

TVS Groundwater Basin Survey of Well Owners



Photo: View of southern portion of TVS Groundwater Basin, by M. Sweeney

by Michelle Sweeney with contributions from Ivo Bergsohn and Alex Johnson

Prepared by Allegro Communication Consulting
South Lake Tahoe, California

Published by South Tahoe Public Utility District

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South Tahoe Public Utility District

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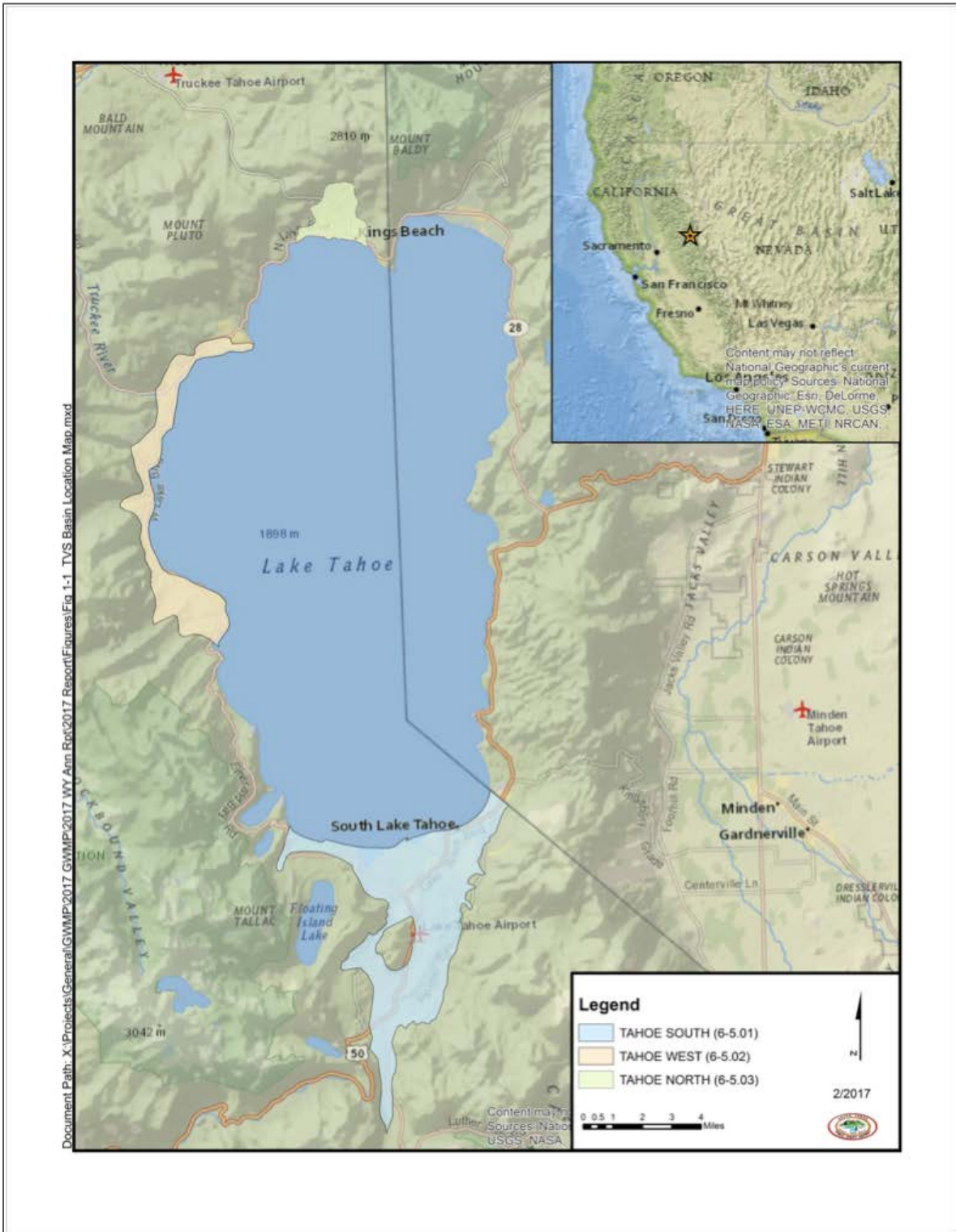


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Figure 1: TVS (6 -5.01) is a Sierra Nevada groundwater basin located within California, south of Lake Tahoe on the California-Nevada border.



Map: TVS groundwater basin in context; provided by STPUD

TVS Groundwater Basin Survey of Well Owners

Introduction

This report conveys findings from a survey of well owners about private wells of Tahoe Valley South (6-5.01), a Sierra Nevada groundwater basin (herein referred to as the TVS Basin). Groundwater is the primary source of drinking water in this basin located in California, south of Lake Tahoe. The vast majority of drinking water in the TVS Basin is provided to consumers by public water systems. Meanwhile more than six hundred (600) private wells, indicated in government databases, potentially draw from this groundwater basin as well.

Called for because information about private wells needed to be updated, this Tahoe Valley South Groundwater Basin Survey of Well Owners report begins to clarify how many private wells are in the basin and how these are used. The survey was conducted online, by phone and door-to-door in summer and fall 2017. This report organizes contemporary information ascertained by the survey regarding private well: counts, ownership, operating status, maintenance, locations and geographic distribution, water usage and water quality. This information creates a basis for communication about groundwater between and among private well owners, water purveyors, policymakers, local government and basin stakeholders.

The TVS Basin ranges in elevation from 6,225 to 6,500 feet. Measuring approximately twenty-three (23) square miles, this basin conforms generally to the Upper Truckee River and Trout Creek valleys in El Dorado County. Overlying the basin are the City of South Lake Tahoe and town of Meyers. Public entities, including the United States Forest Service, own and manage significant portions of the watershed through which snowmelt travels to the basin. This basin accumulates groundwater primarily from precipitation that collects on surrounding peaks, some of which reach elevations above 10,000 feet. Most basin annual precipitation arrives in the form of snow. The snow melts, seeping into cracks and crevices beneath the surface of the mountains and becoming groundwater.

The mean annual precipitation at high elevation areas near the western boundaries of the Upper Truckee River and Taylor Creek averages over sixty (60) inches per year. “Other sources of groundwater recharge include stream-flow seepage and groundwater inflow from surrounding bedrock. In general, groundwater movement is south to north from the basin margins toward Lake Tahoe.” Studies indicate “groundwater levels are relatively stable. Average annual groundwater recharge to the TVS Basin is calculated from the South Lake Tahoe Groundwater Model and is estimated at approximately 42,000 acre-feet per year (AFY) (South Lake Tahoe Groundwater Model, DRI, 2016). Total pumping from public and private wells is inferred to use, on average, about 7,800 AFY, or about 20% of the annual groundwater recharge (Tahoe Valley South Subbasin (6-5.01) Annual Report, 2017 Water Year, STPUD, 2018).

Under some circumstances “pollutants can readily [infiltrate] into groundwater supplies. Groundwater can be polluted by landfills, septic tanks and leaky underground tanks” (groundwater.org) among other things. While “groundwater in the TVS Basin is generally of excellent chemical quality” it has in select locations “been adversely affected by past releases of man-made contaminants. Resultant water quality degradation exists beneath sites located along the main commercial business district near the intersection of Highway 89 and Highway 50”, (TVS Basin Groundwater Management Plan).

Most area consumers receive groundwater provided by South Tahoe Public Utility District. Basin communities not using District water receive groundwater purveyed by Tahoe Keys Water Company, Lukins Brothers Water Company and an array of Small Community Water Systems. There are a few unique instances of surface water use for domestic water in this basin. The only other potable water purveyance in the basin happens via private well.

Survey Impetus

The State of California enacted Sustainable Groundwater Management Act (SGMA) legislation in 2014. This created an impetus for water purveyors in groundwater basins such as the TVS Basin to organize, communicate and form a Groundwater Sustainability Agency (GSA). The South Tahoe Public Utility District (District) led the effort to convene local water purveyors and create the GSA for the TVS Basin. This Survey of Well Owners created a mechanism by

which to invite the community of private well owners to participate in the GSA’s collaborative effort to sustainably manage groundwater resources.

Impetus for this survey derived in part from “medium-high priority” status initially assigned to the TVS Basin by the California Department of Water Resources (DWR). In May 2018 DWR released a draft prioritization which shifted the TVS Basin classification to “low priority”, downgrading legislatively compelled urgency around this survey. This shift places greater discretion regarding near-term efforts to sustainably manage groundwater with citizenry, private well owner community and water purveyors of the basin. DWR expects to issue final priorities for un-modified basins (including the TVS Basin) during January 2019.

California Water Code requires that Basin Management Objectives exist for all groundwater basins. TVS Basin Management Objectives are

- Maintain a sustainable long-term groundwater supply
- Maintain and protect groundwater quality
- Build collaborative capacity with local agencies, businesses, private property owners and the public
- Integrate groundwater quality protection into local land use planning activities
- Assess the interaction of water supply activities with environmental conditions
- Convene an ongoing Strategic Advisory Group (SAG) as a forum for discussion about groundwater issues
- Conduct studies to assess future groundwater needs and issues
- Identify and obtain funding for groundwater projects.

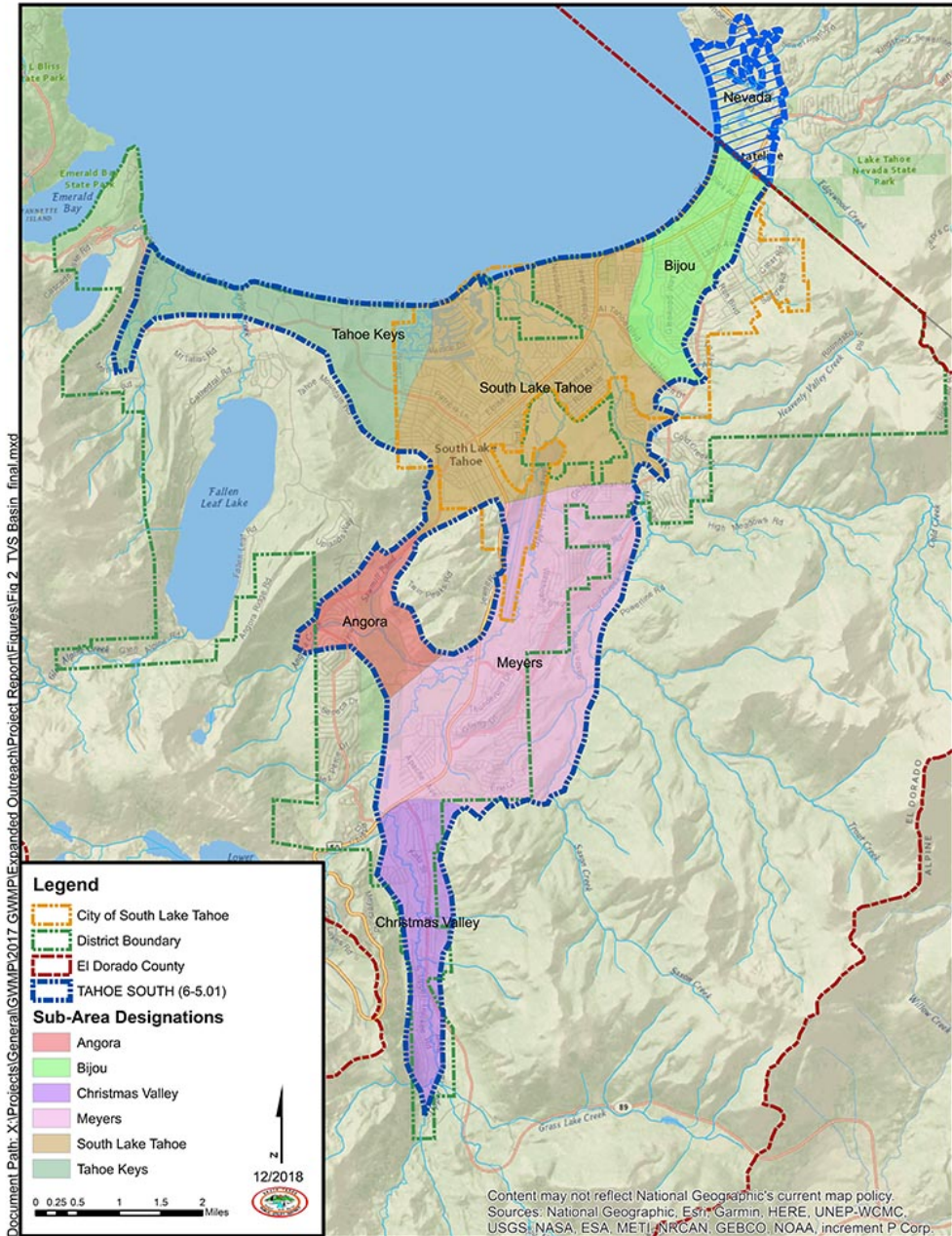
Source: TVS Basin Groundwater Management Plan

This survey corresponds to several of these objectives as discussed further in the context of recommendations.



Photos: View of northeastern portion of TVS groundwater basin, by M. Sweeney

Figure 2: Survey of Well Owners data analysis reveals private well distribution concentrates around six geographic sub-areas of the California portion of the TVS Basin. From the upper watershed to the lake and then northeast, this report refers to these areas as “Christmas Valley”, “Meyers”, “Angora”, “Tahoe Keys”, “South Lake Tahoe” and “Bijou”.



Map: Six geographic areas; provided by STPUD

Findings

Six geographic areas

Survey results reveal private well distribution concentrates around six geographic sub-areas (areas) of the California portion of the TVS Basin. 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. From the upper watershed to the lake and then northeast, this report refers to these areas as “Christmas Valley”, “Meyers”, “Angora”, “Tahoe Keys”, “South Lake Tahoe” and “Bijou”.

Wells within a given area tend to have in common: water use, usage frequency, vintage and history. “Christmas Valley” features many private wells where groundwater is accessed for daily, residential use in year-round and seasonal capacities. Well densities in Christmas Valley are on the order of ten to fifty private wells per square mile. “Meyers” features fewer than twenty private wells used daily, year-round in mixed residential and business contexts in the airport vicinity. More Meyers wells are northwest of the airport. Meyers well density is approximately fifty wells per square mile. Developed for residential use after 1950, “Angora” features no private wells. Not to be confused with the property owners’ association with the same name, “Tahoe Keys” here corresponds to fewer-than-ten residential properties near Lake Tahoe that feature private wells in daily, year-round use. The “South Lake Tahoe” and “Bijou” areas combined feature hundreds of private wells in daily, year-round and seasonal, residential and business use. With density exceeding one hundred (100) private wells per square mile, Bijou features the highest private well density in the basin.

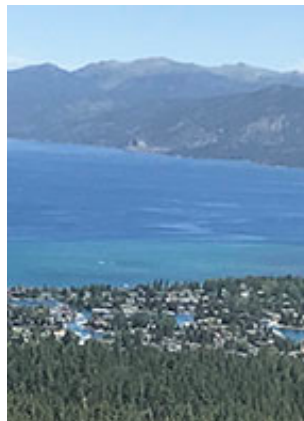
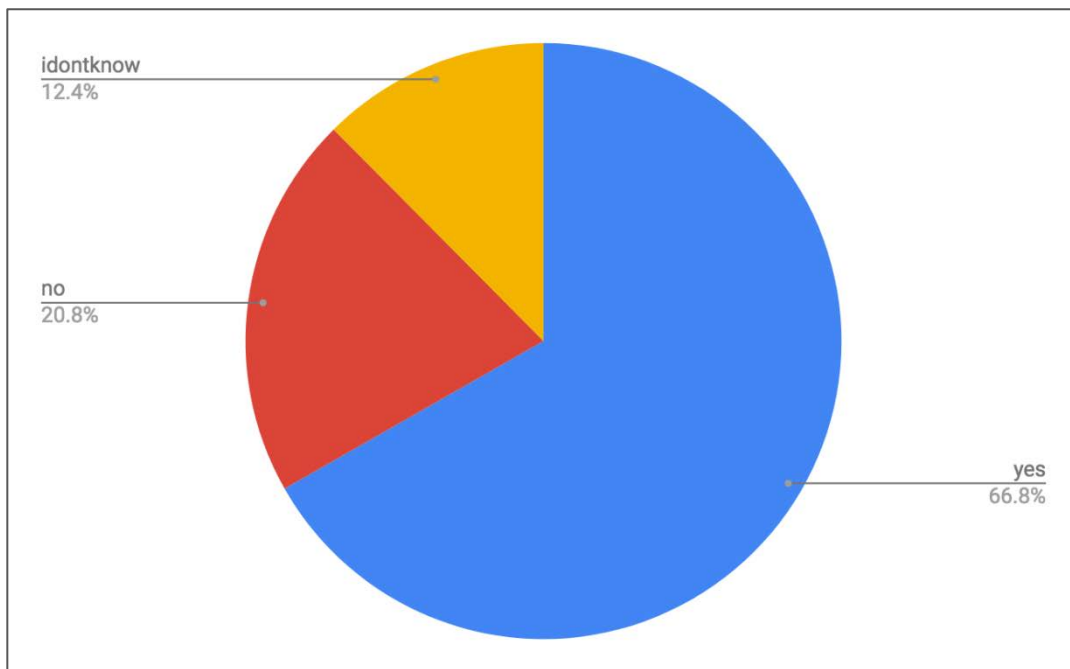


Photo: View of northern portion of TVS groundwater basin, by M. Sweeney

Private well ownership

Three hundred seventy-five (375) private well owners responded to the survey out of six hundred four (604) potential individual well owner contacts attempted. Seventy-two percent (72%) of respondents indicate they own the property at the survey address. The survey asks, “Is there a well located at the property?”. Sixty-six percent (66%) of respondents indicate there is a well on the property. Twenty percent (20%) indicate there is no well. Twelve percent (12%) indicate they do not know whether there is a well.

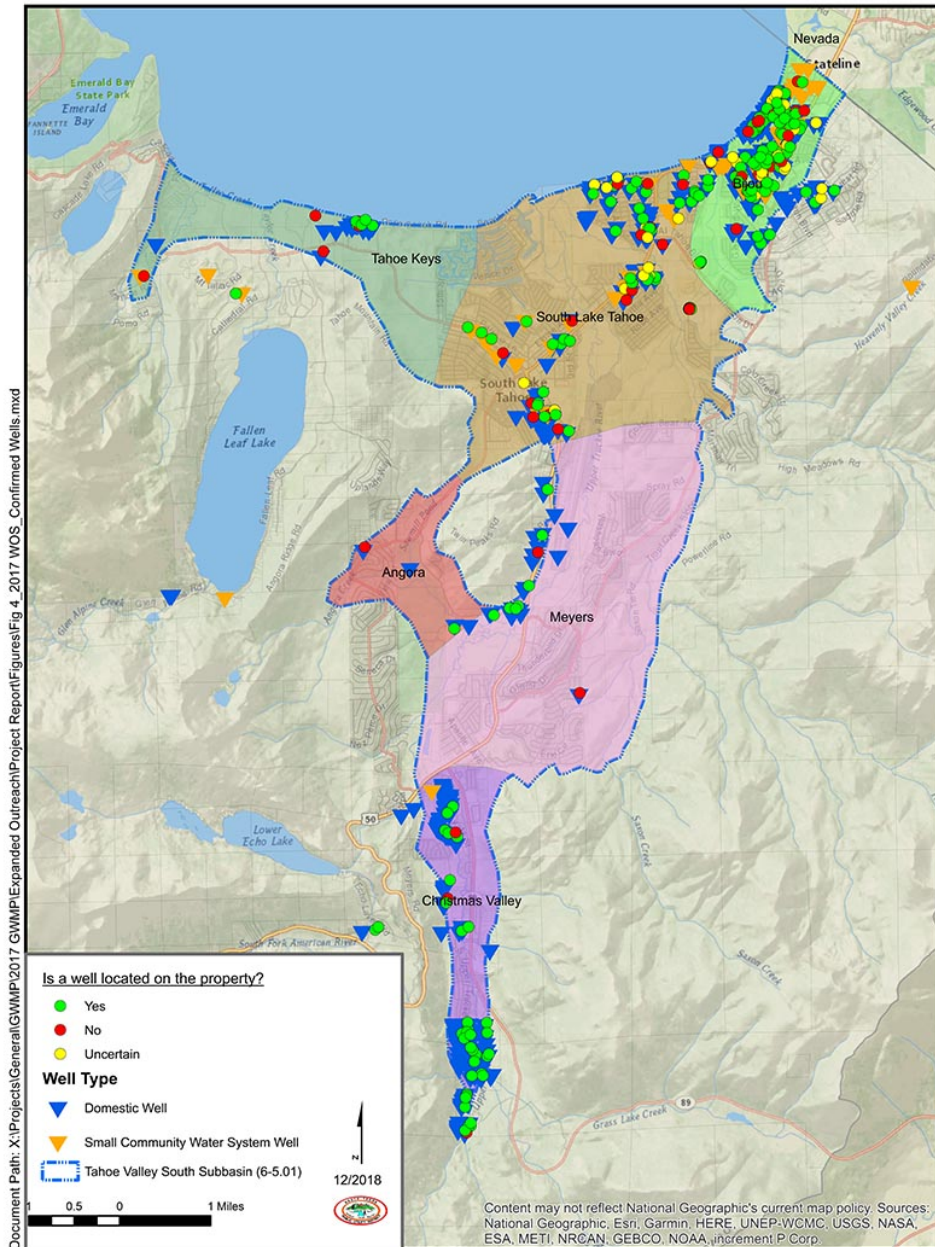
Figure 3: *Is there a well at this property?* Sixty-six percent (66%) of three hundred seventy-five (375) respondents indicate there is a well on the property. Twenty percent (20%) indicate there is no well. Twelve percent (12%) indicate they do not know whether there is a well.





Photos: Private wells in the TVS Basin manifest in the landscape in a variety of ways and in a wide variety of circumstance, by J. Bear and STPUD

Figure 4: Most area consumers receive groundwater provided by South Tahoe Public Utility District. Basin communities not using District water receive groundwater purveyed by Tahoe Keys Water Company, Lukins Brothers Water Company and an array of Small Community Water Systems. These are public-private wells that serve multiple connections (generally 15 to 25) as opposed to a domestic well which serves the water uses of a single household or business. These Small Community Water System wells supply drinking water to schools, resorts, hotels, apartments and recreational areas.



Map: Is a well located on the property? provided by STPUD

The survey asks, “As owner, which best describes your relationship to this property?”. Eighteen percent (18%) identify as “primary residence” owners. Thirty-seven (37%) identify as “secondary residence” owners. Fifteen percent (15%) identify as “business” owners.

Figure 5: *As owner, which best describes your relationship to this property?* Eighteen percent (18%) of three hundred seventy-five (375) respondents identify as “primary residence” owners. Thirty-seven percent (37%) identify as “secondary residence” owners. Fifteen percent (15%) identify as “business” owners.

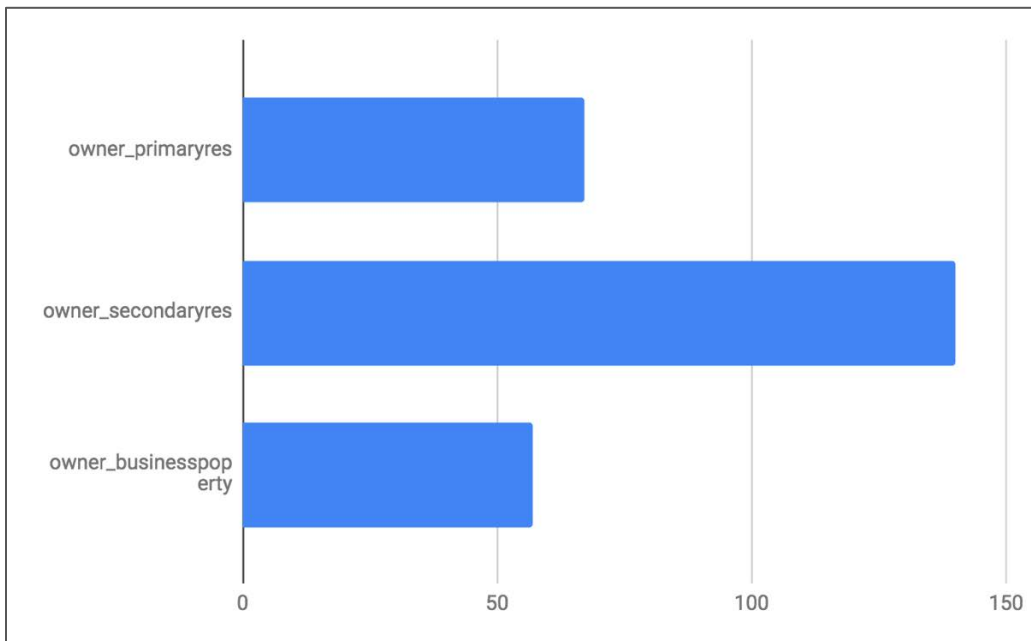
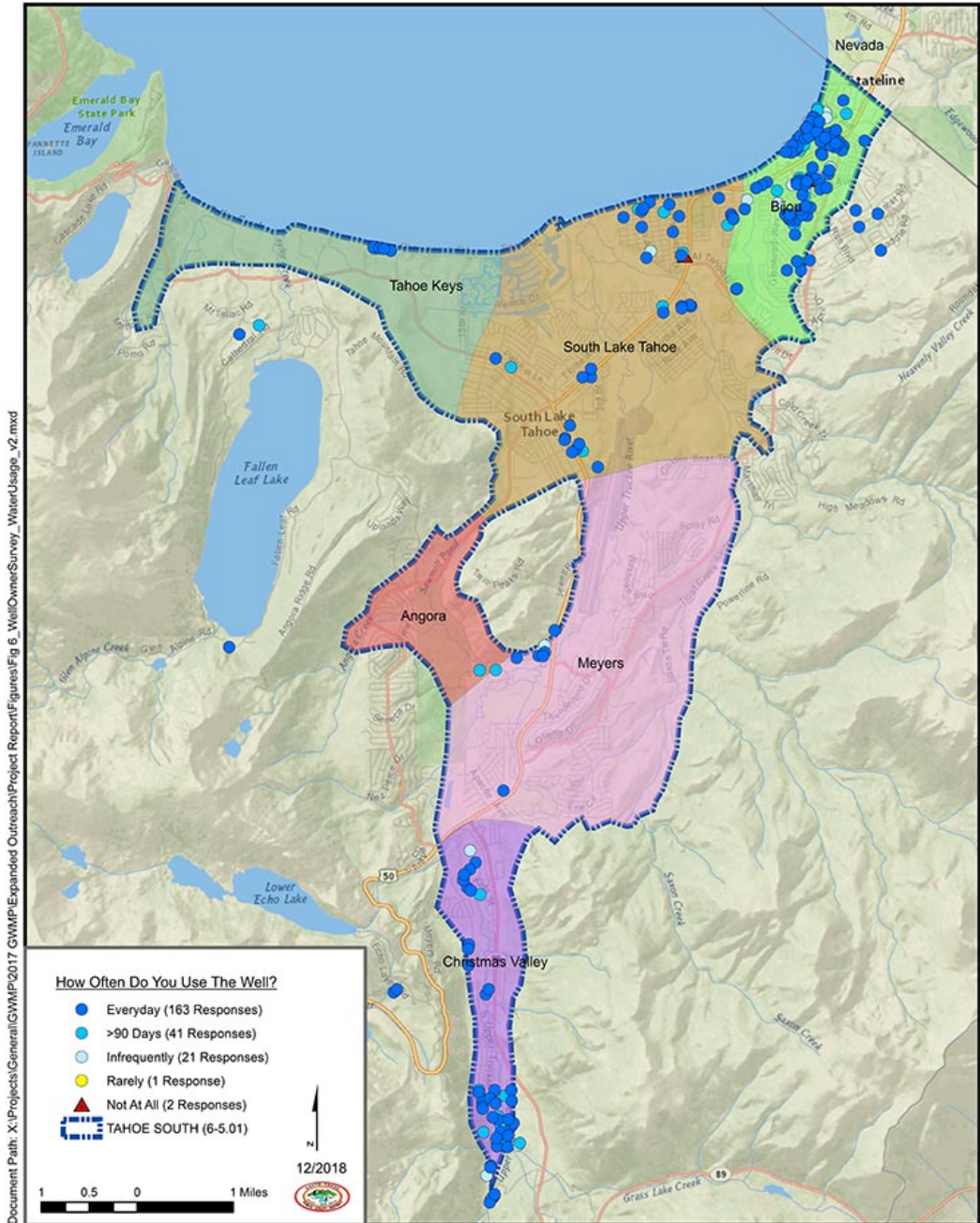


Photo: Under some circumstances secondary residence wells can go unmaintained for many years as in the case of this seasonal-use U.S. Forest Service long-term lease parcel, J. Bear.

Figure 6: How often do you use the well? One hundred sixty-three (163) respondents indicate the well is used in an everyday capacity and forty-one (41) indicate the well is used “more than 90 days” in a year.



Map: How Often Do You Use the Well? Provided by STPUD

Water usage

The survey asks, “Is the well in use?”. Sixty-one percent (61%) indicate the well is in use. Four percent (4%) say the well is not in use. To the question, “Is there a secondary, or backup, source of household water?” three percent (3%) of respondents say “yes”, while forty-eight percent (48%) say “no”.

Figure 7: *Is the well in use?* Sixty-one percent (61%) of three hundred seventy-five (375) respondents indicate the well is in use. Four percent (4%) of respondents say the well is not in use.

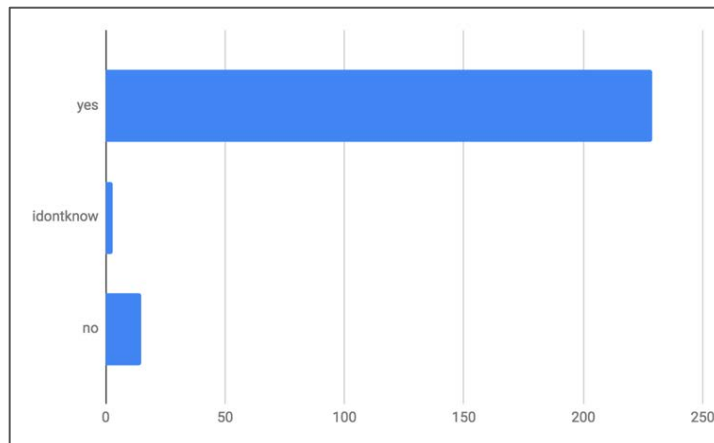
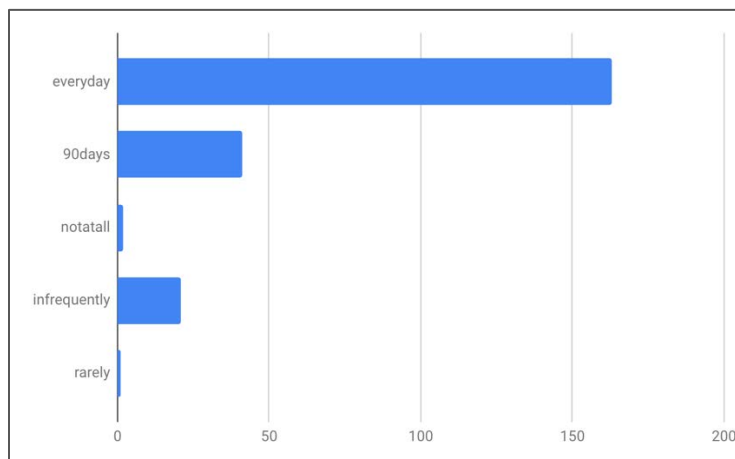


Figure 8: *How often do you use the well?* One hundred sixty-three (163) respondents indicate the well is used in an everyday capacity and forty-one (41) indicate the well is used “more than 90 days” in a year.



The survey asks, “How often do you use the well?”. Forty-three percent (43%) of respondents indicate the well is used in an “everyday” capacity. Ten percent (10%) indicate the well is used “more than ninety days in a year”. As to whether the well is the “primary source of household or business water”, fifty-two (52%) indicate “yes” while eight percent (8%) say “no”.

Figure 9: *Is the well the primary source of household or business water?* Fifty-two (52%) percent of three hundred seventy-five (375) respondents indicate “yes” while eight percent (8%) say “no”.

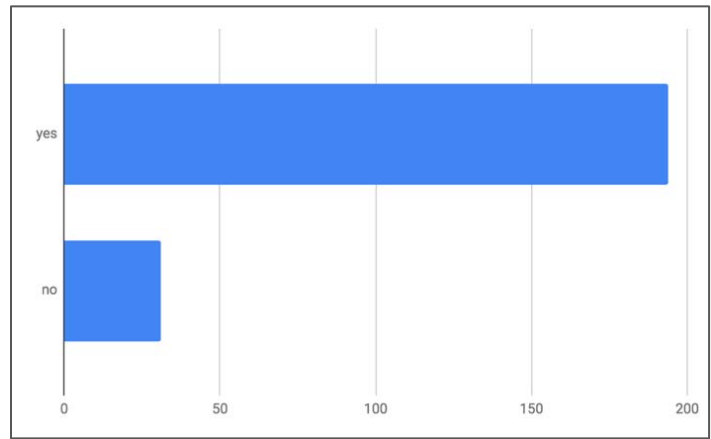


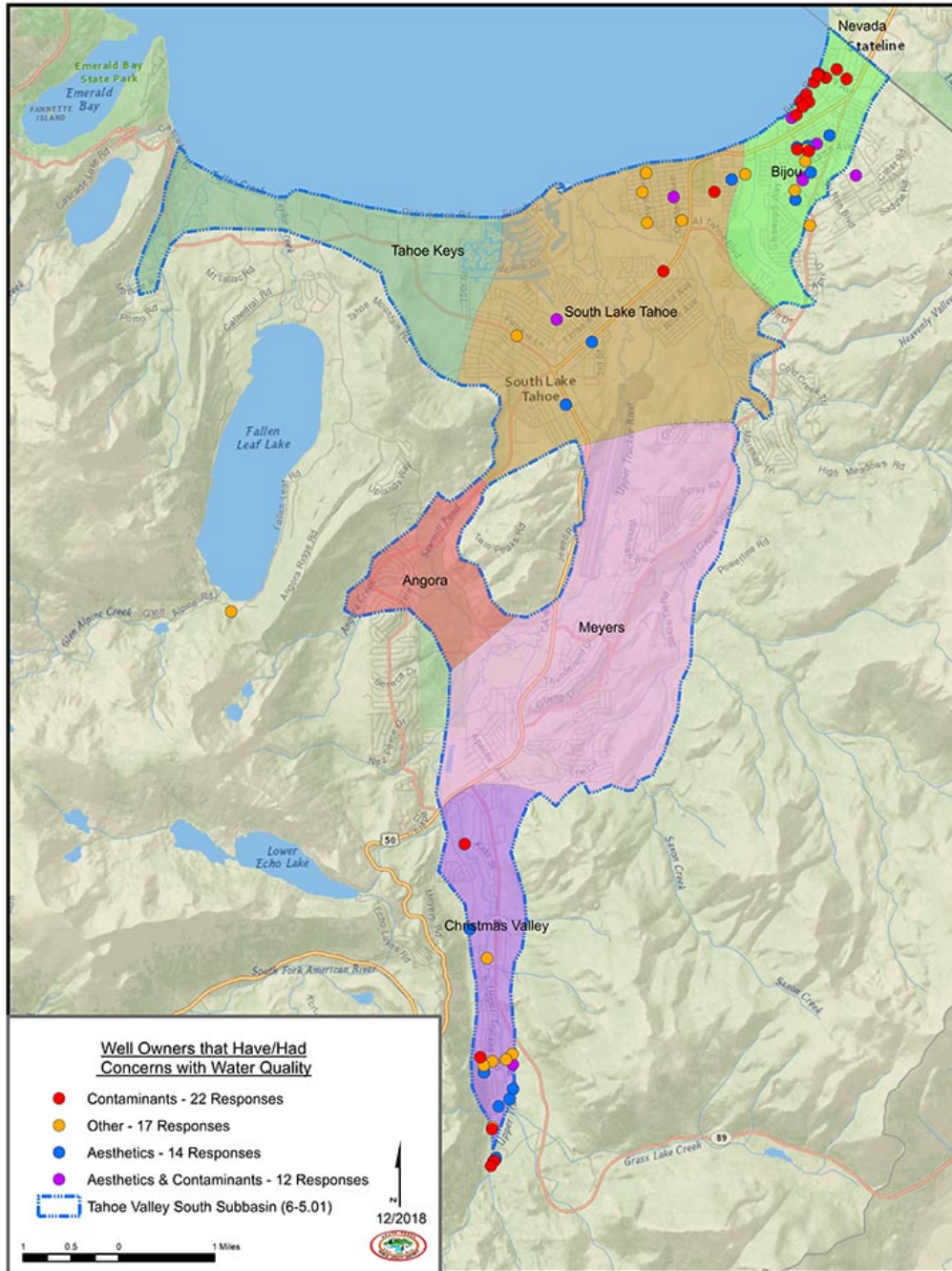
Figure 10: Responses to survey water usage questions serve as a basis for estimating private well owner water usage. These responses combine with the Truckee River Operating Agreement (TROA) assumed usage rate for residential use in the Tahoe Basin. For the business water usage rate calculation, the survey responses combine with the usage rates deriving from a conservative application of the 2015 Murray thesis and Lake Tahoe Visitor Authority occupancy rates.

Water use type	#	Annual Production	
		Gallons	Acre Feet
Residential	182	18,663,960	57.2776
Business	43	11,451,705	35.1439
Water Use Totals	225	30,115,665	92.4214



Photos: TVS Basin from Echo Ridge, by M. Sweeney

Figure 11: Do you now or have you ever had any concern about the well water? Private well owners reporting concerns about water quality mention “contaminants” and “aesthetic” concerns such as taste, color or odor.



Map: Well Owners that Have/Had Concerns with Water Quality, provided by STPUD

Water quality

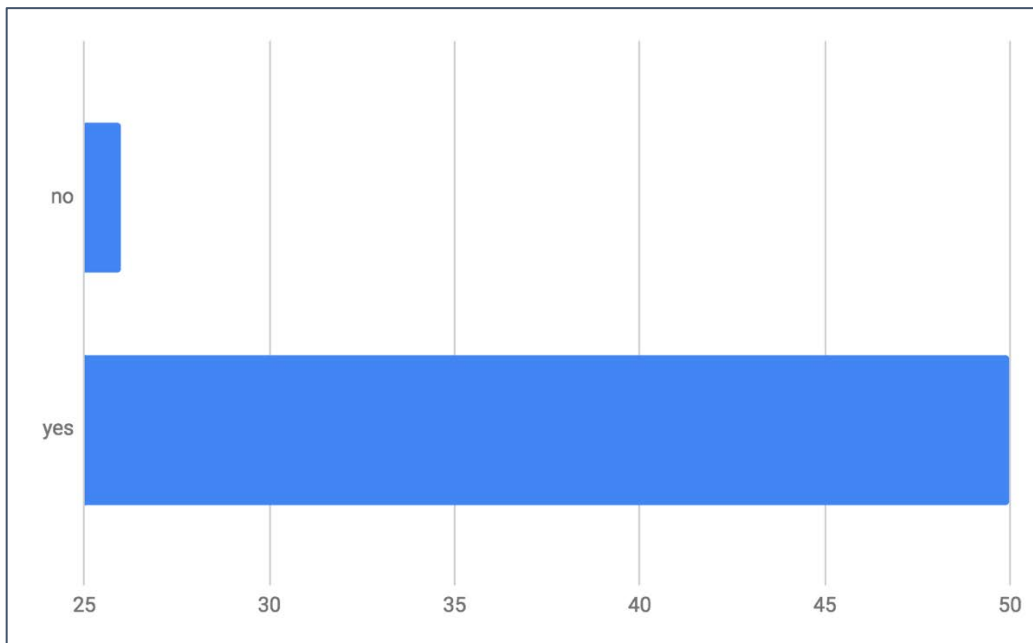
Private well owners overwhelmingly “like” perceived “purity” of well water. “Taste, color and odor” of well water are perceived favorably. Well owners enjoy features of private well water such as “cold temperature”, “low cost”, “quality” and “absence of chlorine”. They highly value well water while the system consistently delivers high quality water.

The survey asks, “Do you now or have you ever had any concern about the well *water*?”. Eighteen percent (18%) of respondents say “yes”. Well owners indicating concern about well water mention quality concerns such as potential contamination as indicated by taste, color, odor or the presence of sediment.

Well system integrity

The survey asks, “Do you now or have you ever had any concern about the well *system*?”. Twenty percent (20%) of respondents say “yes”. Well owners indicating concern about well systems mention “pumps”, “wellhead connections”, “water production” and “system maintenance”. Twenty-six (26) individual respondents characterize the well system concern “unresolved”.

Figure 12: *Has the concern about the system been resolved?* Twenty-six (26) individual respondents characterize well system concerns “unresolved” (at the time of the survey).



Ultimately well owners come to understand cost-benefit of private well ownership by comparing cost of well operation and maintenance over time in relation to cost of connecting to a public water system. Connection cost is unique to each property except in circumstances where neighborhoods organize to seek collective public water system connectivity. Thirty-seven (37) survey respondents indicate a desire for information about connecting to a public water system. Thirty-one (31) survey respondents indicate interest in receiving information about County guidelines and requirements for well abandonments. One hundred eighteen (118) survey respondents indicate interest in receiving occasional District email updates about local groundwater management and wells.

Methods

The District convened a nine-person project team to design and conduct the survey. Private well location and ownership information was culled from federal, state, county and local databases. The survey instrument was designed both to be conducive to query and to allow opportunity for well owners to bring topics to the attention of the survey team. A focus group informed survey design. A letter from South Tahoe Public Utility District notified potential private well owners of the survey and encouraged online or phone response with District personnel dedicated to supporting survey completion. A field team conducted the survey by going door-to-door and by facilitating survey completion by phone and online. Spatial data tools played an important role in survey programming and design. Geographic Information System (GIS) software served as a backbone for in-the-field survey completion, data compilation and mapping.

Recommendations

TVS Groundwater Basin has sufficient groundwater but the resource is not immune to pollutants, spared from drought or exempt from flood, according to studies that informed the TVS Basin Groundwater Management Plan. Consistent with water resource stewardship South Tahoe Public Utility District espouses and with Sustainable Groundwater Management Act principles, the following recommendations center on building groundwater stewardship culture

and incorporating social, institutional and resource resilience into TVS Basin groundwater management. As the TVS Basin Management Objectives underscore; a robust, communicative, informed and proactive groundwater community can serve as a foundation for local control and management of groundwater resources. The primary objective is to “maintain and protect groundwater quality”. Each of the following recommendations points to specific actions consistent with this primary objective.

1) Create capacity within the groundwater community to make technical support available to private well owners.

This recommendation stems from the Basin Management Objective stating that the Groundwater Sustainability Agency will “build collaborative capacity...with private property owners”. The Groundwater Strategic Advisory Group (SAG) the District convenes twice a year is a community of water purveyance professionals. A recommended item for this group’s agenda is to consider how SAG members and the District can collaborate with private well owners to sustainably manage groundwater resources, creating capacity within the groundwater community to make technical support available to private well owners most in need of it.

2) Complete the assessment of the status of private wells.

This recommendation stems from the Basin Management Objective stating that the Groundwater Sustainability Agency will “conduct studies to assess future groundwater needs and issues...”. While this 2017 Survey of Well Owners marks good progress in verifying count and status of private wells there are many more wells on record whose existence and status require verification. Out of an initial six hundred forty-six (646) wells inferred from several government well databases, this survey has been able to confirm absence or presence of three hundred twenty-four (324). Status of the remaining inferred private well inventory remains unknown. Complete the assessment of the status of private wells. In the course of this effort, close data inconsistencies and information gaps.

3) Assess risk and benefit.

This recommendation stems from the Basin Management Objective stating that the Groundwater Sustainability Agency will “assess the interaction of water supply with environmental

conditions”. Findings of this survey provide a starting point for creation of a strategic, criteria-based analysis of risk to groundwater resources from private wells at the intersection of geographic area and topics of the survey instrument: property ownership, water quality, water usage, and well condition. Assess the potential for threats to water quality and water supply from private wells. Also assess the beneficial role private wells potentially offer as a window onto the groundwater basin. A shared public-private partnership for creating an alert system for potential water quality or water quantity issues should be considered. Among the topics to seek funding for in this context are potential climate change and wildfire impacts to groundwater quality and quantity.

4) Cultivate capacity to create and maintain collaborative ties in the groundwater community.

This recommendation stems from the Basin Management Objective stating that the Groundwater Sustainability Agency will “build collaborative capacity...with local agencies, businesses and private property owners”. The survey findings will be of interest to local, regional and state agencies and private and academic partners vested in implementation of SGMA. Share findings and study methodology in the sustainable groundwater community. Make this survey report publication an opportunity to seek capacity building opportunities for which the basin may be eligible.

5) Communicate with private well owners.

This recommendation stems from the Basin Management Objective stating that the Groundwater Sustainability Agency will “convene a forum for discussing groundwater issues”. The survey has opened communication between private well owners and the local groundwater protection community. Exchange information. Build relationships. Keep lines of communication open. Follow up on the survey question inquiring about private well owner interest in participating on the SAG. Create and implement a method for inviting and cultivating private well owner participation in discussion about sustainable groundwater management, groundwater quality protection and long-term groundwater supply.

6) Collaborate with national and state programs that support source water protection.

The U.S. Environmental Protection Agency and the National Ground Water Association are partnering to make information available to private well owners on the website wellowner.org. The Safe Drinking Water Act and the Clean Water Act are mechanisms by which states can access funds for source water protection. State of California source water protection resources are distributed through financing of capital improvement, community development, land acquisition and riparian forest buffer programs among other programs. Private well owners may find support from these federal and state sources by participating as collaborative members of the GSA.

7) Share survey findings with Tahoe Basin partner agencies.

This recommendation stems from the Basin Management Objectives stating that the Groundwater Sustainability Agency (GSA) will “identify and obtain funding for groundwater projects” and “build collaborative capacity”. The Lake Tahoe Basin has been studied extensively for opportunities to benefit water clarity and quality. Findings of this survey add a new layer of understanding to this multi-agency knowledge. Make an effort to share survey findings while simultaneously reaching out to agencies with complementary knowledge about the watershed. Make it an opportunity to strategize about opportunities to share resources for sustainable groundwater management. Assert sustainable groundwater management as a potential focal point for the annual Tahoe Summit of local, regional, state and federal representatives.

Conclusion

“Groundwater management is planned and coordinated locally to ensure a sustainable groundwater basin to meet future water supply needs.” (TVS Basin Groundwater Management Plan). This TVS Groundwater Basin Survey of Well Owners advances groundwater resource stewardship by significantly improving understanding of private well count and status. It also reveals interests of the community of owners that maintains and operates these wells. The survey is a mechanism for facilitating communication between private well owner and local groundwater protection community. It also offers the foundational components of a system by which to understand groundwater stewardship opportunity.

Online Resources

<http://stpud.us/groundwater>

<http://wellowner.org/tools>

https://www.waterboards.ca.gov/water_issues/programs/gmp/docs/sgma/domestic.pdf

**TVS Groundwater Basin
Survey of Well Owners
Appendices**

TVS Groundwater Basin Survey of Well Owners Appendices

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Figure 13: GSA boundaries for the TVS Basin. Through an MOU, the District and County Water Agency GSAs implement the SGMA across the full extent of the TVS Basin. Overlying the basin are the City of South Lake Tahoe and town of Meyers. Public entities, including the United States Forest Service and California State Parks, own and manage significant portions of the watershed through which snowmelt travels to the basin.

Figure 14: Sample question. *About the water well condition.* A respondent answering “no”, sees no further questions on the subject of well water condition.

Figure 15: Sample question (continued). A respondent answering “yes” sees a series of questions about water well condition as follows.

Figure 16: Overview of the survey as seen by the survey respondent online

Figure 17: Survey of Well Owners *Greeting and Survey ID.* The first image the survey respondent sees is the District logo. This is followed by a greeting and a text box prompting the well owner for his/her Survey ID, a unique ID that unlocks the survey.

Figure 18: Survey of Well Owners *Survey Participant Contact Information.* The District well owner database did not contain email addresses or cell phone numbers at the project outset. In many cases, contact information was out-of-date. Therefore, collecting contemporary and up-to-date contact information was a critical objective of the survey.

Figure 19: Survey of Well Owners *About Property Ownership and Usage*

Figure 20: Survey of Well Owners *About the Well and Water Use.* The District well owner database was derived from several sources. Confidence in the data was variable,

given the age and diverse methods of data-gathering for each. The well owners survey sought to increase confidence in the data with contemporary and on-the-ground verification.

Figure 21: Survey of Well Owners, *About the Well and Water Use*

Figure 22: Survey of Well Owners, *About the Well Water Quality*

Figure 23: Survey of Well Owners *About the Well System. Do you now or have you ever had any concern about the well system?*

Figure 24: Survey of Well Owners *About Support Available to Well Owners, Users and Managers*

Figure 25: Survey of Well Owners *About Groundwater*

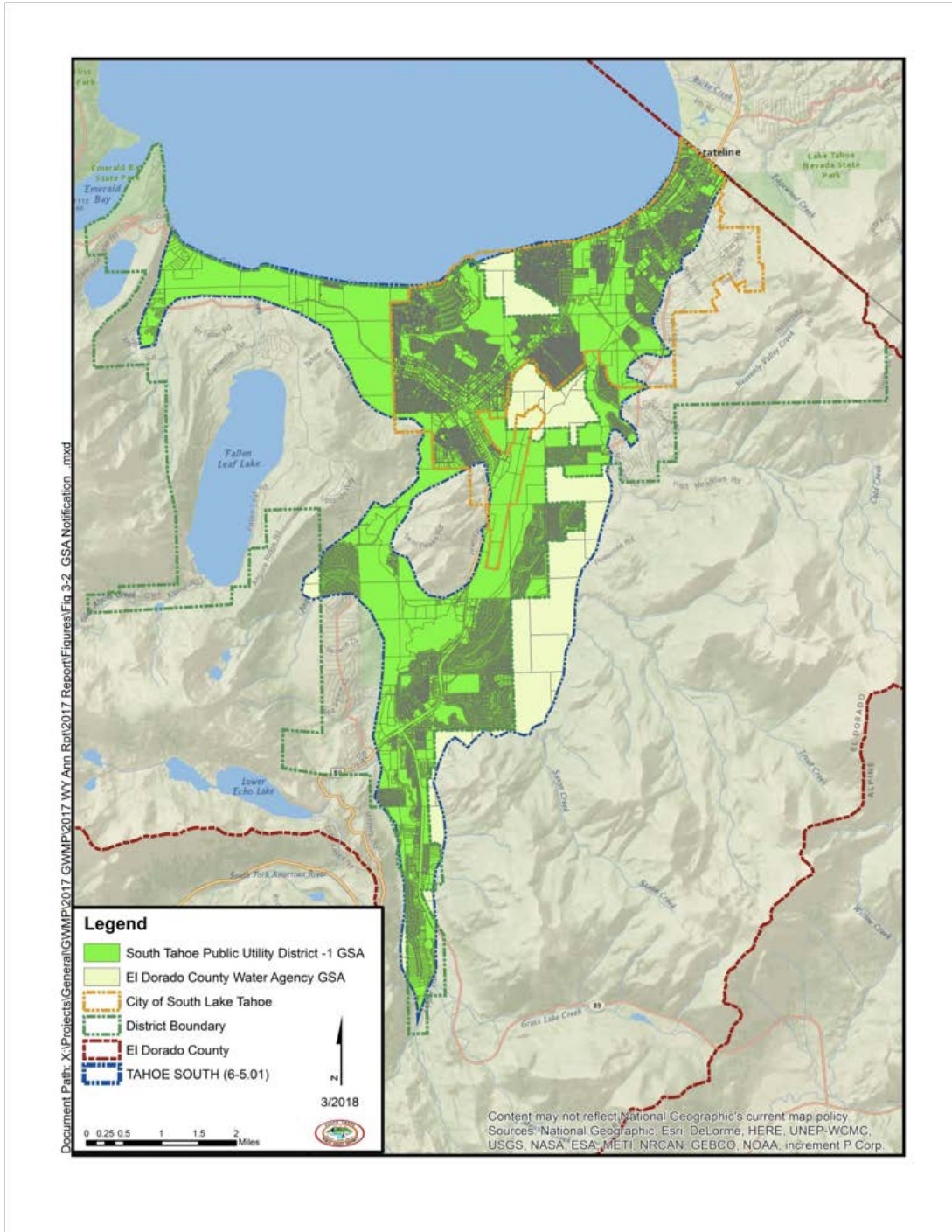
Figure 26: Survey of Well Owners, *Request for photos*

Figure 27: Bijou sub-area response rates to the survey question; As owner, which best describes your relationship to this property?

Figure 28: Well owners with interest in information about connecting to a public water system

Figure 29: Well owners with interest in joining the Strategic Advisory Group

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Map: GSA jurisdictions within TVS groundwater basin; provided by STPUD

1 Introduction

1.1 Groundwater Sustainability Agency

A Groundwater Sustainability Agency (GSA) is any local public agency or combination of local public agencies that has water supply, water management or land use responsibilities within a groundwater basin. GSAs were created by the passage of three legislative bills in California in the year 2014, collectively called the Sustainable Groundwater Management Act (SGMA). GSAs are overseen by the California Department of Water Resources (DWR). The GSA is the primary agency responsible for achieving groundwater sustainability in California jurisdictions. GSAs are required to develop and implement a Groundwater Sustainability Plan (GSP) that considers the interests of all beneficial uses and users of groundwater for high priority and medium priority basins.

TVS Basin classification shifted from medium-high priority to low priority between the time of the survey and publication of this report. In 2014 the TVS Basin was classified as a medium-priority basin under the California Statewide Groundwater Elevation Monitoring Program (CASGEM). In 2015 DWR adopted the 2014 CASGEM prioritization of basins for implementation of the SGMA. In 2018 DWR reassessed the groundwater basin prioritization as a result of basin boundary modifications performed since 2014. A draft of the 2018 reprioritization reclassifies the TVS Basin as a low priority basin.

On November 17, 2015, the South Tahoe Public Utility District (District) was recognized by the California Department of Water Resources (DWR) as the exclusive GSA for the portion of the TVS Basin within its service area jurisdiction. On June 14, 2017, the El Dorado County Water Agency (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. Concurrent with this action, the District and County Water Agency entered into an Amended and Restated Memorandum of Understanding (MOU) to work collaboratively to sustainably manage groundwater resources and implement SGMA throughout the entire TVS Basin. Boundaries of these two GSAs covering the TVS Basin are shown in Figure 3-3.

1.2 Groundwater reliance

Groundwater is the primary source of drinking water and accounts for more than ninety-five percent (95%) of the potable water used throughout TVS. Surface water as a drinking water source is relatively minor. Surface water is provided through a surface water intake to Lake Tahoe by Lakeside Mutual Water Company (LMWC). Surface water may also be a household water source at select United States Forest Service properties.

The majority of the groundwater used in the TVS Basin is produced from water supply wells operated by the District, Tahoe Keys Water Company (TKWC) and Lukins Brothers Water Company (LBWC). Groundwater production from small community water systems and domestic wells is believed to account for a little more than five percent (5%) of the total volume of groundwater extracted from the TVS Basin on an annual basis. The Small Community Water Systems are publicly-privately held wells that serve multiple connections (generally 15 to 25) as opposed to a domestic well, which serves the water uses of a single household or business. TVS Basin small community water system wells supply drinking water to schools, resorts, hotels, apartments and recreational areas.

Private wells have a significant presence on the TVS Basin landscape. Private wells in the TVS groundwater basin are markers of settlement of the basin in the one hundred year period from approximately 1845 to 1950. In the year 1950 the South Tahoe Public Utility District was formed. Subsequent development occurred with integrated source water purveyance. Mapping private well ownership in the TVS Basin reveals a picture of development of the TVS Basin from 1845 to 1950 minus those properties where owners subsequently shut down wells. Private wells are present in clusters along transportation routes with rich history and/or in locations of pre-1950 development. For example, there are well clusters along the routes used by the Pony Express in 1860 -1861 and well clusters marking the first Lake Tahoe summer beach communities of San Francisco Bay area residents. These examples indicate how private wells are both historical markers and vital aspects of the daily life and livelihood of residents and business owners today.

Private wells are clustered through older neighborhoods within the northeastern portion of the TVS Basin, near the south and east flanks of Tahoe Mountain and at the southern end of Christmas Valley. In most of the TVS Basin, well densities are less than ten (10) wells per square mile. Higher well densities are located in the northeast portion of the TVS Basin. Here

densities exceed one hundred (100) wells per square mile within the Bijou area, near Stateline. Another high-density area exists within the Meyers area at the southern tip of Twin Peaks, just south of the “Y” intersection along Highway 89 at the northwest end of the airport. Here well densities exceed fifty (50) wells per square mile. Higher well densities (10 to 50 wells per square mile) are also found in the Christmas Valley area.

2 Methods

The Survey of Well Owners was developed and implemented over a two-year period beginning with the District creating a database of private parcels potentially involving wells. The District made some preliminary motions to communicate with private wells owners and concluded that a door-to-door survey would be the most effective mechanism by which to develop understanding of private well ownership. Once the door-to-door survey method was decided upon, efforts began to recruit a team of partners within and outside the District to design and implement the survey. The following pages detail the methods applied in the development and implementation of the Well Owners Survey with the purpose of providing adequate detail and resource to serve any party that may want to implement a similar survey or extend the reach of this one. The contents of this section are

- 2.1 Survey of Well Owners project team
- 2.2 Survey research and content
- 2.3 Survey programming and design
- 2.4 Survey outreach methods and tools
- 2.5 Survey deployment
- 2.6 Field survey team
- 2.7 Survey of Well Owners
- 2.8 Survey implementation, data compilation and analysis

2.1 Survey of Well Owners project team

The District convened a nine-person project team combining resources from inside and outside the District including

- (1) District regular employees in the role/domains of

- Hydrogeologist
 - Customer Service
 - Information Technology
 - Communication
- (2) District seasonal employees through relationship with a personnel services agency in the roles of
- Field surveyor, team leader
 - Field surveyor
 - Field surveyor
- (3) Independent contractors in the domains of
- Geographic Information Services (GIS)
 - Communication and public outreach services

2.2 Survey research and content

The first step in the project involved District staff compiling a database of potential private well owners from federal, state, county and local well databases. This inventory indicated the possible presence of 52 Small Community Well Systems and 594 Domestic (private) wells within the TVS Basin.

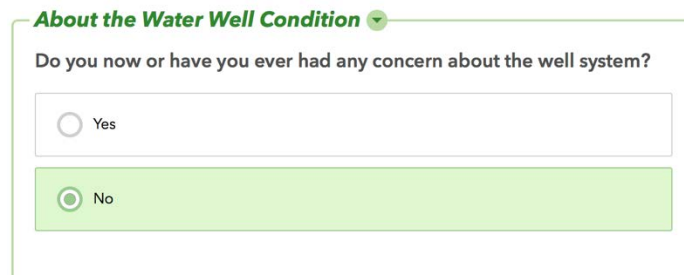
In calendar year 2016 the District distributed a letter to all contacts in this database of potential well owners. The letter was regarding the Sustainable Groundwater Management Act and included an invitation to contact the District for more information. Fewer than five contacts with the District were made conjunction with this letter. This initial communication attempt with private well owners informed the District's decision to conduct the 2017 Survey of Well Owners.

The survey questions originated with the District Hydrogeologist who specified what information--in the domains of property ownership, well location, water usage and water quality--was needed from well owners. The survey questions were designed to move well owners through a series of clear, concise response options that would subsequently translate into an easy-to-query dataset. Attention was given to providing well owners with opportunities to bring topics of their concern to District attention. Care was taken to ensure that well owners understood that the District has no motive or interest in replacing private well ownership with connection to the public water system unless a well owner desires this course of action.

Questions with binary answer options served as entry point to each question set. A “yes” response frequently unlocked a subset of more-detailed questions in the given subject area. A “no” response, in general, would lead the respondent to the next question set (the subset of detailed questions never appearing to the respondent for whom these were irrelevant). The survey was designed to be completed on an electronic interface such as a tablet or computer. ESRI is a supplier of Geographic Information System (GIS) software. The Well Owners Survey employed an ESRI product and web hosting service called Survey123 which framed the survey structure around the medium.

The following figures depict how a question might be a stand-alone question or an entry point question.

Figure 14: Sample question. *About the water well condition.* A respondent answering “no”, sees no further questions on the subject of well water condition.



About the Water Well Condition ▼

Do you now or have you ever had any concern about the well system?

Yes

No

Figure 15: Sample question (continued). A respondent answering “yes” sees a series of questions about water well condition as follows.

About the Water Well Condition ▼

Do you now or have you ever had any concern about the well system?

Yes

No

Well concerns:

Pump failure

Declining water production

Declining water quality

Wellhead in disrepair or lacking tight seal

Well connection to house

Other

Specify other.

Has the concern about the system been resolved?

Yes

No

Behind the scenes the survey connected to services by which the data could be entered into the system, viewed and evaluated real-time during conduct of the survey. This means that as a well owner took the survey online, or a member of the field survey team completed a survey during an in-person interview with a well owner using a tablet, the survey responses posted to the survey databases more-or-less in real time. More about this is explained in section 2.3 (following).

Survey beta-testing

Beta-testing of the survey made evident the diverse dispositions of well owners toward the survey. Five well owner focus group participants, representing diverse private well ownership profiles, participated in beta testing the survey. The beta-test was hosted in person at the District offices. The 90-minute session featured the draft survey on an electronic tablet. A project team member paired with each focus group member to provide assistance and answer questions during the beta test.

Focus group participants indicated that while some well owners might quickly complete the online survey with little need for assistance, others might appreciate in-depth interaction with survey team members providing explanation of survey motives, survey questions and offering survey completion support in the well owner's preferred method. Beta-testing made evident that offering diverse methods of taking the survey would improve the survey completion rate. This helped prepare the field survey team to conduct the survey in-person, online, over the phone or by mail.

2.3 Survey programming and design

Spatial data tools played an important role in survey programming and design. It was also vital that the data set be linked to geospatial locations providing ability to map wells in the watershed.

A Geographic Information System (GIS) makes it possible to work with data such as that from the Well Owners Survey. GIS technology enables the data analyst to query, analyze, map and model survey responses. This technology helped the project team analyze and interpret data and perceive relationships, patterns and trends through the visualization process.

Desired outcomes of the Well Owners Survey included quantitative counts of each type of response to each question in the survey and maps and/or illustrative imaging of the responses. The survey employed ESRI software to create a system by which to connect the District's database of potential well owners with locations on the watershed map. This information is referred to as the Well location GIS point layer. This point layer can be used with the ESRI software, ArcGIS Desktop. The maps in this report are designed and populated with survey data using ESRI software.

The District has the ability to view and publish maps and other visualization of the data through an ArcGIS Online account. This service made it possible for the District to create a web-hosted map. Web-hosting enabled use of the map in the field (real-time where an internet connection could be made).

The field survey team employed the mobile field application of ArcGIS Collector software to navigate in the field as well as collect, input, edit and update data while moving through the watershed collecting survey responses. The survey team used ArcGIS Collector to navigate to each well/customer location. The application provided a map of well locations, as well as well owner information for reference, including owner name, street address, phone number(s), e-mail address, etc. The Collector user interface provided a link, which when selected, would initiate a new survey. It started up the Survey123 application and pre-populated the new survey record with initial information, including APN, owner name, street address, phone numbers, and e-mail address. The survey team would then use Survey123 to prompt the survey questions with the well owner and record responses. The application also provided well location photography capture and attachment capability which attached photographs to the survey record.

Survey status and results were available to the District through the ArcGIS Online organizational account. Web maps and tools were configured for project team members to track and coordinate survey activities. The ArcGIS Online site also featured tools to download survey data to local computers for further review, tracking, updates, analysis and presentation.

2.4 Survey outreach methods and tools

Survey Letter of invitation

A letter to private well owners from South Tahoe Public Utility District marked the start of the survey effort. The letter, featured in the appendices of this report, invites private well owners “to participate in a good neighbor effort to better understand South Tahoe groundwater and... care for our wells”. The letter provides

- (1) the web URL for the survey
- (2) a Parcel Number/APN that functions as the well owner’s key to enter the survey (that is locked to anyone without the key)
- (3) a Well Owners Survey contact in customer service at the District

- (4) an explanation of the reason for the survey
- (5) a description of the survey content
- (6) clarification that the District is *not* trying to persuade well owners to connect to District services
- (7) a description of how to participate in the survey.

The letter of invitation, printed on District letterhead, was postmarked three days prior to the first day of the field survey. The task of printing and preparing the letters for distribution was one of the first tasks of the field survey team.

Public service announcement and local news coverage

A public service announcement (PSA) from South Tahoe Public Utility District helped bring awareness of the Well Owner's Survey to the South Lake Tahoe and Meyers communities. The announcement aired on local radio and television stations for several weeks, concurrent with the field survey. The PSA language is featured in the appendices.

The public service announcement alerted various news outlets of the Well Owners Survey and groundwater management issues. Subsequent coverage included an article in the online *Lake Tahoe News* and an interview on Lake Tahoe TV.

Field survey door hanger

The field survey team was equipped with a door hanger to place on the handle of doors where no occupant of the property was present. The door hanger text features elements of the letter of invitation and text indicating the link to the survey, online. The field survey door hanger is featured in the appendices.

2.5 Survey deployment

The survey offered four ways for well owners to participate (1) in-person (door-to-door) (2) online (3) by phone and (4) by mail. The in-person, door-to-door, survey method evolved out of the District's desire to create opportunity for well owners to connect with groundwater protection efforts, the District and with one another. It facilitated personal connection. The District recognized that person-to-person connection could increase understanding and rapport between and among well owners, small water systems and the District. The online survey

facilitated rapid and easy survey completion for well owners with few questions. The phone participation method gave well owners the opportunity to ask questions and receive clarification about the survey as they verbally completed the survey in a person-to-person conversation with a member of the District survey team. Well owners preferring a print version of the survey could request the survey on paper, with correspondence by print mail.

Survey chronology

DATE	TASK
	Pre-project
Summer 2016	District secures project funding
February - June 2017	District recruits and contracts with consultants
June	District makes arrangements to hire field survey team; Consultants write and design survey and technology interface
July	District hires field survey team
August 2	Survey beta-tested with focus group
August 10-11	Field survey team trained
August 11	Survey <i>letter of invitation</i> postmarked
August 14	Field survey begins
August 20	Dataset management field methods developed by survey team
September	Project team meetings
September 8	Training for field survey team to initiate phone surveys for well locations where no owner is present
October 5-11	Field survey team wrap-up
Fall - Winter 2017	Data cleanup and analysis
Spring - Summer 2018	Data synthesis and report writing, publication

2.6 Field survey team

The District created a four-person field survey team to conduct the 2017 survey. One member of the survey team was a full-time employee of the District with training in the customer service functions of the District's front office. This team member's primary survey functions were to support online and phone completion of the survey and to troubleshoot, via phone and email, any technical difficulties well owners may have had with the survey. The field survey team members worked in the field in the early weeks of the survey, later shifting attention to survey completion by phone for well owners who could not be contacted in person in the field.

An array of expertise contributed to field survey success. Two field survey team members brought extensive experience conducting door-to-door surveys in a variety of subject contexts. One team member emphasized social science perspective, another emphasized social work perspective. Two were familiar with South Lake Tahoe geography and community. Two were from outside the area of the survey. One team member was designated team leader with unique authorities such as access to District facilities on behalf of the team.

Field survey team objectives

Three objectives were given to the survey team (1) Inform well owners of groundwater management (primarily by reiterating the points of the letter of invitation; (2) Encourage participation in collaborative groundwater management efforts; (3) Confirm locations of wells by facilitating well owner survey completion. Survey team training included orientation to role playing in the following subject areas

- Sustainable Groundwater Management Act
- South Tahoe Public Utility District, esp Code of Ethics and District representation
- Geography and Issues of the TVS Groundwater Basin
- Well Owners Survey Objectives
- Well Owners Survey Letter of Invitation
- Survey 1-2-3 and Collector data collection applications and handheld tablets

Survey team members practiced with the survey and associated technology in pilot surveys specifically scheduled with well owners.

Field survey timing

The team was dispatched during the month of August when residential occupancy is highest in the basin. The TVS Basin is located at altitudes between 6,225 and 6,500 feet and is therefore prone to snowfall in winter months. Greater than 50% of housing stock in the Tahoe Basin overall is second homes. Occupancy rates of secondary residences and tourist accommodation are highest during July and August. District efforts to communicate with well owners in the year prior to the 2017 survey indicated that success would likely correlate with a summertime survey season and diverse methods for participating in the survey.

2.7 Survey of Well Owners

The TVS Survey of Well Owners is a mechanism for understanding (1) well ownership (2) water usage (3) water quality status (4) well condition and status, and (5) well owner concerns. The following pages contain images of the Survey of Well Owners interface as viewed by respondents online and as viewed by the field survey team in the field.

Figure 16: Overview of the survey as seen by the survey respondent online



Greeting and survey ID

The survey opens with the South Tahoe Public Utility District logo and a greeting. The greeting, addressed exclusively to the private well owner, depicts participation in the survey as a “portal to shared understanding of your well and its relationship to South Tahoe groundwater”.

Following is a text box with survey ID request. The survey ID, unique to each well owner in the District database, functions as a key for the well owner to open the survey. Absent an invitation and an ID with which to open it, the survey cannot even be viewed. For the data manager, the unique ID creates a well owner data point with which all of the well owner’s responses to the survey are linked.

The well owner received the unique Survey ID in his or her letter of invitation. Other opportunities to obtain the Survey ID were with the field survey team member at the well owner’s door, with the field survey team member available at the District Customer Service phone number (provided) and on the door hanger left at properties on the District database (with the ID handwritten by the field surveyor).

South Lake Tahoe Well Owners Survey



Welcome to the South Tahoe Groundwater Wells Survey. Thank you for participating. Your answers to the following questions are the portal to shared understanding of your well and its relationship to South Tahoe groundwater.

Survey ID:*

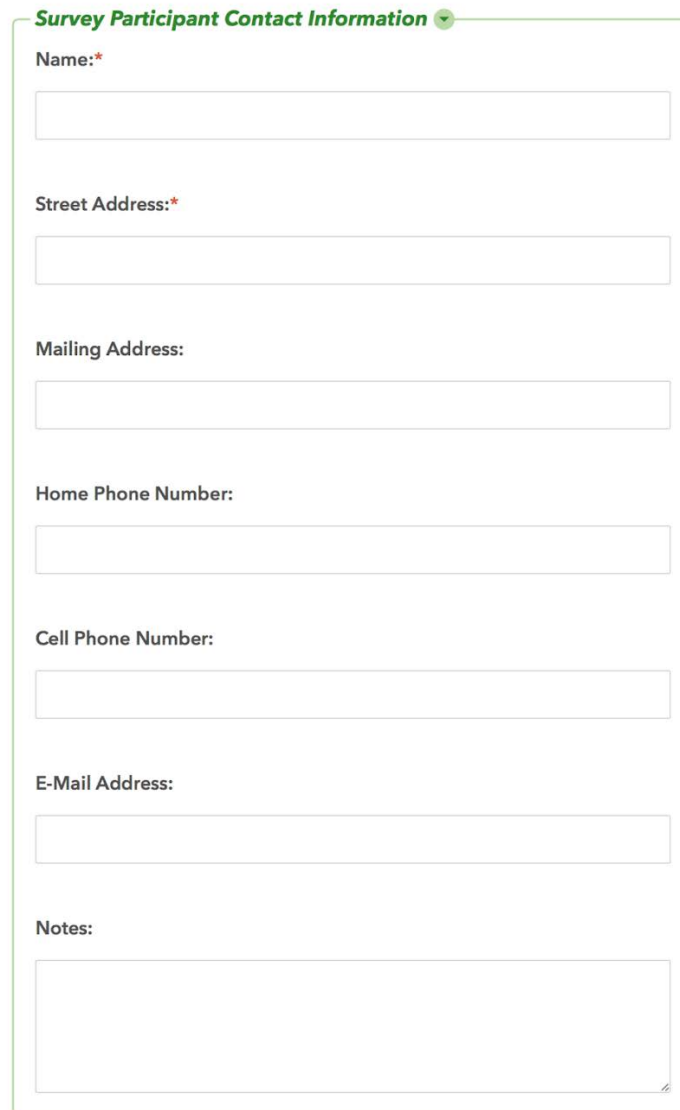
If you need a Survey ID, Please call Ryan Lee, (530) 543-6217

Please Note: * Indicates a Required field

Well ownership

Once the well owner passes the Survey ID portal, the interface prompts the well owner to enter contact information. The responses to this prompt are important because an objective of the survey is to verify and/or update well owner contact information.

Figure 18: Survey of Well Owners *Survey Participant Contact Information*. The District well owner database did not contain email addresses or cell phone numbers at the project outset. In many cases, contact information was out-of-date. Therefore, collecting contemporary and up-to-date contact information was a critical objective of the survey.



The image shows a screenshot of a web form titled "Survey Participant Contact Information" with a green header and a dropdown arrow. The form contains several input fields, each with a label and an asterisk indicating a required field. The fields are: "Name:*" (text input), "Street Address:*" (text input), "Mailing Address:" (text input), "Home Phone Number:" (text input), "Cell Phone Number:" (text input), "E-Mail Address:" (text input), and "Notes:" (text area). The form is enclosed in a green border.

Following the contact information request is the question, “Are you the property owner at this address?” A “no” response closes the well ownership question series. A “yes” response unlocks a subset of more-detailed questions including

- Since when have you owned this property?
- As owner, which best describes your relationship to the property?

Responses to the question, “Since when have you owned this property?” give insight into well vintage and history. Some of the properties in this watershed have been owned and managed by the same families for generations. Sometimes these are in the vicinity of properties that have been recently built or recently acquired by property owners who do not ever occupy them full time.

Responses to the question, “As owner, which best describes your relationship to the property?” give insight into the well owners relationship to the well. Greater than fifty percent (50%) of private residences in the Lake Tahoe Basin are second homes and the twenty-year trend shows constant increase with corresponding decrease in landowner occupancy. This aspect of land use has implications for groundwater use including well operation and maintenance.

Figure 19: Survey of Well Owners *About Property Ownership and Usage*

The image shows a screenshot of a survey form titled "About Property Ownership and Usage". The form contains three questions:

- Are you the property owner at this address?** This question has two radio button options: "Yes (Includes Property Managers)" (which is selected and highlighted in green) and "No".
- Since when have you owned this property?** This question has a text input field with a calendar icon on the left and the value "2005" entered.
- As owner, which best describes your relationship to this property?** This question has three radio button options: "This is my primary residence." (which is selected and highlighted in green), "I use this as a second home / vacation residence.", and "This is a business property."

Water usage

The second section of the survey pertains to water usage. It starts with the central questions of the survey

- Is there a well at this property?
- Is the well in use?
- How often do you use the well?

Affirmative responses to the question, “Is there a well on this property?” confirm the presence of a well and result in this answer in the Survey of Well Owners database. This data can then be translated into a triangle on the District map, *Groundwater wells within the TVS Basin and surrounding area*.

Responses to the question, “Is the well in use?” and to the third question in this section, “How often do you use the well?” create the ability to calculate water usage. Five answer options correspond to five standard quantities based on TVS Basin water use analysis as depicted in the following figure. This data, combined with a map of public water system wells, begins to create a picture of TVS groundwater use for the groundwater manager and well owner.

Figure 20: Survey of Well Owners *About the Well and Water Use*. The District well owner database was derived from several sources. Confidence in the data was variable, given the age and diverse methods of data-gathering for each. The well owners survey sought to increase confidence in the data with contemporary and on-the-ground verification.

About the Well and Water Use ▾

Is there a well at this property?

Yes, there is a well.

No, to my knowledge there is not a well.

I do not know if there is a well on this property.

Is the well in use?

Yes, the well is used.

No, the well is not used.

I do not know whether the well is used.

How often do you use the well?

not at all

rarely, only to check or maintain it (less than 15 days a year)

infrequently (approx. 15 to 90 days a year)

more than 90 days a year (but not every day)

nearly every day

The survey seeks information at the intersection of water usage and water security. Questions in this vein include

- Is the well the primary source of household or business water?
- Is there a secondary, or backup, source of household water?

Sustainable Groundwater Management Act legislation emerged out of the crisis surrounding groundwater overdraft that put some California communities at risk of adverse health effects in the context of drought. A desired outcome of the Survey of Well Owners is to ascertain where risk to water quality may exist and to anticipate where redundancy in the system is low, potentially leaving people vulnerable. Understanding whether the well is the primary and/or the only source of household water is a step toward identifying areas or households in the watershed in need of assistance.

Figure 21: Survey of Well Owners, *About the Well and Water Use*

The image shows a screenshot of a survey form with three sections, each containing two radio button options. The first section asks, "Is the well the primary source of household or business water?" with "Yes, the well is the primary source of water." selected. The second section asks, "Is there a secondary, or backup, source of household water?" with "Yes" selected. The third section asks, "May [I/We] view the well?" with "Yes" selected. A note below the third question states, "(If Yes, you will be asked to attach photos at the end of the survey.)"

Is the well the primary source of household or business water?

Yes, the well is the primary source of water.

No, the well water is not used for household or business purposes but is used solely for irrigation.

Is there a secondary, or backup, source of household water?

Yes

No

May [I/We] view the well?
(If Yes, you will be asked to attach photos at the end of the survey.)

Yes

No

Closing the water use section of the survey is the question, “May[I/we] view the well? Private wells throughout the basin are of diverse vintage and are managed in as many ways as there are well owners. This optional opportunity to share visual images of wells is a valuable way to qualitatively assess the maintenance and operation of the wellhead. It also provides insight into the land use context of the well.

About the well water quality

An important objective of the survey is to ascertain the status of water quality in the TVS groundwater basin. Private well owners have insight into the basin through the lens of the private well. In some cases a perceived water quality issue may be a result of a phenomenon in the groundwater itself. In other cases a perceived water quality issue may be a result of a specific malfunction of the well system. Such malfunctions can, in some contexts, pose risk to the shared groundwater resource. So the Survey of Well Owners asks a series of questions related to these topics in an effort to comprehend the private well owners experience of quality of the water and function of the well. The following figures display the question series which revolves around the core inquiries

- Do you now or have you ever had concern about the well water?
- Do you now or have you ever had concern about the well system?
- If so, has the concern about the well system been resolved?

Figure 22: Survey of Well Owners, *About the Well Water Quality*

About the Well Water Quality

What qualities of the well water do you most like?

Taste, Color, Odor

Purity

None

Other

Specify other.

What qualities of the well water do you most dislike?

Taste, Color, Odor

Mineral Deposits

None

Other

Specify other.

Do you now or have you ever had any concern about the well water?

Yes

No

The well water concern is/was in regard to:

Contaminants

Taste

Color

Odor

Other

Specify other.

About the water well condition

A key objective of the survey is to ascertain the system status of private groundwater wells in the TVS groundwater basin. Historical development patterns are an indicator that many TVS Basin wells (and their constituent parts) may be reaching the end of their intended lifespan. The history of the private well in the TVS Basin spans approximately from seventy to one-hundred seventy years. Having a long history, the wells have been managed by different owners applying diverse protocols. Well owners inheriting wells whose structure and maintenance record can be known are at an advantage in knowing how to budget for management of the well. Older wells generally are at shallower depths than newer or renovated wells. Shallow depth often correlates with more potential for exposure to pollutants. Well owners with well systems that have been proactively managed indicate in the survey that they are pleased with the well and anticipate using it indefinitely. Other well owners are burdened by well maintenance. Still others are affected by pollutants in the system that arise from causes outside of their control. For these reasons it is useful for the survey to ask for information about the well system. The following figures display the question series which revolves around the core inquiries

- Do you now or have you ever had any concern about the well system?
- Has the concern about the system been resolved?

Figure 23: Survey of Well Owners *About the Well System*. Do you now or have you ever had any concern about the well system?

About the Water Well Condition ▼

Do you now or have you ever had any concern about the well system?

Yes

No

Well concerns:

Pump failure

Declining water production

Declining water quality

Wellhead in disrepair or lacking tight seal

Well connection to house

Other

Specify other.

Has the concern about the system been resolved?

Yes

No

About support available to well owners, users and managers

Well owner combined responses to the suite of questions regarding water quality, well condition and support available to well owners signal a private well owner's degree of need for assistance. Well owners signaling declining water quality, well malfunction and interest in connecting to a public water system are few, so this combination of questions facilitates a way of understanding how to prioritize communicating with private well owners for collaborative management of the well and the groundwater resource.

Figure 24: Survey of Well Owners *About Support Available to Well Owners, Users and Managers*

About Support Available to Well Owners, Users and Managers

Are you interested in receiving information about County guidelines and requirements for well abandonments?

Yes

No

Would you like information about connecting to a public water system?

Yes, I would like to know more about connecting to the public water system.

No, I don't need any information about connecting to the public water system.

About groundwater

Robust public discourse about how to manage water resources and set local, regional and state policy priorities is a fundamental aspect of life in the American West. The private well owner has a unique lens on the public issue of groundwater management. This unique private well owner perspective motivated the question *About Groundwater*; “What do you consider the top three groundwater concerns in our South Tahoe community?”

Figure 25: Survey of Well Owners *About Groundwater*

About Groundwater ▼

What do you consider the top three groundwater concerns in our South Tahoe community?

Groundwater contamination

Climate change

Declining groundwater levels

Groundwater regulation

Population growth; future water demands

I do not believe there are any groundwater-related concerns in the South Shore area.

Other

South Tahoe Public Utility District, in collaboration with a stakeholders advisory group, developed a groundwater management plan. A copy of the plan is on the District's website: [Groundwater Management Plan](#)

Would you like to receive occasional District email updates about local groundwater management and wells?

Yes, I would like to be on the District's groundwater email list

No, I would NOT like to be on the District's groundwater email list

Photos

The survey gives the private well owner the opportunity to share images of the well. Wells in the TVS Basin are of very diverse vintage and origin and the setting of each well is unique. The nuance portrayed in a photo can be, as the saying goes, “worth a thousand words”. A selection of images is shared in the executive summary of this report.

Figure 26: Survey of Well Owners, *Request for photos*

In a previous question you were asked if the District might view your well. If you are doing this survey online and are able to share images of the well, please upload 1 to 3 photos in the following space provided (one per spot). We would also appreciate your text description of the image you provide. Thank you.


Photos: 

Photo 1:

[Click here to upload image file. \(<10MB\)](#)

Photo 1 Description:

Photo 2:

[Click here to upload image file. \(<10MB\)](#)

Photo 2 Description:

Photo 3:

[Click here to upload image file. \(<10MB\)](#)

Photo 3 Description:

2.8 Survey implementation, data compilation and analysis

As previously mentioned, the Survey of Well Owners evolved and was implemented over the course of a couple of years. Though the data input was automated as previously described, there is inevitably work to be done to “scrub” the data of duplicates, errors and misleading information. Nearly every team member had a role in this. A literature search for existing surveys of Private Well Owners indicated that the South Tahoe Public Utility District’s information needs from such a survey were unique (up to the present) and that design of a survey tailored to those needs would be necessary. This resulted in the District’s unique survey instrument. While several members of the team had experience managing and harvesting data from door-to-door surveys, the TVS Survey of Well Owners posed its own novel set of problems and issues to solve during implementation, data management and analysis. The project team members consistently endeavored to reflect on the process, to record observations about how to improve the survey methodology and to implement these efficiencies where possible.

Select approaches to data synthesis carried the day. Many other synthesis approaches can be taken with the data and fresh perspective and new information derived from these in subsequent analysis. This first round of analysis prioritized harvesting data that would lay ground for a “picture” of private well use on the landscape of the TVS Basin and bring to the District’s attention seemingly urgent need of assistance on the part of particular well owners. In this process, the team remained open to the possibility that “hot spots”--whole areas in need of operations and maintenance assistance--might come to light. No such phenomenon emerged from the data.

The analysis therefore honed on characterizing the nature of private well ownership in the context of six geographic sub-areas and themes were sought in the data pertaining to each. The survey team does not assert that the numbers of well owner responses in each category of the findings is exact. The survey method was successful in obtaining private well owner responses that give a broad system by which to approach the next phases of engaging all users of groundwater in sustainable management of the public resource and by which to think about private well ownership in the TVS Basin.

3 Findings

3.1 Six geographic sub-areas

This survey makes apparent the relevance of thinking about TVS Basin groundwater use in the context of six geographically-based sub-areas (areas) . Mapping the locations of confirmed wells brings into relief the well distribution pattern reflecting the first hundred years of settlement. Pioneers traveled over the mountain range following dirt paths traversing the TVS Basin area in the decades before California became a state. Underneath the asphalt of today's Highway 50 is the dirt road used for travel (including the Pony Express) across the TVS Basin from the mid 1800s until it was paved. Today several clusters of private wells can be traced along the edges of the old highway's path.

In the year 1950 the South Tahoe Public Utility District was formed. Subsequent development occurred with source water purveyance integrated. Due to this history, mapping private well ownership in the TVS Basin reveals a picture of development of the TVS Basin from 1845-1949, including information about the evolution of land uses on those parcels after 1950. The survey findings illustrate how the contemporary distribution of private wells across the TVS landscape follows the travel routes of 19th century pioneers and footprint of early-20th-century development.

From south and the upper watershed, to north and the lower watershed/Lake Tahoe, these sub-areas are

- Christmas Valley
- Meyers
- Angora
- Tahoe Keys
- South Lake Tahoe
- Bijou

Christmas Valley

Approximately seventy (70) respondents helped increase understanding of groundwater in Christmas Valley by participating in the TVS Well Owners Survey.

- Fifty-two (52) respondents answered “yes” to the question, “Is there a well at this property?”. Ten (10) respondents answered “no”.
- Fifty (50) respondents indicated “yes”, the well is in use, while two (2) answered “no”.
- To the question, “Is the well the primary source of household water?”, thirty-nine (39) responded “yes”, nine (9) said “no”.
- Regarding concerns about the well water, eighteen (18) indicated a concern, thirty-three (33) did not have a concern. “Contaminants” were the most common concern.
- Regarding the well system, twenty-three (23) respondents indicated a concern while twenty-eight (28) indicated none. Thirteen (13) say “yes” the concern is resolved.
- The ten (10) indicating the concern is not resolved point to pump failure, declining water production and quality, wellhead in disrepair, well connection to house, aging pipes, maintenance and leaking water.

Summary of Christmas Valley Responses to Key Survey Questions

Is there a well at this property?

52	Yes
10	No
4	I do not know

Is the well in use?

50	Yes
2	No, the well is not used
0	I do not know whether the well is used

How often do you use the well?

0	Not at all
6	Infrequently, rarely

11	More than 90 days a year (but not every day)
33	Nearly every day

Is the well the primary source of household or business water?

39	Yes
9	No

Do you now or have you ever had any concern about the well water?

18	Yes
33	No

The well water concern was/is in regard to:

3	Taste
6	Color
2	Odor
8	Contaminants
5	Other

Do you now or have you ever had any concern about the *well system*?

23	Yes
28	No

Has the concern been resolved?

13	Yes
10	No

The [unresolved] *well system* concern is in regard to:

3	Pump failure
3	Declining water production
3	Declining water quality
3	Wellhead in disrepair or lacking tight seal
2	Well connection to house
4	Other

Would you like information about connecting to a public water system?

15	Yes
36	No

While travelers passed through Christmas Valley prior, records indicate the first settlement in Christmas Valley was established in 1845 at the eastern end of the valley. Today, Christmas Valley not only has a high rate of private well ownership but also is the area where rural and suburban development first interact with the groundwater basin in terms of the primary direction of base water flow from the headwaters of the Upper Truckee River. The private well ownership rate in this area is high due to its history and its remoteness in the post-1950 development landscape.

A few of the private well properties in the TVS Basin have been in the ownership of only one or two families for over a century. Christmas Valley features residential suburban land use (predominantly post-1950) with pre-1950 “historic” land uses interspersed. Significant features of the Christmas Valley landscape include the privately-held Celio Ranch, homesteaded in 1863 and still owned by the Celio family; Hawley Grade (now a trail) dating to the 1850s and Meyers Grade, the precursor of today’s Highway 50 descending from Echo Pass.

Christmas Valley features largely primary residence properties. In addition it is home to historic parcels also known as “tracts”, with wells in ownership of the US Forest Service under management of the Lake Tahoe Basin Management Unit (LTBMU). On these are rustic cabins on long-term leases to private parties. At the western end of the valley, starting at Highway 50, is

the USFS Rainbow Tract tucked behind a suburban neighborhood. These tracts are seasonally open for summertime use. The Rainbow Tract gate, for example, is open May 15-November 15. Forest Service cabins in these tracts are generally held in long-term (50-to-100-year) leases to families. Toward the headwaters are Bridge Road and Hawley Grade, also host to USFS cabins on long-term leases, relying on wells or surface water.

South Upper Truckee Road runs the east-west length of the valley and private wells are at select residential properties along its length. Though there are many USFS affiliated wells, private wells occur predominantly on privately held residential parcels held by year-round residents in Christmas Valley. Parcels with private wells are interspersed among parcels with District water connections at higher occurrence rates in the southeast portion of the valley. For example, Memory Lane and Morton Drive, as well as Grass Lake Road and Way feature residential properties with wells.

Meyers

Approximately twenty (20) respondents helped increase understanding of groundwater in Meyers by participating in the TVS Well Owners Survey.

- Three (3) respondents answered “no” to the question, “Is there a well at this property”, making the estimated number of wells approximately fifteen (15). One (1) respondent left this question blank and not everyone in the District database of well owners responded to the survey.
- Fourteen (14) respondents (of the fifteen with wells) indicated “yes”, the well is in use, while two (3) answered “no” and seventeen (1) answered “do not know”.
- To the question, Is the well the primary source of household water?, twelve (12) responded “yes”, two (2) said “no”.
- Regarding concerns about the well water, two (2) indicated a concern, fourteen (14) did not have a concern. “Contaminants, Taste, Color, Odor” all registered as concerns.
- Regarding the well system, two (2) respondents indicated a concern while twelve (12) indicated none. Two (2) say “yes” the concern is resolved; one (1) says “no”.
- The one (1) indicating the concern is not resolved points to a problem with the pump.
- No well owners in this sub-area have interest in participating on the SAG.

All of the approximately twenty (20) confirmed and inferred private wells in the Meyers sub-area follow the Highway 50 corridor and historic offshoots of the main travel route through this territory beginning in the mid-1800s, namely Sawmill Road. Land uses associated with private wells on this section of the Highway 50 corridor (before entering South Lake Tahoe) are light industrial associated with residential, interspersed with a few parcels that are residential. Parcel size and dimension are very irregular in this sub-area. The larger parcels are approximately twenty acres while the smallest are portions of an acre. None of the Meyers private well sites are associated with, or in the vicinity of, contemporary (post-1950) suburban development. One such site did show up in the District well owners database; the survey confirms that there is no well at that location.

Summary of Meyers Responses to Key Survey Questions

Is there a well at this property?

15	Yes
3	No
1	I do not know

Is the well in use?

14	Yes, the well is in use
1	No, the well is not used
0	I do not know whether the well is used

How often do you use the well?

0	Not at all
2	Infrequently, rarely
2	More than 90 days a year (but not every day)
10	Nearly every day

Is the well the primary source of household or business water?

12	Yes
2	No

Do you now or have you ever had any concern about the well water?

2	Yes
12	No

The well water concern was/is in regard to:

1	Taste
1	Color
1	Odor
1	Contaminants
	Other

Do you now or have you ever had any concern about the *well system*?

2	Yes
12	No

Has the concern been resolved?

2	Yes
1	No

The [unresolved] *well system* concern is in regard to:

2	Pump failure
	Declining water production
	Declining water quality

	Wellhead in disrepair or lacking tight seal
	Well connection to house
	Other

Would you like information about connecting to a public water system?

3	Yes
12	No

Angora

The District private well database indicated the possible presence of two private wells within the Angora area. The survey confirms that there is no well at one of these locations. The other remains unconfirmed. The suburban Angora area was developed after 1950, with source water delivery infrastructure provided by the District. This land use history corresponds with the absence of private wells.

Tahoe Keys

Approximately nine respondents helped increase understanding of groundwater in the Tahoe Keys by participating in the TVS Well Owners Survey.

- Five (5) respondents answered “yes” to the question, “Is there a well at this property?”. Four (4) respondents answered “no”. Five (5) respondents indicated “yes”, the well is in use.
- To the question, Is the well the primary source of household water?, four (4) responded “yes”, one (1) said “no”.
- Regarding concerns about the well water, all nine (9) responses indicated no concern.
- Regarding the well system, one (1) respondent indicated a concern while four (4) indicated none.
- The one (1) respondent indicating a concern said that it was resolved. The less-than-a-dozen private wells in the Tahoe Keys sub-area are primarily on residential properties on Jameson Beach Road, another may be on Alliklik Road. One exception is the well serving the Camp Richardson Corral, which is a business use.

Summary of Tahoe Keys Responses to Key Survey Questions

Is there a well at this property?

5	Yes
4	No
0	I do not know

Is the well in use?

5	Yes, the well is in use
	No, the well is not used
	I do not know whether the well is used

How often do you use the well?

	Not at all
	Infrequently, rarely
1	More than 90 days a year (but not every day)
4	Nearly every day

Is the well the primary source of household or business water?

4	Yes
1	No

Do you now or have you ever had any concern about the well water?

	Yes
5	No

Do you now or have you ever had any concern about the *well system*?

1	Yes
4	No

Has the concern been resolved?

1	Yes
	No

Would you like information about connecting to a public water system?

	Yes
5	No

South Lake Tahoe

Approximately eighty (80) respondents helped increase understanding of groundwater in the South Lake Tahoe sub-region by participating in the TVS Well Owners Survey.

- Fifty-three (53) answered “yes” to the question, “Is there a well at this property?”. Sixteen (16) respondents answered “no” to the question.
- Ten (10) answered “I don’t know”. Forty-seven (47) respondents indicated “yes”, the well is in use, while six (6) answered “no”. To the question, Is the well the primary source of household water? thirty-eight (38) responded “yes”, nine (9) said “no”.
- Regarding concerns about the well water, fourteen (14) indicated a concern, thirty-seven (37) did not have a concern. “Contaminants” were the most common concern.
- Regarding the well system, twenty-three (12) respondents indicated a concern while thirty-nine (39) indicated none. Nine (9) say “yes” the concern is resolved.
- The nine (9) indicating the concern is not resolved point to problems with pumps, water production, water quality and the “inconvenience” of maintaining a well.
- Eight (8) respondents are interested in information about connecting to a public water system.

Summary of South Lake Tahoe Responses to Key Survey Questions

Is there a well at this property?

53	Yes
16	No
10	I do not know

Is the well in use?

47	Yes, the well is in use
6	No, the well is not used
	I do not know whether the well is used

How often do you use the well?

1	Not at all
3	Infrequently, rarely
7	More than 90 days a year (but not every day)
36	Nearly every day

Is the well the primary source of household or business water?

38	Yes
9	No

Do you now or have you ever had any concern about the well water?

14	Yes
37	No

The well water concern was/is in regard to:

3	Taste
2	Color
2	Odor
3	Contaminants
6	Other

Do you now or have you ever had any concern about the *well system*?

12	Yes
39	No

Has the concern been resolved?

9	Yes
4	No

The [unresolved] *well system* concern is in regard to:

1	Pump failure
1	Declining water production
2	Declining water quality
0	Wellhead in disrepair or lacking tight seal
0	Well connection to house
3	Other

Would you like information about connecting to a public water system?

8	Yes
44	No

South Lake Tahoe features four areas where well ownership is concentrated, on both flanks of Highway 50; one on the southern approach to the “Y” intersection (also known as Emerald Bay Road), another at Sierra Tract, a third in Al Tahoe--the lakefront community between Truckee Marsh and “the Commons”--and the fourth in the vicinity of Rufus Allen.

At the southern approach to the “Y” intersection / Emerald Bay Road, private wells are primarily on properties with small business use: motels, office buildings and light industrial facilities. Eighteen (18) survey respondents indicate business use of well water. Eight (8) respondents indicate residential use of well water; five (5) of these for primary residences and three (3) for secondary residences. Nineteen (19) respondents in this “Y” area indicate “everyday” well water use and four (4) “greater than 90 day” use. Four (4) well owners in this zone register an interest in receiving information about connection to public water supply. Six (6) well owners in this zone indicate they have or have had water concerns; some indicate resolution to these concerns. Separately, (6) well owners in this zone indicate they have or have had well system concerns; some indicate resolution to these concerns.

The fifteen-or-so Sierra Tract private well owners responding to the survey primarily flank Highway 50 and the Trout Creek meadow. Land uses are a mix of primary residential (4) and small business (2). Four well owners in this zone indicate “everyday” use of the well. One (1) indicates having had a well system concern that has been resolved.

Approaching Lake Tahoe along Highway 50, the Al Tahoe zone hosts private wells on properties that respondents indicate are primary residences (4), secondary residences (8) and businesses (2). Eight (8) responses indicate “everyday” well water use, while two (2) indicate “greater than 90 day”, seasonal, use and three (3) others indicate “infrequently” or “not at all”. Four (4) well owners in this zone indicate they have or have had water concerns; some indicate resolution to these concerns. Separately, three (3) well owners in this zone indicate they have or have had well system concerns; some indicate resolution to these concerns. One (1) (mentioned previously) expresses interest in information regarding connecting to a public system.

The vicinity of Rufus Allen, northeast of Al Tahoe along Highway 50, hosts private wells on properties that respondents indicate are primary residences (1), secondary residences (2) and small businesses (1). Five (5) respondents indicate “everyday” use of the well water; 1 indicates “greater than 90 day” use and another, “infrequent” use. Three (3) well owners in this zone indicate they have or have had water concerns; some indicate resolution to these concerns.

Separately, two (2) well owners in this zone indicate they have or have had well system concerns; both indicate resolution to these concerns. One expresses interest in information regarding connecting to a public system.

Bijou

Approximately one hundred seventy-seven (177) respondents helped increase understanding of groundwater in Bijou by participating in the TVS Well Owners Survey.

- One hundred fourteen (114) indicated there is a well on the property. Thirty-four (34) respondents indicated there is no well. Twenty-nine (29) answered “I don’t know” regarding the existence of a well on the property.
- One hundred five (105) respondents indicated “yes”, the well is in use, while six (6) answered “no”.
- To the question, Is the well the primary source of household or business water?, ninety-four (94) responded “yes”, nine (9) said “no”.
- Regarding concerns about the well water, thirty (30) indicated a concern; eighty-three (83) did not have a concern. “Contaminants” were the most common concern.
- Regarding the well system, thirty-two (32) respondents indicated a concern while eighty-two (82) indicated none. Twenty-two (22) said “yes” the concern is resolved.
- The ten (10) indicating the concern is not resolved point to power supply, age of the well and issues with the pump and water quality.
- Eleven (11) respondents indicate interest in information about connecting to a public water system.

Summary of Bijou Responses to Key Survey Questions

Is there a well at this property?

114	Yes
34	No
29	I do not know

Is the well in use?

105	Yes, the well is in use
6	No, the well is not used
3	I do not know whether the well is used

How often do you use the well?

1	Not at all
11	Infrequently, rarely
18	More than 90 days a year (but not every day)
74	Nearly every day

Is the well the primary source of household or business water?

94	Yes
9	No

Do you now or have you ever had any concern about the well water?

30	Yes
83	No

The well water concern was/is in regard to:

1	Taste
6	Color
1	Odor
17	Contaminants
4	Other

Do you now or have you ever had any concern about the *well system*?

32	Yes
82	No

Has the concern been resolved?

22	Yes
10	No

The [unresolved] *well system* concern is in regard to:

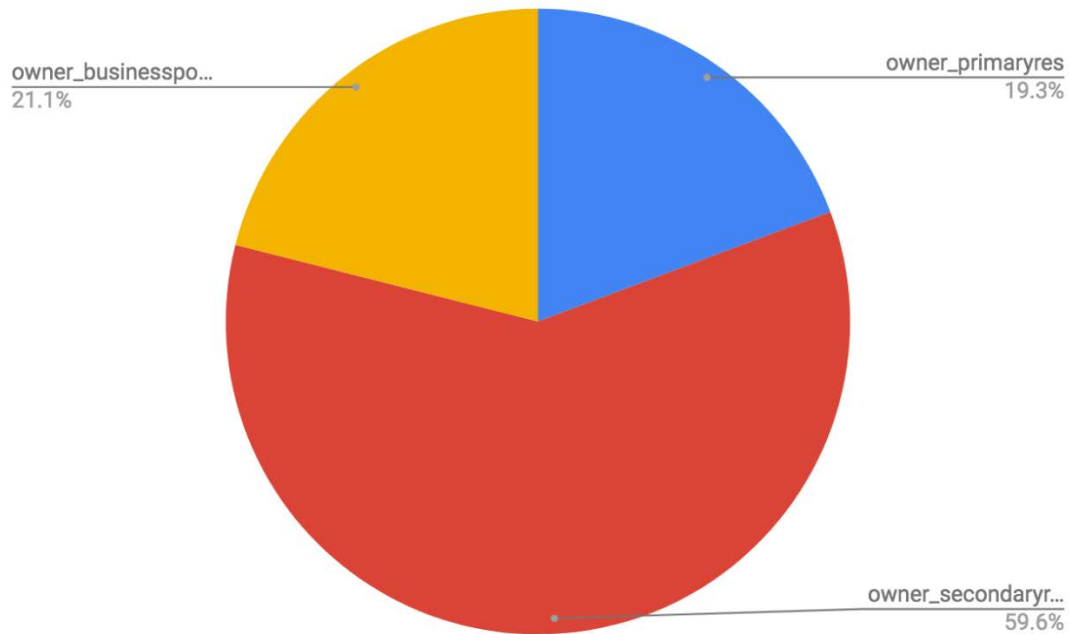
1	Pump failure
	Declining water production
1	Declining water quality
	Wellhead in disrepair or lacking tight seal
	Well connection to house
4	Other

Would you like information about connecting to a public water system?

11	Yes
102	No

The Bijou sub-zone was historically a hub of commercial activity and associated residences and continues so today. Of the six sub-zones discussed in this report, Bijou is the most commercial in terms of land use and private well use. Approximately 21% of respondents indicate the private well is associated with a business property in this area. About 60% of respondents indicate the well is in use at a secondary residence and about 19% indicate use at a primary residence.

Figure 27: Bijou sub-area response rates to the survey question; *As owner, which best describes your relationship to this property?*



It is possible to consider the Bijou sub-area in terms of six (6) zones based on land use and/or neighborhood. (1) Bal Bijou is lakefront starting at the Johnson Blvd boundary with the South Lake Tahoe sub-area. Moving north, (2) Tahoe Meadows is bordered by Lake Tahoe and Highway 50. Moving north along Highway 50 and the lake (3) the Stateline zone is evident at the California-Nevada border. (4) Ski Run Blvd is a commercial district, flanked both north and south by (5) Bijou residential neighborhoods. To the south is a residential section flanked by Pioneer Trail. To the north is a mixed residential/small-commercial zone featuring motels along Pioneer Trail and Highway 50 as they converge, with residential land use in between. Finally, there is (6) Heavenly Ski Resort, on the eastern flank of the Bijou sub-area, whose influence on land use is evident in the surrounding mixed residential and small business land uses.

Bal Bijou is a lakefront zone featuring small resort/large motel properties interspersed with commercial. A business owner in this zone indicated no well, all water coming from the District. At Stateline, a couple of wells are indicated in the District database. One motel property responding indicated the presence of a well for secondary water purposes, a connection to the

District system being the primary source of water. Another indicated that the well is not in use due to MTBE contamination from neighboring gas station.. Business property owners in the Ski Run zone generally reported everyday well use, with positive remarks about the quality and consistency of water supply. On the order of fifty respondents in the Bijou residential/small commercial neighborhoods confirmed the presence of wells. There are also many respondents in this zone indicating “I don’t know” regarding whether a well is associated with the property. Those confirming the presence of wells indicated the well is in use, the majority of these “everyday” though “infrequently” and “greater than 90 days” are among the responses. A few well owners in this zone indicate interest in information about connecting to public water. On Pioneer trail approaching the commercial zone, a few property owners report “everyday” use of private wells. One is interested in information regarding connecting to the public water system.

Tahoe Meadows is a gated, lakefront neighborhood with seven streets spanning about one hundred acres. The area first saw development in 1924 and today maintains historic status. A homeowners’ association helps facilitate community decisions like those related to source water for the community. Though the community has source water infrastructure in collaboration with the District, the survey confirms many homeowners maintain private wells that are used “everyday” in most of these secondary residences. A few well owners in this zone indicate interest in information about connecting to public water.

3.2 Water quality

What qualities of the well water do you most like?

The survey posed the question, “What qualities of the water do you most like?” with the option to select from the following

- Taste, color, odor
- Purity
- None
- Other

Well owners overwhelmingly “like” the perceived “purity” of the well water. Exceptions are where there is a concern with the water of a specific well. While a glitch in the data count methodology prevents a query resulting in an exact count of responses in each category, survey respondents indicate that well water “taste, color and odor” are perceived favorably. A member of the field survey team observed, “the vast majority [of well owners] were very pleased with their well water quality and wells.” Given the opportunity to specify whether s/he “likes” another aspect of the well water, respondents provided such answers as

- No chemicals
- Better than city
- Quality
- Free water
- Price
- No tenant complaints
- No chlorine
- Temperature (cold)
- Cheaper than District water
- Fresh
- I can control it
- Always available

What qualities of the well water do you most dislike?

While the vast majority of well owners indicate no qualities of the well water that they dislike, a glitch in the data count methodology prevents an exact count of each response to this question. There are instances in which well owners report perceived issues relating to “mineral deposits” and/or “taste,color, odor”. Given the opportunity to specify whether s/he “dislikes” another aspect of the well water, respondents provided such answers as

- Sediment
- Winter runoff and heavy snow
- Water leaves a residue on plastic
- Iron smell if not used for a period of time
- MTBE contamination from Tahoe Tom’s (consult Lahontan Water Board)
- Upkeep
- First use takes a period of days to flush clear
- Occasional sand, need to use carbon filter
- Has to be treated
- Occasionally it gets rusty
- Sand and silt

Given the opportunity to provide more information about the well water concern, respondents provided such answers as

- Availability
- Power outage
- Restoration
- Iron
- Not enough water
- Might run out
- Rusty
- Collapsed, lots of rust in the water
- Laundry system had PCE
- Overuse of resource by neighboring water users
- Costs

- Runs dry sometimes
- Minerals and arsenic
- Clogs the pipes
- Sand
- Sediment
- Decline in quality
- Occasional coliform

3.3 Well system concerns

Given the opportunity to provide more information about the well system concern, respondents provided such answers as

- Water production
- Well connection
- Pump
- Wellhead
- Well replacement
- Aging pipes
- Collapse
- Broken pipes
- Inconvenience
- Breaker switches off, water goes out
- General repairs and property damage when laying pipe
- Leaking water
- Contaminants
- Needed technical assistance
- Tree roots caused backup in tub
- Maintenance
- It had to be dug deeper
- It must be old, may be corroding

3.4 About groundwater

What do you consider the top three groundwater concerns in our South Tahoe community?

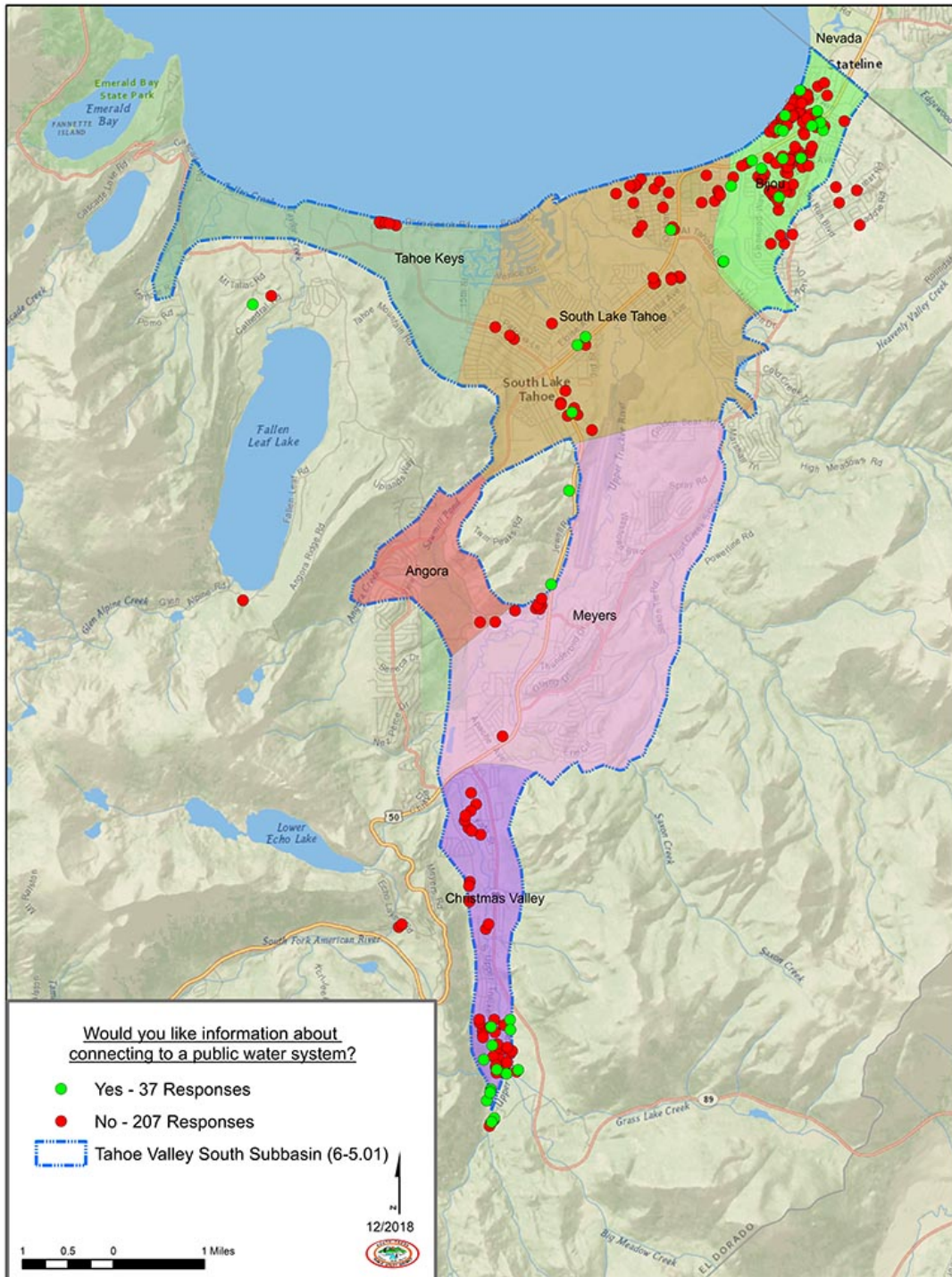
The survey posed the question, “What do you consider the top three groundwater concerns in our South Tahoe community?” with the option to select from the following

- Groundwater contamination
- Climate change
- Declining groundwater levels
- Groundwater regulation
- Population growth; future water demands
- I do not believe there are any groundwater-related concerns in the South Shore area
- Other

The dominant response to this question was “no opinion”. While a glitch in the data count methodology prevents a query resulting in an exact count of responses in each category, respondents indicated concerns such as

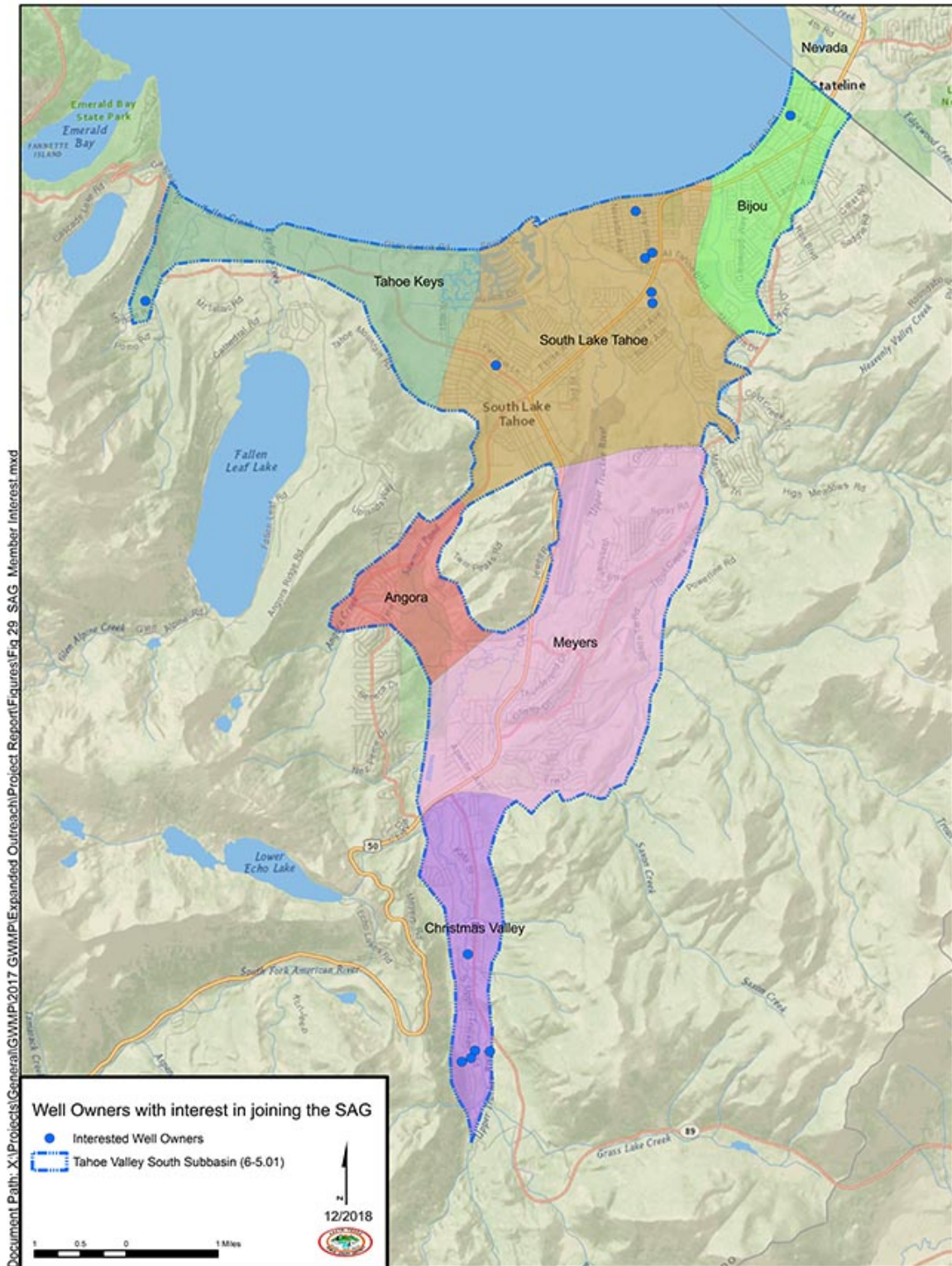
- Drought
- Conservation of groundwater, updating infrastructure, education
- Septic tanks
- Runoff from golf courses
- Impervious surface expansion
- Salt on roads
- Well “artesianing”, percolating all the time
- Water table being too high
- Get rid of [Tahoe} Tom’s and the Blackjack Motel
- Golf course pollution

Figure 28: Well owners with interest in information about connecting to a public water system



Map: Would you like information about connecting to a public water system? provided by STPUD

Figure 29: Well owners with interest in joining the Strategic Advisory Group



Map: Well Owners with interest in joining the Strategic Advisory Group; provided by STPUD

4 Survey of Well Owners, Outreach Materials

4.1 Outreach Materials: invitation to participate

[STPUD Logo

Return Address or Header/Footer on District letterhead]

[Addressee Name

Address]

[Date]

Dear _____;

South Tahoe Public Utility District (the District) invites you to participate in a good neighbor effort to better understand South Tahoe groundwater and how to best care for our wells. You are receiving this letter because county records show you own or manage a well or multiple wells. We ask that you participate in the Well Owners Survey. You can go directly to the online survey using this web URL: [URL]. For the purpose of completing the survey, your Parcel Number/APN is _____. Regarding the survey, District staff can be reached during business hours by calling 530-____-_____.

Why is the District doing a well owners survey?

The District is making a good neighbor effort to manage our shared South Tahoe groundwater resource. In response to public health and groundwater management concerns, the state of California passed legislation that establishes a new structure for managing groundwater. The Sustainable Groundwater Management Act (SGMA) requires the formation of locally-controlled Groundwater Sustainability Agencies (GSAs) to be responsible for developing and implementing a Groundwater Sustainability Plan. By stepping up to serve as the Groundwater Sustainability Agency for the South Tahoe Basin, South Tahoe Public Utility District helped ensure that locals

have the primary say, and responsibility for, managing South Tahoe groundwater instead of the state.

What does the survey involve?

The survey asks for your up-to-date contact information and about 1) property ownership and usage, 2) the well 3) water use 4) well water quality and 5) well condition. The survey closes with an invitation to receive support maintaining your well and a question about what you think groundwater concerns are in our South Tahoe community. There is an option to include a photo of your well in the survey. The photo is optional. The photo can help the District know whether the wellhead is in good condition or whether the well may need some attention. The survey should take 5 to 25 minutes to complete. Please call the District with any questions about the survey at the number above.

Is the trying to get well owners to connect to District services instead of keeping the well?

No, the District is not trying to get well owners to replace private wells with District water service. The purpose of this survey is to extend a hand in invitation to locally manage our shared South Tahoe groundwater resource. There are approximately 600 private wells in South Tahoe in addition to the District's groundwater wells. Well owners and the District have the shared responsibility of stewarding the groundwater resource. The District can offer support and help to well owners. Well owners have insights into the groundwater resource that will help the District. The survey asks questions. It also invites you, as a well owner, to participate in conversation with other well owners.

How do I participate in the Well Owners Survey?

The URL at the top of this letter can be typed into your web browser for direct access to the survey online. Alternatively, a paper copy of the Well Owners Survey is available by calling the District to request one. Finally, the District has a team of surveyors who will come to you in person to have a conversation about the District's invitation to actively participate in South

Tahoe groundwater management and ask the survey questions. You are asked to participate in only one of the above three ways: online, paper or in-person. But you can also fill out the survey and request an in-person visit if you like. The District's purpose is to open conversation about groundwater management. As fellow well-owners, the District and private well owners all have a part in being involved in groundwater management.

Thank you for your time and attention to our shared groundwater resource.

Sincerely,

Ivo Bergsohn

Richard Solbrig

Quick-Reference Information

Access the Well Owners Survey at: _____

Your personal Parcel Number/APN is: _____

Call the District at: _____

For more information about State of California groundwater protection initiatives see:

<http://www.water.ca.gov/groundwater/sgm/gsa.cfm>

END invitation to participate

4.2 Outreach Materials: Door hanger and public service announcement

WELL OWNERS SURVEY 2017

DOOR HANGERS

VERSION: AUGUST 3, 2017

When the field survey team was unable to contact the well owner during the field survey, a door hanger was left with a link to the online version of the survey. The well owner could follow that link and fill out the survey her/himself.

FRONT OF DOOR HANGER

Hello,

We stopped by today to invite you to participate in the South Tahoe Public Utility District survey regarding groundwater wells. This is a good neighbor effort to better understand South Tahoe groundwater and how to best care for our wells. You are receiving this letter because county records show you own or manage a well or multiple wells.

Is the trying to get well owners to connect to District services instead of keeping the well?
No, the District is not trying to get well owners to replace private wells with District water service. The purpose of this survey is to extend a hand in invitation to locally manage our shared South Tahoe groundwater resource

We ask that you participate in the Well Owners Survey. You can go directly to the online survey using this web URL: [URL]. Regarding the survey or to request your Parcel Number/APN, District staff can be reached during business hours by calling 530-____-_____.

Please call us to help arrange a good time to come back to meet with you. Or fill out the survey online.

Thank you, [surveyor signature or Ivo Bergsohn or both]

BACK OF DOOR HANGER

Why is the District doing a well owners survey?

The District is making a good neighbor effort to manage our shared South Tahoe groundwater resource. In response to public health and groundwater management concerns, the state of California passed legislation that establishes a new structure for managing groundwater. The Sustainable Groundwater Management Act (SGMA) requires the formation of locally-controlled Groundwater Sustainability Agencies (GSAs) to be responsible for developing and implementing a Groundwater Sustainability Plan. By stepping up to serve as the Groundwater Sustainability Agency for the South Tahoe Basin, South Tahoe Public Utility District helped ensure that locals have the primary say, and responsibility for, managing South Tahoe groundwater instead of the state.

Quick-Reference Information

Access the Well Owners Survey at: _____

Call the District at: _____

For more information about State of California groundwater protection initiatives see:

<http://www.water.ca.gov/groundwater/sgm/gsa.cfm>

DATE _____

SURVEY ID: _____

Hello,

We stopped by to invite you to participate in the South Tahoe Public Utility District survey regarding groundwater wells. This is a good neighbor effort to better understand South Tahoe groundwater and how to best care for our wells. You are receiving this letter because public records show you own or manage a well or multiple wells.

Is the South Tahoe Public Utility District trying to get well owners to connect to District services instead of keeping private wells?

No, the District is not trying to get well owners to replace private wells with District water service. The purpose of this survey is to extend a hand in invitation to locally manage our shared groundwater resource.

We ask that you participate in the Well Owners Survey. You can go directly to the online survey using this web URL: <http://bit.ly/tahoewells> and the Survey ID provided on this notice. Should you have any questions concerning this survey, please contact Ryan Lee, Customer Service during normal business hours at (530) 543-6217.

Please call the number above to help arrange a good time for us to return to meet with you. Or fill out the survey online.

Thank you,

Signed By: _____



"Serving Customers While Preserving Lake Tahoe"

Why is the District doing a well owners survey?

The District is making a good neighbor effort to manage our shared groundwater resource. In response to drought and groundwater resource concerns, the state of California passed legislation that establishes a new structure for managing groundwater. The Sustainable Groundwater Management Act (SGMA) requires locally formed Groundwater Sustainability Agencies (GSAs) be responsible for developing and implementing a Groundwater Sustainability Plan. By stepping up to serve as the Groundwater Sustainability Agency for the South Tahoe Basin, the District is helping to ensure that locals have the primary say, and responsibility for, managing South Tahoe groundwater, instead of the state.

Quick-Reference Information

Access the Well Owners Survey at:
<http://bit.ly/tahoewells>

Questions: Call Ryan Lee, Customer Service at:
(530) 543-6217

For more information about State of California groundwater management initiatives see:

<http://www.water.ca.gov/groundwater/sgm/gsa.cfm>



"Serving Customers While Preserving Lake Tahoe"

END door hanger

Outreach Materials: Public service announcement

PSA

DRAFT VERSION AUGUST 3 2017

South Tahoe Public Utility District invites all owners of groundwater wells to participate in a survey. The District is making a good neighbor effort to open conversation about groundwater management with owners of private wells. There are approximately 600 private wells in South Tahoe in addition to the District's groundwater wells. Well owners and the District have the shared responsibility of stewarding the groundwater resource.

Call South Tahoe Public Utility District for information about the South Tahoe Well Owners Survey at [Phone #] or visit the District's web page at [SPECIFIC WELL OWNERS DIRECTIONS].

South Tahoe drinking water is a shared, precious resource. Help take care of our drinking water.

END *public service announcement*

4.3 Outreach Materials: Survey of Well Owners coverage in Lake Tahoe News

STPUD getting better grasp on all well use

 laketahoenews.net/2017/08/stpud-getting-better-grasp-well-use/

Published: August 12, 2017

By Kathryn Reed

Red dots fill a map; with most being located in Christmas Valley and near the state line. They represent the more than 600 private wells within South Tahoe Public Utility District's boundaries. Most are at residences, while others are at campgrounds, a school, trailer parks and other commercial entities. Per state requirements South Tahoe PUD is trying to get a firm understanding on how many are operational, exact locations and if people have any issues.

Ivo Bergsohn, a hydrogeologist with the District, is tasked with overseeing all of this. A survey with 19 questions is being sent out to the well owners this month to gather some basic data, see if they have questions, and let them know the district can help where appropriate.

“The information we gather will be used to help guide the groundwater management plan,” Bergsohn told *Lake Tahoe News*.



Photo: I. Bergsohn with STPUD is overseeing the groundwater program. Photo/Kathryn Reed

During the drought California thought it would be a good idea to start regulating groundwater. It was one of the last states to do so. With laws that were passed in 2014, different jurisdictions had to create groundwater management plans. STPUD is in charge of that mandate for much of the basin on the South Shore, though El Dorado County has oversight in some areas.

Groundwater management pertains to the water level, storage, quality, land capability, and ensuring there are no adverse effects to surface water from pumping.

In 2016, per state mandate the district performed a stress test to determine how much water it had. At that time – which was before last year’s record snowfall and at the height of the drought – there was enough water in the aquifer for 31 years. This figure is based on the demand from 2013, 2014 and 2015 which averaged 6,173 acre-feet per year.

The district is not looking for new customers or even to tell people how to use their well or regulate the use in any way. What employees can do is provide tips about maintenance, share how to properly disinfect a well and other related information.

“If we have a properly managed well, there is potentially one less conduit of contaminate into the aquifer,” Bergsohn said.

People keep their wells for various reasons – for historical purposes, not wanting to pay a water bill, not wanting anything added to their water, and staying off the grid, so to speak. STPUD was well ahead of the state in monitoring groundwater issues. It has been doing so since about 2000, three years after the gasoline additive MTBE (methyl tertiary butyl ether) was found in wells. The district won a multi-million-dollar lawsuit against several gas companies as a result of that contamination.

Contamination, though, remains the No. 1 threat to the district’s water supply, according to Bergsohn. PCE (tetrachloroethylene) is an issue today with wells in the Tahoe Keys and Lukins Brothers water districts being contaminated. STPUD is providing those two entities with water.

Arsenic is a naturally occurring contaminate, for which public districts regularly test.


END Survey of Well Owners coverage in Lake Tahoe News

4.4 Outreach Materials: Survey of Well Owners coverage on Lake Tahoe TV

LAKE TAHOE TV interview

<https://www.youtube.com/watch?v=fPR93nTejtg>

The image below is a screenshot. To view the video insert the above link into a search engine or insert the below link into a search engine to navigate to the District Groundwater page, <http://stpud.us/news/groundwater-management-process/tahoewells/>



Lake Tahoe TV - S.T.P.U.D.

41 views

LakeTahoeTelevision
Published on Aug 14, 2017

SUBSCRIBE 683

Lake Tahoe TV "Broadcasting the Active Lifestyle"

Lake Tahoe's ONLY source of LIVE, LOCAL programming!

SHOW MORE

END Survey of Well Owners coverage on Lake Tahoe TV

5 Field Survey Team Handbook

5.1 Introduction to the Survey of Well Owners

The District is the largest Public Water Agency and largest provider of drinking water in the Lake Tahoe Basin, providing on average, more than 2 billion gallons of drinking water per year. It is also 100% reliant on groundwater.

Well survey

- We are interviewing today to fill three positions for the team that will conduct a face-to-face survey of groundwater wells.
- The District has identified more than 600 Private, Community and Noncommunity water system wells within its Service Area.
- About 560 of these are Private Wells; and the remaining 50 are Community and Noncommunity water system wells.
- Each team member will be responsible for conducting somewhere on the order of 200 surveys at the Private Well locations;
- The Well Survey Questionnaire will be available online on the District's Website and will also be loaded onto tablets for use by the Well Survey Team;
- Each team member will be expected to complete about 6 well surveys per day over an 8 week period extending from August 14 through October 6th.
- Well Surveys will be conducted Mondays through Fridays between 8:00 AM – 5:00 PM. Well Surveys are not expected to be performed during Holidays (Labor Day) and Weekends.

Lead surveyor

- The 3-person team will be led by one Lead Surveyor. In addition to completing surveys at the Private Well Locations; the Lead Surveyor will also be responsible for conducting surveys of the roughly 50 Community and Noncommunity well owners.
- Community and Noncommunity wells typically provide drinking water to commercial buildings, apartments, hotels & motels, trailer parks, USFS Cabins and summer resorts that are not connected to Public Water Systems.

Context

In 2015, the Department of Water Resources recognized the District as the exclusive Groundwater Sustainability Agency (GSA) for the TVS Subbasin.

- As the District provides the majority of drinking water and is the largest user of groundwater in the greater South Lake Tahoe area, the District has a vested interest in managing the local groundwater resource.
- In 2014, new regulations were passed requiring that groundwater within selected groundwater basins in California be managed in a sustainable manner, including the groundwater basin underlying the District's service area.
- These regulations require local agencies to form Groundwater Sustainability Agencies responsible for developing and implementing Groundwater Management Plans to use and protect groundwater so it will be available for drinking water use for many generations to come.
- Part of the responsibilities of a Groundwater Sustainability Agency is to consider the interests of all beneficial uses and users of groundwater within the groundwater basin.
- These include Private Well Owners, Community and Noncommunity water systems.
- In order to help meet this goal the District is performing an outreach effort that includes a door-to-door and online survey of local well owners to;
 - Inform well owners of the District's role as a Groundwater Sustainability Agency;
 - Identify well owners groundwater concerns;
 - Encourage well owners to become involved in groundwater management; and
 - Confirm well use at the property.

Concluding message

- The District is a long-time established public agency that takes great pride in providing sewer and water services to our customers. Each well owner or local resident that you meet during the Well Survey is also a likely District customer.

5.2 Field Survey Protocols

by Nathaniel Anderson, Jennie Bear and Dyann Comish

Field Protocols of the 2017 Field Survey of Well Owners of the TVS Groundwater Basin

Contents, Field Survey Protocols

1. Introduction
2. Contact
3. Potential scenarios
4. End of day
5. Meetings

Introduction

Conducting a survey is an excellent way to gather information from the community or region. There are many reasons why surveys are conducted; however, the one thing all surveys have in common is that the information gathered by them will be used to shape and influence future projects in those communities and regions. The primary reason why surveys are so effective at doing this is because they are an amalgamation of qualitative and quantitative data.

If the survey form has sections where individuals may enter information that is not multiple choice, then any form of conducting the survey can lead to qualitative data. However, it is face to face interactions that will yield the most rich, qualitative data. This is because we can collect the respondents' information, as well as record what we observe in the interaction. Once all of the data has been collected, it is easy enough to sort the responses and observe patterns in the data; however, it is the coupling of observations from the field with the observations from the overall dataset that will tell the most complete story attainable by the efforts of the project.

As an example, when observing the data-set as a whole, one would only be able to make inferences about the data-set as a whole. And for some projects this may be all that is necessary. However, typically when conducting a survey in a specific region, there will be region specific patterns that may only be apparent to the initial collector of the data. Opinions, values, issues and

perspectives can vary wildly from neighborhood to neighborhood and that is why recording observations from the field are crucial to the project.

Conducting a survey is a relatively straight forward process. Despite this, there are a number of obstacles any organization conducting a survey will run across. Here is assembled as comprehensive a report from our experiences as we possibly can to assist in future endeavors. It is our hopes that it is of assistance to those going forward.

1. Preparations

Preparations for the field are perhaps the most important step of the day's process. Though the job is relatively simple, the field is a complex place full of unexpected challenges. Due to these unexpected challenges the day can be made or lost as a result of preparations.

1.1 Clipboard and Notebook/Letter and Door Hangers/Tablet/Business Cards/Car Sign/Car Charger and Cell Phone

A clipboard or notebook will be invaluable to daily efforts because, as robust as the applications are for data entry, there are some scenarios that will occur where the application will not be able to handle it at the time. It is best to write down these scenarios and revisit them later, for clarification (using a memo application on the tablet would work too). It is important to remember to bring and utilize the door hangers as they are effective for connecting to the individual if they were not present for the visit. Door hangers are also a great tool to use during contact and conversation if you need information, or simply as a visual aid. The tablet is absolutely necessary for Data Entry and Navigation and is the most crucial tool of this job—without it most of the day's work would not be possible. Business cards for the designated STPUD staff member who can answer respondents' requests for more information should be given as needed. Having a window sign indicating the vehicle makes frequent stops also is advisable.

1.2 Application and Data Entry Familiarization

During the first week it is recommended to perform an extensive field test on proper operation of the applications and proper method of data entry for the data collected. The ease and familiarity of these applications and accompanying hardware can be deceptive and often hide

procedural glitches that will not be noticed until the results begin to be observed—or even worse, they go unnoticed until most of the results are observed. A full check from data collection to data observation should be performed periodically as well to continuously check for errors in the data. It will pay off in the end, to continuously keep track of the data and attempt to correct errors as they arrive. It is also important to note, that once a survey has been opened up for a specific location that any and all further notes for that location must go in the original survey file—which will be stored in the “sent” section of the application.

1.3 Uniform and Appropriate Clothing and Accessories

Each surveyor is to wear the STPUD logo t-shirt whenever out in the field, along with his/her ID badge. Pants or nice jeans are to be worn, and good footwear is a must. A hat and sunscreen are advisable. If sunglasses are worn, they should be removed when meeting a prospective survey respondent. Tahoe’s weather is not very stable and at times can fluctuate pretty erratically throughout the day. Due to this, it is best to keep with oneself changes of clothing to accommodate the extremes of heat and the extremes of cold. An individual may face days of extreme heat and humidity with a glaring sun. An individual may also face a day where the clouds roll in and start hailing or snowing without much notice. It also rains all of the time without much warning on sunny or cloudy days. Due to these factors, it is best to keep optional changes of clothing and an umbrella readily available in case one has to react to the weather.

1.4 Water/Food

Of these items, water is definitely a must to bring with, out into the field. The typical field day will include a good deal of walking. More importantly, there will be days that are extremely hot and humid. Couple that with a day’s worth of walking and an individual will be sweating out more fluids than they can take in! Food is important, but not as important as water. Even the flattest of neighborhoods gets tiring to trek after a few hours. Bringing along snack foods and a lunch is important for maintaining energy levels. One wouldn’t want to go to a door and not be talkative due to being drained and hungry—leaving a sour impression on that respondent!

1.5 Morning Debrief

Morning debriefs should pertain to the day's activities. This is the time for the team members to sort out their daily activities and make sure they are on the same page for the day. This is an important step to make sure redundancies are kept to a minimum. Team members look at the map together, determining which areas each will canvas that day.

1.6 Plan Route

When planning a day's route, there are a number of things to keep in mind: distance to and from the office, access to a bathroom, and an optimal walking path. It is important to keep track of mileage (for reimbursement purposes), as well as keeping the distance to and from the office in one's mind, in case during the day you are called back to the office for some reason or have a meeting. Access to a bathroom is crucial as well. One recommendation is parking at a park or near a large business if possible, for the benefits of easy parking and easy access to a bathroom. You do not want to find yourself with an urgent need to use the restroom and not know where one is or be a great distance away. To ensure a solid day's efforts, you will want to plan out as efficient a walking route as possible. There are a number of effective ways to canvas a neighborhood, depending on the layout of the neighborhood. If you are lucky enough to find yourself in a neighborhood that is laid out on a grid, parking in the middle of the grid and then walking the grid from one end to the next and then so on, is a very effective way to canvas that area. Next to a grid layout, the next most typical layout is neighborhoods with roads that branch off of each other, sometimes into dead ends and sometimes forming out of the way connections with and into it. The most efficient way to canvas these neighborhoods is to park on one end and walk along the parameter and work one's way inward. Regardless of layout, an optimal walking path will allow for continuous work, with relatively easy access back to one's vehicle or starting point. Team members can help each other in route planning by sharing their experiences from previous trips to various parts of town during the morning debriefing.

2. Contact

Making direct contact with residents or owners or employees at the survey locations is the number one objective of the project. It is important to remember that a survey is being conducted with customers of the District and that representing the District is a serious

responsibility. Face-to-face contact takes precedence over other forms of contact due to the information that can be gathered from the experience. One thing to keep in mind when conversing with a respondent is to keep those answers in your mind and record those as you encounter them. Making contact should not be intrusive in regard to time of day. Start knocking on doors after 9 am. As you approach a property, open the survey by selecting the dot on the map associated with this property. Scroll to the first section before knocking at the door or entering the business.

2.1 Greeting/Introduction

The surveyor should have the demeanor of gratitude, of someone that is asking for something that is helpful, but also simple. A brief pleasant greeting is a good start, but letting the person know you are and that you are from STPUD right away is also good way to get the person at ease and leads into one the first questions, “Are you the owner of the property?”. They know who you are; now they can tell you who they are, followed by a request for them to participate in the brief survey. When it comes to these types of social interactions, individuals are quick to cut to the chase and attempt to “complete” the job as quickly as possible (i.e., jumping straight into survey questions as soon as one has made contact). This actually could be counter-productive as the experience is too similar to that of a door-to-door sales pitch (which is the impression we are trying to avoid). On the other hand, some people prefer to cut to the chase or may only have a few minutes to participate. Each surveyor must determine the best approach for each situation. Properly introducing yourself and explaining the project are great ways to break the ice and garner the favor the respondent. The respondent may have read the introductory letter or the door hanger before your visit, so he/she may already be aware of the survey. Most individuals have high opinions of utilities and utility employees, and working with us on something that is official District business tends to ease any worries individuals may have about the project. Also, most people enjoy talking with someone who is confident and comprehends their material well. Even if someone does not want to participate, introductions are a great opportunity to make a positive impression as a representative of the District. Respecting one’s wishes will always garner their favor going forward and may lead to a successful interaction with that customer in the future.

2.2 Verify/Clarify Information

After introductions have concluded, this is a great chance to verify if you are speaking with the owner of the property. There are many ways to initiate a conversation, but a high success rate will be found simply by asking if the individual you are speaking to is the owner of the property. This simple question will allow the surveyor to verify the information is presented is accurate or to then go ahead and correct the information if the initial, preloaded information is not accurate for some reason. Corrections of spelling of name, street address, phone numbers, and email address may be needed. It is important to enter the name of the person being interviewed, regardless whether he or she is the property owner.

2.3 Survey

After wrapping up the verification of the preloaded information, it is time to jump into the body of the survey. It is often easy to carry on with a guided, yet informal conversation with the respondent. While asking the survey questions, often times other questions or concerns will be raised by the respondent. During these conversations, jot down the concerns and keep the conversation going. This is a good time to share information about the District's groundwater management plan and discuss the Stakeholders Advisory Group. At times, a more formal approach will be more successful. It is up to the surveyor to use discretion and judgment at the time of interaction to determine how best to proceed. Remember, it is ok if a person does not want to participate. Though 100% completion is the goal, a survey on its own will not merit disrupting a customer of the District. Also, respondents may have preconceived notions of the District and act upon them. If they are negative, do not take it personally. It is important to put yourself in the shoes of the respondent and act accordingly. On the flip side, it is important to know that conducting a survey is not a crime, nor is it a breach of anyone's privacy, so go forward confidently in your work. Always enter a respondent's answer as given, without influencing his or her opinions or answers.

2.4 Wrap Up/Notes

After asking the final survey question, take a moment to tie up any loose ends that arose during the conversation. Provide a STPUD business card (i.e., Ryan Lee's card was used during this survey), if not done so already, to anyone with questions or who might want to contact the

District in the future. After the survey is completed, thank respondents for their time and wish them a “good day.” After wrapping up the conversation and departing from the respondent, enter notes into the app or into your notebook as needed. Because it can be hard to enter lengthy notes during a conversation and important information might be forgotten, do not put off logging notes for too long. Wrapping up a conversation will differ from respondent to respondent, so it will ultimately be up to the surveyor’s discretion on how to best approach closing the session. Just as on the approach, it is important to remember that one is a representative of the District and has another opportunity to make a lasting, positive impression. To close and submit the survey, perform the following steps:

- a) Select the check mark at the bottom right corner of the tablet. This will take you to the next page, select the “pencil” icon and say “yes” for survey being completed.
- b) Then select “done.” This will turn the dot from red to green on the map.
- c) There is an option to send the survey now or send later. If you are out of Internet range, the tablet stores the information. When you are within range, you can then select “Send Now,” and all surveys completed that were not previously sent will then be sent.

3. Potential Scenarios

Conducting a survey is a relatively straightforward process and it is essentially a binary process: one either speaks with a respondent or does not. In this situation it is a simple task of updating the map, from uncontacted nodes to either red (representing an attempted contact) and leaving a door hanger or green (representing a completed contact). This is the anticipated scenario However, conducting a survey requires the coordination of a number of factors. Because of this, there are a number of other scenarios that may be found.

3.1 *Safety in the Field*

If at any time during your travels to and from the field and while in the field you feel unsafe or uncomfortable, leave the area. This might occur in a neighborhood that appears empty, in the woods, in traffic, at a location’s doorstep, or during an interview. Wild animals as well as neighborhood dogs may be spotted. Know what to do if any of these scenarios occurs while alone in the field. Always try to have a fully charged cell phone for use in emergencies. If

someone invites you inside to conduct the interview, use your judgment about the safety of the situation and the likelihood of completing the interview if you decline the offer.

3.2 Erroneous Data in App

Surveys typically draw from some form of a past, demographical, regional database where the survey is being conducted to populate the initial forms and points of contact. Despite the best efforts of any project to collect information, there will always be errors—especially since time is a factor and circumstances can change between the initial collection of the demographical data and the day that data is accessed for use. Due to this, on occasion a surveyor will occasionally find that the initial data populating the survey form is erroneous. There is a simple resolution, though. By manually entering the correct data into the appropriate forms, the original database will be modified with the new, accurate data. Because it may take a long time for the results to be viewed, it is recommended that changes in initial data (i.e., owner name or spelling, address, phone number, email address) also be noted in an Excel data file set up for this purpose.

3.3 No One Home (or No One Answers the Door)

An interviewer is to leave a door hanger at each location where a home or business is found when a person is not available to take the survey. Sign your name legibly and include the date and Survey ID number on the door hanger. Make a note of all locations where door hangers were left. By returning to each location the next day or so, you can determine if someone might be living at or caring for the property if the door hanger has been removed. Watch also in case the door hanger blew off and may be on the ground or on the porch.

3.3 Multiple Nodes at Same Location

On occasion one may encounter the specific situation where there are multiple nodes located at the same property, indicating different information on each node. Ideally, this issue should be examined before approaching these properties in case of one of the nodes is a duplicate, needing to be deleted. Otherwise, the best possible solution to sort it out is to make contact with the property owner or manager and get the correct information. If it is not possible

at the time of discovery to talk with these individual owners, be sure to take note of the property and attempt to resolve the issue with other methods (phone calls, emails, Springbrook inquiries).

3.4 A Possible Source of Data Not on Map/List

Out in the field, surveyors must look for properties or locations with wells (or potential wells) that are not in the original data set. If possible, the best solution is to attempt to make contact with someone at the property, filling out a blank survey form and conducting a survey. If the property owner is not home or at the business property, the next steps are to leave a door hanger and to record the address for data entry in the future—ideally keeping a list of potential wells to add to the official data-set. At this point, the Springbrook database can be accessed to determine if the property only has a sewer bill, meaning it likely uses well water.

3.5 Inclement Weather

The weather can get pretty hostile in a relatively short amount of time. However, sometimes the weather can just be a passing phenomenon, lasting only a few moments. In the case of extremely bad weather, the best solution is to return to the office and work on other aspects of the project. However, before returning to the office, individuals will want to wait out the weather for a bit and see if it clears up and field work can be resumed. When dealing with the weather, the safety of the surveyors and wellbeing of District equipment are the top priorities.

3.6 Properties Owned by Governing Institutions

On occasion, surveyors may find properties or locations that are owned and managed by local governing bodies. The best way to resolve this situation is to attempt to collect all of the locations or properties owned by the specific governing body and then make contact with that governing body to arrange a formal resolution as soon in the survey period as possible. When dealing with governing institutions, it is best to try completing as much work as possible at one time, because getting time with individuals at these institutions can be difficult—even though they are typically happy to cooperate.

3.7 *Dead Ends*

Due to the nature of the work, there are many ways of collecting the data. Because of this, the only dead ends surveyors will encounter are individuals giving a “hard no” response and the project timeline. Even “hard no’s” can be worked around by leaving a door hanger or attempting to make contact on a different day or speaking with a different person. Also, there will always be respondents who are next to impossible to contact. Efforts to make contact will only end when the project does. Keep track of all the locations for which no method of contact could be found (i.e., no good phone numbers or email address in Springbrook, directory assistance, neighbors, etc.), and give the list to Ryan Lee for future reference.

4. End of Day

There should be a set routine at the end of every day, very much like there should be a set routine at the beginning of every day. Whilst conducting a survey, it may seem that the bulk of the work to be done is out in the field, attempting to contact respondents. However, as should be clear by now, there is more to it than that. There are a few things that should be included in the end of day routine.

4.1 *Return to Office*

Time management is an important skill out in the field. Often times, when conducting field research, one may travel a significant distance away from the office or one may find themselves in a particularly cooperative neighborhood and lose track of time getting caught up in the gathering of results. Either way, it is important to remember to give oneself enough time to make it back to the office on time, before the shift ends. This is important for the following two items.

4.2 *End of Day Recap*

It is best to log one’s notes of the day’s observations as quickly as possible, lest one is likely to forget details. The day’s observations can be anything and everything that happened out in the field that could not be collected in the application. The quantitative side of the project will be managed by the application. The qualitative data really comes from the surveyors of the survey and their observations from the field and their discussions with the respondents. When it

comes to what to note down, anything that seems important or causes one to take notice usually qualifies as worthwhile data. Daily logs should be about a paragraph in length and summarize the daily activities.

4.3 Return Equipment

Despite the personal attachment that can come from using a piece of equipment everyday it is important to remember that the equipment belongs to the District. Since the District owns the hardware, there are District-specific protocols that must be followed with the equipment. It is important to check in any equipment that has been checked out for use at the end of the day.

5. Meetings

Meetings are an essential factor of the project that should happen weekly. Meetings are essential for project coordination and the tracking of progress. Meetings are where any problematic items can be discussed and resolutions for problems can be generated. A meeting may serve the purpose of being a troubleshooting session or a session centered on the qualitative observations from the field. The most important aspect about meetings is that they end with everyone on the team feeling they are on the same page.

5.1 Technical Debrief and Troubleshooting

During the first part of the project, meetings will probably center on technical debriefings and troubleshooting. Team members will want to go to meetings prepared with notes on the issues they are having and locations/properties that need additional attention beyond what the application can provide. And team members will also want to be prepared to articulate their issues as well as they can. As progress continues throughout the project, technical meetings will start to center around alternative methods of project completion and data collection.

When not sorting out technical difficulties and updating progress, meetings will center on qualitative observations from the field. These meetings can be general discussions centered on brainstorming or they can be guided discussions centered on very specific topics. When having a focused meeting, it is best to discuss the topics of the meeting in advance and allow for the team to prepare to discuss that specific topic. A formalized agenda, given in advance, facilitates optimal participation.

