The radius of the model does not have to be defined as Hantush's effective radius; instead, it can be defined to match the distance of observed physical boundaries. Because no physical boundaries can be defined over reasonable distances in the Floridan Aquifer, we arbitrarily chose a radius of 44,608 ft, twice the distance between the boundary of the ONWR and the nearest pumping well. The results of this model are presented in Table 1, which shows the drawdown in the Surficial Aquifer and the Floridan Aquifer at the edge of the ONWR and 1 ft away from the pumping well. For the three cases considered by Holt and Tanner (2020), the drawdown in the Floridan Aquifer ranged from 9.1 to 29.8 ft at a distance of 1 ft from the pumping well and 0.6 to 1.9 ft at the edge of the ONWR. The drawdown in the Surficial Aquifer ranged from ~0.8 to 0.3 ft at a distance of 1 ft from the pumping well and ~ 0.05 to 0.15 ft at the edge of the ONWR. The predicted drawdown in the Floridan is consistent with that predicted by Holt and Tanner (2020) (their Table 2). The drawdown in the surficial aquifer is surprisingly small, considering that the model assumes that the well is pumped forever.

It is important to remember that these results reflect pumping 1,000 gpm from a single well for an infinite period of time; the drawdown in the Surficial Aquifer will be much smaller after pumping for a period of only 4 years. For models of this type, a time constant can be defined to evaluate whether or not drawdown in the unpumped aquifer remains zero (e.g., Hantush, 1960; Neuman and Witherspoon, 1969):

$$\tau_c = 0.1\frac{S_s^* b^{*2}}{K^*}$$

where S_s^* is the specific storage of the aquitard (here 10^{-4} 1/ft), b^* is the thickness of the aquitard (here 325 ft), and K^* is the hydraulic conductivity of the aquitard (here 10^{-4} ft/day). If the time for pumping is less than τ_c, then the drawdown in the unpumped aquifer is essentially zero. In our case, the duration of pumping is 1,460 days, and τ_c = 10,562.5 days; therefore, drawdown in the surficial aquifer will be essentially zero at the end of 4 years. To help put this in perspective, τ_c represents 6.3% of the time required to reach steady state in the aquitard (the Hawthorn), and the time of pumping (1,460 days) is 0.87% of the time required to reach steady state in the Hawthorn. For time periods this short, changes in the head in the Floridan Aquifer will not have time to propagate upward through the Hawthorn and reach the Surficial Aquifer.

Comment 7 c:

Consider possible range of hydraulic conductivity for the aquitard in this analysis. Provide supporting evidence of this range by either literature review or field investigation.

Response to Comment 7c:

We use a realistic value of 10^{-4} ft/day for the hydraulic conductivity of the Hawthorn aquitard; this value is one order of magnitude higher than that used in calibrated USGS groundwater models that include the TPM area. Supporting evidence is listed below.

Williams and Kuniansky (2015) indicate that the vertical hydraulic conductivity of the Hawthorn is small (less than 10^{-4} ft/day) when clays are present and that leakage across the Hawthorn is negligible. Calibrated groundwater models that include the proposed mine and the Okefenokee Swamp area use a vertical hydraulic conductivity of 10-5 ft/day for the Hawthorn (Payne et al., 2005; Cherry, 2015; and Cherry, 2019). In addition, samples of the Hawthorn taken at the Twin Pines Minerals, LLC site show