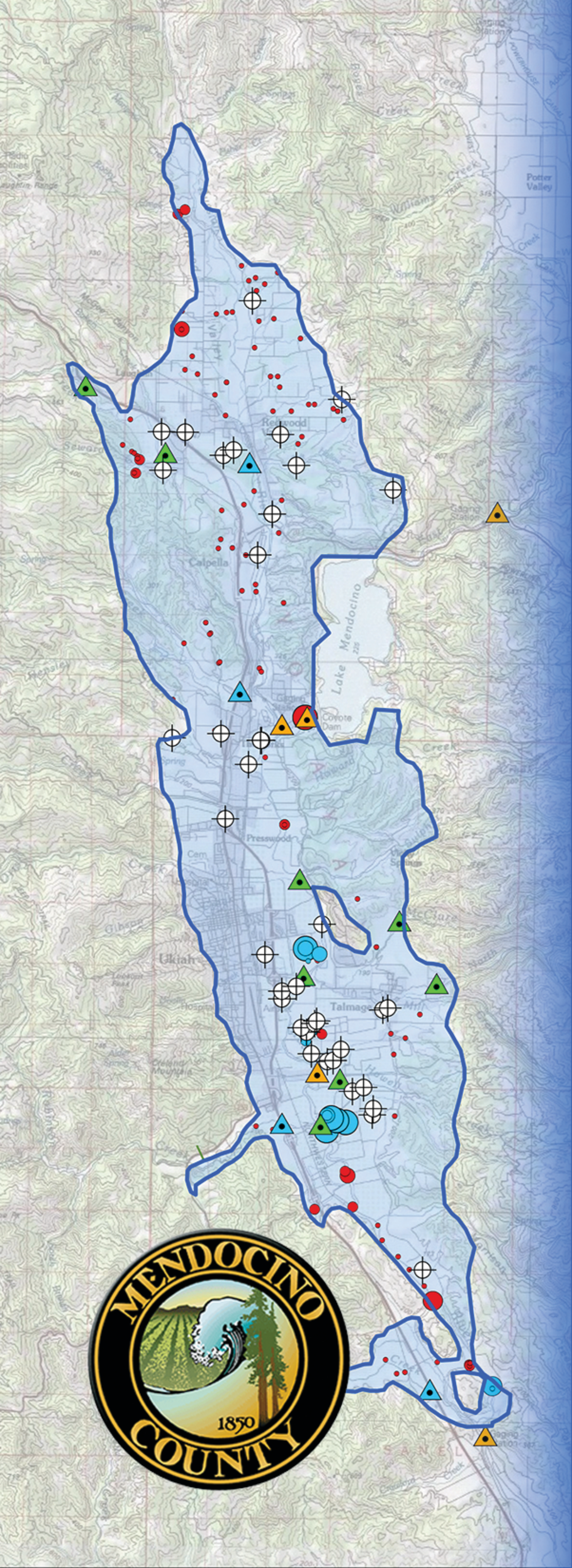

DATA GAP ANALYSIS

Ukiah Valley Groundwater Basin

Initial Groundwater Sustainability Plan

December 2016

Prepared for

Mendocino County Water Agency

DWR Grant No. 4600011503

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1.0 INTRODUCTION

The objective of this data gap analysis is to document existing groundwater and streamflow monitoring efforts, evaluate spatial and temporal data gaps in groundwater and streamflow monitoring networks, and identify new locations to increase groundwater and surface water monitoring data density for the Ukiah Valley Groundwater Basin (UVGB). The primary hydrogeologic concern in the UVGB per the Sustainable Groundwater Management Act (SGMA) is depletion of surface water flows from groundwater extraction. The basin is not adjacent to the ocean and therefore has no risk of saltwater intrusion. The basin is expected to fully recharge in years with normal precipitation and therefore is not expected to be at risk for chronic declines in groundwater levels or excessive depletion of storage (some depletion of storage is inevitable before recharge or discharge can be captured (Bredehoeft, 1982)).

The medium priority of the basin was selected by the Department of Water Resources (DWR) based on 8 factors. The UVGB received an adjusted ranking value of 15.8; approximately 18% above the medium-low priority threshold. The greatest contributions were the number of public supply wells, the total wells per square mile, and the amount of irrigated acreage. An additional point was given based on the assertions that the State Water Resources Control Board (SWRCB) made dictating that the entire groundwater system in the UVGB is underflow of the Russian River; which is regarded as river flow and therefore supports endangered salmonid species. While no salmonid kills have occurred in the UVGB since the construction of Coyote Dam and Lake Mendocino, excessive diversion activities in the basin could reduce flows that could strand salmon downstream.

Underflow wells are not included in SGMA regulations because they are considered surface water diversions. Wells pumping water in the river-channel deposits (Qrc) (Exhibit 1) are generally considered underflow wells; however there is variability in SWRCB classifications. River-channel deposits are described as largely coarse sand and gravel that has the greatest permeability in the UVGB geology.

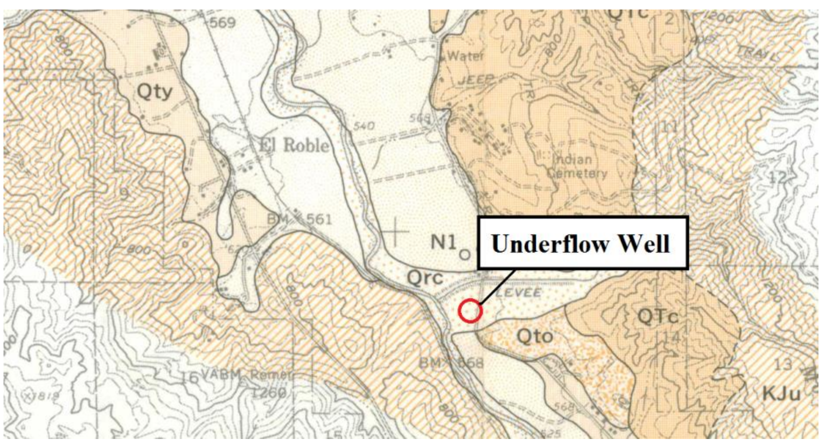

Exhibit 1: Underflow Well in River-Channel Deposit Geology (Qrc) (USGS, 1956)

Groundwater and surface water are often hydraulically connected in alluvial valleys. Water flows back and forth through the streambed depending on the hydraulic gradient between the two systems. Groundwater flows into a gaining stream when the hydraulic head elevation is greater than the adjacent stream stage, and groundwater flows out of a losing stream when the stream stage is greater than the adjacent hydraulic head (Exhibit 2).

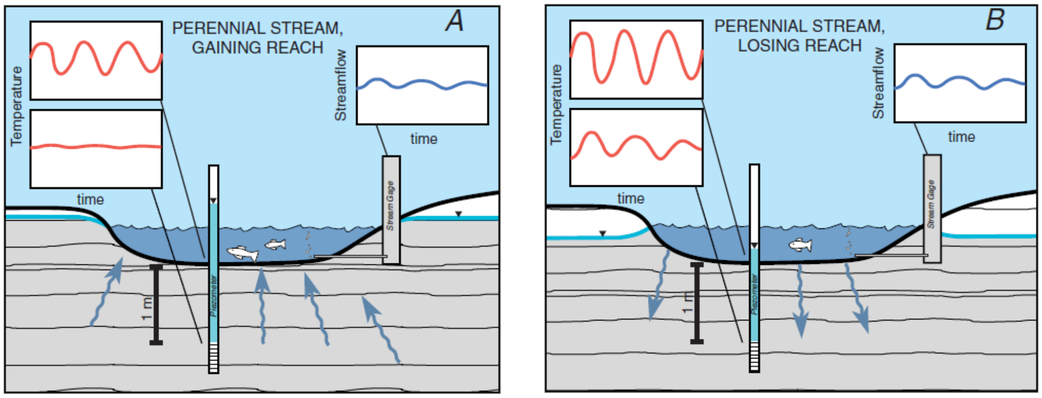

Exhibit 2: Gaining Streams versus Losing Streams (USGS, 2003)

Gaining and losing conditions may occur in the same stream segment at different times, or for stream segments that are in close proximity to each other at the same time. Cool groundwater discharge to streams and rivers as baseflow is important in maintaining quality fisheries and wildlife habitat. Groundwater pumping either captures groundwater that would contribute to surface water flows or affects the rate at which surface water recharge groundwater systems. Gravels, sands, and clays are present in the regions along the Russian River in the UVGB, and The effect of pumping is a function of the distance between the well and the river, well depth and well screen intervals, and the presence of high permeability subsurface strata like boulders, cobbles, gravels, and sands. Groundwater extraction from deeper wells is likely to have less impact on surface water flows when clay layers are present.

The hyporheic exchange between surface water and groundwater is a challenging hydrogeologic process to quantify. Comparing stream stage and hydraulic head in nearby observation wells provides insight to the magnitude of the hydraulic gradient and the direction of the hyporheic flux. Groundwater and stream temperatures can be used to identify the hyporheic exchange of water and the energy budget can be used to quantify groundwater discharge to streams. Characterization of the streambed hydraulic conductivity is essential in estimating the hydraulic flux between the two hydrologically connected water resources. Heat tracers were used in conjunction with mathematical models to estimate streambed conductivities and quantify hyporheic interactions in case studies for the Middle Rio Grande Basin near Albuquerque, New Mexico, on the Russian River between Healdsburg and Forestville, California, on the Santa Clara River near Los Angeles, California, on the Willamette River near Salem, Oregon, on Trout Creek near Lake Tahoe, California, and on Rillito Creek near Tucson, Arizona (USGS, 2003). Coupled energy transport and groundwater flow models VS2DH and SUTRA were recommended in conjunction with the parameter estimation system PEST to solve for the optimal streambed and geologic hydraulic conductivity values; yielding estimates for hyporheic fluxes. Forward-looking infrared (FLIR) images from aircraft were also used to quantify groundwater discharge to Cottonwood Creek in Plumas National Forest (Loheide and Gorelick, 2006).

In this analysis, data gaps are determined based on proximity to the Russian River and its tributaries, and the overall spatial and temporal density of groundwater monitoring and streamflow gauging data. New streamflow gauge locations are proposed based on quantifying measurable objectives of the Initial Groundwater Sustainability Plan (GSP), e.g. placing additional streamflow gauges near wells that are expected to extract large quantities of water during frost protection events in the spring. Frost protection regulations were implemented by the SWRCB due to a fish stranding mortality event in 2008 that occurred south of the UVGB boundary near Hopland. Increased monitoring of groundwater and surface water levels can provide insight to the effectiveness of SWRCB regulation and relate the impacts of frost protection events to the potential for reducing salmonid habitat quality. Approximately 68,600 AFY and an instantaneous maximum withdrawal of 1,540 cubic feet per second (cfs) are apportioned for frost protection pumping in legal surface water and underflow well diversions through the SWRCB (SWRCB, 2016). The impacts that underflow wells have on the piezometric surface on the ability for groundwater wells to extract during frost protection events must be addressed to create new regulations.

Currently, 38 wells are included in the California State Groundwater Elevation Monitoring (CASGEM) system. Areas of low CASGEM well density are identified for development of new monitoring wells and existing wells that can be integrated into the CASGEM network are identified based on Department of Water Resources (DWR) well completion reports provided to the Mendocino County Water Agency (MCWA). In addition to the CASGEM wells, four wells are managed by the DWR, and over 400 wells have data in the GeoTracker system from 1999 to 2016 (GeoTracker, 2016).

2.0 SURFACE WATER MONITORING BACKGROUND

The Russian River meanders for 33 miles through the UVGB. The sum of the lengths of the tributaries to the Russian River within the UVGB boundary is 123 miles. Some streams run seasonally, and in some cases streamflow percolates into the subsurface once it reaches the recent alluvium of the Russian River. Russian River flows are controlled by Sonoma County Water Agency for water supply storage and the U.S. Army Corps of Engineers for flood protection at Coyote Dam (Coyote Dam created Lake Mendocino in 1959). Lake Mendocino has a maximum capacity of 118,000 acre-feet with a water supply capacity of 70,000 acre-feet (SCWA, 2016). The Russian River has drained 362 square miles upon arrival at U.S. Geological Survey (USGS) Gauge 11462500 RUSSIAN R NR HOPLAND CA which is roughly 800 feet south of the UVGB boundary. Since 1940, the average flow rate of the Russian River is 678 cfs. The Russian River Channel Improvement project by the U.S. Army Corps of Engineers during the 1950's and 1960's caused entrenchment of the Russian River; decreasing the elevation of the river's surface and increasing the erosion potential. The construction decreased the width of the flood plain and created a trapezoidal channel through the Ukiah Valley According to the Russian River ISRP, channel entrenchment decreases groundwater elevations that consequently cause tributary flows to go subsurface due to a greater hydraulic gradient between the Russian River stage and the tributary stage after the toe of slope between the bedrock and the alluvium geology (Russian River ISRP, 2016).

Currently, there are ten streamflow gauges in the UVGB (Figure 1). The USGS has three streamflow gauges on the Russian River within the UVGB boundary located south of Talmage and on the forks of the Russian River just before the confluence near Coyote Dam. There are also USGS gauges outside of the UVGB upstream of Lake Mendocino and near Hopland. USGS data has been collected since the early 1900s. NOAA has National Marine Fisheries Service (NFMS) gauges on the west branch of the Russian River, York Creek, Robinson Creek, and McNab Creek. California Land Stewardship Institute (CLSI) has three gauges on McNab Creek.

Contributions to the Russian River north of Redwood Valley consist of flows from Rocky Creek and approximately twenty minor tributaries according to the USGS hydrography dataset (Exhibit 3) (USGS, 2016). Forsythe Creek collects flows from approximately 44 square miles in the watershed along Highway 101 towards Willits and the sub-watershed directly to the south. The Russian River picks up flows from seven minor tributaries as it winds through Calpella along the west bank of Lake Mendocino and receives an additional 11 square miles of runoff from York Creek prior to the confluence with the Russian River East Branch flowing from Coyote Dam.

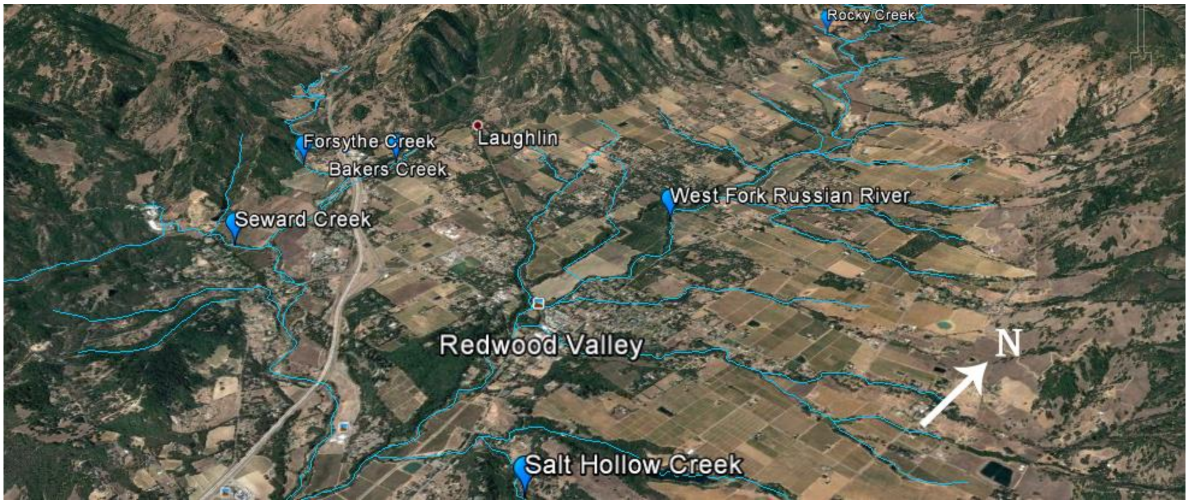

Exhibit 3: Russian River Tributaries North of Redwood Valley (Google Earth, 2016)

York Creek has a NFMS gauge in the alluvial plain before the confluence with the West Branch of the Russian River. Two USGS gauges, 11462000 EF RUSSIAN R NR UKIAH CA and 11461000 RUSSIAN R NR UKIAH CA, are located just before the confluence of the two branches and have data dating back to 2007. South of the confluence, the Russian River receives flow contributions from Hensley Creek, Howard Creek, Ackerman Creek, Sulphur Creek, Orrs Creek, and two minor tributaries prior to flowing adjacent to the city of Ukiah (Exhibit 4). York Creek is the only tributary that currently has a streamflow gauge in the middle Ukiah Valley reach of the Russian River. Ackerman Creek drains approximately 16 square miles of watershed and Orrs Creek drains roughly 8 square miles.

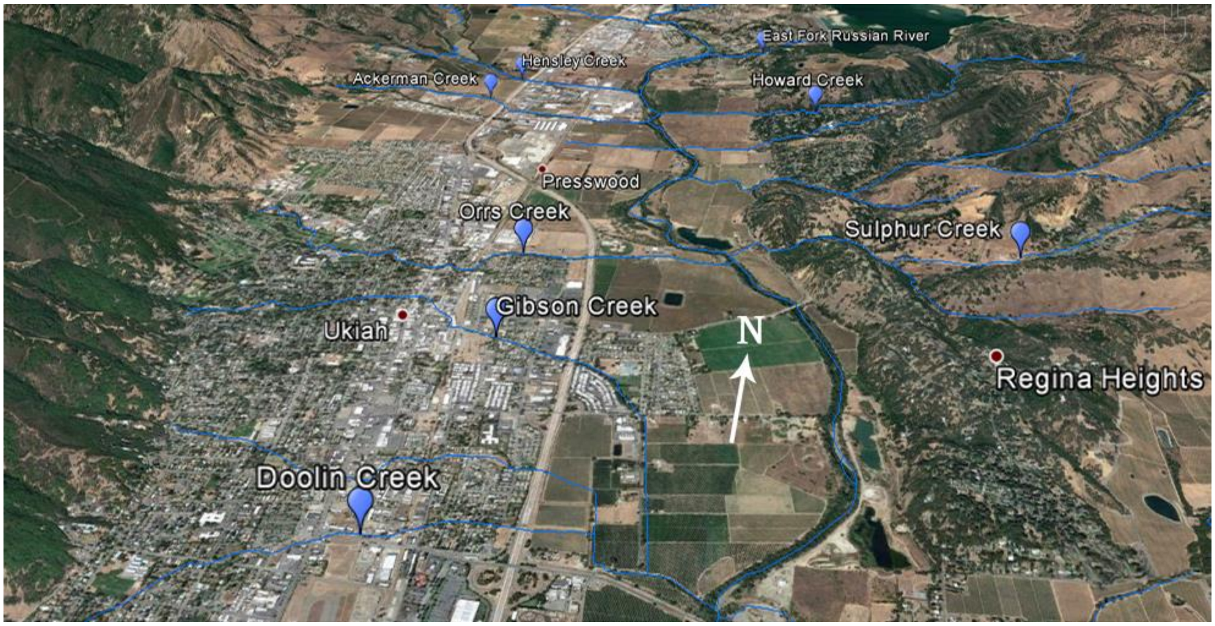

Exhibit 4: Russian River Tributaries near Ukiah (Google Earth, 2016)

Based on spatial analysis in ArcGIS®, streams in the region north of Talmage have less than five square miles of contributing watershed area. The tributaries contributing from the hills of the eastern component of the valley into the Talmage area drain the steep topography of Cow Mountain and Red Mountain. The eastern tributaries include McClure Creek, Mill Creek, Howell Creek, Morrison Creek, and six unnamed tributaries that are expected to receive contributing flows from less than five square miles (Exhibit 5).

Exhibit 5: Russian River Tributaries East of Talmage (Google Earth, 2016)

Robinson Creek drains over 20 square miles of watershed west of Talmage and parallels two minor tributaries south of Talmage near El Roble. NFMS has one streamflow gauge on Robinson Creek roughly one-half mile into the alluvial valley from the mountain-valley toe-of-slope. The final main contributing tributary, McNab Creek, is located in the southern component of the UVGB near Hopland and contains three California Land Stewardship Institute (CLSI) gauges and one NMFS gauge. McNab Creek contributes runoff from approximately 12 square miles to the Russian River.

3.0 UKIAH VALLEY GROUNDWATER MONITORING BACKGROUND

Groundwater monitoring data for 38 wells is obtained biannually at California State Groundwater Elevation Monitoring (CASGEM) wells, during the spring and fall. Tabular information describing the CASGEM wells is provided in Appendix C. Roughly 71 groundwater monitoring wells are currently active for environmental remediation projects according to the GeoTracker website (SWRCB, 2016). Three additional monitoring wells are currently being monitored biannually by the DWR, and one is offline as of 2011. Hydraulic head data is usually acquired in March, April, or May and in October or November.

The Mendocino County Water Agency (MCWA) began involvement in groundwater resources in 1993 by contracting with the USGS to conduct groundwater monitoring in Redwood Valley as part of a groundwater resources reconnaissance project and to identify a possible location for a surface reservoir for the valley. The MCWA started collaborating with the Mendocino City Community Services District (MCCSD) and Redwood Valley Community Water District (RVCWD) after the passage of SBX 7.6.

No groundwater basins within Mendocino County have created a Groundwater Management Plan prior to the development of this Initial Groundwater Sustainability Plan. The primary groundwater studies or actions are the following:

- "Bulletin No. 62 – Recommended Water Well Construction and Sealing Standards – Mendocino County." Department of Water Resources Planning. 1958.
- "Geology and Ground Water in Russian River Valley Areas and in Round, Laytonville, and Little Lake Valleys – Sonoma and Mendocino Counties, California." G.T. Cardwell, U.S. Department of the Interior, Geological Survey. 1965.
- "Dry Year Groundwater Monitoring Program Groundwater Level and Quality Evaluation, Mendocino County, California", Department of Water Resources, Division of Integrated Regional Water Management, Memorandum Report, by Chris Bonds, 2011.
- "Ground-Water Resources in Mendocino County, California", by C. D. Farrar, U.S. Geological Survey, Water Resources Report 85-4258, 1986.
- "Water Supply Assessment for the Ukiah Valley Area Plan." Mendocino County Water Agency. October 20, 2010.
- California Groundwater Bulletin 118.

In October 2014, the Mendocino County Resource Conservation District (MCRCD) started incorporating Ukiah Valley wells into the CASGEM system under contract with the MCWA. Initially, advertisements were placed in local newspapers that requested well data contributions from local residents and farmers. In addition, a cold-call list was developed by the MCWA and MCRCD of potential well owners that would be willing to contribute and they were contacted. Recently, advertisements have been placed in the Farm Bureau and MCRCD newsletters. Other well owners have added their wells to the CASGEM network after being contacted through word of mouth.

Currently there are 38 monitored CASGEM wells in the UVGB. Of the 38 well datasets, 14 wells have 1 data point, 1 well has 2 data points, 7 wells have 3 data points, 15 wells have 4 data points, and 2 wells have 5 data points. Four DWR wells have over 75 points of data (Figure 2). Wells are primarily dispersed on the south side of the city of Ukiah along the river, distributed throughout Redwood Valley, and near Highway 101 north of Ukiah.

In addition to the CASGEM and DWR monitoring programs, the SWRCB has an online data management system for groundwater remediation projects called GeoTracker (SWRCB, 2016). There were a total of 433 monitoring wells within the UVGB boundary for 36 environmental remediation projects. The groundwater monitoring data included 6,546 data points between 1999 and 2016. Some monitoring wells had multiple latitude, longitude, and elevation surveys provided, and the most recent information was used in spatially databasing well locations.

4.0 PROPOSED STREAMFLOW GAUGE NETWORK

4.1 Existing Gauges

One existing NMFS streamflow gauge, located north of the intersection between Highway 101 and Cox Schrader Road on Robinson Creek, is surrounded by vineyards and could provide an indication of the impacts of frost prevention groundwater extraction on tributaries. Similarly, south of McNab Ranch Road, the McNab Creek NFMS streamflow gauge and CLSI Gauge 1A are located near vineyards and agricultural wells. USGS Gauge 11462080 near Talmage is located near the expected highest concentration of agricultural wells.

4.2 New Streamflow Gauges

New streamflow gauges are proposed south of Ukiah near Talmage. Three streamflow gauges are proposed on the Russian River, and three are proposed on its tributaries: McClure Creek, the north fork of Mill Creek, and on Howell Creek in vineyard areas without close proximity to ponds. Surface water gauges are given names SFG for surface water gauge and denoted with RR for Russian River or AG for agriculture. Figure 3 depicts the locations of the proposed surface water gauges. Surface water gauges should be fit with a temperature sensor to aid in the quantification of hyporheic fluxes.

Gauge 11462080 is approximately a half mile from proposed streamflow gauge AG-SFG-1 and is across the river from the wastewater treatment plant. Gauges 11462080 and AG-SFG-1 should be able to demonstrate variability in stage during frost prevention pumping events if frost prevention pumping has an adverse impact on surface water flows. Both gauges are also approximately one mile from the nearest recharge or irrigation pond on the east side of the river to minimize hydraulic head increases from those sources.

Several tributaries south of Lake Mendocino were assessed for proximity to vineyards and agricultural pumps including Mill Creek and its North Fork, McClure Creek, Howard Creek, and Howell Creek. Streamflow monitoring station AG-SFG-1 is recommended downstream of the confluence of an unknown tributary and Howell Creek near the intersection of Ruddlick Cunningham Road and Howell Creek Road (Figure 3). Howell Creek drains roughly 8.5 square miles of watershed. Tributary monitoring gauges AG-SFG-1, AG-SFG-2, and AG-SFG-3 are placed in vineyard areas that do not have close proximity to surface water or underflow diversions, ponds, or existing streamflow gauges where frost protection is expected to take water from groundwater sources. AG-SFG-2 is located on McClure Creek and drains approximately 5.1 square miles. AG-SFG-3 is located on the North Fork of Mill Creek and drains approximately 4.7 square miles. These streamflow gauges are expected to be seasonal and will only provide data during the wet season.

Diversions with water rights were extracted from the Electronic Water Rights Information System (eWRIMS) online database (SWRCB, 2016). Both underflow and surface water diversions were exported into ArcGIS and clipped for the UVGB. Diversions not including Frost Protection were removed from the analysis. The largest cluster of underflow wells is located one mile southwest of Talmage (Figure 3). Three new stream gauges (RR-SFG-1, RR-SFG-2, and RR-SFG-3) are proposed to provide better correlation between underflow well extractors, nearby CASGEM monitoring wells, groundwater extraction wells, and the river stage (Figure 3). In addition, the streamflow gauges can provide higher quality data for observing the impacts of frost protection pumping by comparing the flows upstream of underflow extraction and flows downstream of extraction. Underflow wells are not regulated by SGMA, but their impacts will need to be analyzed in order to quantify impacts of groundwater pumping from non-underflow wells on the Russian River and the tributary systems. River discharge to groundwater or vis versa can be estimated by taking advantage of the absence of contributing flows from tributaries in the reach between RR-SFG-1 and RR-SFG-2 and comparing the minute changes in flow rate between the two gauges. Underflow diversions between RR-SFG-1 and RR-SFG-2 allow maximum flows of 2.2 cfs approximately 50 feet from the river and 10.8 cfs approximately 1,400 feet from the river. The maximum allowable flows from the underflow well field adjacent to RR-SFG-3 are described in Table 1.

Table 1: Underflow Wells near Proposed Streamflow Gauge RR-SFG-3

Maximum Allowable Diversion (cfs)	Distance to River (ft)
8.3	110
2.2	900
8.3	1,035
8.3	1,308
8.3	1,900

The Russian River flows at streamflow gauge USGS 11462080 can be compared to RR-SFG-3 to quantify the impacts of frost protection extraction during frost events. Average stage and discharge for March, April, and May at USGS gauge 11462080 are described in Table 2.

Table 2: Average Spring Discharge at USGS Gauge 11462080 near Talmage

Month	Stage (ft)	Discharge (cfs)
March	7.16	1,225.89
April	5.69	372.28
May	4.84	152.63

Variations in downstream flow in proposed streamflow gauges from the USGS streamflow gauge 11462080 can be compared at 15-minute intervals during future frost protection events. The Russian River discharge-stage curve is demonstrated in Appendix D and is used to correlate river stage with discharge. Uncertainty in the amounts of pumping during frost protection events, the effects of underflow well frost protection extraction, the amounts of surface diversions, and riparian evapotranspiration generates difficulties and decreases the validity in evaluating the impacts of non-underflow groundwater pumping. These additional streamflow gauges will provide higher data density and will enhance the understanding of groundwater extraction for frost protection.

5.0 PROPOSED GROUNDWATER MONITORING NETWORK

5.1 Existing Wells

Incorporating existing wells into the CASGEM system is a cost-effective alternative to developing new monitoring wells. The DWR provided well completion reports for 2,490 wells in the Ukiah Valley area to the MCWA. The majority of the wells serve domestic water supply purposes and monitoring from groundwater remediation projects. Remediation, injection, and agricultural wells are less common in the data set. The well completion reports also demonstrate a large number of destroyed wells that are assumed to be destroyed due to completion of the remediation project and are backfilled with Portland cement. Existing residential, agricultural, and existing monitoring wells could be introduced into the CASGEM monitoring network with owner permission. The MCRCD will be in charge of contacting existing well owners based on addresses of well owners from DWR well completion reports with approval from the MCWA. The wells will be selected based on proximity to surface water and distance to nearby streamflow gauges in areas of low CASGEM well density. Three wells were identified in Talmage, in addition to nine wells east of Talmage based on DWR well completion reports. In addition to the twelve wells near Talmage, three wells were identified near Presswood, three near Calpella, twelve in Redwood Valley, two near Robinson Creek, and three near McNab Creek that could be incorporated into the CASGEM monitoring network.

CASGEM Well Ukiah Valley-26 is a good candidate for high temporal resolution data. The well was once an agricultural well but has been decommissioned and has no pump. The diameter of the well is 12 inches and would be easy to incorporate monitoring systems to report groundwater and temperature data.

5.2 New Groundwater Monitoring Wells

Additional groundwater monitoring will fill data gaps and aid in the characterization of long-term groundwater hydrology. Higher spatial and temporal data density in groundwater and underflow well data points in the River-Channel deposits geology will assist in estimating surface water-groundwater interaction. Potential locations for new groundwater monitoring wells are highlighted in orange (Figure 2). Telemetric monitoring data for groundwater wells near the river can provide real-time data to estimate the hyporheic exchange between groundwater and surface water. Temperature data should be obtained in addition to hydraulic head measurements to compare to temperature profiles in the Russian River and its tributaries. Placement of wells near the heavily irrigated region south of Talmage and near El Roble will provide insight related to the impacts of frost prevention irrigation, but additional information regarding the number of groundwater extractors and their respective extraction rates should be acquired to determine where heavy agricultural pumping occurs.

Higher resolution data for monitoring wells, for instance 15-minute data, for groundwater monitoring wells is expected to enhance the understanding of frost protection extractions through comparison with streamflow or river gauge data. It is recommended that at least one well with a dedicated telemetric pressure transducer and temperature sensor be placed near streamflow gauge AG-SFG-1. The sensitivity in stage and groundwater level data is important in the interpretation in the results, because the impacts of pumping wells may decrease the hydraulic head near the river only slightly depending on the distance between the wells and the river. The sensitivity in streamflow data is to the hundredth of a foot, but the magnitude of streamflow stage decreases from frost protection pumping is currently unknown for the UVGB.

6.0 TEMPORAL DATA GAPS

Groundwater monitoring data for the UVGB is limited to the four DWR monitoring wells prior to 1999, but increased dramatically with GeoTracker and CASGEM head measurements until the early 2010's. GeoTracker groundwater monitoring began in 1999 and contributes data to this day; however the amount of groundwater monitoring data submitted to GeoTracker has declined by 87% since 2012, and will continue to decline as environmental sites are closed. The number of wells in the CASGEM program, facilitated by MCRCD for the MCWA, grew by 200% from 2014 to 2015 and 39 data points have been obtained year to date in 2016. The fall CASGEM data has not been added to the groundwater elevation database and is expected to double the number of data points for 2016. Exhibit 6 demonstrates data density for the UVGB.

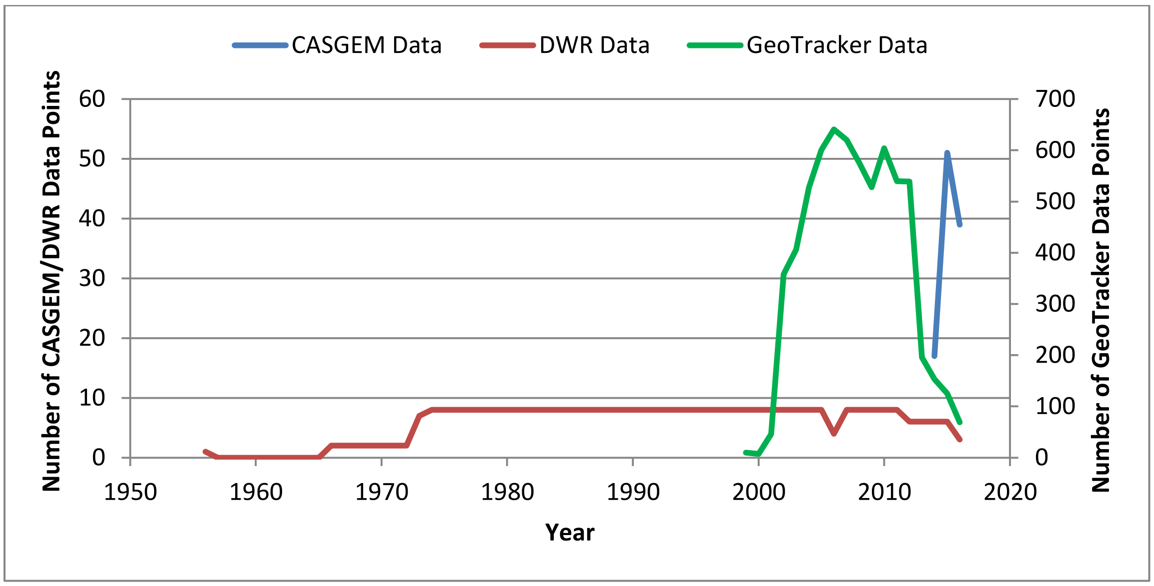

Exhibit 6: Temporal Groundwater Monitoring Data Density

Additional groundwater data can be obtained from farmers with wells that serve irrigation purposes. Pumping efficiency reports provide depth to water prior to pumping and the drawdown in the well during pumping. This information can both bolster past groundwater monitoring data and provide insight to estimating hydraulic conductivity and storativity values for the local region that are required in the development of a hydrogeologic conceptual model. LACO Associates, on behalf of the MCWA, has drafted a letter and a well information data request form for agricultural groundwater extractors. The documents were presented to the agricultural community at a Farm Bureau meeting on December 1st, 2016 in Ukiah. The data request forms ask for information about well depth, well diameter, screened intervals, pump types, locations, pumping efficiency test results, monthly flow rates, and monthly hydraulic head information. The letter and data request forms are presented in Appendix E.

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APPENDIX A – FIGURES

Figure 1: UVGB Existing Surface Water Gauging Network

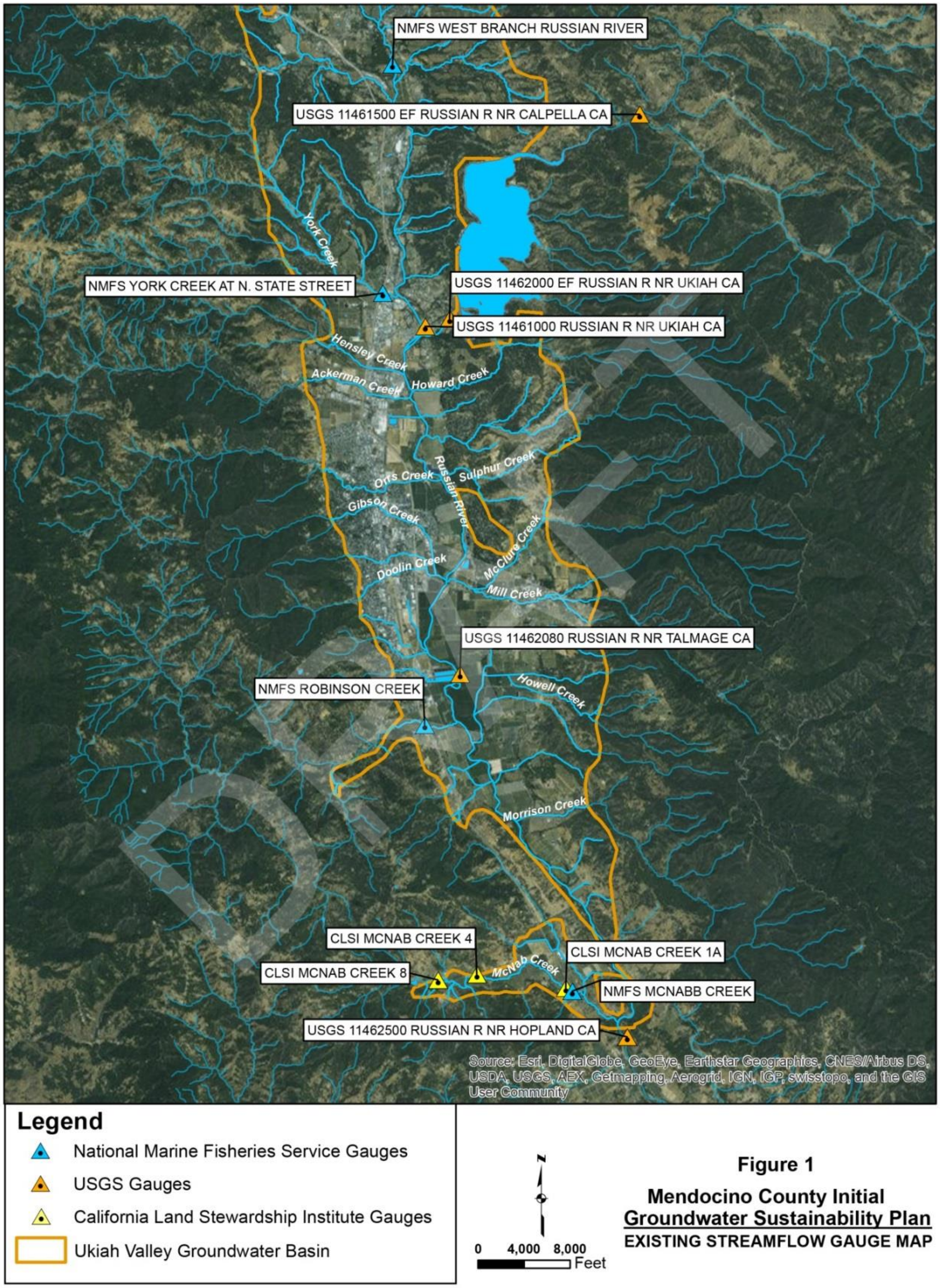

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Figure 2: Current UVGB Groundwater Monitoring and Data Gap Map

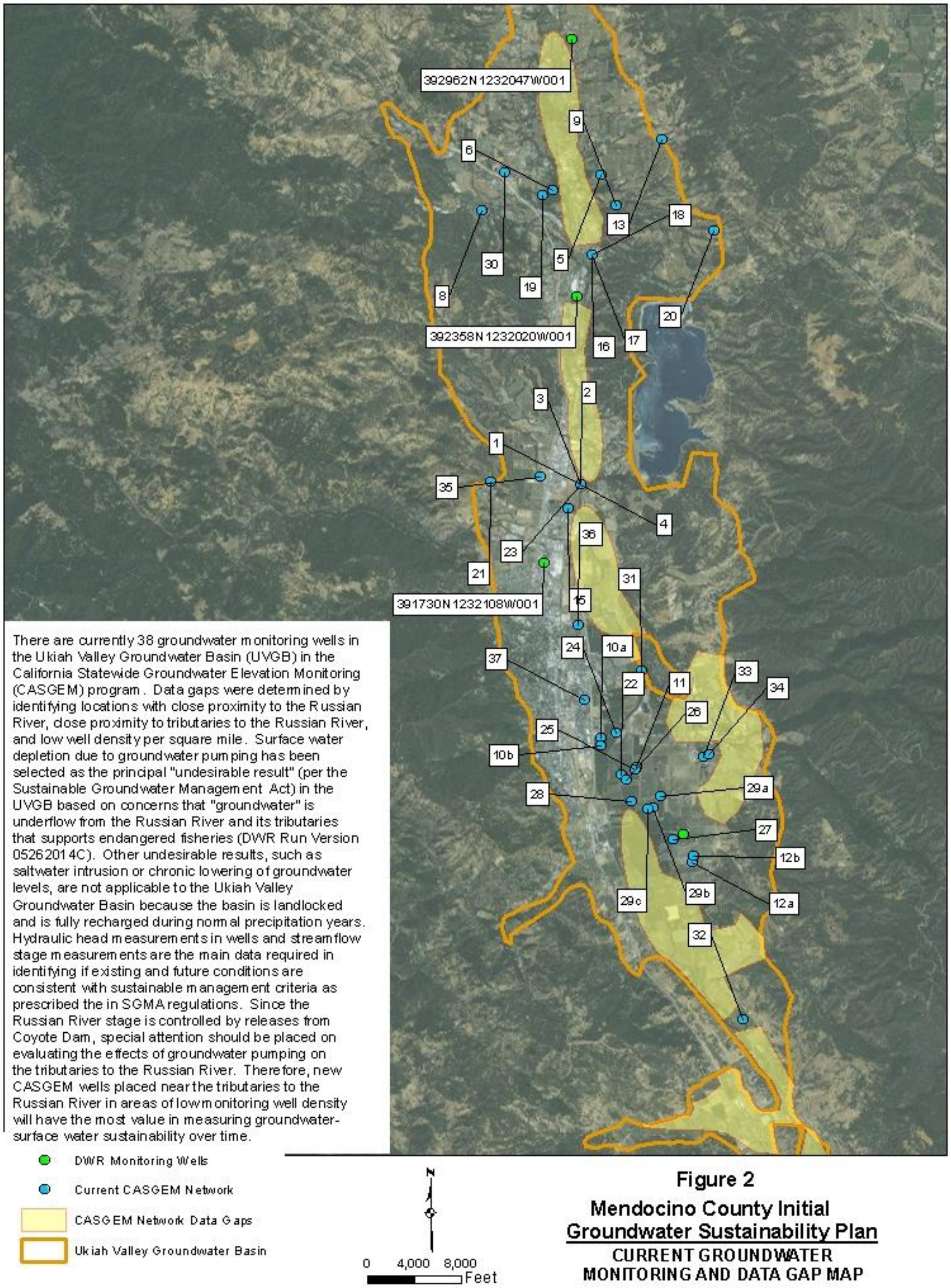

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Figure 3: Proposed Streamflow Gauge Map

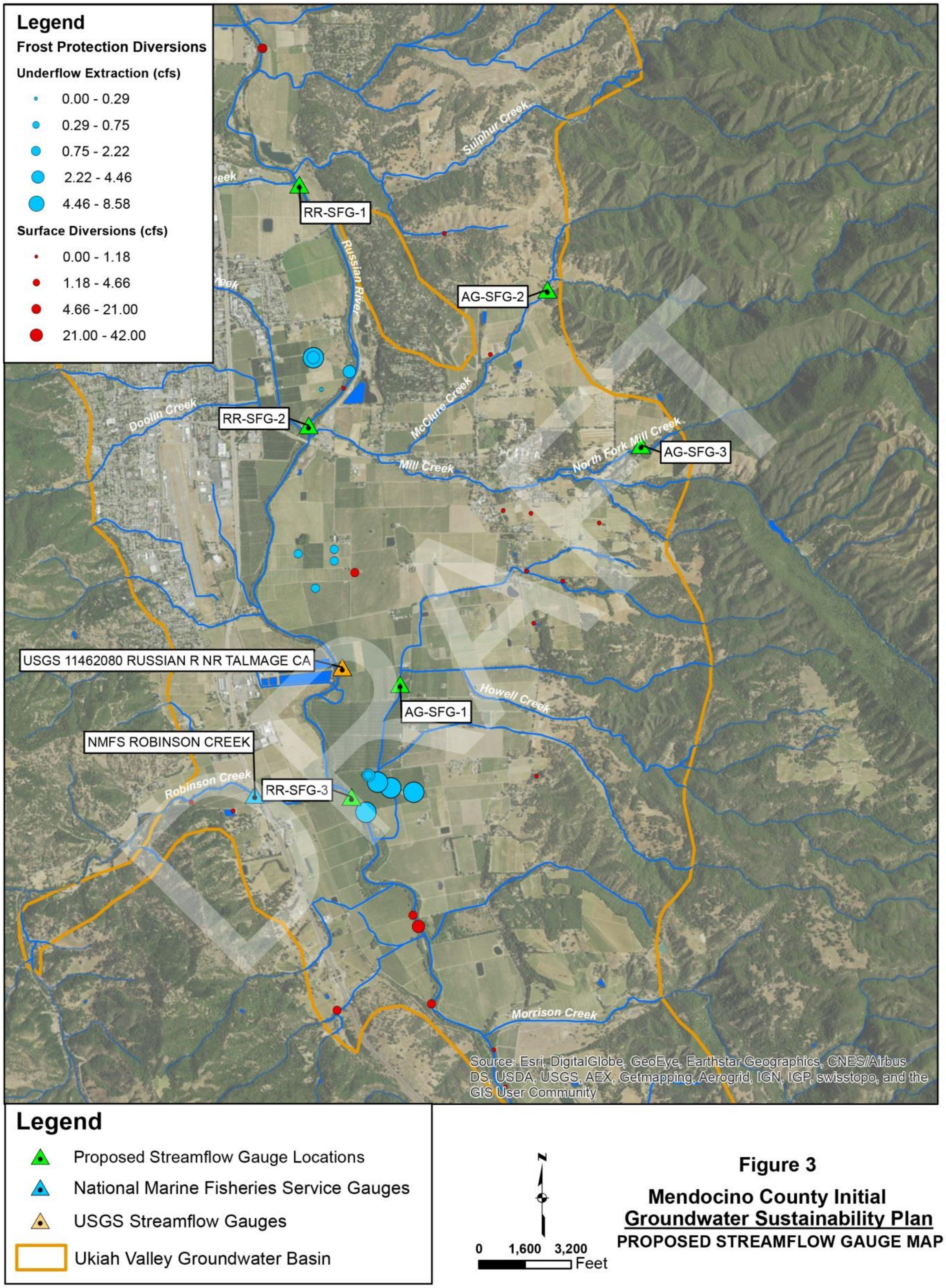

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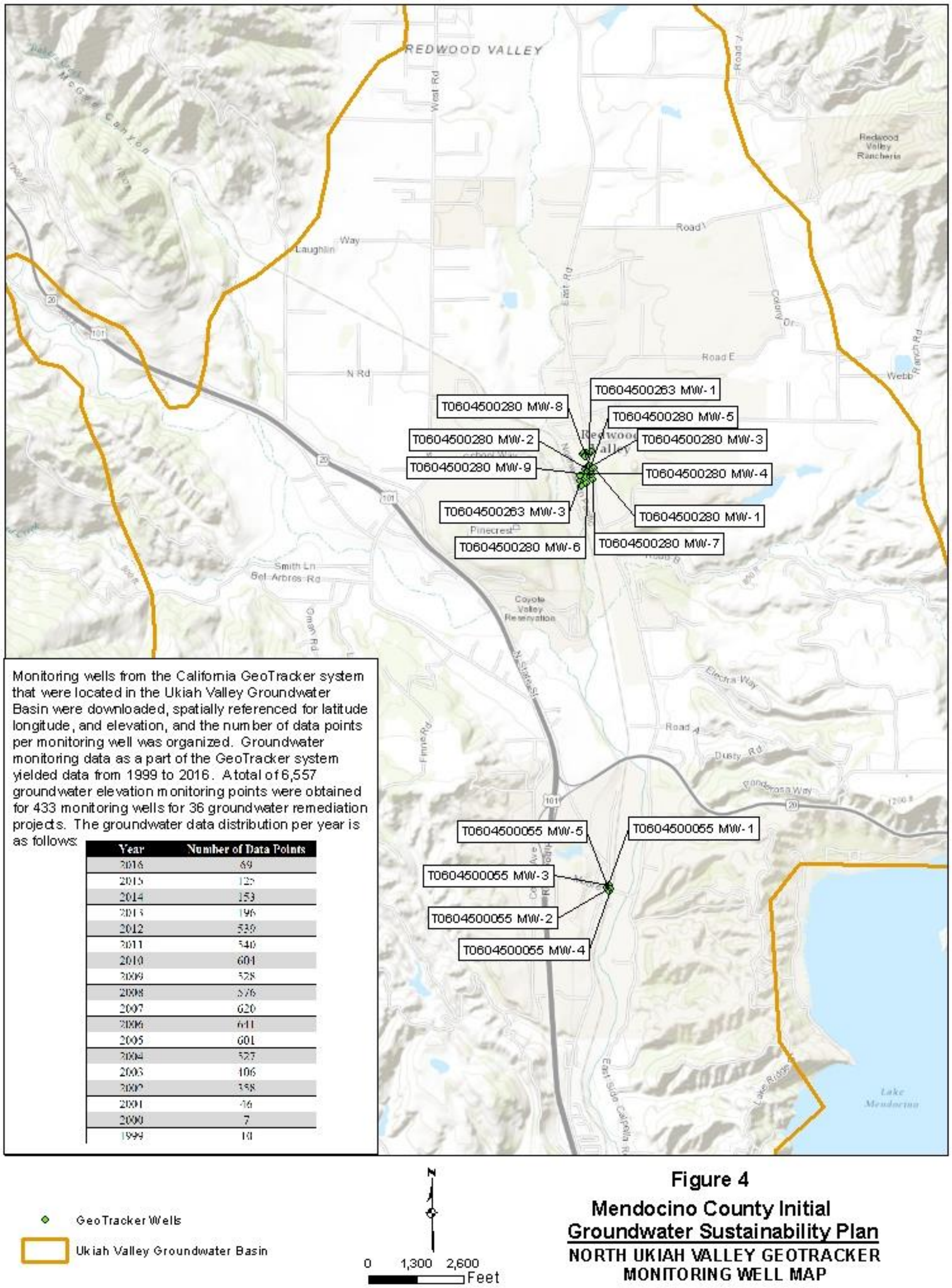
Figure 4: North UVGB GeoTracker Monitoring Well Map



Year	Number of Data Points
2016	69
2015	125
2014	153
2013	196
2012	539
2011	540
2010	604
2009	528
2008	576
2007	620
2006	641
2005	601
2004	527
2003	406
2002	358
2001	46
2000	7
1999	10

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Figure 5: Central UVGB GeoTracker Monitoring Well Map

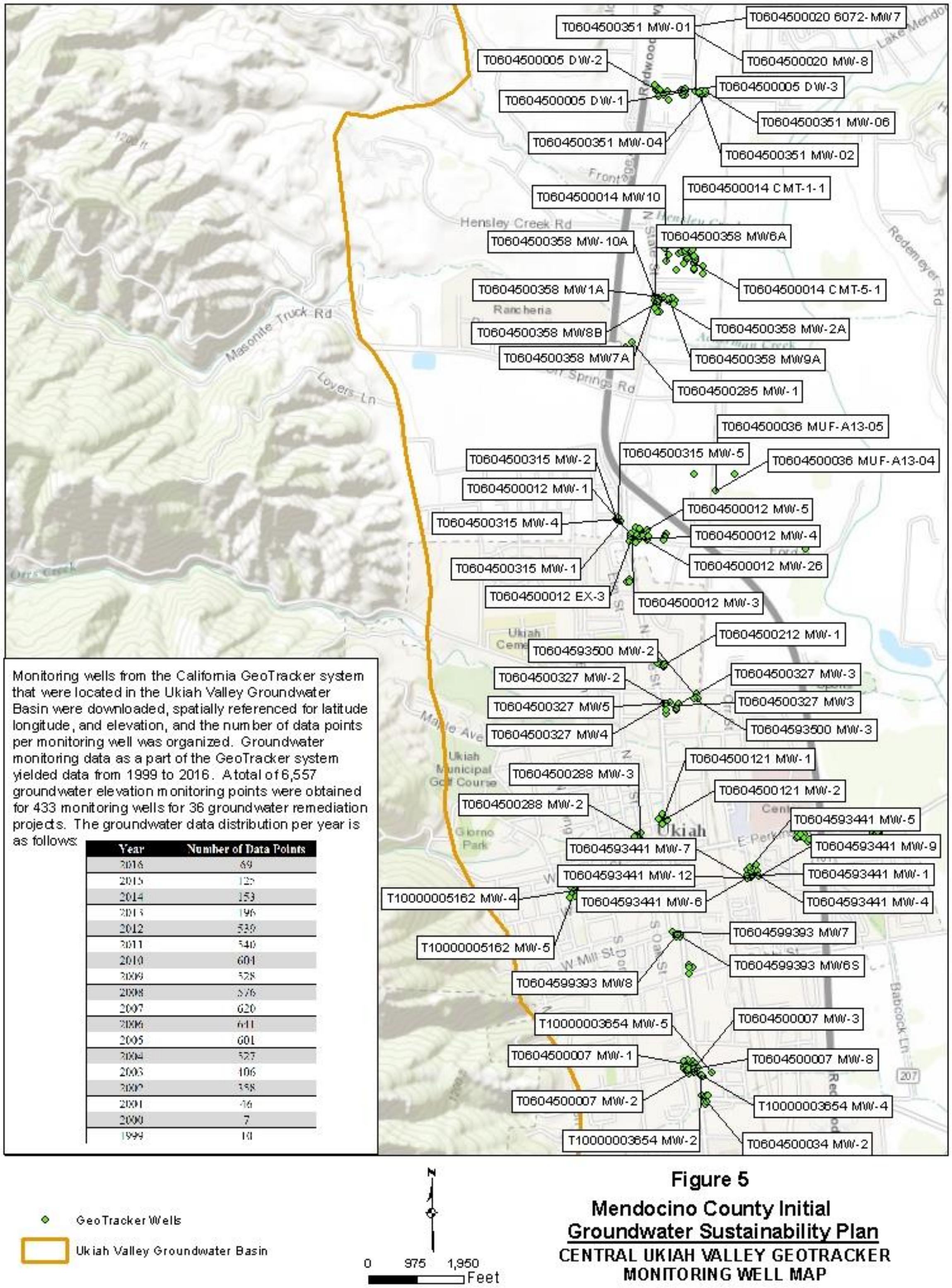

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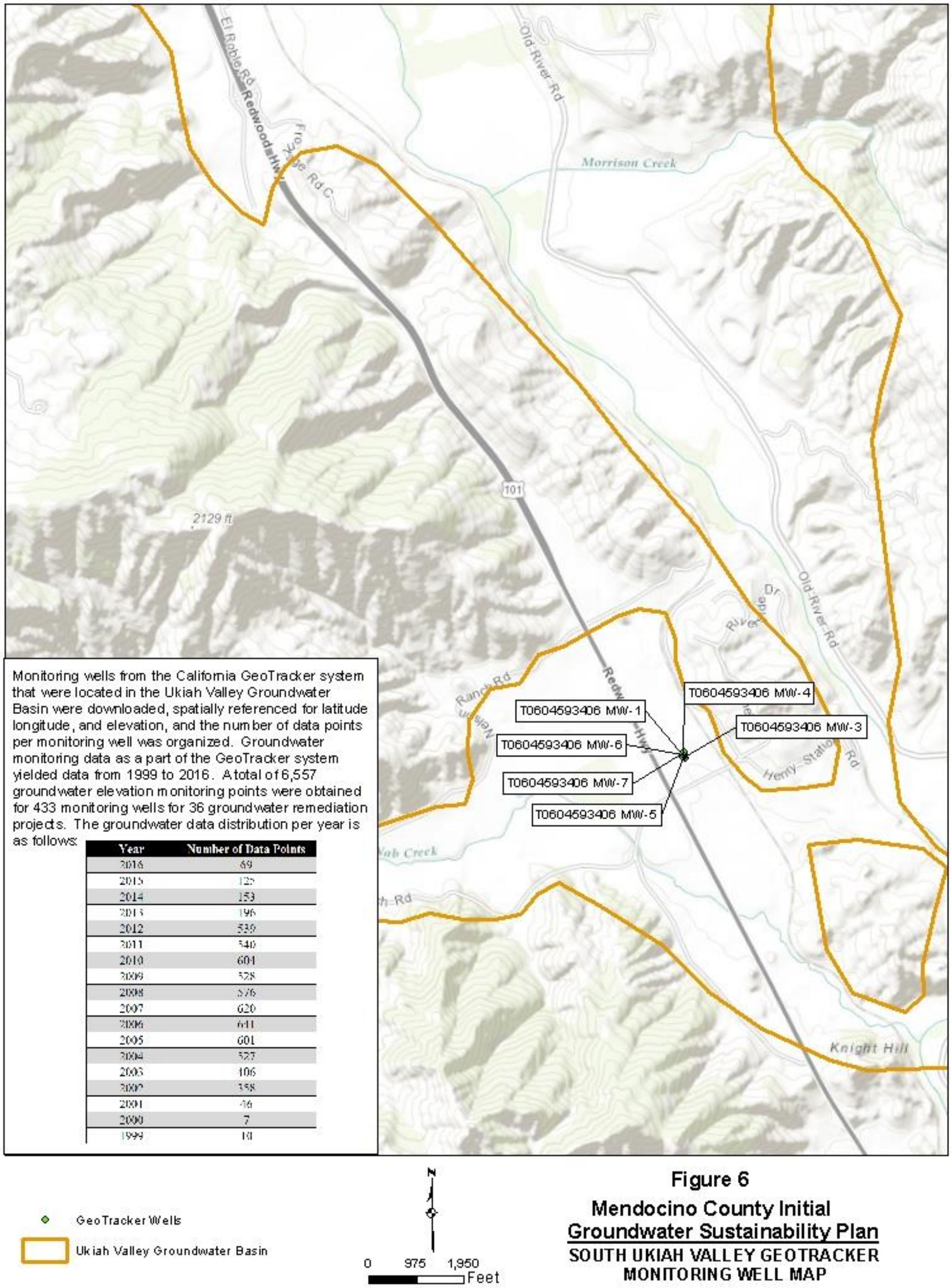
Figure 6: South UVGB GeoTracker Monitoring Well Map



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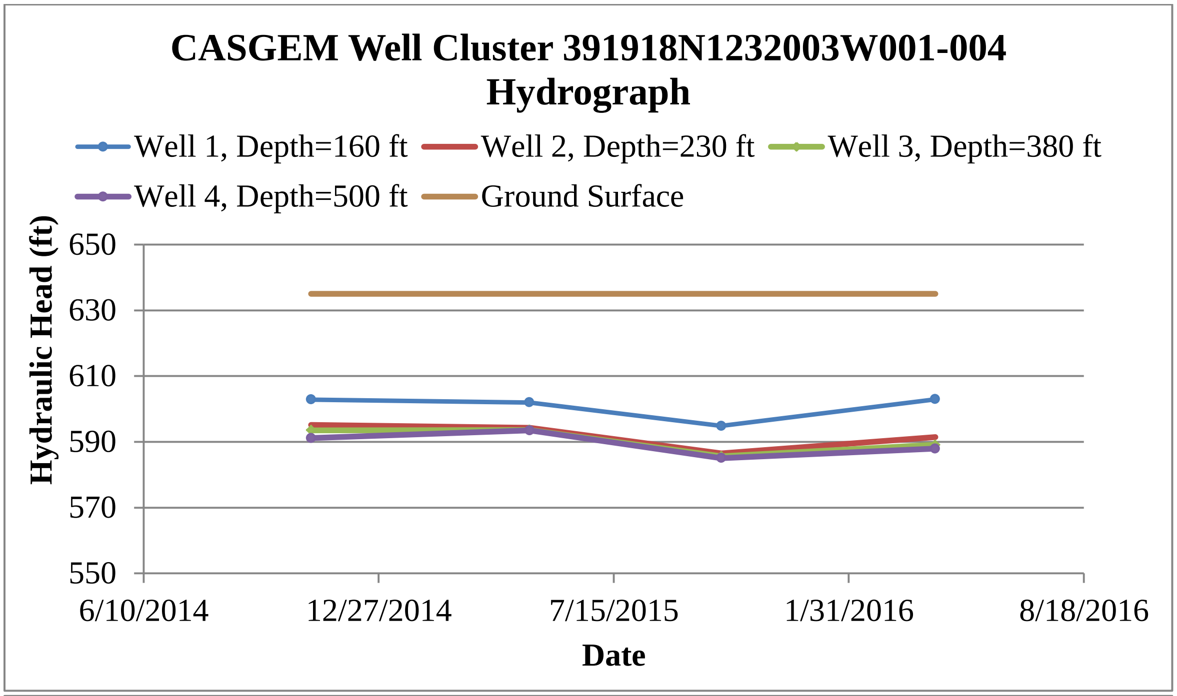
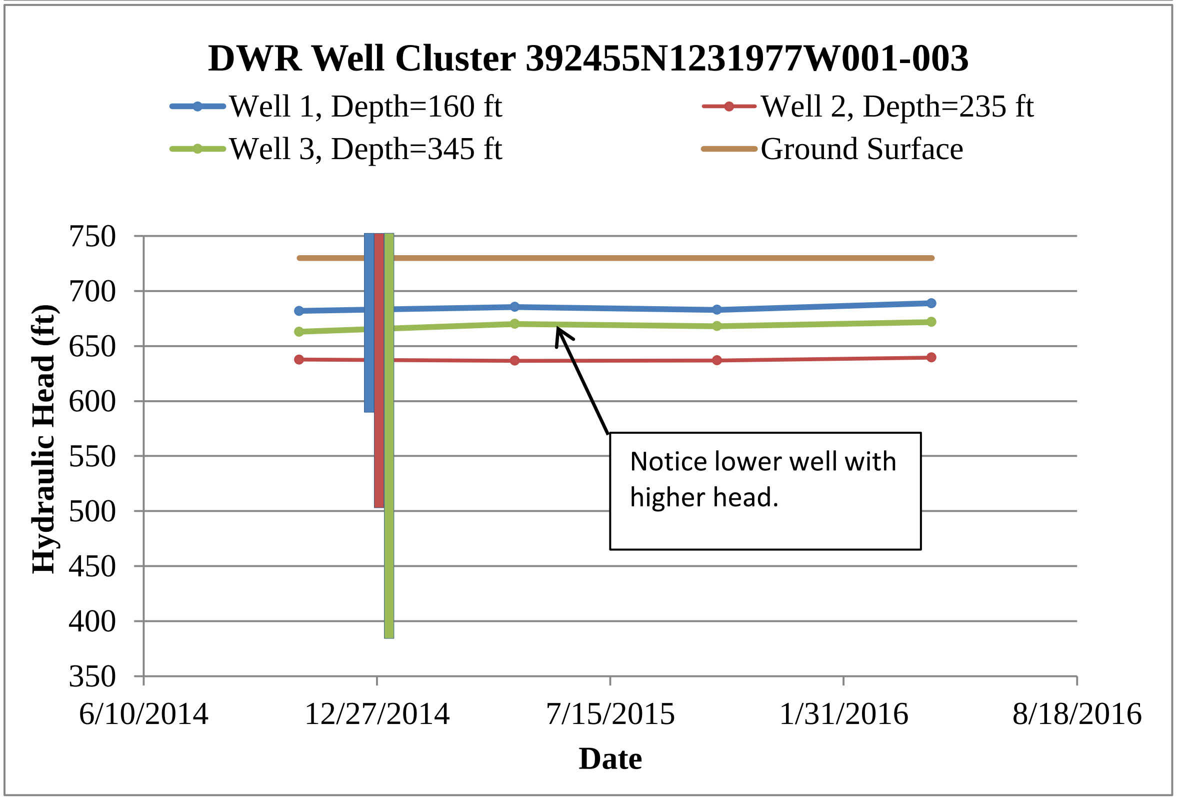
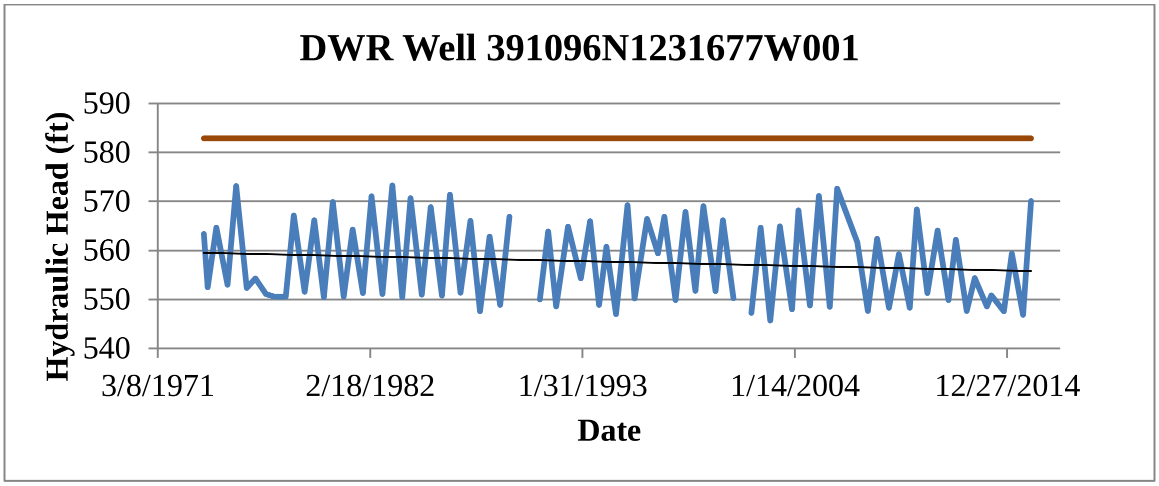
2010	604
2009	528
2008	576
2007	620
2006	641
2005	601
2004	527
2003	406
2002	358
2001	46
2000	7
1999	10

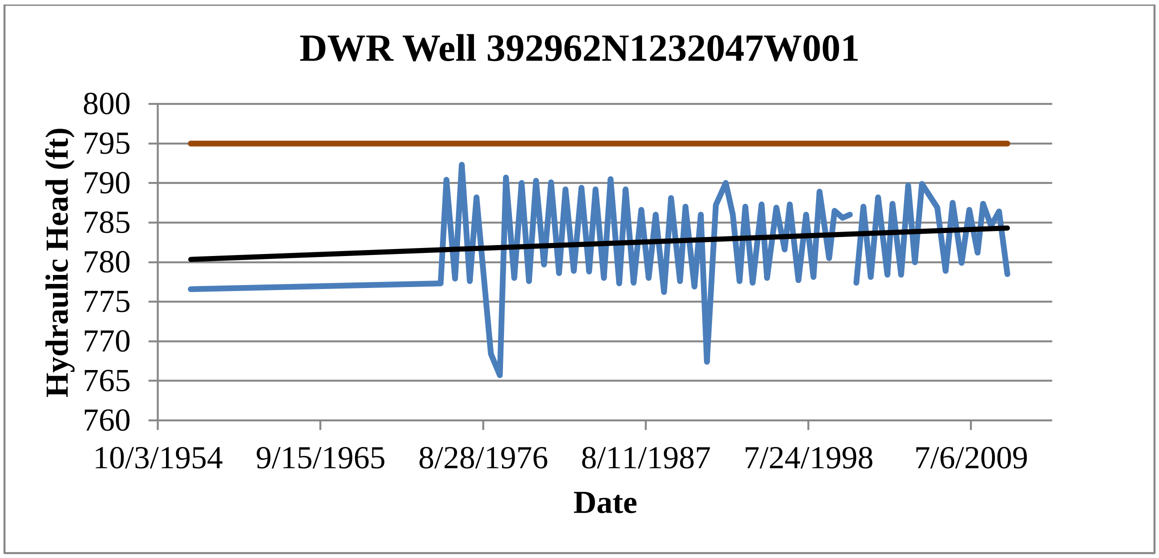
LACO

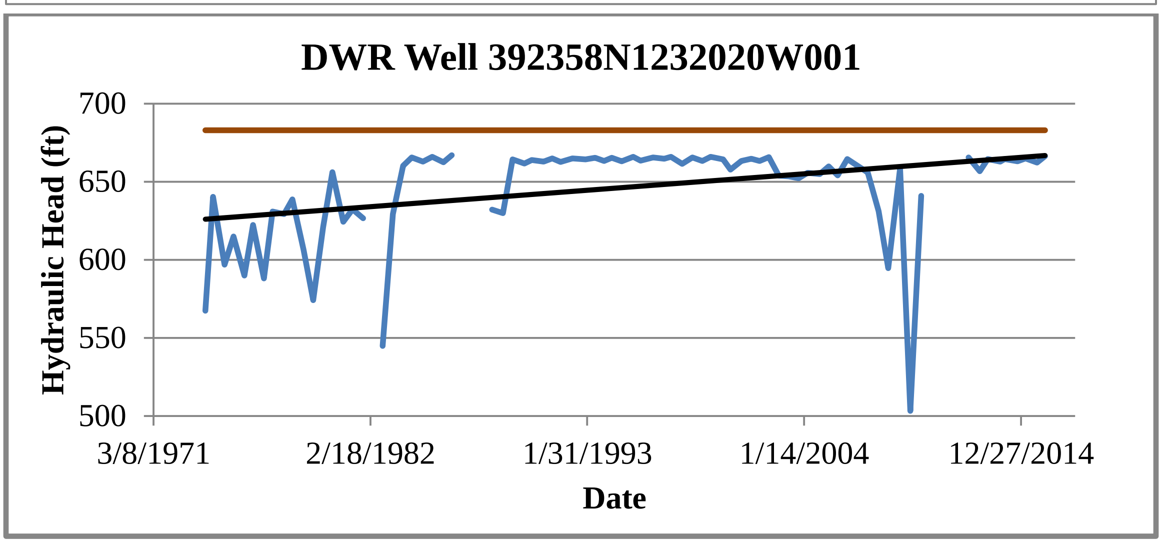
APPENDIX B – UVGB WELL HYDROGRAPHS

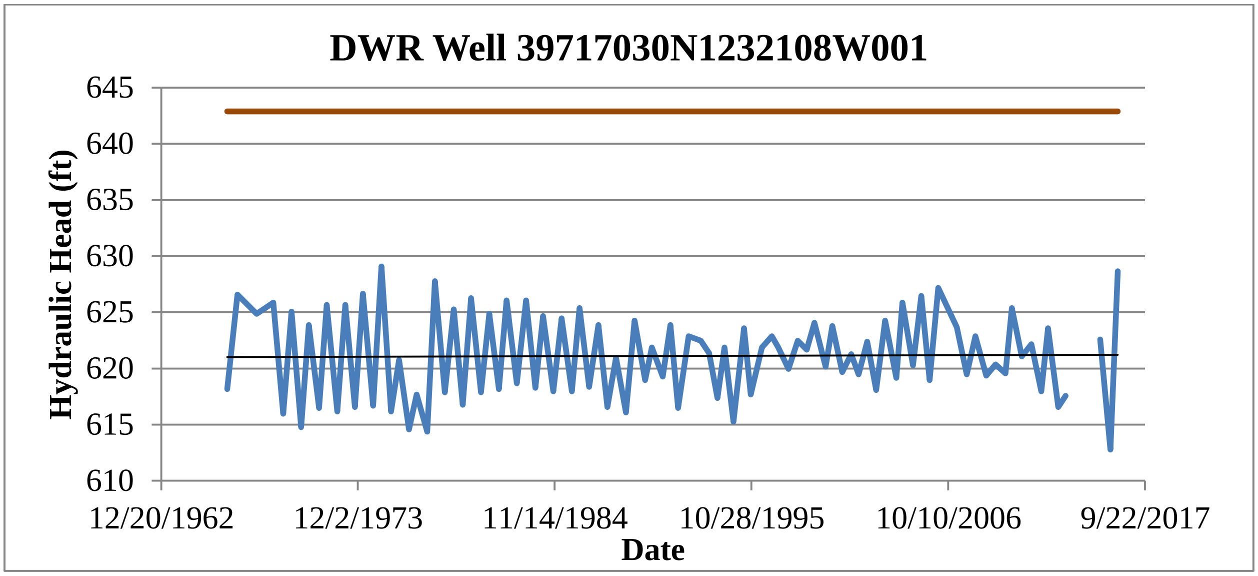

CASGEM Well Cluster 391918N1232003W001-004
Hydrograph
Well 1, Depth=160 ft
Well 2, Depth=230 ft
Well 3, Depth=380 ft
Well 4, Depth=500 ft
Ground Surface
Hydraulic Head (ft)
650
630
610
590
570
550
6/10/2014
12/27/2014
7/15/2015
1/31/2016
8/18/2016
Date

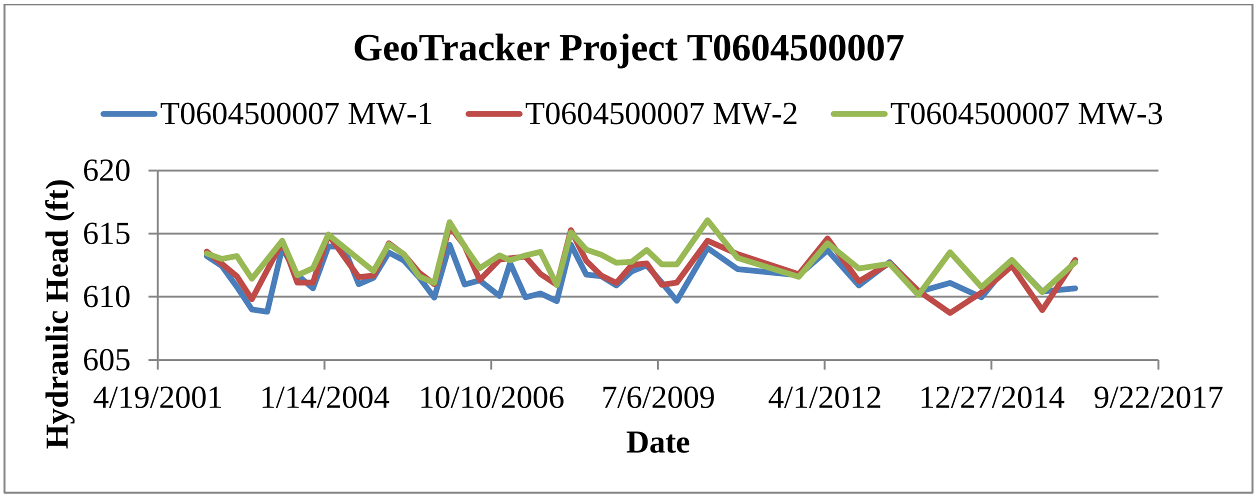

DWR Well Cluster 392455N1231977W001-003
Well 1, Depth=160 ft
Well 2, Depth=235 ft
Well 3, Depth=345 ft
Ground Surface
Hydraulic Head (ft)
750
700
650
600
550
500
450
400
350
Notice lower well with higher head.
6/10/2014
12/27/2014
7/15/2015
1/31/2016
8/18/2016
Date

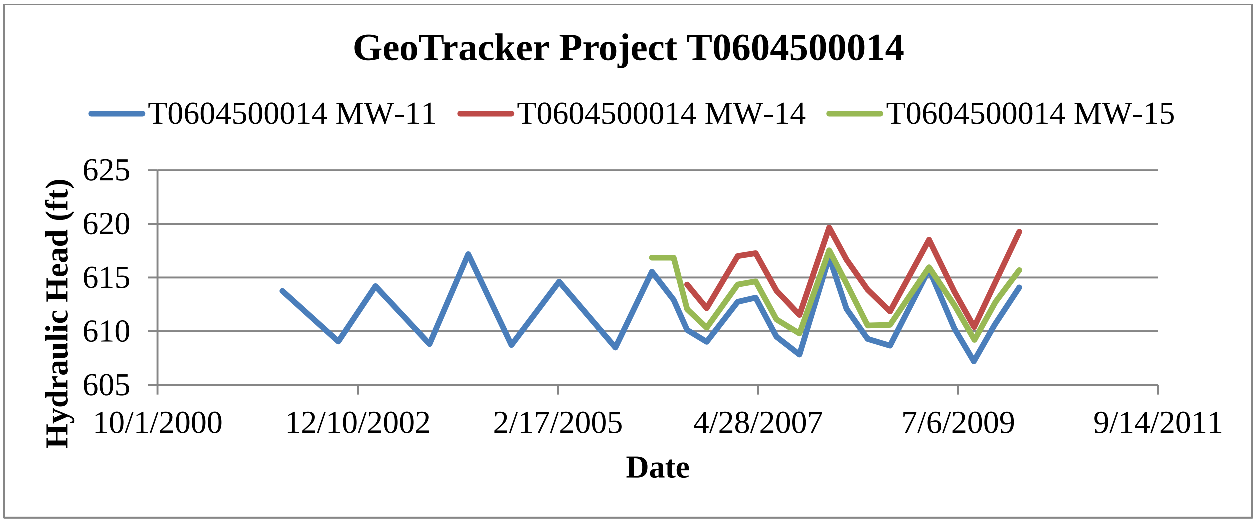

DWR Well 391096N1231677W001
Hydraulic Head (ft)
590
580
570
560
550
540
3/8/1971
2/18/1982
1/31/1993
1/14/2004
12/27/2014
Date


DWR Well 392962N1232047W001
Hydraulic Head (ft)
800
795
790
785
780
775
770
765
760
10/3/1954
9/15/1965
8/28/1976
8/11/1987
7/24/1998
7/6/2009
Date

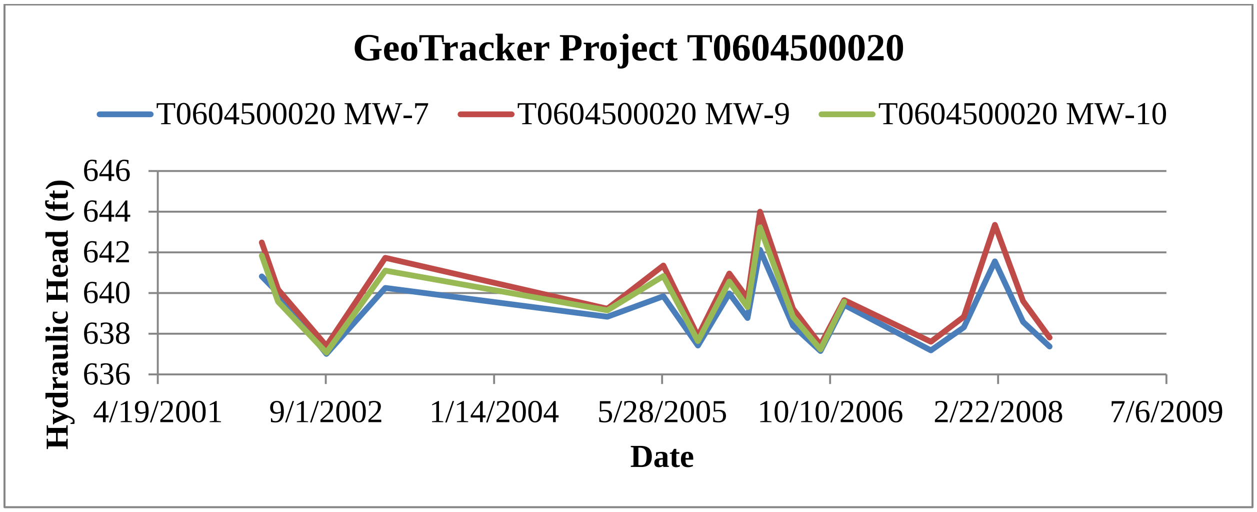

DWR Well 392358N1232020W001
Hydraulic Head (ft)
700
650
600
550
500
3/8/1971
2/18/1982
1/31/1993
1/14/2004
12/27/2014
Date

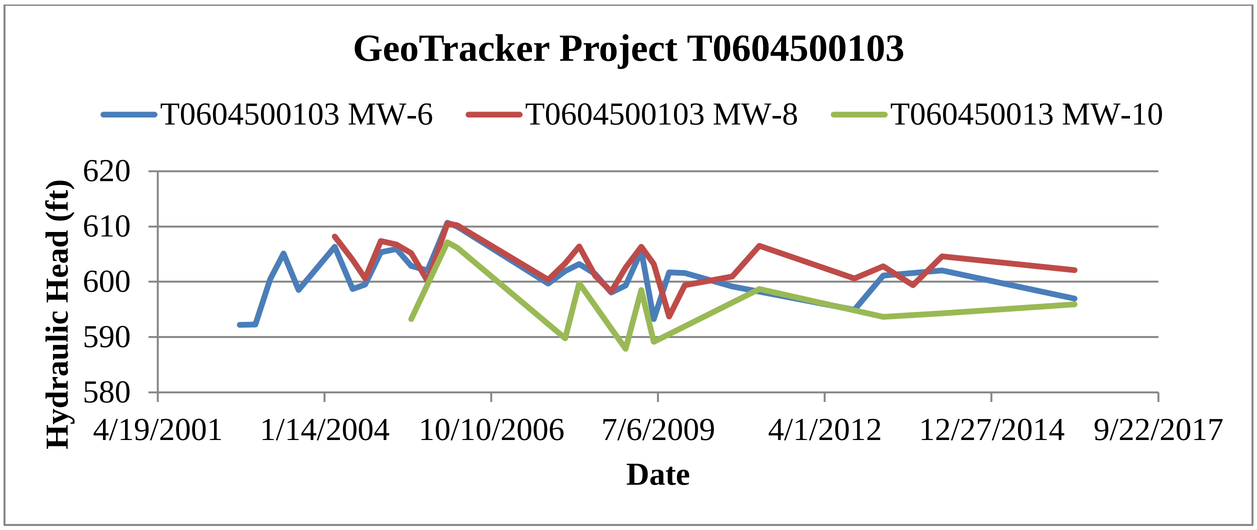

DWR Well 39717030N1232108W001
Hydraulic Head (ft)
645
640
635
630
625
620
615
610
12/20/1962
12/2/1973
11/14/1984
10/28/1995
10/10/2006
9/22/2017
Date

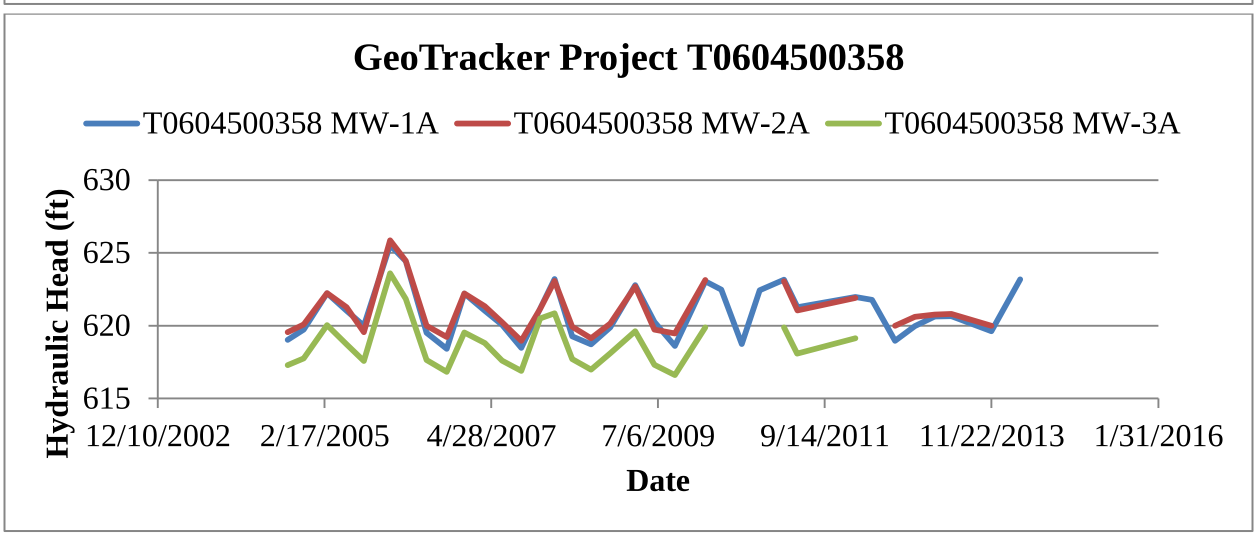

GeoTracker Project T0604500007
T0604500007 MW-1
T0604500007 MW-2
T0604500007 MW-3
Hydraulic Head (ft)
620
615
610
605
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
Date

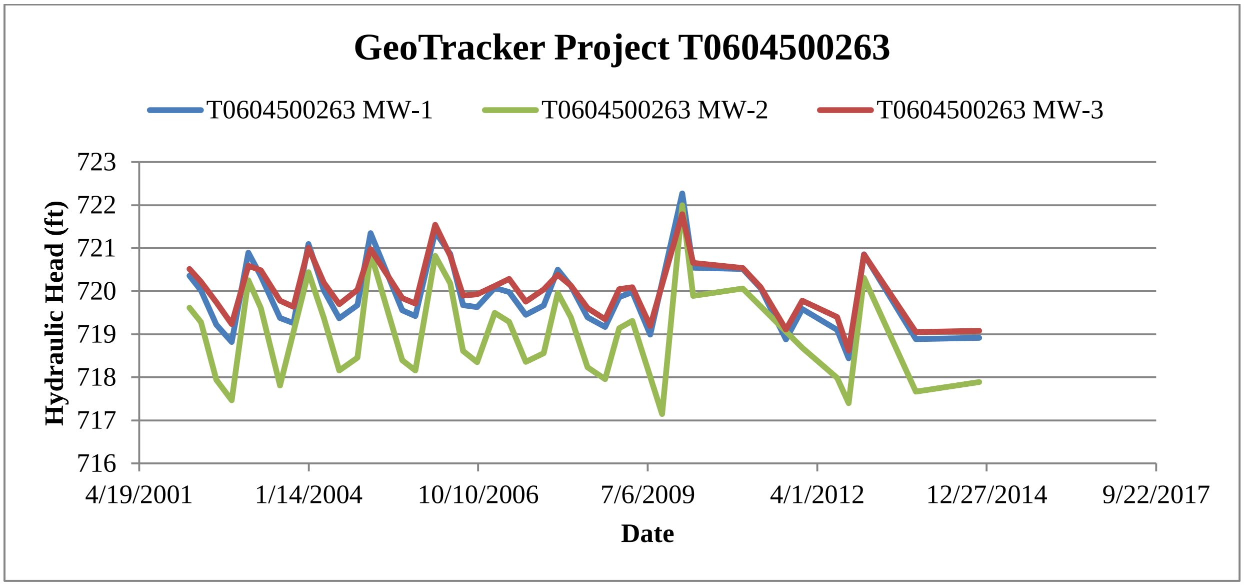

GeoTracker Project T0604500014
T0604500014 MW-11
T0604500014 MW-14
T0604500014 MW-15
Hydraulic Head (ft)
625
620
615
610
605
10/1/2000
12/10/2002
2/17/2005
4/28/2007
7/6/2009
9/14/2011
Date

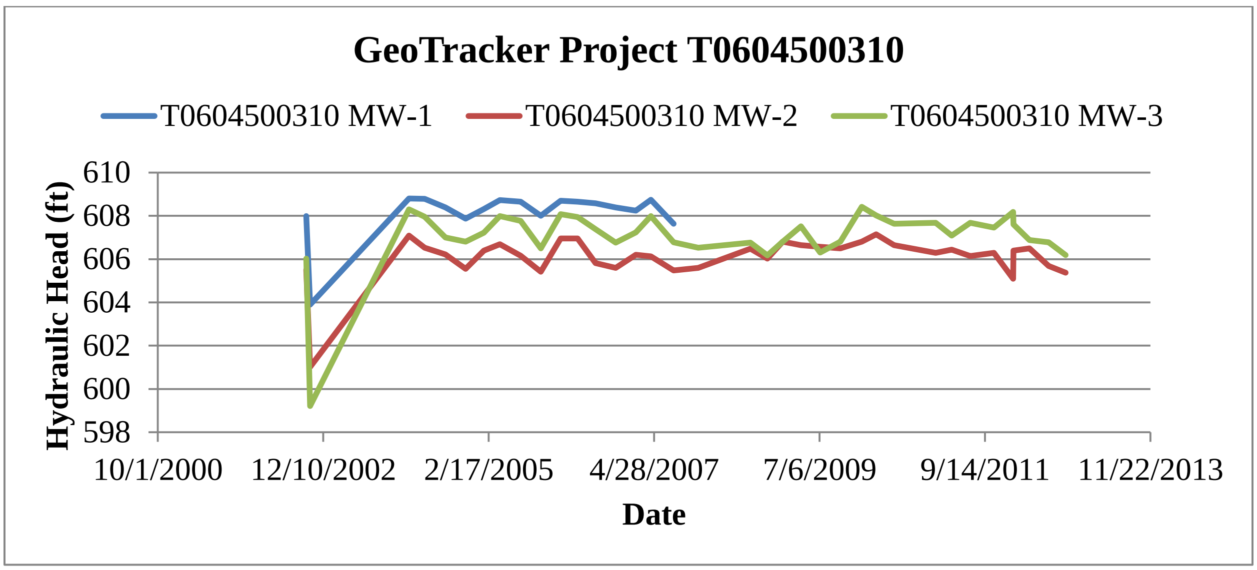
LACO

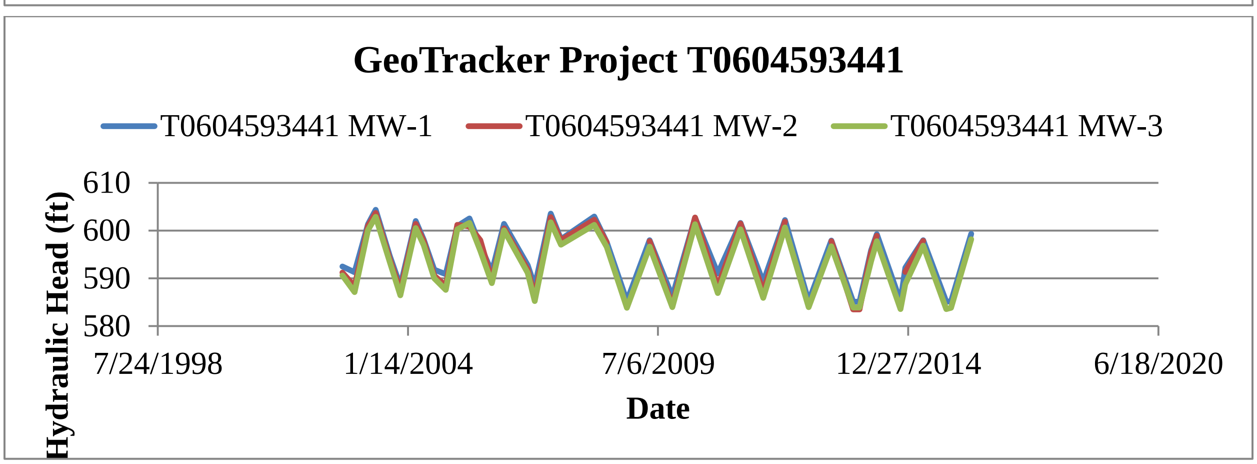

GeoTracker Project T0604500020
T0604500020 MW-7
T0604500020 MW-9
T0604500020 MW-10
Hydraulic Head (ft)
646
644
642
640
638
636
4/19/2001
9/1/2002
1/14/2004
5/28/2005
10/10/2006
2/22/2008
7/6/2009
Date


GeoTracker Project T0604500103
T0604500103 MW-6
T0604500103 MW-8
T060450013 MW-10
Hydraulic Head (ft)
620
610
600
590
580
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
Date

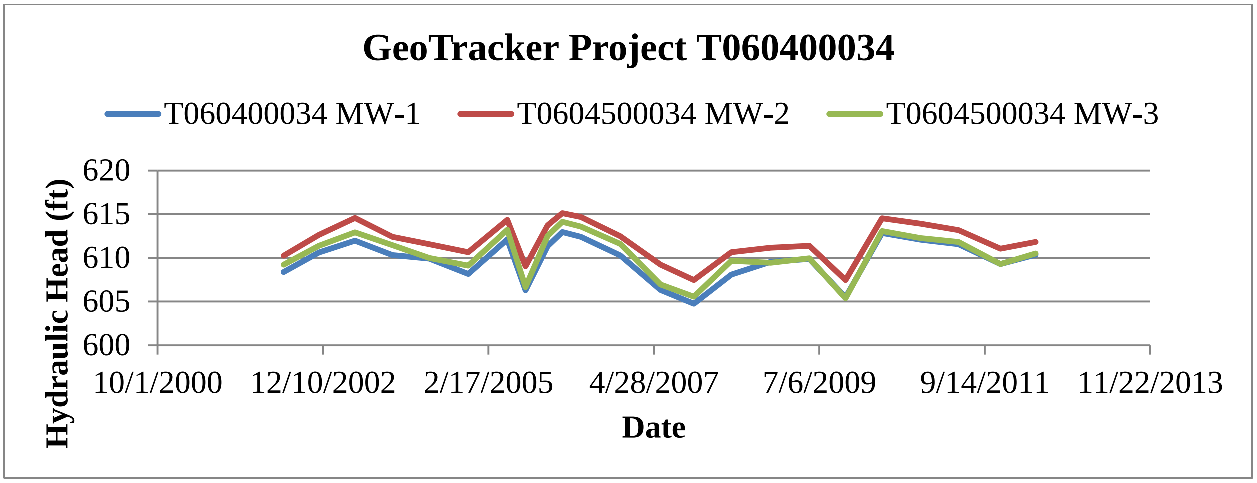

GeoTracker Project T0604500358
T0604500358 MW-1A
T0604500358 MW-2A
T0604500358 MW-3A
Hydraulic Head (ft)
630
625
620
615
12/10/2002
2/17/2005
4/28/2007
7/6/2009
9/14/2011
11/22/2013
1/31/2016
Date


GeoTracker Project T0604500263
T0604500263 MW-1
T0604500263 MW-2
T0604500263 MW-3
Hydraulic Head (ft)
723
722
721
720
719
718
717
716
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
9/22/2017
Date


GeoTracker Project T0604500310
T0604500310 MW-1
T0604500310 MW-2
T0604500310 MW-3
Hydraulic Head (ft)
610
608
606
604
602
600
598
10/1/2000
12/10/2002
2/17/2005
4/28/2007
7/6/2009
9/14/2011
11/22/2013
Date


GeoTracker Project T0604593441
T0604593441 MW-1
T0604593441 MW-2
T0604593441 MW-3
Hydraulic Head (ft)
610
600
590
580
7/24/1998
1/14/2004
7/6/2009
12/27/2014
6/18/2020
Date

LACO


GeoTracker Project T060400034
T060400034 MW-1
T0604500034 MW-2
T0604500034 MW-3
Hydraulic Head (ft)
620
615
610
605
600
10/1/2000
12/10/2002
2/17/2005
4/28/2007
7/6/2009
9/14/2011
11/22/2013
Date

APPENDIX C – CASGEM WELL PARAMETERS

Table 3: CASGEM Well Locations, Uses, and Well Completion Report Numbers

CASGEM Well Number	Local Well Designation:	Latitude (NAD83):	Longitude (NAD83):	Well Use:	Well Completion Report Number:
391918N1232003W001	Ukiah Valley-1	39.191770	-123.200310	Observation	e0207604 A-D - N/A
391918N1232003W002	Ukiah Valley-2	39.191770	-123.200310	Observation	e0207604 A-D - N/A
391918N1232003W003	Ukiah Valley-3	39.191770	-123.200310	Observation	e0207604 A-D - N/A
391918N1232003W004	Ukiah Valley-4	39.191770	-123.200310	Observation	e0207604 A-D - N/A
392645N1231955W001	Ukiah Valley-5	39.264460	-123.195460	Unknown	N/A
392606N1232098W001	Ukiah Valley-6	39.260570	-123.209810	Unknown	N/A
392556N1232312W001	Ukiah Valley-8	39.255550	-123.231160	Unknown	N/A
392572N1231906W001	Ukiah Valley-9	39.257178	-123.190578	Unknown	N/A
391322N1231929W001	Ukiah Valley-10a	39.132200	-123.192884	Irrigation	N/A
391304N1231929W001	Ukiah Valley-10b	39.130389	-123.192880	Irrigation	N/A
391252N1231822W001	Ukiah Valley-11	39.125238	-123.182166	Unknown	N/A
391031N1231649W001	Ukiah Valley-12a	39.103106	-123.164941	Unknown	N/A
391046N1231647W001	Ukiah Valley-12b	39.104619	-123.164739	Irrigation	N/A
392730N1231770W001	Ukiah Valley-13	39.273000	-123.177000	Unknown	e066664
391860N1232039W001	Ukiah Valley-15	39.185992	-123.203880	Unknown	34445
392455N1231977W001	Ukiah Valley-16	39.245510	-123.197680	Observation	N/A
392455N1231977W002	Ukiah Valley-17	39.245510	-123.197680	Observation	N/A
392455N1231977W003	Ukiah Valley-18	39.245510	-123.197680	Observation	N/A
392594N1232129W001	Ukiah Valley-19	39.259390	-123.212880	Residential	N/A
392516N1231610W001	Ukiah Valley-20	39.251614	-123.160997	Residential	N/A
391920N1232273W001	Ukiah Valley-21	39.191990	-123.227260	Unknown	N/A
391236N1231869W001	Ukiah Valley-22	39.123610	-123.186870	Irrigation	N/A
391917N1232000W001	Ukiah Valley-23	39.191747	-123.200031	Other	e0232792 - N/A
391334N1231885W001	Ukiah Valley-24	39.133440	-123.188470	Irrigation	N/A
391246N1231827W001	Ukiah Valley-25	39.124642	-123.182678	Irrigation	N/A
391225N1231852W001	Ukiah Valley-26	39.122450	-123.185200	Irrigation	N/A
391086N1231710W001	Ukiah Valley-27	39.108600	-123.171010	Irrigation	N/A
391174N1231836W001	Ukiah Valley-28	39.117440	-123.183620	Irrigation	N/A
391185N1231747W001	Ukiah Valley-29a	39.118470	-123.174690	Residential	N/A
391159N1231770W001	Ukiah Valley -29b	39.115860	-123.176950	Irrigation	N/A
391156N1231788W001	Ukiah Valley-29c	39.115600	-123.178820	Irrigation	N/A
392647N1232245W001	Ukiah Valley-30	39.264700	-123.224520	Residential	N/A
391482N1231810W001	Ukiah Valley-31	39.148150	-123.181010	Residential	e071160
390664N1231491W001	Ukiah Valley-32	39.066390	-123.149070	Residential	17867
391281N1231621W001	Ukiah Valley-33	39.128060	-123.162140	Irrigation	N/A
391285N1231607W001	Ukiah Valley-34	39.128530	-123.160680	Irrigation	811129
391932N1232124W001	Ukiah Valley-35	39.193150	-123.212360	Unknown	N/A
N/A	Ukiah Valley-36	39.158611	-123.200278	N/A	e0316347
N/A	Ukiah Valley-37	39.141111	-123.198333	N/A	e0317247

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Table 4: CASGEM Well Elevation Parameters, Depths, and Perforated Intervals

CASGEM Well Number	Local Well Designation	Reference Point Elevation (ft)	Ground Surface Elevation (ft)	Depth (ft)	Perforated Interval Depths (ft):
391918N1232003W001	Ukiah Valley-1	639	635	160	130-150
391918N1232003W002	Ukiah Valley-2	638	635	230	200-220
391918N1232003W003	Ukiah Valley-3	638	635	380	350-370
391918N1232003W004	Ukiah Valley-4	638	635	500	470-490
392645N1231955W001	Ukiah Valley-5	813	812	100	N/A
392606N1232098W001	Ukiah Valley-6	848	847	347	N/A
392556N1232312W001	Ukiah Valley-8	739	738	200	N/A
392572N1231906W001	Ukiah Valley-9	738	737	133	N/A
391252N1231822W001	Ukiah Valley-11	583	582	105	30-105
392730N1231770W001	Ukiah Valley-13	927	924	400	186-400
N/A	Ukiah Valley-37	601	600	222	35-55, 75-95, 115-135,
391860N1232039W001	Ukiah Valley-15	621	620	45	20-45
392455N1231977W001	Ukiah Valley-16	733	730	95	80-90
392455N1231977W002	Ukiah Valley-17	733	730	235	190-200, 220-230
392455N1231977W003	Ukiah Valley-18	732	730	345	280-291, 330-340
392594N1232129W001	Ukiah Valley-19	884	883	N/A	N/A
392516N1231610W001	Ukiah Valley-20	1121	1120	200	80-140, 180-200
391920N1232273W001	Ukiah Valley-21	669	667	140	20-40, 60-80, 120-140
391236N1231869W001	Ukiah Valley-22	541	538	100	30-100
391917N1232000W001	Ukiah Valley-23	626	624	420	120-220
391334N1231885W001	Ukiah Valley-24	588	584	120	40-120
391246N1231827W001	Ukiah Valley-25	583	580	80	30-80
391174N1231836W001	Ukiah Valley-28	578	574	75	26-70
392647N1232245W001	Ukiah Valley-30	812	811	80	20-80
391482N1231810W001	Ukiah Valley-31	638	633	283	60-283
390664N1231491W001	Ukiah Valley-32	554	553	60	36-56
391281N1231621W001	Ukiah Valley-33	650	648	41	13-41
391285N1231607W001	Ukiah Valley-34	657	655	160	80-160
391932N1232124W001	Ukiah Valley-35	654	654	N/A	Confidential
N/A	Ukiah Valley-36	N/A	N/A	N/A	N/A
391225N1231852W001	Ukiah Valley-26	603	599	60	30-60
391086N1231710W001	Ukiah Valley-27	582	581	107	30-107
391322N1231929W001	Ukiah Valley-10a	584	583	60	20-60
391304N1231929W001	Ukiah Valley-10b	586	582	200	30-200
391031N1231649W001	Ukiah Valley-12a	589	588	105	30-105
391046N1231647W001	Ukiah Valley-12b	591	589	100	30-100
391185N1231747W001	Ukiah Valley-29a	582	580	170	80-170
391159N1231770W001	Ukiah Valley -29b	576	574	91	25-85
391156N1231788W001	Ukiah Valley-29c	576	574	100	25-95

APPENDIX D – RIVER STAGE DISCHARGE CURVE

Figure 7: River Stage-Discharge Curve at USGS 11462080 near Talmage

APPENDIX E – FARM BUREAU LETTER AND DATA REQUEST FORM

COUNTY OF MENDOCINO
Executive Office

CARMEL J. ANGELO
CHIEF EXECUTIVE OFFICER
WATER AGENCY GENERAL MANAGER

501 Low Gap Road, Room 1010
Ukiah, CA 95482-3734

Email: ceo@co.mendocino.ca.us
Website: www.co.mendocino.ca.us

Office: (707) 463-4441
Fax: (707) 463-5649

November 17, 2016

Mendocino County Farm Bureau
303-C Talmage Road
Ukiah, CA 95482

Subject: Request for Groundwater Usage Information
Ukiah Valley Initial Groundwater Sustainability Plan
Sustainable Groundwater Management Act

Dear Farm Bureau Members:

I am writing to bring to your attention a grant-funded project which requires stakeholder input and data regarding groundwater in the Ukiah Valley Groundwater Basin. With the passage of the Sustainable Groundwater Management Act (SGMA) in November 2014, all high and medium priority groundwater basins (as determined by the Department of Water Resources [DWR]) are required by law to have a GSP in place by 2022. The Mendocino County Water Agency (MCWA) was recently awarded grant funding to complete an Initial Groundwater Sustainability Plan (GSP) for the Ukiah Valley Groundwater Basin. This Initial Sustainability Plan, funded through the DWR using Proposition 1 funds, will characterize the groundwater aquifer systems of the Ukiah Valley groundwater basin, identify surface water and groundwater data gaps, include a manual for surface water and groundwater monitoring methods and protocol, quantify the inflows and outflows of the groundwater system, and develop sustainable management criteria for the groundwater basin. The management criteria will help ensure that all current and future users of water in the basin have access to the water they need without stressing the basin beyond its limits. The development of this GSP is happening concurrently with the formation of the Groundwater Sustainability Agency for the Ukiah Valley Basin, and the Initial GSP and its underlying data will be used to help inform the GSA's decision-making process. MCWA has retained LACO Associates (LACO), a local consulting firm, to develop the Initial GSP. LACO will be working closely with MCWA and stakeholders to gather the necessary information and draft the Plan.

In order to move forward with this project, the first steps involve collecting data from a variety of public sources, stakeholders, and water users within the basin. By collecting both current and historical data regarding water use and land use, we will be able to better model the budget of the groundwater basin and develop management criteria that will be more accurate and more suitable for the conditions in the basin. The more high quality data we can collect, the better we can tailor the management criteria to best serve the public.

I am reaching out to you to introduce LACO and the project, and to gauge your interest and ability to share data for use in the project. Please note that any data shared may become publically available as part of the Initial Groundwater Sustainability Plan. We will take the necessary measures, such as only publishing hydrographs, well type, well depths, and non-exact coordinates, to preserve anonymity for contributors who are uncomfortable with having their information published, but ask that you provide the requested data for implementation into the aquifer budget project. The principal issue in the analysis will likely be the effects of groundwater extraction on nearby surface waters. A robust data set in the Ukiah Valley will enhance our ability to characterize the relationship between extraction and recharge from precipitation, streamflow, and return flows.

Thank you for taking the time to consider our project. Please contact Brian Wallace with LACO Associates at (707) 525-1222 with any questions you have regarding this project. Enclosed you will find a worksheet which can be filled out with information regarding your well and pumping habits. We ask that you please fill out one worksheet for each well on your property, or indicate on the worksheet if you are not interested in providing data for this project. We are looking forward to working with you in the near future and appreciate your help in building a sustainable groundwater environment for the Ukiah Valley.

Sincerely,

Sarah Dukett

Sarah Dukett
Program Manager
Mendocino County Water Agency
duketts@co.mendocino.ca.us

Enclosure (1)

Ukiah Valley Groundwater Basin
Initial Groundwater Sustainability Plan
Well Information Form

Company Name:____________________________ Date:_____________

First Name:________________________________ Last Name:___________________________

Phone Number:______________________________ Email:_______________________________

Property Address: ____

Number of wells on property*:____

* Fill out one Well Information Form for each well on the property.

Total Well Depth (ft):_____ Well Diameter (in):_____

Screened Intervals (ft):____________ Pump Type:____________

Attachments

- Attach Pump Curve and Pumping Efficiency Test Results if available.
- Fill out the attached Pump Operation Data table or attach your pump data if available**.

** Estimate your withdrawals if you do not have records of your pump operation.

Permissions

Will you allow a representative of the Mendocino County Water Agency to access your property for the purposes of collecting a GPS waypoint coordinate of your well location?

☐ Yes ☐ No

If you will not allow access to the property for obtaining the coordinates of the well location, use the <u>backside of this page</u> for a sketch of the well location(s) in relation to existing structures, roads and/or property lines.

Signature:_______________________________________

☐ Please check this box if you would like to receive periodic email updates regarding this groundwater study and the resulting Initial Groundwater Sustainability Plan.

Additional Information/Concerns

____

____

____

Send this completed form and any attachments to the Mendocino County Water Agency, located at 501 Low Gap Road, Room 1010, in Ukiah. The form can also be returned electronically via email to wallaceb@lacoassociates.com.

		Pump Operation Data – Please provide extraction rates (AF/month or gallons/month), and depth to water (prior to pumping and after pumping) if available										
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
2016												
2015												
2014												
2013												
2012												
2011												
2010												
2009												
2008												
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Site Map