The Upper Truckee River and Trout Creek are the two largest surface inflows into Lake Tahoe. The 1996-2002 average flow of the Upper Truckee River at the I-50 crossing was 90 ft^3/sec. The 1996-2002 average flow of Trout Creek at Martin Avenue was 36 ft^3/sec.

3. PRIOR GROUNDWATER MODELING STUDIES

3.1 Woodling (1987) Model

Woodling (1987) developed a two-dimensional, steady-state groundwater flow model of the South Lake Tahoe area. The U.S. Geological Survey (USGS) groundwater flow model MODFLOW (McDonald and Harbaugh, 1988) was used to simulate the net water exchange between groundwater and Lake Tahoe. The model grid consisted of 25 rows (north-south) and 17 columns (east-west). Row spacing varied from 2,000 ft at the southern boundary to 1,000 ft at the lakeshore. Column spacing was a constant 2,000 ft. The model consisted of 1 layer with a total of 193 active cells.

Transmissivity values were derived from analysis of pumping tests. The distribution of transmissivity values correlated with sediment thickness, increasing gradually from the mountain fronts to the Tahoe Keys. Sediment depths ranged from zero at the mountain fronts to greater than 800 ft towards the Tahoe Keys area. Hydraulic conductivity of the sediments was assumed to be 10-15 ft/day. The specification of transmissivity in the model assumed that drawdown at wells was insignificant compared to aquifer thickness. This is a reasonable assumption.

Lake Tahoe was simulated using a constant head boundary specified as 6226 ft MSL. The southern model boundary near the airport was simulated using a constant head boundary. Outcrops on the east and west sides of the site were simulated using a specified flux boundary.

Simulated results indicated a net discharge to the lake of 1.9 ft^3/sec (164,000 ft^3/day). Over half of this discharge occurred in the Tahoe Keys area. The model simulated total flux to the lake, rather than net flux i.e. outflows – inflows. Significant inflows from the lake likely occurred due to pumping at the Al Tahoe and Paloma wells. The model did not simulate streams. Additionally, the new Valhalla pumping well near the western shoreline of the study area was not in operation at the time of model development.

3.2 AGRA (1999) Model

AGRA (1999) developed a three-dimensional groundwater flow (MODFLOW) model of the study area. The focus of the study was groundwater resource evaluation of the Al Tahoe and Paloma well fields. The model grid consisted of 46 rows (north-south) and 39 columns (east-west). Row and column spacing varied from 1,000 ft at the mountain fronts, and 500 ft at the well fields. The model consisted of 4 layers with a total of 4,073 active cells. Layer bottom elevations (MSL) were specified as: 6200 ft, 6100 ft, 5900 ft, and bedrock (5850 ft-5400 ft).

Hydraulic conductivity values were specified as a function of grain size distribution ranging from 2 ft/day for fine-grain sediments to 45 ft/day for coarse-grain sediments. The hydraulic conductivity of weathered granitic rocks was specified as 0.2 ft/day. Specified leakance values allowed for simulation of vertical flow in the model domain. Values of effective vertical hydraulic conductivity incorporated into the leakance term were less than 0.1 times the value of horizontal hydraulic conductivity.

Lake Tahoe was simulated using a constant head boundary specified as 6226 ft MSL. The lake boundary was specified to be a vertical plane. The conductance of lakebed sediments was not addressed. Streams were represented using the MODFLOW River Package. This algorithm requires the specification of stream stage, and allows for specification of riverbed sediment conductance. The algorithm does not simulate stream flow. The Tahoe Keys were also represented using the MODFLOW River Package. The southern model boundary south of the airport was simulated using a constant head boundary. Outcrops on the east and west sides of the site were simulated using specified flux boundaries. Recharge to groundwater from precipitation and snowmelt was assigned to be 25% of surface recharge. The model was calibrated under steady-state and transient conditions. Model results were used to estimate the effects of increased South Tahoe Public Utilities District pumping in the alluvial aquifer near Lake Tahoe.

4. DATA ANALYSIS

4.1 Surface of Lakebed Sediments

Previous models (Woodling,1987; AGRA,1999) represented the lake as a vertical boundary. However, analysis of the bathymetric surface indicates that the lakebed slopes gently away from the shoreline, especially at shallow depths. The depth of aquifer sediments at the shoreline ranges from 400 to 1,000 ft. The elevation of the lakebed surface decreases as little as 25 ft over a distance of 2,000 ft away from the shoreline. In deeper sediments, the location of the lake-groundwater interface is as great as 8,000 ft beyond the shoreline.

4.2 Fluctuations in Lake and Groundwater Elevations

Lake and groundwater elevations do not appear to vary greatly on a seasonal basis. Rather, lake and groundwater elevations show a rising trend during multi-year periods of above average precipitation and a declining trend during drought periods. Loeb et al. (1987) noted that lake and groundwater elevation differences were fairly consistent throughout most years. This “rough correlation between groundwater level and lake level changes made a steady-state model for this basin more credible.” (Loeb et al., 1987) Between 1957 and 2002, lake elevation varied from a high of 6228.1 ft MSL and a low of 6219.1 ft MSL. The average lake elevation during this period was 6225.0 ft MSL.