South Tahoe Public Utility District

Tahoe South Subbasin (6-005.01) Annual Report

2019 Water Year

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4/27/2020

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CERTIFICATION

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GLOSSARY

2012-2016 Event: Statewide drought emergency declared under the California Emergency Services Act

2014 GMP: Groundwater Management Plan prepared by the District in accordance with Assembly Bill 3030 pursuant to CWC Section 10750 et *seq*.

AF: Acre-feet

AFY: Acre-feet per year

Alternative: Alternative to a GSP developed pursuant to Part 2.75 of the Water Code

Alternative Materials: Additional plans, reports and other documents related to the 2014 GMP

BMOs: Basin Management Objectives specified in the 2014 GMP

BHHRA: Baseline Human Health Risk Assessment

CASGEM: California State Groundwater Elevation Monitoring

Cleanup and Abatement Order: CAO

COC: Constituents of Concern

County Water Agency: El Dorado County Water Agency

CSLT: City of South Lake Tahoe

CWC: California Water Code

District: South Tahoe Public Utility District

DRI: Desert Research Institute

DWR: California Department of Water Resources

Feasibility Study: Engineering feasibility study of remedial alternatives to mitigate PCE groundwater contamination in the South Y Area

GAC: Granular Activated Carbon

GMP: Groundwater Management Plan

GSA: Groundwater Sustainability Agency

GSP: Groundwater Sustainability Plan

GSP Regulations: California Code of Regulations Title 23. Waters; Division 2. Department of Water Resources; Chapter 1.5. Groundwater Management; Subchapter 2. Groundwater Sustainability Plans

LBWC: Lukins Brothers Water Company

LPA: Lakeside Park Association

LRWQCB: Lahontan Regional Water Quality Control Board

LTBMU: US Forest Service, Lake Tahoe Basin Management Unit

MCLs: maximum contaminant levels

MDD: Maximum daily demand

MGD: Million gallons per day

Model Domain: Areal extent of the South Tahoe Groundwater Model encompassing the TVS Basin and the surrounding watersheds to the watershed divide.

MOU: Memorandum of Understanding

MtBE: Methyl tert-Butyl Ether

MT3DMS: Modular three-dimensional transport model

NRCS: National Resources Conservation Service

OW: Observation well

Parts per Billion: ppb, equivalent to micrograms per liter (µg/L)

Parts per Million: ppm, equivalent to milligrams per liter (mg/L)

PCA: Potential contaminating activity

PCE: Tetrachloroethylene

PDI: Groundwater investigation performed in support of the Feasibility Study

PTAS: Packed Tower Air Stripper

PWS: Public water system

SAG: Stakeholders Advisory Group

SCWS: Small community water system is a public water system that serves at least 15 service connections used by yearlong residents or regularly serves at least 25 yearlong residents.

SGMA: Sustainable Groundwater Management Act

SMCLs: Secondary maximum contaminant levels

SNOTEL: NRCS snow telemetry station

South Y: Intersection of US Route 50 and California State Highway 89, in the City of South Lake Tahoe, CA

South Y Area: General area within a one-mile radius of the South Y

South Y Plume: Groundwater plume characterized by high concentrations of dissolved tetrachloroethylene contamination, above maximum contaminant levels, generally located between the South Y and the Tahoe Keys lagoon, in South Lake Tahoe, CA

South Tahoe Groundwater Model: Groundwater flow model developed by DRI for the TVS Basin and its surrounding watersheds using MODFLOW-NWT

SWRCB: California State Water Resources Control Board

SWRCB-DFA: SWRCB Division of Financial Assistance

Tahoe South Subbasin Alternative: 2014 GMP and Alternative Materials approved by DWR as an Alternative for the TVS Basin

TKPOA: Tahoe Keys Property Owners Association

TKWC: Tahoe Keys Water Company

TRPA: Tahoe Regional Planning Agency

TVS Basin: Tahoe South Subbasin of the Tahoe Valley Groundwater Basin, Basin No. 6-005.01

USGS: U.S. Geological Survey

UWMP: South Tahoe Public Utility District 2015 Urban Water Management Plan

WBZs: Water-bearing zones

WY: Water Year

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0 Executive Summary

The Tahoe South Subbasin of the Tahoe Valley Groundwater Basin, designated by DWR as Groundwater Basin 6-005.01 (TVS Basin) is a discrete, highly productive sedimentary geologic basin located in the City of South Lake Tahoe (CSLT) and portions of El Dorado County, California. The 2019 Annual Report presents a management level summary of groundwater conditions within the TVS Basin using groundwater production and hydrologic data collected from the TVS Basin and results from numerical hydrologic models. District progress on implementation of BMOs defined in Section 8 of its 2014 GMP (Kennedy-Jenks, 2014) is also reported.

In 2016, the 2014 GMP and Alternative Materials were submitted by the District to DWR for assessment as an existing plan Alternative. On July 17, 2019, DWR formally accepted the District's 2014 GMP and Alternative Materials as an approved Alternative for the TVS Basin. This is the fifth annual report issued since adoption of the 2014 GMP and third annual report submitted to DWR since District submittal of the 2014 GMP and Alternative Materials to DWR.

Groundwater Conditions

The 2019 Annual Report provides hydrologic data for the for the 2019 Water Year (WY), which is the 12-month period starting October 1, 2018 through September 30, 2019.

Water Year Classification. In terms of precipitation, 2019 WY was an above normal water year, which followed a normal water year (2018 WY), a very wet water year (2017 WY), a normal year (2016 WY) and a three year below normal period (2012 WY -2015 WY).

Groundwater Recharge. For the 2019 WY, groundwater recharge for the model domain is calculated at 53,935 acre-feet (AF); groundwater recharge for the TVS Basin is calculated at 7,123 AF.

Groundwater Levels. Measured groundwater elevations were above normal for the 2019 WY, compared to the 10-year base period for groundwater levels (2001 WY -2010 WY). Spring 2019 WY groundwater levels increased on average about 0.04 feet compared to spring 2018 WY groundwater levels.

Groundwater Quality. Tetrachloroethylene (PCE) groundwater contamination continued to have an impact on groundwater supplies in the South "Y" Area. The South Y is a local reference to the intersection of US Route 50 and State Highway 89 located in the north central portion of the TVS Basin. The South "Y" Plume extends for more than one mile north of this intersection to the Tahoe Keys Lagoon. Groundwater contamination within this plume has impaired three public water system

(PWS) wells and threatens one other active PWS well. The total source capacity of active PWS wells in the TVS Basin presently exceeds the maximum day demand (MDD) minimum threshold for water quality by about 6 million gallons per day (MGD). Although source capacity has declined due to wells impaired by degraded water quality, these impairments have not risen to a level such that available source capacity cannot meet current potable water demands. To help satisfy LBWC water demands the District provided 2.79 million gallons through its inter-tie connection to the LBWC water system. During the 2019 WY, the District continued on-going work to complete the South Y Feasibility Study. The feasibility study is being conducted to identify a preferred remedy to mitigate PCE contamination in the South Y Area. This work is being funded in part through an agreement with the SWRCB using Groundwater Clean-up Program planning grant funds from Proposition 1 and cost share funding from the County Water Agency.

Groundwater Production. Metered groundwater production from PWS wells, which accounts for more than 90% of groundwater extractions in the TVS Basin, totaled 6,771 AF; this is approximately 13% below the median value (7,729 AF) over the groundwater production period of record (2005 WY – 2019 WY).

Groundwater Storage. For the 2019 WY, the annual change in groundwater storage for the model domain is +7,199 AF; the annual change in groundwater storage for the TVS Basin is +838 AF. Since the 2005 WY, the cumulative change in groundwater storage for the model domain is +56,692 AF; the cumulative change in groundwater storage for the TVS Basin is +8,720 AF.

Basin Management Objectives

Groundwater management activities performed during the 2019 WY included items required for ongoing compliance with SGMA and other efforts to address BMOs under the 2014 GMP. Accomplishments during the 2019 WY included:

- Fulfilled the Alternative annual reporting requirements for the preceding water year for the TVS Basin.
- Fulfilled monitoring entity groundwater level elevation monitoring and reporting requirements for the TVS Basin under the CASGEM program.
- Continued conducting SAG workshops for collaboration around groundwater-related activities occurring within the TVS Basin.
- Received DWR approval of the District's existing plan Alternative for the TVS Basin.

- Made significant progress towards completing the South Y Feasibility Study including publication of the following technical reports;
    a. Feasibility Study Work Plan (KJ, November 2018)
    b. Human Health Risk Assessment (KJ, January 2019)
    c. Fate & Transport Modeling Report (DRI, June 2019)
    d. Pre-Design Investigation Report (KJ, July 2019)
    e. Fate & Transport Modeling Report – Addendum (DRI, September 2019)

- Continued leadership in public outreach through press releases and public workshops explaining activities undertaken by local water purveyors and the LRWQCB to address groundwater contamination in the TVS Basin.

1 Introduction

The District has prepared this report for the TVS Basin. The 2019 Annual Report presents a management level summary to assess groundwater conditions and supplies within the TVS Basin, using groundwater production and hydrologic data collected from the TVS Basin. Progress on implementation of BMOs defined in the 2014 GMP is also reported. BMOs are described in Section 8 of the 2014 GMP.

The 2014 GMP was prepared in accordance with Assembly Bill 3030 (AB 3030) pursuant to CWC Section 10750 et *seq*. The 2014 GMP was adopted by the District and an accompanying Groundwater Ordinance was added as Division 7 to the District's Administrative Code on December 4, 2014. On December 28, 2016, the District concurrently submitted (1) its 2014 GMP and Alternative Materials as an existing plan Alternative pursuant to Water Code section 10733.6(b)(1) and (2) an analysis of basin conditions as an analysis Alternative pursuant to Water Code section 10733.6(b)(2) to DWR for public comment and DWR review and evaluation.[1] On July 17, 2019, DWR determined that the existing plan Alternative satisfied the objectives of SGMA and approved it as an Alternative for the TVS Basin (DWR, 2019a).

This report was prepared in compliance with both the annual reporting requirements of the 2014 GMP and the requirement to submit an annual report by April 1 of each year. Since 2016, DWR has required Groundwater Sustainability Agency's (GSAs) which have submitted Alternatives to DWR for evaluation, also submit annual reports [2]. The 2019 Annual Report is the fifth annual report issued since adoption of the 2014 GMP and the first annual report issued since DWR approved the District's existing plan Alternative for the TVS Basin. Table 1-1 lists the components required for inclusion in annual reports submitted by a GSA to DWR. Also listed are the corresponding section(s) where this information is found in this report.

§ 356.2	ANNUAL REPORT COMPONENT	SECTION(s)
(a)	General information, including an executive summary and a location map depicting the basin covered by the report	Executive Summary; Section 1.1; Fig. 1-1; Fig. 1-2
(b)	A detailed description and graphical representation of the following conditions of the basin managed in the Plan:	
(1)	Groundwater elevation data from monitoring wells identified in the monitoring network shall be analyzed and displayed as follows:	

[1] As part of its submittals, the District indicated its preference to DWR that the review be sequenced in such a manner that its existing plan Alternative be reviewed first, and should DWR agree that the existing plan Alternative is functionally equivalent to a GSP, review of the analysis Alternative would not be necessary.

[2] Due to ongoing health and safety concerns, DWR waived the reporting deadline and accepted reports submitted after the April 1, 2020 due date.

(A)	Groundwater elevation contour maps for each principal aquifer in the basin illustrating, at a minimum, the seasonal high and seasonal low groundwater conditions.	Section 2.4.2; Fig. 2-6
(B)	Hydrographs of groundwater elevations and water year type using historical data to the greatest extent available, including from January 1, 2015, to current reporting year.	Section 2.4; Fig. 2-4; Appendix A
(2)	Groundwater extraction for the preceding water year. Data shall be collected using the best available measurement methods and shall be presented in a table that summarizes groundwater extractions by water use sector, and identifies the method of measurement (direct or estimate) and accuracy of measurements, and a map that illustrates the general location and volume of groundwater extractions.	Section 2.6; Table 2-2; Fig. 2-8, Fig. 2-9. All reported water use in Section 2.6 is for single-family and multi-family residential, commercial and landscape uses.
(3)	Surface water supply used or available for use, for groundwater recharge or in-lieu use shall be reported based on quantitative data that describes the annual volume and sources for the preceding water year.	Not Applicable; surface water for recharge or in-lieu use is not used as a source of supply, except for Lakeside Park Association, since the SWRCB has not been processing water rights applications until recently. Now that the Truckee River Operating Agreement has been implemented, surface water may be used as a potential future source of supply. The annual volume of surface water used by this system is not provided in this report.
(4)	Total water use shall be collected using the best available measurement methods and shall be reported in a table that summarizes total water use by water use sector, water source type, and identifies the method of measurement (direct or estimate) and accuracy of measurements. Existing water use data from the most recent Urban Water Management Plans or Agricultural Water Management Plans within the basin may be used, as long as the data are reported by water year.	Section 2.6.1; Table 2-3; The water use data provided in Section 2.6 is from the District's customer service database and is representative of more than 80% of the groundwater use in the TVS Basin. These data are presented in calendar years.
(5)	Change in groundwater in storage shall include the following:	
(A)	Change in groundwater in storage maps for each principal aquifer in the basin.	Section 2.7- The annual change in groundwater storage is presented as a single value for the entire basin which is

		derived from the water budget calculated by the groundwater model for the TVS Basin. As the model calculates groundwater storage for all layers within the principal aquifer (e.g. Basin-fill Aquifer), a storage map is not provided in this report. A graph depicting annual and cumulative change in groundwater storage is provided as Figure 2-10.
(B)	A graph depicting water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the basin based on historical data to the greatest extent available, including from January 1, 2015, to the current reporting year.	Section 2.7; Fig. 2-10. All water use, in terms of groundwater production, shown in Figure 2-10 is for residential, commercial and landscaping uses.
(c)	A description of progress towards implementing the Plan, including achieving interim milestones, and implementation of projects or management actions since the previous annual report.	Section 3.0[3]

Table 1-1. Component requirements of Annual Reports submitted to DWR by GSAs (§356.2).

1.1 TVS Basin

The TVS Basin is part of the larger Tahoe Valley Groundwater Basin, which is located within the Lake Tahoe Hydrologic Basin and incorporates the sediment-filled basins bordering Lake Tahoe. The Tahoe Valley Groundwater Basin is subdivided into three sub-basins: the TVS Basin, the Tahoe Valley West Subbasin, and the Tahoe Valley North Subbasin (Figure 1-1). Of these three subbasins, the TVS Basin is the largest and most productive.

Elevations within the TVS Basin range from 6,225 feet at lake level, rising to above 6,500 feet within the groundwater basin. Elevations extend above 10,000 feet within the surrounding watersheds along the Carson Range and Sierra Nevada Range. Portions of seven watersheds overlie the TVS Basin; the largest of these is the Upper Truckee River watershed. The Upper Truckee River flows north across the entire length of the TVS Basin and drains into Lake Tahoe through the Upper Truckee Marsh. The Upper Truckee River is joined by Grass Lake and Big Meadow Creeks along the southern extent of its course, Angora Creek centrally, and Trout Creek near Lake Tahoe.

[3] The discussion in Section 3.0 of this Annual Report applies to the 2014 GMP.

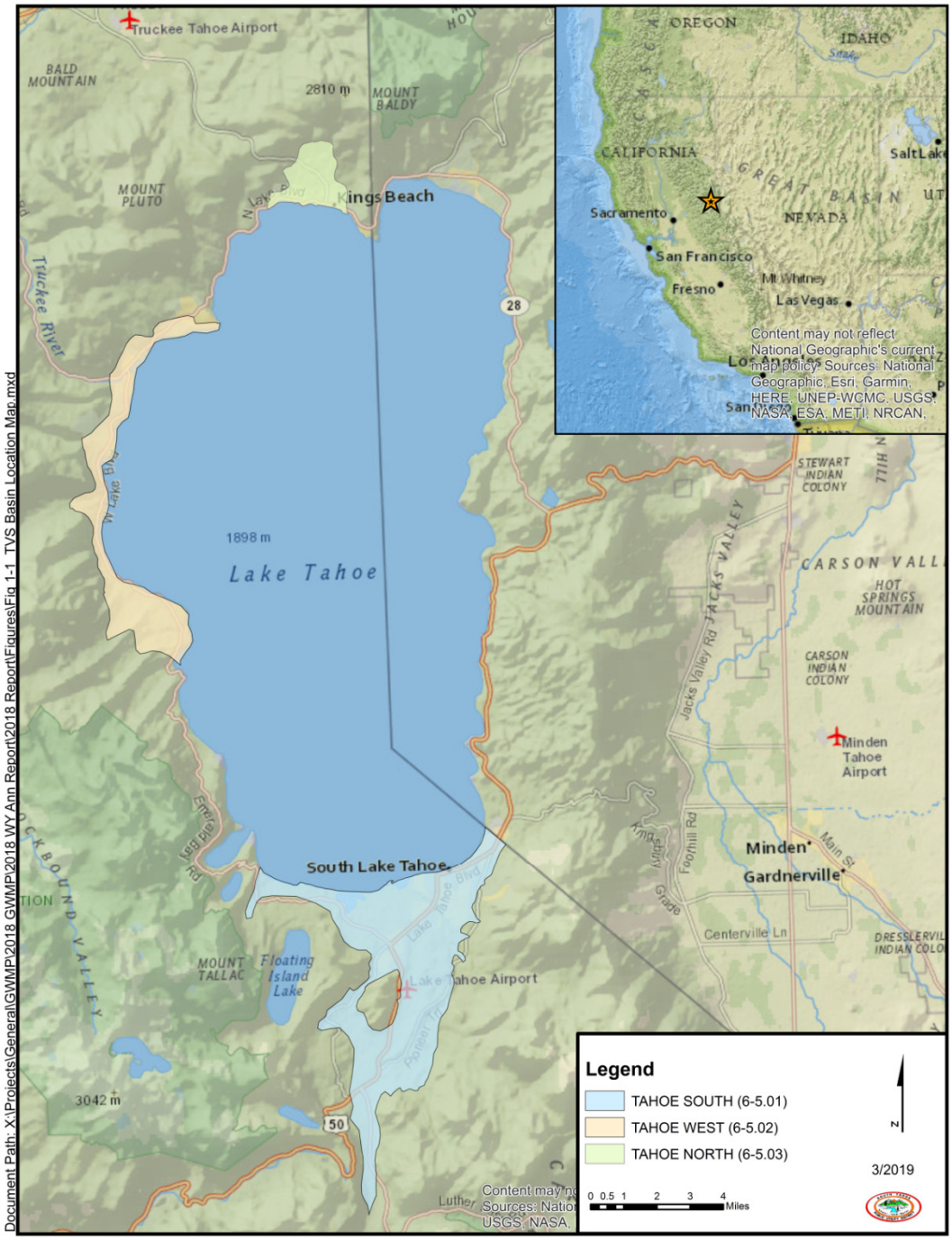

Figure 1-1. Lake Tahoe area regional map with DWR-designated groundwater subbasins.

The TVS Basin has an area of approximately 23 square miles (14,814 acres) and is located in El Dorado County, California (Figure 1-2). The TVS Basin is roughly triangular-shaped, bounded on the southwest by the Sierra Nevada Range, on the southeast by the Carson Range, and on the north by the southern shore of Lake Tahoe. The TVS Basin generally conforms to the valleys of the Upper Truckee River and Trout Creek. The TVS Basin does not share a boundary with any other DWR groundwater basin or sub-basin. The CSLT overlies the northern portion of the TVS Basin. The southern boundary extends about 3 miles south of the town of Meyers. The northeast boundary of the TVS Basin is defined by the California-Nevada state line. For ease of description, the TVS Basin is subdivided into six geographically based sub-areas, referred to as the Tahoe Keys, South Lake Tahoe, Bijou, Angora, Meyers and Christmas Valley sub-areas. The location and extent of these sub-areas are shown on Figure 1-2.

The TVS Basin includes the CSLT and portions of eastern El Dorado County, which encompasses the unincorporated communities of Meyers, Angora Highlands and Christmas Valley. Within the greater South Lake Tahoe area, the majority of the land use is classified as Conservation area, followed by Residential, Recreation, Commercial and Public Service, and Tourist areas. The majority of the Conservation areas are federal lands managed by the United States Forest Service - Lake Tahoe Basin Management Unit (LTBMU). Most of the federally managed land is located outside of the TVS Basin, but does include large areas around the Camp Richardson/Fallen Leaf Lake area within the northwest portion of the TVS Basin; and along the basin margin on the east side of the TVS Basin.

Groundwater is the primary source of drinking water for the communities overlying the TVS Basin. Surface water for recharge or in-lieu use is not presently used, except by Lakeside Park Association (LPA), since the SWRCB has not been processing water rights applications until recently. Now that the Truckee River Operating Agreement has been implemented, surface water may be used as a potential future source of supply. Most water wells drilled in the TVS Basin are completed in basin-fill deposits that generally consist of unconsolidated glacial, lake and stream sediments. These sedimentary deposits fill the lower reaches of the canyons that drain toward Lake Tahoe and underlie the relatively flat lying valley floors. These deposits can be over 1,000 feet thick in the deeper portions of the TVS Basin, but thin toward the basin margins where they cover shallow bedrock areas. Numerous water-bearing zones (WBZs) have been identified using lithologic and geophysical logs, and interpreted correlations to divide the basin-fill into multiple layers, representing regionally correlated units of high and low permeability. Units of relatively high permeability typically correspond to coarse-grained glacial outwash, fluvial and deltaic deposits forming the basin-fill aquifer. The laterally continuous fine-grained lacustrine (lake-bed) deposits form local confining layers or aquitards that affect groundwater flow between these higher permeability deposits.

Figure 1-3 is a conceptual hydrogeological cross section across the northern portion of the TVS Basin used to illustrate the WBZs. The different WBZ designations are informal and are based on the local geographic area and the stratigraphic order in which the unit occurs. This is indicated as a subscript from deep to shallow depth (1 = lowermost zone; 5 = uppermost zone). The deepest zone (WBZ1) occurs in the deepest portions of the basin, generally at depths below 600 feet, and may act as a confined aquifer

and show artesian conditions in some areas. The middle two zones (WBZ2 and WBZ3) represent the interval at depths between 200 to 600 feet and the shallowest two zones (WBZ4 and WBZ5) represent depths from 0 to 200 feet (Bergsohn, 2011).

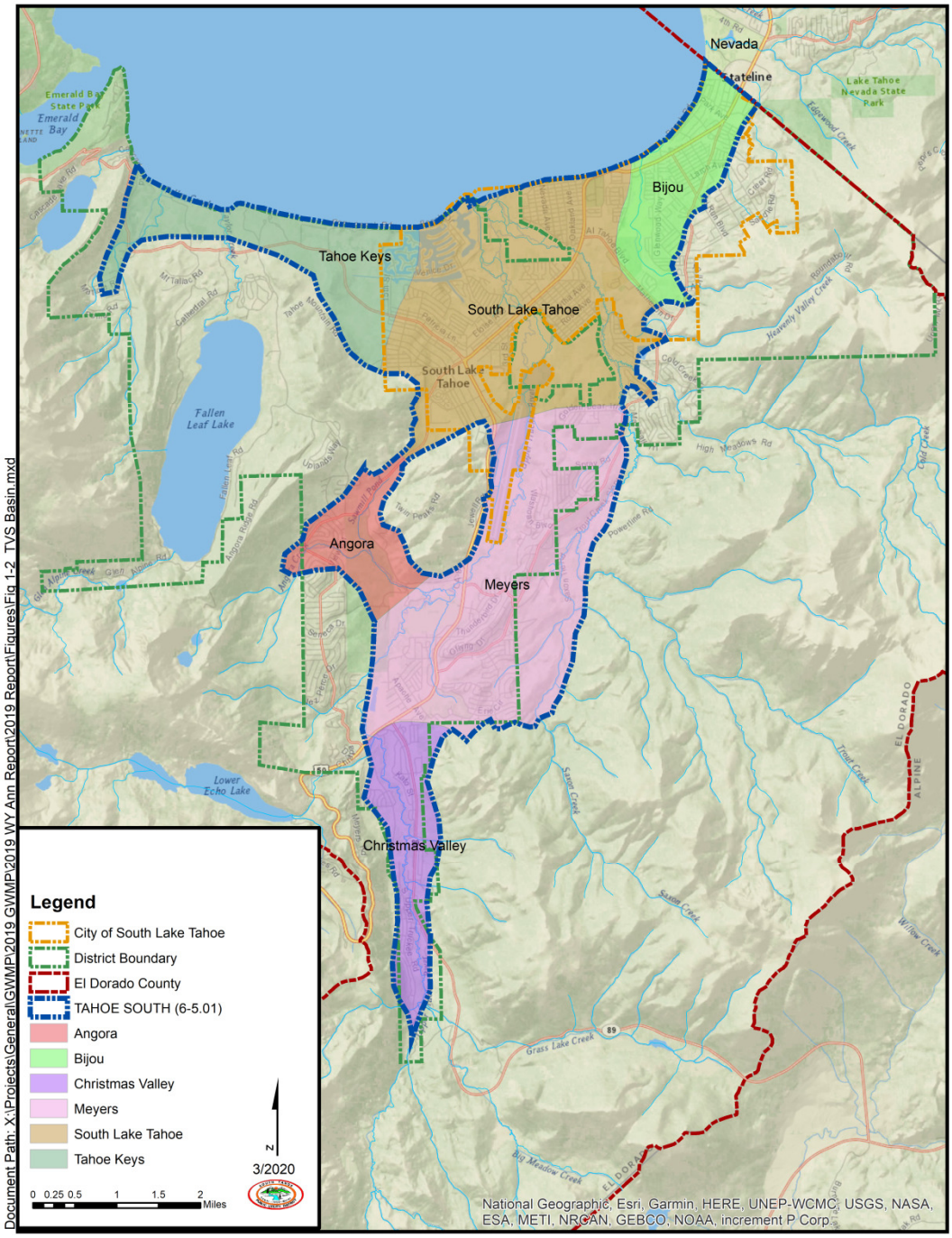

Figure 1-2. TVS Basin showing jurisdictional boundaries and geographically-based sub-area designations used in this report.

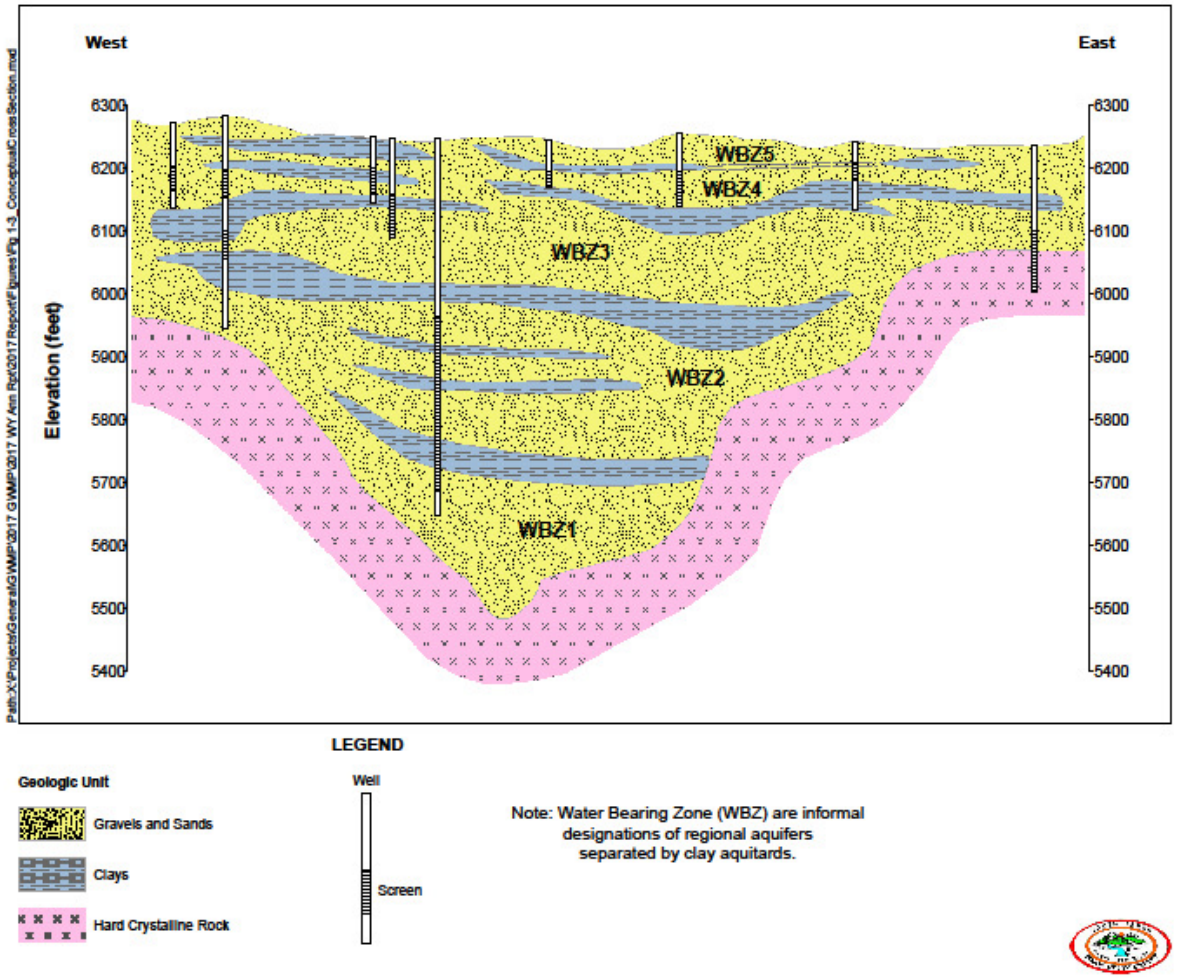

Figure 1-3. Conceptual geologic cross-section oriented east-west showing typical WBZs within the TVS Basin (Adapted from Kennedy-Jenks (2014)).

1.2 Water Year Classification

In terms of precipitation, 2019 WY was an above normal water year using the water year classification developed for the TVS Basin. Under the GSP Regulations, annual precipitation in a basin is required to be described in terms of water year type. DWR generally assigns water year type based on river flow indices or precipitation amounts and has developed water year classification systems for several hydrologic basins in California. For example, for the Sacramento Valley hydrologic basin, SWRCB developed five categories based on runoff forecasts and previous water year's index: 1) wet, 2) above normal, 3) below normal, 4) dry, and 5) critical (SWRCB, 1978).

DWR has not developed a water year classification for the Lake Tahoe hydrologic basin. As such, the District requested the Desert Research Institute (DRI) to develop a water year classification for the TVS Basin. The water year classification was created following development of the TVS Basin water budget by DRI. During development of the water budget, a strong linear correlation was identified between simulated precipitation from the regional Groundwater Surface Water Flow Model for the Truckee River Basin and groundwater recharge to the TVS Basin. Linear correlation was also found between groundwater recharge to model calculated change in groundwater storage. Using these relationships from the modeling analysis, total accumulated precipitation measured at four National Resources Conservation Service (NRCS) SNOTEL stations within the model area were further evaluated to find the SNOTEL station with the best correlation to the simulated precipitation from the Groundwater Surface Water Flow Model. SNOTEL 508: Hagan's Meadow, CA was found to have the best correlation with model simulated groundwater recharge and change in groundwater storage. Therefore, NRCS precipitation records for this station were used as a reference station to classify water year type for the TVS Basin (Carroll et al., 2016b). The regression equation between annual total precipitations at SNOTEL 508: Hagan's Meadow, CA to groundwater recharge within the TVS Basin and surrounding watersheds is shown below in Figure 1-4. The regression equation has an R-squared (R^2) of 0.92, which is a statistical measure of how close the data are to the fitted regression line.

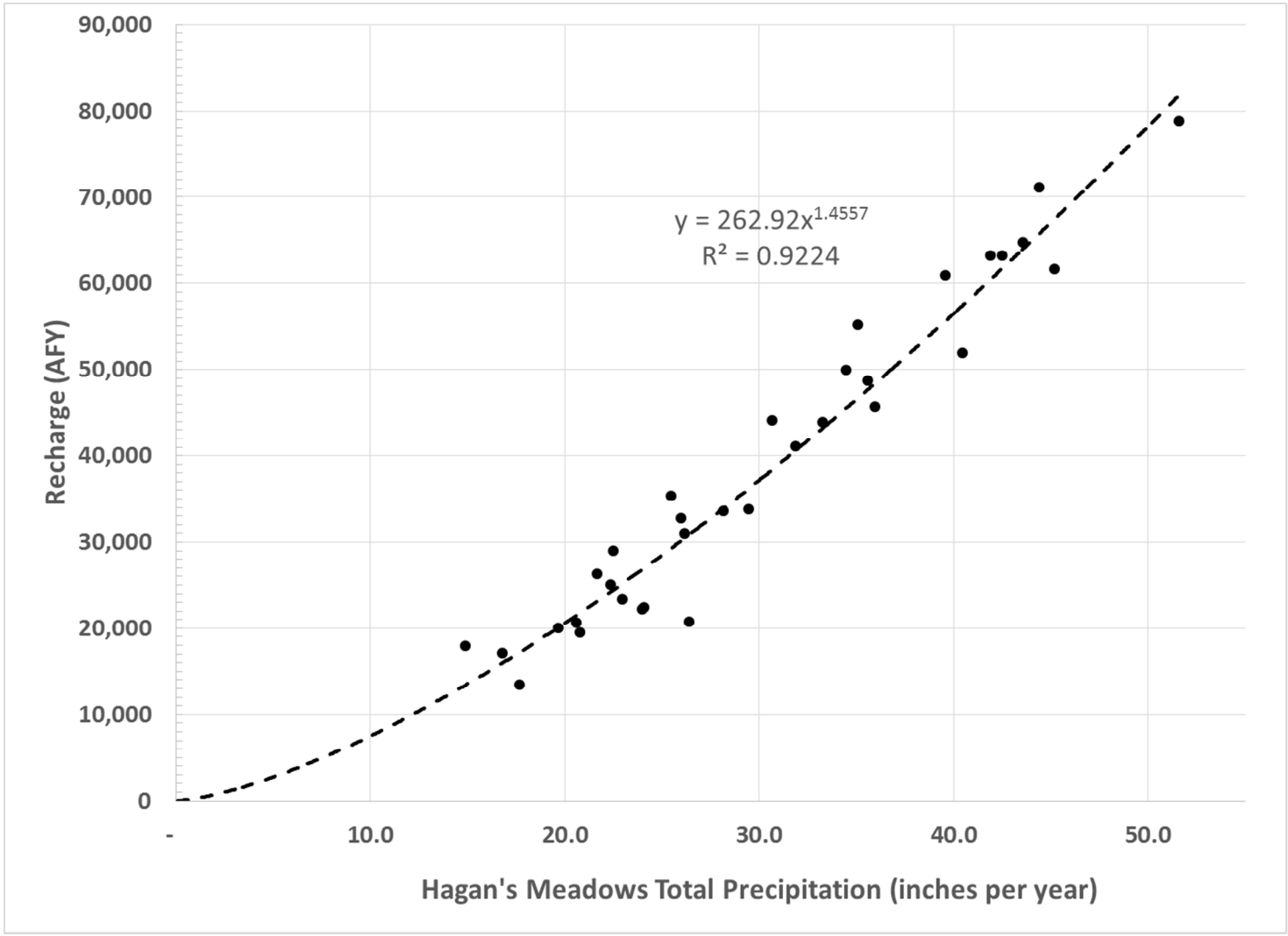

Figure 1-4. SNOTEL 508: Hagan's Meadow, CA annual precipitation versus modeled groundwater recharge within the model domain (G. Pohll et al., 2016)

For the TVS Basin, water years 1979 – 2017 were categorically defined by assuming a normal distribution in precipitation and establishing ranges based on the z-statistics in Table 1-2. To allow more flexibility in WY type, seven categories were established: 1) very wet, 2) wet, 3) above normal, 4), normal, 5) below normal, 6) dry, and 7) critical. The very wet periods are indicated by a z-statistic > 1.5 and occur in 1982 WY, 2011 WY and 2017 WY. The critical water year is indicated by a z-statistic – 1.5 and occurs when total accumulated precipitation is less than 14 inches. During the 2019 WY, total accumulated precipitation measured at SNOTEL 508: Hagan's Meadow, CA was 39.2 inches. Table 1-2 shows the z-statistics, the calculated precipitation range for each water year type, and the number of each water year type (Count) occurring over the period of record (1979 – 2019) for this station. Figure 1-5 shows a graphical representation of this record.

WY Type	z (upper)	Precipitation (in) (1979-2017)		Count (1979 -2019)
		>	≤	
Very Wet	> 1.5	49	-	3
Wet	1.5	43	49	4
Above Normal	1	37	43	5
Normal	0.5	26	37	13
Below Normal	-0.5	20	26	12
Dry	-1.0	14	20	4
Critical	-1.5	0	14	0

Table 1-2. Classification system for Water Year (WY) Type based on observed WY accumulated precipitation at SNOTEL 508: Hagan's Meadows, CA. Upper bound of z-statistic and ranges in precipitation (inches) (Adapted from Carroll *et al.,* 2016b).

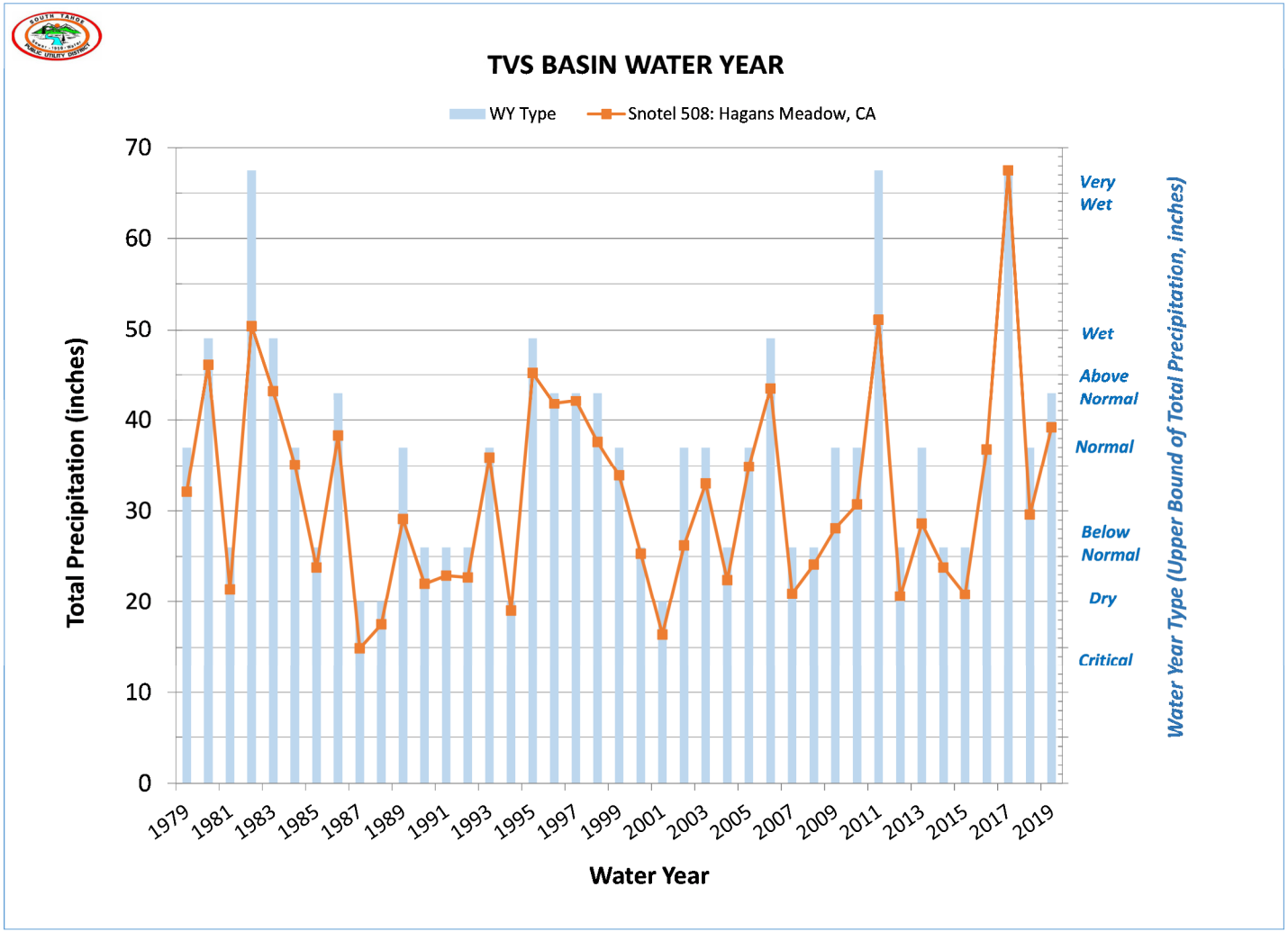

Figure 1-5. The annual accumulated precipitation measured at SNOTEL 508: Hagan's Meadow, CA and water year type indicated on the vertical axis along the right-side of the graph. Precipitation ranges for each water year type are listed in Table 1-2.

2 Groundwater Conditions

The following section presents data collected by the District and derived from numeric groundwater models to show the current state of the TVS Basin. Hydrographs showing groundwater elevation trends across the TVS Basin are provided in Appendix A.

2.1 South Tahoe Groundwater Model

The South Tahoe Groundwater Model was developed by DRI for the TVS Basin and its surrounding watersheds to prepare a water budget, perform complex hydrologic analyses, and inform BMOs specified in the 2014 GMP (Carroll, *et al.*, 2016a). The South Tahoe Groundwater Model quantifies basin conditions using the U.S. Geological Survey (USGS) MODFLOW-NWT (Niswonger *et al.,* 2011) software. MODFLOW-NWT is the latest installment of the USGS modular program and relies on the Newton solution method and an unstructured, asymmetric matrix solver to calculate groundwater head. MODFLOW-NWT is specifically designed to work with the upstream weighted package to solve complex, unconfined groundwater flow simulations to maintain numerical stability during the wetting and drying of model cells.

The model grid for the South Tahoe Groundwater Model is oriented north-south and contains 342 rows and 251 columns. Horizontal cell size is 100 meters (328 feet) and is based on the need to capture steep topography, narrow canyons and potentially steep hydrologic gradients, which are present in the model area (Figure 2-1). The model is subdivided into four subsurface layers to maintain reasonable computation time. Layers are determined based on production well screen intervals. Land surface elevations are based on 30 meter (98 ft) Digital Elevation Model aggregated to a 100 meter (328 ft) resolution. Layer thicknesses are 40 meters (131 ft) for layer 1 and layer 2, and 100 meters (328 ft) for layer 3. The layer 4 bottom elevation is set to a constant 1,600 meters (5,248 ft) to produce variable thickness ranging from approximately 114 meters (274 ft) along the northern boundary with Lake Tahoe to 1,300 meters (4,264 ft) at watershed divides.

The South Tahoe Groundwater Model simulates two distinct time periods. The first represents steady-state conditions prior to any significant groundwater production in the basin. Hydraulic conductivity was calibrated using the steady-state model configuration. The transient model simulates the period 1983-2019 to calculate changes in groundwater levels and flux due to variations in precipitation and groundwater extractions.

The South Tahoe Groundwater Model is constructed in a manner that allows reporting of the annual flow budget for both the model domain and the TVS Basin. The model domain covers an area of approximately 156 square miles (99,907 acres) which includes the TVS Basin and the seven surrounding watersheds (Figure 2-1). The TVS Basin covers an area of 23 square miles (14,814 acres) confined to the

valley floor area designated by DWR as the extent of the groundwater basin. In this report, groundwater recharge, storage and cumulative change in storage are reported on an annual WY basis for both the model domain and the TVS Basin.

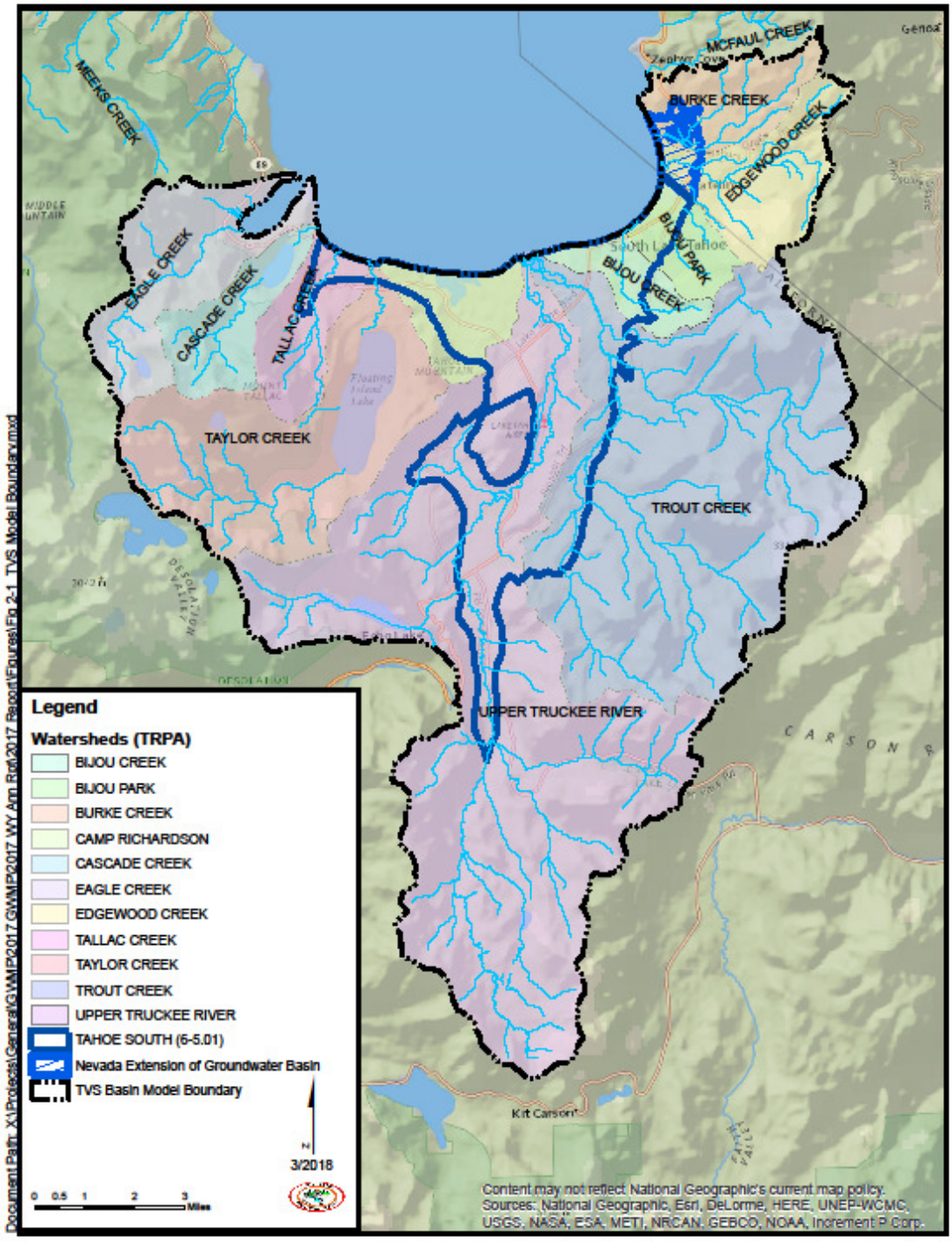

Figure 2-1. The model domain for the TVS Basin encompasses the TVS Basin, as well as the surrounding watersheds contributing recharge to the basin.

2.2 Groundwater Recharge

Recharge for the TVS Basin was extracted from the transient model of the South Tahoe Groundwater Model. Figure 2-2 shows annual groundwater recharge over the simulation period of the transient model (1983 WY- 2019 WY). During the 2019 WY, the groundwater recharge for the model domain is 53,935 AF. The groundwater recharge for the TVS Basin is 7,123 AF. This is about 136% of the average groundwater recharge to the TVS Basin (5,241 AF) over the simulation period of the transient model (1983 WY through 2019 WY).

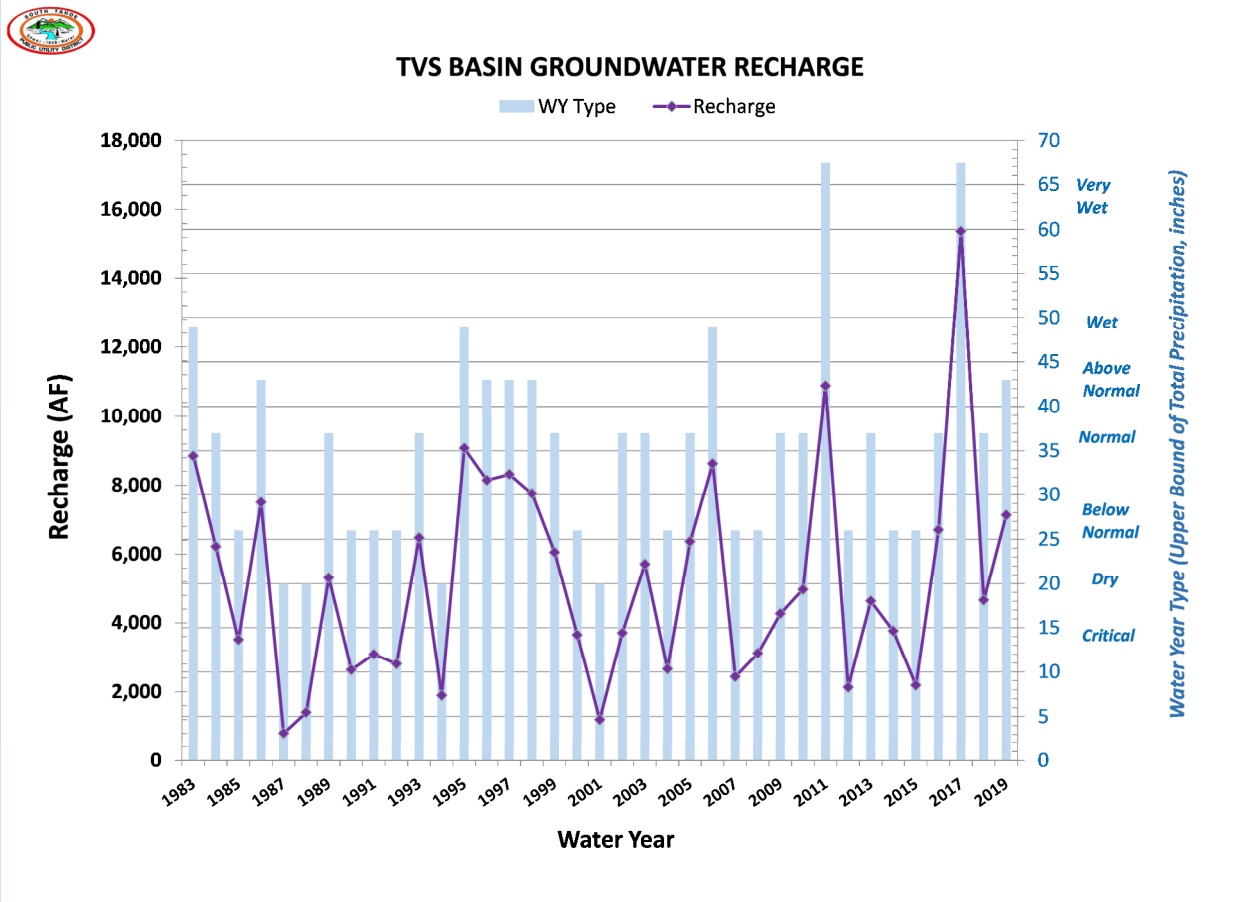

Figure 2-2. Model recharge (AFY) for the TVS Basin (1983 WY – 2019 WY). Water year type using the TVS Basin classification from total precipitation measured at SNOTEL 508 Hagan's Meadow, CA is indicated on the secondary vertical axis on the far right-side of the graph.

2.3 Groundwater Level Monitoring

The District is the designated monitoring entity for the TVS Basin under the CASGEM program. As such, groundwater level elevation monitoring data is reported semi-annually to DWR through the CASGEM online reporting system. These data were reported to DWR in November 2018 and May 2019 for the 2019 WY.

Groundwater levels are regularly measured in forty-seven (47) wells located throughout the TVS Basin. The District well network includes thirty (30) observation wells and seventeen (17) PWS wells (Figure 2-3). The majority of the PWS wells (13 of 17) are actively used for drinking water supply. Two of these wells are on stand-by status, used only for emergency purposes. Another two of these wells are off-line and currently used as observation wells. The observation wells include monitoring wells, sentinel wells and test wells, as well as former drinking water supply wells that have been removed from service and are no longer connected to the District's water distribution system. Only the observation wells are used for reporting to the CASGEM program.

Construction details for selected wells for which hydrographs are provided (Appendix A) are set forth in Table 2-1. The sub-areas, shown in Table 2-1, are informal designations using the geographically-based designations (Christmas Valley, Meyers, Angora, South Lake Tahoe, Tahoe Keys and Bijou) shown in Figure 1-2. The Christmas Valley sub-area is in the southernmost portion of the TVS Basin, south of Lake Valley and US Route 50. The Meyers sub-area is located in the southern portion of Lake Valley from US Route 50 north to Twin Peaks. The Angora sub-area is located in the northern portion of Lake Valley west of Twin Peaks. The South Lake Tahoe sub-area is located north of Lake Valley. The Tahoe Keys sub-area is located at the north end of the TVS Basin, west of the South Lake Tahoe sub-area; while the Bijou sub-area is located east of the South Lake Tahoe sub-area.

Basin monitoring generally involves the collection, compilation and evaluation of groundwater level, groundwater quality, groundwater production and climate data from numerous sources for the TVS Basin. A detailed description of the groundwater monitoring conducted in the TVS Basin is provided in Section 9.0 of the 2014 GMP. As part of the groundwater level monitoring effort, the District uses both hand and continuous readings to monitor groundwater elevation trends across the TVS Basin. Hand readings are collected from each of the TVS Basin groundwater elevation monitoring wells in the fall and spring of each water year. Hand readings from active PWS wells are collected a minimum of 12 hours after well pumps are turned-off for static water level measurements. A smaller number of observation wells (13) are fitted with dedicated water-level monitoring equipment. The data loggers are programmed to collect pressure head and temperature readings at 6:00 AM and 6:00 PM on a daily basis to provide a continuous record of groundwater levels in the TVS Basin.

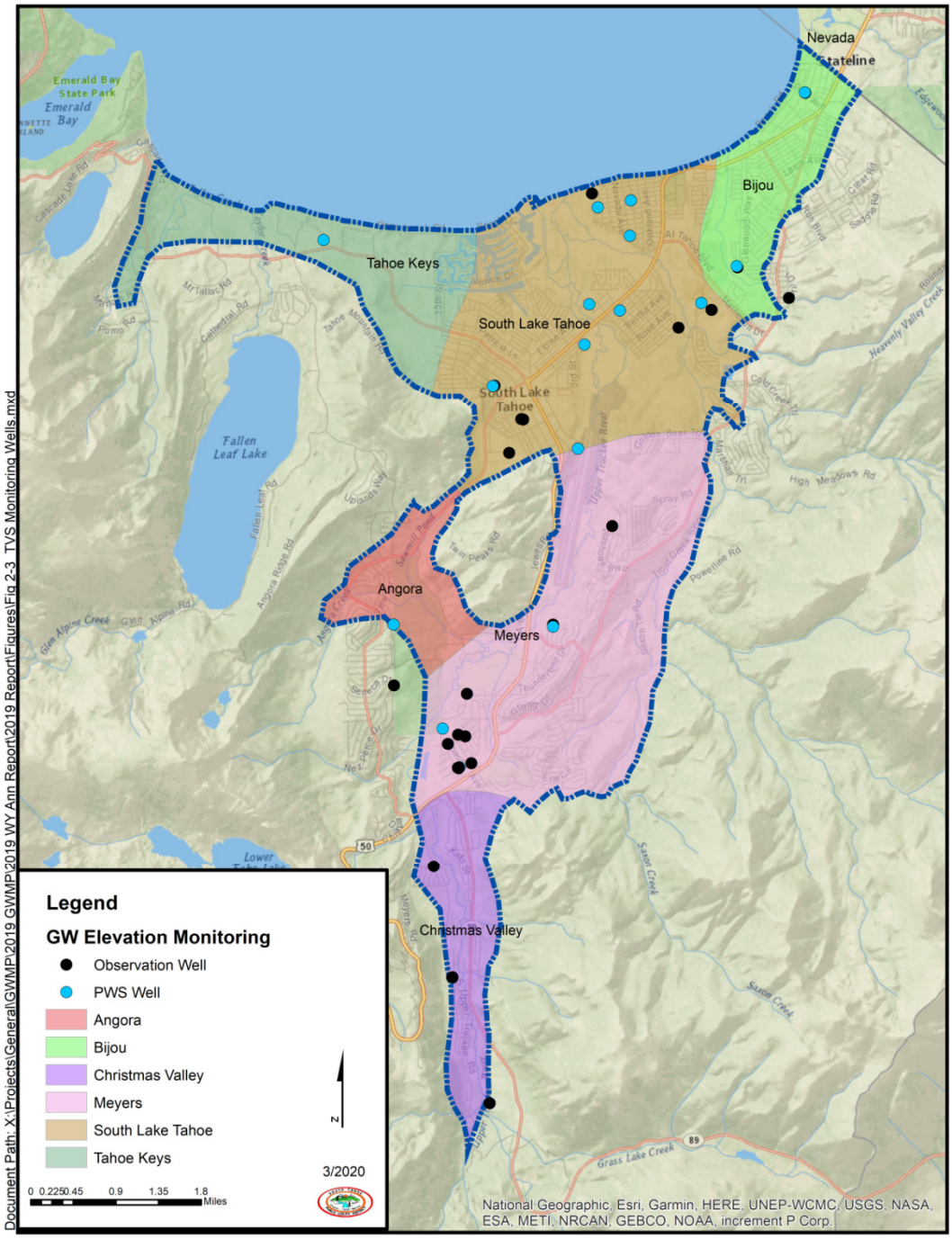

Figure 2-3. Locations of wells used for monitoring changes in groundwater elevation within the TVS Basin.

Well	Sub-Area	Reference Point Elevation (ft msl)	Top of Screen Depth (ft bgs)	Bottom of Screen Depth (ft bgs)
Mountain View	Angora	6313.14	95	164
Blackrock Well #1	Bijou	6242.72	168	180
Glenwood Well #3	Bijou	6261.68	112	192
Henderson OW	Christmas Valley	6369.78	79	100
			142	205
Bakersfield	Meyers	6310.50	130	170
			180	240
Elks Club Well #1	Meyers	6284.63	110	142
Washoan OW	Meyers	6307.84	102	144
			165	186
			207	228
			249	270
CL-1	South Lake Tahoe	6278.37	104	114
CL-3	South Lake Tahoe	6278.49	39	49
Paloma	South Lake Tahoe	6267.10	188	248
			268	408
Sunset	South Lake Tahoe	6249.00	275	430
Martin OW	South Lake Tahoe	6262.42	95	115
			125	145
			160	180
			200	240
USGS TCF-1-1	South Lake Tahoe	6296.48	325	340
USGS TCF-1-2	South Lake Tahoe	6296.47	245	260
USGS TCF-1-3	South Lake Tahoe	6296.65	158	163
USGS TCF-1-4	South Lake Tahoe	6296.63	130	140
USGS TCF-1-5	South Lake Tahoe	6296.63	88	98
Lily OW	South Lake Tahoe	6236.08	35	37.5
Valhalla	Tahoe Keys	6256.50	110	170

NOTES:
feet msl: Elevation in feet above mean sea level (NAVD88).
ft bgs: Depth in feet below ground surface.

Table 2-1. Screen intervals for selected groundwater elevation wells within the TVS Basin. Hydrographs for these wells showing groundwater level trends within each sub-area are provided in Appendix A.

2.4 Groundwater Levels

Hydrographs of continuous groundwater elevation readings collected from four observation wells across the TVS Basin are provided below in Figure 2-4. The Henderson Observation Well (OW) is located near the south end of the TVS Basin at the north end of the Christmas Valley sub-area. The Washoan OW is located near the center of the TVS Basin, within the north half of the Meyers sub-area. The Martin OW and Lily OW are both located at the north end of the TVS Basin, within the South Lake Tahoe sub-area. The Martin OW is located near the east margin of the TVS Basin within the south half of the sub-area; and the Lily OW is located near the south shore of Lake Tahoe within the north half of the sub-area.

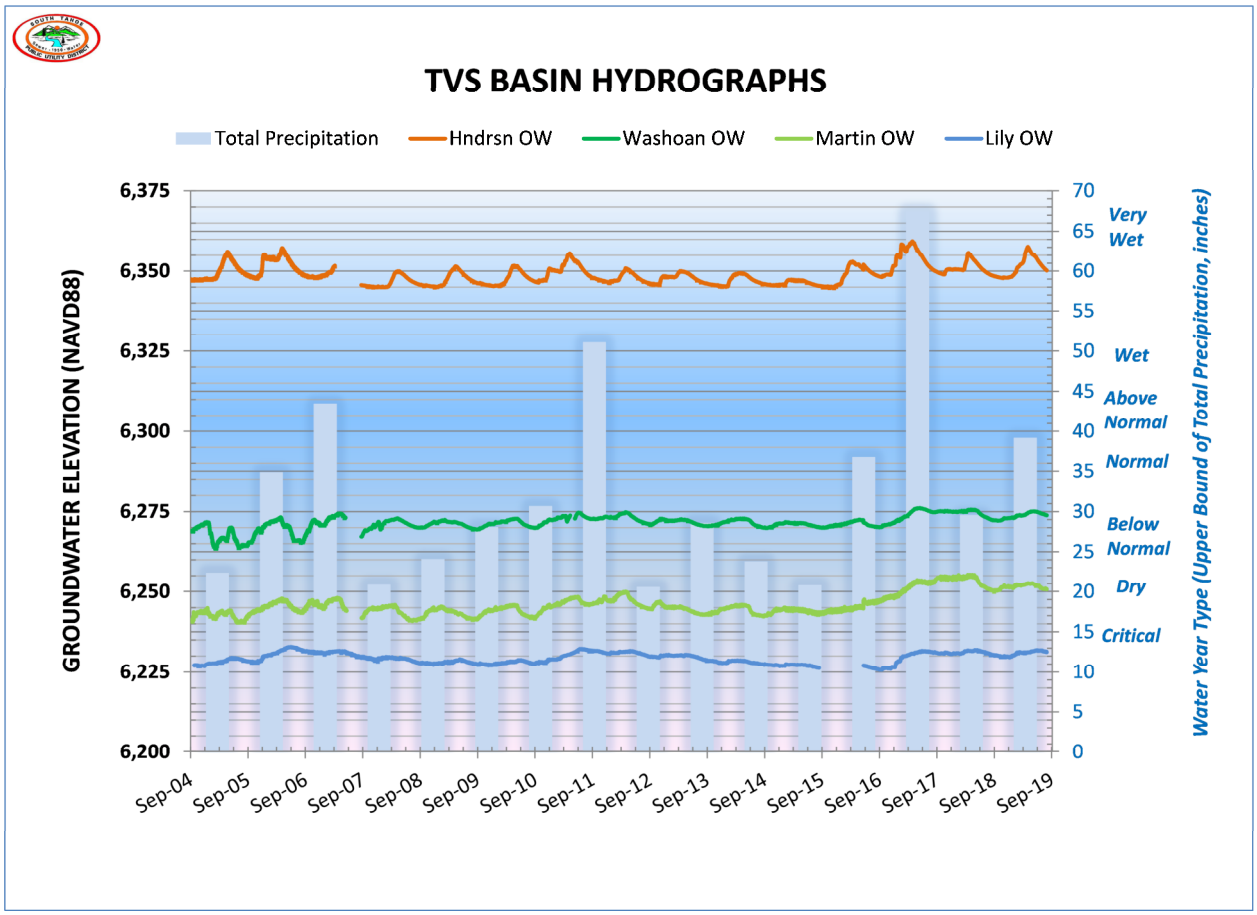

Figure 2-4. Continuous groundwater level readings collected from selected wells distributed across the TVS Basin.

Over the period of record (2005 WY – 2019 WY), the continuous readings show that groundwater elevations have been relatively stable. During this period, there were five below normal water years; six normal water years; one above normal water year; one wet water year; and two very wet water years (*see* Figure 1-5). Regular fluctuations representing seasonal changes in groundwater elevations are most

pronounced in the Henderson OW. This may be due to its remote location, away from the pumping influence of neighboring wells and away from the groundwater elevation influence of Lake Tahoe. Groundwater elevations tend to rise during the winter storm season when precipitation exceeds evaporation, plant transpiration (evapotranspiration) is at its lowest and groundwater production is at or near seasonal low water demands. As a result, seasonal high groundwater levels typically occur between early-April through mid-June. Groundwater levels then tend to decline during the summer and into the fall, when evapotranspiration exceeds precipitation and groundwater production is at or near seasonal high water demands. Seasonal low groundwater elevations typically occur at the end of this seasonal cycle from between mid-July through mid-November.

Groundwater elevations within the TVS Basin declined from between the 2012 WY through 2015 WY and then recovered during the 2016 WY (normal) and 2017 WY (very wet). Groundwater elevations during the 2018 WY (normal) declined compared to 2017 WY levels. During the 2019 WY (above normal), groundwater elevations increased slightly compared to 2018 WY levels. The magnitude of these changes is relatively minor and ascertained by comparing inter-annual changes in seasonal high groundwater levels (May readings) measured from all of the groundwater elevation monitoring wells.

2.4.1 Basin Condition (Groundwater Levels)

Hand readings collected from the groundwater elevation monitoring wells in May of each water year are compared to hand readings collected during a 10-year period (2001 WY- 2010 WY) prior to the 2012 WY through 2015 WY. A statewide drought emergency was declared in California during a 5-year event spanning water years 2012 through 2016, referred to as the 2012-2016 Event (https://water.ca.gov/Water-Basics/Drought).

The purpose of this analysis is to gage the current condition of groundwater levels compared to the 2001 WY- 2010 WY base period for groundwater levels selected for the TVS Basin. This base period was selected as groundwater level data for the groundwater elevation monitoring wells are relatively complete and was collected prior to the 2012-2016 Event. During the base period accumulated precipitation measured at SNOTEL 508: Hagan's Meadow, CA averaged 29.3 inches, which is within the normal range of precipitation for the TVS Basin. During the base period for groundwater levels there were: one dry water year; three below normal water years; five normal water years; and one wet water year (see Figure 1-5).

Hand readings collected during the May 2019 WY were used to define current basin conditions as being either normal, above normal, or below normal with respect to the record of groundwater levels collected during the base period (2001 WY – 2010 WY). The percentile rank of the groundwater elevation measured during the May 2019 monitoring event at each well was determined for more than thirty (30) of the groundwater elevation monitoring wells using the record of hand readings collected for that well during the base period. The percentile rank of the May 2019 groundwater elevation for each

well was then plotted on a cumulative frequency diagram to show the current state of the TVS Basin in terms of groundwater levels (Figure 2-5).

Figure 2-5 shows the distribution of groundwater elevations measured during the May 2015, May 2016, May 2017, May 2018 and May 2019 monitoring events using their respective percentile ranks within the record of groundwater levels measured for the same wells during the base period. The 2015 WY was a below normal water year near the end of the 2012-2016 Event. During 2015 WY, the median for the May 2015 groundwater elevations was in the middle of the normal range (52%) of the base period elevations and seven wells had below normal groundwater elevations. During 2016 WY, the median for the May 2016 groundwater elevations was at the lower end of the above normal range (86%) of the base period elevations and only one well had below normal groundwater elevations. This well (Seneca Observation Well) is located outside the west boundary of the TVS Basin. During 2017 WY, the median for the May 2017 groundwater elevations was at the higher end of the above normal range (97%) of the base period elevations and all wells were in the above normal range, with the exception of the Sunset Well (48%) which was within the normal range. During the 2018 WY, the median for the May 2018 groundwater elevations was near the center of the above normal range (93%) of the base period elevations with six wells in the normal and thirty-one wells in the above normal range. Groundwater elevations in the Sunset Well further declined compared to the base period elevations to near the bottom of the normal range (28%). During the 2019 WY, the median for the May 2019 groundwater elevations was near the center of the above normal range (93%) of the base period elevations with one well in the normal and thirty-six wells in the above normal range. Groundwater elevations in the Sunset Well increased during the 2019 WY compared to the base period elevations to near the middle of the normal range (48%).

Between May 2011 and May 2015, the difference in groundwater elevations decreased an average of 3.98 feet. Between May 2015 and May 2016, the difference in groundwater elevations increased an average of 2.21 feet; and between May 2016 and May 2017, the difference in groundwater elevations increased 4.70 feet. Using these averages, groundwater levels across the TVS Basin appear to have fully recovered from the total decline in groundwater levels that occurred during the2012-2016 event. Between May 2017 and May 2018, the difference in groundwater elevations decreased an average of -1.89 feet. Between May 2018 and May 2019, the difference in groundwater elevations increased slightly by an average of 0.04 feet.

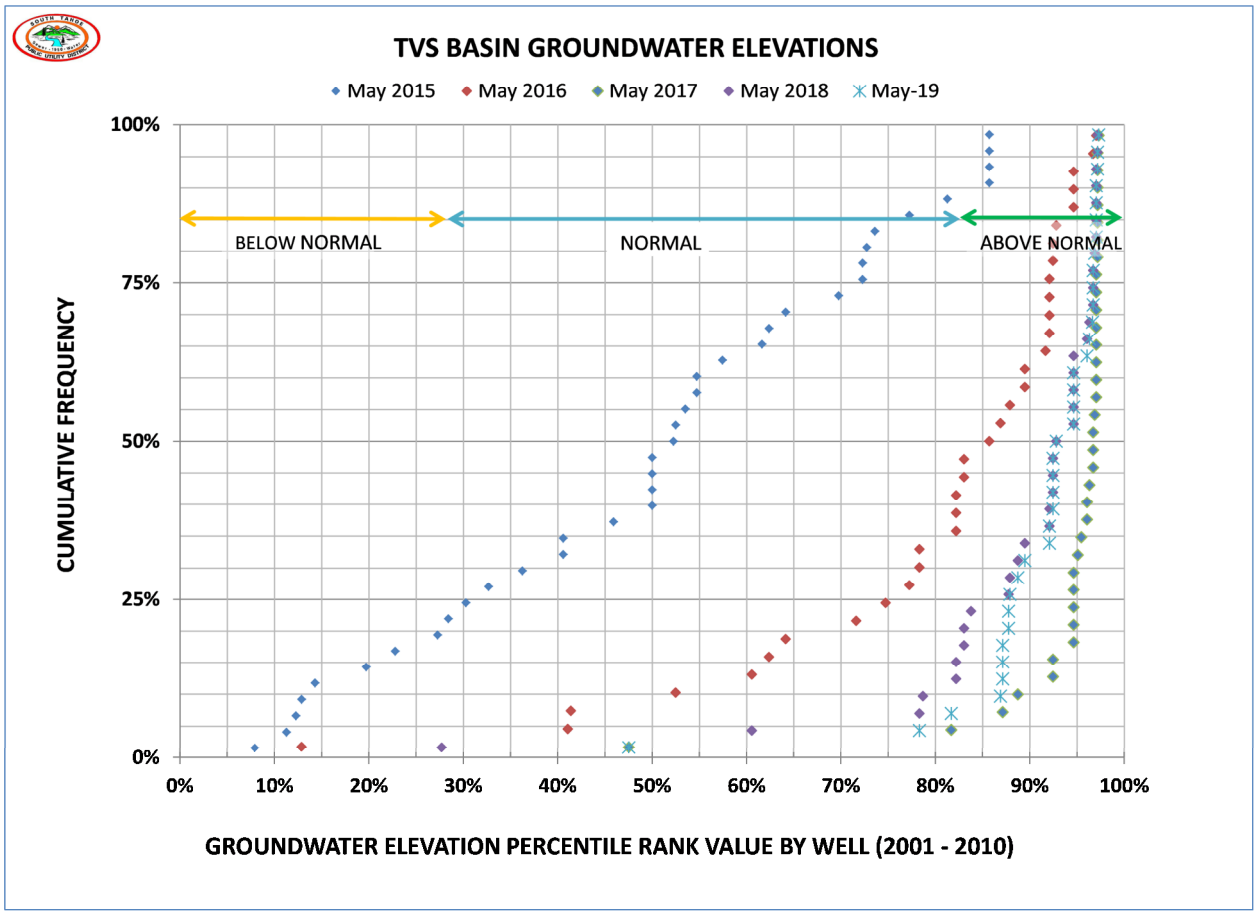

Figure 2-5. Hand readings collected during the May groundwater elevation monitoring event for the 2015 WY through 2019 WY compared to the record of hand readings for the same wells collected during the 2001 WY through 2010 WY base period for groundwater levels.

2.4.2 Groundwater Elevation Contours

Isocontours of groundwater elevations for October 2018 and May 2019 are presented in Figure 2-6 and represent seasonal low and seasonal high groundwater elevation conditions. The typical pattern is for seasonal low groundwater conditions to occur in the late summer and early fall due to low recharge following the relatively dry summer months and increased groundwater pumping to meet high water demands. Seasonal high groundwater conditions typically occur in the spring following the spring snowmelt and runoff and lower groundwater pumping needed to meet low water demands.

The groundwater model for the TVS Basin simulates the period 1983-2019 to calculate changes in groundwater levels and flux due to variations in precipitation and groundwater extractions. Model simulated groundwater levels were used to generate the groundwater elevation contours presented in

Figure 2-6. These contours are considered appropriate to illustrate the general pattern of groundwater flow in the TVS Basin.

Comparison of contours shows that the generalized pattern of groundwater flow remains similar between October 2018 and May 2019. This is consistent with the hydrograph data (Appendix A) that shows the typical variation in groundwater levels is on the order of only a few feet. In most of the TVS Basin, the May 2019 water level contours progress northward indicating a general rise of groundwater levels compared to October 2018 groundwater levels. Inspection of Figure 2-6 shows that rising groundwater levels reduced the extent of a local groundwater depression defined by the 6227 contour along the north margin of the TVS Basin, within the South Lake Tahoe sub-area. Within this contour, the general direction of groundwater flow may locally reverse, with a component of groundwater flow moving south from Lake Tahoe toward the depression. Outside the 6227 contour, groundwater flow through the South Lake Tahoe sub-area is generally directed northward from the TVS Basin toward Lake Tahoe.

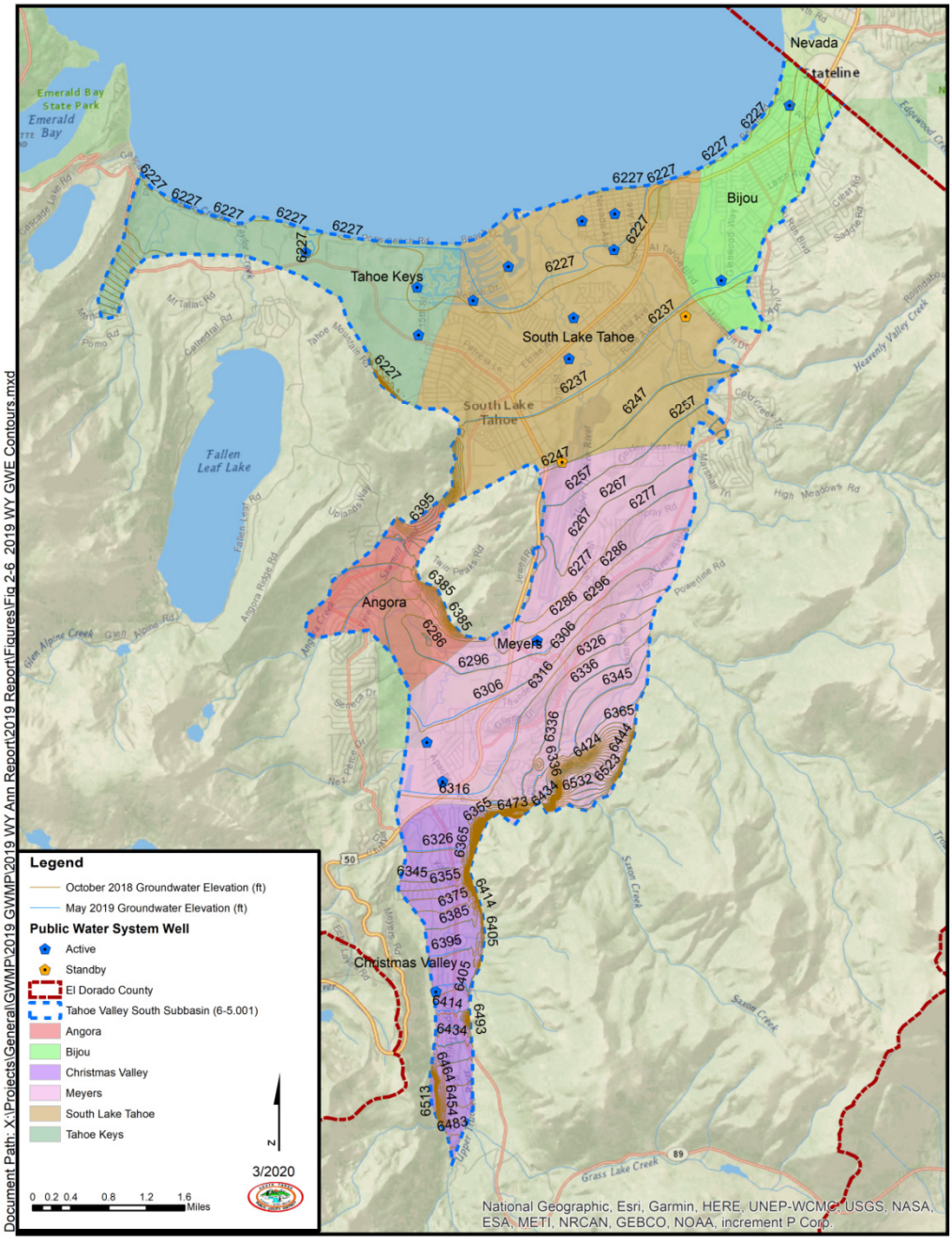

Figure 2-6. Model simulated groundwater elevations (upper 300 ft) for the TVS Basin, representing seasonal low (October 2018) and seasonal high (May 2019) groundwater conditions. Contour interval is 10 ft.

2.5 Groundwater Quality

Groundwater in the TVS Basin is typically of excellent quality; however, there is a history of groundwater contamination from regulated industrial and commercial chemicals impairing drinking water sources within the basin. Over the past ten years, arsenic, iron, and radionuclides (uranium) have been found in both PWS wells and private wells at concentrations exceeding primary or secondary maximum contaminant levels (MCLs) (Pohll *et al.,* 2016). Well head treatment is presently used to remove arsenic from groundwater produced at one active PWS well (Arrowhead Well No. 3). Two other PWS wells are currently on stand-by status due to concentrations of arsenic (Airport Well) and uranium (College Well) in groundwater above MCLs.

Man-made contaminants which have occurred in the TVS Basin include petroleum hydrocarbon and chlorinated hydrocarbon compounds. Of these, the two most prominent constituents of concern (COC) are Methyl tert-Butyl Ether (MtBE) and PCE. Well head treatment (Granular Activated Carbon) is presently used to remove PCE from groundwater at one active PWS well (TKWC #2) within the South Lake Tahoe sub-area. A second wellhead treatment system (Packed Tower Air Stripper) is also used for the removal of PCE from groundwater, within this same sub-area at the Clement Well, which is presently inactive. Chlorinated hydrocarbons have been detected in private and municipal supply wells within this area since 1989, when these compounds were first required to be tested in raw water samples collected from regulated drinking water sources.

During the 2019 WY, MtBE was not detected in any groundwater samples collected from District drinking water wells. Trace levels of PCE was detected in one sample collected from the District's Clement Well. The level of PCE detected in this sample was below the minimum reporting level (<0.5 ppb). PCE was not detected in groundwater samples collected from the LBWC #1 well. Trace levels of several volatile organic contaminants (VOCs) including disinfection by-products (i.e., bromodichloromethane, bromoform and chlorodibromomethane); contaminants with notification levels (i.e, methyl isobutyl ketone, and naphthalene); and other VOCs (i.e., cis-1,3-Dichloropropene and trans-1,3-Dichloropropene) were detected below minimum reporting levels in groundwater samples collected from the District's Bayview, Blackrock No.2, Clement, Paloma and Sunset wells.

In March 2019 the Lahontan Regional Water Quality Control Board (LRWQCB) was awarded a $4.6 million grant under the Site Cleanup Program to investigate the South Y Plume (Figure 2-7). The South Y Plume is believed to have resulted from spills and releases associated with the use of commercial grade dry cleaning solvents in the South Y Area during the mid to late 1970's. During 2019, the LRWQCB undertook a regional plume characterization that involved the drilling and sampling of sixty-four (64) borings to determine the lateral and vertical extent of PCE contamination; identify contaminant pathways; and using detailed graphics show the current distribution of PCE in groundwater.

Review of preliminary data collected during the regional plume characterization shows that the South Y Plume extends more than 5,300 feet north from the South Y towards the south shore of Lake Tahoe.

Within this plume, PCE concentrations above maximum contaminant levels (5 ppb) were detected in groundwater samples collected from subsurface depths to 185 feet below ground surface. PCE concentrations in groundwater samples collected from within the plume ranged from below 0.5 ppb to greater than 500 ppb. Isoconcentration maps showing the distribution of PCE within the upper 100 feet of the plume show a broad area of PCE groundwater contamination greater than 50 ppb extending from the south end of the plume (near inferred source areas) to the north end of the South Y Plume (near the leading edge of the plume front).

Regulatory activities and environmental data for the South Y Regional Contamination investigation (T10000007984) are available online through the SWRCB GeoTracker website at;

https://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T10000007984

The South Y Plume has impaired three PWS wells (LBWC #2, LBWC #5 and TKWC #2) with a combined source capacity of 3.25 MGD. Potential impairment of TKWC #1 would further reduce the total production capacity of area drinking water sources by an additional 1.44 MGD. Two other PWS wells (LBWC #1 and TKWC #3) west of the South Y Plume are presently non-detect for PCE. The District has mutual aid and assistance agreements for the emergency provision of drinking water using inter-tie connections from its water distribution system to both the LBWC and TKWC water systems. During the 2019 WY, the District provided 2.79 million gallons of drinking water to LBWC through its inter-tie connection, which is about 3% of LBWC's total water production for the 2019 WY.

A file review of District and El Dorado County records indicated that as many as 24 private wells and 14 small community water system wells may be located within or in close proximity to the South Y Plume (KJ, 2019). A majority of these wells are relatively shallow, constructed to total depths of less than 100 feet and are believed to be susceptible to water quality impairment from this plume.

Groundwater management actions taken to mitigate the South Y Plume are described in Sections 3.7 of this report.

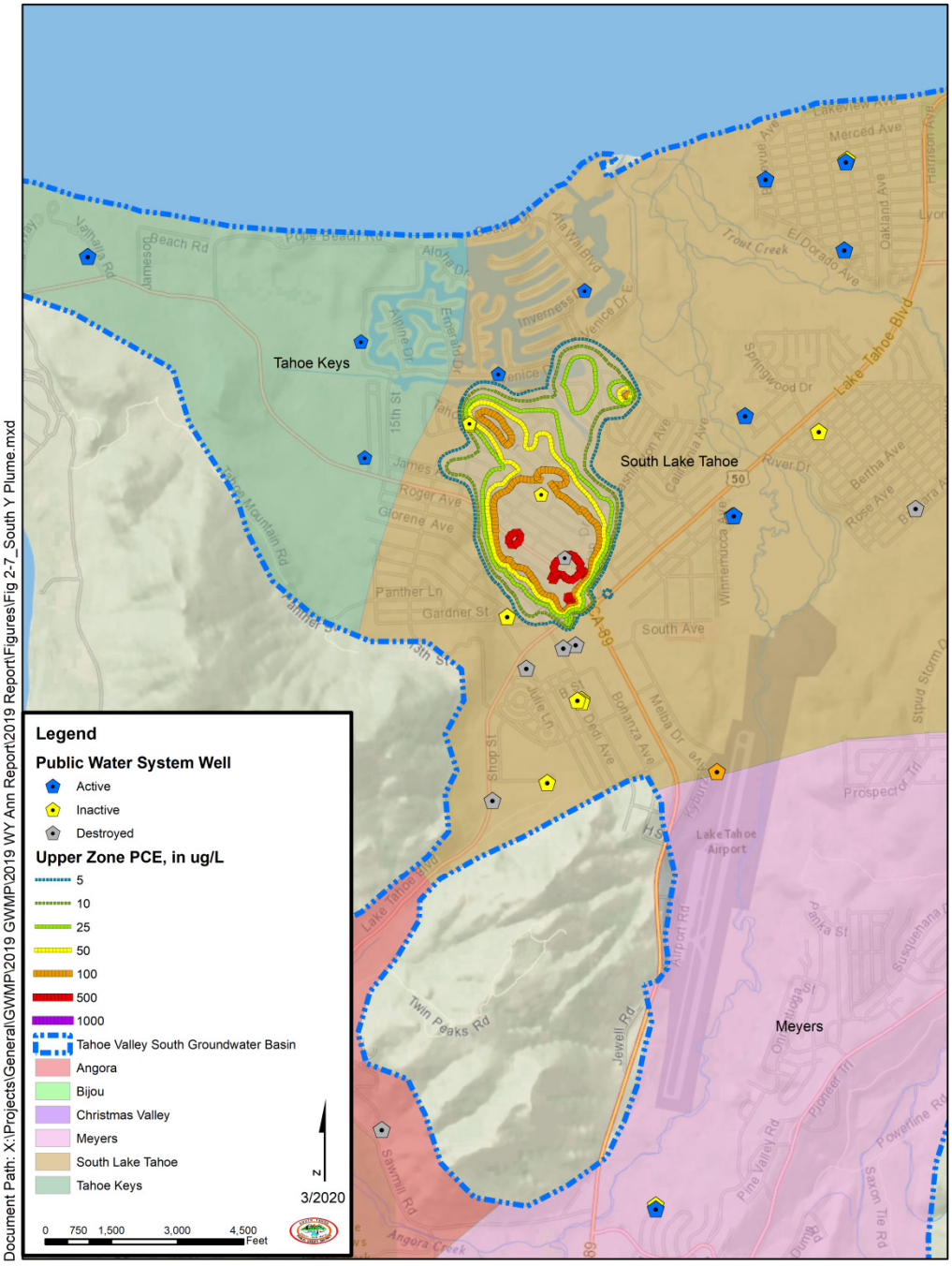

Figure 2-7. Location of the South Y Plume within the TVS Basin, as defined by PCE in groundwater detected above 5 micrograms per liter in the upper zone (preliminary data provided by LRWQCB).

High reliance on groundwater requires that PWS wells must have sufficient source capacity to meet water system demands within the TVS Basin. Because of this reliance and susceptibility of groundwater sources to contamination, the total source capacity of active PWS wells is used as an indicator to describe current basin conditions with respect to groundwater quality (Pohll *et al.,* 2016). During the 2019 WY, the total source capacity of PWS wells operating within the TVS Basin is estimated at 28.76 MGD. The minimum threshold for groundwater quality within the TVS Basin is the total MDD requirement for all beneficial users of groundwater within the TVS Basin, estimated at 22.78 MGD (Pohll *et al.,* 2016). As the total source capacity of PWS wells exceeds the MDD requirement for all beneficial users, the impact of the South Y Plume has not reached the level where existing source capacity can no longer satisfy potable water demands. However, the total source capacity of PWS wells has declined by more than 10% compared to 2011 levels (32.4 MGD). The majority of this decline is attributed to degraded water quality impacts from the South Y Plume (see Figure 3-1). At present, the total source capacity of PWS wells exceeds the MDD requirement by 5.98 MGD or about 25% of the MDD.

In 2016, the District in partnership with LBWC and the TKWC undertook renewed investigations to describe the extent of PCE contamination and identify remedial measures that may be used to remove this contamination from groundwater to protect existing groundwater sources used for drinking water supply. This included completion of an engineering assessment of an inactive water supply well (LBWC #4) for use as a potential extraction well (GEI, 2016a); compilation of historical data to show the spatial and temporal distribution of PCE contamination near the South Y GEI, 2016b); and initial development of a modular three-dimensional transport model (MT3DMS) that could be used to evaluate the effectiveness of various remedial alternatives designed to mitigate contamination from the South Y Plume. During 2017, water quality data was collected to better understand the current extent of PCE contamination in PWS wells; the preliminary MT3DMS model (South Y Fate and Transport Model) was completed, and negotiations were initiated with the SWRCB –DFA to conduct a Feasibility Study under a Proposition 1 Groundwater Planning Grant, addressing this groundwater contaminant problem. An agreement with the SWRCB-DFA to conduct the Feasibility Study was executed in 2018. The Feasibility Study included performance of a groundwater investigation (referred to as the PDI) in the mid-section of the South Y Plume. Information from the PDI was used to inform the preliminary engineering design of extraction wells for the removal of PCE from groundwater. As part of the Feasibility Study, water quality data collected during 2018 was used to update the South Y Fate and Transport Model and initial management scenarios were developed for evaluation.

During the 2019 WY, the District continued on-going activities to complete the Feasibility Study. Initial management scenarios were refined to interim remedial alternatives to manage on-going contamination from the South Y Plume. Six interim remedial alternatives were developed and initially screened for effectiveness using the South Y Fate and Transport Model. The alternatives were also reviewed and screened for ease of implementation using input from the water purveyors. Based on this screening three interim remedial alternatives were selected for detailed analysis, including 20-year project life cost analysis, to select a preferred remedy. Technical reports presenting information from the PDI; Baseline Human Health Risk Assessment; and South Y Fate and Transport Modeling were

completed and are posted on the District's website (https://stpud.us). The Feasibility Study Report and accompanying Interim Remedial Action Plan were started and are expected to be completed by June 2020.

In May 2017, the LRWQCB issued a Clean Up and Abatement Order (CAO No. R6T-2017-0022) requiring remediation and additional investigation of PCE groundwater contamination resulting from historic PCE release from the former Lake Tahoe Laundry Works site, located at 1024 Lake Tahoe Boulevard, South Lake Tahoe, CA (Case No. SL0601754315). During the 2018 WY, consultants for the working parties (Seven Springs Limited Partnership and Fox Capital Management Corporation), prepared work plans, planning reports and conducted initial contaminant investigations required in the CAO. During the 2019 WY, the working parties conducted Phase II and Phase III off-site groundwater investigations; Phase 1 (on-site) and Phase 2 (off-site) Preferential Pathway Evaluations; and completed a work plan to conduct an on-site chemical oxidation pilot test. These tasks are summarized in two Investigation Summary Reports issued for this site (EKI, 2019a, 2019b).

A full list of documents describing the regulatory activities performed at this site can be found online through the SWRCB GeoTracker website at;

(https://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL0601754315)

During 2019, the LRWQCB initiated technical meetings with the water purveyors and working parties to discuss recent work completed by all parties involved with the investigation and clean-up of the South Y Plume. South Y PCE Technical meetings were convened in May and September 2019.

2.6 Groundwater Production

Groundwater is the primary source of drinking water throughout the TVS Basin, provided primarily for residential and commercial water uses (see Section 2.6.1). About 92 percent of groundwater produced from the TVS Basin is from PWS wells operated by the District, TKWC and LBWC. The remaining 8 percent of groundwater production is pumped from Noncommunity Water System wells (4%); Domestic wells (3%); and Nontransient Noncommunity Water System and State Small Water System wells (about 1%). Groundwater extractions from the PWS wells are metered using propeller or turbine type flowmeters with a register for total flow and a flow rate indicator. Totalizer readings are recorded on a daily basis by the District and on a monthly basis by TKWC and LBWC. Accuracy of measurement for these flow meters is typically on the order of +/- 2%. Groundwater extractions from Noncommunity Water System, Domestic, Nontransient Noncommunity Water System, and State Small Water System wells are typically not metered.

Table 2-2 shows the monthly and total pumping volumes of groundwater produced by PWS wells during the 2019 WY. During the 2019 WY, a total of seventeen (17) PWS wells were active, of which two were on stand-by status (restricted for emergency use only).

PUBLIC WATER SYSTEM (PWS)	UNITS	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEPT	2019 WY
South Tahoe Public Utility District (District)	AF	418	312	386	351	285	322	293	458	651	791	743	582	5591
Tahoe Keys Water Company (TKWC)	AF	60	18	18	18	15	15	22	98	139	161	161	133	859
Lukins Brothers Water Company (LBWC)	AF	19	19	19	17	17	18	18	27	40	49	49	33	321
TVS BASIN PWS TOTALS		497	349	422	387	316	355	332	583	830	1,001	952	748	6771

Table 2-2. Monthly pumping volumes for PWS wells in the TVS Basin during the 2019 water year, reported in AF.

Annual groundwater production from each of the PWS included in Table 2-2 above is shown below in Figure 2-8. Since the 2005 WY, annual groundwater production from the pumping of PWS wells has ranged from a low of approximately 6,298 AF in 2015 WY to a high of approximately 9,652 AF in 2007 WY, with a median value of 7,729 AF. During the 2019 WY, total groundwater production (6,771 AF)

was about 12% below the median value. Figure 2-9 shows the locations of the active PWS wells and their pumping volumes for the 2019 WY. Slightly more than 70% of the total groundwater used in the TVS Basin is produced from the South Lake Tahoe sub-area.

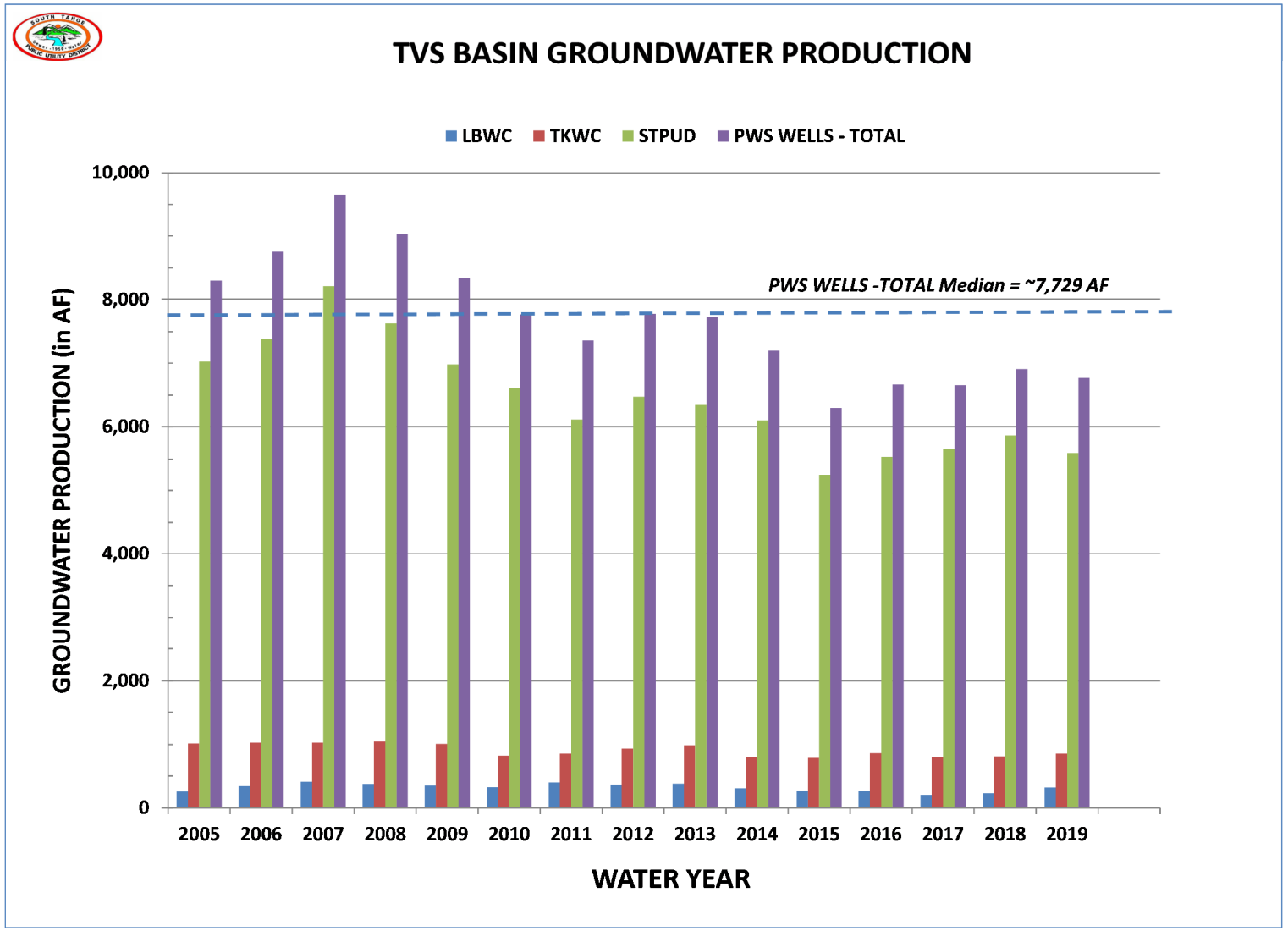

Figure 2-8. Groundwater production trends for public water system wells in the TVS Basin since the 2005 WY, in AF.

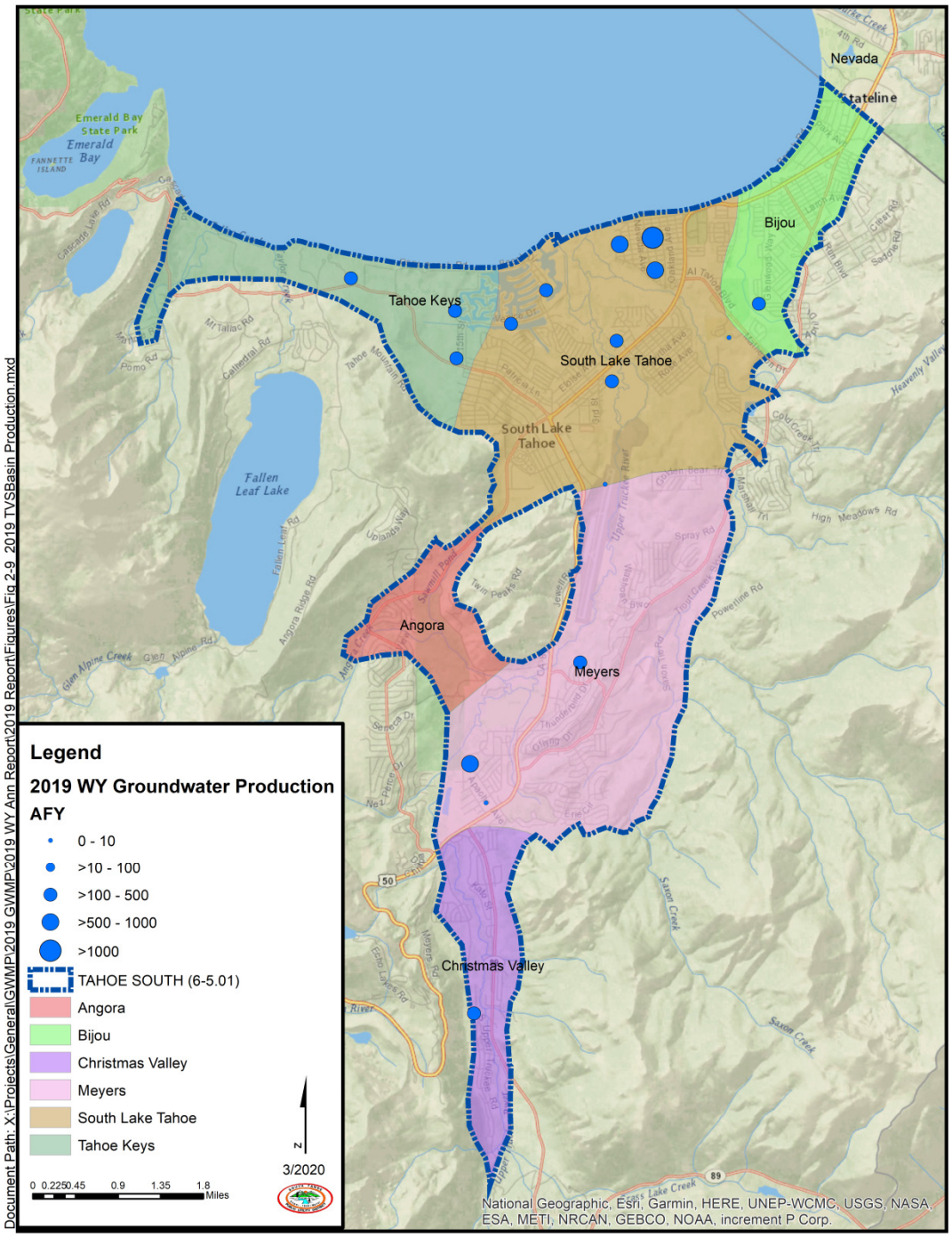

Figure 2-9. Groundwater production from PWS wells during the 2019 WY, in AF. Production from PWS wells accounts for more than 90% of the groundwater extracted from the TVS Basin.

2.6.1 Water Use

Water use information provided in this section is from the District's customer service database. As indicated in Table 2-2, the District produces the majority of drinking water used within the TVS Basin, typically accounting for more than 80% of total groundwater production. Although not complete, information from the District's customer service database is believed to be adequate to show the general pattern of water use within the TVS Basin.

Table 2-3 shows water use by sector from metered data for the District's water system during the 2018 calendar year. The District is in the process of installing meters on all connections and is planned to be fully metered by 2022. The 2018 data captures about 75% of the total number of water accounts in the District's water system. The majority of the District's customers are residential. The District's commercial category includes office and retail, as well as the resorts including hotels, restaurants, and snowmaking. The "Other" category is for water transfers through the District's intertie to the LBWC water system under its Mutual Aid and Assistance Agreement. "Losses" are the non-revenue water system losses reported in the validated water loss audit reports submitted by the District to DWR for 2018, in accordance with regulatory requirements (CWC § 10608.34).

Use Type *(Add additional rows as needed)*	2018 Actual		
	Additional Description *(as needed)*	Level of Treatment When Delivered	Volume, AF
Single Family	RES	Drinking Water	1,946
Multi-Family	MFR	Drinking Water	730
Commercial	COM +MHT	Drinking Water	1,097
Government	GOV	Drinking Water	211
Other	Mutual Aid Transfers	Drinking Water	23
Losses	non-revenue water	Drinking Water	1,335
		TOTAL	**5,342**

Table 2-3. 2018 water use by sector for the District water system, in acre feet. The total volume accounts for about 75% of the Districts total water accounts which were metered in 2018, with the exception of losses which were estimated in accordance with regulatory requirements (CWC § 10608.34).

Because use of recycled water within the Lake Tahoe basin is generally prohibited by the Porter-Cologne Act there is no recycled water use in the TVS Basin.

2.7 Groundwater Storage

The annual change in groundwater storage is the difference in the volume of water in an aquifer from one year to the next. Figure 2-10 shows the annual trends of groundwater extractions from PWS wells and the changes in groundwater storage, as derived from the annual water budget calculated by the TVS Basin Model from 2005 WY through 2019 WY. The main components of the water budget include groundwater recharge; groundwater discharge to streams (baseflow); groundwater flux to Lake Tahoe; and groundwater pumping. Changes in groundwater storage are calculated from the differences in total inflow (recharge) and total outflows (baseflow, flux to Lake Tahoe and groundwater pumping) to the modeled region over a specified period (Carroll, *et al.*, 2016a).

Groundwater storage changes in response to changes in precipitation and groundwater production. During the 2019 WY, the change in groundwater storage for the model domain was +7,199 AF. The change in groundwater storage for the TVS Basin was +838 AF. Figure 2-10 shows that the annual change in groundwater storage for the TVS Basin ranged from -2,870 AF during the 2015 WY (below normal) to +7,725 AF during the 2011 WY (very wet). During water years when the annual change in groundwater storage is negative, groundwater levels decrease slightly. During water years when the annual change in groundwater storage is positive, groundwater levels increase slightly. As the trend in annual groundwater production has generally been stable or slightly declining since 2007, the variation in groundwater storage after 2007 likely reflects annual changes that have occurred in response to changes in total precipitation and groundwater recharge.

Long-term reductions in groundwater storage within the TVS Basin are not occurring. This is evidenced by stable groundwater levels (*see* Section 2.4) and the cumulative change in groundwater storage. Since the 2005 WY, the cumulative change in groundwater storage for the model domain is + 56,692 AF. The cumulative change in groundwater storage for the TVS Basin is +8,720 AF.

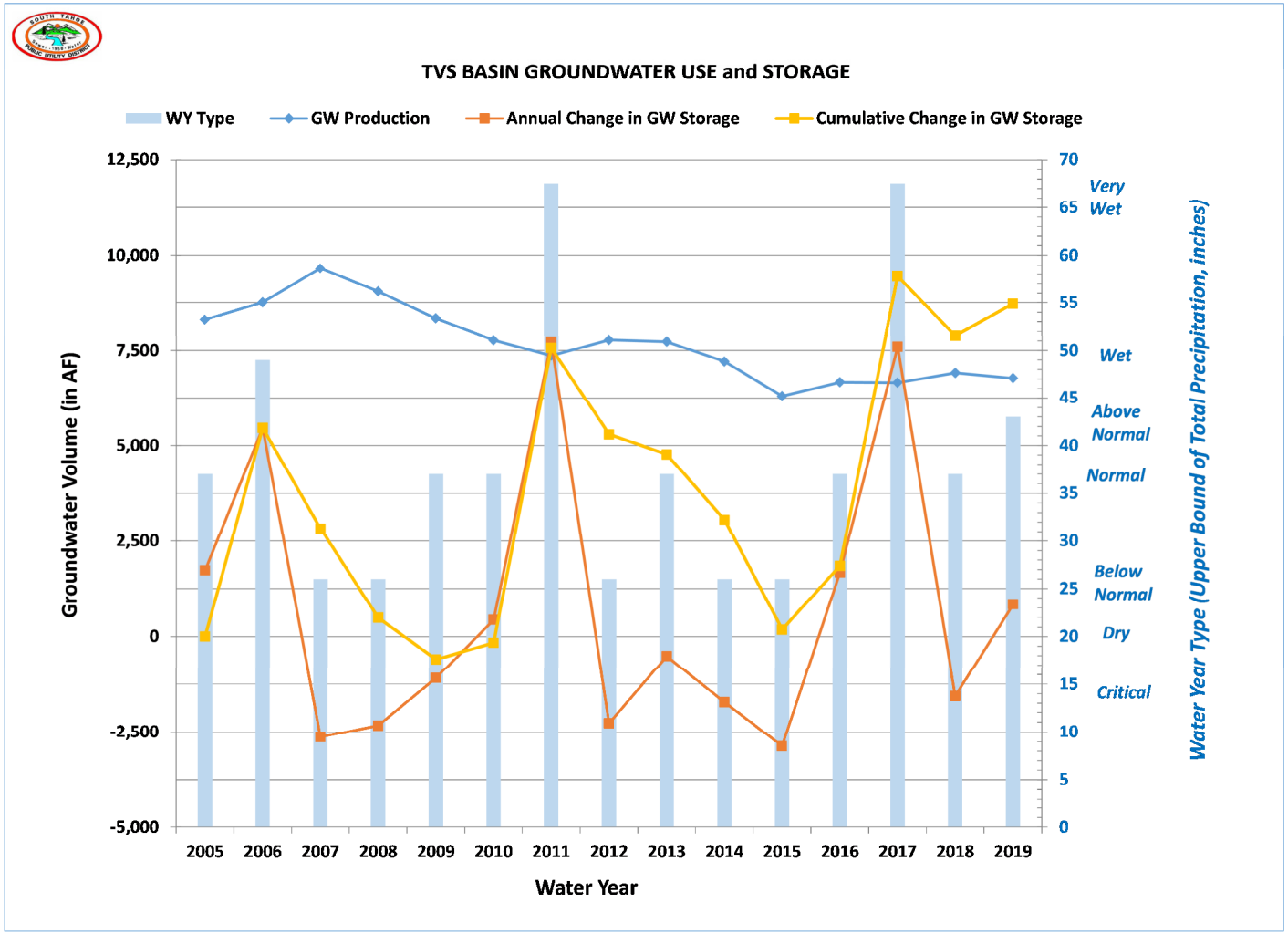

Figure 2-10. Annual groundwater production from public water supply wells and modeled annual and cumulative change in groundwater storage, in AFY, for the TVS Basin (2005 WY through 2019 WY). Water year type using the TVS Basin classification is indicated on the vertical axis along the right-side of the graph. Positive annual changes in groundwater storage indicate periods of rising groundwater level.

3 Basin Management Objectives

BMOs are flexible guidelines for the management of groundwater resources that describe specific actions to be taken by the District to meet locally developed objectives at the basin or sub-area scale. Under the 2014 GMP, eight BMOs have been defined for groundwater management of the TVS Basin.

- BMO #1 – Maintain a sustainable long-term groundwater supply.
- BMO #2 – Maintain and protect groundwater quality.
- BMO #3 – Strengthen collaborative relationships with local water purveyors, governmental agencies, businesses, private property owners and the public.
- BMO #4 – Integrate groundwater quality protection into local land use planning activities.
- BMO #5 – Assess the interaction of water supply activities with environmental conditions.
- BMO #6 – Convene an ongoing Stakeholder's Advisory Group (SAG) as a forum for future groundwater issues.
- BMO #7 – Conduct technical studies to assess future groundwater needs and issues.
- BMO #8 - Identify and obtain funding for groundwater projects.

The following section describes the implementation of projects and management actions taken during the 2019 WY.

3.1 BMO #1- Maintain a Sustainable Supply

The purpose of BMO #1 is to implement measures to manage the groundwater levels for long term sustainability and reliability of the water supply for all users within the TVS Basin. The measurable goal for tracking groundwater levels is to sustain groundwater levels within the normal range of groundwater levels during the base period (2001 WY – 2010 WY) for groundwater levels (Section 2.2.1). If long-term groundwater levels show a consistent declining trend that falls below the normal range, then an assessment of the cause for the decline would be conducted. If excessive groundwater pumping is found to be the cause, then measures would need to be taken to either redistribute the pumping to other portions of the basin, or reduce pumping at the implicated well(s). No action would be required if the condition described above is not observed.

During the 2019 WY, the median for the May 2019 groundwater elevations were near the center of the above normal range (93%) of the base period. Groundwater levels will continue to be monitored in accordance with the District's DWR-approved Groundwater Elevation Monitoring Plan (STPUD, 2011).

3.2 BMO #2 – Maintain and Protect Groundwater Quality

Groundwater in the TVS Basin is typically of excellent quality; however, the South Y Plume remains from past use of commercial grade dry cleaning solvents (PCE) in the South Y Area, which continues to impair groundwater sources (see Section 2.5).

The purpose of BMO #2 is to implement measures to maintain and protect groundwater quality in order to sustain the beneficial use of groundwater resources. These measures would address contamination from man-made contaminants and not natural constituents intrinsic to the aquifer. This would include setting measurable goals and continuing proactive measures to protect groundwater quality. The groundwater quality measurable goals are consistent with existing regulations and policies. These would include:

- All groundwater supply wells will meet drinking water standards as defined by the SWRCB Division of Drinking Water.
- Groundwater quality in the TVS Basin will not be impaired so as to affect its beneficial use of current or potential future use of groundwater for public water supply as defined by the LRWQCB Basin Plan.
- Detection of contaminants from regulated industrial and commercial chemicals in any well within the TVS Basin will be evaluated as to its potential as an emerging groundwater quality threat to the water supply.
- Information on areas of degraded water quality will be collected and maintained in order to consider its effect on available water supply and the development of future groundwater supplies.

The objective of setting quantitative goals for BMO #2 is to provide a means for assessing the relative threat of contamination. The goals are tied to the regulatory requirements, but also make the detection of any man-made contaminant require review and analysis. In this manner, the goals establish a mechanism to be proactive in addressing contamination issues before they reach levels that threaten the beneficial use of groundwater sources within the TVS Basin.

3.2.1 Source Capacity

The measurable goal for BMO #2 is that degraded water quality within the TVS Basin should not rise to a level that threatens the ability of groundwater sources (PWS Wells) to meet water system demands. Demand requirements for public water systems are calculated in accordance with methods described

under Section 64554 of the California Waterworks Standards. Under these standards, a PWS's sources shall have the capacity to meet the system's MDD calculated using water system's daily, monthly or annual water use data, as available. These standards also include a water system's requirements for peak hourly demand; however, these requirements are directed toward the adequacy of the water system's distribution system to provide sufficient flows. As the goal for BMO #2 is to prevent degraded water quality from impairing groundwater sources to a point where water demands can no longer be met and that the PWS wells account for more than 90% of the groundwater use, only the MDD for the PWS wells are used to establish a minimum threshold for degraded water quality in the TVS Basin.

More than 90% of the total water demand is satisfied by the PWS wells operated by the District, TKWC and LBWC. To account for the beneficial users of groundwater not connected to these water systems, a 10 percent safety factor is added to the MDD derived for these water systems to determine the minimum threshold for the TVS Basin. Results of these calculations provide a minimum threshold of 22.775 MGD needed to meet of the MDD for all beneficial users in the TVS Basin.

The current state of the TVS Basin with regard to groundwater quality is indicated below in Figure 3-1. The total production capacity for all active PWS wells operating within the TVS Basin is 28.76 MGD. This exceeds the MDD minimum threshold for water quality by 5.99 MGD. However, total source capacities have declined since 2011 and continue to be of concern if capacity is not replaced. Groundwater management actions taken to mitigate this groundwater concern are described in Sections 3.7 and 3.8.

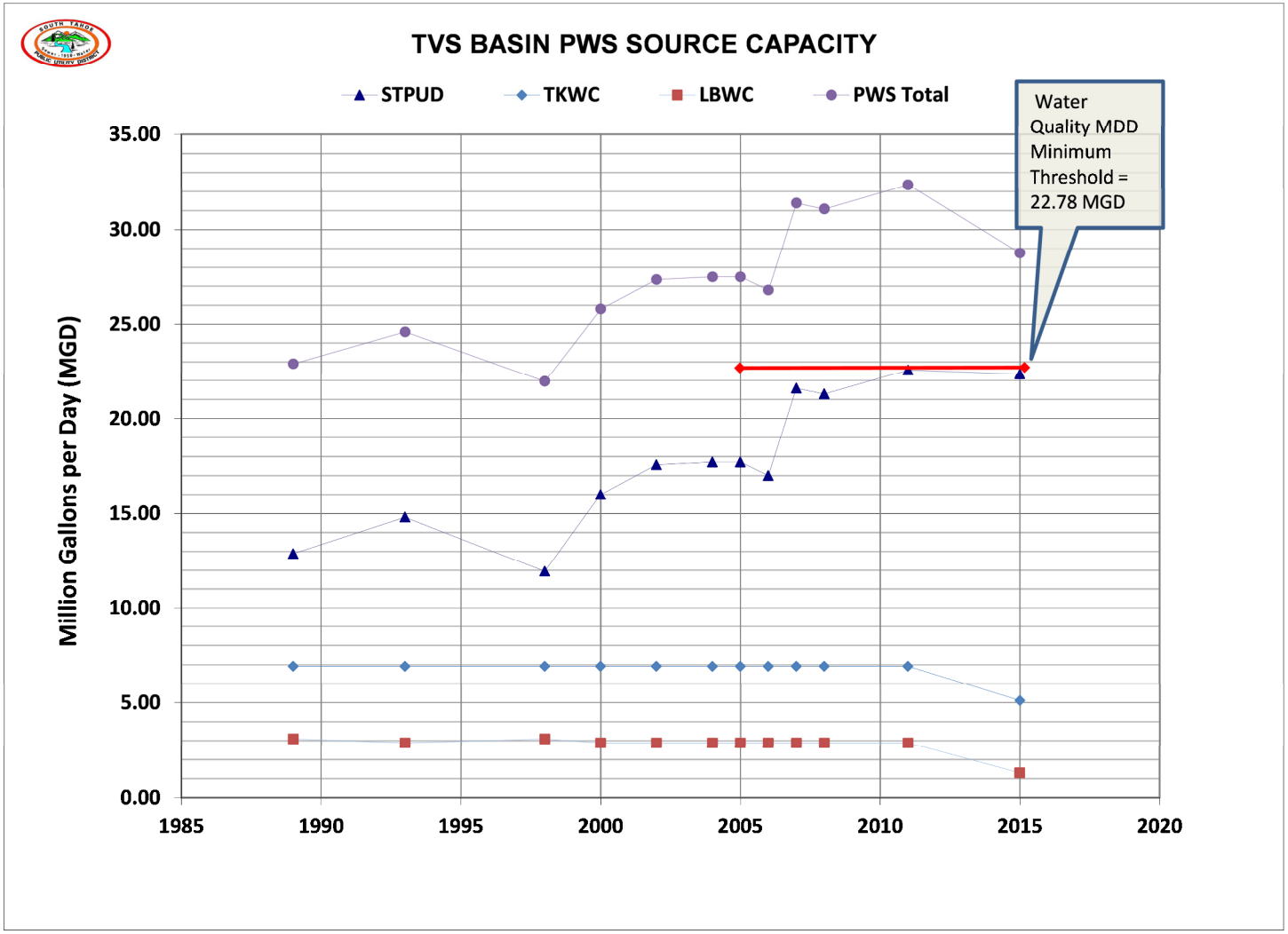

Figure 3-1. Source capacity, in million gallons per day, for active public water system wells operating within the TVS Basin from 1989 through 2015 (adapted from Pohll *et al*., 2016).

3.3 BMO #3 – Building Collaborative Relationships

The TVS Basin includes a wide range of stakeholders in addition to the District, including smaller water companies and domestic well owners. Government agencies, local business interests, environmental groups and private citizens also have interests in local groundwater management. Collaboration and coordination with other local agencies and stakeholders for implementation of the 2014 GMP is achieved through the SAG. SAG members during the 2019 WY are listed in Table 3-1.

Member	Title	Affiliation
Jason Burke	Storm Water Coordinator	City of South Lake Tahoe
Ken Payne, PE	General Manager	El Dorado County Water Agency
Robert Lauritzen, PG	Geologist	El Dorado County Environmental Management Division
Brian Grey, PG	Engineering Geologist	Lahontan Regional Water Quality Control Board
Joey Keely	Ecosystem Staff Officer	USFS-Lake Tahoe Basin Management Unit
Jennifer Lukins	Manager	Lukins Brothers Water Company
Kirk Wooldridge,	General Manager	Tahoe Keys Property Owners Association
Nakia Foskett	Water Systems Manager	Lakeside Mutual Water Company
Scott Carroll	Environmental Planner	California Tahoe Conservancy/Real Property Owner
Paul Nielsen	Special Projects Manager	Tahoe Regional Planning Agency
Harold Singer	Retired	Non-Business Community Rate Payer

Table 3-1. 2019 WY Stakeholder Advisory Group members.

3.3.1 GSA Formation

The TVS Basin lies entirely within El Dorado County, and largely within the jurisdiction of the District. Since November 17, 2015, the District has been recognized as the exclusive GSA for the portion of the TVS Basin within its jurisdiction (South Tahoe Public Utility District GSA 1). During the summer of 2016, the County Water Agency and the District began discussing options to form a GSA in the portion of the TVS Basin outside of the District's jurisdiction. Pursuant to these discussions—as well as additional conversations with DWR—the County Water Agency and the District determined that it would be appropriate for the District to become the GSA for the portion of the TVS Basin outside of its jurisdiction (i.e., within the County Water Agency's jurisdiction). Concurrent with this decision, the County Water Agency and the District drafted an MOU setting forth the County Water Agency's and the District's agreement to cooperatively manage and coordinate implementation and enforcement of SGMA in this portion of the Basin. The County Water Agency and the District subsequently entered into this MOU and the District submitted a groundwater sustainability agency formation notice (GSA Formation Notice) to DWR on September 16, 2016 for the portion of the TVS Basin outside of its jurisdiction (2016 GSA Formation Notice).

On December 28, 2016, the District was recognized as the exclusive GSA for the portion of the TVS Basin located outside of its service area jurisdiction (South Tahoe Public Utility District GSA-2). In March 2017, discussions with the SWRCB raised concerns about an agency forming a GSA outside of its jurisdiction. These concerns raised the risk that the South Tahoe Public Utility District GSA-2 may be considered invalid and that the TVS Basin could potentially be designated as "probationary" by the SWRCB and be put under state management. To ensure that the County Water Agency and the District are able to retain local control of the TVS Basin's groundwater resources, the District agreed to rescind its 2016 GSA Formation Notice and the County Water Agency agreed to elect to act as the GSA for the portion of the TVS Basin covered by the District's 2016 GSA Formation Notice.

On May 4, 2017, the District adopted a resolution rescinding its 2016 GSA Formation Notice. The withdrawal notice had no effect on formation of the South Tahoe Public Utility District GSA -1 or its status as the exclusive GSA for the portion of the TVS Basin within its service area. On June 14, 2017, the County Water Agency held a public hearing and elected to become the GSA for the portion of the TVS Basin outside of the District's service area boundaries; and the District submitted to DWR its notice of intent to withdraw the South Tahoe Public Utility District GSA-2 for the portion of the TVS Basin outside of its service area. On June 15, 2017, the County Water Agency GSA formation notice for the El Dorado County Water Agency GSA was posted on the DWR website through the SGMA Portal.

Concurrent with the County Water Agency GSA formation notice for the El Dorado County Water Agency GSA and the District's notice of intent to withdraw the South Tahoe Public Utility District GSA-2, the District and County Water Agency entered into an Amended and Restated MOU to work collaboratively to sustainably manage groundwater resources and implement SGMA throughout the entire TVS Basin.

With execution of the MOU (on June 14, 2017), the TVS Basin is in full compliance with GSA formation requirements.

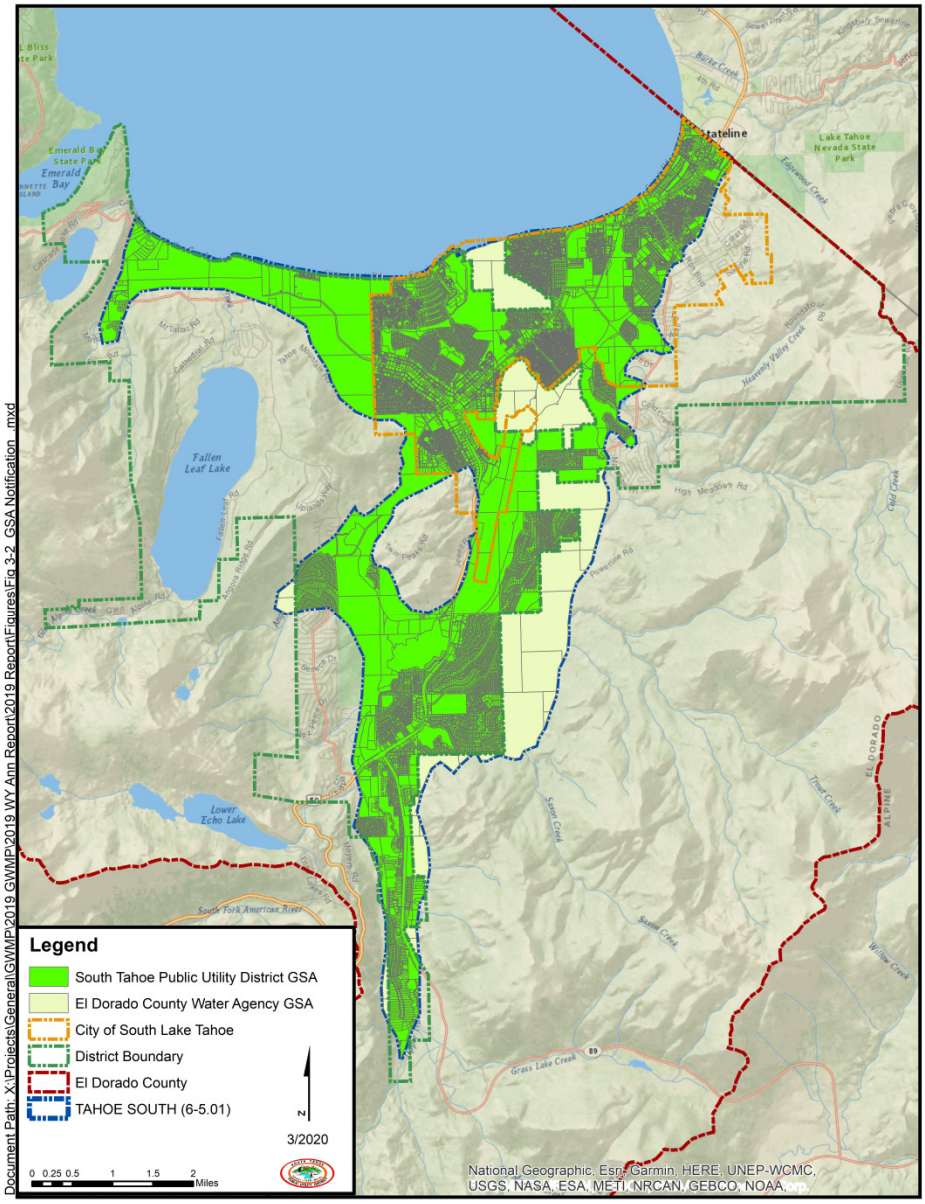

Figure 3-2. GSA boundaries for the TVS Basin. The District is regarded as the exclusive GSA for portions of the basin within its service area. The County Water Agency is regarded as the exclusive GSA for portions of the basin outside the District' service area. Through an MOU, the District and County Water Agency GSAs implement SGMA across the full extent of the TVS Basin.

3.3.2 Tahoe South Subbasin Alterative

In addition to completing GSA formation requirements for the TVS Basin, the District and County Water Agency are required under SGMA to adopt either a GSP or GSP Alternative by January 31, 2022.

During the 2016 WY, the District: conferred with the SAG about submitting the 2014 GMP and Alternative Materials to DWR as a GSP Alternative; compared the 2014 GMP and Alternative Materials to SGMA requirements to demonstrate functionally equivalency to a GSP; completed an analysis of basin conditions to demonstrate that the TVS Basin had operated within its sustainable yield for a minimum 10-year period; and completed DWR's Alternative Elements Guide to demonstrate that the analysis of basin conditions is functionally equivalent to a GSP.

In December 2016, the District concurrently submitted both the 2014 GMP and Alternative Materials as an existing plan Alternative; and the analysis of basin conditions as an analysis Alternative for public comment and DWR review and evaluation. As part of its submittals, the District indicated its preference to DWR that the review be sequenced in such a manner that its existing plan Alternative be reviewed first and should DWR agree that the existing plan Alternative is functionally equivalent to a GSP, review of the analysis of basin conditions would not be necessary. Acceptance of the existing plan Alternative would allow the District to continue groundwater management of the TVS Basin under the 2014 GMP in accordance with SGMA and amend this plan in compliance with SGMA and AB3030.

On July 17, 2019, DWR determined that the District's existing plan Alternative satisfied the objectives of SGMA and was approved as a GSP Alternative for the TVS Basin, referred to as the Tahoe South Subbasin Alternative (DWR, 2019a). Under SGMA, approved Alternatives are required to submit annual reports to DWR on April 1 of each year; and to resubmit the alternative by January 1 every five years (CWC § 10733.6 (c)). The first five year update is required to be resubmitted to DWR by January 1, 2022.

During staff review of the existing plan Alternative, DWR identified a number of recommended actions that include both information that may be included in the five-year update of the 2014 GMP and recommendations to improve the 2014 GMP as part of the development of a resubmitted alternative. During SAG Workshop 2, the recommended actions were reviewed with the SAG and preliminary plans to address these actions were considered. These plans will be further developed during the 2020 WY to initiate the added work needed to satisfy the information needs identified by DWR. The regulatory process needed to update the 2014 GMP and the 2017 Amended and Restated MOU with the County Water Agency were also discussed with the SAG. Steps to start this process, including adopting a resolution of intent to update the 2014 GMP will be completed during the 2020 WY.

3.3.3 GMP Outreach

Over the past year, the District convened the following presentations, public hearings and/or workshops to inform the interested public and agencies of groundwater management activities being performed in the TVS Basin.

1. March 6, 2019: Groundwater at the South Y Public Workshop 4.
2. April 4, 2019: District Board Meeting; Groundwater Management Plan 2018 Water Year Annual Report.
3. June 26, 2019: Groundwater at the South Y Public Workshop 5
4. July 23, 2019: SAG Workshop No. 1.
5. August 14, 2019: County Water Agency Board of Directors: TVS Basin Groundwater Management (2018/2019) Cost Share Projects.
6. November 22, 2019: SAG Workshop No. 2.

In addition to these public meetings, the District regularly updates its website which includes a Groundwater Page used to post information about current groundwater management issues within the TVS Basin and activities being performed by the GSAs (https://stpud.us/groundwater/). 2014 GMP documents, workshop agendas, meeting materials and meeting notes are linked to this web page, which are available for download at http://stpud.us/news/groundwater-management-process/.

3.3.3.1 Survey of Well Owners

As part of its outreach efforts, the District conducted a survey of SCWS and domestic well owners and users of wells not connected to municipal water services within the TVS Basin. The purposes of this well survey were to;

1. Inform well owners of groundwater management planning and implementation efforts within the TVS Basin;
2. Encourage participation of well owners in the SAG; and
3. Confirm the inferred location and use of SCWS and domestic wells within the TVS Basin.

The well survey spanned a two-month period from August through October 2017. Planning for the survey involved the development of the survey questionnaire, survey team recruitment, preparation of outreach materials and compilation of available well owner lists from the District and SAG members, including El Dorado County and the United States Forest Service –Lake Tahoe Basin Management Unit. From these lists a total of 578 domestic and 56 SCWS potential wells were inferred to be located on parcels located within or surrounding the TVS Basin (Figure 3-3).

The well survey was advertised using local media, public service announcements, direct mail notification letters, door hangers and the District's website. Participation in the well survey was made available through a URL for direct access to the survey online, through paper copy on request from the District, and through direct door-to-door survey performed by a dedicated 3-member survey team. The well survey was successful in collecting information from a total of 370 respondents. Of these respondents, 247 confirmed the presence of a well on their parcel; 77 indicated that there was no well on the parcel; and 2 were uncertain if a well was located on their parcel. Figure 3-3 shows the locations of the inferred wells and the confirmed locations from the well survey. Results from this survey are provided in Appendix B of the 2017 WY Annual Report (STPUD, 2018a).

During the 2018 WY, a final report documenting the well survey was completed (Allegro Communications, December 2018); and made available to the public through the District's website (http://stpud.us/news/groundwater-management-process/).

Major findings from the *TVS Groundwater Basin Survey of Well Owners* report include;

- Private well geographic distribution reflects travel and settlement patterns of the one hundred year period prior to South Tahoe Public Utility District formation, from 1845 to 1950;
- The majority of respondents to the well survey were property owners (72%). Most of these properties were used as "secondary" residences.
- The majority of respondents (61%) indicated that the well on their property is currently in-use. The majority of this use is either daily or more than 90 days out of the year.
- Private well owners overwhelmingly "like" perceived "purity" of well water. "Taste, color and odor" of well water are perceived favorably. Well owners enjoy features of private well water such as "cold temperature", "low cost", "quality" and "absence of chlorine". They highly value well water while the system consistently delivers high quality water; and
- Well owners indicating concern about well systems mention "pumps", "wellhead connections", "water production" and "system maintenance;

Recommendations based on the information gathered during this survey include;

1. Create capacity within the groundwater community to make technical support available to private well owners;
2. Complete the assessment of the status of private wells;
3. Assess risk to groundwater resources from private wells;
4. Cultivate capacity to create and maintain collaborative ties in the groundwater community;
5. Communicate with private well owners;
6. Collaborate with national and state programs that support source water protection; and
7. Share survey findings with Tahoe Basin partner agencies.

During the 2019 WY, the District started planning to complete the survey of private well owners started in 2017. The Phase II well survey will include the approximately 300 remaining private well owners that have been identified, but not contacted during the 2017 well owner's survey. The Phase II well survey is planned to start in the late spring/summer of 2020.

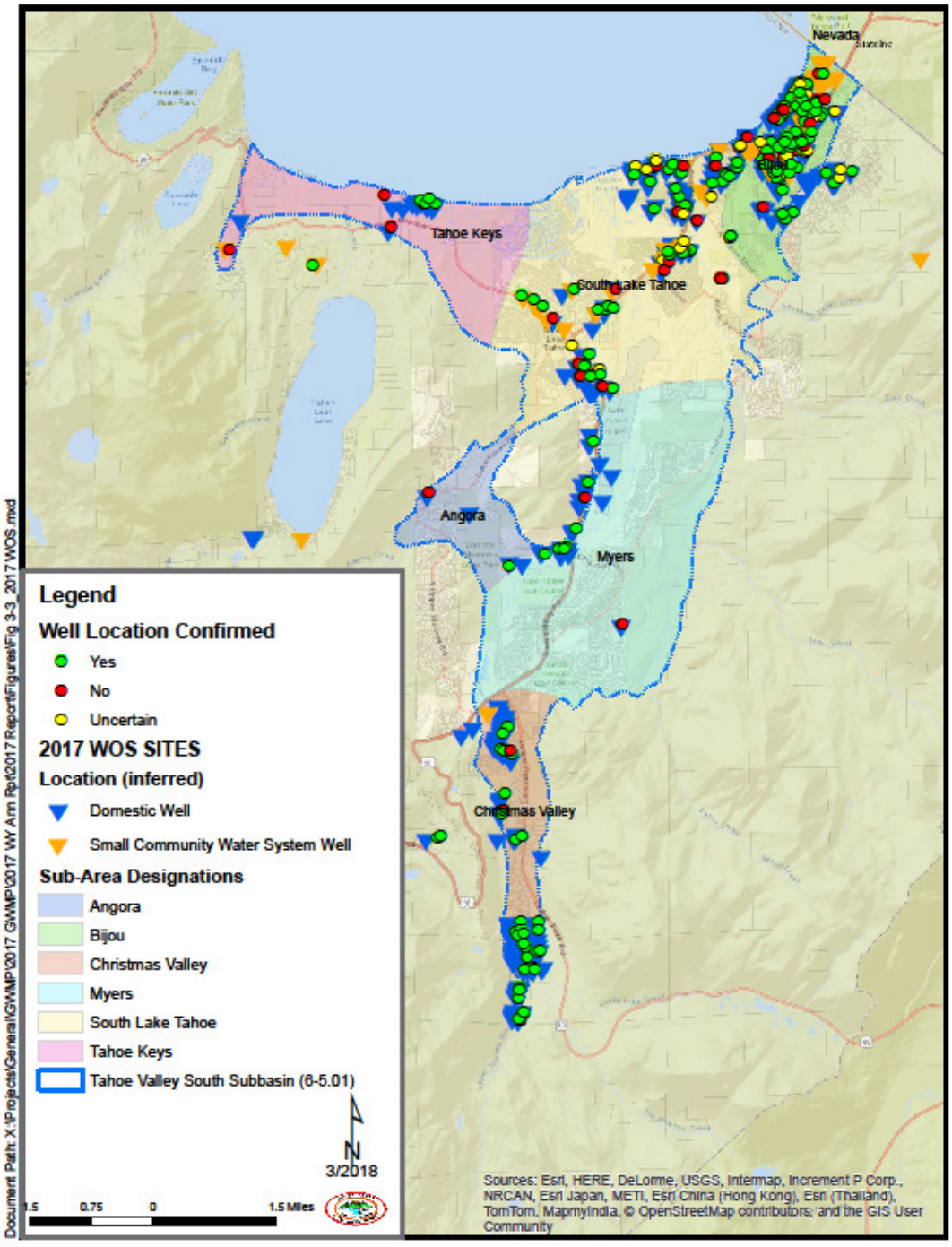

Figure 3-3. Inferred and confirmed locations of SCWS and Domestic wells identified by the 2017 survey of well owners.

3.4 BMO #4 – Integrating Groundwater Quality Protection and Land Use Planning

A key element of the 2014 GMP is an ongoing program of monitoring groundwater conditions and the potential threat of groundwater contamination within the TVS Basin. In order to better understand this potential threat, the locations of potential contaminating activity (PCA) sites operating within the TVS Basin were updated in 2017 and compared to source water production zones surrounding active PWS wells, defined using the modified calculated fixed radius method (CDHS- DDW, 1999). Descriptions of these zones are as follows:

- **Zone A: Microbial/Direct Chemical Contamination Zone.** Protects the drinking water supply from viral, microbial and direct chemical contamination and is defined by the surface area overlying the portion of the aquifer that contributes water to the well within a two-year time-of-travel.
- **Zone B5: Chemical Contamination Zone.** Prevents chemical contamination of the water supply, and to protect the drinking water source for the long term; encompassing the area between the two- and five-year time-of-travel. This zone provides for more response time for chemical spills.
- **Zone B10: Chemical Contamination Zone.** Prevents chemical contamination of the water supply, and to protect the drinking water source for the long term; encompassing the area between the five- and ten-year time-of-travel. This zone allows for some attenuation or remediation of contaminant sites, or if necessary, time to develop alternate sources of water supply.

The number and types of PCA found within each source water protection zone are summarized in Table 3-2. The 2017 Drinking Water Source Assessment and Protection map for the TVS Basin is presented as Figure 3-4.

Potential Contaminating Activity Sites		
Number of sites (count)	**Type(s)**	**Potential Contaminants (CDPH, 1999)**
Zone A		
2	Sewer Pump Station	Sewage, treatment chemicals
1	Wastewater Treatment Plant	Municipal wastewater; sludge; treatment chemical; nitrates; heavy metals; coliform and non-coliform bacteria; nonhazardous wastes
1	Wells(such as water supply, monitoring well)	Treatment chemicals

Zone B5		
4	Gas Stations	Gasoline, Diesel fuel, Oils; solvents; miscellaneous wastes
2	Cleaners	Soaps; detergents, waxes; miscellaneous chemicals, hydrocarbons
2	Automotive Repair	Waste oils; solvents; acids; paints; automotive wastes; miscellaneous cutting oils.
1	Sewer Pump Station	Sewage, treatment chemicals
Zone B10		
3	Sewer Pump Station	Sewage, treatment chemicals
2	Automotive Repair	Waste oils; solvents; acids; paints; automotive wastes; miscellaneous cutting oils.
2	Gas Stations	Gasoline, Diesel fuel, Oils; solvents; miscellaneous wastes
1	Auto Body	Waste oils; solvents; acids; paints; automotive wastes; miscellaneous cutting oils
1	Boat Building and Repair	Diesel fuels; oil; sewage from boat waste disposal area; wood preservative and treatment chemicals; paints; waxes; varnishes; automotive wastes
1	Car Wash	Soaps; detergents, waxes; miscellaneous chemicals, hydrocarbons
1	Dry Cleaners	Solvents (perchloroethylene, petroleum solvents, Freon); spotting chemicals (trichloroethane, methylchloroform, ammonia, peroxides, hydrochloric acid, rust removers, amyl acetate)
1	Hardware/lumber/parts stores	Hazardous chemical products in inventories; heating oil and fork lift fuel from storage tanks; wood-staining and treating products such as creosote; paints; thinners; lacquers; varnishes
1	Medical/dental offices and clinics	Various chemical substances.

Table 3-2. The numbers and types of potential contaminating activity sites found within source water protection zones delineated within the TVS Basin.

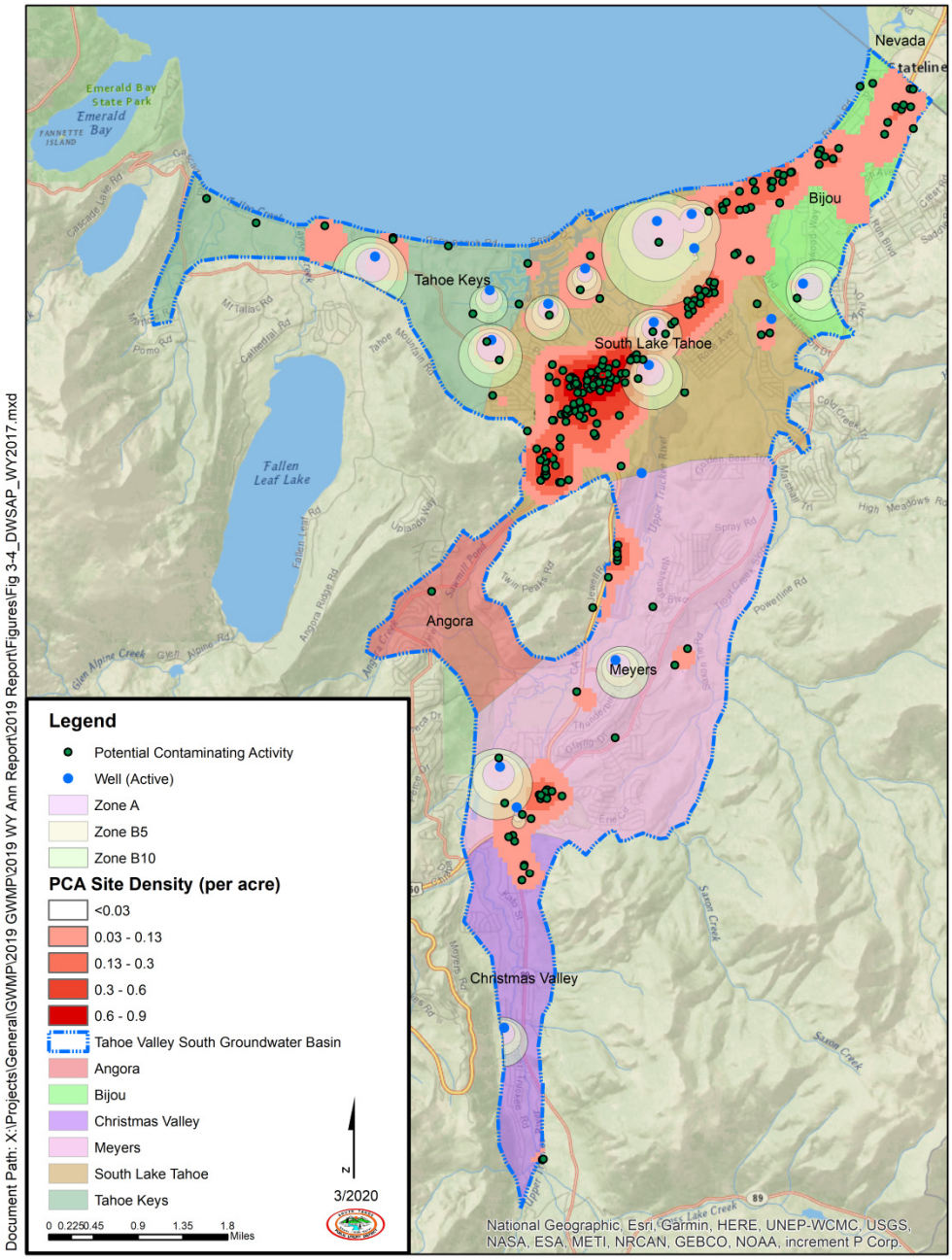

Figure 3-4. Drinking water protection areas for PWS wells in the TVS Basin. Drinking water protection areas surrounding these wells are generated using the modified calculated fixed radius method (CDHS-DDW, 1999) and the average groundwater production rate for each active well (2008 WY -2017 WY).

3.5 BMO #5 – Interaction of Water Supply Extractions on Environmental Conditions

The TVS Basin is located in a unique environmental setting. Water supply operations using groundwater may affect environmental conditions or be affected by changes in the environment. Groundwater – surface water interactions with Lake Tahoe and rivers and streams serve as both groundwater discharge and recharge locations depending on their location and the time of year. Understanding the interactions is a necessary part of providing sound groundwater management for the TVS Basin.

During the 2017 WY, additional analyses of the hydrologic system were completed using recently developed hydrologic modeling tools developed by DRI (Pohll, *et al.,* 2018). Two types of calculations were performed to address pumping effects on surface water (BMO #5, Action 1). The first approach involved evaluating model simulated groundwater levels with and without pumping at individual wells to determine the reduction in groundwater flows to surface water over time. The second approach used the model to produce maps of surface water depletion within the TVS Basin. These maps are referred to as "capture maps" which are useful for illustrating the effects of pumping locations on surface water depletion over a large set of possible pumping locations within an aquifer (Leake *et al,* 2010).

Figure 3-5 presents the results of evaluation from the first approach used to assess the impacts of pumping effects on surface waters. The analysis shows that as pumping rates increased during the 1980s, depletion rates for streams steadily increased from a few hundred AFY in 1983 to an average of 2,500 AFY from 2000 – 2015. Following 2000, the baseflow reduction from streams represents about 2 percent of the average annual runoff (124,000 AFY). This is well below the minimum threshold defined as baseflow depletions in excess of 10 percent of average annual runoff (Pohll *et al.,* 2016).

Capture maps from Lake Tahoe and local streams revealed two areas where the sources of water withdrawal are different. North of the Lake Tahoe Airport, most of water withdrawal is from Lake Tahoe. South of the Lake Tahoe Airport, most of water withdrawal is from streams. To ensure that depletion rates to surface waters at the south end of the TVS Basin do not cause harm to stream ecology, DRI recommended that pumping rates do not exceed 12,400 AFY south of the Lake Tahoe Airport (Pohll, *et al,* 2018). During the 2019 WY, four active wells were operating south of the Lake Tahoe Airport having a combined total pumping rate of about 1,171 AFY, which is less than 10% of the recommended maximum.

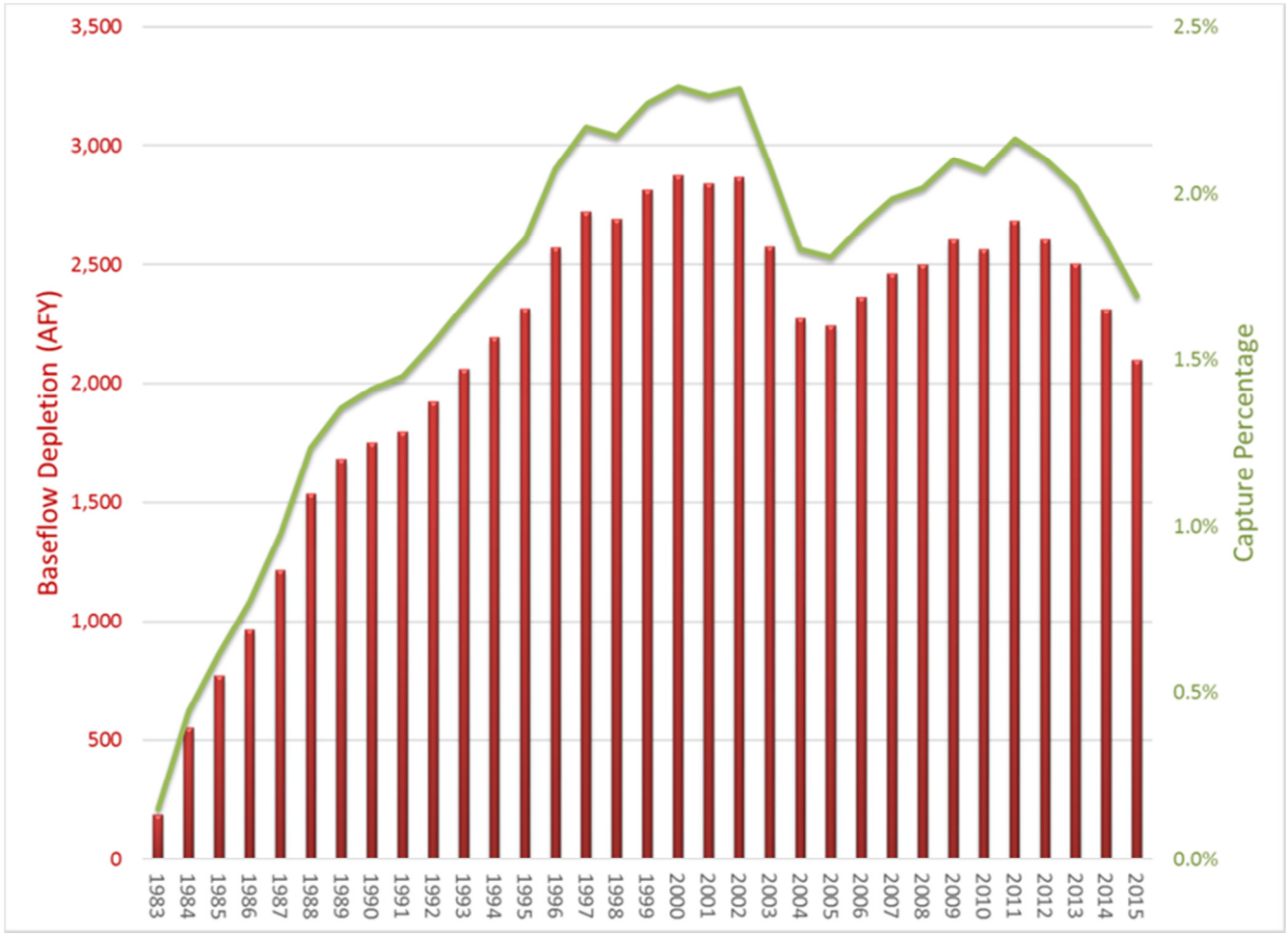

Figure 3-5. The effect of groundwater pumping on baseflow depletion for the TVS Basin as calculated using modeled differences in groundwater levels with and without pumping. The capture percentage is calculated as the ratio of baseflow depletion and average annual runoff for the model domain (124,000 AFY) (Adapted from Pohll, *et al*. 2018).

3.6 BMO #6 – Stakeholders Advisory Group (SAG)

The purpose of BMO #6 is to provide guidance regarding the role of the SAG in plan implementation. This includes hosting regular SAG workshops in order to provide a forum for discussion of groundwater management issues in the TVS Basin and receive a regional perspective from different members of the community (*see* Table 3-1). Other important functions of the SAG include:

1. Facilitation for interagency collaboration;
2. Assessing groundwater supply issues;
3. Assessing groundwater protection issues;
4. Data sharing; and
5. Developing regional support for groundwater projects.

During the 2019 WY, SAG workshops were convened in July and November. Major topics discussed during these workshops are listed in Table 3-3. Minutes from these workshops are provided in Appendix B.

WORKSHOP 1 (July 23rd, 2019)	**TOPICS**
	South "Y" Activity Updates Stormwater Management 2019 Groundwater Management Activities
WORKSHOP 2 (November 22nd, 2019)	**TOPICS**
	Groundwater Management Plan – 5 Year Update 2019 Groundwater Conditions

Table 3-3. Major discussion topics for SAG Workshops convened during the 2019 WY.

3.7 BMO #7 – Technical Studies

Understanding the factors that control groundwater conditions in the TVS Basin is important for long-term management. Several studies have been conducted over the years, but additional work is needed to help address emerging issues. The District and/or other local water purveyors and well owners will need to conduct various studies to support groundwater management decision makers. The projects reported under BMO #7 outline some of the studies being conducted by the District to further the understanding of the groundwater basin to help support groundwater management.

3.7.1 South Tahoe Groundwater Model

During the 2016 WY, DRI completed the initial phase (Phase 1) of development of groundwater models and hydrologic modeling tools for implementation of the 2014 GMP. Phase 1 generally involved: acquiring the data to update the District's existing groundwater flow model and DRI's existing integrated GSFLOW hydrologic model for the South Tahoe watersheds; constructing and calibrating a steady-state groundwater flow model for the TVS Basin; constructing and calibrating a transient integrated hydrologic model for the South Tahoe watersheds; and calculating a water budget for the TVS groundwater system (Carroll *et al*., 2016a).

DRI completed work on Phase 1 in February 2016 and completed work on Phase 2 in February 2018. Phase 2 work completed by DRI extended all boundary stresses through 2015 WY for Phase 2 modeling analysis and provided detailed analysis concerning the spatial and temporal distribution of recharge across the model domain for the TVS Basin Model. During initial work on Phase 2, DRI also defined a threshold between recharge and groundwater storage at approximately 43,200 AFY (Carroll *et al*., 2016b). Recharge below this threshold results in negative changes in groundwater storage and falling groundwater levels, while recharge above this threshold results in positive changes in groundwater storage and rising groundwater levels.

Results of the Phase 2 modeling work are documented in the South Lake Tahoe Groundwater Model Update (Carroll *et al.,* 2016b) and in the report Addressing Basin Management Objectives for the Tahoe Valley South (6-5.01) Groundwater Basin, California, Desert Research Institute (BMO Report) (Pohll et al., 2018). Both the South Lake Tahoe Groundwater Model Update and BMO Report are available for download from the District's website (http://stpud.us/news/groundwater-management-process/).

The District successfully updated the South Lake Tahoe Groundwater Model through the end of the 2019 WY. Groundwater recharge and change in groundwater storage outputs presented in model flow budgets were reported for both the model domain and TVS Basin.

3.7.2 South Y Investigations

As part of the work for the Feasibility Study, the District collected additional groundwater samples from inactive drinking water source wells in the vicinity of the South Y including the LBWC #2 Well (Offline, impaired), the LBWC #4 Well (Offline, abandoned), the LBWC #5 Well (Offline, impaired), the Rockwater Apartment Well (Offline, abandoned) and the Tahoe Valley Elementary School Well (Offline, abandoned). Groundwater samples were also collected from CL-1, a deep monitoring well located at the District's Clement Well Site. Groundwater samples were collected from these wells during four sampling events from between December 2016 through October 2017 to provide up to date information on the extent of PCE concentrations for use during the Feasibility Study. TKWC provided water quality monitoring results through June 2017 for each of their three wells to supplement this data set.

In October 2016, the District entered into an agreement with DRI to add a fate and transport model to the existing groundwater model framework developed for the TVS Basin. It was recognized that a fate and transport groundwater model would be needed to simulate PCE migration of the South Y Plume and evaluate the effectiveness of varying remedial alternatives, in terms of their capacity to remove PCE contaminant mass and inhibit the further movement of the contaminant plume. Results from this alternatives analysis would then be used to refine the Feasibility Study by identifying the likely best alternative(s) for mass removal and cleanup time, thereby reducing the number of remedial alternatives requiring further engineering evaluation for the Feasibility Study.

During the 2017 WY, hydrologic information was compiled and DRI developed the fate and transport model grid by extracting a section of the original model grid covering the area of the South Y Plume and extending northward to Lake Tahoe. The fate and transport model grid was further refined in the area of the existing plume and along the expected plume migration path. model boundary conditions were established for local areal recharge, streams (Upper Truckee River and Trout Creek), Lake Tahoe, and groundwater pumping from area wells.

Review of the groundwater production data from South "Y" Area wells showed that substantial changes in the location and magnitude of groundwater pumping across the South "Y" Area have occurred since at least 2008. A transient model was subsequently developed to adequately simulate the response of the groundwater system to changing pumping conditions. Flow simulations were run using MODFLOW-NWT. Fate and transport simulations were run using MT3DMS. MT3DMS is a modular three-dimensional transport model for the simulation of advection, dispersion, and chemical reactions of dissolved constituents in groundwater systems (Zheng and Wang, 1999).

In April 2017, the preliminary model was presented to stakeholders, along with a matrix of remedial alternatives proposed for fate and transport modeling evaluation. During the meeting it was determined that simulations of remedial alternatives should be postponed until after additional groundwater sampling planned during the 2017 WY was completed.

During the 2018 WY, the District successfully negotiated and executed an Agreement with the SWRCB-DFA to complete a Feasibility Study of Remedial Alternatives to Mitigate Tetrachloroethylene Contamination (Agreement D1712508). As part of the Feasibility Study, Agreement D1712508 requires the District to perform numerous activities including but not limited to: conducting a PDI; completing a Baseline Human Health Risk Assessment (BHHRA); conducting groundwater modeling for the purposes of evaluating potential implementation projects that will prevent or clean-up groundwater contamination; completing a feasibility study to develop interim remedial alternatives that prevent or clean contamination of groundwater that serves or has served as a source of drinking water; develop an Interim Remedial Action Plan (IRAP) that will lead to the implementation of the preferred remedial action alternative; complete environmental analysis checklists and identify mitigation measures required for implementation of the preferred alternative; and perform public outreach to inform the public concerning the progress of these activities.

Following approval of the PDI Workplan, the District and Kennedy Jenks Consultants (KJC) conducted the groundwater investigation at 953 Eloise Avenue, near the intersection of Eloise Avenue and 5th Street, situated within the middle-section of the South Y Plume. The groundwater investigation involved the drilling and logging of a borehole to a total depth of 150 feet; the drilling and construction of two test wells; aquifer testing, soil and groundwater testing and collection of groundwater elevation readings. The data collection was used to characterize the vertical extent of PCE contamination in groundwater and inform the development of design strategies for hydraulic control and/or removal of PCE contamination from groundwater. As extra work for this project the District also updated its Well Owners Survey for the South Y Area. The update was performed in order to gather information on private wells situated within or neighboring the South Y Plume in order to: identify potential wells that may serve as vertical conduits for contaminant migration; and identify property owners with active wells that may be impacted by PCE groundwater contamination.

Following performance of the PDI, KJC conducted a screening level Human Health Risk Assessment (HHRA) addressing risks associated with PCE impacted groundwater at PWS wells in the South Y Area. The HHRA was completed and submitted to the SWRCB-DFA in January 2019.

Groundwater modeling for the Feasibility Study resumed in 2018. During 2018, the South Y PCE Model was updated through 2018 and used to evaluate management scenarios developed for the feasibility study. Modeling evaluation used best- and worst-case conditions to forecast the effectiveness of management scenarios to prevent or clean-up groundwater contamination over the next twenty years, through 2038. Scenarios evaluated using the South Y PCE Model included: 1) No Action; 2) Use of new extraction wells to clean-up the PCE plume; 3) Use of new PWS wells to prevent groundwater contamination and provide replacement water supply; and 4) Use of existing PWS wells to clean-up the South Y Plume.

During the 2019 WY, the District continued on-going activities to complete the Feasibility Study. Initial management scenarios were refined to interim remedial alternatives to manage on-going contamination from the PCE Plume. Six interim remedial alternatives were developed and initially screened for effectiveness using the South Y Fate and Transport Model. The alternatives were also reviewed and screened for implementability using input from the water purveyors. Based on this screening three interim remedial alternatives were selected for detailed analysis, including 20-year project life cost analysis, to select a preferred remedy. Technical reports presenting information from the PDI; Baseline Human Health Risk Assessment; and South Y Fate and Transport Modeling were completed and are posted on the District's website (https://stpud.us) . The Feasibility Study Report and accompanying Interim Remedial Action Plan were started and are expected to be completed by April 2020.

Public outreach completed for the Feasibility Study involved the development of press releases, flyers and public announcements; and the presentation of three Public Workshops convened at the City Council Chambers, in South Lake Tahoe, CA. These workshops were available by live stream. Video

recording from these workshops are also available on the District's website: http://stpud.us/groundwater/.

The South Y Feasibility Study is expected to be completed by June 2020.

3.8 BMO #8 – Funding

Groundwater projects require funding. In addition to funding from local sources, there are state and federal grants and other funding programs available. These types of opportunities require effort to prepare and process grant funding applications.

3.8.1 Proposition 1 GSP

During the 2016 WY, the District in collaboration with the SAG identified potential projects for funding to address the PCE groundwater contamination in the South "Y" Area. Using the findings of the South Y Investigations (Section 3.7.2), the District in partnership with the LBWC and TKPOA, prepared pre-applications and a full proposal (FAAST # 36772) requesting funding through the Proposition 1 Groundwater Sustainability Program to conduct an engineering feasibility study of remedial alternatives to mitigate PCE groundwater contamination in the South Y Area. The total project budget for this request is $588,540.00 with a 50% funding match of $294,270.00 and a grant request of $294,720.00. Expenditures for supporting studies (e.g., South "Y" Investigations) and technical planning used to develop the feasibility study are used for the funding match.

On March 30, 2017, the District received notice of preliminary grant award of up to $294,270.00, conditioned on the successful negotiation of an agreement with SWRCB-DOFA. On May 18, 2017, the District Board adopted Resolution No. 3059-17 to accept the grant award. Following adoption of the Resolution, the District entered into negotiations with SWRCB-DOFA staff considering changes to the scope of work and budget presented in the proposal. During these negotiations, current groundwater quality data for the South Y Plume was available and a Pre-Design Investigation was developed which was subsequently added to the scope of work. The Pre-Design Investigation involves installing a test well that can be used for data collection to identify the vertical extent of PCE contamination and which could be used as a pumping well during added field tests to define aquifer properties for engineering design. Inclusion of the Pre-Design Investigation increased total project budget to $1,008,590.00 with a 50% funding match of $504,295.00 and a grant request of $504,295.00. Expenditures for supporting studies (e.g., South Y Investigations) and technical planning used to develop the PDI and Feasibility Study are used for the funding match. This will also include County Water Agency funds through the County Water Agency Cost Share Grant Program.

On March 20, 2018, SWRCB-DFA and the District executed Agreement D1712508 funding a feasibility study of remedial alternatives to mitigate PCE contamination. Agreement D1712508 is funded at a level 0f $504,295, with a work completion date of June 30, 2019. The Proposition 1 Groundwater Planning Grant is for the purpose of conducting the PDI and Feasibility Study to evaluate whether existing and/or new wells can be used to provide hydraulic control and removal of PCE from groundwater in the South Lake Tahoe Basin.

Work to complete the South Y Feasibility Study continued through the 2019 WY. During the course of this project, extra work was required to satisfy the purpose and requirements of the Grant Agreement that were not anticipated in the original work scope. Completion of this extra work resulted in changes to the project schedule and adjustments to the project budget. A Request for Time Extension prepared by the District was approved by the SWRCB in November 2019 which changed the project completion date from June 30, 2019 to June 30 2020. An accompanying Deviation Request addressing the cumulative budget impact of extra work to the South Y Feasibility Study ($78,140) was also approved.

3.8.2 GMP Costs

Costs for implementation of the 2014 GMP are accounted from the District's Water Enterprise Fund. Development and implementation costs for groundwater management activities have been supported by the County Water Agency under its Cost Share Grant program. Under this program, the County Water Agency assists projects eligible under Section 96-11 of the El Dorado County Water Agency Act and Board Expenditure Priority Policy (No. B-1003). Grants used for these projects are typically at a 50% matching fund level.

Figure 3-6 shows the 2014 GMP expenditures during the fiscal year ending June 30, 2019. Costs for groundwater management projects and activities totaled $346,430. A cost summary of major items expended during the 2018-19 fiscal year (FY 2018-19) is provided below (Table 3-4). Over the first 5-years of implementation; the total cost of GMP implementation is $1,898,929.

ITEM	DESCRIPTION	APPROXIMATE COST ($)
Groundwater Sustainability Agency	• SAG Workshops • Basin Monitoring • Reporting	$ 19,865
Technical Studies	• South Y Investigation • Groundwater Modeling	$326,565
FY 2018-2019 Total		***$346,430***

Table 3-4. Summary of costs for major groundwater management activities expended during the fiscal year ending June 30, 2019.

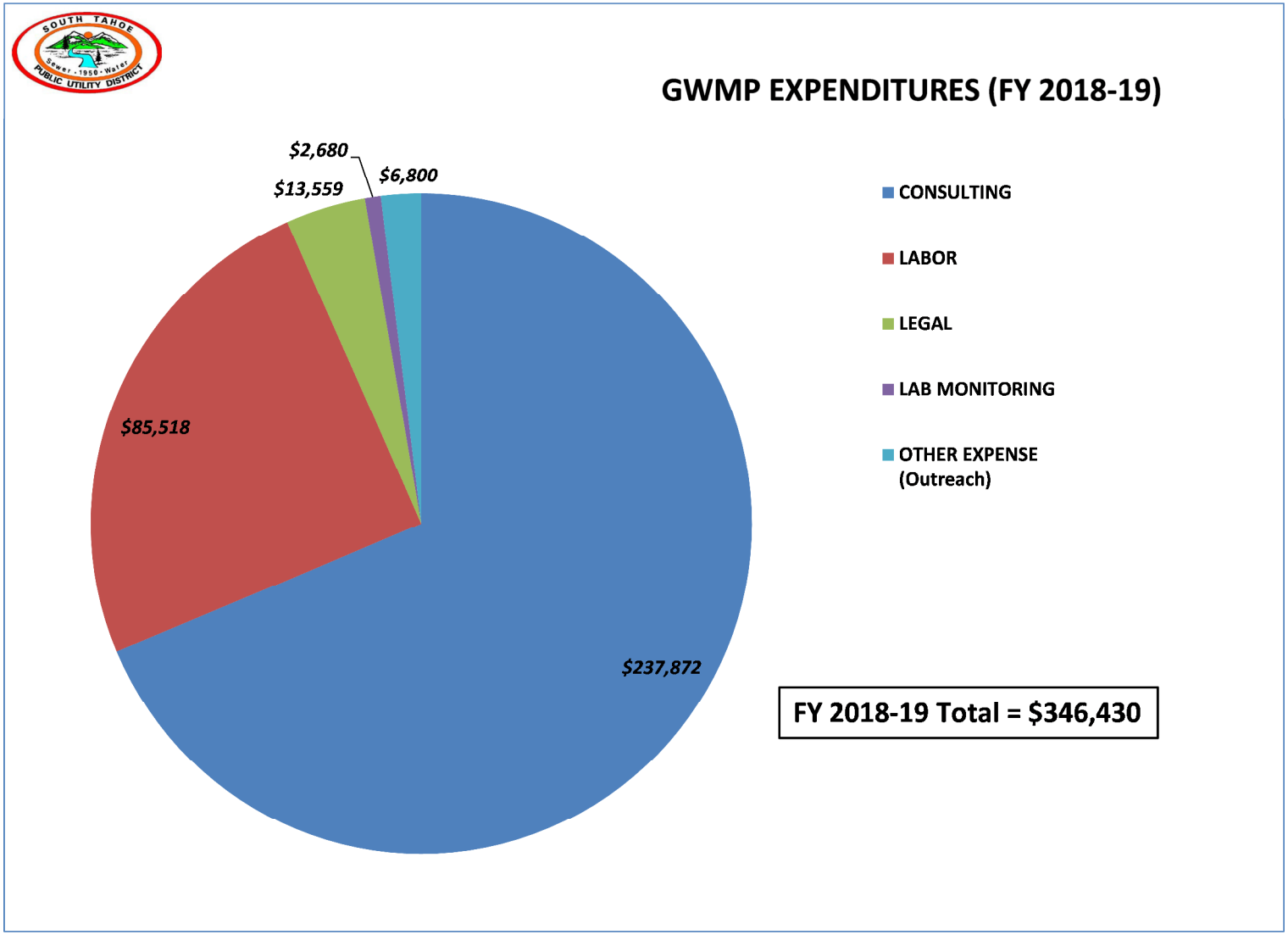

Figure 3-6. GMP implementation costs for FY 2018-19.

4 Proposed Actions (2020 WY)

Groundwater management activities for the 2020 WY will generally involve continuing the progress of on-going work from the 2019 WY and the proposed actions listed below;

1. Continue to monitor new regulations and Basin Monitoring Program guidance issued by the DWR and SWRCB for implementation of SGMA;
2. Continue to monitor basin conditions and groundwater supplies;
3. Continue to update the SAG on the progress of 2014 GMP-related activities, seeking active participation of its members;
4. Continue to inform the public of groundwater management activities through public hearings, SAG workshops, notifications through its interested parties list, and the District's web page;
5. Consider recommendations from the *TVS Groundwater Basin Survey of Well Owners* (Section 3.3.2.1) for implementation;
6. Update the 2017 MOU between the District and County Water Agency (Section 3.3.2);
7. Adopt a resolution of intent to draft an updated 2014 GMP (Section 3.3.2);
8. Conduct hydrologic investigations to address recommended actions from DWR for the Tahoe South Subbasin Alternative (Section 3.3.2);
9. Amend and adopt the 2014 GMP for development of a resubmitted Alternative to DWR by January 1, 2020 (Section 3.3.2);
10. Consider the findings and conclusions of the BMO report for potential changes to the 2014 GMP (Section 3.7.1); and
11. Complete the South Y Feasibility Study (Section 3.7.2).

5 2014 GMP Changes

The 2014 GMP was last updated in late 2014 to be fully compliant with DWR requirements (AB3030 Plan; Water Code § 10750 et seq.). Under SGMA, existing groundwater management plans remain in effect until a GSP or GSP Alternative is adopted (CWC § 10750.1). As DWR has determined that the 2014 GMP and Alternative Materials satisfied the objectives of SGMA and was approved as an Alternative for the TVS Basin, the District will start updating the 2014 GMP for development of a resubmitted Alternative during the 2020 WY.

There were no plan component changes, including addition or modification of BMOs, during the period covered by this report.

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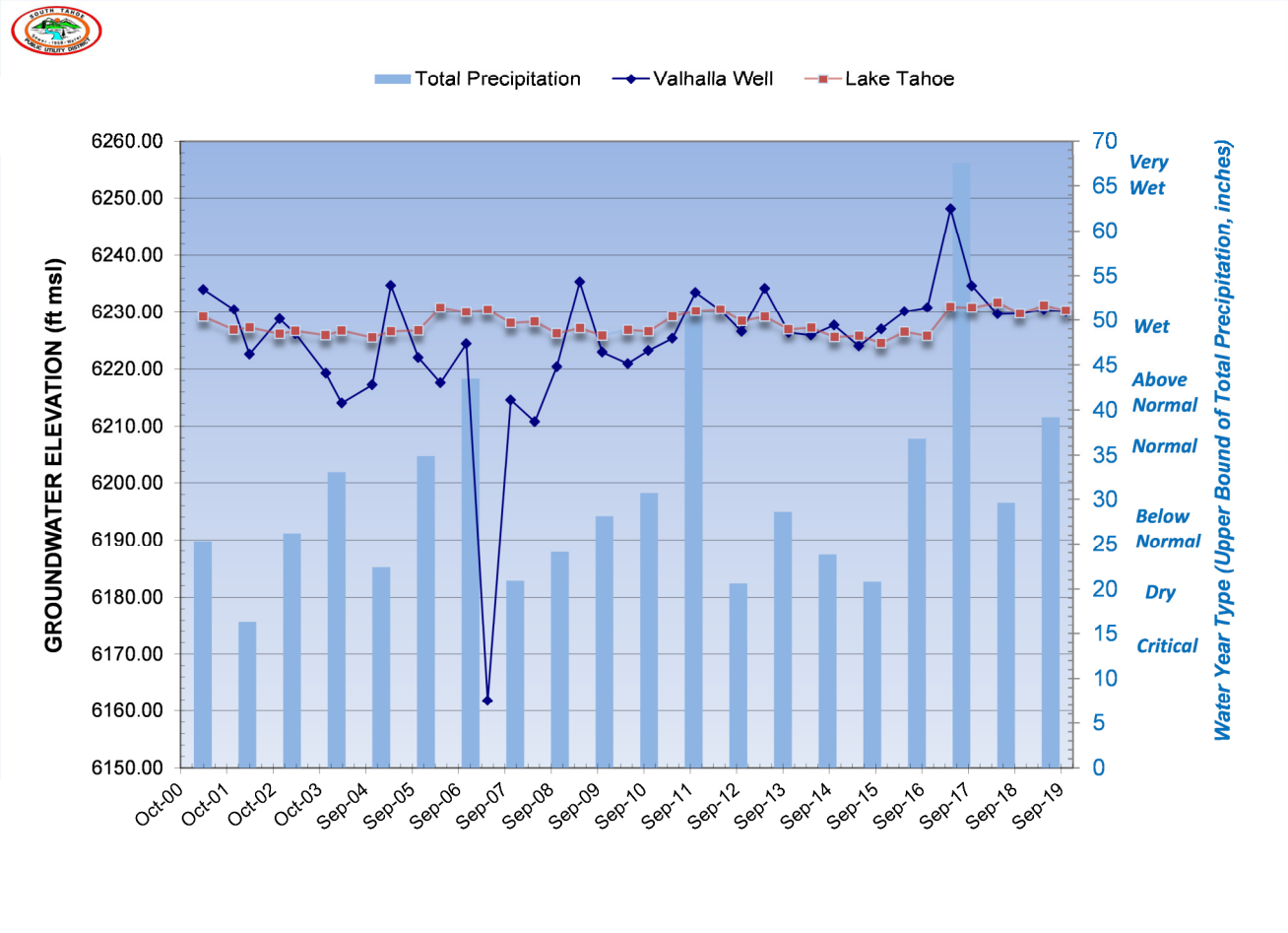
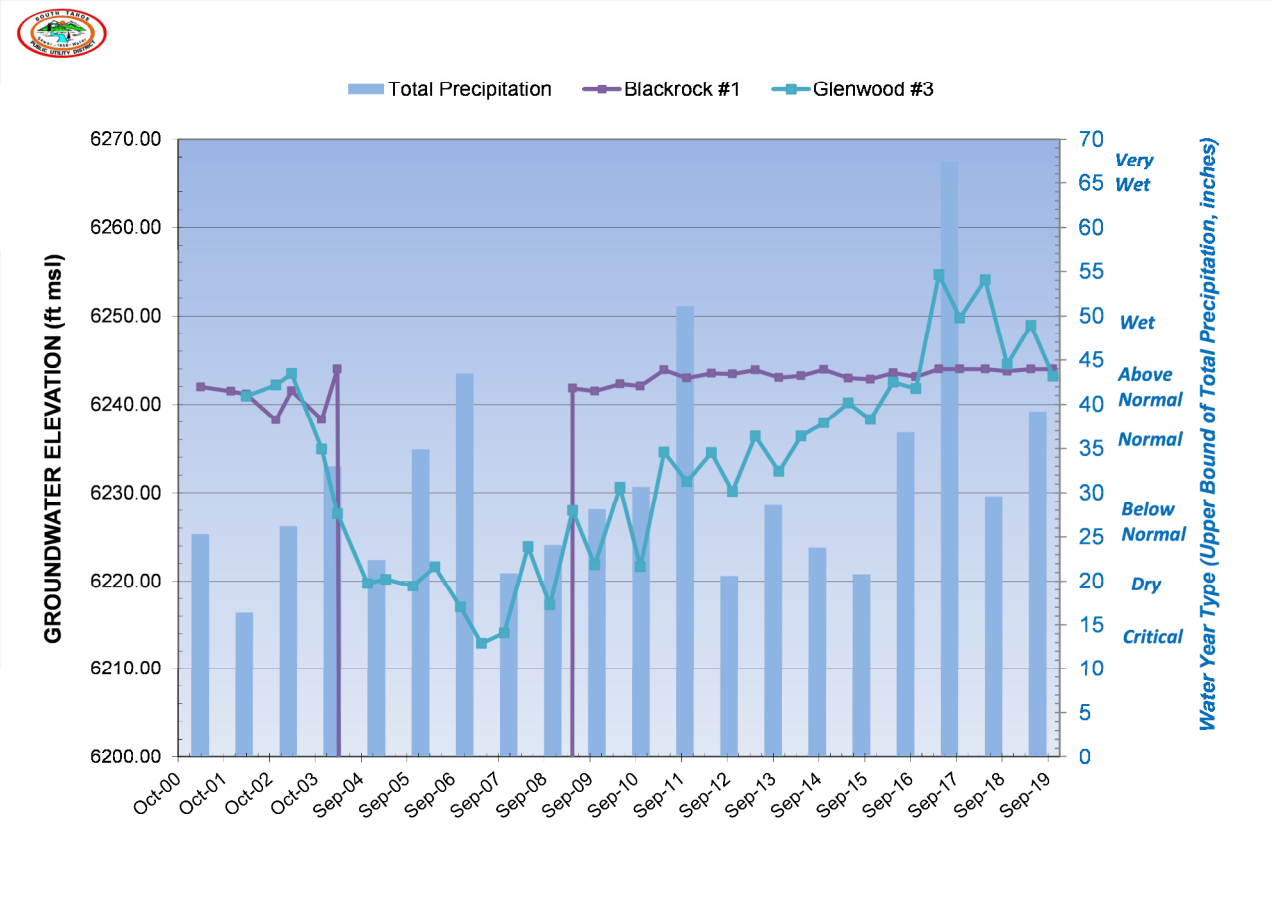
APPENDIX A

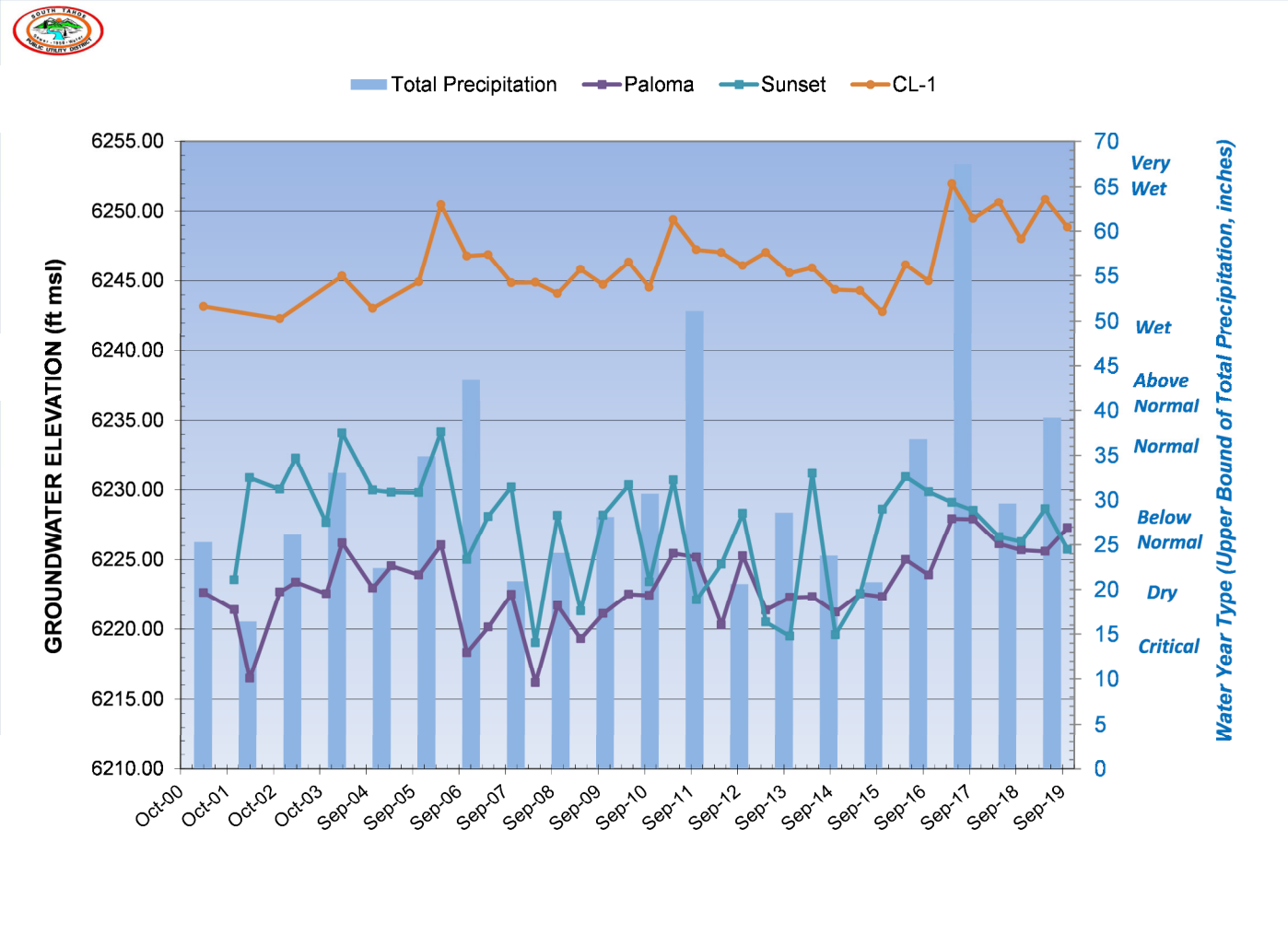
TVS Basin Hydrographs



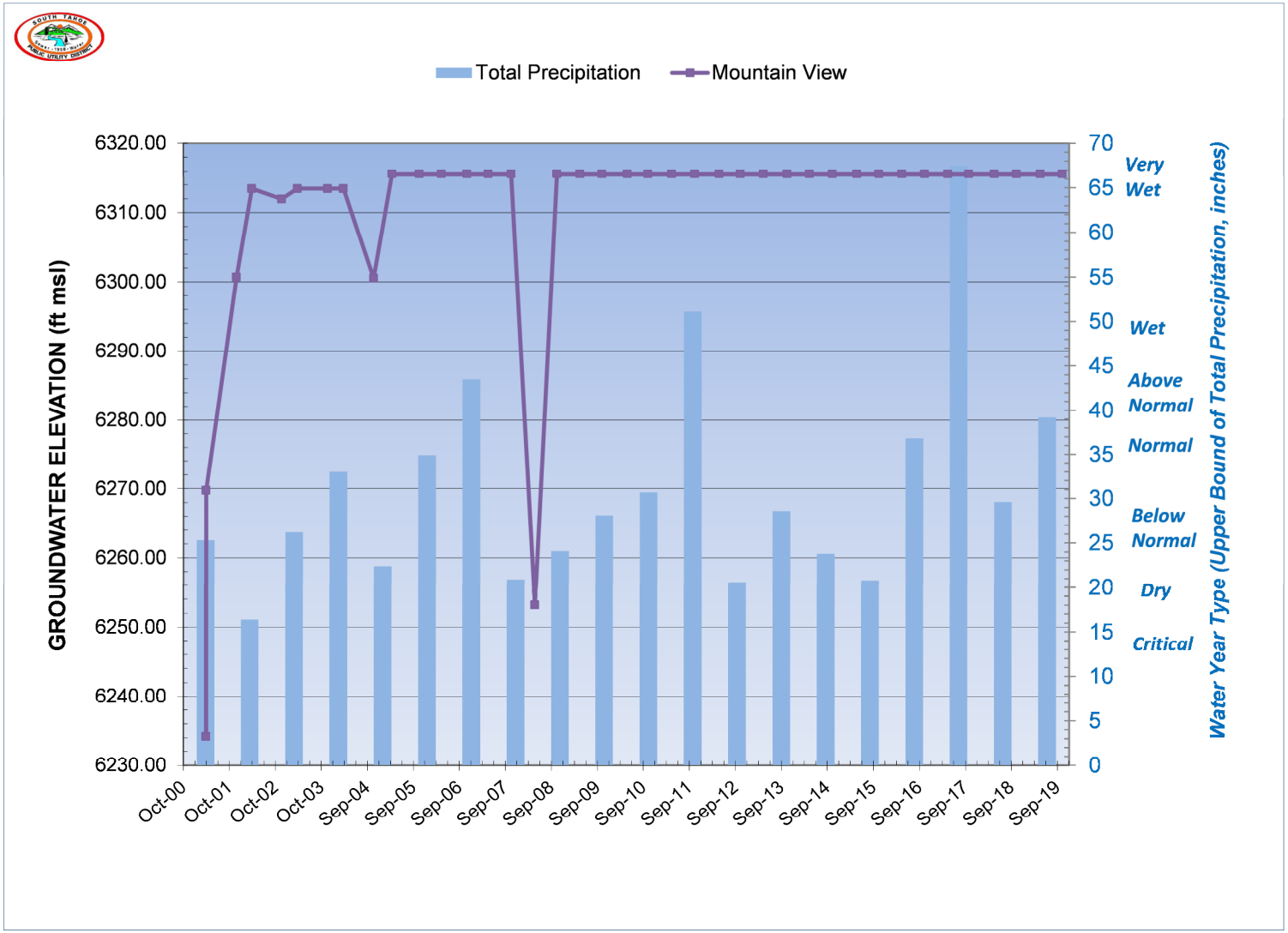
Appendix A – 1. Groundwater hydrograph for the Valhalla Well (6,257 feet msl) within the Tahoe Keys sub-area. Also shown is the water level (stage) of Lake Tahoe measured at USGS 10337000. All readings are static water levels collected following a minimum 12-hour recovery time, with the exception of the May 2007 reading, which is a pumping water level measured at a well pumping rate of 700 gallons per minute(gpm). Water year type using the TVS Basin Water Classification is indicated using the bar chart and upper bound of total precipitation displayed on the secondary-y axis.



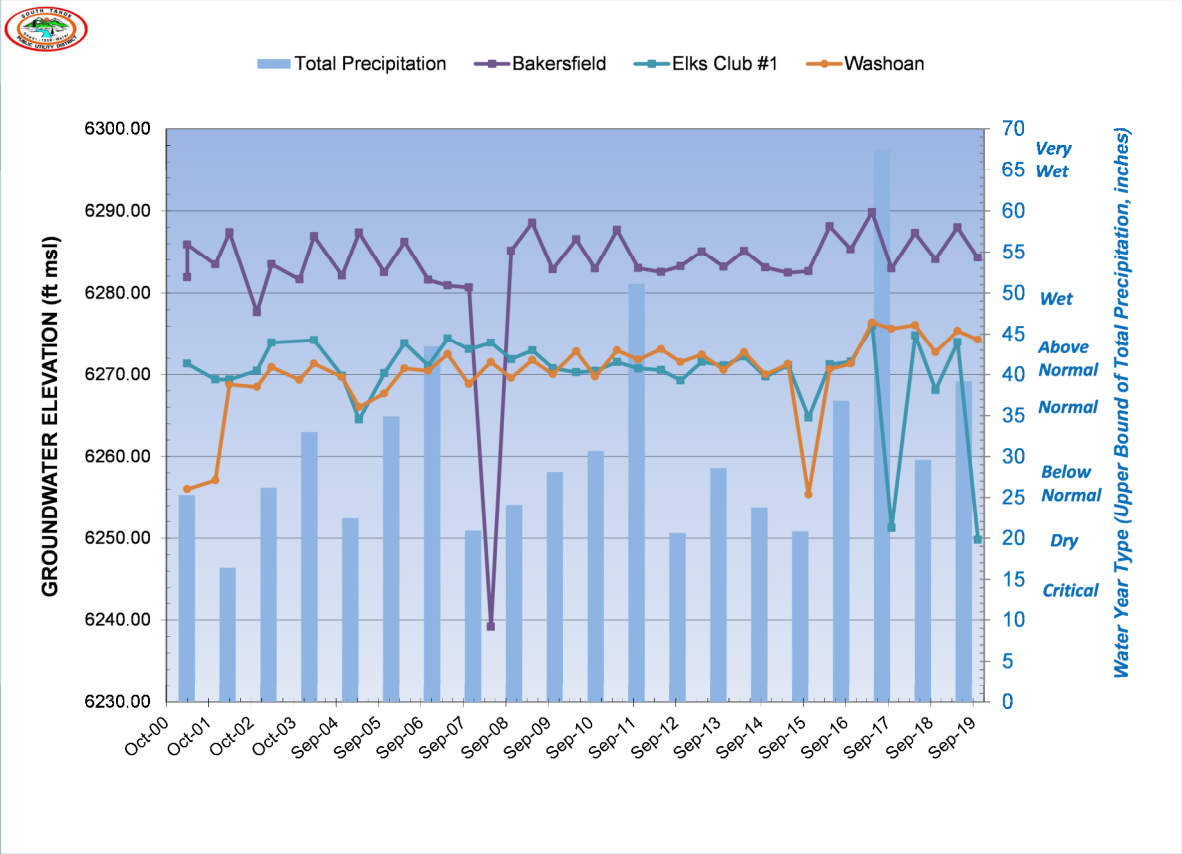
Appendix A – 2. Groundwater hydrograph for the Blackrock #1 (6,241 feet msl) and Glenwood #3 (6,260 feet msl) wells within the Bijou sub-area. Static water levels in the Blackrock #1 well are stable and slightly rise above ground surface (6,240 feet msl). The Glenwood #3 well is used to monitor water levels near an active PWS well (Glenwood #5). In 2007, the District restricted water production from Glenwood #5 in order to sustain groundwater production from this sub-area. The water level response in Glenwood #3 shows that this change in operation has been successful in allowing groundwater levels to recover to sustainable levels.



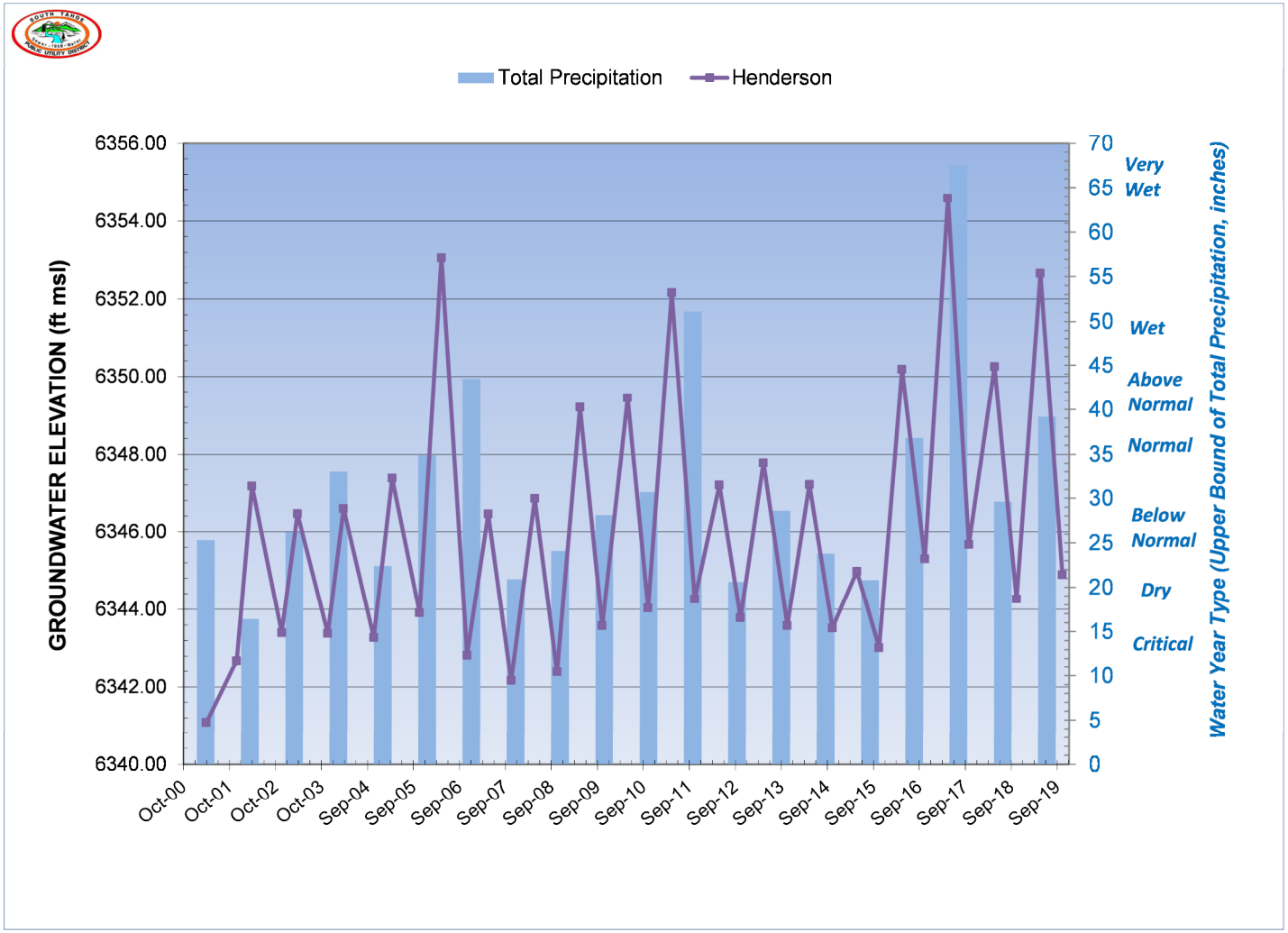
Appendix A – 3. Groundwater hydrograph for the Paloma (6,267 feet msl); Sunset (6,249 feet msl) and CL-1 (6,279 feet msl) wells in the South Lake Tahoe sub-area. Groundwater levels in these wells appear stable. Since 2017, groundwater production from the Sunset and Paloma wells has increased by 162 million gallons.



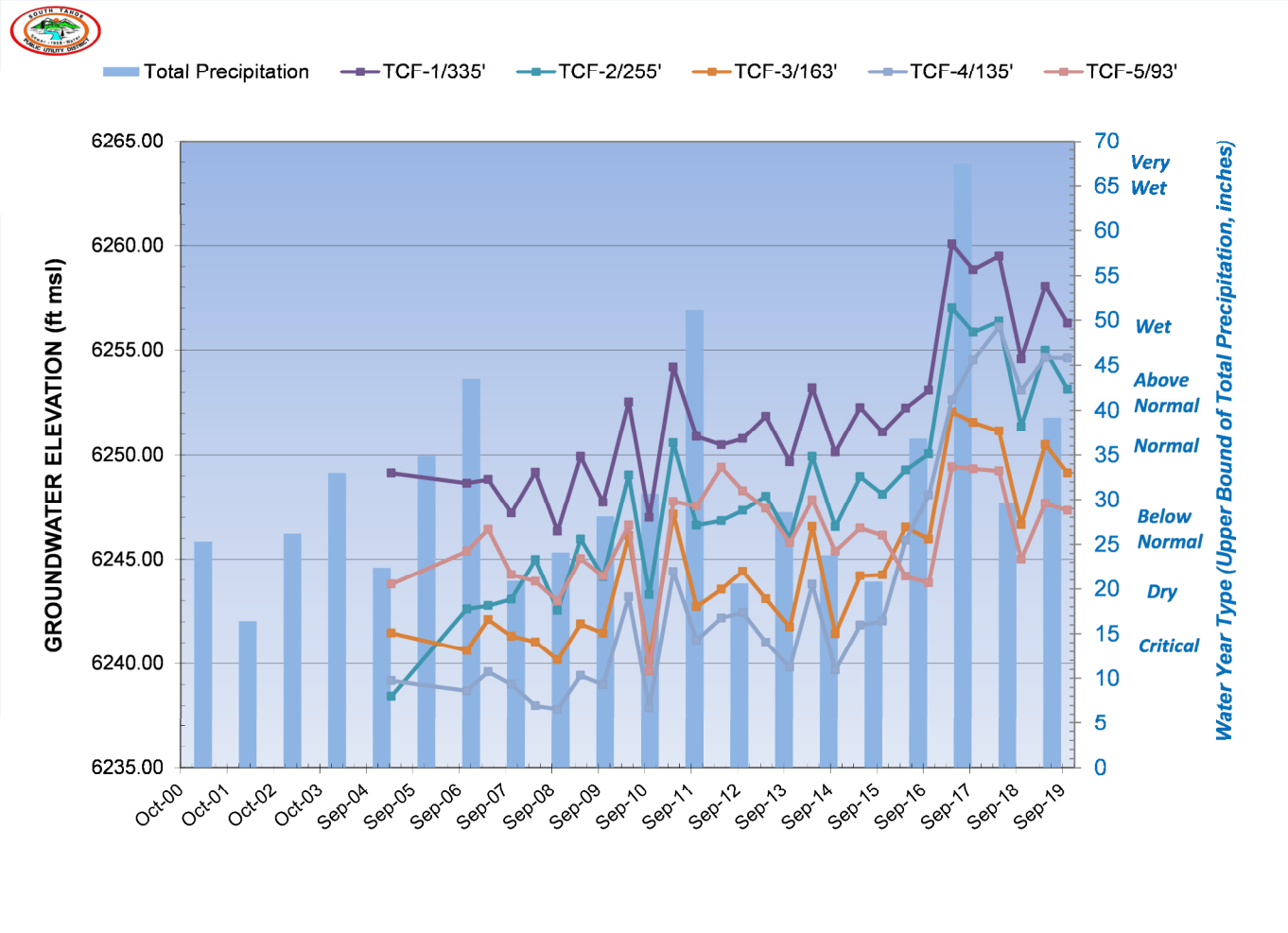
Appendix A – 4. Groundwater hydrograph for the Mountain View (6,313 feet msl) well (artesian flowing well) in the Angora sub-area.



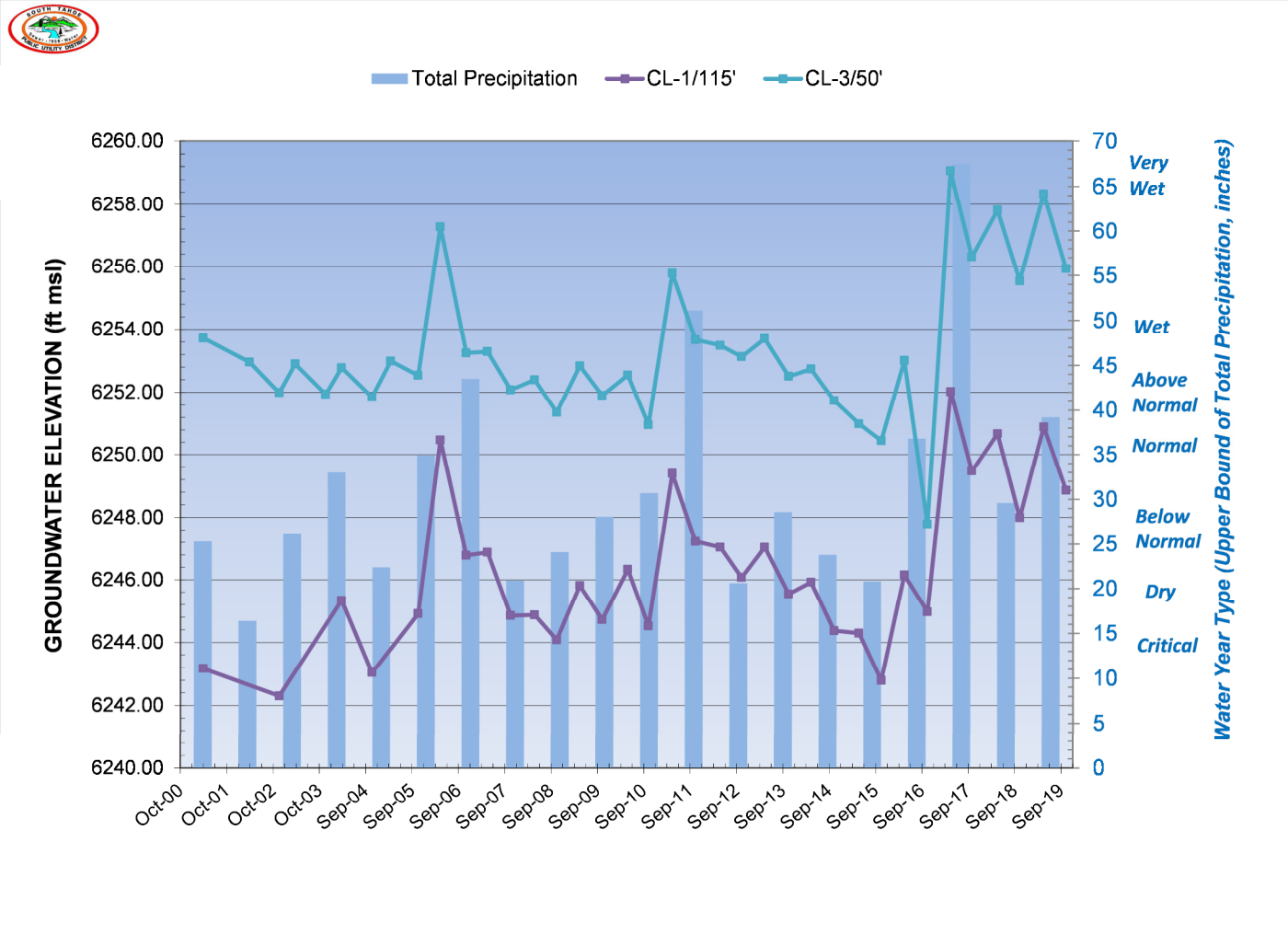
Appendix A - 5. Groundwater hydrograph for the Bakersfield (6,311 feet msl); Elks Club #1 (6,283 feet msl) and Washoan (6,308 feet msl) wells in the Meyers sub-area. Groundwater levels in the Meyers sub-area are relatively stable with short periods of declining water levels in response to increased pumping rates. Static water levels collected from the Bakersfield Well are following a minimum 12-hour recovery time, with the exception of the May 2008 reading which is a pumping water level measured at a well pumping rate of 1,500 gallons per minute(gpm). The Elks Club #1 Well is situated in close proximity to an active pumping well (Elks Club Well #2). Static water levels collected from the Elks Club #1 are typically collected when the Elks Club Well #2 is off. The October 2017 reading is a water level measured when the Elks Club #2 Well was pumping at a rate of 310 gallons per minute (gpm).



Appendix A-6. Groundwater hydrograph for the Henderson Well (6,366 feet msl) within the Christmas Valley sub-area. Groundwater levels in this well are stable and do not exhibit a long-term downward trend.



Appendix A – 7. Groundwater hydrograph for the USGS TCF nested well (6,296 feet msl) within the South Lake Tahoe sub-area. Total well depths for the observation wells completed within the common borehole are as indicated. The complex vertical flow directions indicated by differences in groundwater levels in this well are believed to result from lowered head in BZ 4 induced by pumping of the Glenwood #5 well.



Appendix A - 8. Groundwater hydrograph for the Clement Well cluster (6,279 feet msl) within the South Lake Tahoe sub-area. Total well depths for the observation wells comprising the well cluster are as indicated. Both CL-1 and CL-3 monitor groundwater levels from the uppermost water-bearing zone (TKZ5). Vertical flow is directed downward indicative of recharge adjacent to Tahoe Mountain.

APPENDIX B

SAG Workshop Minutes

Workshop 1 (July 23, 2019)

Workshop 2 (November 22, 2019)

Tahoe Valley South Subbasin (6.5.01) Groundwater Management Plan
MEETING NOTES

Tuesday, July 23rd, 2019 1:30-4:30 p.m.
Location: 1275 Meadow Crest Drive, South Lake Tahoe CA

ATTENDEES:
Ken Payne (El Dorado County Water Agency – via Teleconference); Jason Burke (City of South Lake Tahoe); Nakia Foskett (Lakeside Park Water Co.); Jennifer Lukins (Lukins Brothers Water Co); Dave Patterson (Tahoe Keys Water Co.); Brian Grey (Lahontan Regional Water Quality Control Board); Jason Burke (City of South Lake Tahoe); Michael Conger (Tahoe Regional Planning Agency); Andrea Buxton (Tahoe Resource Conservation District); Shay Navarro (Tahoe Regional Planning Agency); Russ Wigart (El Dorado County Department of Transportation); Christina Boggs-Chavira (California Department of Water Resources-NCRO – via Teleconference); Ivo Bergsohn, P.G., HG (South Tahoe PUD); John Thiel (South Tahoe PUD).

BASIN MANAGEMENT OBJECTIVES:
Ivo opened the meeting with a brief explanation of the workshop objectives.

1. Maintain a sustainable long-term groundwater supply.
2. Maintain and protect groundwater quality.
3. Strengthen collaborative relationships with local water purveyors, governmental agencies, businesses, private property owners and the public.
4. Integrate groundwater quality protection into local land use planning activities.
5. Assess the interaction of water supply activities with environmental conditions.
6. Convene an on-going Stakeholders Advisory Group (SAG) as a forum for future groundwater issues.
7. Conduct technical studies to assess future groundwater needs and issues.
8. Identify and obtain funding for groundwater projects.

WORKSHOP OBJECTIVES

1. Learn about stormwater management in the South Shore Area.
2. Consider groundwater management program activities being planned for the 2019/2020 fiscal year.

Att 1: 2019 SAG Roster Changes

- Welcome
    - Nakia Foskett, Water Systems Manager, Lakeside Mutual Water Company – NEW; and
    - Andrea Buxton, Stormwater Program Manager, Tahoe Resource Conservation District – NEW
- Farewell
    - Dave Peterson, Water Company Manager, TKWC, - LEAVING
- Please review and return with any changes

DISCUSSION

TVS Basin (6-5.01) - Open Forum

Ivo asked if there were any topics outside of the Agenda outline that anyone wanted to discuss now or bring up for another meeting.

Att 2 - 21 Dec 2018 – Meeting Notes – Provided for Your File; On District Web Page

Att 3 – LRWQCB General Order

- Email received from LRWQCB last Wednesday (7/17/2019)

- LRWQCB is seeking input with regard to proposed changes to a General Order defining the waste discharge requirements for Groundwater Remediation and Disposal of Treated Groundwater to Land.
- LRWQCB is seeking input with respect to a list of amendments that may be added which would broaden the scope of activities that could be permitted under the General Order
- Specifically LRWQCB is seeking input on;
    - Potential impacts that may occur within your jurisdiction in the event of an unauthorized release of the amendments and/or concentration of the constituents of concern above the maximum contaminant level and public health goals. Indicate your most sensitive areas if possible; and
    - Potential impacts associated with extraction and injection of the water to the groundwater basin(s).
- Initial feedback from Stakeholders due tomorrow (7/24/2019)

Lake Tahoe Basin Climate Change Vulnerability Assessment

- CTC awarded SB1 Climate Adaptation Planning Grant through CalTrans ($359,756)to develop Vulnerability Assessment and Action Plan
- Vulnerability Assessment (In-progress)
    - Potential climate change impacts on
        - Lake Tahoe System (includes Groundwater -Low Elevation)
        - Upland System ((includes Groundwater -High Elevation)
        - Built Environment/Communities
- Action Plan (to-do)
    - Identify Adaptation Measures – measures that benefit multiple resources to bolster Basin's resilience to impacts from Climate Change
- Contacts
    - Dorian Fougeres, Chief of Natural Resources, CTC
    - Ben Pogue, Catalyst Environmental Solutions

EDF – email received this morning from the Environmental Defense Fund

- The Groundwater Game;
- Game to facilitate understanding about approaches that may be used when developing Groundwater Sustainability Plans which balance supply and demand within their groundwater basin.

TVS Basin 2018 WY Annual Report (3/18/2019) is on the Groundwater Management Process page of the District's website –

- Normal water year (10/1/2017 – 9/30/2018)
- GW Recharge (37,746 AF)
- GW Production (6,910 AF)
- GW Storage (-8,621 AF); Since 2005 (+49,356 AF)
- GW Levels Above Normal compared to base period (2001 – 2010 WY)

South Y Activity Updates

Former LTLW Off-Site Investigation and Regional Plume Characterization (B. Grey, LRWQCB)

- Brian Grey gave a slide presentation on the progress of investigations being performed by the responsible parties (RP) at the former Lake Tahoe Laundry Works (LTLW) site, including an overview of the Phase 1 and Phase 2 groundwater sampling results, passive vapor survey sampling results and proposed work at the Tucker Basin, Big O Tires site and development of a Remedial Action Plan for the former LTLW site.

During the presentation Jason Burke questioned LRWQCB's interpretation of the CSLT stormwater system layout as presented for the Tucker Avenue Basin site. (See Attached Presentation).

- Brian also provided an update on the Regional Plume Characterization under the direction of the LRWQCB, using SB445 funds. This included the issuance of more than 200 requests for site history letters to property owners where LRWQCB has reason to believe that PCE had been used on the premises. 114 Responses received, 29 NOVs issued (responses to questionnaires -not received or incomplete). Work will be used to help build inventory for source identification use. LRWQCB Issued a letter to Big O and Hurzel Properties, LLC requesting a work plan for additional site characterization and a completed questionnaire. A questionnaire and Phase 1 report were received from Hurzel Properties. (See Attached Presentation).

- Brian also described up-coming tasks planned for the upcoming field season for the Regional Plume Characterization (RPC).The RPC also includes a vertical conduit (well) survey; non-municipal (private ?) well sampling and evaluation of possible sentry well locations to monitor plume movement. Christina Boggs (DWR) noted that the funding through DWR's Technical Support Services may also be available for installation of sentry wells for this project (See Attached Presentation).

South Y Feasibility Study (I. Bergsohn, STPUD)

- Ivo Bergsohn gave a slide presentation on the progress of the South Y Feasibility Study (FS). This project is being funded, in part, by a Proposition 1 Groundwater Clean-Up Grant administered through the State Water Resources Control Board. The purpose of the FS is to evaluate whether existing and/or new wells can be used to provide hydraulic control and removal of tetrachloroethylene (PCE) from groundwater. Ivo provided a series of tables listing project milestones to illustrate the progress of the FS. A "To-Do" Table was presented listing the major milestones required to complete the FS by the end of 2019. The Interim Remedial Action Plan (RAP) is required to include: a conceptual design for the recommended alternative; a project schedule; and a project financing and governance plan (See Attached Presentation).

Discussion

- S. Navarro- any effort made to look at source control and removal of contaminated soils?
    - South Y FS constraint – efforts undertaken by water purveyors should not overlap with responsibilities of RPs. LRWQCB Is responsible for directing these types of activities (Ivo B.). RPs are under a Clean-Up and Abatement Order to investigate these types of activities (Brian G.).
- D. Peterson – have there ever been borings drilled between TKWC #1 and Lake Tahoe to determine if PCE plume has reached the Lake?
    - Not to my knowledge (Ivo B.)
- R. Wigart – Who is liable for contamination; what are costs of remediation?
    - LRWQCB SB 445 Grant: $4.5 million; LBWC; $ 500 – 750 thousand (without future costs for remediation, estimated at about $2.15 million capital cost, does not include O&M); TKWC; $ 750 thousand (to-date?); STPUD Prop 1 Grant; $ 500 thousand.
    - How are water purveyors paying for this? LBWC- dedicated line-item surcharges on customer water bills: purchase water, contaminated water treatment, water quality testing, and litigation. LRWQCB has been working to attain state-grant funding since 2014 (Jennifer Lukins); TKWC – paid through Homeowner Association fees.
    - LRWQCB must make determination on source(s) and liability.

Stormwater Management

Ivo Bergsohn gave a brief introduction introducing this topic to SAG. Program managers from the City, EDC, TRCD and TRPA were invited to provide brief presentations describing the primary objectives of their respective programs to provide an understanding of the scope of stormwater management within our groundwater basin. The SAG was encouraged to consider the connections between storm water management and groundwater protection; and whether storm water systems should be considered within the basin's groundwater management plan.

City of South Lake Tahoe Stormwater Management Program (J. Burke, CSLT)

- Jason Burke provided a slide presentation describing the City's Storm Water Management Program, including an overview of the regulatory drivers necessitating storm water management by the CSLT, including NPDES requirements under LRWQCB Orders, Municipal Stormwater Permit Requirements (MS4 Permit); Lake Tahoe TMDL) and Regional Stormwater Monitoring Program (RSWMP). Program elements include Construction- ensure no pollutants in construction site runoff; Commercial/Industrial – ensure businesses do not pollute water; Municipal - ensure no pollutants in runoff from City operations; Illicit Discharge Elimination; New Development/Redevelopment – require infiltration BMPs to satisfy TRPA mandate; Education and Outreach. The Lake Tahoe TMDL Report shows that the greatest majority of Total Suspended Solids (TSS) (aka Fine Sediment) and Dissolved Nitrogen (N) occur in stormwater runoff from primary roads. Pollutant Load Reduction Model (PLRM) uses the runoff concentrations to estimate pollutant loads from differing land use categories. The PLRM is then used to identify high pollutant load areas in order to develop plans for the construction of stormwater systems to reduce pollutant loads to Lake Tahoe. CSLT stormwater system constructed since the mid-1980s, most recent improvements constructed within past 20 years (grant-funded). Challenge(s): 1) many areas within City limits do not have stormwater infrastructure or drainage necessary for effective stormwater management; i.e., Al Tahoe area- no utility easements for drainage; 2) Aging Infrastructure (stormwater pipe failures – potential pathways for groundwater contamination); and 3) Aging Equipment (See Attached Presentation)..

El Dorado County Storm Water Management Program (R. Wigart, EDC-DOT)

- Russ Wigart provided a slide presentation describing the County's Storm Water Management Program, including an overview of the regulatory drivers necessitating storm water management within the Lake Tahoe Basin; environmental concerns within the Lake Tahoe Basin; and impacts of development and urbanization on stormwater run-off (greater runoff volume, higher peak discharge). Lake Clarity: 72% of Lake Clarity loss is due to fine sediment; 73% of fine sediment is clay size fraction (0.5 – 1.0 microns size), particles dissolve at ~0.4 microns. Lake clarity natural cycle - improves during lake level highstands; declines during droughts (periods of low lake levels). Lake Tahoe TMDL objective- Reduce Fine Sediment and Pollutants (FSP) by 65%. Storm Water is managed to meet this objective using Lake Clarity Crediting Program and Pollutant Load Reduction Model (PLRM). Baseline loading surface runoff: 500 - 1,300 ac-ft/yr. Surface runoff control measures– Infiltrate Urban runoff; subsurface drain systems; residential BMPs; rain gardens/micro basins. Costs for non-compliance $10,000/day plus $10/gallon over 1,000 gallons. County Efforts: Staff training/education – water quality and road damage prevention; beet-juice based deicing solutions; pavement maintenance (stormwater concentrations increase as paving deteriorates (Paving Condition Index (PCI)) (See Attached Presentation).

Regional Storm Water Monitoring Program (A. Buxton, TRCD)

- Andrea Buxton provided a slide presentation with an overview of the Tahoe Resource Conservation District's Regional Stormwater Monitoring Program (RSWMP), including need for a regional program, benefits of collaboration and partnership with multiple City and County agencies and program funding sources. TRCD maintains a current network of 12 stormwater monitoring sites and 6 weather stations

distributed around the perimeter of Lake Tahoe. Collected water quality samples are analyzed for fine sediment particles (FSP), Total Nitrogen (TN) and total phosphorus (TP). Automated samplers are used to collect stormwater quality samples and monitor continuous flow and selected weather data (precipitation, temperature). The collected data are analyzed for status and trends. Status: precipitation amounts, runoff volumes, and pollutant loads for a given water year. Trend analysis used to compare year-to-year changes in annual volumes and pollutant loads. Volumes and pollutant loads are normalized against precipitation amounts for comparison purposes. Currently, TRCD dataset includes 5 – 6 water years of stormwater monitoring data. Data is reported annually to LRWQCB and NDEP. Inspection of average annual pollutant concentrations and runoff volumes shows that Upper Truckee Catchment area tends to have high concentrations of both TN and TP as most runoff originates from US Highway 50. However, this catchment is small, therefore the runoff volumes are small, and the resulting loads are small. In contrast, Tahoe Valley which has a very large catchment size, and even though TN and TP pollutant concentrations are low, loads are very high from this catchment because of the large runoff volumes. Runoff volume has the greatest influence on pollutant loads – focus on reducing runoff volumes using infiltration whenever possible to reduce pollutant loads. Infiltration also addresses capture of fine sediment particles which are typically not removed using stormwater cartridge filtration systems. PLRM used to model urban catchments. Model uses 18-year average precipitation event (1989 – 2006). Difficult to compare PLRM predicted values with TRCD field data because of differences between modeled and actual runoff volumes. However, field data has been used to update load reductions used for cartridge filters in the PLRM model (See Attached Presentation).

TRPA Stormwater Management Program Overview (S. Navarro, TRPA)

- Shay Navarro provided a slide presentation with an overview of the Tahoe Regional Planning Agency (TRPA) Stormwater Management Program, including a description of TRPA's Planning Framework, primary objectives for the stormwater management program, how TRPA collaborates with other agencies to implement stormwater management in the South Shore area; and how stormwater is considered within TRPA's source water protection program. TRPA's program is focused on managing stormwater on private parcels with existing uses within the Lake Tahoe Basin. Stormwater Management part of EIP Division, one of many water quality programs including TMDL water quality thresholds, lake clarity and groundwater protection. Primary objectives: Maintain and Restore Lake Clarity; Encourage use of BMP Practice Requirements; and Implement BMP Action Plan recommendations. Coordination occurs through participation in: EIP Working Group's Stormwater Quality Improvement Committee and Parcel BMP Working Groups; coordination with local agencies to help set annual stormwater program priorities; and partnering for grant funding opportunities. Stormwater is considered under TRPA Code Standards: prevention of potential contaminating activities within defined source water protection areas; discharge limits to groundwater – where direct connection between surface water and groundwater; BMPs require pre-treatment of runoff prior to infiltration in high groundwater areas (1-foot separation requirement), can be waived if connected to a regional treatment system. BMP Action Plan- restricts use of infiltration on parcels with known incidences of shallow soil contamination (See Attached Presentation).

Discussion (Group)

- Are there actions that should be completed that would benefit stormwater management and groundwater protection within the South Shore Area?
- Tucker Ave. Basin- Basin was created after LTLW site was active. At the time LTLW was active, it was an open stormwater ditch. Raley's Center has a stormwater treatment system; system should not be infiltrating when shallow soil contamination may be present.

- 2nd Nature Study – study was focused on occurrence of VOCs in stormwater discharges. Major finding was concentrations of VOCs were at trace or non-detect levels. Trace concentrations of low molecular weight VOCs suggest that volatile fraction was removed prior to entrainment in stormwater runoff and collection and infiltration through stormwater retention basins.
- Given the need for infiltration of stormwater and groundwater quality concerns with respect to source water protection, should a section on stormwater management be added to the Groundwater Management Plan (Ivo B.)? For example, TRPA expressed need for identifying parcels with known incidences of shallow soil contamination. These data are readily available through GeoTracker. Maps showing the occurrence of shallow soil contamination could then be created for inclusion in the GWMP. This could help prevent infiltration of shallow soil contamination to groundwater benefitting stormwater and groundwater managers.
- Are there water quality parameters that could be added to TRCD's stormwater sampling protocol that would benefit groundwater protection (Ivo B.)? Source control was a likely cause of many of the groundwater contamination problems that we currently see in the groundwater basin. A stringent stormwater sampling program focusing on toxic substances in characterizing first-flush storm events was completed in California around 2001 - 2004, as part of the California Toxics Rule. Sampling results brought back limited information on pollutant sources of toxic substances (R. Wigart). This should be revisited before considering another similar type of sampling effort. Agreed, better approach may be to focus on education and outreach to prevent illicit discharges to stormwater systems (Ivo B.).
- Jason Burke – Would a pre-treatment system prevented the groundwater contamination which occurred due to illicit discharges to the stormwater system from the former LTLW site? Important to recognize that the purity of the dry cleaning solvents used at the former LTLW site was likely very high (95% +). Also proper waste handling and disposal practices were not well established. At these high concentrations, very small amounts of PCE can result in large groundwater contamination problems (Ivo B.).
- S. Navarro- It is important that parcels with known shallow soil contamination are identified. Agreed, mapping of these sites should be performed.
- Tucker Ave Basin- Basin is currently used for infiltration. Funding should be sought to address shallow soil contamination at this site so that continued use as a stormwater retention basin does not exacerbate the South Y Groundwater Contamination problem (Ivo B.). Source removal did occur at former LTLW and Hurzel Properties; however the source removal occurred many years after the release which contributed to the groundwater contamination (B. Grey).

2019/2020 Groundwater Management Projects (I. Bergsohn, STPUD)

- DWR approved the District's 2014 Groundwater Management Plan (GWMP) as an Alternative to a GSP. District will be able to continue to manage groundwater basin under this plan in accordance with SGMA; and amend the plan as needed to address changing groundwater conditions and/or groundwater concerns. District will need to address Recommended Actions identified by DWR in the first 5-year update of the GWMP (due January 2022)
- South Y FS- Technical proposal for implementation will be contingent on the recommended alternative proposed in the FS.
- Complete Survey of Private Well Owners (Phase II).

MEETING ADJOURNED

SIGN-IN SHEET

South Tahoe Public Utility District

TAHOE VALLEY SOUTH BASIN (6-5.01)
GROUNDWATER MANAGEMENT PLAN

2019 STAKEHOLDERS ADVISORY GROUP
WORKSHOP No. 1

Tuesday, July 23rd, 2019
(1:30 PM – 4:30 PM)

NAME	AFFILIATION	PHONE	EMAIL
Shay Navarro	TRPA	775.589.5282	snavarro@trpa.org
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Jason Burke	CSLT	530-542-6038	jburke@cityofslt.us
Andrea Buxton	Tahoe RCD	530-412-0456	abuxton@tahoercd.org
Brian Grey	Lahontan WB	530 542-5421	brian.grey@waterboards.ca.gov
Jenn Wilkins	UBWC	530-541-2006	jennifer@wilkinswater.com
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RUSS WIGART	EDC-DOT	530.573.7924	RUSSELL.WIGART@EDCGOV.US

AGENDA

DATE	Tuesday, July 23rd, 1:30 PM – 4:30 PM
LOCATION	South Tahoe Public Utility District Board Room, 1275 Meadow Crest Drive, South Lake Tahoe, CA
STAKEHOLDER ADVISORY GROUP LIST	Ken Payne, P.E., (El Dorado County Water Agency); Robert Lauritzen, P.G., Karen Bender, REHS, RD (El Dorado County -EMD); Jason Burke (City of South Lake Tahoe); Scott Carroll (CA Tahoe Conservancy); Andrea Buxton (Tahoe Resource Conservation District; Brian Grey, P.G. (Lahontan Regional Water Quality Control Board); Paul Nielsen (TRPA); Joey Keely, Nicole Bringolf (USFS – LTBMU); Nakia Foskett (Lakeside Park Water Co.); Jennifer Lukins (Lukins Brothers Water Co); Dave Peterson. (Tahoe Keys Water Co.); Harold Singer (Community Rate Payer); John Thiel, PE and Ivo Bergsohn, P.G., HG (South Tahoe PUD)
MEETING HOST	Ivo Bergsohn (South Tahoe PUD)
GO TO MEETING	https://global.gotomeeting.com/join/521639373 Call-In: 1(669) 224-3412; Access Code: 521-639-373

BASIN MANAGEMENT OBJECTIVES (BMO)

1. Maintain a sustainable long-term groundwater supply.
2. Maintain and protect groundwater quality.
3. Strengthen collaborative relationships with local water purveyors, governmental agencies, businesses, private property owners and the public.
4. Integrate groundwater quality protection into local land use planning activities.
5. Assess the interaction of water supply activities with environmental conditions.
6. Convene an on-going Stakeholders Advisory Group (SAG) as a forum for future groundwater issues.
7. Conduct technical studies to assess future groundwater needs and issues.
8. Identify and obtain funding for groundwater projects.

WORKSHOP OBJECTIVES

OBJECTIVES

1. Learn about stormwater management in the South Shore Area.
2. Consider groundwater management program activities being planned for the 2019/2020 fiscal year.

SEE REVERSE FOR AGENDA

AGENDA

Time	Description	
1:30	**Welcome and Self-Introductions**	**Round Robin**
1:40	**TVS Basin (6-5.01) - Open Forum** **Opportunity for members to briefly raise topics within the subject matter of the SAG and not listed on the Agenda.**	**Round Robin**
1:50	**South Y Activity Updates** • **LRWQCB Regional Plume Characterization (J. Brooks, LRWQCB)** • **former LTLW Off-Site Investigation (B. Grey, LRWQCB)** • **South Y Feasibility Study (I. Bergsohn, STPUD)** • **Discussion**	
2:30	**Break**	
2:40	**Stormwater Management** • **City of South Lake Tahoe (J. Burke)** • **El Dorado County (Russ Wigart)** • **Tahoe Resource Conservation District (Andrea Buxton)** • **Tahoe Regional Planning Agency (Shay Navarro)** • **Discussion**	
4:10	**2019 Groundwater Management Activities** • **Prop 1 Implementation Grant** • **2014 GWMP Update** • **TVS Basin Survey of Well Owners - II**	**SAG**
4:30	**Adjourn**	

Tahoe Valley South Groundwater Management Plan 2019 SAG Workshop 1

July 23, 2019

Lahontan Regional Water Quality Control Board
South Y Activity Updates

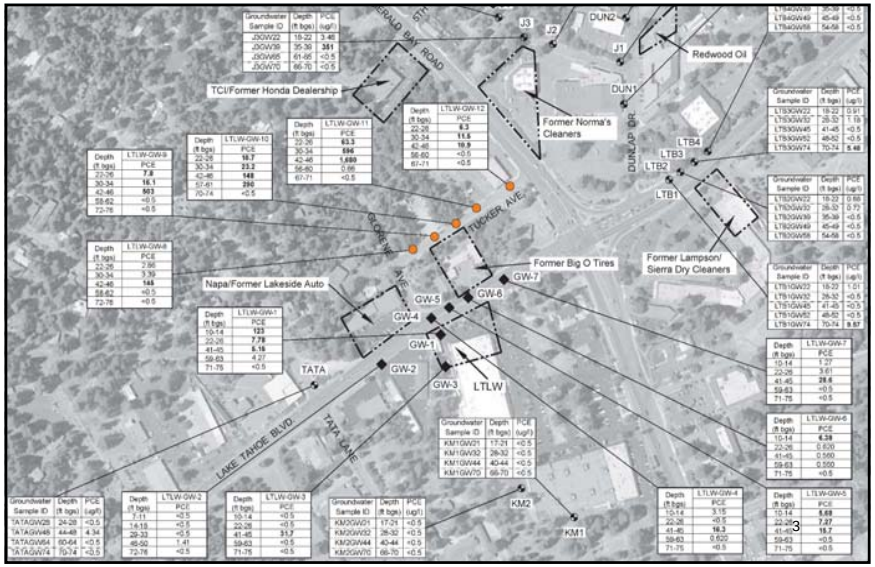
Brian Grey, PG
Engineering Geologist

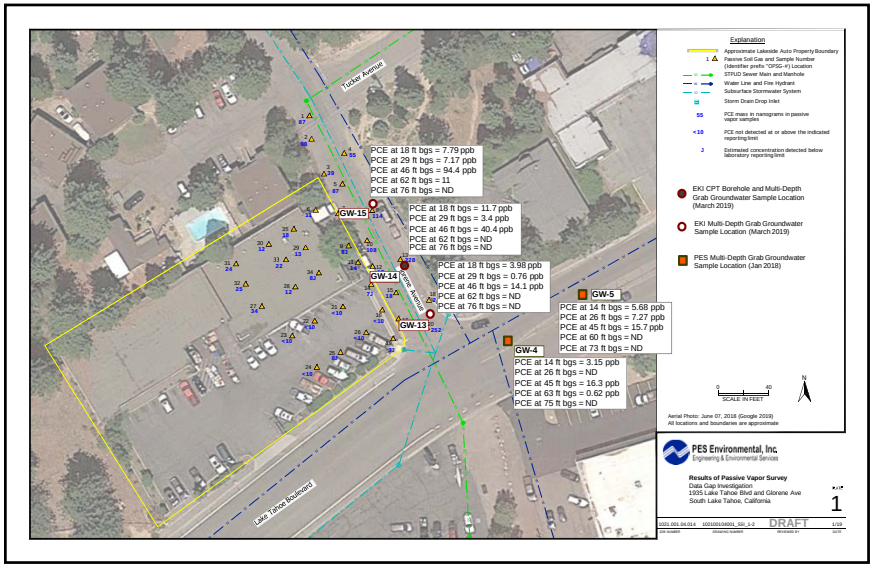
Presentation

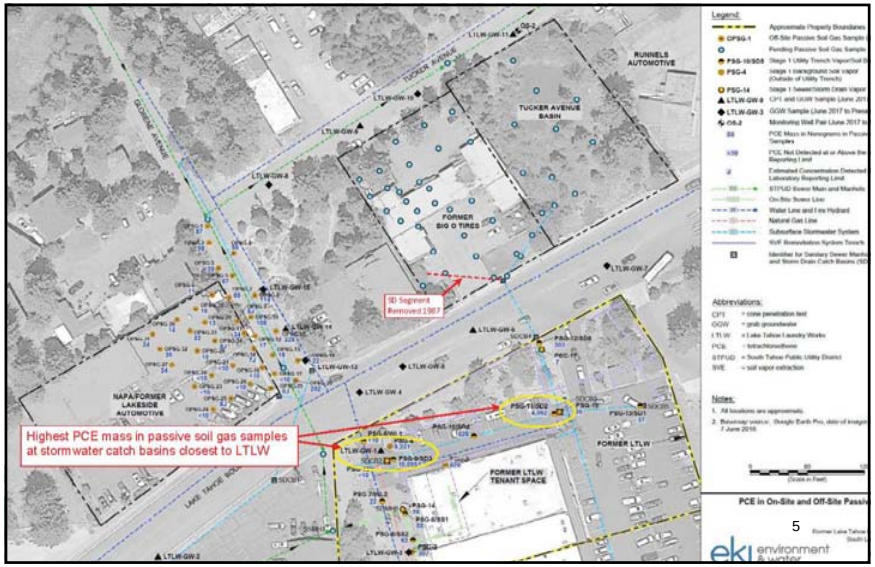
South Y Activity Updates

- Lake Tahoe Laundry Works
  - Results overview
  - Upcoming work
- Regional Plume Characterization
  - Recent directives
  - Framework
  - Initial SB 445 results

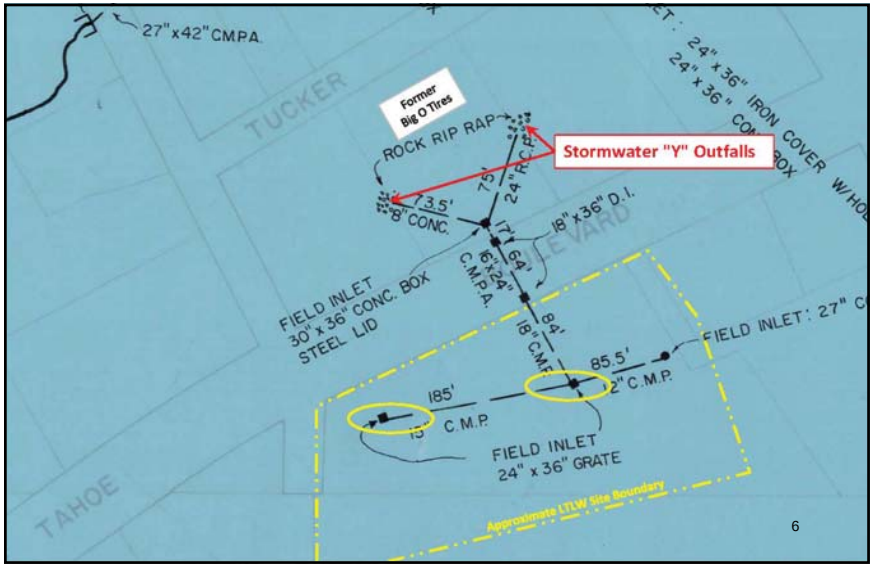
2


TCI/Former Honda Dealership
Redwood Oil
Former Norma's Cleaners
Former Big O Tires
Former Lampson/ Sierra Dry Cleaners
Napa/Former Lakeside Auto
TATA
LTLW
TUCKER AVE
GLORY AVE
TATA LANE
LAKE TAHOE BLVD
DUNLAP DR
DUN1
DUN2
J1
J2
J3
LTB1
LTB2
LTB3
LTB4
KM1
KM2
GW-1
GW-2
GW-3
GW-4
GW-5
GW-6
GW-7

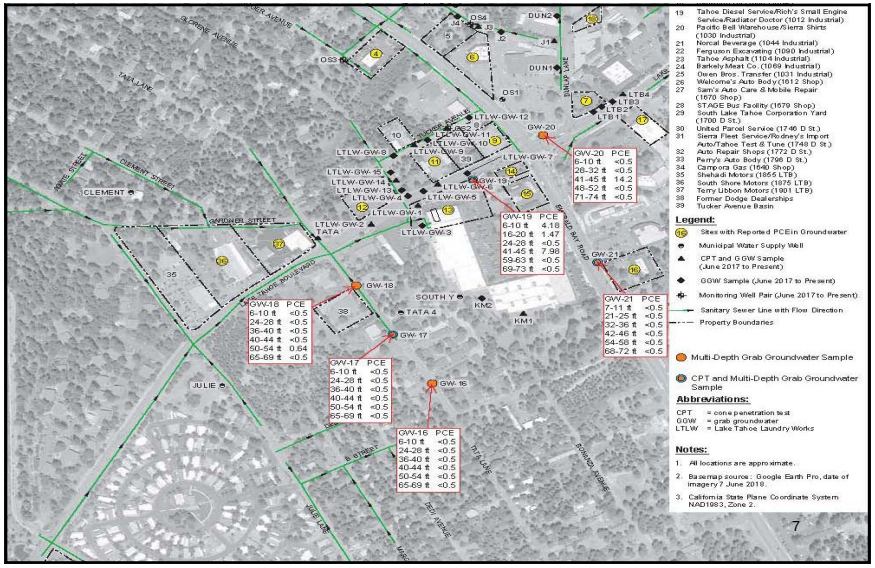

Tucker Avenue
Lake Tahoe Boulevard
GW-15
GW-14
GW-13
GW-5
GW-4
PCE at 18 ft bgs = 7.79 ppb
PCE at 29 ft bgs = 7.17 ppb
PCE at 46 ft bgs = 94.4 ppb
PCE at 62 ft bgs = 11
PCE at 76 ft bgs = ND
PCE at 18 ft bgs = 11.7 ppb
PCE at 29 ft bgs = 3.4 ppb
PCE at 46 ft bgs = 40.4 ppb
PCE at 62 ft bgs = ND
PCE at 76 ft bgs = ND
PCE at 18 ft bgs = 3.98 ppb
PCE at 29 ft bgs = 0.76 ppb
PCE at 46 ft bgs = 14.1 ppb
PCE at 62 ft bgs = ND
PCE at 76 ft bgs = ND
PCE at 14 ft bgs = 5.68 ppb
PCE at 26 ft bgs = 7.27 ppb
PCE at 45 ft bgs = 15.7 ppb
PCE at 60 ft bgs = ND
PCE at 73 ft bgs = ND
PCE at 14 ft bgs = 3.15 ppb
PCE at 26 ft bgs = ND
PCE at 45 ft bgs = 16.3 ppb
PCE at 63 ft bgs = 0.62 ppb
PCE at 75 ft bgs = ND
Explanation
EKI CPT Borehole and Multi-Depth Grab Groundwater Sample Location (March 2019)
EKI Multi-Depth Grab Groundwater Sample Location (March 2019)
PES Multi-Depth Grab Groundwater Sample Location (Jan 2018)
SCALE IN FEET
PES Environmental, Inc.
Engineering & Environmental Services
Results of Passive Vapor Survey
Data Gap Investigation
1935 Lake Tahoe Blvd and Glorane Ave
South Lake Tahoe, California
DRAFT


Highest PCE mass in passive soil gas samples at stormwater catch basins closest to LTLW
SD Segment Removed 1987
TUCKER AVENUE BASIN
FORMER BIG O TIRES
RUNNELS AUTOMOTIVE
NAPA/FORMER LAKESIDE AUTOMOTIVE
FORMER LTLW TENANT SPACE
Legend:
Abbreviations:
Notes:
PCE in On-Site and Off-Site Passiv
environment & water

5


27" x 42" CMPA
Former Big O Tires
ROCK RIP RAP
Stormwater "Y" Outfalls
24" R.C.P.
7.5'
3.5'
8" CONC.
18" x 36" D.I.
17'
64'
6" - 24" C.M.P.A.
FIELD INLET 30" x 36" CONC. BOX STEEL LID
84'
18" C.M.P.
85.5'
12" C.M.P.
185'
15" C.M.P.
FIELD INLET 24" x 36" GRATE
FIELD INLET: 27" C
24" x 36" IRON COVER W/HO
TUCKER
TAHOE
Approximate LTLW Site Boundary

6



Lake Tahoe Laundry Works

Proposed Work

- Tucker Basin
- Big O
  - Passive soil gas
  - Sewer
- On-site Remedial Action Plan

8

Regional Plume Characterization

Recent Directives and Status

- Requests for Site History
  - 114 responses received
  - 29 notices of violation
- Big O
  - Petition and Request for Stay
  - No work plan received
- Hurzel Properties LLC
  - No petition
  - No work plan; questionnaire/Phase 1 received
- Lakeside Napa
  - Revised questionnaire received
  - Recommend No Further Action Required

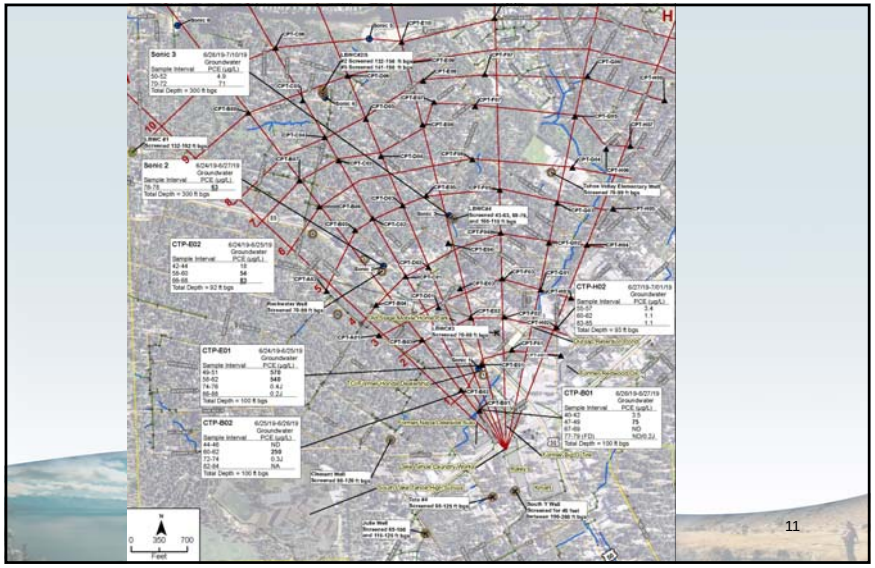
9

Regional Plume Characterization

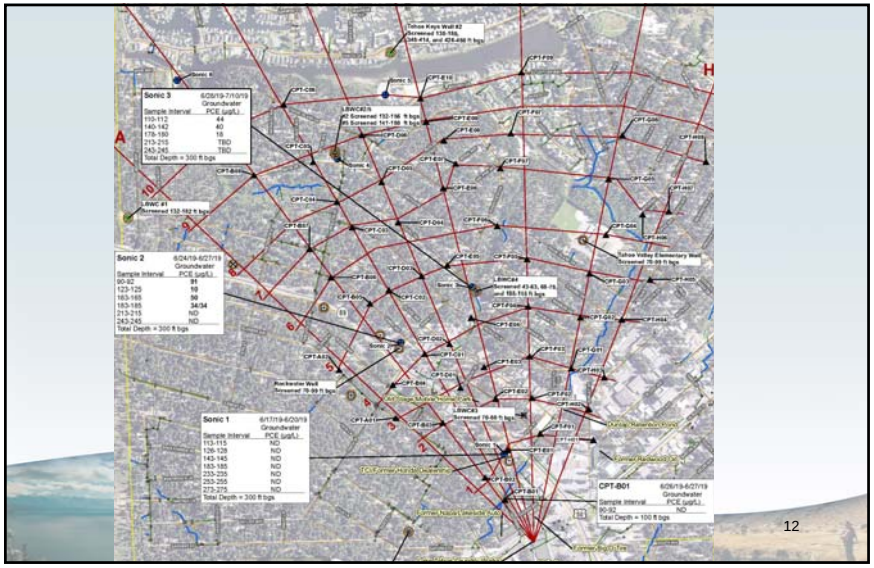
Upcoming Tasks

- Continue regional characterization
- Inventory and database development
- Prioritize vertical conduits for destruction
- Perform non-municipal well sampling
- Evaluate sentry well locations

10


H
Sonic 3
6/26/19-7/10/19
Groundwater
Sample Interval PCE (µg/L)
50-52 11
70-72 11
Total Depth = 300 ft bgs
Sonic 2
6/24/19-6/27/19
Groundwater
Sample Interval PCE (µg/L)
78-78 53
Total Depth = 300 ft bgs
CTP-E02
6/24/19-6/25/19
Groundwater
Sample Interval PCE (µg/L)
42-44 78
54-56 54
88-90 83
Total Depth = 92 ft bgs
CTP-H02
6/27/19-7/01/19
Groundwater
Sample Interval PCE (µg/L)
58-59 3.4
60-62 1.1
63-65 1.1
Total Depth = 93 ft bgs
CTP-E01
6/24/19-6/25/19
Groundwater
Sample Interval PCE (µg/L)
49-51 578
56-62 549
74-76 0.4 J
98-98 0.2 J
Total Depth = 100 ft bgs
CTP-B02
6/25/19-6/26/19
Groundwater
Sample Interval PCE (µg/L)
44-46 ND
60-62 259
72-74 0.3J
82-84 NA
Total Depth = 100 ft bgs
CTP-B01
6/26/19-6/27/19
Groundwater
Sample Interval PCE (µg/L)
40-42 3.5
47-49 75
67-69 ND
77-79 (FD) ND/0.2J
Total Depth = 100 ft bgs
N
0 350 700
Feet

11


H
A
Sonic 3
6/26/19-7/10/19
Groundwater
Sample Interval PCE (µg/L)
110-112 44
140-142 40
178-180 18
213-215 TBD
243-245 TBD
Total Depth = 300 ft bgs
Sonic 2
6/24/19-6/27/19
Groundwater
Sample Interval PCE (µg/L)
90-92 91
123-125 59
163-165 50
183-185 34/34
213-215 ND
243-245 ND
Total Depth = 300 ft bgs
Sonic 1
6/17/19-6/20/19
Groundwater
Sample Interval PCE (µg/L)
113-115 ND
126-128 ND
143-145 ND
183-185 ND
233-235 ND
253-255 ND
273-275 ND
Total Depth = 300 ft bgs
CPT-B01
6/26/19-6/27/19
Groundwater
Sample Interval PCE (µg/L)
90-92 ND
Total Depth = 100 ft bgs

12

Jason Burke

City of South Lake Tahoe Stormwater Management Program

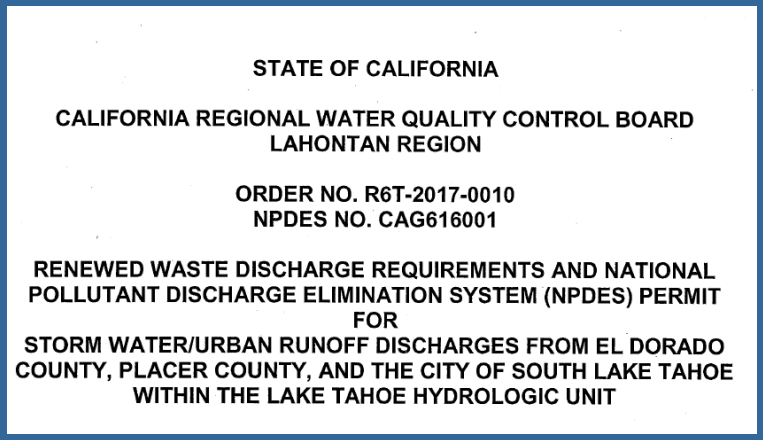
Jason Burke
Stormwater Program Coordinator
7/23/2019

Municipal Stormwater Permit

National Pollutant Discharge Elimination System (NPDES)

- Order No. R6T-2017-0010
  (NPDES No. CAG616001)
  (3/9/2017 through 3/9/2022)

- Previous Permits:
  - Order No. R6T-2011-0101A1
  - Order No. R6T-2005-0026
  - Order No. 6-00-82
  - Order No. 6-92-02



STATE OF CALIFORNIA

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION

ORDER NO. R6T-2017-0010
NPDES NO. CAG616001

RENEWED WASTE DISCHARGE REQUIREMENTS AND NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT FOR
STORM WATER/URBAN RUNOFF DISCHARGES FROM EL DORADO COUNTY, PLACER COUNTY, AND THE CITY OF SOUTH LAKE TAHOE WITHIN THE LAKE TAHOE HYDROLOGIC UNIT

Municipal Stormwater Permit Requirements (MS4 Permit)

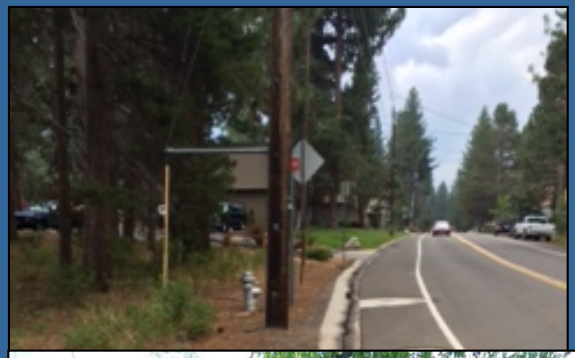
MS4 = Municipal Separate Storm Sewer System

Stormwater Management Program:

- Construction
- Commercial/Industrial/Residential
- Municipal Stormwater Facilities
- Illicit Discharge
- New Development/Redevelopment
- Education and Outreach (public and municipal)

Lake Tahoe Total Maximum Daily Load (TMDL)
Regional Stormwater Monitoring Program (RSWMP)

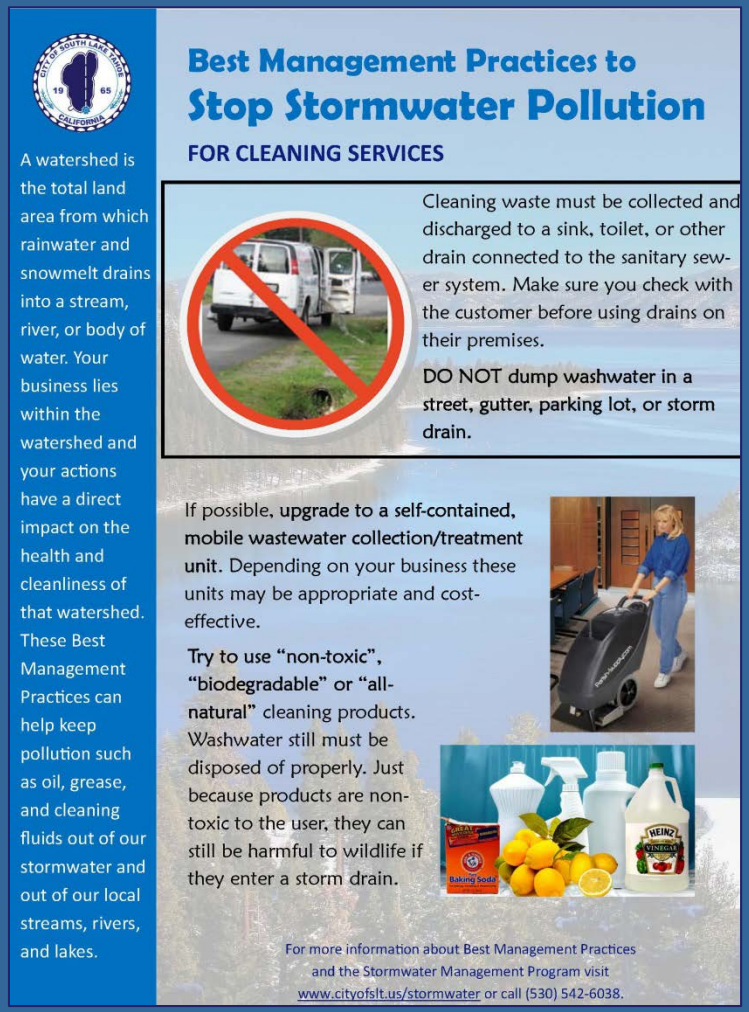
Construction: Ensure no pollutants in construction site runoff



- Building Permits
- Grading Permits
- Standard Details
- Inspections
- Enforcement

Commercial/Industrial: Ensure businesses do not pollute water

- Outreach
- Inspections
- Enforcement



Municipal: Ensure no pollutants in runoff from City operations

- Inspect
- Clean drains
- Operations
  - Traction material
  - Street Sweeping

Illicit Discharge Elimination

- Inspections
- Clean up
- Enforcement

City of South Lake Tahoe

"making a positive difference now"

June 13, 2014

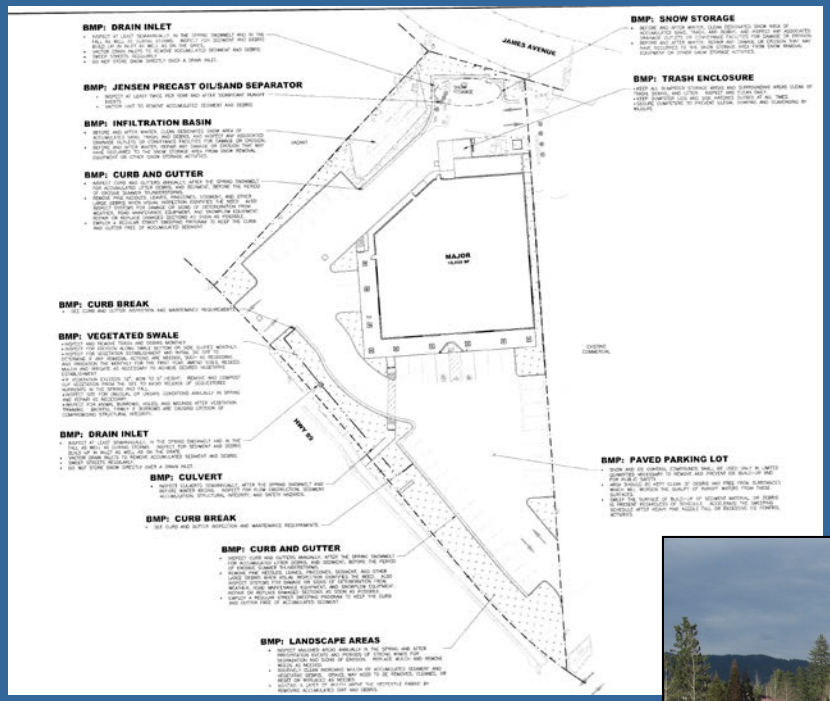
[redacted]

Re: Notice of Urban Runoff and Stormwater Quality Management Code Violation [redacted]

Dear [redacted]

On June 10, 2014, City of South Lake Tahoe was notified of a sewage discharge from the

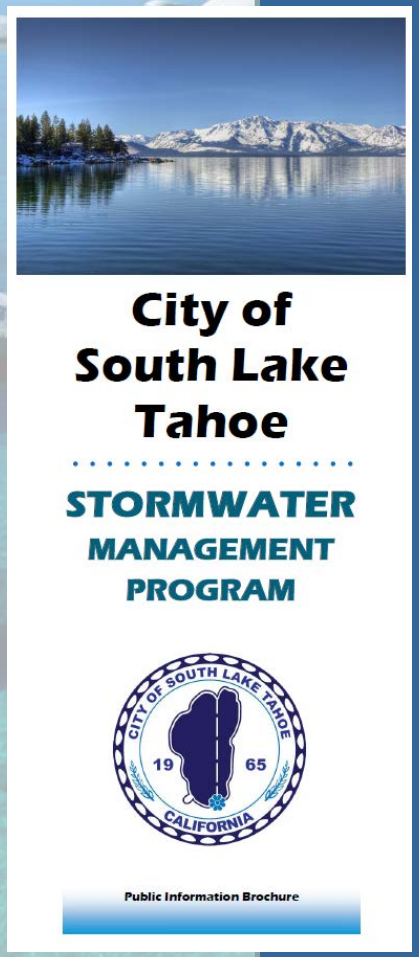
New Development/Redevelopment

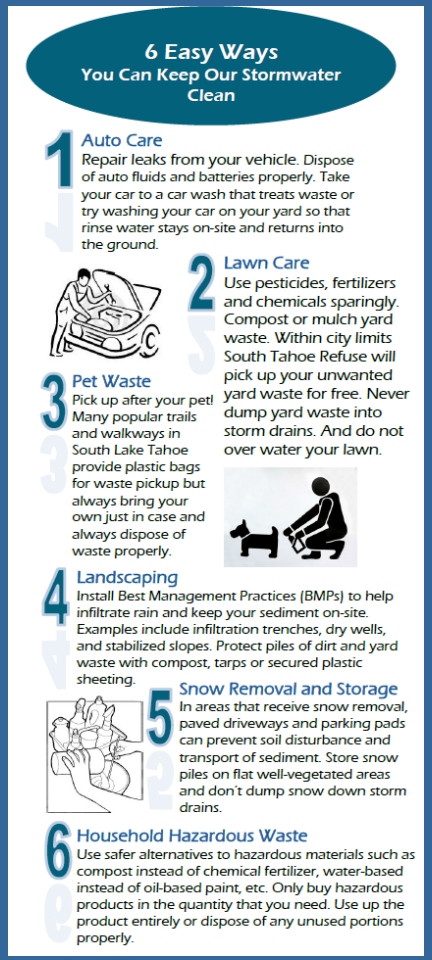


- Plan Review
- Inspection
- Project Completion

Education and Outreach

- Community and volunteer events
- Municipal staff training

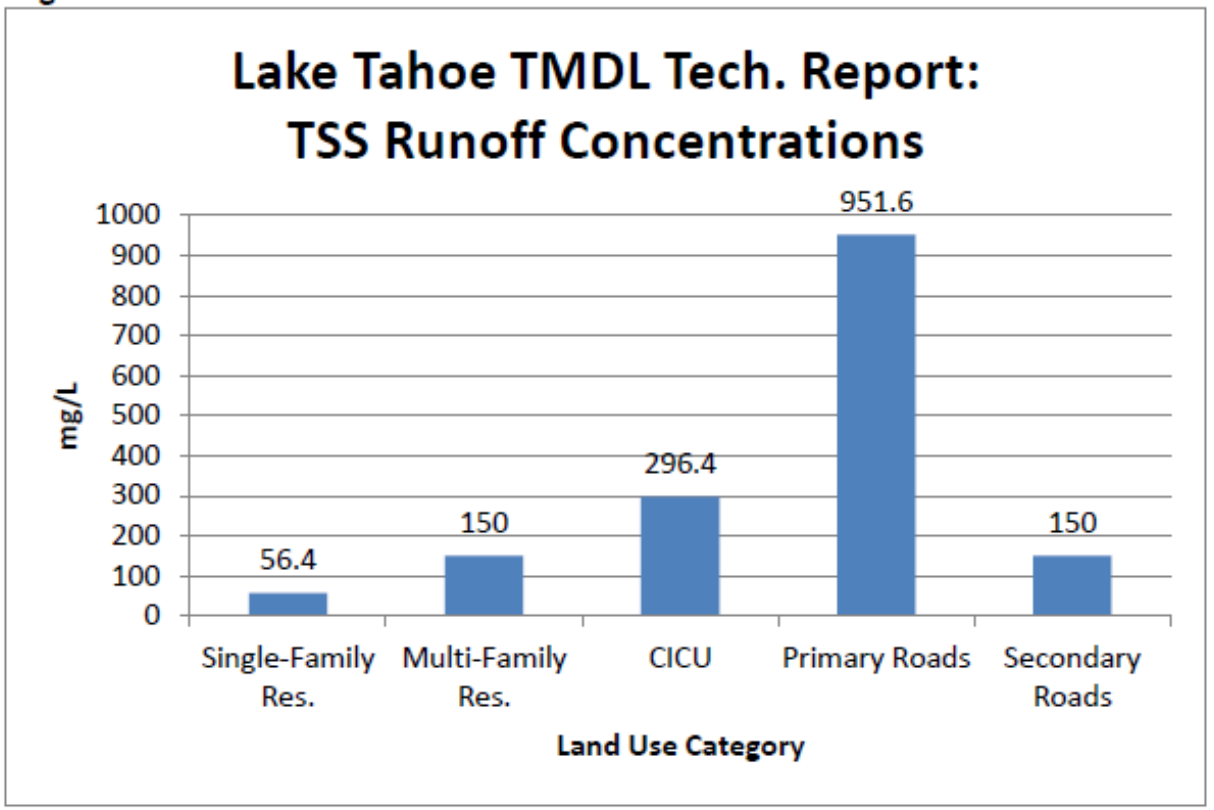




Lake Tahoe TMDL

Lake Tahoe Total Maximum Daily Load

Figure 1

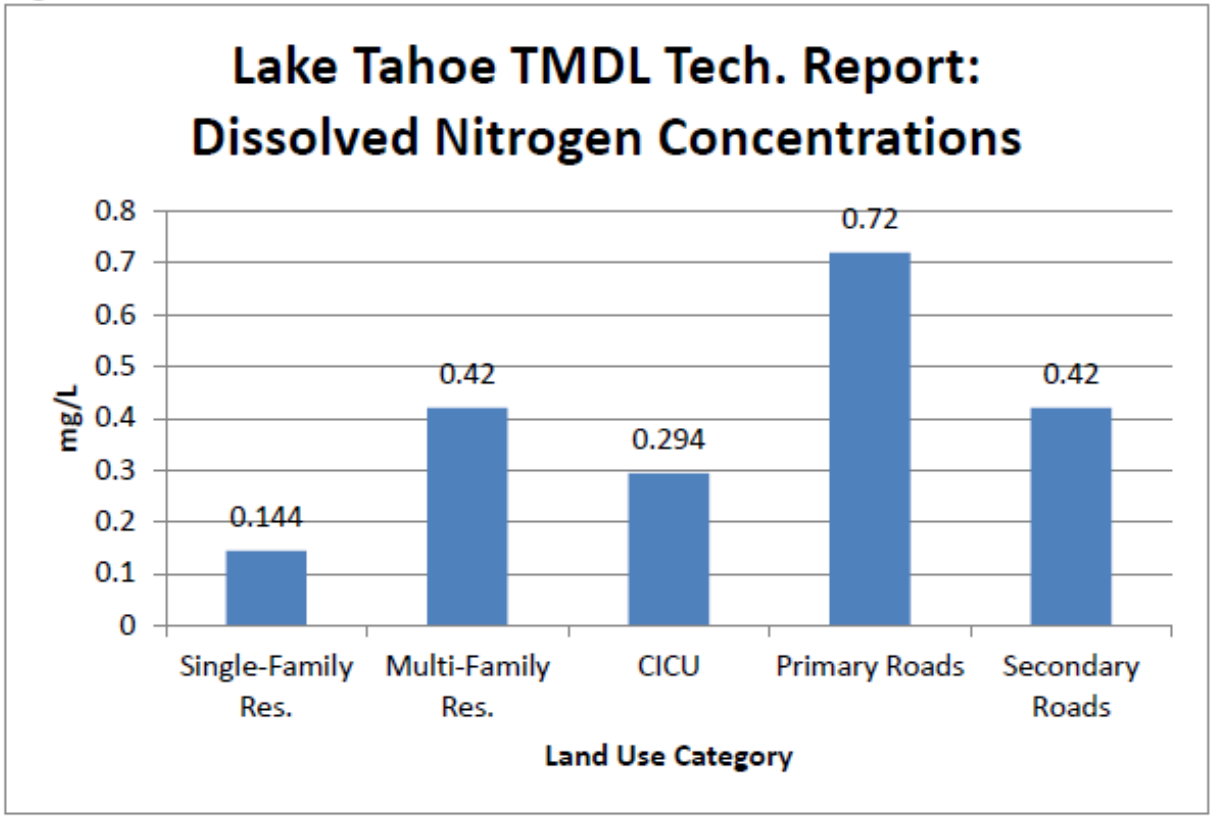


Source: Lake Tahoe TMDL Technical Report, June 2010, Source Analysis, page 4-61

Lake Tahoe TMDL

Lake Tahoe Total Maximum Daily Load

Figure 2

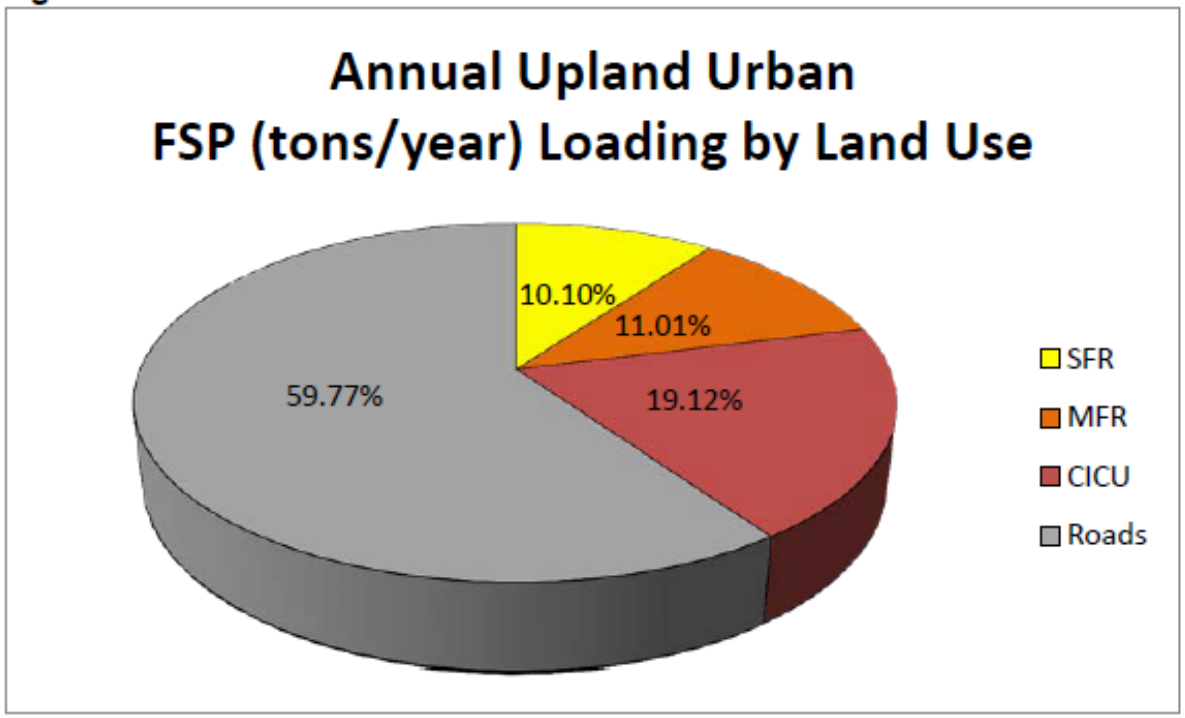


Source: Lake Tahoe TMDL Technical Report, June 2010, Source Analysis, page 4-61

Lake Tahoe TMDL

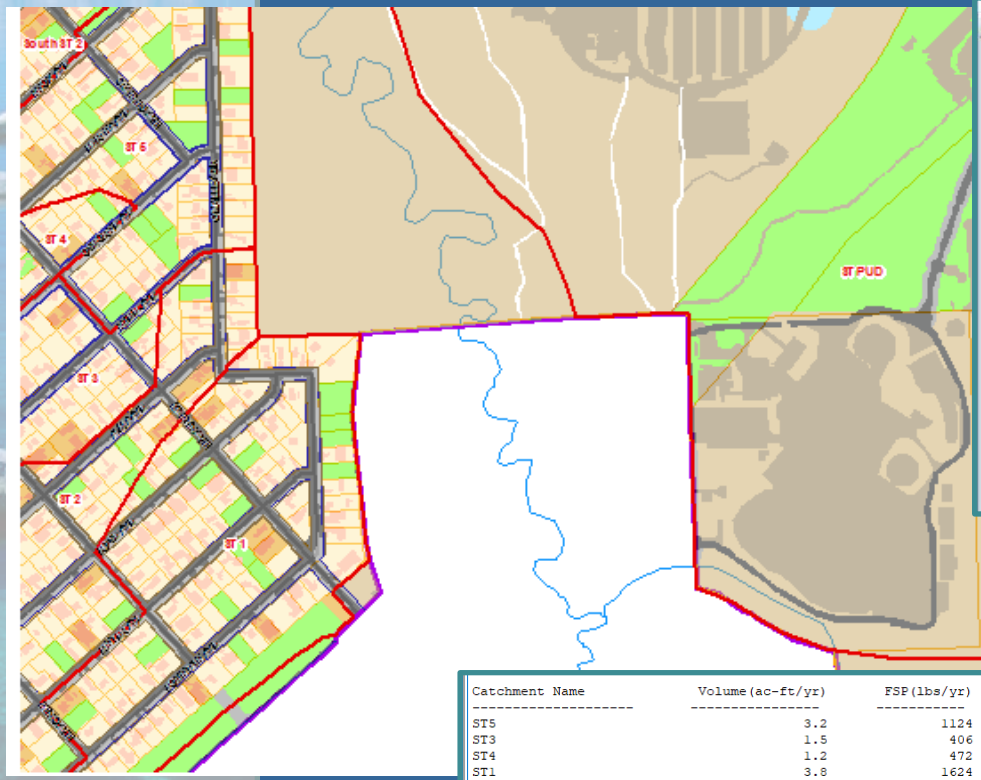
Lake Tahoe Total Maximum Daily Load

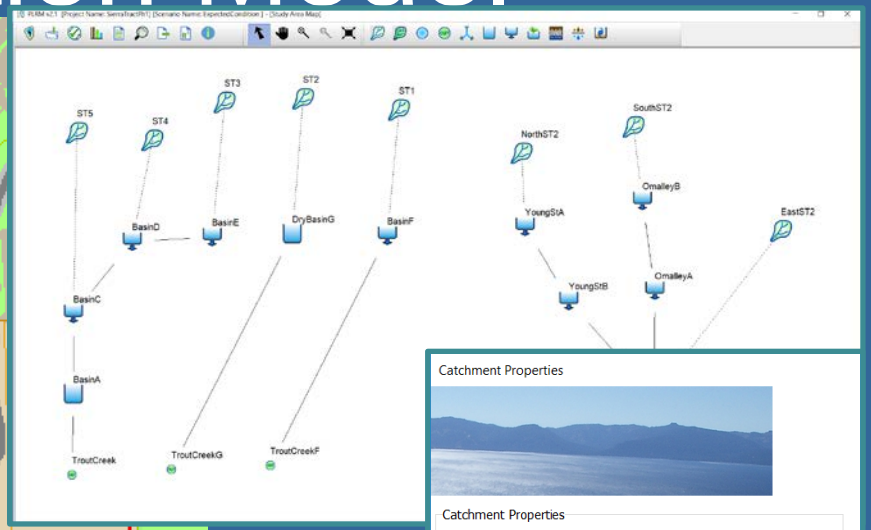
Figure 3

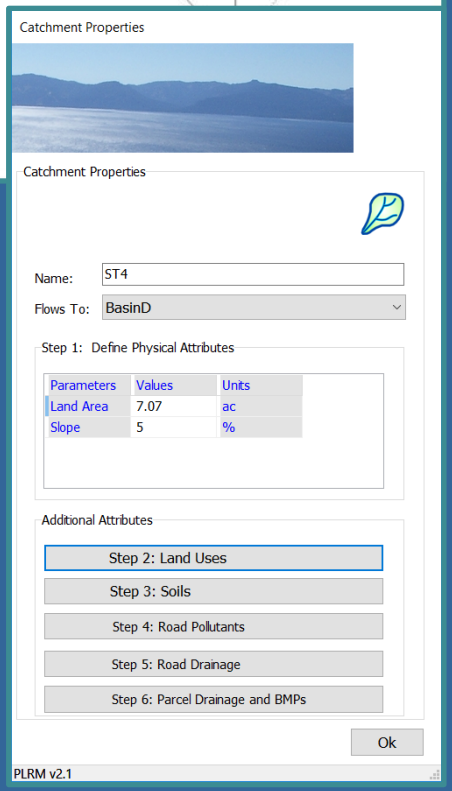


Source: Lake Tahoe TMDL Technical Report, June 2010, Source Analysis, page 4-77

PLRM – Pollutant Load Reduction Model







Catchment Name	Volume (ac-ft/yr)	FSP (lbs/yr)	TP (lbs/yr)	TN (lbs/yr)
ST5	3.2	1124	5	21
ST3	1.5	406	2	10
ST4	1.2	472	2	8
ST1	3.8	1624	7	27
SouthST2	2.9	1013	5	19
EastST2	1.2	304	2	8
NorthST2	6.6	2463	11	47
ST2	4.9	1938	8	31

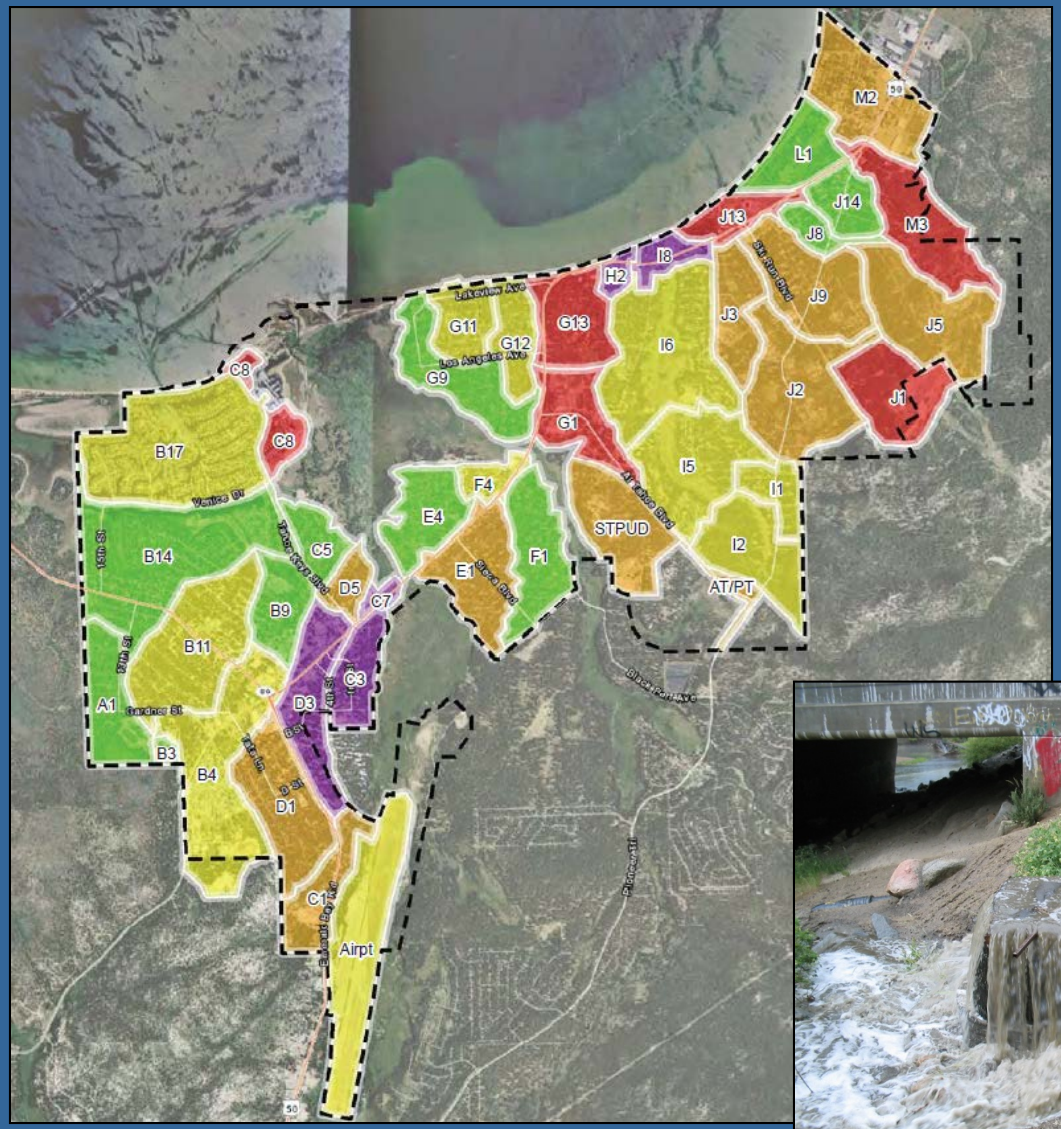
****
Storm Water Treatment
****

BasinA	Volume (ac-ft/yr)	FSP (lbs/yr)	TP (lbs/yr)	TN (lbs/yr)
Volume/Load Removed	0.0	4	0	0
%Removed	2%	4%	3%	3%
%Treated	3%			

DryBasinG	Volume (ac-ft/yr)	FSP (lbs/yr)	TP (lbs/yr)	TN (lbs/yr)
Volume/Load Removed	2.2	1842	8	28
%Removed	45%	95%	93%	89%
%Treated	99%			

Lake Tahoe TMDL

Lake Tahoe Total Maximum Daily Load



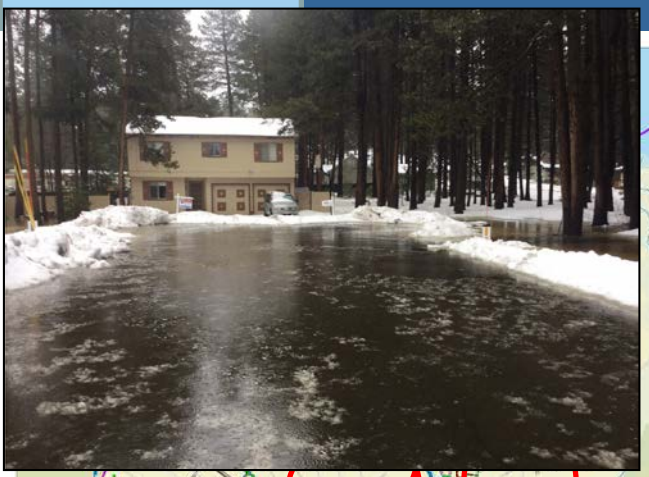
Legend

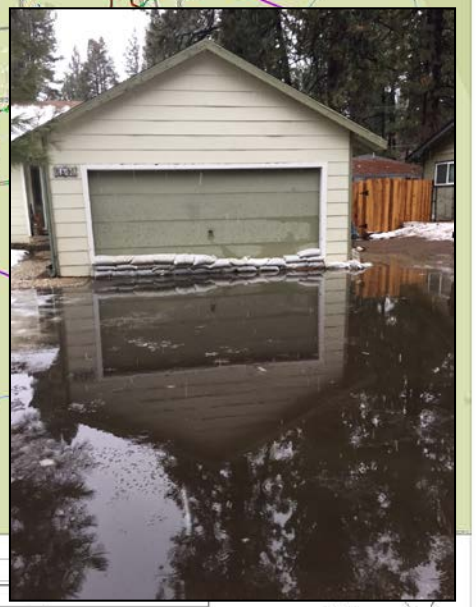
City Boundary

Fine Sediment Particle Load (lbs per acre per year)

- Lowest (Less than 23)
- Low (23 - 57)
- Moderate (58 - 114)
- High (115 - 209)
- Highest (210 to 455)

Drai ck of

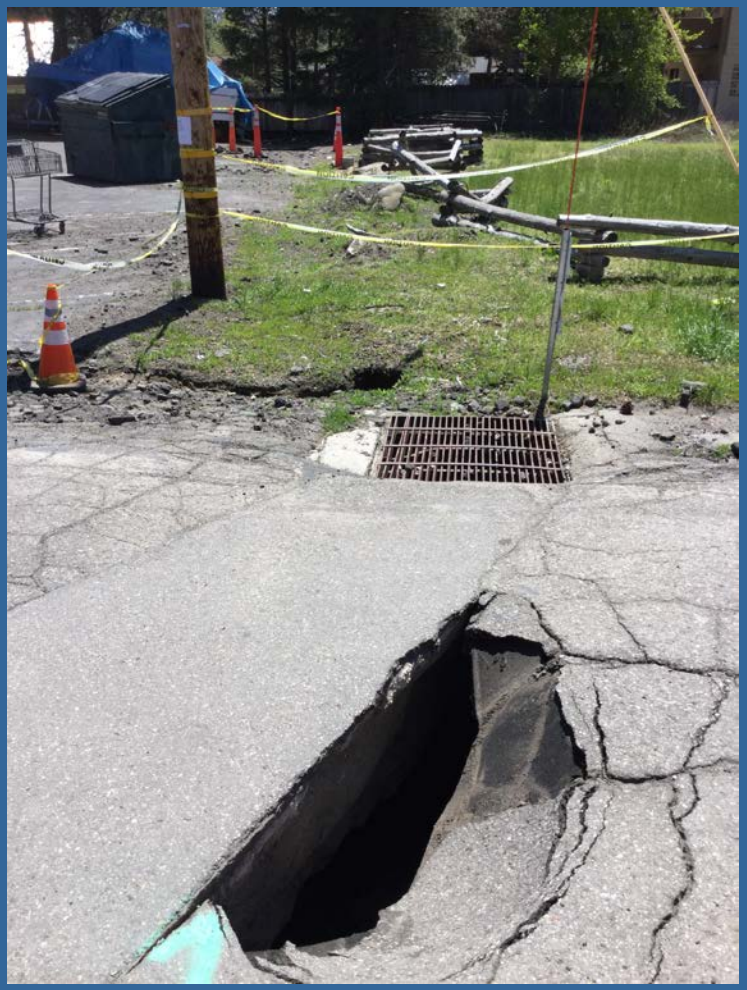




City of South Lake Tahoe
Stormwater Infrastructure

Engineering

Aging Infrastructure



Aging Equipment

PUBLIC WORKS
94 VEH, 38%
AVG AGE 17 YEARS

OTHER / ADMIN
11 VEH, 4%
AVG AGE 11 YEARS

1970 Michigan


QUESTIONS?

El Dorado County Storm Water Management Program

July 22, 2019

"Pollution is nothing but the resources we are not harvesting…"
—Buckminster Fuller

Driving Forces For Watershed Management & Storm Water Control

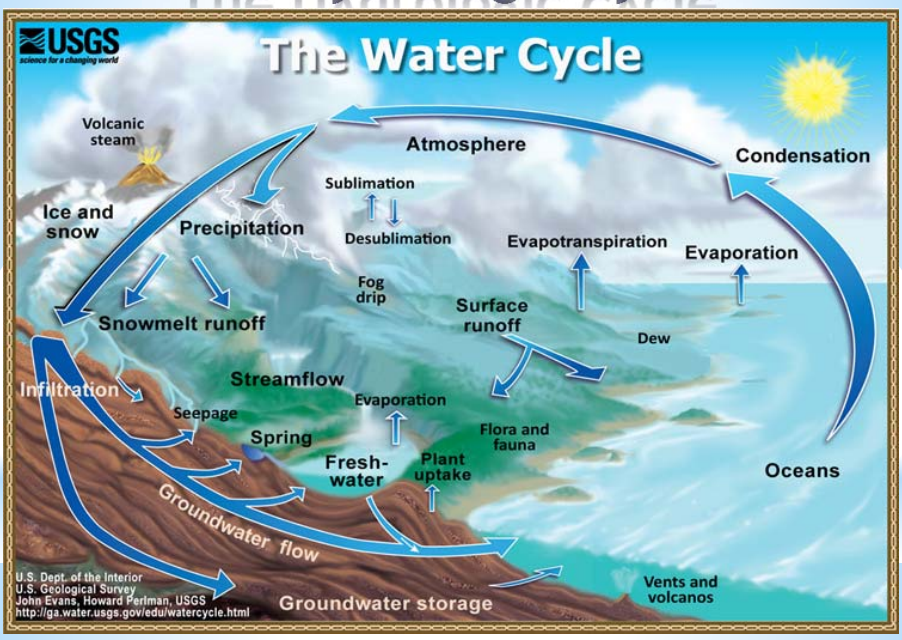
* Clean Water Act - 1972
* State & Federal Water Laws - NPDES
* Environmental Protection Agency
* Lahontan Regional Water Quality Control Board
* Central Valley Regional Water Quality Control Board
* TRPA - 208 Water Quality Management Plan

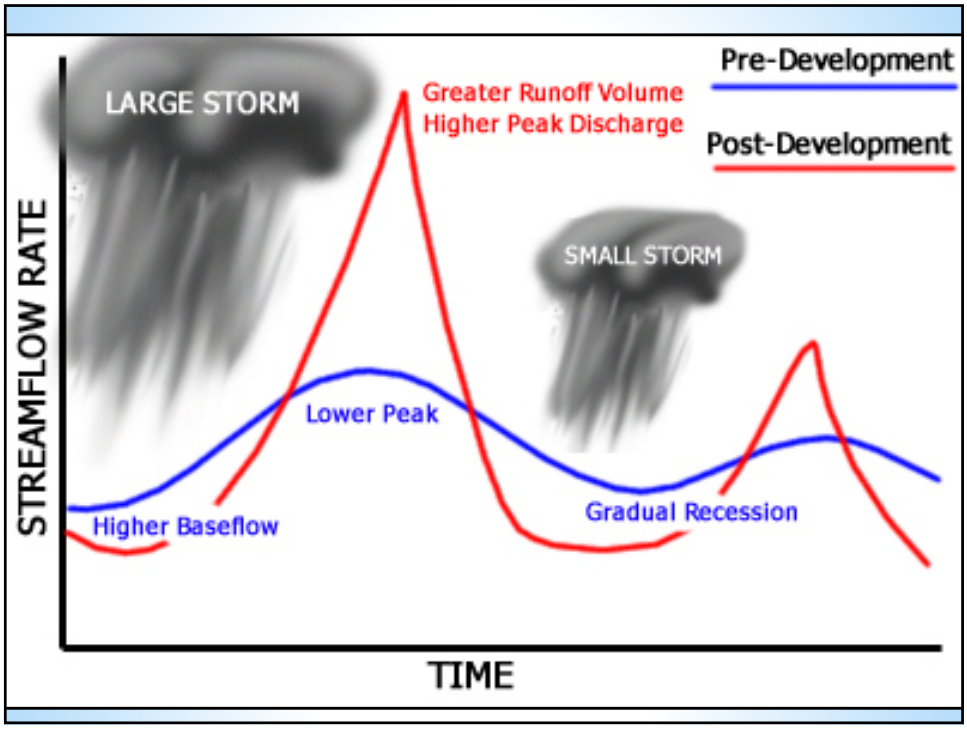
Clean Water Act Goals:

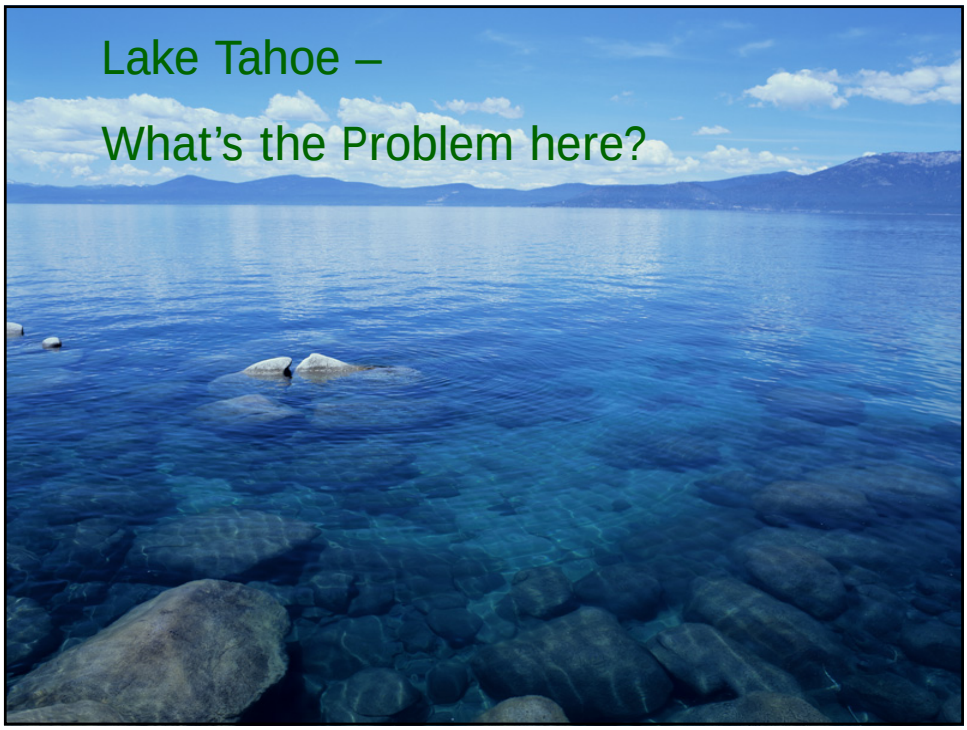
* "Restore and maintain the chemical, physical and biological integrity of the Nation's waters"

* "Water quality which provides for ensuring the Nation's waters are fishable and swimmable"

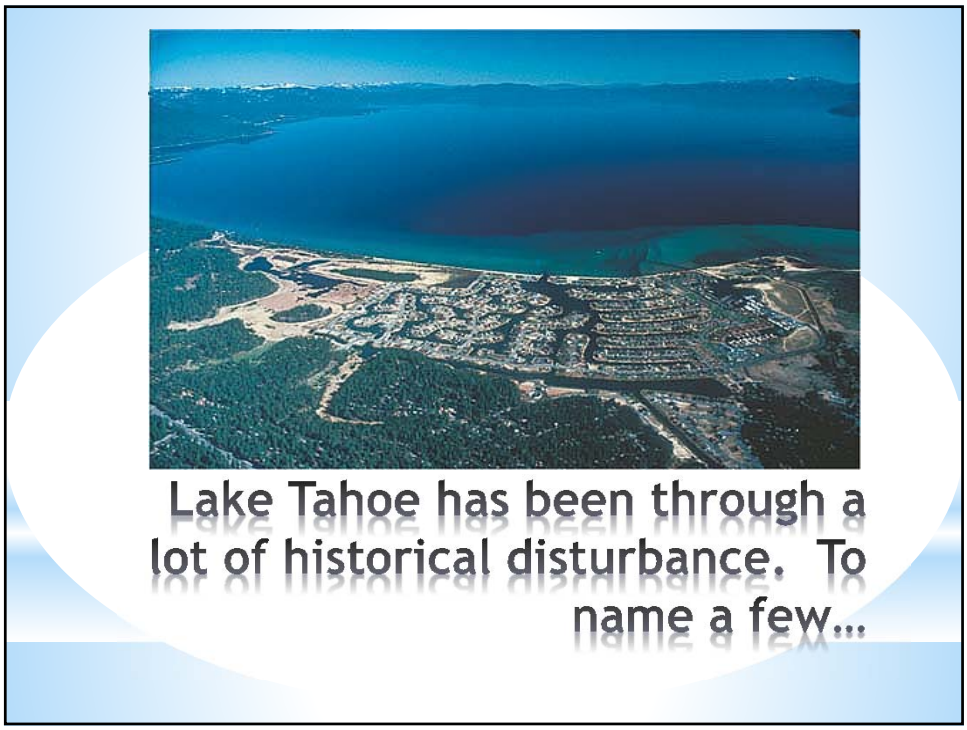
The Hydrologic Cycle




LARGE STORM
Greater Runoff Volume
Higher Peak Discharge
Pre-Development
Post-Development
SMALL STORM
STREAMFLOW RATE
Lower Peak
Higher Baseflow
Gradual Recession
TIME


Lake Tahoe –
What's the Problem here?


Asian Clams
Snails
Native Mussel


Lake Tahoe has been through a lot of historical disturbance. To name a few…

Logging / Clearcutting

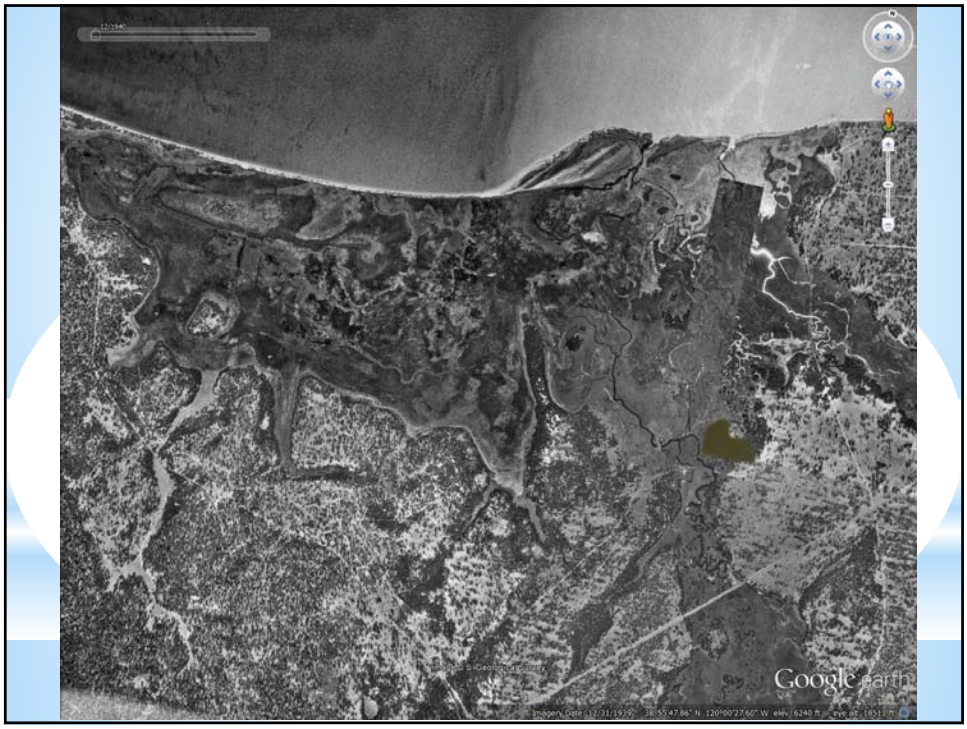
Overfishing

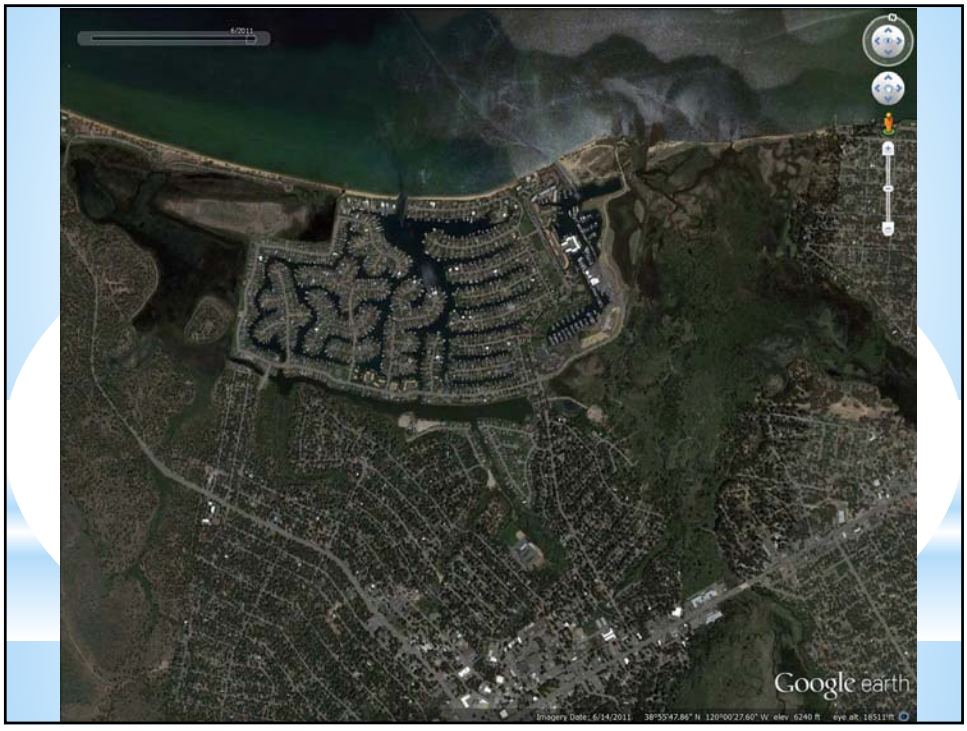
A DAM

Introduction of Invasives

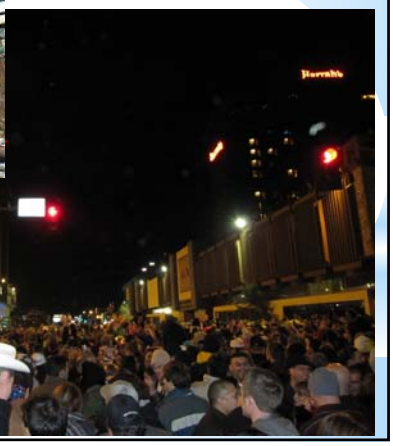

Asian Clams
Snails
Native Mussel

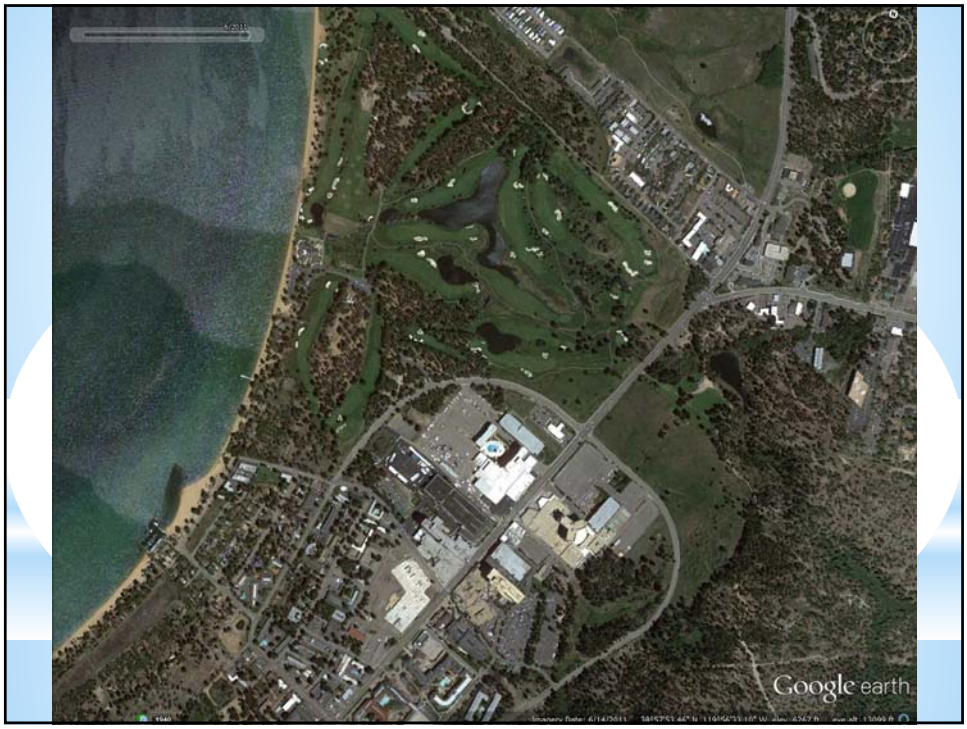

Destruction of Wetlands


Google earth

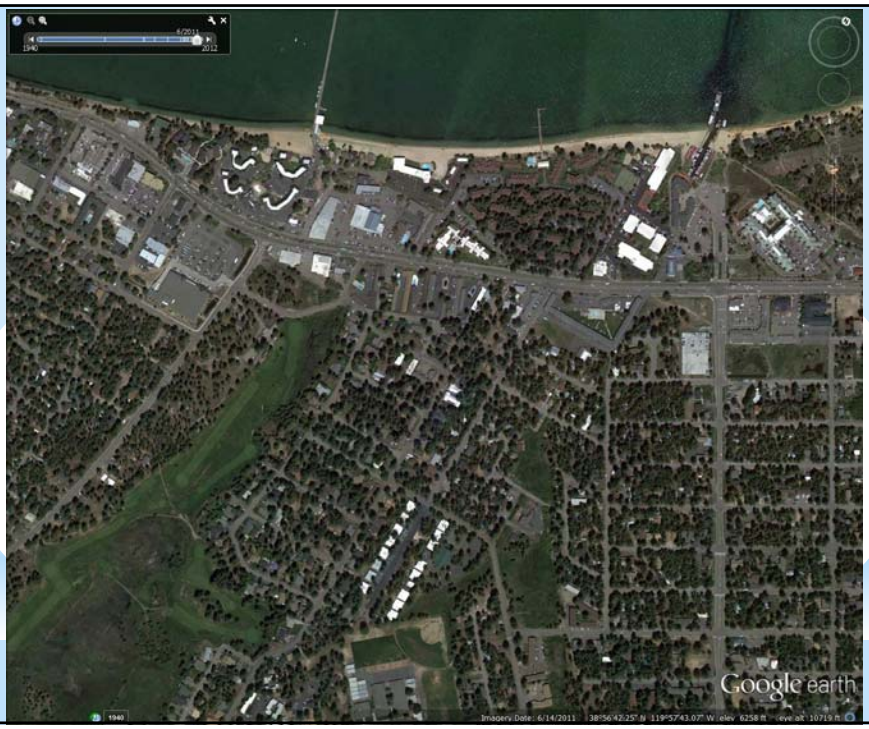

Google earth

Urbanization




Google earth


Google earth



I Think We Took Jimmy Buffett To Seriously!

Traction Sand

Material Distribution based on 1000 ton of aggregate used as winter abrasive	<16 micron load (lbs)
Volcanic Cinders	32,436
Washoe Sand (DG)	2,008
% Reduction	94%
Total Load Reduction	30,428
Credits	152

UCDAVIS TAHOE ENVIRONMENTAL RESEARCH CENTER

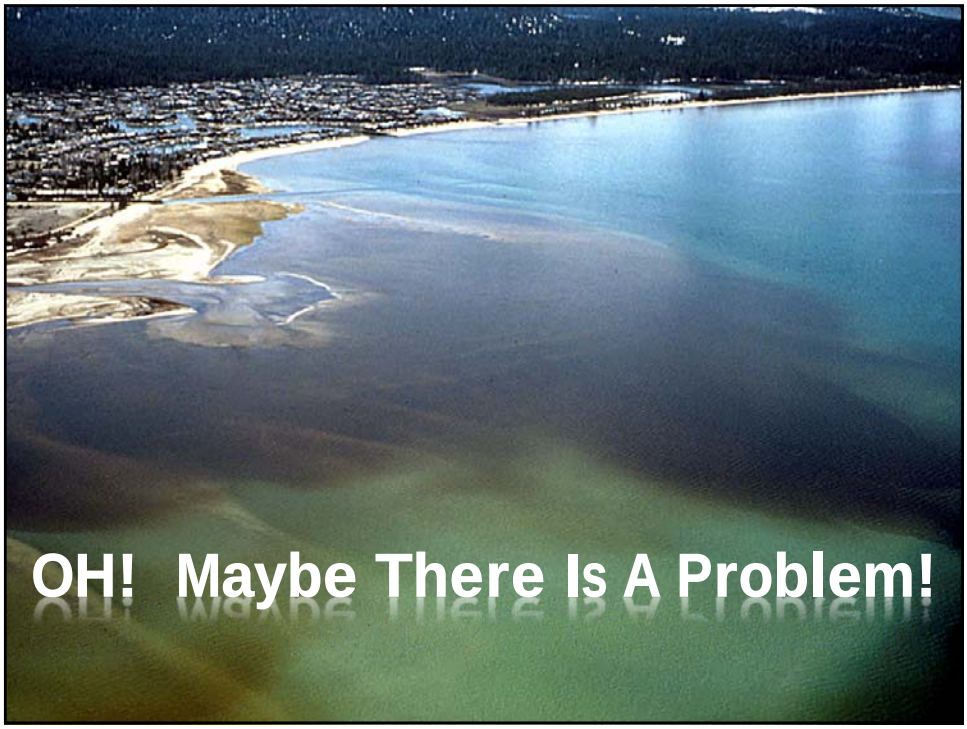
TAHOE: STATE OF THE LAKE REPORT 2017

CLARITY

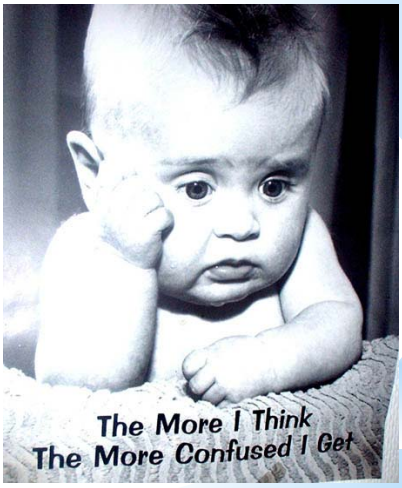
Winter Secchi depth

Yearly since 1968

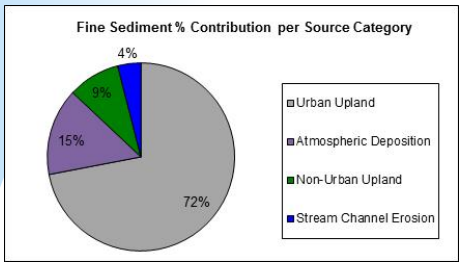
Annual winter (December-March) Secchi depth measurements from 1968 to the present indicate that winter clarity at Lake Tahoe is showing definite improvement. In 2016, winter clarity increased by 11.7 feet. The winter average of 83.3 feet (25.4 m) was still well above the worst winter average, 65.6 feet (20.0 m), seen in 1997. Winter precipitation (which was close to the long-term average) had little effect on clarity, due to stormwater control and watershed restoration projects.



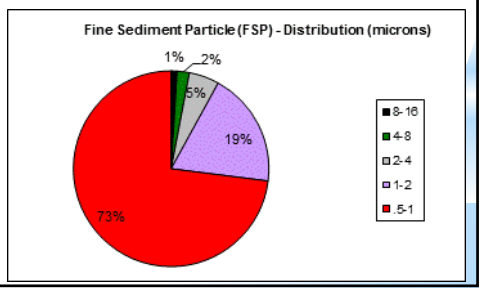
What Can We Control For Optimizing Lake Clarity?

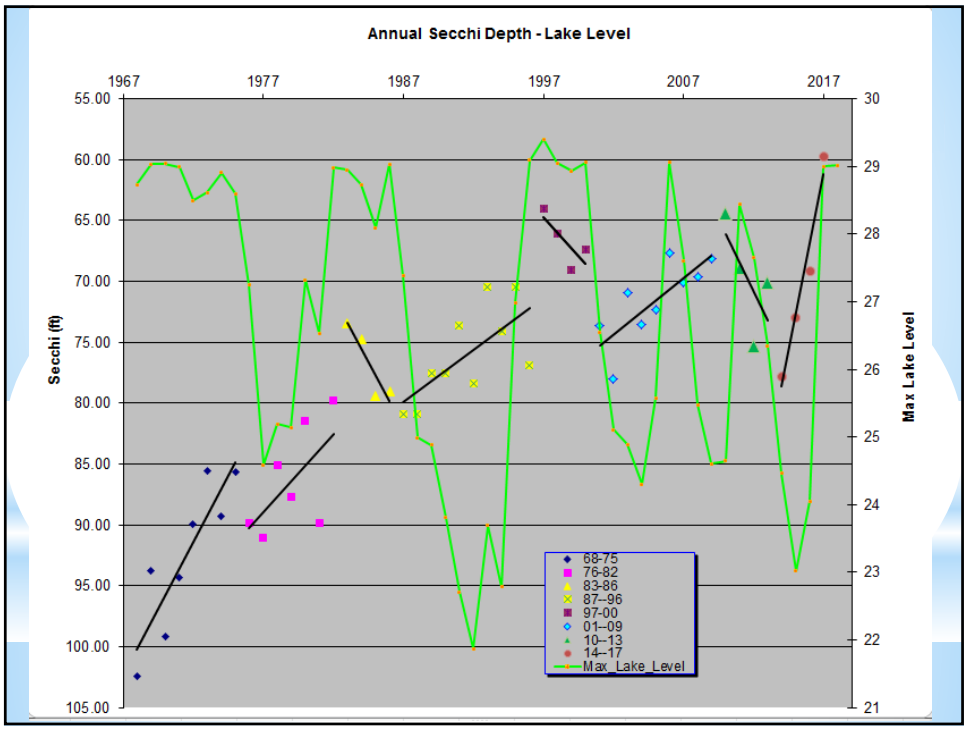


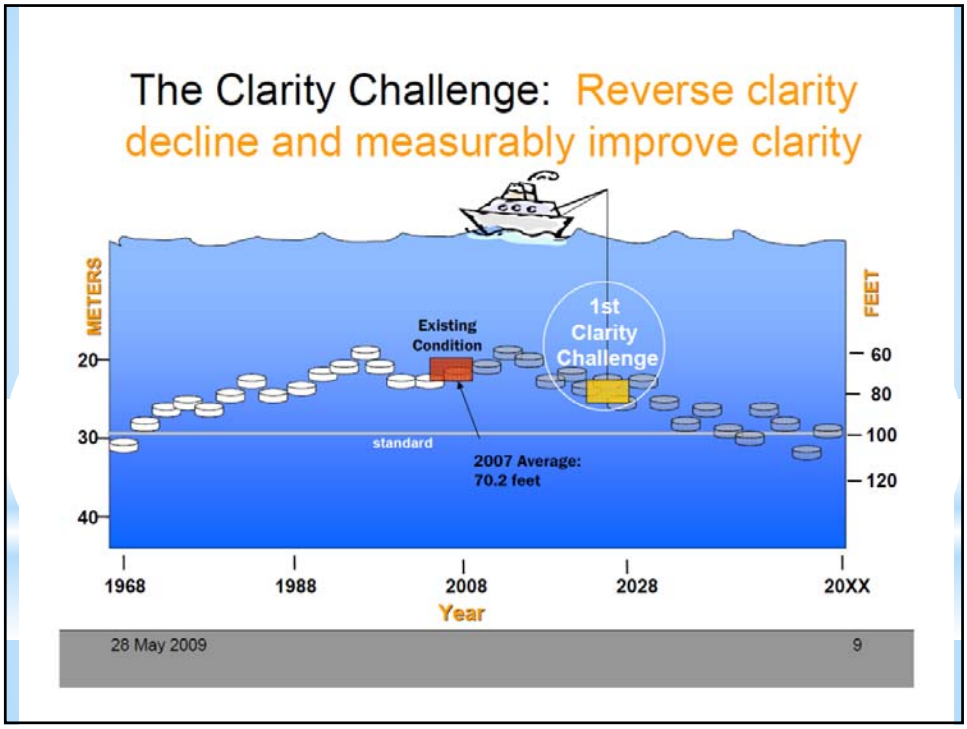
* Lake Clarity Source Distribution (Clarity Pie)



* Urban Upland is Stormwater\







*Lake Tahoe TMDL

Problem

* Lake Tahoe lost about one third of its clarity between 1968 and 2000

Goal

* Restore lake clarity to 1968 levels – about 100 feet

Primary Objective

* Reduce FSP by 65% over several decades – (Primary driver for clarity loss)

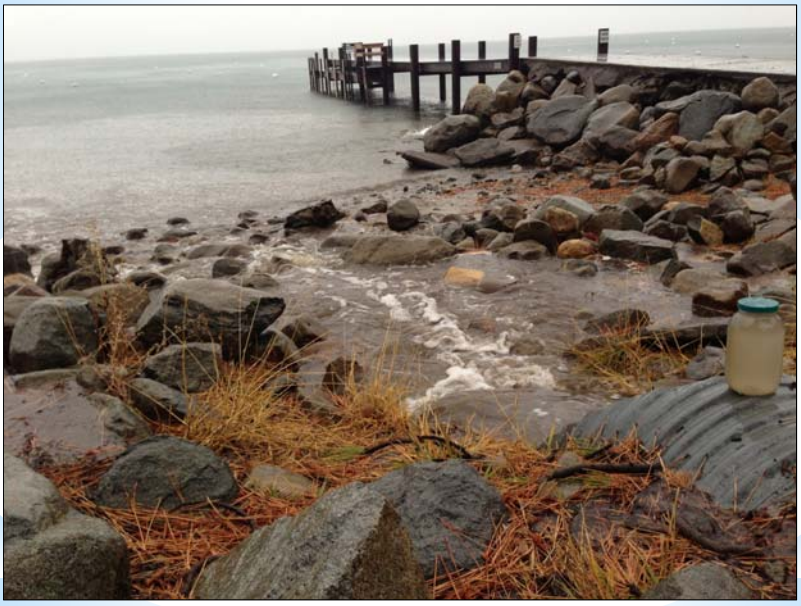
Lake Clarity Crediting Program

* 1 Lake Clarity Credit = A box of Fine Sediment Particles (> 16 um) that weighs 200 lbs
* Based on Average Annual Conditions
* 65 Years of Load Reduction Strategies to Restore Lake Clarity to the 1968 Standard
* Storm Water Tools - PLRM, Road RAM, BMP RAM, CAP
* Our Path to NPDES Permit Compliance
* BMPs, Sweeping, Abrasives, etc.

Baseline Loading

Pollutant Load	Total Area[1]	Surface Runoff	Pollutant Loading			
			FSP		TP	TN
(iteration)	(ac)	(ac-ft/yr)	(lbs/yr)	(#/yr)[2]	(lbs/yr)	(lbs/yr)
PLRMv1 Baseline	19,738	1,360	439,000	2.20E+19	2,300	9,000
PLRMv2: without catchment connectivity	18,250	874	551,480	2.75E+19	1,980	7,000
PLRMv2 Baseline: with catchment connectivity	18,250	526	326,960	1.63E+19	1,170	4,170

When it's Raining – This is Happening!



Infiltrate Urban Runoff

BMPs

Rain Gardens / Micro basin

Costs for Non-Compliance

§ 13385 (a) (California Water Code)	For NPDES permit program violations or discharges to surface water: Up to $10,000 per day of violation plus an additional liability of $10 per gallon for each gallon over 1,000 gallons where there is a discharge that is not cleaned up. A "discharge" as used in this section is defined as any discharge from a point source to navigable waters of the United States, any introduction of pollutants into a POTW, or any use or disposal of sewage sludge.

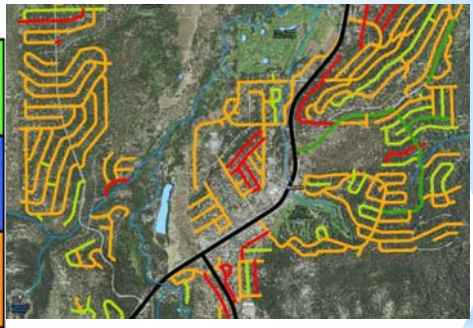
* Communication and Collaboration

Other Means to Prevent Road and Environmental Damage

Paving the Road to Clarity

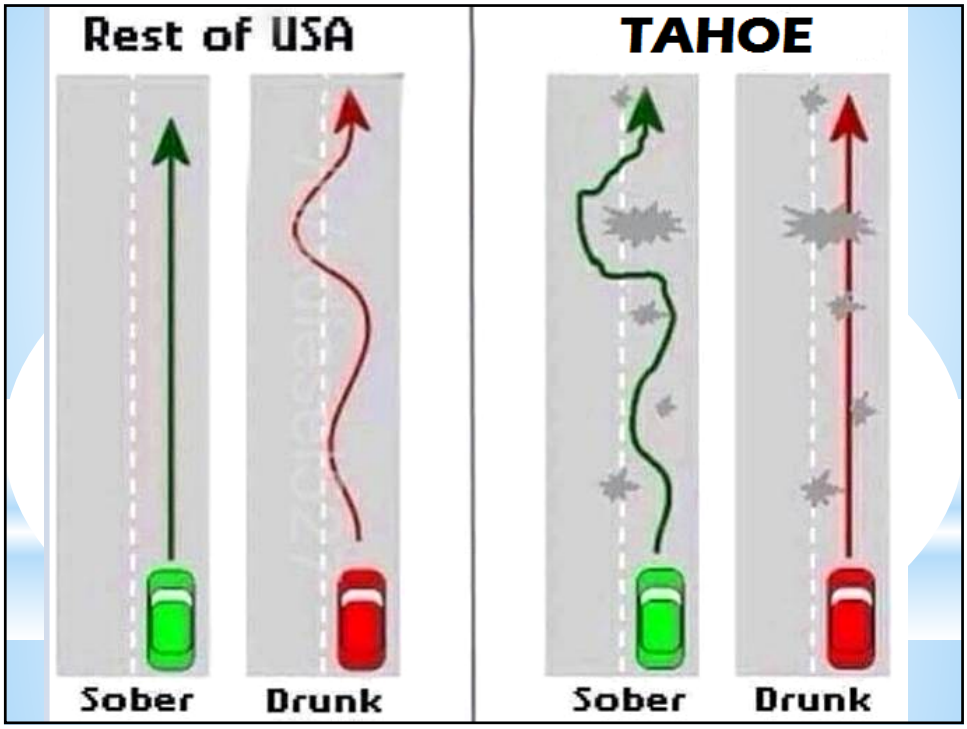
Maintaining pavement is a BMP

Pavement Condition Index (PCI)



Conflicting interests… But are they?

KEEP TAHOE BLUE®
League to Save Lake Tahoe


Rest of USA
TAHOE
Sober
Drunk
Sober
Drunk


SHIT
IS GOING DOWN
DANGER!
SURVIVE THE
SINKING

Multiple Benefit

That's It!!,

For now anyway

OMG Its Still Going

California Toxics Rule

* USEPA established water quality criteria for priority pollutants in the National Toxics Rule and the California Toxics Rule, and RWQCBs establish water quality objectives for priority pollutants in basin plans.
* The SWRCB *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California* (the Policy) went into effect on May 22, 2000 and generally requires limitations for all constituents that will cause, have the reasonable potential to cause, or contribute to chronic toxicity in receiving waters.
* Tahoe Sampling and Analysis indicated low threat levels and therefore no need for continual analysis

Detention Basin Treatment of Hydrocarbon Compounds in Urban Stormwater Report March 2006

* STPUD funded in collaboration with partner agencies
* Purpose – Evaluate potential risk of inadvertent hydrocarbon contamination to shallow groundwater resources from infiltration
* WY2005 – WY2006
* Measured SW inflow, and shallow groundwater in infiltration basins.

Regional Stormwater Monitoring Program

Andrea Buxton
Stormwater Program Manager
530-412-0456
abuxton@tahoercd.org
TahoeRCD.org

RSWMP Background

- Conceived in 2004 to support Lake Tahoe TMDL
- Needed comprehensive monitoring to answer scientific questions
- Coordinated program (RSWMP) established 2013
- Meet NPDES permit requirements
- Collaborative approach encouraged

Regional Stormwater Monitoring Program

Partnership

- City of South Lake Tahoe
- El Dorado County
- Placer County
- Washoe County
- Douglas County
- Nevada Department of Transportation
- Caltrans

Regional Stormwater Monitoring Program

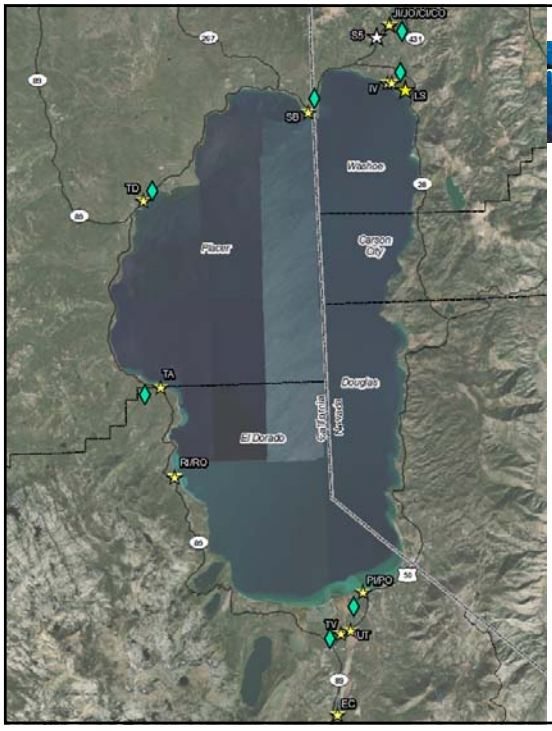
RSWMP Development

- Two original funding sources
  - SNPLMA
  - California State Proposition 84
- Document development
  - Monitoring Plan
  - Sampling and Analysis Plan
  - Quality Assurance Project Plans
  - Framework and Implementation Guidance Document

Regional Stormwater Monitoring Program

Framework and Implementation Guidance Document

- Purpose and objectives
- Partner roles and responsibilities
- Funding needs and mechanisms
- Monitoring network (selected sites)
- Priority pollutants and data collection needs
- Data management and analysis methods
- Reporting formats



m

Current Network
- 12 stormwater monitoring sites
- 6 meteorological stations

Priority Pollutants
- Fine sediment particles (FSP)
- Total nitrogen (TN)
- Total phosphorus (TP)

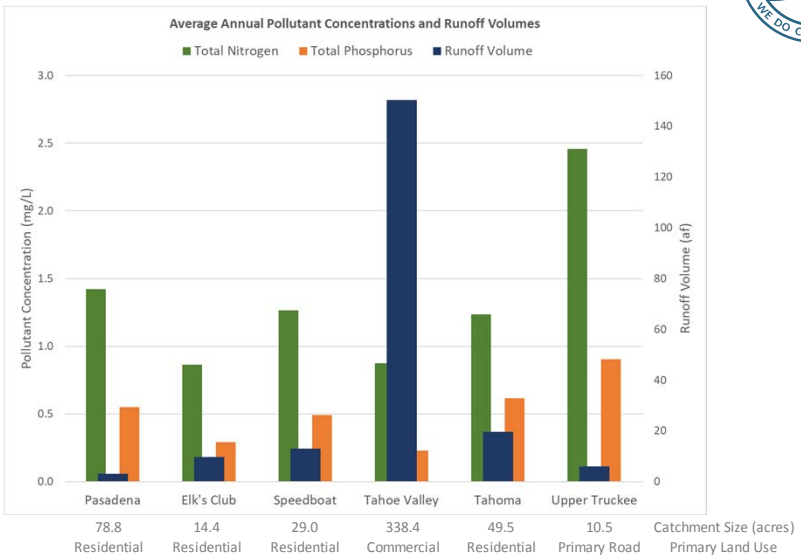
Data Collected
- Continuous flow
- Continuous turbidity
- Water quality samples during chosen events
- Precipitation amount and type
- Temperature

Regional Stormwater Monitoring Program

Analysis and Reporting

- **Status and trends analysis**
  - Status: what was recorded in a particular year
  - Trends: change over time in volume and loading
- **Reporting**
  - Charts, tables, and text to satisfy NPDES permit requirements
  - Submitted to Lahontan Regional Water Quality Control Board (CA) and Nevada Division of Environmental Protection (NV)

Regional Stormwater Monitoring Program



Regional Stormwater Monitoring Program

Pollutant Load Reduction Model (PLRM)

- Used to model urban catchments
- Uses 18 year precipitation record (1989-2006)
- Compare baseline conditions (2004) to current conditions to receive credits
- Comparing monitoring data to PLRM outputs instigated update of cartridge filter effluent values

	FSP Concentrations (mg/L)			TN Concentrations (mg/L)			TP Concentrations (mg/L)		
Site Name	Min	Max	Average	Min	Max	Average	Min	Max	Average
Contech In	94	279	175	1.08	2.12	1.64	0.71	1.87	1.05
Contech Out	69	244	131	0.80	1.87	1.31	0.45	1.54	0.77
Jellyfish In	91	367	202	0.91	2.22	1.44	0.73	1.78	1.14
Jellyfish Out	62	194	114	0.97	1.54	1.29	0.39	1.53	0.78
Pasadena In	27	85	62	1.36	2.21	1.63	0.49	0.85	0.71
Pasadena Out	20	68	44	0.93	2.00	1.42	0.30	0.76	0.55
Original Default CEC			13			1.50			0.14
New Suggested Range			18 - 140			1.0 - 2.2			0.04 - 0.15

Regional Stormwater Monitoring Program

Benefits of a Coordinated Program

- Consistency
  - Data parameters
  - Collection protocols
  - Collection frequency
  - Data analysis
  - Reporting formats
- Data comparability
- Economies of scale
- Unbiased perspective

Andrea Buxton
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Regional Stormwater Monitoring Program

Sites	Runoff Volumes (af)			FSP Concentrations (mg/L)			FSP Loads (lbs)		
	Min	Max	Average	Min	Max	Average	Min	Max	Average
Pasadena	1.04	7.52	3.15	20	68	44	148	454	282
Elk's Club	9.71	9.71	9.71	24	24	24	646	646	646
Speedboat	5.29	30.29	12.95	59	201	134	1,492	9,218	4,136
Tahoe Valley	13.44	466.18	150.42	15	42	26	846	29,143	9,515
Tahoma	4.03	57.02	19.53	15	165	72	978	2,615	1,917
Upper Truckee	2.36	11.40	6.04	118	164	142	754	3,902	2,311

Sites	TN Concentrations (mg/L)			TN Loads (lbs)			TP Concentrations (mg/L)			TP Loads (lbs)		
	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
Pasadena	0.93	2.00	1.42	5.3	24.7	11.0	0.30	0.76	0.55	1.7	8.9	4.1
Elk's Club	0.86	0.86	0.86	22.8	22.8	22.8	0.29	0.29	0.29	7.7	7.7	7.7
Speedboat	1.01	1.43	1.26	19.2	84.0	40.7	0.38	0.61	0.49	5.9	31.7	15.8
Tahoe Valley	0.81	0.99	0.87	36.2	1,050.4	341.9	0.17	0.31	0.23	9.3	225.3	76.7
Tahoma	0.53	1.95	1.24	15.5	82.6	48.6	0.16	0.94	0.62	7.1	40.0	21.7
Upper Truckee	1.79	3.50	2.46	11.4	60.4	39.0	0.67	1.27	0.91	4.3	20.9	14.5

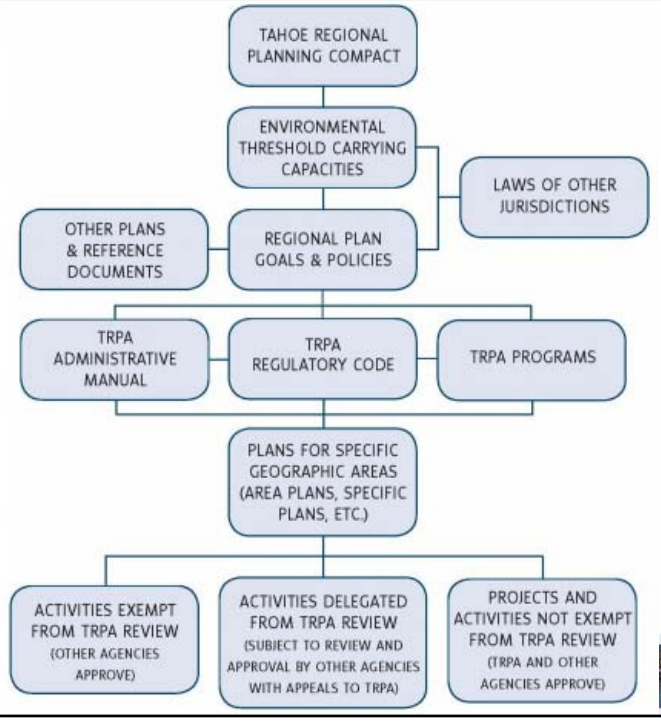
TRPA Stormwater Management Program Overview

Presentation to the GWMP SAG

Shay Navarro, TRPA Stormwater Program Manager

STPUD, 07/23/2019

RESTORATION IN PROGRESS
LAKE TAHOE ENVIRONMENTAL IMPROVEMENT PROGRAM
continuing the commitment



What are the primary objectives for TRPA's Stormwater Management Program?

- Maintain and Restore Lake Clarity
- Best Management Practices Requirements
- Implement BMP Action Plan

How does TRPA collaborate with other agencies to implement stormwater management in the South Shore?

- EIP Working Group
  - Storm Water Quality Improvement Committee
  - Parcel BMP Working Group
- Annual Priority Setting
- Grant requirements & Funding Opportunities

How is stormwater management considered within TRPA's Source Water Protection Program?

- TRPA Code standards
  - Source water
  - Discharge limits
  - BMP requirements
- BMP Action Plan
  - Sub-surface contamination

Questions/Discussion

Restoration in Progress
Lake Tahoe Environmental Improvement Program
continuing the commitment

Tahoe Valley South Subbasin (6.5.01) Groundwater Management Plan
MEETING NOTES

Friday, November 22nd, 2019 8:30-11:30 p.m.
Location: 1275 Meadow Crest Drive, South Lake Tahoe CA

ATTENDEES:
Ken Payne (El Dorado County Water Agency – via teleconference); Jason Burke (City of South Lake Tahoe); Jennifer Lukins (Lukins Brothers Water Co); Kirk Woolridge (Tahoe Keys Water Co.); Daniel Larson (Tahoe Keys Water Co.); Michael Conger (Tahoe Regional Planning Agency); Harold Singer (Ratepayer); Margaret (Katy) Janes (California Department of Water Resources-NCRO); Elisabeth Esposito (BHFS); G. Kvistad (BHFS); Ivo Bergsohn, P.G., HG (South Tahoe PUD).

BASIN MANAGEMENT OBJECTIVES:
1. Maintain a sustainable long-term groundwater supply.
2. Maintain and protect groundwater quality.
3. Strengthen collaborative relationships with local water purveyors, governmental agencies, businesses, private property owners and the public.
4. Integrate groundwater quality protection into local land use planning activities.
5. Assess the interaction of water supply activities with environmental conditions.
6. Convene an on-going Stakeholders Advisory Group (SAG) as a forum for future groundwater issues.
7. Conduct technical studies to assess future groundwater needs and issues.
8. Identify and obtain funding for groundwater projects.

WORKSHOP OBJECTIVES
1. Consider actions to prepare the first 5-Year Update of the Groundwater Management Plan for the Tahoe Valley – Tahoe South Groundwater Basin (Basin No. 6-005.01).
2. Review groundwater elevation trends during the 2019 water year.

Welcome and Self-Introductions

Sign-Up Sheet
Att 1: 2019 SAG Roster

Kirk Woolridge introduced Daniel Larson to the group. Dan is the new Water Systems Manager for Tahoe Keys Water Company replacing Dave Peterson.

Action Items: Add Daniel Larson to 2019 Roster representing Tahoe Keys Water Company (TKWC)

TVS Basin (6-5.01) - Open Forum (Group)

Current groundwater-related topics outside of the Agenda

J. Lukins, LBWC – LBWC Well #5 Grant Funding Update
- LBWC received funding agreement from SWRCB for construction of GAC Treatment Plant
- LBWC went out to Bid for Construction at beginning of November; mandatory pre-bid conference yesterday.
- Bid Award anticipated end of January 2020.
- Start construction spring 2020 (9-week construction schedule, estimated)
- Construction End Date (scheduled): February 2021 or earlier, if possible

Tahoe Valley South Subbasin (6.5.01) Groundwater Management Plan
MEETING NOTES
Friday, November 22nd, 2019 8:30-11:30 p.m.
Location: 1275 Meadow Crest Drive, South Lake Tahoe CA

Groundwater Management Plan Update

Groundwater Management Plan 5-Year Update (E. Esposito, G. Kvistad, BHFS)

Elisabeth Esposito (Liz) gave a power point presentation on the upcoming 5-Year Update for the Tahoe Valley South Subbasin 2014 Groundwater Management Plan (GMP). The SAG was encouraged to provide input on addressing recommended actions provided by DWR, potential improvements to the GMP; groundwater issues of greatest concern; and possible use of an outside consultant to assist in this effort. The adopted final GMP is due to the California Department of Water Resources (DWR) by January 1, 2022.

Att 2: Table 1-1 from 2014 GMP
Att 3. 2014 GMP BMOs
Att 4 GMP Update Recommended Actions for SAG Review
Handout: Excerpts from GSP Emergency Regulations; Plan Review

- DWR Assessment. DWR made several key findings upon review of the District's existing plan Alternative (2014 GMP). The Alternative Plan is the functional equivalent of a GSP and satisfies the objectives of SGMA. Other findings - District can continue groundwater management of the TVS Basin under the existing GMP; and may amend this GMP in compliance with SGMA and AB3030. Eight (8) recommendations for improvement to the GMP were provided by DWR, but approval of the GMP is not contingent on completing these recommended actions. The District can amend the GMP and will need to update its MOU with the El Dorado County Water Agency (EDCWA) reflecting DWR approval of the GMP as an Alternative to a GSP (see attached presentation).

- Components of the Approved Plan include the 2014 GMP and four additional documents interrelated with the GMP. Ivo noted that a lot of work documented in technical reports issued since submittal of the GMP in 2016 has been completed. Important findings from this Post-2016 work address many of the recommended actions identified by DWR and may be incorporated into the GMP as part of the 5-Year Update. Action items going forward include updating the MOU with EDCWA; and consideration of possible amendments to the GMP. It was recommended that the District schedule an evaluation follow-up meeting with DWR to discuss the substance of the update process and discuss the DWR recommended actions.

- California Regulations require DWR to periodically review approved GSPs and approved Alternatives to a GSP. GSP Regulations (Section 355.6) require DWR to use four primary factors for plan review including; whether there are any exceedances of minimum thresholds or failure to meet interim milestones; whether an Agency can demonstrate progress on implementing projects or management actions described in the Plan; whether the Agency can demonstrate that data gaps described in the Plan are being addressed; and whether the plan continues to satisfy Section 355.4 Criteria for Plan Evaluation (see Handout). Section 355.4 is the criteria used by DWR to evaluate the functional equivalency of the District's 2014 GMP as an Alternative to a GSP.

DISCUSSION (Group)

- How can the GMP be improved?
- What groundwater conditions are of greatest concern?
- What changes/amendments should be made to the GMP?
- Should the District use an outside facilitator to assist this process?

J. Lukins-

- Group has done a wonderful job of trying to address BMOs over past 5 Years, especially South Y Plume.
- Moving forward, more focus should be spent on Stormwater.
- Information on work being performed at Tahoe Keys Lagoon (Aquatic Invasive Species) and along Ski Run Blvd. should be included in the GMP.

J. Burke

- What is timing between 2020 UWMP and 5-Year Update; Is it worth waiting until LRWQCB Regional Plume Investigation and South Y Fate & Transport Model is updated?

H. Singer

- Where are we in terms of accomplishing the BMOs in the GMP? Status: completed; in-progress; still need to be started.
- Recommended Actions – should we just commit to get these done? Does not appear to be difficult.
- Should we consider using the GMP as a platform to consider potential next steps following review of groundwater investigations being performed within the groundwater basin?

G. Kvistad

- Fair amount of work has already been completed to address BMO's; how can this work be captured?

I. Bergsohn

- Process of updating MOU and adopting amended GMP may take several months in itself; don't want to be put in a box by delaying start of 5-Year Update waiting-on investigations being performed by others to be completed. Would prefer to use available time to focus on important items to produce a high quality Plan. Plan is a living document that will continually be updated in the future.
- BMOs /possible goal for 5-Year Update – Improve outreach to Private Well Owners; recruit Private Well Owner representative to SAG.

K. Janes

- DWR offers Facilitation Support Services (FSS); these are funds which can be used to hire consultants for facilitation services and outreach. It is recommended that the District look into possible use of these funds for the 5-Year Update; FSS information available on DWR website. Katy will follow-up with link to website.

Action Items: Update MOU with EDCWA; Review 2014 GMP Contents; Review Status of BMOs with SAG at next Workshop; Investigate use of DWR FSS funds for 5-Year Update and Outreach.

- Att. 4 –Recommended Action Review - How can the eight (8) recommended actions (RA) be incorporated into the Updated GMP?
- RA 1, RA 2, RA3 – Water Budget Information: DRI Feb. 2018 BMO Report –ran groundwater model using Global Climate Models (GCMs) to project future water budgets; could be used to address RA 2. Concern: Question value of future water budget projections which may be out of date within several years as GCMs are updated (discuss with DWR). RA3 requires that water demand projections are reconciled between UWMP with projections used in GMP. Will need to coordinate during update for both plans.
- RA 4 – Water Budget Calculation: DRI 2016 Groundwater Model Report – groundwater recharge for water budget is currently calculated for basin including mountain front recharge from contributing watershed areas; DWR requests that water budget be calculated only for basin area. For discussion with DWR - Hydrologic rationale for current approach recognizing mountain front recharge from contributing watersheds as it applies to the TVS Basin. H. Singer – Also surrounding watersheds are mostly undeveloped forest lands (USFS), with no significant groundwater use. This provides additional justification for counting these areas in the recharge calculation for the TVS Basin.

- RA 5 – Pumping Impacts on Plume Migration: DRI 2019 Fate and Transport Modeling Report provides significant amount of technical information addressing this item.
- RA 6 – Quantity and timing of depletions of interconnected surface water: DRI 2018 BMO Report provides depletion analyses of interconnected surface waters in TVS Basin; may need further modeling work.
- RA 7 – Quantitative criteria for groundwater levels, storage and depletion: DRI 2016 Analysis of Basin Conditions presents minimum thresholds that could be incorporated into the updated GMP for groundwater levels and storage. Additional work may be needed to establish for depletions. One approach may be reviewing groundwater level monitoring records collected within the Upper Truckee Marsh by CTC.
- RA 8 – Table 10- 1 BMO5 – Review current status of actions identified in Table 10-1 BMO5; grey-out items completed to help identify any remaining items that may still need funding.

DISCUSSION (Group)

H. Singer – for discussion with DWR
- Do all of the DWR RAs need to be addressed?
- Are all of the RAs appropriate for this groundwater basin?

J. Burke-
- When considering potential impacts of pumping on surface water, may also be worthwhile to provide an accounting of the numerous stream and meadow restoration projects which have been performed within the TVS Basin.

H. Singer –
- Future stream and meadow restoration projects planned within the basin include TRCD - Johnson Meadow; and CTC – Upper Truckee River projects. Key component of these projects is to improve channel - floodplain connectivity by "overbanking" to improve surface water quality flows (reduce turbidity and nutrient loading to Lake Tahoe). Secondary benefits – infiltration for meadow vegetation, wetlands and groundwater recharge.

Action Items: RA 1, RA 2, RA3 – For discussion with DWR: Need to address all RAs and to what level of detail?; for example cost/benefit of projected water budgets for groundwater basin with stable groundwater levels and abundant recharge; Invite Consultant responsible for developing UWMP to discuss development with SAG.
RA 4 – Discuss hydrologic rationale for inclusion of recharge from contributing watersheds in water budget calculations for TVS Basin. RA 5 – discuss incorporation of major findings of Fate & Transport Report with DRI; RA 6– discuss incorporation of depletion analysis with DRI and additional work that may be performed to address this item; RA 7 – identify appropriate contact at CTC for Upper Truckee Marsh groundwater level monitoring data. RA 8 - Review current status of actions identified in Table 10-1 BMO5 and need for outside funding to address any remaining items.

- GMP Amendment Process. Similar process as used for adopting the current GMP involves; publishing notice of an initial Public Hearing on whether to adopt a resolution of intent to draft an updated GMP; convening the Public Hearing; adopting the resolution; publishing public notice of the adopted resolution; and providing a copy of the adopted resolution to DWR.
- Following completion of the updated GMP the updated GMP will need to be formally adopted. This involves, publishing notice of a second Public Hearing on whether to adopt the updated GMP; convening a second Public Hearing; adopting the updated GMP; publishing public notice of the adopted resolution; and providing a copy of the adopted GMP to DWR by January 1, 2022.

- As EDCWA is GSA for fringe areas within TVS Basin, the entire process from adoption of the intent to update to adoption of the updated GMP will need to be coordinated with EDCWA. In this manner, the full extent of the TVS Basin would be managed under a single groundwater management plan.

Action Items: Develop a detailed planning schedule for development of the 5-Year Plan Update (January 2020 through Dec 2021) and present to SAG for review. Work with BHFS to develop a resolution of intent to draft an Updated GMP.

2019 Groundwater Conditions

2019 Groundwater Conditions (I. Bergsohn, STPUD)

Ivo Bergsohn (Ivo) gave a power point presentation on Groundwater Elevation Monitoring and Groundwater Conditions in the TVS Basin using current 2019 Water Year (2019 WY) data. Groundwater Level Monitoring is important to groundwater management as it is the primary tool through which Agencies determine whether a groundwater basin is being managed in a sustainable manner. During the presentation, the following topics were discussed; water year classification; groundwater level monitoring; and data evaluation for determination of basin conditions. 2019 WY groundwater production data was requested from the water purveyors at the end of the presentation in order to update the groundwater model and prepare the annual report (see attached presentation).

- Water Year Type is a classification used to generally describe hydrologic conditions within a defined area over a particular water year. Under GSP regulations, water year type is required to be described in terms of Annual Precipitation. During development of the basin groundwater model, a water year type classification was developed using precipitation records from the Hagan's Meadow SNOTEL Station 508. Records from this station were selected as they correlated very closely to modeled recharge in the groundwater basin. For the 2019 WY, total precipitation at the Hagan's Meadow Station measured 39.2 inches. Based on the distribution of total annual precipitation measured at this station (1979-2017), the Water Year type was determined to be "Above Normal" (37" – 43").

- Groundwater Level Monitoring: The District collects groundwater level data from thirty (30) Observation Wells and fifteen (15) Water Supply Wells located at thirty-one (31) different sites across the TVS Basin. Regular collection of water level data began in 2001. Prior to 2001, water levels were collected only at District water supply wells on an intermittent basis. Groundwater monitoring is currently performed semi-annually at all well locations. Groundwater levels from water supply wells are static water levels collected after a minimum 12-hour recovery period. Dedicated groundwater level data loggers are also used to record daily changes in groundwater levels at thirteen (13) wells. The semi-annual readings are reported to DWR, not including the active water supply wells. The original intent of the groundwater level monitoring program was to assist in the development and calibration of a future groundwater model.

- Hydrographs. Hydrographs for each of the six (6) geographic subareas delineated within the groundwater basin were reviewed. For all of the monitored wells (2001 – Present), groundwater level trends are stable. Changes in groundwater water levels do occur seasonally and are also influenced by water year type/groundwater recharge, aquifer characteristics and well condition. For active wells, pumping schedule is another factor influencing groundwater levels.

- Basin Condition (Groundwater Levels). Hand readings collected during the May monitoring event of the current water year are used to describe Basin Conditions as being either normal, above normal, or below normal in terms of groundwater levels. Determining Basin Condition is a 3-step process that generally involves; 1) Distributing the May reading of the current Water Year for a given well along with the full set of groundwater level readings collected from the same well during the base period (2001 WY – 2010 WY) to calculate a percentile rank for the current Water Year reading compared to the base period readings ; 2) Using the Percentile Rank for each well, generate a cumulative frequency distribution for the current water year readings; and 3) Use the cumulative frequency distribution for the percentile ranks to determine its current condition with respect to the Base Period. The 10-year base period was selected for two reasons; 1) there was sufficient data for analysis of the monitoring network; and 2) the 10-year base period is a period of record that generally reflects "Normal" hydrologic conditions in the basin. Based on this analysis, the Basin Condition during the 2019 WY is "Above Normal" with respect to groundwater levels measured during the Base Period.

DISCUSSION (Group)

H. Singer-

- Many of the hydrographs reviewed were from active water supply wells; would it be better to rely strictly on observation wells in order to eliminate having to explain pumping influences?
- Base Period – what is sensitivity of analysis if the base period were changed? How would the analyses change if the base period were shifted from WY 2001 – 2010 to WY 2003 – 2012?

Action Items: Discuss with DRI automating the Basin Condition (Groundwater Level) methodology with ability to change base period.

MEETING ADJOURNED

SIGN-IN SHEET

South Tahoe Public Utility District

TAHOE VALLEY SOUTH BASIN (6-5.01)
GROUNDWATER MANAGEMENT PLAN

2019 STAKEHOLDERS ADVISORY GROUP
WORKSHOP No. 2
Friday, November 22, 2019
(8:30 PM – 11:30 PM)

NAME	AFFILIATION	PHONE	EMAIL
Ivo Bergsohn	So. Tahoe PUD	530. 543.6204	IBERGSOHN@STPUD.DST.CA.US
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M Katy Janes	DWR-NCRO	530-613-6722	Margaret.janes@water.ca.gov

AGENDA

DATE	Friday, November 22, 2019 , 8:30 AM – 11:30 AM
LOCATION	South Tahoe Public Utility District Board Room, 1275 Meadow Crest Drive, South Lake Tahoe, CA
STAKEHOLDER ADVISORY GROUP LIST	Ken Payne, P.E., (El Dorado County Water Agency); Robert Lauritzen, P.G., Karen Bender, REHS, RD (El Dorado County -EMD); Jason Burke (City of South Lake Tahoe); Scott Carroll (CA Tahoe Conservancy); Andrea Buxton (Tahoe Resource Conservation District; Brian Grey, P.G. (Lahontan Regional Water Quality Control Board); Paul Nielsen (TRPA); Joey Keely, Nicole Bringolf (USFS – LTBMU); Nakia Foskett (Lakeside Park Water Co.); Jennifer Lukins (Lukins Brothers Water Co); Kirk Woolridge (Tahoe Keys Water Co.); Harold Singer (Community Rate Payer); John Thiel, PE and Ivo Bergsohn, P.G., HG (South Tahoe PUD)
MEETING HOST	Ivo Bergsohn (South Tahoe PUD)
GO TO MEETING	https://global.gotomeeting.com/install/659987189 Call-In: 1(646) 749-3122; Access Code: 659-987-189

BASIN MANAGEMENT OBJECTIVES (BMO)

1. Maintain a sustainable long-term groundwater supply.
2. Maintain and protect groundwater quality.
3. Strengthen collaborative relationships with local water purveyors, governmental agencies, businesses, private property owners and the public.
4. Integrate groundwater quality protection into local land use planning activities.
5. Assess the interaction of water supply activities with environmental conditions.
6. Convene an on-going Stakeholders Advisory Group (SAG) as a forum for future groundwater issues.
7. Conduct technical studies to assess future groundwater needs and issues.
8. Identify and obtain funding for groundwater projects.

WORKSHOP OBJECTIVES

OBJECTIVES

1. Consider actions to prepare the first 5-Year Update of the Groundwater Management Plan for the Tahoe Valley – Tahoe South Groundwater Basin (Basin No. 6-005.01)
2. Review groundwater elevation trends during the 2019 water year.

SEE REVERSE FOR AGENDA

AGENDA

Time	Description	
8:30	**Welcome and Self-Introductions**	**Round Robin**
8:40	**TVS Basin (6-5.01) - Open Forum** **Opportunity for members to briefly raise topics within the subject matter of the SAG and not listed on the Agenda.**	**Round Robin**
8:50	**Groundwater Management Plan – 5-Year Update** • **GMP and GSP Content** • **DWR Recommended Actions** • **Discussion**	**SAG**
11:00	**2019 Groundwater Conditions** • **Water Year Classification** • **Groundwater Elevation Trends** • **Data Needs: Groundwater Production Data**	**I. Bergsohn**
11:30	**Adjourn**	

Tahoe Valley South Subbasin (6-5.01)Groundwater Management Plan

2019 Stakeholder Advisory Group Workshop 2

November 22, 2019

Groundwater Management Plan- 5-Year Update

DWR Alternative Plan Approval

- DWR approved the 2014 GMP as an Alternative Plan to a GSP on July 17, 2019
- DWR made findings that the Alternative is the functional equivalent of a GSP and that it satisfies the objectives of SGMA
- The District can continue groundwater management of the TVS Basin under the existing GMP in accordance with SGMA
- District to update its MOU with El Dorado County to reflect DWR approval
- District can amend its GMP in compliance with SGMA and AB3030

Components of the Approved Plan

- 2014 Groundwater Management Plan
- Supporting Documents submitted to DWR:
  - March 11, 2016 South Tahoe Public Utility District: Tahoe Valley South Basin (6-5.01) Annual Report – 2015 Water Year;
  - February 25, 2016 Desert Research Institute: South Lake Tahoe Groundwater Model;
  - August 26, 2016 Desert Research Institute: South Lake Tahoe Groundwater Model Update; and,
  - June 2016 South Tahoe Public Utility District: 2015 Urban Water Management Plan.

Action Items Going Forward

- Update MOU with El Dorado County to reflect DWR approval
- Consider Amendments to the approved Alternative Plan
  - DWR Recommended Actions to GMP
  - SAG recommendations to improve the GMP to address issues or concerns
- Schedule Alternative evaluation follow-up meeting with DWR
- District to submit its Annual Report to DWR due by April 1, 2020
- District to complete five year update of the GMP and submit to DWR by January 1, 2022

DWR Periodic Review of GMP

California Code of Regulations, title 23, section 355.6 requires DWR to periodically review an approved Plan:

(a) The Department shall periodically review an approved Plan to ensure the Plan, as implemented, remains consistent with the Act and in substantial compliance with this Subchapter, and is being implemented in a manner that will likely achieve the sustainability goal for the basin.

(b) The Department shall evaluate approved Plans and issue an assessment at least every five years. The Department review shall be based on information provided in the annual reports and the periodic evaluation of the Plan prepared and submitted by the Agency.

(c) The Department shall consider the following in determining whether a Plan and its implementation remain consistent with the Act.

DWR Periodic Review of GMP

(c) The Department shall consider the following in determining whether a Plan and its implementation remain consistent with the Act:

(1) Whether the exceedances of any minimum thresholds or failure to meet any interim milestones are likely to affect the ability of the Agency to achieve the sustainability goal for the basin.

(2) Whether the Agency is implementing projects and management actions consistent with the Plan, or that the Agency has demonstrated that actions described in the Plan have been rendered unnecessary based on changing basin conditions or an improved understanding of basin conditions.

(3) Whether the Agency is addressing data gaps and reducing the levels of uncertainty identified in the Plan.

DWR Periodic Review of GMP

(c) The Department shall consider the following in determining whether a Plan and its implementation remain consistent with the Act (Cont.):

(4) Whether the Plan continues to satisfy the criteria described in Section 355.4. (see Handout)

SAG Recommendations to Improve the GMP

- How can the GMP be improved?
- What current groundwater issues are of greatest concern to the SAG?
- How and to what extent should the GMP be amended to incorporate any new information?
- Should an outside consultant be used as a facilitator for this effort?

DWR Recommended Actions to GMP

How and to what extent should the GMP be amended to incorporate the following recommended actions from DWR?

- Provide water budget information in tabular form for the historical, current, and projected water budgets.
- Provide a projected water budget incorporating climate change over the planning and implementation horizon of 50 years. The first five-year update should address the apparent discrepancy between the Groundwater Management Plan indicating a shift from snow to rain and the Urban Water Management Plan indicating no detrimental effects on the Subbasin.
- Reconcile the differing future water demand trend projections between the Groundwater Management Plan, Urban Water Management Plan, and incorporate the reconciliation into the projected water budget.

DWR Recommended Actions to GMP

- In order to understand the change in groundwater storage for the Subbasin, the water budget calculated by the TVS Model should be calculated within the Subbasin boundary rather than the surrounding watershed area inclusive of the Subbasin. Recharge that becomes baseflow prior to entering the Subbasin should not be included in the TVS Model water budget calculations. In addition, storage outside of the Subbasin should not be included in the TVS Model water budget calculations. While these terms may cancel out on an annual basis, the offset between supply and demand may misrepresent the change in groundwater storage annually.
- The Alternative demonstrates the District's management of the Subbasin to avoid causing undesirables results to water supply related to degraded groundwater quality. However, Department staff recommend that additional explanation be provided in the first five-year update for how pumping may impact plume migration or cause degraded water quality.

DWR Recommended Actions to GMP

- Provide estimates of the quantity and timing of depletions of interconnected surface water and further define what would cause depletions to become significant and unreasonable for the Subbasin.
- Define quantitative criteria for groundwater levels, storage, and depletion of interconnected surface water that can be used to objectively determine compliance of the Plan with the objectives of SGMA on an ongoing basis. The District may consider using groundwater levels as a proxy for the other sustainability indicators.
- Provide a description of how the data gaps identified will be addressed; specifically, the projects identified in Table 10- 1 for BMO 5 that are dependent upon the District obtaining outside funding.

Process to Amend the GMP

- Notice and hold a public hearing on whether to adopt a resolution of intention to draft an updated GMP. Water Code § 10753.2(a).
- Adopt a resolution of intention after the conclusion of the hearing. Water Code § 10753.2(b).
- Provide DWR with a copy of the adopted resolution of intention within 30 days of its adoption. Water Code § 10753.2(c).
- Publish the adopted resolution of intention in the same manner as the notice of the hearing on the resolution of intention. Water Code § 10753.3(a).

Process to Amend the GMP

- Prepare an updated GMP within two years of the date of the adoption of the resolution of intention. Water Code § 10753.4(a).
- After preparation of the updated GMP, notice and hold a second hearing to consider any protests to the adoption of the GMP and determine whether to adopt the GMP. Water Code § 10753.5(a)–(b).
- Adopt the updated GMP within 35 days of the conclusion of the second hearing, provided a majority protest has not been filed. Water Code § 10753.6(c)(3).
- Provide a copy of the adopted updated GMP to DWR. Water Code § 10753.7(b)(2).

Tahoe Valley South Subbasin (6-5.01)Groundwater Management Plan

2019 Stakeholder Advisory Group Workshop 2

November 22, 2019

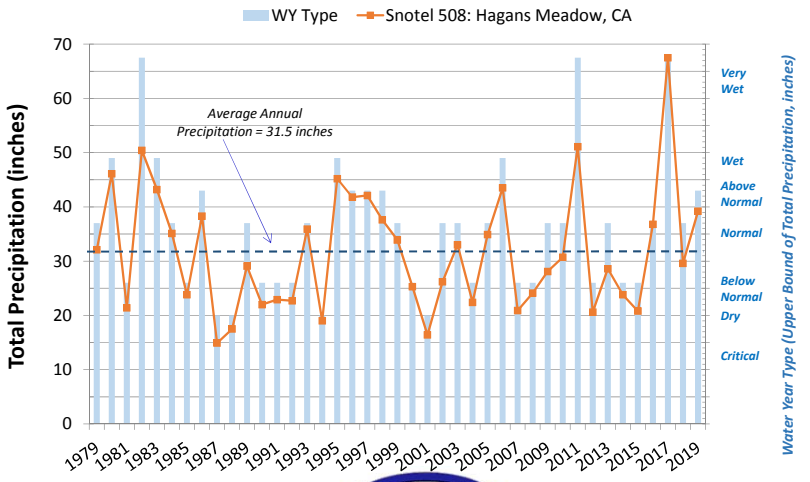
2019 Groundwater Conditions

2019 Groundwater Conditions

- Water Year Classification
- Groundwater Level Monitoring
- Groundwater Elevation Trends

- Groundwater Production – Data Request

TVS Basin Water Year



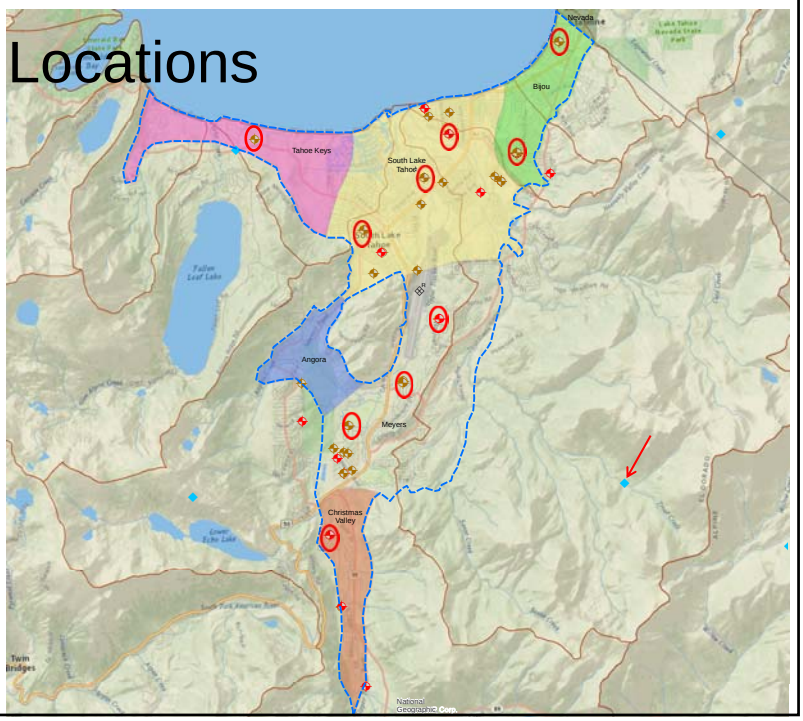
Groundwater Level Monitoring

- 45 wells at 31 Locations
  - Observation Wells (30)
    - Monitoring Wells
    - Sentinel Wells
    - Test Wells
    - Former Water Supply Wells
  - Water Supply Wells (15)
    - Active
    - Stand-By

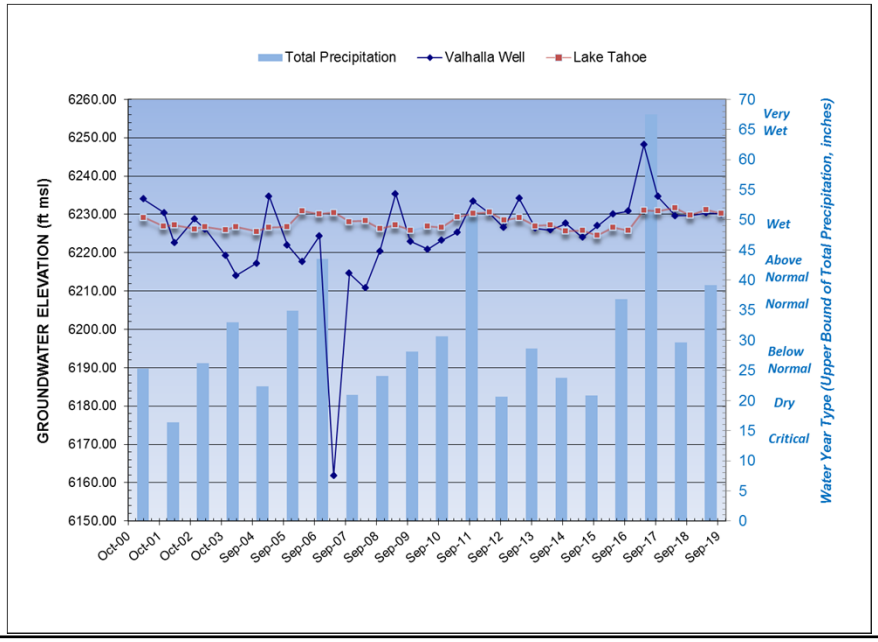
Monitoring Schedule

- March 2001- Present
- Semi-Annual Readings (45 Wells)
  - Hand Readings
  - May (spring)/November(fall)
- Automated Readings (13 Wells)
  - Daily
  - Every 12 Hours (6:00 AM/6:00 PM)

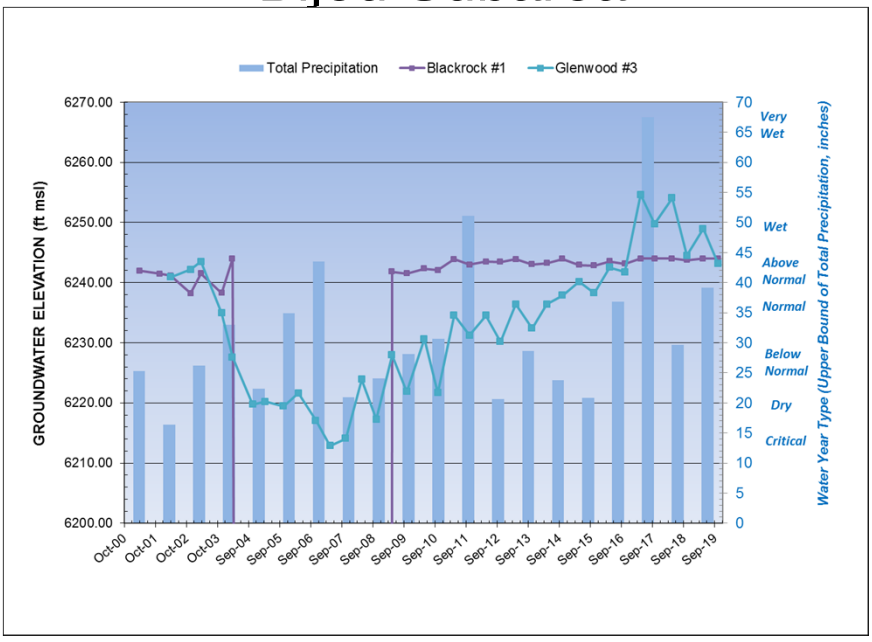
Well Locations



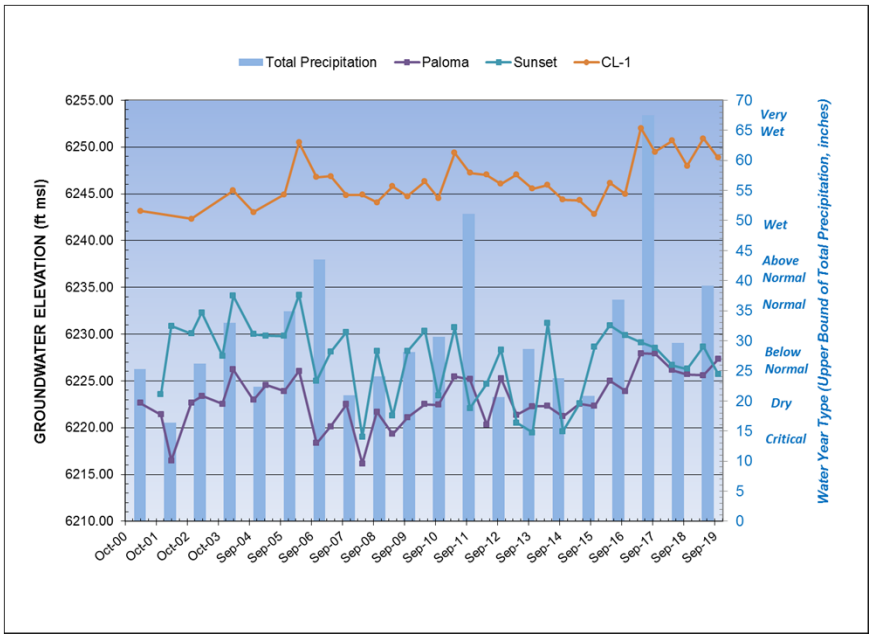
Tahoe Keys Subarea



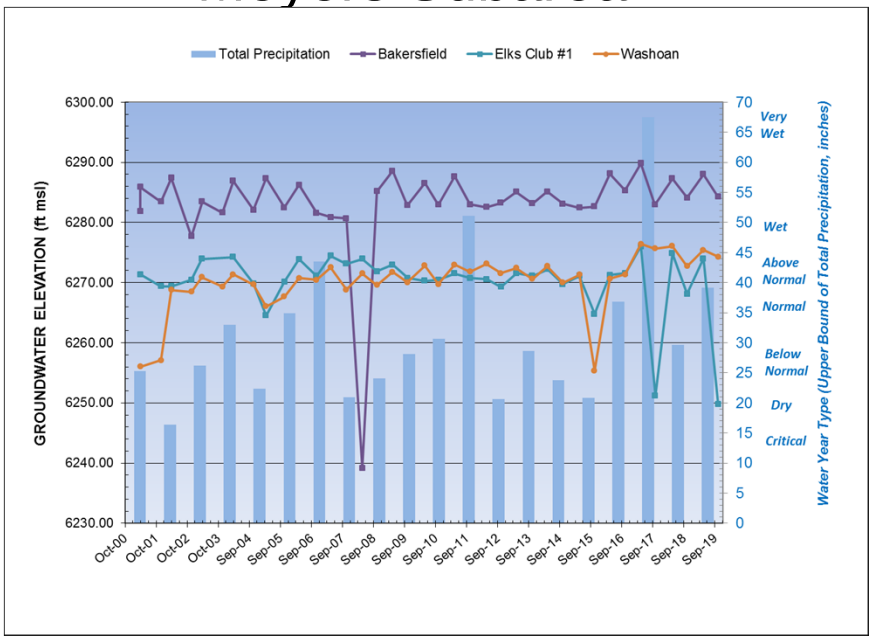
Bijou Subarea



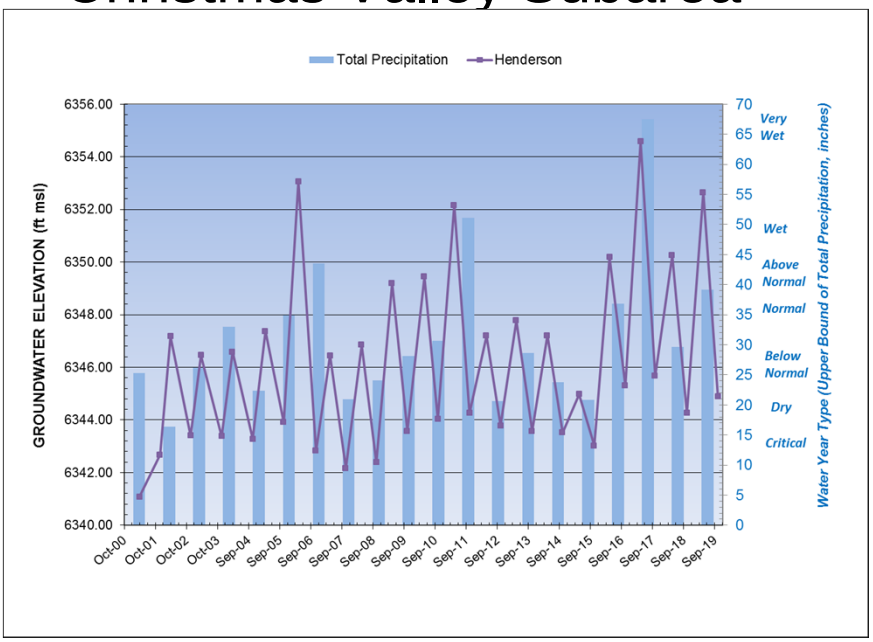
South Lake Tahoe Subarea



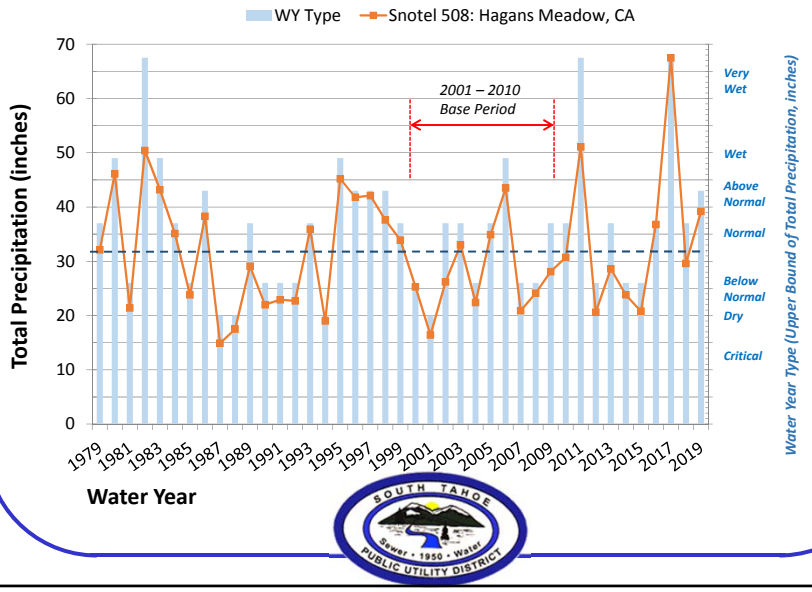
Meyers Subarea



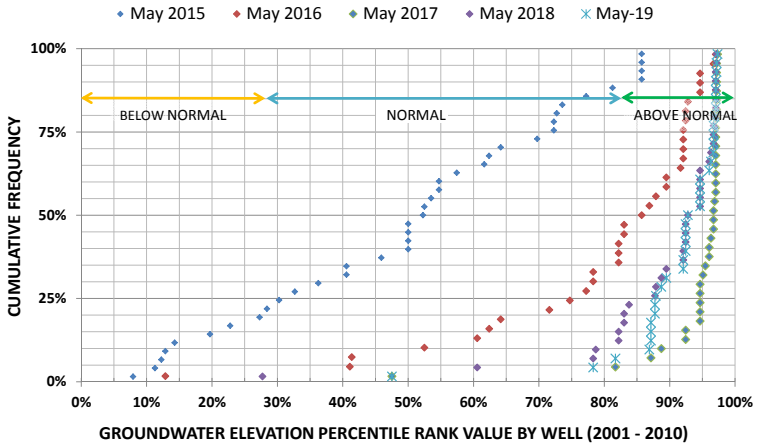
Christmas Valley Subarea



TVS Basin Water Year



Basin Condition (GW Levels)



2019 Groundwater Conditions

- 2019 Water Year Classification:
  - Total PPt = 39.2” ; 37” < Above Normal < 43”
- Basin Condition (Groundwater Levels)
  - Above Normal (compared to 2001 – 2010 Base Period)

2019 GW Production Data

- 2019 WY Period
  - (Oct 1, 2018 – Sept. 30, 2019)
- Groundwater Production Data;
  - By Well;
  - By Month;
  - By Volume (in MG or Gallons)
- Needed by December 20th