Twin Pines Minerals is proposing to drill three production wells designated (FPW-01, FPW-02, FPW-03) in the upper Floridian aquifer at their proposed mine site located in Charlton county, Georgia (Figures 1A and 1B). The production wells will supply water for heavy-minerals concentration plants at the mine and will be pumped at 1,000 gallons per minute. The proposed mine will operate for eight years, and mining operations and pumping will be staged. Well FPW-01 will operate from year 0 to 3, well FPW-02 will operate from year 0.5 to 7, and well FPW-03 will be pumped from year 1 to 8.

The objective of this report is to predict the drawdown from these wells during the eight-year life of the mine. The Theis (1935) solution is used to predict well drawdown, and the total drawdown in the aquifer is determined by linearly superimposing the contributions from each well. Two MATLAB codes were developed to predict the total drawdown (Appendices A, B, and C).

Williams and Kuniansky (2016) report transmissivity and storage coefficient values for 11 wells in the upper Floridian Aquifer. One well had an anomalously low transmissivity value, and therefore was excluded from our analysis. The transmissivity and storage coefficient values for the remaining 10 wells were averaged to define a Base Case scenario (Table 1). Hydraulic properties for the "Minimum-Drawdown" and "Maximum-Drawdown" scenarios (Table 2), were determined by selecting the well pairs with the highest and lowest hydraulic diffusivity (Table 1).

The predicted drawdown at each of the proposed production wells is shown in Figures 2 – 4. The maximum drawdown at each of the wells is shown in Table 2. FPW-02 does not begin pumping until year 0.5, and FPW-03 begins pumping after year 1. Pumping ceases for FPW-01 at year 3, FPW-02 is not pumped after year 7, and pumping stops at FPW-03 at year 8. The drawdown at each well is impacted by the pumping schedule of the other wells. For example, pumping at FPW-01 causes drawdown at FPW-02 and FPW-03 before these wells begin pumping, and pumping at FPW-02 and FPW-03 leads to additional drawdown at FPW-01. Figure 2 shows the drawdown for the Base Case scenario, and the maximum observed drawdown is 35.6 ft at FPW-02 (Table 2). Drawdown for the Maximum-Drawdown scenario is displayed in Figure 3, and the greatest drawdown is 80.8 ft at FPW-02 (Table 2). The Minimum-Drawdown scenario is illustrated in Figure 4, and, again, the largest drawdown is at FPW-02 (16.5 ft, Table 2). Because FPW-02 is between FPW-01 and FPW-03, the drawdown at FPW-02 always exceeds the drawdown at the other wells.

The aerial distribution of the predicted drawdown in the Floridian Aquifer for the Base Case scenario is shown in Figures 5 – 8. Figure 5 shows the drawdown after 1 year (365 days). All three wells are pumping, and most of the drawdown is concentrated around the wells. The drawdown at 5 years (1,825 days) (Figure 6) is primarily influenced by pumping in FPW-02 and FPW-03, as FPW-01 stops pumping at year 3. At 8 years (2,920 days) (Figure 7), only FPW-03 is pumping, and the drawdown has decreased substantially from year 5. All pumping wells are shut down after year 8. Ten days after pumping at FPW-03 ceases (2,930 days), the upper Floridian Aquifer shows significant recovery (Figure 8).

References Cited

Williams, L. J., and Kuniansky, E. L., 2016, Revised hydrogeologic framework of the Floridian Aquifer System in Florida and parts of Georgia, Alabama, and South Carolina: U.S. Geological Survey Professional Paper 1807, 140 p.

Theis, C.V., 1935, The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage: Transactions of the American Geophysical Union, 16th Annual Meeting, p. 519-524.