4.0 SUMMARY AND CONCLUSIONS

AI currently conducts sand and gravel mining activities at the Chelsea Plant in two areas of the site, the North Plant area and the South Plant area. AI is proposing to conduct additional sand and gravel mining activities on two parcels of land (the proposed expansion area) located near the northwest corner of the South Plant area. Currently, sand and gravel mining is conducted above the water table at both the North and South Plant areas. Gravel mining below the water table is restricted to only the North Plant area, per the terms of the existing MDEQ Part 301 Inland Lakes and Streams Permit No. 12-038-0010-P. All proposed sand and gravel mining at the expansion area will be conducted above the water table.

AI has previously conducted numerous hydrogeological investigations related to the sand and gravel mining operations at the site. The previous investigations at the site have characterized the site's geology and groundwater conditions and have fulfilled all requirements for applicable MDEQ permits and plans. The findings of these previous investigations have identified the vertical and horizontal extent of the geologic deposits, groundwater flow direction, and groundwater velocity at the site. Groundwater flow is generally from the South Plant area towards Clear Lake, to the northwest, at an average groundwater velocity of approximately 365 feet per year. Additionally, AI has been conducting water level monitoring in site monitoring wells and nearby surface water bodies. The monitoring data identifies the maximum values, minimum values, range of variability of the water levels, and the seasonality or cyclic variations of the water levels. Table 1 presents a summary of all water levels measured, and Figure 7 presents the water elevation data graphically to illustrate the range and timing of groundwater and surface water level variations.

The maximum range of water level variations in monitoring wells throughout the monitoring period were MW-2 (3.24 feet), MW-3 (3.92 feet), MW-4 (4.24 feet), and MW-5 (3.65 feet), with the average groundwater elevation range of 3.76 feet.

The maximum range of water level variation in AI's Freshwater Lake was 3.60 feet, which is very consistent with the range of the groundwater level fluctuation (3.76 feet) at the site.

The maximum range of water level variation in Pond Lily Lake was 2.28 feet, slightly less than the range of variation observed in the groundwater at the site and in Freshwater Lake.

The timing of the variations of the water level changes described above show a clear annual cycle. The water levels described above exhibit the lowest water levels after the end of summer and the end of the growing season, while the highest observed water levels occur after the end of winter and near the beginning of the growing season. The observed seasonal cycles are very common for natural groundwater surface-water interactions.

The range of water level variation in Clear Lake, only 1.22 feet, are much less than those observed at, and adjacent to, AI's Chelsea Plant. The limited range of water level fluctuations and the lack of strong seasonal/cyclic water level changes are consistent with the water levels in Clear Lake being largely controlled by the outflow hydraulics of Clear Lake, more so than groundwater level fluctuations. Many of the soil borings at the AI Chelsea Plant identified the presence of clay-rich soil below at an elevation of 960 feet amsl, while the surface water elevation of Clear Lake is approximately 966 feet amsl. Clear Lake appears to drain toward the west-northwest through a series of poorly developed wetland drainages that are consistent with low permeability clay-rich soils. Water levels in Clear Lake above an elevation of approximately 966 feet amsl are expected to result in increased surface water or wetland water flow so that the surface elevation of Clear Lake cannot effectively rise above approximately 966 feet amsl. Water levels in Clear Lake during drought conditions can, however, fall below 966 feet amsl due to lack of rainfall, evaporation, and increased irrigation (lawn sprinkling) by lake area residents.

Figures 8, 9, and 10 illustrate the water levels measured during March 2012, September 2012, and December 2012 to update those submitted in previous hydrogeological reports (see Section 1.2, Appendix 2, and Appendix 3). The groundwater elevations are very consistent with those identified previously. The resulting groundwater flow direction is generally to the northwest, and the groundwater gradients are uniform indicating no significant geologic variations across the study area. Groundwater flow directions near the southern-most end of the Chelsea Plant area are influenced by the proximity to Pond Lily Lake, and groundwater flow adjacent to Pond Lily Lake is expected to discharge into Pond Lily Lake.

As the proposed sand and gravel mining in the proposed expansion area will be conducted only above the water table, no changes to groundwater flow direction or groundwater velocity will occur from the proposed sand and gravel mining activities. Therefore, the observed groundwater conditions at the site will remain within the range of normal variations similar to those that have already been identified at the site.

If sand and gravel mining is approved for the proposed expansion areas, trees will be removed over an area up to approximately 50 acres. Each mature tree is expected to use between 50 and 200 gallons of water per day during the growing season. The removal of these trees during the mining process will eliminate the transpiration losses of rain water, thus allowing more precipitation to infiltrate and recharge the groundwater. The sand and gravel mining on the proposed expansion area is expected to increase the quantity of groundwater that recharges the aquifer and results in groundwater flow towards Clear Lake. Therefore, based on the result of this hydrogeological evaluation, the proposed expansion of AI's sand and gravel mining operation will not result in a negative impact on the local groundwater or surface water systems.