June 23, 2022; rev. July 21, 2022 022038.00

Mr. Michael Drosihn
749 Atherton Ave
Novata, CA 94945

SUBJECT: WATER SUSTAINABILITY EVALUATION FOR WELL ON PARCEL NO. 208-221-009, HUMBOLDT COUNTY, CALIFORNIA

INTRODUCTION

This letter presents the results of a water-availability analysis for cannabis cultivation for your parcel at 9 West River Road, APN No. 208-221-009, near Dinsmore, Humboldt County, California (**Figures 1** and **2**). We understand that you plan use a groundwater well located on this parcel to cultivate cannabis on the adjacent parcels (APN 208-221-013 and -014).

On the latter parcels, there will be a total of 237,000 gallons of storage (30,000-gallon pond and 207,000 gallons of tank storge). Cultivation will occur in existing greenhouses totalling 26,750 square feet and an outdoor area of 1,500 square feet, for a total of approximately 28,000 square feet.

Humboldt County requires a water-availability analysis that contains analysis of the following elements (email S. Santos to B. Lampley, 05-12-22; emails S. Santos to C. Day-Wilson, July 2022):

- Project description (pumping schedule, volume used).
- Description of well (stratigraphy, seal depth, multiple well screens present, aquitards).
- Site description (well location, other wells, seeps, springs, wetlands).
- Regional and local geology.
- Hydrogeological Conceptual Model (hydrogeological setting, groundwater recharge areas, aquifer properties, data gaps).
- Description of geologic strata over the screened interval.

Our analysis was based on review of published literature (geologic setting, cannabis water demand) and your operations plans prepared by Green Road Consulting.

SUMMARY

Per the Operations Plans, total annual water demand will be 240,000 gallons (185,000 + 55,000 gallons).[1,2] This equates to an average pumping rate of approximately 0.5 gallons per minute (gpm).

[1] Green Road Consulting, undated, *Site Plan Overview and Cultivation and Operations Plan,* APN 208-221-013.
[2] Green Road Consulting, undated, *Site Plan Overview and Cultivation and Operations Plan,* APN 208-221-014.

Based on published research on cannabis cultivation water use in northern California, water demand could range between 7 and 15 gallons per year (gpy) per square foot (foot^2) of cultivation.[3] Assuming a 7 to 15 gpy/foot^2 for 28,000 feet^2 gives a total annual demand of between 196,000 and 420,000 gallons or an average annual pumping rate between 0.4 and 0.8 gpm. The estimated demand in the Operations Plans is consistent with this research.

The well elevation is approximately 2,680 feet MSL. The static water level in the well is approximately 2,660 feet MSL. The river elevation is approximately 2,185 feet MSL, making the river 575 feet lower in elevation than the top of the well and 435 feet lower than the bottom of the well. Thus, it is unlikley that the well is directly hydraulically connected to the Mad River.

The nearest springs are located uphill from the well to the northeast and northwest, approximately one-quarter mile. The elevation of the spring to the northeast is approximately 3,200 feet MSL (**Figure 1**). The elevation of the spring to the northwest is approximately 2,720 feet MSL **Figure 2**). Thus, the springs are unlikely to be hydraulically connected to the water-bearing unit at the well location. Additionally, there are no mapped ("blue line") streams on the parcel.

The subject well is 140 feet deep, completed as an open hole with 6-inch diameter steel casing slotted from 20 to 140 feet below ground surface (bgs), with one blank section from 100 to 120 feet bgs. The driller's log indicates the stratigraphy is "black shale with sandstone." This is consistent with the geologic mapping in the area which shows the geologic units as Melange Matrix of the Central Terrane of the Franciscan Complex.

The driller's log indicates that the well yielded 40 gpm during a four-hour air-lift test. A short constant-discharge test conducted for this project showed that the well would yield 5 gpm without any drawdown.

The subject well is located 333 feet from the parcel's southern boundary (the boundary of the cultivation parcels), 548 feet from the parcel's eastern boundary, 815 feet from the western boundary, and 958 feet from the northern boundary. Although the exact location of neighboring wells is unknown, the closest well would be no closer than approximately 550 feet (there is not a well on the cultivation parcels). Pumped at a long-term rate of approximately 0.5 gpm, there would be no interference impacts on neighboring wells because interference would not extend beyond the parcel boundaries.

The annual project demand of 240,000 gallons is less than 2% of estimated annual recharge on the 40-acare parcel and less than 4% of one-half of the estimated recharge. Thus, deep percolation of precipitation on the parcel would be sufficient to supply the project demand.

[3] Dillis, C. *et al.*, October 15, 2020, *Water Storage and Irrigation Practices for Cannabis Drive Seasonal Patterns of Water Extraction and Use in Northern California*, Journal of Environmental Management, Vol. 272.

WATER DEMAND

The proposed cultivation will be approximately 28,000 square feet in size, with most of the cultivation occurring indoors. Therefore, irrigation is assumed to occur year-round.

Per the Operations Plans, total annual water demand will be 240,000 gallons (185,000 + 55,000 gallons). This equates to an average pumping rate of approximately 0.5 gallons per minute (gpm). Average monthly demand would be approximately 20,000 gallons.

Based on published research on cannabis cultivation water use in northern California, water demand could range between 7 and 15 gpy per foot^2 of cultivation. Assuming a 7 to 15 gpy/foot^2 for 28,000 feet^2 gives a total annual demand of between 196,000 and 420,000 gallons or an average annual pumping rate between 0.4 and 0.8 gpm. The estimated demand in the Operations Plans is consistent with this research.

WATER SUPPLY/WELL DESCRIPTION

Irrigation water will be pumped from an existing on-site well. The well is 140 feet deep and was installed with an air-rotary drill rig. The casing is low-carbon steel and is 8 inches in diameter to a depth of 20 feet and 6 inches in diameter to total depth. The well was completed with a 20-foot deep surface seal of bentonite. There is no annular fill (*e.g.,* the well is not gravel packed).

There are two slotted intervals, 20 to 100 feet and 120 to 140 feet. Because the well is not gravel packed and the slots extend essentially the entire length of the casing below the surface seal and the stratigraphy is likely uniform (see discussion below), the two slotted intervals act as one screened interval.

The stratigraphy as described on the driller's log (**Attachment A**) consists of brown clay with sandstone to a depth of 20 feet bgs, with black shale and sandstone below that to total depth. The first encountered groundwater was at 30 feet bgs, with a static level of 22 feet. The current depth to water is 22 feet from the top of casing.

The well log indicates that well produced 40 gpm for 4 hours during air lifting. Drawdown was not measured. Although driller's often overestimate well production on the log, it is likely that this well produces over 10 to 20 gpm for shorter (hours) periods.

To check the well's production, a short, two-hour constant-discharge aquifer test was performed by Watson Well and Pump of Eureka, California on June 3, 2022. The test used the existing solar-powered pump, which is capable of discharging 5 gpm. During pumping, water levels were recorded by using a two-wire electronic sounder; **Attachment B** contains the field data sheet from Watson Well and Pump. Water levels were measured from the top of the well casing. During the testing, no rainfall occurred.

The well showed no drawdown during pumping at 5 gpm, a rate more than five times higher than the projected demand.

PHYSICAL & HYDROGEOLOGIC SETTING

The site is located in relatively steep terrain approximately 20 miles directly north of Dinsmore and approximately one-half to a mile east of the Mad River, in Township 2 North, Range 5 East, Section 28, Humboldt Meridian (**Figure 1**).

Figure 2 shows an aerial photo of the parcel relative to the Mad River and other local features, such as nearby development. The subject well is located in the upper central portion of the parcel, more than 1,000 feet from the parcel boundaries on all sides. Thus, there are no neighboring wells within 1,000 feet of the subject well.

The well elevation is approximately 2,680 feet MSL. The static water level is approximately 2,660 feet MSL. The river elevation is approximately 2,185 feet MSL, making the river 575 feet lower in elevation than the top of the well and 435 feet lower than the bottom of the well. Thus, it is unlikley that the well is directly hydraulically connected to the Mad River.

The nearest springs are located uphill from the well to the northeast and northwest, approximately one-quarter mile. The elevation of the spring to the northeast is approximately 3,200 feet MSL (**Figure 1**). The elevation of the spring to the northwest is approximately 2,720 feet MSL **Figure 2**). Thus, the springs are unlikely to be hydraulically connected to the water-bearing unit at the well location. Additionally, there are no mapped ("blue line") streams on the parcel.

The entire parcel, and the surrounding areas are wholly within the Franciscan Complex, within the Central Terrane.[4] The Central Terrane is a tectonic melange consisting of resistant blocks in a highly sheared argillaceous matrix. The subject parcel is located in a Central Terrane unit mapped as ctmm – Melange Matrix. It is specifically described as mainly sheared argillite and lithic sandstone or graywache with some interbedded green tuff. The driller's log description of "black shale with sandstone" is consistent with the geologic mapping: The "black shale" represents the melange matix.

The relatively high well yield likely reflects the geology. Sheared rocks often have greater permeability because they are highly fractured. This allows for faster movement of groundwater and better infiltration of precipitation, which is likely the major source of groundwater recharge in the area.

Because the site is located in hilly terrain, without significant waterways, recharge likely occurs mainly from infiltration of precipitation as opposed to recharge from creeks or rivers. Annual precipitation in the Dinsmore area has ranged from approximately 40 inches in water-year 2021 to 79 inches in water-year 2019.[5] Not all of this amount is available for percolation because some will run off and some will be taken up by vegetation. Previous work in Mendocino County, in areas with average annual precipitation between 30 and 40 inches has estimated deep

[4] Fraticelli, L.A. *et al.*, 1987, *Geologic Map of the Redding 1° × 2° Quadrangle, Shasta, Tehama, Humboldt, and Trinity Counties, California*, U.S.G.S. Open File Report 87-257; https://pubs.usgs.gov/of/2012/1228/ (map) and https://pubs.usgs.gov/of/2012/1228/of2012-1228_pamphlet.pdf (description of units).

[5] https://wys.cocorahs.org/CA/2021, Dinsmore Station CA-HM-79; recording began in March 2018.

vertical percolation at approximately one foot per year.[6] For the purpose of estimating groundwater recharge, we are assuming a similar level of infiltration for the site vicinity.

The subject parcel is approximately 40 acres in size. Therefore, the annual potential recharge on the parcel could be up to approximately 13,034,040 gallons (40 acres × 1 foot deep percolation × 325,851 gallons per acre foot = 13,034,040 gallons). In dry years, recharge could be negligible to none and in wet years recharge could be more. Assuming on average that recharge is half of the historical average gives an annual amount of approximately 6,517,020 gallons. Note that this assumes that runoff from impermeable areas (*e.g.*, buildings, patios, etc.) is routed to permeable areas of the property and allowed to infiltrate.

The annual project demand of 240,000 gallons is less than approximately 4% of estimated annual recharge and 2% of one-half of the estimated recharge. Thus, deep percolation of precipitation on the parcel would be sufficient to supply the project demand.

The work was conducted under my supervision (California Certified Hydrogeologist No. 626) with support from L&A staff.

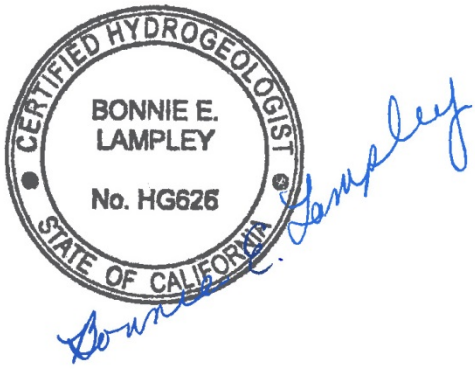
Please feel free to contact me at 530-275-4800 or blampley@lwrnc.com if you have any questions regarding this report.

Sincerely,

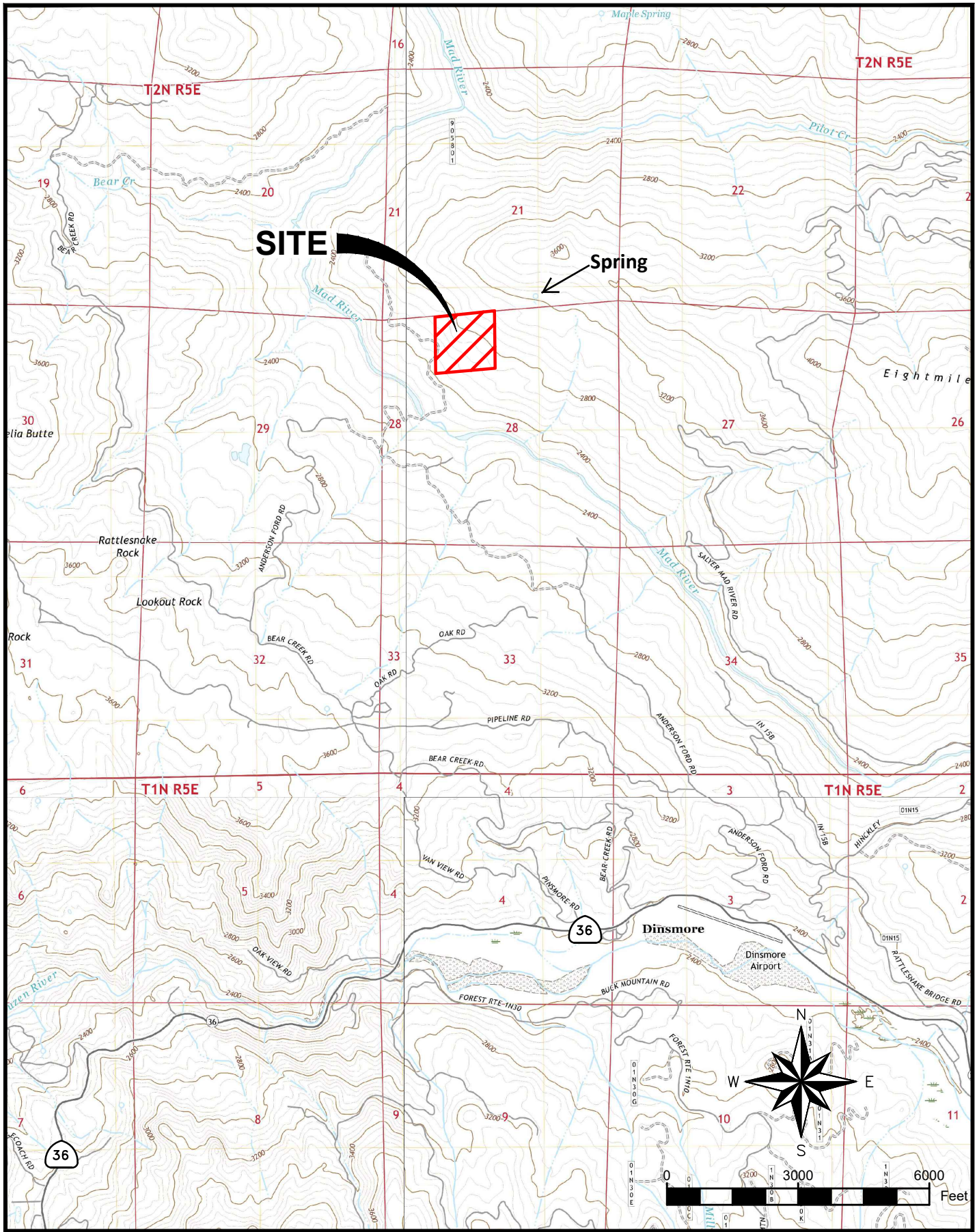
Bonnie E. Lampley

Bonnie Lampley
Principal Hydrogeologist

enc.: Figure 1. Location Map
Figure 2. Site Map
Figure 3. Geologic Map
Attachment A. DWR Driller's Logs
Attachment B. Field Notes



[6] Questa Engineering, 2004, *Groundwater Modeling Study of the Mendocino Headlands, Mendocino, California*.



LAWRENCE & ASSOCIATES
ENGINEERS & GEOLOGISTS

SITE LOCATION MAP

MAP ADAPTED FROM U.S.G.S.
7.5–MINUTE TOPOGRAPHIC QUADS:
BLAKE MOUNTAIN, SHOWERS MOUNTAIN,
LARABEE VALLEY & DINSMORE, CA.

PROJECT NAME:	PROJECT NO:	DATE:
WATER SUSTAIN.	022038.00	6/17/2022
CLIENT:	DRAWN BY:	FIGURE 1
DROSIHN	J. BEERS	
SCALE:	CHECKED BY:	
1" = 3,000'	B. LAMPLEY	

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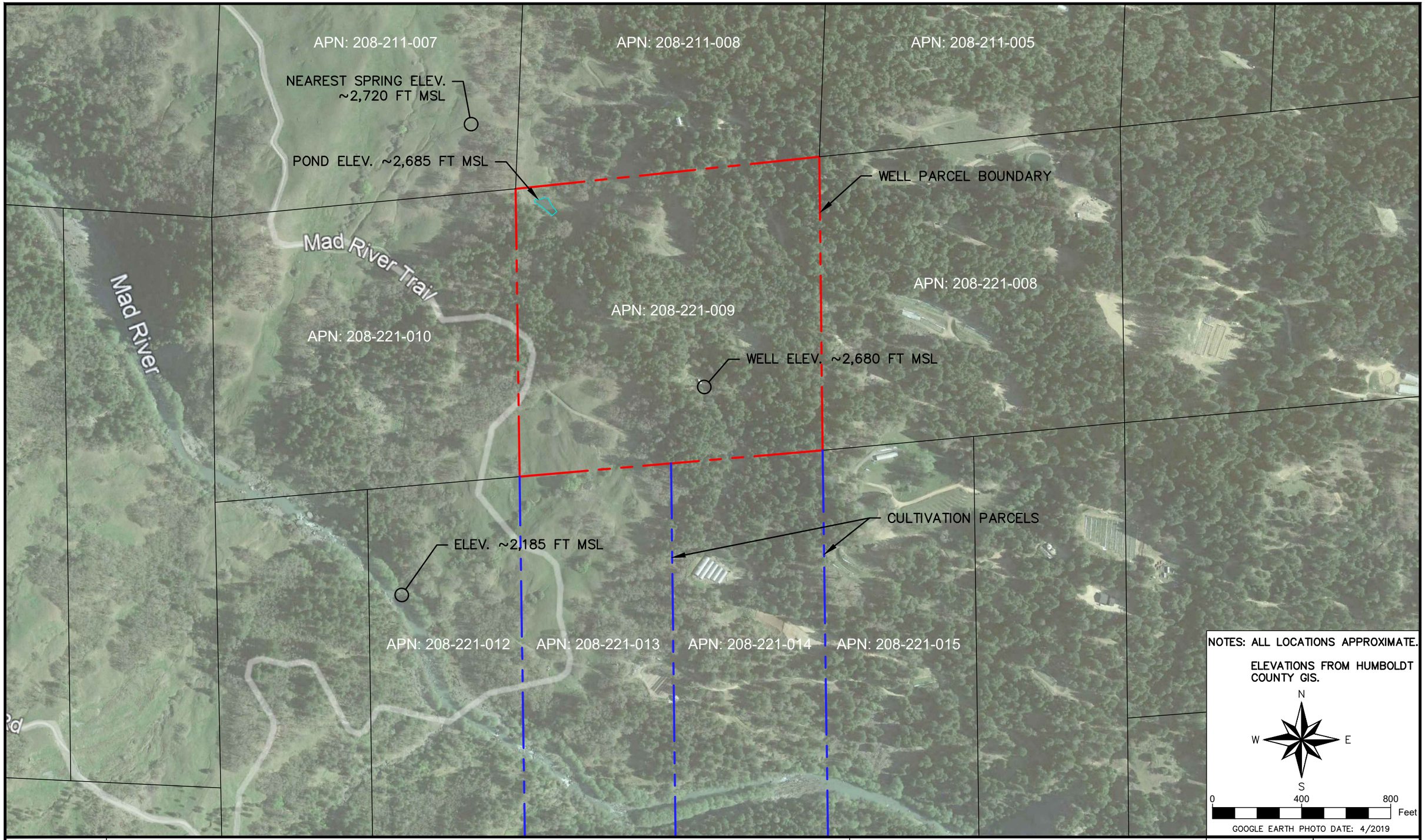


LAWRENCE & ASSOCIATES
ENGINEERS & GEOLOGISTS

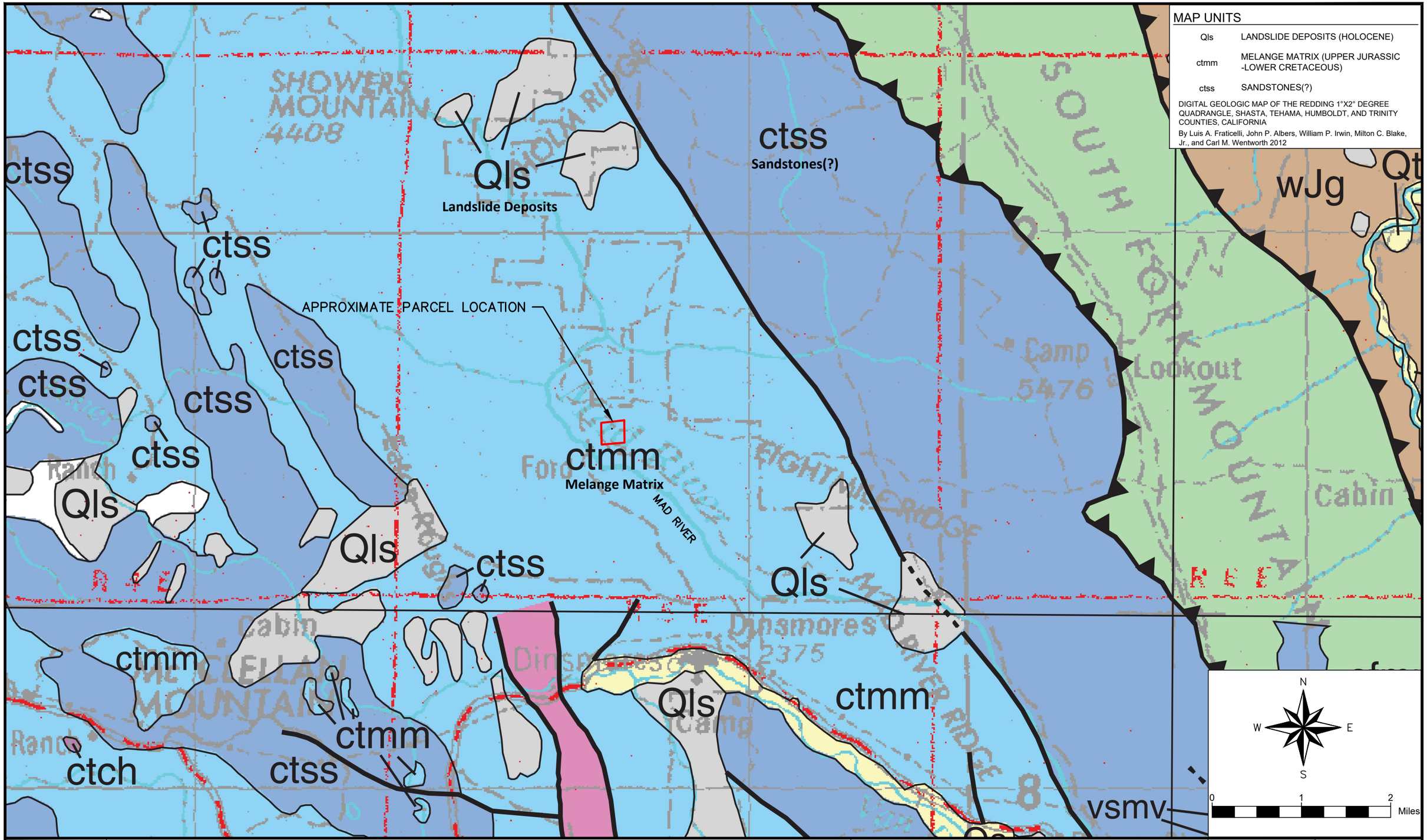
SITE MAP

WATER SUSTAINABILITY EVALUATION

MICHAEL DROSIHN
APN: 208-221-009
HUMBOLDT COUNTY, CA

PROJECT NO: 022038.00	SCALE: 1" = 400'
DRAWN BY: J. BEERS	DATE: 7/13/2022
CHECKED BY: B. LAMPLEY	FIGURE 2

p:\022038.00_drosihn\site_map.dwg J.R.B. 7/13/2022



LAWRENCE & ASSOCIATES
ENGINEERS & GEOLOGISTS

GEOLOGIC MAP

WATER SUSTAINABILITY EVALUATION

MICHAEL DROSIHN
APN: 208-221-009
HUMBOLDT COUNTY, CA

PROJECT NO: 022038.00	SCALE: 1" = 1 MILE
DRAWN BY: J. BEERS	DATE: 6/22/2022
CHECKED BY: B. LAMPLEY	FIGURE 3

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ATTACHMENT A

Driller's Log

State of California

Well Completion Report

Form DWR 188 Submitted 11/1/2017

WCR2017-004912

Owner's Well Number 1 | Date Work Began 10/14/2017 | Date Work Ended 10/17/2017

Local Permit Agency Humboldt County Department of Health & Human Services - Land Use Program

Secondary Permit Agency | Permit Number 16/17-0207 | Permit Date 09/19/2016

Well Owner (must remain confidential pursuant to Water Code 13752)

Name Tyler Meeman

Mailing Address PO Box 464

City Arcata State CA Zip 95518

Planned Use and Activity

Activity New Well

Planned Use Water Supply Domestic

Well Location

Address 9 West River RD

City Mad River Zip 95552 County Humboldt

Latitude ___ Deg. ___ Min. ___ Sec. N Longitude ___ Deg. ___ Min. ___ Sec. W

Dec. Lat. | Dec. Long.

Vertical Datum | Horizontal Datum WGS84

Location Accuracy | Location Determination Method

APN 208-221-009

Township | Range | Section | Baseline Meridian | Ground Surface Elevation | Elevation Accuracy | Elevation Determination Method

Borehole Information

Orientation Vertical Specify

Drilling Method Other - Casing Advance Drilling Fluid Air

Total Depth of Boring 140 Feet

Total Depth of Completed Well 140 Feet

Water Level and Yield of Completed Well

Depth to first water 30 (Feet below surface)

Depth to Static Water Level 22 (Feet) Date Measured 10/17/2017

Estimated Yield* 40 (GPM) Test Type Air Lift

Test Length 4 (Hours) Total Drawdown (feet)

*May not be representative of a well's long term yield.

Geologic Log - Free Form

Depth from Surface Feet to Feet		Description
0	20	Brown Clay with Sandstone
20	140	Black Shale with Sandstone

Casings

Casing #	Depth from Surface Feet to Feet		Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	0	20	Blank	Low Carbon Steel	N/A	0.188	8.625			
2	0	20	Blank	Low Carbon Steel	N/A	0.188	6.625			
2	20	100	Other: Knife Cut	Low Carbon Steel	N/A	0.188	6.625		0.25	
2	100	120	Blank	Low Carbon Steel	N/A	0.25	6.625			
2	120	140	Other: Knife Cut	Low Carbon Steel	N/A	0.25	6.625		0.25	

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	20	Bentonite	Non Hydrated Bentonite		3/8 Hole Plug
20	140	Other Fill	See description.		No Annular Fill

Other Observations:

Borehole Specifications

Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	20	13
20	140	7.44

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name: WATSON WELL DRILLING, INC.
Person, Firm or Corporation

500 Summer Street (Address) | Eureka (City) | CA (State) | 95501 (Zip)

Signed: *electronic signature received* (C-57 Licensed Water Well Contractor) | 11/01/2017 (Date Signed) | 1014048 (C-57 License Number)

DWR Use Only

CSG #	State Well Number	Site Code	Local Well Number

N — Latitude Deg/Min/Sec

W — Longitude Deg/Min/Sec

TRS:

APN:

ATTACHMENT B

Field Notes

WELL TEST REPORT

WATSON WELL SERVICE
3144 Broadway STE 4-315, Eureka, CA 95501 707-733-1730 License #947596 C57 & C36

Customer: Lawrence and Associates
Location: 9 Mile Rd. Mad River CA
Phone: 530-604-3380 Cell:
Well Depth: 140' Static Level: 22'
Pump Size: HR-14H-C Set Pump @: 136'
Start Date: 6/3/2022
End Date: 6/3/2022
Fax:
Casing Size: 8" Steel
Total Test Time: 2 Hours Gallons Per Minute: 5gpm+

Date	TIME		TEST DATA			COMMENTS
	AM	PM	WATER LEVEL	GPM	WATER COLOR	
6/3/2022		1:15	22'	5	brown	System sized for 3,125 gallons per solar pumping period.
		1:20	22'	5	brown	
		1:25	22'	5	cloudy	
		1:30	22'	5	tan	Well is capable of more than 5gpm but test limited to existing equipment in the well.
		1:35	22'	5	tan	
		1:40	22'	5	clear	
		1:45	22'	5	brown	
		1:50	22'	5	tan	
		1:55	22'	5	tan	
		2:00	22'	5	tan	
		2:10	22'	5	tan	
		2:20	22'	5	clear	
		2:30	22'	5	clear	
		2:40	22'	5	clear	
		2:50	22'	5	clear	
		3:00	22'	5	clear	
		3:10	22'	5	clear	
		3:15	22'	5	clear	