Groundwater Sustainability Plan
Alternative Annual Report
2017 Water Year

(October 1, 2016 to September 30, 2017)

Eel River Valley Groundwater Basin
Humboldt County, California

Prepared for:

Humboldt County Public Works Department

SHN Engineers & Geologists

in collaboration with:

County of Humboldt Public Works Department
and
Humboldt County Resource Conservation District

March 2018
016219

Reference: 016219

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Eel River Valley Groundwater Basin Humboldt County, California

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March 2018

QA/QC:GDS gds

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Abbreviations and Acronyms

mg/L	milligrams per liter
Basin	Eel River Valley Groundwater Basin
BOS	Board of Supervisors
CASGEM	California Statewide Groundwater Elevation Monitoring
CCR	California Code of Regulations
CSD	Community Service District
DWR	Department of Water Resources
GSP Alternative	groundwater sustainability plan alternative
HCRCD	Humboldt County Resource Conservation District
MW-#	monitoring well-number
N/A	not available
NAVD88	North American Vertical Datum, 1988
NR	no reference
PECG	Palmer Environmental Consulting Group
SGMA	Sustainable Groundwater Management Act
SGWP	Sustainable Groundwater Planning
SHN	SHN Engineers & Geologists
T-#	major rivers-number
USGS	U.S> Geological Survey
Working Group	Eel River Valley Groundwater Basin Working Group
WY	Water Year

Executive Summary

The groundwater sustainability plan alternative (GSP Alternative) submitted to Department of Water Resources (DWR) in December 2016 (SHN, 2016) showed that groundwater levels within the Eel River Valley Groundwater Basin (Basin) (Figure 1 in Attachment 1) have a relatively narrow range of fluctuation and have remained generally stable over time, including during the droughts of 1976-1977, 1987-1992, and the most recent drought of 2013-2015. The 2017 Water Year (WY) from October 1, 2016, through September 30, 2017, was a very wet year with the highest precipitation measured in over 30 years at the Scotia climate station (048045). Groundwater level measurements collected over the course of the 2017 WY indicate that conditions are consistent with the historical fluctuations, though some of the California Statewide Groundwater Elevation Monitoring (CASGEM) wells had elevations higher than had ever been recorded. Continuous monitoring within a number of wells and river locations within the Basin have provided valuable insight into the surface water/groundwater interaction, confirming the strong connection and recharge potential associated with the rivers discussed in the GSP Alternative.

Groundwater extraction within the Basin is primarily associated with irrigation and municipal use. Studies carried out to support the preparation of the GSP Alternative (HCRCD, 2016; PECG, 2016) indicated that the total volume of groundwater use represents only a small percentage of annual recharge within the Basin. There is very little growth of the agricultural sector or the general population within the Basin. Further, there are no ongoing or anticipated future changes to the conditions of use within the Basin that would significantly change the conclusions in the GSP Alternative. One of the external factors that could affect conditions within the Basin is the ongoing regulatory changes associated with cannabis cultivation (which was legalized in California during WY 2017). Increases in groundwater extraction associated with cannabis cultivation within the upper watersheds have the potential to affect the surface water inflow into the Basin if not appropriately regulated. Enforcement actions, water use regulations, and adherence to permit conditions associated with California Regional Water Quality Control Board and/or the California Department of Fish and Wildlife requirements may facilitate an overall reduction in upstream water taking. Cannabis cultivation has long been a part of the Eel River watershed, and it is not clear how the recent legalization will affect water use within the Eel River and Van Duzen watersheds.

An additional development that will continue to be monitored is the relicensing of Pacific Gas and Electric's Potter Valley Project hydroelectric facility, located on the Eel River in Lake and Mendocino Counties, approximately 150 miles upstream of the Basin. The Potter Valley Project diverts water from the Eel River at Cape Horn Dam into the Russian River watershed. The relicensing process through the Federal Energy Regulatory Commission may result in changes to the volume and timing of flow diversions. In addition, hydraulic studies resulting from this process may provide new information on the effects of flow diversions at Cape Horn Dam on Eel River flows through the Basin.

The Eel River Valley Groundwater Basin is a coastal basin and seawater intrusion is a potentially undesirable condition. As reported in the GSP Alternative, chloride sampling conducted in fall 2016 within the lower Basin indicated the position of the seawater/freshwater transition zone is comparable to the position mapped in 1975 (USGS, 1978). An additional round of sampling was conducted in the spring of 2017, the results for which show the transition zone to be mapped in the same location.

Based on the data reviewed in this 2017 annual report, we submit that the conclusions presented in the GSP Alternative remain applicable and appropriate. In our opinion, the GSP Alternative is still the most appropriate compliance option for achieving the goals of the Sustainable Groundwater Management Act (SGMA) for the Eel River Valley Groundwater Basin. The GSP Alternative provides for a monitoring plan and commitments for annual reporting that are appropriate and effective for monitoring changing conditions. Combined with the five-year assessment due to be completed and submitted with the annual report in 2021, we anticipate that no projects or additional management actions are needed to maintain the sustainability goal associated with the SGMA.

1.0 Introduction

As a result of Sustainable Groundwater Management Act (SGMA) regulations approved in 2014, the County of Humboldt Public Works Department (County) was appointed in 2015 as the administering agency for SGMA compliance by the Board of Supervisors (BOS). In October 2015 the Eel River Valley Groundwater Basin Working Group (Working Group) was formed. The Working Group includes stakeholders representing agricultural, municipal, and environmental interests and is instrumental in facilitating compliance with the SGMA. From 2015 through December 2016, the County and Working Group conducted several meetings to discuss compliance and data needs to meet requirements of the SGMA.

The County submitted to the Department of Water Resources (DWR) a groundwater sustainability plan alternative (GSP Alternative) in December 2016 for the Eel River Valley Groundwater Basin (Basin; Figure 1) in collaboration with the Working Group as the local response to the SGMA. The GSP Alternative was prepared in accordance with the regulations in California Code of Regulations (CCR), Title 23, §350 et seq. and provides information demonstrating that the Basin has operated within its sustainable yield over a period of at least 10 years. The monitoring network and sampling program proposed in the GSP Alternative is shown on Figure 2 and summarized in Table 1.

Table 1. Monitoring Network and Sampling Program
Eel River Valley Groundwater Basin

Location	Analysis	Frequency	Responsible Agency
CASGEM[1] Wells	Depth-to-Water (feet)	Bi-annually	DWR[2]
River Stations	River Stage (feet)	Continuous	USGS[3]
County Monitoring Wells (All)	Depth-to-Water (feet)	Bi-annually	County
	Chlorides (mg/L)[4]	1X/5 Years	County
MW-2	Depth-to-Water (feet)	Continuous	County
MW-5/MW-7	Chlorides (mg/L)	Bi-annually	County

1. CASGEM: California Statewide Groundwater Elevation Monitoring
2. DWR: State of California Department of Water Resources
3. USGS: U.S. Geological Survey
4. mg/L: milligrams per liter

Based on the requirements contained in the regulations at CCR, Title 23, §350 et seq. an annual report must be submitted to the DWR by April 1st of each year. This annual report provides a discussion and the results of studies conducted during the 2017 Water Year that weren't included in the GSP Alternative. Also included is an update on water use, and groundwater storage for the preceding water year and describes progress toward implementing the measures identified in the GSP Alternative. This submittal will be processed through the SGMA Portal – Alternative Reporting System monitored by DWR.

2.0 2017 Water Year

The 2017 Water Year (WY) was a very wet year in the vicinity of the Eel River Valley. Precipitation totals for the water year as measured at the Scotia Station 048045, and reported by the Western Regional Climate Center totaled over 75 inches (Figure 3). Significant storm events produced high river flows and multiple significant flooding events early in January 2017 (Photos 1 and 2). Bank erosion and sediment redistribution within the main stem rivers were common. River discharge and gage height data for the U.S. Geological Survey (USGS) stations at Scotia (11477000) and Bridgeville (11478500) on the Eel and Van Duzen Rivers, respectively, are provided as Figures 4 and 5.

Photo 1. Eel River Flood January 11, 2017, looking to the southwest. Fernbridge in foreground.

Photo 2. Eel River Flood January 11, 2017, looking to the southeast.

3.0 Groundwater Elevation Data

The principal aquifers within the Eel River Valley Groundwater Basin (Basin) have been loosely defined based on the primary stratigraphic units of the Basin; the shallow alluvial aquifer and the underlying aquifer associated with the Carlotta Formation. Groundwater use in the Basin is primarily sourced from the alluvial aquifer, which is on the order of 100 to 200 feet thick. Most wells within the valley have been installed at a depth of less than 100 feet. Due to the scarcity of wells screened within the deeper Carlotta aquifer, and the lack of historical data, the discussion and presentation of groundwater elevation data provided in this report is focused on the shallow alluvial aquifer.

Groundwater elevation data for the 2017 WY included in this annual report (Attachment 2) has been made available from the following sources:

1. Two rounds of groundwater elevation measurements conducted by DWR as part of the California Statewide Groundwater Elevation Monitoring (CASGEM) Program
2. Two large groundwater elevation measurement campaigns, one conducted in Fall 2016 and one in Spring 2017 as part of a Proposition 1 Sustainable Groundwater Planning (SGWP) Grant
3. A transducer study conducted within selected private and newly installed County wells

3.1 CASGEM Program

The seasonal groundwater elevation measurements collected as part of DWR's CASGEM program provide the best opportunity to evaluate long-term groundwater elevation trends. Groundwater elevations were measured in six wells in fall 2016 and five wells in spring 2017. The groundwater elevations recorded are observed to be consistent with historical values. Due to a very wet 2016/2017 winter season, some of the spring 2017 groundwater elevation measurements were the highest on record. The locations of the CASGEM wells and hydrographs of the seven wells with relatively complete data sets are shown on Figure 6. Individual hydrographs are also included in Attachment 3.

3.2 Groundwater Elevation Contour Maps

In fall 2016, and again in spring 2017 groundwater elevations were recorded in approximately 60 wells in a coordinated effort with members of the Working Group. Land owners, farmers, and municipal agencies provided access to their wells for the study. The area of focus was limited to the alluvial plains of the Eel River Valley, the Van Duzen River, and Yager Creek, with one well in Metropolitan (an unincorporated community near Rio Dell). The wells measured included municipal wells, private wells, and newly-installed monitoring wells.

Depth-to-water measurements were collected by a team of staff from SHN Engineers & Geologists (SHN); the Humboldt County Resource Conservation District (HCRCD); Humboldt County Public Works; and Don and Cheryl Laffranchi (volunteers). Groundwater elevation contour maps and the locations of the wells used to develop them for the fall 2016 and spring 2017 sampling events are shown as Figures 7 and 8, respectively, and details of the monitoring are included in Tables 2-1 and 2-2 (Attachment 2).

Groundwater contours in both fall 2016 and spring 2017 indicate that flow is consistently toward the ocean (westward) with gradients and directions mimicking the topography of the valley floors. Flow gradients within the Eel River Valley are generally shallow with fall elevations ranging from approximately 30 feet along the eastern edge of the valley floor to 5 feet nearest the ocean. A much steeper groundwater gradient is observed within the Van Duzen watershed with elevations ranging from 120 feet within the Yager Creek down to 30 feet at the intersection with the Eel River Valley.

3.3 Freshwater-Seawater Transition Zone

Chloride sampling was conducted during the Fall 2016 and Spring 2017 groundwater elevation measurement campaigns discussed above. Chloride sampling and testing were conducted in 29 select wells within the vicinity of the freshwater-seawater transition zone previously mapped by the USGS in 1975 (USGS, 1978). The 1975 study used a chloride concentration of 100 milligrams per liter (mg/L) as an indicator of poor-quality water. More specifically, the study applied the 100 mg/L concentration limit as an indication of the landward edge of the freshwater-seawater transition zone. The fall 2016 results were included in the GSP Alternative and the freshwater-seawater transition zone mapped in 1975 was shown to remain applicable as an approximation of the location of the freshwater-seawater transition zone. The spring 2017 results, as shown on Figure 9, also confirm that the location as mapped in 1975 remains appropriate. This data would suggest that the freshwater-seawater transition zone is stable under current conditions.

3.4 Surface and Groundwater Monitoring using Pressure Transducers

To monitor the surface water and groundwater levels over the course of the 2017 WY, pressure transducers were installed at multiple locations throughout the Eel River Valley Basin. River and well locations that were part of the monitoring program for the 2017 water year are shown on Figure 10. Transducers were installed within temporary installations at five locations within the major rivers (R-1 through R-5), three private wells (Wells 20, 22, and 23), and eight newly installed monitoring wells (MW-1, -2, -3, -5, -7, -8, -9, and -10). Transducers were installed in late September/early October 2016 and the final retrieval and data download of most transducers was conducted in November 2017. Some river installations were destroyed during a significant flooding event in early January 2017, so there are data gaps for some of these locations. Transducers were left in place at select locations to continue monitoring water levels for an indefinite period, as part of the ongoing monitoring commitments outlined in the GSP Alternative.

A review of the hydrographs through the course of the winter season shows a very dynamic relationship between the river and the adjacent alluvial aquifers. The fluctuation of river flows associated with winter storms is clearly affecting the aquifer, with groundwater elevations tracking those fluctuations closely. This is consistent with the relatively high hydraulic conductivity of the granular alluvial material that the wells encountered.

The last significant rains occurred in mid-April 2017 after which the river levels steadily dropped. At the monitoring well MW-1 location, the gradient toward the river was maintained at least into June 2017, after which the Fernbridge USGS gauging station was no longer useful because it reached its lower elevation measurement limit of ~0.5 foot (North American Vertical Datum, 1988 [NAVD88]).

Water levels within the MW-2 well dropped below the level of the transducers shortly after the re-installation of R-3, so a complete dry season relationship cannot be measured at this location. However, the relationship of the river and the aquifer level at MW-2 for approximately three weeks in mid-July indicates that the river and aquifer levels are essentially equal, or in a slight gaining stream condition. If a gradient direction transition from the river (gaining stream) to the aquifer (losing stream) occurred at the MW-2 site, it appears it would have occurred toward the end of July or early August. In general, surface water and groundwater along the west bank of the Eel River stabilized during the final months of the dry season.

Monitoring of the Van Duzen River and adjacent aquifer was primarily accomplished with monitoring well MW-9 and the River 4 installation (R-4), situated approximately 1,300 feet apart from each other. Additional data was provided by transducers in private wells 22 and 23, situated down valley within the alluvial terrace of the Van Duzen River.

The hydrographs of MW-9 and R-4 indicate that the aquifer is being positively recharged by the river over the course of the winter. Water elevations within the aquifer are relatively slow to recede following peak flows, and result in consistent gradients toward the river in all but the earliest parts of the wet season.

Over the course of the dry season the relative water elevations of MW-9 and R-4 indicate a transition from gaining to losing stream conditions in early July. Water elevations of the aquifer remain below the surface water elevations (less than 1 foot) until the wet season begins again. Similar to the surface water elevations in the Eel River, the water elevations in the Van Duzen River appear to stabilize during the months of August, September, and October.

Table 2-3 (Attachment 2) provides details on the locations, including the timeframes for which water level data was collected. The resulting hydrographs are provided within Attachment 3.

4.0 Groundwater Extraction for WY 2017 (Oct 2016 – Sept 2017)

Groundwater use within the Eel River Valley Groundwater Basin supports agricultural irrigation, municipal distribution, and rural domestic water use. Historically, there has been no comprehensive program for yearly measurement or quantification of total groundwater use in the Basin. In an effort to gain a better understanding of total water use, the Humboldt County Resource Conservation District (HCRCD) carried out a study to estimate irrigated acreage and annual irrigation volume estimates (HCRCD, 2016). Collaboration with the nine entities that extract and distribute municipal water within the Basin continues to be refined for municipal use. Rural domestic use (private domestic wells) is conservatively estimated at this time. Below, the three primary water use sectors are discussed and the quantification of their extraction volumes for the 2017 water year is provided.

4.1 Irrigation Water Use

The GSP Alternative presented a technical memorandum completed by the HCRCD that estimated the irrigation water use rates of irrigated lands within the Basin. From information contained in the technical memorandum and personal conversation with HCRCD in March 2018, the total acre-feet of groundwater used for irrigation is 10,265 based on a "wet" irrigation season determination, with irrigation starting around June 1, 2017. The estimated irrigated acreage for WY 2017 remained the same as that presented in the GSP Alternative and technical memorandum (13,558 acres). Approximately 73% of the irrigated land is situated in the Ferndale area, with the remainder distributed within several geographic areas (Alton, Carlotta, Fortuna, Hydesville, Loleta, Rio Dell, Rohnerville, and Scotia). Figures 11a, 11b, and 11c show the distribution of irrigated acres within the Basin. Table 2 summarizes irrigation water use.

Table 2. Irrigation Groundwater Use Rate by Water Year (2007-2017)
Eel River Valley Groundwater Basin

Irrigation Season Type	Water Use Estimate (Acre-Feet)	Associated Years
Dry Irrigation Season (April 15-October 1)	16,680	2008, 2009, 2013, 2014, 2015
Normal Irrigation Season (May 15-October 1)	13,600	2007, 2012, 2016
Wet Irrigation Season (June 1-October 1)	10,265	2010, 2011, 2017

4.2 Municipal Water Use

There are nine identified municipal users in the Basin. They are made up of Community Service Districts (CSDs), cities/towns, and one tribal nation, all of which collect and distribute water within a larger community. Most extraction is facilitated with source wells, though in the case of the towns of Scotia and Rio Dell, water is partially sourced from infiltration galleries below the river bed. Del Oro CSD has both wells and shallow collection systems near springs within the hill slopes south of the Eel River Valley. Figure 12 shows the location and service area extent of the municipal water users.

Eight of the nine water suppliers have cooperated in providing extraction volume data covering the past 10 years. A summary of historical (past 10 years) and current municipal water use associated with the eight users is provided in Table 3 below. Record-keeping has varied between entities and not all years were made available. The 2006 to 2015 entries are reported as annual volumes, whereas the 2017 entries are for the 2017 WY. All current and future reporting will be associated with the WY.

Although not considered significant to the overall water balance, it should be noted that there are some adjustments made to the reporting for 2017 WY that were not included in the information submitted in the GSP Alternative.

Specifically the following corrections in reporting were made for the 2017 WY values:

- The Town of Scotia previously reported only water from the town's use of treated water, it did not account for raw water that went to the mill operations.
- Del Oro Water Company was only reporting the volumes associated with extraction from its well, not the data for extraction from near its springs.
- Loleta CSD and Palmer Creek CSD reported volumes in million gallons and cubic-feet, respectively instead of acre-feet.

The correction to reporting numbers for the 2017 WY has been made and will be consistent moving forward.

Table 3 summarizes municipal water use (domestic, commercial, industrial).

Table 3. Municipal Water Use, 2006-2017 (Acre-Feet per Year)
Eel River Valley Groundwater Basin

Supplier	Measuring Device	Accuracy	2017[1]	2015[2]	2014	2013	2012	2011	2010	2009	2008	2007	2006
City of Fortuna	McCrometer flow meter	99-101 %	1,262	1,445	1,595	1,654	1,540	1,333	1,399	1,423	1,439	N/A[3]	N/A
City of Rio Dell	Electromagnetic flow meter	to 0.5% (+or-)	264	254	294	351	315	304	305	327	330	365	280
Town of Scotia	Sparling flow meter	to 2% (+or-)	693	346	363	325	362	422	432	421	430	471	N/A
Del Oro Water Co.	Propeller meter	95%	177	46	41	33	29	12	11	19	26	44	58
Loleta CSD[4]	Water Specialties mag meter	to 2% (+or-)	73	23	23	21	20	20	20	20	19	21	25
Riverside CSD	Siemens Mag flow meter	to 5% (+or-)	24	24	N/A	35	32	32	33	32	N/A	26	26
Palmer Creek CSD	Sensus turbo meter	to 1.5% (+or-)	23	3	3	3	3	3	3	4	N/A	N/A	N/A
Hydesville CSD	Electromagnetic meter	to 1 cubic foot	97	97	107	118	124	161	153	126	138	148	162
Bear River	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	**---**	**---**	**2,613**	**2,238**	**2,426**	**2,540**	**2,425**	**2,287**	**2,356**	**2,372**	**2,382**	**1,075**	**551**

1. Water Year
2. 2006 to 2015 are reported in Annual Totals
3. N/A: not available
4. CSD: Community Services District

4.3 Rural Domestic Water Use

No targeted study for the Basin has been completed to quantify the volume of groundwater extracted by users outside the municipal service areas other than for irrigation purposes. These users would include residential, agricultural, or commercial uses that supply their water from private wells. For the purposes of capturing the volume of extraction associated with these miscellaneous or otherwise minor uses in the Basin, a conservative estimate is used. An estimate of 1,000 acre-feet was included in the water balance prepared by Palmer Environmental Consulting Group (PECG, 2016), which was included with the GSP Alternative. Until further evaluation of this use sector has been completed, we maintain this value as part of the 2017 WY extraction estimates.

4.4 Total Water Use

Agricultural Water Use:..... **10,265 Acre-feet (estimated)**
Municipal Water Use:..... **2,613 Acre-feet (measured)**
(domestic, commercial, industrial)
Rural Domestic Water Use:..... **1,000 Acre-feet (estimated)**
Surface Water Use..... **Presumed Negligible***

Total Water Use:.....13,878 Acre-Feet

***** No significant industrial, municipal, or commercial surface water withdrawals are known. Some private or otherwise insignificant uses may exist.

5.0 Changes in Groundwater Storage

Within the Basin, the only long-term data set available to evaluate change in storage over time are the hydrographs for the CASGEM wells. For this reason, our evaluation is focused on the alluvial aquifer of the Lower Eel River Valley. Because use is concentrated in the Lower Eel River Valley, we conclude that the alluvial aquifer underlying it is a good proxy for the Basin as a whole.

For the purposes of evaluating trends in the change in groundwater storage, the Eel River Valley was broken into representative polygons based on position within the Basin and general compositional variations in the aquifer material. Each polygon was assigned to a representative CASGEM well within its area. The polygons and their representative CASGEM wells are shown on Figure 13. Sea level was used as a basal boundary to define the storage capacity. This is a practical lower limit as it relates to seawater intrusion and it simplifies the volume calculation. The area within approximately 1.5 miles of the coast was not considered as it is within the intertidal zone, the fluctuation is small, and the water quality is poor. The height of the spring groundwater elevations in each respective well was multiplied by the area of the associated polygon to derive a bulk volume. This volume was then multiplied by a specific yield estimated for each area to develop a quantity of water in storage. Figure 14 shows the change in storage year to year from 1989 to 2017 plotted with the yearly precipitation totals (water year) as measured in Scotia. As expected, the precipitation and storage track very closely with each other. Figure 15 plots the cumulative change over the same period with a net positive in 2017.

6.0 Plan Implementation Progress–Projects and Management Actions

The monitoring network that was expanded in 2016 with support from the Proposition 1 Sustainable Groundwater Planning Grant and volunteer participation is sufficient to monitor Basin parameters into the future. Ongoing monitoring will provide relevant, high-quality data and information to support a continuously improving understanding of groundwater conditions and verification of sustainable groundwater management. Humboldt County will develop a data management system to compile the data and make it publicly available, and will continue to share information at meetings of the Working Group.

Based on the evaluation presented in the previously submitted GSP Alternative, and the updated information presented herein, the sustainability goal for the Basin is being met and will continue to be met for at least the next five years. The monitoring network and program outlined in Section 4.5 of the GSP Alternative remains appropriate after our review of 2017 water year data. In addition to the monitoring summarized in Table 1, we will maintain transducers at both the River 4 and MW-9 locations (Figure 10) to provide surface water-groundwater monitoring along the Van Duzen River. No additional monitoring network components are considered necessary at this time. Therefore, Humboldt County concludes that periodic monitoring, and the submittal of annual reports is sufficient, and that projects or additional management actions are not needed to achieve the Sustainability Goal.

7.0 References

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Figures 1

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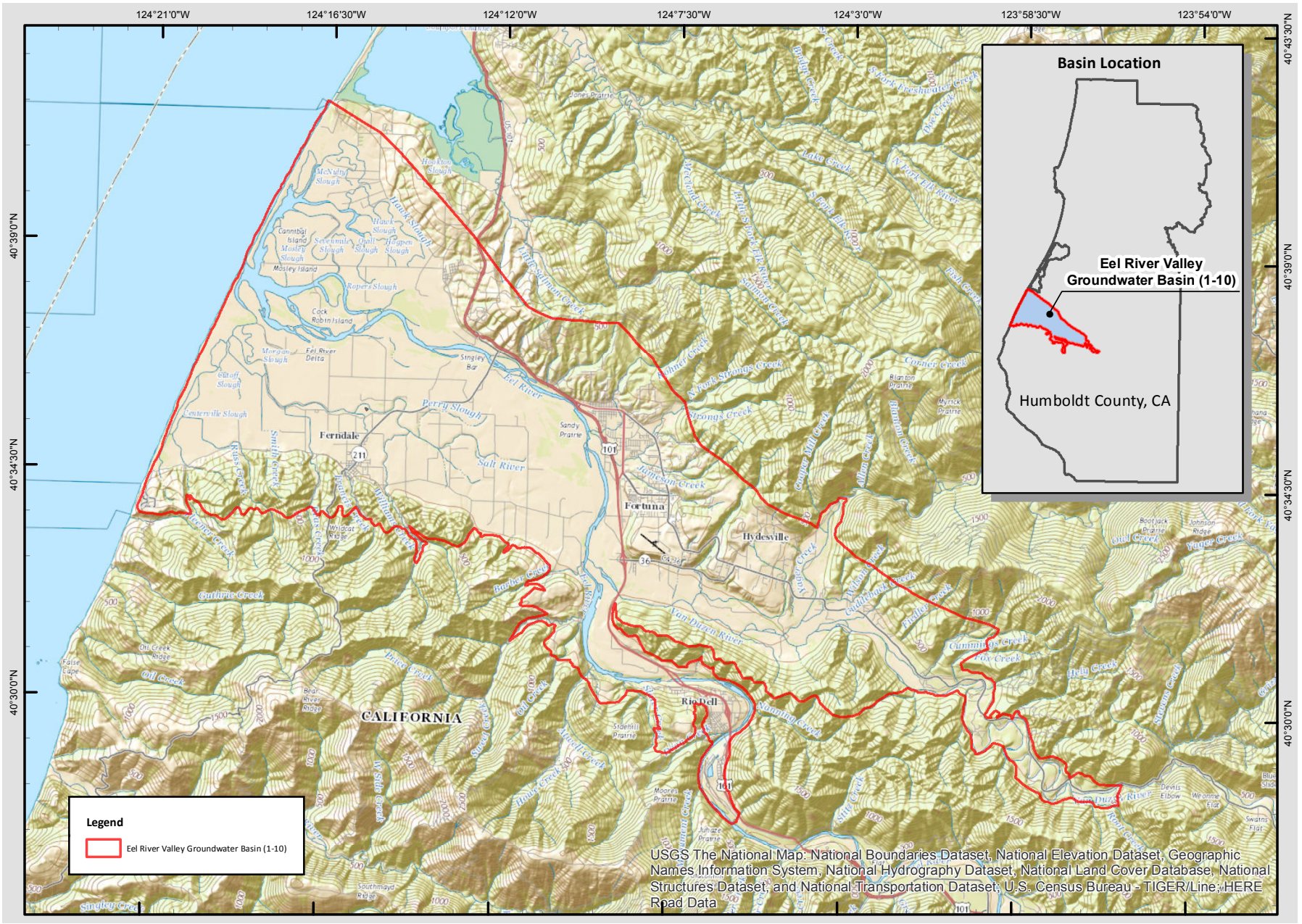

BASEMAP FROM HUMBOLDT COUNTY PUBLIC WORKS (DECEMBER, 2016)

SHN Consulting Engineers & Geologists, Inc.

Humboldt County Public Works
Eel River Groundwater Assessment
Humboldt County, California

Site Location Map
SHN 016219

March 2018 | 1_SiteLocationMap.ai | Figure 1

23182

MW-1 (S/D)
23181

MW-5 (S/D)

23183

36944

MW-7 (S/D)

36943

23178

BI-ANNUAL CHLORIDE SAMPLING IN MW-5 & MW-7

36942

TRANSDUCER IN MW-2

MW-8

MW-2 (S/D)

R3

TRANSDUCER IN RIVER

MW-10

MW-3 (S/D)

MW-9 (S/D)

MW-11

USGS BRIDGEVILLE STATION-11478500

USGS SCOTIA STATION-11477000

EXPLANATION

- RIVER STATION
- CASGEM Wells Monitored Bi-annually by DWR
- USGS Stream Gauge Station
- County Monitoring Wells 2016
- Eel River Groundwater Basin

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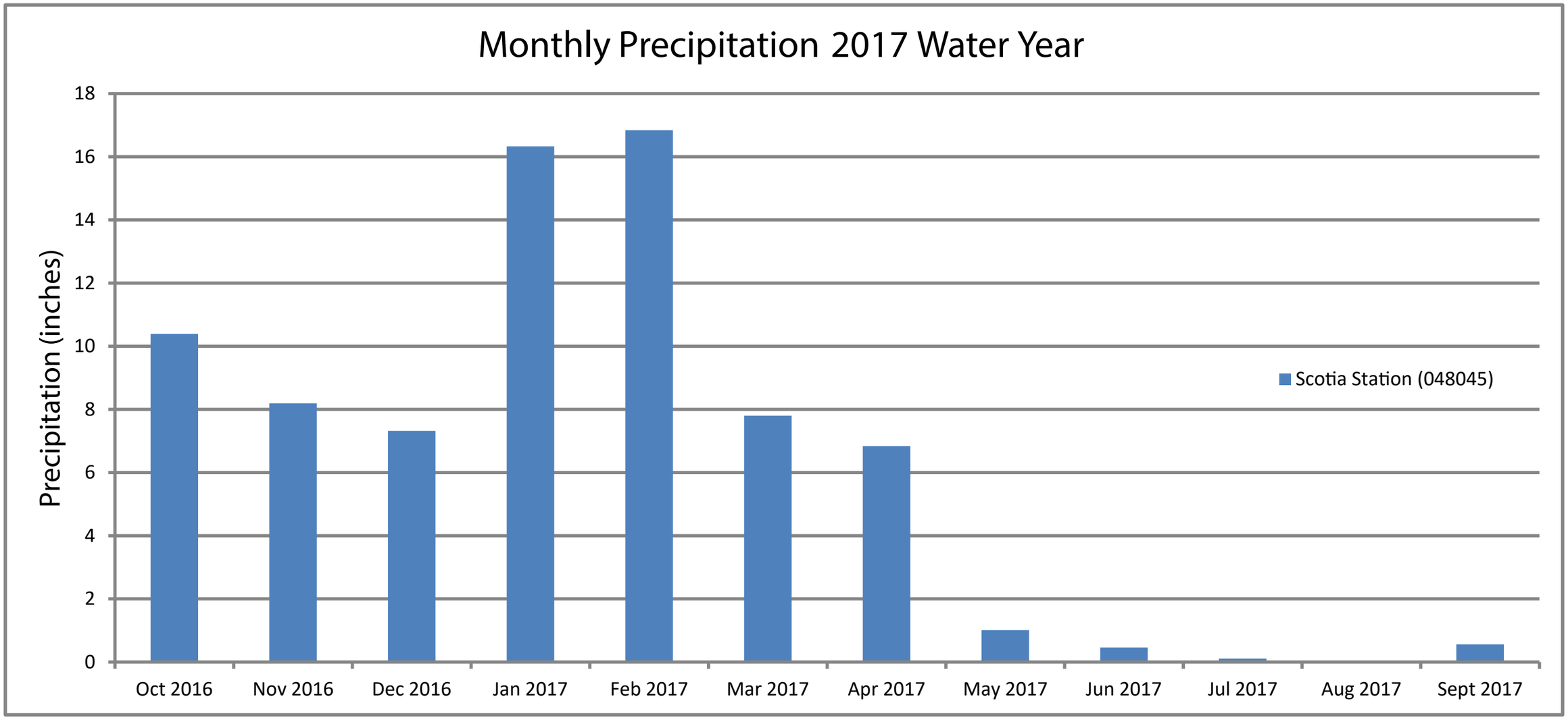
Eel River Groundwater Assessment
Humboldt County, California

Monitoring Network Locations
SHN 016219

March 2018 | Monitoring_Network_Locations | Figure 2



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Humboldt County, California

Monthly Precipitation Totals
SHN 016219

March 2018 | Figure3a.ai | Figure 3

USGS

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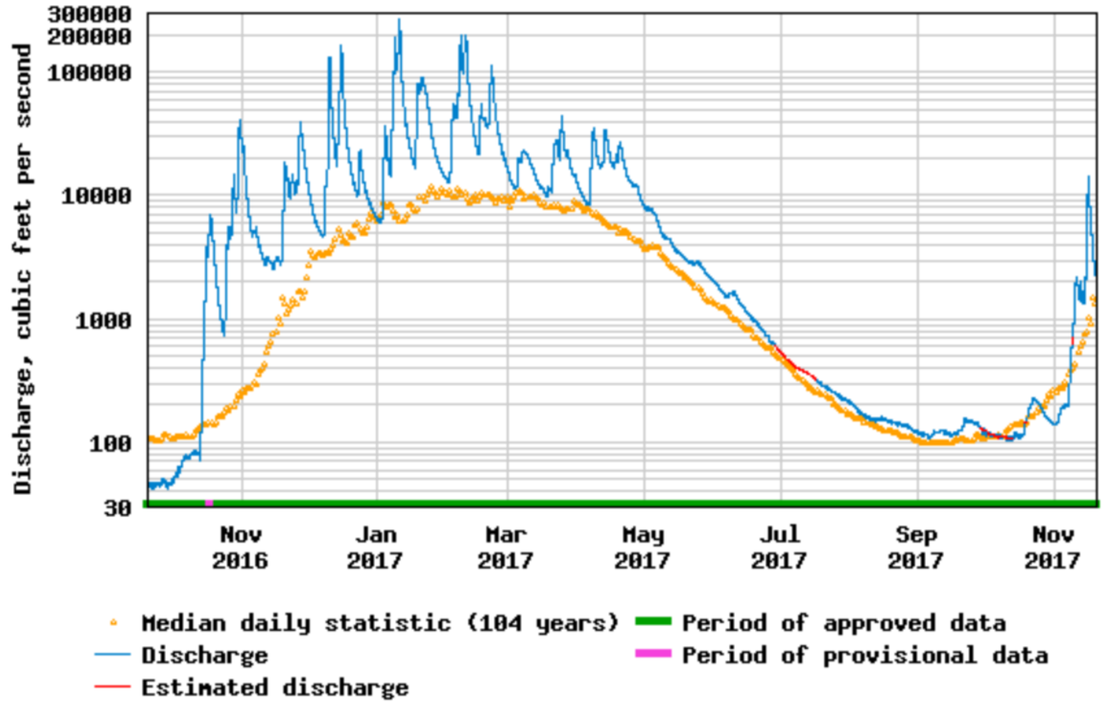

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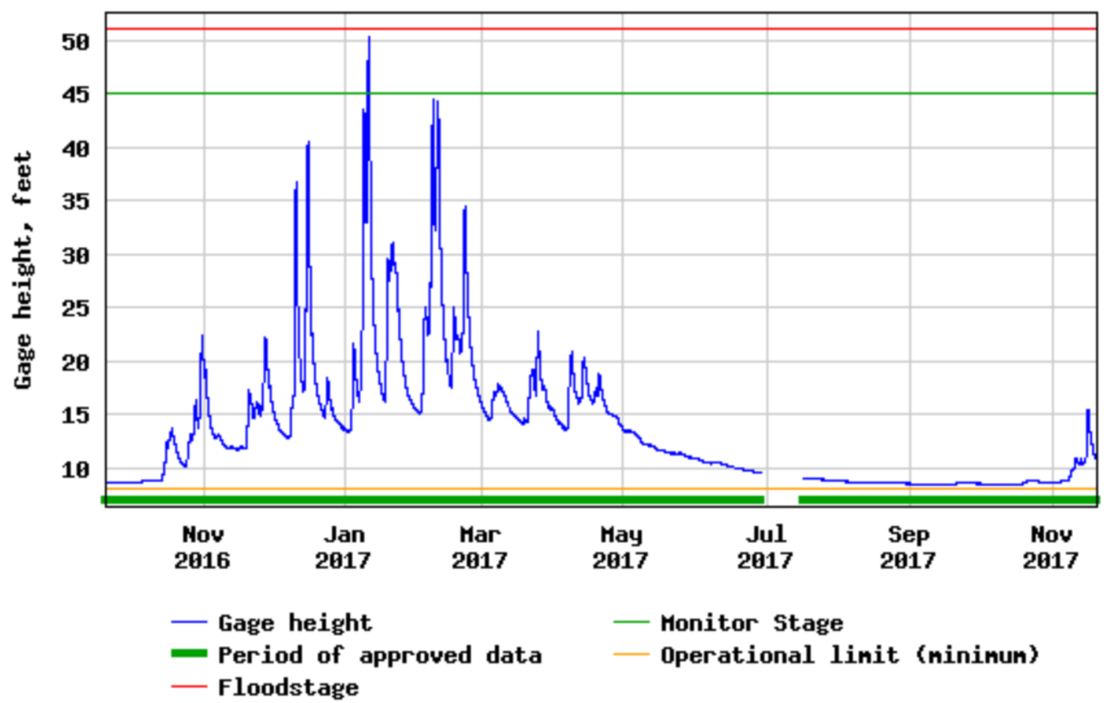

Consulting Engineers & Geologists, Inc.	Humboldt County Public Works Eel River Groundwater Assessment Humboldt County, California		Flow and Gage Data USGS Scotia Station 11477000 SHN 016219
	March 2018	Figure4a.ai	Figure 4

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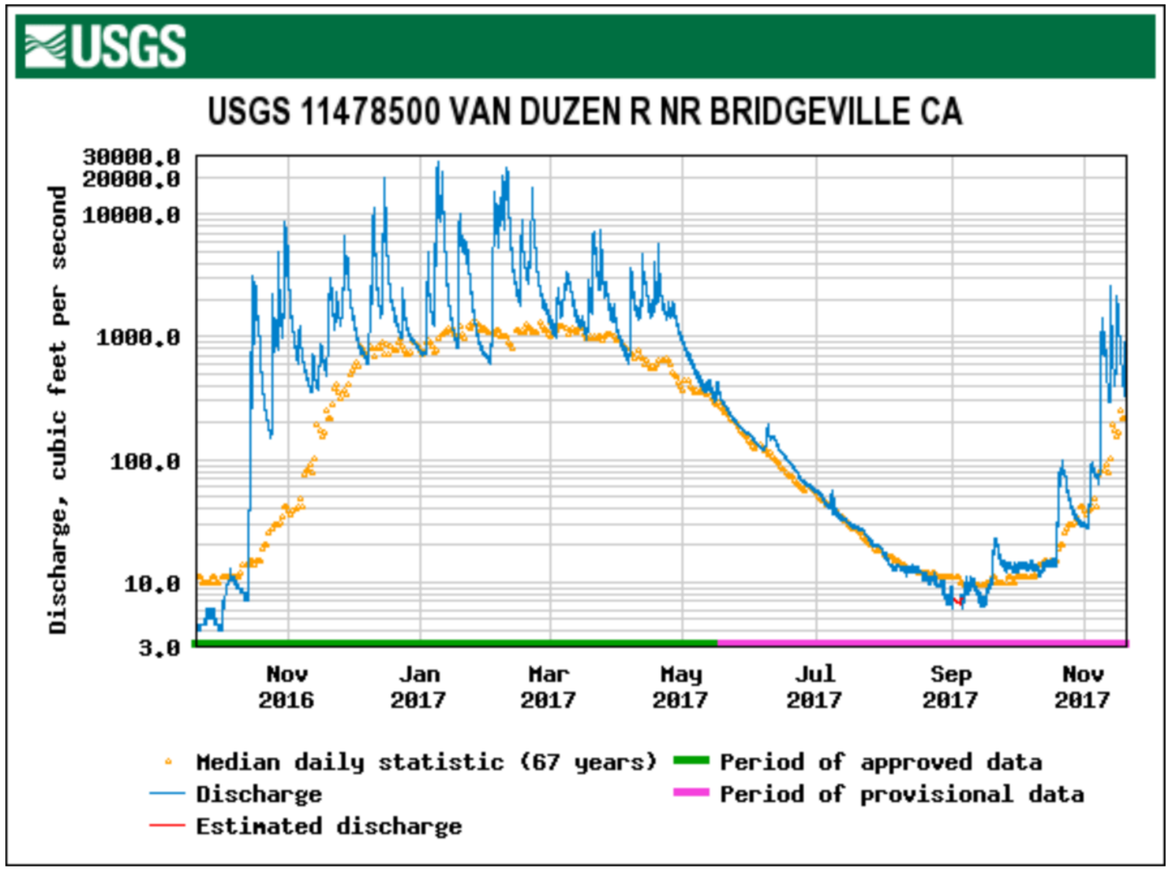

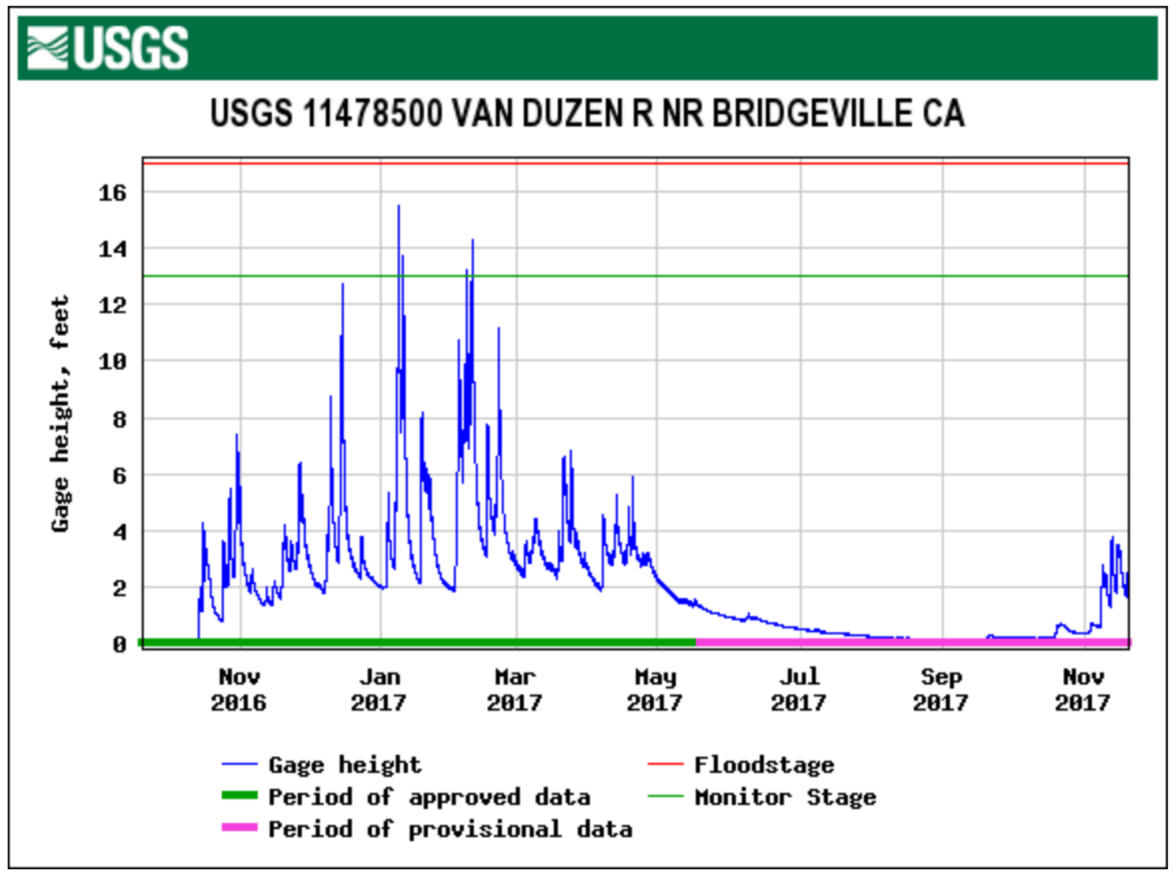

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Humboldt County Public Works
Eel River Groundwater Assessment
Humboldt County, California

Flow and Gage Data
USGS Bridgeville Station 11478500
SHN 016219

March 2018 | Figure5a.ai | Figure 5

NO RECORDS BEYOND 1999

23180

23182

23181

23183

36944

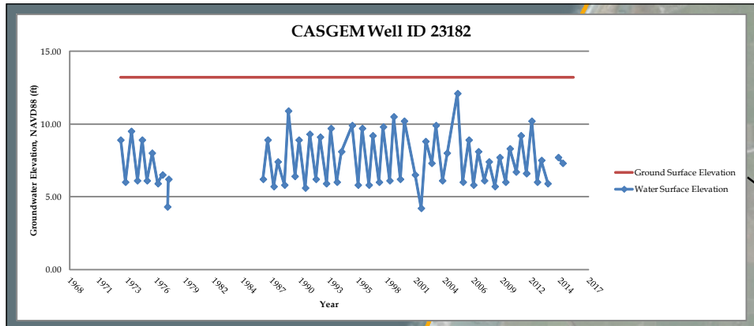
36943

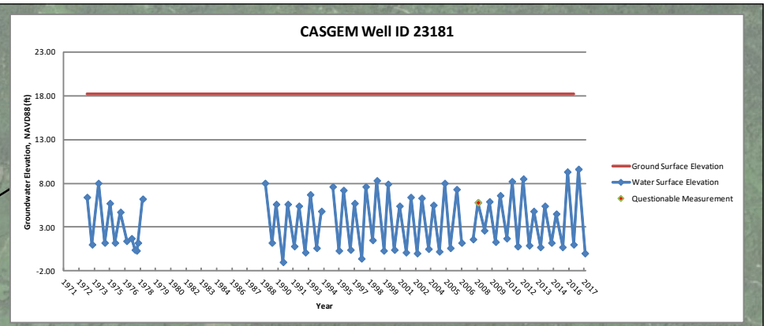
23178

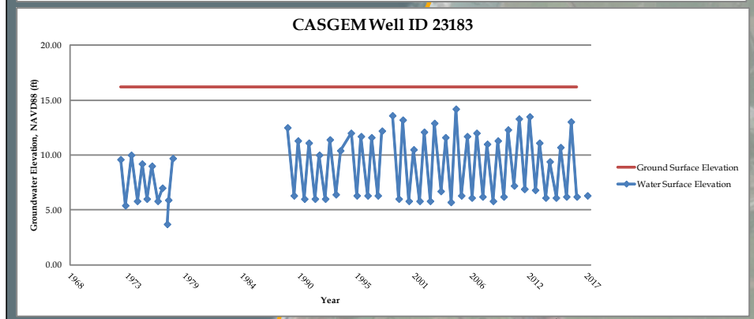
36942

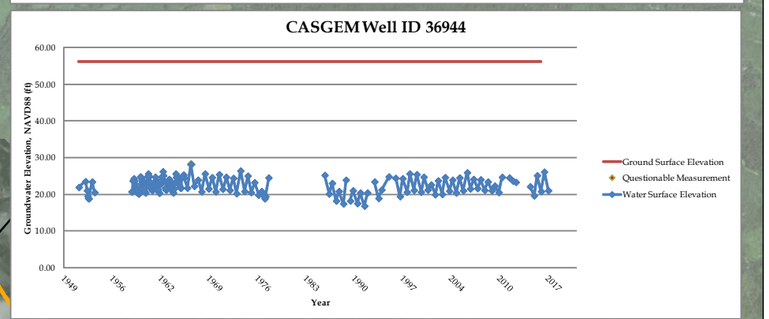
ONLY HAD RECORD FROM 1986 TO 1994

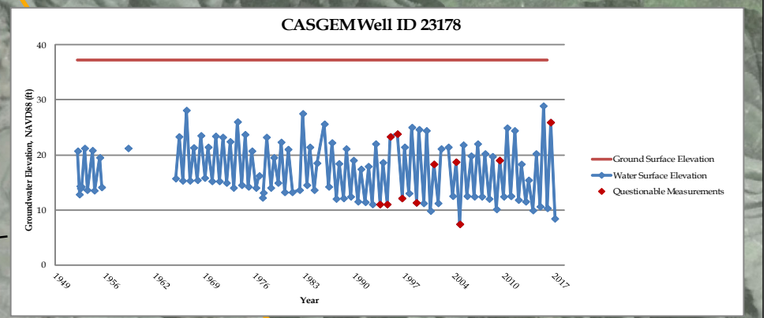
23179

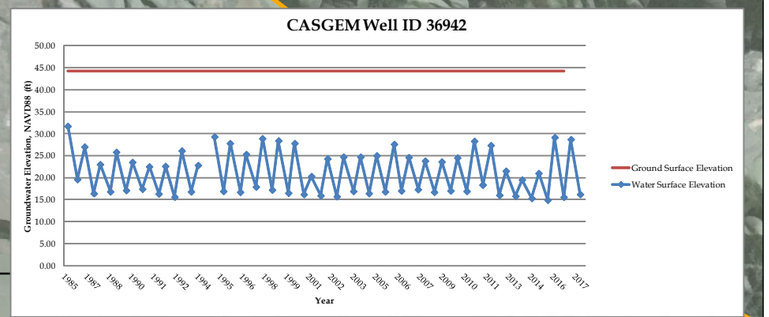


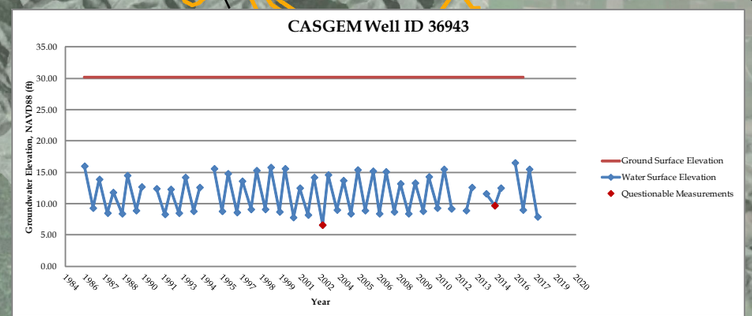












EXPLANATION

CASGEM WELLS

EEL RIVER GROUNDWATER BASIN

0 1

MILES

N

1 "= 1 MILES

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Path: \\Eureka\Projects\2016\016219-EelRiverGW\GIS\PROJ_MXD\2018\CASGEMWell_Locations.mxd

Consulting Engineers & Geologists, Inc.

Humboldt County Public Works Eel River GW Assessment Humboldt County, California		CASGEM Well Locations and Hydrographs SHN 016219
March 2018	CASGEMWell_Locations	Figure 6

FALL 2016 GROUNDWATER CONTOUR MAP

EXPLANATION

EEL RIVER GOUNDWATER BASIN

WELLS

- CASGEM WELLS
- HUMBOLDT CREAMERY WELLS
- MUNICIPAL WELLS
- PRIVATE WELL
- COUNTY MONITORING WELLS

N

1 "= 10,000 '±

0 10,000

FEET

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Path: \\eureka\projects\2016\016219-EelRiverGW\GIS\PROJ_MXD\2018\GW_Elevations_Fall20162018.mxd

Consulting Engineers & Geologists, Inc.

Humboldt County Public Works
Eel River GW Assessment
Humboldt County, California

Groundwater Elevation
Map - Fall 2016
SHN 016219

March 2018 | GW_Elevations_Fall20162018 | Figure 7

SPRING 2017 GROUNDWATER CONTOUR MAP

10
20
30
40
50
60
70
80
90
100
110
120

EXPLANATION

EEL RIVER GOUNDWATER BASIN

WELLS

- CASGEM WELLS
- HUMBOLDT CREAMERY WELLS
- MUNICIPAL WELLS
- PRIVATE WELL
- COUNTY MONITORING WELLS

N

1 "= 10,000 '±

0 10,000

FEET

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Path: \\eureka\projects\2016\016219-EelRiverGW\GIS\PROJ_MXD\2016\GW_Elevations_Spring20172018.mxd

Consulting Engineers & Geologists, Inc.

Humboldt County Public Works Eel River GW Assessment Humboldt County, California		Groundwater Elevation Map - Spring 2017 SHN 016219
March 2018	GW_Elevations_Spring20172018	Figure 8

EXPLANATION

100 MG/L LINE OF EQUAL CHLORIDE CONCENTRATION (JOHNSON, 1975)

CERTAIN

APPROXIMATE

SPRING 2017 CHLORIDE DATA VALUES (MG/L)

INDICATES WELL DEPTH >100 FEET

23/20 INDICATES SHALLOW/DEEP CONCENTRATIONS

N

1"=3,000'±

0 3,000

FEET

1600
280
75
1975 CHLORIDE CONCENTRATION
100 MG/L
120
140
28
4
28
22
23/20
63
29
40
30
62
38
2100
97
36/170
33
43
290
51
43

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Path: \\Eureka\Projects\2016\016219-EelRiverGW\GIS\PROJ_MXD\2018\Chloride_ConcentrationssPRING17.mxd

Consulting Engineers & Geologists, Inc.

Humboldt County Public Works
Eel River Groundwater Assessment
Humboldt County, California

Spring 2017 Chloride Concentrations Map
SHN 016219

March 2018 | Chloride_ConcentrationssPRING17 | Figure 9

RIVER AND WELL LOCATIONS MONITORED THROUGH THE 2017 WATER YEAR

R-1
MW-1 (S/D)
MW-5 (S/D)
MW-7 (S/D)
R-2
MW-8
MW-2 (S/D)
R-3
MW-3 (S/D)
20
22
MW-10
C-23
MW-9 (S/D)
R-4
R-5
MW-11

EXPLANATION

- SURFACE WATER TRANSDUCERS
- PRIVATE WELLS WITH TRANSDUCERS

COUNTY MONITORING WELLS

- WITH TRANSDUCER
- WITHOUT TRANSDUCER
- EEL RIVER GROUNDWATER BASIN

0 6,000
FEET

1 "= 6,000 '

N

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Path: \\eureka\projects\2016\016219-EelRiverGW\GIS\PROJ_MXD\2018\F-1_GWSW_Monitoring_Locations.mxd

Consulting Engineers & Geologists, Inc.

Humboldt County Public Works
Eel River Groundwater Assessment
Humboldt County, California

Groundwater and Surface Water Monitoring Locations
SHN 016219

March 2018 | F-1_GWSW_Monitoring_Locations | Figure 10

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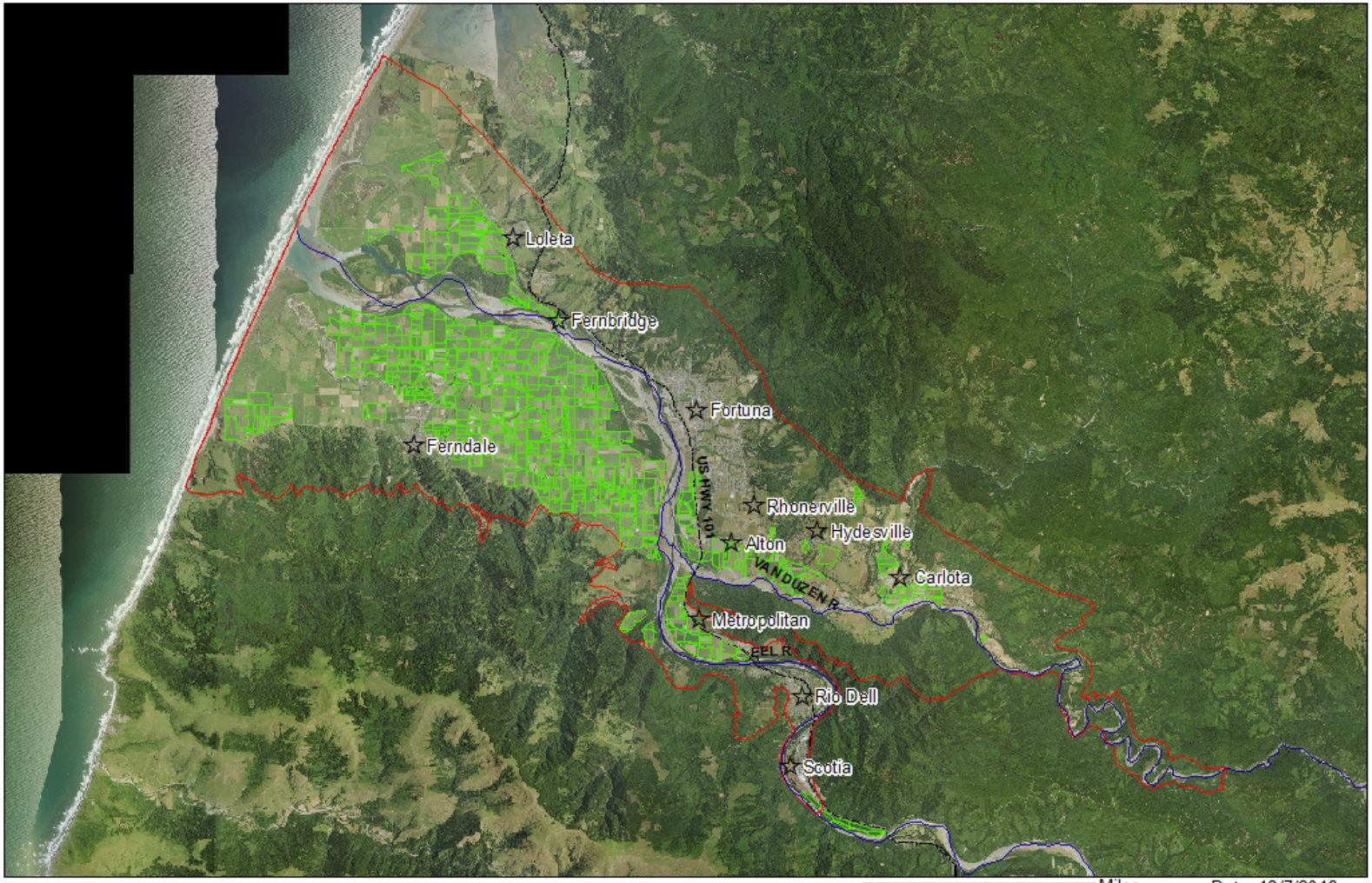


BASEMAP FROM HUMBOLDT COUNTY RESOURCE CONSERVATION DISTRICT (2016)	SHN Consulting Engineers & Geologists, Inc.	Humboldt County Public Works Eel River Groundwater Assessment Humboldt County, California	Irrigated Acreages SHN 016219
		March 2018 | IrrigatedAcreages7a.ai	Figure 11a

Path: \\eureka\Projects\2016\016219-EelRiverGW\GIS\FIGURES\2018\AI\IrrigatedAcreages7b.ai

BASEMAP FROM HUMBOLDT COUNTY RESOURCE CONSERVATION DISTRICT (2016)

SHN Consulting Engineers & Geologists, Inc.

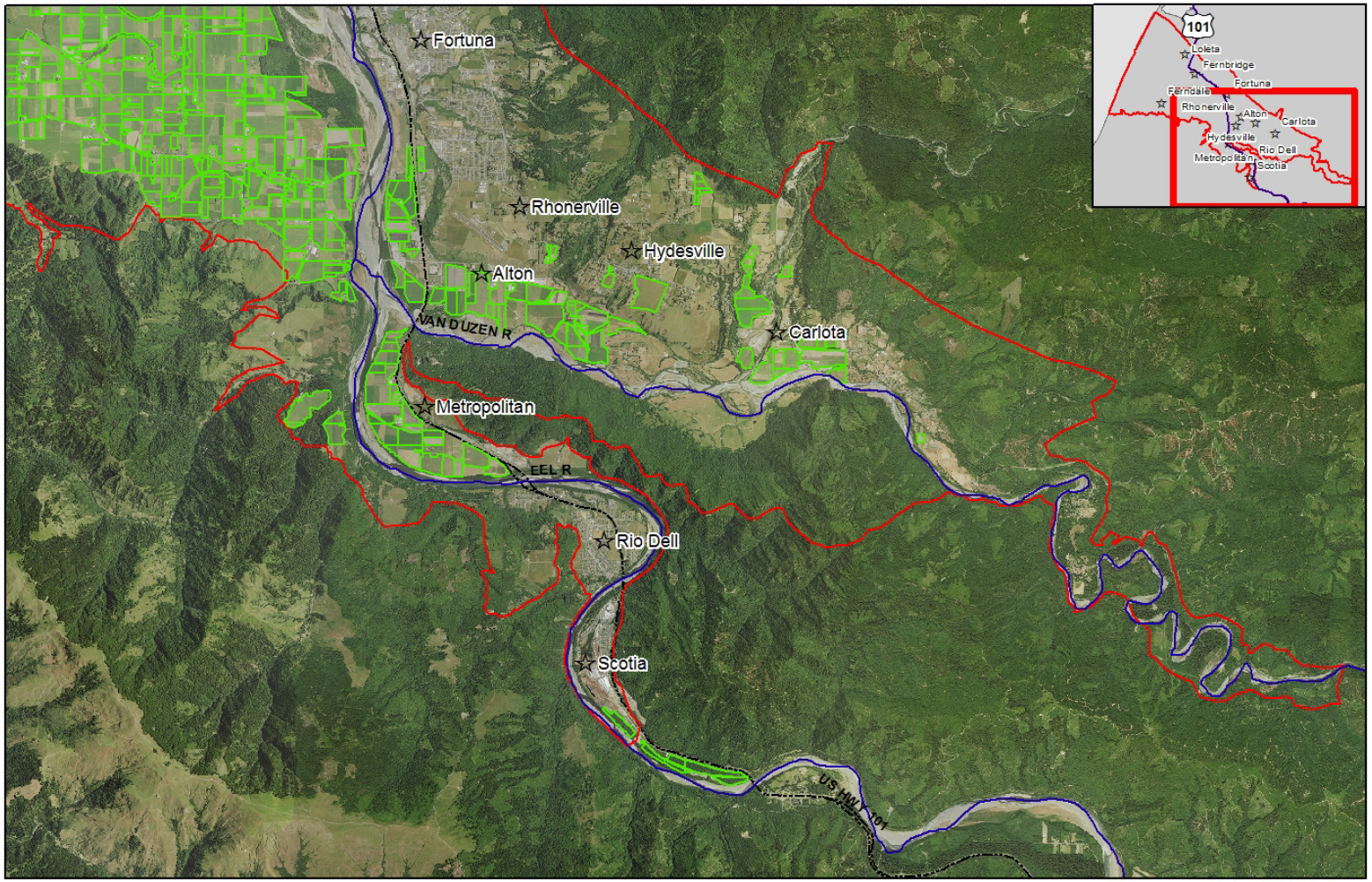
Humboldt County Public Works
Eel River Groundwater Assessment
Humboldt County, California

Irrigated Acreages

SHN 016219

March 2018 | IrrigatedAcreages7b.ai | Figure 11b

Path: \\eureka\Projects\2016\016219-EelRiverGW\GIS\FIGURES\2018\AI\IrrigatedAcreages7c.ai



Irrigated Acres

- Irrigated Acres
- Eel River Valley Groundwater Basin 1-010
- Major Waterways
- Highways
- ☆ City

Miles
0 1.5 3

Date: 12/7/2016
2014 NAIP Imagery

Humboldt County RESOURCE CONSERVATION DISTRICT

Maps are for graphical purposes only. They do not represent a legal survey. While every care has been taken to prepare this map, the HCRCD makes no representations about its accuracy, reliability or completeness for any particular purpose, and thus cannot accept any liability or responsibility of any kind which may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable.

N

BASEMAP FROM HUMBOLDT COUNTY RESOURCE CONSERVATION DISTRICT (2016)	SHN Consulting Engineers & Geologists, Inc.	Humboldt County Public Works Eel River Groundwater Assessment Humboldt County, California	Irrigated Acreages SHN 016219
		March 2018 | IrrigatedAcreages7.ai	Figure 11c

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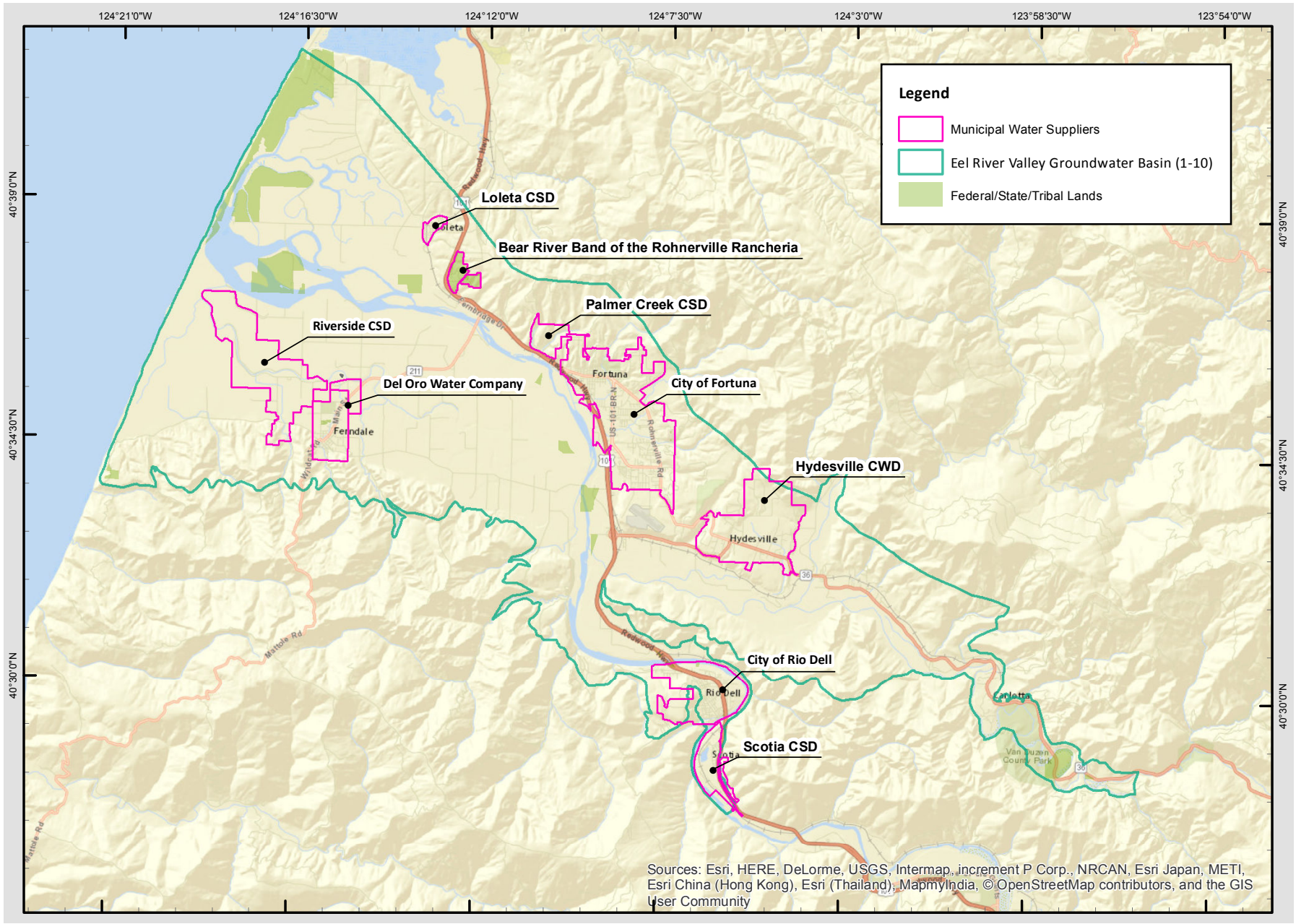


BASEMAP FROM HUMBOLDT COUNTY PUBLIC WORKS (DECEMBER, 2016)	SHN Consulting Engineers & Geologists, Inc.	Humboldt County Public Works Eel River Groundwater Assessment Humboldt County, California	Municipal Water Suppliers SHN 016219
		March 2018 | 2-1_MunicipalWaterSuppliers.ai	Figure 12

Parameters Used in Analysis of Storage Changes

CASGEM Well ID#	Area of Associated Polygon (acres)	Estimated Specific Yield
23182	4346	15%
23181	2673	20%
23183	7331	10%
36942	5724	22%

CASGEM WELL 23182

CASGEM WELL 23181

CASGEM WELL 23183

CASGEM WELL 36942

EXPLANATION

- CASGEM WELLS
- CHANGE IN STORAGE CALCULATION AREAS
- EEL RIVER GROUNDWATER BASIN

0 6,000 FEET

1 "= 6,000 '

Path: \\eureka\projects\2016\016219-EelRiverGW\GIS\PROJ_MXD\2018\Change_in_Storage_Analysis.mxd

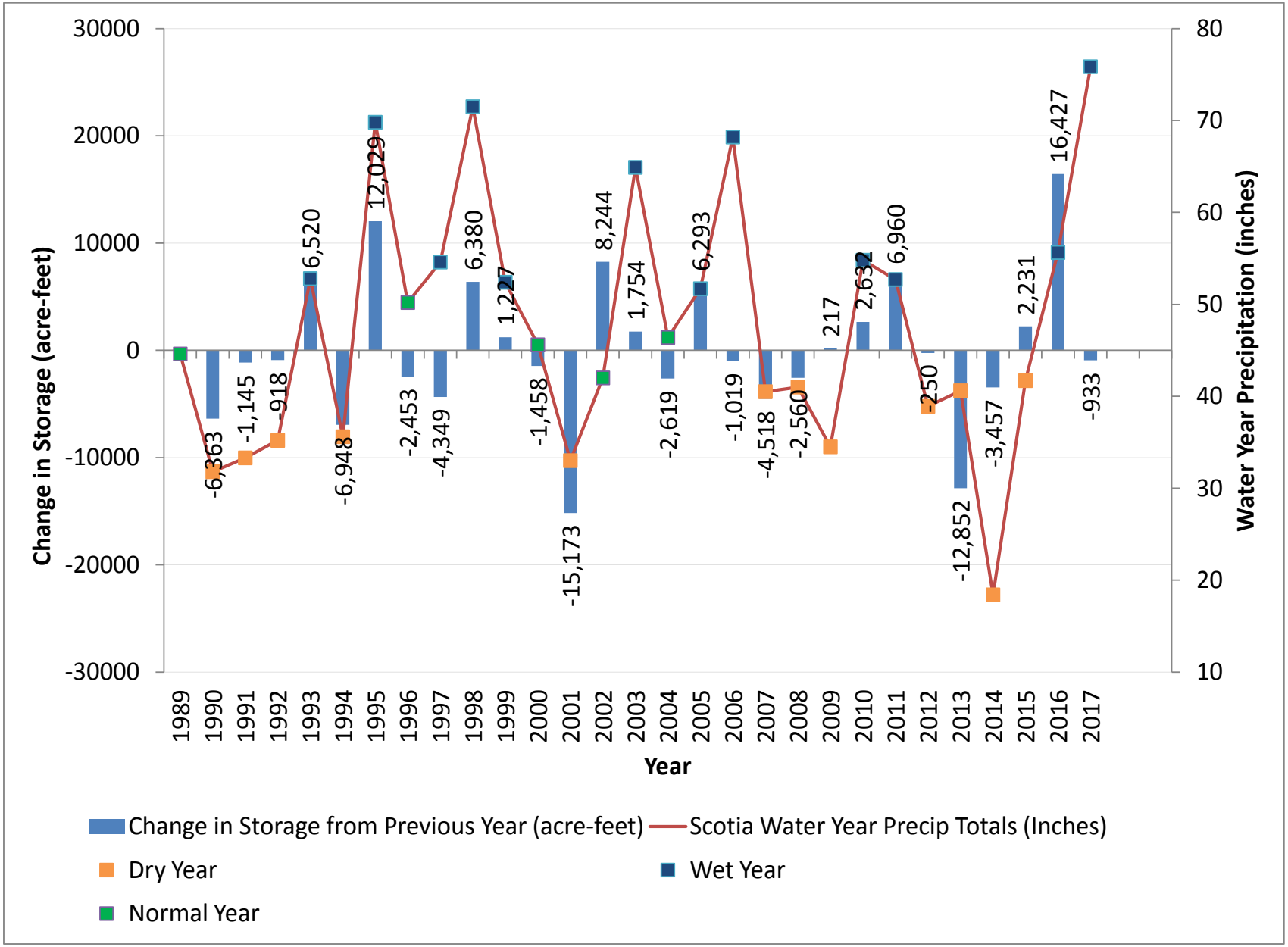
Consulting Engineers & Geologists, Inc.

Humboldt County Public Works
Eel River Groundwater Assessment
Humboldt County, California

CASGEM Wells and Associated Areas Used in Change in Storage Analysis
SHN 016219

March 2018 | Change_in_Storage_Analysis | Figure 13

Path: \\eureka\Projects\2016\016219-EelRiverGW\GIS\FIGURES\2018\AI\StorageWY.ai



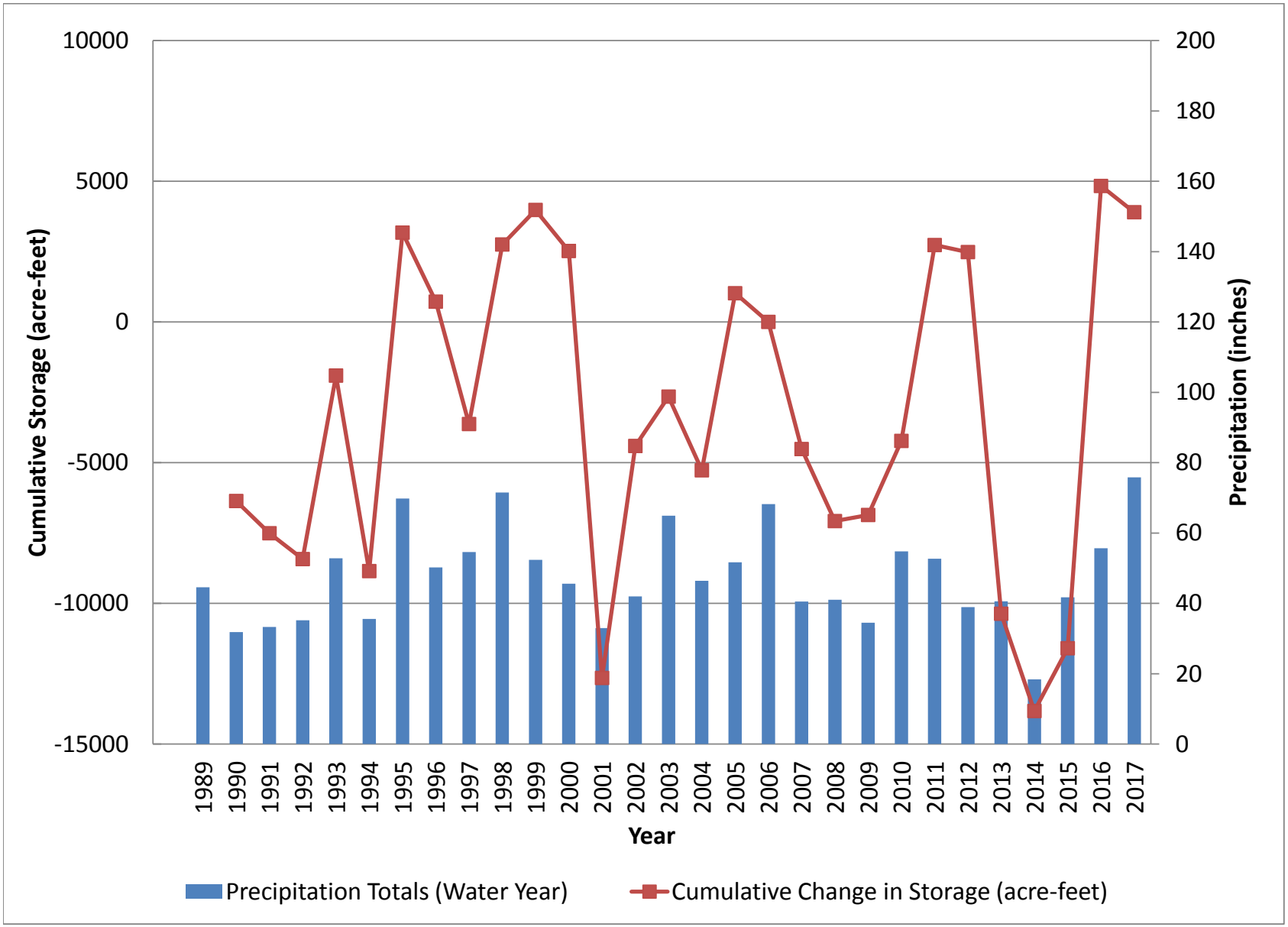
NOTE: CHANGES IN GROUNDWATER STORAGE WERE CALCULATED USING THE LONG-TERM BI-ANNUAL WATER LEVELS RECORDED BY DWR IN REPRESENTATIVE WELLS (SEE FIGURE 13).

Consulting Engineers & Geologists, Inc.

Humboldt County Public Works
Eel River Groundwater Assessment
Humboldt County, California

Changes in Groundwater Storage
in the Lower Eel River Valley
SHN 016219

March 2018 | StorageWY.ai | Figure 14



	Consulting Engineers & Geologists, Inc.	Humboldt County Public Works Eel River Groundwater Assessment Humboldt County, California	Cumulative Changes in Storage in the Lower Eel River Valley SHN 016219
		March 2018 | CumulativeStorage.pdf	Figure 15

Groundwater Elevation Data Tables

2

Table 2-1. Fall 2016 Elevation Monitoring
Eel River Valley Groundwater Basin

Well Location	Field ID	Depth to Water Measurement Date	GW Elevation (ft, NAVD88)[1]	Well Depth	Analyzed by
Private Wells					
03N02W34K002H	2	10/24/2016	7.18	260	SHN[3]/HCRCD[4]
03N02W34K001H	3	10/24/2016	2.91	26	SHN/HCRCD
03N02W34H001H	4	10/25/2016	4.86	80	SHN/HCRCD
03N02W34R001H	5	10/25/2016	7.09	120	SHN/HCRCD
03N02W35B001H	6	10/24/2016	2.95	40	SHN/HCRCD
03N02W26Q001H	7	10/25/2016	5.03	40	SHN/HCRCD
03N02W26G001H	8	10/25/2016	4.72	--	SHN/HCRCD
03N02W13G001H	10	10/25/2016	-0.03	--	SHN/HCRCD
03N02W36C001H	11	10/25/2016	7.63	--	SHN/HCRCD
03N02W36P001H	12	10/24/2016	6.33	60	SHN/HCRCD
02N01W06J001H	13	10/24/2016	0.15	45	SHN/HCRCD
02N01W05B001H	14	10/25/2016	9.93	--	SHN/HCRCD
03N01W33P001H	15	10/24/2016	7.17	55	SHN/HCRCD
02N01W08Q001H	16	10/24/2016	13.55	55	SHN/HCRCD
02N01W09F001H	17	10/24/2016	14.61	--	SHN/HCRCD
02N01W08D001H	18	10/25/2016	11.09	--	SHN/HCRCD
02N01W16J001H	19	10/24/2016	11.39	100	SHN/HCRCD
02N01W22H002H	20	10/24/2016	26.92	110	SHN/HCRCD
02N01W35C001H	21	10/24/2016	33.91	60	SHN/HCRCD
02N01W24E001H	22	10/24/2016	40.55	60	SHN/HCRCD
02N01E19L001H	C-23	10/24/2016	63.17	80	SHN/HCRCD
03N01W19D001H	24	10/25/2016	2.45	--	SHN/HCRCD
03N01W18P001H	25	10/25/2016	0.79	--	SHN/HCRCD
03N02W02R001H	26	10/25/2016	10.83	40	SHN/HCRCD
02N01W16C001H	28	10/31/2016	8.96	200	SHN/HCRCD
03N02W22J001H	29	11/1/2016	-0.12	30	SHN/HCRCD
02N01E27C001H	A	11/1/2016	106.79	50	SHN/HCRCD
02N01E30B001H	B	11/1/2016	62.78	45	SHN/HCRCD
02N01W22C001H	D	11/1/2016	24.22	120	SHN/HCRCD
02N01W09N001H	E	11/1/2016	17.24	45	SHN/HCRCD
02N01W08N001H	F	11/1/2016	7.22	50	SHN/HCRCD
02N02W03F001H	G	11/1/2016	9.44	160	SHN/HCRCD
03N02W34M001H	H	11/3/2016	7.49	120	SHN/HCRCD

Table 2-1. Fall 2016 Elevation Monitoring
Eel River Valley Groundwater Basin

Well Location	Field ID	Depth to Water Measurement Date	GW Elevation (ft, NAVD88)[1]	Well Depth	Analyzed by
02N02W05E001H	I	11/1/2016	13.55	200	SHN/HCRCD
Private Wells (Cont.)					
03N01W31A001H	J	11/1/2016	8.41	50	SHN/HCRCD
03N02W26M001H	L	11/1/2016	6.96	40	SHN/HCRCD
03N02W13R001H	M	11/1/2016	6.39	50	SHN/HCRCD
03N02W12R001H	N	11/1/2016	8.74	--	SHN/HCRCD
03N02W27G001H	Q	11/1/2016	5.91	60	SHN/HCRCD
03N02W13N001H	R	11/1/2016	8.11	--	SHN/HCRCD
County Wells					
03N01W29Q001H	MW-1s	10/28/2016	2.98	35	SHN
03N01W29Q002H	MW-1d	10/28/2016	3.04	60	SHN
02N01W10R002H	MW-2s	10/28/2016	22.78	35	SHN
02N01W10R002H	MW-2d	10/28/2016	22.55	60	SHN
02N01W22H001H	MW-3d	10/30/2016	32.39	60	SHN
02N01W07J001H	MW-8	10/30/2016	3.51	160	SHN
02N01E19Q001H	MW-9s	10/28/2016	64.77	25	SHN
02N01E16R001H	MW-10	10/30/2016	130.01	29	SHN
02N01E23N001H	MW-11	10/30/2016	119.12	46	SHN
CASGEM Wells [5]					
02N01W08B001H	23178	10/19/2016	10.33	40	DWR[6]
02N01W09K001H	36942	10/19/2016	15.59	30	DWR
03N01W34J001H	36944	10/19/2016	20.80	496	DWR
02N02W02G001H	36943	10/19/2016	9.02	210	DWR
03N02W35M001H	23183	10/19/2016	6.21	42	DWR
03N01W30N001H	23181	10/19/2016	1.02	50	DWR
Municipal Wells					
02N02W01D001H	Del Oro	10/25/2016	16.16	--	MUNICIP.
02N02W03Q001H	Riverside	10/25/2016	16.50	--	MUNICIP.
02N01W11G001H	Fortuna #1	10/25/2016	31.54	--	MUNICIP.
02N01W11G002H	Fortuna #4	10/25/2016	23.41	--	MUNICIP.
03N01W33A001H	Palmer Creek #1	10/25/2016	8.12	--	MUNICIP.
03N01W33A002H	Palmer Creek #2	10/25/2016	7.00	--	MUNICIP.

Table 2-1. Fall 2016 Elevation Monitoring
Eel River Valley Groundwater Basin

Well Location	Field ID	Depth to Water Measurement Date	GW Elevation (ft, NAVD88)[1]	Well Depth	Analyzed by
Humboldt Creamery Wells					
03N01W29H001H	GWR-1	11/8/2016	21.85	34.10	SHN
03N01W29C001H	GWR-2	11/9/2016	7.51	29.60	SHN
03N01W29D002H	GWR-3	11/9/2016	7.38	29.45	SHN
03N01W19R002H	GWR-4	11/8/2016	7.91	29.45	SHN
03N01W29G001H	GWR-5	11/8/2016	29.09	28.70	SHN
03N01W29G002H	GWR-6	11/8/2016	19.69	31.56	SHN
03N01W30A001H	GWR-7	11/9/2016	7.37	31.30	SHN
03N01W19Q001H	GWR-8	11/8/2016	7.71	31.44	SHN
03N01W19R001H	GWR-9	11/9/2016	7.64	31.15	SHN
03N01W29D001H	GWR-10	11/9/2016	23.92	28.69	SHN

1. Groundwater elevation (measured by the foot; North American Vertical Datum of 1988)
2. Chloride concentration measured in milligrams per liter (mg/L)
3. SHN: SHN Engineers & Geologists
4. HCRCD: Humboldt County Resource Conservation District
5. CASGEM: California Statewide Groundwater Elevation Monitoring (CASGEM) wells
6. DWR: California Department of Water Resources

Table 2-2. Spring 2017 Elevation Monitoring
Eel River Valley Groundwater Basin

Well Location	Field ID	Depth to Water Measurement Date	GW Elevation (ft, NAVD88)[1]	Well Depth	Analyzed by
Private Wells					
02N02W03E001H	1	3/31/2017	9.11	--	SHN3/HCRCD4
03N02W34K001H	3	3/29/2017	7.63	26	SHN/HCRCD
03N02W34H001H	4	3/31/2017	10.56	80	SHN/HCRCD
03N02W34R001H	5	3/29/2017	12.71	120	SHN/HCRCD
03N02W35B001H	6	3/29/217	10.00	40	SHN/HCRCD
03N02W26Q001H	7	3/29/2017	11.38	40	SHN/HCRCD
03N02W26G001H	8	3/29/2017	9.67	--	SHN/HCRCD
03N02W13G001H	10	3/31/2017	4.24	--	SHN/HCRCD
03N02W36C001H	11	3/29/2017	16.09	--	SHN/HCRCD
03N02W36P001H	12	3/30/2017	16.56	60	SHN/HCRCD
02N01W06J001H	13	3/29/2017	14.05	45	SHN/HCRCD
02N01W05B001H	14	3/30/2017	21.90	--	SHN/HCRCD
03N01W33P001H	15	3/29/2017	16.17	55	SHN/HCRCD
02N01W08Q001H	16	3/29/2017	30.67	55	SHN/HCRCD
02N01W09F001H	17	3/29/2017	27.22	--	SHN/HCRCD
02N01W08D001H	18	3/29/2017	25.97	--	SHN/HCRCD
02N01W16J001H	19	3/29/2017	22.46	100	SHN/HCRCD
02N01W22H002H	20	3/29/2017	33.50	110	SHN/HCRCD
02N01W35C001H	21	3/29/2017	43.78	60	SHN/HCRCD
02N01W24E001H	22	3/29/2017	46.58	60	SHN/HCRCD
02N01E19L001H	C-23	3/29/2017	70.47	80	SHN/HCRCD
03N01W18P001H	25	3/30/2017	4.77	--	SHN/HCRCD
03N02W22J001H	29	3/31/2017	8.68	30	SHN/HCRCD
02N01E30B001H	B	3/30/2017	65.37	45	SHN/HCRCD
02N01W22C001H	D	3/30/2017	33.26	120	SHN/HCRCD
02N01W09N001H	E	3/30/2017	33.20	45	SHN/HCRCD
02N01W08N001H	F	3/29/2017	24.33	50	SHN/HCRCD
02N02W03F001H	G	3/31/2017	14.67	160	SHN/HCRCD
03N02W34M001H	H	3/31/2017	9.03	120	SHN/HCRCD
02N02W05E001H	I	3/31/2017	>14.05 (artesian)	200	SHN/HCRCD
03N01W31A001H	J	3/30/2017	17.11	50	SHN/HCRCD
03N02W26M001H	L	3/31/2017	9.44	40	SHN/HCRCD

Table 2-2. Spring 2017 Elevation Monitoring
Eel River Valley Groundwater Basin

Well Location	Field ID	Depth to Water Measurement Date	GW Elevation (ft, NAVD88)[1]	Well Depth	Analyzed by
03N02W13R001H	M	3/31/2017	7.69	50	SHN/HCRCD
Private Wells (Cont'd)					
03N02W12R001H	N	3/30/2017	11.16	--	SHN/HCRCD
03N02W27G001H	Q	3/31/2017	5.89	60	SHN/HCRCD
03N02W13N001H	R	3/31/2017	9.11		SHN/HCRCD
County Wells					
03N01W29Q001H	MW-1s	4/11/2017	6.02	35	SHN
03N01W29Q002H	MW-1d	4/11/2017	4.91	60	SHN
02N01W10R002H	MW-2s	3/30/2017	26.72	35	SHN
02N01W22H001H	MW-3s	3/30/2017	38.51	35	SHN
03N02W34A002H	MW-5s	4/10/2017	9.62	110	SHN
03N02W34A002H	MW-5d	4/10/2017	11.71	210	SHN
02N02W03C001H	MW-7s	4/10/2017	17.71	40	SHN
02N02W03C002H	MW-7d	4/10/2017	13.18	240	SHN
02N01W07J001H	MW-8	3/30/2017	27.61	160	SHN
02N01E19Q001H	MW-9s	3/30/2017	69.02	25	SHN
02N01E16R001H	MW-10	3/30/2017	135.2	29	SHN
02N01E23N001H	MW-11	3/30/2017	127.61	46	SHN
Casgem Wells [5]					
02N01W08B001H	23178	3/28/2017	25.93	40	DWR[6]
02N01W09K001H	36942	3/28/2017	28.73	30	DWR
03N01W34J001H	36944	3/28/2017	26.13	496	DWR
02N02W02G001H	36943	3/28/2017	15.52	210	DWR
03N01W30N001H	23181	3/28/2017	9.62	50	DWR
Municipal Wells					
02N02W01D001H	Del Oro	3/29/2017	26.48	--	MUNICIP.
02N02W03Q001H	Riverside	3/30/2017	17.90	--	MUNICIP.
02N01W11G001H	Fortuna #1	3/10/2017	33.54	--	MUNICIP.
02N01W11G002H	Fortuna #4	3/10/2017	30.91	--	MUNICIP.
Humboldt Creamery Wells					
03N01W29H001H	GWR-1	3/27/2017	23.06	34.10	SHN
03N01W29C001H	GWR-2	3/28/2017	12.2	29.60	SHN
03N01W29D002H	GWR-3	3/28/2017	11.85	29.45	SHN

Table 2-2. Spring 2017 Elevation Monitoring
Eel River Valley Groundwater Basin

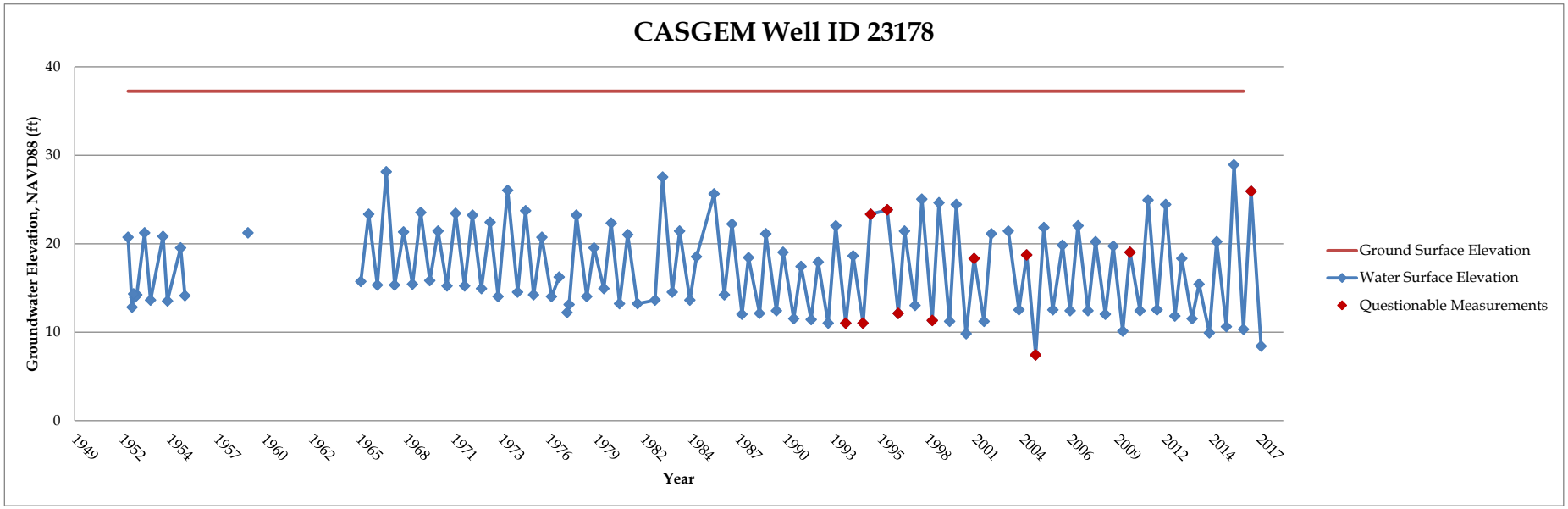
Well Location	Field ID	Depth to Water Measurement Date	GW Elevation (ft, NAVD88)[1]	Well Depth	Analyzed by
03N01W19R002H	GWR-4	3/28/2017	11.88	29.45	SHN
03N01W29G001H	GWR-5	3/27/2017	29.44	28.70	SHN
Humboldt Creamery Wells (Cont'd)					
03N01W29G002H	GWR-6	3/27/2017	20.51	31.56	SHN
03N01W30A001H	GWR-7	3/28/2017	11.68	31.30	SHN
03N01W19Q001H	GWR-8	3/28/2017	11.36	31.44	SHN
03N01W19R001H	GWR-9	3/28/2017	11.63	31.15	SHN
03N01W29D001H	GWR-10	3/27/2017	27.08	28.69	SHN

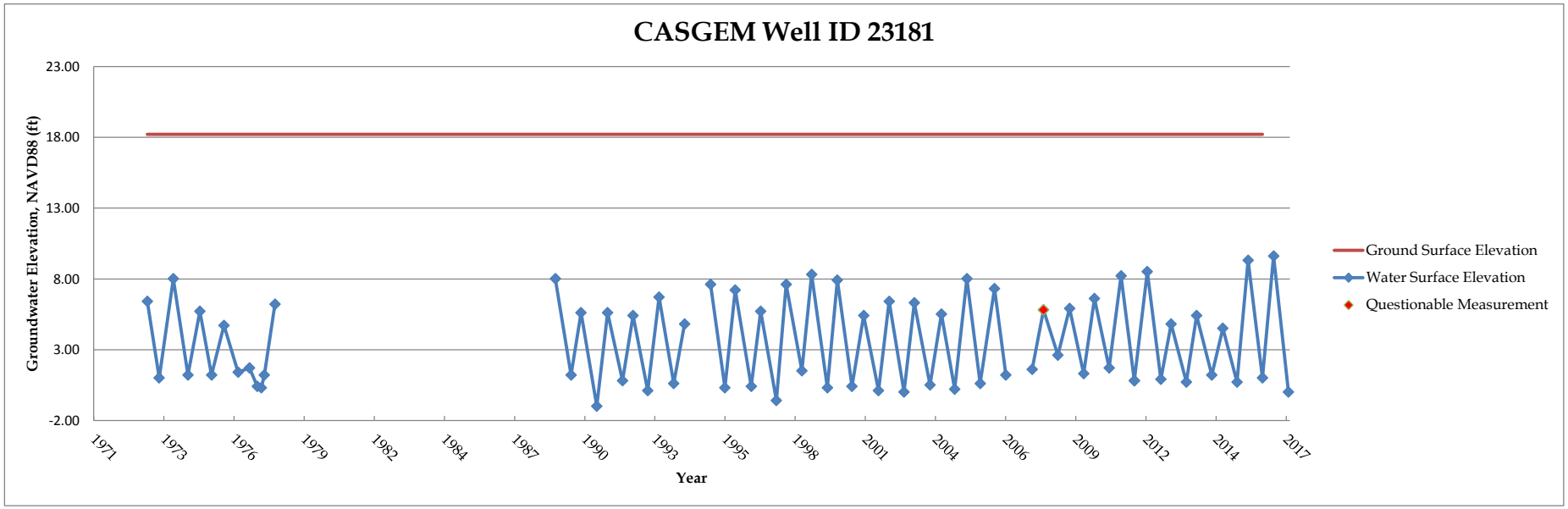
1. Groundwater elevation (measured by the foot; North American Vertical Datum of 1988)
2. Chloride concentration measured in milligrams per liter (mg/L)
3. SHN: SHN Engineers & Geologists
4. HCRCD: Humboldt County Resource Conservation District
5. CASGEM: California Statewide Groundwater Elevation Monitoring (CASGEM) wells
6. DWR: California Department of Water Resources

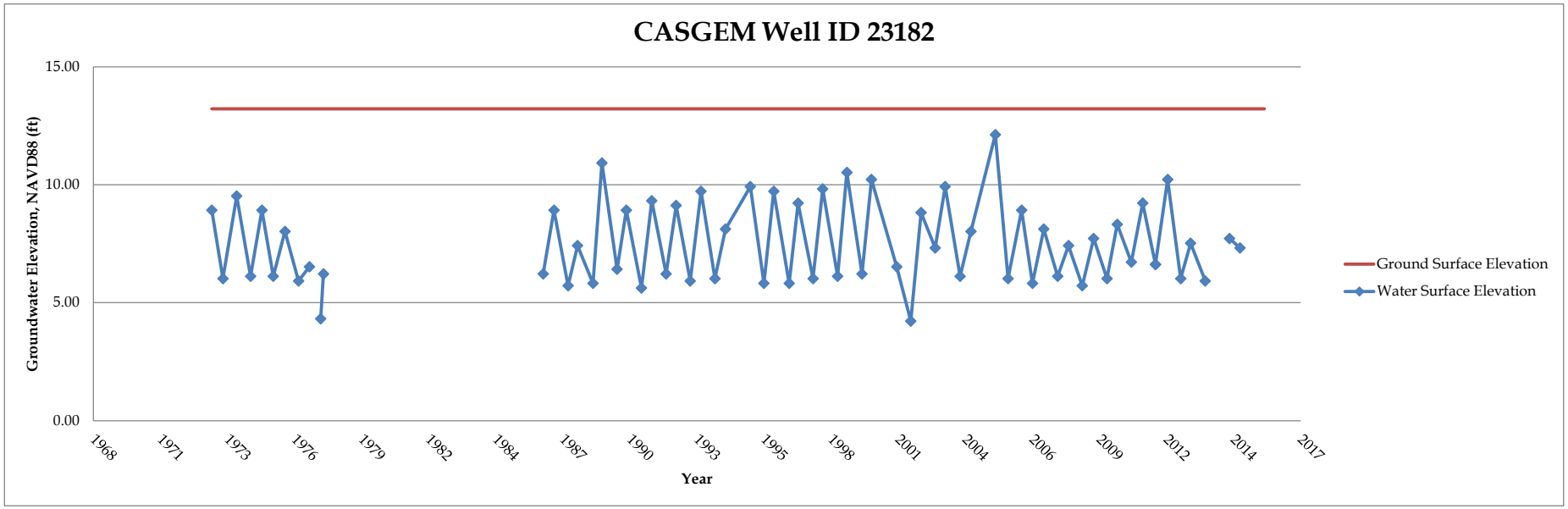
Table 2-3. River and Groundwater Monitoring Sites
Eel River Valley Groundwater Basin

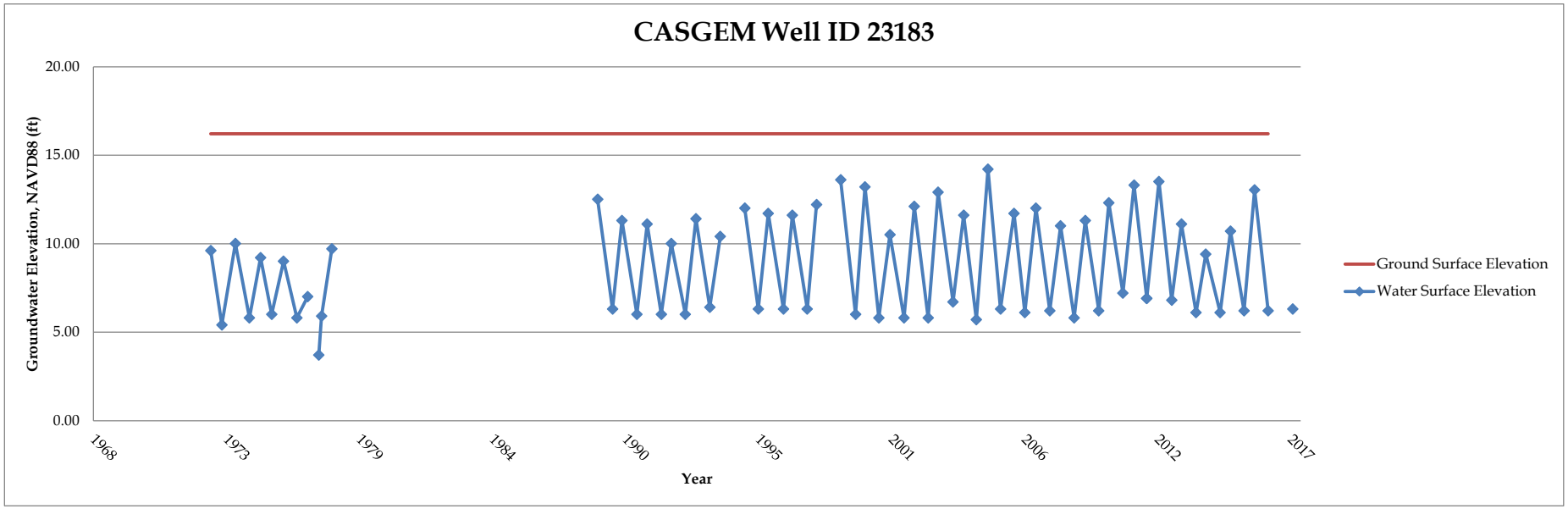
Location	Field ID	Date(s) Monitored	Well Depth	Notes
River Sites				
Eel River	River 1	9/30/16 – 12/10/16	--	Destroyed in Flood
Eel River	River 2	9/30/16 – 12/10/16	--	Destroyed in Flood
Eel River	River 3	9/30/16 – 12/10/16 and 7/5/17 – 11/16/17	--	Destroyed in Flood (Replaced)
Van Duzen	River 4	9/30/16 – 11/16/17	--	Silted In
Van Duzen	River 5	8/10/17 – 11/16/17	--	
Private Wells				
02N01W 22H002H	20	10/12/16 – 11/16/17	110	
02N01W 24E001H	22	10/12/16 – 11/16/17	60	Pumped During Summer
02N01E 19L001H	23	10/12/16 – 11/16/17	80	Pumped During Summer
County Monitoring Wells				
03N01W 29Q001H	MW-1s	10/30/16 -12/9/16 and 3/9/17 – 11/17/17	35	Period of Dry Transducer
03N01W 29Q002H	MW-1d	10/30/16 – 2/28/17	60	
02N01W 10R002H	MW-2s	10/30/16 – 11/17/17	35	Period of Dry Transducer
02N01W 10R002H	MW-2d	10/30/16 – 11/17/17	60	Period of Dry Transducer
02N01W 22H001H	MW-3d	10/31/16 – 11/17/17	60	Period of Dry Transducer
03N02W 34A002H	MW-5s	10/30/16 – 11/16/17	110	
03N02W 34A002H	MW-5d	10/30/16 – 11/16/17	210	
02N02W 03C002H	MW-7s	10/30/16 – 11/16/17	40	
02N02W 03C002H	MW-7d	10/30/16 – 11/16/17	240	
02N01W 07J001H	MW-8	10/30/16 – 11/16/17	160	Period of Dry Transducer
02N01E 19Q001H	MW-9s	10/30/16 – 11/16/17	25	
02N01E 19Q001H	MW-9d	10/30/16 – 11/16/17	48	
02N01E 16R001H	MW-10	10/30/16 – 11/16/17	29	

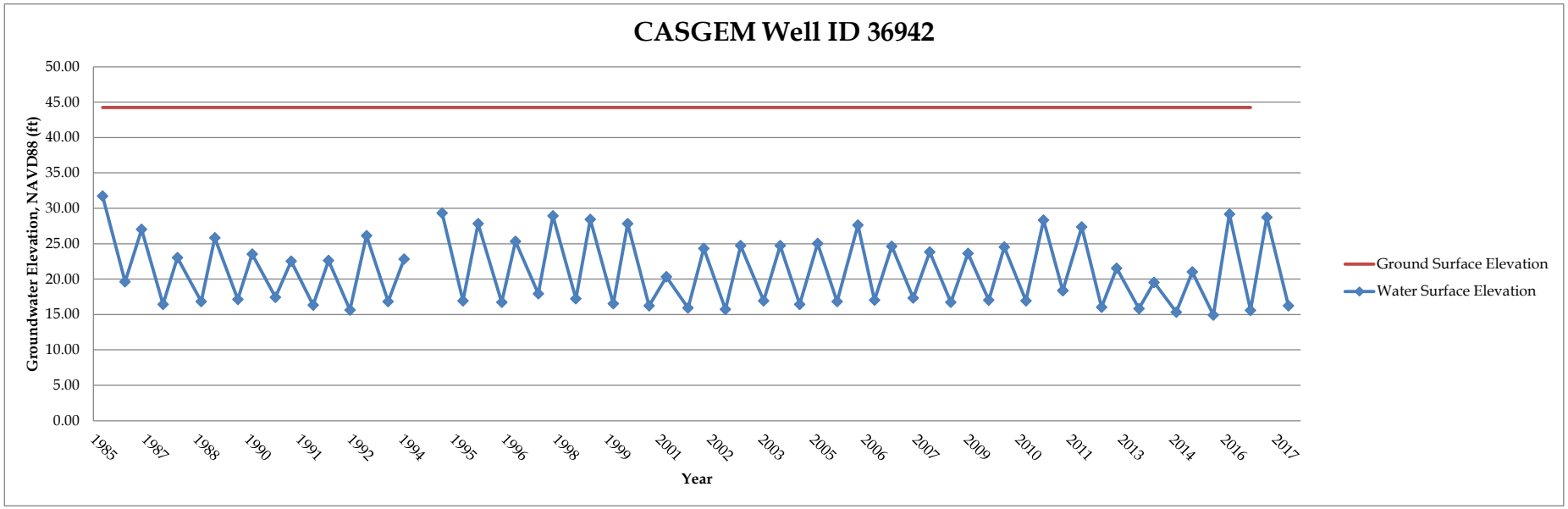
Hydrographs 3

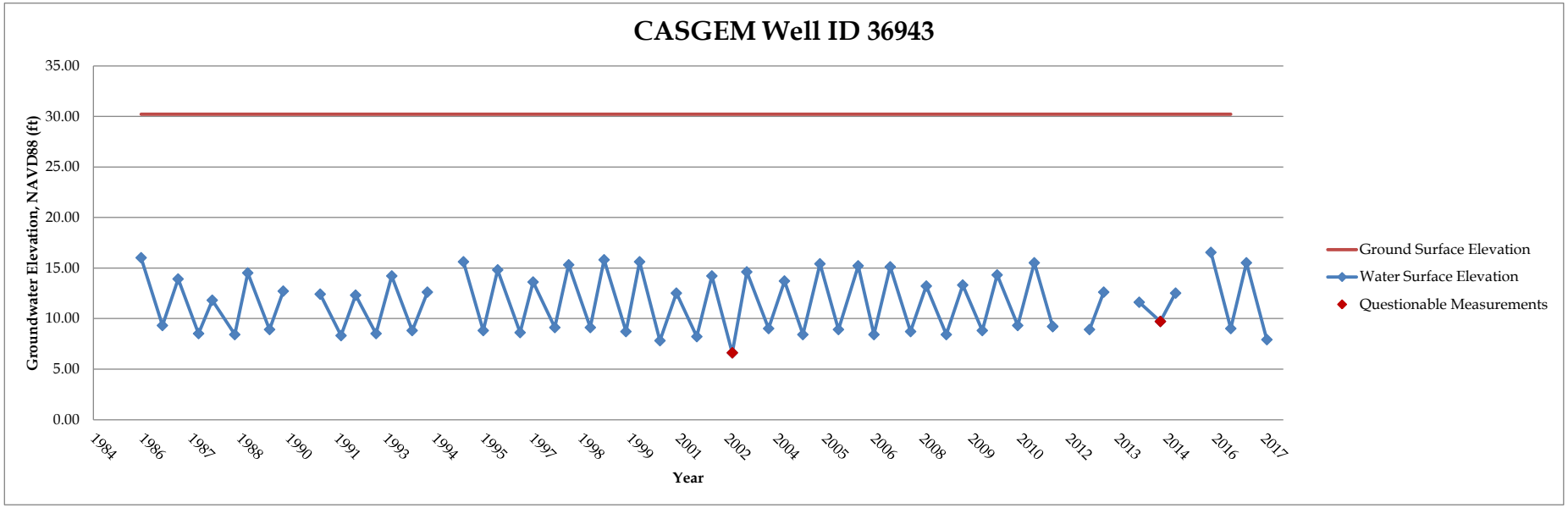

CASGEM Well ID 23178
Groundwater Elevation, NAVD88 (ft)
40
30
20
10
0
1949
1952
1954
1957
1960
1962
1965
1968
1971
1973
1976
1979
1982
1984
1987
1990
1993
1995
1998
2001
2004
2006
2009
2012
2014
2017
Year
Ground Surface Elevation
Water Surface Elevation
Questionable Measurements

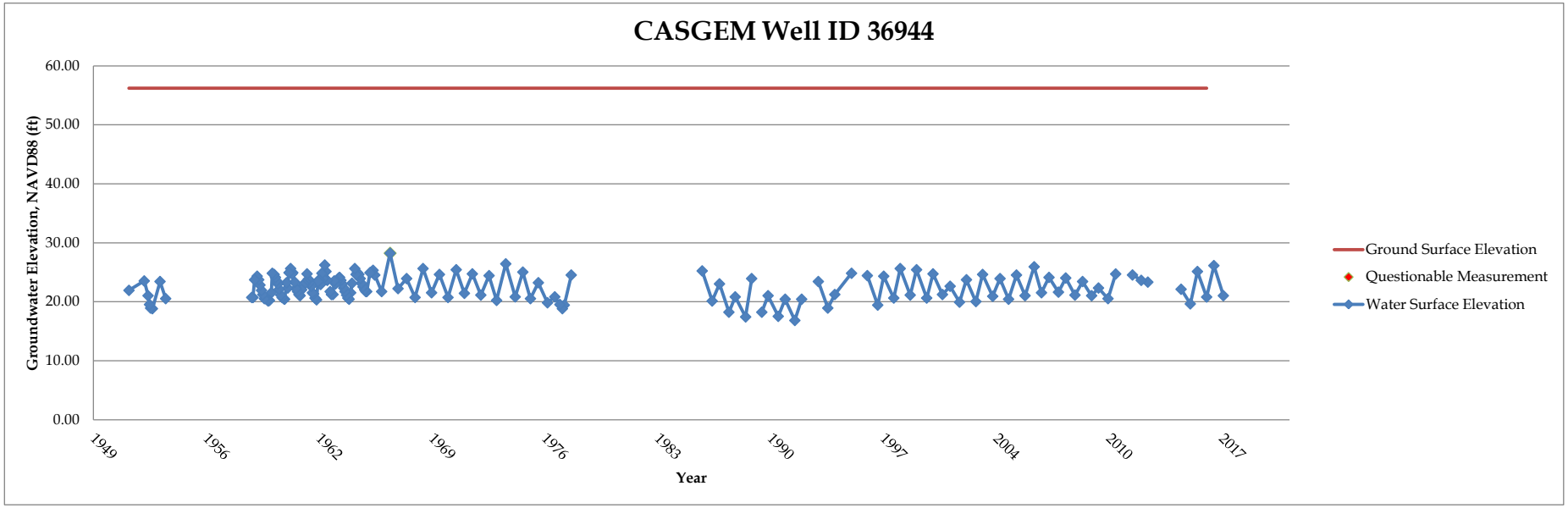

CASGEM Well ID 23181
Groundwater Elevation, NAVD88 (ft)
23.00
18.00
13.00
8.00
3.00
-2.00
1971
1973
1976
1979
1982
1984
1987
1990
1993
1995
1998
2001
2004
2006
2009
2012
2014
2017
Year
Ground Surface Elevation
Water Surface Elevation
Questionable Measurement

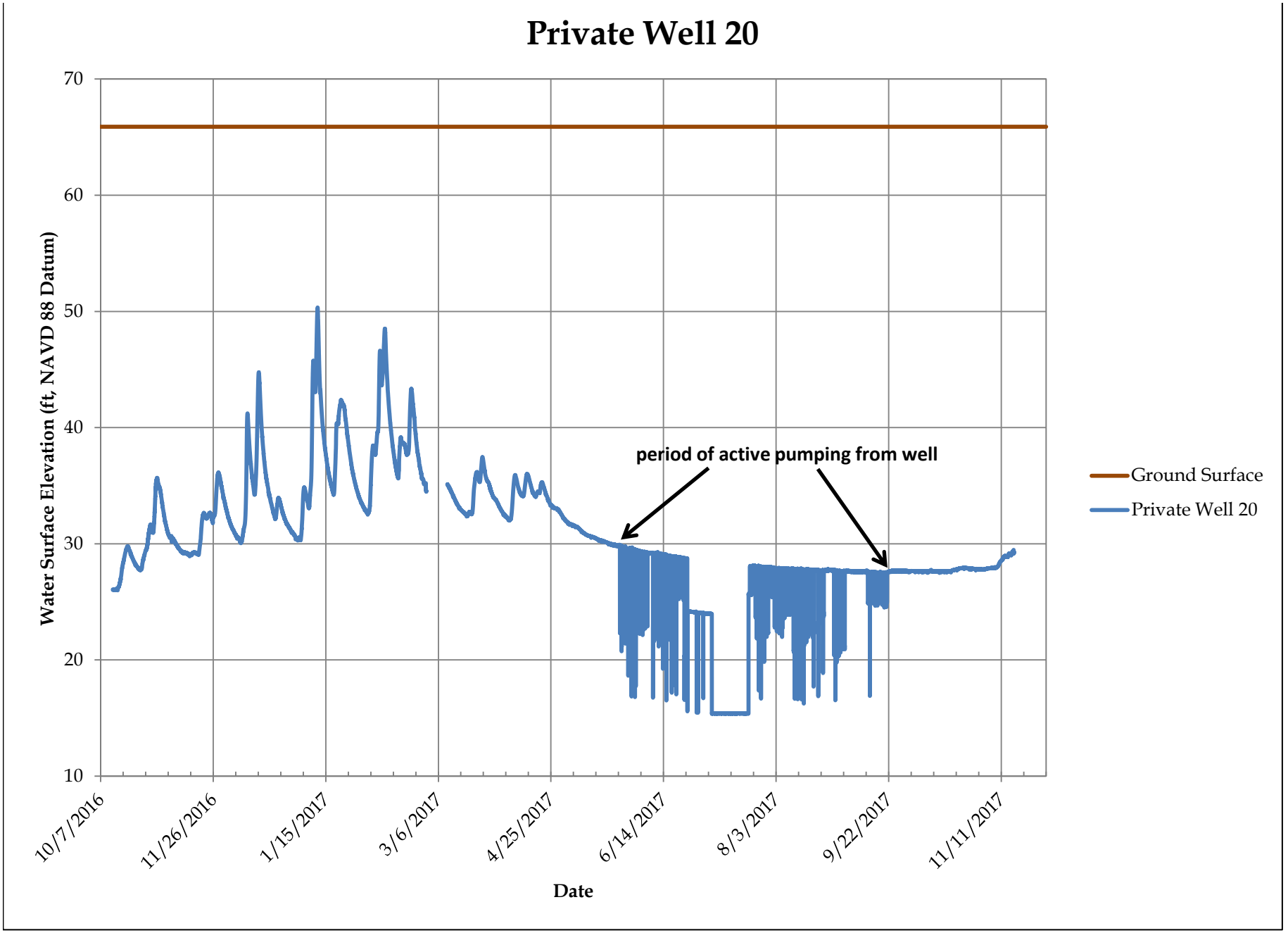

CASGEM Well ID 23182
15.00
10.00
5.00
0.00
Groundwater Elevation, NAVD88 (ft)
1968
1971
1973
1976
1979
1982
1984
1987
1990
1993
1995
1998
2001
2004
2006
2009
2012
2014
2017
Year
Ground Surface Elevation
Water Surface Elevation


CASGEM Well ID 23183
Groundwater Elevation, NAVD88 (ft)
20.00
15.00
10.00
5.00
0.00
1968
1973
1979
1984
1990
1995
2001
2006
2012
2017
Year
Ground Surface Elevation
Water Surface Elevation

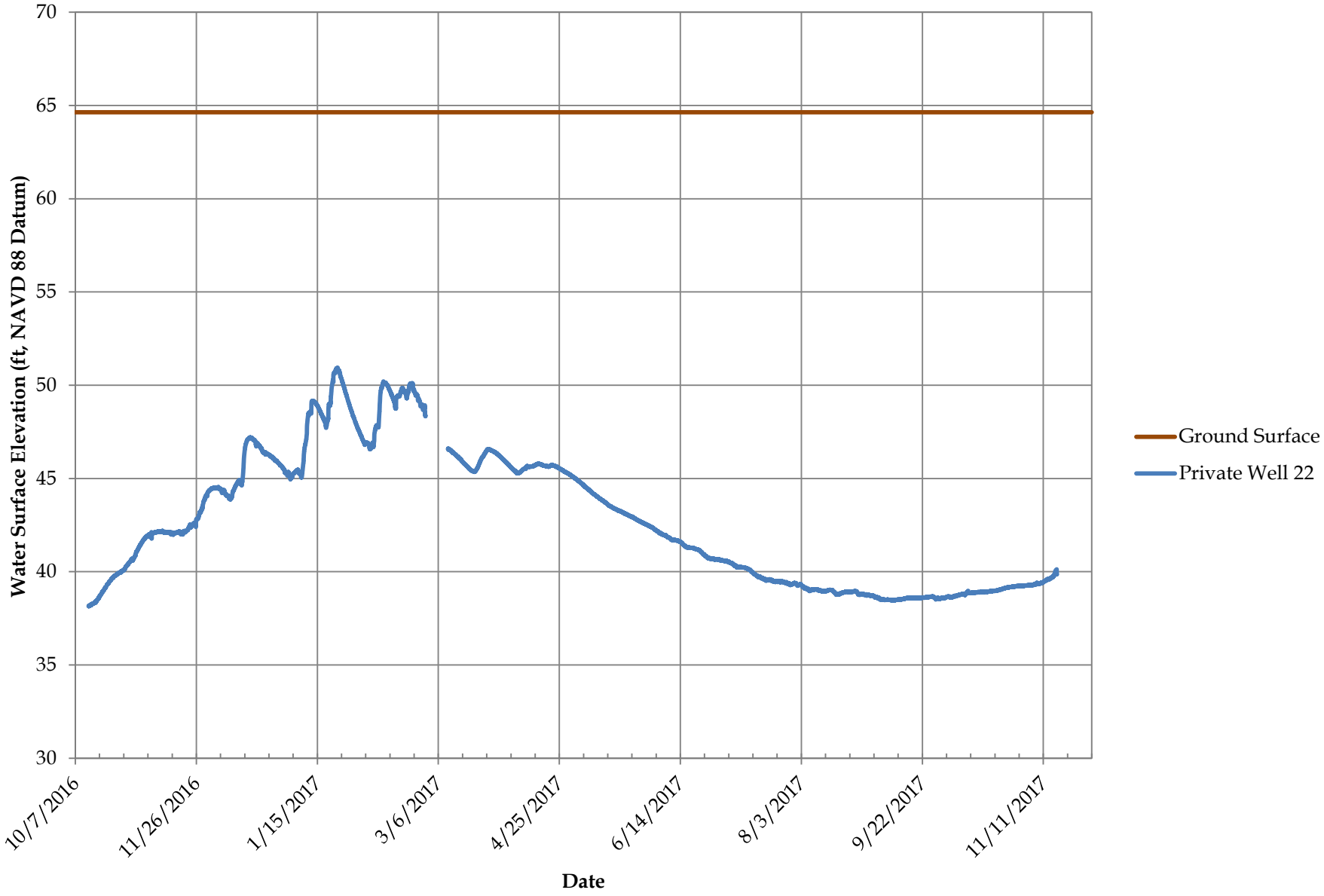

CASGEM Well ID 36942
Groundwater Elevation, NAVD88 (ft)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
1985
1987
1988
1990
1991
1992
1994
1995
1996
1998
1999
2001
2002
2003
2005
2006
2007
2009
2010
2011
2013
2014
2016
2017
Year
Ground Surface Elevation
Water Surface Elevation

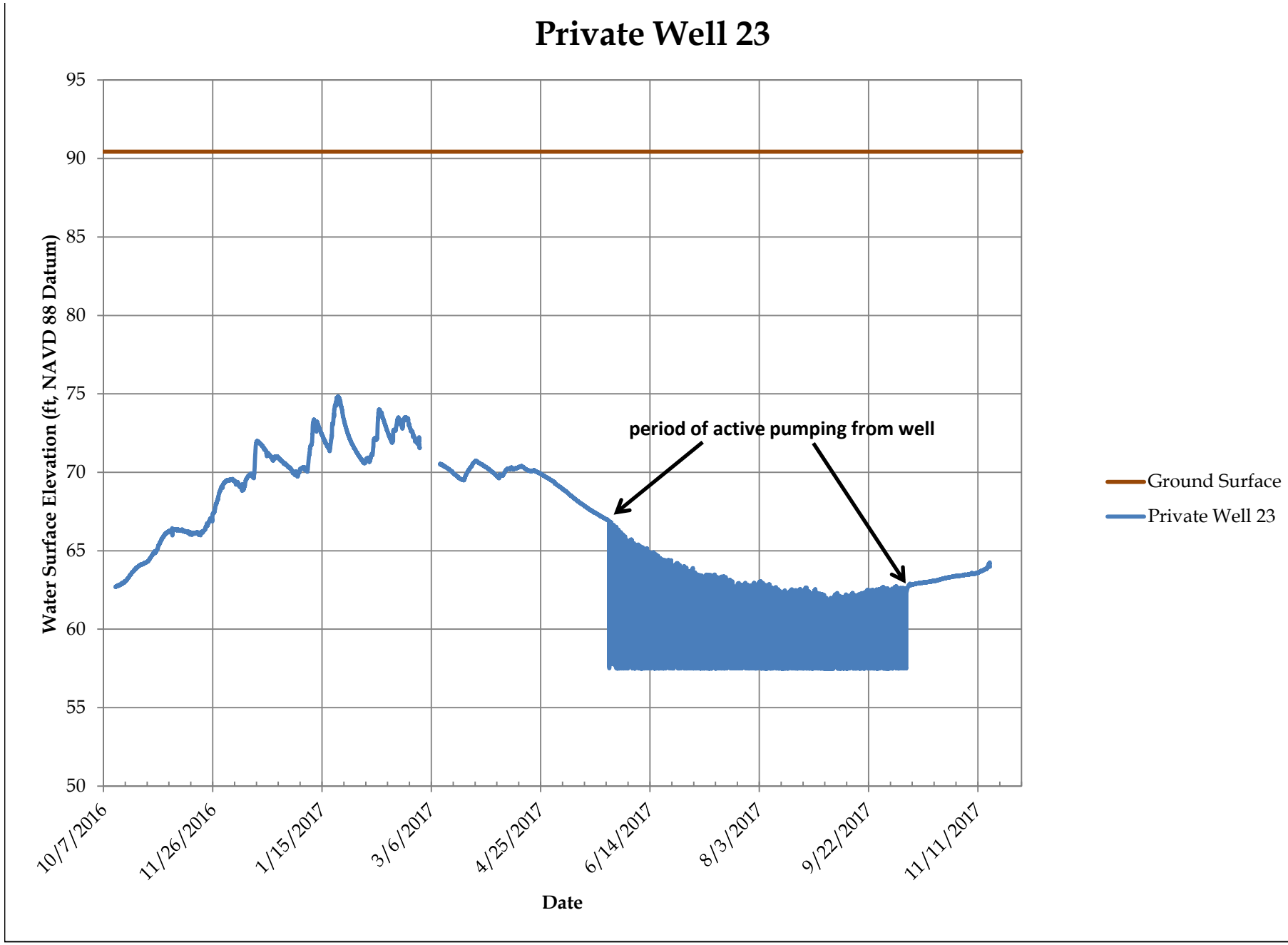

CASGEM Well ID 36943
Groundwater Elevation, NAVD88 (ft)
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
1984
1986
1987
1988
1990
1991
1993
1994
1995
1997
1998
1999
2001
2002
2004
2005
2006
2008
2009
2010
2012
2013
2014
2016
2017
Year
Ground Surface Elevation
Water Surface Elevation
Questionable Measurements

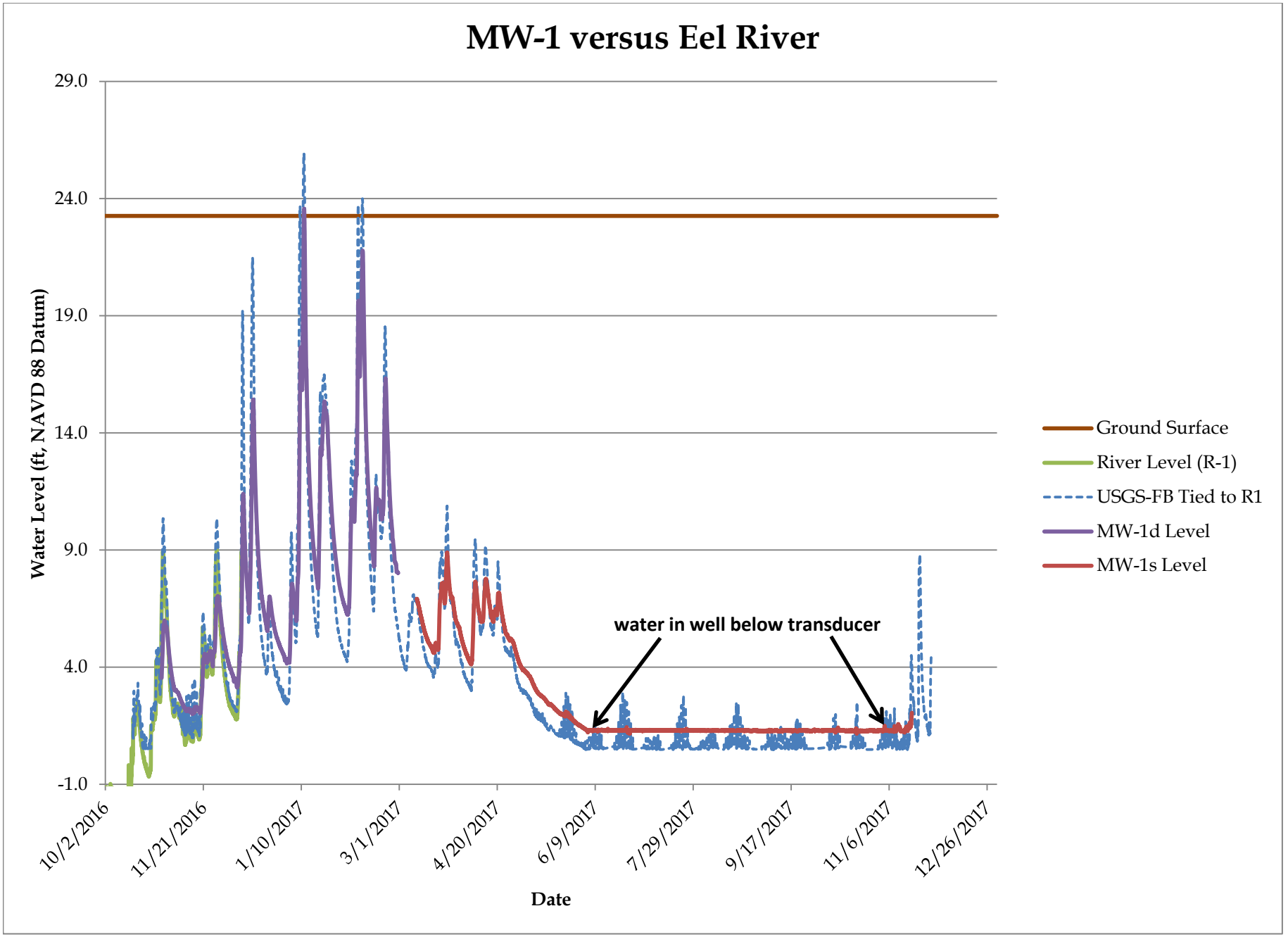

CASGEM Well ID 36944
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Groundwater Elevation, NAVD88 (ft)
1949
1956
1962
1969
1976
1983
1990
1997
2004
2010
2017
Year
Ground Surface Elevation
Questionable Measurement
Water Surface Elevation

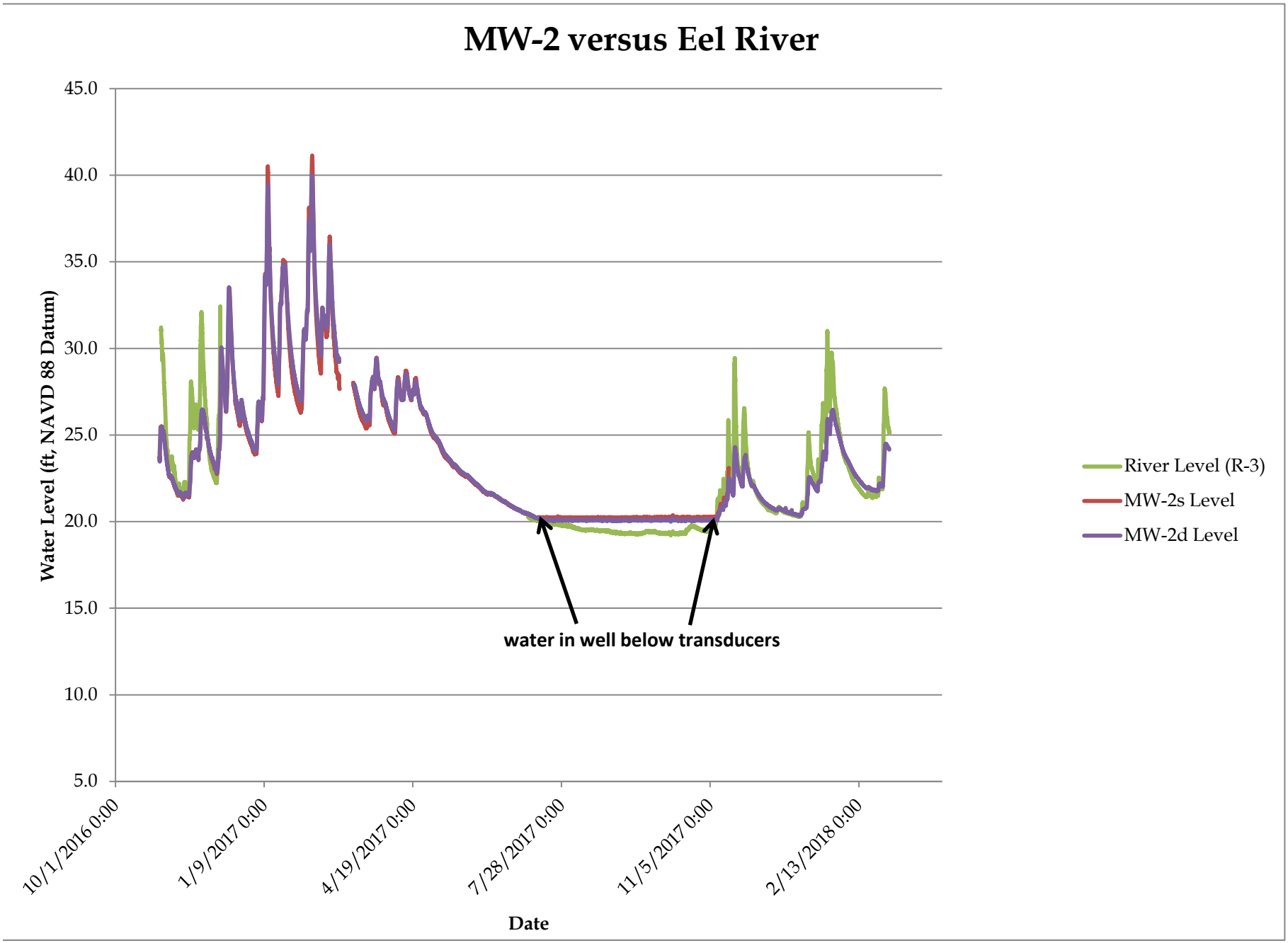

Private Well 20
70
60
50
40
30
20
10
Water Surface Elevation (ft, NAVD 88 Datum)
10/7/2016
11/26/2016
1/15/2017
3/6/2017
4/25/2017
6/14/2017
8/3/2017
9/22/2017
11/11/2017
Date
period of active pumping from well
Ground Surface
Private Well 20

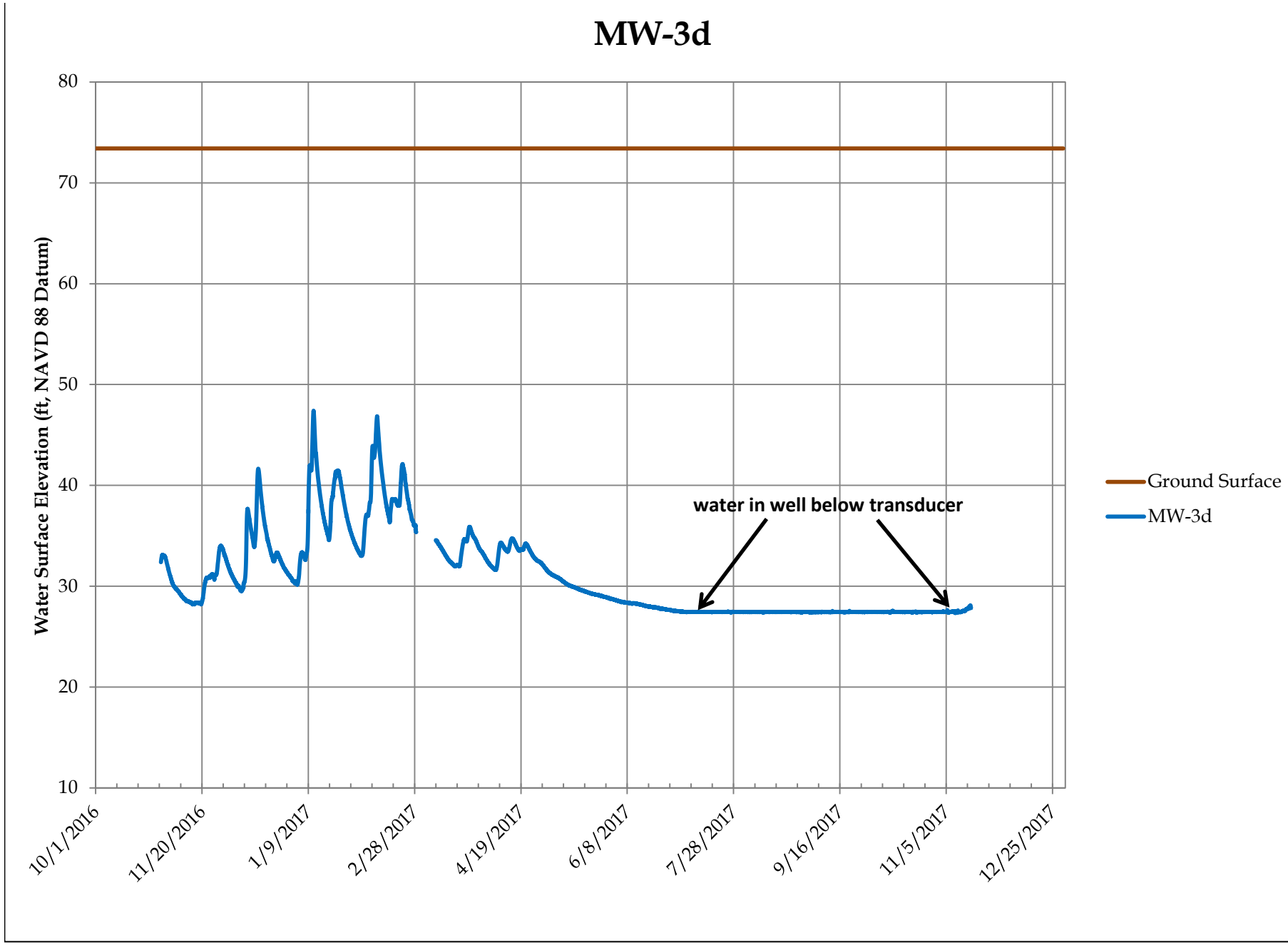
Private Well 22

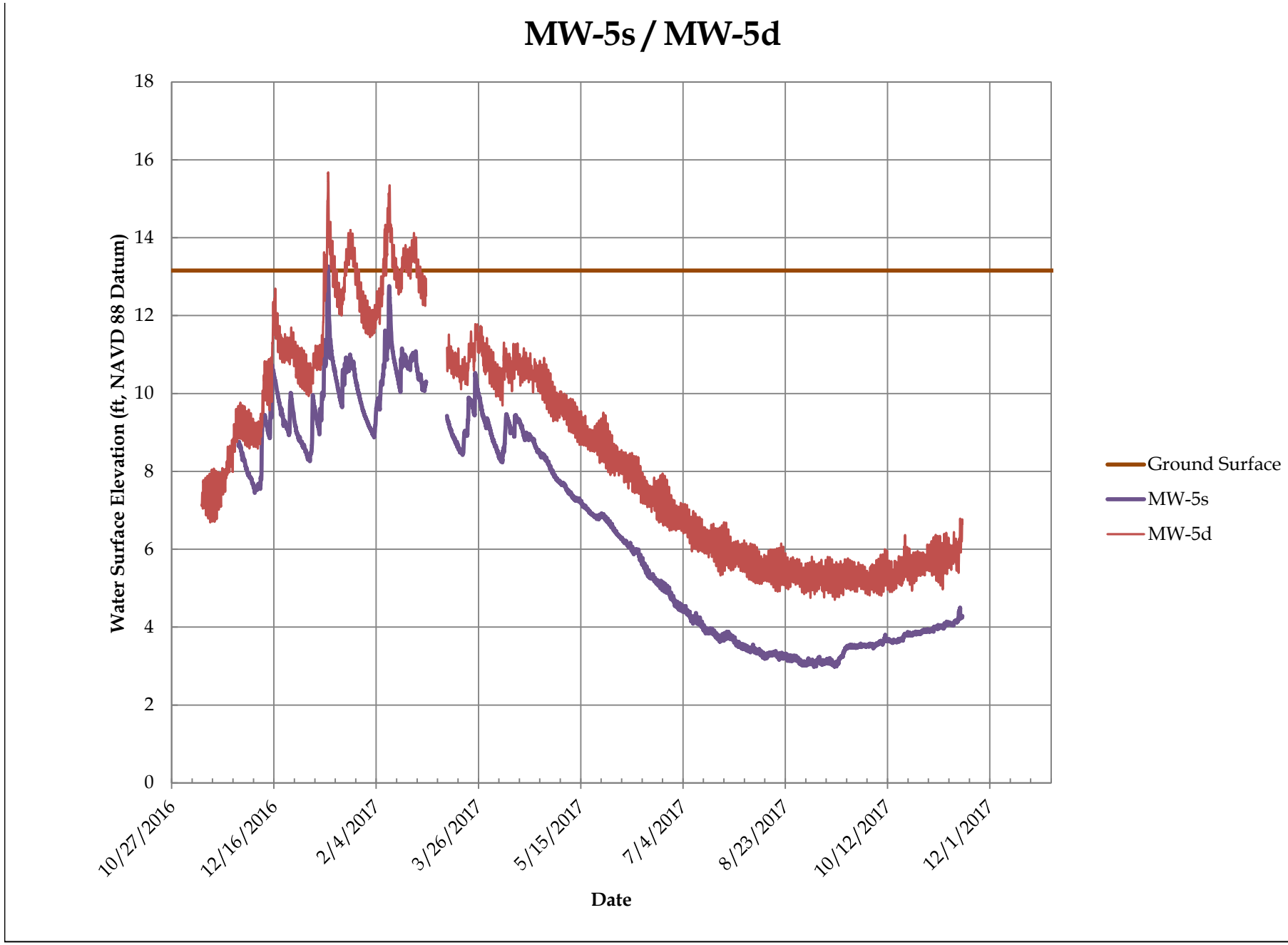


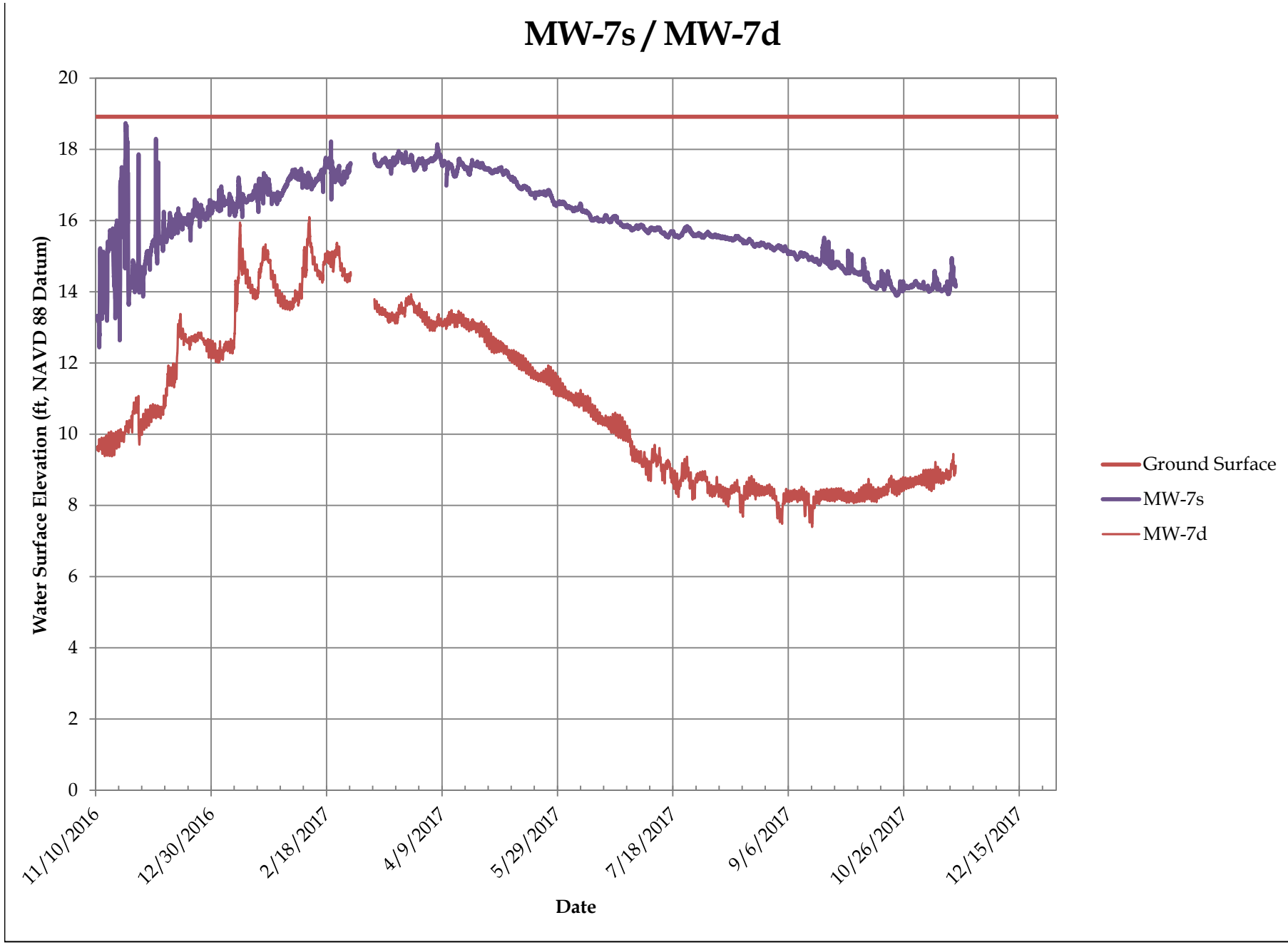

Private Well 23
Water Surface Elevation (ft, NAVD 88 Datum)
95
90
85
80
75
70
65
60
55
50
10/7/2016
11/26/2016
1/15/2017
3/6/2017
4/25/2017
6/14/2017
8/3/2017
9/22/2017
11/11/2017
Date
period of active pumping from well
Ground Surface
Private Well 23

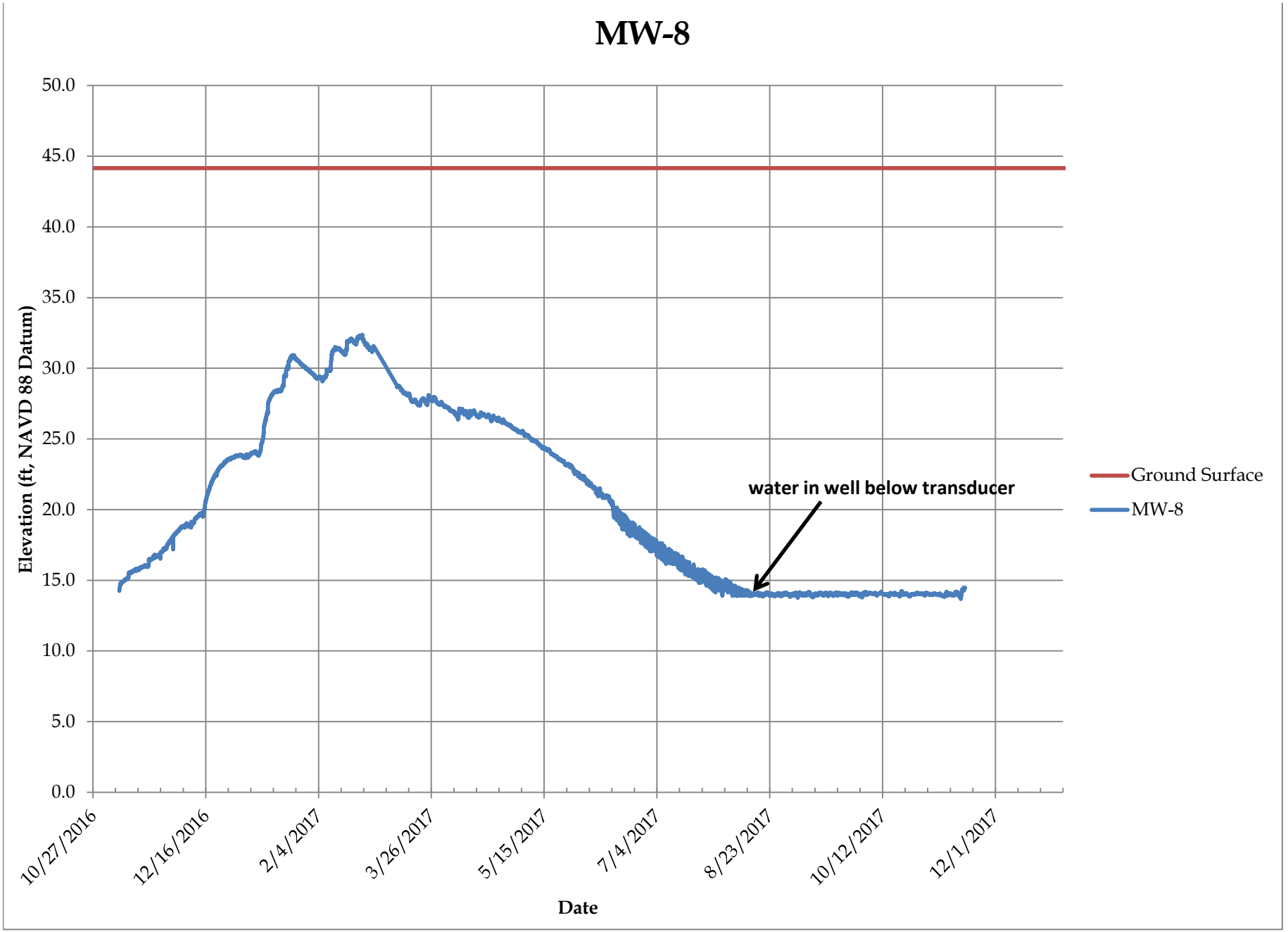

MW-1 versus Eel River
29.0
24.0
19.0
14.0
9.0
4.0
-1.0
Water Level (ft, NAVD 88 Datum)
10/2/2016
11/21/2016
1/10/2017
3/1/2017
4/20/2017
6/9/2017
7/29/2017
9/17/2017
11/6/2017
12/26/2017
Date
water in well below transducer
Ground Surface
River Level (R-1)
USGS-FB Tied to R1
MW-1d Level
MW-1s Level

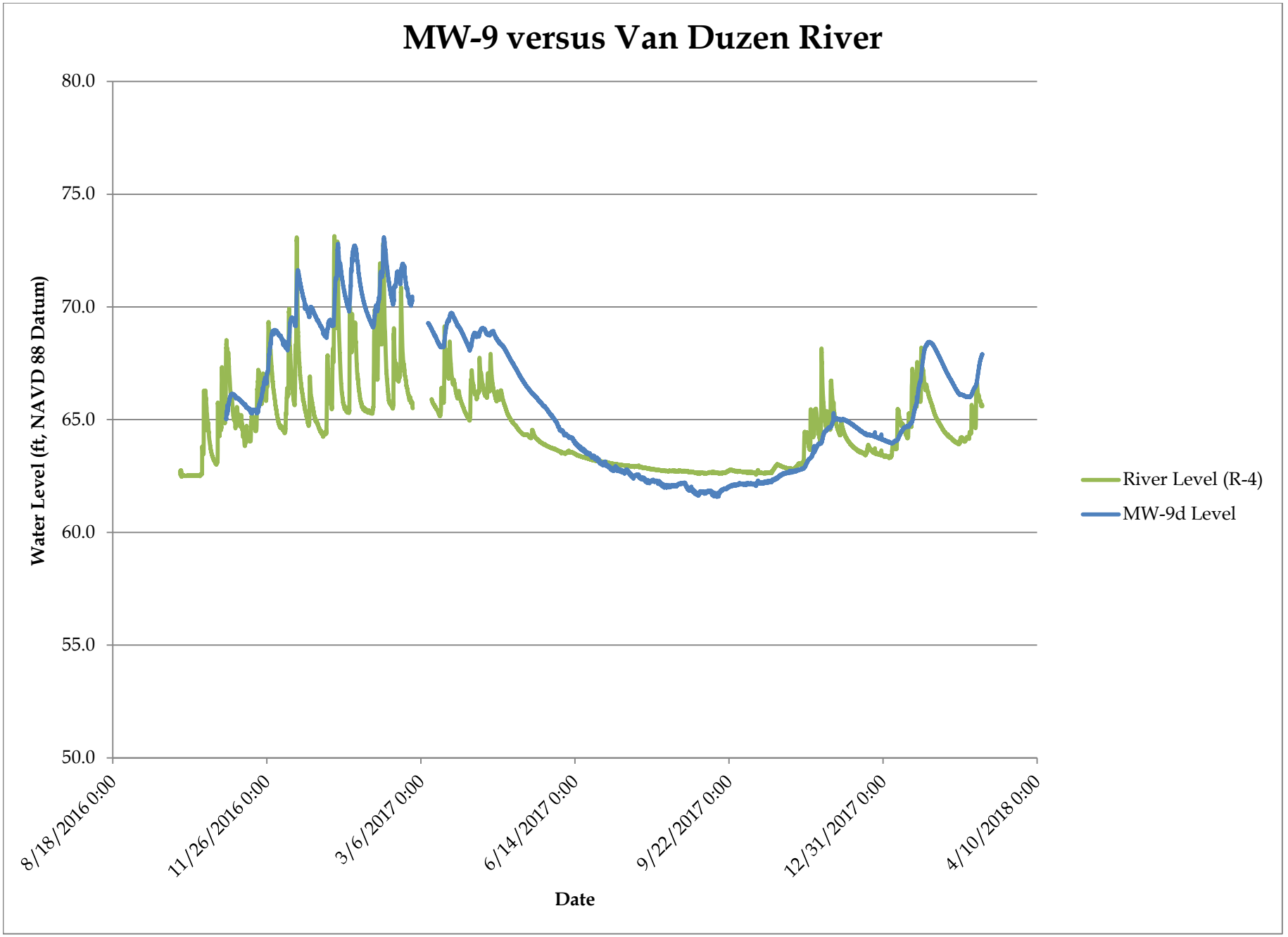

MW-2 versus Eel River
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
Water Level (ft, NAVD 88 Datum)
water in well below transducers
10/1/2016 0:00
1/9/2017 0:00
4/19/2017 0:00
7/28/2017 0:00
11/5/2017 0:00
2/13/2018 0:00
Date
River Level (R-3)
MW-2s Level
MW-2d Level

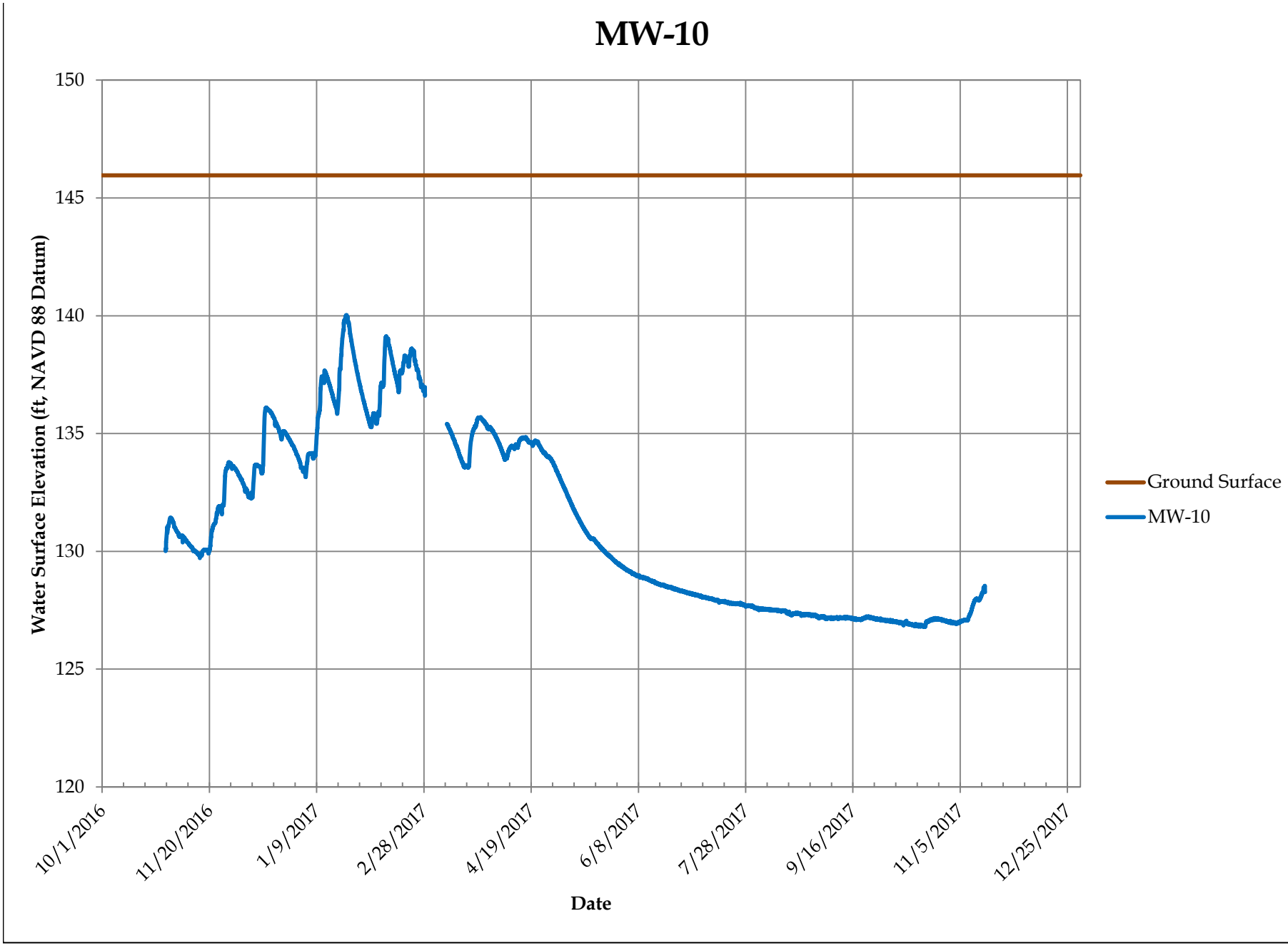

MW-3d
Water Surface Elevation (ft, NAVD 88 Datum)
80
70
60
50
40
30
20
10
10/1/2016
11/20/2016
1/9/2017
2/28/2017
4/19/2017
6/8/2017
7/28/2017
9/16/2017
11/5/2017
12/25/2017
water in well below transducer
Ground Surface
MW-3d


MW-5s / MW-5d
Water Surface Elevation (ft, NAVD 88 Datum)
18
16
14
12
10
8
6
4
2
0
10/27/2016
12/16/2016
2/4/2017
3/26/2017
5/15/2017
7/4/2017
8/23/2017
10/12/2017
12/1/2017
Date
Ground Surface
MW-5s
MW-5d


MW-7s / MW-7d
Water Surface Elevation (ft, NAVD 88 Datum)
20
18
16
14
12
10
8
6
4
2
0
11/10/2016
12/30/2016
2/18/2017
4/9/2017
5/29/2017
7/18/2017
9/6/2017
10/26/2017
12/15/2017
Date
Ground Surface
MW-7s
MW-7d


MW-8
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Elevation (ft, NAVD 88 Datum)
10/27/2016
12/16/2016
2/4/2017
3/26/2017
5/15/2017
7/4/2017
8/23/2017
10/12/2017
12/1/2017
Date
water in well below transducer
Ground Surface
MW-8


MW-9 versus Van Duzen River
80.0
75.0
70.0
65.0
60.0
55.0
50.0
Water Level (ft, NAVD 88 Datum)
8/18/2016 0:00
11/26/2016 0:00
3/6/2017 0:00
6/14/2017 0:00
9/22/2017 0:00
12/31/2017 0:00
4/10/2018 0:00
Date
River Level (R-4)
MW-9d Level


MW-10
150
145
140
135
130
125
120
Water Surface Elevation (ft, NAVD 88 Datum)
10/1/2016
11/20/2016
1/9/2017
2/28/2017
4/19/2017
6/8/2017
7/28/2017
9/16/2017
11/5/2017
12/25/2017
Date
Ground Surface
MW-10

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