EMERY MINE HYDROLOGY MONITORING REPORT
2014-1015

This report represents a summary of data collected from the Emery Mine hydrologic monitoring network during 2014 and 2015. The reader should refer to Plate VI-4 and Table VI-17 of the approved Mining and Reclamation Plan for locations and monitoring parameters, respectively, associated with the monitoring plan.

Groundwater Summary

Groundwater data were collected from monitoring wells associated with the Emery Mine during 2014 and 2015 in accordance with Table VI-17 of the approved Mining and Reclamation Plan. These data are summarized in the attached Figures VI-2 through VI-7, which correspond to and update equivalent figures in the approved Plan. The data used to create these figures were downloaded from the DOGM database on March 10, 2016. The following general observations are based on the data presented in these figures:

- Water levels remained essentially unchanged during 2014 and 2015 (compared to previous years) in wells monitoring Quaternary alluvium. Concentrations of total dissolved solids ("TDS") vary substantially between the two wells from which samples were collected from Quaternary alluvium. At a value of approximately 47,000 mg/L, the TDS concentration of groundwater sampled at well RDA-6 is within the range of values measured at that well for the past 15 years. However, the TDS concentration of groundwater collected from well SM1-3 (at about 30,000 mg/L) was substantially lower than measured at that well since the mid-1980s, probably due to cleaning of the well to remove sediment from a flood that occurred in the adjacent Christiansen Wash in the fall of 2014 (see below).
- The depth to groundwater in well T1-B monitoring the Blue Gate Shale remained relatively constant during 2014 and 2015, with no substantial changes from prior years. Water levels increased in well R2-B during 2014 to levels similar to those prior to 2013 and then remained relatively constant during 2015. Well USGS4-1 is functioning properly but has been dry since 2007. Unfortunately, the depth-to-water data reported for this wells in the DOGM database since 2007 are actually the depth to the bottom of the dry well. The DOGM database should be changed to remove the water-level data for that period and simply indicate that the well was dry. This can only be done by DOGM personnel.
- Water levels in well Muddy #1, monitoring the upper Ferron Sandstone, remained relatively constant during 2014 and 2015 and similar to levels measured in prior years. However, the elevation of the groundwater surface continued to decrease in well H-U during 2014 and 2015, a phenomenon that has been occurring in this well since 2005. With no mining and no increased groundwater use known to be occurring in the vicinity of well H-U for the past several years, the reason for the decreasing water levels at H-U remains unknown.
- The elevation of the groundwater surface has been increasing in well R2-M, monitoring the middle Ferron Sandstone, since 2013.

- Water levels in the Kemmerer well and well R1-L, monitoring the lower Ferron Sandstone, remained with the range of historic data collected from these wells. It is of note that a new pressure gauge was installed on the Kemmerer well in late 2011 or early 2012, to replace the prior gauge that had been providing spurious data since 2009. Therefore, the depth-to-water data reported in the database for 2009 through 2011 are not considered valid. Furthermore, beginning in 2002, the pressure data (measured in psi) were reported sometimes as the depth to water, sometimes as the flow from the well, and sometimes as a comment only. Also, between 1995 and 2002, the depth-to-water data were all reported as "0", which was the common practice at the time for all pressure measurements. Thus, the water-level data contained in the DOGM database for the Kemmerer well need to be converted from a positive pressure value or other value to a negative depth value for the period of 1995 through 2014. Similarly, pressure measurements (in psi) collected from R1-L were entered into the DOGM database as the depth to water since at least 1994. Some of these pressure measurements were entered as negative values and some were entered as positive values. In any case, none of the values were properly entered into the database. Any inaccurately-recorded data should be converted to a negative depth to water and the DOGM database should be properly updated. This must be done by DOGM once the correct data are provided to them.

In addition to the routine collection of water-level and –quality data from the approved groundwater monitoring network, the following wells were evaluated in 2014 and 2015 and found to contain blockages or other factors that made data collection inaccurate: Where possible, the wells have been rehabilitated as indicated below.

- RDA-6: Beginning in March 2008, the depth to water in this well was consistently reported at about 12 feet. In 2012, the database indicates that an "obstruction" was encountered at this depth. This well was cleaned in April 2015 by injecting high pressure water until the water discharging from the well was clear. It appeared that the obstruction was a dead animal. The injected water was then bailed from the well. Although this may affect water-quality measurements in the near term, the effect is minimized by the fact that this well is completed in the low-permeability Blue Gate Shale. Thus, the injected water did not likely infiltrate significantly into the formation. Given the obstruction that was in the well, the data obtained from this well should not be considered valid for the period of March 2008 through March 2015. The DOGM database should be changed to remove data from the “water level” column for this period, with an indication that the well was obstructed and then cleaned in April 2015. The well should now be yielding accurate water-level data.
- T1-U: The depth and completion of this well are unknown. Based on the logs of nearby wells (T2 and TP), this well is likely about 380 to 420 feet deep. The database indicates that this well is dry at reported depths ranging from 13 to 330 feet. Repeated attempts to extend a probe to the bottom of the well have verified that the well is currently either obstructed or the casing is broken and offset at a depth of 43 feet. Since the area beneath the well was mined in the mid- to late-1980s, it is possible that the well casing broke due to subsidence. Recent data in the DOGM database report the depth to water for well T1-U as being 43 feet, when this is actually the depth to the obstruction or offset. This should be corrected in the DOGM database. Given the inadequacy of well T1-U for

monitoring the upper Ferron Sandstone, nearby well TP-U was cleaned in October 2015 by injecting water under high pressure and bailing the excess water from the well. The depth to water in the well was subsequently measured as 394 feet. The applicant proposes to substitute well TP-U for well T1-U to monitor groundwater in this area of the mine site. Since coal was mined from the upper Ferron Sandstone, water level data collected from the well drilled near Pump 3 will also be used to monitor groundwater levels in the upper Ferron Sandstone.

- SM1-3: This well, which monitors the alluvial aquifer adjacent to Christiansen Wash, filled with sediment from runoff during a storm event in the fall of 2014. The well was cleaned in April 2015 by injecting water under high pressure and then bailing excess water from the well. Although a sample collected from this well in September 2015 suggested that this well rehabilitation effort likely affected the water quality to some degree, this well should now yield acceptable water-level data.
- Other Monitoring Wells: Attempts were made in the spring and fall of 2015 to clear the obstructions from monitoring wells Muddy #2 and USGS1-2, both of which were completed in the upper Ferron Sandstone. These attempts were unsuccessful. Muddy #2 is located approximately 2000 feet northeast of Muddy #1 in an area where the upper Ferron Sandstone is adequately monitored by Muddy #1. USGS1-2 is located about 4000 feet northeast of Muddy #1 in an area where additional groundwater level data would be helpful for interpreting the influence of mining on the groundwater regime. Therefore, the applicant will evaluate additional methods for removing the obstruction from this well in attempt to render USGS1-2 useful for the collection of water-level data.

In summary, the following actions were taken with respect to the Emery Mine groundwater monitoring program during the period of 2014 through 2015:

- Kemmerer well: The pressure gauge was replaced on this well and is now functioning properly. Prior pressure data should be converted to negative depths to water in the DOGM database.
- USGS4-1: This well is currently a dry well. The DOGM database needs to be modified to indicate that the well is dry rather than showing a depth to water that is actually the depth of the well.
- R1-L: Pressure data in the DOGM database should be converted to a negative depth to water as appropriate.
- RDA-6: This well was rehabilitated in April 2015 and is now functioning properly.
- T1-U: Repeated attempts to extend a probe to the bottom of this well have been unsuccessful. The applicant proposes that this well be dropped from the approved monitoring plan and be replaced with well TP-U.
- TP-U: This well was cleaned in October 2015 and is now functioning properly. The applicant proposes that this well be added to the approved monitoring plan in place of well T1-U.
- Unnamed monitoring well near Pump 3: A monitoring well was drilled near Pump 3 in 2011 to monitor water levels in the mine near the location where water is pumped from the mine to Pond 6. The applicant proposes to monitor groundwater levels at this well, which is drilled into the upper Ferron Sandstone, on a quarterly basis.
- SM1-3: This well was rehabilitated in April 2015 and is now functioning properly.

- USGS1-2: The applicant will evaluate additional options for removing the obstruction from this well to render it suitable for the collection of groundwater level data. If an appropriate option is identified, attempts will be made during 2016 to remove the obstruction.

With implementation of the above actions, the applicant considers the groundwater monitoring system at the Emery Mine to be adequate for assessing potential groundwater impacts associated with mining at the Emery Mine.

Surface Water Summary

Water samples were collected from seven of the eight surface-water monitoring stations during 2014 and 2015. No flow occurred at the eighth location (SWMS-8, located on an unnamed ephemeral wash in the south-central portion of the mine area) during 2014 or 2015.

The value of surface water parameters monitored in the area during 2014 and 2015 were generally within the range of those parameter values monitored previously. Exceptions to this generality occurred as follows:

- In March 2015, the dissolved iron concentration (0.95 mg/l) exceeded previous measurements at SWMS-1A (located on Quitchupah Creek immediately downstream from State Route 10 and upstream from all mine-related disturbances). This concentration is substantially lower than the effluent limitation of 6.0 to 7.0 mg/l established for total iron by 40 CFR 434.42 through 434.45. Given the fact that this sample location is upstream from surface disturbance associated with the Emery Mine, this concentration is considered a function of upstream influences and not mine-related influences.
- In March 2015, the total dissolved solids concentration (448 mg/l) measured at SWMS-2 (located on Christiansen Wash upstream from all mine-related disturbances) was less than previously measured at this location. The relatively low specific conductance measured in this sample verified the probable correctness of the TDS concentration. Given the fact that this sample location is upstream from surface disturbance associated with the Emery Mine, this concentration is considered a function of upstream influences and not mine-related influences.
- In June 2014, the reported bicarbonate concentration (44.08 mg/l) at SWMS-4 (located on Quitchupah Creek immediately upstream from the disturbed area associated with the mine office) was lower than previously measured. This concentration was probably improperly reported since it is the same as that reported for dissolved sodium even though the total alkalinity of the sample is well within the range of historic values reported for that sample location.
- In September 2014, the total manganese concentration (0.002 mg/l) at SWMS-5 (located on Christiansen Wash upstream from its confluence with Quitchupah Creek) was the lowest measured at this location since monitoring began in 1979. The low dissolved manganese concentration at this location (<0.002 mg/l) serves to validate the low total manganese concentration.

- In December 2014, the sample collected from SWMS-9 (located on Ivie Creek upstream from its confluence with Quitchupah Creek) contained concentrations of dissolved magnesium, dissolved sodium, sulfate, total hardness, and total dissolved solids that exceeded previous maxima detected at this site since monitoring began in 1979. The fact that all of these parameters were at their maxima validates the analyses. Since all mine-related impacts to surface water in the area would be realized in Quitchupah Creek, and since this sample location is upstream from the confluence of Ivie Creek with Quitchupah Creek, these elevated concentrations are considered a function of upstream influences and not mine-related influences.

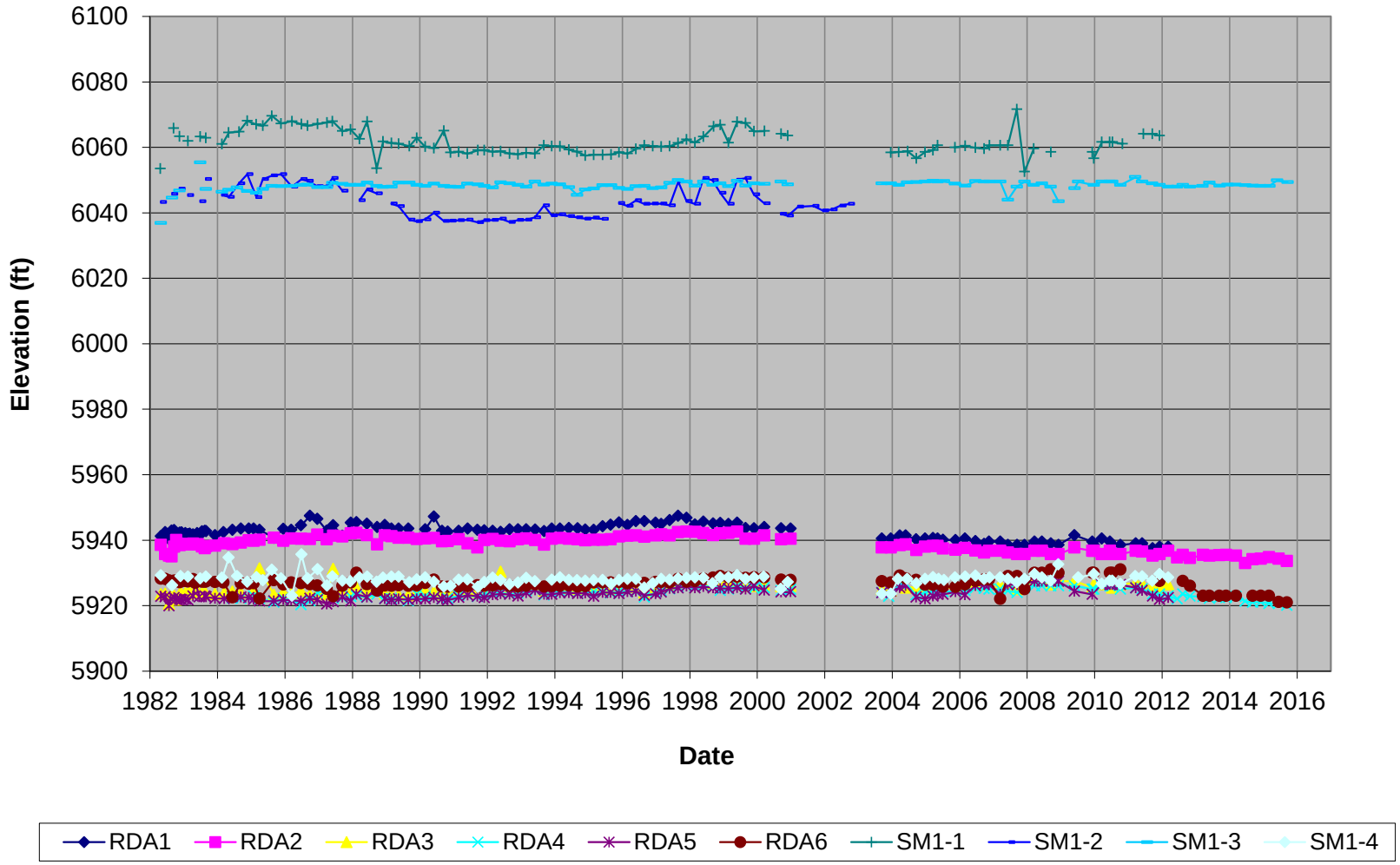

FIGURE VI-2. HYDROGRAPHS OF WELLS COMPLETED IN QUATERNARY DEPOSITS.

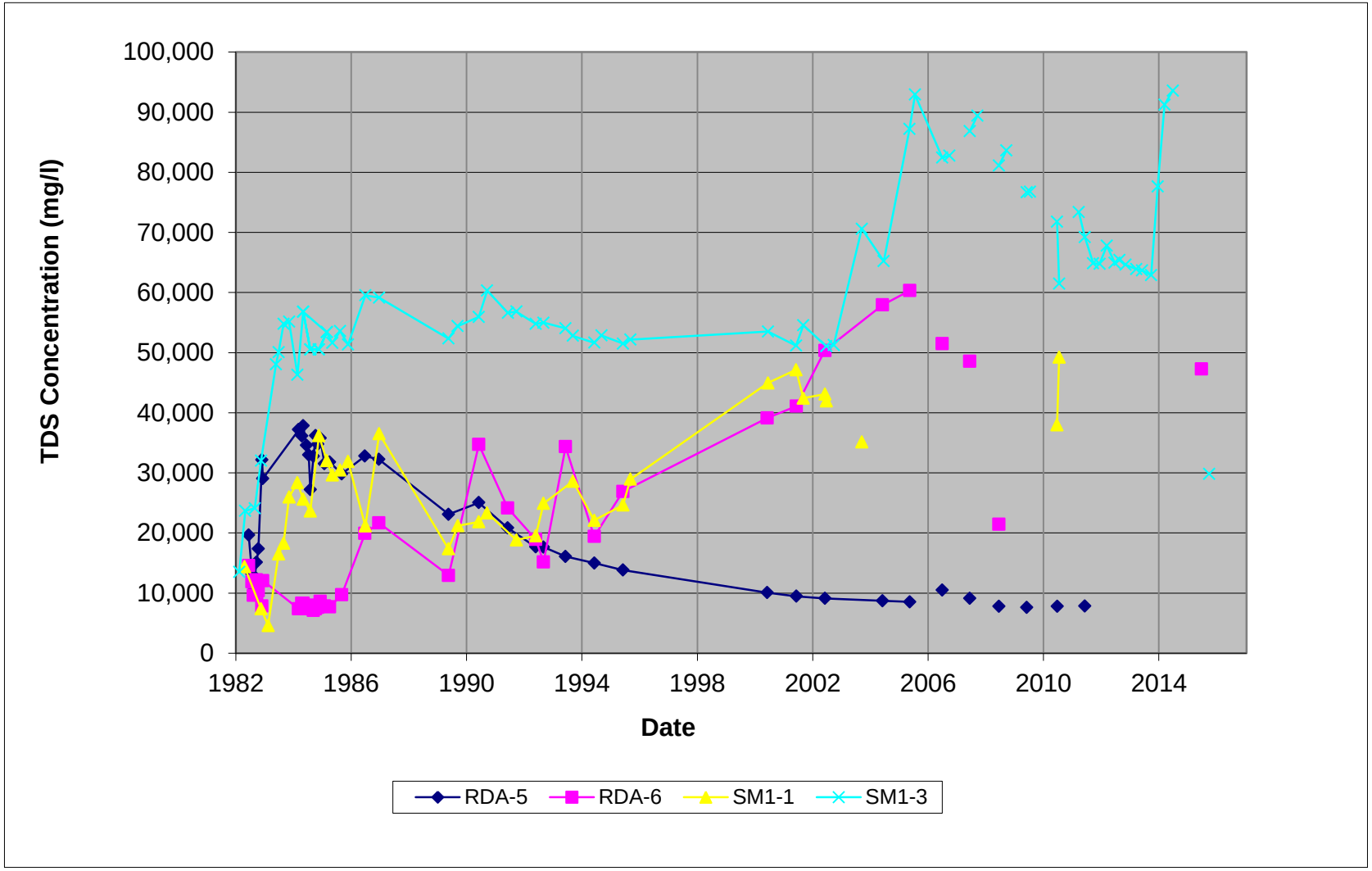

FIGURE VI-3. TDS CONCENTRATIONS OF SELECTED WELLS COMPLETED IN QUATERNARY DEPOSITS.

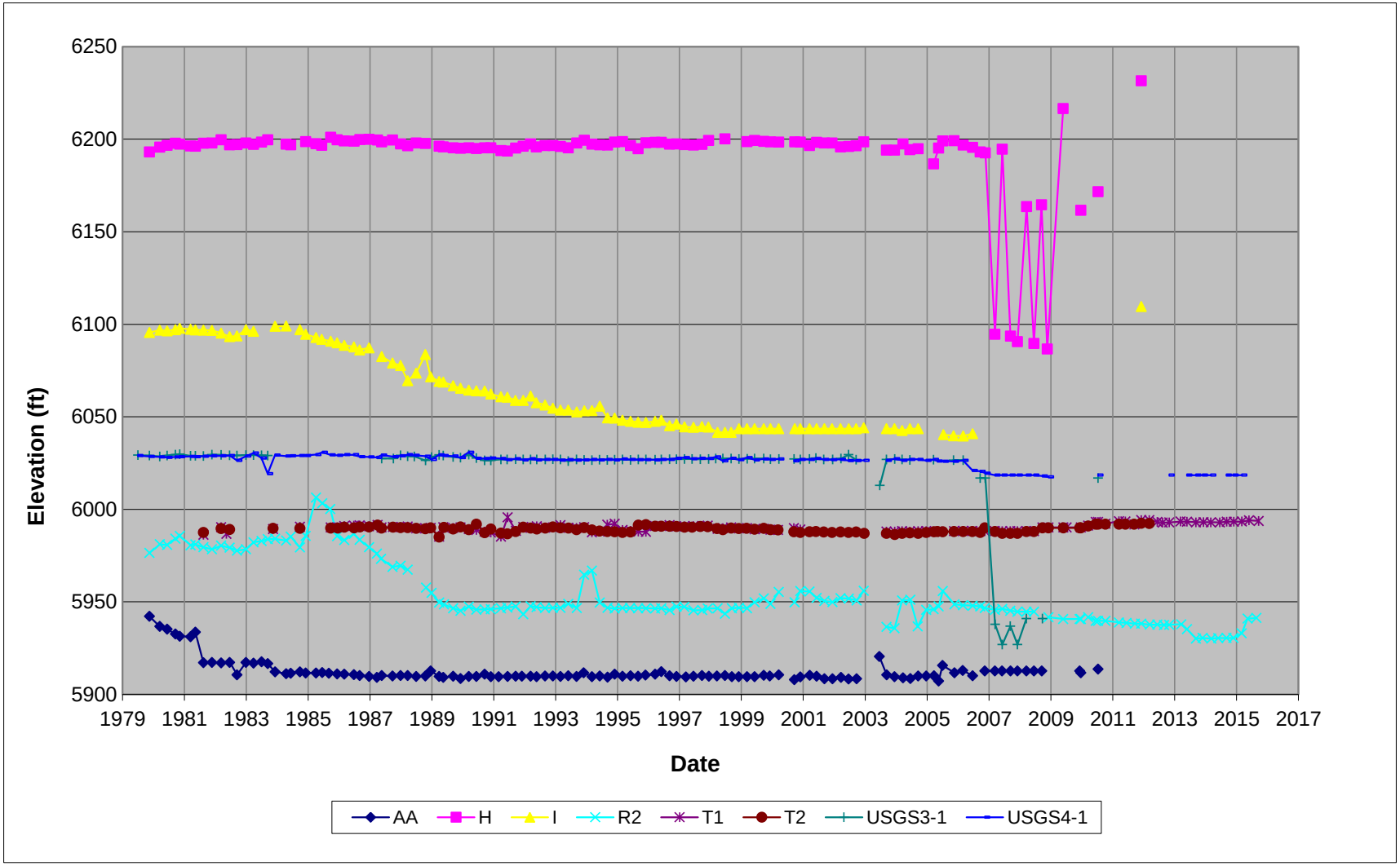

FIGURE VI-4. HYDROGRAPHS OF WELLS COMPLETED IN THE BLUE GATE MEMBER

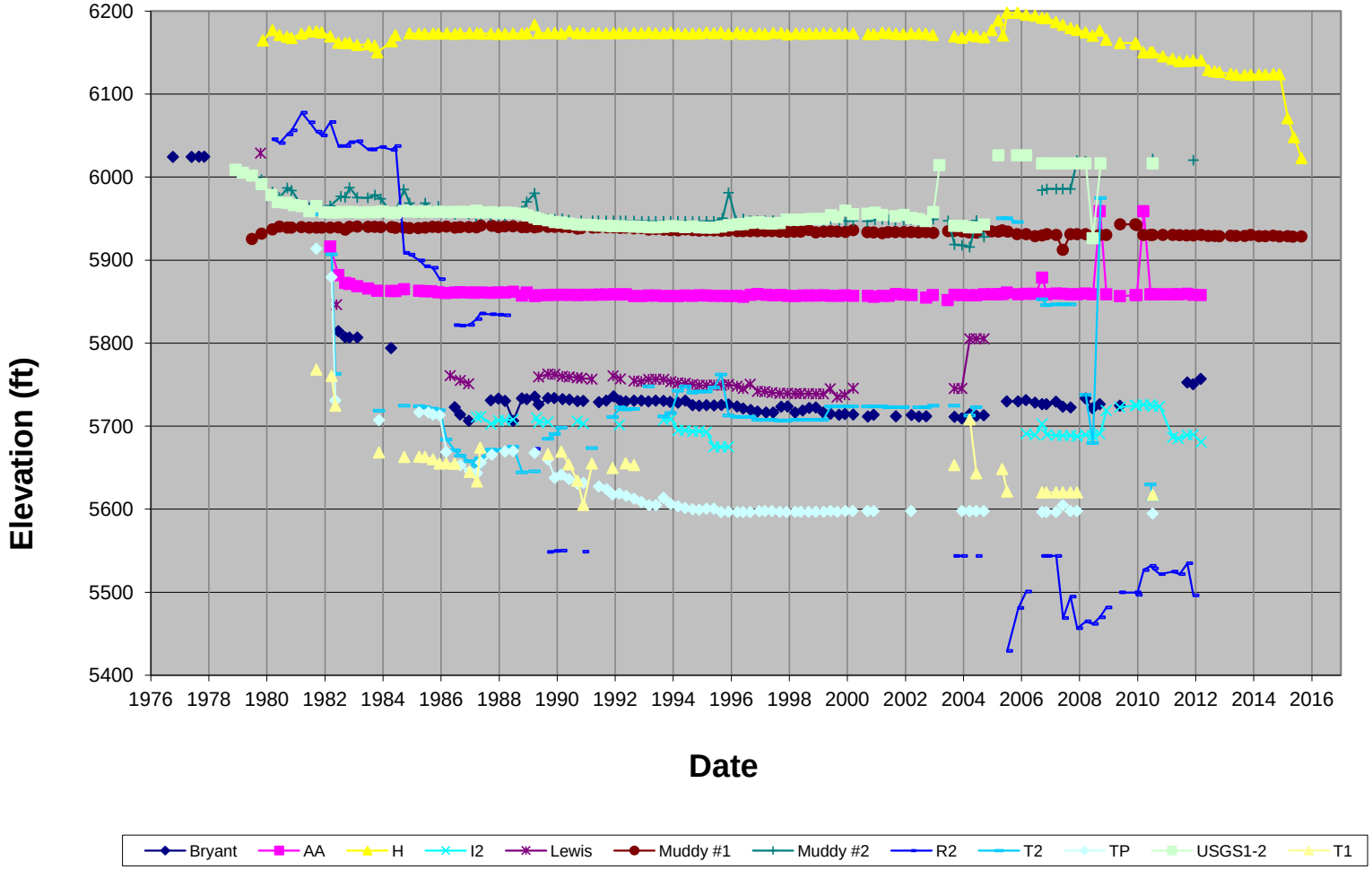

FIGURE VI-5. HYDROGRAPHS OF WELLS COMPLETED IN THE UPPER FERRON SANDSTONE.

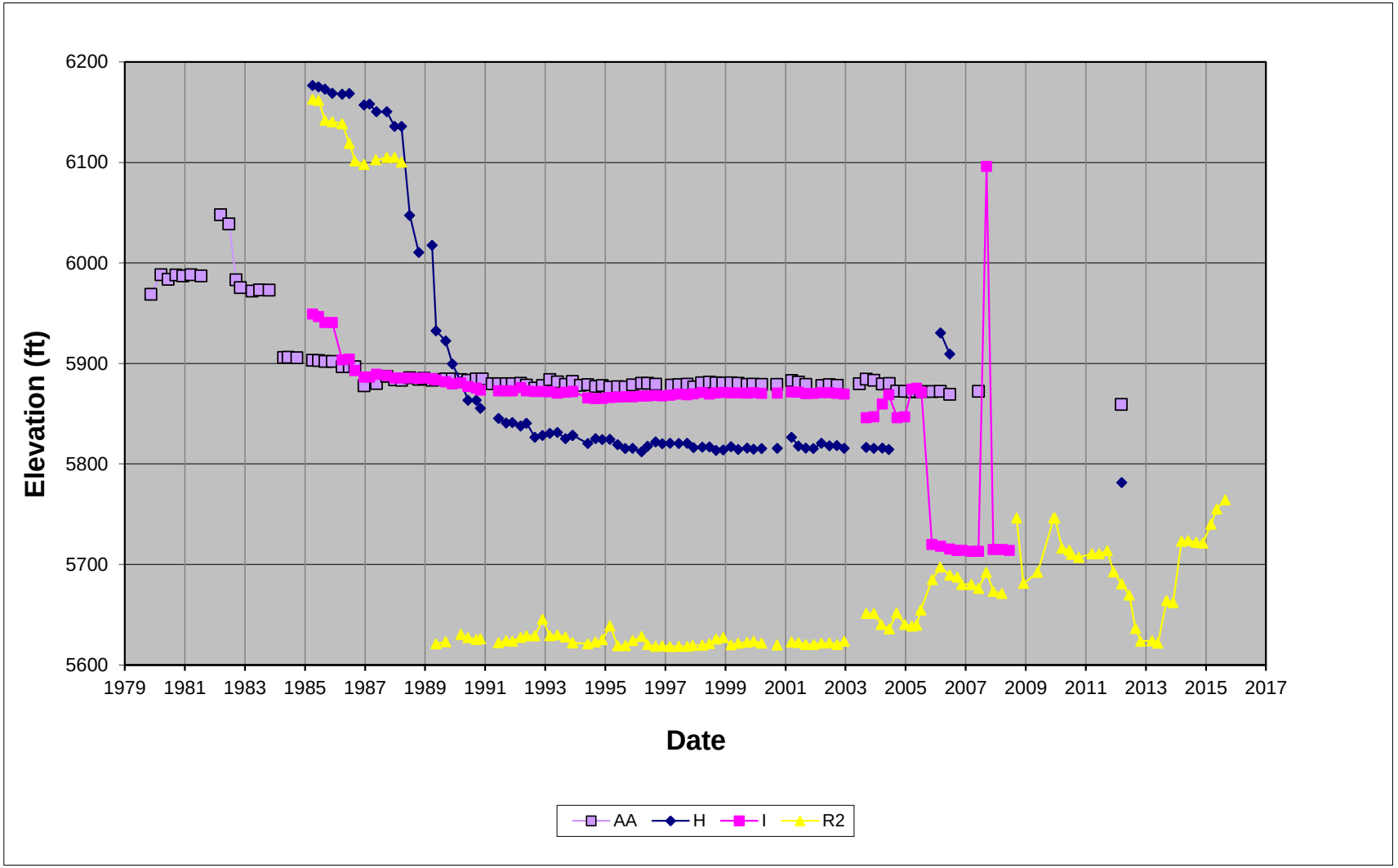

FIGURE VI-6. HYDROGRAPHS OF WELLS COMPLETED IN THE MIDDLE FERRON SANDSTONE.

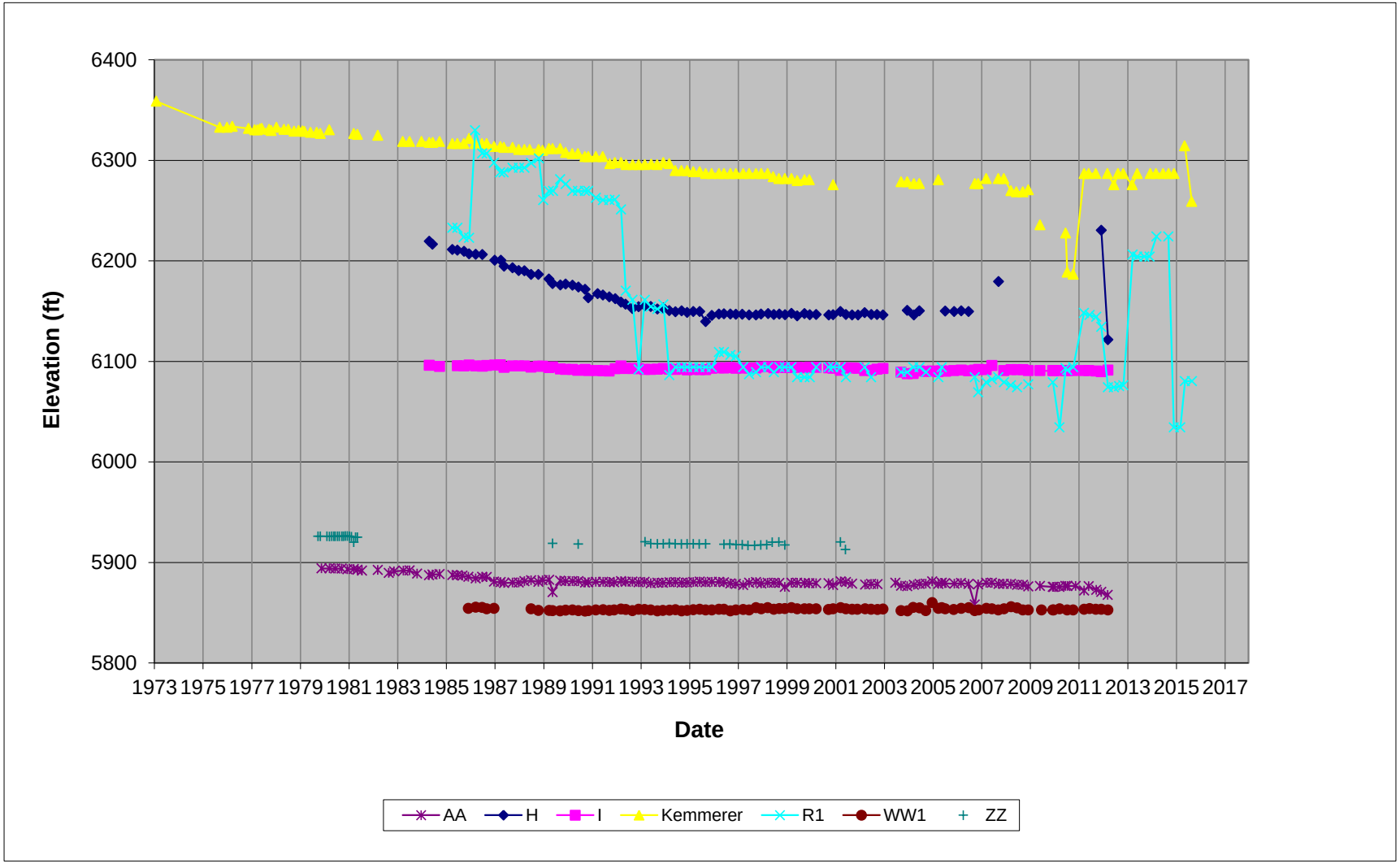

FIGURE VI-7. HYDROGRAPHS OF WELLS COMPLETED IN THE LOWER FERRON SANDSTONE.