0020

WATER QUALITY MEMORANDUM

Utah Coal Regulatory Program

July 27, 2006

TO: Internal File

THRU: D. Wayne Hedberg, Permit Supervisor

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

RE: 2005 Third Quarter Water Monitoring, Nevada Electric Investment Corporation, Wellington Preparation Plant, C/007/0012-WQ05-3, Task #2535

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	Total Alkalinity	652 mg/L	4.58	315.15 mg/L
SW-1	Bicarbonate	652 mg/L	2.44	343.75 mg/L
SW-1	Settleable Solids	30 mg/L	4.59	2.38 mg/L
SW-1	Cation/Anion Balance	21.3 %	3.83	3.55 %
SW-1	Total Iron	187 mg/L	5.78	11.42 mg/L
SW-1	Total Manganese	4.02 mg/L	3.25	0.41 mg/L
SW-2A	Total Suspended Solids	4354 mg/L	5.60	309.79 mg/L
SW-2A	Total Alkalinity	591 mg/L	5.38	297.75 mg/L
SW-2A	Settleable Solids	20 mg/L	5.66	2.82 mg/L
SW-2A	Cation/Anion Balance	22.1 %	6.76	1.98 %
SW-2A	Total Iron	142 mg/L	7.07	6.48 mg/L
SW-2A	Total Manganese	3.54 mg/L	2.09	0.48 mg/L
GW-1	Total Dissolved Solids	4469 mg/L	3.93	4936.25 mg/L
GW-1	Depth	15.82 feet	2.26	11.29 feet
GW-1	Total Cations	63.3 meq/L	3.27	70.36 meq/L
GW-1	Dissolved Magnesium	222 mg/L	2.37	254 mg/L
GW-1	Dissolved Sodium	529 mg/L	3.17	634.95 mg/L
GW-4	Dissolved Boron	0.39 mg/L	2.54	1.01 mg/L
GW-4	Dissolved Magnesium	232 mg/L	2.06	258.06 mg/L

GW-6	Dissolved Magnesium	241 mg/L	2.07	263.94 mg/L
GW-7	Total Iron	92.4 mg/L	2.11	28.12 mg/L
GW-8	Total Selenium	40 µg/L	2.58	17.54 µg/L
GW-9	Total Selenium	40 µg/L	3.07	17.38 µg/L
GW-9B	Total Selenium	60 µg/L	2.87	16.60 µg/L
GW-9B	Dissolved Iron	14.9 mg/L	2.08	5.5 mg/L
GW-9B	Cation/Anion Balance	10.4 %	2.05	2.98 %
GW-9B	Sulfate	7271 mg/L	2.07	5379.40 mg/L
GW-15A	Depth	12.53 mg/L	2.68	7.36 mg/L
GW-15A	Cation/Anion Balance	7.2 %	2.53	1.19 %
GW-15B	Lab Specific Conductivity	3920 µmhos/cm	2.79	3399.78 µmhos/cm
GW-15B	Total Alkalinity	448 mg/L	3.81	486.78 mg/L
GW-15B	Total Cations	47.4 meq/L	2.78	43.03 meq/L
GW-15B	Total Anions	50.6 meq/L	2.83	44.94 meq/L
GW-15B	Dissolved Calcium	448 mg/L	3.45	374.14 mg/L
GW-15B	Dissolved Magnesium	164 mg/L	2.35	148.27 mg/L
GW-15B	Total Hardness	1794 mg/L	3.42	1545.52 mg/L
GW-15B	Sulfate	1904 mg/L	3.04	1608.87 mg/L
GW-17	Total Alkalinity	270 mg/L	2.41	793.45 mg/L
GW-17	Lab Specific Conductivity	1127 µmhos/cm	2.19	2288.95 µmhos/cm
GW-17	Total Cations	10.8 meq/L	2.32	25.58 meq/L
GW-17	Total Dissolved Solids	673 mg/L	2.20	1483.30 mg/L
GW-17	Dissolved Sodium	85.8 mg/L	2.46	407.95 mg/L
GW-17	Dissolved Potassium	5.29 mg/L	2.84	7.47 mg/L

There is no real trend in the bicarbonate at SW-1 ($R^2 = 0.008$), though this is the highest reading ever. There are no water quality standards for bicarbonate. Bicarbonate is an important constituent of alkalinity, which is desirable to buffer against acid mine drainage, so an increase is not of great concern. High amounts of bicarbonate can cause problems in boilers when hardness is high, but the hardness here is less than the average for the site, so there is not a concern at this time.

The cation/anion balance at SW-1, SW-2A, GW-9B, and GW-15A is both outside 2 standard deviations, and above the 5% attention value. It is not clear why it is so high at so many sites, but as discussed below, it is something that the Permittee should work with the lab to ensure it stays within accepted values.

There is a strong downward trend in water elevation at GW-1, and GW-15A ($R^2 = 9.219$, 0.764). It is unclear why the elevation is trending downward so strongly at these two sites. The elevation seems to follow the Palmer Hydrologic Drought Index (PHDI) and Surface Water Supply Index (SWSI) until this quarter.

There is no real trend in the dissolved boron at GW-4, and no correlation to flow. This unusually low reading for boron is not of concern, and is actually a positive for water quality.

The dissolved calcium level at GW-15B has a fairly weak overall upward trend (R^2 = 0.3969), with a weak negative correlation to water level. There are no criteria for this metal, but it does contribute to water hardness. The hardness at GW-15B has always fallen into the very hard (>300 mg/l) classification. It is not clear why the calcium level has been changing, but this does not represent a degradation of water quality.

Dissolved magnesium has a fairly strong downward trend at GW-1 ($R^2 = 0.611$), and a slight downward trend at GW-4, and GW-6 ($R^2 = 0.231, 0.208$), and no real trend at GW-15B ($R^2 = 8 X 10^{-5}$). There is a fairly strong positive correlation to water level at GW-1, and no real correlation to water level at the other sites. There are no criteria for this metal, but it contributes to water hardness, which has a fairly strong downward trend at GW-1 ($R^2 = 0.495$), a slight downward trend at GW-4, and GW-6 ($R^2 = 0.101, 0.117$), and a slight upward trend at GW-15B ($R^2 = 0.184$). Hardness at each of these sites has always fallen in the very hard (>300 mg/L) category, with all but two samples (at GW-15B) above 1000 mg/L.

The dissolved potassium was lower than average at GW-17. There is a fairly strong downward trend in potassium at this site ($R^2 = 0.508$), with no real correlation to water level. There are no water quality standards for potassium and this lowering of the potassium level does not hurt the water quality.

The dissolved sodium was lower than average at GW-1, and GW-17. There is a very slight downward trend at GW-1 ($R^2 = 0.020$), and a strong downward trend at GW-17. There is a weak negative correlation to well elevation at GW-17, and a weak positive correlation to well elevation at GW-1. There is no water quality standard for sodium, but it does increase the salinity of water. High salinity in irrigation water can decrease yields, depending on the crop. The reduction in sodium is a positive trend.

The settleable solids concentrations at SW-1, and SW-2A were unusually high this quarter. The Permittee indicated that the flow was very high and turbid. These values are extreme outliers for the sites. There is a very slight upward trend in settleable solids at SW-1 and SW-2A ($R^2 = 0.053, 0.048$), with a weak positive correlation to flow. Since the high settleable solids are most likely due to the high flow reported, and would not logically come from any current operations at the Wellington Preparation Plant, they are not of concern at this time.

Sulfate has a fairly strong upward trend at GW-15B, and a weak upward trend at GW-9B. There is a weak negative correlation between sulfate and well elevation at both sites. There is no indication of acid mine drainage (AMD), since the pH has remained at or above 6.2, and the total alkalinity of the water is quite high (>448 mg/L). 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 at or above 1380 mg/L. The sulfate at GW-9B has been at or above 3700 mg/L, except for one reading of 525 mg/L in 1990.

The total alkalinity has a slight upward trend at SW-1, and SW-2A ($R^2 = 0.012, 0.069$), a weak downward trend at GW-17 ($R^2 = 0.185$), and a fairly strong downward trend at GW-15B ($R^2 = 0.500$). The upward trends at SW-1, and SW-2A is welcome, since it means the water is better able to buffer any acids it may encounter. Though the downward trend at GW-15B is not desirable, it has just dropped from 508 mg/L at the highest to 448 mg/L at the lowest, which is still quite a high number. At GW-17 the alkalinity has fluctuated more widely, and has a range from 270 to 1060 mg/L. The pH at these sites has only been below 6.9 once each (in 1998), and actually has a very weak *upward* trend at these sites. Alkalinity is an important measure of buffering capacity (ability to absorb acids without lowering pH), and the Division will continue to monitor the trend of this parameter.

The number of anions counted is unusually high at GW-15A. The number of cations counted is unusually low at GW-1, and GW-17, and unusually high at GW-15. There is a negative correlation to water level, except for cations at GW-16, and GW-1 which have a positive correlation to water level. There is no correlation to water level at GW-17. The cation/anion balance is within the 5% recommended limit at each of these sites. The number of cations and anions relate to the total dissolved solids in the water sample, and that number is not out of the ordinary, except at GW-1 and GW-17.

There is a strong downward trend in the total dissolved solids (TDS) at GW-1, and 17. There is a weak correlation to water level at GW-1, but no correlation at GW-17. A reduction in total dissolved solids is an improvement to water quality, and not a concern at this time.

There is a weak upward trend in the total hardness at GW-15B, with a weak negative correlation to water level. The hardness at GW-15B has never been below 1424 mg/L, which is well into the very hard (>300 mg/L) range. This does not represent a degradation of the water quality.

There is a very slight upward trend in dissolved iron at GW-9B ($R^2 = 0.063$), with a weak negative correlation to water level. The total iron has a weak upward trend at GW-7, a very weak upward trend at SW-2, and a very weak downward trend at SW-1. There no real correlation to water level/flow. The secondary water quality standard for iron (based on taste and appearance only) is 0.3 mg/l, and for industrial use, the limit is 0.2 mg/l. The aquatic life standard (warm water fisheries) is 1.0 mg/l. Since the groundwater at the Wellington Preparation Plant does not support aquatic life, and the iron has usually been above 0.2 mg/l, the rise in dissolved iron does not represent a degradation of water quality in GW-7. Though the preparation plant is most likely not the source of the iron, and there have been readings of this magnitude before, the high readings at SW-1, and SW-2A are disconcerting. The Division will keep a close eye on this parameter.

The total manganese has a very weak upward trend at SW-2A, and a very weak downward trend at SW-1. There is no correlation to flow. The only water quality standard for manganese is that for domestic use it should be below 0.05 mg/L because it stains. Since the water in the Price River is almost always treated before domestic use, and just 11 of 99 samples have ever been below 0.05 mg/L, this is not a concern.

The total selenium has a very weak upward trend at GW-8, and GW-9, and a very slight upward trend at GW-9B, with a weak negative correlation to flow at GW-8, and GW-9B, and a weak positive correlation to flow at GW-9. 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 selenium at GW-9B has always been above the drinking water quality standard and the aquatic life standard. It is still well below the human-life standard. The selenium at GW-8, and GW-9B has only been below the drinking water quality standard 3 times in 161 samples (1999 and 2000). 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.

The total suspended solids at SW-2A have a very weak upward trend ($R^2 = 0.084$), with a weak positive correlation to flow. There seems to be a sharp rise in the curve since late 2004. There have also been some high flows in the same period, and it is quite possible that the rise in river level has made it possible for the flow to pick up extra sediments. There are no quantitative criteria for total suspended solids.

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

Site	Reliability Check	Value Should Be…	Value is…
SW-1	Cation/Anion Balance	<5 %	21.3 %
SW-1	TDS/Conductivity	>0.55 & <0.75	0.49
SW-1	Mg/(Ca + Mg)	< 40 %	47 %
SW-1	Ca/ (Ca + SO4)	> 50 %	31 %
SW-2A	Cation/Anion Balance	<5 %	21.9 %
SW-2A	TDS/Conductivity	>0.55 & <0.75	0.55
SW-2A	Mg/(Ca + Mg)	< 40 %	47%
SW-2A	Ca/ (Ca + SO4)	> 50 %	34 %
GW-1	Cation/Anion Balance	<5 %	5.2 %
GW-1	TDS/Conductivity	>0.55 & <0.75	1.09
GW-1	Conductivity/Cations	> 90 & < 110	65
GW-1	Mg/(Ca + Mg)	< 40 %	46%
GW-1	Ca/ (Ca + SO4)	> 50 %	27%
GW-4	Cation/Anion Balance	<5 %	7.0 %
GW-4	TDS/Conductivity	>0.55 & <0.75	1.06

GW-4	Conductivity/Cations	> 90 & < 110	72
GW-4	Mg/(Ca + Mg)	< 40 %	53%
GW-4	Ca/ (Ca + SO4)	> 50 %	24%
GW-6	TDS/Conductivity	>0.55 & <0.75	1.07
GW-6	Conductivity/Cations	> 90 & < 110	68
GW-6	Mg/(Ca + Mg)	< 40 %	55%
GW-6	Ca/ (Ca + SO4)	> 50 %	25%
GW-7	Cation/Anion Balance	<5 %	6.2 %
GW-7	TDS/Conductivity	>0.55 & <0.75	0.82
GW-7	Conductivity/Cations	> 90 & < 110	86
GW-7	Mg/(Ca + Mg)	< 40 %	58%
GW-7	Ca/ (Ca + SO4)	> 50 %	19%
GW-8	TDS/Conductivity	>0.55 & <0.75	1.14
GW-8	Conductivity/Cations	> 90 & < 110	63
GW-8	Mg/(Ca + Mg)	< 40 %	76%
GW-8	Ca/ (Ca + SO4)	> 50 %	11%
GW-9	Cation/Anion Balance	<5%	6.1%
GW-9	TDS/Conductivity	>0.55 & <0.75	1.35
GW-9	Conductivity/Cations	> 90 & < 110	57
GW-9	Mg/(Ca + Mg)	< 40 %	77%
GW-9	Ca/ (Ca + SO4)	> 50 %	10%
GW-9B	Cation/Anion Balance	<5%	10.4 %
GW-9B	TDS/Conductivity	>0.55 & <0.75	1.16
GW-9B	Conductivity/Cations	> 90 & < 110	66
GW-9B	Mg/(Ca + Mg)	< 40 %	67%
GW-9B	Ca/ (Ca + SO4)	> 50 %	15%
GW-10	TDS/Conductivity	>0.55 & <0.75	0.95
GW-10	Conductivity/Cations	> 90 & < 110	76
GW-10	Mg/(Ca + Mg)	< 40 %	70%
GW-10	Ca/ (Ca + SO4)	> 50 %	14%
GW-12	Cation/Anion Balance	<5%	5.7 %
GW-12	TDS/Conductivity	>0.55 & <0.75	1.50
GW-12	Conductivity/Cations	> 90 & < 110	50
GW-12	Mg/(Ca + Mg)	< 40 %	80%
GW-12	Ca/ (Ca + SO4)	> 50 %	9%
GW-13	TDS/Conductivity	>0.55 & <0.75	1.14
GW-13	Conductivity/Cations	> 90 & < 110	54
GW-13	Mg/(Ca + Mg)	< 40 %	64%
GW-13	Ca/ (Ca + SO4)	> 50 %	8%
GW-14	Cation/Anion Balance	<5%	7.1 %
GW-14	TDS/Conductivity	>0.55 & <0.75	1.21

GW-14	Conductivity/Cations	> 90 & < 110	62
GW-14	Mg/(Ca + Mg)	< 40 %	70%
GW-14	Ca/ (Ca + SO4)	> 50 %	15%
GW-15A	Cation/Anion Balance	<5%	7.2 %
GW-15A	TDS/Conductivity	>0.55 & <0.75	1.02
GW-15A	Conductivity/Cations	> 90 & < 110	74
GW-15A	Ca/ (Ca + SO4)	> 50 %	34%
GW-15B	TDS/Conductivity	>0.55 & <0.75	1.03
GW-15B	Conductivity/Cations	> 90 & < 110	68
GW-15B	Ca/ (Ca + SO4)	> 50 %	36%
GW-16	Cation/Anion Balance	<5%	5.6 %
GW-16	TDS/Conductivity	>0.55 & <0.75	1.07
GW-16	Conductivity/Cations	> 90 & < 110	69
GW-16	Mg/(Ca + Mg)	< 40 %	53%
GW-16	Ca/ (Ca + SO4)	> 50 %	26%
GW-17	Cation/Anion Balance	<5%	7.3%
GW-17	TDS/Conductivity	>0.55 & <0.75	0.52
GW-17	Conductivity/Cations	> 90 & < 110	120
GW-17	Mg/(Ca + Mg)	< 40 %	47%
GW-17	Ca/ (Ca + SO4)	> 50 %	35%

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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