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Historically, wells at the site have a slow (several months) lag time to reaching an equilibrium static water level. This lag is observed in the newly installed piezometers; the potentiometric surface (as indicated by the piezometers) on the eastern portion of the site is observed to slowly rise.

The hydraulic gradient for the western portion of the site was previously estimated at 0.02 ft/ft by Rust, during their 1994 investigation. The 2014–2015 Golder investigation determined a hydraulic gradient of 0.005 ft/ft for the eastern portion of the site based on potentiometric surfaces for the December 2014, March 2015, and June 2015 gauging events. The difference in hydraulic gradients between the western and eastern portions of the site are attributed to the western portion of the site occupying a more hydraulically upgradient position as observed in Figure III-4-13.1 where it can be seen that there is a downward trend in elevation from west to east across the site.

6.2.2 Hydraulic Properties and Groundwater Velocity

Table III-4-10 summarizes the hydraulic properties for the site. The overall hydraulic conductivity of Stratum II is low due to the fine-grained nature of the materials and the irregularity of the thin cracks at the interface. Consequently, groundwater flow, where present, is relatively slow, as shown on Table III-4-11. The thickness of the uppermost aquifer depends on the seasonal groundwater levels and is defined from the unweathered/weathered interface to the top of the saturated zone. The uppermost aquifer thickness was calculated by subtracting the unweathered/weathered interface elevation (found from the cross-sections) from the groundwater elevation average for 2015 at each borehole. The average aquifer thickness determined from borings in the eastern expansion area was approximately 31.45 feet. Aquifer thicknesses ranged, for example borehole GA-22 on the northern point of cross-section D determined a thickness of approximately 38.35 feet, borehole GA-24 in the middle of cross-section E determined a thickness of 30.12 feet, and borehole GA-14 at the southern point of cross-section E determined a thickness of approximately 28.65 feet.

The top of Stratum II was found between approximately elevation 517 and 601 ft-msl, with a thickness up to 49 ft. The average top of the layer is approximately at elevation 563 ft-msl and corresponds to the weathered claystone described in Permit MSW-692A. The top of Stratum III (unweathered claystone) was found between approximately elevation 506 and 565 ft-msl. The average top of the stratum is approximately 533 ft-msl.

During the investigation described in the Rust (1994) report, slug tests were performed in piezometers located on the portion of the facility west of the proposed expansion area to determine the hydraulic properties of the Stratum II/III interface. Golder slug tested four additional wells during the 2015 investigation to measure the hydraulic properties of the Stratum II/III interface in the area of the proposed expansion. These tests were conducted using the falling and rising head methods, whereby the water levels were displaced by introducing a “slug” into the water column. The drop and subsequent rise (following removal of the slug) in water level was then monitored with respect to time to determine the horizontal hydraulic conductivity. Hydraulic conductivity values for each test were determined using AqteSolv Pro® software. The output from each AqteSolv Pro® analysis may be found in Appendix III-4F. From the results of the slug testing, Golder calculated the geometric mean hydraulic conductivity to be as follows:

Table III-4-10: Summary of Aquifer (Slug) Tests

Consultant	**Stratum**	**Geometric Mean Hydraulic Conductivity (cm/sec)**
Rust (1994) (West)	II	2.2×10^{-7}
Rust (1994) (West)	III	5×10^{-10}
Golder (2015) (East)	II	9.1×10^{-7}

Horizontal travel velocities were estimated for the saturated zone above the Stratum II/III interface from the hydraulic gradient calculated for the December 2014, March 2015, and June 2015 potentiometric surfaces using the formula:

$$V = (ki)/n_e$$

Where:

V= travel velocity

k= hydraulic conductivity of the aquifer

i= hydraulic gradient (West = 0.02; East = 0.005)

n_e = effective porosity (0.06)

Resulting values indicate an average velocity of approximately 0.08 ft/year for both western and eastern portions of the site. Values used for calculations are as shown in Table III-4-11 and calculation steps are shown below.

Table III-4-11: Estimated Groundwater Velocities

Consultant	**Area of Site**	**Hydraulic Conductivity (k) (cm/sec)**	**Approximate Hydraulic Gradient (i)* (ft/ft)**	**Effective Porosity (n_e)****	**Linear Velocity (v) (ft/yr)**
Rust (1994)	West	2.2×10^{-7}	0.02	0.06	<0.1
Golder (2015)	East	9.1×10^{-7}	0.005	0.06	0.08
			Golder Mean		0.08

* Gradient estimated from December 2014, March 2015, and June 2015 potentiometric maps.
** Effective porosity for clay from McWorter and Sunada (1977).[WM1]

Hydraulic properties of the uppermost aquifer on the western portion of the site are as follows:

- Average Linear Velocity: 0.08 ft/yr (7.33×10^{-8} cm/s)
  - Calculated from: (2.20×10^{-7} * 0.02) / 0.06

Hydraulic properties of the uppermost aquifer on the eastern portion of the site are as follows:

- Average Linear Velocity: 0.08 ft/yr (7.57×10^{-8} cm/s)
  - Calculated from (9.08×10^{-7} * 0.005) / 0.06