WATER QUALITY MEMORANDUM

Utah Coal Regulatory Program

August 24, 2007

TO: Internal File

THRU: Pamela Grubaugh-Littig, Permit Supervisor

FROM: Dana Dean, P.E, Senior Reclamation Hydrologist

RE: 2006 First Quarter Water Monitoring, Nevada Electric Investment Corporation, Wellington Preparation Plant, C/007/0012-WQ06-1, Task #2537

The Wellington Preparation Plant is currently idle. No mining or coal processing activities currently take place there, nor is the site in active reclamation.

Pertinent water monitoring requirement information is in the MRP in Sections 7.23, and 7.31.2-22, and tables 7.24-2, and 7.24-5.

1. Was data submitted for all of the MRP required sites? YES ☒ NO ☐

Springs –

The Permittee is not required to monitor any springs at the Wellington Preparation Plant.

Streams –

The Permittee is required to sample SW-1, SW-2A, SW-3, SW-4, SW-5, SW-6, SW-7, and SW-8 for flow, and the laboratory parameters outlined in Table 7.24-5 each quarter. They are to sample SW-2 for flow-only each quarter.

The Permittee monitored and reported the essential data for all streams as required during this quarter.

Wells–

The Permittee is required to sample GW-1, GW-3, GW-4, GW-6, GW-7, GW-8. GW-9, GW-9B, GW-10, GW-12, GW-13, GW-14, GW-15A, GW-15B, GW-16, and GW-17 for depth, and the laboratory parameters outlined in Table 7.24-2 each quarter. They are to sample GW-2 for depth-only each quarter.

The Permittee monitored and reported the essential data for all wells as required during this quarter.

UPDES–

There are six active UPDES sites at the Wellington Preparation Plant. They are all under the permit #UTG040010, and include outfalls 003, 004, 005, 006, 007, and 008. The Permittee is required to monitor each UPDES site monthly.

The Permittee monitored and reported the essential data for all UPDES sites as required during this quarter. None of the UPDES sites recorded any flow during the period.

2. Were all required parameters reported for each site? YES ☐ NO ☒

There was not enough water at GW-3 to properly purge/sample. For this reason, the Permittee was unable to sample the water, and only recorded depth information.

3. Were any irregularities found in the data? YES ☒ NO ☐

Several parameters fell outside of 2 standard deviations from the mean encountered at the respective sites. They were:

Site	Parameter	Value	Standard Deviations from Mean	Mean
SW-1	Dissolved Oxygen	17 mg/L	2.92	8.56 mg/L
GW-8	Total Selenium	80 µg/L	3.29	23.06 µg/L
GW-9	Total Selenium	120 µg/L	2.22	32.40 µg/L
GW-9B	Total Selenium	100 µg/L	2.84	28.15 µg/L
GW-10	Total Selenium	50 µg/L	2.41	20.31 µg/L
GW-12	Total Selenium	130 µg/L	3.71	26.65 µg/L
GW-13	Total Selenium	390 µg/L	2.39	132.22 µg/L
GW-14	Total Selenium	80 µg/L	2.71	25.00 µg/L
GW-15A	Total Alkalinity	475 mg/L	2.13	522.50 mg/L
GW-15B	Dissolved Calcium	504 mg/L	3.36	384.63 mg/L
GW-15B	Dissolved Magnesium	183 mg/L	3.29	150.11 mg/L
GW-15B	Dissolved Sodium	302 mg/L	2.05	273.67 mg/L
GW-15B	Chloride	79 mg/L	2.36	61.87 mg/L
GW-15B	Sulfate	2163 mg/L	3.23	1658.18 mg/L
GW-15B	Total Hardness	2012 mg/L	3.52	1577.96 mg/L
GW-15B	Lab Specific Conductivity	4260 mg/L	2.87	3485.18 mg/L

GW-15B	Total Cations	53.5 meq/L	3.71	43.6 meq/L
GW-15B	Total Anions	56.4 meq/L	3.27	45.9 meq/L

Many of the parameters that are unusually high or low in concentration this quarter were measured at well GW-15B. Most of these parameters have at least a weak negative correlation to water elevation, and the water level has a strong downward trend ($R^2 = 0.7764$), with ups and downs mostly consistent with the Palmer Hydrologic Drought Index. In fact, this quarter the water level was just 0.6 inches above the all time low reading (obtained last quarter). The water quality at GW-15B has never been particularly good, and the increased solute concentrations are not of concern at this time, since they are more than likely related to the low water level in the well. The salinity at GW-15B, which is affected by several parameters (Cl, Na, Mg, SO_4, Ca, K, HCO_3, etc.) has always been in the "brackish" category (500-30000 mg/L NaCl equivalent), with only 1 reading of 27 below 2000 mg/L NaCl equivalent.

Chloride has no real trend at GW-15B ($R^2 = 0.007$), and a very weak negative correlation to water levels ($R^2 = 0.0710$). A level of 79 mg/L is well below any water quality limits, and the range of values for chloride is quite small (52-82 mg/L). These levels of chloride do not warrant any concern.

There is a weak upward trend in dissolved calcium at GW-15B ($R^2 = 0.4726$), with a weak negative correlation to water levels ($R^2 = 0.4692$). There are no criteria for this metal, but it does contribute to water hardness. The hardness at this site has always fallen into the very hard (>300 mg/l) classification; the lowest hardness on record is 1424 mg/L.

Dissolved magnesium has a very weak upward trend overall at GW-15B ($R^2 = 0.0835$), with a weak negative correlation to water level. There are no criteria for this metal, but it contributes to water hardness. The hardness at this site has always fallen into the very hard (>300 mg/l) classification; the lowest hardness on record is 1424 mg/L.

The dissolved oxygen at SW-1 was high this quarter, and equated with an oxygen saturation of 120%. As expected, the dissolved oxygen concentration has a negative correlation to water temperature. With cool water temperatures, higher dissolved oxygen levels are necessary for acceptable oxygen saturation, however levels above 110% can be harmful to aquatic life. The operator did note that the oxygen probe was difficult to operate at such a low temperature.

The value for sodium (302 mg/L) is the largest ever recorded at GW-15B, and there is a strong upward trend in sodium over the past year ($R^2 = 0.8625$), with a weak negative correlation to water level. Overall, there is actually a very slight downward trend in dissolved sodium at GW-15B ($R^2 = 0.07$), with a weak positive correlation to water elevation. There is no water quality standard for sodium.

The laboratory measured specific conductivity at GW-15B is the highest ever recorded at that site. There is an overall weak upward trend ($R^2 = 0.2925$), but the upward trend has been very strong ($R^2 = 0.9731$) since August of 2004. The field measurements for specific conductivity do not correlate well with the laboratory measurements ($R^2 = 0.0001$). The field measurements have only a very weak upward trend overall ($R^2 = 0.0519$), and since August of 2004 ($R^2 = 0.0862$). There are no water quality standards for specific conductivity, but it is closely related to total dissolved solids (TDS). There is a weak correlation between lab specific conductivity and TDS ($R^2 = 0.1343$), but it is even weaker for field conductivity ($R^2 = 0.0265$).

The TDS at GW-15B did not fall outside of 2 standard deviations from the mean, only because a concentration of 238 mg/L was reported in June of 2000. All other TDS samples have ranged from 2660 to 3282 mg/L. If not for the one-time low reading of 228 mg/L, the TDS concentration would have been marked as more than two standard deviations higher than the mean for the last three quarters (including this one). There is a weak overall upward trend in TDS at GW-15B ($R^2 = 0.1662$; without the 228 reading $R^2 = 0.3261$) with a weak negative correlation to water level ($R^2 = 0.2347$). Since August of 2004, the upward trend is very strong ($R^2 = 0.871$), with a stronger negative correlation to water level ($R^2 = 0.3028$). The TDS at GW-15B has always been quite high (e.g. the secondary water quality standard for TDS is 500 mg/L), as mentioned above, and this trend is not of concern at the present.

Sulfate has a fair upward overall trend at GW-15B ($R^2 = 0.5177$), with a weak negative correlation to water elevation. Since November of 2004, the upward trend is very strong ($R^2 = 0.9716$). Sulfate is not toxic to plants or animals (even at very high concentration), but has a cathartic effect on humans in concentrations over 500 mg/L. For this reason, the EPA has set the secondary standard as 250 mg/L. The sulfate at GW-15B has always been above 1380 mg/L, and this is not a drinking water source. There is no indication of acid mine drainage (AMD), since the pH has remained at or above 6.7, the alkalinity is fairly high (455 mg/L), and the levels of iron, manganese and aluminum have remained low.

The total alkalinity at GW-15A has a very weak upward trend overall, but has a strong downward trend since May 2005. There is a very weak negative correlation to water level overall, but a very strong positive correlation since May 2005. The pH has remained above 7.45, so there is no fear of acid mine drainage.

The number of cations and anions counted at GW-15B is unusually high. There is a weak negative correlation to water level. The cation/anion balance is within the 5% recommended limit at this site. The number of cations and anions relate to the total dissolved solids in the water sample, which has an upward trend as discussed above.

The total hardness at GW-15B has a weak general upward trend ($R^2 = 0.3118$), with a much sharper upward trend ($R^2 = 0.9112$) since March of 2005, the last three quarters recording the highest concentrations ever at this site. Because all recorded values of hardness at this site

are greater than 1400 mg/L, and therefore in the very hard range (>300 mg/l), the increased values do not represent a degradation of water quality.

The total selenium has a weak upward trend at GW-8, GW-9, GW-9B, GW-10, GW-12, and GW-14 ($0.109 < R^2 < 0.2851$), and a very weak downward trend ($R^2 = 0.0066$) at GW-13. At all sites the correlation to water level was positive and weak to very weak. At GW-8 this quarter (80 mg/L) represented a significant drop-off from last quarter (240 mg/L), which was the highest value ever recorded at the site. At GW-9 the highest concentration was recorded in May of 2005 (170 mg/L), the concentration dropped to 40 mg/L for the subsequent two quarters and rose to 120 mg/L this quarter. The highest concentration ever recorded at GW-13 was 598 mg/L in May of 1986; this is the second highest recorded concentration (390 mg/L). This is the highest concentration ever recorded at GW-9B, GW-10, GW-12, and GW-14.

The drinking water quality standard for selenium is 0.05 mg/L, the fresh-water aquatic life standard is 0.005 mg/L, and the human-life standard is 170 mg/L. The number of times the selenium has been below the drinking water quality standard is as follows:

Site	# of samples <0.05 mg/L	Total Samples
GW-8	2	46
GW-9	1	45
GW-9B	0	38
GW-10	0	45
GW-12	0	46
GW-13	0	20
GW-14	0	45

This water is not used as a fishery or for drinking water, and this change in selenium does not represent a degradation of water quality.

Several routine Reliability Checks were outside of standard values. They were:

Site	Reliability Check	Value Should Be...	Value is...
SW-1	Mg/(Ca + Mg)	< 40 %	43 %
SW-2A	Conductivity/Cations	> 90 & < 110	90
SW-2A	Mg/(Ca + Mg)	< 40 %	43 %
GW-1	TDS/Conductivity	>0.55 & <0.75	1.19
GW-1	Conductivity/Cations	> 90 & < 110	61
GW-1	Mg/(Ca + Mg)	< 40 %	47 %
GW-1	Ca/ (Ca + SO4)	> 50 %	27 %
GW-4	TDS/Conductivity	>0.55 & <0.75	1.22
GW-4	Conductivity/Cations	> 90 & < 110	60
GW-4	Mg/(Ca + Mg)	< 40 %	52 %

GW-4	Ca/ (Ca + SO4)	> 50 %	26 %
GW-6	TDS/Conductivity	>0.55 & <0.75	1.16
GW-6	Conductivity/Cations	> 90 & < 110	63
GW-6	Mg/(Ca + Mg)	< 40 %	56 %
GW-6	Ca/ (Ca + SO4)	> 50 %	25 %
GW-7	TDS/Conductivity	>0.55 & <0.75	0.88
GW-7	Conductivity/Cations	> 90 & < 110	77
GW-7	Mg/(Ca + Mg)	< 40 %	59 %
GW-7	Ca/ (Ca + SO4)	> 50 %	20 %
GW-8	TDS/Conductivity	>0.55 & <0.75	1.36
GW-8	Conductivity/Cations	> 90 & < 110	51
GW-8	Mg/(Ca + Mg)	< 40 %	77 %
GW-8	Ca/ (Ca + SO4)	> 50 %	11 %
GW-9	TDS/Conductivity	>0.55 & <0.75	1.68
GW-9	Conductivity/Cations	> 90 & < 110	43
GW-9	Mg/(Ca + Mg)	< 40 %	78 %
GW-9	Ca/ (Ca + SO4)	> 50 %	11 %
GW-9B	TDS/Conductivity	>0.55 & <0.75	1.59
GW-9B	Conductivity/Cations	> 90 & < 110	46
GW-9B	Mg/(Ca + Mg)	< 40 %	69 %
GW-9B	Ca/ (Ca + SO4)	> 50 %	16 %
GW-10	TDS/Conductivity	>0.55 & <0.75	1.23
GW-10	Conductivity/Cations	> 90 & < 110	60
GW-10	Mg/(Ca + Mg)	< 40 %	67 %
GW-10	Ca/ (Ca + SO4)	> 50 %	15 %
GW-12	Cation/Anion Balance	<5%	5.0 %
GW-12	TDS/Conductivity	>0.55 & <0.75	1.91
GW-12	Conductivity/Cations	> 90 & < 110	37
GW-12	Mg/(Ca + Mg)	< 40 %	80 %
GW-12	Ca/ (Ca + SO4)	> 50 %	9 %
GW-13	TDS/Conductivity	>0.55 & <0.75	1.39
GW-13	Conductivity/Cations	> 90 & < 110	51
GW-13	Mg/(Ca + Mg)	< 40 %	64 %
GW-13	Ca/ (Ca + SO4)	> 50 %	9 %
GW-14	TDS/Conductivity	>0.55 & <0.75	1.46
GW-14	Conductivity/Cations	> 90 & < 110	51
GW-14	Mg/(Ca + Mg)	< 40 %	70 %
GW-14	Ca/ (Ca + SO4)	> 50 %	15 %
GW-15A	TDS/Conductivity	>0.55 & <0.75	1.17
GW-15A	Conductivity/Cations	> 90 & < 110	61
GW-15A	Ca/ (Ca + SO4)	> 50 %	36 %

GW-15B	TDS/Conductivity	>0.55 & <0.75	1.13
GW-15B	Conductivity/Cations	> 90 & < 110	64
GW-15B	Ca/ (Ca + SO4)	> 50 %	36 %
GW-16	TDS/Conductivity	>0.55 & <0.75	1.12
GW-16	Conductivity/Cations	> 90 & < 110	64
GW-16	Mg/(Ca + Mg)	< 40 %	53 %
GW-16	Ca/ (Ca + SO4)	> 50 %	27 %
GW-17	Mg/(Ca + Mg)	< 40 %	57 %
GW-17	Ca/ (Ca + SO4)	> 50 %	47 %

The Permittee should work with the lab to make sure that samples pass all quality checks so that the reliability of the samples does not come into question. These inconsistencies do not necessarily mean that a sample is wrong, but it does indicate that something is unusual. An analysis and explanation of the inconsistencies by the Permittee would help to increase the Division's confidence in the samples. The Permittee can learn more about these reliability checks and some of the geological and other factors that could influence them by reading Chapter 4 of *Water Quality Data: Analysis and Interpretation* by Arthur W. Hounslow.

4. On what date does the MRP require a five-year re-sampling of baseline water data.

December 10, 2009

5. Based on your review, what further actions, if any, do you recommend?

No further actions are required at this time.

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