sd	(1- $\alpha$ )th UPL	sd	LROS(1- $\alpha$ )th UPL	KM (1- $\alpha$ )th UPL	WH (1- $\alpha$ )th UPL	HW (1- $\alpha$ )th UPL	k star for detected data <sup>1</sup>	GROS-WH (1- $\alpha$ )th UPL	GROS-HW (1- $\alpha$ )th UPL	KM-WH (1- $\alpha$ )th UPL	KM-HW (1- $\alpha$ )th UPL	(1- $\alpha$ )th UPL	KM (1- $\alpha$ )th UPL	(1- $\alpha$ )th UPL	Chebyshev (1- $\alpha$ )th UPL	Per-Test FPR ( $\alpha$ ) <sup>4</sup>	No. of Verification Samples	BTv <sup>5</sup>			
2_1_102	Dissolved Metals	aluminum (dissolved)	mg/L	9	4	44%	7			3.25	1,415	554			0.237	151	181	129	144		119	130	309	130	Gamma; Lognormal	Gamma	0.0207	3	136
2_1_104	Dissolved Metals	antimony (dissolved)	mg/L	9	7	78%	4			0.187	0.00326	0.00262			N/A			0.00235	0.00241		0.00205	0.00250	0.0182	0.00130	Nonparametric	Nonparametric	0.0001	6	0.00130 **>
2_1_106	Dissolved Metals	arsenic (dissolved)	mg/L	9	4	44%	7			1.08	0.0165	0.0142			0.532	0.0327	0.0384	0.0104	0.0109		0.00940	0.0100	0.0230	0.0100	Gamma; Lognormal	Gamma	0.0207	3	0.0107
2_1_108	Dissolved Metals	barium (dissolved)	mg/L	9	0	0%	9	1.46	1.07				0.702	0.738						0.650		0.670	1.67	0.670	Lognormal	Gamma	0.0207	3	0.720
2_1_110	Dissolved Metals	beryllium (dissolved)	mg/L	9	7	78%	4			1.65	13.6	0.583			N/A			0.0370	0.0524		0.0122	0.00550	0.179	0.00550	Nonparametric	Nonparametric	0.0001	6	0.00550 **
2_1_112	Dissolved Metals	cadmium (dissolved)	mg/L	9	9	100%	1																	N/A	na	na	na	0.00100 *	
2_1_114	Dissolved Metals	calcium (dissolved)	mg/L	9	0	0%	9	1.43	1,572				577	670						356		292	847	292	Gamma; Lognormal; Normal	Gamma	0.0207	3	623
2_1_116	Dissolved Metals	chromium (dissolved)	mg/L	9	5	56%	6			3.50	7,610,259	106			0.284	0.980	1.41	1.12	1.79		0.312	0.140	4.58	0.140	Gamma; Lognormal	Nonparametric	0.0001	6	0.140 **
2_1_118	Dissolved Metals	cobalt (dissolved)	mg/L	9	3	33%	8			2.06	0.105	0.0816			0.302	0.0590	0.0730	0.0323	0.0349		0.0312	0.0340	0.0804	0.0340	Gamma; Lognormal	Gamma	0.0207	3	0.0336
2_1_120	Dissolved Metals	copper (dissolved)	mg/L	9	4	44%	7			1.47	0.101	0.0726			0.442	0.0500	0.0584	0.0393	0.0433		0.0289	0.0280	0.0706	0.0280	Gamma; Lognormal; Normal	Gamma	0.0207	3	0.0413
2_1_122	Dissolved Metals	iron (dissolved)	mg/L	9	4	44%	7			4.20	5,138	267			0.252	120	139	101	108		101	110	262	110	Gamma; Lognormal	Gamma	0.0207	3	104
2_1_124	Dissolved Metals	lead (dissolved)	mg/L	9	6	67%	5			4.20	54,225,184	4.10			N/A	0.238	0.375	0.188	0.272		0.0598	0.0270	0.877	0.0270	Lognormal; Normal	Nonparametric	0.0001	6	0.0270 **
2_1_126	Dissolved Metals	magnesium (dissolved)	mg/L	9	0	0%	9	1.61	357			101	121						55.2		39.0	130	39.0	Gamma; Lognormal	Gamma	0.0207	3	111	
2_1_128	Dissolved Metals	manganese (dissolved)	mg/L	9	1	11%	9			2.07	20.8	25.0			0.498	2.81	3.43	2.71	3.43		1.51	1.40	3.61	1.40	Gamma; Lognormal; Normal	Gamma	0.0207	3	3.07
2_1_130	Dissolved Metals	mercury (dissolved)	mg/L	9	9	100%	2																N/A	na	na	na	0.000100 *		
2_1_132	Dissolved Metals	nickel (dissolved)	mg/L	9	5	56%	6			2.33	6,942	24.7			0.286	0.605	0.900	0.621	0.937		0.186	0.0840	2.73	0.0840	Gamma; Lognormal	Nonparametric	0.0001	6	0.0840 **
2_1_136	Dissolved Metals	potassium (dissolved)	mg/L	9	0	0%	9	1.14	51.3			26.6	29.6						18.4		16.0	43.3	16.0	Gamma; Lognormal	Gamma	0.0207	3	28.1	
2_1_138	Dissolved Metals	selenium (dissolved)	mg/L	9	9	100%	2																N/A	na	na	na	0.00200 *		
2_1_140	Dissolved Metals	silver (dissolved)	mg/L	9	8	89%	3													0.0000460				0.0001	6	0.0000460 **>			
2_1_142	Dissolved Metals	sodium (dissolved)	mg/L	9	0	0%	8	0.641	6,517			5,118	5,362						4,136		3,530	8,928	3,530	Gamma; Lognormal; Normal	Gamma	0.0207	3	5.240	
2_1_144	Dissolved Metals	thallium (dissolved)	mg/L	9	8	89%	3												0.000350				0.0001	6	0.000350 **>				
2_1_146	Dissolved Metals	vanadium (dissolved)	mg/L	9	5	56%	6			2.53	33,965	17.0			0.344	0.560	0.730	0.674	0.983		0.216	0.0980	3.15	0.0980	Nonparametric	Nonparametric	0.0001	6	0.0980 **
2_1_148	Dissolved Metals	zinc (dissolved)	mg/L	9	8	89%	3															0.250			0.0001	6	0.250 **		
2_2_133	Nitrate	nitrate	mg/L	9	8	89%	7															0.0870			0.0001	6	0.0870 **>		
2_3_134	Perchlorate	perchlorate	mg/L	9	6	67%	6			0.198	0.0000286	0.0000308			N/A	0.542	1.60	0.0000238	0.0000251		0.0000181	0.0000500	0.0000171	0.00000950	Lognormal; Normal	Nonparametric	0.0001	6	0.00000950 **>
2_4_101	Total Metals	aluminum	mg/L	9	2	22%	9			3.17	25,328	20,401			0.375	772	1,140	666	916		322	260	775	260	Gamma; Lognormal; Normal	Gamma	0.0207	3	791
2_4_103	Total Metals	antimony	mg/L	9	8	89%	3												505				0.00380			0.0001	6	0.00380 **	
2_4_105	Total Metals	arsenic	mg/L	9	3	33%	8			1.33	0.0865	0.0524			5.88	7.65		1.08	0.0296		0.0321</td								

<sup>5</sup> To optimize the process for estimating a reference background concentration when there are multiple forms of the UPL equations for data sets with assumed distributional properties, the averaging of the results over the multiple methods or equations under the recommended distribution assumption is done. The equations are comparable and each one offers advantages and also has inherent errors in their methods. The action of averaging the estimates from the equations produces a pooled estimate closest to the unknown common truth based on how this error is perceived.

The first step in this process is to select one parametric distribution or failing results from the goodness of fit tests (or having 50% or more NDs), selecting nonparametric methods. The ProUCL authors have recognized that the GOF tests at a given significance level can indicate multiple distributions as the best or discernable fit. We see examples of all three parametric distributions passing the GOF tests, two of the three passing or just one. The very small datasets are unreliable to have confirmation as to the best fit, though results are indicative of a distribution from a type of parametric distribution. For this reason, the latest version of ProUCL no longer recommends a best fit. When multiple distributions are noted as fitting a distribution, we prioritize the selection of the 'recommended' distribution in this order: Gamma, lognormal (provided the standard deviation of the log-transformed data is less than 1), and normal. The ProUCL authors highly recommend gamma over lognormal even if both pass GOF tests as the lognormal can have extremely long tails and may produce unrealistic BTVs. (e.g., page 38 of ProUCL Version 5.1 Technical Guide).

Once a parametric distribution has been assigned, and depending on the censorship level of the sample, one or multiple equations are available to estimate the UPL. If there is more than one equation, we average the outputs. The averaging of multiple equations is a method drawn from both meta-analysis (combining outputs from the experts) and machine learning (combining outputs from different algorithms trying to predict the same value).

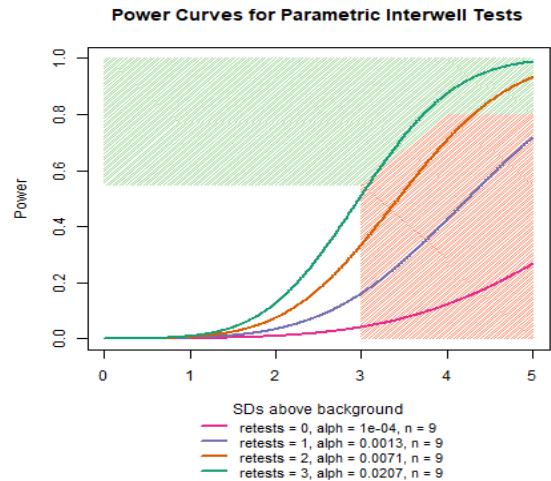
The work contained in the Unified Guidance and ProUCL are based on information as of the late nineties or early 2000's. Nuances as to how to interpret UPL results using very small datasets are not addressed in depth (e.g., the issue of overfitting a dataset due to small sample size), leaving the ambiguity to be resolved by the practitioner. We have resolved such ambiguity by averaging the different equations within a distribution class as supported by state of the practice for statistical and machine learning analyses. The averaging or pooling is a means to negate the biases from the different equations under very small sample conditions to produce a UPL that is more representative than any one estimate produced by a particular equation. It is noted that the averaging approach in this study will have minimal impact on the recommended UPLs as the approach specific methods within a parametric class produce very similar UPL estimates.

Notes:

\* Constituent is 100% Non-Detect (ND) so the maximum detection limit is chosen as the BTV. Recommend using the DQR process to determine if an exceedance has occurred.

\*\* Data set is too small to compute reliable and meaningful statistics and estimates! Recommend maximum value as the upper background limit until more samples can be calculated.

> Sample contains MDLs that are greater than the maximum detect value.



Preliminary Data Analysis With Full Data Set

Code	Aquifer	Constituent Type	Constituent	Unit	n	No. ND <sup>1</sup> BDL <sup>2</sup>	% ND BDL	Mean	Median	Standard Deviation (sd)	Minimum	Maximum	Skewness	Kurtosis	Standard Error of Mean	MAD <sup>3</sup> /0.675	Percentile <sup>4</sup>					Mean + 2sd	110% Maximum	120% Maximum	Serial Correlation with 1 Lag			ProUCL's Best Fit <sup>5</sup>	HDR's Recommended Fit
																	25th	75th	85th	90th	95th	Auto-correlation	Sig.	Auto-correlation Test					
1_1_102	Alluvium	Dissolved Metals	aluminum (dissolved)	mg/L	15	10	67%	0.108	0.0700	0.180	0.00400	0.730	3.34	11.9	0.0465	0.0578	0.0310	0.100	0.180	0.412	0.468	0.803	0.876	-0.11	0.6 No evidence of autocorrelation	Gamma; Lognormal	Nonparametric		
1_1_104	Alluvium	Dissolved Metals	antimony (dissolved)	mg/L	15	13	87%	0.000837	0.000600	0.000508	0.000410	0.00250	2.77	8.97	0.000131	0.000119	0.000600	0.00100	0.00100	0.00160	0.00185	0.00275	0.00300	0.11	0.6 No evidence of autocorrelation	Nonparametric	Nonparametric		
1_1_106	Alluvium	Dissolved Metals	arsenic (dissolved)	mg/L	15	1	7%	0.000857	0.000800	0.000195	0.000660	0.00130	1.43	1.26	0.0000505	0.000133	0.000730	0.000950	0.00115	0.00127	0.00125	0.00143	0.00156	0.00156	0.10	0.7 No evidence of autocorrelation	Lognormal	Lognormal	
1_1_108	Alluvium	Dissolved Metals	barium (dissolved)	mg/L	15	0	0%	0.0175	0.0160	0.00316	0.0140	0.0260	1.61	2.76	0.000815	0.00148	0.0150	0.0190	0.0210	0.0230	0.0238	0.0286	0.0312	0.11	0.6 No evidence of autocorrelation	Gamma; Lognormal	Gamma		
1_1_110	Alluvium	Dissolved Metals	beryllium (dissolved)	mg/L	15	15	100%	0.000319	0.000300	0.000191	0.000240	0.00100	3.71	14.1	0.0000492	0.0000741	0.000240	0.000300	0.000580	0.000700	0.00110	0.00120	0.00120	0.054	0.8 No evidence of autocorrelation	Nonparametric	Nonparametric		
1_1_112	Alluvium	Dissolved Metals	cadmium (dissolved)	mg/L	15	15	100%	0.000618	0.00100	0.000429	0.000120	0.00100	-0.234	-2.16	0.000111	0.00	0.000120	0.00100	0.00100	0.00148	0.00110	0.00120	0.086	<0.001	The data exhibits serial correlation	Nonparametric	Nonparametric		
1_1_114	Alluvium	Dissolved Metals	calcium (dissolved)	mg/L	15	0	0%	45.6	44.0	7.08	37.0	58.6	0.698	-0.669	1.83	7.41	40.0	51.0	56.4	58.2	59.8	64.5	70.3	-0.0050	>0.9	No evidence of autocorrelation	Gamma; Lognormal	Normal	
1_1_116	Alluvium	Dissolved Metals	chromium (dissolved)	mg/L	15	13	87%	0.00165	0.00150	0.000461	0.000970	0.00300	1.56	5.24	0.000119	0.000444	0.00150	0.00180	0.00228	0.00257	0.00330	0.00360	-0.11	0.6 No evidence of autocorrelation	Nonparametric	Nonparametric			
1_1_118	Alluvium	Dissolved Metals	cobalt (dissolved)	mg/L	15	2	13%	0.000417	0.000300	0.000281	0.000200	0.00110	1.83	2.32	0.0000725	0.0000889	0.000240	0.000420	0.00104	0.000978	0.00121	0.00132	0.19	0.4 No evidence of autocorrelation	Lognormal	Lognormal			
1_1_120	Alluvium	Dissolved Metals	copper (dissolved)	mg/L	15	6	40%	0.00262	0.00150	0.00375	0.000580	0.0140	2.65	6.56	0.000967	0.000444	0.000910	0.00180	0.00611	0.0110	0.0101	0.0154	0.0168	-0.049	0.8 No evidence of autocorrelation	Nonparametric	Nonparametric		
1_1_122	Alluvium	Dissolved Metals	iron (dissolved)	mg/L	15	8	53%	0.0978	0.0480	0.140	0.0220	0.560	2.99	9.44	0.0362	0.0385	0.0290	0.0850	0.184	0.374	0.378	0.616	0.672	-0.075	0.7 No evidence of autocorrelation	Nonparametric	Nonparametric		
1_1_124	Alluvium	Dissolved Metals	lead (dissolved)	mg/L	15	12	80%	0.000560	0.000500	0.000138	0.000280	0.000700	-0.553	-0.468	0.0000356	0.000237	0.000500	0.000700	0.000700	0.000836	0.000770	0.000840	0.17	0.5 No evidence of autocorrelation	Lognormal; Normal	Nonparametric			
1_1_126	Alluvium	Dissolved Metals	magnesium (dissolved)	mg/L	15	0	0%	25.1	24.0	2.80	21.0	32.2	1.30	1.99	0.723	1.48	23.0	26.0	28.6	30.3	30.7	35.4	38.6	0.13	0.6 No evidence of autocorrelation	Gamma; Lognormal	Gamma		
1_1_128	Alluvium	Dissolved Metals	manganese (dissolved)	mg/L	15	0	0%	0.195	0.180	0.0449	0.150	0.330	2.13	5.63	0.0116	0.0296	0.170	0.210	0.229	0.270	0.284	0.363	0.396	0.14	0.6 No evidence of autocorrelation	Gamma; Lognormal	Normal		
1_1_130	Alluvium	Dissolved Metals	mercury (dissolved)	mg/L	15	15	100%	0.0000795	0.0000800	0.00000918	0.0000520	0.000100	-1.29	7.79	0.00000237	0.00	0.0000800	0.0000800	0.0000880	0.0000978	0.000110	0.000120	-0.00024	>0.9	No evidence of autocorrelation	Nonparametric	Nonparametric		
1_1_132	Alluvium	Dissolved Metals	nickel (dissolved)	mg/L	15	1	7%	0.00207	0.00170	0.00129	0.00100	0.00630	2.82	9.09	0.000333	0.000593	0.00140	0.00220	0.00286	0.00438	0.00465	0.00693	0.00756	-0.18	0.5 No evidence of autocorrelation	Lognormal	Lognormal		
1_1_134	Alluvium	Dissolved Metals	potassium (dissolved)	mg/L	15	2	13%	0.835	0.670	0.500	0.400	2.40	2.36	7.03	0.129	0.370	0.500	1.00	1.10	1.62	1.83	2.64	2.88	3.43	0.07	No evidence of autocorrelation	Gamma; Lognormal	Gamma	
1_1_138	Alluvium	Dissolved Metals	selenium (dissolved)	mg/L	15	14	93%	0.00203	0.00200	0.000297	0.00150	0.00300	2.37	9.74	0.0000766	0.00	0.00200	0.00200	0.00240	0.00263	0.00330	0.00360	-0.0090	>0.9	No evidence of autocorrelation	Nonparametric	Nonparametric		
1_1_140	Alluvium	Dissolved Metals	silver (dissolved)	mg/L	15	12	80%	0.000188	0.000100	0.000255	0.000330	0.00100	2.84	8.04	0.0000658	0.00	0.00100	0.0000402	0.000730	0.000698	0.00110	0.00120	-0.14	0.5 No evidence of autocorrelation	Lognormal; Normal	Nonparametric			
1_1_142	Alluvium	Dissolved Metals	sodium (dissolved)	mg/L	15	0	0%	811	830	96.0	520	920	-2.06	5.90	24.8	59.3	790	870	896	908	1,003	1,012	1,104	0.16	0.5 No evidence of autocorrelation	Normal	Normal		
1_1_144	Alluvium	Dissolved Metals	thallium (dissolved)	mg/L	15	15	100%	0.000244	0.000200	0.000211	0.000100	0.00100	3.76	14.4	0.0000544	0.00	0.000200	0.000200	0.000520	0.000666	0.00110	0.00120	0.010	>0.9	No evidence of autocorrelation	Nonparametric	Nonparametric		
1_1_146	Alluvium	Dissolved Metals	vanadium (dissolved)	mg/L	15	1	7%	0.00230	0.00200	0.00125	0.00100	0.00554	1.58	2.29	0.0000324	0.000889	0.00140	0.00280	0.00388	0.00486	0.00481	0.00609	0.00665	-0.18	>0.9	No evidence of autocorrelation	Gamma; Lognormal	Gamma	
1_1_148	Alluvium	Dissolved Metals	zinc (dissolved)	mg/L	15	10	67%	0.00963																					

Code	Aquifer	Constituent Type	Constituent	Unit	n	No. ND <sup>1</sup> BDL <sup>2</sup>	% ND BDL	Mean	Median	Standard Deviation (sd)	Minimum	Maximum	Skewness	Kurtosis	Standard Error of Mean	MAD <sup>3</sup> /0.675	Percentile <sup>4</sup>					Mean + 2sd	110% Maximum	120% Maximum	Serial Correlation with 1 Lag			ProUCL's Best Fit <sup>5</sup>	HDR's Recommended Fit
																	25th	75th	85th	90th	95th	Auto-correlation	Sig.	Auto-correlation Test					
2_4_125	Bedrock	Total Metals	magnesium	mg/L	9	0	0%	29.6	28.0		29.1	0.870	72.0	0.423	-1.55		9.69	39.9	1.01	59.5	70.5		87.8	79.2	86.4	0.19	0.5 No evidence of autocorrelation	Gamma; Lognormal; Normal	Gamma
2_4_127	Bedrock	Total Metals	manganese	mg/L	9	0	0%	1.35	0.716		1.58	0.0230	3.80	0.783	-1.48		0.526	1.03	0.0246	3.20	3.60		4.51	4.18	4.56	0.38	0.2 No evidence of autocorrelation	Gamma; Lognormal	Gamma
2_4_129	Bedrock	Total Metals	mercury	mg/L	9	8	89%	0.0000771	0.0000800		0.0000252	0.0000260	0.000100	-1.23	1.02		0.00000839	0.0000296	0.0000640	0.000100	0.000100		0.000127	0.000110	0.000120	0.26	0.4 No evidence of autocorrelation	Nonparametric	Nonparametric
2_4_131	Bedrock	Total Metals	nickel	mg/L	9	1	11%	0.0444	0.0114		0.0578	0.000420	0.170	1.47	1.87		0.0193	0.0163	0.00265	0.0770	0.132		0.160	0.187	0.204	0.10	0.7 No evidence of autocorrelation	Gamma; Lognormal; Normal	Gamma
2_4_135	Bedrock	Total Metals	potassium	mg/L	9	1	11%	10.5	5.13		11.0	0.660	27.0	0.610	-1.69		3.65	6.62	0.890	23.0	25.5		32.4	29.7	32.4	0.29	0.3 No evidence of autocorrelation	Gamma; Lognormal; Normal	Gamma
2_4_137	Bedrock	Total Metals	selenium	mg/L	9	9	100%	0.00183	0.00200		0.000250	0.00150	0.00200	-0.857	-1.71		0.0000833	0.00	0.00150	0.00200	0.00200		0.00233	0.00220	0.00240	0.61	0.03 The data exhibits serial correlation	Nonparametric	
2_4_139	Bedrock	Total Metals	silver	mg/L	9	7	78%	0.000394	0.000100		0.000455	0.0000460	0.00100	0.851	-1.71		0.000152	0.00	0.000100	0.00100	0.00100		0.00130	0.000110	0.00120	0.62	0.03 The data exhibits serial correlation	Nonparametric	Nonparametric
2_4_141	Bedrock	Total Metals	sodium	mg/L	9	0	0%	1.647	1.150		1.170	623	3.610	0.875	-1.02		390	756	640	2,900	3,405		3,986	3,971	4,332	-0.089	0.8 No evidence of autocorrelation	Gamma; Lognormal	Gamma
2_4_143	Bedrock	Total Metals	thallium	mg/L	9	6	67%	0.000560	0.000440		0.000366	0.000200	0.00100	0.325	-2.06		0.000122	0.000356	0.000200	0.00100	0.00100		0.00129	0.00110	0.00120	0.44	0.1 No evidence of autocorrelation	Lognormal; Normal	Nonparametric
2_4_145	Bedrock	Total Metals	vanadium	mg/L	9	2	22%	0.0558	0.0204		0.0663	0.000560	0.180	0.934	-0.353		0.0221	0.0294	0.00225	0.108	0.155		0.188	0.198	0.216	0.16	0.6 No evidence of autocorrelation	Gamma; Lognormal; Normal	Gamma
2_4_147	Bedrock	Total Metals	zinc	mg/L	9	5	56%	0.120	0.0500		0.162	0.00800	0.530	2.47	6.59		0.0540	0.0622	0.0290	0.145	0.340		0.444	0.583	0.636	-0.15	0.6 No evidence of autocorrelation	Gamma; Lognormal	Nonparametric

<sup>1</sup>ND - Non Detect<sup>2</sup>BDL - Below Method Detection Limit<sup>3</sup>MAD - Median Absolute Deviation<sup>4</sup>Percentiles are computed using the weighted average percentile method whereby results are output if the computed rank is within the valid range for the data set (e.g. 95th percentiles are often not produced when sample sizes are small)<sup>5</sup>Goodness of fit is based on detected data

## Preliminary Data Analysis Without Non-Detects

Code	Aquifer	Constituent Type	Constituent	Unit	n	No. ND <sup>1</sup> BDL <sup>2</sup>	% ND BDL <sup>2</sup>	Mean	Median	Standard Deviation (sd)	Minimum	Maximum	Skewness	Kurtosis	Standard Error of Mean	MAD <sup>3</sup> /0.675	Percentile <sup>4</sup>					Mean + 2sd	110% Maximum	120% Maximum	Serial Correlation with 1 Lag			ProJCL's Best Fit <sup>5</sup>	HDR's Recommended Fit	
																	25th	75th	85th	90th	95th	Auto-correlation	Sig.	Auto-correlation Test						
1_1_102	Alluvium	Dissolved Metals	aluminum (dissolved)	mg/L	5			0.174	0.0200		0.313	0.00400	0.730	2.16	4.70		0.140	0.0237	0.0110	0.415				0.800	0.803	0.876	-0.15	0.5 No evidence of autocorrelation	Gamma; Lognormal	Nonparametric
1_1_104	Alluvium	Dissolved Metals	antimony (dissolved)	mg/L	2			0.000470	0.000470	0.0000849	0.000410	0.000530					0.0000600	0.0000889	0.000410					0.000640	0.000583	0.000636			Nonparametric	
1_1_106	Alluvium	Dissolved Metals	arsenic (dissolved)	mg/L	14			0.000829	0.000795	0.000168	0.000660	0.00130	1.87	4.11		0.0000450	0.000111	0.000725	0.000920	0.000988	0.00115		0.00117	0.00143	0.00156	0.31	0.2 No evidence of autocorrelation	Lognormal		
1_1_108	Alluvium	Dissolved Metals	barium (dissolved)	mg/L	15			0.0175	0.0160	0.00316	0.0140	0.0260	1.61	2.76		0.000815	0.00148	0.0150	0.0190	0.0210	0.0230		0.0238	0.0286	0.0312	0.11	0.6 No evidence of autocorrelation	Gamma; Lognormal	Gamma	
1_1_110	Alluvium	Dissolved Metals	beryllium (dissolved)	mg/L	0																							Nonparametric		
1_1_112	Alluvium	Dissolved Metals	cadmium (dissolved)	mg/L	0																							Nonparametric		
1_1_114	Alluvium	Dissolved Metals	calcium (dissolved)	mg/L	15			45.6	44.0		7.08	37.0	58.6	0.698	-0.669		1.83	7.41	40.0	51.0	56.4	58.2		59.8	64.5	70.3	-0.050 >0.9	No evidence of autocorrelation	Gamma; Lognormal; Normal	Gamma
1_1_116	Alluvium	Dissolved Metals	chromium (dissolved)	mg/L	2			0.00199	0.00199	0.00144	0.000970	0.00300				0.00102	0.00150	0.000970					0.00486	0.00330	0.00360			Nonparametric		
1_1_118	Alluvium	Dissolved Metals	cobalt (dissolved)	mg/L	13			0.000388	0.000300	0.000243	0.000210	0.00110	2.50	6.59		0.0000673	0.0000889	0.000250	0.000390	0.000636	0.000924		0.000874	0.00121	0.00132	0.34	0.2 No evidence of autocorrelation	Lognormal		
1_1_120	Alluvium	Dissolved Metals	copper (dissolved)	mg/L	9			0.00330	0.00110	0.00482	0.000580	0.0140	1.89	2.57		0.00161	0.000356	0.000740	0.00515	0.0115			0.0129	0.0154	0.0168	-0.13	0.6 No evidence of autocorrelation	Nonparametric		
1_1_122	Alluvium	Dissolved Metals	iron (dissolved)	mg/L	7			0.110	0.0290	0.199	0.0220	0.560	2.60	6.81		0.0753	0.00593	0.0250	0.0750	0.463			0.509	0.616	0.672	-0.11	0.6 No evidence of autocorrelation	Nonparametric		
1_1_124	Alluvium	Dissolved Metals	lead (dissolved)	mg/L	3			0.000401	0.000340	0.000161	0.000280	0.000584	1.47			0.0000930	0.0000889	0.000280					0.000723	0.000642	0.000701	0.0		Lognormal; Normal	Nonparametric	
1_1_126	Alluvium	Dissolved Metals	magnesium (dissolved)	mg/L	15			25.1	24.0	2.80	21.0	32.2	1.30	1.99		0.723	1.48	23.0	26.0	28.6	30.3		30.7	35.4	38.6	0.13	0.6 No evidence of autocorrelation	Gamma; Lognormal	Gamma	
1_1_128	Alluvium	Dissolved Metals	manganese (dissolved)	mg/L	15			0.195	0.180	0.0449	0.150	0.330	2.13	5.63		0.0116	0.0296	0.0170	0.210	0.229	0.270		0.284	0.363	0.396	0.14	0.6 No evidence of autocorrelation	Gamma; Lognormal; Normal	Gamma	
1_1_130	Alluvium	Dissolved Metals	mercury (dissolved)	mg/L	0																						Nonparametric			
1_1_132	Alluvium	Dissolved Metals	nickel (dissolved)	mg/L	14			0.00204	0.00165	0.00133	0.00100	0.00630	2.86	9.07		0.000356	0.000519	0.00135	0.00213	0.00288	0.00470		0.00471	0.00693	0.00756	-0.16	0.5 No evidence of autocorrelation	Lognormal	Lognormal	
1_1_136	Alluvium	Dissolved Metals	potassium (dissolved)	mg/L	13			0.852	0.670	0.530	0.400	2.40	2.27	6.34		0.147	0.370	0.485	1.05	1.10	1.88		1.91	2.64	2.88	-0.42	0.8 No evidence of autocorrelation	Gamma; Lognormal	Gamma	
1_1_138	Alluvium	Dissolved Metals	selenium (dissolved)	mg/L	1			0.00300	0.00300		0.00300	0.00300				0.0	0.00300	0.00300	0.00300	0.00300	0.00300		0.00330	0.00360	0.00360			Nonparametric		
1_1_140	Alluvium	Dissolved Metals	silver (dissolved)	mg/L	3			0.000213	0.0000550	0.000292	0.0000330	0.000550	1.72			0.000169	0.0000326	0.0000330					0.000797	0.000605	0.000660	-0.35	0.2 No evidence of autocorrelation	Lognormal; Normal	Nonparametric	
1_1_142	Alluvium	Dissolved Metals	sodium (dissolved)	mg/L	15			811	830	25.6	24.0	32.0	1.30	1.99		0.723	1.48	23.0	26.0	28.6	30.3		30.7	35.4	38.6	0.13	0.6 No evidence of autocorrelation	Gamma; Lognormal	Normal	
1_1_144	Alluvium	Dissolved Metals	thallium (dissolved)	mg/L	0																						Nonparametric			
1_1_146	Alluvium	Dissolved Metals	vanadium (dissolved)	mg/L	14			0.00232	0.00185	0.00130	0.00100	0.00554	1.49	1.90		0.000347	0.000889	0.00138	0.00288	0.00408	0.00497		0.00492	0.00609	0.00665	-0.25 >0.9	No evidence of autocorrelation	Gamma; Lognormal; Normal	Gamma	
1_1_148	Alluvium	Dissolved Metals	zinc (dissolved)	mg/L	5			0.0570	0.0340	0.0497	0.0220	0.0140	1.62	2.36		0.00222	0.00178	0.00225	0.0103				0.0156	0.0154	0.0168	-0.33	0.2 No evidence of autocorrelation	Gamma; Lognormal; Normal	Nonparametric	
1_2_133	Alluvium	Nitrogen	nitrate	mg/L	4			0.609	0.220	0.864	0.0970	1.90	1.95	3.84		0.432	0.135	0.113	1.49				2.34	2.09	2.28	0.066	0.7 No evidence of autocorrelation	Gamma; Lognormal	Nonparametric	
1_3_134	Alluvium	Perchlorate	perchlorate	mg/L	0																						Nonparametric			
1_4_101	Alluvium	Total Metals	aluminum	mg/L	13			0.603	0.100	1.27	0.0190	4.20	2.50	5.70		0.352														

Code	Aquifer	Constituent Type	Constituent	Unit	n	No. ND <sup>1</sup> BDL <sup>2</sup>	% ND BDL	Mean	Median	Standard Deviation (sd)	Minimum	Maximum	Skewness	Kurtosis	Standard Error of Mean	MAD <sup>3</sup> /0.675	Percentile <sup>4</sup>					Mean + 2sd	110% Maximum	120% Maximum	Serial Correlation with 1 Lag			ProUCL's Best Fit <sup>5</sup>	HDR's Recommended Fit
																	25th	75th	85th	90th	95th	Auto-correlation	Sig.	Auto-correlation Test					
2_4_131	Bedrock	Total Metals	nickel	mg/L	8			0.0496	0.0332	0.0595	0.000420	0.170	1.31	1.43	0.0210	0.0447	0.00292	0.0850	0.143		0.169	0.187	0.204	-0.058	0.8 No evidence of autocorrelation	Gamma; Lognormal; Normal	Gamma		
2_4_135	Bedrock	Total Metals	potassium	mg/L	8			11.7	8.39	11.1	0.660	27.0	0.391	-2.02	3.91	11.3	1.30	23.5	26.0		33.9	29.7	32.4	0.45	0.1 No evidence of autocorrelation	Gamma; Lognormal; Normal	Gamma		
2_4_137	Bedrock	Total Metals	selenium	mg/L	0																					Nonparametric			
2_4_139	Bedrock	Total Metals	silver	mg/L	2			0.0000730	0.0000730	0.0000382	0.0000460	0.000100			0.0000270	0.0000400	0.0000460				0.000149	0.000110	0.000120				Nonparametric		
2_4_141	Bedrock	Total Metals	sodium	mg/L	9			1,647	1,150	1,170	623	3,610	0.875	-1.02	390	756	640	2,900	3,405		3,986	3,971	4,332	-0.089	0.8 No evidence of autocorrelation	Gamma; Lognormal	Gamma		
2_4_143	Bedrock	Total Metals	thallium	mg/L	3			0.000480	0.000440	0.000203	0.000300	0.000700	0.852		0.000117	0.000207	0.000300				0.000886	0.000770	0.000840	-0.11	0.7 No evidence of autocorrelation	Lognormal; Normal	Nonparametric		
2_4_145	Bedrock	Total Metals	vanadium	mg/L	7			0.0712	0.0780	0.0680	0.000560	0.180	0.518	-0.926	0.0257	0.0853	0.00310	0.130	0.170		0.207	0.198	0.216	-0.027 >0.9	No evidence of autocorrelation	Gamma; Lognormal; Normal	Gamma		
2_4_147	Bedrock	Total Metals	zinc	mg/L	4			0.228	0.145	0.203	0.0910	0.530	1.90	3.71	0.102	0.0437	0.103	0.435			0.634	0.583	0.636	-0.12	0.7 No evidence of autocorrelation	Gamma; Lognormal	Nonparametric		

<sup>1</sup>ND - Non Detect

<sup>2</sup>BDL - Below Method Detection Limit

<sup>3</sup>MAD - Median Absolute Deviation

<sup>4</sup>Percentiles are computed using the weighted average percentile method whereby results are output if the computed rank is within the valid range for the data set (e.g. 95th percentiles are often not produced when sample sizes are small)

<sup>5</sup>Goodness of fit is based on detected data

Potential Outlier Values at the 1% Significance Level based on Dixon's and Rosner's Tests

Code	Test	Constituent Type	Constituent	Unit	Non-Censored Data			Outliers - Tests conducted at the 1% level of significance <sup>1</sup>	
					Mean	StDev	No. of Obs.		
1_1_142	Dixon's	Dissolved Metals	sodium (dissolved)	mg/L	811	96.0	15	none	520
1_4_107	Dixon's	Total Metals	barium	mg/L	0.0209	0.00888	15	0.0450	
1_4_127	Dixon's	Total Metals	manganese	mg/L	0.226	0.0984	15	0.530	
2_1_108	Dixon's	Dissolved Metals	barium (dissolved)	mg/L	0.0960	0.217	9	0.670	

Code	Test	Constituent Type	Constituent	Unit	Censored Data Excluding Non-Detects						Outliers - Tests conducted at the 1% level of significance <sup>1</sup>
					Total N	No. NDs	No. Detects	Mean of Detects	SD of Detects	No. of Data	
1_1_102	Dixon's	Dissolved Metals	aluminum (dissolved)	mg/L	15	10	5	0.174	0.313	5	0.730
1_1_118	Dixon's	Dissolved Metals	cobalt (dissolved)	mg/L	15	2	13	0.000388	0.000243	13	0.00110
1_1_122	Dixon's	Dissolved Metals	iron (dissolved)	mg/L	15	8	7	0.110	0.199	7	0.560
1_1_132	Dixon's	Dissolved Metals	nickel (dissolved)	mg/L	15	1	14	0.00204	0.00133	14	0.00630
1_1_136	Dixon's	Dissolved Metals	potassium (dissolved)	mg/L	15	2	13	0.852	0.530	13	2.40
1_2_133	Dixon's	Nitrogen	nitrate	mg/L	15	11	4	0.609	0.864	4	1.90
1_4_101	Dixon's	Total Metals	aluminum	mg/L	15	2	13	0.603	1.27	13	4.20
1_4_105	Dixon's	Total Metals	arsenic	mg/L	15	1	14	0.000905	0.000270	14	0.00170
1_4_117	Dixon's	Total Metals	cobalt	mg/L	15	2	13	0.000549	0.000472	13	0.00180
1_4_121	Dixon's	Total Metals	iron	mg/L	15	2	13	0.384	0.763	13	2.50
1_4_131	Dixon's	Total Metals	nickel	mg/L	15	2	13	0.00262	0.00222	13	0.00930
1_4_139	Dixon's	Total Metals	silver	mg/L	15	11	4	0.00133	0.00212	4	0.00450
2_1_102	Dixon's	Dissolved Metals	aluminum (dissolved)	mg/L	9	4	5	28.8	56.7	5	130
2_1_106	Dixon's	Dissolved Metals	arsenic (dissolved)	mg/L	9	4	5	0.00309	0.00393	5	0.0100
2_1_116	Dixon's	Dissolved Metals	chromium (dissolved)	mg/L	9	5	4	0.0384	0.0678	4	0.140
2_1_118	Dixon's	Dissolved Metals	cobalt (dissolved)	mg/L	9	3	6	0.00650	0.0135	6	0.0340
2_1_122	Dixon's	Dissolved Metals	iron (dissolved)	mg/L	9	4	5	23.7	48.3	5	110
2_1_132	Dixon's	Dissolved Metals	nickel (dissolved)	mg/L	9	5	4	0.0232	0.0405	4	0.0840
2_1_146	Dixon's	Dissolved Metals	vanadium (dissolved)	mg/L	9	5	4	0.0293	0.0458	4	0.0980

<sup>1</sup> Dixon's test checks for an outlier in both tails. By default, the high value outlier is displayed. If two values are displayed, then the value in the first cell indicates a high outlier while the value in the adjacent cell indicates a low outlier. A result of 'none' indicates no high outlier value.

**Attributes of Potential Outliers**

<b>Code</b>	<b>Aquifer</b>	<b>Well</b>	<b>Event</b>	<b>Sample Date</b>	<b>Constituent Type</b>	<b>Constituent</b>	<b>Units</b>	<b>Reported Value</b>
1_2_133	Alluvium	BGMW01	Facility-wide Groundwater April 2012	4/25/2012	Nitrogen	nitrate	mg/L	1.90
1_4_105	Alluvium	BGMW01	Facility-wide Groundwater April 2012	4/25/2012	Total Metals	arsenic	mg/L	0.00170
1_1_132	Alluvium	BGMW01	Facility-wide Groundwater April 2014	4/15/2014	Dissolved Metals	nickel (dissolved)	mg/L	0.00630
1_4_131	Alluvium	BGMW01	Facility-wide Groundwater April 2014	4/15/2014	Total Metals	nickel	mg/L	0.00930
1_1_142	Alluvium	BGMW01	Facility-wide Groundwater April 2016	4/15/2016	Dissolved Metals	sodium (dissolved)	mg/L	520
1_1_136	Alluvium	BGMW01	Facility-wide Groundwater April 2017	4/24/2017	Dissolved Metals	potassium (dissolved)	mg/L	2.40
1_1_102	Alluvium	BGMW01	Facility-wide Groundwater April 2018	4/27/2018	Dissolved Metals	aluminum (dissolved)	mg/L	0.730
1_1_122	Alluvium	BGMW01	Facility-wide Groundwater April 2018	4/27/2018	Dissolved Metals	iron (dissolved)	mg/L	0.560
1_4_101	Alluvium	BGMW01	Facility-wide Groundwater April 2018	4/27/2018	Total Metals	aluminum	mg/L	4.20
1_4_107	Alluvium	BGMW01	Facility-wide Groundwater April 2018	4/27/2018	Total Metals	barium	mg/L	0.0450
1_4_117	Alluvium	BGMW01	Facility-wide Groundwater April 2018	4/27/2018	Total Metals	cobalt	mg/L	0.00180
1_4_121	Alluvium	BGMW01	Facility-wide Groundwater April 2018	4/27/2018	Total Metals	iron	mg/L	2.50
1_4_127	Alluvium	BGMW01	Facility-wide Groundwater April 2018	4/27/2018	Total Metals	manganese	mg/L	0.530
1_4_139	Alluvium	BGMW01	Facility-wide Groundwater April 2018	4/27/2018	Total Metals	silver	mg/L	0.00450
1_1_118	Alluvium	BGMW01	Facility-wide Groundwater October 2012	10/26/2012	Dissolved Metals	cobalt (dissolved)	mg/L	0.00110
2_1_102	Bedrock	BGMW09	Facility-wide Groundwater April 2018	5/1/2018	Dissolved Metals	aluminum (dissolved)	mg/L	130
2_1_106	Bedrock	BGMW09	Facility-wide Groundwater April 2018	5/1/2018	Dissolved Metals	arsenic (dissolved)	mg/L	0.0100
2_1_108	Bedrock	BGMW09	Facility-wide Groundwater April 2018	5/1/2018	Dissolved Metals	barium (dissolved)	mg/L	0.670
2_1_116	Bedrock	BGMW09	Facility-wide Groundwater April 2018	5/1/2018	Dissolved Metals	chromium (dissolved)	mg/L	0.140
2_1_118	Bedrock	BGMW09	Facility-wide Groundwater April 2018	5/1/2018	Dissolved Metals	cobalt (dissolved)	mg/L	0.0340
2_1_122	Bedrock	BGMW09	Facility-wide Groundwater April 2018	5/1/2018	Dissolved Metals	iron (dissolved)	mg/L	110
2_1_132	Bedrock	BGMW09	Facility-wide Groundwater April 2018	5/1/2018	Dissolved Metals	nickel (dissolved)	mg/L	0.0840
2_1_146	Bedrock	BGMW09	Facility-wide Groundwater April 2018	5/1/2018	Dissolved Metals	vanadium (dissolved)	mg/L	0.0980

**Non-Detects MLE Regression Trend Analysis for Parametric Constituent-Aquifer Pairs with Sufficient Sample Size and Small Number of Nondetects (n≥8 and BDL<50%)**

<b>Code</b>	<b>Aquifer</b>	<b>Constituent Type</b>	<b>Constituent</b>	<b>Unit</b>	<b>n</b>	<b>No. BDL</b>	<b>% BDL</b>	<b>Slope</b>	<b>P-Value</b>	<b>Trend</b>
1_1_106	Alluvium	Dissolved Metals	arsenic (dissolved)	mg/L	15	1	7%	-0.000094	0.2	↔
1_1_108	Alluvium	Dissolved Metals	barium (dissolved)	mg/L	15	0	0%	-0.000075	0.1	↔
1_1_114	Alluvium	Dissolved Metals	calcium (dissolved)	mg/L	15	0	0%	-0.000029	0.5	↔
1_1_118	Alluvium	Dissolved Metals	cobalt (dissolved)	mg/L	15	2	13%	-0.00024	0.2	↔
1_1_126	Alluvium	Dissolved Metals	magnesium (dissolved)	mg/L	15	0	0%	0.000049	0.1	↔
1_1_128	Alluvium	Dissolved Metals	manganese (dissolved)	mg/L	15	0	0%	-0.000015	0.8	↔
1_1_132	Alluvium	Dissolved Metals	nickel (dissolved)	mg/L	15	1	7%	-0.00032	0.02	↓
1_1_136	Alluvium	Dissolved Metals	potassium (dissolved)	mg/L	15	2	13%	-0.000064	0.7	↔
1_1_142	Alluvium	Dissolved Metals	sodium (dissolved)	mg/L	15	0	0%	-0.000026	0.5	↔
1_1_146	Alluvium	Dissolved Metals	vanadium (dissolved)	mg/L	15	1	7%	-0.00016	0.3	↔
1_4_101	Alluvium	Total Metals	aluminum	mg/L	15	2	13%	-0.000036	>0.9	↔
1_4_105	Alluvium	Total Metals	arsenic	mg/L	15	1	7%	-0.00020	0.006	↓
1_4_113	Alluvium	Total Metals	calcium	mg/L	15	0	0%	-0.000058	0.3	↔
1_4_119	Alluvium	Total Metals	copper	mg/L	15	5	33%	-0.00058	0.06	↔
1_4_125	Alluvium	Total Metals	magnesium	mg/L	15	0	0%	0.0000099	0.8	↔
1_4_131	Alluvium	Total Metals	nickel	mg/L	15	2	13%	-0.00037	0.08	↔
1_4_135	Alluvium	Total Metals	potassium	mg/L	15	1	7%	0.000081	0.6	↔
1_4_141	Alluvium	Total Metals	sodium	mg/L	15	0	0%	0.0000034	>0.9	↔
2_1_102	Bedrock	Dissolved Metals	aluminum (dissolved)	mg/L	9	4	44%	-0.022	0.1	↔
2_1_106	Bedrock	Dissolved Metals	arsenic (dissolved)	mg/L	9	4	44%	-0.0024	0.5	↔
2_1_108	Bedrock	Dissolved Metals	barium (dissolved)	mg/L	9	0	0%	-0.0050	0.07	↔
2_1_114	Bedrock	Dissolved Metals	calcium (dissolved)	mg/L	9	0	0%	0.00045	0.9	↔
2_1_118	Bedrock	Dissolved Metals	cobalt (dissolved)	mg/L	9	3	33%	-0.0042	0.5	↔
2_1_120	Bedrock	Dissolved Metals	copper (dissolved)	mg/L	9	4	44%	0.0023	0.6	↔
2_1_122	Bedrock	Dissolved Metals	iron (dissolved)	mg/L	9	4	44%	-0.010	0.3	↔
2_1_126	Bedrock	Dissolved Metals	magnesium (dissolved)	mg/L	9	0	0%	-0.0011	0.8	↔
2_1_128	Bedrock	Dissolved Metals	manganese (dissolved)	mg/L	9	1	11%	0.0024	0.7	↔
2_1_136	Bedrock	Dissolved Metals	potassium (dissolved)	mg/L	9	0	0%	-0.0028	0.3	↔
2_1_142	Bedrock	Dissolved Metals	sodium (dissolved)	mg/L	9	0	0%	0.00073	0.6	↔
2_4_101	Bedrock	Total Metals	aluminum	mg/L	9	2	22%	-0.0091	0.3	↔
2_4_105	Bedrock	Total Metals	arsenic	mg/L	9	3	33%	-0.0030	0.4	↔
2_4_107	Bedrock	Total Metals	barium	mg/L	9	0	0%	-0.0062	0.2	↔
2_4_109	Bedrock	Total Metals	beryllium	mg/L	9	4	44%	-0.0052	0.3	↔
2_4_113	Bedrock	Total Metals	calcium	mg/L	9	0	0%	-0.00061	0.9	↔
2_4_115	Bedrock	Total Metals	chromium	mg/L	9	1	11%	-0.0090	0.05	↓
2_4_117	Bedrock	Total Metals	cobalt	mg/L	9	2	22%	-0.0049	0.4	↔
2_4_119	Bedrock	Total Metals	copper	mg/L	9	3	33%	-0.0051	0.2	↔
2_4_121	Bedrock	Total Metals	iron	mg/L	9	1	11%	-0.0089	0.2	↔
2_4_123	Bedrock	Total Metals	lead	mg/L	9	2	22%	-0.0061	0.3	↔
2_4_125	Bedrock	Total Metals	magnesium	mg/L	9	0	0%	-0.0022	0.6	↔
2_4_127	Bedrock	Total Metals	manganese	mg/L	9	0	0%	-0.0033	0.5	↔
2_4_131	Bedrock	Total Metals	nickel	mg/L	9	1	11%	-0.0068	0.2	↔
2_4_135	Bedrock	Total Metals	potassium	mg/L	9	1	11%	-0.0034	0.3	↔
2_4_141	Bedrock	Total Metals	sodium	mg/L	9	0	0%	0.00075	0.6	↔
2_4_145	Bedrock	Total Metals	vanadium	mg/L	9	2	22%	-0.0052	0.4	↔

**Mann-Kendall Trend Tests at the 5% Sig. Level for Non-Parametric Constituent-Aquifer Pairs with Sufficient Sample Size and Small Number of Nondetects (n≥8 and BDL<50%)**

Code	Aquifer	Type	Constituent	Unit	n	Minimum	Maximum	Medium	Mean	SD	P-Value	Trend
1_4_107	Alluvium	Total Metals	barium	mg/L	15	0.0140	0.0450	0.0170	0.0209	0.00888	0.3	↔
1_4_127	Alluvium	Total Metals	manganese	mg/L	15	0.160	0.530	0.190	0.226	0.0984	0.4	↔
1_4_145	Alluvium	Total Metals	vanadium	mg/L	15	0.00150	0.00780	0.00210	0.00315	0.00208	0.08	↔
2_4_111	Bedrock	Total Metals	cadmium	mg/L	9	0.000300	0.00100	0.00100	0.000813	0.000287	0.2	↔

**Test of Differences between Alluvium and Bedrock Aquifers**

Constituent Type	Constituent	Unit	Full													
			Sample Size			Kruskal-Wallis			ANOVA			Log ANOVA				
			Alluvium	Bedrock	Total							Alluvium	Bedrock	Total		
Total Metals	aluminum	mg/L	15	9	24	Difference among aquifers is statistically significant			Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		13	7	20
Dissolved Metals	aluminum (dissolved)	mg/L	15	9	24	Difference among aquifers is statistically significant						Difference among aquifers is statistically significant		5	5	10
Total Metals	antimony	mg/L	15	9	24	Difference among aquifers is statistically significant			Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		2	1	3
Dissolved Metals	antimony (dissolved)	mg/L	15	9	24	Difference among aquifers is statistically significant			Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		2	2	4
Total Metals	arsenic	mg/L	15	9	24	Difference among aquifers is statistically significant			Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		14	6	20
Dissolved Metals	arsenic (dissolved)	mg/L	15	9	24	Difference among aquifers is statistically significant						Difference among aquifers is statistically significant		14	5	19
Total Metals	barium	mg/L	15	9	24				Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		15	9	24
Dissolved Metals	barium (dissolved)	mg/L	15	9	24									15	9	24
Total Metals	beryllium	mg/L	15	9	24	Difference among aquifers is statistically significant			Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		2	5	7
Dissolved Metals	beryllium (dissolved)	mg/L	15	9	24	Difference among aquifers is statistically significant						Difference among aquifers is statistically significant		2	2	
Total Metals	cadmium	mg/L	15	9	24									2	3	5
Dissolved Metals	cadmium (dissolved)	mg/L	15	9	24	Difference among aquifers is statistically significant			Difference among aquifers is statistically significant			Difference among aquifers is statistically significant				
Total Metals	calcium	mg/L	15	9	24				Difference among aquifers is statistically significant					15	9	24
Dissolved Metals	calcium (dissolved)	mg/L	15	9	24									15	9	24
Total Metals	chromium	mg/L	15	9	24	Difference among aquifers is statistically significant			Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		5	8	13
Dissolved Metals	chromium (dissolved)	mg/L	15	9	24									2	4	6
Total Metals	cobalt	mg/L	15	9	24	Difference among aquifers is statistically significant			Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		13	7	20
Dissolved Metals	cobalt (dissolved)	mg/L	15	9	24									13	6	19
Total Metals	copper	mg/L	15	9	24	Difference among aquifers is statistically significant			Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		10	6	16
Dissolved Metals	copper (dissolved)	mg/L	15	9	24									9	5	14
Total Metals	iron	mg/L	15	9	24	Difference among aquifers is statistically significant			Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		13	8	21
Dissolved Metals	iron (dissolved)	mg/L	15	9	24	Difference among aquifers is statistically significant						Difference among aquifers is statistically significant		7	5	12
Total Metals	lead	mg/L	15	9	24	Difference among aquifers is statistically significant			Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		4	7	11
Dissolved Metals	lead (dissolved)	mg/L	15	9	24	Difference among aquifers is statistically significant								3	3	6
Total Metals	magnesium	mg/L	15	9	24									15	9	24
Dissolved Metals	magnesium (dissolved)	mg/L	15	9	24				Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		15	9	24
Total Metals	manganese	mg/L	15	9	24				Difference among aquifers is statistically significant					15	9	24
Dissolved Metals	manganese (dissolved)	mg/L	15	9	24									15	8	23
Total Metals	mercury	mg/L	15	9	24											
Dissolved Metals	mercury (dissolved)	mg/L	15	9	24											
Total Metals	nickel	mg/L	15	9	24	Difference among aquifers is statistically significant			Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		13	8	21
Dissolved Metals	nickel (dissolved)	mg/L	15	9	24									14	4	18
Nitrogen	nitrate	mg/L	15	9	24									4	1	5
Perchlorate	perchlorate	mg/L	15	9	24									3	3	
Total Metals	potassium	mg/L	15	9	24	Difference among aquifers is statistically significant			Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		14	8	22
Dissolved Metals	potassium (dissolved)	mg/L	15	9	24	Difference among aquifers is statistically significant			Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		13	9	22
Total Metals	selenium	mg/L	15	9	24											
Dissolved Metals	selenium (dissolved)	mg/L	15	9	24											
Total Metals	silver	mg/L	15	9	24									4	2	6
Dissolved Metals	silver (dissolved)	mg/L	15	9	24									3	1	4
Total Metals	sodium	mg/L	15	9	24				Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		15	9	24
Dissolved Metals	sodium (dissolved)	mg/L	15	9	24				Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		15	9	24
Total Metals	thallium	mg/L	15	9	24	Difference among aquifers is statistically significant			Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		1	3	4
Dissolved Metals	thallium (dissolved)	mg/L	15	9	24	Difference among aquifers is statistically significant						Difference among aquifers is statistically significant				
Total Metals	vanadium	mg/L	15	9	24				Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		13	7	20
Dissolved Metals	vanadium (dissolved)	mg/L	15	9	24	Difference among aquifers is statistically significant						Difference among aquifers is statistically significant		14	4	18
Total Metals	zinc	mg/L	15	9	24	Difference among aquifers is statistically significant			Difference among aquifers is statistically significant			Difference among aquifers is statistically significant		5	4	9
Dissolved Metals	zinc (dissolved)	mg/L	15	9	24	Difference among aquifers is statistically significant						Difference among aquifers is statistically significant		5	1	6

Test of Differences between Alluvium and Bedrock Aquifers

Constituent Type	Constituent	Without Non-Detects		
		Test		
		Kruskal-Wallis	ANOVA	Log ANOVA
Total Metals	aluminum	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Dissolved Metals	aluminum (dissolved)			Difference among aquifers is statistically significant
Total Metals	antimony		Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Dissolved Metals	antimony (dissolved)			Difference among aquifers is statistically significant
Total Metals	arsenic	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Dissolved Metals	arsenic (dissolved)		Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Total Metals	barium		Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Dissolved Metals	barium (dissolved)			
Total Metals	beryllium			Difference among aquifers is statistically significant
Dissolved Metals	beryllium (dissolved)			Difference among aquifers is statistically significant
Total Metals	cadmium			
Dissolved Metals	cadmium (dissolved)			Difference among aquifers is statistically significant
Total Metals	calcium		Difference among aquifers is statistically significant	
Dissolved Metals	calcium (dissolved)			
Total Metals	chromium	Difference among aquifers is statistically significant		Difference among aquifers is statistically significant
Dissolved Metals	chromium (dissolved)			
Total Metals	cobalt	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Dissolved Metals	cobalt (dissolved)			
Total Metals	copper	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Dissolved Metals	copper (dissolved)			
Total Metals	iron	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Dissolved Metals	iron (dissolved)	Difference among aquifers is statistically significant		Difference among aquifers is statistically significant
Total Metals	lead			Difference among aquifers is statistically significant
Dissolved Metals	lead (dissolved)	Difference among aquifers is statistically significant		
Total Metals	magnesium			
Dissolved Metals	magnesium (dissolved)		Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Total Metals	manganese		Difference among aquifers is statistically significant	
Dissolved Metals	manganese (dissolved)			
Total Metals	mercury			
Dissolved Metals	mercury (dissolved)			
Total Metals	nickel	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Dissolved Metals	nickel (dissolved)		Difference among aquifers is statistically significant	
Nitrogen	nitrate			
Perchlorate	perchlorate			
Total Metals	potassium	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Dissolved Metals	potassium (dissolved)	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Total Metals	selenium			
Dissolved Metals	selenium (dissolved)			
Total Metals	silver			
Dissolved Metals	silver (dissolved)			
Total Metals	sodium		Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Dissolved Metals	sodium (dissolved)		Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Total Metals	thallium			Difference among aquifers is statistically significant
Dissolved Metals	thallium (dissolved)			Difference among aquifers is statistically significant
Total Metals	vanadium	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Dissolved Metals	vanadium (dissolved)	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Total Metals	zinc	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant	Difference among aquifers is statistically significant
Dissolved Metals	zinc (dissolved)		Difference among aquifers is statistically significant	Difference among aquifers is statistically significant