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Solute Chemistry and Isotopic Investigation of the Groundwater Flow Paths in Honey Lake Basin, Lassen County, California and Washoe County, Nevada

Rachel M. Henderson
Brigham Young University - Provo

SOLUTE CHEMISTRY AND ISOTOPIC INVESTIGATION OF THE GROUNDWATER FLOW PATHS IN HONEY LAKE BASIN, LASSEN COUNTY, CALIFORNIA AND WASHOE COUNTY, NEVADA

By

Rachel M. Henderson

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Of the thesis submitted by

Rachel M. Henderson

This thesis has been read by each member of the following graduate committee and by majority has been found to be satisfactory.

Date	Alan L. Mayo
Date	Stephen T. Nelson
Date	Barry R. Bickmore

BRIGHAM YOUNG UNIVERSITY

As chair of the candidate's graduate committee, I have read the thesis of Rachel M. Henderson in its final form and have found that (1) its format, citations, and bibliographical style are consistent and acceptable and fulfill university and department style requirements; (2) its illustrative materials including figures, tables, and charts are in place; and (3) the final manuscript is satisfactory to the graduate committee and is ready for submission to the university library.

_____ _____

Date

Alan L. Mayo
Chair, Graduate Committee

Accepted for the Department

_____

Michael J. Dorias
Graduate Coordinator

Accepted for the Department

_____

Thomas W. Sederberg
Dean, College of Physical and Mathematical Sciences

ABSTRACT

SOLUTE CHEMISTRY AND ISOTOPIC INVESTIGATION OF THE GROUNDWATER FLOW PATHS IN HONEY LAKE BASIN, LASSEN COUNTY, CALIFORNIA AND WASHOE COUNTY, NEVADA

Rachel M. Henderson

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Honey Lake Basin is a large, hydrologically closed valley with two playa lakes that are separated by a low elevation sill. The Basin has a complex hydrogeologic setting, with numerous groundwater flow paths that interact with surface waters and three basic aquifers; shallow, deep, and geothermal. Thirteen flow paths; eleven cold and two thermal, are identified and the geochemical evolution of those paths are characterized by integrating solute chemistry and isotopic data. The chemical flow paths include recharge in either granitoid or volcanic terrains in the Sierra Nevada Range and the Modoc Plateau, respectively. The groundwater then flows through alluvial fan and stream sedimentary environments and eventually flows through lacustrine and playa sediments in the closed basin. This investigating characterizes geochemical evolution of groundwater flow from both mafic and granitic terrains to lacustrine sediments with evaporite minerals, in a closed basin environment.

Temperature data reveal that thermal waters circulate to 1.6-3.0 km and 2.8-3.8 km along two major fault zones. Shallow groundwaters above 17°C are determined to

have a component of thermal water and mixing ratios are presented. $\delta^{18}O$ and δD data show that deep groundwater was recharged by cooler, more humid precipitation from the last ice age, whereas shallow groundwaters reflect current meteoric conditions and show extensive evaporation trends. The two thermal flow paths show exchange with silicate minerals at high temperatures (>100°C). $\delta^{13}C$ data show interaction with carbonate minerals in basin fill lacustrine sediments. ^{3}H concentrations and ^{14}C ages show that deep groundwaters throughout the Basin and shallower groundwaters in the center of the basin are not greatly affected by post-1952 recharge. Mean ^{14}C ages range from modern to 23,500 years old.

NETPATH was used to model geochemical evolution along the flow paths. Groundwater on the west side of the basin (granitic terrain) is typically low TDS (~150 mg/L) calcium-bicarbonate water and evolves into higher TDS (~300 mg/L) sodium-bicarbonate groundwater as it interacts with granitic rocks and then lacustrine sediments. Groundwater on the east side of the basin (mafic terrain) is typically low TDS (~200 mg/L) sodium-bicarbonate water and evolves into high TDS (~300 mg/L) sodium-bicarbonate water groundwater as it interacts with mafic rocks and then lacustrine sediments. Dissolution of silicate minerals and calcite, and ion exchange with clays is responsible for major chemistry changes. As both of these types of groundwaters come into contact with lacustrine sediments with evaporite minerals on the playas, dissolution of halite and gypsum dominate and the groundwater becomes extremely high in TDS (~ 1100 mg/L on the Honey Lake Playa and ~ 43,000 mg/L on the Fish Spring Playa) and strongly sodium-chloride in character.

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INTRODUCTION

The northwest-trending Honey Lake Basin is located approximately 57 km north of Reno, Nevada on the California-Nevada border (Figure 1). This large closed basin, about 72.5 km northwest-southeast and 24 km north-south, is situated at the junction of three geologic provinces; the Basin and Range (normal faults) to the east, the Sierra Nevada Batholith (granitic terrain) to the south and west, and the Modoc Plateau (volcanic terrain) to the north (Varian, 1997). Two playas occupy the valley; to the west a large playa containing Honey Lake is the terminus of Susan River and Long Valley Creek. To the east the smaller Fish Springs Playa is usually dry and is supported by the perennial Cottonwood Creek and other ephemeral streams. These two playas are separated by a low elevation surface water divide located close to the California-Nevada border. Along with this complex geologic setting, Honey Lake Basin has an equally complex hydrogeologic setting with numerous groundwater flow paths.

Investigating the Honey Lake Basin groundwater flow paths will provide a better understanding of the geochemical evolution of groundwater flow from both mafic and granitic terrains to lacustrine sediments with evaporite minerals, in a closed basin environment. The data will also provide insight into the salinity relationship between groundwater beneath the two playas. This is accomplished by analyzing solute chemistry to determine interactions with local igneous and sediment deposits, temperature to determine circulation depths, stable isotopes of oxygen and hydrogen to determine recharge sources and other environmental conditions, Tritium and carbon-14 to determine the extent of modern recharge and groundwater residence time, and carbon-13 to

determine the extent of interaction with carbonate minerals and possibly organic material. All of these individual analyses must be used to completely characterize the geochemical evolution of a groundwater flow path.

In an effort to understand the hydrogeology of Honey Lake Basin, two thesis studies, by Webber (1996) at Brigham Young University and Varian (1997) at the University of Nevada, Reno, have been conducted. Webber (1996) concentrated on the solute chemistry of the shallow groundwater systems in the basin, whereas Varian (1997) concentrated on the use of isotopes ($\delta^{18}O$, δD, ^{3}H, and ^{14}C) to evaluate the hydrologic processes in the basin. Webber (1996) concluded that the solute load of the groundwater increases as it flows toward the basin floor, but that the magnitude of the increase depends on the availability and abundance of CO_2 and deposits of calcite, dolomite, fluorite, gypsum, halite and clay minerals along flow paths; all of which appear to be more abundant on the Fish Springs Playa side of the basin. Varian (1997) concluded that modern Sierra Nevada runoff is present in the groundwater on the Honey Lake Playa side of the basin in limited amounts and that recharge in this area likely occurred several thousand years ago. Conversely, on the Fish Springs Playa side of the basin, modern recharge occurs, but is limited due to minimal precipitation. Also, isotopic data indicates that the groundwater in the northern part of the basin is recharged from further north in the Willow Creek drainage, and that the deep groundwater system in the basin was recharged during a cooler, wetter climate than today, possibly some 17,000 years ago.

Although both of these studies were thorough and useful, neither provided a complete solute chemistry and isotopic analysis of the various Honey Lake Basin flow paths, and lacked any analysis of temperature, carbon-13, and the solute chemistry of

thermal groundwaters. A combination of their methods and further interpretation must be used to gain a complete understanding of the various Honey Lake Basin groundwater flow paths and their geochemical evolutions.

The purpose of this investigation is to integrate these studies and supplement their data to evaluate the groundwater flow path geochemical evolutions in a closed basin with granitic and mafic terrains. Specifically, geothermal analysis, $\delta^{13}C$ data and ^{14}C data help to define groundwater movement along flow paths. To achieve this purpose, existing data was verified to check validity and internal consistency. It was then combined and samples were collected to fill in data gaps. Solute chemistry and isotopic data were then used to characterize groundwater flow paths, and the factors responsible for the different geochemical evolutions were evaluated.

The results of this investigation provide understanding of groundwater flow paths and geochemical evolutions in areas of similar geology (granitic to lacustrine terrain and/or mafic to lacustrine terrain) and in closed basins throughout the world.

METHODS

Existing solute and isotopic data (220 wells, 61springs, 29 streams, and 2 snow samples) were obtained from published and unpublished sources. Data from 178 samples from Webber (1996), 189 samples from Varian (1997), 115 samples from Rose et. al. (1997), 36 samples taken by BYU class field trips, 3 samples from Reed (1978), and 1 sample from Laird et. al. (1986) were all included in the database. This data was supplemented with analysis of 36 wells, 12 springs, and 9 surface waters collected as part of this investigation. The data includes samples from 312 different locations in the Honey Lake Basin area (Figure 2). Several of these locations were sampled by different investigators at different times, and the data from these different sample events for the same location were combined.

Field Methods (this investigation)

Temperature and conductivity were measured in the field using an YSI 30/10 conductivity meter, and pH was measured using a VWR Scientific pH meter. Before sampling, wells were pumped or allowed to free-flow until the temperature stabilized. Sample locations, reported in UTM coordinates, were taken using a Trimble GeoExplorer3.

Thirty seven samples were collected for solute chemistry analysis in 1.0 L polyethylene bottles. Fifty five samples were collected for $\delta^{18}O$ and δD analysis in 50mL amber vials with polyseal caps. Thirty eight samples were collected in 1 L high-density brown polyethylene bottles for ^{3}H analysis. Five samples were collected for ^{13}C and ^{14}C analysis in acid washed high-density polyethylene containers. These samples were

immediately treated with 30 g of $BaCl_2$ and 100 g of NaOH per 5 gallons of sample, to precipitate dissolved carbonate species as $BaCO_3$ (Clark and Fritz, 1997).

Laboratory Analytical Methods (this investigation)

Samples were analyzed for major cation and anion concentrations: Na^+, Ca^+, K^+, Mg^+, SiO_2, HCO_3^-, F^-, SO_4^{2-}, Br^- and Cl^-, and for the isotopes $\delta^{18}O$, δD, ^3H , $\delta^{13}C$, and ^{14}C.

All solute chemistry analysis was performed at Brigham Young University. Samples were filtered and split for cation and anion analysis. Cation splits were acidified with 5-6 drops of nitric acid per ~50 mL of sample. Cation concentrations were measured with a PerkinElmer 5100C Atomic Absorption Spectrometer. Anion concentrations were determined using an ICS-90 ion chromatograph. Bicarbonate (HCO_3^-) was measured on a Mettler Toledo DL50 Graphix automatic titrator. Cation and anion measurements were evaluated for accuracy by determining charge balance error based on mil-equivalents per liter. The acceptable charge balance error was within ±5%.

Stable isotope ratios for $\delta^{18}O$ and δD were determined by BYU using a Finnigan MAT Delta^{plus} mass spectrometer equipped with the GasbenchII and HDevice. Methods similar to Epstein and Mayeda (1953) and Gehre et. al. (1996) were used. Reproducibility was evaluated using an internal laboratory standards. Data were reduced by the method established by Nelson (2000) and Nelson and Dettman (2001), according to which $\delta^{18}O$ and δD values were normalized to the VSMOW/SLAP scale. The reproducibility of the internal laboratory standard is <±1.0‰ (n= 102) for δD_{vsmow} and 0.12‰ (n= 30) for $\delta^{18}O_{vsmow}$. All values are reported in permil (‰) by delta notation.

All tritium (^{3}H) samples were measured at BYU. Sample preparation included distilling, enriching and vacuum distilling in a method similar to the University of Waterloo Environmental Isotope Laboratory (1998), before a liquid scintillation cocktail was added. This method decreases the lower limit of detection (LLD) from ~5 TU to <0.2 TU. Samples were run on a PerkinElmer Quantulus liquid scintillation counter for 12, 120 minute cycles. Final results were calculated as described by Neary (1997). Concentrations are reported in tritium units (TU; 1 TU = 3.2 pCi/L).

Samples that had been treated in the field to precipitate dissolved carbonate species as $BaCO_3$ were monitored and treated with $BaCl_2$ and NaOH until a pH > 11 was achieved (Clark and Fritz, 1997). The samples were then decanted into a 1 L high-density polyethylene container where they were stored until they were decanted further and transferred to amber glass bottles with polyseal caps. These carbonates slurries were vacuum dried prior to reacting with phosphoric acid. CO_2 gas resulting from this reaction was isolated, split, and then analyzed for $\delta^{13}C$ using a Finnigan MAT Delta^{plus} mass spectrometer (McCrea, 1950)

A portion of the CO_2 gas splits for four of the ^{14}C samples were analyzed by AMS (Accelerated Mass Spectrometry) methods at the University of Georgia, Center for Applied Isotope Studies for ^{14}C. One of the ^{14}C samples was analyzed at Brigham Young University by a method similar to Polach and Stipp (1967). Precipitated barium carbonate was converted into benzene, and once the benzene was synthesized, 0.5 mL of spectrograde benzene containing POP and POPOP flours were added prior to counting in a PerkinElmer 1414 Guardian scintillation counter. Samples were counted in 6, 100 minute cycles. Percent modern carbon (pmc) were calculated following the method of

Stuvier and Polach (1977). Carbon-14 ages were calculated by the methods described by Fontes and Garnier (1979), Fontes (1983), and Pearson and Henshaw (1970).

Data Analysis

Appendix A contains all solute and isotopic data. Selected subsets are included as tables in the text.

Major ion chemistry was plotted as Stiff diagrams, contour maps, and Piper diagrams. Stable isotopic data was analyzed relative to the local meteoric water line (LWML) of Varian (1997) and was used to evaluate potential thermal rock-water interactions. Carbon-14 ages were determined and compared with ^{3}H data. Carbon-13 data were analyzed to determine the sources for carbon in Honey Lake groundwaters. Conceptual models of potential groundwater flow paths for various regions of the basin were then developed. Geochemical evolutions along the conceptual models were quantitatively analyzed using the computer programs GEOTHERM and NETPATH (Plummer et. al., 1994 and Truesdell, 1976).

GEOLOGIC SETTING

Honey Lake Basin is a fault bounded valley filled with unconsolidated and semi-consolidated material derived from lacustrine, terrestrial, fluvial, and volcanic sediments (Figure 3). Deep (1500 to 1700 m thick) semi-consolidated Pliocene lacustrine deposits consist of thick layers of volcanic tuff and ash along with clay, silt, and minor amounts of sand (Mayo and Slosson, 1992; Handman et. al., 1990; and California Department of Water Resources, 2003). These deposits have low permeability and interfinger with volcanic rocks on the north- northeast side of the basin (Figure 3). Shallower (maximum of 300 m thick) Pleistocene Lake Lahontan deposits consist of mostly low permeability fine grained clay and silt on the east side of the basin and coarse, more permeable deltaic deposits to the west (Handman et. al., 1990). Deltaic deposits consisting of sand and gravel formed when the Susan River and Long Valley Creek flowed into the Pleistocene Lake Lahontan and are located to the northwest and southeast of Honey Lake. Poorly sorted, highly permeable alluvial fan deposits, consisting of clasts derived from granodiorite and volcanic rocks, flank the basin in most areas and interfinger with lacustrine deposits (Handman et. al., 1990 and California Department of Water Resources, 2003). These valley fill sediments can be up to 1800 meters thick (California Department of Water Resources, 1963 and Varian, 1997). Shoreline and geothermal tufa deposits are also present.

The basin is bounded on all sides by mountain ranges (Figure 1). The Honey Lake Playa area in the west is bounded by the northern Sierra Nevada Mountains to the south and west, and by the Modoc Plateau (the Shaffer, Skedaddle, and Amedee Mountains) to the north. The Fish Springs Playa area in the east is bounded by the

Amedee Mountains to the north, the Terraced Hills to the northeast, and the Virginia and Fort Sage Mountains to the southeast and south. The Sierra Nevada and Fort Sage Mountains are comprised of relatively impermeable Cretaceous granodiorite overlain by Tertiary volcanic rocks (Handman et. al., 1990 and Grose et. al., 1991; Figure 3). The remaining mountains are comprised of porous, highly transmissive, Tertiary basalt flows and andesite volcanic rocks overlying rhyolitic tuffs and a granodiorite basement (McDonald, 1966; Grose, 1984; Handman et. al., 1990; and Tyalor, 1992). Rhyolititc ash-flow tuffs and volcanic-flow breccias are present in the pass that separates the Fort Sage and Virginia Mountains (Handman et. al., 1990).

Basin and Range extension has displaced the granitic bedrock (Figure 3) below the basin to depths of about 1,500 – 2,100 meters below the land surface (Bonham, 1969; Reed, 1978; Grose, 1984; Grose et. al., 1991; and Varian, 1997). According to Fuis et. al. (1987), granitic bedrock with a seismic-refraction velocity similar to Sierra Nevada bedrock, also underlies the Modoc Plateau. On the east side of the basin, granitic bedrock lies about 300 meters beneath lacustrine deposits and basalts on the valley floor (Mayo and Slosson, 1992).

Several fault zones exist in Honey Lake Basin The major fault zones include the Antelope Mountain, Litchfield, and Amedee fault zones to the north, and the Honey Lake and Warm Springs fault zones to the south (Figure 1). These are northwest-trending right lateral faults and north-trending normal faults (Bonham, 1967 and Varian, 1997). A small horst, Bald Mountain, separates the smaller Susanville structural basin from the large Honey Lake structural basin (Schimschal, 1991).

Hydrothermal tufa deposits are associated with faults in the basin (Reed, 1978). These tufa deposits formed as hydrothermal groundwater escaped along the faults into Pleistocene Lake Lahontan and precipitated calcium carbonate. These faults continue to sustain hot springs throughout the basin as thermal water at depth leaks out along the faults (Schimschal, 1991).

HYDROLOGIC SETTING

Water-bearing material in the Honey Lake Basin occurs in the fractured volcanic rocks, alluvial fans, and unconsolidated to semi-consolidated lake deposits. Possible sources for recharge include: direct precipitation, spring discharges, runoff from rivers and streams, seepage of irrigation water, and groundwater inflow from outside areas (Handman et. al., 1990; Varian, 1997; and California Department of Water Resources, 2003). Three groundwater systems exist in Honey Lake Basin; shallow (<180 m), deep (>180 m), and geothermal (Varian, 1997).

The basin has a total drainage area of 5700 km^2 and due to the semi-arid climate much of the potential recharge water is lost to evapotranspiration (Rockwell, 1993). Recharge not lost to evapotranspiration infiltrates through unconsolidated sediments, faults, and fractures. Later, it either discharges as springs or continues to flow down gradient toward the basin playas. Most springs occur in the surrounding mountains, although several fault related thermal springs discharge along the edge of the basin floor. On the basin floor, groundwater ascends and discharges onto the playas or is lost through evapotranspiration. Discharge is controlled by a transition from high to low hydraulic conductivity material; unconsolidated valley fill to semi-consolidated, clay-rich material (Taylor et. al., 1992).

The Honey Lake and Fish Springs Playas are hydrologically distinct. A low elevation surface water divide currently separates the playas and prevents hydrologic communication, or mixing, between the two sides of the basin (Webber, 1996; Figure 4). The Honey Lake play commonly is covered with water due to relatively high precipitation (~36 in/yr) in the west and inflow from the Susan River and Long Valley

Creek (Figure 5). Conversely, the Fish Spring Playa and the surrounding streams typically have low flow (Table 1) and are often dry due to low precipitation (~16 in/yr; Figure 5) in the east caused by the Sierra Nevada rain shadow (Webber, 1996 and Varian, 1997). Shallow groundwater in the Fish Spring Playa has higher maximum Total Dissolved Solids (TDS; 50,295 mg/L) content than shallow groundwater associated with the Honey Lake Playa (1790 mg/L; Figure 6).

ANALYSIS

Flow Path Solute Chemistry

Eleven groundwater flow paths in Honey Lake Basin are designated based on groundwater potential (Figure 4), and assuming that shallow, non-thermal, groundwater flow mimics surface topography – flows perpendicular to elevation and potentiometric contours. Two thermal flow paths are based on fault locations and groundwater temperature data. These flow paths are (Figure 6):

Non-thermal
1. Susan River (SR)
2. Sierra Nevada (SN)
3. Long Valley Creek (LV)
4. Fort Sage Mountains (FSM)
5. Cottonwood (CW)
6. Virginia Mountains (VM)
7. Neversweat (NV)
8. Astor/Sand Pass (ASP)
9. East Skedaddle/Amedee (ESA)
10. West Skedaddle/Amedee (WSA)
11. Shaffer Mountain (SHAF)

Thermal
12. Honey Lake/Warm Springs Fault Zone (HLW), and
13. Antelope Mountain/Litchfield Fault Zone (AML)

Near the down gradient end of four physical flow paths; Susan River, Shaffer Mountain, Long Valley Creek, and West Skedaddle/Amedee, it appears as if some thermal fault water upwells and mixes with the overlying cold water systems, consequently effecting both groundwater temperature and chemistry. Also, the ends of the Susan River and Shaffer Mountain flow paths mix before finally terminating in Honey Lake.

The 13 groundwater flow paths have been organized into seven chemical evolutionary paths; five cold and two thermal (Table 2). The chemistries in Table 2 are the mean compositions of spring and well samples located at critical locations along the flow path. Along each groundwater chemical path, low TDS recharge (i.e. highland) waters evolve to elevated TDS water in the basin floor (Figure 6). The seven chemical paths are described below and illustrated in the following Piper diagrams (Figure 7).

1. Susan River, Shaffer Mountain, and Long Valley (SR/SHAF/LV): The low TDS (~ 150 mg/L) calcium-bicarbonate groundwater at the head of the SR/SHAF/LV chemical flow path evolves into high TDS (~ 530 mg/L) sodium-bicarbonate groundwater with considerable sulfate concentrations, on the basin floor (Figure 7a).
2. Sierra Nevada (SN): As the low TDS (~ 130 mg/L) groundwater from the highlands of this chemical flow path travels to the basin floor, it increases slightly in TDS (~ 190 mg/L) but remains calcium-bicarbonate in character (Figure 7d).
3. West Skedaddle/Amedee (WSA): The low TDS (~ 190 mg/L) groundwater at the head of the WSA chemical flow path is sodium-bicarbonate and as it flows down gradient, it increases in TDS (~ 620 mg/L) and becomes sodium-chloride dominated (Figure 7d).
4. Fort Sage Mountains, Virginia Mountains, and Cottonwood (FSM/VM/CW): The low TDS (~ 170 mg/L) FSM/VM/CW beginning groundwater is typically calcium-bicarbonate in character and evolves into extremely high TDS (~ 10,000 mg/L), sodium-chloride groundwater on the basin floor (Figure 7b).

5. East Skedaddle/Amedee, Astor/Sand Pass, and Neversweat (ESA/ASP/NV): The ESA/ASP/NV chemical flow path highland groundwater is low TDS (~ 200 mg/L) sodium-bicarbonate that, like the FSM/VM/CW flow path, evolves into extremely high TDS (~ 32,350 mg/L), sodium-chloride groundwater (Figure 7c).
6. Honey Lake/Warm Springs Fault Zone (HLW): The HLW thermal groundwaters (41°C mean temperature) are low TDS (~ 290 mg/L), primarily sodium-bicarbonate groundwater with considerable sulfate concentrations (Figure 7d).
7. Antelope Mountain/Litchfield Fault Zone (AML): The much hotter AML thermal waters (83°C mean temperature) are higher TDS (~ 820 mg/L), sodium-sulfate groundwater with much chloride (Figure 7d).

Geochemical evolution models for these seven chemical flow paths are discussed below.

Temperature and Groundwater Circulation Depth

Groundwater temperatures in the Honey Lake Basin range from 5°C to 102.8°C (Table 2 in Appendix A). Although most groundwater are 20-30°C, thermal waters can be as warm as 60-102°C (Figure 8). A contour map of groundwater temperatures (Figure 9) shows that the hottest groundwaters are associated with fault zones, especially at fault intersections.

The hottest of the fault related thermal groundwaters; > 50°C in the Antelope Mountain/Litchfield Fault Zone (AML) and > 30°C in the Honey Lake/Warm Springs Fault Zone (HLW), were analyzed using GEOTHERM to determine maximum in-situ

aquifer temperature conditions (Table 3). GEOTHERM is based on temperature equilibrium of mineral-water reactions (Fournier and Rowe, 1966; Fournier and Truesdell, 1973; Fournier and Rowe, 1977; and Fournier, 1979). Maximum temperatures were calculated using the assumptions described by (Fournier et. al., 1974). The silica-conductive, silica-adiabatic, and Na-K-Ca (1/3) geothermometers were determined to be good geothermometers (Mayo, written communication, 2005) for the thermal waters in Honey Lake Basin as described in Table 4. The silica geothermometers were used when ever possible because the amount of dissolved silica increases substantially with temperature (Figure 10), and Fournier and Rowe (1966) reported that the silica method consistently yields maximum temperatures within 2°C of the measured temperatures at depth.

According to the selected geothermometers, the AML groundwaters have a maximum temperature of 117-140°C (Table 4). These estimates agree with, or are slightly lower than, previously published geothermometer estimates (Table 5). They also agree well with published field measurements of 121°C for the maximum down-hole well temperature in the vicinity of the Wendel and Amedee Hot Springs (Skiba, 1985).

According to the selected geothermometers, the HLW groundwaters have a maximum temperature of 65-112°C (Table 4). There is no published data on the thermal waters in the HLW path to use for comparison. The cooler of the HLW groundwaters, samples RE1 and W21, have slightly different chemistries than the other samples in this flow path (Figure 11) and are located at the very western end of the fault zone. This may indicate different sources, different circulation patterns and mixing, or both (Hardt et. al., 1975). These samples may need to be considered as a separate thermal flow path. If they

are separate, then the estimated maximum temperature for that path would be 102-112°C, and 65°C for the HLW. For now, however, they will be included in the HLW flow path based on their relatively "low" temperatures.

Nathenson and Guffanti (1988) averaged the geothermal gradient for the western United States as 34°C/km. Using this gradient and the GEOTHERM estimated maximum temperatures, it was calculated that the waters along the HLW flow path circulate to a depth of about 1.6-3.0 kilometers and the waters along the AML flow path circulate to a depth of 2.8-3.8 kilometers (Table 4). This is slightly less than the 4-6 kilometers reported by Blackwell et. al. (2000) for most extensional systems in the U.S.

According to the Western Regional Climate Center (2007), the mean annual air temperature in Honey Lake Basin is about 10°C. However, many of the groundwaters in the basin are much hotter than 10°C. Statistical analysis was conducted on the 248 temperature data sets using SAS (SAS Institute, 2004) procedures to evaluate the temperature at which mixing of cold and thermal waters becomes significant (Eggett, personal communication 2007). Based on cumulative percents from the SAS analysis, groundwaters cooler than 17°C have little to no thermal component, and groundwaters warmer than 17°C have an increasingly significant component of thermal water. Of the 248 samples, 113 of those (46%) have a temperature greater than 17°C (Table 2 in Appendix A). Approximate mixing ratios for the groundwater (> 17°C) in Honey Lake Basin based on mixing with thermal waters from HLW (87°C average maximum temperature) and AML (123°C average maximum temperature) flow paths are presented in Table 6. These mixing ratios can be applied to shallow, warm groundwaters found in the western portion of the basin in the Susan River, Sierra Nevada, Long Valley Creek,

Fort Sage Mountains, Shaffer Mountain, and West Skedaddle/Amedee flow paths. Temperatures above 17°C for deep groundwaters do not indicate thermal mixing, but do indicate heating by the natural geothermal gradient (Figure 12).

Several flow paths on the east side of the basin, Astor/Sand Pass, East Skedaddle/Amedee and Neversweat (Table 2 in Appendix A), also appear to be influenced by thermal waters, as evidenced by warm, shallow waters and the presence of geothermally deposited tufa. However, no thermal groundwaters (> 30°C) have been sampled on the east side of the basin, and thus maximum temperatures, circulation depths, and mixing ratios could not be calculated. The calculated mixing ratios can be applied to these flow paths, but are less reliable since the fault zones present on the east side of the basin may allow groundwater to circulate to different depths, and thus have a different effect when mixed with the cold groundwaters.

Isotopes

Oxygen-18 and Deuterium

Stable isotopes of oxygen and hydrogen are useful in defining groundwater environmental conditions. Isotope abundances (δ) are reported as positive or negative deviations of heavy to light isotope ratios, compared to Standard Mean Ocean Water (SMOW) (Domenico and Schwartz, 1998).

Craig (1961) determined a linear correlation in the relationship between $\delta^{18}O$ and δD abundances in natural meteoric waters from all over the world. This correlation, known as the meteoric water line (MWL), is defined as:

$$\delta D = 8\delta^{18}O + 10 \quad \textbf{(1)}$$

$\delta^{18}O$ and δD values along the MWL are controlled by the temperature of condensation, altitude, and distance from the ocean of the precipitation event (Faure and Mensing, 2005). Values that deviate from the MWL experienced fractionation due to, evaporation and hydrothermal exchange, following precipitation. A full discussion of oxygen and hydrogen fractionation is given by Clark and Fritz (1997).

Varian (1997) defined a local meteoric water line (LMWL) for the basin as:

$$\delta D = 7.1\delta^{18}O - 8.4 \quad \textbf{(2)}$$

This LMWL was derived by fitting a regression line, with a correlation coefficient of 0.98, to $\delta^{18}O$ and δD values from local precipitation. The LWML varies quite a bit from the MWL in both the slope (7.1) and the deuterium excess factor (-8.4), and is controlled by local climate factors, including the origin of vapor mass, secondary evaporation during rainfall and seasonality of precipitation (Clark and Fritz, 1997).

When $\delta^{18}O$ vs. δD values are plotted, recharge waters from direct infiltration of precipitation lie along the LMWL because they are unaltered (have the same isotopic composition as the precipitation) and reflect the latitude at which precipitation occurred. Groundwaters that have undergone evaporation, or that were recharged from waters which experienced evaporation, are enriched in heavier isotopes and therefore deviate to the right of the LMWL (Figure 13). Groundwaters that have experienced ^{18}O exchange with silicate minerals due to high temperatures (> 100°C), usually in basinal flow or geothermal systems, are enriched in ^{18}O (Domenico and Schwartz, 1998).

Two hundred and seven samples from surface waters, springs, and wells with $\delta^{18}O$ and δD data are plotted in Figure 14 through 16 by the physical flow paths. The majority of these waters plot close to the local meteoric water line, indicating a meteoric origin of winter precipitation that fell in a cool, high latitude, high altitude, inland region. This is consistent both with what one would expect from current precipitation in the highlands of the Honey Lake Basin area and from cooler, more humid precipitation from the last ice age (up to 17,000 years ago), which is likely the source of deep (> 180m) groundwater in the basin (Varian, 1997).

Those waters that do not plot close to the local meteoric water line, typically plot to the right and thus have experienced evaporation to some extent. Again, this is expected of groundwater in the arid Honey Lake Basin. The flow paths farthest from the main areas of recharge – Astor/Sand Pass, East Skedaddle/Amedee, Fort Sage Mountains, Long Valley, and West Skedaddle/Amedee, show a more pronounced evaporation trend than those located close to the areas that receive much precipitation (Figure 5, 14d, 15a, 15d, 16a and 16b).

The Antelope Mountain/Litchfield Fault Zone flow path isotopes are enriched in $\delta^{18}O$ and therefore show that the groundwater has experienced exchange with rock minerals at high temperatures (> 100°C) in this deeply circulating geothermal system (Figure 16d). The West Skedaddle/Amedee and Susan River flow path shows a similar trend due to mixing with thermal waters from the Antelope Mountain/Litchfield Fault Zone flow path (Figure 14). Conversely, the cooler Honey Lake/Warm Springs Fault Zone flow path plots directly along the local meteoric water no exchange with rock minerals (Figure 16c).

Contour maps of $\delta^{18}O$ and δD values in Honey Lake Basin (Figure 17) show that the groundwaters at the ends of the flow paths, or on the basin floor, are much more enriched in both $\delta^{18}O$ and δD then those at the beginning of the flow paths, or in the highlands, reflecting the effects of evaporation.

Tritium

All ^{3}H data reported in previous studies were normalized to 2005, the year samples were collected for this investigation, using a half life of 12.32 years (Table 6 in Appendix A). A map of the ^{3}H values (Figure 18) shows that the highlands have the highest concentrations of ^{3}H, and are thus composed of modern water. Generally, the concentration of ^{3}H in each flow path decreases down gradient toward the basin floor and eventually become non-detectable at the end of the flow path (Figure 19). Thus, groundwaters at the start of the flow paths are modern waters, but groundwaters in the center of the basin are not greatly affected by post-1952 recharge.

Carbon-13

The $\delta^{13}C$ values for 68 groundwater samples in Honey Lake Basin range from -20.7 to +0.4 ‰. According to Clark and Fritz (1997), a $\delta^{13}C$ value of -23‰ if typical for soil gas in areas with C3 plants, and values of +8 to 9‰ are common for fractionation between soil gas and bicarbonate. Based on these assumptions, $\delta^{13}C$ values of ~ -15 to -14‰ are expected for groundwaters in the Sierra Nevadas, and have been documented in other highlands in the north-western United States which lack carbonate minerals (Tarbet, 2005). Honey Lake Basin groundwater generally becomes more enriched in $\delta^{13}C$ as it

flows down gradient from the highlands toward the center of the basin (Figure 20), indicating increased interaction with carbonate minerals (~ 0‰).

Carbonate mineral sources in the basin are found in lacustrine sediments, shoreline and geothermal tufa deposits, and likely in the soil zone. Large HCO_3^- concentrations (> 300 mg/L) and enriched $\delta^{13}C$ values (significantly > -15‰) indicate a carbonate mineral source (Table 7 in Appendix A; Mayo, personal communication, 2007). Honey Lake Basin samples which fit this description are, for the most part, located on the basin floor at the end of the flow paths (Figure 20), and thus are not associated with shoreline and geothermal tufas. These samples have enriched $\delta^{13}C$ values due to interaction with carbonates which precipitated directly from Lake Lahontan, similar to those found in sediments deposited by Lake Bonneville (Oviatt et. al., 1994). During the Pleistocene, the mean annual air temperature of Honey Lake Basin would have been ~ 5°C and atmospheric CO_2 would have had a $\delta^{13}C$ value of ~ -7‰ (Nelson, personal communication, 2007). Under these conditions, calcite that precipitated in Lake Lahontan would have a $\delta^{13}C$ value of ~ 5‰ (Beaudoin and Therrien, 2007, and Deines, 1974). Groundwater flowing down gradient from the surrounding highlands becomes increasingly enriched in $\delta^{13}C$ toward the center of the basin as it interacts with this calcite.

According to Benson et. al. (1996), tufa deposited by Lake Lahontan has $\delta^{13}C$ values that range from 0.44 to 5.68‰ for shoreline tufa, and ~ 4.76‰ for geothermal tufa. Groundwater interaction with these tufa and other lacustrine carbonates deposited by Lake Lahontan would effectively enrich $\delta^{13}C$. The Astor Pass B2041 sample (Table 7

in Appendix A) has much HCO_3^-, is enriched in $\delta^{13}C$, and is located at the head of the flow path, indicating interaction with shoreline tufa.

The three samples in Honey Lake Basin (W96, B682, and H4099; Table 7 in Appendix A) with $\delta^{13}C$ values that are more depleted than the -15‰ value expected for groundwaters in the Sierra Nevadas are likely the result of the effects of organic matter in aerobic conditions. These three samples are located at the beginning of their respective flow paths.

Carbon-13 values become less variable with depth and range between -13 and -10‰ (Figure 21), suggesting that the effects of interactions with carbonates and organic matter on $\delta^{13}C$ balance each other at depth.

The possible role of organic matter in $\delta^{13}C$ changes in Honey Lake Basin requires further investigation and $\delta^{13}C_{CH4}$ measurement.

Carbon-14

Forty four samples from Honey Lake Basin, with ^{14}C activities ranging from 2.8 pmc to 112.8 pmc, were included in this thesis (Table 8 in Appendix A). Carbon-14 ages were calculated by the methods described by Fontes and Garnier (1979) and Fontes (1983) for samples with $\delta^{13}C$ values between -8 and -12‰, and the method described by Pearson and Henshaw (1970) for samples with $\delta^{13}C$ values of -14‰ and larger (Table 9 in Appendix A). Mean ^{14}C ages range from modern to 23,500 years old (Figure 22). The oldest groundwaters are found along fault zones and at the ends of flow paths on the basin floor. Generally, ^{14}C activities decrease, and thus mean groundwater ages increase, with depth (Figure 24). Deep (>180 m) groundwaters have small ^{14}C activities (< 40 pmc) and are much older than the shallow groundwaters. Deep wells with high pmc

activities have large perforation intervals that span shallow and deep aquifers, and therefore do not reflect accurate measurements for the well bottom. Shallow groundwaters (>100 m) have a variety of ^{14}C activities (13 to 113 pmc) that, according to Rose et. al. (1997), represent the mixing of young groundwater with old waters that ascend to discharge zones. ^{3}H vs. mean ^{14}C ages (Figure 24) show limited mixing between young and old groundwaters in Honey Lake Basin.

NETPATH

NETPATH (Plummer et. al., 1994), a mass balance computer modeling code, was used to determine a model for the geochemical evolution of the groundwater along each of the seven chemical flow paths. Mean solute chemistry values for the end members of each physical flow path, as explained earlier, were organized according to similarities in solute chemistry (Table 2). The low TDS groundwater at the beginning of each flow path was defined as the "initial" water. The high TDS groundwater on the valley floor, at the end of the flow paths, was designated as the "final" water. For the three chemical flow paths with more than one physical flow path member, the physical flow that was most representative of overall chemical changes was modeled to show the possible groundwater evolution for those paths (marked with a † in Table 2). Two of the chemical flow paths; SR/SHAF/LV and WSA are believed to mix with neighboring thermal waters and were modeled as mixing problems. An additional model was run to account for mixing of the Susan River and Shaffer Mountain flow paths on the basin floor near Honey Lake.

In order to use NETPATH to model flow path geochemical evolutions, the possible chemical reactions that the groundwater would undergo had to first be identified. This was done by evaluating the solute chemistry of the water samples and the mineralogy of the basin using geologic maps. The following chemical reaction regimes (Domenico and Schwartz, 1998 and Klein, 2002) are possible reactions that the groundwater could undergo, as it flowed through the igneous and lake sediment deposits of Honey Lake Basin. These reactions were used to determine the constraints and phases used for modeling.

Soil Zone

When the precipitation that falls in Honey Lake Basin infiltrates the unsaturated zone, or soil zone, it absorbs CO_2 gas generated by soil zone activities such as root and microbial respiration (Domenico and Schwartz, 1998). This absorption of CO_2 gas in an open environment forms carbonic acid which disassociates in the groundwater into bicarbonate and carbonate.

(Absorption) $CO_{2(gas)} + H_2O = CO_{2(aq)} + H_2O$ **(3)**

(Carbonic Acid) $CO_{2(aq)} + H_2O = H_2CO_3$ **(4)**

(Bicarbonate) $H_2CO_3 = H^+ + HCO_3^-$ **(5)**

(Carbonate) $HCO_3^- = H+ + CO_3^{2-}$ **(6)**

Slightly acidic, carbonate undersaturated groundwater easily dissolves carbonate minerals, such as calcite, present in small quantities in the mountain

soils (Webber, 1996). Dissolution of calcite will increase Ca^{2+} and HCO_3^- concentrations in the groundwater. Calcite may be precipitated if groundwater becomes supersaturated with respect to calcite.

(Calcite) $CaCO_{3(S)} + H^+ \Leftrightarrow Ca^{2+} + HCO_3^-$ **(7)**

Igneous Deposits

When groundwater comes in contact with the igneous rocks in the mountains of Honey Lake Basin, several reactions may occur. Incongruent dissolution takes place with biotite, which produces clay and ions of K^+, Mg^{2+}, and Fe^{2+}. Biotite is more common in the Cretaceous granodiorites than in the Tertiary volcanics.

(Biotite)
$K(Mg, Fe)_3(AlSi_3O_{10})(OH)_{2(S)} = clay + K^+ + Mg^{2+} + Fe^{2+}$ **(8)**

Incongruent dissolution of K-feldspar also produces clay and increases the concentration of K^+.

(K-feldspar) $KAlSi_3O_8 = clay + K^+$ **(9)**

The same process happens when water comes in contact with plagioclase feldspars. Incongruent dissolution of albite, a Na-rich aluminosilicate, causes Na^+ and SiO_2 concentrations increase. Ca-rich aluminosilicates, such as anorthite, are

likely present in the basin, but as discussed by Webber (1996), are not believed to be major contributors to solute chemistry and were therefore not included in NETPATH.

(Albite) $NaAlSi_3O_8 = clay + Na^+ + SiO_2$ **(10)**

Olivine is common in the mafic volcanics in the northern and eastern mountains of Honey Lake Basin (Grose, 1984). Olivine readily reacts with groundwater, due to its instability at low temperatures, thus increasing concentrations of Mg^{2+}, and SiO_4^{2-}. Forsterite, the magnesium rich end-member of the olivine group, was used in NETPATH.

(Forsterite) $MgSiO_4 = Mg^{2+} + SiO_4^{2-}$ **(11)**

Much Mg^{2+} and SiO_3^{2-} are added to the groundwater system from pyroxenes such as enstatite that are present in the local mafic volcanics (Grose, 1984).

(Enstatite) $MgSiO_3 = Mg^{2+} + SiO_3^{2-}$ **(12)**

The above silicates; biotite, K-feldspar, albite, forsterite, and enstatite, cannot be precipitated, but the products of their incongruent dissolution can (K^+, Mg^{2+}**,** and Na^+) be precipitated out and incorporated into clays.

(K-clay) $K^+ = K^+$-clay **(13)**

(Mg-clay) $Mg^{2+} = Mg^{2+}$-clay **(14)**

(Na-clay) $Na^+ = Na^+$-clay **(15)**

Ion exchange may occur when water comes in contact with these clays. These clays may be found in alluvial fans, near shore deposits, and in basin fill sediments (Handman et. al., 1990). The most common type of ion exchange happens with Na-clays and is between Ca^{2+} and Na^+ ions. Ion exchange will increase the concentration of Na+ while at the same time decreasing the concentration of Ca^{2+}. Ion exchange is not an easily reversible chemical reaction, but it is possible when there are extremely large concentrations of Na^+.

(Ca^{2+}/Na^+ Exchange) $2Na^+$ clay + Ca^{2+} = Ca^{2+} clay + $2Na^+$ **(14)**

Lacustrine Deposits

Lacustrine sediments found on the basin floor contain much carbonate minerals. These minerals commonly occur as cements or as tufa. Studies done on lacustrine carbonate deposits in Pyramid Lake, NV, western Utah, and Death Valley, CA suggest that the composition is dominantly calcite (5) with little dolomite present (Benson, 1993 and 2004; Anderson et. al, 2005; Nelson et. al, 2005; Miner et. al, 2006). It was determined that Lake Lahontan deposits in Honey Lake Basin are similar in composition. Dolomite, therefore, was not

included in the NETPATH models as it was not considered a major contributor to solute chemistry compared with calcite. Dissolution of calcite would add increase both Ca^{2+} and HCO_3^- concentrations in groundwater.

Clay minerals, and therefore ion exchange, (14) are also common in lacustrine deposits in the basin.

Halite, an abundant precipitate on the basin margins and increasingly more abundant toward the middle of the basin, easily dissolves upon contact with halite undersaturated water and just as easily precipitates in halite supersaturated water. Concentrations of Na^+ and Cl^- in the water increase when halite disassociates, and vice versa. Calcium and magnesium sulfates and chlorides are common, but minor, impurities in halite and disassociate in, or precipitate from, water as easily as halite. Although they occur on the basin playas, they do not contribute significantly to the solute chemistry and were not included in the NETPATH models. Halite may also be present in the soil zone in small quantities.

(Halite) $NaCl_{(S)} \Leftrightarrow Na^+ + Cl^-$ **(15)**

Gypsum, a common precipitate with calcite, disassociates in gypsum undersaturated water and thus increases Ca^{2+} and SO_4^{2-} concentrations (Klein, 2002). Gypsum may also be present in the soil zone in small quantities.

(Gypsum) $CaSO_4 \cdot 2H_2O_{(S)} \Leftrightarrow Ca^{2+} + SO_4^{2-} + 2\ H_2O$ **(16)**

Fluorite is a common hydrothermal deposit and is also associated with calcite and gypsum deposits (Klein, 2002). When fluorite reacts with fluorite undersaturated water, it disassociates and the concentrations of Ca^{2+} and F^- in the water increase.

(Fluorite) $CaF_{2(S)} \Leftrightarrow Ca^{2+} + F^-$ **(17)**

Sylvite easily precipitates from, or disassociates in, groundwater depending on the saturation conditions. High concentrations of K^+ from the dissolution of biotite and K-feldspar, and high concentrations of Cl^- from the dissolution of halite may result in the precipitation of sylvite on the playas (Klein, 2002).

(Sylvite) $K^+ + Cl^- \Leftrightarrow KCl_{(S)}$ **(18)**

The occurrence of these minerals, along with those of calcite, clay minerals, halite, gypsum, fluorite, and sylvite increase in deep (>180 m) water and playa deposits (Webber, 1996).

The constraints used in all of the NETPATH models included the major ions involved in the possible flow path reactions: C, Ca^{2+}, Mg^{2+}, Na^+, K^+, Cl^-, SO_4^{2-}, F^-, and Si, and $\delta^{13}C$ isotope values. The major phases that could produce these ions include CO_2 gas, calcite, gypsum, halite, fluorite, biotite, sylvite, Ca^{2+}/Na^+ Exchange, albite, K-

feldspar, forsterite, enstatite, quartz, Na-clay, and Mg-clay. Not all of the phases were included in each flow path model – only those deemed applicable to each path were included in the individual models (Table 8).

The published solute chemistry data for Mt. Lassen, CA snow (Laird et. al., 1986) and initial waters for the seven chemical flow paths were used to model geochemical changes at the very beginning of the flow paths. Geochemical changes from initial to final waters were then modeled. Each NETPATH run produced one or more feasible models which describe the water's evolution from precipitation to the initial water and then to the final water (Table 9 and Figures 25 through 27). For the flow paths with more than one model, the author assumes that a combination of the models is the best representation of the processes occurring in Honey Lake Basin. Carbon-13 was used to determine the credibility of the models produced by NETPATH using Rayleigh calculations and a CO_2 gas value of -20‰. A comparison of observed and computed values shows that there is excellent agreement (Table 9), and that the reported NETPATH models are reasonable.

The models from NETPATH indicate that the precipitation in the high elevations easily evolves into the flow path initial waters because it is undersaturated with respect to all minerals. Upon infiltration, the precipitation generally dissolves CO_2 gas and minor amounts of calcite, gypsum, halite, and fluorite from the soil zone, and undergoes some ion exchange. Feldspars are also dissolved from the igneous rocks, and enstatite and/or forsterite are dissolved along the more mafic flow paths. The Susan River and Sierra Nevada flow paths do not undergo ion exchange, but lose K^+, as the product of

incongruent dissolution, to the production of clays. Additionally, and Mg^{2+} was removed and incorporated in to clays along the Antelope Mountain/Litchfield flow path.

As the still undersaturated and unmixed initial waters flow down gradient to the basin floor and evolve into the final waters, they generally dissolve CO_2 gas, calcite, gypsum, halite, feldspars, biotite, and fluorite and undergo ion exchange. Exceptions include the release of CO_2 gas and precipitation of gypsum along the Sierra Nevada flow path, and no ion exchange along the West Skedaddle/Amedee flow path. Enstatite and forsterite are dissolved along the more mafic flow paths while quartz is dissolved in the more felsic areas. Few solutes are removed from solution expect for Na^+ which is incorporated into clays as a product for an incongruent dissolution of feldspar.

For the Susan River and Shaffer Mountain mixing model, NETPATH determined that an approximately 40/60, Susan River/Shaffer Mountain ratio was need and that this mixture would dissolve CO_2 gas, albite, calcite, and fluorite, undergo ion exchange, and precipitate halite, gypsum, sylvite, and Na-clay.

For the two chemical flow paths, Susan River and West Skedaddle/Amedee, which were modeled using a mix of initial waters and thermal waters, NETPATH determined that 5-28% of the final water was from the thermal component. With these mixtures, the initial waters dissolved CO_2 gas, calcite, halite, gypsum, fluorite, K-feldspar, biotite, enstatite, forsterite, and quartz, and experienced ion exchange. Both mixing flow paths lost Na^+ to the formation of clays.

FLOW PATH DESCRIPTIONS

Fault Controlled Flow Paths

There are two main fault controlled groundwater flow paths in Honey Lake Basin: the Honey Lake/Warm Springs Fault Zone and the Antelope Mountain/Litchfield Fault Zone. They are located along the edges of the basin floor in the west-southwest and in the north, respectively, where several deep cutting normal faults are exist. These faults are the western extension of the Basin and Range Province.

The Honey Lake/Warm Springs Fault Zone flow path has Na^{+}-HCO_3^{-} to Ca^{2+}-HCO_3^{-} groundwaters that range in temperature from 35-52°C and circulate approximately 1.6-3.0 km down along the faults. Oxygen-18 and δD isotopes show that these groundwaters do not deviate from the local meteoric water line and were thus recharged from precipitation that fell under similar climatic conditions as the present. Very little ^{3}H (0.4 TU) was detected along this flow path and therefore, post-1952 precipitation is not thought to play a significant role in recharge. Carbon-14 ages could not be calculated. Carbon-13 values (mean of -13‰) show moderate interaction with carbonates. NETPATH results indicate the thermal waters of this flow path evolved from precipitation. Upon infiltration, the recharge waters dissolved CO_2 gas from the soil zone, dissolve calcite, fluorite, gypsum, and halite from lacustrine deposits, experienced ion exchange with clays, and dissolved K-feldspar, biotite, and quartz from the granitoid basement. None of which was done in large amounts, and thus these groundwaters have relatively low conductivity (TDS ~ 290 mg/L).

The Antelope Mountain/Litchfield Fault Zone flow path groundwaters are Na^{+}-SO_4^{2-} in composition, range in temperature from 63-103°C, and circulate to approximately 2.8-3.8 km along the faults. Very little (0.2 TU) to no ^{3}H was detected in these thermal groundwaters. Carbon-14 isotopes indicate that the mean groundwater age along the Antelope Mountain Fault Zone is 13,000-14,500 years. This suggest that the flow path contains very little, if any, modern recharge. Carbon-13 values (mean of -12‰) show moderate interaction with carbonates. Oxygen-18 and δD isotopes show that the Antelope Mountain/Litchfield Fault Zone groundwaters were recharged by cool, high latitude and altitude precipitation, but also experienced much rock-water interaction due to extremely high groundwater temperatures. NETPATH results indicate the thermal waters of this flow path easily evolve from precipitation and that high temperatures allowed the groundwater to dissolve CO_2, halite and gypsum and some calcite from lacustrine deposits, quartz, albite, and biotite from the igneous rocks, undergo ion exchange, and produce Mg-clays.

Susan River Flow Path

The Susan River flow path begins as precipitation in the northernmost Sierra Nevada Mountains and eventually terminates at the Susan River delta, where it flows into Honey Lake. As the groundwater flows along this path, it interacts with the Sierra Nevada granodiorites, some volcanics from the Modoc Plateau, and basin fill lacustrine sediments. It also mixes with thermal waters from the north-western portion of the Honey Lake Fault Zone, at a ratio of approximately 30/70 thermal to cold water. Consequently, the groundwater at the beginning of the flow path is fairly clean but as it

flows toward Honey lake, it slightly increases in Ca^{2+}, Mg^{2+}, and K^{+} concentrations and increases much in Na^{+}, HCO_3^{-}, Cl^{-}, SO_4^{2-}, and SiO_2 concentrations. These increases are a result of the dissolution of CO_2 from the soil zone, small amounts of biotite, K-feldspar, enstatite, and forsterite and much quartz from granodiorites and volcanics, calcite, gypsum, and halite from lacustrine sediments, ion exchange with clays, and the production of much Na-clay.

Groundwaters at the head of this flow path have detectable ^{3}H measurements and thus have a component of post-1952 recharge. However, these measurements decrease toward the basin floor where ^{3}H eventually becomes non-detectable. This trend is also reflected in the calculated mean ^{14}C ages. Most of the groundwaters have modern ages, except those near the terminus of the path (21,500-23,500 years) and those located near the faults (2500 years near the Honey Lake Fault Zone, and 13,000-14,500 years near the Antelope Mountain/Litchfield Fault Zone).

Carbon-13 values increase toward the end of this flow path, reflecting an increasing interaction with carbonates as the groundwater interacts with more lacustrine sediments.

Oxygen-18 and δD isotopes for groundwaters along this flow path plot close to the local meteoric water line and exhibit little evaporation, with some rock-water interactions as a result of mixing with thermal waters.

Shaffer Mountain Flow Path

The Shaffer Mountain flow path begins as precipitation on Shaffer Mountain and the surrounding highlands of the Modoc Plateau. It then infiltrates the ground, where it comes in contact with Tertiary Volcanics and lacustrine sediments as it flows down

gradient. Along its way, it mixes with some of the high temperature thermal waters from the Antelope Mountain/Litchfield Fault Zone at an approximately 30/70 thermal to cold water ratio. It eventually terminates at the Susan River delta where it mixes with the end of the Susan River flow path before discharging into Honey Lake.

Like the Susan River flow path, the Shaffer Mountain flow path slightly increases in Ca^{2+}, Mg^{2+}, and K^{+} concentrations and increases much in Na^{+}, HCO_3^{-}, Cl^{-}, SO_4^{2-}, and SiO_2 concentrations as the groundwater flows to the basin floor. These increases are a result of the dissolution of CO_2 from the soil zone, small amounts of biotite, K-feldspar, enstatite, and forsterite and much quartz from granodiorites and volcanics, calcite, gypsum, and halite from lacustrine sediments, ion exchange with clays, and the production of much Na-clay. This flow path then mixes with the Susan River flow path close to Honey Lake at an approximately 40/60, Susan River/Shaffer Mountain ratio. The mixture then dissolves CO_2 gas, albite, calcite, and fluorite, undergoes ion exchange, and precipitates halite, gypsum, sylvite, and Na-clay.

Unlike the Susan River flow path, none of the samples in the Shaffer Mountain flow path that were analyzed for ^{3}H contained an appreciable amount (maximum of 0.6 TU). Indicating that post-1952 recharge does not play a large role in this flow path. Mean ^{14}C ages, however, indicate that the groundwaters at the head and toward the end of the flow path are relatively modern. This supports Varian's (1997) conclusion that groundwater in the northwestern part of the basin are recharged from waters further to the north, and not locally.

Carbon-13 values increase toward the end of this flow path, reflecting an increasing interaction with carbonates as the groundwater interacts with more lacustrine sediments.

Oxygen-18 and δD isotopes plot close to the local meteoric water line, but also show some rock-water interactions as a result of mixing with thermal waters.

Long Valley Creek Flow Path

The Long Valley Creek flow paths begins as precipitation in both the eastern Sierra Nevada Mountains and the western Fort Sage Mountains and terminates down gradient in Honey Lake. As it travels, it interacts with granodiorites, Tertiary volcanics, and much lacustrine sediment. It also mixes with thermal groundwaters from the Honey Lake/Warm Springs Fault Zone at an approximately 30/70 thermal to cold water mixing ratio.

This flow path's geochemical evolution is similar to that of the Susan River flow path in that the groundwater slightly increases in Ca^{2+}, Mg^{2+}, and K^{+} concentrations and increases much in Na^{+}, SO_4^{2-}, HCO_3^{-}, Cl^{-}, and SiO_2 concentrations along the flow path. These increases are a result of the dissolution of CO_2 from the soil zone, small amounts of biotite, K-feldspar, enstatite, and forsterite and much quartz from granodiorites and volcanics, calcite, gypsum, and halite from lacustrine sediments, ion exchange with clays, and the production of much Na-clay.

Many waters in the Long Valley flow path are believed to have a component of post-1952 recharge, as reflected by ^{3}H measurements which are generally large in the highlands at the beginning of the flow path and decrease toward the basin floor where ^{3}H was not detected. Mean ^{14}C ages also show that most of the groundwater along this path

consists of modern water, with noted exceptions in the area of the Sierra Army Depot, along the Warms Springs Fault Zone. These groundwaters were found to range between 1000-12,000 years old, with ^{14}C ages increasing with depth (Varian, 1997).

Carbon-13 values tend to increase toward the end of this flow path, reflecting an increasing interaction with carbonates as the groundwater interacts with more lacustrine sediments.

Several of the $\delta^{18}O$ and δD isotopes plot close to the local meteoric water line, but the majority exhibit a consistent evaporative trend that becomes more pronounced toward the end of the flow path.

Sierra Nevada Flow Path

The Sierra Nevada flow path begins as precipitation in the highlands of the Sierra Nevada Mountains and flows down into the basin toward Honey Lake. This flow path is fairly wide, but relatively short, compared with the other twelve flow paths. It consequently interacts with much granodiorite and a limited amount of lacustrine sediments as it flows down gradient.

According to the NETPATH results, the groundwater dissolves small amounts of CO_2 from the soil zone, biotite, K-feldspar, and quartz from the igneous bedrock, and calcite, halite, fluorite, and gypsum from lacustrine sediments, and undergoes some ion exchange with clays. The groundwater also loses some Na^+, from incongruent dissolution of albite, to clays. This results in a rather small net increase of Ca^{2+}, Mg^{2+}, K^+, Na^+, HCO_3^-, SO_4^{2-}, Cl^-, F^-, and SiO_2.

Tritium measurements are generally large in the highlands at the beginning of the flow path, reflecting post-1952 recharge, and decrease toward the basin floor where ^{3}H becomes non-detectable. No ^{14}C ages were calculated for this flow path.

Groundwater $\delta^{13}C$ values along this path remain relatively depleted because of limited interaction with lacustrine sediments.

Like the Susan River flow path, $\delta^{18}O$ and δD isotopes for groundwaters along this flow path plot close to the local meteoric water line.

West Skedaddle/Amedee Flow Path

The West Skedaddle/Amedee flow path begins as precipitation in the Modoc Plateau and flows down gradient, and west, toward Honey Lake where it terminates. As it travels, it interacts with Tertiary volcanics and lacustrine sediments, and mixes with the high temperature thermal waters of the Antelope Mountain/Litchfield Fault Zone at an approximately 5/95 thermal to cold water ratio. Consequently, the groundwater along this flow path increases in Ca^{2+}, Mg^{2+}, K^{+}, Na^{+}, HCO_3^{-}, SO_4^{2-}, Cl^{-}, F^{-}, and SiO_2 concentrations much more so than the groundwaters along Sierra Nevada flow path. These increases are due to dissolution of CO_2 from the soil zone, K-feldspar, enstatite, forsterite and quartz from the igneous bedrock, and calcite, halite, gypsum, and fluorite from lacustrine sediments, and the production of Na-clay.

Like the Shaffer Mountain flow path, none of the samples analyzed contained much (maximum 0.3 TU), if any ^{3}H, again, indicating that post-1952 recharge does not play a large role in this flow path. Mean ^{14}C ages show that the groundwaters in this flow path are considerably older than those on the opposite side of the basin. They range in

age from 9000-13,500 years old and are closely associated with the deeply circulating, old, thermal waters of the Antelope Mountain/Litchfield Fault Zone flow path.

Carbon-13 values along this flow path appear to be constant (~ 10‰) throughout the flow path. Groundwater at the beginning of this flow path is likely more depleted at but no samples have been collected from that area.

Several of the $\delta^{18}O$ and δD isotopes for groundwaters along this flow path plot close to the local meteoric water line, however, the influence of mixing with the Antelope Mountain/Litchfield Fault Zone thermal waters can be seen in the shift to the right in the rock-water interaction direction. Some of these waters also appear to experience evaporation.

East Skedaddle/Amedee Flow Path

The East Skedaddle/Amedee flow path begins as precipitation in the Modoc Plateau and flows down gradient, and east, toward Fish Springs Playa where it terminates. It is separated from the West Skedaddle/Amedee flow path by a low elevation surface water divide. As the groundwater travels along this flow path, it interacts with Tertiary volcanics and lacustrine sediments and thus experiences moderate increases in Ca^{2+}, Mg^{2+}, K^{+}, HCO_3^{-}, SO_4^{2-}, and F^{-}, extremely large increases in Cl^{-} and Na^{+}, and a decrease of SiO_2. According to NEPATH, this is a result of the dissolution of much CO_2 from the soil zone, K-feldspar, quartz, enstatite, and forsterite from the volcanics, and calcite, gypsum, halite, and some fluorite from lacustrine sediments, much ion exchange, and the production of much Na-clay.

Some ^{3}H (maximum of 1 TU) was found in several water samples in this flow path, indicating a small component of post-1952 recharge to the flow path. Mean ^{14}C

ages show that the groundwater toward the middle of the flow path shows some modern ages, but that closer to Fish Springs Playa, the groundwater becomes much older (7500-10,000 years old).

Carbon-13 values increase along the flow path, reflecting an increased interaction with carbonates as the groundwater flows through lacustrine sediments.

Several of the $\delta^{18}O$ and δD isotopes plot close to the local meteoric water line, but the majority exhibit a consistent evaporative trend, which is present in both the samples in the highlands and on basin floor.

Neversweat Flow Path

The Neversweat flow path begins as precipitation in the north-eastern Virginia Mountains where upon infiltration, interacts with Tertiary volcanics and lacustrine sediments as it flows down gradient and terminates in the Fish Springs Playa. Along this path, the groundwater experiences a moderate increases in Ca^{2+}, Mg^{2+}, K^{+}, HCO_3^{-}, SO_4^{2-}, and F^{-}, extremely large increases in Cl^{-} and Na^{+}, and decrease in SiO_2. According to NEPATH, this is a result of the dissolution of much CO_2 from the soil zone, K-feldspar, quartz, enstatite, and forsterite from the volcanics, and calcite, gypsum, halite, and some fluorite from lacustrine sediments, much ion exchange, and the production of much Na-clay.

Tritium analysis along the Neversweat flow path show that ^{3}H, and therefore post-1953 recharge, is present in the highlands in some groundwaters, but is absent in others. Mean ^{14}C ages indicate the groundwaters at the start and middle of this flow path are modern. Samples taken at the end of this flow path were not analyzed for ^{14}C and therefore, no ages could be calculated.

The limited amount of $\delta^{13}C$ data available shows values that indicate some interaction with carbonates along this flow path.

Extremely few locations were available for sample collection along this flow path, but those that were show $\delta^{18}O$ and δD isotope values that bound the local meteoric water line.

Astor/Sand Pass Flow Path

The Astor/Sand Pass flow path begins as precipitation in the Terraced Hills, north of the Virginia Mountains, and flows down gradient into the basin where it eventually terminates in Fish Springs Playa. Along this path, it interacts with Tertiary volcanics and lacustrine sediments, and thus experiences the same changes in solute chemistry as the Neversweat flow path; a moderate increases in Ca^{2+}, Mg^{2+}, K^{+}, HCO_3^{-}, SO_4^{2-}, and F^{-}, extremely large increases in Cl^{-} and Na^{+}, and a decrease in SiO_2. According to NEPATH, these changes are a result of the dissolution of much CO_2 from the soil zone, K-feldspar, quartz, enstatite, and forsterite from the volcanics, and calcite, gypsum, halite, and some fluorite from lacustrine sediments, much ion exchange, and the production of much Na-clay.

Little ^{3}H data is available for the groundwaters in this flow path, but in it as found in the one sample that was analyzed. This sample was located more toward the middle of the flow path, indicating that post-1952 recharge could be fairly important to this flow path. No ^{14}C ages were available for age calculations.

Carbon-13 values along this flow path are low (~ -5.5‰), indicating much interaction with carbonates or organic matter.

Like the Neversweat flow path, extremely few locations were available for sample collection along this flow path but those that were, show $\delta^{18}O$ and δD isotope values that bound the local meteoric water line and follow an evaporative trend.

Virginia Mountains Flow Path

The Virginia Mountains Flow Path begins as precipitation in the Virginia Mountains where upon infiltration, the groundwater interacts with Tertiary volcanics and lacustrine sediments as it flows down gradient and eventually terminates in the Fish Springs Playa. It is very similar to the Neversweat, East Skedaddle/Amedee, and Astor/Sand Pass flow paths in that there is a moderate increases in Ca^{2+}, Mg^{2+}, K^{+}, HCO_3^{-}, SO_4^{2-}, and F^{-}, extremely large increases in Na^{+} and Cl^{-}, and a decrease in SiO_2 along the flow path. This is accomplished by the dissolution of much CO_2 from the soil zone, quartz, biotite, K-feldspar, enstatite, and forsterite from the volcanics, and calcite, gypsum, halite, and some fluorite from lacustrine sediments, much ion exchange, and the production of Na-clay.

No ^{3}H was detected in most areas of the flow path, but some ^{3}H was present in the end of the flow path (maximum of 1.7 TU), adjacent to Fish Springs Playa. Thus, post-1952 recharge is present in this flow path. Mean ^{14}C ages adjacent to Fish Springs Playa are 1500-4000 years. This flow path appears to be a good mix of both modern and old groundwaters.

Carbon-13 values increase toward Fish Springs Playa, and show that the groundwater in this flow path picks up almost as much carbon from interaction with carbonates as it does from the soil zone.

Several of the $\delta^{18}O$ and δD isotopes plot close to the local meteoric water line, but the majority exhibit a consistent evaporative trend, especially those groundwaters closer to the playa.

Cottonwood Flow Path

The Cottonwood flow path begins as precipitation in the Virginia Mountains, infiltrates the ground, flows a relatively short distance, discharges as springs halfway down the mountain slope, and then either re-infiltrates the ground or flows down to the basin in streams where it then infiltrates the lacustrine sediments and flows into Fish Springs Playa. Along this path, it interacts with Tertiary volcanics and lacustrine sediments, and thus there are a moderate increases in Ca^{2+}, Mg^{2+}, K^{+}, HCO_3^{-}, SO_4^{2-}, and F^{-}concentrations, extremely large increases in Na^{+} and Cl^{-} concentrations, and a slight decrease in the SiO_2 concentration along the flow path. According to the NETPATH models, this is accomplished by the dissolution of much CO_2 from the soil zone, quartz, biotite, K-feldspar, enstatite, and forsterite from the volcanics, and calcite, gypsum, halite, and some fluorite from lacustrine sediments, much ion exchange, and the production of Na-clay.

Most, if not all, of the groundwaters in the Cottonwood flow path are thought to contain post-1952 recharge. Tritium is very high (> 8 TU) at the head of the flow path, and is also found toward the end (1.2 TU). No ^{14}C ages were calculated for this flow path.

Carbon-13 measured at the head of the flow path shows addition of carbon to the system from CO_2 in the soil zone and organic matter in aerobic conditions. Values are

likely to decrease toward Fish Springs Playa as the groundwater interacts with carbonates in lacustrine sediments, but not data is available to support this assumption.

Oxygen-18 and δD isotopes plot close to the local meteoric water line, but also exhibit a slight evaporative trend.

Fort Sage Mountains Flow Path

The Fort Sage Mountains flow path begins as precipitation in the Fort Sage Mountains and flows into the basin where it terminates in Fish Springs Playa. This flow path interacts with granodiorites, some Tertiary volcanics, and lacustrine sediments. As the groundwater flows down gradient, it increases slightly in Ca^{2+}, Mg^{2+}, K^{+}, HCO_3^{-}, SO_4^{2-}, and F^{-}concentrations, increases much in Na^{+} and Cl^{-} concentrations, and decreases in SiO_2 along the flow path. According to the NETPATH models, this is accomplished by the dissolution of much CO_2 from the soil zone, quartz, biotite, K-feldspar, enstatite, and forsterite from the volcanics, and calcite, gypsum, halite, and some fluorite from lacustrine sediments, much ion exchange, and the production of Na-clay.

No ^{3}H data was available for the groundwaters in the highlands of this flow path, and very little ^{3}H was measured at the end of the flow path (maximum 0.5 TU). Post-1952 recharge more than likely plays a role in the recharge of this flow path much like it does in the neighboring Virginia Mountains flow path. Mean ^{14}C ages indicate that the groundwater near the middle of the flow path is modern to 2500 years old.

Carbon-13 measurements were only made on one of the samples, located in the middle of this flow path (-14.1‰). Like the Fort Sage Mountains flow path, $\delta^{13}C$ values are likely to decrease toward Fish Springs Playa as the groundwater interacts with carbonates in lacustrine sediments, but not data is available to support this assumption.

Several of the $\delta^{18}O$ and δD isotopes plot close to the local meteoric water line, but the majority exhibit a consistent evaporative trend, especially those groundwaters closer to the playa.

CONCLUSION

Groundwater flowing through granitic terrain (west-southwest Honey Lake Basin) is dominantly calcium-bicarbonate in character and has low TDS (~ 150 mg/L), whereas groundwater flowing through mafic terrain (north and east Honey Lake Basin) is dominantly sodium-bicarbonate in character with a slightly higher TDS (~ 200 mg/L; Figure 28). Once these low TDS groundwaters encounter lacustrine deposits down gradient on the basin floor, the solute load increases (~ 300 mg/L) and the groundwater becomes sodium-bicarbonate in character. Dissolution of silicate minerals, calcite, and ion exchange with clays is responsible for these geochemical changes. Further down gradient, contact with evaporite minerals, such as halite and gypsum, in the playa areas causes the evolution to sodium-chloride groundwater and dramatically increases the TDS (~ 1100 mg/L on the Honey Lake Playa and 43,000 mg/L on the Fish Springs Playa). The sharp contrast in the concentrations of evaporite minerals in the groundwater from the two separate playas seems counterintuitive since both playas have the same origin, Lake Lahontan, and should therefore exhibit the same characteristics. It is concluded that episodic post Lahontan flooding of the basin, via inflow from Susan River and Long Valley Creek on the west, dissolved evaporite minerals on Honey Lake Playa and flushed them east to Fish Springs Playa (Figure 29). Much evaporation in this area and closed basin conditions prevent groundwater out flow and effectively concentrate the solute load on the playa.

Stable isotopes show that groundwater throughout the closed basin has a meteoric origin and experiences much evaporation, especially in areas which receive little

precipitation annually (eastern Honey Lake Basin). Groundwater in areas which experience mixing with upwelling thermal groundwater have stable isotope values which show exchange with silicate minerals at high temperatures (> 100°C), as well as evaporation.

Carbon -13 analysis shows increased interaction with carbonates, and possibly organic matter, in lacustrine sediments as groundwater flows down gradient to the basin floor. Tritium analysis shows that post-1952 precipitation is an important source to highland groundwater recharge, but does not greatly affect groundwater on the basin floor. Carbon-14 ages show that these geochemical evolutions occur over a long period; 1,000-5,000 years for the shorter flow paths in eastern Honey Lake Basin and 10,000-23,500 years for the longer flow paths in western Honey Lake Basin.

This investigation provides insight into the geochemical evolution of groundwater flow from both mafic and granitic terrains to lacustrine sediments with evaporite minerals, in a closed basin environment.

REFERENCES

Adams, M.C., 1984, Geochemistry of the Wendel-Amedee geothermal system, California: Geothermal Resources Council, Transactions, Vol. 8, pp. 363-368.

Adams, K.D., 1997, Late Quaternary pluvial history, isostatic rebound, and active faulting in the Lake Lahontan Basin, Nevada and California: Doctoral dissertation, University of Nevada-Reno, 169 p.

Anderson, K., Nelson, S.T., Mayo, A.L., and Tingey, D.G., 2005, Interbasin flow revisited: the contribution of local recharge to high-discharge springs, Death Valley, CA: Journal of Hydrology, Vol. 323, pp. 276-302.

Beaudoin, G. and Therrien, P., 2007, Stable isotope fractionation calculator (SIFC); Université Laval, *http://www.ggl.ulaval.ca/cgi-bin/isotope/generisotope_4alpha.cgi.*

Benson, L., 1993, Carbonate deposition, Pyramid Lake Subbasin, Nevada: 1.sequence of formation and elevation distribution of carbonate deposits (tufas): Palaeogeography, Palaeoclimatology, Palaeoecology, Vol. 109, pp. 55-87.

Benson, L., White, L.D., and Rye, R., 1996, Carbonate deposition, Pyramid Lake Subbasin, Nevada: 4. comparison of the stable isotope values of carbonate deposits (tufas) and the Lahontan lake-level record: Palaeogeography, Palaeoclimatology, Palaeoecology, Vol. 122, pp. 45-76.

Benson, L., 2004, The tufas of Pyramid Lake, Nevada: Geological Survey Circular, Report C 1267, 14 p.

Blackwell, D.D., Wisian, K.W., Richards, MC., and Steele, J.L., 2000, Geothermal resource/reservoir investigations based on heat flow and thermal gradient data for the United States: US Department of Energy, Technical Report 13504, 51 p.

Bonham, H.F., 1969, Geology and mineral deposits of Washoe and Story Counties, Nevada: Nevada Bureau of Mines and Geology, Bulletin 70, p. 140.

California Department of Water Resources, 1962, Geographic distribution of precipitation in northeastern California: California Department of Water Resources, map.

California Department of Water Resources, 1963, Northeastern counties ground-water investigation: California Department of Water Resources, Water Resources Bulletin 98, V. 1, 244 p.

California Department of Water Resources, 2003, Honey Lake Valley groundwater basin: California Department of Water Resources, California's Groundwater Bulletin 118, 7 p.

Clark, I. and Fritz, P., 1997, Environmental Isotopes in Hydrogeology: Boca Raton, Florida, Lewis Publishers, 328 p.

Coplen, T.B., 1998, Normalization of oxygen and hydrogen isotope data: Chemical Geology, Vol. 72, pp. 293-297.

Craig, H., 1961, Isotopic variations in meteoric waters: Science, Vol. 133, pp. 1702-1703.

Deines, P., D. Langmuir, and R. S. Harmon, 1974, Stable carbon isotope rations and the existence of gas phase in the evolution of carbonate ground waters: Geochimica et Cosmochimica Acta, Vol.38, no.7, pp.1147-1164.

Domenico, P.A. and Schwartz, F. W., 1998, Physical and chemical hydrogeology: New York, New York, John Wiley & Sons, pp. 279-280 and 319-322.

Eggett, D., 2007, Research Associate Professor of Statistics: Brigham Young University, personal communication.

Environmental Isotopes Laboratory, 1998, Tritium analysis: technical procedure 1.0: Department of Earth Sciences, University of Waterloo.

Faure, G. and Mensing, T.M., 2005, Isotopes: principles and applications, Third Edition: Hoboken, New Jersey, John Wiley & Sons, pp.693-744.

Fontes, J.Ch., 1983, Dating of groundwater in guidebook on nuclear techniques in hydrology: International Atomic Energy Agency, Technical Report Services 91, p. 285-317.

Fontes, J.Ch. and Garnier, J.M., 1979, Determination of the initial 14C activity of the total dissolved carbon: a review of the existing models and a new approach: Water Resource Research, Vol. 15, n. 2, p. 399-413.

Fournier, R.O. and Rowe, J.J., 1966, Estimation of underground temperatures from the silica content of water from hot springs and wet-steam wells: American Journal of Science, Vol. 264, pp. 685-697.

Fournier, R.O., and Truesdell, A.H., 1973, An empirical Na-K-Ca geothermometer for natural waters: Geochimica et Cosmochimica Acta, Vol. 37, Issue 5, p. 1255-1275.

Fournier, R.O, White, D.E., and Truesdell, A.H., 1974, Geochemical indicators of subsurface temperature; Part I, basic assumptions: U.S. Geological Survey, Open-File Report 74-1033, 384 p.

Fournier, R.O., and Rowe, J.J., 1977, The solubility of amorphous silica in water at high temperatures and high pressures: American Mineralogist, Vol. 62, p. 1052-1056.

Fournier, R.O., 1979, A revised equation for the Na-K geothermometer: Geothermal Resource Council, Trans., Vol. 3, p. 221-224.

Fuis, G.S., Zucca, J.J., Mooney, W.D., and Milkereit, B., 1987, A geologic interpretation of seismic-refraction results in northeastern California: Geological Society of America Bulletin, Vol. 98, No. 1, pp. 53-65.

Geoproducts Corporation, 1984, The Honey Lake geothermal project, Lassen County, California: U.S. Department of Energy, Final Technical Report 12262-T1, 56 p.

Grose, T.L.T., 1984, Geologic map of the State Line Peak Quadrangle, Nevada-California: Nevada Bureau of Mines and Geology, Map 82, scale 1:24,000.

Grose, T.L.T, Saucedo, G.J., and Wagner, D.L., 1991, Geologic Map of the Susanville Quadrangle, Lassen and Plumas Counties, California: California Division of Mines and Geology, Map 20 p., scale 1:100,000.

Handman, E.H., Lonquist, C.J., and Maurer, D.K., 1990, Ground-water resources of Honey Lake Valley, Lassen County, California, and Washoe County, Nevada: U.S. Geological Survey, Report 90-4050, 112 p.

Hardt, W.F., Olmsted, F.H., and Trainer, F.W., 1975, Susanville-Honey Lake geothermal reconnaissance, southern Lassen County, California: U.S. Geological Survey, Open-File Report 76-429, 73 p.

IAEA, 2001, Global Network of Isotopes in Precipitation Maps and Animations: International Atomic Energy Agency, Vienna, Accessible at *http://isohis.iaea.org*.

Jones, B.F., Vandenburgh, A.S., Truesdell, A.H., and Rettig, S.L., 1969, Interstitial brines in playa sediments: Chemical Geology, Vol. 4, Issue 1-2, pp. 253-262.

Klein, C., 2002, Mineral Science: New York, New York, John Wiley & Sons, 641 p.

Laird, L.B., Taylor, H.E., and Lombard, R.R., 1986, Data on snow chemistry of the Cascade-Sierra Nevada Mountains: U.S. Geological Survey, Open-File Report 86-61, 25 p.

Mariner, R.H., Presser, T.S., and Evans, W.C., 1977, Chemical composition data and calculated aquifer temperature for selected wells and springs of Honey Lake Valley, California: U.S. Geological Survey, Open-File Report 76-0783, 10 p.

Mayo, A.L. and. Slosson, J.E, 1992, The application of ground-water flow models as predictive tools—a review of two ground-water models of eastern Honey Lake Valley, California-Nevada: Bulletin of the Association of Engineering Geologists, Vol. XXIX, No. 2, pp. 151-163.

Mayo, A.L., 2005, Professor of Geology: Brigham Young University, written communication.

McDonald, G.A., 1966, Geology of the Cascade Range and Modoc Plateau: California Division of Mines and Geology, Bulletin 190, pp. 65-96.

Miner, R.E., Nelson, S.T., Tingey, D.G., and Murrell, M.T., 2006, Using fossil spring deposits in the Death Valley region, USA to evaluate Palaeoflowpaths: Journal of Quaternary Science, Vol. 21.

Moll, N.E., 2000, A groundwater flow model of eastern Honey Lake Valley, Lassen County, California and Washoe County, Nevada: Abstracts with Programs - Geological Society of America, Vol. 32, Issue 7, pp.252.

Morrison, R.B., 1991, Quaternary stratigraphic , hydrologic, and climatic history of the Great Basin, with emphasis on Lakes Lahontan, Bonneville, and Tecopa; The Geology of North America, Quaternary Nonglacial Geology: Conterminous U.S.: Geological Society of America, Vol. K-2, pp. 283-320.

Nathenson, M. and Guffanti, M., 1988, Geothermal gradients in the conterminous United States: Journal of Geophysical Research, Vol. 93, Issue B6, p. 6437-6450.

Neary, M.P., 1997, Tritium enrichment: to enrich or not to enrich?: Radioactivity and Radiochemistry, Vol. 8:4, pp. 23-35.

Nelson, S.T., 2007, Associate Professor of Geology: Brigham Young University, personal communication.

Nelson, S.T., 2000, A simple, practical methodology for routine VSMOW/SLAP normalization of water sample analyzed by continuous flow methods: Rapid Communications in Mass Spectrometry, Vol. 14, pp. 1044-1046.

Nelson, S.T. and Dettman, D., 2001, Improving hydrogen isotope ratio measurement for on-line Cr reduction systems: Rapid Communications in Mass Spectrometry, Vol. 15, pp. 2301-2306.

Nelson, S.T., Wood, M.J., Mayo, A.L., Tingey, D.G., and Eggett, D., 2005, Shoreline tufa and tufaglomerate from Pleistocene Lake Bonneville, Utah, USA: stable isotopic and mineralogical records of lake conditions, processes, and climate: Journal of Quaternary Science, Vol. 20, pp.3-19.

Oviatt, C.G., McCoy, W.D., and Nash, W.P., 1994. Sequence stratigraphy of lacustrine deposits – a quaternary example form the Bonneville basin, Utah: Geological Society of America, Bulletin 106, p. 133-144.

Pearson, F.J., Jr., and Hanshaw, B.B., 1970, Sources of dissolved carbonate species in groundwater and their effects on carbon-14 dating: Isotope Hydrology: Proceedings Symp. IAEA, Vienna, pp. 271-286.

Piper, A.M., 1944, A graphic procedure in the geochemical interpretation of water analyses: Transcripts of the American Geophysical Union, 25, p. 914-923.

Plummer, L.N., Jones, B.F., and Truesdell, A.H., 1976, WATEQF a Fortran version of WATEQ a computer program for calculating chemical equilibrium of natural waters: U.S. Geological Survey Water Resources Investigation, 76-13, 60 p.

Plummer, L.N., Prestemon, E.C., and Parkhurst, D.L., 1994, An interactive code (NETPATH) for modeling NET geochemical reactions along a flow PATH-version 2.0: U.S. Geological Survey Water Resources Investigation, Report 94-4169, 130 p.

Polach, H.A., Stipp, J.J., 1967, Improved synthesis techniques for methane and benzene radiocarbon dating: International Journal of Applied Radiocarbon and Isotopes, v. 18, pp. 359-364.

Reed, M.J., 1978, Chemistry of thermal waters in selected geothermal areas of California: California Division of Oil & Gas, Report TR15, pp. 13-16.

Rockwell, G.L., 1993, Surface-water hydrology of Honey Lake Valley, Lassen County, California and Washoe County, Nevada: U.S. Geological Survey, Open-File Report 90-177.

Roberts, C.T., 1985, Cenozoic evolution of the Northwestern Honey Lake Basin, Lassen County, CA: Colorado School of Mines Quarterly, Vol. 80, No. 1, pp. 283-320.

Rose, T.P., Davisson, M.L., Hudson, G.B., and Varian, A.R., 1997, Environmental isotope investigation of groundwater flow in the Honey Lake Basin, California and Nevada: Lawrence Livermore National Laboratory, Technical Report UCRL-ID-127978, 72 p.

SAHRA, 2006, Sustainability of semi-arid hydrology and riparian areas; Oxygen: University of Arizona, Accessible at: www.sahra.arizona.edu/programs/isotopes/oxygen.html.

SAS Institute Inc., 2004, SAS Version 9.1: Cary, North Carolina.

Schimschal, U., 1991, Integrated exploration for low-temperature geothermal resources in the Honey Lake Basin, California: Geophysical Prospecting, Vol. 39, pp. 279-291.

Skiba, P.A., 1985, Artesian flow testing of the geothermal production wells WEN-1 and WEN-2, Honey Lake hybrid power plant project, California: Transactions, V. 9, Part II, pp. 585-589.

Stiff, H.A. Jr., 1951, The interpretation of chemical water analyses by means of patterns: Journal of Petroleum Technology 3, p. 15-17.

Stuvier, M., and Polach, H.A., 1977, Discussion: reporting of 14C data: Radiocarbon, Vol. 19, n. 3, pp. 355-363.

Tarbet, M.E.S., 2005, Evolution of paleo-climate for the Boise area, Idaho, from the last glacial maximum to the present based on delta^{2}H and delta^{18}O groundwater composition: Master's thesis, Brigham Young University, 56 p.

Taylor, K., Widmer, M., and Chesley, M., 1992, Use of transient electromagnetic to define local hydrogeology in an arid alluvial environment: Geophysics, Vol. 57, No. 2, pp. 343-352.

Truesdell, A.H., 1976, GEOTHERM, a geothermometric computer program for hot spring systems: Proceedings 2nd UN Symposium on the Development and Use of Geothermal Resources, San Francisco, 1975, Vol. 1, p. 831-836.

Varian, A.R., 1997, Use of environmental isotopes to investigate hydrologic processes at Honey Lake Basin, Lassen County, California and Washoe County, Nevada: Master's thesis, University of Nevada-Reno, 132 p.

Webber, W.D., 1996, Salinization of shallow ground waters in Honey Lake Valley, California-Nevada: Master's thesis, Brigham Young University, 106 p.

Western Regional Climate Center, 2007, Susanville Airport and Doyle 4SSE stations: http://www.wrcc.dri.edu/summary/Climsmnca.html.

Wills, C.J. and Borchardt, G., 1993, Holocene slip rate and earthquake recurrence on the Honey Lake fault zone, northeastern California: Geology, Vol. 21, pp. 853-856.

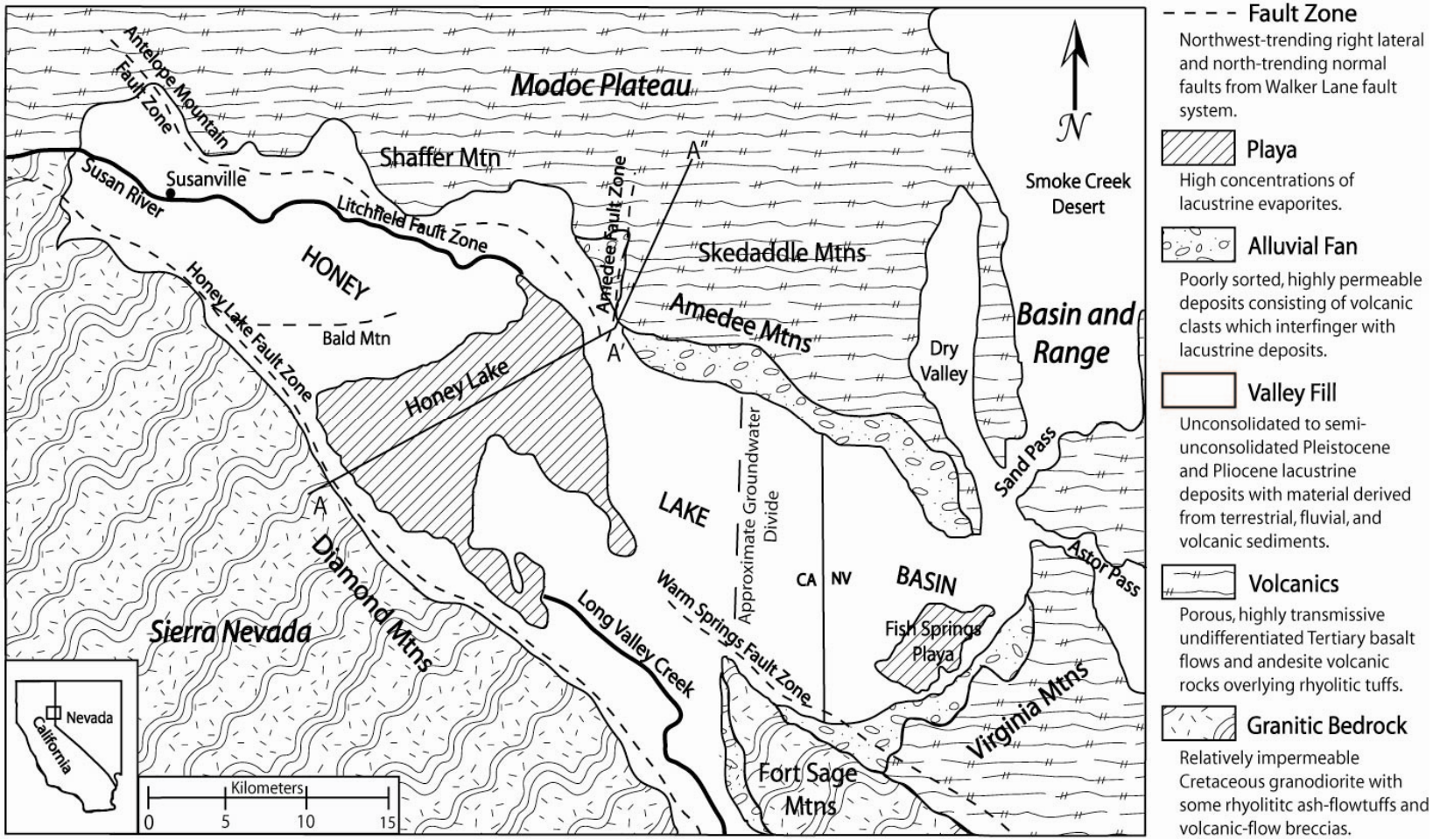


Figure 1. A simplified geologic map of the Honey Lake Basin, CA-NV. Modified from Mayo and Slosson, 1992 and Varian, 1997. Figure 3 is a cross section along A-A".

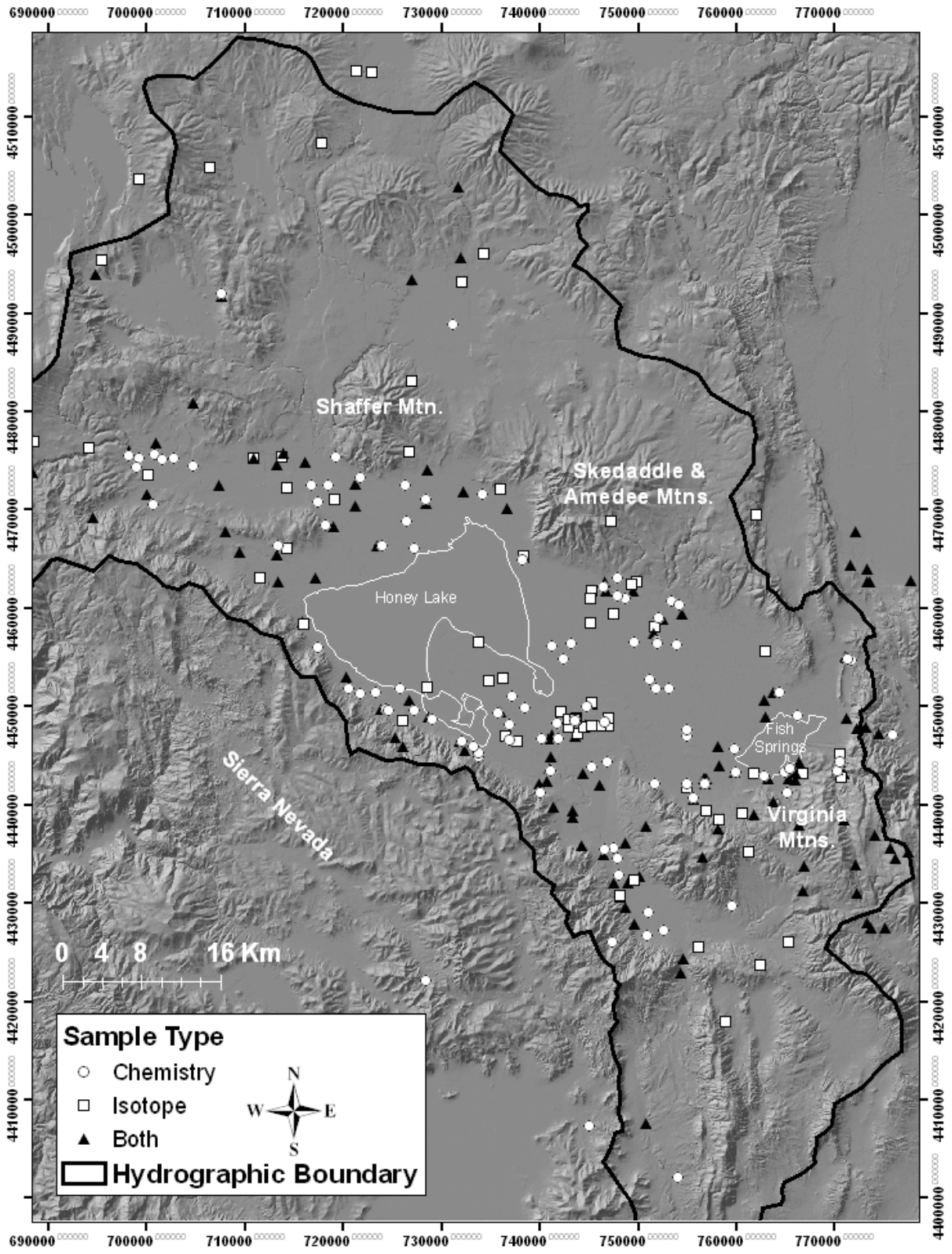


Figure 2. Honey Lake Basin sample location map. The hydrographic boundary was defined by Rockwell (1993).

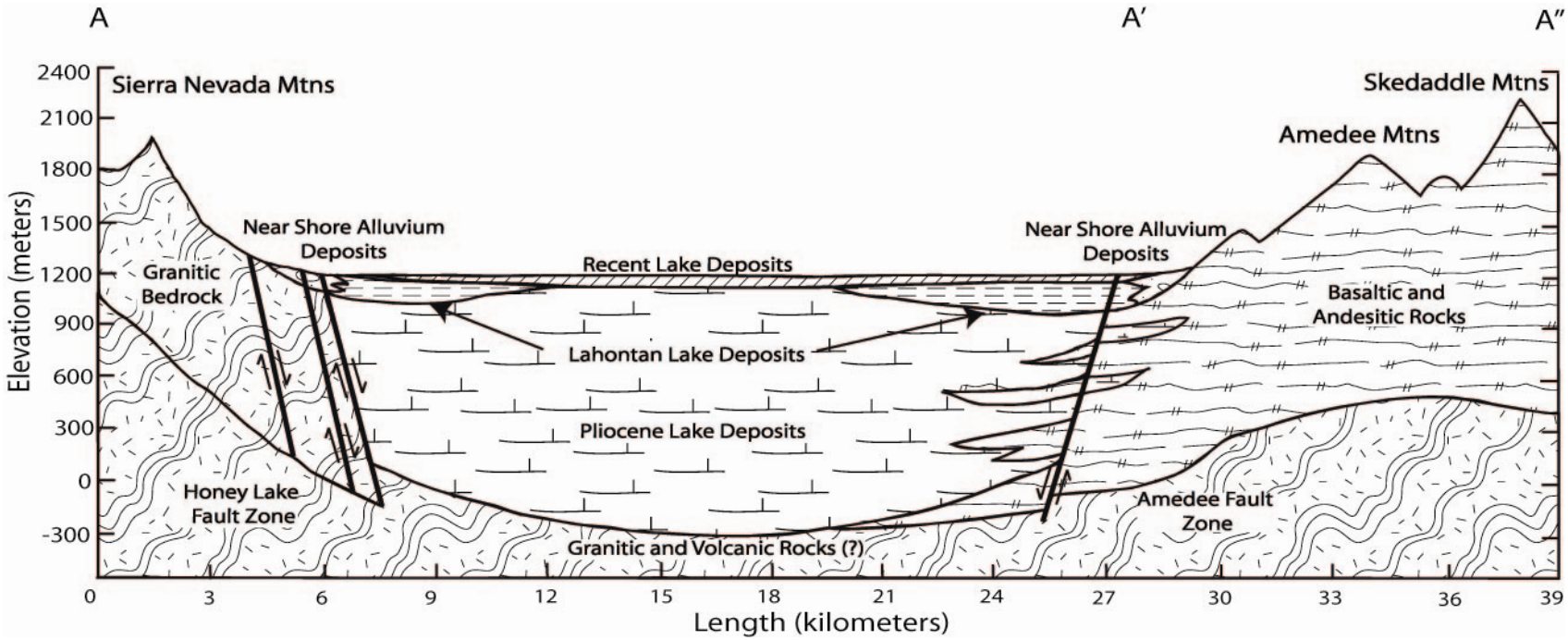


Figure 3. A simplified geologic cross section of Honey Lake Basin (Modified from California Department of Water Resource, 1963).

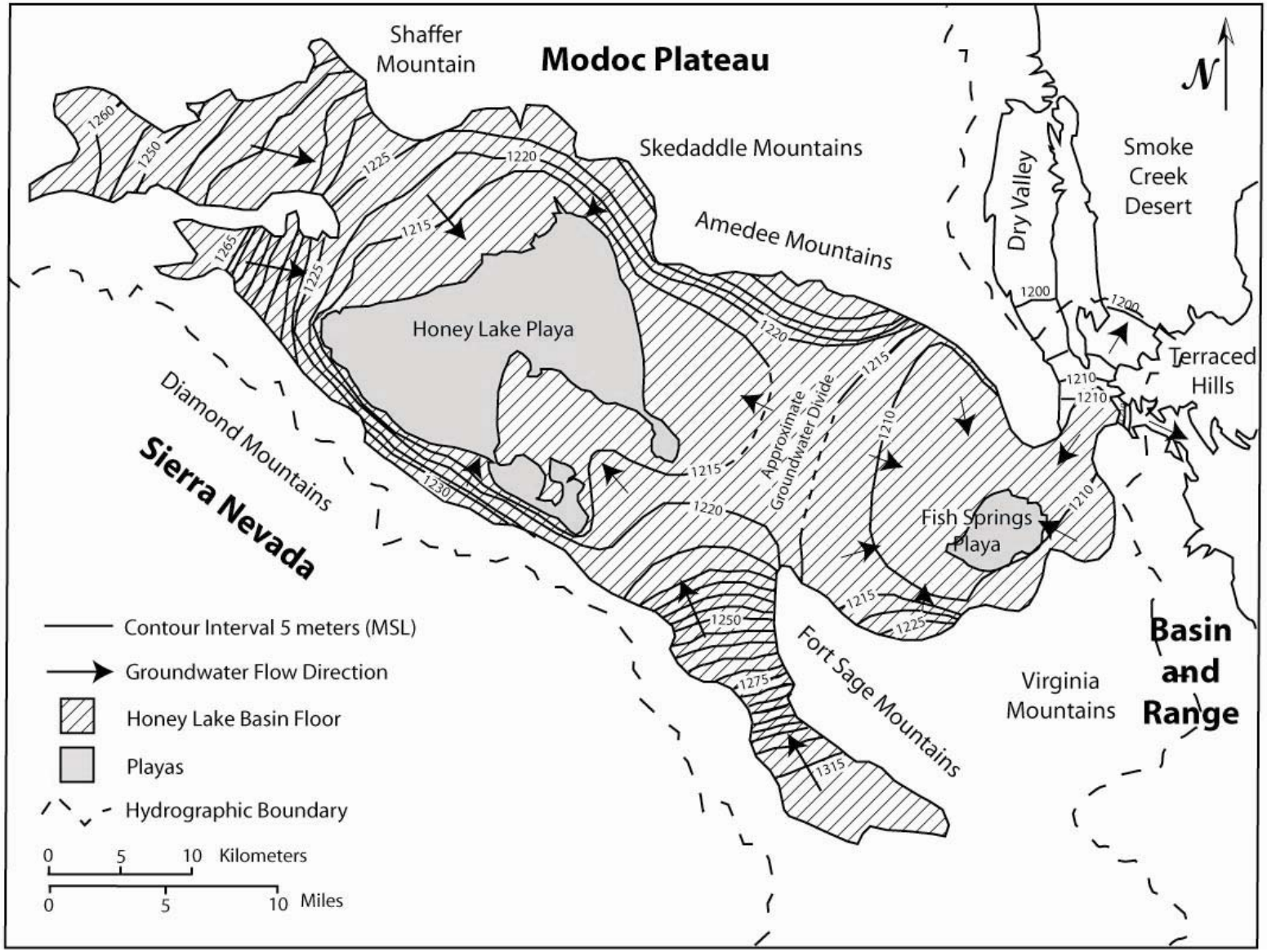


Figure 4. Groundwater level contour map. Groundwater flows from higher to lower water levels, or toward the basin floor.

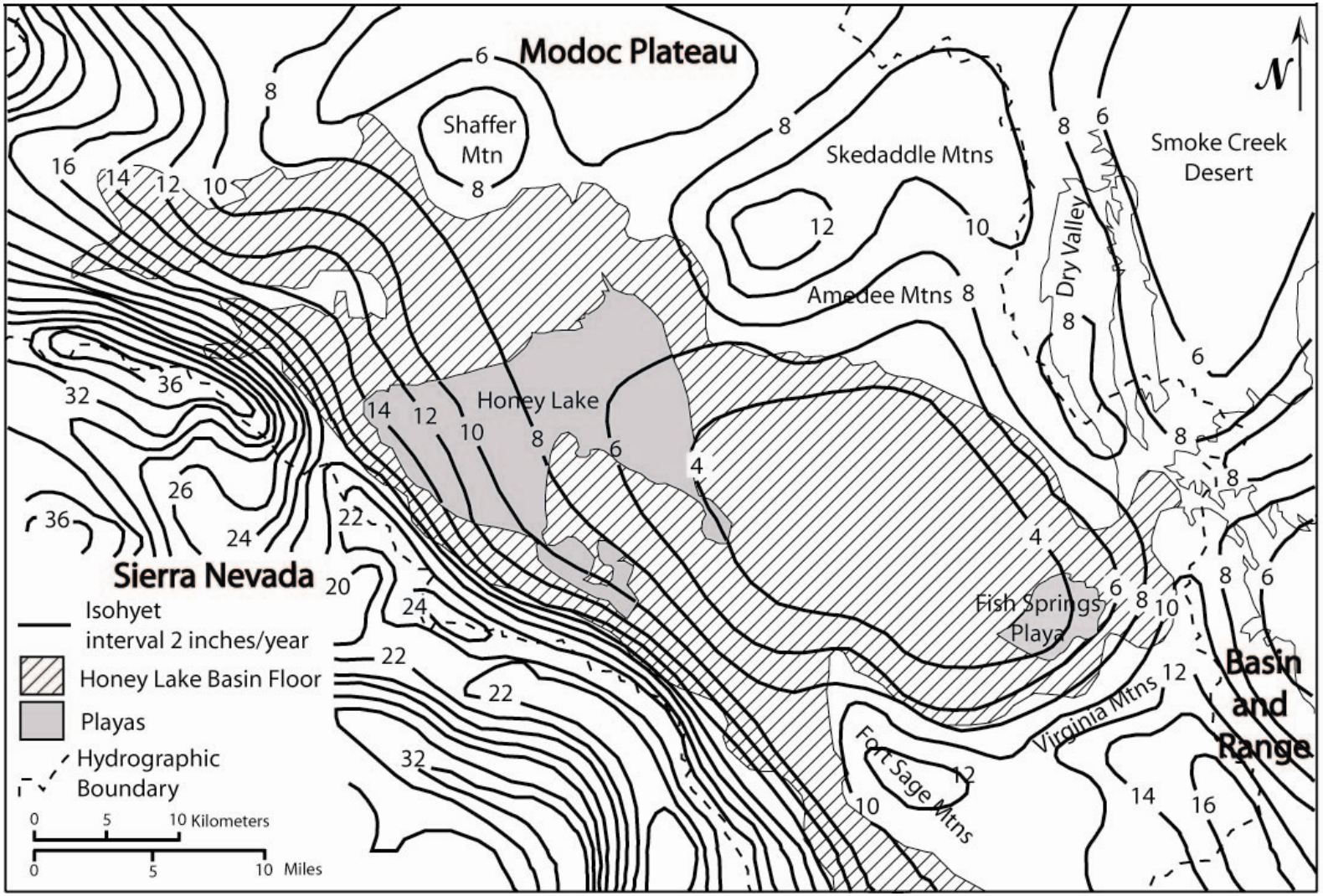


Figure 5. Isohyetal map of Honey Lake Basin. Note the large difference in the amount of precipitation between the east and west sides of the basin. Modified from Mayo and Slosson, 1992 and California Department of Water Resources, 1962.

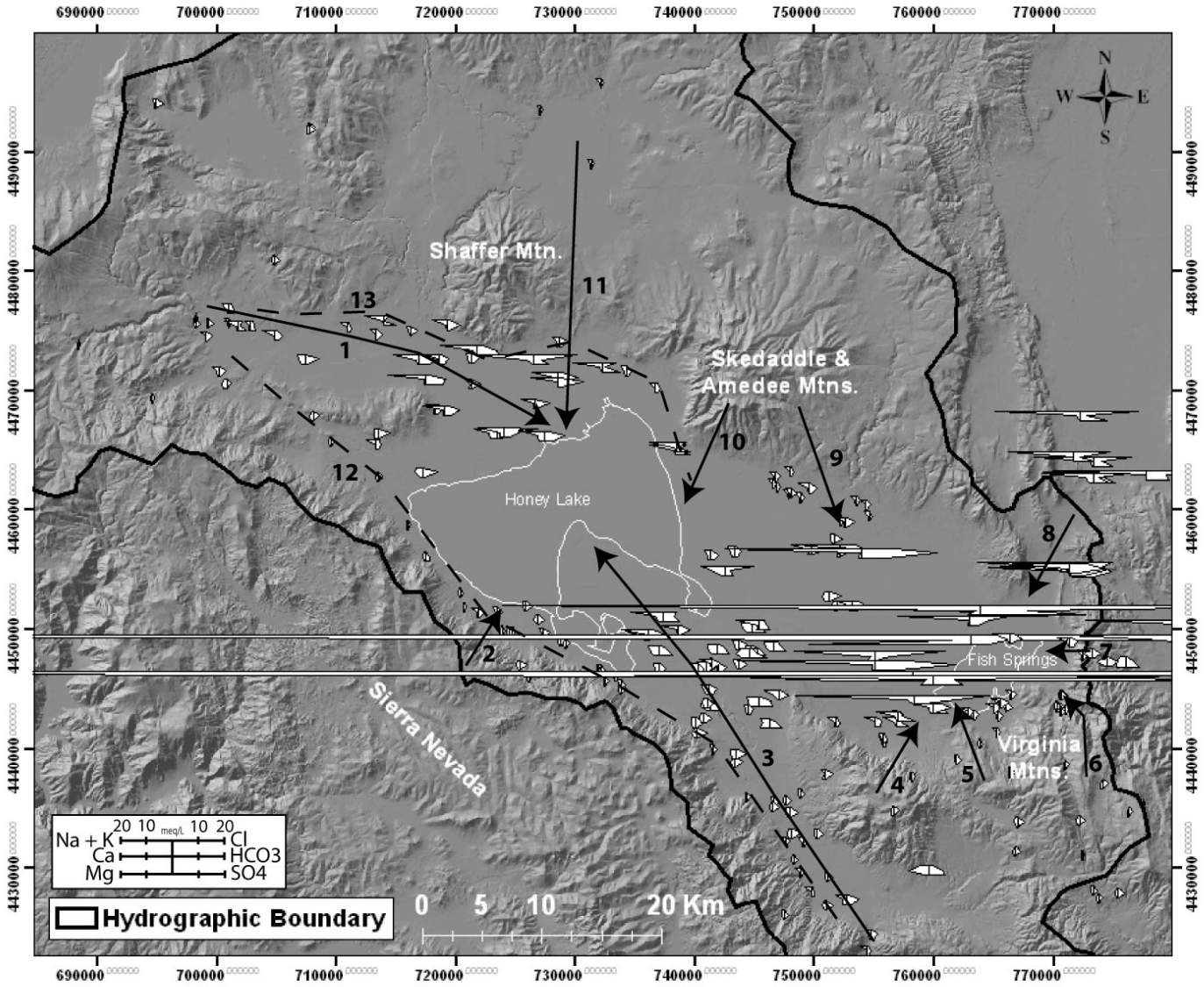


Figure 6. Stiff diagrams of all samples in Honey Lake Basin with solute chemistry data, and Honey Lake Basin flow paths. 1) Susan River path, 2) Sierra Nevada path, 3) Long Valley Creek path, 4) Fort Sage Mountains path, 5) Cottonwood path, 6) Virginia Mountains path, 7) Neversweat path, 8) Astor/Sand Pass path, 9) East Skedaddle/Amedee path, 10) West Skedaddle/Amedee path, 11) Shaffer Mountain path, 12) Honey Lake/Warm Springs Fault Zone path, and 13) Antelope Mountain/Litchfield Fault Zone path.

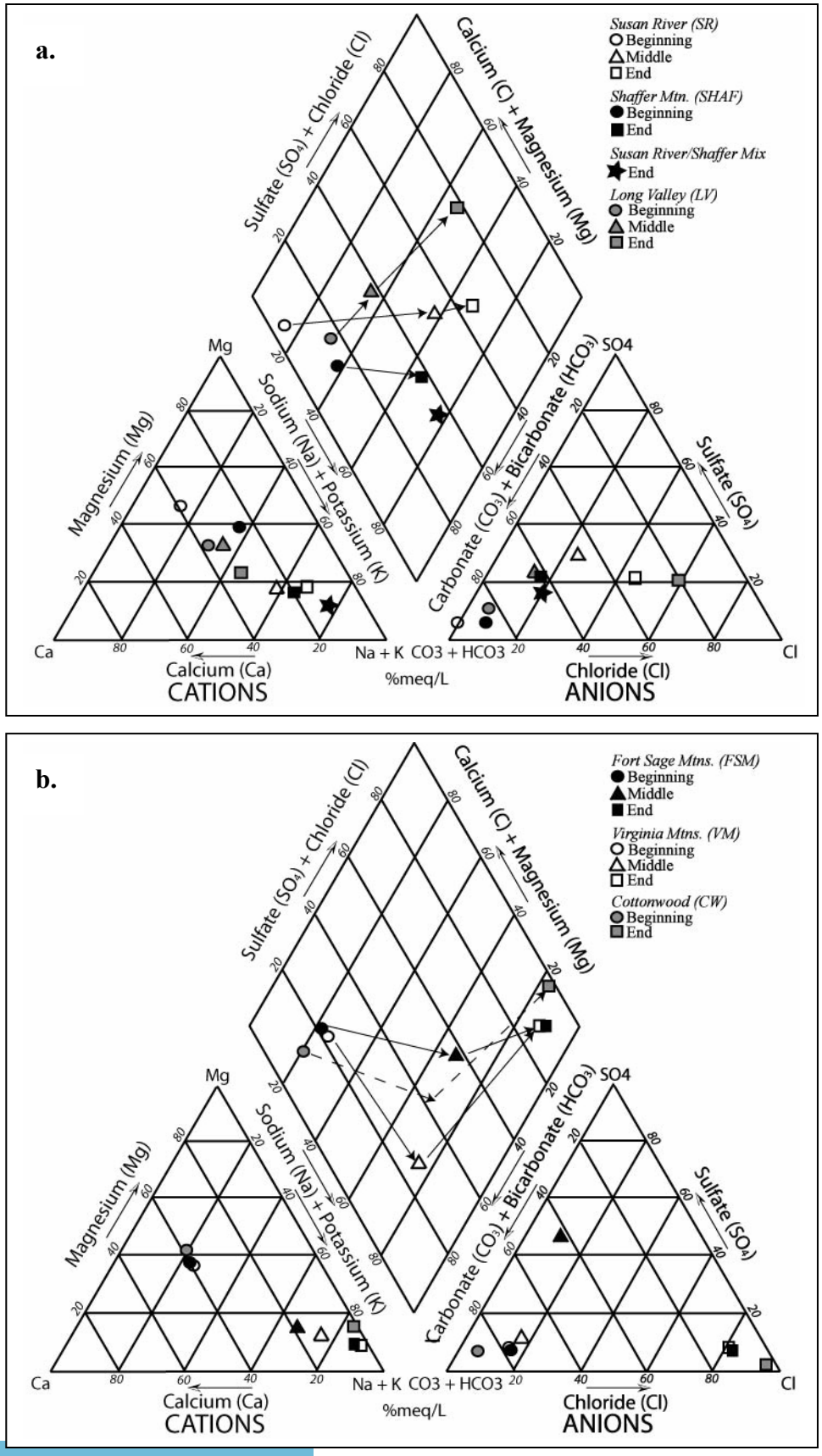
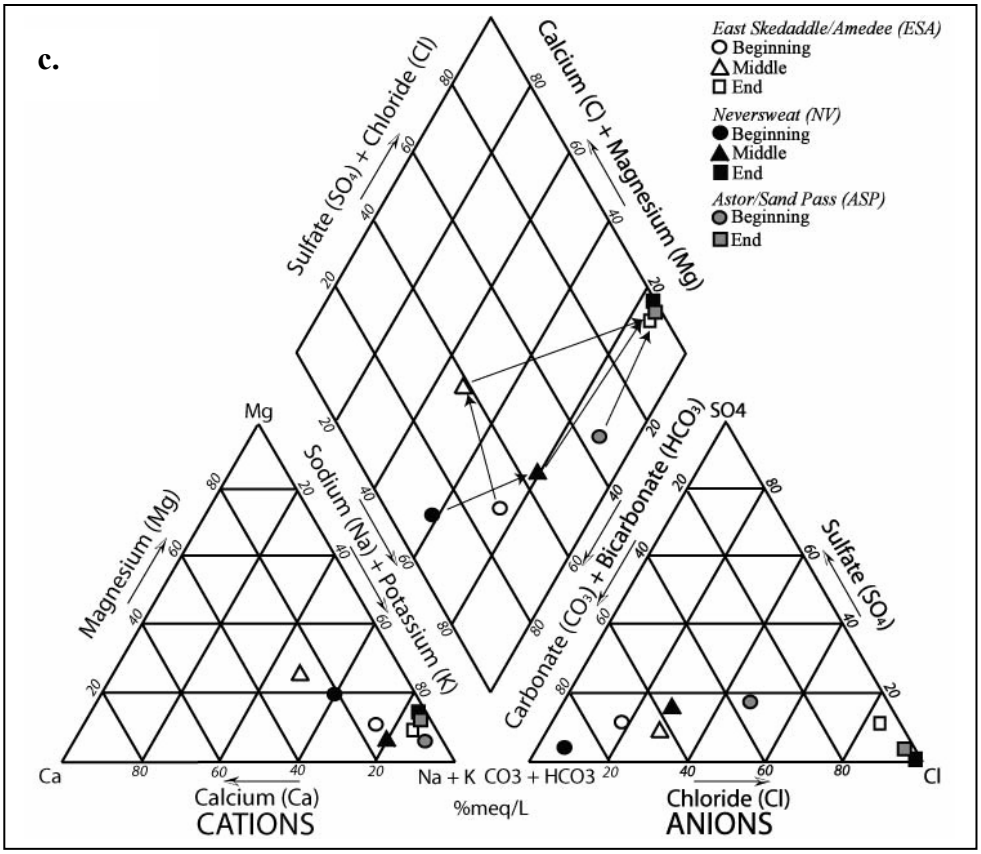


Figure 7. Piper diagrams of median solute chemistry data for the Honey Lake Basin flow paths. These diagrams illustrate how the groundwater changes chemically from the beginning to the end of each flow path. The 13 physical flow paths are grouped into 7 chemical flow paths – paths with similar chemical evolutions.



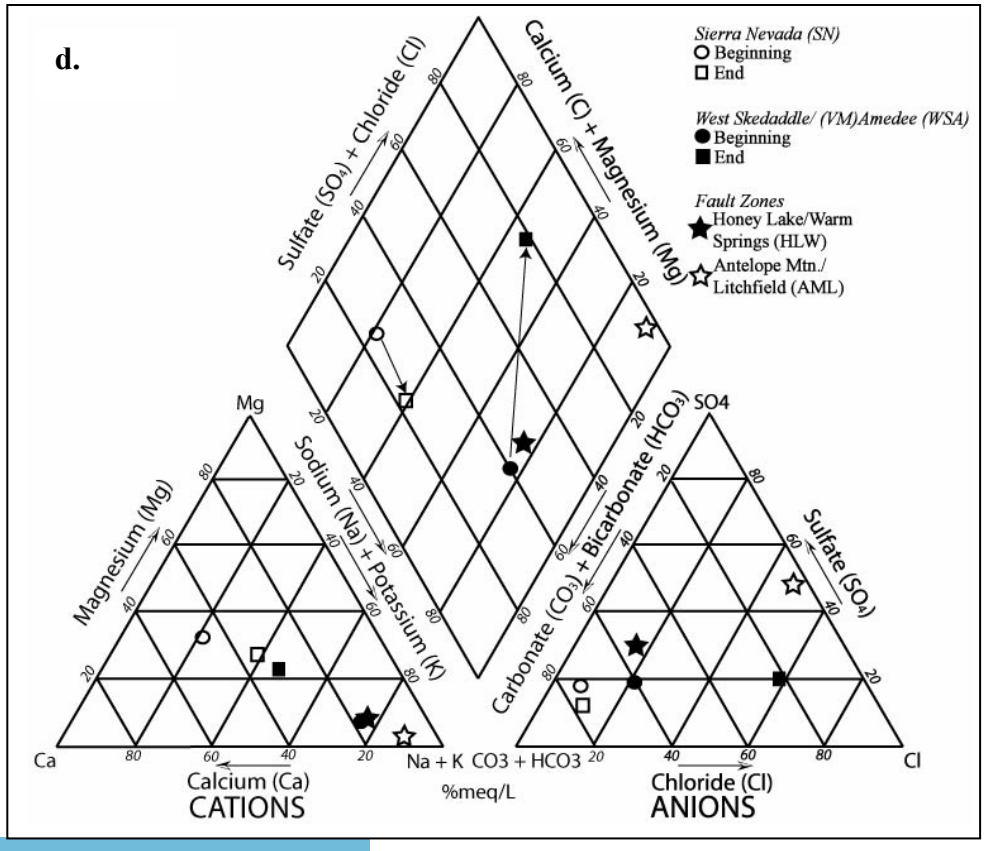


Figure 7 (continued). Piper diagrams of median solute chemistry data for the Honey Lake Basin flow paths. These diagrams illustrate how the groundwater changes chemically from the beginning to the end of each flow path. The 13 physical flow paths are grouped into 7 chemical flow paths – paths with similar chemical evolutions.

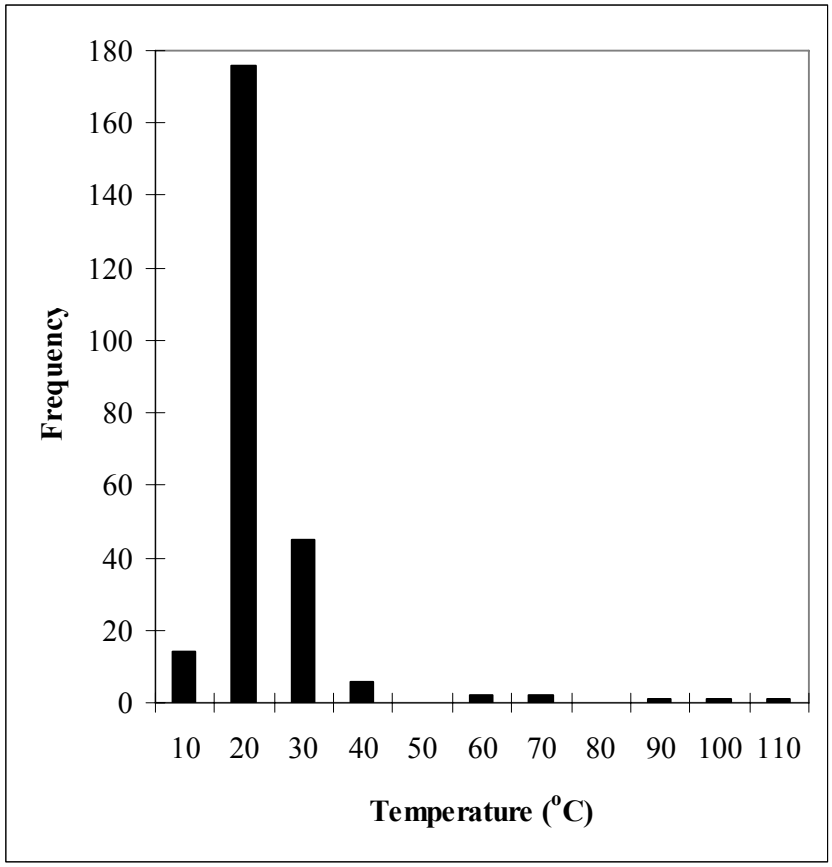


Figure 8. Histogram of groundwater temperatures in Honey Lake Basin.

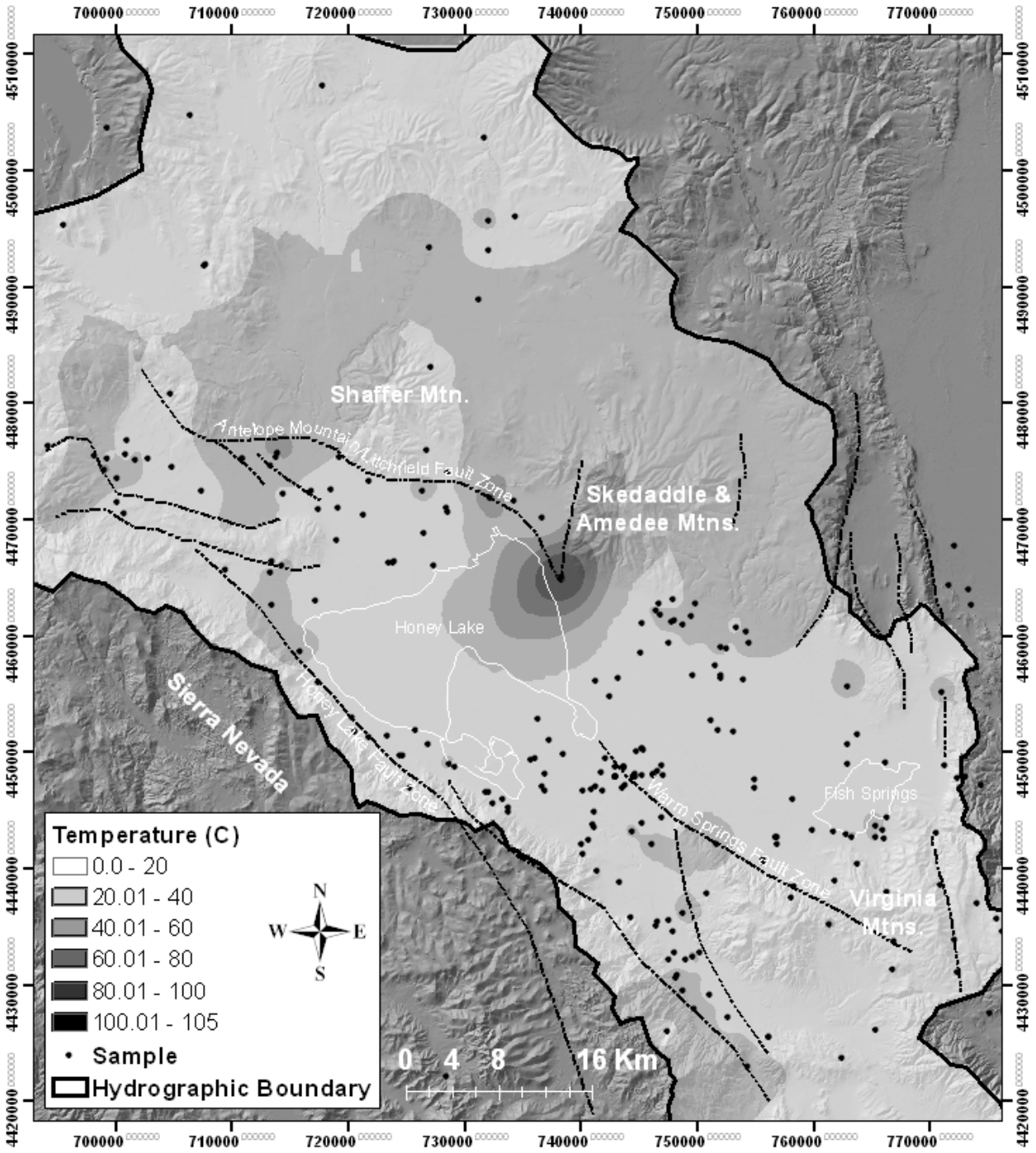


Figure 9. Contour map of groundwater temperatures in Honey Lake Basin. Note that the hottest waters are closely associated with faults zones.

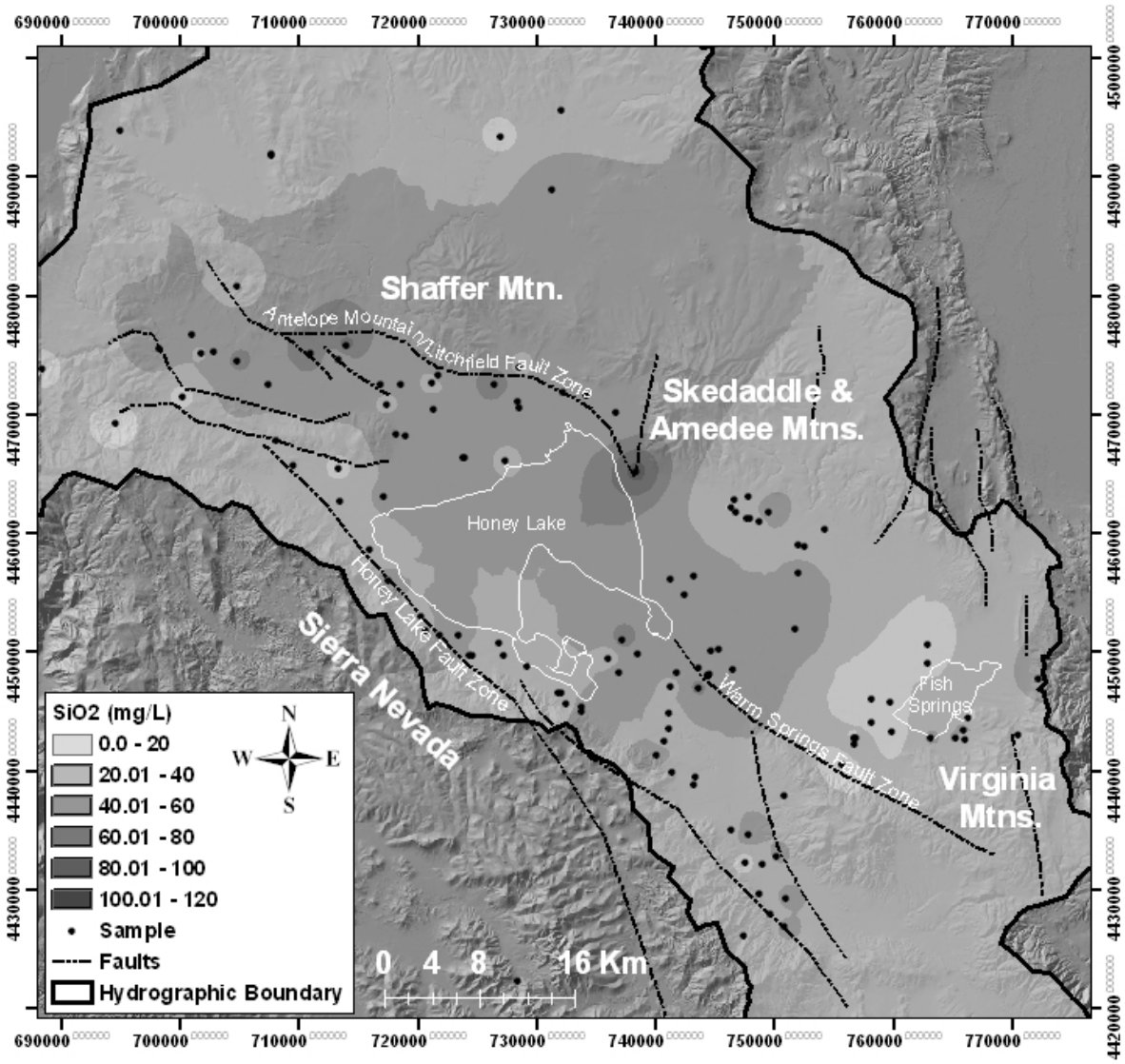


Figure 10. Contour map of silica concentrations in Honey Lake Basin groundwater. The highest concentrations of silica are associated with fault zones.

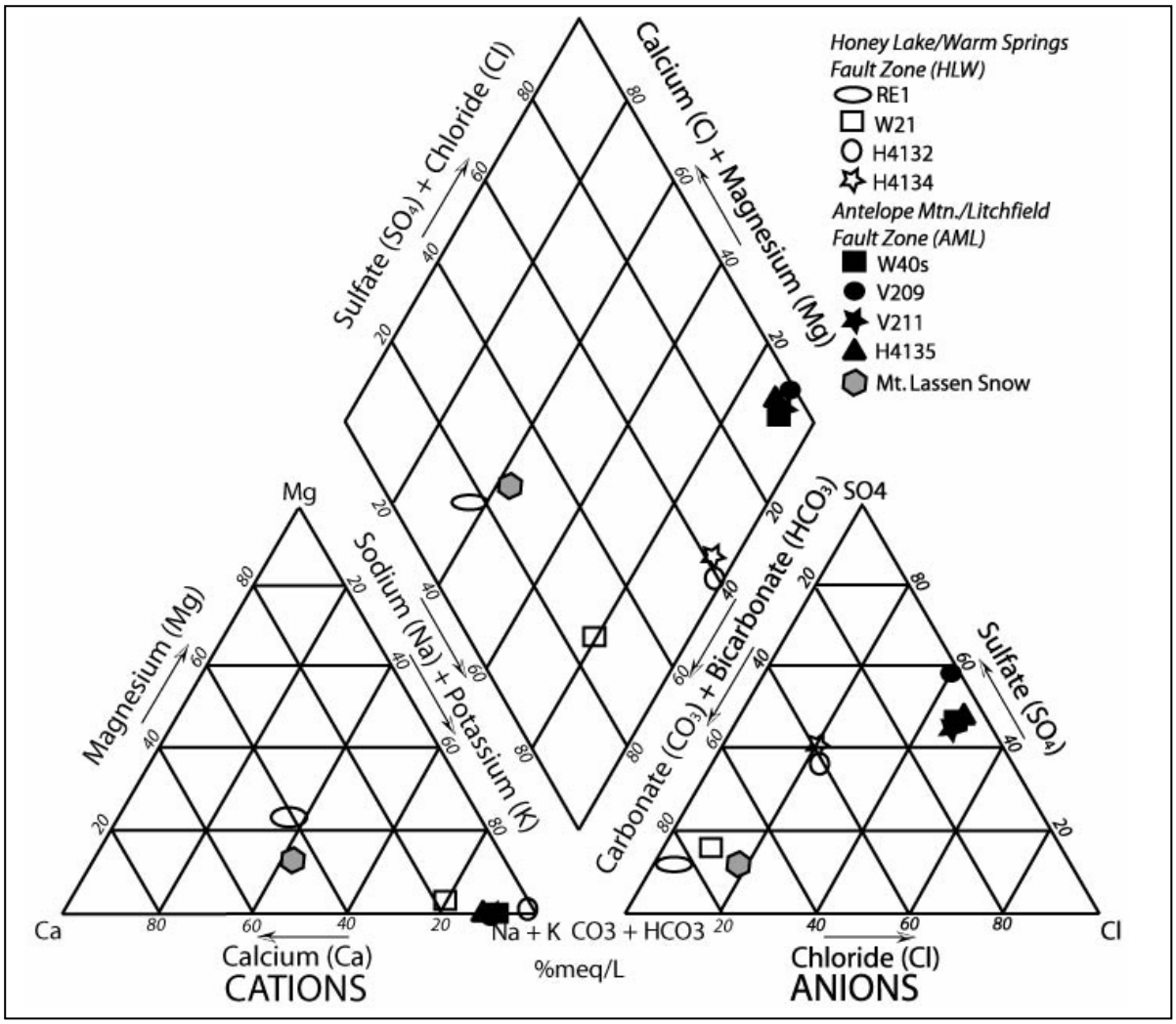


Figure 11. Piper diagram of the solute chemistry of the thermal water in Honey Lake Basin.

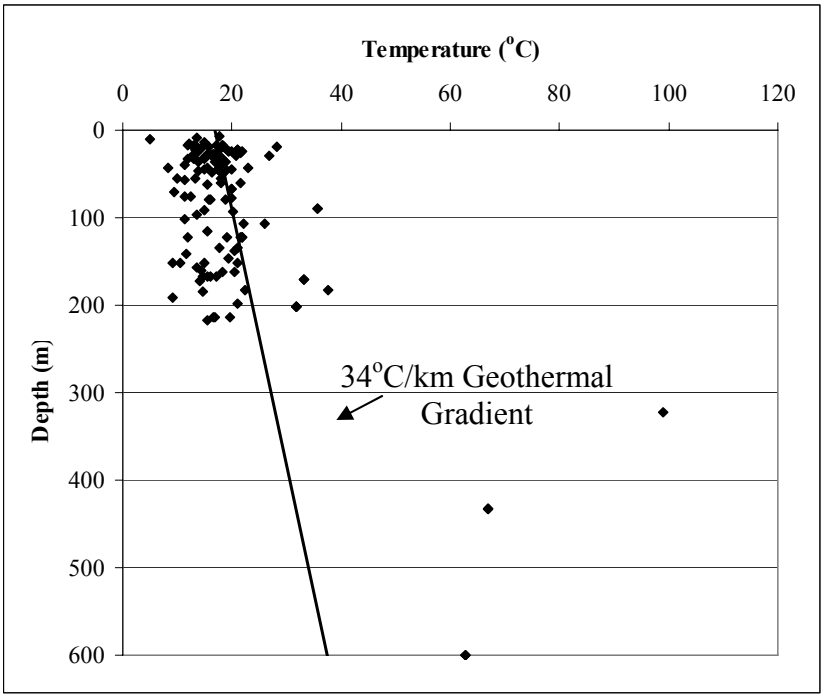


Figure 12. The geothermal gradient (34°C/km) and groundwater temperatures plotted according to depth.

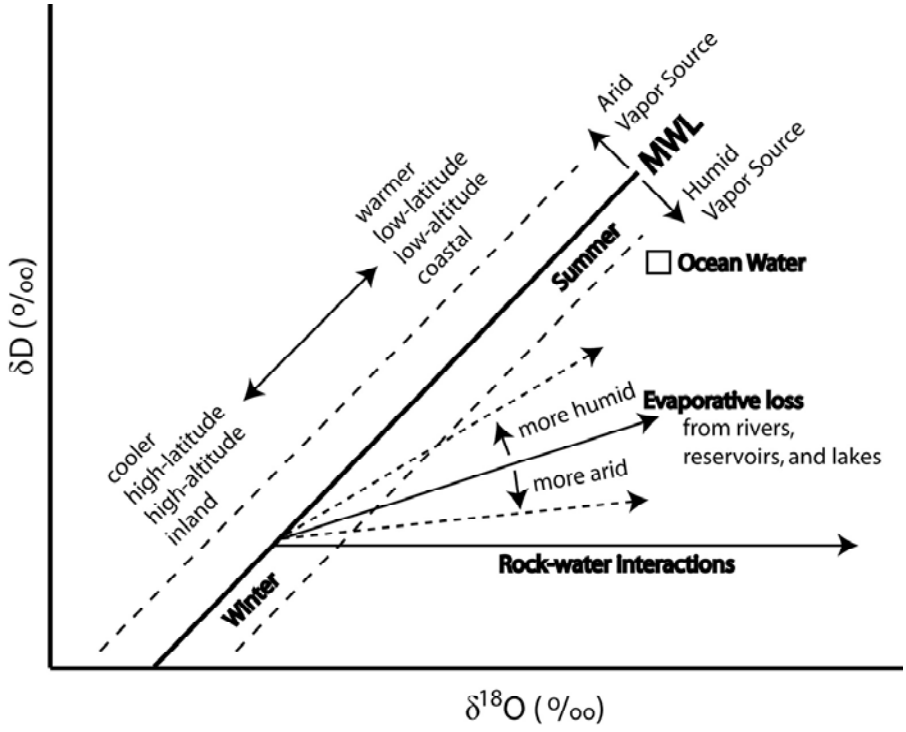


Figure 13. Oxygen-18 vs. deuterium graph showing deviations from the meteoric water line (SAHRA, 2006).

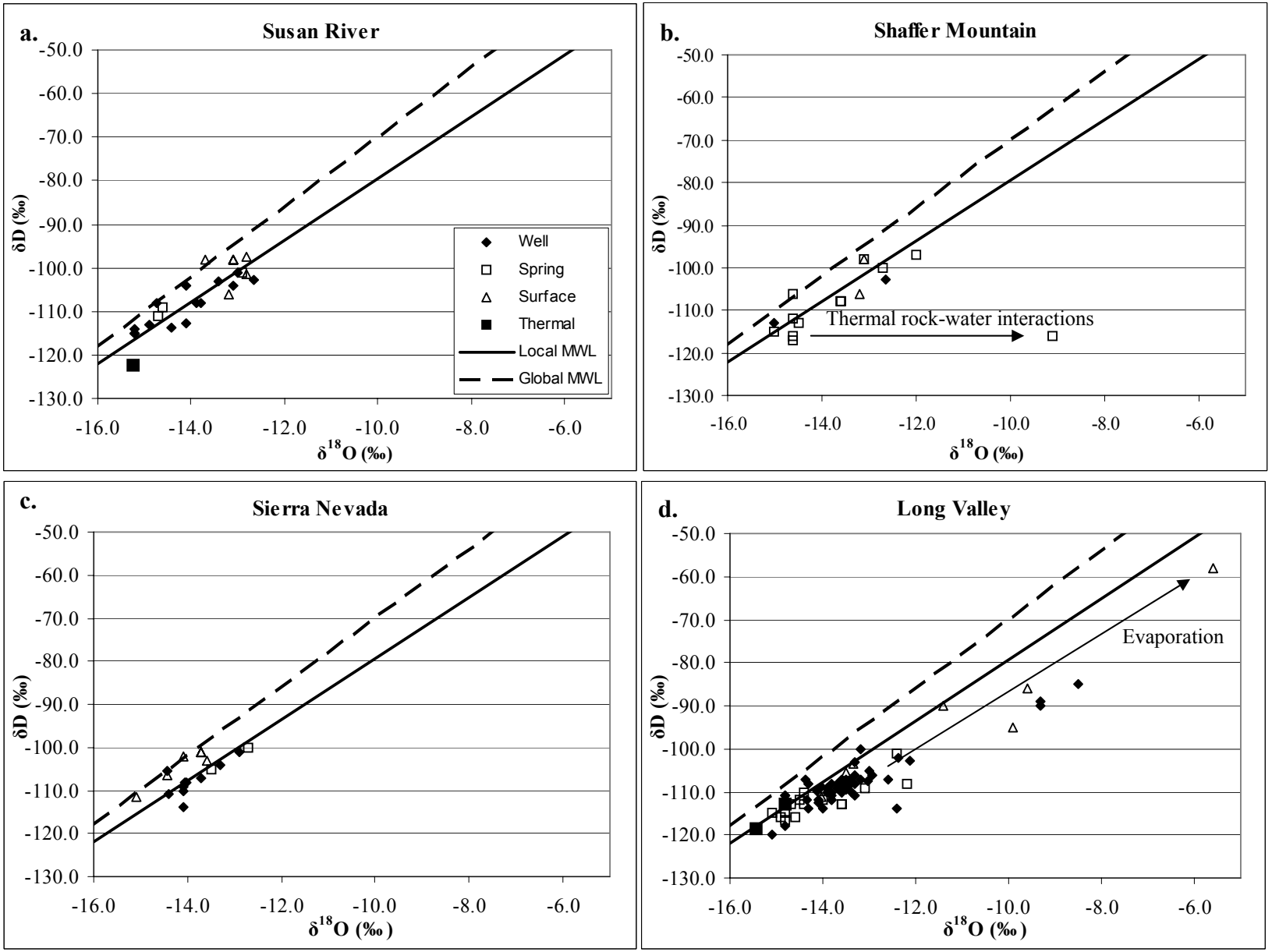


Figure 14. Oxygen-18 vs. deuterium vales for western Honey Lake Basin flow paths.

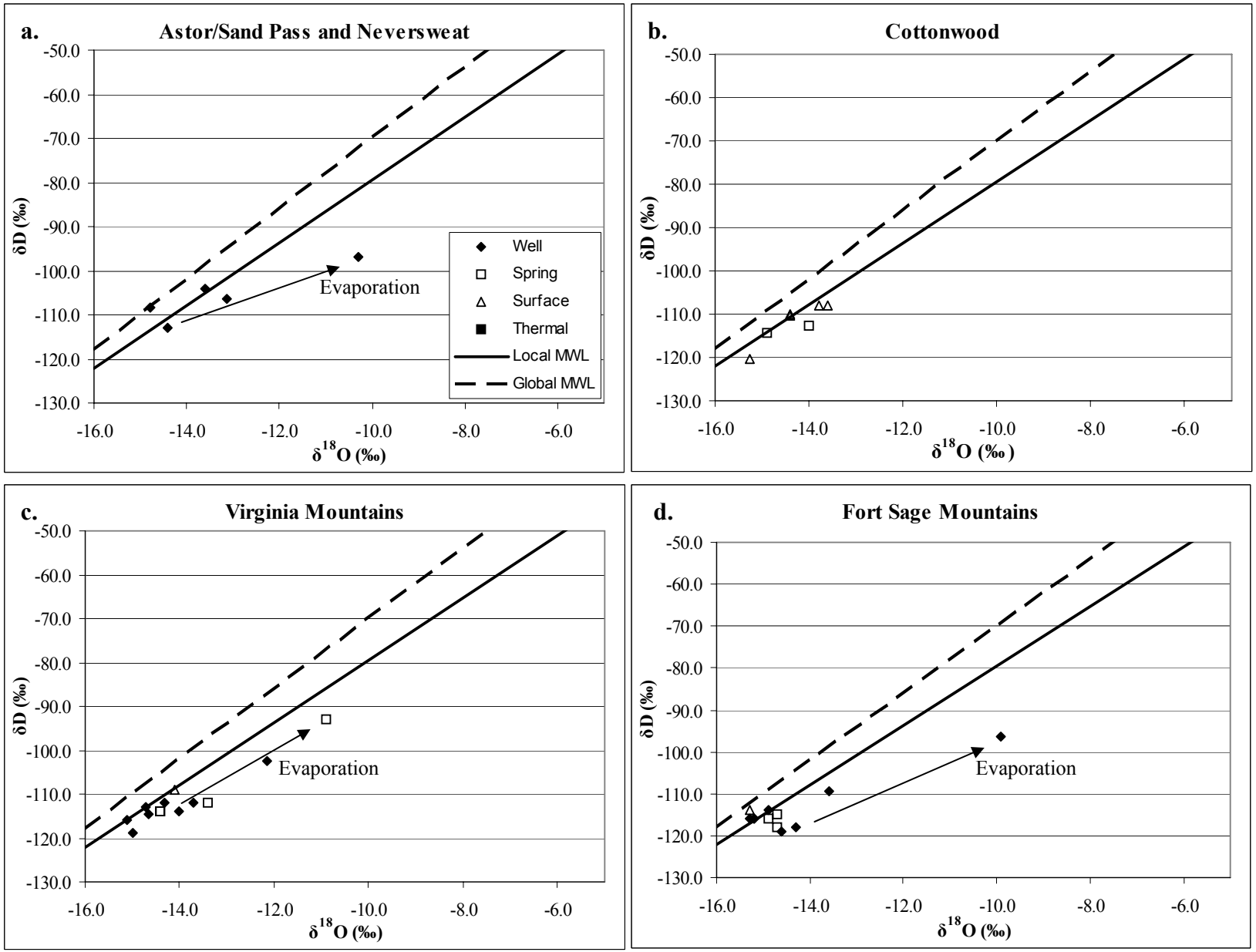


Figure 15. Oxygen-18 vs. deuterium vales for eastern Honey Lake Basin flow paths.

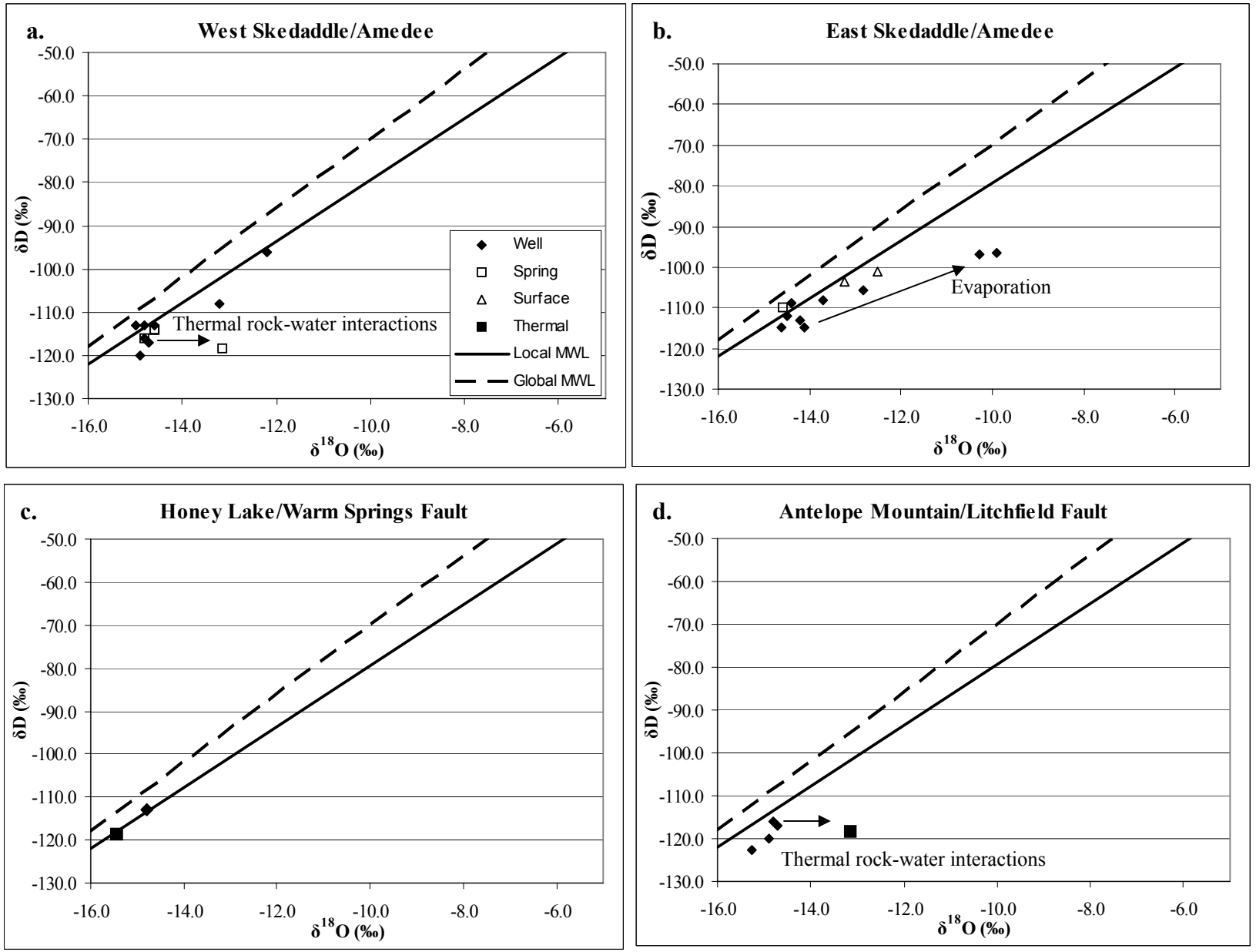


Figure 16. Oxygen-18 vs. deuterium vales for central Honey Lake Basin and fault zone flow paths.

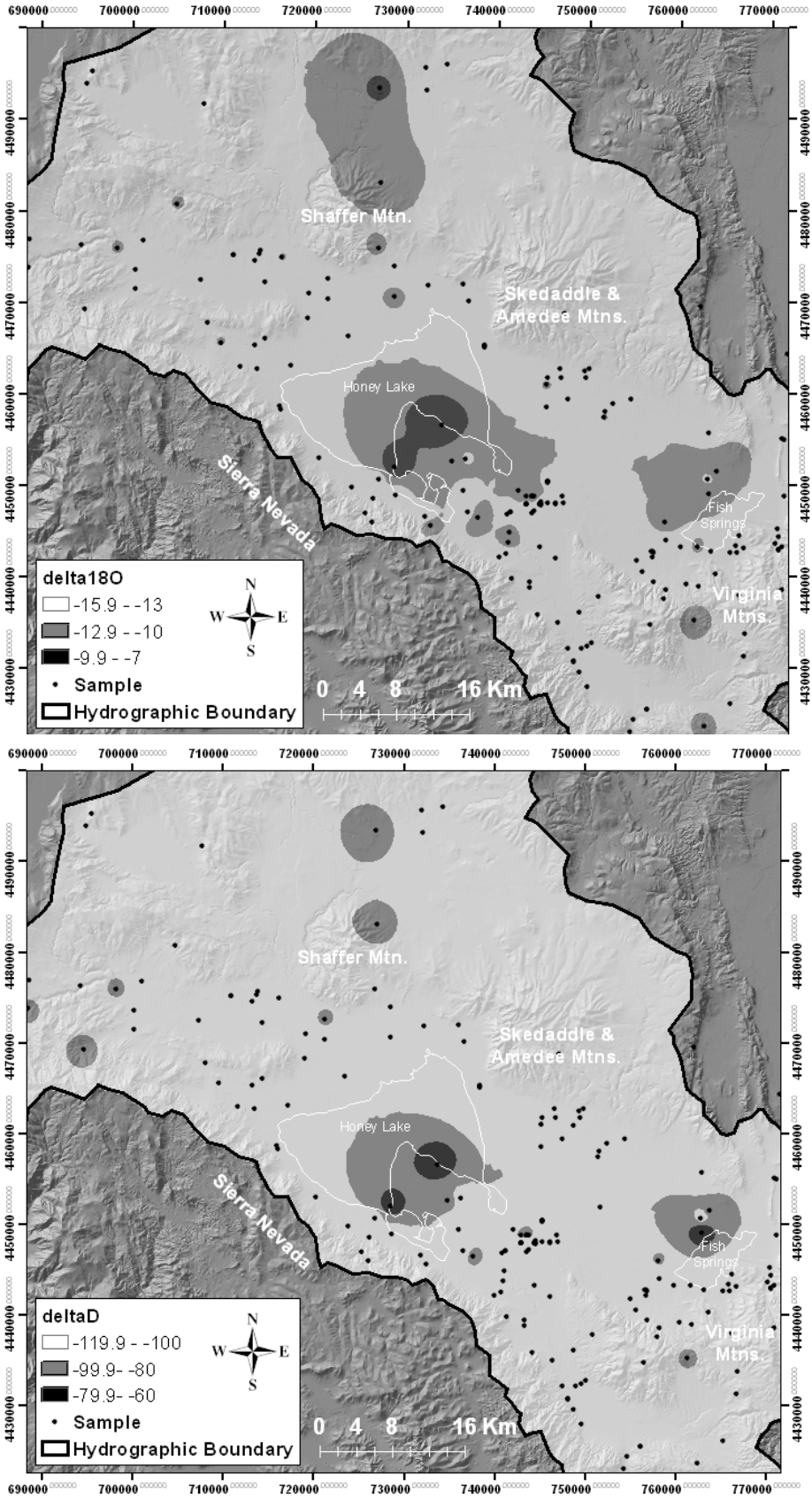


Figure 17. Contour map of $\delta^{18}O$ (top) and δD values (bottom). Both become more enriched down gradient.

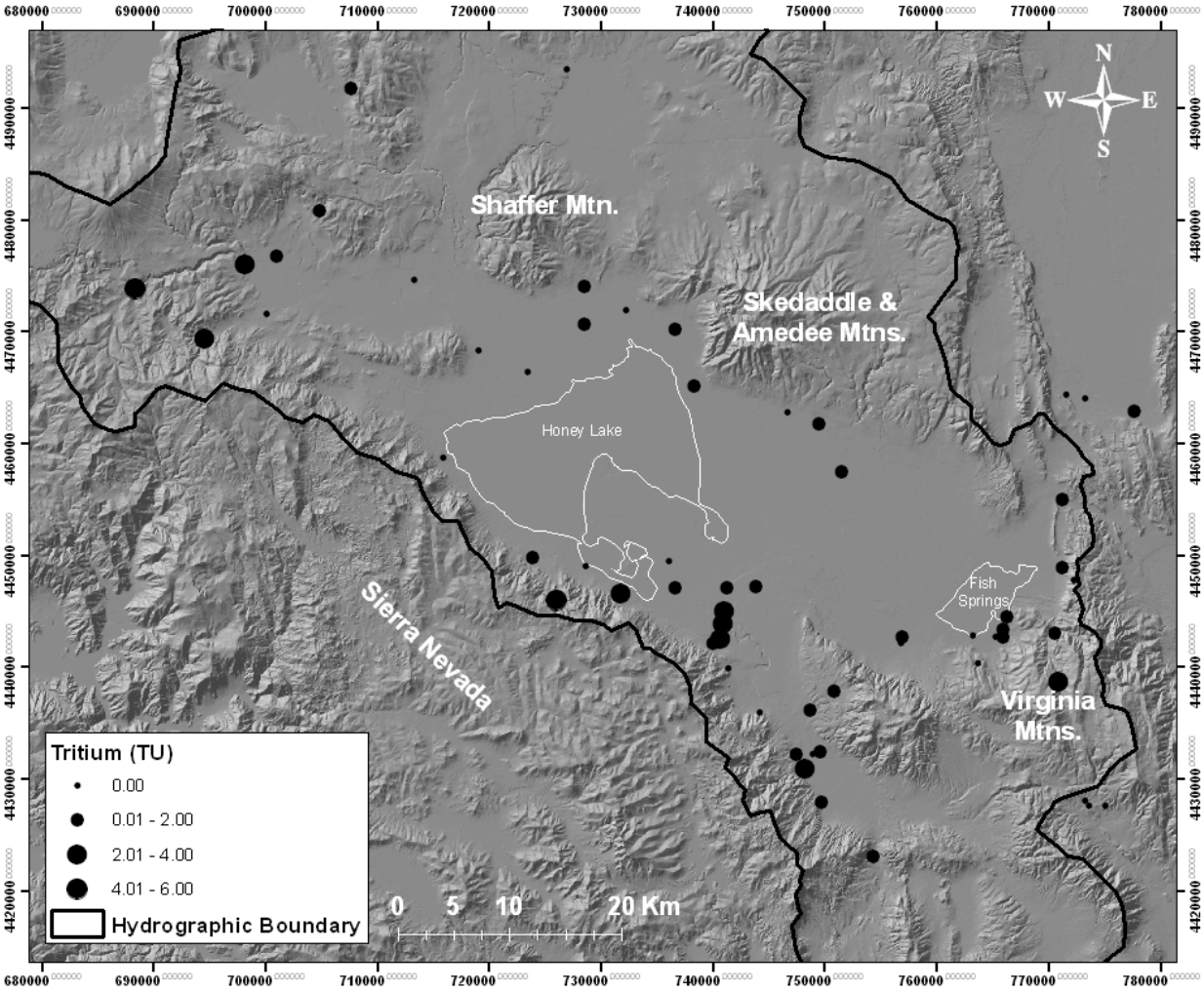


Figure 18. Tritium concentrations throughout Honey Lake Basin. The presence of ^{3}H in groundwater indicates some component of post-1952 recharge. Concentrations are generally highest in areas of recharge (highlands) and decrease down gradient.

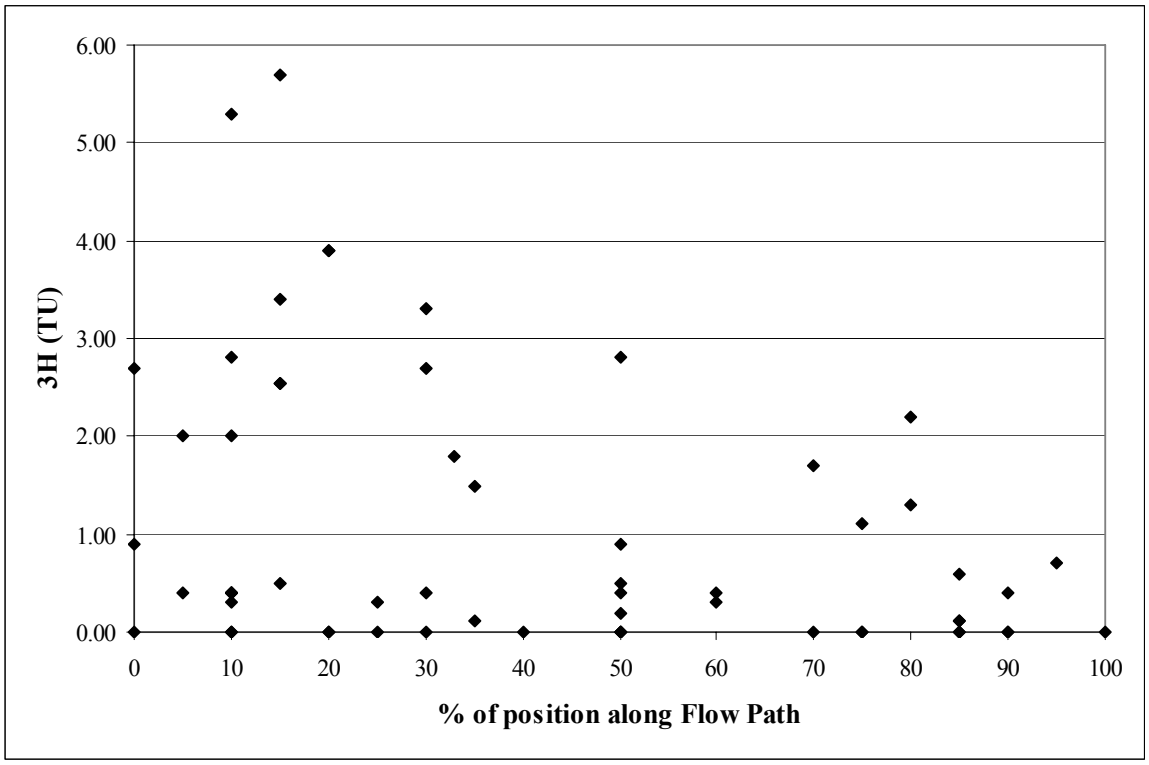


Figure 19. Tritium values in Honey Lake Basin groundwaters according to the sample's position along the flow path. Values decrease, and thus post-1952 recharge decreases, down gradient toward the end of the flow paths.

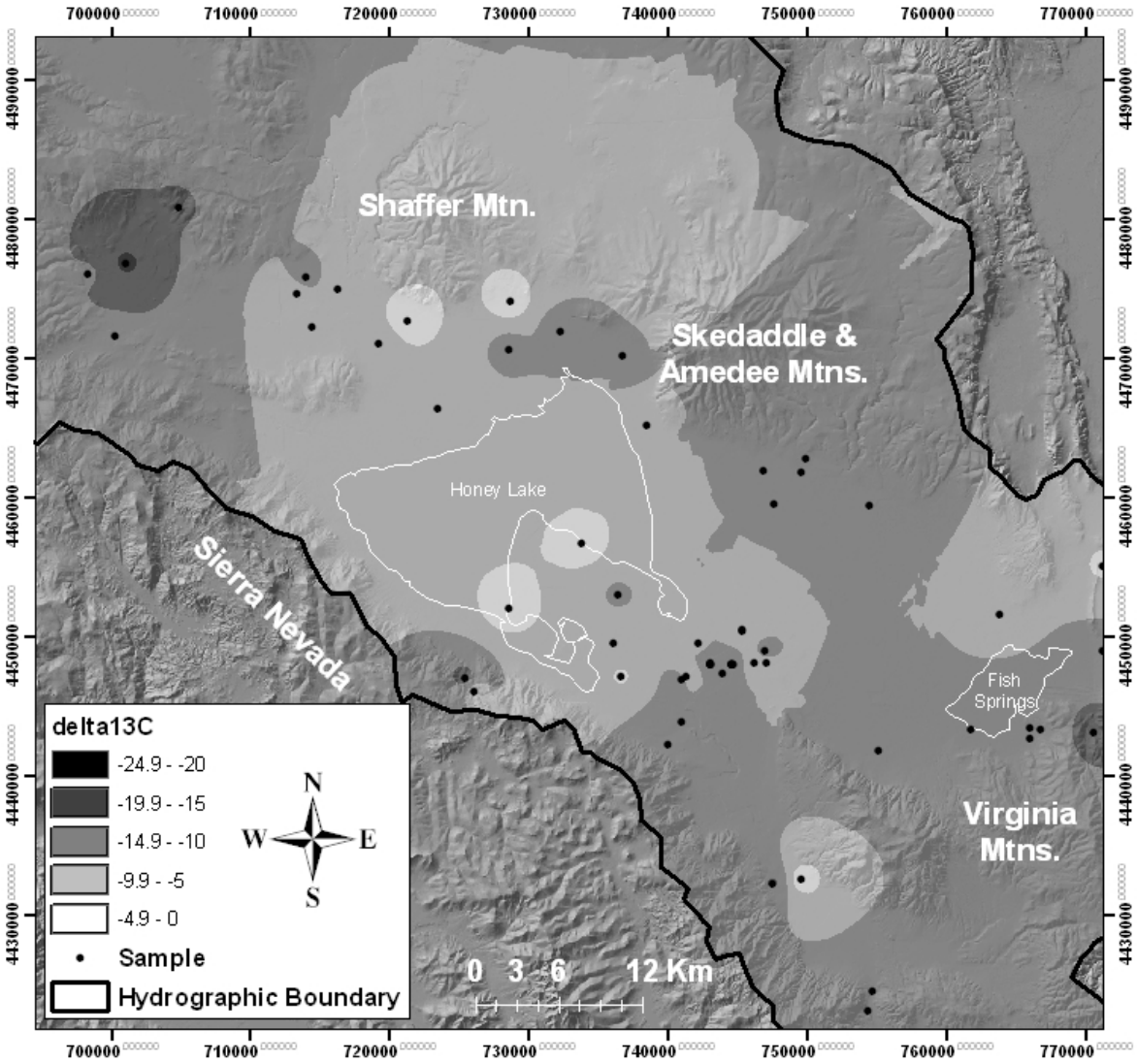


Figure 20. Contour map of groundwater carbon-13 values, which become more enriched toward the basin floor.

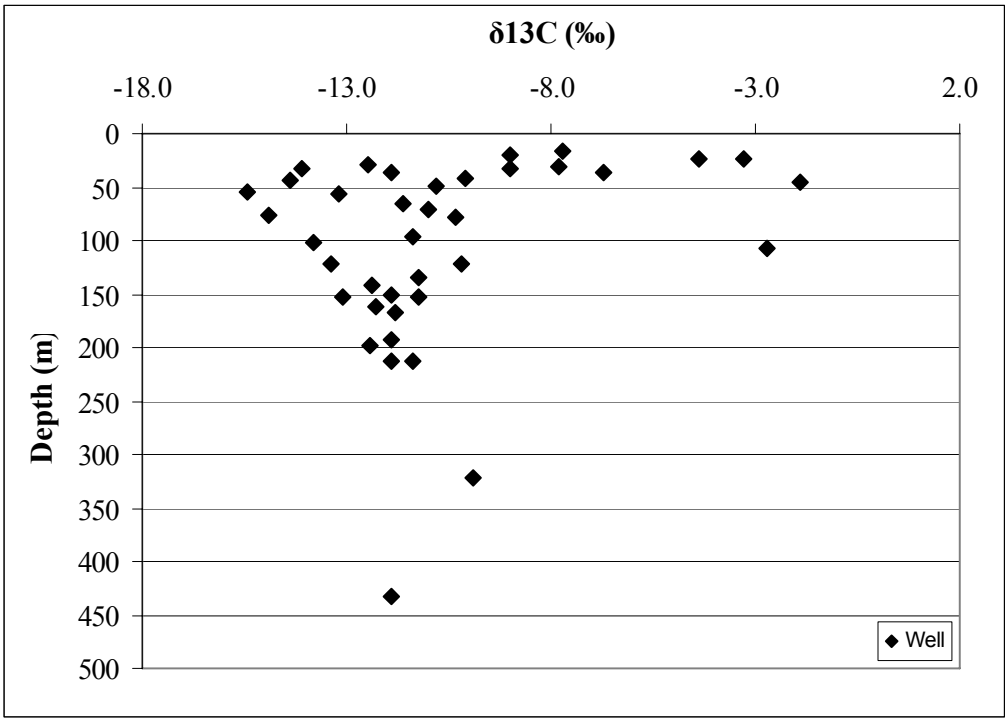


Figure 21. Carbon-13 variations with depth. Values become less variable with depth and generally range between -14 and -10‰.

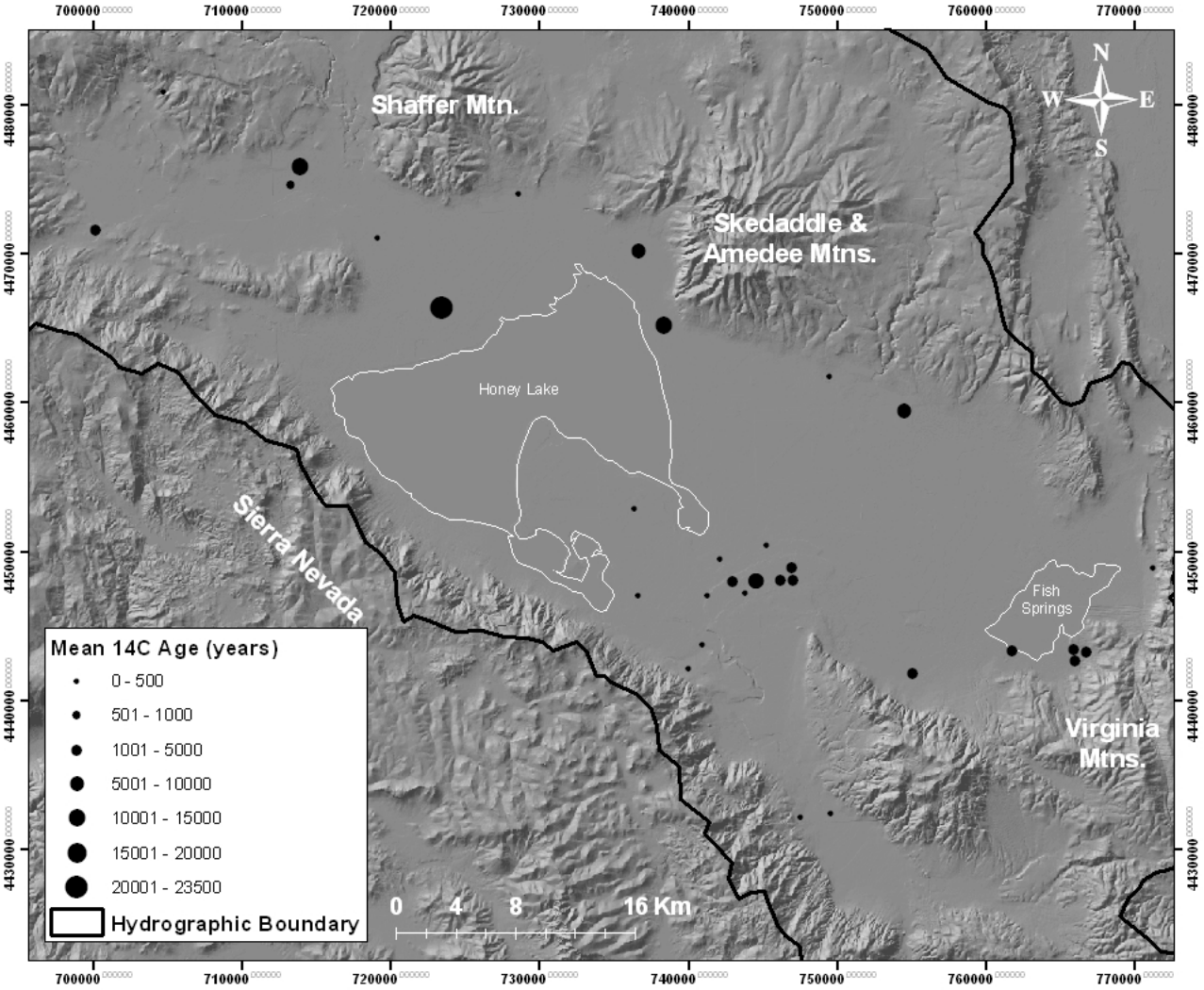


Figure 22. Mean ^{14}C ages for Honey Lake Basin groundwaters. Deep groundwaters on the basin floor show much older ages than highland and shallow basin floor groundwaters.

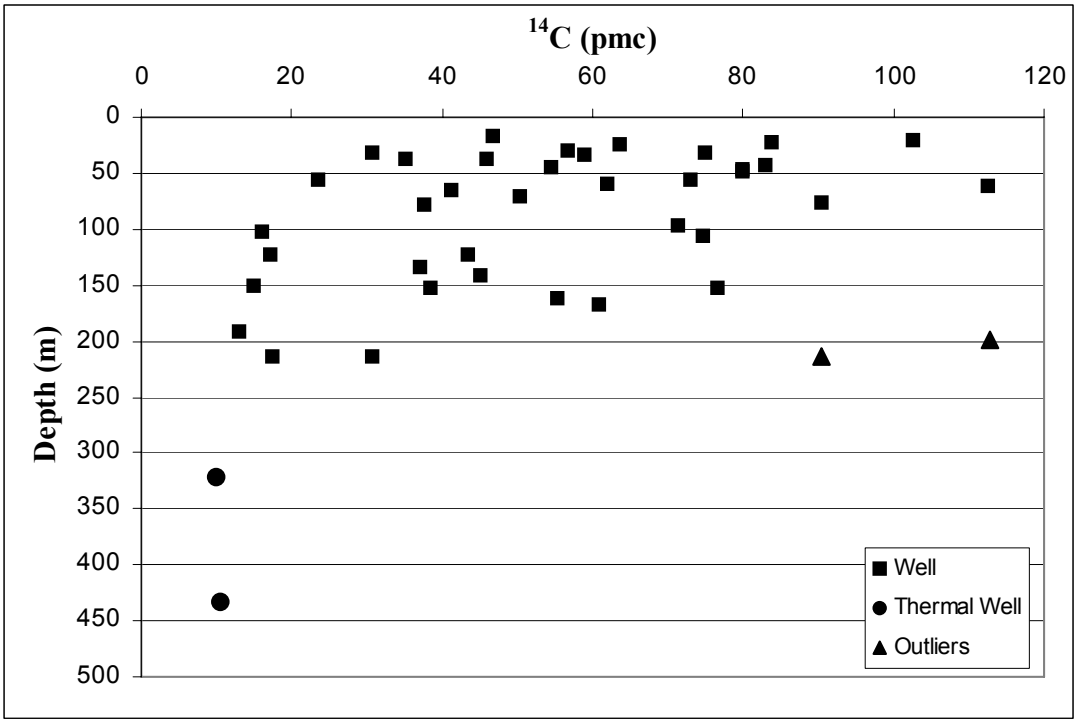


Figure 24. Carbon-14 variations with depth. Groundwaters become more depleted in ^{14}C with depth, indicating older waters. Deep wells with high ^{14}C pmc (outliers) have large perforation intervals that span shallow and deep aquifers and therefore do not reflect accurate measurements for the well bottom.

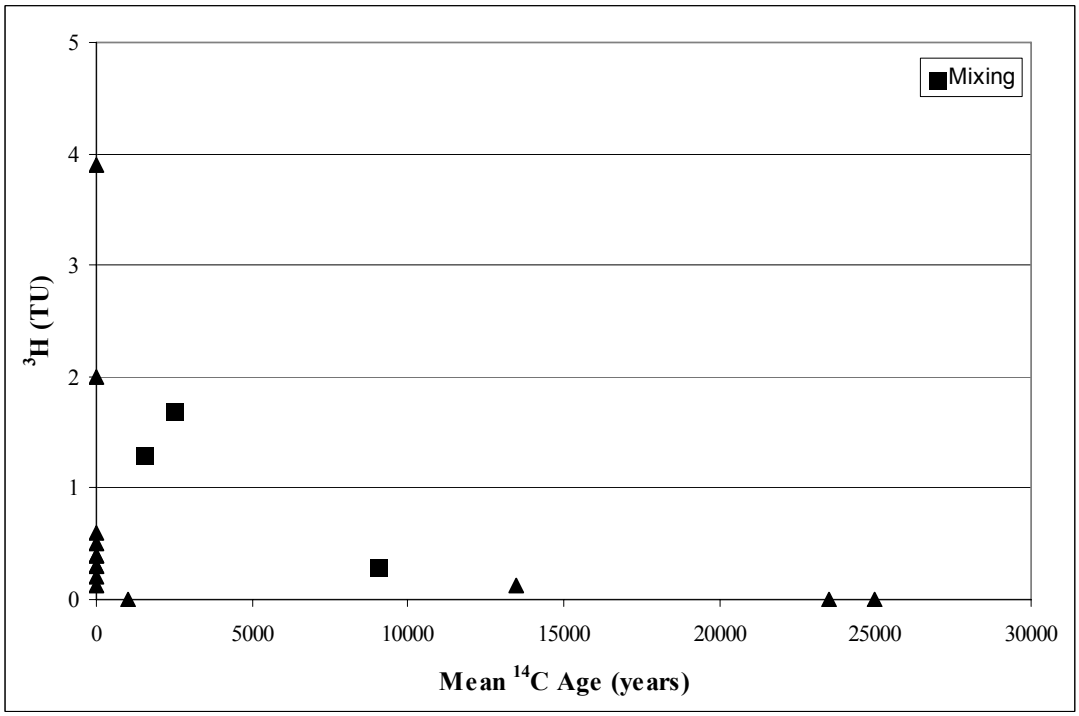


Figure 23. Mean ^{14}C ages vs. ^{3}H concentrations. This graph shows that little mixing occurs between groundwaters recharged by post-1952 precipitation and old groundwaters found in the center of the Basin.

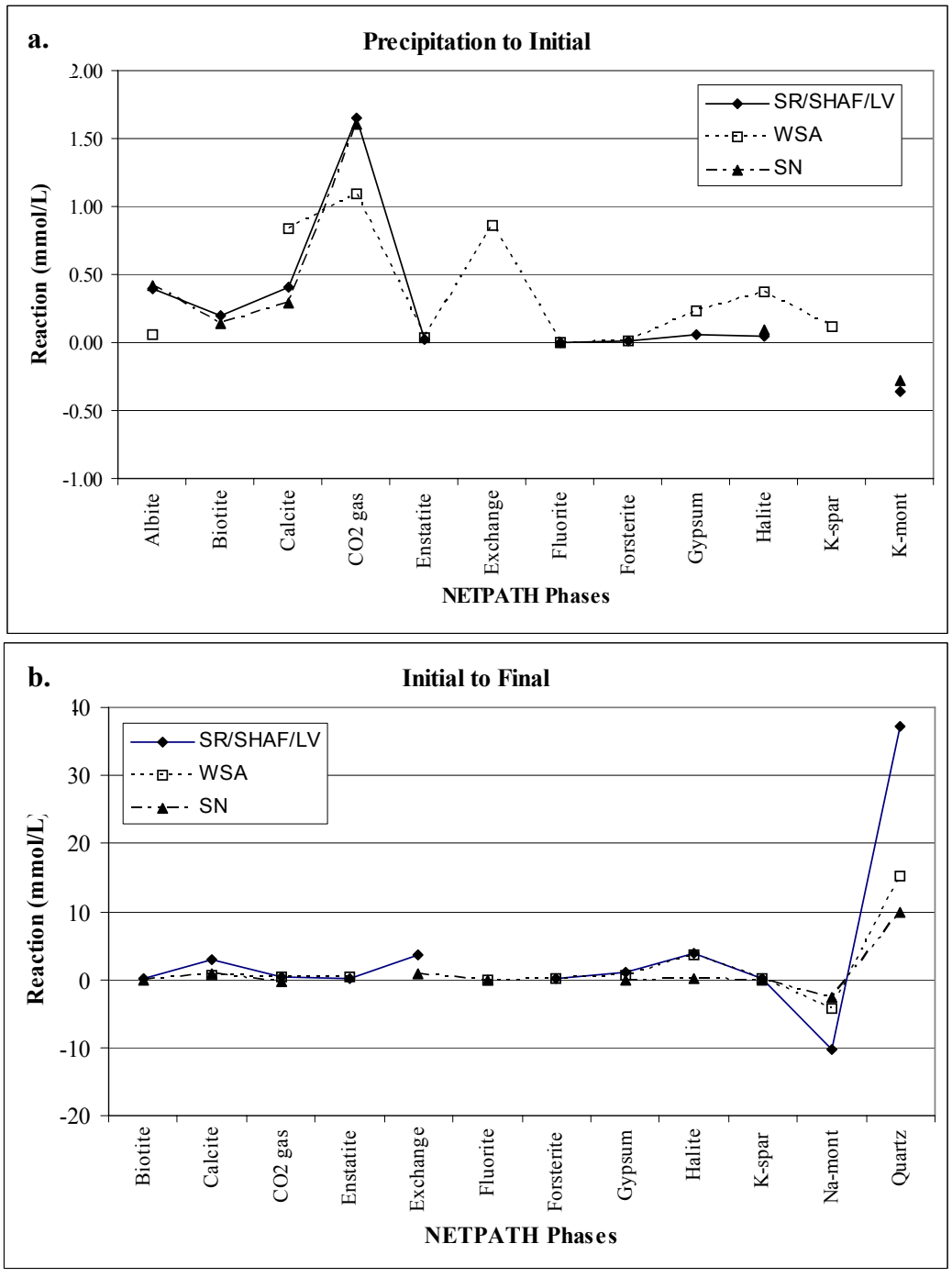
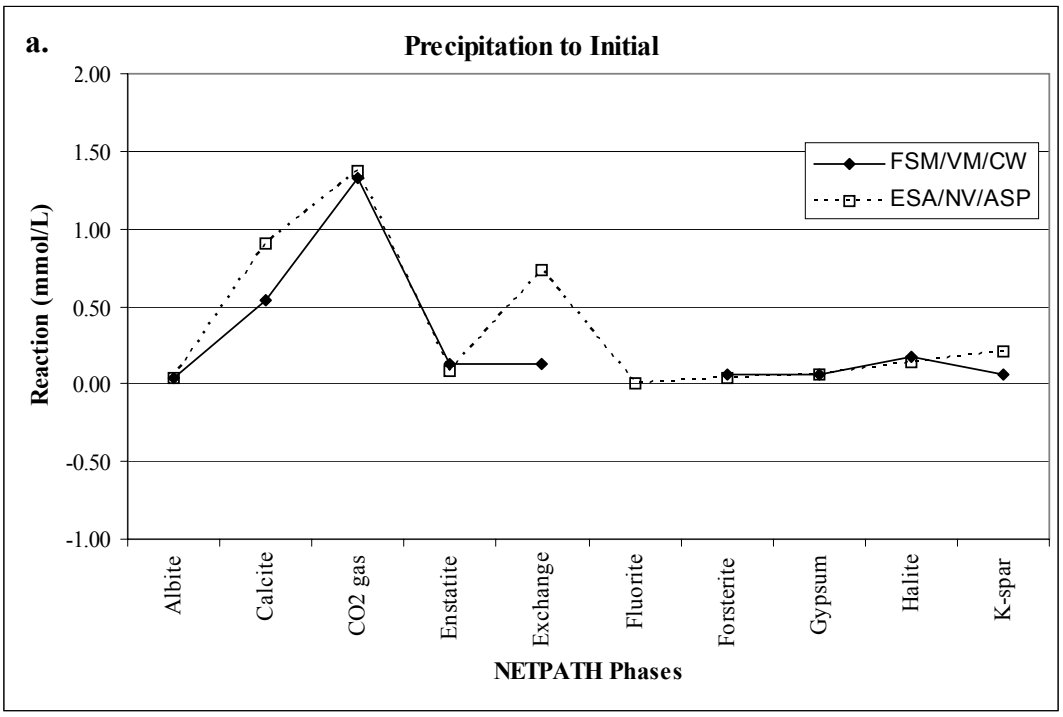


Figure 25. NETPATH geochemical evolution models for eastern Honey Lake Basin flow paths, as modeled from (a) precipitation to initial water and from (b) initial to final waters. Positive values represent dissolution and negative values represent precipitation.



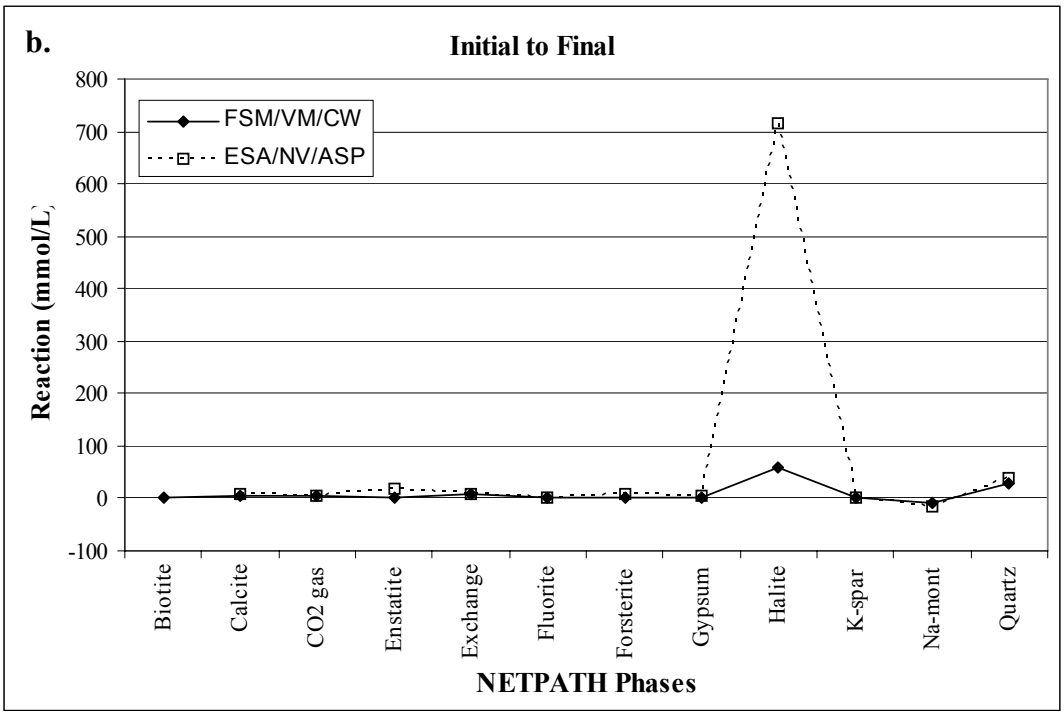


Figure 26. NETPATH geochemical evolution models for western Honey Lake Basin flow paths, as modeled from (a) precipitation to initial water and from (b) initial to final waters Positive values represent dissolution and negative values represent precipitation.

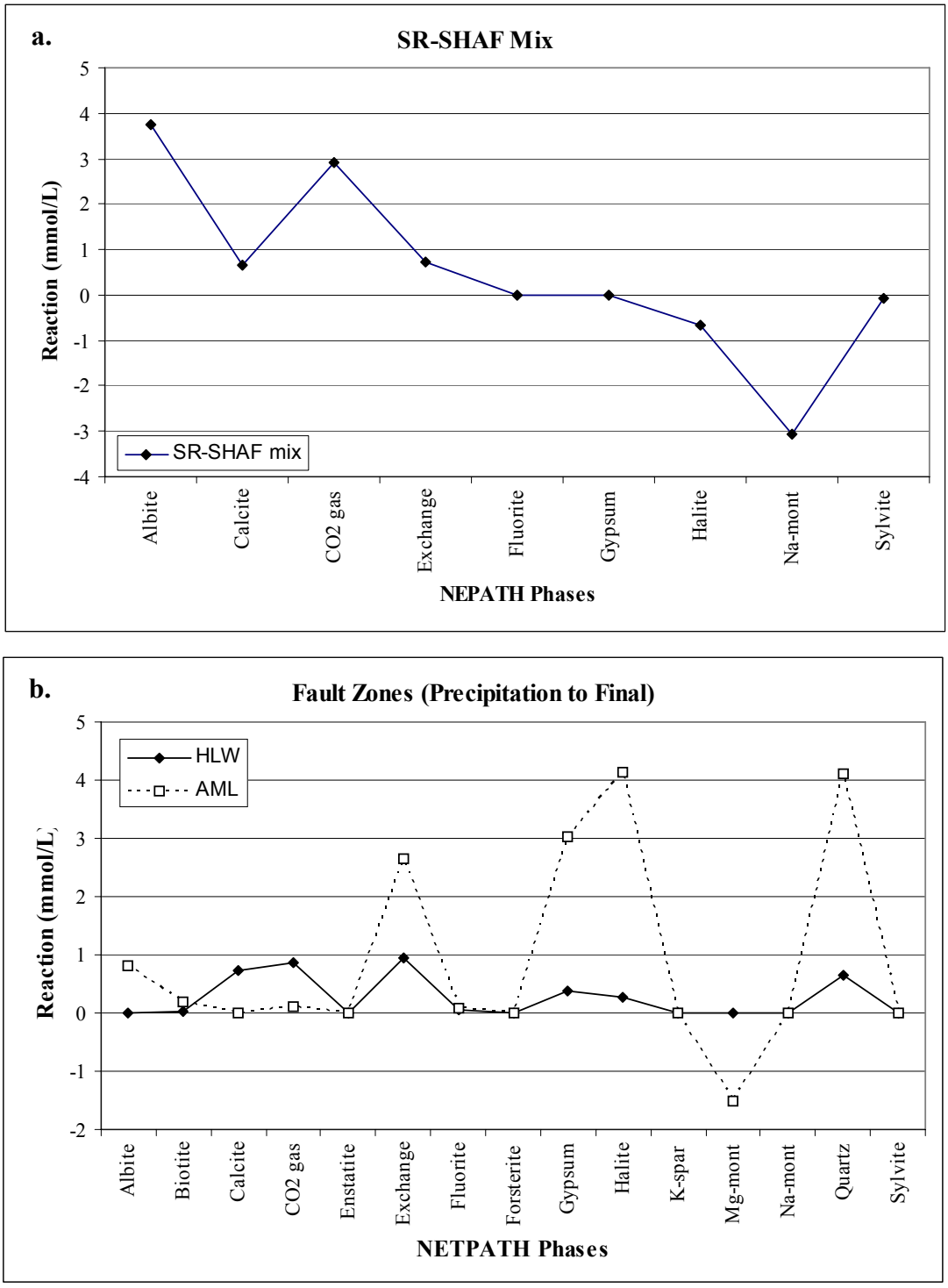


Figure 27. NETPATH geochemical evolution models for (a) groundwater mixing at the end of the Susan River and Shaffer Mountain flow paths and (b) fault zone thermal waters. Positive values represent dissolution and negative values represent precipitation.

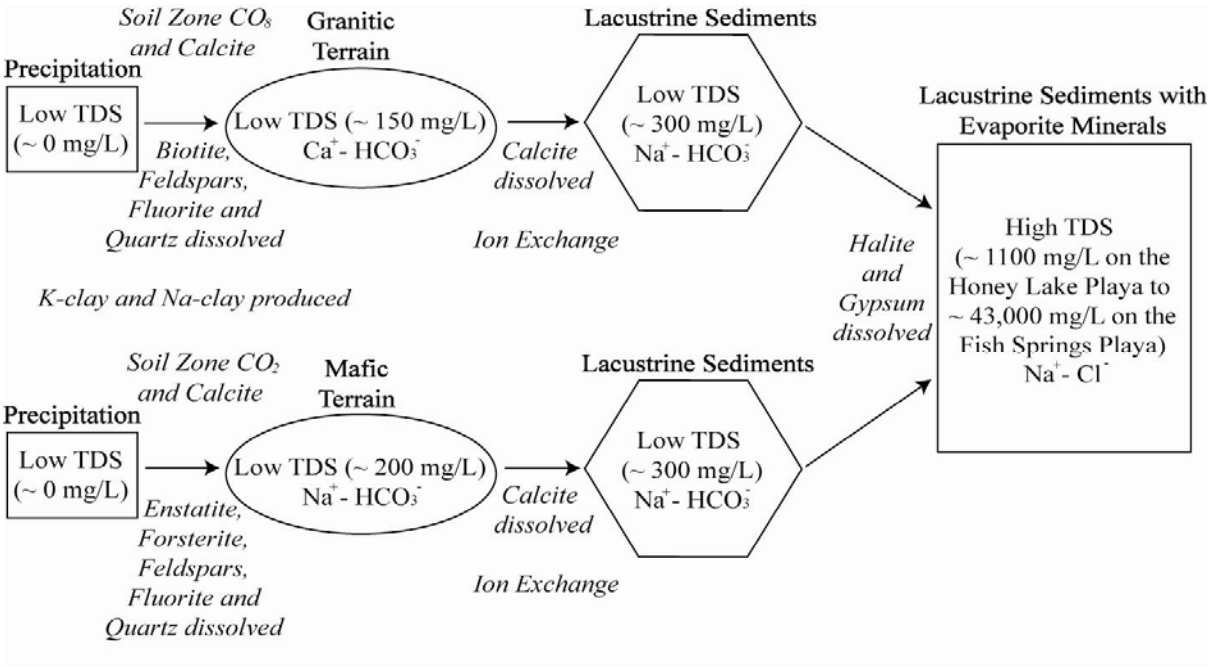


Figure 28. Summary of flow path geochemical evolution as groundwater flows through (top) granitic terrain to lacustrine sediments with evaporite minerals and (bottom) mafic terrain to lacustrine sediments with evaporite minerals.

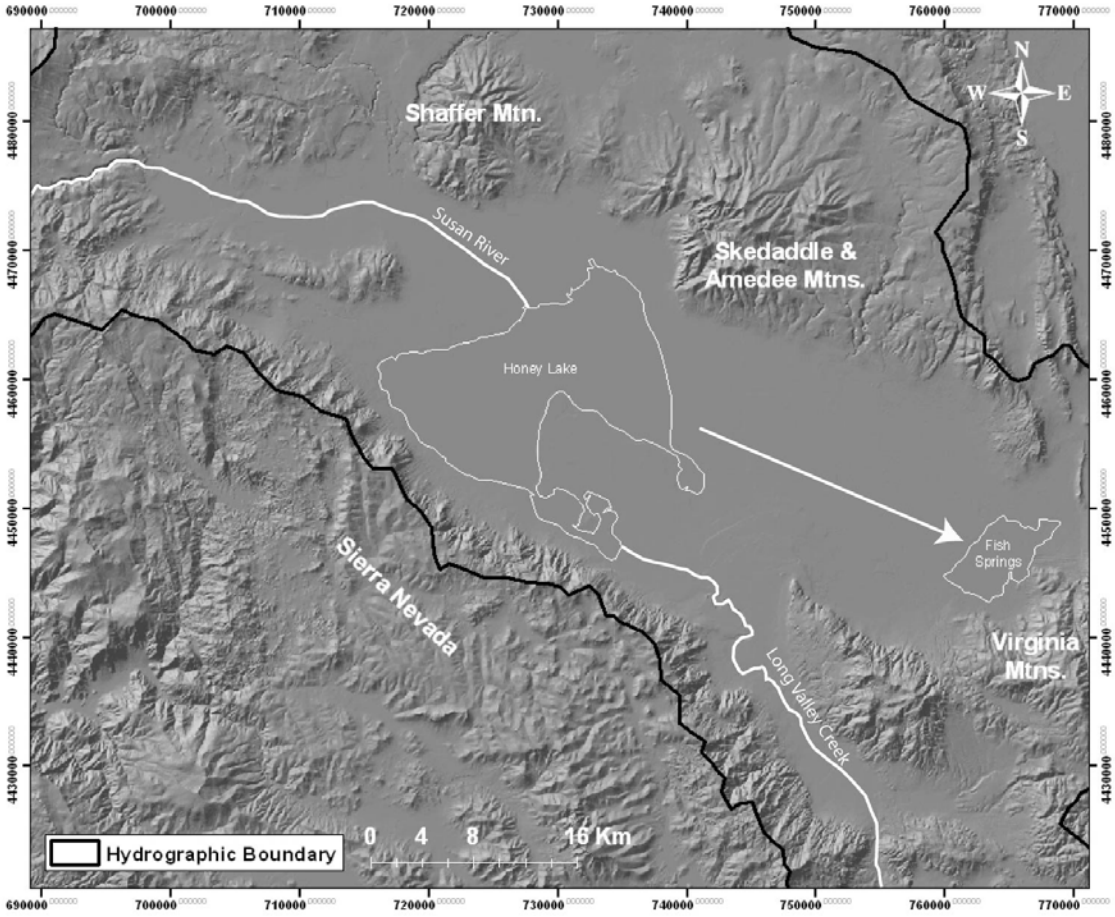


Figure 29. Post Lahontan episodic flooding of Honey Lake Playa flushes solutes east, to Fish Springs Playa.

Table 1. Total stream flow into Honey Lake Basin. Data from Rockwell (1993), table modified from Webber (1996).

		Mean Annual Measurements		
	Name	**ft^3/sec**	**acre-ft/yr**	**% Total**
Susan River Area	Cascade Range and Intervening Area	28.50	20,639	9.09
	Balls Canyon Creek	26.00	18,828	8.29
	Gold Run Creek	6.10	4,417	1.94
	Hills Creek	2.20	1,593	0.7
	Lassen Creek	1.40	1,014	0.45
	Petes Creek	11.00	7,966	3.51
	Piute Creek	4.70	3,404	1.5
	Shaffer Creek	0.22	159	0.07
	Susan River	94.70	68,578	30.19
	Willow Creek near Susanville	34.70	25,128	11.06
	Total	**209.52**	**151,726**	**66.8**
Sierra Nevada Area	Diamond Mtns Intervening	28.50	20,639	9.09
	Bankhead Creek	0.98	710	0.31
	Baxter Creek	2.30	1,666	0.73
	Elysian Creek	4.90	3,548	1.56
	Hallet Creek	0.55	398	0.18
	McDermott Creek	1.50	1,086	0.48
	Mill Creek	2.80	2,028	0.89
	Parker Creek	0.86	623	0.27
	Sloss Creek	0.59	427	0.19
	Total	**42.98**	**31,125**	**13.7**
Long Valley Creek Area	Long Valley Creek and Intervening Area	24.00	17,380	7.65
	Long Valley Creek	11.00	7,966	3.51
	Willow Creek	2.90	2,100	0.92
	Total	**37.90**	**27,446**	**12.08**
West Skedaddle Mtn Area	Skedaddle Creek-West	3.45	2,498	1.1
	Spencer Creek	0.53	384	0.17
	Total	**3.98**	**2,882**	**1.27**
Fish Springs Playa Area	Virginia & Fort Sage Mtns and Intervening Area	3.30	2,390	1.05
	Shaffer Mtn to Neversweat and Intervening Area	8.20	5,938	2.61
	Antoinette Creek	0.04	29	0.01
	Butler Creek	0.04	29	0.01
	Cottonwood Creek	2.20	1,593	0.7
	Fish Springs Creek	0.43	311	0.14
	Fort Sage Creek	0.61	442	0.19
	Gasperoni Creek	0.08	58	0.03
	Milne Creek	0.27	196	0.09
	Mullen Creek	0.15	109	0.05
	Rock Springs Creek	0.29	210	0.09
	Skedaddle Creek-East	3.45	2,498	1.1
	Willow Springs Creek	0.22	159	0.07
	Total	**19.28**	**13,962**	**6.14**
Total Stream Flow Into Honey Lake Basin		**313.66**	**227,141**	**100**

Table 2. Median values for the end members of the Honey Lake Basin flow paths, arranged by chemical and physical flow paths. * Indicates estimated numbers. † Indicates the physical flow paths that are later modeled using NETPATH.

Chemical Flow Path	Physical Flow Path		n (# of samples)	Temp (°C)	pH	TDS (mg/L)	Cations (meq/L)				Anions (meq/L)				SiO_2 (mg/L)	Balance Error %	$\delta^{13}C$ (‰)
							Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	HCO_3^{-}	SO_4^{2-}	Cl^{-}	F^{-}			
	Precipitation		1	0.0	5.7		0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00		0.0	
LV/SHAF/SR	SR†	Beginning	2	15.3	8.01	119.00	0.93	0.66	0.44	0.07	2.05	0.10	0.05	0.00	28.1	-2.8	-15.3
		Middle	10	17.1	7.81	311.71	0.95	0.55	2.96	0.10	2.44	1.23	0.70	0.06	47.0	-1.5	-14.3
		End	9	14.6	7.90	770.6	1.54	1.18	8.71	0.23	5.24	2.45	4.03	0.03	47.8	-2.2	-7.2
		Δ					0.61	0.53	8.27	0.16	3.19	2.35	3.98	0.03	19.7		
	SHAF	Beginning	6	20.6	8.07		0.51	0.53	0.92	0.07	1.83	0.09	0.11	0.00	30.4	-0.1	-15.1
		End	3	23.3	8.09	340.0	0.89	0.49	3.69	0.19	3.67	1.00	0.55	0.01	36.8	-0.20	-1.9
		Δ					0.38	-0.04	2.77	0.12	1.84	0.92	0.44	0.00	6.4		
	SR & SHAF Mix End†		4	14.0	8.50	654.9	1.06	0.82	9.53	0.13	8.02	1.68	1.37	0.03	43.2	-1.3	-11.9
	LV	Beginning	11	17.2	7.59	176.2	0.93	0.49	0.94	0.06	1.99	0.15	0.14	0.03	23.6	1.3	-15.4
		Middle	29	17.6	7.67	312.1	1.61	0.99	1.98	0.13	3.11	0.92	0.37	0.02	45.7	1.4	-11.3
		End	10	15.4	7.74	619.5	2.84	1.34	4.82	0.28	2.68	2.03	4.24	0.02	54.1	1.5	-10.1
		Δ					1.91	0.86	3.88	0.22	0.69	1.88	4.11	-0.01	30.6		
SN	SN†	Beginning	7	17.5	6.93	129.7	0.91	0.41	0.52	0.04	1.58	0.32	0.10	0.00	37.1	-4.4	-16.8
		End	18	16.5	7.59	186.8	1.04	0.51	1.35	0.08	2.39	0.28	0.21	0.01	37.3	-0.6	~ -10*
		Δ					0.13	0.10	0.83	0.04	0.82	-0.03	0.11	0.01	0.2		
WSA	WSA†	Beginning	8	22.1	8.31	193.9	0.44	0.13	2.11	0.12	1.97	0.46	0.37	0.01	32.9	-0.6	-10.3
		End	4	15.4	7.74	619.5	2.84	1.34	4.82	0.28	2.68	2.03	4.24	0.02	54.1	1.5	-10.1
		Δ					2.40	1.22	2.71	0.16	0.71	1.57	3.87	0.01	21.2		
ASP/NV/ESA	ESA	Beginning	7	22.1	8.32	274.5	0.37	0.20	2.53	0.12	2.24	0.40	0.42	0.01	38.1	-2.2	-12.7
		Middle	5	15.4	8.23	496.1	1.80	1.23	3.98	0.20	4.85	0.62	1.34	0.05	54.0	2.2	~ -12*
		End	11	13.5	8.01	11973	8.60	11.02	188.44	1.08	14.32	27.44	142.00	0.14	21.1	6.4	-6.4
		Δ					8.24	10.82	185.91	0.96	12.08	27.04	141.59	0.13	-17.0		
	NV†	Beginning	1	18.8	7.88	199.8	0.49	0.33	1.63	0.21	2.25	0.13	0.14	0.01	51.0	1.4	~ -15*
		Middle	2	15.3	8.26	660.2	0.78	0.33	5.76	0.24	4.29	1.15	1.55	0.02		-2.5	-11.2
		End	1	12.4	7.09	42700	7.49	67.48	700.35	2.40	15.57	7.29	685.50	0.02	18.0	4.7	~ -10*
		Δ					7.00	67.15	698.72	2.20	13.32	7.16	685.36	0.02	-33.0		
	ASP	Beginning	4	21.0	8.23	2403.0	0.95	1.17	31.41	0.30	14.55	5.84	11.74	0.14	~25*	2.3	-4.5
		End	2	11.8	7.32	42700	4.64	36.43	448.71	2.61	17.71	25.51	423.38	0.23	18.0	2.7	-6.4
		Δ					3.68	35.26	417.30	2.31	3.16	19.67	411.63	0.09	-7.0		

Table 2 (continued). Median values for the end members of the Honey Lake Basin flow paths, arranged by chemical and physical flow paths. * Indicates estimated numbers. † Indicates the physical flow paths that are later modeled using NETPATH.

Chemical Flow Path	Physical Flow Path		n (# of samples)	Temp (°C)	pH	TDS (mg/L)	Cations (meq/L)				Anions (meq/L)				SiO2 (mg/L)	Balance Error %	$\delta^{13}C$ (‰)
							Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	HCO_3^{-}	SO_4^{2-}	Cl^{-}	F^{-}			
	Precipitation		1	0.0	5.7		0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00		0.0	
CW/VM/FSM	FSM†	Beginning	2	15.0	7.40	156.6	0.94	0.49	0.48	0.06	1.72	0.12	0.18		~30*	-1.2	~ -15*
		Middle	10	16.9	8.23	370.9	0.92	0.45	3.62	0.12	1.93	2.50	0.45	0.05	22.1	-3.1	-14.1
		End	3	15.0	8.12	4632	2.43	2.84	68.32	0.97	11.34	4.55	57.66	0.02	15.3	0.4	~ -10*
		Δ					1.49	2.35	67.84	0.91	9.61	4.43	57.48		-14.7		
	VM	Beginning	3	14.7	7.32	166.6	0.91	0.47	0.64	0.06	1.72	0.12	0.18		~25*	1.7	~ -15*
		Middle	9	19.8	8.16	222.2	0.38	0.20	2.54	0.17	2.39	0.32	0.44	0.01	34.2	-1.1	-11.9
		End	2	14.7	8.34	4614.5	2.17	3.15	65.69	0.96	6.99	6.79	57.42	0.05	12.7	-1.4	~ -10*
		Δ					1.25	2.67	65.04	0.90	5.27	6.67	57.24		-12.3		
	CW	Beginning	4	15.0	7.49	177.3	1.10	0.65	0.59	0.13	2.19	0.13	0.14	0.01	21.7	-0.8	-19.0
		End	2	14.0	7.68	21628	4.09	33.93	353.60	1.34	10.25	4.05	343.79	0.02	18.0	4.6	~ -10*
		Δ					2.99	33.27	353.01	1.21	8.06	3.92	343.64	0.01	-3.7		
HLW	HWL†		4	41.3	8.43		0.40	0.09	2.17	0.03	1.73	0.67	0.26	0.10	45.4	-1.7	-12.8
AML	AML†		4	82.8	8.64	820.8	0.90	0.02	10.23	0.16	0.60	6.03	4.13	0.18	85.7	1.0	-11.6

Table 3. Data for the two fault zone flow paths which used in GEOTHERM. * Indicates an estimated number.

Flow Path	Name	Sample #	Temp (°C)	pH	$Si0_2$ (mg/L)	Na^{+} (ppm)	K^{+} (ppm)	Ca^{2+} (ppm)	Mg^{2+} (ppm)
HLW	Mormon Church Heating	W21	52.0	7.7	62.0	56.00	0.90	9.50	0.60
	Roosevelt Swimming Pool	RE1	35.8	8	53.0	20.00	3.80	19.00	3.40
	Rose 27	H4132	38.0	8.9	21.1*	60.70	0.30	0.71	0.06
	Zamboni Hot Spring	H4134	40.0	9.1	21.1	63.00	0.80	2.40	0.10
AML	Amedee Hot Springs	W40	103.0	8.6	95.0	238.00	6.00	16.00	0.50
	Johnston 1	V209	67.0	8.8	88.6	172.00	2.90	13.50	0.00
	Norcal2	V211	99.0	8.9	106.0	254.00	7.00	17.60	0.00
	HL Power Plant	H4135	63.0	8.3	53.0	277.00	11.70	25.30	0.10

Table 4. GEOTHERM results. All geothermometers in grey were eliminated based on the criteria listed. * Temperatures less than the measured reservoir temperature were automatically eliminated. A geothermal gradient of 34°C/Km was used to determine circulation depths (Nathenson and Guffanti, 1988). [+] Mayo, written personal communication (2005). [#] Fournier and Rowe (1977). ^ Fournier and Truesdell (1973). [%] Fournier (1979).

Flow Path	Name	Sample #	Temp (°C)	Silica Conductive (good for reservoir temps <100°C) [+]	Silica Adiabatic (good for reservoir temps >100°C)[+]	Silica Chalcedony (good for reservoir temps <150-225°C>)[+]	Silica Cristobalite (good for reservoir temps <150-225°C>)[+]	Silica Amorphous (good for reservoir temps <150-225°C>)[+#]	Na-K (good for reservoir temps >100-150°C)^ [%]	Na-K-Ca (1/3)[+]^ (good for -ß and temps >100°C)	Na-K-Ca (4/3)[+]^ (good for +ß and temps >100°C)	Average GEO-THERM Temp (°C)	Depth of Circul-ation (km)
HLW	Mormon Church Heating	W21	52.0	112.00	111.00	83.00	62.00	-5.00*	74.00	90.00	36.00*	112	3.00
	Roosevelt Swimming Pool	RE1	35.8	105.00	105.00	75.00	54.00	-12.00*	227.00	177.00	53.00	105	2.79
	Rose 27	H4132	38.0	65.00	71.00	33.00*	16.00*	-44.00*	-31.00*	9.00*	0.00*	65	1.62
	Zamboni Hot Spring	H4134	40.0	65.00	71.00	33.00	16.00*	-44.00*	64.00*	91.00	58.00	65	1.62
AML	Amedee Hot Springs	W40	103.0	140.00	135.00	114.00	90.00*	20.00*	94.00*	122.00	97.00*	117	3.15
	Johnston 1	V209	67.0	131.00	127.00	103.00	80.00	11.00*	76.00	103.00	73.00	131	3.56
	Norcal2	V211	99.0	140.00	135.00	114.00	90.00*	20.00*	99.00	126.00	101.00	140	3.82
	HL Power Plant	H4135	63.0	105.00	150.00	75.00	54.00*	-12.00*	121.00	144.00	113.00	105	2.79

Table 5. Published maximum temperature results based on geothermometers for the Antelope Mountain/Litchfield Fault Zone.

Author	Estimated Groundwater Temp (°C)	Notes
This Investigation	117-133	Silica conductive, silica adiabatic, and Na-K-Ca (1/3) geothermometers
Hardt et. al. (1975)	100-120 or 150-200	Maximum range calculated for mixing with shallow, cool waters
Reed (1978)	140	
Adams (1984)	150-160	Silica geothermometer
Geoproducts Corporation (1984)	110-141	Na-K-Ca, silica chalcedony, and quartz geothermometers

Table 6. Approximate mixing ratios for the groundwater (>17°C) in Honey Lake Basin based on mixing with thermal waters from the Antelope Mountain/Litchfield Fault Zone (123°C average maximum temperature) and Honey Lake/Warm Springs Fault Zone (87°C average maximum temperature).

"Thermal" Component (%)	"Cold" Component (%)	Resulting Temperature (°C)	
		AML	HLW
100	0	123	87
90	10	112.4	80
80	20	101.8	73
70	30	91.2	66
60	40	80.6	59
50	50	70	52
40	60	59.4	45
30	70	48.8	38
20	80	38.2	31
10	90	27.6	24
0	100	17	17

Table 7. Mean ^{14}C age data. $^{+}$ indicates and estimated value.

Flow Path	Sample #	Temp (°C)	pH	HCO_3^- (meq/L)	Activity of HCO_3^-	$\delta^{13}C$ ($^{o}/_{oo}$)	^{14}C (pmc)	^{14}C Age (years) Fonts	^{14}C Age (years) Pearson	^{3}H (TU)
ESA	W32*	24.00	7.70	1.40	0.971	-12.80	21.60	7500		
ESA	V194*	20.60	9.00	3.60	0.953	-12.50	56.80	modern		0.5
FSM	V165*	17.80^{+}	8.25^{+}	1.70	0.968	-14.10	59.00		2500	
LV	V195*	9.10	8.10	3.25	0.958	-11.90	13.10	1100		
LV	V196*	9.00	8.10	3.54	0.956	-11.90	15.00	10000		
LV	V197*	11.30	8.30	3.41	0.956	-13.80	16.10	9500		
LV	V203*	16.90	8.20	3.25^{+}	0.957	-11.40	17.50	9000		
LV	V198*	11.30	8.10	3.25	0.957	-13.20	23.40	6500		
LV	V206*	16.70	8.30	3.25^{+}	0.957	-11.90	30.70	4000		
LV	V178*	18.30	7.40	3.62	0.955	-9.00	30.70	5000		
LV	V180*	18.10	7.70	1.61	0.969	-6.70	35.00	3500		
LV	V199*	10.40	7.83^{+}	3.11^{+}	0.958	-13.10	38.50	2500		
LV	V200*	11.60	7.83^{+}	3.11^{+}	0.958	-12.40	45.20	modern		
LV	V177*	18.90	7.30	7.38	0.938	-11.90	46.00	1500		
LV	V202*	9.40	7.60	3.11^{+}	0.959	-11.00	50.30	500		
LV	V207*	18.30	8.10	3.11^{+}	0.958	-12.30	55.40	modern		0.2
LV	V205*	17.10	8.50	3.49	0.955	-11.80	60.90	modern		
LV	H4115*	21.85	8.46	3.56	0.955	-3.30	63.60	modern		0.4
LV	V201*	13.60	7.70	3.11^{+}	0.958	-11.40	71.40	modern		
LV	H4130*	18.00	8.42	1.79	0.967	-15.43	73.13		modern	0.3
LV	V174*	22.20	7.40	2.88^{+}	0.959	-2.70	74.60	modern	modern	0.9
LV	V192*	14.80	8.10	4.90^{+}	0.948	-7.80	75.00	modern		
LV	V141*	18.20	8.60	11.31	0.924	-10.80	79.80	modern		
LV	V168*	20.90	7.30	3.02^{+}	0.958	-4.40	83.80	modern	modern	0.3
LV	W127*	11.25	7.31	3.02	0.959	-14.91	90.50		modern	4.1
LV	V183*	18.60	8.20	3.34^{+}	0.956	-9.00	102.60	modern		
LV	H4084*	21.00	7.35	2.60	0.961	-12.45	112.84	modern		3.9
NV	W102*	14.90	8.25	3.66	-	-11.23	76.70	modern	modern	
SM	H4106*	17.10	7.82	1.80	0.967	-15.10	72.74		modern	
SM	H4092*	18.70	7.76	3.19	0.957	-1.90	79.90	modern		0.6
SR	W43*	14.10	6.90	5.76	0.945	-7.19	2.80	25500	21500	0
SR	H4096*	17.10	7.92	2.35	0.963	-7.70	46.70	1000		0.0
SR	H4114*	17.37	7.99	2.90	0.959	-14.40	54.50		2500	0.0
SR	H4097*	17.40	7.92	2.04	0.965	-15.28	74.72		modern	0.4
SR	V111*	15.60	7.50	7.54	0.938	-10.10	83.00	modern		
SR/AML	V209*	66.95	8.75	0.19	0.985	-11.90	10.60	13000		
VM	V153*	17.70	8.10	1.88	0.967	-11.25	37.00	3000		
VM	H4136*	15.85	8.67	3.04	0.958	-10.32	37.60	2500		1.7
VM	V145*	15.85^{+}	8.67^{+}	1.69	0.968	-11.60	41.30	1500		
VM	W93*	19.17	8.30	2.55	0.961	-13.40	43.48	1500		1.4
WSA	H4116*	21.85	8.25	2.06	0.965	-10.20	17.10	9000		0.3
WSA/AML	V211*	98.90	8.90	1.00	0.964	-9.90	10.00	13500		0.2

Table 8. The constraints and phases used in each NEPTPATH model.

		SR for SR/SHAF/LV		**SR-SHAF**	**SN**		**WSA**		**NV** for ESA/NV/ASP		**FSM** for FSM/VM/CW		**HLW**	**AML**
Constraint (used in ALL models)	**Phase**	Precip. to Initial	Initial and Thermal Mix to Final	Mix	Precip. to Initial	Initial to Final	Precip. to Initial	Initial and Thermal Mix to Final	Precip. to Initial	Initial to Final	Precip. to Initial	Initial to Final	Precip. to Median Chem.	Precip. to Median Chem.
Sulfur	Albite	x		x	x		x		x		x		x	x
Calcium	Biotite	x	x		x	x						x	x	x
Magnesium	Calcite	x	x	x	x	x	x	x	x	x	x	x	x	x
Sodium	CO_2 gas	x	x	x	x	x	x	x	x	x	x	x	x	x
Potassium	Enstatite	x	x				x	x	x	x	x	x		
Chloride	Exchange		x	x		x	x	x	x	x	x	x	x	x
Carbon	Fluorite	x	x	x	x	x	x	x	x	x		x	x	x
Silica	Forsterite	x	x				x	x	x	x	x	x		
	Gypsum	x	x	x	x	x	x	x	x	x	x	x	x	x
	Halite	x	x	x	x	x	x	x	x	x	x	x	x	x
	K-spar		x			x	x	x	x	x	x	x	x	
	Mg-mont	x			x									x
	Na-mont		x	x	x	x		x		x		x		
	Quartz		x			x		x		x		x	x	x
	Sylvite			x										

Table 9. NETPATH geochemical evolution model results. Positive numbers represent dissolution and negative numbers represent precipitation. These results are graphed in Figures 24 and 25.

	SR for SR/SHAF/LV		**SR-SHAF**	**SN**		**WSA**		**NV** for ESA/NV/ASP		**FSM** for FSM/VM/CW		**HLW**	**AML**
	Precip. to Initial (mmol/ L)	Initial and Thermal Mix to Final (mmol/L)	Mix (mmol/L)	Precip. to Initial (mmol/ L)	Initial to Final (mmol/ L)	Precip. to Initial (mmol/ L)	Initial and Thermal Mix to Final (mmol/L)	Precip. to Initial (mmol/ L)	Initial to Final (mmol/ L)	Precip. to Initial (mmol/ L)	Initial to Final (mmol/ L)	Precip. to Final (mmol/ L)	Precip. to Final (mmol/ L)
Phase													
Albite	0.40		3.74	0.42		0.06		0.04		0.04			0.80
Biotite	0.20	0.09		0.14	0.03						0.26	0.03	0.18
Calcite	0.41	2.91	0.65	0.30	0.89	0.84	0.56	0.91	9.78	0.54	5.22	0.74	
CO2 gas	1.65	0.49	2.92	1.61	-0.28	1.10	0.35	1.38	5.75	1.33	4.27	0.86	0.10
Enstatite	0.02	0.15				0.03	0.30	0.08	17.54	0.13	0.40		
Exchange		3.62	0.73		0.81	0.86		0.73	9.86	0.13	6.70	0.96	2.65
Fluorite	0.002		0.01	0.002	0.00	0.003	0.001	0.003	0.01		0.01	0.05	0.09
Forsterite	0.01	0.09				0.02	0.15	0.04	8.77	0.06	1.97		
Gypsum	0.05	1.09	-0.001		-0.02	0.23	0.63	0.06	3.74	0.06	2.22	0.37	3.02
Halite	0.05	3.92	-0.66	0.10	0.11	0.37	3.67	0.14	715.91	0.18	57.74	0.26	4.13
K-spar		0.09			0.004	0.12	0.16	0.21	2.30	0.06	0.91	0.01	
Mg-mont	-.37			0.00									-1.52
Na-mont		-10.22	-3.05	-0.28	-2.71		-4.34		-17.10		-9.05		
Quartz		37.16			9.84		15.15		37.78		29.64	0.65	4.10
Sylvite			-0.07										
Mix													
% Initial		0.72	0.44				0.95						
% Thermal		0.28	0.56				0.05						
$\delta^{13}C$													
Observed		-7.19	-11.87		-10.40		-10.10		-10.00		-10.00		
Computed		-7.19	-11.87		-10.00		-10.10		-10.00		-10.00		

APPENDIX A

Table 1a. All Honey Lake Basin sample data.

KEY

- Has solute chemistry data.
- Has isotope data.
- Has both solute chemistry and isotope data.
- Sample included in multiple flow paths.
- Averaged value
- Combined data from different investigations.
- * Sample location included in multiple investigations.
- HCO_3^- calculated from $CaCO_3$ to by dividing by 0.8202
- Calculated, not measured value.
- R=Rose (1997)
- W=Webber (1996)
- V=Varian (1997)
- B=BYU
- H=Henderson

Flow Path	Name	Sample #	Multiple Sample Location Sample #	Sample Date	Zone	Easting	Northing	Easting (converted to zone 10)	Northing (converted to zone 10)	Elevation (m)	Water Source	Depth Interval (ft)	Perf. Interval (ft)	Q (gpm)
Susan River Flow Path (SR)														
SR/SHAF	F. Dewitt Dom.	W4		2/16/67	10	726542.7	4468882.3				well			
SR/SHAF	Ca Fish & Game Irr.	W8		9/10/59	10	728457.7	4471118.6				well			
SR/SHAF	Mapes Ranch Irr.	W9		7/8/58	10	726430.3	4472564.5				well			
SR	McClure Ranch Irr.	W10		8/24/57	10	718243.5	4468464.6				well			
SR	E. Grant Dom.	W12			10	717446.6	4470925.8				well	86		
SR	T. Swickard Dom.	W13			10	716858.6	4472551.6				well	150		
SR	J. Ferre Dom.	W14		6/12/58	10	718558.3	4472628.7				well			
SR/SHAF	B. Piango Irr.	W15			10	721774.6	4473338.8				well	550		
SR	P.E. Milton Dom.	W17		2/16/67	10	700806.3	4470607.7				well			
SR	Ca Conserv. Ctr. Dom.	W18		2/15/67	10	700928.4	4475649.0				well			
SR	Johnston Ranch Dom.	W19			10	704851.5	4474585.5				well	60		
SR	MacDonald Dom.	W20		2/16/67	10	699299.5	4475330.6				well			
SR/HLW	Mormon Church Heating	W21*	RE2	??/06/67	10	699094.1	4474419.9				well			
SR	Fruit Growers Supply Ind.	W22			10	701712.8	4475174.4				well			
SR	Abraham Jensen Irr.	W23		7/10/58	10	702816.7	4475356.6				well			
SR/SHAF	Tanner Ranch Dom.	W41			10	727353.3	4466190.4				well			
SR	Ca Fish & Game Irr.	W42			10	723825.9	4466431.4				well			
SR	Darkin Well	W43*	V130, B678		10	723453.4	4466413.2				well			
SR	Ca Fish & Game Irr.	W44			10	723975.6	4466486.2				well			
SR	Spring S. Roop Mtn.	V39*	R114	4/10/96	10	688595.6	4476986.8				spring			
SR	Cady Spring	V40*	R115	4/10/96	10	694240.3	4476432.1				spring			
SR	Pete's Creek	V84*	R10, B684		10	716208.1	4474987.0				surface			
SR	SE of Standish	V110*	R12	6/20/95	10	721280.1	4470528.1				well	91.3		
SR	Lassen County Well	V111*	R6	6/18/95	10	719153.8	4471095.5				well	140		
SR	Standish	V112*	R7	6/18/95	10	714365.3	4472273.1				well	144	81-140	
SR	Susanville Prison	V114		8/11/95	10	710944.1	4475300.1				well	660	536, 573-603-660	
SR	Susanville Prison	V115		8/11/95	10	710944.1	4475300.1				well	560	380-540	
SR		V118		6/20/95	10	700197.3	4473643.2				well	148	60-144	
SR/AML	Johnston 1	V209*	V210, R38		10	713916.0	4475844.1				geo well	1420	775-1414	
SR	NCCC PA-12	R55		8/11/95	10	713816.2	4475440.6				well	660	185-660	
SR/HLW	Roosevelt Swimming Pool	RE1		7/18/73	10	698211.9	4475618.7				well	90m		
SR	Gold Run Creek	H4081*	V85, R15		10	694585.85	4469367.57			1405.64	surface			
SR	Susan River in Susanville	H4082*	B680, B3991		10	698238.33	4476070.29			1264.68	surface			
SR/SHAF	Fish & Game Well	H4093*	W7, B683		10	728532.0	4470685.4			1211.69	well	525		
SR/SHAF	Susan River at Litchfield	H4094*	V83, R11		10	721235.0	4472749.2			1226.69	surface			
SR	Goni Well	H4095*	W11		10	719029.8	4468338.8			1225.69	well			
SR	NW of Standish	H4096*	V116, R9		10	713299.3	4474681.6			1239.68	well	56		
SR	Plummer Spring	H4097*	V38, R91		10	704802.5	4480897.8			1519.61	spring			
SR	Susan River North of Susanville	H4098*	V86, R14		10	688411.6	4473885.8			1400.64	surface			
SR	Trussell Well	H4099*	W1, B685		10	701001.6	4476863.0			1266.68	well			
SR	Johnstonville	H4113*	V113, R8		10	707358.5	4472601.9			1247.68	well	72		
SR	Richmond School	H4114*	V117, V119, R13		10	700163.0	4471615.0			1280.67	well	145	75-145	
Shaffer Mountain Flow Path (SHAF)														
SR/SHAF	F. Dewitt Dom.	W4		2/16/67	10	726542.7	4468882.3				well			
SHAF/WSA	Spring	W5		7/8/58	10	734212.2	4471642.3				spring			
SR/SHAF	Ca Fish & Game Irr.	W8		9/10/59	10	728457.7	4471118.6				well			
SR/SHAF	Mapes Ranch Irr.	W9		7/8/58	10	726430.3	4472564.5				well			
SR/SHAF	B. Piango Irr.	W15			10	721774.6	4473338.8				well	550		
SHAF	C.L. Curtis Dom.	W16		2/15/67	10	719281.3	4475475.5				well	220		
SR/SHAF	Tanner Ranch Dom.	W41			10	727353.3	4466190.4				well			
SHAF	Spring S. Horse Mtn.	V28		4/8/96	10	717824.0	4507332.1				spring			
SHAF	Murrers Meadow Spring	V33*	R92	4/8/96	10	695548.0	4495424.0				spring			
SHAF	Spring S. of Snowstorm Mtn.	V34*	R99	4/8/96	10	732121.0	4493258.1				spring			
SHAF	Spring NW Five Spring Mtn.	V35*	R101	4/8/96	10	734340.9	4496107.4				spring			
SHAF	Gilman Spring	V37*	R102	4/8/96	10	727085.2	4483183.6				spring			
SHAF	Shaffer Spring	V45*	R87	2/3/96	10	726803.2	4476035.0				spring			
SHAF	Spr. S Horse Mtn.	R95		4/8/96	10	706445.7	4504887.9				spring			
SHAF	BLM Horse Corral Well	H4092*	V109, R39		10	728600.0	4474097.7			1247.68	well	150	110-150	
SR/SHAF	Fish & Game Well	H4093*	W7, B683		10	728532.0	4470685.4			1211.69	well	525		
SR/SHAF	Susan River at Litchfield	H4094*	V83, R11		10	721235.0	4472749.2			1226.69	surface			
SHAF	Earll Well	H4100		7/15/05	10	707708.2	4492009.9			1539.61	well			
SHAF	Spring E. Horse Lake Mtn.	H4101*	V31, R94		10	707687.7	4491856.7			1539.61	spring			
SHAF	Willow Creek	H4102*	V82, R93		10	694913.9	4493994.1			1503.61	surface			
SHAF	Cognina Well	H4103		7/15/05	10	731268.7	4488959.4			1346.66	well			
SHAF	Spring S. of Snowstorm Mtn	H4104*	V34, R99		10	732052.7	4495760.4			1353.65	spring			
SHAF	Railroad Spring	H4105*	V36, R100		10	726993.7	4493493.2			1356.65	spring			
SHAF	Tule Patch Spring	H4106*	V30, R98		10	731735.1	4502941.5			1515.61	spring			
Sierra Nevada Flow Path (SN)														
SN	Newkirk Dom.	W45		2/14/67	10	713495.6	4466442.4				well			
SN	27N15E32G01M.a	W72		6/11/58	10	729158.6	4448840.2							
SN	27N15E30B01M.a	W73		8/23/57	10	727249.7	4449706.2							
SN	27N14E26E01M.e	W77		7/27/78	10	724410.4	4449799.5				well	202		
SN	27N14E26G01M.a	W78		8/16/60	10	724671.1	4449748.0							
SN	27N14E24E01M.a	W80		7/10/85	10	725817.1	4451930.6							
SN	27N14E23J01M.a	W81		8/22/57	10	723412.4	4451473.5							
SN	27N14E22A01M.b	W82			10	721812.5	4451422.0				well	563		
SN	27N14E21A01M.a	W83		7/15/58	10	720640.7	4451863.0							
SN	27N14E06B01M.a	W85		9/30/80	10	717463.4	4456105.8				well	400		
SN	26N15E11H01M.a	W137		6/10/58	10	733784.4	4444982.9							
SN	26N15E11B06M.a	W138		9/15/58	10	733794.1	4445374.0							
SN	26N15E03F01M.f	W139			10	732102.7	4446619.0							
SN	D Price Well.a	W140		9/29/80	10	733275.9	4446045.4				well	478		
SN	Brownell Creek	V90*	R36	8/10/95	10	716096.8	4458447.7				surface			
SN	Parker Creek	V91*	R17	6/22/95	10	711629.8	4463119.3				surface			
SN	"McDermott" Creek	V95*	V101, R5, R4, B679, B3988		10	726067.0	4446023.0				surface			
SN	Milford Grade Creek	V96*	R3	6/17/95	10	726168.9	4448651.9				surface			
SN		V134*	R32	8/10/95	10	713309.6	4465484.6				well	198	40-198	
SN	N of Buntingville	V135*	R33	8/10/95	10	714336.1	4466108.1				well	400		
SN	Pluma National Forest	B682		3/9/00	10	725338.5	4446996.1				well	180		
SN	Mill Creek	H4083*	W76		10	723876.6	4449864.9			1267.68	surface			
SN	Humphries #1	H4086*	W79		10	726823.2	4450802.0			1229.69	well			
SN	Humphries #2	H4087*	W74		10	728703.0	4449073.0			1211.69	well			
SN	Reinhart Well	H4090*	V131, R37		10	715926.6	4458738.8			1240.68	well	140	120-140	
SN	Ottis Canyon	H4091*	V100, R117		10	731867.4	4446614.6			1240.68	spring/surface			
SN	SE of Otis Canyon	H4107*	V53, R116		10	732449.8	4445666.5			1300.67	spring/well			
SN	Webber 84	H4108*	W84		10	720330.6	4453051.7			1246.68	well			
SN	Buntingville	H4109*	V132, R34		10	713464.6	4462794.1			1246.68	well			
SN	Basler Well	H4110*	V129, R35		10	717195.7	4463159.1			1221.69	well	100	0-100	
SN	Elysian Creek	H4111*	V92, R16		10	708021.8	4467902.9			1283.67	surface			
SN	SW of Bass Hill	H4112*	V133, R31		10	709502.1	4465727.7			1295.67	well	200	0-140, 180-200	

Sample #	Temp (°C)	pH	Cond (µS/cm)	TDS (mg/L)	Cations (mg/L) Ca^{2+}	Mg^{2+}	Na^+	K^+	Fe^{2+}	Anions (mg/L) $CaCO_3$	CO_3^{2-}	HCO_3^-	SO_4^{2-}	Cl^-	NO_3^-	F^-
Susan River Flow Path (SR)																
W4	12.50	8.50		377.00	12.00	3.20	129.00	4.20			9.00	365.00	11.00	7.00	0.50	
W8	15.50	8.80		738.00	18.00	6.80	244.00	7.20			35.00	456.00	83.00	66.00	0.70	0.50
W9	23.80	8.10		1790.00	51.00	7.30	574.00	22.00	0.04		0.00	227.00	295.00	651.00	2.80	0.30
W10		8.00			16.00	6.60	89.00	6.70			0.00	185.00	48.00	51.00	2.60	0.20
W12	13.61	8.25		1097.50	16.20	7.85	356.00	7.80	0.15		31.00	468.00	343.50	39.50	46.05	2.35
W13	13.75	8.30		814.00	16.90	7.07	239.67	8.20	0.01		11.00	432.67	210.67	28.33	25.70	1.00
W14	15.00	8.10		485.00	14.00	6.40	138.00	5.20			0.00	249.00	102.00	44.00	2.60	0.40
W15	14.72	8.25		1210.00	37.00	9.90	354.50	12.50	0.07		16.00	467.50	421.00	64.50	7.60	
W17	5.10	7.10		348.00	36.00	18.00	22.00	1.30				122.00	19.00	16.00	91.00	
W18	16.67	8.00		196.00	7.10	0.40	34.00	9.80				109.00	15.00	5.80	0.50	
W19	13.69	7.97		406.67	4.40	0.80	118.33	4.90				183.67	73.67	20.67	26.33	1.05
W20	13.11	8.10		119.00	18.00	7.00	12.00	4.30			0.00	126.00	4.80	1.40	1.90	
W21*	52.20	7.70			9.50	0.60	56.00	0.90	0.20		0.00	143.00	20.00	5.90	0.30	
W22	23.61	8.05		445.50	13.00	2.50	126.00	4.00				90.00	158.50	58.50	0.90	1.65
W23	16.67	7.20		323.00	22.00	10.00	58.00	3.70	0.92		0.00	95.00	91.00	38.00	0.00	0.30
W41	13.61	8.30		800.00	50.50	27.50	194.50	4.50			15.00	472.00	175.50	71.00	0.60	0.55
W42	13.89	7.45		1155.00	94.50	42.50	256.50	14.00	0.23			282.00	22.50	532.50	1.10	0.10
W43*	14.10	6.90	1195.00		45.10	24.00	224.00	11.00				351.50	79.36	294.38	0.46	0.02
W44	13.00	8.35		913.00	39.50	17.50	245.00	6.75	0.07		7.00	336.00	98.50	237.50	2.90	0.45
V39*	8.50	8.62	175.80							90.00		109.73				
V40*	10.50	8.16	181.50							85.00		103.63				
V84*	13.30	8.18	375.00		19.52	2.77	34.02	5.47				162.50	6.00	4.67	0.13	0.03
V110*	16.70	7.50	431.00	270.00	17.70	11.10	53.70	12.70	0.24		0.33	223.00	21.20	7.61		0.05
V111*	15.60	7.50	2070.00							350.00		460.00				
V112*	18.50	8.00	456.00							160.00		132.00				
V114	31.70	8.50														
V115	33.20	8.80		244.00	1.90	0.10	71.30	1.71	0.37		2.28	85.80	38.40	17.50		4.53
V118	20.00	7.90	355.00													
V209*	66.95	8.75	970.00	620.00	13.50		172.00	2.87			0.27	11.50	245.00	89.00		3.33
R55	31.70	8.50														
RE1	35.80	8.01			19.00	3.40	20.00	3.80			1.00	120.00	11.00	2.00		<0.1
H4081*	15.60	7.95	81.75		12.12	3.13	4.34	0.79		37.00		61.80	2.31	0.48	0.00	0.01
H4082*	10.73	7.68	86.17		9.81	3.94	4.25	1.00	0.27			59.60	2.13	1.94	0.26	
H4093*	14.33	8.40	1232.50	704.50	4.24	2.42	308.65	5.19			29.00	664.50	53.08	50.86	1.03	0.70
H4094*	25.15	8.54	320.50		32.43	13.70	45.93	7.23		75.00		128.00	52.32	8.06	0.00	0.29
H4095*	16.50	8.29	445.50	660.00	18.00	6.60	200.00	9.00	0.00		8.00	350.00	135.00	50.00	3.80	0.60
H4096*	17.10	7.92	351.60		7.74	2.07	54.97	5.41		117.00		114.60	29.26	12.05	0.07	0.66
H4097*	17.40	7.92	235.50		19.36	9.01	8.38	1.58				124.30	5.50	2.09	0.44	0.07
H4098*	20.90	7.62	64.10		5.72	2.76	2.11	0.25		35.00		25.80	0.20	0.77	0.11	
H4099*	14.54	7.78	544.50	342.50	24.50	10.90	64.50	3.80	0.06			122.50	92.00	37.00	3.55	0.75
H4113*	13.20	7.28	519.50	188.00	34.45	13.90	48.53	2.65	0.08	133.00	0.12	260.20	21.51	9.49	0.05	0.23
H4114*	17.37	7.99	283.50		23.61	5.68	60.96	0.47		94.00		134.45	37.00	28.83	0.07	0.43
Shaffer Mountain Flow Path (SHAF)																
W4	12.50	8.50		377.00	12.00	3.20	129.00	4.20			9.00	365.00	11.00	7.00	0.50	
W5	31.10	8.20		239.00	17.00	2.10	49.00	7.20	0.14		0.00	144.00	29.00	15.00	2.20	0.10
W8	15.50	8.80		738.00	18.00	6.80	244.00	7.20			35.00	456.00	83.00	66.00	0.70	0.50
W9	23.80	8.10		1790.00	51.00	7.30	574.00	22.00	0.04		0.00	227.00	295.00	651.00	2.80	0.30
W15	14.72	8.25		1210.00	37.00	9.90	354.50	12.50	0.07		16.00	467.50	421.00	64.50	7.60	
W16	20.00	8.30		461.00	12.00	3.90	141.00	9.50				333.00	54.00	22.00	5.30	
W41	13.61	8.30		800.00	50.50	27.50	194.50	4.50			15.00	472.00	175.50	71.00	0.60	0.55
V28	17.60	8.25	282.00													
V33*	15.80	7.64	210.00													
V34*	17.6	7.68	217							95.00		115.825408				
V35*	15.70	7.96	274.00							115.00		140.21				
V37*	18.90	8.12	172.30							80.00		97.54				
V45*	8.30		89.00									114.00				
R95	17.60	8.30	282.00							140.00		170.69				
H4092*	18.70	7.76	552.50	320.00	27.83	13.48	76.06	4.65		110.00	0.32	162.70	71.12	24.62	0.90	0.11
H4093*	14.33	8.40	1232.50	704.50	4.24	2.42	308.65	5.19			29.00	664.50	53.08	50.86	1.03	0.70
H4094*	25.15	8.54	320.50		32.43	13.70	45.93	7.23		75.00		152.95	52.32	8.06	0.00	0.29
H4100	20.10	7.45	756.60		17.01	12.44	11.56	1.31				145.90	1.85	1.56	0.26	0.05
H4101*	16.60	7.77	241.95		19.52	13.39	12.01	1.46		120.00		160.00	1.20	1.57	0.01	0.02
H4102*	18.20	8.19	303.70		13.12	12.59	32.32	7.45				188.60	0.59	4.18	0.10	0.03
H4103	26.70	8.13	169.10		2.51	1.18	28.07	3.18				77.70	3.70	5.43	0.25	0.11
H4104*	20.80	8.29	214.65		0.94	0.51	41.17	1.87		95.00		88.10	11.08	9.47	0.23	0.12
H4105*	22.55	8.94	919.45		7.19	2.57	22.68	4.19		400.00		89.00	2.59	2.01	0.02	0.07
H4106*	17.10	7.82	199.50		13.96	8.33	11.44	3.39		92.00		109.60	4.03	2.95	0.52	0.08
Sierra Nevada Flow Path (SN)																
W45	14.56	7.80		314.00	36.00	22.00	39.00	6.70			0.00	304.00	6.90	2.10	7.30	
W72	12.20	7.00		147.00	24.00	4.60	8.00	2.40		73.00		89.00	14.00	3.00	7.30	0.20
W73		7.60		196.00	9.10	9.60	41.00	3.80		138.00		168.25	8.70	1.90	0.10	0.20
W77	15.35	6.78		134.33	17.57	3.05	13.65	2.02		63.00		76.81	9.15	5.86	13.25	0.13
W78	14.40	7.80		147.00	19.00	3.00	17.00	2.00		63.00		76.81	11.00	11.00	12.00	
W80	15.50	7.00		202.00	26.00	6.00	34.00	2.00		140.00		170.69	14.00	4.00	1.20	
W81	16.70	6.60		196.00	15.00	4.50	41.00	1.90		119.00		145.09	13.00	4.40	1.90	0.50
W82	14.20	7.10		254.50	13.35	2.25	60.50	1.75		138.50		168.86	28.00	4.60	22.00	0.40
W83	18.90	7.00		92.00	9.10	1.80	11.00	0.90		49.00		59.74	2.00	1.40	0.70	0.10
W85	12.00	6.60		152.00	20.00	7.50	9.00	3.00		74.00		90.22	81.00	2.30		0.10
W137	14.40	7.50		179.00	21.00	7.50	18.00	4.60		116.00		141.43	3.30	3.00	1.70	0.40
W138	15.50	7.90		170.00	7.00	1.60	36.00	5.30		98.00		119.48	4.90	4.00	1.00	0.30
W139	18.44	7.73		141.33	17.67	4.38	18.67	3.35		90.00		109.73	13.12	2.88	0.57	0.17
W140	19.40	7.30		157.20	20.00	5.00	16.00	4.30				96.50	15.00	3.00		0.10
V90*	20.60	7.79	164.00							90.00		109.73				
V91*	12.40	7.73	110.00							50.00		60.96				
V95*	17.80	8.24	144.00		15.34	3.45	9.55	1.97	0.21	85.00		64.93	3.88	2.73	0.07	0.07
V96*	17.80	8.24	144.00							85.00						
V134*	21.70	9.70	451.00	196.00	2.86	0.30	91.80	0.47		100.00	1.13	121.92	37.00	59.60		
V135*	21.60	9.70	429.00													
B682	10.00	6.38	269.00		30.13	6.40	24.83	1.64				155	4.59	8.21	0.09	0.07
H4083*	16.87	7.29	224.10	161.67	18.33	5.70	8.73	3.13		57.00		69.50	6.20	5.00	42.00	
H4086*	13.55	8.12	330.00	218.00	39.00	5.00	20.00	2.70		121.00		147.52	15.00	8.80	18.00	0.50
H4087*	24.90	8.02	235.90	149.00	20.00	4.00	24.00	1.40		93.00		113.39	18.00	2.00	0.20	
H4090*	22.90	6.95	177.20		11.46	3.26	11.08	3.31		95.00		84.70	1.81	3.57	0.45	0.08
H4091*	17.35	7.49	109.20		10.17	5.50	7.17	3.44		22.00		77.60	6.23	1.49	0.01	0.03
H4107*	14.50	7.78	156.45		13.37	8.75	10.01	4.83		40.00		111.00	2.78	2.90	0.20	0.05
H4108*	18.20	7.54	233.90	145.00	22.00	2.90	11.00	0.80		72.00		87.78	4.80	4.00	15.00	0.20
H4109*	22.40	7.14	181.55		15.32	7.11	8.73	1.32		97.00		97.50	8.72	2.64	0.42	0.05
H4110*	17.85	7.46	538.50		64.70	14.29	62.42	4.18				388.30	24.36	7.51	0.61	0.24
H4111*	20.55	7.59	154.50		24.64	10.57	7.45	2.65		40.00		138.00	2.17	1.41	0.05	0.05
H4112*	17.95	6.90	227.75		19.71	5.58	7.37	0.46		110.00		67.25	2.96	2.90	3.03	0.06

Sample #	Cations (meq/L) Ca^{2+}	Mg^{2+}	Na^+	K^+	Fe^{2+}	Anions (meq/L) CO_3^{2-}	HCO_3^-	SO_4^{2-}	Cl^-	NO_3^-	F^-	SiO2 (mg/L)	Total Cations	Total Anions	Balance Error %	^3H (TU)	δ^2H (‰)	$\delta^{18}O$ (‰)	$\delta^{13}C$ (‰)	^{14}C (pmc)
Susan River Flow Path (SR)																				
W4	0.60	0.26	5.61	0.11		0.30	5.98	0.23	0.20	0.01			6.58	6.72	-1.0					
W8	0.90	0.56	10.61	0.18		1.17	7.47	1.73	1.86	0.01	0.03	51.00	12.26	12.27	0.0					
W9	2.54	0.60	24.97	0.56	0.00	0.00	3.72	6.14	18.36	0.05	0.02	79.00	28.68	28.29	0.7					
W10	0.80	0.54	3.87	0.17		0.00	3.03	1.00	1.44	0.04	0.01	53.00	5.38	5.52	-1.3					
W12	0.81	0.65	15.49	0.20	0.00	0.52	7.67	7.15	1.11	0.74	0.12	33.50	17.14	17.32	-0.5					
W13	0.84	0.58	10.43	0.21	0.00	0.37	7.09	4.39	0.80	0.41	0.05	42.50	12.06	13.11	-4.2					
W14	0.70	0.53	6.00	0.13			4.08	2.12	1.24	0.04	0.02	51.00	7.36	7.51	-1.0					
W15	1.85	0.81	15.42	0.32	0.00	0.27	7.66	8.77	1.82	0.12		60.00	18.40	18.64	-0.6					
W17	1.80	1.48	0.96	0.03			2.00	0.40	0.45	1.47			4.27	4.31	-0.5					
W18	0.35	0.03	1.48	0.25			1.79	0.31	0.16	0.01			2.12	2.27	-3.5					
W19	0.22	0.07	5.15	0.13			3.01	1.53	0.58	0.42	0.06	66.50	5.56	5.61	-0.4					
W20	0.90	0.58	0.52	0.11		0.00	2.07	0.10	0.04	0.03			2.11	2.24	-3.0					
W21*	0.47	0.05	2.44	0.02	0.01	0.00	2.34	0.42	0.17	0.00		62.00	2.99	2.93	1.0					
W22	0.65	0.21	5.48	0.10			1.48	3.30	1.65	0.01	0.09	36.50	6.44	6.52	-0.6					
W23	1.10	0.82	2.52	0.09	0.03	0.00	1.56	1.89	1.07	0.00	0.02	52.00	4.57	4.54	0.3					
W41	2.52	2.26	8.46	0.12		0.50	7.74	3.65	2.00	0.01	0.03	34.50	13.36	13.93	-2.1					
W42	4.72	3.50	11.16	0.36	0.01		4.62	0.47	15.02	0.02	0.01	50.50	19.74	20.14	-1.0					
W43*	2.25	1.97	9.74	0.28			5.76	1.65	8.30	0.01	0.00		14.24	15.72	-4.9	<2.5	-112.7	-14.1	-7.2	2.8
W44	1.97	1.44	10.66	0.17	0.00	0.47	5.51	2.05	6.70	0.05	0.02	46.00	14.24	14.79	-1.9					
V39*							1.80										-109.0	-14.6		
V40*							1.70										-111.0	-14.7		
V84*	0.97	0.23	1.48	0.14			2.66	0.12	0.13	0.00	0.00		2.82	2.91	-1.6		-101.5	-12.8	-8.2	
V110*	0.88	0.91	2.34	0.32	0.01	0.01	3.65	0.44	0.21		0.00	49.80	4.46	4.31	1.7		-101.0	-13.0		
V111*							7.54										-104.0	-13.1	-10.1	83.0
V112*							2.16										-104.0	-14.1	-8.0	
V114																	-115.0	-15.2		
V115	0.09	0.01	3.10	0.04	0.02	0.08	1.41	0.80	0.49		0.24	72.90	3.26	3.02	3.8		-114.0	-15.2		
V118																	-103.0	-13.4		
V209*	0.67		7.48	0.07		0.01	0.19	5.10	2.51		0.18	88.60	8.22	7.99	1.4		-122.5	-15.3	-11.9	10.6
R55																	-115.0	-15.2		
RE1	0.95	0.28	0.87	0.10		0.03	1.97	0.23	0.06			53.00	2.20	2.29	-2.0					
H4081*	0.60	0.26	0.19	0.02			1.01	0.05	0.01	0.00	0.00	13.30	1.07	1.07	0.0	3.4	-98.0	-13.7		
H4082*	0.49	0.32	0.18	0.03	0.01		0.98	0.04	0.05	0.00			1.03	1.07	-1.9	3.3	-97.4	-12.8	-14.7	
H4093*	0.21	0.20	13.43	0.13		0.97	10.89	1.11	1.44	0.02	0.04	44.00	13.97	14.45	-1.7	0.4	-102.7	-12.6	-11.9	
H4094*	1.62	1.13	2.00	0.19			3.61	1.09	0.23	0.00	0.02	21.80	4.94	4.95	-0.1		-98.0	-13.1	-0.3	
H4095*	0.90	0.54	8.70	0.23	0.00	0.27	5.74	2.81	1.41	0.06	0.03	56.00	10.37	10.32	0.3	<.2	-113.6	-14.4		
H4096*	0.39	0.17	2.39	0.14			2.35	0.61	0.34	0.00	0.03	38.10	3.09	3.33	-3.7	<.2	-113.0	-14.9	-7.7	46.7
H4097*	0.97	0.74	0.36	0.04			2.04	0.11	0.06	0.01	0.00	28.10	2.11	2.22	-2.5	0.4	-101.0	-12.9	-15.3	74.7
H4098*	0.29	0.23	0.09	0.01			0.65	0.00	0.02	0.00	0.00	17.60	0.62	0.67	-3.9	5.7	-98.0	-13.1	-2.4	
H4099*	1.22	0.90	2.81	0.10	0.00		2.01	1.92	1.04	0.06	0.04	44.50	5.02	5.06	-0.4	1.5	-108.1	-14.7	-20.7	
H4113*	2.46	1.39	3.06	0.07			5.87	0.79	0.43	0.00	0.02	52.05	6.98	7.11	-0.9		-108.0	-13.9		
H4114*	1.18	0.47	2.65	0.01			2.90	0.77	0.81	0.00	0.02	13.40	4.31	4.50	-2.2	<.2	-108.0	-13.8	-14.4	54.5
Shaffer Mountain Flow Path (SHAF)																				
W4	0.60	0.26	5.61	0.11		0.30	5.98	0.23	0.20	0.01			6.58	6.72	-1.0					
W5	0.85	0.17	2.13	0.18	0.01	0.00	2.36	0.60	0.42	0.04	0.01	40.00	3.34	3.43	-1.3					
W8	0.90	0.56	10.61	0.18		1.17	7.47	1.73	1.86	0.01	0.03	51.00	12.26	12.27	0.0					
W9	2.54	0.60	24.97	0.56	0.00	0.00	3.72	6.14	18.36	0.05	0.02	79.00	28.68	28.29	0.7					
W15	1.85	0.81	15.42	0.32	0.00	0.27	7.66	8.77	1.82	0.12		60.00	18.40	18.64	-0.6					
W16	0.60	0.32	6.13	0.24			5.46	1.12	0.62	0.09			7.30	7.29	0.1					
W41	2.52	2.26	8.46	0.12		0.50	7.74	3.65	2.00	0.01	0.03	34.50	13.36	13.93	-2.1					
V28																	-108.0	-13.6		
V33*																	-112.0	-14.6		
V34*							1.90										-116.0	-14.6		
V35*							2.30										-117.0	-14.6		
V37*							1.60										-97.0	-12.0		
V45*							1.87										-100.0	-12.7		
R95							2.80										-108.0	-13.6		
H4092*	1.21	0.98	2.80	0.13			3.19	1.28	0.60	0.02	0.01	33.55	5.12	5.10	0.2	0.6	-113.0	-15.0	-1.9	79.9
H4093*	0.21	0.20	13.43	0.13		0.97	10.89	1.11	1.44	0.02	0.04	44.00	13.97	14.45	-1.7	0.4	-105.5	-12.6	-11.9	
H4094*	1.62	1.13	2.00	0.19			3.61	1.09	0.23	0.00	0.02	21.80	4.94	4.95	-0.1		-98.0	-13.1	-0.3	
H4100	0.85	1.02	0.50	0.03			2.39	0.04	0.04	0.00	0.00	39.80	2.40	2.47	-1.4	<.2				
H4101*	0.97	1.10	0.52	0.04			2.62	0.03	0.04	0.00	0.00	23.70	2.63	2.69	-1.1	0.4	-115.0	-15.0		
H4102*	0.65	1.04	1.41	0.19			3.09	0.01	0.12	0.00	0.00	33.60	3.29	3.22	1.1		-106.0	-13.2		
H4103	0.13	0.10	1.22	0.08			1.27	0.08	0.15	0.00	0.01	52.90	1.53	1.51	0.7	<.2				
H4104*	0.05	0.04	1.79	0.05			1.44	0.23	0.27	0.00	0.01	34.20	1.93	1.95	-0.5		-116.0	-14.6		
H4105*	0.36	0.21	0.99	0.11			1.46	0.05	0.06	0.00	0.00	16.20	1.67	1.57	3.1	<.2	-88.0	-9.1		
H4106*	0.70	0.69	0.50	0.09			1.80	0.08	0.08	0.01	0.00	15.70	1.98	1.97	0.3		-113.0	-14.5	-15.1	72.7
Sierra Nevada Flow Path (SN)																				
W45	1.80	1.81	1.70	0.17			4.98	0.14	0.06	0.12			5.47	5.30	1.6					
W72	1.20	0.38	0.35	0.06			1.46	0.29	0.08	0.12	0.01	40.00	1.99	1.96	0.5					
W73	0.45	0.79	1.78	0.10			2.76	0.18	0.05	0.00	0.01	39.00	3.12	3.01	1.9					
W77	0.88	0.25	0.59	0.05			1.26	0.19	0.14	0.17	0.01	43.00	1.77	1.76	0.2					
W78	0.95	0.25	0.74	0.05			1.26	0.23	0.31	0.19	0.00	34.00	1.99	1.99	-0.2					
W80	1.30	0.49	1.48	0.05			2.80	0.29	0.11	0.02			3.32	3.22	1.5					
W81	0.75	0.37	1.78	0.05			2.38	0.27	0.12	0.03	0.03	43.00	2.95	2.83	2.1					
W82	0.67	0.19	2.63	0.04			2.77	0.58	0.13	0.35	0.02	46.00	3.53	3.86	-4.5					
W83	0.45	0.15	0.48	0.02			0.98	0.04	0.04	0.01	0.01	36.00	1.10	1.08	1.2					
W85	1.00	0.62	0.40	0.10			1.48	1.69	0.06		0.01	41.00	2.12	3.24	-20.9					
W137	1.05	0.62	0.78	0.12			2.32	0.07	0.08	0.03	0.02	50.00	2.57	2.52	0.9					
W138	0.35	0.13	1.57	0.14			1.96	0.10	0.11	0.02	0.02	51.00	2.18	2.21	-0.6					
W139	0.88	0.36	0.81	0.09			1.80	0.27	0.08	0.01	0.01	32.25	2.14	2.17	-0.8					
W140	1.00	0.41	0.70	0.11			1.60	0.31	0.10		0.01		2.22	2.02	4.7					
V90*							1.80										-103.0	-13.6		
V91*							1.00										-102.0	-14.1		
V95*	0.77	0.28	0.42	0.05	0.01		1.41	0.08	0.08	0.00	0.01		1.52	1.57	-1.6	9.2	-106.5	-14.4	-7.9	
V96*																	-101.0	-13.7		
V134*	0.14	0.02	3.99	0.01		0.04	2.00	0.77	1.68			12.00	4.16	4.49	-3.8		-114.0	-14.1		62.0
V135*																	-110.0	-14.1		
B682	1.50	0.53	1.08	0.04			2.54	0.10	0.23	0.00	0.00		3.15	2.87	4.7		-105.5	-14.4	-16.8	
H4083*	0.91	0.47	0.38	0.08			1.14	0.13	0.09	0.45			1.84	1.81	0.8	0.4	-111.6	-15.1		
H4086*	1.95	0.41	0.87	0.07			2.42	0.31	0.25	0.29	0.03	37.00	3.30	3.30	0.0		-108.3	-14.1		
H4087*	1.00	0.33	1.04	0.04			1.86	0.37	0.06	0.00			2.41	2.29	2.4	<.2	-110.8	-14.4		
H4090*	0.57	0.27	0.48	0.08			1.39	0.04	0.10	0.01	0.00	35.60	1.40	1.54	-4.8	<.2	-109.0	-14.1		
H4091*	0.51	0.45	0.31	0.09			1.27	0.13	0.04	0.00	0.00	25.90	1.36	1.44	-2.9	2.2	-105.0	-13.5		
H4107*	0.67	0.72	0.44	0.12			1.82	0.06	0.08	0.00	0.00	25.50	1.95	1.96	-0.3		-100.0	-12.7		
H4108*	1.10	0.24	0.48	0.02			1.44	0.10	0.11	0.24	0.01	40.00	1.84	1.91	-1.9		-108.2	-14.0		
H4109*	0.76	0.58	0.38	0.03			1.60	0.18	0.07	0.01	0.00	30.80	1.75	1.86	-3.0		-107.0	-13.7		
H4110*	3.23	1.18	2.72	0.11			6.36	0.51	0.21	0.01	0.01	43.50	7.24	7.10	1.0		-104.0	-13.3		
H4111*	1.23	0.87	0.32	0.07			2.26	0.05	0.04	0.00	0.00	20.50	2.49	2.35	2.9		-101.0	-13.7		
H4112*	0.98	0.46	0.32	0.01			1.60	0.06	0.08	0.05	0.00	38.90	1.77	1.79	-0.6		-101.0	-12.9		112.4

Table 1b. All Honey Lake Basin sample data.

KEY

Has solute chemistry data.
Has isotope data.
Has both solute chemistry and isotope data.
Sample included in multiple flow paths.
Averaged value
Combined data from different investigations.
* Sample location included in multiple investigations.

HCO_3^- calculated from $CaCO_3$ to by dividing by 0.8202
Calculated, not measured value.
R=Rose (1997)
W=Webber (1996)
V=Varian (1997)
B=BYU
H=Henderson

Flow Path	Name	Sample #	Multiple Sample Location Sample #	Sample Date	Zone	Easting	Northing	Easting (converted to zone 10)	Northing (converted to zone 10)	Elevation (m)	Water Source	Depth Interval (ft)	Perf. Interval (ft)	Q (gpm)	Temp (°C)	pH	Cond (µS/cm)	TDS (mg/L)	Cations (mg/L) Ca^{2+}	Mg^{2+}	Na^+	K^+
Long Valley Creek Flow Path (LV)																						
LV	27N17E31K01M.a	W53		5/30/56	10	746585.1	4448525.2								18.30	7.40		633.00	76.00	23.00	94.00	6.30
LV	27N16E36Q01M.c	W61*	V204		10	744619.5	4448254.7								16.19	7.51		738.45	82.96	28.33	99.88	6.63
LV	27N16E35P01M.m	W62			10	743638.3	4448698.6				well	550			16.07	7.46		389.08	33.93	13.17	64.27	8.27
LV	27N16E34R01M.a	W63		10/2/52	10	741784.1	4448373.4								15.50	7.60		626.00	80.00	23.00	88.00	
LV	27N16E31M.a	W64		8/27/56	10	736936.1	4448280.1								15.50	7.40		712.00	78.00	27.00	96.00	6.00
LV	27N16E29D01M.a	W66		6/11/58	10	738523.1	4449925.1								14.40	8.00		465.00	5.60	1.10	154.00	8.00
LV	27N16E25M.a	W67		8/27/56	10	744761.8	4450127.9								15.50	7.40		690.00	78.00	27.00	97.00	6.10
LV	27N16E19M.a	W68		1/12/56	10	737248.3	4451093.6								15.50	7.70		1110.00	60.00	20.00	299.00	8.60
LV	27N15E25K01M.b	W75			10	735764.3	4449468.0								16.35	8.05		574.00	13.00	5.60	191.00	3.40
LV	26N17E18B01M.a	W122			10	746941.5	4444490.8				well				17.60	7.30		543.67	36.00	6.00	134.00	3.87
LV	26N16E21J01M.a	W126		6/10/58	10	740159.2	4441339.2								15.25	8.05		318.00	50.50	17.50	20.00	2.60
LV	Garrod Well #2.a	W127*	B681		10	740006.1	4442193.1				well	250			11.25	7.31	246.00		30.67	9.46	33.92	3.18
LV	26N16E15E03M.a	W129			10	741189.1	4443581.5				well	60			15.87	7.72		538.27	77.00	14.71	71.86	5.46
LV	26N16E13A01M.a	W131		4/13/88	10	745285.9	4443949.8				well	145			18.90	8.60		824.05	88.00	46.00	107.00	5.20
LV	26N16E06D01 M.b	W133			10	736955.5	4446733.1				well	75			17.77	7.10		326.50	29.67	12.00	47.00	4.07
LV	26N16E04M01M.a	W134		6/10/58	10	740224.4	4446801.5								15.50	8.10		309.00	31.00	5.90	77.00	6.20
LV	26N16E03D02M.c	W135			10	741919.2	4446791.8				well	80			19.48	8.23		362.00	11.50	1.85	93.00	16.25
LV	26N16E02G01M.e	W136			10	743610.7	4447075.3				well	530			20.37	7.83		319.00	29.33	9.23	52.67	4.95
LV	Horse Spring.a	W141*	V59	09/13/89	11	254528.0	4430656.0	766775.5	4431391.0	2362.20	spring			2	12.0	7.3		181.5	25.60	7.00	7.70	0.40
LV	Upper Scott Spring.b	W143*	V56		11	264191.9	4433344.1	776229.4	4434697.3	2301.24	spring				14.00	7.19		134.70	18.10	8.00	7.20	3.15
LV	Lower Scott Spring.a	W144*	V55	9/13/89	11	263744.0	4434368.1	775712.2	4435731.2	2203.70	spring			0.25	14.00	7.80		194.70	22.90	11.70	7.00	2.40
LV	Mud Spring.b	W145*	V57		11	262207.9	4435840.0	774089.4	4437079.7	2051.30	spring				6.00	6.96		119.20	10.05	3.40	8.15	1.00
LV	25N17E34L01M.a	W157		6/10/58	10	751040.5	4429227.3								15.00	7.50		171.00	20.00	6.70	18.00	3.00
LV	Webber 159	W159*	V172		10	750176.0	4432872.1				well	120			18.30	7.15	211.00	237.00	28.00	11.00	30.00	1.70
LV	S of Doyle	W160*	R26		10	748990.7	4432207.6				well	120			16.96	7.31	211.00	167.94	8.36	2.36	42.22	0.74
LV	25N17E20B01M.c	W161			10	748052.4	4432920.5				well	260			16.10	7.55		297.90	43.00	13.25	30.75	1.38
LV	25N17E17A01M	W162			10	747894.0	4434690.5								16.10	7.60		279.00	29.00	11.00	35.00	9.00
LV	Hd4 Dom. Well.a	W163			10	747586.3	4435662.3				well	513			13.50	6.93		213.83	30.33	8.67	19.33	2.47
LV	25N17E07J01.a	W165			10	746574.9	4435546.5				well				16.10	8.57		186.27	18.67	6.67	23.67	2.23
LV	Sugarcane.a	W169*	V73	8/31/89	10	741324.1	4447204.1			1621.54	spring			30		7.90		174.90	18.80	7.40	11.70	5.60
LV	Boot legger Spring.a	W172		12/04/89 ?	11	247234.4	4429579.5	759563.1	4429826.7		spring					8.00		908.00	170.00	33.00	84.00	7.90
LV	24N17E03M01M.a	W173		8/27/57	10	750937.9	4426884.3									8.20		194.00	34.00	6.60	13.00	4.70
LV	23N17E02N01M.c	W175			10	752644.3	4427362.8								16.10	7.03		492.00	35.33	18.00	94.67	8.95
LV	22N17E26H01M.a	W176			10	754073.5	4402197.4								14.60	7.43		250.67	32.67	15.33	18.00	8.40
LV	22N17E11M01M.a	W177		7/18/58	10	745113.0	4407459.7								15.00			314.00	48.00	18.00	17.00	9.10
LV	22N17E08K01M.b	W178			10	747403.8	4426104.1								17.75	7.65		157.50	16.50	4.20	24.50	2.50
LV	Higgens Spring	V72*	R106	4/9/96	11	252809.8	4425514.1	765379.0	4426159.8		spring				14.30	7.87	434.00					
LV	Spring E. Seven Lakes Mtn.	V76*	R105	4/9/96	11	249709.4	4423292.5	762480.3	4423765.1		spring				15.00	8.33	137.50					
LV	Spring N. Seven Lakes Mtn.	V77*	R107	4/9/96	10	756212.0	4425589.3				spring				13.60	7.71	259.00					
LV	August Spring	V80*	R104	4/9/96	11	245807.4	4417943.9	758951.3	4418093.6		spring				9.60	8.59	204.00					
LV	Honey Lake-W. arm	V93*	R48	9/30/95	10	728552.4	4452065.9				surface				24.40	8.80	713.00					
LV	Honey Lake-E. arm	V94*	R47	9/30/95	10	733777.8	4456676.5				surface				23.90	9.03	917.00					
LV	Long Valley Creek, Herlong	V99*	R24	7/5/95	10	737712.0	4446584.1				surface				28.60	8.21	463.00					
LV	SIAD Sewage Treatment Plant	V106		12/20/95	10	743816.0	4448888.0				surface				6.90		1900.00					
LV	JDS Wetlands - surface water	V105*	R128	6/10/96	10	734896.9	4452688.8				surface				26.10	9.70	1340.00					
LV	JDS Wetlands	V141*	R126	6/10/96	10	736367.0	4452954.0				well	160			18.20	8.60	1950.00					
LV	NE of Herlong Junction	V168*	R29	7/7/95	10	736624.0	4447104.0				well	75	55-75		20.90	7.30	455.00					
LV		V170		7/6/95	10	748752.1	4429656.1				well	600	-365, 420-500, 580-600		22.40	8.10	237.00	160.00	7.89	2.75	42.60	0.77
LV	S of Doyle	V171*	R25	7/6/95	10	748239.0	4430880.4				well	80	54-80		21.40	6.80	215.00					
LV	E of Doyle	V174*	R30	8/8/95	10	749603.6	4432482.8				well	350	250-350		22.20	7.40	412.00					
LV	SAID ALF-3	V175*	R67	12/20/95	10	745304.0	4448128.1				well	106	86-105.7		12.90	7.70	1820.00					
LV	SIAD ALF-8-MWA	V176*	R66	12/20/95	10	744544.0	4447952.0				well	110	90-110		11.80	7.60	1630.00					
LV	SIAD B21-3-MW	V177*	R45	9/25/95	10	746988.7	4448939.7				well	120	85-105		18.90	7.30	2170.00					
LV	SIAD B21-5-PZ	V178*	R46	9/25/95	10	747087.4	4448111.5				well	105	90-105		18.30	7.40	2660.00					
LV	SIAD DMO-13-A	V180*	R52	10/11/95	10	746211.5	4448076.5				well	119	97.5-117.5		18.10	7.70	1210.00					
LV	SIAD DMO-11-A	V181*	R53	10/11/95	10	746264.0	4448192.1				well	110	90-110		17.60	7.50	1330.00					
LV	SIAD LF-1	V183*	R43	8/23/95	10	742136.1	4449544.1				well	65	42.5-65		18.60	8.20	1750.00					
LV	SIAD STP-2	V184*	R44	8/23/95	10	743664.0	4448848.1				well	57.5	37-57		18.30	6.90	2320.00					
LV	STP-03-PZ	V185*	R61	12/20/95	10	743016.0	4448832.1				well	56	36-56		13.10	7.20	1790.00					
LV	SIAD STP-4-PZ	V186*	R62	12/20/95	10	743664.0	4448848.1				well	57	35-55		11.80	6.70	1940.00					
LV	SIAD STP-5-PZ	V187*	R65	12/20/95	10	743664.0	4448848.1				well	91	69-89		13.10	7.70	1250.00					
LV	SIAD TNT-1-MWB	V189*	R121	1/23/96	10	745280.0	4450472.0				well	102.98	90-100									
LV	SIAD TNT-1-MWC	V190*	R122	1/23/96	10	745280.0	4450472.0				well	147	128-138									
LV	SIAD TNT-7-MWA	V191*	R49	10/4/95	10	745348.3	4450341.2				well	68.71	58-68		14.40	9.10	1210.00	748.00	6.46	14.10	194.00	45.10
LV	SIAD TNT-7-MWB	V192*	R50	10/4/95	10	745280.0	4450472.0				well	103.57	92-102		14.80	8.10	1280.00					
LV	SIAD TNT-7-MWC	V193*	R51	10/4/95	10	745280.0	4450472.0				well	147	130-140		14.90	7.90	1190.00					
LV	SIAD PSW8 PZ-4	V195*	R77	1/30/96	10	744496.1	4448000.0				well	630	605-615		9.10	8.10	818.00	548.00	63.10	0.15	64.60	7.57
LV	SIAD PSW8 PZ-3	V196*	R75	1/30/06	10	744496.1	4448000.0				well	495	482-492		9.00	8.10	864.00	573.00	63.70	22.90	81.30	6.54
LV	SIAD PSW8 PZ-2	V197*	R76	1/30/96	10	744496.1	4448000.0				well	335	302-312		11.30	8.30	928.00	572.00	58.90	25.50	90.10	5.08
LV	SIAD PSW8 PZ-1	V198*	R78	1/30/96	10	744496.1	4448000.0				well	185	174-184		11.30	8.10	1220.00	818.00	112.00	42.90	72.00	7.06
LV	SIAD PSW5 PZ-4	V199*	R83	1/31/96	10	742992.0	4448008.0				well	500	484-94		10.40		822.00					
LV	SIAD PSW5 PZ-3	V200*	R82	1/31/96	10	742992.0	4448008.0				well	463.3	450-460		11.60		883.00					
LV	SIAD PSW5 PZ-2	V201*	R79	1/31/96	10	742992.0	4448008.0				well	315	303-313		13.60	7.70	917.00					
LV	SIAD PSW5 PZ-1	V202*	R80	1/31/96	10	742992.0	4448008.0				well	231.5	220-230		9.40	7.60	596.00					
LV	SAID PSW #2	V203*	R57	11/14/95	10	744608.0	4448000.1				well	700	lots		16.90	8.20	1119.00					
LV	SIAD PSW #5	V205*	R58	11/14/95	10	743016.7	4448041.4				well	550	180-540		17.10	8.50	697.00					
LV	SIAD PSW #8	V206*	R59	11/14/95	10	744608.0	4448000.1				well	700	lots		16.70	8.30	955.00					
LV	SIAD PSW #9	V207*	R60	11/14/95	10	743848.0	4447288.1				well	530	lots		18.30	8.10	433.00					
LV	Spr.- N Seven Lakes Mnt.	R107		4/9/96	10	756212.3	4425589.3				spring				13.60	7.70	259.00					
LV	Breshears Well	B688		3/10/00	10	740905.1	4446861.7				well	140			8.40	6.83	636.00		34.60	5.87	89.33	4.72
LV	Long Valley Creek, S of Doyle	B690*	B2750		10	754677.0	4424456.0				surface				7.30	7.73	416.80		20.90	7.67	50.21	4.30
LV	Bird Flat Ranch #1	H4084*	W128		10	740996.4	4443827.8			1249.68	well	650			21.00	7.35	1204.00	280.43	40.33	12.00	30.00	3.00
LV	Bird Flat Ranch #2	H4085*	V166, V167, R28		10	740717.0	4442552.5			1249.68	well	700	85-650		19.55	7.25	447.50		38.61	13.49	29.59	3.65
LV	Cowboy Joe Spring	H4088*	V52, R118		10	741442.9	4439934.3			1314.66	spring				17.65	7.46	213.90		13.80	5.03	20.67	2.15
LV	N of Bird Flat Ranch	H4089*	W132		10	741103.7	4444963.8			1229.69	well				18.85	7.23	776.00	380.00	40.00	11.00	71.00	6.20
LV	W of Herlong	H4115*	V169, R23		10	741300.7	4447119.9			1236.68	well	80	64-80		21.85	8.46	571.00	276.00	5.79	1.43	100.80	12.73
LV	Webber 125	H4120*	W125		10	743323.9	4438891.0			1269.67	well				18.70	7.54	279.60	220.00	38.00	7.30	22.00	1.80
LV	Webber 167	H4121*	W167		10	744274.8	4435952.6			1316.66	well	158			16.30	7.57	210.90	164.00	15.00	9.00	13.00	1.00
LV	Briggs Well	H4122*	W164		10	746472.0	4435115.7			1309.66	well				19.05	7.24	302.40	169.00	27.00	7.40	14.00	2.80
LV	Indian Spring	H4123*	V70, R113		10	750868.6	4437897.2			1483.62	spring				18.75	8.78	410.75		7.81	14.40	43.41	9.80
LV	Rat Auto Salvage	H4124*	W130		10	744434.6	4443309.9			1267.68	well				20.58	7.64	598.00	293.20	28.00	10.00	43.00	4.10
LV	Heald Well	H4125*	W121		10	746145.8	4442151.0			1279.67	well				21.53	7.61	1446.00	655.93	45.33	46.67	75.67	6.07
LV	Bell's Ranch	H4126*	W166		10	748784.5	4436233.1			1342.66	well	350			26.00	7.54	356.40	206.70	24.33	8.33	17.67	2.97
LV	Long Valley Creek, N of Doyle	H4127*	V104, R2, B2042, B2752		10	743391.1	4439559.5			1259.68	surface				16.63	8.13	485.33		36.60	12.30	61.10	4.00
LV	JDS Wetland Dom. Well	H4129*	W65, V142, R127		10	736077.4	4449554.8			1215.69	well	304			20.20	8.80	972.50	954.67	11.44	4.94	283.67	7.41
LV	Burkhard Place - Constantia Rd.	H4130*	V173, R125		10	747534.7	4432239.1			1321.66	well	180	85-180		18.00	8.42	211.00		9.95	2.05	29.35	1.48
LV	Webber 158	H4131*	W158		10	748212.0	4430700.6			1339.66	well	80			20.04	7.09	198.40	147.00	24.50	4.55	13.00	1.30
LV/HLW	Rose 27	H4132*	R27		10	749695.5	4428001.9			1317.66	well	600	30-600		37.60	8.90	282.20		0.71	0.06	60.67	0.03
LV	Long Valley Creek-HJ	H4133*	B2043, B2749, B3989		10	750790.3	4407771.7			1445.63	surface				8.60	8.00	265.90		23.34	10.04	17.03	3.38
LV/HLW	Zamboni Hot Spring	H4134*	V78, V79, R103, B2751, B3		10	754357.6	4423082.0			1370.65	spring				39.46	9.13	347.98		2.42	0.10	63.00	0.82
West Skedaddle/Amedee Flow Path (WSA)																						
SHAF/WSA	29N15E24F01.a	W5		7/8/58	10	734212.2	4471642.3				spring				31.10	8.20		239.00	17.00	2.10	49.00	7.20
WSA	28N17E20J01 M.e	W34			10	747761.9	4461341.2								25.84	7.90		184.60	8.60	1.86	44.00	4.64
WSA	28N17E20L01 M.b	W35			10	747991.9	4461385.0				well	85			21.50	7.93		173.67	4.30	2.00	42.33	3.43
WSA	Artesian Well #2.a	W36*	V126, R89	??/??/76	10	746797.8	4461885.2				well				22.93	8.55	255.50	179.00	5.00	1.50	43.00	3.50
WSA	28N17E19B02M.a	W37		7/10/58	10	746458.2	4462210.2								21.60	8.10		137.00	5.80	0.40	46.00	1.80
WSA	Smf4 Art. Well #1.a	W39		??/??/76	10	747900.6	4463188.9				well				15.00	9.00		216.90	4.00	0.90	57.00	3.00
WSA/AML	Amedee Hot Springs	W40*	V215, RE5	2/15/67	10	738308.0	4465011.0				spring				102.78	8.60		948.00	16.00	0.50	238.00	6.00
WSA	27N16E11E01M.k	W69			10	742495.5	4454930.9				well	380			15.56	7.47		1172.64	113.64	24.00	220.36	15.57
WSA	27N16E03M.a	W70		8/27/56	10	741281.9	4456234.6				well	550			15.50	7.20		348.00	29.00	13.00	56.00	8.90
WSA	27N16E02M.a	W71*	V208	8/27/56	10	743248.8	4456517.9								15.50	7.40		338.00	28.00	12.00	56.00	8.20
WSA	Spring nr. Herlong Siding	V46		3/13/96	10	745320.1	4461872.1				spring											
WSA	Skedaddle Mountain Ranch	V108		8/1/86	10	736064.0	4472128.1															
WSA	SIAD LBG-2	V182*	R68	1/24/96	10	745233.5	4461122.5				well	29	9 f-29		13.60	8.70	11340.00					
WSA	SIAD STP-7	V188*	R64	12/20/95	10	745168.0	4458632.0				well	68	44-64		13.70	7.90	1710.00					
WSA/AML	Norcal2	V211*	V214, R40		10	738388.5	4465219.4				geo well	1058	312-1047		98.90	8.90	1750.00	748.00	17.60	0.09	254.00	6.99
WSA/AML	Norcal 1	V212		9/1/95	10	738424.1	4465368.0				geo well	1491	744-1037									
WSA/AML	Norcal 1	V213		9/1/95	10	738392.1	4465320.0				geo well	1491	744-1037									
WSA	Spr. NE of Stacy	R90		3/12/96	10	747545.5	4459536.1				spring				15.00	8.90	300.00					
WSA	Lee Rd	H4116*	V107, R41		10	736647.7	4470216.4			1227.69	well	400			21.85	8.25	375.55	220.00	8.74	1.96	62.78	9.00
WSA	Tinsley Fountain	H4117*	W38, V47		10	746699.1	4462833.5			1221.69	spring	100			16.69	8.57	302.50	201.40	16.89	1.05	50.75	3.89
WSA/AML	HL Power Plant	H4135*	W6, V44		10	732239.6	4471941.9			1220.69	spring/well				62.71	8.30	1800.00	967.00	25.30	0.12	276.70	11.71
East Skedaddle/Amedee Flow Path (ESA)																						
ESA	Spencer Spring.b	W3*	V43		10	747233.6	4468882.3				spring											
ESA	28N17E35D01 M.a	W27		7/10/58	10	752102.1	4459115.5								26.10	8.10		156.00	5.40	0.40	45.00	1.70
ESA	St1 Dom. Well.a	W30		10/11/88	10	753422.5	4460777.7				well	100			17.15	8.35		175.50	6.00	2.00	47.00	1.55
ESA	28N17E25P01M.b	W31			10	754225.8	4460435.9								26.74	8.31		182.58	5.17	0.67	50.43	2.53
ESA	High Rock Ranch.a	W32*	V124, V127, V128		10	754503.4	4459466.1				well				24.00	7.70			4.00	0.80	48.00	2.00
ESA	Artesian Well #3.a	W33*	V125		10	748766.0	4461031.9				well				22.77	8.30		173.73	3.33	2.00	42.00	3.10
ESA	F11.a	W48		8/23/66	11	253565.1	4450824.5	764478.8	4451465.1							7.80		5346.00	53.00	49.00	1810.00	
ESA	Tipton Well.a	W52*	V138	2/6/90	11	251948.8	4450218.4	762904.5	4450723.5	1216.15	well	180		7	13.30	8.46		2000.00	5.00	9.00	680.00	18.00
ESA	27N17E23D01M.a	W54			10	753131.7	4451905.6				well	44			15.00	8.40		713.10	34.00	15.00	169.00	11.00
ESA	Duck Lake Irrig. Well.a	W55*	V140	??/??/76	10	751814.0	4451983.3				well				18.00	7.70		368.00	44.00	13.00	25.00	8.00
ESA	27N17E15P02 M.a	W56		4/16/88	10	751192.3	4452780.6				well	53			12.20	8.40		437.20	56.00	19.00	40.00	9.10
ESA	27N17E04A02 M.b	W57			10	749682.0	4456662.8				well	120			13.95	8.56		679.60	15.20	17.60	191.60	5.20
ESA	27N17E03H01 M.a	W58			10	752047.1	4456703.3								16.65	8.40		1308.60	6.50	9.80	406.00	12.00
ESA	Parks Ranch.a	W59		11/7/88	10	752047.1	4456446.5				well				9.20	7.60		509.45	11.00	9.00	144.00	6.80
ESA	Frank Whitt.a	W60		11/7/88	10	753918.9	4456368.8				well	109			15.00	9.00		3846.10	16.00	14.00	1300.00	27.00
ESA/FSM	Austin North Dom. Well.a	W114*	V162	1/24/90	11	246914.9	4445860.4	758176.9	4446034.6	1214.63	well				13.60	7.80		50259.00	1516.00	382.10	17800.00	42.00
ESA/FSM/VM	Stanley Well.a	W115		2/6/90	11	248523.6	4445509.4	759804.4	4445791.6	1207.92	well	490				8.30		8140.00	52.00	60.00	2830.00	51.00
ESA/CW/ASP	May Well.a	W116*	V164	2/6/90	11	251902.6	4448577.8	762969.7	4449083.6	1213.10	well	250			12.40	7.09		42700.00	150.00	820.00	16100.00	94.00
ESA/FSM	26N17E01P01 M.a	W123		11/7/88	10	754959.0	4447036.2								15.00	8.30		3320.00	16.00	14.00	1300.00	27.00
ESA/FSM	B Victory Irr. Well.a	W124		11/7/88	10	754959.0	4447733.6				well	300			15.00	7.85		2305.15	35.00	41.00	752.00	33.00
ESA	Skedaddle Creek	V87*	V88, R1, R1b		10	751680.1	4458184.0				surface											
ESA	Spencer Creek	V89*	R124	4/16/96	10	749404.0	4462531.2				surface											
ESA	Flanigan Ranch Well	V139		8/1/86	11			762952.5	4455744.6		well				22.00							
ESA	SIAD DEMO-1	V179*	R123	4/16/96	10	749900.1	4462811.8				well	94			26.70		800.00					
ESA	SIAD UBG-4-MWA	V194*	R42	8/23/95	10	749514.5	4461823.9				well	96.5	76-96		20.60	9.00	575.00	348.00	12.20	3.87	93.90	15.90
ASP/ESA	Stone Well	B687		3/10/00	11	253040.2	4450965.2	763807.1	4451577.2		well	130			11.20	7.54	14280.00		35.91	65.43	4530.00	110.10
ESA	Droeger Well	H4118*	W29		10	752552.7	4458955.0			1228.69	well				17.55	8.48	224.20	611.00	15.12	7.18	80.60	5.45
ESA	Harding Well	H4119*	W28		10	751563.1	4457544.6			1222.69	well	152			17.60	8.07	1228.00	282.75	31.00	10.00	32.00	6.50

Sample #	Solutes: Cations (mg/L) Fe^{2+}	Anions (mg/L) $CaCO_3$	CO_3^{2-}	HCO_3^-	SO_4^{2-}	Cl^-	NO_3^-	F^-	Cations (meq/L) Ca^{2+}	Mg^{2+}	Na^+	K^+	Fe^{2+}	Anions (meq/L) CO_3^{2-}	HCO_3^-	SO_4^{2-}	Cl^-	NO_3^-	F^-	SiO2 (mg/L)	Total Cations	Total Anions	Balance Error %	Isotopes: ^3H (TU)	δ^2H (‰)	$\delta^{18}O$ (‰)	$\delta^{13}C$ (‰)	^{14}C (pmc)
W53		169.00		206.05	237.00	47.00	0.00	1.40	3.79	1.89	4.09	0.16			3.38	4.93	1.33	0.00	0.07	48.00	9.94	9.71	1.1					
W61*		162.35		235.00	302.54	41.13	6.63	0.51	4.14	2.33	4.34	0.17			3.85	6.30	1.16	0.11	0.03	46.65	10.99	11.44	-2.0		-112.5	-14.1		
W62		155.57		192.00	95.07	22.27	1.27	0.47	1.69	1.08	2.80	0.21			3.15	1.98	0.63	0.02	0.02	55.23	5.78	5.80	-0.1					
W63		167.00		203.61	240.00	47.00	0.10	0.50	3.99	1.89	3.83				3.34	5.00	1.33	0.00	0.03	47.00	9.71	9.69	0.1					
W64		163.00		198.73	271.00	48.00	0.10	0.40	3.89	2.22	4.18	0.15			3.26	5.64	1.35	0.00	0.02	46.00	10.44	10.28	0.8					
W66		248.00		302.37	51.00	39.00	1.00	0.60	0.28	0.09	6.70	0.20			4.96	1.06	1.10	0.02	0.03	56.00	7.27	7.17	0.7					
W67		166.00		202.39	269.00	48.00	0.10	0.40	3.89	2.22	4.22	0.16			3.32	5.60	1.35	0.00	0.02	49.00	10.49	10.30	0.9					
W68		244.00		297.49	342.00	203.00	1.90	0.50	2.99	1.65	13.01	0.22			4.88	7.12	5.73	0.03	0.03	71.00	17.87	17.78	0.2					
W75		250.00		304.80	106.00	74.00	7.70		0.65	0.46	8.31	0.09			5.00	2.21	2.09	0.12			9.50	9.42	0.5					
W122		187.00	0.00	264.00	51.67	35.33	123.33	1.20	1.80	0.49	5.83	0.10			4.33	1.08	1.00	1.99	0.06		8.22	8.45	-1.4					
W126		204.50		249.33	10.95	10.00	26.50	0.40	2.52	1.44	0.87	0.07			4.09	0.23	0.28	0.43	0.02	57.50	4.90	5.05	-1.5					
W127*				184.00	22.04	6.59	0.21	0.18	1.53	0.78	1.48	0.08			3.02	0.46	0.19	0.00			3.87	3.67	2.7	4.1	-108.7	-14.0	-14.9	90.5
W129		173.70		210.50	192.86	18.79	9.16	0.89	3.84	1.21	3.13	0.14			3.45	4.02	0.53	0.15	0.05	36.43	8.32	8.19	0.8					
W131				307.00	280.00	25.00	1.80	0.40	4.39	3.79	4.65	0.13			5.03	6.00	0.71	0.03	0.02		12.96	11.79	4.8					
W133		137.50		184.00	58.00	14.00	1.40	0.30	1.48	0.99	2.04	0.10			3.02	1.21	0.39	0.02	0.02		4.62	4.66	-0.4					
W134		177.00		215.80	43.00	28.00	12.00	0.60	1.55	0.49	3.35	0.16			3.54	0.90	0.79	0.19	0.03		5.54	5.45	0.8					
W135				208.00	41.33	19.50	6.03	0.40	0.57	0.15	4.05	0.42			3.41	0.86	0.55	0.10	0.02		5.19	4.94	2.5					
W136	0.18	160.00		190.00	49.00	13.67	0.30	0.50	1.46	0.76	2.29	0.13	0.01		3.11	1.02	0.39	0.00	0.03	71.00	4.65	4.55	1.1		-109.0	-13.9		
W141*				131.68	<3	6.00			1.28	0.58	0.33	0.01			2.16		0.17				2.20	2.33	-2.8		-113.0	-14.7		
W143*	<0.1			96.00	<5	6.20			0.90	0.66	0.31	0.08			1.60		0.17				1.96	1.77	4.8		-110.0	-14.4		
W144*				142.65	<3	5.00			1.14	0.96	0.30	0.06			2.34		0.14				2.47	2.48	-0.2		-115.0	-14.8		
W145*	0.48			59.65	3.00	3.45			0.50	0.28	0.35	0.01	0.02		0.98	0.06	0.10				1.17	1.14	1.2		-108.0	-12.2		
W157		122.00		148.74	0.00	1.50	0.20	0.30	1.00	0.55	0.78	0.08			2.44	0.00	0.04	0.00	0.02	48.00	2.41	2.50	-1.9					
W159*		144.00		175.57	13.00	8.20	13.00	0.10	1.40	0.91	1.31	0.04			2.88	0.27	0.23	0.21	0.01	46.00	3.65	3.60	0.7		-111.0	-14.8		
W160*		78.14		87.65	27.42	9.57	2.34	2.01	0.42	0.19	1.84	0.02			1.44	0.57	0.27	0.04	0.11	24.50	2.47	2.42	0.9	0.3 ± 0.1	-111.0	-14.8		
W161				215.75	9.60	8.35	12.00	0.20	2.15	1.09	1.34	0.04			3.54	0.20	0.24	0.19	0.01		4.61	4.18	4.9					
W162		164.00		199.95	15.00	20.00	1.80	0.50	1.45	0.91	1.52	0.23			3.28	0.31	0.56	0.03	0.03	60.00	4.11	4.21	-1.3					
W163				132.67	8.67	4.33	43.00	0.10	1.51	0.71	0.84	0.06			2.17	0.18	0.12	0.69	0.01		3.13	3.18	-0.7					
W165				124.00	13.00	3.00	6.60	0.30	0.93	0.55	1.03	0.06			2.03	0.27	0.08	0.11	0.02		2.57	2.51	1.1					
W169*				124.36	<3	4.00			0.94	0.61	0.51	0.14			2.04		0.11				2.20	2.15	1.1	<3.13	-113.0	-14.4		
W172	<0.1			320.00	320.00	51.00			8.48	2.70	3.65	0.20			5.24	6.70	1.44				15.03	13.38	5.8					
W173		143.00		174.35	0.00	4.00	0.90	0.30	1.70	0.54	0.57	0.12			2.86	0.00	0.11	0.01	0.02	45.00	2.93	3.00	-1.3					
W175		252.67		308.05	108.00	9.00	18.33		1.76	1.48	4.12	0.23			5.05	2.25	0.25	0.30			7.59	7.85	-1.7					
W176		156.00		190.20	13.33	12.33	8.20		1.63	1.26	0.78	0.21			3.12	0.28	0.35	0.13			3.89	3.88	0.2					
W177		189.00		230.43	34.00	12.00	1.10	0.20	2.40	1.48	0.74	0.23			3.78	0.71	0.34	0.02	0.01	62.00	4.85	4.85	-0.1					
W178		95.50		116.44	2.50	4.30	13.00	0.10	0.82	0.35	1.07	0.06			1.91	0.05	0.12	0.21	0.01	32.50	2.30	2.30	0.0					
V72*		150.00		182.88											3.00										-116.0	-14.6		
V76*		75.00		91.44											1.50										-101.0	-12.4		
V77*																									-113.0	-13.6		
V80*		100.00		121.92											2.00										-112.0	-14.5		
V93*				287.00											4.70										-57.0	-4.9	-2.0	
V94*				422.00											6.92										-58.0	-5.6	-2.6	
V99*																									-90.0	-11.4		
V106																									-86.0	-9.6		
V105*																									-95.0	-9.9		
V141*		500.00		690.00											11.31										-108.0	-13.6	-10.8	79.8
V168*																								0.3	-114.0	-14.0	-4.4	83.8
V170			0.58	112.00	11.10	4.10		0.88	0.39	0.23	1.85	0.02		0.02	1.84	0.23	0.12		0.05	32.40	2.49	2.26	4.8		-113.0	-14.8		
V171*		85.00		25.00											0.41									4.7	-108.0	-14.3	0.4	
V174*																								0.9	-108.0	-13.3	-2.7	74.6
V175*																									-105.0	-13.0		
V176*																									-107.0	-13.2		
V177*		320.00		450.00											7.38										-103.0	-13.3	-11.9	46.0
V178*		170.00		221.00											3.62										-109.0	-13.5	-9.0	30.7
V180*		118.00		98.00											1.61										-107.0	-13.5	-6.7	35.0
V181*																									-106.0	-13.3		
V183*																									-107.0	-12.6	-9.0	102.6
V184*																									-89.0	-9.3		
V185*																									-90.0	-9.3		
V186*																									-85.0	-8.5		
V187*																									-100.0	-13.2		
V189*																									-111.0	-13.3		
V190*																									-114.0	-12.4		
V191*		245.00	10.70	298.71	201.00	80.70	2.15	0.08	0.32	1.16	8.44	1.15		0.36	4.90	4.18	2.28	0.03	0.00	54.90	11.07	11.75	-3.0		-107.0	-13.4	-7.9	
V192*																									-108.0	-13.4	-7.8	75.0
V193*																									-107.0	-13.4		
V195*	0.06		1.12	198.00	93.20	116.00	0.01	0.07	3.15	0.01	2.81	0.19	0.00	0.04	3.25	1.94	3.27	0.00	0.00	47.40	6.16	8.50	-16.0		-120.0	-15.1	-11.9	13.1
V196*	0.03		1.17	216.00	190.00	31.10		0.07	3.18	1.88	3.54	0.17	0.00	0.04	3.54	3.96	0.88		0.00	45.10	8.77	8.42	2.0		-118.0	-14.8	-11.9	15.0
V197*			1.83	208.00	219.00	34.00	0.17	0.09	2.94	2.10	3.92	0.13		0.06	3.41	4.56	0.96	0.00	0.00	35.20	9.09	8.99	0.6		-114.0	-14.3	-13.8	16.1
V198*			1.10	198.00	343.00	40.70	7.33	0.12	5.59	3.53	3.13	0.18		0.04	3.25	7.14	1.15	0.12	0.01	42.60	12.43	11.71	3.0		-110.0	-13.8	-13.2	23.4
V199*																									-108.0	-13.8	-13.1	38.5
V200*																									-108.0	-13.7	-12.4	45.2
V201*																									-110.0	-13.6	-11.4	71.4
V202*																									-110.0	-13.9	-11.0	50.3
V203*																									-112.0	-14.1	-11.4	17.5
V205*		160.00		213.00											3.49										-109.0	-13.6	-11.8	60.9
V206*																									-112.0	-13.8	-11.9	30.7
V207*																								0.2	-111.0	-13.8	-12.3	55.4
R107		100.00		121.92											2.00										-113.0	-13.6		
B688				256	53.27	31.86	0.00	0.25	1.73	0.48	3.89	0.12		0.00	4.20	1.11	0.90	0.00	0.01		6.22	6.22	0.0		-109.5	-13.5	-14.4	
B690*	0.13			162.93	55.44	14.29	0.10	0.98	1.05	0.63	2.19	0.11	0.01		2.67	1.16	0.40	0.00	0.05	0.00	3.98	4.28	-3.6		-111.3	-14.0	-11.0	
H4084*				155.33	35.67	11.00	14.00	0.13	2.00	0.98	1.30	0.08			2.60	0.80	0.30	0.23	0.01		4.36	3.94	5.0	3.9	-102.7	-12.1	-12.5	112.8
H4085*				178.70	36.32	12.21	3.45	0.19	1.93	1.11	1.29	0.09			2.93	0.76	0.34	0.06	0.01	30.70	4.42	4.10	3.8	2.55	-110.0	-13.9		90.5
H4088*		92.00		113.90	4.43	4.05	0.10	0.08	0.69	0.41	0.90	0.05			1.87	0.09	0.11	0.00	0.00	20.70	2.05	2.07	-0.5	<2	-112.0	-14.0		
H4089*		184.00		224.34	81.00	23.00	4.00	0.90	2.00	0.91	3.09	0.16			3.68	1.69	0.65	0.06	0.05	33.00	6.15	6.13	0.2	2.7	-102.2	-12.4		
H4115*		187.00	2.05	220.05	39.79	19.06	1.30	0.18	0.12	0.02	4.52	0.21			3.56	0.76	0.47	0.04	0.02	31.30	4.87	4.85	0.2	0.4	-107.0	-13.6	-3.3	63.6
H4120*		157.00		191.42	1.30	7.50	5.70	0.40	1.90	0.60	0.96	0.05			3.14	0.03	0.21	0.09	0.02	42.00	3.50	3.49	0.1		-109.8	-14.1		
H4121*				122.00	2.00	2.00	2.90		0.75	0.74	0.57	0.03			2.00	0.04	0.06	0.05			2.08	2.14	-1.5	<2	-111.9	-14.3		
H4122*		116.00		141.43	4.00	5.00	6.70	0.10	1.35	0.61	0.61	0.07			2.32	0.08	0.14	0.11	0.01	33.00	2.64	2.66	-0.4		-109.2	-13.9		
H4123*		160.00		189.00	5.33	14.57	0.39	0.33	0.39	1.18	1.89	0.25			3.10	0.11	0.41	0.01	0.02	34.60	3.71	3.65	0.8	2.0	-109.0	-13.1		
H4124*	0.05			137.50	41.00	13.00	31.00	0.50	1.40	0.82	1.87	0.10	0.00		2.25	0.85	0.37	0.50	0.03		4.20	4.00	2.4		-106.3	-13.0		
H4125*		200.50		186.00	255.67	10.67	1.43	0.93	2.26	3.84	3.29	0.16			3.05	5.32	0.30	0.02	0.05		9.55	8.74	4.4		-110.1	-13.4		
H4126*				106.00	10.33	8.33	29.00	0.20	1.21	0.69	0.77	0.08			1.74	0.22	0.24	0.47	0.01		2.74	2.67	1.5	0.4	-107.4	-13.0		
H4127*	0.06			200.55	62.11	16.33	0.12	0.70	1.82	1.01	2.66	0.10			3.81	1.29	0.46	0.00	0.04	16.87	5.60	5.60	0.0		-105.4	-13.5	-7.5	
H4129*		294.17		352.55	193.33	88.95	2.43	0.41	0.11	0.06	11.27	0.27			7.49	3.50	1.63	0.01	0.01	28.60	11.71	12.64	-3.8	0.0	-112.0	-13.8	-6.8	
H4130*				109.50	3.14	2.65	0.55	0.08	0.50	0.17	1.28	0.04			1.79	0.07	0.07	0.01	0.00	7.70	1.99	1.94	1.3	0.3	-109.0	-13.7	-15.4	73.1
H4131*		90.00		93.67	6.35	5.95	17.50	0.10	1.22	0.37	0.57	0.03			1.54	0.13	0.17	0.28	0.01		2.20	2.12	1.7		-107.1	-14.4		
H4132*		95.00		82.10	47.67	15.17	0.01	1.80	0.04	0.01	2.64	0.00			1.35	0.99	0.43	0.00	0.09	21.10	2.69	2.86	-3.1	0.4	-113.0	-14.8		
H4133*	0.14			163.57	5.33	2.92	0.08	0.10	1.16	0.83	0.74	0.09	0.01		2.68	0.11	0.08		0.00		2.83	2.88	-0.9	2.7	-103.4	-13.4	-12.0	
H4134*	0.07	68.00		70.21	50.30	13.92	0.09	1.96	0.12	0.01	2.74	0.02	0.00		1.26	1.05	0.39		0.11		2.88	2.81	1.3	0.4	-118.5	-15.4	-12.8	
W5	0.14		0.00	144.00	29.00	15.00	2.20	0.10	0.85	0.17	2.13	0.18	0.01	0.00	2.36	0.60	0.42	0.04	0.01	40.00	3.34	3.43	-1.3					
W34		97.20		118.51	15.20	9.68	1.65	0.15	0.43	0.15	1.91	0.12			1.94	0.32	0.27	0.02	0.01	38.75	2.61	2.56	1.1					
W35		107.67		131.00	17.00	10.00	0.47	0.17	0.21	0.20	1.90	0.10			2.10	0.35	0.28	0.01	0.01	35.00	2.41	2.75	-6.6					
W36*					18.00	10.00			0.25	0.12	1.87	0.09			1.61	0.37	0.28			35.00	2.33	2.26	1.5		-113.0	-14.8	-10.4	
W37		82.00		99.98	18.00	12.00	1.10	0.10	0.29	0.03	2.00	0.05			1.64	0.37	0.34	0.02	0.01	3.10	2.37	2.38	-0.1					
W39				118.00	22.00	12.00			0.20	0.07	2.48	0.08			1.93	0.46	0.34			29.00	2.83	2.73	1.8					
W40*			11.00	25.00	303.00	160.00	0.50		0.80	0.04	10.35	0.15		0.37	0.41	6.31	4.51	0.01		95.00	11.35	11.61	-1.1					
W69		120.27		146.64	156.91	415.18	3.68	0.29	5.67	1.97	9.59	0.40			2.40	3.27	11.71	0.06	0.02	53.36	17.63	17.45	0.5					
W70		152.00		185.32	69.00	18.00	1.50	0.40	1.45	1.07	2.44	0.23			3.04	1.44	0.51	0.02	0.02	54.00	5.18	5.03	1.5					
W71*		153.00		186.54	67.00	18.00	1.40	0.40	1.40	0.99	2.44	0.21			3.06	1.39	0.51	0.02	0.02	55.00	5.03	5.01	0.2					
V46																									-116.0	-14.8		
V108																									-113.0	-15.0		
V182*																									-96.0	-12.2		
V188*																									-108.0	-13.2		
V211*		50.00	1.65	60.96	268.00	148.00		3.99	0.88	0.01	11.05	0.18		0.05	1.00	5.58	4.18		0.21	106.00	12.12	11.02	4.8	0.2	-120.0	-14.9	-9.9	10.0
V212																									-117.0	-14.7		
V213																									-116.0	-14.8		
R90		110.00		134.11											2.20										-114.0	-14.6	-10.1	
H4116*		75.00	0.57	105.90	38.43	25.39	0.55	0.12	0.44	0.17	2.40	0.25			2.06	0.78	0.67	0.01	0.01	45.70	3.26	3.53	-4.0	0.3	-113.0	-14.6	-10.2	17.1
H4117*		92.57		129.00	21.88	11.95	2.89	0.16	0.84	0.09	2.21	0.10			2.11	0.46	0.34	0.05	0.01	36.50	3.24	2.96	4.4	<2	-114.0	-14.6		
H4135*	0.03		9.00	49.25	342.20	188.91	0.29	2.87	1.26	0.00	12.04	0.25	0.00	0.15	0.81	7.13	5.33	0.00	0.15	53.00	13.55	13.56	0.0	0.0	-118.4	-13.2	-12.9	
W3*																									-110.0	-14.6		
W27		78.00		95.10	16.00	13.00	0.80		0.27	0.03	1.96	0.04			1.56	0.33	0.37	0.01	0.00	27.00	2.30	2.27	0.7					
W30		94.00		114.00	18.00	12.00	0.40		0.30	0.16	2.04	0.04			1.87	0.37	0.34	0.01			2.55	2.59	-0.8					
W31		94.40		118.00	14.40	10.14	4.90	0.35	0.26	0.06	2.19	0.06			1.93	0.30	0.29	0.08	0.02	25.00	2.57	2.62	-0.9					
W32*				85.00	13.00	9.00			0.20	0.07	2.09	0.05			1.40	0.30	0.30				2.41	2.00	9.3		-112.0	-14.5	-12.8	21.6
W33*				98.53	15.33	9.33	0.30	0.20	0.17	0.16	1.83	0.08			1.61	0.32	0.26	0.00	0.01	34.00	2.24	2.21	0.5		-113.3			
W48				224.00	1200.00	2010.00			2.64	4.03	78.74				3.67	24.98	56.70				85.41	85.36	0.0					
W52*	0.10		<1.0	530.00	180.00	590.00	12.00	1.70	0.25	0.74	29.58	0.46	0.00		8.69	3.75	16.64	0.19	0.09	14.00	31.03	29.36	2.8		-108.0	-13.7		
W54				354.00	72.00	95.00	2.60	1.90	1.70	1.23	7.35	0.28			5.80	1.50	2.68	0.04	0.10		10.56	10.12	2.1					
W55*				267.00	8.00	3.00			2.20	1.07	1.09	0.20			4.38	0.17	0.08			54.00	4.56	4.63	-0.8		-101.6			
W56				294.00	25.00	14.00	4.20	0.40	2.79	1.56	1.74	0.23			4.82	0.52	0.39	0.07	0.02		6.33	5.82	4.2					
W57	0.10			339.20	37.20	121.40	1.02	1.20	0.76	1.45	8.33	0.13	0.00		5.56	0.77	3.42	0.02	0.06		10.68	9.84	4.1					
W58		506.00		593.00	71.50	247.00	5.10	1.40	0.32	0.81	17.66	0.31			9.72	1.49	6.97	0.08	0.07	48.00	19.10	18.33	2.0					
W59				227.50	11.00	93.00	26.00	0.30	0.55	0.74	6.26	0.17			3.73	0.23	2.62	0.42	0.02		7.73	7.02	4.8					
W60	0.70			1898.00	464.00	465.00	11.00	6.20	0.80	1.15	56.55	0.69	0.03		31.11	9.66	13.12	0.18	0.33		59.22	54.39	4.2					
W114*	0.20		<1.0	921.00	9000.00	16476.00	3.10	1.70	75.65	31.44	774.30	1.07	0.01		15.10	187.38	464.79	0.05	0.09	5.30	882.47	667.41	13.9		-96.5	-9.9		
W115	<0.1		<1.0	567.00	620.00	3960.00	8.00	0.20	2.59	4.94	123.11	1.30	0.00		9.29	12.91	111.71	0.13	0.01	20.00	131.94	134.05	-0.8					
W116*	9.00		<1.0	950.00	350.00	24300.00	1.00	0.40	7.49	67.48	700.35	2.40	0.32		15.57	7.29	685.50	0.02	0.02	18.00	778.04	708.40	4.7		-49.0	-10.9		
W123		1710.00		2084.86	464.00	465.00	11.00	6.20	0.80	1.15	56.55	0.69			34.17	9.66	13.12	0.18	0.33		59.19	57.45	1.5					
W124				405.00	34.00	1050.00	63.00	0.50	1.75	3.37	32.71	0.84			6.64	0.71	29.62	1.02	0.03		38.68	38.01	0.9					
V87*																									-103.5	-13.3		
V89*																									-101.0	-12.5		
V139																									-113.0	-14.2		
V179*				218.00											3.57										-115.0	-14.1	-10.2	
V194*		180.00	8.23	219.46	33.80	20.30		0.03	0.61	0.32	4.08	0.41		0.27	3.60	0.70	0.57		0.00	63.80	5.42	5.14	2.7	0.5	-109.0	-14.4	-12.5	56.8
B687				1211	2100.90	5716.00	0.00	8.45	1.79	5.38	197.06	2.82			19.85	43.74	161.25	0.00	0.44		207.05	225.28	-4.2		-96.8	-10.3	-6.4	
H4118*				226.00	22.63	27.77	0.10	0.20	0.75	0.59	3.51	0.14			3.70	0.47	0.78	0.00	0.01	40.55	4.99	4.97	0.2		-114.9	-14.6		
H4119*		184.00		224.00	6.50	4.00	4.20	0.30	1.55	0.82	1.39	0.17			3.67	0.14	0.11	0.07	0.02		3.93	4.00	-0.9	0.9	-105.9	-12.8		

Table 1c. All Honey Lake Basin sample data.

KEY	
Has solute chemistry data.	HCO_3^- calculated from $CaCO_3$ to by dividing by 0.8202
Has isotope data.	Calculated, not measured value.
Has both solute chemistry and isotope data.	R=Rose (1997)
Sample included in multiple flow paths.	W=Webber (1996)
Averaged value	V=Varian (1997)
Combined data from different investigations.	B=BYU
* Sample location included in multiple investigations.	H=Henderson

Flow Path	Name	Sample #	Multiple Sample Location Sample #	Sample Date	Zone	Easting	Northing	Easting (converted to zone 10)	Northing (converted to zone 10)	Elevation (m)	Water Source	Depth Interval (ft)	Perf. Interval (ft)	Q (gpm)	Temp (°C)	pH	Cond (µS/cm)	TDS (mg/L)
Fort Sage Mountians Flow Path (FSM)																		
FSM	McCorkle Dom. Well.a	W104*	V152	1/24/90	11	245270.9	4442764.3	756745.9	4442833.0	1213.10	well	65			13.00	7.36		316.00
FSM	Austin Dom. Well.a	W105*	V151	1/21/90	11	245326.4	4442716.3	756803.7	4442789.1	1213.10	well				16.00	8.10		321.00
FSM	Wilson #5 Well.a	W107			11	245356.7	4442155.7	756872.9	4442232.2		well					8.20		467.25
FSM	Wilson Well.c	W108*	V156		11	245308.7	4442148.1	756825.7	4442220.0		well				16.00	8.15		467.89
FSM	Perkle Dom. Well.a	W113*	V161	1/21/90	11	246884.6	4443919.4	758277.7	4444094.7	1214.63	well					8.20		3449.60
ESA/FSM	Austin North Dom. Well.a	W114*	V162	1/24/90	11	246914.9	4445860.4	758176.9	4446034.6	1214.63	well				13.60	7.80		50259.00
ESA/FSM/VM	Stanley Well.a	W115		2/6/90	11	248523.6	4445509.4	759804.4	4445791.6	1207.92	well	490				8.30		8140.00
FSM	Hail Dom. Well.a	W117*	V163	1/21/90	10	755708.1	4440617.6			1228.34	well	35			5.00	8.60		173.00
FSM	W Havil Dom. Well.a	W118		4/13/88	10	755708.1	4440858.7				well	25			17.80	8.25		192.05
FSM	26N17E24F01 M.a	W119		3/7/89	10	755014.4	4442261.6				well	67				8.90		354.00
FSM	26N17E22G01.a	W120		4/13/88	10	751706.3	4442206.2				well	60			28.30	8.60		315.15
ESA/FSM	26N17E01P01 M.a	W123		11/7/88	10	754959.0	4447036.2								15.00	8.30		3320.00
ESA/FSM	B Victory Irr. Well.a	W124		11/7/88	10	754959.0	4447733.6				well	300			15.00	7.85		2305.15
FSM	2TP Spring.a	W152*	V65	9/28/89	11	244589.8	4434789.7	756576.5	4434844.9	2097.02	spring			0.02		7.50		176.30
FSM	Rat Spring.a	W153*	V67	9/28/89	11	246270.5	4437469.9	758080.0	4437628.2	1578.86	spring			1	15.00	7.30		136.80
FSM	Mullen Creek.a	W154*	V102	??/??/89	11	245292.3	4439356.2	756976.2	4439464.4		surface							
FSM	Spring N. Ft. Sage Mtn.	V68*	R109	4/9/96	11	246520.7	4438393.7	758279.2	4438595.1		spring				10.30	8.02	307.00	
FSM	Cal Neva Rd. - DWR West	V165*	R152	8/15/96	10	755068.9	4441810.4				well	109	99-109					
FSM	Nork/Francone Well	H4128*	W106, V155		11	245434.4	4442664.5	756915.3	4442744.3	1205.69	well				22.35	7.88	2730.00	731.90
Virginia Mountains Flow Path (VM)																		
VM	First Fault.a	W90*	V143	5/27/90	11	253634.5	4440710.2	765211.1	4441366.5		well					8.00		173.00
VM	Jarboe Well.c	W91*	V144		11	253801.7	4442102.6	765301.7	4442749.9		well	497			21.00	8.14		181.66
VM	Ferrel Playa Well.a	W92		3/30/90	11	253516.3	4442771.9	764970.0	4443397.8		well	477				8.30		201.00
VM	Headquarters	W93*	V146, B3251, B3559		11	254496.0	4442760.1	765949.5	4443452.6		well	400			19.17	8.30	302.00	213.30
VM	Fish Spring.a	W97		7/27/66	11	253976.0	4443152.0	765403.6	4443807.9		spring				22.80	8.00		298.00
VM	Willow Spring.a	W103*	V42		11	252122.3	4439882.8	763748.3	4440431.9	1414.27	spring				16.60	7.47		159.45
VM	Ferrel Test Well.a	W109*	V158	4/23/90	11	251751.1	4442307.2	763241.8	4442814.4	1212.40	well	450			20.33	8.27		230.31
VM	Ferrel #1 Well.a	W110*	V157	7/27/66	11	251347.0	4442564.8	762821.3	4443044.1		well	252			20.00	7.90		257.90
VM	Ford #2 Well.a	W111*	V159	8/21/84	11	248528.6	4443097.6	759973.3	4443386.9	1216.15	well	600				7.80		751.00
VM	Ford #1 Well.a	W112*	V160	1/24/90	11	248445.3	4443100.2	759889.1	4443383.4	1216.15	well	605			14.70	8.37		1089.00
ESA/FSM/VM	Stanley Well.a	W115		2/6/90	11	248523.6	4445509.4	759804.4	4445791.6	1207.92	well	490				8.30		8140.00
VM	Mustang Spring.a	W151*	V64	9/15/89	11	254528.0	4437264.1	766328.5	4438014.2	1630.68	spring			12	15.00	7.30		165.70
VM	Fish Springs Creek.a	W155*	V103		11	248818.7	4438836.1	760567.3	4439215.0	1310.64	surface				14.00			
VM	Sheep Spring.a	W156*	V69		11	250086.2	4438618.7	761818.2	4439050.4	1469.14	spring				12.50	7.20		174.50
VM	Spring E. Ft. Sage Mtn.	V66*	R108	4/9/96	11	249387.0	4434933.4	761346.0	4435318.2		spring				20.50	7.87	286.00	
VM	Fish Springs Irrigation Well-SE	V145*	R151	8/15/96	11	255343.9	4442520.1	766785.1	4443269.4		well	215	80-150					
VM	Fish Springs Irrigation Well-SW	V153*	V154, R110, R110b		11	250321.1	4442905.2	761748.8	4443332.3		well	440	160-440		17.70	8.10	747.00	
VM	Fish Springs Ranch Dom. Well	H4136*	V148, R149, B2753		11	254088.0	4443192.1	766046.2	4442697.7	1212.69	well	258	218-138		15.85	8.67	410.10	
VM	Fish Spring Ranch Irrigation Well	H4137		7/21/05	11	254959.1	4443790.1	766341.4	4444515.8	1217.69	well				19.10	7.89	296.80	
Cottonwood Flow Path (CW)																		
CW	Cottonwood Test Well.a	W94*	V147	5/10/90	11	258816.0	4442528.1	770276.9	4443511.3	1351.27	well	665				7.10		203.00
CW	Cottonwood Creek South	W95*	B3993		11	259214.0	4443453.0	770612.7	4444460.2		surface				12.20	8.40	127.60	163.85
CW	Cottonwood Springs	W96*	W149, V49, V50, V63, R11		11	259091.2	4442129.6	770577.4	4443131.2		spring				14.77	7.77	162.68	78.30
CW	Cottonwood Well #2.a	W98		5/8/90	11	259200.0	4443456.1	770596.1	4444465.2	1314.45	well	495				7.60		227.00
CW/ASP/NV	BB2-C.a	W101*	V149	5/14/90	11	255170.5	4448512.1	766235.2	4449235.3	1208.44	well	85			15.67	8.27		555.67
ESA/CW/ASP	May Well.a	W116*	V164	2/6/90	11	251902.6	4448577.8	762969.7	4449083.6	1213.10	well	250			12.40	7.09		42700.00
CW	Upper Red Spring.a	W146*	V58	11/17/89	11	260031.9	4430016.1	772321.9	4431126.9		spring				14.00	7.93		198.00
CW	Black Canyon.a	W147*	V60	9/12/89	11	260032.0	4432896.1	772118.7	4433991.6	1956.82	spring			3	14.00	7.40		161.90
CW	Newcombe Spring.a	W148*	V61	??/??/89	11	254848.0	4433088.0	766938.0	4433849.3	1633.73	spring				20	7.3		247.7
CW	Cold Spring.a	W150*	V62	9/12/89	11	259159.9	4437600.1	770940.4	4438644.1	1798.32	spring			5	12.00	7.30		125.00
CW	Cottonwood Creek	V97		7/3/86	11	259072.0	4441888.1	770642.3	4442955.8		surface				15.00			
CW	E. Cottonwood Canyon Creek	V98*	R112	4/9/96	11	259128.0	4444304.1	770542.6	4445300.0		surface				14.10	8.29	149.10	
CW	Cottonwood Snow	B689		3/10/00	11	259613.1	4442289.0	770959.2	4443303.2		snow							
CW	Cottonwood Creek	B3992		3/23/05	11	258739.0	4442608.0	770243.3	4443654.0		surface				6.50		107.40	
Neversweat Flow Path (NV)																		
NV	Hodges Well.b	W100*	V150		11	261147.6	4446701.7	772321.5	4447833.9		well	260			18.75	7.88		199.75
CW/ASP/NV	BB2-C.a	W101*	V149	5/14/90	11	255170.5	4448512.1	766235.2	4449235.3	1208.44	well	85			15.67	8.27		555.67
NV	Never Sweat Ranch	W102*	B2755, B3252		11	260150.6	4447858.0	771247.8	4448920.6		well	500			14.90	8.25	352.80	764.70
ESA/CW/ASP	May Well.a	W116*	V164	2/6/90	11	251902.6	4448577.8	762969.7	4449083.6	1213.10	well	250			12.40	7.09		42700.00
Astor/Sand Pass (ASP)																		
ASP	Astor Pass 1.a	W49			11	261008.7	4453665.5	771714.1	4454772.8		well	180				8.30		2619.80
ASP	Astor Pass 2.a	W50			11	260633.1	4453839.2	771327.2	4454920.3		well	180				8.50		2120.10
ASP	Astor Pass Test Well.a	W51*	V137	4/3/90	11	260380.5	4454142.2	771055.6	4455205.5	1204.90	well	440			21.00	7.90		2469.00
CW/ASP/NV	BB2-C.a	W101*	V149	5/14/90	11	255170.5	4448512.1	766235.2	4449235.3	1208.44	well	85			15.67	8.27		555.67
ESA/CW/ASP	May Well.a	W116*	V164	2/6/90	11	251902.6	4448577.8	762969.7	4449083.6	1213.10	well	250			12.40	7.09		42700.00
ASP/ESA	Stone Well	B687		3/10/00	11	253040.2	4450965.2	763807.1	4451577.2		well	130			11.20	7.54	14280.00	
ASP	Astor Pass	B2041		3/15/01	11	260577.4	4454017.5	771259.4	4455095.3		well							
Honey Lake/Warm Springs Fault Zone Flow Path (HLW)																		
SR/HLW	Mormon Church Heating	W21*	RE2	??/06/67	10	689499.7	4474238.5				well				52.20	7.70		
SR/HLW	Roosevelt Swimming Pool	RE1		7/18/73	10	698211.9	4475618.7				well	90m			35.80	8.01		
LV/HLW	Rose 27	H4132*	R27		10	749695.5	4428001.9			1317.66	well	600	30-600		37.60	8.90	282.20	
LV/HLW	Zamboni Hot Spring	H4134*	V78, R103, B2751, B3250, I		10	754357.6	4423082.0			1370.65	spring				39.46	9.13	347.98	
Antelope Moutnain/Litchfield Fault Zone Flow Path (AML)																		
WSA/AML	Amedee Hot Springs	W40*	V215, RE5	2/15/67	10	738308.0	4465011.0				spring				102.78	8.60		948.00
SR/AML		V209*	V210, R38		10	713916.0	4475844.1				geo well	1420	775-1414		66.95	8.75	970.00	620.00
WSA/AML		V211*	V214, R40		10	738388.5	4465219.4				geo well	1058	312-1047		98.90	8.90	1750.00	748.00
WSA/AML	Norcal 1	V212		9/1/95	10	738424.1	4465368.0				geo well	1491	744-1037					
WSA/AML	Norcal 1	V213		9/1/95	10	738392.1	4465320.0				geo well	1491	744-1037					
WSA/AML	HL Power Plant	H4135*	W6, V44		10	732239.6	4471941.9			1220.69	spring/well				62.71	8.30	1800.00	967.00
Outside the basin (OUT)																		
OUT	Pipe Spring.b	W2*	V41		11	252409.7	4469117.9	762113.4	4469589.8		spring							
OUT	Well 3891.a	W24*	V120	10/03/89	11	263232.0	4462784.0	773307.4	4464039.7	1185.98	well			6	22.2	8.4		1773.7
OUT	Well 3902.a	W25*	V121	10/03/89	11	261568.0	4463296.1	771637.3	4464426.3	1189.33	well			1	20.0	8.1		1734.8
OUT	Bonham Ranch 1.a	W26*	V122, V123	09/13/66	11	262336.0	4466688.1	772178.5	4467874.8		well				23.3	8		
OUT	Sand Pass Test Well.a	W46*	V136	03/27/90	11	263360.0	4461504.0	773523.9	4462725.3	1203.38	well	712			15.5	8.7		1562
OUT	Sand Pass #2 Well.a	W47		04/08/90	11	263104.0	4461504.1	773276.5	4462709.8	1203.62	well	580				8.1		1634
OUT	W. Goeth. Needles #1 Well.a	W86		??/??/73	11	271936.0	4448512.1	782966.5	4450386.9		well				56.1	8.4		
OUT	Shallow Spring.a	W87		12/04/89 ?	11	264768.0	4445888.1	775961.9	4447273.7		spring					7.32		632
OUT	The Needle Rocks Well.a	W88		08/??/75	11	269631.9	4447424.1	780732.0	4449119.0		well				82.2	7.4		4615
OUT	Upper Adobe Spring.a	W89*	V48	10/26/89	11	263218.4	4446019.9	774443.0	4447286.3	1432.56	spring				7.0	7.5		454
OUT	Upper Juniper Spring.a	W99*	V51	10/26/89	11	261979.0	4446764.5	773137.4	4447951.6	1554.48	spring				8.0	7.5		380
OUT	Tule Spring.a	W142*	V54	9/13/89	11	265472.0	4433920.0	777491.3	4435375.9	2377.44	spring			0.12	12	7.2		54.9
OUT	Suzie Spring.a	W168*	V71	9/12/89	11	262725.4	4426482.5	775151.1	4427646.6	1676.40	spring			10	17.00	7.70		223.40
OUT	ADP Spring.a	W170*	V74	8/31/89	11	261202.9	4426459.7	773710.2	4427599.7	1621.54	spring			25		8.10		172.70
OUT	Spring de Casa.a	W171*	V75	8/31/89	11	260705.9	4426990.1	773354.5	4428125.0	1645.92	spring			10		7.90		156.80
OUT	24N15E20A02M.a	W174		9/8/59	10	728480.6	4422264.6								18.00	7.90		419.00
OUT	Fleming Spring	V29*	R96	4/8/96	10	721408.0	4514628.0				spring				16.80	8.29	120.50	
OUT	Eagle Lake Spring	V32*	R119	5/28/95	10	699260.0	4503744.1				spring				17.00		165.00	
OUT	Fleming Creek	V81*	R97	4/8/96	10	722944.0	4514560.1				surface				16.40	7.84	102.40	
OUT	Soda Springs	B2756		3/14/02	11	267542.0	4461224.0	777690.6	4462936.5		spring				14.30	8.53	4039.00	
OUT	Mt. Lassen Snow	Laird		3/9/83	10	626561.5	4483138.8			2432m	snow				0.00	5.69	2.32	

Sample #	Solutes: Cations (mg/L) Ca^{2+}	Mg^{2+}	Na^+	K^+	Fe^{2+}	Anions (mg/L) $CaCO_3$	CO_3^{2-}	HCO_3^-	SO_4^{2-}	Cl^-	NO_3^-	F^-	Cations (meq/L) Ca^{2+}	Mg^{2+}	Na^+	K^+	Fe^{2+}	Anions (meq/L) CO_3^{2-}	HCO_3^-	SO_4^{2-}	Cl^-	NO_3^-	F^-	SiO2 (mg/L)	Total Cations	Total Anions	Balance Error %	Isotopes: ^3H (TU)	δ^2H (‰)	$\delta^{18}O$ (‰)	$\delta^{13}C$ (‰)	^{14}C (pmc)
FSM																																
W104*	18.70	22.40	31.00	8.10	<0.1		<1.0	181.00	49.00	5.00	3.50	0.30	0.93	1.84	1.35	0.21			2.97	1.02	0.14	0.06	0.02	12.00	4.33	4.20	1.5		-116.0	-15.2		
W105*	39.30	12.90	18.00	0.40	<0.1		<1.0	187.00	26.00	3.90	2.70	0.30	1.96	1.06	0.78	0.01			3.06	0.54	0.11	0.04	0.02	8.00	3.82	3.78	0.5		-114.0	-14.9		
W107	21.00	1.60	122.50	3.93	0.04	93.75		114.30	228.25	20.00	1.10	1.03	1.05	0.13	5.33	0.10	0.00		1.87	4.75	0.56	0.02	0.05		6.61	7.26	-4.7					
W108*	20.00	1.56	126.57	3.66	0.04	93.33	4.93	108.45	202.63	20.09	0.18	0.95	1.00	0.13	5.51	0.09	0.00	0.25	1.78	4.22	0.57	0.00	0.05	38.50	6.73	6.86	-1.0	<3.13	-118.0	-14.3		
W113*	59.30	2.70	1130.00	30.00	0.50			1103.00	2.00	1122.00	2.70	0.70	2.96	0.22	49.16	0.77	0.02		18.08	0.04	31.65	0.04	0.04	10.50	53.12	49.85	3.2		-109.5	-13.6		
W114*	1516.00	382.10	17800.00	42.00	0.20		<1.0	921.00	9000.00	16476.00	3.10	1.70	75.65	31.44	774.00	1.00	0.01		15.10	187.40	464.90	0.10	0.09	5.30	882.10	667.58	13.8		-96.5	-9.9		
W115	52.00	60.00	2830.00	51.00	<0.1		<1.0	567.00	620.00	3960.00	8.00	0.20	2.59	4.94	123.11	1.30	0.00		9.29	12.91	111.71	0.13	0.01	20.00	131.94	134.05	-0.8					
W117*	12.00	<1.0	33.00	5.50	<0.1		20.00	56.00	35.00	12.00	<1.0	0.50	0.60	0.00	1.44	0.14		0.67	0.90	0.70	0.30		0.03	8.00	2.17	2.59	-8.8		-116.0	-15.3		
W118	9.00	3.00	36.00	5.70				77.70	34.00	10.00	2.10	0.50	0.45	0.25	1.57	0.15			1.27	0.71	0.28	0.03	0.03		2.41	2.32	1.8					
W119	1.00	1.00	108.00	2.20		131.00		159.72	97.00	9.00	3.00	0.60	0.05	0.08	4.70	0.06			2.62	2.02	0.25	0.05	0.03		4.89	4.97	-0.9					
W120	11.00	4.00	70.00	7.50				99.50	70.00	29.00	5.80	2.40	0.55	0.33	3.05	0.19			1.63	1.46	0.82	0.09	0.13		4.11	4.13	-0.1					
W123	16.00	14.00	1300.00	27.00		1710.00		2084.86	464.00	465.00	11.00	6.20	0.80	1.15	56.55	0.69			34.17	9.66	13.12	0.18	0.33		59.19	57.45	1.5					
W124	35.00	41.00	752.00	33.00				405.00	34.00	1050.00	63.00	0.50	1.75	3.37	32.71	0.84			6.64	0.71	29.62	1.02	0.03		38.68	38.01	0.9					
W152*	18.60	10.20	7.70	1.90				126.00	4.00	7.00			0.93	0.84	0.33	0.05			2.07	0.08	0.20				2.15	2.35	-4.3		-115.0	-14.7		
W153*	19.20	1.80	14.50	3.10				84.10	8.00	6.00			0.96	0.15	0.63	0.08			1.38	0.17	0.17				1.82	1.71	2.9		-118.0	-14.7		
W154*																													-114.0	-15.3		
V68*						130.00		158.50											2.60										-116.0	-14.9		
V165*								104.00											1.70										-116.0	-15.2	-14.1	59.0
H4128*	34.45	2.65	206.00	4.40	<0.05			88.30	339.50	36.00	1.80	1.60	1.70	0.20	8.90	0.10			1.50	7.10	1.02	0.03	0.10	44.00	10.90	9.74	5.6	0.5	-119.0	-14.6		
VM																																
W90*	8.90	0.60	37.50	3.50	0.13	81.00		98.76	11.00	9.00	1.00	0.20	0.44	0.05	1.63	0.09	0.00		1.62	0.23	0.25	0.02	0.01		2.22	2.13	2.1					
W91*	12.55	4.32	27.46	6.54	0.01	98.50	5.90	120.46	10.17	7.12	4.45	0.16	0.63	0.40	1.20	0.17	0.00	0.20	1.97	0.20	0.20	0.07	0.01	44.00	2.40	2.65	-5.0	<3.13	-112.0	-13.7		
W92	7.10	1.10	77.00	5.80	<0.02			154.85	22.00	27.00	4.00		0.35	0.09	3.35	0.15			2.54	0.46	0.76	0.06			3.94	3.82	1.6					
W93*	11.78	2.03	56.86	6.58	0.23	132.00	1.60	155.57	11.88	10.54	2.71	0.19	0.59	0.17	2.47	0.17	0.01	0.05	2.55	0.25	0.30	0.04	0.01	53.00	3.41	3.20	3.2	1.4	-113.0	-14.7	-13.4	43.5
W97	3.00	3.00	78.00					179.00	17.00	18.00			0.15	0.25	3.39				2.93	0.35	0.51				3.79	3.80	-0.1					
W103*	16.10	5.95	10.65	2.65	<0.1			97.32	5.00	5.10			0.80	0.49	0.46	0.07			1.59	0.10	0.14				1.82	1.84	-0.5	<3.13	-114.0	-14.4		
W109*	5.96	1.58	66.50	6.08	0.05	122.50	7.46	136.09	17.67	18.22	4.57	0.31	0.30	0.13	2.89	0.16	0.00	0.25	2.23	0.37	0.51	0.07	0.02	43.50	3.48	3.45	0.4	<3	-114.0	-14.0		
W110*	4.00	2.90	67.00					144.00	18.00	22.00			0.20	0.24	2.91				2.36	0.37	0.62				3.35	3.36	0.0					
W111*	15.10	4.90	195.00	12.50		199.00		242.62	280.00	24.00			0.75	0.40	8.48	0.32			3.98	5.83	0.68				9.96	10.49	-2.6					
W112*	34.90	16.50	190.00	23.70	0.20		80.00	286.00	32.00	110.60	3.10	1.70	1.74	1.36	8.27	0.61	0.01	2.67	4.69	0.67	3.12	0.05	0.09	5.30	11.98	11.28	3.0		-119.0	-15.0		
W115	52.00	60.00	2830.00	51.00	<0.1		<1.0	567.00	620.00	3960.00	8.00	0.20	2.59	4.94	123.11	1.30	0.00		9.29	12.91	111.71	0.13	0.01	20.00	131.94	134.05	-0.8					
W151*	21.30	7.70	11.20	1.70				109.73	6.00	8.00			1.06	0.63	0.49	0.04			1.80	0.12	0.23				2.23	2.15	1.8		-114.0	-14.4		
W155*																													-109.0	-14.1		
W156*	17.50	3.60	22.30	2.20	<0.1			107.00	6.10	5.85			0.87	0.30	0.97	0.06			1.75	0.13	0.17				2.20	2.05	3.5		-112.0	-13.4		
V66*						115.00		140.21											2.30										-93.0	-10.9		
V145*								103.00											1.69										-116.0	-15.1	-11.6	41.3
V153*						105.00		115.00											1.88										-102.5	-12.2	-11.3	37.0
H4136*	5.59	2.05	75.49	7.87	0.09			185.11	21.40	18.10	1.40	0.15	0.28	0.17	3.29	0.21			3.04	0.45	0.51	0.03	0.01	17.40	3.94	4.03	-1.1	1.7	-114.4	-14.6	-10.3	37.6
H4137	9.15	3.82	39.45	9.67				139.80	9.08	9.02	0.45	0.05	0.46	0.31	1.72	0.25			2.29	0.19	0.25	0.01	0.00	13.00	2.74	2.74	0.0	0.7	-112.0	-14.3		
CW																																
W94*	22.20	8.60	17.70	6.50	0.12	122.00		148.74	7.00	7.00	4.80	0.10	1.11	0.71	0.77	0.17	0.00		2.44	0.15	0.20	0.08	0.01		2.76	2.87	-2.0					
W95*	14.53	8.21	13.36	2.29	0.09		12.00	103.55	3.91	2.32	0.87	0.15	0.72	0.70	0.60	0.06	0.00	0.40	1.70	0.08	0.07	0.01	0.01		2.09	2.26	-4.0		-110.4	-14.4		
W96*	12.81	5.09	11.70	4.93	0.06			95.02	3.56	2.93	0.89	0.09	0.64	0.42	0.51	0.13			1.56	0.08	0.08	0.02	0.01	21.67	1.69	1.75	-1.5	1.2	-114.3	-14.9	-19.0	
W98	22.20	7.80	15.50	5.60	0.28	127.00		154.84	11.00	7.00	1.60	0.10	1.11	0.64	0.70	0.14	0.01		2.54	0.23	0.20	0.03	0.01		2.60	3.00	-7.0					
W101*	13.87	4.60	157.33	10.47	0.11		11.99	300.33	39.33	73.33	1.00	0.40	0.69	0.38	6.84	0.27	0.00	0.40	4.92	0.82	2.07	0.02	0.02		8.18	8.25	-0.4					
W116*	150.00	820.00	16100.00	94.00	9.00		<1.0	950.00	350.00	24300.00	1.00	0.40	7.49	67.48	700.35	2.40	0.32		15.57	7.29	685.50	0.02	0.02	18.00	778.04	708.40	4.7		-49.0	-10.9		
W146*	33.00	11.00	13.00	4.70	<0.1		0.00	160.00	6.40	5.00			1.65	0.90	0.57	0.12			2.62	0.13	0.14				3.23	2.90	5.5		-116.5	-14.8		
W147*	19.40	8.40	7.70	3.50				115.83	3.00	4.00			0.97	0.69	0.33	0.09			1.90	0.06	0.11				2.08	2.07	0.2		-115.0	-15.1		
W148*	30	9	23	5.7				168.00	6.00	6.00			1.50	0.74	1.00	0.15			2.80	0.12	0.17				3.38	3.09	4.5		-116.0	-14.9		
W150*	14.30	5.80	5.40	4.70				87.78	<3	4.00			0.71	0.48	0.23	0.12			1.44		0.11				1.55	1.55	-0.2	8.44	-112.5	-14.0		
V97																													-110.0	-14.4		
V98*																													-108.0	-13.8		
B689	25.00	0.77	9.10	0.34				95.00	2.02	3.25	2.58		1.25	0.06	0.40	0.01			1.56	0.04	0.09	0.04			1.72	1.73	-0.3		-120.2	-15.3		
B3992	14.39	7.62	8.70	2.61	0.12			98.40	3.78	2.76	0.50	0.11	0.72	0.63	0.38	0.07	0.01		1.61	0.08	0.08	0.01	0.01		1.81	1.79	0.6		-107.9	-13.6		
NV																																
W100*	9.77	3.95	37.48	8.08	0.02	118.00		137.33	6.33	5.07	2.68	0.11	0.49	0.33	1.63	0.21	0.00		2.25	0.13	0.14	0.04	0.01	51.00	<0.001	<0.1	-0.1	<3.13	-113.0	-14.4		
W101*	13.87	4.60	157.33	10.47	0.11		11.99	300.33	39.33	73.33	1.00	0.40	0.69	0.38	6.84	0.27	0.00	0.40	4.92	0.82	2.07	0.02	0.02		8.18	8.25	-0.4					
W102*	17.17	3.38	107.35	8.32	0.34			223.13	71.48	36.48	5.20	0.22	0.86	0.28	4.67	0.21	0.02		3.66	1.49	1.03	0.08	0.01		6.04	6.27	-1.9	1	-108.5	-14.8	-11.2	76.8
W116*	150.00	820.00	16100.00	94.00	9.00		<1.0	950.00	350.00	24300.00	1.00	0.40	7.49	67.48	700.35	2.40	0.32		15.57	7.29	685.50	0.02	0.02	18.00	778.04	708.40	4.7		-49.0	-10.9		
ASP																																
W49	13.00	12.00	828.00	12.20	0.11			940.00	367.00	447.00	0.50	3.10	0.65	0.99	36.02	0.31	0.00		15.41	7.64	12.61	0.01	0.16		37.97	35.83	2.9					
W50	9.80	7.90	668.00	9.20	0.15			888.00	253.00	284.00	0.50	3.20	0.49	0.65	29.06	0.24	0.01		14.55	5.27	8.01	0.01	0.17		30.44	28.01	4.2					
W51*	39.60	27.80	849.00	13.40	0.04			846.00	330.00	677.00	<0.1	2.20	1.98	2.29	36.93	0.34	0.00		13.87	6.87	19.10	0.00	0.12		41.54	39.95	1.9		-104.0	-13.6		
W101*	13.87	4.60	157.33	10.47	0.11		11.99	300.33	39.33	73.33	1.00	0.40	0.69	0.38	6.84	0.27	0.00	0.40	4.92	0.82	2.07	0.02	0.02		8.18	8.25	-0.4					
W116*	150.00	820.00	16100.00	94.00	9.00		<1.0	950.00	350.00	24300.00	1.00	0.40	7.49	67.48	700.35	2.40	0.32		15.57	7.29	685.50	0.02	0.02	18.00	778.04	708.40	4.7		-49.0	-10.9		
B687	35.91	65.43	4530.00	110.10				1211	2100.90	5716.00	0.00	8.45	1.79	5.38	197.06	2.82			19.85	43.74	161.25	0.00	0.44		207.05	225.28	-4.2		-96.8	-10.3	-6.4	
B2041	14.04	9.27	542.90	11.92	0.05			876.00	172.87	256.87	0.07	2.38	0.70	0.76	23.62	0.30	0.00		14.36	3.60	7.25	0.00	0.13		25.38	25.34	0.1	2.1	-106.5	-13.1	-4.5	
HLW																																
W21*	9.50	0.60	56.00	0.90	0.20		0.00	143.00	20.00	5.90	0.30		0.47	0.05	2.44	0.02	0.01	0.00	2.34	0.42	0.17	0.00		62.00	2.99	2.93	1.0					
RE1	19.00	3.40	20.00	3.80			1.00	120.00	11.00	2.00		<0.1	0.95	0.28	0.87	0.10		0.03	1.97	0.23	0.06			53.00	2.20	2.29	-2.0					
H4132*	0.71	0.06	60.67	0.03		95.00		82.10	47.67	15.17	0.01	1.80	0.04	0.01	2.64	0.00			1.35	0.99	0.43	0.00	0.09	21.10	2.69	2.86	-3.1	0.4	-113.0	-14.8		
H4134*	2.42	0.10	63.00	0.82	0.07	68.00		70.21	50.30	13.92	0.09	1.96	0.12	0.01	2.74	0.02	0.00		1.26	1.05	0.39		0.11		2.88	2.81	1.3	0.4	-118.5	-15.4	-12.8	
AML																																
W40*	16.00	0.50	238.00	6.00			11.00	25.00	303.00	160.00	0.50		0.80	0.04	10.35	0.15		0.37	0.41	6.31	4.51	0.01		95.00	11.35	11.61	-1.1					
V209*	13.50		172.00	2.87			0.27	11.50	245.00	89.00		3.33	0.67		7.48	0.07		0.01	0.19	5.10	2.51		0.18	88.60	8.22	7.99	1.4		-122.5	-15.3	-11.9	10.6
V211*	17.60	0.09	254.00	6.99		50.00	1.65	60.96	268.00	148.00		3.99	0.88	0.01	11.05	0.18		0.05	1.00	5.58	4.18		0.21	106.00	12.12	11.02	4.8	0.2	-120.0	-14.9	-9.9	10.0
V212																													-117.0	-14.7		
V213																													-116.0	-14.8		
H4135*	25.30	0.12	276.70	11.71	0.03		9.00	49.25	342.20	188.91	0.29	2.87	1.26	0.00	12.04	0.25	0.00	0.15	0.81	7.13	5.33	0.00	0.15	53.00	13.55	13.56	0.0	0.0	-118.4	-13.2	-12.9	
OUT																																
W2*																													-110.0	-14.3		
W24*	27.20	9.60	544.00	42.00				215.00	386.00	549.00			1.36	0.79	23.66	1.07			3.52	8.04	15.49				26.89	27.05	-0.3	<3.13	-112.0	-13.0		
W25*	8.60	1.50	611.00	31.00				164.00	383.00	535.00			0.43	0.12	26.58	0.79			2.69	7.97	15.09				27.92	25.75	4.0	<3.13	-114.0	-13.3		
W26*	37.00	2.30	815.00					155.00	528.00	849.00			1.85	0.19	35.45				2.54	10.99	23.95				37.49	37.48	0.0		-115.5	-13.7		
W46*	49.40	14.80	481.00	35.00	0.12		19.18	115.83	387.00	514.00	0.30	0.70	2.47	1.22	20.92	0.90	0.00	0.64	1.90	8.06	14.50	0.00	0.04		25.51	25.14	0.7		-106.0	-13.6		
W47	62.00	17.80	468.00	32.00	0.10			152.00	307.00	519.00	1.60	0.60	3.09	1.46	20.36	0.82	0.00		2.49	6.39	14.64	0.03	0.03		25.74	23.58	4.4		-106.0	-13.6		
W86	260.00	0.10	1100.00	160.00				24.00	340.00	1900.00		3.00	12.97	0.01	47.85	4.09			0.39	7.08	53.60		0.16	6.10	64.93	61.23	2.9					
W87	82.00	44.00	44.00	2.90	<0.1			210.00	264.00	29.00			4.09	3.62	1.91	0.07			3.44	5.50	0.82				9.70	9.76	-0.3					
W88	163.00	0.10	1040.00	120.00				50.00	335.00	1950.00			8.13	0.01	45.24	3.07			0.82	6.97	55.01			117.00	56.45	62.80	-5.3					
W89*	86.00	19.00	47.00	<1	<0.1			273.00	113.00	12.00			4.29	1.56	2.04	0.00			4.47	2.35	0.34				7.90	7.17	4.9		-104.0	-12.7		
W99*	66.00	10.00	38.00	1.20	<0.1		0.00	204.00	69.00	16.00			3.29	0.80	1.65	0.03		0.00	3.34	1.44	0.45	0.00			5.77	5.23	4.9		-105.0	-12.8		
W142*	5.4	2.1	4.2	2.8				35.36	<3	2.00			0.27	0.17	0.18	0.07			0.58		0.06				0.70	0.64	4.5		-113.0	-14.4		
W168*	26.60	9.70	12.60	4.90				158.50	4.00	7.00			1.33	0.80	0.55	0.13			2.60	0.08	0.20				2.80	2.88	-1.4	<3.13	-118.0	-15.2		
W170*	19.80	6.90	11.90	5.30				120.70	<3	5.00			0.99	0.57	0.52	0.14			1.98		0.14				2.21	2.12	2.1	<3.13	-116.0	-14.4		
W171*	16.90	6.00	11.60	5.20				106.07	7.00	4.00			0.84	0.49	0.50	0.13			1.74	0.15	0.11				1.97	2.00	-0.6	<3.13	-117.0	-14.2		
W174	44.00	15.00	71.00	5.60		244.00		297.49	73.00	14.00		0.30	2.20	1.23	3.09	0.14			4.88	1.52	0.39		0.02	50.00	6.66	6.81	-1.1					
V29*																													-107.0	-13.8		
V32*																													-116.0	-15.2		
V81*																													-109.0	-13.9		
B2756	3.48	1.64	875.3	37.8	0.142			502	447.15	822.18	0.11	1.14	0.17	0.13	38.08	0.97			8.23	9.31	23.19	0.00	0.06		39.35	40.79	-1.8	0.8	-109.5	-12.9		
Laird	0.03	0.003	0.02	0.01				0.00	0.09	0.10	0.02	0.01	0.0000	0.0000	0.0000	0.0000			0.0000	0.0000	0.0000	0.0000	0.0000		0.00	0.00	0.0					

Table 2. Honey Lake Basin groundwater temperature data. * indicates a sample location with more than one sampling event.

Flow Path	Name	Sample #	Water Source	Depth Interval (m)	Temp (°C)	pH	SiO2 (mg/L)
FSM	Hail Dom. Well	W177*	well	10.668	5.00	8.60	8.00
SR	P. Milton Dom.	W17	well		5.10	7.10	
LV	Mud Spring	W145*	spring		6.00	6.96	
OUT	Upper Adobe Spring	W89*	spring		7.00	7.5	
OUT	Upper Juniper Spring	W99*	spring		8.00	7.5	
SHAF	Shaffer Spring	V45*	spring		8.30		
LV	Breshears Well	B688	well	42.672	8.40	6.83	
SR	Spring S. Roop Mtn.	V39*	spring		8.50	8.62	
LV	SIAD PSW8 PZ-3	V196*	well	150.876	9.00	8.10	45.10
LV	SIAD PSW8 PZ-4	V195*	well	192.024	9.10	8.10	47.40
ESA	Parks Ranch	W59	well		9.20	7.60	
LV	SIAD PSW5 PZ-1	V202*	well	70.5612	9.40	7.60	
LV	August Spring	V80*	spring		9.60	8.59	
SN	Pluma National Forest	B682	well	54.864	10.00	6.38	
FSM	Spring N. Ft. Sage Mtn.	V68*	spring		10.30	8.02	
LV	SIAD PSW5 PZ-4	V199*	well	152.4	10.40		
SR	Cady Spring	V40*	spring		10.50	8.16	
ASP/ESA	Stone Well	B687	well	39.624	11.20	7.54	
LV	Garrod Well #2	W127*	well	76.2	11.25	7.31	
LV	SIAD PSW8 PZ-1	V198*	well	56.388	11.30	8.10	42.60
LV	SIAD PSW8 PZ-2	V197*	well	102.108	11.30	8.30	35.20
LV	SIAD PSW5 PZ-3	V200*	well	141.21384	11.60		
LV	SIAD STP-4-PZ	V186*	well	17.3736	11.80	6.70	
LV	SIAD ALF-8-MWA	V176*	well	33.528	11.80	7.60	
SN	27N14E06B01M	W85	well	121.92	12.00	6.60	41.00
LV	Horse Spring	W141*	spring		12.00	7.3	
CW	Cold Spring	W150*	spring		12.00	7.30	
OUT	Tule Spring	W142*	spring		12.00	7.2	
ESA	27N17E15P02 M	W56	well	16.1544	12.20	8.40	
SN	27N15E32G01M	W72			12.20	7.00	40.00
ESA/CW/ASP	May Well	W116*	well	76.2	12.40	7.09	18.00
SR/SHAF	F. Dewitt Dom.	W4	well		12.50	8.50	
VM	Sheep Spring	W156*	spring		12.50	7.20	
LV	SIAD ALF-3	V175*	well	32.3088	12.90	7.70	
FSM	McCorkle Dom. Well	W104*	well	19.812	13.00	7.36	12.00
SR	Ca Fish & Game Irr.	W44	well		13.00	8.35	46.00
LV	STP-03-PZ	V185*	well	17.0688	13.10	7.20	
LV	SIAD STP-5-PZ	V187*	well	27.7368	13.10	7.70	
SR	MacDonald Dom.	W20	well		13.11	8.10	
SR	Johnstonville	H4113*	well	21.9456	13.20	7.28	52.05
ESA	Upton Well	W52*	well	54.864	13.30	8.46	14.00
LV	Hd4 Dom. Well	W163	well	156.3624	13.50	6.93	
SN	Humphries #1	H4086*	well		13.55	8.12	37.00
WSA	SIAD LBG-2	V182*	well	8.8392	13.60	8.70	
LV	SIAD PSW5 PZ-2	V201*	well	96.012	13.60	7.70	
LV	Spring N. Seven Lakes Mtn.	V77*	spring		13.60	7.71	
LV	Spr. - N Seven Lakes Mnt.	R107	spring		13.60	7.70	
ESA/FSM	Austin North Dom. Well	W114*	well		13.60	7.80	5.30
SR	E. Grant Dom.	W12	well	26.2128	13.61	8.25	33.50
SR/SHAF	Tanner Ranch Dom.	W41	well		13.61	8.30	34.50
SR	Johnston Ranch Dom.	W19	well	18.288	13.69	7.97	66.50
WSA	SIAD STP-7	V188*	well	20.7264	13.70	7.90	
SR	T. Swickard Dom.	W13	well	45.72	13.75	8.30	42.50
SR	Ca Fish & Game Irr.	W42	well		13.89	7.45	50.50
ESA	27N17E04AA02 M	W57	well	36.576	13.95	8.56	
LV	Upper Scott Spring	W143*	spring		14.00	7.19	
LV	Lower Scott Spring	W144*	spring		14.00	7.80	
CW	Upper Red Spring	W146*	spring		14.00	7.93	
CW	Black Canyon	W147*	spring		14.00	7.40	
SR	Darkin Well	W43*	well		14.10	6.90	
SN	27N14E22A01M	W82	well	171.6024	14.20	7.10	46.00
LV	Higgens Spring	V72*	spring		14.30	7.87	
OUT	Soda Springs	B2756	spring		14.30	8.53	
SR/SHAF	Fish & Game Well	H4093*	well	160.02	14.33	8.40	44.00
LV	SIAD TNT-7-MWA	V191*	well	20.942808	14.40	9.10	54.90
SN	27N14E26G01M	W78			14.40	7.80	34.00
SN	26N15E11H01M	W137			14.40	7.50	50.00
LV	27N16E29D01M	W66			14.40	8.00	56.00
SN	SE of Otis Canyon	H4107*	spring/well		14.50	7.78	25.50
SR	Trussell Well	H4099*	well		14.54	7.78	44.50
SN	Newkirk Dom.	W45	well		14.56	7.80	
LV	22N17E26H01M	W176			14.60	7.43	
VM	Ford #1 Well	W112*	well	184.404	14.70	8.37	5.30
SR/SHAF	B. Piango Irr.	W15	well	167.64	14.72	8.25	60.00
CW	Cottonwood Springs	W96*	spring		14.77	7.77	21.67
LV	SIAD TNT-7-MWB	V192*	well	31.568136	14.80	8.10	
LV	SIAD TNT-7-MWC	V193*	well	44.8056	14.90	7.90	
NV	Never Sweat Ranch	W102*	well	152.4	14.90	8.25	
ESA	27N17E23D01M	W54	well	13.4112	15.00	8.40	
ESA	Frank Whitt	W60	well	33.2232	15.00	9.00	
ESA/FSM	B Victory Irr. Well	W124	well	91.44	15.00	7.85	
SR	J. Ferre Dom.	W14	well		15.00	8.10	51.00
LV	25N17E34L01M	W157			15.00	7.50	48.00
LV	22N17E11M01M	W177			15.00		62.00
LV	Spring E. Seven Lakes Mtn.	V76*	spring		15.00	8.33	
WSA	Smfd Art. Well #1	W39	well		15.00	9.00	29.00
WSA	Spr. NE of Stacy	R90	spring		15.00	8.90	
ESA/FSM	26N17E01P01 M	W123			15.00	8.30	
FSM	Rat Spring	W153*	spring		15.00	7.30	
VM	Mustang Spring	W151*	spring		15.00	7.30	
LV	26N16E21J01M	W126			15.25	8.05	57.50
SN	27N14E26E01M	W77	well	61.5696	15.35	6.78	43.00
WSA	27N18E03M	W70	well	167.64	15.50	7.20	54.00
OUT	Sand Pass Test Well	W46*	well	217.0176	15.50	8.7	
SR/SHAF	Ca Fish & Game Irr.	W8	well		15.50	8.80	51.00
SN	27N14E24E01M	W80			15.50	7.00	
SN	26N15E11B06M	W138			15.50	7.90	51.00
LV	27N16E34R01M	W63			15.50	7.60	47.00
LV	27N16E31M	W64			15.50	7.40	46.00
LV	27N16E25M	W67			15.50	7.40	49.00
LV	27N16E19M	W68			15.50	7.70	71.00
LV	26N16E04M01M	W134			15.50	8.10	
WSA	27N16E02M	W71*			15.50	7.40	55.00
WSA	27N16E11E01M k	W69	well	115.824	15.56	7.47	53.36
SR	Laisen County Well	V111*	well	42.672	15.60	7.50	
CW/ASP/NV	BB2-C	W101*	well	25.908	15.67	8.27	
SHAF	Spring NW Five Spring Mtn.	V35*	spring		15.70	7.96	
SHAF	Murrers Meadow Spring	V33*	spring		15.80	7.64	
VM	Fish Springs Ranch Dom. Well	H4136*	well	78.6384	15.85	8.67	17.40
LV	26N16E15E03M	W129	well	18.288	15.87	7.72	36.43
FSM	Austin Dom. Well	W105*	well		16.00	8.10	8.00
FSM	Wilson Well	W108*	well		16.00	8.15	38.50
LV	27N16E35P01M m	W62	well	167.64	16.07	7.46	55.23
LV	25N17E20B01M	W161	well	79.248	16.10	7.55	
LV	25N17E17A01M	W162			16.10	7.60	60.00
LV	25N17E07J01	W165	well		16.10	8.57	
LV	23N17E02N01M	W175			16.10	7.03	
LV	27N16E36Q01M	W61*			16.19	7.51	46.65
LV	Webber 167	H4121*	well	48.1584	16.30	7.57	
LV	27N15E25K01M	W75			16.35	8.05	
SR	Goni Well	H4095*	well		16.50	8.29	56.00
SHAF	Spring E. Horse Lake Mtn.	H4101*	spring		16.60	7.77	23.70
VM	Willow Spring	W103*	spring		16.60	7.47	
ESA	27N17E05H01 M	W58			16.65	8.40	48.00
SR	Ca Conserv. Ctr. Dom.	W18	well		16.67	8.00	
SR	Abraham Jensen Irr.	W23	well		16.67	7.20	52.00
WSA	Tinsley Fountain	H4117*	spring	30.48	16.69	8.52	36.50
SR	SE of Standish	V110*	well	27.82824	16.70	7.50	49.80
LV	SIAD PSW #8	V206*	well	213.36	16.70	8.30	
SN	27N14E23J01M	W81			16.70	6.60	43.00
OUT	Fleming Spring	V29*	spring		16.80	8.29	
LV	SAID PSW #2	V203*	well	213.36	16.90	8.20	
LV	S of Doyle	W160*	well	36.576	16.96	7.31	24.50
OUT	Suzie Spring	W168*	spring		17.00	7.70	
OUT	Eagle Lake Spring	V32*	spring		17.00		
SR	NW of Standish	H4096*	well	17.0688	17.10	7.92	38.10
LV	SIAD PSW #5	V205*	well	167.64	17.10	8.50	
SHAF	Tule Patch Spring	H4106*	spring		17.10	7.82	15.70
ESA	S1 Dom. Well	W30	well	30.48	17.15	8.35	
SN	Otis Canyon	H4091*	spring/surface		17.35	7.49	25.90
SR	Richmond School	H4114*	well	44.196	17.37	7.99	13.40
SR	Plummer Spring	H4097*	spring		17.40	7.92	28.10
ESA	Droegge Well	H4118*	well		17.55	8.48	40.55
LV	SIAD DMO-11-A	V181*	well	33.528	17.60	7.50	
ESA	Harding Well	H4119*	well	46.3296	17.60	8.07	
SHAF	Spr. S Horse Mtn.	R95	spring		17.60	8.30	
SHAF	Spring S. Horse Mtn.	V28	spring		17.60	8.25	
SHAF	Spring S. of Snowstorm Mtn.	V34*	spring		17.60	7.68	
LV	26N17E18B01M	W122	well		17.60	7.30	
LV	Cowboy Joe Spring	H4088*	spring		17.65	7.46	20.70
VM	Fish Springs Irrigation Well-SW	V153*	well	134.112	17.70	8.10	
LV	22N17E08K01M	W178			17.75	7.65	32.50

Flow Path	Name	Sample #	Water Source	Depth Interval (m)	Temp (°C)	pH	SiO2 (mg/L)
LV	26N16E06D01 M	W133	well	22.86	17.77	7.10	
ESM	W Havil Dom. Well	W118	well	7.62	17.80	8.25	
SN	Basler Well	H4110*	well	30.48	17.85	7.46	43.50
SN	SW of Bass Hill	H4112*	well	60.96	17.95	6.90	38.90
LV	Burkhard Place - Constantia Rd.	H4130*	well	54.864	18.00	8.42	7.70
ESA	Duck Lake Irrig. Well	W55*	well		18.00	7.70	54.00
OUT	24N15E20A02M	W174			18.00	7.90	50.00
LV	SIAD DMO-13-A	V180*	well	36.2712	18.10	7.70	
LV	JDS Wetlands	V141*	well	48.768	18.20	8.60	
SN	Webber 84	H4108*	well		18.20	7.54	40.00
LV	SIAD STP-2	V184*	well	17.526	18.30	6.90	
LV	SIAD B21-5-PZ	V178*	well	32.004	18.30	7.40	
LV	Webber 159	W159*	well	36.576	18.30	7.15	46.00
LV	SIAD PSW #9	V207*	well	161.544	18.30	8.10	
LV	27N17E31K01M	W53			18.30	7.40	48.00
SN	26N15E03F01M	W139			18.44	7.73	32.25
SR	Standish	V112*	well	43.8912	18.50	8.00	
LV	SIAD LF-1	V183*	well	19.812	18.60	8.20	
SHAF	BLM Horse Corral Well	H4092*	well	45.72	18.70	7.76	33.55
LV	Webber 125	H4120*	well		18.70	7.54	42.00
NV	Hodgen Well	W100*	well	79.248	18.75	7.88	51.00
LV	Indian Spring	H4123*	spring		18.75	8.78	34.60
LV	N. of Bird Flat Ranch	H4089*	well		18.85	7.23	33.00
LV	SIAD B21-3-MW	V177*	well	36.576	18.90	7.30	
LV	26N16E13A01M	W131	well	44.196	18.90	8.60	
SHAF	Gilman Spring	V37*	spring		18.90	8.12	
SN	27N14E21A01M	W83			18.90	7.00	36.00
LV	Briggs Well	H4122*	well		19.05	7.24	33.00
VM	Fish Spring Ranch Irrigation Well	H4137	well		19.10	7.89	13.00
VM	Headquarters	W93*	well	121.92	19.17	8.30	53.00
SN	D Price Well	W140	well	145.6944	19.40	7.30	
LV	26N16E03D02M	W135	well	24.384	19.48	8.23	
LV	Bird Flat Ranch #2	H4085*	well	213.36	19.55	7.25	30.70
SR		W1	well	45.1104	20.00	7.90	
SHAF	C.L. Curtis Dom.	W16	well	67.056	20.00	8.30	
VM	Ferrel #1 Well	W110*	well	76.8096	20.00	7.90	
CW	Newsombe Spring	W185*	spring		20.00	7.3	
OUT	Well 3902	W25*	well		20.00	8.1	
LV	Webber 158	H4131*	well	24.384	20.04	7.09	
SHAF	Earll Well	H4100	well		20.10	7.45	39.80
LV	JDS Wetland Dom. Well	H4129*	well	92.6592	20.20	8.80	28.60
VM	Ferrel Test Well	W109*	well	137.16	20.33	8.27	43.50
LV	26N16E02G01M	W136	well	161.544	20.37	7.83	71.00
VM	Spring E. Ft. Sage Mtn.	V66*	spring		20.50	7.87	
LV	Rat Auto Salvage	H4124*	well		20.58	7.64	
ESA	SIAD LBG-4-MWA	V194*	well	29.4132	20.60	9.00	63.80
SHAF	Spring S. of Snowstorm Mtn.	H4104*	spring		20.80	8.29	34.20
LV	NE of Herlong Junction	V168*	well	22.86	20.90	7.30	
ASP	Astor Pass Test Well	W51*	well	134.112	21.00	7.90	
VM	Jerboe Well	W91*	well	151.4856	21.00	8.14	44.00
LV	Bird Flat Ranch #1	H4084*	well	198.12	21.00	7.35	
LV	S of Doyle	V171*	well	24.384	21.40	6.80	
WSA	28N17E20L01 M	W35	well	25.908	21.50	7.93	35.00
LV	Heald Well	H4125*	well		21.53	7.61	
SN	N of Buntingville	V135*	well	121.92	21.60	9.70	
WSA	28N17E19H02M	W37			21.60	8.10	3.10
SN		V134*	well	60.3504	21.70	9.70	12.00
LV	W of Herlong	H4115*	well	24.384	21.85	8.46	31.30
WSA	Lee Rd	H4116*	well	121.92	21.85	8.25	45.70
ESA	Flanigan Ranch Well	V139	well		22.00		
LV	E of Doyle	V174*	well	106.68	22.20	7.40	
OUT	Well 3891	W24*	well		22.20	8.4	
FSM	Nork/Francone Well	H4128*	well		22.35	7.88	44.00
LV		V170	well	182.88	22.40	8.10	32.40
SN	Buntingville	H4109*	well		22.40	7.14	30.80
SHAF	Railroad Spring	H4105*	spring		22.55	8.94	16.20
ESA	Artesian Well #3	W33*	well		22.77	8.30	34.00
VM	Fish Spring	W97	spring		22.80	8.00	
SN	Rembart Well	H4090*	well	42.672	22.90	6.95	35.60
WSA	Artesian Well #2	W36*	well		22.93	8.55	35.00
OUT	Bonham Ranch 1	W26*	well		23.30	8	
SR	Fruit Growers Supply Ind.	W22	well		23.61	8.05	36.50
SR/SHAF	Mapes Ranch Irr.	W9	well		23.80	8.10	79.00
ESA	High Rock Ranch	W32*	well		24.00	7.70	
SN	Humphries #2	H4087*	well		24.90	8.02	
WSA	28N17E20J01 M	W34			25.84	7.90	38.75
LV	Bell's Ranch	H4126*	well	106.68	26.00	7.54	
ESA	28N17E35D01 M	W27			26.10	8.10	27.00
ESA	SIAD DEMO-1	V179*	well	28.6512	26.70		
SHAF	Cognina Well	H4103	well		26.70	8.13	52.90
ESA	28N17E25P01M	W31			26.74	8.31	25.00
FSM	26N17E22G01	W120	well	18.288	28.30	8.60	
SHAF/WSA	Spring	W5	spring		31.10	8.20	40.00
SR	Susanville Prison	V114	well	201.168	31.70	8.50	
SR	NCCC PA-12	R35	well	201.168	31.70	8.50	
SR	Susanville Prison	V115	well	170.688	33.20	8.80	72.90
SR/HLW	Roosevelt Swimming Pool	RE1	well	90	35.80	8.01	53.00
LV/HLW	Rose 27	H4132*	well	182.88	37.60	8.90	21.10
LV/HLW	Zamboni Hot Spring	H4134*	spring		39.46	9.13	
SR/HLW	Mormon Church Heating	W21*	well		52.20	7.70	
OUT	W. Goeth. Needles #1 Well	W86	well		56.10	8.4	6.10
WSA/AML	HL Power Plant	H4135*	spring/well	600	62.71	8.30	53.00
SR/AML	Johnston 1	V209*	geo well	432.816	66.95	8.75	88.60
OUT	The Needle Rocks Well	W88	well		82.20	7.4	117.00
WSA/AML	Norcal2	V211*	geo well	322.4784	98.90	8.90	106.00
WSA/AML	Amedee Hot Springs	W40*	spring		102.78	8.60	

Table 3. Honey Lake Basin solute chemistry data, in mg/L. * indicates a sample location with more than one sampling event.

Flow Path	Name	Sample #	Water Source	Depth (m)	Temp (°C)	pH	Cond (μS/cm)	TDS (mg/L)	Solute Chemistry (mg/L) Ca^{2+}	Mg^{2+}	Na^+	K^+	Fe^{2+}	$CaCO_3$	CO_3^{2-}	HCO_3^-	SO_4^{2-}	Cl^-	NO_3^-	F^-	SiO_2 (mg/L)
SR/SHAF	F. Dewitt Dom.	W4	well		12.50	8.50		377.0	12.0	3.2	129.0	4.2			9.0	365.0	11.0	7.0	0.5		
SR/SHAF	Ca Fish & Game Irr.	W8	well		15.50	8.80		738.0	18.0	6.8	244.0	7.2			35.0	456.0	83.0	66.0	0.7	0.5	51.00
SR/SHAF	Mapes Ranch Irr.	W9	well		23.80	8.10		1790.0	51.0	7.3	574.0	22.0	0.0		0.0	227.0	295.0	651.0	2.8	0.3	79.00
SR	McClure Ranch Irr.	W10	well			8.00			16.0	6.6	89.0	6.7			0.0	185.0	48.0	51.0	2.6	0.2	53.00
SR	E. Grant Dom.	W12	well	26.21	13.61	8.25		1097.5	16.2	7.9	356.0	7.8	0.2		31.0	468.0	343.5	39.5	46.1	2.4	33.50
SR	T. Swickard Dom.	W13	well	45.72	13.75	8.30		814.0	16.9	7.1	239.7	8.2	0.0		11.0	432.7	210.7	28.3	25.7	1.0	42.50
SR	J. Ferre Dom.	W14	well		15.00	8.10		485.0	14.0	6.4	138.0	5.2			0.0	249.0	102.0	44.0	2.6	0.4	51.00
SR/SHAF	B. Piango Irr.	W15	well	167.64	14.72	8.25		1210.0	37.0	9.9	354.5	12.5	0.1		16.0	467.5	421.0	64.5	7.6		60.00
SR	P.E. Milton Dom.	W17	well		5.10	7.10		348.0	36.0	18.0	22.0	1.3				122.0	19.0	16.0	91.0		
SR	Ca Conserv. Ctr. Dom.	W18	well		16.67	8.00		196.0	7.1	0.4	34.0	9.8				109.0	15.0	5.8	0.5		
SR	Johnston Ranch Dom.	W19	well	18.29	13.69	7.97		406.7	4.4	0.8	118.3	4.9				183.7	73.7	20.7	26.3	1.1	66.50
SR	MacDonald Dom.	W20	well		13.11	8.10		119.0	18.0	7.0	12.0	4.3			0.0	126.0	4.8	1.4	1.9		
SR/HLW	Mormon Church Heating	W21*	well		52.20	7.70			9.5	0.6	56.0	0.9	0.2		0.0	143.0	20.0	5.9	0.3		
SR	Fruit Growers Supply Ind.	W22	well		23.61	8.05		445.5	13.0	2.5	126.0	4.0				90.0	158.5	58.5	0.9	1.7	36.50
SR	Abraham Jensen Irr.	W23	well		16.67	7.20		323.0	22.0	10.0	58.0	3.7	0.9		0.0	95.0	91.0	38.0	0.0	0.3	52.00
SR/SHAF	Tanner Ranch Dom.	W41	well		13.61	8.30		800.0	50.5	27.5	194.5	4.5			15.0	472.0	175.5	71.0	0.6	0.6	34.50
SR	Ca Fish & Game Irr.	W42	well		13.89	7.45		1155.0	94.5	42.5	256.5	14.0	0.2			282.0	22.5	532.5	1.1	0.1	50.50
SR	Darkin Well	W43*	well		14.10	6.90	1195.0		45.1	24.0	224.0	11.0				351.5	79.4	294.4	0.5	0.0	
SR	Ca Fish & Game Irr.	W44	well		13.00	8.35		913.0	39.5	17.5	245.0	6.8	0.1		7.0	336.0	98.5	237.5	2.9	0.5	46.00
SR	Pete's Creek	V84*	surface		13.30	8.18	375.0		19.5	2.8	34.0	5.5				162.5	6.0	4.7	0.1	0.0	
SR	SE of Standish	V110*	well	27.83	16.70	7.50	431.0	270.0	17.7	11.1	53.7	12.7	0.2		0.3	223.0	21.2	7.6		0.0	49.80
SR	Susanville Prison	V115	well	170.69	33.20	8.80		244.0	1.9	0.1	71.3	1.7	0.4		2.3	85.8	38.4	17.5		4.5	72.90
SN		V134*	well	60.35	21.70	9.70	451.0	196.0	2.9	0.3	91.8	0.5		100.0	1.1	121.9	37.0	59.6			12.00
SR/AML	Johnston 1	V209*	geo well	432.82	66.95	8.75	970.0	620.0	13.5		172.0	2.9			0.3	11.5	245.0	89.0		3.3	88.60
SR/HLW	Roosevelt Swimming Pool	RE1	well	90.00	35.8	8.0			19.0	3.4	20.0	3.8			1.0	120.0	11.0	2.00		<0.1	53.0
SR	Gold Run Creek	H4081*	surface		15.60	7.95	81.8		12.1	3.1	4.3	0.8		37.0		61.8	2.3	0.5	0.0	0.0	13.30
SR	Susan River in Susanville	H4082*	surface		10.73	7.68	86.2		9.8	3.9	4.3	1.0	0.3			59.6	2.1	1.9	0.3		
SR/SHAF	Fish & Game Well	H4093*	well	160.02	14.33	8.40	1232.5	704.5	4.2	2.4	308.7	5.2			29.0	664.5	53.1	50.9	1.0	0.7	44.00
SR/SHAF	Susan River at Litchfield	H4094*	surface		25.15	8.54	320.5		32.4	13.7	45.9	7.2		75.0		128.0	52.3	8.1	0.0	0.3	21.80
SR	Goni Well	H4095*	well		16.50	8.29	445.5	660.0	18.0	6.6	200.0	9.0	0.0		8.0	350.0	135.0	50.0	3.8	0.6	56.00
SR	NW of Standish	H4096*	well	17.07	17.10	7.92	351.6		7.7	2.1	55.0	5.4		117.0		114.6	29.3	12.0	0.1	0.7	38.10
SR	Plummer Spring	H4097*	spring		17.40	7.92	235.5		19.4	9.0	8.4	1.6				124.3	5.5	2.1	0.4	0.1	28.10
SR	Susan River North of Susanville	H4098*	surface		20.90	7.62	64.1		5.7	2.8	2.1	0.2		35.0		25.8	0.2	0.8	0.1		17.60
SR	Trussell Well	H4099*	well		14.54	7.78	544.5	342.5	24.5	10.9	64.5	3.8	0.1			122.5	92.0	37.0	3.6	0.8	44.50
SR	Johnstonville	H4113*	well	21.95	13.20	7.28	519.5	188.0	34.4	13.9	48.5	2.7	0.1	133.0	0.1	260.2	21.5	9.5	0.0	0.2	52.05
SR	Richmond School	H4114*	well	44.20	17.37	7.99	283.5		23.6	5.7	61.0	0.5		94.0		134.5	37.0	28.8	0.1	0.4	13.40
SHAF/WSA	Spring	W5	spring		31.10	8.20		239.0	17.0	2.1	49.0	7.2	0.1		0.0	144.0	29.0	15.0	2.2	0.1	40.00
SHAF	C.L. Curtis Dom.	W16	well	67.06	20.00	8.30		461.0	12.0	3.9	141.0	9.5				333.0	54.0	22.0	5.3		
SHAF	BLM Horse Corral Well	H4092*	well	45.72	18.70	7.76	552.5	320.0	27.8	13.5	76.1	4.7		110.0	0.3	162.7	71.1	24.6	0.9	0.1	33.55
SHAF	Earll Well	H4100	well		20.10	7.45	756.6		17.0	12.4	11.6	1.3				145.9	1.9	1.6	0.3	0.1	39.80
SHAF	Spring E. Horse Lake Mtn.	H4101*	spring		16.60	7.77	242.0		19.5	13.4	12.0	1.5		120.0		160.0	1.2	1.6	0.0	0.0	23.70
SHAF	Willow Creek	H4102*	surface		18.20	8.19	303.7		13.1	12.6	32.3	7.4				188.6	0.6	4.2	0.1	0.0	33.60
SHAF	Cognina Well	H4103	well		26.70	8.13	169.1		2.5	1.2	28.1	3.2				77.7	3.7	5.4	0.3	0.1	52.90
SHAF	Spring S. of Snowstorm Mtn	H4104*	spring		20.80	8.29	214.7		0.9	0.5	41.2	1.9		95.0		88.1	11.1	9.5	0.2	0.1	34.20
SHAF	Railroad Spring	H4105*	spring		22.55	8.94	919.5		7.2	2.6	22.7	4.2		400.0		89.0	2.6	2.0	0.0	0.1	16.20
SHAF	Tule Patch Spring	H4106*	spring		17.10	7.82	199.5		14.0	8.3	11.4	3.4		92.0		109.6	4.0	3.0	0.5	0.1	15.70
SN	Newkirk Dom.	W45	well		14.56	7.80		314.0	36.0	22.0	39.0	6.7			0.0	304.0	6.9	2.1	7.3		
SN	27N15E32G01M.a	W72			12.20	7.00		147.0	24.0	4.6	8.0	2.4		73.0		89.0	14.0	3.0	7.3	0.2	40.00
SN	27N15E30B01M.a	W73				7.60		196.0	9.1	9.6	41.0	3.8		138.0		168.3	8.7	1.9	0.1	0.2	39.00
SN	27N14E26E01M.e	W77	well	61.57	15.35	6.78		134.3	17.6	3.1	13.7	2.0		63.0		76.8	9.2	5.9	13.3	0.1	43.00
SN	27N14E26G01M.a	W78			14.40	7.80		147.0	19.0	3.0	17.0	2.0		63.0		76.8	11.0	11.0	12.0		34.00
SN	27N14E24E01M.a	W80			15.50	7.00		202.0	26.0	6.0	34.0	2.0		140.0		170.7	14.0	4.0	1.2		
SN	27N14E23J01M.a	W81			16.70	6.60		196.0	15.0	4.5	41.0	1.9		119.0		145.1	13.0	4.4	1.9	0.5	43.00
SN	27N14E22A01M.b	W82	well	171.60	14.20	7.10		254.5	13.4	2.3	60.5	1.8		138.5		168.9	28.0	4.6	22.0	0.4	46.00
SN	27N14E21A01M.a	W83			18.90	7.00		92.0	9.1	1.8	11.0	0.9		49.0		59.7	2.0	1.4	0.7	0.1	36.00
SN	27N14E06B01M.a	W85	well	121.92	12.00	6.60		152.0	20.0	7.5	9.0	3.0		74.0		90.2	81.0	2.3		0.1	41.00
SN	26N15E11H01M.a	W137			14.40	7.50		179.0	21.0	7.5	18.0	4.6		116.0		141.4	3.3	3.0	1.7	0.4	50.00
SN	26N15E11B06M.a	W138			15.50	7.90		170.0	7.0	1.6	36.0	5.3		98.0		119.5	4.9	4.0	1.0	0.3	51.00
SN	26N15E03F01M.f	W139			18.44	7.73		141.3	17.7	4.4	18.7	3.4		90.0		109.7	13.1	2.9	0.6	0.2	32.25
SN	D Price Well.a	W140	well	145.69	19.40	7.30		157.2	20.0	5.0	16.0	4.3				96.5	15.0	3.0		0.1	
SN	"McDermott" Creek	V95*	surface		17.80	8.24	144.0		15.3	3.4	9.5	2.0	0.2	85.0		64.9	3.9	2.7	0.1	0.1	
SN	Pluma National Forest	B682	well	54.86	10.00	6.38	269.0		30.1	6.4	24.8	1.6				155.0	4.6	8.2	0.1	0.1	
SN	Mill Creek	H4083*	surface		16.87	7.29	224.1	161.7	18.3	5.7	8.7	3.1		57.0		69.5	6.2	5.0	42.0		
SN	Humphries #1	H4086*	well		13.55	8.12	330.0	218.0	39.0	5.0	20.0	2.7		121.0		147.5	15.0	8.8	18.0	0.5	37.00
SN	Humphries #2	H4087*	well		24.90	8.02	235.9	149.0	20.0	4.0	24.0	1.4		93.0		113.4	18.0	2.0	0.2		
SN	Reinhart Well	H4090*	well	42.67	22.90	6.95	177.2		11.5	3.3	11.1	3.3		95.0		84.7	1.8	3.6	0.5	0.1	35.60
SN	Ottis Canyon	H4091*	spring/surface		17.35	7.49	109.2		10.2	5.5	7.2	3.4		22.0		77.6	6.2	1.5	0.0	0.0	25.90
SN	SE of Otis Canyon	H4107*	spring/well		14.50	7.78	156.5		13.4	8.7	10.0	4.8		40.0		111.0	2.8	2.9	0.2	0.0	25.50
SN	Webber 84	H4108*	well		18.20	7.54	233.9	145.0	22.0	2.9	11.0	0.8		72.0		87.8	4.8	4.0	15.0	0.2	40.00
SN	Buntingville	H4109*	well		22.40	7.14	181.6		15.3	7.1	8.7	1.3		97.0		97.5	8.7	2.6	0.4	0.1	30.80
SN	Basler Well	H4110*	well	30.48	17.85	7.46	538.5		64.7	14.3	62.4	4.2				388.3	24.4	7.5	0.6	0.2	43.50
SN	Elysian Creek	H4111*	surface		20.55	7.59	154.5		24.6	10.6	7.4	2.6		40.0		138.0	2.2	1.4	0.0	0.0	20.50
SN	SW of Bass Hill	H4112*	well	60.96	17.95	6.90	227.8		19.7	5.6	7.4	0.5		110.0		67.3	3.0	2.9	3.0	0.1	38.90
LV	27N17E31K01M.a	W53			18.30	7.40		633.0	76.0	23.0	94.0	6.3		169.0		206.0	237.0	47.0	0.0	1.4	48.00
LV	27N16E36Q01M.c	W61*			16.19	7.51		738.5	83.0	28.3	99.9	6.6		162.4		235.0	302.5	41.1	6.6	0.5	46.65
LV	27N16E35P01M.m	W62	well	167.64	16.07	7.46		389.1	33.9	13.2	64.3	8.3		155.6		192.0	95.1	22.3	1.3	0.5	55.23
LV	27N16E34R01M.a	W63			15.50	7.60		626.0	80.0	23.0	88.0			167.0		203.6	240.0	47.0	0.1	0.5	47.00
LV	27N16E31M.a	W64			15.50	7.40		712.0	78.0	27.0	96.0	6.0		163.0		198.7	271.0	48.0	0.1	0.4	46.00
LV	27N16E29D01M.a	W66			14.40	8.00		465.0	5.6	1.1	154.0	8.0		248.0		302.4	51.0	39.0	1.0	0.6	56.00
LV	27N16E25M.a	W67			15.50	7.40		690.0	78.0	27.0	97.0	6.1		166.0		202.4	269.0	48.0	0.1	0.4	49.00
LV	27N16E19M.a	W68			15.50	7.70		1110.0	60.0	20.0	299.0	8.6		244.0		297.5	342.0	203.0	1.9	0.5	71.00
LV	27N15E25K01M.b	W75			16.35	8.05		574.0	13.0	5.6	191.0	3.4		250.0		304.8	106.0	74.0	7.7		
LV	26N17E18B01M.a	W122	well		17.60	7.30		543.7	36.0	6.0	134.0	3.9		187.0	0.0	264.0	51.7	35.3	123.3	1.2	
LV	26N16E21J01M.a	W126			15.25	8.05		318.0	50.5	17.5	20.0	2.6		204.5		249.3	11.0	10.0	26.5	0.4	57.50
LV	Garrod Well #2.a	W127*	well	76.20	11.25	7.31	246.0		30.7	9.5	33.9	3.2				184.0	22.0	6.6	0.2	0.2	
LV	26N16E15E03M.a	W129	well	18.29	15.87	7.72		538.3	77.0	14.7	71.9	5.5		173.7		210.5	192.9	18.8	9.2	0.9	36.43
LV	26N16E13A01M.a	W131	well	44.20	18.90	8.60		824.1	88.0	46.0	107.0	5.2				307.0	280.0	25.0	1.8	0.4	
LV	26N16E06D01 M.b	W133	well	22.86	17.77	7.10		326.5	29.7	12.0	47.0	4.1		137.5		184.0	58.0	14.0	1.4	0.3	
LV	26N16E04M01M.a	W134			15.50	8.10		309.0	31.0	5.9	77.0	6.2		177.0		215.8	43.0	28.0	12.0	0.6	
LV	26N16E03D02M.c	W135	well	24.38	19.48	8.23		362.0	11.5	1.9	93.0	16.3				208.0	41.3	19.5	6.0	0.4	
LV	26N16E02G01M.e	W136	well	161.54	20.37	7.83		319.0	29.3	9.2	52.7	5.0	0.2	160.0		190.0	49.0	13.7	0.3	0.5	71.00
LV	Horse Spring.a	W141*	spring		12.0	7.3		181.5	25.6	7.0	7.7	0.4				131.7	<3	6.0			
LV	Upper Scott Spring.b	W143*	spring		14.00	7.19		134.7	18.1	8.0	7.2	3.2	<0.1			96.0	<5	6.2			
LV	Lower Scott Spring.a	W144*	spring		14.00	7.80		194.7	22.9	11.7	7.0	2.4				142.7	<3	5.0			
LV	Mud Spring.b	W145*	spring		6.00	6.96		119.2	10.1	3.4	8.2	1.0	0.5			59.7	3.0	3.5			
LV	25N17E34L01M.a	W157			15.00	7.50		171.0	20.0	6.7	18.0	3.0		122.0		148.7	0.0	1.5	0.2	0.3	48.00
LV	Webber 159	W159*	well	36.58	18.30	7.15	211.0	237.0	28.0	11.0	30.0	1.7		144.0		175.6	13.0	8.2	13.0	0.1	46.00
LV	S of Doyle	W160*	well	36.58	16.96	7.31	211.0	167.9	8.4	2.4	42.2	0.7		78.1		87.7	27.4	9.6	2.3	2.0	24.50
LV	25N17E20B01M.c	W161	well	79.25	16.10	7.55		297.9	43.0	13.3	30.8	1.4				215.8	9.6	8.4	12.0	0.2	
LV	25N17E17A01M	W162			16.10	7.60		279.0	29.0	11.0	35.0	9.0		164.0		200.0	15.0	20.0	1.8	0.5	60.00
LV	Hd4 Dom. Well.a	W163	well	156.36	13.50	6.93		213.8	30.3	8.7	19.3	2.5				132.7	8.7	4.3	43.0	0.1	
LV	25N17E07J01.a	W165	well		16.10	8.57		186.3	18.7	6.7	23.7	2.2				124.0	13.0	3.0	6.6	0.3	
LV	Sugarcane.a	W169*	spring			7.90		174.9	18.8	7.4	11.7	5.6				124.4	<3	4.0			
LV	Boot legger Spring.a	W172	spring			8.00		908.0	170.0	33.0	84.0	7.9	<0.1			320.0	320.0	51.0			
LV	24N17E03M01M.a	W173				8.20		194.0	34.0	6.6	13.0	4.7		143.0		174.3	0.0	4.0	0.9	0.3	45.00
LV	23N17E02N01M.c	W175			16.10	7.03		492.0	35.3	18.0	94.7	9.0		252.7		308.1	108.0	9.0	18.3		
LV	22N17E26H01M.a	W176			14.60	7.43		250.7	32.7	15.3	18.0	8.4		156.0		190.2	13.3	12.3	8.2		
LV	22N17E11M01M.a	W177			15.00			314.0	48.0	18.0	17.0	9.1		189.0		230.4	34.0	12.0	1.1	0.2	62.00
LV	22N17E08K01M.b	W178			17.75	7.65		157.5	16.5	4.2	24.5	2.5		95.5		116.4	2.5	4.3	13.0	0.1	32.50
LV		V170	well	182.88	22.40	8.10	237.0	160.0	7.9	2.8	42.6	0.8			0.6	112.0	11.1	4.1		0.9	32.40
LV	SIAD TNT-7-MWA	V191*	well	20.94	14.40	9.10	1210.0	748.0	6.5	14.1	194.0	45.1		245.0	10.7	298.7	201.0	80.7	2.2	0.1	54.90
LV	SIAD PSW8 PZ-4	V195*	well	192.02	9.10	8.10	818.0	548.0	63.1	0.2	64.6	7.6	0.1		1.1	198.0	93.2	116.0	0.0	0.1	47.40
LV	SIAD PSW8 PZ-3	V196*	well	150.88	9.00	8.10	864.0	573.0	63.7	22.9	81.3	6.5	0.0		1.2	216.0	190.0	31.1		0.1	45.10
LV	SIAD PSW8 PZ-2	V197*	well	102.11	11.30	8.30	928.0	572.0	58.9	25.5	90.1	5.1			1.8	208.0	219.0	34.0	0.2	0.1	35.20
LV	SIAD PSW8 PZ-1	V198*	well	56.39	11.30	8.10	1220.0	818.0	112.0	42.9	72.0	7.1			1.1	198.0	343.0	40.7	7.3	0.1	42.60
LV	Breshears Well	B688	well	42.67	8.40	6.83	636.0		34.6	5.9	89.3	4.7				256.0	53.3	31.9	0.0	0.2	
LV	Long Valley Creek, S of Doyle	B690*	surface		7.30	7.73	416.8		20.9	7.7	50.2	4.3	0.1			162.9	55.4	14.3	0.1	1.0	0.00
LV	Bird Flat Ranch #1	H4084*	well	198.12	21.00	7.35	1204.0	280.4	40.3	12.0	30.0	3.0				155.3	35.7	11.0	14.0	0.1	
LV	Bird Flat Ranch #2	H4085*	well	213.36	19.55	7.25	447.5		38.6	13.5	29.6	3.7				178.7	36.3	12.2	3.4	0.2	30.70
LV	Cowboy Joe Spring	H4088*	spring		17.65	7.46	213.9		13.8	5.0	20.7	2.1		92.0		113.9	4.4	4.1	0.1	0.1	20.70
LV	N of Bird Flat Ranch	H4089*	well		18.85	7.23	776.0	380.0	40.0	11.0	71.0	6.2		184.0		224.3	81.0	23.0	4.0	0.9	33.00
LV	W of Herlong	H4115*	well	24.38	21.85	8.46	571.0	276.0	5.8	1.4	100.8	12.7		187.0	2.1	220.1	39.8	19.1	1.3	0.2	31.30
LV	Webber 125	H4120*	well		18.70	7.54	279.6	220.0	38.0	7.3	22.0	1.8		157.0		191.4	1.3	7.5	5.7	0.4	42.00
LV	Webber 167	H4121*	well	48.16	16.30	7.57	210.9	164.0	15.0	9.0	13.0	1.0				122.0	2.0	2.0	2.9		
LV	Briggs Well	H4122*	well		19.05	7.24	302.4	169.0	27.0	7.4	14.0	2.8		116.0		141.4	4.0	5.0	6.7	0.1	33.00
LV	Indian Spring	H4123*	spring		18.75	8.78	410.8		7.8	14.4	43.4	9.8		160.0		189.0	5.3	14.6	0.4	0.3	34.60
LV	Rat Auto Salvage	H4124*	well		20.58	7.64	598.0	293.2	28.0	10.0	43.0	4.1	0.1			137.5	41.0	13.0	31.0	0.5	
LV	Heald Well	H4125*	well		21.53	7.61	1446.0	655.9	45.3	46.7	75.7	6.1		200.5		186.0	255.7	10.7	1.4	0.9	
LV	Bell's Ranch	H4126*	well	106.68	26.00	7.54	356.4	206.7	24.3	8.3	17.7	3.0				106.0	10.3	8.3	29.0	0.2	
LV	Long Valley Creek, N of Doyle	H4127*	surface		16.63	8.13	485.3		36.6	12.3	61.1	4.0	0.1			200.6	62.1	16.3	0.1	0.7	16.87
LV	JDS Wetland Dom. Well	H4129*	well	92.66	20.20	8.80	972.5	954.7	11.4	4.9	283.7	7.4		294.2		352.6	193.3	88.9	2.4	0.4	28.60
LV	Burkhard Place - Constantia Rd.	H4130*	well	54.86	18.00	8.42	211.0		9.9	2.1	29.4	1.5				109.5	3.1	2.7	0.5	0.1	7.70
LV	Webber 158	H4131*	well	24.38	20.04	7.09	198.4	147.0	24.5	4.6	13.0	1.3		90.0		93.7	6.4	6.0	17.5	0.1	
LV/HLW	Rose 27	H4132*	well	182.88	37.60	8.90	282.2		0.7	0.1	60.7	0.0		95.0		82.1	47.7	15.2	0.0	1.8	21.10
LV	Long Valley Creek-HJ	H4133*	surface		8.60	8.00	265.9		23.3	10.0	17.0	3.4	0.1			163.6	5.3	2.9	0.1	0.1	
LV/HLW	Zamboni Hot Spring	H4134*	spring		39.46	9.13	348.0		2.4	0.1	63.0	0.8	0.1	68.0		70.2	50.3	13.9	0.1	2.0	
WSA	28N17E20J01 M.e	W34			25.84	7.90		184.6	8.6	1.9	44.0	4.6		97.2		118.5	15.2	9.7	1.7	0.2	38.75
WSA	28N17E20L01 M.b	W35	well	25.91	21.50	7.93		173.7	4.3	2.0	42.3	3.4		107.7		131.0	17.0	10.0	0.5	0.2	35.00
WSA	Artesian Well #2.a	W36*	well		22.93	8.55	255.5	179.0	5.0	1.5	43.0	3.5					18.0	10.0			35.00
WSA	28N17E19B02M.a	W37			21.60	8.10		137.0	5.8	0.4	46.0	1.8		82.0		100.0	18.0	12.0	1.1	0.1	3.10
WSA	Smf4 Art. Well #1.a	W39	well		15.00	9.00		216.9	4.0	0.9	57.0	3.0				118.0	22.0	12.0			29.00
WSA/AML	Amedee Hot Springs	W40*	spring		102.78	8.60		948.0	16.0	0.5	238.0	6.0			11.0	25.0	303.0	160.0	0.5		
WSA	27N16E11E01M.k	W69	well	115.82	15.56	7.47		1172.6	113.6	24.0	220.4	15.6		120.3		146.6	156.9	415.2	3.7	0.3	53.36
WSA	27N16E03M.a	W70	well	167.64	15.50	7.20		348.0	29.0	13.0	56.0	8.9		152.0		185.3	69.0	18.0	1.5	0.4	54.00
WSA	27N16E02M.a	W71*			15.50	7.40		338.0	28.0	12.0	56.0	8.2		153.0		186.5	67.0	18.0	1.4	0.4	55.00
WSA/AML	Norcal2	V211*	geo well	322.48	98.90	8.90	1750.0	748.0	17.6	0.1	254.0	7.0		50.0	1.7	61.0	268.0	148.0		4.0	106.00
WSA	Lee Rd	H4116*	well	121.92	21.85	8.25	375.6	220.0	8.7	2.0	62.8	9.0		75.0	0.6	105.9	38.4	25.4	0.5	0.1	45.70
WSA	Tinsley Fountain	H4117*	spring	30.48	16.69	8.57	302.5	201.4	16.9	1.1	50.8	3.9		92.6		129.0	21.9	12.0	2.9	0.2	36.50
WSA/AML	HL Power Plant	H4135*	spring/well		62.71	8.30	1800.0	967.0	25.3	0.1	276.7	11.7	0.0		9.0	49.3	342.2	188.9	0.3	2.9	53.00
ESA	28N17E35D01 M.a	W27			26.10	8.10		156.0	5.4	0.4	45.0	1.7		78.0		95.1	16.0	13.0	0.8		27.00
ESA	St1 Dom. Well.a	W30	well	30.48	17.15	8.35		175.5	6.0	2.0	47.0	1.6		94.0		114.0	18.0	12.0	0.4		
ESA	28N17E25P01M.b	W31			26.74	8.31		182.6	5.2	0.7	50.4	2.5		94.4		118.0	14.4	10.1	4.9	0.4	25.00
ESA	High Rock Ranch.a	W32*	well		24.00	7.70			4.0	0.8	48.0	2.0				85.0	13.0	9.0			
ESA	Artesian Well #3.a	W33*	well		22.77	8.30		173.7	3.3	2.0	42.0	3.1				98.5	15.3	9.3	0.3	0.2	34.00
ESA	F11.a	W48				7.80		5346.0	53.0	49.0	1810.0					224.0	1200.0	2010.0			
ESA	Tipton Well.a	W52*	well	54.86	13.30	8.46		2000.0	5.0	9.0	680.0	18.0	0.1		<1.0	530.0	180.0	590.0	12.0	1.7	14.00
ESA	27N17E23D01M.a	W54	well	13.41	15.00	8.40		713.1	34.0	15.0	169.0	11.0				354.0	72.0	95.0	2.6	1.9	
ESA	Duck Lake Irrig. Well.a	W55*	well		18.00	7.70		368.0	44.0	13.0	25.0	8.0				267.0	8.0	3.0			54.00
ESA	27N17E15P02 M.a	W56	well	16.15	12.20	8.40		437.2	56.0	19.0	40.0	9.1				294.0	25.0	14.0	4.2	0.4	
ESA	27N17E04A02 M.b	W57	well	36.58	13.95	8.56		679.6	15.2	17.6	191.6	5.2	0.1			339.2	37.2	121.4	1.0	1.2	
ESA	27N17E03H01 M.a	W58			16.65	8.40		1308.6	6.5	9.8	406.0	12.0		506.0		593.0	71.5	247.0	5.1	1.4	48.00
ESA	Parks Ranch.a	W59	well		9.20	7.60		509.5	11.0	9.0	144.0	6.8				227.5	11.0	93.0	26.0	0.3	
ESA	Frank Whitt.a	W60	well	33.22	15.00	9.00		3846.1	16.0	14.0	1300.0	27.0	0.7			1898.0	464.0	465.0	11.0	6.2	
ESA/FSM	Austin North Dom. Well.a	W114*	well		13.60	7.80		50259.0	1516.0	382.1	17800.0	42.0	0.2		<1.0	921.0	9000.0	16476.0	3.1	1.7	5.30
ESA/FSM/VM	Stanley Well.a	W115	well	149.35		8.30		8140.0	52.0	60.0	2830.0	51.0	<0.1		<1.0	567.0	620.0	3960.0	8.0	0.2	20.00

Flow Path	Name	Sample #	Water Source	Depth (m)	Temp (°C)	pH	Cond (μS/cm)	TDS (mg/L)	Solute Chemistry (mg/L) Ca^{2+}	Mg^{2+}	Na^+	K^+	Fe^{2+}	$CaCO_3$	CO_3^{2-}	HCO_3^-	SO_4^{2-}	Cl^-	NO_3^-	F^-	SiO_2 (mg/L)
ESA/CW/ASP	May Well.a	W116*	well	76.20	12.40	7.09		42700.0	150.0	820.0	16100.0	94.0	9.0		<1.0	950.0	350.0	24300.0	1.0	0.4	18.00
ESA/FSM	26N17E01P01 M.a	W123			15.00	8.30		3320.0	16.0	14.0	1300.0	27.0		1710.0		2084.9	464.0	465.0	11.0	6.2	
ESA/FSM	B Victory Irr. Well.a	W124	well	91.44	15.00	7.85		2305.2	35.0	41.0	752.0	33.0				405.0	34.0	1050.0	63.0	0.5	
ESA	SIAD UBG-4-MWA	V194*	well	29.41	20.60	9.00	575.0	348.0	12.2	3.9	93.9	15.9		180.0	8.2	219.5	33.8	20.3		0.0	63.80
ASP/ESA	Stone Well	B687	well	39.62	11.20	7.54	14280.0		35.9	65.4	4530.0	110.1				1211.0	2100.9	5716.0	0.0	8.5	
ESA	Droeger Well	H4118*	well		17.55	8.48	224.2	611.0	15.1	7.2	80.6	5.4				226.0	22.6	27.8	0.1	0.2	40.55
ESA	Harding Well	H4119*	well	46.33	17.60	8.07	1228.0	282.8	31.0	10.0	32.0	6.5		184.0		224.0	6.5	4.0	4.2	0.3	
FSM	McCorkle Dom. Well.a	W104*	well	19.81	13.00	7.36		316.0	18.7	22.4	31.0	8.1	<0.1		<1.0	181.0	49.0	5.0	3.5	0.3	12.00
FSM	Austin Dom. Well.a	W105*	well		16.00	8.10		321.0	39.3	12.9	18.0	0.4	<0.1		<1.0	187.0	26.0	3.9	2.7	0.3	8.00
FSM	Wilson #5 Well.a	W107	well			8.20		467.3	21.0	1.6	122.5	3.9	0.0	93.8		114.3	228.3	20.0	1.1	1.0	
FSM	Wilson Well.c	W108*	well		16.00	8.15		467.9	20.0	1.6	126.6	3.7	0.0	93.3	4.9	108.4	202.6	20.1	0.2	0.9	38.50
FSM	Perkle Dom. Well.a	W113*	well			8.20		3449.6	59.3	2.7	1130.0	30.0	0.5			1103.0	2.0	1122.0	2.7	0.7	10.50
FSM	Hail Dom. Well.a	W117*	well	10.67	5.00	8.60		173.0	12.0	<1.0	33.0	5.5	<0.1		20.0	56.0	35.0	12.0	<1.0	0.5	8.00
FSM	W Havil Dom. Well.a	W118	well	7.62	17.80	8.25		192.1	9.0	3.0	36.0	5.7				77.7	34.0	10.0	2.1	0.5	
FSM	26N17E24F01 M.a	W119	well	20.42		8.90		354.0	1.0	1.0	108.0	2.2		131.0		159.7	97.0	9.0	3.0	0.6	
FSM	26N17E22G01.a	W120	well	18.29	28.30	8.60		315.2	11.0	4.0	70.0	7.5				99.5	70.0	29.0	5.8	2.4	
FSM	2TP Spring.a	W152*	spring			7.50		176.3	18.6	10.2	7.7	1.9				126.0	4.0	7.0			
FSM	Rat Spring.a	W153*	spring		15.00	7.30		136.8	19.2	1.8	14.5	3.1				84.1	8.0	6.0			
FSM	Nork/Francone Well	H4128*	well		22.35	7.88	2730.0	731.9	34.5	2.7	206.0	4.4	<0.05			88.3	339.5	36.0	1.8	1.6	44.00
VM	First Fault.a	W90*	well			8.00		173.0	8.9	0.6	37.5	3.5	0.1	81.0		98.8	11.0	9.0	1.0	0.2	
VM	Jarboe Well.c	W91*	well	151.49	21.00	8.14		181.7	12.6	4.3	27.5	6.5	0.0	98.5	5.9	120.5	10.2	7.1	4.5	0.2	44.00
VM	Ferrel Playa Well.a	W92	well	145.39		8.30		201.0	7.1	1.1	77.0	5.8	<0.02			154.9	22.0	27.0	4.0		
VM	Headquarters	W93*	well	121.92	19.17	8.30	302.0	213.3	11.8	2.0	56.9	6.6	0.2	132.0	1.6	155.6	11.9	10.5	2.7	0.2	53.00
VM	Fish Spring.a	W97	spring		22.80	8.00		298.0	3.0	3.0	78.0					179.0	17.0	18.0			
VM	Willow Spring.a	W103*	spring		16.60	7.47		159.5	16.1	6.0	10.7	2.7	<0.1			97.3	5.0	5.1			
VM	Ferrel Test Well.a	W109*	well	137.16	20.33	8.27		230.3	6.0	1.6	66.5	6.1	0.0	122.5	7.5	136.1	17.7	18.2	4.6	0.3	43.50
VM	Ferrel #1 Well.a	W110*	well	76.81	20.00	7.90		257.9	4.0	2.9	67.0					144.0	18.0	22.0			
VM	Ford #2 Well.a	W111*	well	182.88		7.80		751.0	15.1	4.9	195.0	12.5		199.0		242.6	280.0	24.0			
VM	Ford #1 Well.a	W112*	well	184.40	14.70	8.37		1089.0	34.9	16.5	190.0	23.7	0.2		80.0	286.0	32.0	110.6	3.1	1.7	5.30
VM	Mustang Spring.a	W151*	spring		15.00	7.30		165.7	21.3	7.7	11.2	1.7				109.7	6.0	8.0			
VM	Sheep Spring.a	W156*	spring		12.50	7.20		174.5	17.5	3.6	22.3	2.2	<0.1			107.0	6.1	5.9			
VM	Fish Springs Ranch Dom. Well	H4136*	well	78.64	15.85	8.67	410.1		5.6	2.1	75.5	7.9	0.1			185.1	21.4	18.1	1.4	0.1	17.40
VM	Fish Spring Ranch Irrigation Well	H4137	well		19.10	7.89	296.8		9.2	3.8	39.5	9.7				139.8	9.1	9.0	0.5	0.1	13.00
CW	Cottonwood Test Well.a	W94*	well	202.69		7.10		203.0	22.2	8.6	17.7	6.5	0.1	122.0		148.7	7.0	7.0	4.8	0.1	
CW	Cottonwood Creek South	W95*	surface		12.20	8.40	127.6	163.9	14.5	8.2	13.4	2.3	0.1		12.0	103.6	3.9	2.3	0.9	0.2	
CW	Cottonwood Springs	W96*	spring		14.77	7.77	162.7	78.3	12.8	5.1	11.7	4.9	0.1			95.0	3.6	2.9	0.9	0.1	21.67
CW	Cottonwood Well #2.a	W98	well	150.88		7.60		227.0	22.2	7.8	15.5	5.6	0.3	127.0		154.8	11.0	7.0	1.6	0.1	
CW/ASP/NV	BB2-C.a	W101*	well	25.91	15.67	8.27		555.7	13.9	4.6	157.3	10.5	0.1		12.0	300.3	39.3	73.3	1.0	0.4	
CW	Upper Red Spring.a	W146*	spring		14.00	7.93		198.0	33.0	11.0	13.0	4.7	<0.1		0.0	160.0	6.4	5.0			
CW	Black Canyon.a	W147*	spring		14.00	7.40		161.9	19.4	8.4	7.7	3.5				115.8	3.0	4.0			
CW	Newcombe Spring.a	W148*	spring		20	7.3		247.7	30.0	9.0	23.0	5.7				168.0	6.0	6.0			
CW	Cold Spring.a	W150*	spring		12.00	7.30		125.0	14.3	5.8	5.4	4.7				87.8	<3	4.0			
CW	Cottonwood Snow	B689	snow						25.0	0.8	9.1	0.3				95.0	2.0	3.2	2.6		
CW	Cottonwood Creek	B3992	surface		6.50		107.4		14.4	7.6	8.7	2.6	0.1			98.4	3.8	2.8	0.5	0.1	
NV	Hodges Well.b	W100*	well	79.25	18.75	7.88		199.8	9.8	4.0	37.5	8.1	0.0	118.0		137.3	6.3	5.1	2.7	0.1	51.00
NV	Never Sweat Ranch	W102*	well	152.40	14.90	8.25	352.8	764.7	17.2	3.4	107.4	8.3	0.3			223.1	71.5	36.5	5.2	0.2	
ASP	Astor Pass 1.a	W49	well	54.86		8.30		2619.8	13.0	12.0	828.0	12.2	0.1			940.0	367.0	447.0	0.5	3.1	
ASP	Astor Pass 2.a	W50	well	54.86		8.50		2120.1	9.8	7.9	668.0	9.2	0.2			888.0	253.0	284.0	0.5	3.2	
ASP	Astor Pass Test Well.a	W51*	well	134.11	21.00	7.90		2469.0	39.6	27.8	849.0	13.4	0.0			846.0	330.0	677.0	<0.1	2.2	
ASP	Astor Pass	B2041	well						14.0	9.3	542.9	11.9	0.1			876.0	172.9	256.9	0.1	2.4	
OUT	Well 3891.a	W24*	well		22.2	8.4		1773.7	27.2	9.6	544.0	42.0				215.0	386.0	549.0			
OUT	Well 3902.a	W25*	well		20.0	8.1		1734.8	8.6	1.5	611.0	31.0				164.0	383.0	535.0			
OUT	Bonham Ranch 1.a	W26*	well		23.3	8			37.0	2.3	815.0					155.0	528.0	849.0			
OUT	Sand Pass Test Well.a	W46*	well	217.02	15.5	8.7		1562.0	49.4	14.8	481.0	35.0	0.1		19.2	115.8	387.0	514.0	0.3	0.7	
OUT	Sand Pass #2 Well.a	W47	well	176.78		8.1		1634.0	62.0	17.8	468.0	32.0	0.1			152.0	307.0	519.0	1.6	0.6	
OUT	W. Goeth. Needles #1 Well.a	W86	well		56.1	8.4			260.0	0.1	1100.0	160.0				24.0	340.0	1900.0		3.0	6.10
OUT	Shallow Spring.a	W87	spring			7.32		632.0	82.0	44.0	44.0	2.9	<0.1			210.0	264.0	29.0			
OUT	The Needle Rocks Well.a	W88	well		82.2	7.4		4615.0	163.0	0.1	1040.0	120.0				50.0	335.0	1950.0			117.00
OUT	Upper Adobe Spring.a	W89*	spring		7.0	7.5		454.0	86.0	19.0	47.0	<1	<0.1			273.0	113.0	12.0			
OUT	Upper Juniper Spring.a	W99*	spring		8.0	7.5		380.0	66.0	10.0	38.0	1.2	<0.1		0.0	204.0	69.0	16.0			
OUT	Tule Spring.a	W142*	spring		12	7.2		54.9	5.4	2.1	4.2	2.8				35.4	<3	2.0			
OUT	Suzie Spring.a	W168*	spring		17.00	7.70		223.4	26.6	9.7	12.6	4.9				158.5	4.0	7.0			
OUT	ADP Spring.a	W170*	spring			8.10		172.7	19.8	6.9	11.9	5.3				120.7	<3	5.0			
OUT	Spring de Casa.a	W171*	spring			7.90		156.8	16.9	6.0	11.6	5.2				106.1	7.0	4.0			
OUT	24N15E20A02M.a	W174			18.00	7.90		419.0	44.0	15.0	71.0	5.6		244.0		297.5	73.0	14.0		0.3	50.00
OUT	Soda Springs	B2756	spring		14.30	8.53	4039.0		3.5	1.6	875.3	37.8	0.1			502.0	447.2	822.2	0.1	1.1	
OUT	Mt. Lassen Snow	Laird			0.00	5.69	2.32		0.03	0.003	0.02	0.01				0.00	0.09	0.10	0.02	0.01	

Table 4. Honey Lake Basin solute chemistry data, in meq/L. * indicates a sample location with more than one sampling event.

							Solute Chemistry (meq/L)											
Flow Path	Name	Sample #	Temp (°C)	pH	Cond (µS/cm)	TDS (mg/L)	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	Fe^{2+}	CO_3^{2-}	HCO_3^{-}	SO_4^{2-}	Cl^{-}	NO_3^{-}	F^{-}	Balance Error %
SR/SHAF	F. Dewitt Dom.	W4	12.50	8.50		377.0	0.60	0.26	5.61	0.11		5.98	0.23	0.20	0.01			-1.0
SR/SHAF	Ca Fish & Game Irr.	W8	15.50	8.80		738.0	0.90	0.56	10.61	0.18		7.47	1.73	1.86	0.01	0.03	51.00	0.0
SR/SHAF	Mapes Ranch Irr.	W9	23.80	8.10		1790.0	2.54	0.60	24.97	0.56	0.00	3.72	6.14	18.36	0.05	0.02	79.00	0.7
SR	McClure Ranch Irr.	W10		8.00			0.80	0.54	3.87	0.17		3.03	1.00	1.44	0.04	0.01	53.00	-1.3
SR	E. Grant Dom.	W12	13.61	8.25		1097.5	0.81	0.65	15.49	0.20	0.00	7.67	7.15	1.11	0.74	0.12	33.50	-0.5
SR	T. Swickard Dom.	W13	13.75	8.30		814.0	0.84	0.58	10.43	0.21	0.00	7.09	4.39	0.80	0.41	0.05	42.50	-4.2
SR	J. Ferre Dom.	W14	15.00	8.10		485.0	0.70	0.53	6.00	0.13		4.08	2.12	1.24	0.04	0.02	51.00	-1.0
SR/SHAF	B. Piango Irr.	W15	14.72	8.25		1210.0	1.85	0.81	15.42	0.32	0.00	7.66	8.77	1.82	0.12		60.00	-0.6
SR	P.E. Milton Dom.	W17	5.10	7.10		348.0	1.80	1.48	0.96	0.03		2.00	0.40	0.45	1.47			-0.5
SR	Ca Conserv. Ctr. Dom.	W18	16.67	8.00		196.0	0.35	0.03	1.48	0.25		1.79	0.31	0.16	0.01			-3.5
SR	Johnston Ranch Dom.	W19	13.69	7.97		406.7	0.22	0.07	5.15	0.13		3.01	1.53	0.58	0.42	0.06	66.50	-0.4
SR	MacDonald Dom.	W20	13.11	8.10		119.0	0.90	0.58	0.52	0.11		2.07	0.10	0.04	0.03			-3.0
SR/HLW	Mormon Church Heating	W21*	52.20	7.70			0.47	0.05	2.44	0.02	0.01	2.34	0.42	0.17	0.00			1.0
SR	Fruit Growers Supply Ind.	W22	23.61	8.05		445.5	0.65	0.21	5.48	0.10		1.48	3.30	1.65	0.01	0.09	36.50	-0.6
SR	Abraham Jensen Irr.	W23	16.67	7.20		323.0	1.10	0.82	2.52	0.09	0.03	1.56	1.89	1.07	0.00	0.02	52.00	0.3
SR/SHAF	Tanner Ranch Dom.	W41	13.61	8.30		800.0	2.52	2.26	8.46	0.12		7.74	3.65	2.00	0.01	0.03	34.50	-2.1
SR	Ca Fish & Game Irr.	W42	13.89	7.45		1155.0	4.72	3.50	11.16	0.36	0.01	4.62	0.47	15.02	0.02	0.01	50.50	-1.0
SR	Darkin Well	W43*	14.10	6.90	1195.0		2.25	1.97	9.74	0.28		5.76	1.65	8.30	0.01	0.00		-4.9
SR	Ca Fish & Game Irr.	W44	13.00	8.35		913.0	1.97	1.44	10.66	0.17	0.00	5.51	2.05	6.70	0.05	0.02	46.00	-1.9
SR	Pete's Creek	V84*	13.30	8.18	375.0		0.97	0.23	1.48	0.14		2.66	0.12	0.13	0.00	0.00		-1.6
SR	SE of Standish	V110*	16.70	7.50	431.0	270.0	0.88	0.91	2.34	0.32	0.01	3.65	0.44	0.21		0.00	49.80	1.7
SR	Susanville Prison	V115	33.20	8.80		244.0	0.09	0.01	3.10	0.04	0.02	1.41	0.80	0.49		0.24	72.90	3.8
SN		V134*	21.70	9.70	451.0	196.0	0.14	0.02	3.99	0.01		2.00	0.77	1.68			12.00	-3.8
SR/AML	Johnston 1	V209*	66.95	8.75	970.0	620.0	0.67		7.48	0.07		0.19	5.10	2.51		0.18	88.60	1.4
SR/HLW	Roosevelt Swimming Pool	RE1	35.8	8.0			0.95	0.28	0.87	0.10		0.03	1.97	0.23	0.1			-1.3
SR	Gold Run Creek	H4081*	15.60	7.95	81.8		0.60	0.26	0.19	0.02		1.01	0.05	0.01	0.00	0.00	13.30	0.0
SR	Susan River in Susanville	H4082*	10.73	7.68	86.2		0.49	0.32	0.18	0.03	0.01	0.98	0.04	0.05	0.00			-1.9
SR/SHAF	Fish & Game Well	H4093*	14.33	8.40	1232.5	704.5	0.21	0.20	13.43	0.13		10.89	1.11	1.44	0.02	0.04	44.00	-1.7
SR.SHAF	Susan River at Litchfield	H4094*	25.15	8.54	320.5		1.62	1.13	2.00	0.19		3.61	1.09	0.23	0.00	0.02	21.80	-0.1
SR	Goni Well	H4095*	16.50	8.29	445.5	660.0	0.90	0.54	8.70	0.23	0.00	5.74	2.81	1.41	0.06	0.03	56.00	0.3
SR	NW of Standish	H4096*	17.10	7.92	351.6		0.39	0.17	2.39	0.14		2.35	0.61	0.34	0.00	0.03	38.10	-3.7
SR	Plummer Spring	H4097*	17.40	7.92	235.5		0.97	0.74	0.36	0.04		2.04	0.11	0.06	0.01	0.00	28.10	-2.5
SR	Susan River North of Susanville	H4098*	20.90	7.62	64.1		0.29	0.23	0.09	0.01		0.65	0.00	0.02	0.00	0.00	17.60	-3.9
SR	Trussell Well	H4099*	14.54	7.78	544.5	342.5	1.22	0.90	2.81	0.10	0.00	2.01	1.92	1.04	0.06	0.04	44.50	-0.4
SR	Johnstonville	H4113*	13.20	7.28	519.5	188.0	2.46	1.39	3.06	0.07		5.87	0.79	0.43	0.00	0.02	52.05	-0.9
SR	Richmond School	H4114*	17.37	7.99	283.5		1.18	0.47	2.65	0.01		2.90	0.77	0.81	0.00	0.02	13.40	-2.2
SHAF/WSA	Spring	W5	31.10	8.20		239.0	0.85	0.17	2.13	0.18	0.01	2.36	0.60	0.42	0.04	0.01	40.00	-1.3
SHAF	C.L. Curtis Dom.	W16	20.00	8.30		461.0	0.60	0.32	6.13	0.24		5.46	1.12	0.62	0.09			0.1
SHAF	BLM Horse Corral Well	H4092*	18.70	7.76	552.5	320.0	1.21	0.98	2.80	0.13		3.19	1.28	0.60	0.02	0.01	33.55	0.2
SHAF	Earll Well	H4100	20.10	7.45	756.6		0.85	1.02	0.50	0.03		2.39	0.04	0.04	0.00	0.00	39.80	-1.4
SHAF	Spring E. Horse Lake Mtn.	H4101*	16.60	7.77	242.0		0.97	1.10	0.52	0.04		2.62	0.03	0.04	0.00	0.00	23.70	-1.1
SHAF	Willow Creek	H4102*	18.20	8.19	303.7		0.65	1.04	1.41	0.19		3.09	0.01	0.12	0.00	0.00	33.60	1.1
SHAF	Cognina Well	H4103	26.70	8.13	169.1		0.13	0.10	1.22	0.08		1.27	0.08	0.15	0.00	0.01	52.90	0.7
SHAF	Spring S. of Snowstorm Mtn	H4104*	20.80	8.29	214.7		0.05	0.04	1.79	0.05		1.44	0.23	0.27	0.00	0.01	34.20	-0.5
SHAF	Railroad Spring	H4105*	22.55	8.94	919.5		0.36	0.21	0.99	0.11		1.46	0.05	0.06	0.00	0.00	16.20	3.1
SHAF	Tule Patch Spring	H4106*	17.10	7.82	199.5		0.70	0.69	0.50	0.09		1.80	0.08	0.08	0.01	0.00	15.70	0.3
SN	Newkirk Dom.	W45	14.56	7.80		314.0	1.80	1.81	1.70	0.17		4.98	0.14	0.06	0.12			1.6
SN	27N15E32G01M.a	W72	12.20	7.00		147.0	1.20	0.38	0.35	0.06		1.46	0.29	0.08	0.12	0.01	40.00	0.5
SN	27N15E30B01M.a	W73		7.60		196.0	0.45	0.79	1.78	0.10		2.76	0.18	0.05	0.00	0.01	39.00	1.9
SN	27N14E26E01M.e	W77	15.35	6.78		134.3	0.88	0.25	0.59	0.05		1.26	0.19	0.14	0.17	0.01	43.00	0.2
SN	27N14E26G01M.a	W78	14.40	7.80		147.0	0.95	0.25	0.74	0.05		1.26	0.23	0.31	0.19	0.00	34.00	-0.2
SN	27N14E24E01M.a	W80	15.50	7.00		202.0	1.30	0.49	1.48	0.05		2.80	0.29	0.11	0.02			1.5
SN	27N14E23J01M.a	W81	16.70	6.60		196.0	0.75	0.37	1.78	0.05		2.38	0.27	0.12	0.03	0.03	43.00	2.1
SN	27N14E22A01M.b	W82	14.20	7.10		254.5	0.67	0.19	2.63	0.04		2.77	0.58	0.13	0.35	0.02	46.00	-4.5
SN	27N14E21A01M.a	W83	18.90	7.00		92.0	0.45	0.15	0.48	0.02		0.98	0.04	0.04	0.01	0.01	36.00	1.2
SN	27N14E06B01M.a	W85	12.00	6.60		152.0	1.00	0.62	0.40	0.10		1.48	1.69	0.06		0.01	41.00	-20.9
SN	26N15E11H01M.a	W137	14.40	7.50		179.0	1.05	0.62	0.78	0.12		2.32	0.07	0.08	0.03	0.02	50.00	0.9
SN	26N15E11B06M.a	W138	15.50	7.90		170.0	0.35	0.13	1.57	0.14		1.96	0.10	0.11	0.02	0.02	51.00	-0.6
SN	26N15E03F01M.f	W139	18.44	7.73		141.3	0.88	0.36	0.81	0.09		1.80	0.27	0.08	0.01	0.01	32.25	-0.8
SN	D Price Well.a	W140	19.40	7.30		157.2	1.00	0.41	0.70	0.11		1.60	0.31	0.10		0.01		4.7
SN	"McDermott" Creek	V95*	17.80	8.24	144.0		0.77	0.28	0.42	0.05	0.01	1.41	0.08	0.08	0.00	0.01		-1.6
SN	Pluma National Forest	B682	10.00	6.38	269.0		1.50	0.53	1.08	0.04		2.54	0.10	0.23	0.00	0.00		4.7
SN	Mill Creek	H4083*	16.87	7.29	224.1	161.7	0.91	0.47	0.38	0.08		1.14	0.13	0.09	0.45			0.8
SN	Humphries #1	H4086*	13.55	8.12	330.0	218.0	1.95	0.41	0.87	0.07		2.42	0.31	0.25	0.29	0.03	37.00	0.0
SN	Humphries #2	H4087*	24.90	8.02	235.9	149.0	1.00	0.33	1.04	0.04		1.86	0.37	0.06	0.00			2.4
SN	Reinhart Well	H4090*	22.90	6.95	177.2		0.57	0.27	0.48	0.08		1.39	0.04	0.10	0.01	0.00	35.60	-4.8
SN	Ottis Canyon	H4091*	17.35	7.49	109.2		0.51	0.45	0.31	0.09		1.27	0.13	0.04	0.00	0.00	25.90	-2.9
SN	SE of Otis Canyon	H4107*	14.50	7.78	156.5		0.67	0.72	0.44	0.12		1.82	0.06	0.08	0.00	0.00	25.50	-0.3
SN	Webber 84	H4108*	18.20	7.54	233.9	145.0	1.10	0.24	0.48	0.02		1.44	0.10	0.11	0.24	0.01	40.00	-1.9
SN	Buntingville	H4109*	22.40	7.14	181.6		0.76	0.58	0.38	0.03		1.60	0.18	0.07	0.01	0.00	30.80	-3.0
SN	Basler Well	H4110*	17.85	7.46	538.5		3.23	1.18	2.72	0.11		6.36	0.51	0.21	0.01	0.01	43.50	1.0
SN	Elysian Creek	H4111*	20.55	7.59	154.5		1.23	0.87	0.32	0.07		2.26	0.05	0.04	0.00	0.00	20.50	2.9
SN	SW of Bass Hill	H4112*	17.95	6.90	227.8		0.98	0.46	0.32	0.01		1.60	0.06	0.08	0.05	0.00	38.90	-0.6
LV	27N17E31K01M.a	W53	18.30	7.40		633.0	3.79	1.89	4.09	0.16		3.38	4.93	1.33	0.00	0.07	48.00	1.1
LV	27N16E36Q01M.c	W61*	16.19	7.51		738.5	4.14	2.33	4.34	0.17		3.85	6.30	1.16	0.11	0.03	46.65	-2.0
LV	27N16E35P01M.m	W62	16.07	7.46		389.1	1.69	1.08	2.80	0.21		3.15	1.98	0.63	0.02	0.02	55.23	-0.1
LV	27N16E34R01M.a	W63	15.50	7.60		626.0	3.99	1.89	3.83			3.34	5.00	1.33	0.00	0.03	47.00	0.1
LV	27N16E31M.a	W64	15.50	7.40		712.0	3.89	2.22	4.18	0.15		3.26	5.64	1.35	0.00	0.02	46.00	0.8
LV	27N16E29D01M.a	W66	14.40	8.00		465.0	0.28	0.09	6.70	0.20		4.96	1.06	1.10	0.02	0.03	56.00	0.7
LV	27N16E25M.a	W67	15.50	7.40		690.0	3.89	2.22	4.22	0.16		3.32	5.60	1.35	0.00	0.02	49.00	0.9
LV	27N16E19M.a	W68	15.50	7.70		1110.0	2.99	1.65	13.01	0.22		4.88	7.12	5.73	0.03	0.03	71.00	0.2
LV	27N15E25K01M.b	W75	16.35	8.05		574.0	0.65	0.46	8.31	0.09		5.00	2.21	2.09	0.12			0.5
LV	26N17E18B01M.a	W122	17.60	7.30		543.7	1.80	0.49	5.83	0.10		4.33	1.08	1.00	1.99	0.06		-1.4
LV	26N16E21J01M.a	W126	15.25	8.05		318.0	2.52	1.44	0.87	0.07		4.09	0.23	0.28	0.43	0.02	57.50	-1.5
LV	Garrod Well #2.a	W127*	11.25	7.31	246.0		1.53	0.78	1.48	0.08		3.02	0.46	0.19	0.00			2.7
LV	26N16E15E03M.a	W129	15.87	7.72		538.3	3.84	1.21	3.13	0.14		3.45	4.02	0.53	0.15	0.05	36.43	0.8
LV	26N16E13A01M.a	W131	18.90	8.60		824.1	4.39	3.79	4.65	0.13		5.03	6.00	0.71	0.03	0.02		4.8
LV	26N16E06D01 M.b	W133	17.77	7.10		326.5	1.48	0.99	2.04	0.10		3.02	1.21	0.39	0.02	0.02		-0.4
LV	26N16E04M01M.a	W134	15.50	8.10		309.0	1.55	0.49	3.35	0.16		3.54	0.90	0.79	0.19	0.03		0.8
LV	26N16E03D02M.c	W135	19.48	8.23		362.0	0.57	0.15	4.05	0.42		3.41	0.86	0.55	0.10	0.02		2.5
LV	26N16E02G01M.e	W136	20.37	7.83		319.0	1.46	0.76	2.29	0.13	0.01	3.11	1.02	0.39	0.00	0.03	71.00	1.1
LV	Horse Spring.a	W141*	12.0	7.3		181.5	1.28	0.58	0.33	0.01		2.16		0.17				-2.8
LV	Upper Scott Spring.b	W143*	14.00	7.19		134.7	0.90	0.66	0.31	0.08		1.60		0.17				4.8
LV	Lower Scott Spring.a	W144*	14.00	7.80		194.7	1.14	0.96	0.30	0.06		2.34		0.14				-0.2
LV	Mud Spring.b	W145*	6.00	6.96		119.2	0.50	0.28	0.35	0.01	0.02	0.98	0.06	0.10				1.2
LV	25N17E34L01M.a	W157	15.00	7.50		171.0	1.00	0.55	0.78	0.08		2.44	0.00	0.04	0.00	0.02	48.00	-1.9
LV	Webber 159	W159*	18.30	7.15	211.0	237.0	1.40	0.91	1.31	0.04		2.88	0.27	0.23	0.21	0.01	46.00	0.7
LV	S of Doyle	W160*	16.96	7.31	211.0	167.9	0.42	0.19	1.84	0.02		1.44	0.57	0.27	0.04	0.11	24.50	0.9
LV	25N17E20B01M.c	W161	16.10	7.55		297.9	2.15	1.09	1.34	0.04		3.54	0.20	0.24	0.19	0.01		4.9
LV	25N17E17A01M	W162	16.10	7.60		279.0	1.45	0.91	1.52	0.23		3.28	0.31	0.56	0.03	0.03	60.00	-1.3
LV	Hd4 Dom. Well.a	W163	13.50	6.93		213.8	1.51	0.71	0.84	0.06		2.17	0.18	0.12	0.69	0.01		-0.7
LV	25N17E07J01.a	W165	16.10	8.57		186.3	0.93	0.55	1.03	0.06		2.03	0.27	0.08	0.11	0.02		1.1
LV	Sugarcane.a	W169*		7.90		174.9	0.94	0.61	0.51	0.14		2.04		0.11				1.1
LV	Boot legger Spring.a	W172		8.00		908.0	8.48	2.70	3.65	0.20		5.24	6.70	1.44				5.8
LV	24N17E03M01M.a	W173		8.20		194.0	1.70	0.54	0.57	0.12		2.86	0.00	0.11	0.01	0.02	45.00	-1.3
LV	23N17E02N01M.c	W175	16.10	7.03		492.0	1.76	1.48	4.12	0.23		5.05	2.25	0.25	0.30			-1.7
LV	22N17E26H01M.a	W176	14.60	7.43		250.7	1.63	1.26	0.78	0.21		3.12	0.28	0.35	0.13			0.2
LV	22N17E11M01M.a	W177	15.00			314.0	2.40	1.48	0.74	0.23		3.78	0.71	0.34	0.02	0.01	62.00	-0.1
LV	22N17E08K01M.b	W178	17.75	7.65		157.5	0.82	0.35	1.07	0.06		1.91	0.05	0.12	0.21	0.01	32.50	0.0
LV		V170	22.40	8.10	237.0	160.0	0.39	0.23	1.85	0.02		1.84	0.23	0.12		0.05	32.40	4.8
LV	SIAD TNT-7-MWA	V191*	14.40	9.10	1210.0	748.0	0.32	1.16	8.44	1.15		4.90	4.18	2.28	0.03	0.00	54.90	-3.0
LV	SIAD PSW8 PZ-4	V195*	9.10	8.10	818.0	548.0	3.15	0.01	2.81	0.19	0.00	3.25	1.94	3.27	0.00	0.00	47.40	-16.0
LV	SIAD PSW8 PZ-3	V196*	9.00	8.10	864.0	573.0	3.18	1.88	3.54	0.17	0.00	3.54	3.96	0.88		0.00	45.10	2.0
LV	SIAD PSW8 PZ-2	V197*	11.30	8.30	928.0	572.0	2.94	2.10	3.92	0.13		3.41	4.56	0.96	0.00	0.00	35.20	0.6
LV	SIAD PSW8 PZ-1	V198*	11.30	8.10	1220.0	818.0	5.59	3.53	3.13	0.18		3.25	7.14	1.15	0.12	0.01	42.60	3.0
LV	Breshears Well	B688	8.40	6.83	636.0		1.73	0.48	3.89	0.12		4.20	1.11	0.90	0.00	0.01		0.0
LV	Long Valley Creek, S of Doyle	B690*	7.30	7.73	416.8		1.05	0.63	2.19	0.11	0.01	2.67	1.16	0.40	0.00	0.05	0.00	-3.6
LV	Bird Flat Ranch #1	H4084*	21.00	7.35	1204.0	280.4	2.00	0.98	1.30	0.08		2.60	0.80	0.30	0.23	0.01		5.0
LV	Bird Flat Ranch #2	H4085*	19.55	7.25	447.5		1.93	1.11	1.29	0.09		2.93	0.76	0.34	0.06	0.01	30.70	3.8
LV	Cowboy Joe Spring	H4088*	17.65	7.46	213.9		0.69	0.41	0.90	0.05		1.87	0.09	0.11	0.00	0.00	20.70	-0.5
LV	N of Bird Flat Ranch	H4089*	18.85	7.23	776.0	380.0	2.00	0.91	3.09	0.16		3.68	1.69	0.65	0.06	0.05	33.00	0.2
LV	W of Herlong	H4115*	21.85	8.46	571.0	276.0	0.12	0.02	4.52	0.21		3.56	0.76	0.47	0.04	0.02	31.30	0.2
LV	Webber 125	H4120*	18.70	7.54	279.6	220.0	1.90	0.60	0.96	0.05		3.14	0.03	0.21	0.09	0.02	42.00	0.1
LV	Webber 167	H4121*	16.30	7.57	210.9	164.0	0.75	0.74	0.57	0.03		2.00	0.04	0.06	0.05			-1.5
LV	Briggs Well	H4122*	19.05	7.24	302.4	169.0	1.35	0.61	0.61	0.07		2.32	0.08	0.14	0.11	0.01	33.00	-0.4
LV	Indian Spring	H4123*	18.75	8.78	410.8		0.39	1.18	1.89	0.25		3.10	0.11	0.41	0.01	0.02	34.60	0.8
LV	Rat Auto Salvage	H4124*	20.58	7.64	598.0	293.2	1.40	0.82	1.87	0.10	0.00	2.25	0.85	0.37	0.50	0.03		2.4
LV	Heald Well	H4125*	21.53	7.61	1446.0	655.9	2.26	3.84	3.29	0.16		3.05	5.32	0.30	0.02	0.05		4.4
LV	Bell's Ranch	H4126*	26.00	7.54	356.4	206.7	1.21	0.69	0.77	0.08		1.74	0.22	0.24	0.47	0.01		1.5
LV	Long Valley Creek, N of Doyle	H4127*	16.63	8.13	485.3		1.82	1.01	2.66	0.10		3.81	1.29	0.46	0.00	0.04	16.87	0.0
LV	JDS Wetland Dom. Well	H4129*	20.20	8.80	972.5	954.7	0.11	0.06	11.27	0.27		7.49	3.50	1.63	0.01	0.01	28.60	-3.8
LV	Burkhard Place - Constantia Rd.	H4130*	18.00	8.42	211.0		0.50	0.17	1.28	0.04		1.79	0.07	0.07	0.01	0.00	7.70	1.3
LV	Webber 158	H4131*	20.04	7.09	198.4	147.0	1.22	0.37	0.57	0.03		1.54	0.13	0.17	0.28	0.01		1.7
LV/HLW	Rose 27	H4132*	37.60	8.90	282.2		0.04	0.01	2.64	0.00		1.35	0.99	0.43	0.00	0.09	21.10	-3.1
LV	Long Valley Creek-HJ	H4133*	8.60	8.00	265.9		1.16	0.83	0.74	0.09	0.01	2.68	0.11	0.08		0.00		-0.9
LV/HLW	Zamboni Hot Spring	H4134*	39.46	9.13	348.0		0.12	0.01	2.74	0.02	0.00	1.26	1.05	0.39		0.11		1.3
WSA	28N17E20J01 M.e	W34	25.84	7.90		184.6	0.43	0.15	1.91	0.12		1.94	0.32	0.27	0.02	0.01	38.75	1.1
WSA	28N17E20L01 M.b	W35	21.50	7.93		173.7	0.21	0.20	1.90	0.10		2.10	0.35	0.28	0.01	0.01	35.00	-6.6
WSA	Artesian Well #2.a	W36*	22.93	8.55	255.5	179.0	0.25	0.12	1.87	0.09		1.61	0.37	0.28			35.00	1.5
WSA	28N17E19B02M.a	W37	21.60	8.10		137.0	0.29	0.03	2.00	0.05		1.64	0.37	0.34	0.02	0.01	3.10	-0.1
WSA	Smf4 Art. Well #1.a	W39	15.00	9.00		216.9	0.20	0.07	2.48	0.08		1.93	0.46	0.34			29.00	1.8
WSA/AML	Amedee Hot Springs	W40*	102.78	8.60		948.0	0.80	0.04	10.35	0.15		0.41	6.31	4.51	0.01			-1.1
WSA	27N16E11E01M.k	W69	15.56	7.47		1172.6	5.67	1.97	9.59	0.40		2.40	3.27	11.71	0.06	0.02	53.36	0.5
WSA	27N16E03M.a	W70	15.50	7.20		348.0	1.45	1.07	2.44	0.23		3.04	1.44	0.51	0.02	0.02	54.00	1.5
WSA	27N16E02M.a	W71*	15.50	7.40		338.0	1.40	0.99	2.44	0.21		3.06	1.39	0.51	0.02	0.02	55.00	0.2
WSA/AML	Norcal2	V211*	98.90	8.90	1750.0	748.0	0.88	0.01	11.05	0.18		1.00	5.58	4.18		0.21	106.00	4.8
WSA	Lee Rd	H4116*	21.85	8.25	375.6	220.0	0.44	0.17	2.40	0.25		2.06	0.78	0.67	0.01	0.01	45.70	-4.0
WSA	Tinsley Fountain	H4117*	16.69	8.57	302.5	201.4	0.84	0.09	2.21	0.10		2.11	0.46	0.34	0.05	0.01	36.50	4.4
WSA/AML	HL Power Plant	H4135*	62.71	8.30	1800.0	967.0	1.26	0.00	12.04	0.25	0.00	0.81	7.13	5.33	0.00	0.15	53.00	0.0
ESA	28N17E35D01 M.a	W27	26.10	8.10		156.0	0.27	0.03	1.96	0.04		1.56	0.33	0.37	0.01	0.00	27.00	0.7
ESA	St1 Dom. Well.a	W30	17.15	8.35		175.5	0.30	0.16	2.04	0.04		1.87	0.37	0.34	0.01			-0.8
ESA	28N17E25P01M.b	W31	26.74	8.31		182.6	0.26	0.06	2.19	0.06		1.93	0.30	0.29	0.08	0.02	25.00	-0.9
ESA	High Rock Ranch.a	W32*	24.00	7.70			0.20	0.07	2.09	0.05		1.40	0.30	0.30				9.3
ESA	Artesian Well #3.a	W33*	22.77	8.30		173.7	0.17	0.16	1.83	0.08		1.61	0.32	0.26	0.00	0.01	34.00	0.5
ESA	F11.a	W48		7.80		5346.0	2.64	4.03	78.74			3.67	24.98	56.70				0.0
ESA	Tipton Well.a	W52*	13.30	8.46		2000.0	0.25	0.74	29.58	0.46	0.00	8.69	3.75	16.64	0.19	0.09	14.00	2.8
ESA	27N17E23D01M.a	W54	15.00	8.40		713.1	1.70	1.23	7.35	0.28		5.80	1.50	2.68	0.04	0.10		2.1
ESA	Duck Lake Irrig. Well.a	W55*	18.00	7.70		368.0	2.20	1.07	1.09	0.20		4.38	0.17	0.08			54.00	-0.8
ESA	27N17E15P02 M.a	W56	12.20	8.40		437.2	2.79	1.56	1.74	0.23		4.82	0.52	0.39	0.07	0.02		4.2
ESA	27N17E04A02 M.b	W57	13.95	8.56		679.6	0.76	1.45	8.33	0.13	0.00	5.56	0.77	3.42	0.02	0.06		4.1
ESA	27N17E03H01 M.a	W58	16.65	8.40		1308.6	0.32	0.81	17.66	0.31		9.72	1.49	6.97	0.08	0.07	48.00	2.0
ESA	Parks Ranch.a	W59	9.20	7.60		509.5	0.55	0.74	6.26	0.17		3.73	0.23	2.62	0.42	0.02		4.8
ESA	Frank Whitt.a	W60	15.00	9.00		3846.1	0.80	1.15	56.55	0.69	0.03	31.11	9.66	13.12	0.18	0.33		4.2
ESA/FSM	Austin North Dom. Well.a	W114*	13.60	7.80		50259.0	75.65	31.44	774.30	1.07	0.01	15.10	187.38	464.79	0.05	0.09	5.30	13.9
ESA/FSM/VM	Stanley Well.a	W115		8.30		8140.0	2.59	4.94	123.11	1.30	0.00	9.29	12.91	111.71	0.13	0.01	20.00	-0.8
ESA/CW/ASP	May Well.a	W116*	12.40	7.09		42700.0	7.49	67.48	700.35	2.40	0.32	15.57	7.29	685.50	0.02	0.02	18.00	4.7
ESA/FSM	26N17E01P01 M.a	W123	15.00	8.30		3320.0	0.80	1.15	56.55	0.69		34.17	9.66	13.12	0.18	0.33		1.5
ESA/FSM	B Victory Irr. Well.a	W124	15.00	7.85		2305.2	1.75	3.37	32.71	0.84		6.64	0.71	29.62	1.02	0.03		0.9
ESA	Skedaddle Creek	V87*																
ESA	SIAD UBG-4-MWA	V194*	20.60	9.00	575.0	348.0	0.61	0.32	4.08	0.41		3.60	0.70	0.57		0.00	63.80	2.7
ASP/ESA	Stone Well	B687	11.20	7.54	14280.0		1.79	5.38	197.06	2.82		19.85	43.74	161.25	0.00	0.44		-4.2
ESA	Droeger Well	H4118*	17.55	8.48	224.2	611.0	0.75	0.59	3.51	0.14		3.70	0.47	0.78	0.00	0.01	40.55	0.2
ESA	Harding Well	H4119*	17.60	8.07	1228.0	282.8	1.55	0.82	1.39	0.17		3.67	0.14	0.11	0.07	0.02		-0.9
FSM	McCorkle Dom. Well.a	W104*	13.00	7.36		316.0	0.93	1.84	1.35	0.21		2.97	1.02	0.14	0.06	0.02	12.00	1.5
FSM	Austin Dom. Well.a	W105*	16.00	8.10		321.0	1.96	1.06	0.78	0.01		3.06	0.54	0.11	0.04	0.02	8.00	0.5
FSM	Wilson #5 Well.a	W107		8.20		467.3	1.05	0.13	5.33	0.10	0.00	1.87	4.75	0.56	0.02	0.05		-4.7
FSM	Wilson Well.c	W108*	16.00	8.15		467.9	1.00	0.13	5.51	0.09	0.00	1.78	4.22	0.57	0.00	0.05	38.50	-1.0
FSM	Perkle Dom. Well.a	W113*		8.20		3449.6	2.96	0.22	49.16	0.77	0.02	18.08	0.04	31.65	0.04	0.04	10.50	3.2
FSM	Hail Dom. Well.a	W117*	5.00	8.60		173.0	0.60	0.00	1.44	0.14		0.90	0.70	0.30		0.03	8.00	-8.8
FSM	W Havil Dom. Well.a	W118	17.80	8.25		192.1	0.45	0.25	1.57	0.15		1.27	0.71	0.28	0.03	0.03		1.8
FSM	26N17E24F01 M.a	W119		8.90		354.0	0.05	0.08	4.70	0.06		2.62	2.02	0.25	0.05	0.03		-0.9
FSM	26N17E22G01.a	W120	28.30	8.60		315.2	0.55	0.33	3.05	0.19		1.63	1.46	0.82	0.09	0.13		-0.1
FSM	2TP Spring.a	W152*		7.50		176.3	0.93	0.84	0.33	0.05		2.07	0.08	0.20				-4.3
FSM	Rat Spring.a	W153*	15.00	7.30		136.8	0.96	0.15	0.63	0.08		1.38	0.17	0.17				2.9
FSM	Nork/Francone Well	H4128*	22.35	7.88	2730.0	731.9	1.70	0.20	8.90	0.10		1.50	7.10	1.02	0.03	0.10	44.00	5.6
VM	First Fault.a	W90*		8.00		173.0	0.44	0.05	1.63	0.09	0.00	1.62	0.23	0.25	0.02	0.01		2.1
VM	Jarboe Well.c	W91*	21.00	8.14		181.7	0.63	0.40	1.20	0.17	0.00	1.97	0.20	0.20	0.07	0.01	44.00	-5.0
VM	Ferrel Playa Well.a	W92		8.30		201.0	0.35	0.09	3.35	0.15		2.54	0.46	0.76	0.06			1.6
VM	Headquarters	W93*	19.17	8.30	302.0	213.3	0.59	0.17	2.47	0.17	0.01	2.55	0.25	0.30	0.04	0.01	53.00	3.2
VM	Fish Spring.a	W97	22.80	8.00		298.0	0.15	0.25	3.39			2.93	0.35	0.51				-0.1
VM	Willow Spring.a	W103*	16.60	7.47		159.5	0.80	0.49	0.46	0.07		1.59	0.10	0.14				-0.5
VM	Ferrel Test Well.a	W109*	20.33	8.27		230.3	0.30	0.13	2.89	0.16	0.00	2.23	0.37	0.51	0.07	0.02	43.50	0.4
VM	Ferrel #1 Well.a	W110*	20.00	7.90		257.9	0.20	0.24	2.91			2.36	0.37	0.62				0.0
VM	Ford #2 Well.a	W111*		7.80		751.0	0.75	0.40	8.48	0.32		3.98	5.83	0.68				-2.6
VM	Ford #1 Well.a	W112*	14.70	8.37		1089.0	1.74	1.36	8.27	0.61	0.01	4.69	0.67	3.12	0.05	0.09	5.30	3.0
VM	Mustang Spring.a	W151*	15.00	7.30		165.7	1.06	0.63	0.49	0.04		1.80	0.12	0.23				1.8
VM	Sheep Spring.a	W156*	12.50	7.20		174.5	0.87	0.30	0.97	0.06		1.75	0.13	0.17				3.5
VM	Fish Springs Ranch Dom. Well	H4136*	15.85	8.67	410.1		0.28	0.17	3.29	0.21		3.04	0.45	0.51	0.03	0.01	17.40	-1.1
VM	Fish Spring Ranch Irrigation Well	H4137	19.10	7.89	296.8		0.46	0.31	1.72	0.25		2.29	0.19	0.25	0.01	0.00	13.00	0.0
CW	Cottonwood Test Well.a	W94*		7.10		203.0	1.11	0.71	0.77	0.17	0.00	2.44	0.15	0.20	0.08	0.01		-2.0
CW	Cottonwood Creek South	W95*	12.20	8.40	127.6	163.9	0.72	0.70	0.60	0.06	0.00	1.70	0.08	0.07	0.01	0.01		-4.0
CW	Cottonwood Springs	W96*	14.77	7.77	162.7	78.3	0.64	0.42	0.51	0.13		1.56	0.08	0.08	0.02	0.01	21.67	-1.5
CW	Cottonwood Well #2.a	W98		7.60		227.0	1.11	0.64	0.70	0.14	0.01	2.54	0.23	0.20	0.03	0.01		-7.0
CW/ASP/NV	BB2-C.a	W101*	15.67	8.27		555.7	0.69	0.38	6.84	0.27	0.00	4.92	0.82	2.07	0.02	0.02		-0.4
CW	Upper Red Spring.a	W146*	14.00	7.93		198.0	1.65	0.90	0.57	0.12		2.62	0.13	0.14				5.5
CW	Black Canyon.a	W147*	14.00	7.40		161.9	0.97	0.69	0.33	0.09		1.90	0.06	0.11				0.2
CW	Newcombe Spring.a	W148*	20	7.3		247.7	1.50	0.74	1.00	0.15		2.80	0.12	0.17				4.5
CW	Cold Spring.a	W150*	12.00	7.30		125.0	0.71	0.48	0.23	0.12		1.44		0.11				-0.2
CW	Cottonwood Snow	B689					1.25	0.06	0.40	0.01		1.56	0.04	0.09	0.04			-0.3
CW	Cottonwood Creek	B3992	6.50		107.4		0.72	0.63	0.38	0.07	0.01	1.61	0.08	0.08	0.01	0.01		0.6
NV	Hodges Well.b	W100*	18.75	7.88		199.8	0.49	0.33	1.63	0.21	0.00	2.25	0.13	0.14	0.04	0.01	51.00	-0.1
NV	Never Sweat Ranch	W102*	14.90	8.25	352.8	764.7	0.86	0.28	4.67	0.21	0.02	3.66	1.49	1.03	0.08	0.01		-1.9
ASP	Astor Pass 1.a	W49		8.30		2619.8	0.65	0.99	36.02	0.31	0.00	15.41	7.64	12.61	0.01	0.16		2.9
ASP	Astor Pass 2.a	W50		8.50		2120.1	0.49	0.65	29.06	0.24	0.01	14.55	5.27	8.01	0.01	0.17		4.2
ASP	Astor Pass Test Well.a	W51*	21.00	7.90		2469.0	1.98	2.29	36.93	0.34	0.00	13.87	6.87	19.10	0.00	0.12		1.9
ASP	Astor Pass	B2041					0.70	0.76	23.62	0.30	0.00	14.36	3.60	7.25	0.00	0.13		0.1
OUT	Well 3891.a	W24*	22.2	8.4		1773.7	1.36	0.79	23.66	1.07		3.52	8.04	15.49				-0.3
OUT	Well 3902.a	W25*	20.0	8.1		1734.8	0.43	0.12	26.58	0.79		2.69	7.97	15.09				4.0
OUT	Bonham Ranch 1.a	W26*	23.3	8			1.85	0.19	35.45			2.54	10.99	23.95				0.0
OUT	Sand Pass Test Well.a	W46*	15.5	8.7		1562.0	2.47	1.22	20.92	0.90	0.00	1.90	8.06	14.50	0.00	0.04		0.7
OUT	Sand Pass #2 Well.a	W47		8.1		1634.0	3.09	1.46	20.36	0.82	0.00	2.49	6.39	14.64	0.03	0.03		4.4
OUT	W. Goeth. Needles #1 Well.a	W86	56.1	8.4			12.97	0.01	47.85	4.09		0.39	7.08	53.60		0.16	6.10	2.9
OUT	Shallow Spring.a	W87		7.32		632.0	4.09	3.62	1.91	0.07		3.44	5.50	0.82				-0.3
OUT	The Needle Rocks Well.a	W88	82.2	7.4		4615.0	8.13	0.01	45.24	3.07		0.82	6.97	55.01			117.00	-5.3
OUT	Upper Adobe Spring.a	W89*	7.0	7.5		454.0	4.29	1.56	2.04	0.00		4.47	2.35	0.34				4.9
OUT	Upper Juniper Spring.a	W99*	8.0	7.5		380.0	3.29	0.80	1.65	0.03		3.34	1.44	0.45	0.00			4.9
OUT	Tule Spring.a	W142*	12	7.2		54.9	0.27	0.17	0.18	0.07		0.58		0.06				4.5
OUT	Suzie Spring.a	W168*	17.00	7.70		223.4	1.33	0.80	0.55	0.13		2.60	0.08	0.20				-1.4
OUT	ADP Spring.a	W170*		8.10		172.7	0.99	0.57	0.52	0.14		1.98		0.14				2.1
OUT	Spring de Casa.a	W171*		7.90		156.8	0.84	0.49	0.50	0.13		1.74	0.15	0.11				-0.6
OUT	24N15E20A02M.a	W174	18.00	7.90		419.0	2.20	1.23	3.09	0.14		4.88	1.52	0.39		0.02	50.00	-1.1
OUT	Soda Springs	B2756	14.30	8.53	4039.0		0.17	0.13	38.08	0.97		8.23	9.31	23.19	0.00	0.06		-1.8
OUT	Mt. Lassen Snow	Laird	0.00	5.69	2.32		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00		0.00

Table 5. Honey Lake Basin isotope data. * indicates a sample location with more than one sampling event.

Flow Path	Name	Sample #	Source	Depth (m)	Temp (°C)	pH	^{3}H (TU)	δ^2H (‰)	δ^{18}O (‰)	δ^{13}C (‰)	^{14}C (pmc)
ASP	Astor Pass	B2041	well				2.1	-106.5	-13.1	-4.5	
ASP	Astor Pass Test Well	W51*	well	134.11	21.00	7.90		-104.0	-13.6		
ASP/ESA	Stone Well	B687	well	39.62	11.20	7.54		-96.8	-10.3	-6.4	
ESA/LW/ASP	May Well	W116*	well	76.20	12.40	7.09		-49.0	-10.9		
CW	Cottonwood Springs	W96*	spring		14.77	7.77	1.2	-114.3	-14.9	-19.0	
CW	Cottonwood Creek South	W95*	surface		12.20	8.40		-110.4	-14.4		
CW	Cold Spring	W150*	spring		12.00	7.30	8.44	-112.5	-14.0		
CW	Cottonwood Creek	V97	surface		15.00			-110.0	-14.4		
CW	E. Cottonwood Canyon Creek	V98*	surface		14.10	8.29		-108.0	-13.8		
CW	Cottonwood Snow	B689	snow					-120.2	-15.3		
CW	Cottonwood Creek	B3992	surface		6.50			-107.9	-13.6		
ESA	High Rock Ranch	W32*	well		24.00	7.70		-112.0	-14.5	-12.8	21.6
ESA	SIAD UBG-4-MWA	V194*	well	29.41	20.60	9.00	0.5	-109.0	-14.4	-12.5	56.8
ESA	SIAD DEMO-1	V179*	well	28.65	26.70			-115.0	-14.1	-10.2	
ESA	Spencer Spring	W3*	spring					-110.0	-14.6		
ESA	Tipton Well	W52*	well	54.86	13.30	8.46		-108.0	-13.7		
ESA	Duck Lake Irrig. Well	W55*	well		18.00	7.70		-101.6			
ESA	Skedaddle Creek	V87*	surface					-103.5	-13.3		
ESA	Spencer Creek	V89*	surface					-101.0	-12.5		
ESA	Flanigan Ranch Well	V139	well		22.00			-113.0	-14.2		
ESA	Droeger Well	H4118*	well		17.55	8.48		-114.9	-14.6		
ESA	Harding Well	H4119*	well	46.33	17.60	8.07	0.9	-105.9	-12.8		
ESA/FSM	Austin North Dom. Well	W114*	well		13.60	7.80		-96.5	-9.9		
FSM	Cal Neva Rd. - DWR West	V165*	well	33.22				-116.0	-15.2	-14.1	59.0
FSM	McCorkle Dom. Well	W104*	well	19.81	13.00	7.36		-116.0	-15.2		
FSM	Austin Dom. Well	W105*	well		16.00	8.10		-114.0	-14.9		
FSM	Wilson Well	W108*	well		16.00	8.15	0	-118.0	-14.3		
FSM	Perkle Dom. Well	W113*	well			8.20		-109.5	-13.6		
FSM	Hail Dom. Well	W117*	well	10.67	5.00	8.60		-116.0	-15.3		
FSM	2TP Spring	W152*	spring			7.50		-115.0	-14.7		
FSM	Rat Spring	W153*	spring		15.00	7.30		-118.0	-14.7		
FSM	Mullen Creek	W154*	surface					-114.0	-15.3		
FSM	Spring N. Ft. Sage Mtn.	V68*	spring		10.30	8.02		-116.0	-14.9		
FSM	Nork/Francone Well	H4128*	well		22.35	7.88	0.5	-119.0	-14.6		
LV	SIAD PSW8 PZ-4	V195*	well	192.02	9.10	8.10		-120.0	-15.1	-11.9	13.1
LV	SIAD PSW8 PZ-3	V196*	well	150.88	9.00	8.10		-118.0	-14.8	-11.9	15.0
LV	SIAD PSW8 PZ-2	V197*	well	102.11	11.30	8.30		-114.0	-14.3	-13.8	16.1
LV	SAID PSW #2	V203*	well	213.36	16.90	8.20		-112.0	-14.1	-11.4	17.5
LV	SIAD PSW8 PZ-1	V198*	well	56.39	11.30	8.10		-110.0	-13.8	-13.2	23.4
LV	SIAD PSW #8	V206*	well	213.36	16.70	8.30		-112.0	-13.8	-11.9	30.7
LV	SIAD B21-5-PZ	V178*	well	32.00	18.30	7.40		-109.0	-13.5	-9.0	30.7
LV	SIAD DMO-13-A	V180*	well	36.27	18.10	7.70		-107.0	-13.5	-6.7	35.0
LV	SIAD PSW5 PZ-4	V199*	well	152.40	10.40			-108.0	-13.8	-13.1	38.5
LV	SIAD PSW5 PZ-3	V200*	well	141.21	11.60			-108.0	-13.7	-12.4	45.2
LV	SIAD B21-3-MW	V177*	well	36.58	18.90	7.30		-103.0	-13.3	-11.9	46.0
LV	SIAD PSW5 PZ-1	V202*	well	70.56	9.40	7.60		-110.0	-13.9	-11.0	50.3
LV	SIAD PSW #9	V207*	well	161.54	18.30	8.10	0.2	-111.0	-13.8	-12.3	55.4
LV	SIAD PSW #5	V205*	well	167.64	17.10	8.50		-109.0	-13.6	-11.8	60.9
LV	W of Herlong	H4115*	well	24.38	21.85	8.46	0.4	-107.0	-13.6	-3.3	63.6
LV	SIAD PSW5 PZ-2	V201*	well	96.01	13.60	7.70		-110.0	-13.6	-11.4	71.4
LV	Burkhard Place - Constantia Rd.	H4130*	well	54.86	18.00	8.42	0.3	-109.0	-13.7	-15.4	73.1
LV	E of Doyle	V174*	well	106.68	22.20	7.40	0.9	-108.0	-13.3	-2.7	74.6
LV	SIAD TNT-7-MWB	V192*	well	31.57	14.80	8.10		-108.0	-13.4	-7.8	75.0
LV	JDS Wetlands	V141*	well	48.77	18.20	8.60		-108.0	-13.6	-10.8	79.8
LV	NE of Herlong Junction	V168*	well	22.86	20.90	7.30	0.3	-114.0	-14.0	-4.4	83.8
LV	Garrod Well #2	W127*	well	76.20	11.25	7.31	4.1	-108.7	-14.0	-14.9	90.5
LV	Bird Flat Ranch #2	H4085*	well	213.36	19.55	7.25	2.55	-110.0	-13.9		90.5
LV	SIAD LT-1	V183*	well	19.81	18.60	8.20		-107.0	-12.6	-9.0	102.6
LV	Bird Flat Ranch #1	H4084*	well	198.12	21.00	7.35	3.9	-102.7	-12.1	-12.5	112.8
LV	Breshears Well	B688	well	42.67	8.40	6.83		-109.5	-13.5	-14.4	
LV	Long Valley Creek-HJ	H4133*	surface		8.60	8.00	2.7	-103.4	-13.4	-12.0	
LV	Long Valley Creek, S of Doyle	B690*	surface		7.30	7.73		-111.3	-14.0	-11.0	
LV	SIAD TNT-7-MWA	V191*	well	20.94	14.40	9.10		-107.0	-13.4	-7.9	
LV	Long Valley Creek, N of Doyle	H4127*	surface		16.63	8.13		-105.4	-13.5	-7.5	
LV	JDS Wetland Dom. Well	H4129*	well	92.66	20.20	8.80	0.0	-112.0	-13.8	-6.8	
LV	Honey Lake-E. arm	V94*	surface		23.90	9.03		-58.0	-5.6	-2.6	
LV	Honey Lake-W. arm	V93*	surface		24.40	8.80		-57.0	-4.9	-2.0	
LV	S of Doyle	V171*	well	24.38	21.40	6.80	4.7	-108.0	-14.3	0.4	
LV	27N16E36Q01M	W61*			16.19	7.51		-112.5	-14.1		
LV	26N16E02G01M	W136	well	161.54	20.37	7.83		-109.0	-13.9		
LV	Horse Spring	W141*	spring		12.0	7.3		-113.0	-14.7		
LV	Upper Scott Spring	W143*	spring		14.00	7.19		-110.0	-14.4		
LV	Lower Scott Spring	W144*	spring		14.00	7.80		-115.0	-14.8		
LV	Mud Spring	W145*	spring		6.00	6.96		-108.0	-12.2		
CW	Upper Red Spring	W146*	spring		14.00	7.93		-116.5	-14.8		
CW	Black Canyon	W147*	spring		14.00	7.40		-115.0	-15.1		
CW	Newcombe Spring	W148*	spring		20	7.3		-116.0	-14.9		
LV	Webber 159	W159*	well	36.58	18.30	7.15		-111.0	-14.8		
LV	S of Doyle	W160*	well	36.58	16.96	7.31	0	-111.0	-14.8		
LV	Sugarcane	W169*	spring			7.90	0	-113.0	-14.4		
LV	Higgens Spring	V72*	spring		14.30	7.87		-116.0	-14.6		
LV	Spring E. Seven Lakes Mtn.	V76*	spring		15.00	8.33		-101.0	-12.4		
LV	Spring N. Seven Lakes Mtn.	V77*	spring		13.60	7.71		-113.0	-13.6		
LV	August Spring	V80*	spring		9.60	8.59		-112.0	-14.5		
LV	Long Valley Creek, Herlong	V99*	surface		28.60	8.21		-90.0	-11.4		
LV	SIAD Sewage Treatment Plant	V106	surface		6.90			-86.0	-9.6		
LV	JDS Wetlands - surface water	V105*	surface		26.10	9.70		-95.0	-9.9		
LV		V170	well	182.88	22.40	8.10		-113.0	-14.8		
LV	SAID ALF-3	V175*	well	32.31	12.90	7.70		-105.0	-13.0		
LV	SIAD ALF-8-MWA	V176*	well	33.53	11.80	7.60		-107.0	-13.2		
LV	SIAD DMO-11-A	V181*	well	33.53	17.60	7.50		-106.0	-13.3		
LV	SIAD STP-2	V184*	well	17.53	18.30	6.90		-89.0	-9.3		
LV	STP-03-PZ	V185*	well	17.07	13.10	7.20		-90.0	-9.3		
LV	SIAD STP-4-PZ	V186*	well	17.37	11.80	6.70		-85.0	-8.5		
LV	SIAD STP-5-PZ	V187*	well	27.74	13.10	7.70		-100.0	-13.2		
LV	SIAD TNT-1-MWB	V189*	well	33.39				-111.0	-13.3		
LV	SIAD TNT-1-MWC	V190*	well	44.81				-114.0	-12.4		
LV	SIAD TNT-7-MWC	V193*	well	44.81	14.90	7.90		-107.0	-13.4		
LV	Spr. - N Seven Lakes Mnt.	R107	spring		13.60	7.70		-113.0	-13.6		
LV	Cowboy Joe Spring	H4088*	spring		17.65	7.46	0.0	-112.0	-14.0		
LV	N of Bird Flat Ranch	H4089*	well		18.85	7.23	2.7	-102.2	-12.4		
LV	Webber 125	H4120*	well		18.70	7.54		-109.8	-14.1		
LV	Webber 167	H4121*	well	48.16	16.30	7.57	0.0	-111.9	-14.3		
LV	Briggs Well	H4122*	well		19.05	7.24		-109.2	-13.9		
LV	Indian Spring	H4123*	spring		18.75	8.78	2.0	-109.0	-13.1		
LV	Rat Auto Salvage	H4124*	well		20.58	7.64		-106.3	-13.0		
LV	Heald Well	H4125*	well		21.53	7.61		-110.1	-13.4		
LV	Bell's Ranch	H4126*	well	106.68	26.00	7.54	0.4	-107.4	-13.0		
LV	Webber 158	H4131*	well	24.38	20.04	7.09		-107.1	-14.4		
LV/HLW	Zamboni Hot Spring	H4134*	spring		39.46	9.13	0.4	-118.5	-15.4	-12.8	
LV/HLW	Rose 27	H4132*	well		37.60	8.90	0.4	-113.0	-14.8		
NV	Never Sweat Ranch	W102*	well	152.40	14.90	8.25	1	-108.5	-14.8	-11.2	76.7
NV	Hodges Well	W100*	well	79.25	18.75	7.88	0	-113.0	-14.4		
OUT	Pipe Spring	W2*	spring					-110.0	-14.3		
OUT	Well 3891	W24*	well		22.2	8.4	0	-112.0	-13.0		
OUT	Well 3902	W25*	well		20.0	8.1	0	-114.0	-13.3		
OUT	Bonham Ranch 1	W26*	well		23.3	8		-115.5	-13.7		
OUT	Sand Pass Test Well	W46*	well	217.02	15.5	8.7		-106.0	-13.6		
OUT	Sand Pass #2 Well	W47	well	176.78		8.1		-106.0	-13.6		
OUT	Upper Adobe Spring	W89*	spring		7.0	7.5		-104.0	-12.7		
OUT	Upper Juniper Spring	W99*	spring		8.0	7.5		-105.0	-12.8		
OUT	Tule Spring	W142*	spring		12	7.2		-113.0	-14.4		
OUT	Suzie Spring	W168*	spring		17.00	7.70	0	-118.0	-15.2		
OUT	ADP Spring	W170*	spring			8.10	0	-116.0	-14.4		
OUT	Spring de Casa	W171*	spring			7.90	0	-117.0	-14.2		
OUT	Fleming Spring	V29*	spring		16.80	8.29		-107.0	-13.8		
OUT	Eagle Lake Spring	V32*	spring		17.00			-116.0	-15.2		
OUT	Fleming Creek	V81*	surface		16.40	7.84		-109.0	-13.9		
OUT	Soda Springs	B2756	spring		14.30	8.53	0.8	-109.5	-12.9		
SHAF	Tule Patch Spring	H4106*	spring		17.10	7.82		-113.0	-14.5	-15.1	72.7
SHAF	BLM Horse Corral Well	H4092*	well	45.72	18.70	7.76	0.6	-113.0	-15.0	-1.9	79.9
SHAF	Spring S. Horse Mtn.	V28	spring		17.60	8.25		-108.0	-13.6		
SHAF	Murrers Meadow Spring	V33*	spring		15.80	7.64		-112.0	-14.6		
SHAF	Spring S. of Snowstorm Mtn.	V34*	spring		17.6	7.68		-116.0	-14.6		
SHAF	Spring NW Five Spring Mtn.	V35*	spring		15.70	7.96		-117.0	-14.6		
SHAF	Gillman Spring	V37*	spring		18.90	8.12		-97.0	-12.0		
SHAF	Shaffer Spring	V45*	spring		8.30			-100.0	-12.7		
SHAF	Spr. S Horse Mtn.	R95	spring		17.60	8.30		-108.0	-13.6		
SR/SHAF	Susan River at Litchfield	H4094*	surface		25.15	8.54		-98.0	-13.1	-0.3	
SHAF	Spring E. Horse Lake Mtn.	H4101*	spring		16.60	7.77	0.4	-115.0	-15.0		
SHAF	Willow Creek	H4102*	surface		18.20	8.19		-106.0	-13.2		
SHAF	Spring S. of Snowstorm Mtn	H4104*	spring		20.80	8.29		-116.0	-14.6		
SHAF	Railroad Spring	H4105*	spring		22.55	8.94	0.0	-88.0	-9.1		
SR/SHAF	Fish & Game Well	H4093*	well	160.02	14.33	8.40	0.4	-102.7	-12.6	-11.9	
SN	SW of Bass Hill	H4112*	well	60.96	17.95	6.90		-101.0	-12.9		112.4
SN	Plumas National Forest	B682	well	54.86	10.00	6.38		-105.5	-14.4	-16.8	
SN	"McDermott" Creek	V95*	surface		17.80	8.24	9.2	-106.5	-14.4	-7.9	
SN	Brownell Creek	V90*	surface		20.60	7.79		-103.0	-13.6		
SN	Parker Creek	V91*	surface		12.40	7.73		-102.0	-14.1		
SN	Milford Grade Creek	V96*	surface		17.80	8.24		-101.0	-13.7		
SN		V134*	well	60.35	21.70	9.70		-114.0	-14.1		62.0
SN	N of Buntingville	V135*	well	121.92	21.60	9.70		-110.0	-14.1		
SN	Mill Creek	H4083*	surface		16.87	7.29	0.4	-111.6	-15.1		
SN	Humphries #1	H4086*	well		13.55	8.12		-108.3	-14.1		
SN	Humphries #2	H4087*	well		24.90	8.02	0.0	-110.8	-14.4		
SN	Reinhart Well	H4090*	well	42.67	22.90	6.95	0.0	-109.0	-14.1		
SN	Otis Canyon	H4091*	spring/surface		17.35	7.49	2.2	-105.0	-13.5		
SN	SE of Otis Canyon	H4107*	spring/well		14.50	7.78		-100.0	-12.7		
SN	Webber 84	H4108*	well		18.20	7.54		-108.2	-14.0		
SN	Buntingville	H4109*	well		22.40	7.14		-107.0	-13.7		
SN	Basler Well	H4110*	well	30.48	17.85	7.46		-104.0	-13.3		
SN	Elysian Creek	H4111*	surface		20.55	7.59		-101.0	-13.7		
SR	Durkin Well	W43*	well		14.10	6.90	0	-112.7	-14.1	-7.2	2.8
SR	NW of Standish	H4096*	well	17.07	17.10	7.92	0.0	-113.0	-14.9	-7.7	46.7
SR	Richmond School	H4114*	well	44.20	17.37	7.99	0.0	-108.0	-13.8	-14.4	54.5
SR	Plummer Spring	H4097*	spring		17.40	7.92	0.4	-101.0	-12.9	-15.3	74.7
SR	Lassen County Well	V111*	well	42.67	15.60	7.50		-104.0	-13.1	-10.1	83.0
SR	Trussell Well	H4099*	well		14.54	7.78	1.5	-108.1	-14.7	-20.7	
SR	Susan River in Susanville	H4082*	surface		10.73	7.68	3.3	-97.4	-12.8	-14.7	
SR	Pete's Creek	V84*	surface		13.30	8.18		-101.5	-12.8	-8.2	
SR	Standish	V112*	well	43.89	18.50	8.00		-104.0	-14.1	-8.0	
SR	Susan River North of Susanville	H4098*	surface		20.90	7.62	5.7	-98.0	-13.1	-2.4	
SR	Spring S. Roop Mtn.	V39*	spring		8.50	8.62		-109.0	-14.6		
SR	Cady Spring	V40*	spring		10.50	8.16		-111.0	-14.7		
SR	SE of Standish	V110*	well	27.83	16.70	7.50		-101.0	-13.0		
SR	Susanville Prison	V114	well	201.17	31.70	8.50		-115.0	-15.2		
SR	Susanville Prison	V115	well	170.69	33.20	8.80		-114.0	-15.2		
SR		V118	well	45.11	20.00	7.90		-103.0	-13.4		
SR	NCCC PA-12	R55	surface	201.17	31.70	8.50		-115.0	-15.2		
SR	Gold Run Creek	H4081*	surface		15.60	7.95	3.4	-98.0	-13.7		
SR	Goni Well	H4095*	well		16.50	8.29	0.0	-113.6	-14.4		
SR	Johnsonville	H4113*	well	21.95	13.20	7.28		-108.0	-13.9		
SR/AML	Johnston 1	V209*	geo well	432.82	66.95	8.75		-122.5	-15.3	-11.9	10.6
VM	Fish Springs Irrigation Well-SW	V153*	well	134.11	17.70	8.10		-102.5	-12.2	-11.3	37.0
VM	Fish Springs Ranch Dom. Well	H4136*	well	78.64	15.85	8.67	1.7	-114.4	-14.6	-10.3	37.6
VM	Fish Springs Irrigation Well-SE	V145*	well	65.53				-116.0	-15.1	-11.6	41.3
VM	Headquarters	W93*	well	121.92	19.17	8.30	1.4	-113.0	-14.7	-13.4	43.5
VM	Jarboe Well	W91*	well	151.49	21.00	8.14	0	-112.0	-13.7		
VM	Willow Spring	W103*	spring		16.60	7.47	0	-114.0	-14.4		
VM	Ferrel Test Well	W109*	well	137.16	20.33	8.27	0	-114.0	-14.0		
VM	Ford #1 Well	W112*	well	184.40	14.70	8.37		-119.0	-15.0		
VM	Mustang Spring	W151*	spring		15.00	7.30		-114.0	-14.4		
VM	Fish Springs Creek	W155*	surface		14.00			-109.0	-14.1		
VM	Sheep Spring	W156*	spring		12.50	7.20		-112.0	-13.4		
VM	Spring E. Ft. Sage Mtn.	V66*	spring		20.50	7.87		-93.0	-10.9		
VM	Fish Spring Ranch Irrgation Well	H4137	well		19.10	7.89	0.7	-112.0	-14.3		
WSA	Lee Rd	H4116*	well	121.92	21.85	8.25	0.3	-113.0	-14.6	-10.2	17.1
WSA	Artesian Well #2	W36*	well		22.93	8.55		-113.0	-14.8	-10.4	
WSA	Spr. NE of Stacy	R90	spring		15.00	8.90		-114.0	-14.6	-10.1	
WSA	Spring nr. Herlong Siding	V46	spring					-116.0	-14.8		
WSA	Skedaddle Mountain Ranch	V108						-113.0	-15.0		
WSA	SIAD LBG-2	V182*	well	8.84	13.60	8.70		-96.0	-12.2		
WSA	SIAD STP-7	V188*	well	20.73	13.70	7.90		-108.0	-13.2		
WSA	Tinsley Fountain	H4117*	spring	30.48	16.69	8.57	0.0	-114.0	-14.6		
WSA/AML	Norcal2	V231*	geo well	322.48	98.90	8.90	0.2	-120.0	-14.9	-9.9	10.0
WSA/AML	HL Power Plant	H4135*	spring/well		62.71	8.30	0.0	-118.4	-13.2	-12.9	
WSA/AML	Norcal 1	V212	geo well	454.46				-117.0	-14.7		
WSA/AML	Norcal 1	V213	geo well	454.46				-116.0	-14.8		

Table 6. Honey Lake Basin ^{3}H data. Data was normalized to 2005 based on the 12 year half life of ^{3}H. * indicates a sample location with more than one sampling event.

Flow Path	Name	Sample #	Sample Year	^{3}H (TU)	^{3}H Normalized to 2005 (TU)
SR	NW of Standish	H4096*	2005	0.00	0.00
LV	NE of Herlong Junction	V168*	1995	0.30	0.20
LV	W of Herlong	H4115*	2005	0.40	0.40
LV	S of Doyle	V171*	1995	4.70	2.80
ESA	SIAD UBG-4-MWA	V194*	1995	0.50	0.30
WSA	Tinsley Fountain	H4117*	2005	0.00	0.00
LV	S of Doyle	W160*	1995	0.00	0.00
SN	Reinhart Well	H4090*	2005	0.00	0.00
SR	Richmond School	H4114*	2005	0.00	0.00
SHAF	BLM Horse Corral Well	H4092*	2005	0.60	0.60
ESA	Harding Well	H4119*	2005	0.90	0.90
LV	Webber 167	H4121*	2005	0.00	0.00
LV	Burkhard Place - Constantia Rd.	H4130*	2005	0.30	0.30
LV	Garrod Well #2	W127*	1990	4.10	2.00
VM	Fish Springs Ranch Dom. Well	H4136*	2005	1.70	1.70
NV	Hodges Well	W100*	1989	0.00	0.00
LV	JDS Wetland Dom. Well	H4129*	2005	0.00	0.00
LV	Bell's Ranch	H4126*	2005	0.40	0.40
LV	E of Doyle	V174*	1995	0.90	0.50
WSA	Lee Rd	H4116*	2005	0.30	0.30
VM	Headquarters	W93*	2004	1.40	1.30
VM	Ferrel Test Well	W109*	1990	0.00	0.00
VM	Jarboe Well	W91*	1989	0.00	0.00
NV	Never Sweat Ranch	W102*	2003	1.00	0.90
SR/SHAF	Fish & Game Well	H4093*	2005	0.40	0.40
LV	SIAD PSW #9	V207*	1995	0.20	0.12
LV/HLW	Rose 27	H4132*	2005	0.40	0.40
WSA/AML	Norcal2	V211*	1995	0.20	0.12
LV	Bird Flat Ranch #1	H4084*	2005	3.90	3.90
LV	Bird Flat Ranch #2	H4085*	2005	2.55	2.55
ASP	Astor Pass	B2041	2001	2.10	1.80
OUT	Soda Springs	B2756	2002	0.80	0.70
SR	Gold Run Creek	H4081*	2005	3.40	3.40
SR	Susan River in Susanville	H4082*	2005	3.30	3.30
SN	Mill Creek	H4083*	2005	0.40	0.40
SN	Humphries #2	H4087*	2005	0.00	0.00
LV	Cowboy Joe Spring	H4088*	2005	0.00	0.00
LV	N of Bird Flat Ranch	H4089*	2005	2.70	2.70
SN	Ottis Canyon	H4091*	2005	2.20	2.20
SR	Goni Well	H4095*	2005	0.00	0.00
SR	Plummer Spring	H4097*	2005	0.40	0.40
SR	Susan River North of Susanville	H4098*	2005	5.70	5.70
SR	Trussell Well	H4099*	2005	1.50	1.50
SHAF	Spring E. Horse Lake Mtn.	H4101*	2005	0.40	0.40
SHAF	Railroad Spring	H4105*	2005	0.00	0.00
LV	Indian Spring	H4123*	2005	2.00	2.00
FSM	Nork/Francone Well	H4128*	2005	0.50	0.50
LV	Long Valley Creek-HJ	H4133*	2005	2.70	2.70
LV/HLW	Zamboni Hot Spring	H4134*	2005	0.40	0.40
WSA/AML	HL Power Plant	H4135*	2005	0.00	0.00
VM	Fish Spring Ranch Irrigation Well	H4137	2005	0.70	0.70
SN	"McDermott" Creek	V95*	1995	9.20	5.30
VM	Willow Spring	W103*	1989	0.00	0.00
FSM	Wilson Well	W108*	1989	0.00	0.00
CW	Cold Spring	W150*	1989	8.44	2.80
OUT	Suzie Spring	W168*	1989	0.00	0.00
LV	Sugarcane	W169*	1989	0.00	0.00
OUT	ADP Spring	W170*	1989	0.00	0.00
OUT	Spring de Casa	W171*	1989	0.00	0.00
OUT	Well 3891	W24*	1989	0.00	0.00
OUT	Well 3902	W25*	1989	0.00	0.00
SR	Darkin Well	W43*	1990	0.00	0.00
CW	Cottonwood Springs	W96*	2002	1.20	1.10

Table 7. Honey Lake Basin $\delta^{13}C$ data. * indicates a sample location with more than one sampling event.

Flow Path	Name	Sample #	Source	Depth (m)	Temp (°C)	pH	HCO_3 (mg/L)	HCO_3 (meq/L)	$\delta^{13}C$ (‰)	^{14}C (pmc)
ASP/ESA	Stone Well	B687	well		11.20	7.54	1211	19.85	-6.4	
ASP	Astor Pass	B2041	well				876.00	14.36	-4.5	
LV	JDS Wetlands	V141*	well	48.77	18.20	8.60	690.00	11.31	-10.8	79.8
SR/SHAF	Fish & Game Well	H4093*	well		14.33	8.40	664.50	10.89	-11.9	
SR	Lassen County Well	V111*	well	42.67	15.60	7.50	460.00	7.54	-10.1	83.0
LV	SIAD B21-3-MW	V177*	well	36.58	18.90	7.30	450.00	7.38	-11.9	46.0
LV	Honey Lake-E. arm	V94*	surface		23.90	9.03	422.00	6.92	-2.6	
LV	JDS Wetland Dom. Well	H4129*	well		20.20	8.80	352.55	7.49	-6.8	
SR	Darkin Well	W43*	well		14.10	6.90	351.50	5.76	-7.2	2.8
LV	SIAD TNT-7-MWA	V191*	well		14.40	9.10	298.71	4.90	-7.9	
LV	Honey Lake-W. arm	V93*	surface		24.40	8.80	287.00	4.70	-2.0	
LV	Breshears Well	B688	well		8.40	6.83	256	4.20	-14.4	
NV	Never Sweat Ranch	W102*	well	152.40	14.90	8.25	223.13	3.66	-11.2	76.7
LV	SIAD B21-5-PZ	V178*	well	32.00	18.30	7.40	221.00	3.62	-9.0	30.7
LV	W of Herlong	H4115*	well	24.38	21.85	8.46	220.05	3.56	-3.3	63.6
ESA	SIAD UBG-4-MWA	V194*	well	29.41	20.60	9.00	219.46	3.60	-12.5	56.8
ESA	SIAD DEMO-1	V179*	well		26.70		218.00	3.57	-10.2	
LV	SIAD PSW8 PZ-3	V196*	well	150.88	9.00	8.10	216.00	3.54	-11.9	15.0
LV	SIAD PSW #5	V205*	well	167.64	17.10	8.50	213.00	3.49	-11.8	60.9
LV	SIAD PSW8 PZ-2	V197*	well	102.11	11.30	8.30	208.00	3.41	-13.8	16.1
LV	Long Valley Creek, N of Doyle	H4127*	surface		16.63	8.13	200.55	3.81	-7.5	
LV	SIAD PSW8 PZ-4	V195*	well	192.02	9.10	8.10	198.00	3.25	-11.9	13.1
LV	SIAD PSW8 PZ-1	V198*	well	56.39	11.30	8.10	198.00	3.25	-13.2	23.4
VM	Fish Springs Ranch Dom. Well	H4136*	well	78.64	15.85	8.67	185.11	3.04	-10.3	37.6
LV	Garrod Well #2	W127*	well	76.20	11.25	7.31	184.00	3.02	-14.9	90.5
LV	Long Valley Creek-HJ	H4133*	surface		8.60	8.00	163.57	2.68	-12.0	
LV	Long Valley Creek, S of Doyle	B690*	surface		7.30	7.73	162.93	2.67	-11.0	
SHAF	BLM Horse Corral Well	H4092*	well	45.72	18.70	7.76	162.70	3.19	-1.9	79.9
SR	Pete's Creek	V84*	surface		13.30	8.18	162.50	2.66	-8.2	
VM	Headquarters	W93*	well	121.92	19.17	8.30	155.57	2.55	-13.4	43.5
LV	Bird Flat Ranch #1	H4084*	well	198.12	21.00	7.35	155.33	2.60	-12.5	112.8
SN	Pluma National Forest	B682	well		10.00	6.38	155	2.54	-16.8	
SR	Richmond School	H4114*	well	44.20	17.37	7.99	134.45	2.90	-14.4	54.5
WSA	Spr. NE of Stacy	R90	spring		15.00	8.90	134.11	2.20	-10.1	
SR	Standish	V112*	well		18.50	8.00	132.00	2.16	-8.0	
SR/SHAF	Susan River at Litchfield	H4094*	surface		25.15	8.54	128.00	3.61	-0.3	
SR	Plummer Spring	H4097*	spring		17.40	7.92	124.30	2.04	-15.3	74.7
SR	Trussell Well	H4099*	well		14.54	7.78	122.50	2.01	-20.7	
VM	Fish Springs Irrigation Well-SW	V153*	well	134.11	17.70	8.10	115.00	1.88	-11.3	37.0
SR	NW of Standish	H4096*	well	17.07	17.10	7.92	114.60	2.35	-7.7	46.7
SHAF	Tule Patch Spring	H4106*	spring		17.10	7.82	109.60	1.80	-15.1	72.7
LV	Burkhard Place - Constantia Rd.	H4130*	well	54.86	18.00	8.42	109.50	1.79	-15.4	73.1
WSA	Lee Rd	H4116*	well	121.92	21.85	8.25	105.90	2.06	-10.2	17.1
FSM	Cal Neva Rd. - DWR West	V165*	well	33.22			104.00	1.70	-14.1	59.0
VM	Fish Springs Irrigation Well-SE	V145*	well	65.53			103.00	1.69	-11.6	41.3
LV	SIAD DMO-13-A	V180*	well	36.27	18.10	7.70	98.00	1.61	-6.7	35.0
CW	Cottonwood Springs	W96*	spring		14.77	7.77	95.02	1.56	-19.0	
ESA	High Rock Ranch	W32*	well		24.00	7.70	85.00	1.40	-12.8	21.6
LV/HLW	Zamboni Hot Spring	H4134*	spring		39.46	9.13	70.21	1.26	-12.8	
LV/HLW	Zamboni Hot Spring	H4134*	spring		39.46	9.13	70.21	1.26	-12.8	
SN	"McDermott" Creek	V95*	surface		17.80	8.24	64.93	1.41	-7.9	
WSA/AML	Norcal2	V211*	geo well	322.48	98.90	8.90	60.96	1.00	-9.9	10.0
SR	Susan River in Susanville	H4082*	surface		10.73	7.68	59.60	0.98	-14.7	
WSA/AML	HL Power Plant	H4135*	spring/well		62.71	8.30	49.25	0.81	-12.9	
WSA/AML	HL Power Plant	H4135*	spring/well		62.71	8.30	49.25	0.81	-12.9	
SR	Susan River North of Susanville	H4098*	surface		20.90	7.62	25.80	0.65	-2.4	
LV	S of Doyle	V171*	well		21.40	6.80	25.00	0.41	0.4	
SR/AML	Johnston 1	V209*	geo well	432.82	66.95	8.75	11.50	0.19	-11.9	10.6
LV	SIAD PSW #8	V206*	well	213.36	16.70	8.30			-11.9	30.7
LV	SAID PSW #2	V203*	well	213.36	16.90	8.20			-11.4	17.5
LV	SIAD PSW #9	V207*	well	161.54	18.30	8.10			-12.3	55.4
LV	SIAD PSW5 PZ-4	V199*	well	152.40	10.40				-13.1	38.5
LV	SIAD PSW5 PZ-3	V200*	well	141.21	11.60				-12.4	45.2
LV	E of Doyle	V174*	well	106.68	22.20	7.40			-2.7	74.6
LV	SIAD PSW5 PZ-2	V201*	well	96.01	13.60	7.70			-11.4	71.4
LV	SIAD PSW5 PZ-1	V202*	well	70.56	9.40	7.60			-11.0	50.3
LV	SIAD TNT-7-MWB	V192*	well	31.57	14.80	8.10			-7.8	75.0
LV	NE of Herlong Junction	V168*	well	22.86	20.90	7.30			-4.4	83.8
LV	SIAD LF-1	V183*	well	19.81	18.60	8.20			-9.0	102.6
WSA	Artesian Well #2	W36*	well		22.93	8.55		1.61	-10.4	

Table 8. Honey Lake Basin ^{14}C data. * indicates a sample location with more than one sampling event.

Flow Path	Name	Sample #	$\delta^{13}C$ (‰)	^{14}C (pmc)
LV	SIAD PSW #8	V206*	-11.9	30.7
LV	SAID PSW #2	V203*	-11.4	17.5
LV	SIAD PSW8 PZ-4	V195*	-11.9	13.1
LV	SIAD PSW #5	V205*	-11.8	60.9
LV	SIAD PSW #9	V207*	-12.3	55.4
LV	SIAD PSW5 PZ-4	V199*	-13.1	38.5
LV	SIAD PSW8 PZ-3	V196*	-11.9	15.0
LV	SIAD PSW5 PZ-3	V200*	-12.4	45.2
VM	Fish Springs Irrigation Well-SW	V153*	-11.3	37.0
VM	Headquarters	W93*	-13.4	43.5
WSA	Lee Rd	H4116*	-10.2	17.1
LV	E of Doyle	V174*	-2.7	74.6
LV	SIAD PSW8 PZ-2	V197*	-13.8	16.1
LV	SIAD PSW5 PZ-2	V201*	-11.4	71.4
VM	Fish Springs Ranch Dom. Well	H4136*	-10.3	37.6
LV	Garrod Well #2	W127*	-14.9	90.5
LV	SIAD PSW5 PZ-1	V202*	-11.0	50.3
VM	Fish Springs Irrigation Well-SE	V145*	-11.6	41.3
SN	SW of Bass Hill	H4112*		112.4
SN		V134*		62.0
LV	SIAD PSW8 PZ-1	V198*	-13.2	23.4
LV	Burkhard Place - Constantia Rd.	H4130*	-15.4	73.1
LV	JDS Wetlands	V141*	-10.8	79.8
SHAF	BLM Horse Corral Well	H4092*	-1.9	79.9
SR	Richmond School	H4114*	-14.4	54.5
SR	Lassen County Well	V111*	-10.1	83.0
LV	SIAD B21-3-MW	V177*	-11.9	46.0
LV	SIAD DMO-13-A	V180*	-6.7	35.0
FSM	Cal Neva Rd. - DWR West	V165*	-14.1	59.0
LV	SIAD B21-5-PZ	V178*	-9.0	30.7
LV	SIAD TNT-7-MWB	V192*	-7.8	75.0
ESA	SIAD UBG-4-MWA	V194*	-12.5	56.8
LV	W of Herlong	H4115*	-3.3	63.6
LV	NE of Herlong Junction	V168*	-4.4	83.8
LV	SIAD LF-1	V183*	-9.0	102.6
SR	NW of Standish	H4096*	-7.7	46.7
SR/AML	Johnston 1	V209*	-11.9	10.6
WSA/AML	Norcal2	V211*	-9.9	10.0
LV	Bird Flat Ranch #1	H4084*	-12.5	112.8
LV	Bird Flat Ranch #2	H4085*		90.5
NV	Never Sweat Ranch	W102*	-11.2	76.7
SR	Plummer Spring	H4097*	-15.3	74.7
SHAF	Tule Patch Spring	H4106*	-15.1	72.7
ESA	High Rock Ranch	W32*	-12.8	21.6
SR	Darkin Well	W43*	-7.2	2.8

Table 9. Mean solute chemistry vlaues for beginning, middle, and end of the 13 flow paths in Honey Lake Basin. See Table 10 for calculations.

† indicates a flow path that was modeled with NETPATH.

* indicates an estimated value

Chemical Flow Path	Physical Flow Path		n (# of samples)	Temp (°C)	pH	TDS (mg/L)	Cations (meq/L)				Anions (meq/L)				SiO2 (mg/L)	Balance Error %	$\delta^{13}C$ (‰)
							Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	HCO_3^{-}	SO_4^{2-}	Cl^{-}	F^{-}			
	Precipitation		1	0.0	5.7		0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00		0.0	
LV/SHAF/SR	SR†	Beginning	2	15.3	8.01	119.00	0.93	0.66	0.44	0.07	2.05	0.10	0.05	0.00	28.1	-2.8	-15.3
		Middle	10	17.1	7.81	311.71	0.95	0.55	2.96	0.10	2.44	1.23	0.70	0.06	47.0	-1.5	-14.3
		End	9	14.6	7.90	770.6	1.54	1.18	8.71	0.23	5.24	2.45	4.03	0.03	47.8	-2.2	-7.2
		Δ					0.61	0.53	8.27	0.16	3.19	2.35	3.98	0.03	19.7		
	SHAF	Beginning	6	20.6	8.07		0.51	0.53	0.92	0.07	1.83	0.09	0.11	0.00	30.4	-0.1	-15.1
		End	3	23.3	8.09	340.0	0.89	0.49	3.69	0.19	3.67	1.00	0.55	0.01	36.8	-0.20	-1.9
		Δ					0.38	-0.04	2.77	0.12	1.84	0.92	0.44	0.00	6.4		
	SR & SHAF Mix End†		4	14.0	8.50	654.9	1.06	0.82	9.53	0.13	8.02	1.68	1.37	0.03	43.2	-1.3	-11.9
	LV	Beginning	11	17.2	7.59	176.2	0.93	0.49	0.94	0.06	1.99	0.15	0.14	0.03	23.6	1.3	-15.4
		Middle	29	17.6	7.67	312.1	1.61	0.99	1.98	0.13	3.11	0.92	0.37	0.02	45.7	1.4	-11.3
		End	10	15.4	7.74	619.5	2.84	1.34	4.82	0.28	2.68	2.03	4.24	0.02	54.1	1.5	-10.1
		Δ					1.91	0.86	3.88	0.22	0.69	1.88	4.11	-0.01	30.6		
SN	SN†	Beginning	7	17.5	6.93	129.7	0.91	0.41	0.52	0.04	1.58	0.32	0.10	0.00	37.1	-4.4	-16.8
		End	18	16.5	7.59	186.8	1.04	0.51	1.35	0.08	2.39	0.28	0.21	0.01	37.3	-0.6	~ -10*
		Δ					0.13	0.10	0.83	0.04	0.82	-0.03	0.11	0.01	0.2		
WSA	WSA†	Beginning	8	22.1	8.31	193.9	0.44	0.13	2.11	0.12	1.97	0.46	0.37	0.01	32.9	-0.6	-10.3
		End	4	15.4	7.74	619.5	2.84	1.34	4.82	0.28	2.68	2.03	4.24	0.02	54.1	1.5	-10.1
		Δ					2.40	1.22	2.71	0.16	0.71	1.57	3.87	0.01	21.2		
ASP/NV/ESA	ESA	Beginning	7	22.1	8.32	274.5	0.37	0.20	2.53	0.12	2.24	0.40	0.42	0.01	38.1	-2.2	-12.7
		Middle	5	15.4	8.23	496.1	1.80	1.23	3.98	0.20	4.85	0.62	1.34	0.05	54.0	2.2	~ -12*
		End	11	13.5	8.01	11973	8.60	11.02	188.44	1.08	14.32	27.44	142.00	0.14	21.1	6.4	-6.4
		Δ					8.24	10.82	185.91	0.96	12.08	27.04	141.59	0.13	-17.0		
	NV†	Beginning	1	18.8	7.88	199.8	0.49	0.33	1.63	0.21	2.25	0.13	0.14	0.01	51.0	1.4	~ -15*
		Middle	2	15.3	8.26	660.2	0.78	0.33	5.76	0.24	4.29	1.15	1.55	0.02		-2.5	-11.2
		End	1	12.4	7.09	42700	7.49	67.48	700.35	2.40	15.57	7.29	685.50	0.02	18.0	4.7	~ -10*
		Δ					7.00	67.15	698.72	2.20	13.32	7.16	685.36	0.02	-33.0		
	ASP	Beginning	4	21.0	8.23	2403.0	0.95	1.17	31.41	0.30	14.55	5.84	11.74	0.14	~25*	2.3	-4.5
		End	2	11.8	7.32	42700	4.64	36.43	448.71	2.61	17.71	25.51	423.38	0.23	18.0	2.7	-6.4
		Δ					3.68	35.26	417.30	2.31	3.16	19.67	411.63	0.09	-7.0		
CW/VM/FSM	FSM†	Beginning	2	15.0	7.40	156.6	0.94	0.49	0.48	0.06	1.72	0.12	0.18		~30*	-1.2	~ -15*
		Middle	10	16.9	8.23	370.9	0.92	0.45	3.62	0.12	1.93	2.50	0.45	0.05	22.1	-3.1	-14.1
		End	3	15.0	8.12	4632	2.43	2.84	68.32	0.97	11.34	4.55	57.66	0.02	15.3	0.4	~ -10*
		Δ					1.49	2.35	67.84	0.91	9.61	4.43	57.48		-14.7		
	VM	Beginning	3	14.7	7.32	166.6	0.91	0.47	0.64	0.06	1.72	0.12	0.18		~25*	1.7	~ -15*
		Middle	9	19.8	8.16	222.2	0.38	0.20	2.54	0.17	2.39	0.32	0.44	0.01	34.2	-1.1	-11.9
		End	2	14.7	8.34	4614.5	2.17	3.15	65.69	0.96	6.99	6.79	57.42	0.05	12.7	-1.4	~ -10*
		Δ					1.25	2.67	65.04	0.90	5.27	6.67	57.24		-12.3		
	CW	Beginning	4	15.0	7.49	177.3	1.10	0.65	0.59	0.13	2.19	0.13	0.14	0.01	21.7	-0.8	-19.0
		End	2	14.0	7.68	21628	4.09	33.93	353.60	1.34	10.25	4.05	343.79	0.02	18.0	4.6	~ -10*
		Δ					2.99	33.27	353.01	1.21	8.06	3.92	343.64	0.01	-3.7		
HLW	HWL†		4	41.3	8.43		0.40	0.09	2.17	0.03	1.73	0.67	0.26	0.10	45.4	-1.7	-12.8
AML	AML†		4	82.8	8.64	820.8	0.90	0.02	10.23	0.16	0.60	6.03	4.13	0.18	85.7	1.0	-11.6

Table 10. Honey Lake Basin sample data statistics, organized by location along each flow path. * indicates a sample location with more than one sampling event.

Flow Path	Name	Sample #	Water Source		Temp (°C)	pH	Cations (mg/L)				Anions (mg/L)				SiO2 (mg/L)	$\delta^{13}C$ (‰)	^{14}C (pmc)
							Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	HCO_3^-	SO_4^{2-}	Cl^-	F^-			
Susan River Flow Path																	
SR	MacDonald Dom.	W20	well	BEGINNING	13.11	8.10	18.00	7.00	12.00	4.30	126.00	4.80	1.40				
SR	Plummer Spring	H4097*	spring		17.40	7.92	19.36	9.01	8.38	1.58	124.30	5.50	2.09	0.07	28.10	-15.3	74.7
				MEAN	15.26	8.01	18.68	8.00	10.19	2.94	125.15	5.15	1.74	0.07	28.10	-15.28	74.72
SR	BEGINNING		n = 2	MEDIAN	15.26	8.01	18.68	8.00	10.19	2.94	125.15	5.15	1.74	0.07	28.10	-15.28	74.72
				Standard DEV	3.03	0.13	0.96	1.42	2.56	1.92	1.20	0.50	0.48				
SR	P.E. Milton Dom.	W17	well		5.10	7.10	36.00	18.00	22.00	1.30	122.00	19.00	16.00				
SR	Ca Conserv. Ctr. Dom.	W18	well		16.67	8.00	7.10	0.40	34.00	9.80	109.00	15.00	5.80				
SR	Johnston Ranch Dom.	W19	well		13.69	7.97	4.40	0.80	118.33	4.90	183.67	73.67	20.67	1.05	66.50		
SR	Fruit Growers Supply Ind.	W22	well		23.61	8.05	13.00	2.50	126.00	4.00	90.00	158.50	58.50	1.65	36.50		
SR	Abraham Jensen Irr.	W23	well	MIDDLE	16.67	7.20	22.00	10.00	58.00	3.70	95.00	91.00	38.00	0.30	52.00		
SR	Susanville Prison	V115	well		33.20	8.80	1.90	0.10	71.30	1.71	85.80	38.40	17.50	4.53	72.90		
SR	NW of Standish	H4096*	well		17.10	7.92	7.74	2.07	54.97	5.41	114.60	29.26	12.05	0.66	38.10	-7.7	46.7
SR	Trussell Well	H4099*	well		14.54	7.78	24.50	10.90	64.50	3.80	122.50	92.00	37.00	0.75	44.50	-20.7	
SR	Johnstonville	H4113*	well		13.20	7.28	34.45	13.90	48.53	2.65	260.20	21.51	9.49	0.23	52.05		
SR	Richmond School	H4114*	well		17.37	7.99	23.61	5.68	60.96	0.47	134.45	37.00	28.83	0.43	13.40	-14.4	54.5
				MEAN	17.11	7.81	17.47	6.43	65.86	3.77	131.72	57.53	24.38	1.20	46.99	-14.25	50.60
SR	MIDDLE		n = 10	MEDIAN	16.67	7.94	17.50	4.09	59.48	3.75	118.30	37.70	19.08	0.70	48.25	-14.40	50.60
				Standard DEV	7.30	0.51	12.36	6.37	33.07	2.64	53.12	45.88	16.26	1.42	18.62	6.48	5.52
SR	McClure Ranch Irr.	W10	well			8.00	16.00	6.60	89.00	6.70	185.00	48.00	51.00	0.20	53.00		
SR	E. Grant Dom.	W12	well		13.61	8.25	16.20	7.85	356.00	7.80	468.00	343.50	39.50	2.35	33.50		
SR	T. Swickard Dom.	W13	well		13.75	8.30	16.90	7.07	239.67	8.20	432.67	210.67	28.33	1.00	42.50		
SR	J. Ferre Dom.	W14	well		15.00	8.10	14.00	6.40	138.00	5.20	249.00	102.00	44.00	0.40	51.00		
SR	Ca Fish & Game Irr.	W42	well	END	13.89	7.45	94.50	42.50	256.50	14.00	282.00	22.50	532.50	0.10	50.50		
SR	Darkin Well	W43*	well		14.10	6.90	45.10	24.00	224.00	11.00	351.50	79.36	294.38	0.02		-7.2	2.8
SR	Ca Fish & Game Irr.	W44	well		13.00	8.35	39.50	17.50	245.00	6.75	336.00	98.50	237.50	0.45	46.00		
SR	SE of Standish	V110*	well		16.70	7.50	17.70	11.10	53.70	12.70	223.00	21.20	7.61	0.05	49.80		
SR	Goni Well	H4095*	well		16.50	8.29	18.00	6.60	200.00	9.00	350.00	135.00	50.00	0.60	56.00		
				MEAN	14.57	7.90	30.88	14.40	200.21	9.04	319.69	117.86	142.76	0.57	47.79	-7.19	2.80
SR	END		n = 9	MEDIAN	13.99	8.10	17.70	7.85	224.00	8.20	336.00	98.50	50.00	0.40	50.15	-7.19	2.80
				Standard DEV	1.37	0.51	26.41	12.17	93.05	2.95	94.12	103.23	177.72	0.74	7.09		
SR/AML	Johnston 1	V209*	geo well		66.95	8.75	13.50		172.00	2.87	11.50	245.00	89.00	3.33	88.60	-11.9	10.6
SR/HLW	Mormon Church Heating	W21*	well	THERMAL	52.20	7.70	9.50	0.60	56.00	0.90	143.00	20.00	5.90		62.00		
SR/HLW	Roosevelt Swimming Pool	RE1	well		35.80	8.01	19.00	3.40	20.00	3.80	120.00	11.00	2.00	<0.1	53.00		
				MEAN	51.65	8.15	14.00	2.00	82.67	2.52	91.50	92.00	32.30	3.33	67.87	-8.76	5.40
SR	THERMAL		n = 3	MEDIAN	52.20	8.01	13.50	2.00	56.00	2.87	120.00	20.00	5.90	3.33	62.00	-7.19	2.80
				Standard DEV	15.58	0.54	4.77	1.98	79.43	1.48	70.23	132.58	49.14		18.51	2.72	4.50
Shaffer Mountain Flow Path																	
SHAF	Earll Well	H4100	well		20.10	7.45	17.01	12.44	11.56	1.31	145.90	1.85	1.56	0.05	39.80		
SHAF	Spring E. Horse Lake Mtn.	H4101*	spring		16.60	7.77	19.52	13.39	12.01	1.46	160.00	1.20	1.57	0.02	23.70		
SHAF	Cognina Well	H4103	well		26.70	8.13	2.51	1.18	28.07	3.18	77.70	3.70	5.43	0.11	52.90		
SHAF	Spring S. of Snowstorm Mtn	H4104*	spring		20.80	8.29	0.94	0.51	41.17	1.87	88.10	11.08	9.47	0.12	34.20		
SHAF	Railroad Spring	H4105*	spring	BEGINNING	22.55	8.94	7.19	2.57	22.68	4.19	89.00	2.59	2.01	0.07	16.20		
SHAF	Tule Patch Spring	H4106*	spring		17.10	7.82	13.96	8.33	11.44	3.39	109.60	4.03	2.95	0.08	15.70	-15.1	72.7
				MEAN	20.64	8.07	10.19	6.40	21.16	2.57	111.72	4.07	3.83	0.07	30.42	-15.10	72.74
SHAF	BEGINNING		n = 6	MEDIAN	20.45	7.98	10.57	5.45	17.35	2.53	99.30	3.14	2.48	0.07	28.95	-15.10	72.74
				Standard DEV	3.73	0.52	7.76	5.76	12.01	1.18	33.87	3.60	3.12	0.04	14.64		
SHAF	C.L. Curtis Dom.	W16	well		20.00	8.30	12.00	3.90	141.00	9.50	333.00	54.00	22.00				
SHAF/WSA	Spring	W5	spring	END	31.10	8.20	17.00	2.10	49.00	7.20	144.00	29.00	15.00	0.10	40.00		
SHAF	BLM Horse Corral Well	H4092*	well		18.70	7.76	27.83	13.48	76.06	4.65	162.70	71.12	24.62	0.11	33.55	-1.9	79.9
				MEAN	23.27	8.09	18.94	6.49	88.69	7.12	213.23	51.37	20.54	0.11	36.78	-1.90	79.90
SHAF	END		n =3	MEDIAN	20.00	8.20	17.00	3.90	76.06	7.20	162.70	54.00	22.00	0.11	36.78	-1.90	79.90
				Standard DEV	6.81	0.29	8.09	6.12	47.28	2.42	104.14	21.18	4.97	0.01			
SR/SHAF	Mapes Ranch Irr.	W9	well		23.80	8.10	51.00	7.30	574.00	22.00	227.00	295.00	651.00	0.30	79.00		
WSA/AML	HL Power Plant	H4135*	spring/well	THERMAL	62.71	8.30	25.30	0.12	276.70	11.71	49.25	342.20	188.91	2.87	53.00	-12.9	
				MEAN	43.25	8.20	38.15	3.71	425.35	16.86	138.13	318.60	419.96	1.59	66.00	-12.94	
SHAF	THERMAL		n = 2	MEDIAN	43.25	8.20	38.15	3.71	425.35	16.86	138.13	318.60	419.96	1.59	66.00	-12.94	
				Standard DEV	27.51	0.14	18.18	5.08	210.22	7.28	125.69	33.38	326.75	1.82	18.38		
Susan River/Shaffer Mix																	
SR/SHAF	F. Dewitt Dom.	W4	well		12.50	8.50	12.00	3.20	129.00	4.20	365.00	11.00	7.00				
SR/SHAF	Ca Fish & Game Irr.	W8	well	MIX	15.50	8.80	18.00	6.80	244.00	7.20	456.00	83.00	66.00	0.50	51.00		
SR/SHAF	Tanner Ranch Dom.	W41	well		13.61	8.30	50.50	27.50	194.50	4.50	472.00	175.50	71.00	0.55	34.50		
SR/SHAF	Fish & Game Well	H4093*	well		14.33	8.40	4.24	2.42	308.65	5.19	664.50	53.08	50.86	0.70	44.00	-11.9	
				MEAN	13.99	8.50	21.18	9.98	219.04	5.27	489.38	80.65	48.71	0.58	43.17	-11.87	
SR/SHAF	MIX		n = 4	MEDIAN	13.97	8.45	15.00	5.00	219.25	4.85	464.00	68.04	58.43	0.55	44.00	-11.87	
				Standard DEV	1.26	0.22	20.34	11.83	76.08	1.35	125.90	69.79	29.10	0.10	8.28		
Sierra Nevada Flow Path																	
SN	Pluma National Forest	B682	well		10.00	6.38	30.13	6.40	24.83	1.64	155	4.59	8.21	0.07		-16.8	
SN	Webber 84	H4108*	well		18.20	7.54	22.00	2.90	11.00	0.80	87.78	4.80	4.00	0.20	40.00		
SN	Buntingville	H4109*	well		22.40	7.14	15.32	7.11	8.73	1.32	97.50	8.72	2.64	0.05	30.80		
SN	SW of Bass Hill	H4112*	well	BEGINNING	17.95	6.90	19.71	5.58	7.37	0.46	67.25	2.96	2.90	0.06	38.90		112.4
SN	27N14E21A01M.a	W83			18.90	7.00	9.10	1.80	11.00	0.90	59.74	2.00	1.40	0.10	36.00		
SN	27N14E06B01M.a	W85	well		12.00	6.60	20.00	7.50	9.00	3.00	90.22	81.00	2.30	0.10	41.00		
SN	Reinhart Well	H4090*	well		22.90	6.95	11.46	3.26	11.08	3.31	84.70	1.81	3.57	0.08	35.60		
				MEAN	17.48	6.93	18.25	4.94	11.86	1.63	91.74	15.13	3.57	0.09	37.05	-16.82	112.40
SN	BEGINNING		n = 7	MEDIAN	18.20	6.95	19.71	5.58	11.00	1.32	87.78	4.59	2.90	0.08	37.45	-16.82	112.40
				Standard DEV	4.87	0.37	7.06	2.26	5.89	1.11	30.89	29.14	2.21	0.05	3.74		
SN	Basler Well	H4110*	well		17.85	7.46	64.70	14.29	62.42	4.18	388.30	24.36	7.51	0.24	43.50		
SN		V134*	well		21.70	9.70	2.86	0.30	91.80	0.47	121.92	37.00	59.60		12.00		62.0
SN	Newkirk Dom.	W45	well		14.56	7.80	36.00	22.00	39.00	6.70	304.00	6.90	2.10				
SN	27N15E32G01M.a	W72			12.20	7.00	24.00	4.60	8.00	2.40	89.00	14.00	3.00	0.20	40.00		
SN	27N15E30B01M.a	W73				7.60	9.10	9.60	41.00	3.80	168.25	8.70	1.90	0.20	39.00		
SN	27N14E26E01M.e	W77	well		15.35	6.78	17.57	3.05	13.65	2.02	76.81	9.15	5.86	0.13	43.00		
SN	27N14E26G01M.a	W78			14.40	7.80	19.00	3.00	17.00	2.00	76.81	11.00	11.00		34.00		
SN	27N14E24E01M.a	W80			15.50	7.00	26.00	6.00	34.00	2.00	170.69	14.00	4.00				
SN	27N14E23J01M.a	W81		END	16.70	6.60	15.00	4.50	41.00	1.90	145.09	13.00	4.40	0.50	43.00		
SN	27N14E22A01M.b	W82	well		14.20	7.10	13.35	2.25	60.50	1.75	168.86	28.00	4.60	0.40	46.00		
SN	26N15E11H01M.a	W137			14.40	7.50	21.00	7.50	18.00	4.60	141.43	3.30	3.00	0.40	50.00		
SN	26N15E11B06M.a	W138			15.50	7.90	7.00	1.60	36.00	5.30	119.48	4.90	4.00	0.30	51.00		
SN	26N15E03F01M.f	W139			18.44	7.73	17.67	4.38	18.67	3.35	109.73	13.12	2.88	0.17	32.25		
SN	D Price Well.a	W140	well		19.40	7.30	20.00	5.00	16.00	4.30	96.50	15.00	3.00	0.10			
SN	Humphries #1	H4086*	well		13.55	8.12	39.00	5.00	20.00	2.70	147.52	15.00	8.80	0.50	37.00		
SN	Humphries #2	H4087*	well		24.90	8.02	20.00	4.00	24.00	1.40	113.39	18.00	2.00				
SN	Ottis Canyon	H4091*	spring/surface		17.35	7.49	10.17	5.50	7.17	3.44	77.60	6.23	1.49	0.03	25.90		
SN	SE of Otis Canyon	H4107*	spring/well		14.50	7.78	13.37	8.75	10.01	4.83	111.00	2.78	2.90	0.05	25.50		
				MEAN	16.50	7.59	20.88	6.18	31.01	3.17	145.91	13.58	7.34	0.25	37.30		62.00
SN	END		n = 18	MEDIAN	15.50	7.55	18.33	4.80	22.00	3.03	120.70	13.06	3.50	0.20	39.50		62.00
				Standard DEV	3.21	0.68	14.26	5.11	22.50	1.60	80.50	8.89	13.29	0.16	10.68		

Flow Path	Name	Sample #	Water Source		Temp (°C)	pH	Cations (mg/L)				Anions (mg/L)				SiO2 (mg/L)	$\delta^{13}C$ (‰)	^{14}C (pmc)
							Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	HCO_3^-	SO_4^{2-}	Cl^-	F^-			
Long Valley Flow Path																	
LV	Horse Spring.a	W141*	spring		12.0	7.3	25.60	7.00	7.70	0.40	131.68	<3	6.00				
LV	Upper Red Spring.a	W146*	spring		14.00	7.93	33.00	11.00	13.00	4.70	160.00	6.40	5.00				
LV	Black Canyon.a	W147*	spring		14.00	7.40	19.40	8.40	7.70	3.50	115.83	3.00	4.00				
LV	Newcombe Spring.a	W148*	spring		20	7.3	30	9	23	5.7	168.00	6.00	6.00				
LV	S of Doyle	W160*	well		16.96	7.31	8.36	2.36	42.22	0.74	87.65	27.42	9.57	2.01	24.50		
LV	22N17E08K01M.b	W178		BEGINNING	17.75	7.65	16.50	4.20	24.50	2.50	116.44	2.50	4.30	0.10	32.50		
LV		V170	well		22.40	8.10	7.89	2.75	42.60	0.77	112.00	11.10	4.10	0.88	32.40		
LV	Cowboy Joe Spring	H4088*	spring		17.65	7.46	13.80	5.03	20.67	2.15	113.90	4.43	4.05	0.08	20.70		
LV	Webber 167	H4121*	well		16.30	7.57	15.00	9.00	13.00	1.00	122.00	2.00	2.00				
LV	Burkhard Place - Constantia Rd.	H4130*	well		18.00	8.42	9.95	2.05	29.35	1.48	109.50	3.14	2.65	0.08	7.70	-15.4	73.1
LV	Webber 158	H4131*	well		20.04	7.09	24.50	4.55	13.00	1.30	93.67	6.35	5.95	0.10			
				MEAN	17.19	7.59	18.54	5.94	21.52	2.20	120.97	7.23	4.87	0.54	23.56	-15.43	
LV	BEGINNING		n = 11	MEDIAN	17.65	7.46	16.50	5.03	20.67	1.48	115.83	5.21	4.30	0.10	24.50	-15.43	
				Standard DEV	3.04	0.40	8.70	3.09	12.43	1.75	24.53	7.59	2.03	0.79	10.23		
LV	26N17E18B01M.a	W122	well		17.60	7.30	36.00	6.00	134.00	3.87	264.00	51.67	35.33	1.20			
LV	26N16E21J01M.a	W126			15.25	8.05	50.50	17.50	20.00	2.60	249.33	10.95	10.00	0.40	57.50		
LV	Garrod Well #2.a	W127*	well		11.25	7.31	30.67	9.46	33.92	3.18	184.00	22.04	6.59	0.18		-14.9	90.5
LV	26N16E13A01M.a	W131	well		18.90	8.60	88.00	46.00	107.00	5.20	307.00	280.00	25.00	0.40			
LV	26N16E06D01 M.b	W133	well		17.77	7.10	29.67	12.00	47.00	4.07	184.00	58.00	14.00	0.30			
LV	26N16E04M01M.a	W134			15.50	8.10	31.00	5.90	77.00	6.20	215.80	43.00	28.00	0.60			
LV	26N16E03D02M.c	W135	well		19.48	8.23	11.50	1.85	93.00	16.25	208.00	41.33	19.50	0.40			
LV	26N16E02G01M.e	W136	well		20.37	7.83	29.33	9.23	52.67	4.95	190.00	49.00	13.67	0.50	71.00		
LV	25N17E34L01M.a	W157			15.00	7.50	20.00	6.70	18.00	3.00	148.74	0.00	1.50	0.30	48.00		
LV	Webber 159	W159*	well		18.30	7.15	28.00	11.00	30.00	1.70	175.57	13.00	8.20	0.10	46.00		
LV	25N17E20B01M.c	W161	well		16.10	7.55	43.00	13.25	30.75	1.38	215.75	9.60	8.35	0.20			
LV	25N17E17A01M	W162			16.10	7.60	29.00	11.00	35.00	9.00	199.95	15.00	20.00	0.50	60.00		
LV	Hd4 Dom. Well.a	W163	well	MIDDLE	13.50	6.93	30.33	8.67	19.33	2.47	132.67	8.67	4.33	0.10			
LV	25N17E07J01.a	W165	well		16.10	8.57	18.67	6.67	23.67	2.23	124.00	13.00	3.00	0.30			
LV	Sugarcane.a	W169*	spring			7.90	18.80	7.40	11.70	5.60	124.36	<3	4.00				
LV	24N17E03M01M.a	W173				8.20	34.00	6.60	13.00	4.70	174.35	0.00	4.00	0.30	45.00		
LV	22N17E26H01M.a	W176			14.60	7.43	32.67	15.33	18.00	8.40	190.20	13.33	12.33				
LV	22N17E11M01M.a	W177			15.00		48.00	18.00	17.00	9.10	230.43	34.00	12.00	0.20	62.00		
LV	Breshears Well	B688	well		8.40	6.83	34.60	5.87	89.33	4.72	256	53.27	31.86	0.25		-14.4	
LV	Bird Flat Ranch #1	H4084*	well		21.00	7.35	40.33	12.00	30.00	3.00	155.33	35.67	11.00	0.13		-12.5	112.8
LV	Bird Flat Ranch #2	H4085*	well		19.55	7.25	38.61	13.49	29.59	3.65	178.70	36.32	12.21	0.19	30.70		90.5
LV	N of Bird Flat Ranch	H4089*	well		18.85	7.23	40.00	11.00	71.00	6.20	224.34	81.00	23.00	0.90	33.00		
LV	W of Herlong	H4115*	well		21.85	8.46	5.79	1.43	100.80	12.73	220.05	39.79	19.06	0.18	31.30	-3.3	63.6
LV	Webber 125	H4120*	well		18.70	7.54	38.00	7.30	22.00	1.80	191.42	1.30	7.50	0.40	42.00		
LV	Briggs Well	H4122*	well		19.05	7.24	27.00	7.40	14.00	2.80	141.43	4.00	5.00	0.10	33.00		
LV	Indian Spring	H4123*	spring		18.75	8.78	7.81	14.40	43.41	9.80	189.00	5.33	14.57	0.33	34.60		
LV	Rat Auto Salvage	H4124*	well		20.58	7.64	28.00	10.00	43.00	4.10	137.50	41.00	13.00	0.50			
LV	Heald Well	H4125*	well		21.53	7.61	45.33	46.67	75.67	6.07	186.00	255.67	10.67	0.93			
LV	Bell's Ranch	H4126*	well		26.00	7.54	24.33	8.33	17.67	2.97	106.00	10.33	8.33	0.20			
				MEAN	17.60	7.67	32.38	12.08	45.43	5.23	189.79	43.79	13.31	0.37	45.70	-11.26	89.36
LV	MIDDLE		n = 29	MEDIAN	18.30	7.55	30.67	9.46	30.75	4.10	189.00	28.02	12.00	0.30	45.00	-13.42	90.50
				Standard DEV	3.56	0.53	15.35	10.29	33.44	3.46	46.37	66.70	8.75	0.27	13.38	5.41	20.15
LV	27N16E36Q01M.c	W61*			16.19	7.51	82.96	28.33	99.88	6.63	235.00	302.54	41.13	0.51	46.65		
LV	27N16E35P01M.m	W62	well		16.07	7.46	33.93	13.17	64.27	8.27	192.00	95.07	22.27	0.47	55.23		
LV	27N16E29D01M.a	W66			14.40	8.00	5.60	1.10	154.00	8.00	302.37	51.00	39.00	0.60	56.00		
LV	27N15E25K01M.b	W75			16.35	8.05	13.00	5.60	191.00	3.40	304.80	106.00	74.00				
LV	SIAD TNT-7-MWA	V191*	well	END	14.40	9.10	6.46	14.10	194.00	45.10	298.71	201.00	80.70	0.08	54.90	-7.9	
LV	SIAD PSW8 PZ-4	V195*	well		9.10	8.10	63.10	0.15	64.60	7.57	198.00	93.20	116.00	0.07	47.40	-11.9	13.1
LV	SIAD PSW8 PZ-3	V196*	well		9.00	8.10	63.70	22.90	81.30	6.54	216.00	190.00	31.10	0.07	45.10	-11.9	15.0
LV	SIAD PSW8 PZ-2	V197*	well		11.30	8.30	58.90	25.50	90.10	5.08	208.00	219.00	34.00	0.09	35.20	-13.8	16.1
LV	SIAD PSW8 PZ-1	V198*	well		11.30	8.10	112.00	42.90	72.00	7.06	198.00	343.00	40.70	0.12	42.60	-13.2	23.4
LV	JDS Wetland Dom. Well	H4129*	well		20.20	8.80	11.44	4.94	283.67	7.41	352.55	193.33	88.95	0.41	28.60	-6.8	
				MEAN	13.83	8.15	45.11	15.87	129.48	10.51	250.54	179.41	56.78	0.27	45.74	-10.92	16.90
LV	END		n = 10	MEDIAN	14.40	8.10	46.42	13.64	94.99	7.23	225.50	191.67	40.91	0.12	46.65	-11.90	15.55
				Standard DEV	3.60	0.50	36.68	13.86	73.66	12.24	58.26	94.68	30.91	0.22	9.34	2.88	4.51
LV/HLW	Zamboni Hot Spring	H4134*	spring		39.46	9.13	2.42	0.10	63.00	0.82	70.21	50.30	13.92	1.96		-12.8	
LV/HLW	Rose 27	H4132*	well	THERMAL	37.60	8.90	0.71	0.06	60.67	0.03	82.10	47.67	15.17	1.80	21.10		
				MEAN	38.53	9.01	1.56	0.08	61.84	0.42	76.15	48.98	14.54	1.88	21.10	-12.82	
LV	THERMAL		n = 2	MEDIAN	38.53	9.01	1.56	0.08	61.84	0.42	76.15	48.98	14.54	1.88	21.10	-12.82	
				Standard DEV	1.32	0.16	1.21	0.03	1.65	0.56	8.41	1.86	0.89	0.11			
West Skedaddle/Amedee Flow Path																	
SHAF/WSA	29N15E24F01.a	W5	spring		31.10	8.20	17.00	2.10	49.00	7.20	144.00	29.00	15.00	0.10	40.00		
WSA	28N17E20J01 M.e	W34			25.84	7.90	8.60	1.86	44.00	4.64	118.51	15.20	9.68	0.15	38.75		
WSA	28N17E20L01 M.b	W35	well		21.50	7.93	4.30	2.00	42.33	3.43	131.00	17.00	10.00	0.17	35.00		
WSA	Artesian Well #2.a	W36*	well	BEGINNING	22.93	8.55	5.00	1.50	43.00	3.50		18.00	10.00		35.00	-10.4	
WSA	28N17E19B02M.a	W37			21.60	8.10	5.80	0.40	46.00	1.80	99.98	18.00	12.00	0.10	3.10		
WSA	Smf4 Art. Well #1.a	W39	well		15.00	9.00	4.00	0.90	57.00	3.00	118.00	22.00	12.00		29.00		
WSA	Tinsley Fountain	H4117*	spring		16.69	8.57	16.89	1.05	50.75	3.89	129.00	21.88	11.95	0.16	36.50		
WSA	Lee Rd	H4116*	well		21.85	8.25	8.74	1.96	62.78	9.00	105.90	38.43	25.39	0.12	45.70	-10.2	17.1
				MEAN	22.06	8.31	8.79	1.47	49.36	4.56	120.91	22.44	13.25	0.13	32.88	-10.30	17.10
WSA	BEGINNING		n = 8	MEDIAN	21.73	8.23	7.20	1.68	47.50	3.69	118.51	19.94	11.98	0.13	35.75	-10.30	17.10
				Standard DEV	5.01	0.37	5.34	0.62	7.27	2.38	15.16	7.75	5.20	0.03	12.95	0.14	
WSA	27N16E11E01M.k	W69	well		15.56	7.47	113.64	24.00	220.36	15.57	146.64	156.91	415.18	0.29	53.36		
WSA	27N16E03M.a	W70	well	END	15.50	7.20	29.00	13.00	56.00	8.90	185.32	69.00	18.00	0.40	54.00		
WSA	27N16E02M.a	W71*			15.50	7.40	28.00	12.00	56.00	8.20	186.54	67.00	18.00	0.40	55.00		
WSA	Spr. NE of Stacy	R90	spring		15.00	8.90					134.11					-10.1	
				MEAN	15.39	7.74	56.88	16.33	110.79	10.89	163.15	97.64	150.39	0.36	54.12	-10.10	
WSA	END		n = 4	MEDIAN	15.50	7.44	29.00	13.00	56.00	8.90	165.98	69.00	18.00	0.40	54.00	-10.10	
				Standard DEV	0.26	0.78	49.16	6.66	94.90	4.07	26.80	51.34	229.31	0.06	0.82		
WSA/AML	Amedee Hot Springs	W40*	spring		102.78	8.60	16.00	0.50	238.00	6.00	25.00	303.00	160.00		95.00		
WSA/AML	Norcal2	V211*	geo well	THERMAL	98.90	8.90	17.60	0.09	254.00	6.99	60.96	268.00	148.00	3.99	106.00	-9.9	10.0
WSA/AML	HL Power Plant	H4135*	spring/well		62.71	8.30	25.30	0.12	276.70	11.71	49.25	342.20	188.91	2.87	53.00	-12.9	
				MEAN	88.13	8.60	19.63	0.24	256.23	8.23	45.07	304.40	165.64	3.43	53.00	-11.42	10.00
WSA	THERMAL		n = 3	MEDIAN	98.90	8.60	17.60	0.12	254.00	6.99	49.25	303.00	160.00	3.43	53.00	-11.42	10.00
				Standard DEV	22.10	0.30	4.97	0.23	19.45	3.05	18.34	37.12	21.03	0.79		2.15	
East Skedaddle/Amedee Flow Path																	
ESA	28N17E35D01 M.a	W27			26.10	8.10	5.40	0.40	45.00	1.70	95.10	16.00	13.00		27.00		
ESA	St1 Dom. Well.a	W30	well		17.15	8.35	6.00	2.00	47.00	1.55	114.00	18.00	12.00				
ESA	28N17E25P01M.b	W31			26.74	8.31	5.17	0.67	50.43	2.53	118.00	14.40	10.14	0.35	25.00		
ESA	High Rock Ranch.a	W32*	well		24.00	7.70	4.00	0.80	48.00	2.00	85.00	13.00	9.00			-12.8	21.6
ESA	Artesian Well #3.a	W33*	well	BEGINNING	22.77	8.30	3.33	2.00	42.00	3.10	98.53	15.33	9.33	0.20	34.00		
ESA	SIAD UBG-4-MWA	V194*	well		20.60	9.00	12.20	3.87	93.90	15.90	219.46	33.80	20.30	0.03	63.80	-12.5	56.8
ESA	Droeger Well	H4118*	well		17.55	8.48	15.12	7.18	80.60	5.45	226.00	22.63	27.77	0.20	40.55		
				MEAN	22.13	8.32	7.32	2.42	58.13	4.60	136.58	19.02	14.51	0.19	38.07	-12.65	39.20
ESA	BEGINNING		n = 7	MEDIAN	22.77	8.31	5.40	2.00	48.00	2.53	114.00	16.00	12.00	0.20	34.00	-12.65	39.20
				Standard DEV	3.85	0.39	4.50	2.41	20.42	5.15	59.93	7.22	7.00	0.13	15.64	0.21	24.89
ESA	27N17E23D01M.a	W54	well		15.00	8.40	34.00	15.00	169.00	11.00	354.00	72.00	95.00	1.90			
ESA	Duck Lake Irrig. Well.a	W55*	well		18.00	7.70	44.00	13.00	25.00	8.00	267.00	8.00	3.00		54.00		
ESA	27N17E15P02 M.a	W56	well	MIDDLE	12.20	8.40	56.00	19.00	40.00	9.10	294.00	25.00	14.00	0.40			
ESA	27N17E04A02 M.b	W57	well		13.95	8.56	15.20	17.60	191.60	5.20	339.20	37.20	121.40	1.20			
ESA	Harding Well	H4119*	well		17.60	8.07	31.00	10.00	32.00	6.50	224.00	6.50	4.00	0.30			
				MEAN	15.35	8.23	36.04	14.92	91.52	7.96	295.64	29.74	47.48	0.95	54.00		
ESA	MIDDLE		n = 5	MEDIAN	15.00	8.40	34.00	15.00	40.00	8.00	294.00	25.00	14.00	0.80	54.00		
				Standard DEV	2.45	0.34	15.21	3.60	81.61	2.25	53.05	26.82	56.37	0.75			
ESA	F11.a	W48				7.80	53.00	49.00	1810.00		224.00	1200.00	2010.00				
ESA	Tipton Well.a	W52*	well		13.30	8.46	5.00	9.00	680.00	18.00	530.00	180.00	590.00	1.70	14.00		
ESA	27N17E03H01 M.a	W58			16.65	8.40	6.50	9.80	406.00	12.00	593.00	71.50	247.00	1.40	48.00		
ESA	Parks Ranch.a	W59	well		9.20	7.60	11.00	9.00	144.00	6.80	227.50	11.00	93.00	0.30			
ESA	Frank Whitt.a	W60	well		15.00	9.00	16.00	14.00	1300.00	27.00	1898.00	464.00	465.00	6.20			
ESA/FSM	Austin North Dom. Well.a	W114*	well	END	13.60	7.80	1516.00	382.10	17800.00	42.00	921.00	9000.00	16476.00	1.70	5.30		
ESA/FSM/VM	Stanley Well.a	W115	well			8.30	52.00	60.00	2830.00	51.00	567.00	620.00	3960.00	0.20	20.00		
ESA/CW/ASP	May Well.a	W116*	well		12.40	7.09	150.00	820.00	16100.00	94.00	950.00	350.00	24300.00	0.40	18.00		
ESA/FSM	26N17E01P01 M.a	W123			15.00	8.30	16.00	14.00	1300.00	27.00	2084.86	464.00	465.00	6.20			
ESA/FSM	B Victory Irr. Well.a	W124	well		15.00	7.85	35.00	41.00	752.00	33.00	405.00	34.00	1050.00	0.50			
ASP/ESA	Stone Well	B687	well		11.20	7.54	35.91	65.43	4530.00	110.10	1211	2100.90	5716.00	8.45		-6.4	
				MEAN	13.48	8.01	172.40	133.94	4332.00	42.09	873.76	1317.76	5033.82	2.71	21.06	-6.38	
ESA	END		n = 11	MEDIAN	13.60	7.85	35.00	41.00	1300.00	30.00	593.00	464.00	1050.00	1.55	18.00	-6.38	
				Standard DEV	2.28	0.53	447.50	251.73	6371.98	34.43	631.53	2621.61	7984.75	3.04	16.08		

Flow Path	Name	Sample #	Water Source		Temp (°C)	pH	Cations (mg/L)				Anions (mg/L)				SiO2 (mg/L)	$\delta^{13}C$ (‰)	^{14}C (pmc)
							Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	HCO_3^{-}	SO_4^{2-}	Cl^{-}	F^{-}			
Fort Sage Mountains Flow Path																	
FSM	2TP Spring.a	W152*	spring			7.50	18.60	10.20	7.70	1.90	126.00	4.00	7.00				
FSM	Rat Spring.a	W153*	spring	BEGINNING	15.00	7.30	19.20	1.80	14.50	3.10	84.10	8.00	6.00				
				MEAN	15.00	7.40	18.90	6.00	11.10	2.50	105.05	6.00	6.50				
FSM	BEGINNING		n = 2	MEDIAN	15.00	7.40	18.90	6.00	11.10	2.50	105.05	6.00	6.50				
				Standard DEV		0.14	0.42	5.94	4.81	0.85	29.63	2.83	0.71				
FSM	McCorkle Dom. Well.a	W104*	well		13.00	7.36	18.70	22.40	31.00	8.10	181.00	49.00	5.00	0.30	12.00		
FSM	Austin Dom. Well.a	W105*	well		16.00	8.10	39.30	12.90	18.00	0.40	187.00	26.00	3.90	0.30	8.00		
FSM	Wilson #5 Well.a	W107	well			8.20	21.00	1.60	122.50	3.93	114.30	228.25	20.00	1.03			
FSM	Wilson Well.c	W108*	well		16.00	8.15	20.00	1.56	126.57	3.66	108.45	202.63	20.09	0.95	38.50		
FSM	Hail Dom. Well.a	W117*	well	MIDDLE	5.00	8.60	12.00	<1.0	33.00	5.50	56.00	35.00	12.00	0.50	8.00		
FSM	W Havil Dom. Well.a	W118	well		17.80	8.25	9.00	3.00	36.00	5.70	77.70	34.00	10.00	0.50			
FSM	26N17E24F01 M.a	W119	well			8.90	1.00	1.00	108.00	2.20	159.72	97.00	9.00	0.60			
FSM	26N17E22G01.a	W120	well		28.30	8.60	11.00	4.00	70.00	7.50	99.50	70.00	29.00	2.40			
FSM	Cal Neva Rd. - DWR West	V165*	well								104.00					-14.1	59.0
FSM	Nork/Francone Well	H4128*	well		22.35	7.88	34.45	2.65	206.00	4.40	88.30	339.50	36.00	1.60	44.00		
				MEAN	16.92	8.23	18.49	6.14	83.45	4.60	117.60	120.15	16.11	0.91	22.10	-14.10	59.00
FSM	MIDDLE		n = 10	MEDIAN	16.00	8.20	18.70	2.83	70.00	4.40	106.22	70.00	12.00	0.60	12.00	-14.10	59.00
				Standard DEV	7.29	0.45	12.20	7.60	62.27	2.44	44.05	110.82	11.01	0.70	17.66		
FSM	Perkle Dom. Well.a	W113*	well			8.20	59.30	2.70	1130.00	30.00	1103.00	2.00	1122.00	0.70	10.50		
ESA/FSM/VM	Stanley Well.a	W115	well	END		8.30	52.00	60.00	2830.00	51.00	567.00	620.00	3960.00	0.20	20.00		
ESA/FSM	B Victory Irr. Well.a	W124	well		15.00	7.85	35.00	41.00	752.00	33.00	405.00	34.00	1050.00	0.50			
				MEAN	15.00	8.12	48.77	34.57	1570.67	38.00	691.67	218.67	2044.00	0.47	15.25		
FSM	END		n = 3	MEDIAN	15.00	8.20	52.00	41.00	1130.00	33.00	567.00	34.00	1122.00	0.50	15.25		
				Standard DEV		0.24	12.47	29.19	1106.87	11.36	365.32	347.93	1659.70	0.25	6.72		
Virginia Mountains Flow Path																	
VM	Willow Spring.a	W103*	spring		16.60	7.47	16.10	5.95	10.65	2.65	97.32	5.00	5.10				
VM	Mustang Spring.a	W151*	spring	BEGINNING	15.00	7.30	21.30	7.70	11.20	1.70	109.73	6.00	8.00				
VM	Sheep Spring.a	W156*	spring		12.50	7.20	17.50	3.60	22.30	2.20	107.00	6.10	5.85				
				MEAN	14.70	7.32	18.30	5.75	14.72	2.18	104.68	5.70	6.32				
VM	BEGINNING		n = 3	MEDIAN	15.00	7.30	17.50	5.95	11.20	2.20	107.00	6.00	5.85				
				Standard DEV	2.07	0.13	2.69	2.06	6.57	0.48	6.52	0.61	1.51				
VM	First Fault.a	W90*	well			8.00	8.90	0.60	37.50	3.50	98.76	11.00	9.00	0.20			
VM	Jarbee Well.c	W91*	well		21.00	8.14	12.55	4.32	27.46	6.54	120.46	10.17	7.12	0.16	44.00		
VM	Ferrel Playa Well.a	W92	well			8.30	7.10	1.10	77.00	5.80	154.85	22.00	27.00				
VM	Headquarters	W93*	well		19.17	8.30	11.78	2.03	56.86	6.58	155.57	11.88	10.54	0.19	53.00	-13.4	43.5
VM	Fish Spring.a	W97	spring		22.80	8.00	3.00	3.00	78.00		179.00	17.00	18.00				
VM	Ferrel Test Well.a	W109*	well		20.33	8.27	5.96	1.58	66.50	6.08	136.09	17.67	18.22	0.31	43.50		
VM	Ferrel #1 Well.a	W110*	well	MIDDLE	20.00	7.90	4.00	2.90	67.00		144.00	18.00	22.00				
VM	Fish Springs Ranch Dom. Well	H4136*	well		15.85	8.67	5.59	2.05	75.49	7.87	185.11	21.40	18.10	0.15	17.40	-10.3	37.6
VM	Fish Spring Ranch Irrigation Well	H4137	well		19.10	7.89	9.15	3.82	39.45	9.67	139.80	9.08	9.02	0.05	13.00		
				MEAN	19.75	8.16	7.56	2.38	58.36	6.58	145.96	15.35	15.45	0.18	34.18	-11.86	40.54
VM	MIDDLE		n = 9	MEDIAN	20.00	8.14	7.10	2.05	66.50	6.54	144.00	17.00	18.00	0.17	43.50	-11.86	40.54
				Standard DEV	2.13	0.25	3.30	1.23	19.10	1.90	26.96	4.91	6.84	0.08	17.80	2.18	4.16
VM	Ford #1 Well.a	W112*	well		14.70	8.37	34.90	16.50	190.00	23.70	286.00	32.00	110.60	1.70	5.30		
ESA/FSM/VM	Stanley Well.a	W115	well	END		8.30	52.00	60.00	2830.00	51.00	567.00	620.00	3960.00	0.20	20.00		
				MEAN	14.70	8.34	43.45	38.25	1510.00	37.35	426.50	326.00	2035.30	0.95	12.65		
VM	END		n = 2	MEDIAN	14.70	8.34	43.45	38.25	1510.00	37.35	426.50	326.00	2035.30	0.95	12.65		
				Standard DEV		0.05	12.09	30.76	1866.76	19.30	198.70	415.78	2721.94	1.06	10.39		
Cottonwood Flow Path																	
CW	Cottonwood Test Well.a	W94*	well			7.10	22.20	8.60	17.70	6.50	148.74	7.00	7.00	0.10			
CW	Upper Red Spring.a	W146*	spring		14.00	7.93	33.00	11.00	13.00	4.70	160.00	6.40	5.00				
CW	Black Canyon.a	W147*	spring		14.00	7.40	19.40	8.40	7.70	3.50	115.83	3.00	4.00				
CW	Newcombe Spring.a	W148*	spring		20	7.3	30	9	23	5.7	168.00	6.00	6.00				
CW	Cottonwood Springs	W96*	spring		14.77	7.77	12.81	5.09	11.70	4.93	95.02	3.56	2.93	0.09	21.67	-19.0	
CW	Cottonwood Well #2.a	W98	well	BEGINNING		7.60	22.20	7.80	15.50	5.60	154.84	11.00	7.00	0.10			
CW	Cold Spring.a	W150*	spring		12.00	7.30	14.30	5.80	5.40	4.70	87.78	<3	4.00				
				MEAN	14.95	7.49	21.99	7.96	13.43	5.09	132.89	6.16	5.13	0.10	21.67	-18.99	
CW	BEGINNING		n = 4	MEDIAN	14.00	7.40	22.20	8.40	13.00	4.93	148.74	6.20	5.00	0.10	21.67	-18.99	
				Standard DEV	3.00	0.29	7.48	1.99	5.98	0.96	32.81	2.86	1.59	0.01			
CW/ASP/NV	BB2-C.a	W101*	well		15.67	8.27	13.87	4.60	157.33	10.47	300.33	39.33	73.33	0.40			
ESA/CW/ASP	May Well.a	W116*	well	END	12.40	7.09	150.00	820.00	16100.00	94.00	950.00	350.00	24300.00	0.40	18.00		
				MEAN	14.03	7.68	81.93	412.30	8128.67	52.23	625.17	194.67	12186.67	0.40	18.00		
CW	END		n = 2	MEDIAN	14.03	7.68	81.93	412.30	8128.67	52.23	625.17	194.67	12186.67	0.40	18.00		
				Standard DEV	2.31	0.83	96.26	576.57	11273.17	59.07	459.39	219.67	17130.84	0.00			
Neversweat Flow Path																	
NV	Hodges Well.b	W100*	well	BEGINNING	18.75	7.88	9.77	3.95	37.48	8.08	137.33	6.33	5.07	0.11	51.00		
NV	BEGINNING		n = 1	MEAN	18.75	7.88	9.77	3.95	37.48	8.08	137.33	6.33	5.07	0.11	51.00		
CW/ASP/NV	BB2-C.a	W101*	well		15.67	8.27	13.87	4.60	157.33	10.47	300.33	39.33	73.33	0.40			
NV	Never Sweat Ranch	W102*	well	MIDDLE	14.90	8.25	17.17	3.38	107.35	8.32	223.13	71.48	36.48	0.22		-11.2	76.7
				MEAN	15.28	8.26	15.52	3.99	132.34	9.39	261.73	55.41	54.91	0.31		-11.23	
NV	MIDDLE		n = 2	MEDIAN	15.28	8.26	15.52	3.99	132.34	9.39	261.73	55.41	54.91	0.31		-11.23	76.70
				Standard DEV	0.54	0.02	2.34	0.86	35.34	1.52	54.59	22.73	26.06	0.13			
ESA/CW/ASP	May Well.a	W116*	well	END	12.40	7.09	150.00	820.00	16100.00	94.00	950.00	350.00	24300.00	0.40	18.00		
NV	END		n = 1	MEAN	12.4	7.09	150	820	16100	94	950	350	24300	0.4	18		
Astor/Sand Pass Flow Path																	
ASP	Astor Pass 1.a	W49	well			8.30	13.00	12.00	828.00	12.20	940.00	367.00	447.00	3.10			
ASP	Astor Pass 2.a	W50	well			8.50	9.80	7.90	668.00	9.20	888.00	253.00	284.00	3.20			
ASP	Astor Pass Test Well.a	W51*	well	BEGINNING	21.00	7.90	39.60	27.80	849.00	13.40	846.00	330.00	677.00	2.20			
ASP	Astor Pass	B2041	well				14.04	9.27	542.90	11.92	876.00	172.87	256.87	2.38		-4.5	
				MEAN	21.00	8.23	19.11	14.24	721.98	11.68	887.50	280.72	416.22	2.72		-4.53	
ASP	BEGINNING		n = 4	MEDIAN	21.00	8.30	13.52	10.64	748.00	12.06	882.00	291.50	365.50	2.74		-4.53	
				Standard DEV		0.31	13.78	9.20	144.17	1.77	39.20	86.16	193.07	0.50			
ESA/CW/ASP	May Well.a	W116*	well	END	12.40	7.09	150.00	820.00	16100.00	94.00	950.00	350.00	24300.00	0.40	18.00		
ASP/ESA	Stone Well	B687	well		11.20	7.54	35.91	65.43	4530.00	110.10	1211	2100.90	5716.00	8.45		-6.4	
				MEAN	11.80	7.32	92.96	442.72	10315.00	102.05	1080.50	1225.45	15008.00	4.43	18.00	-6.38	
ASP	END		n = 2	MEDIAN	11.80	7.32	92.96	442.72	10315.00	102.05	1080.50	1225.45	15008.00	4.43	18.00	-6.38	
				Standard DEV	0.85	0.32	80.67	533.56	8181.23	11.38	184.55	1238.07	13140.87	5.69			
Honey Lake/Warm Springs Fault Zone Flow Path																	
SR/HLW	Mormon Church Heating	W21*	well		52.20	7.70	9.50	0.60	56.00	0.90	143.00	20.00	5.90		62.00		
SR/HLW	Roosevelt Swimming Pool	RE1	well		35.80	8.01	19.00	3.40	20.00	3.80	120.00	11.00	2.00	<0.1	53.00		
LV/HLW	Rose 27	H4132*	well	THERMAL	37.60	8.90	0.71	0.06	60.67	0.03	82.10	47.67	15.17	1.80	21.10		
LV/HLW	Zamboni Hot Spring	H4134*	spring		39.46	9.13	2.42	0.10	63.00	0.82	70.21	50.30	13.92	1.96		-12.8	
				MEAN	41.27	8.43	7.91	1.04	49.92	1.39	103.83	32.24	9.25	1.88	45.37	-12.82	
HLW			n = 4	MEDIAN	38.53	8.45	5.96	0.35	58.34	0.86	101.05	33.83	9.91	1.88	53.00	-12.82	
				Standard DEV	7.44	0.69	8.32	1.59	20.16	1.66	33.66	19.71	6.34	0.11	21.49		
Antelope Mountain/Litchfield Fault Zone Flow Path																	
WSA/AML	Amedee Hot Springs	W40*	spring		102.78	8.60	16.00	0.50	238.00	6.00	25.00	303.00	160.00		95.00		
SR/AML		V209*	geo well		66.95	8.75	13.50		172.00	2.87	11.50	245.00	89.00	3.33	88.60	-11.9	10.6
WSA/AML		V211*	geo well	THERMAL	98.90	8.90	17.60	0.09	254.00	6.99	60.96	268.00	148.00	3.99	106.00	-9.9	10.0
WSA/AML	HL Power Plant	H4135*	spring/well		62.71	8.30	25.30	0.12	276.70	11.71	49.25	342.20	188.91	2.87	53.00	-12.9	
				MEAN	82.83	8.64	18.10	0.24	235.18	6.89	36.68	289.55	146.48	3.40	85.65	-11.58	10.30
AML			n =4	MEDIAN	82.93	8.68	16.80	0.12	246.00	6.50	37.13	285.50	154.00	3.33	91.80	-11.90	10.30
				Standard DEV	20.92	0.26	5.09	0.23	45.01	3.66	22.49	42.43	41.99	0.56	22.92	1.55	0.42