March 14, 2023

To: Mr. Jim Mickelson
Jerry and Don's Yager Pump and Well
P.O. Box 2689
Petaluma, California 94953

Subject: Well Interference & Water Use Assessment Report
Proposed AG/Livestock Well
400 Estero Ln,
Bodega Bay, CA 94923

This letter is intended to address two requirements for satisfying the Governor's drought emergency executive order EO N-7-22. The request was made by Becky Ver Meer (REHS) of the Sonoma County PRMD.

An existing, low yield well, referred to as the Solar Well, was drilled and constructed at 400 Estero Lane outside of Bodega Bay in August of 2022 under Permit No. WEL21-0168. A second site, referred to herein as the Proposed Well, was initially intended as an alternative to the Solar Well site, is now proposed to be drilled under the same permit. In response to the new EO requirements two tasks have been requested as follows:

1. Perform an Interference Analysis for wells located within 500 feet of one another;
2. Provide a Water Use Assessment.

The locations of the existing Solar Well and the Proposed Well are shown on attached Plate 1. It is important to recognize that this request has been made before the Proposed Well has been drilled. Consequently, the conditions utilized in this analysis are based on the nearby Solar Well and actual conditions at the Proposed Well may be differ from those.

General Conditions

Both the Solar Well and the Proposed Well are atop a broad, gently southeast-sloping ridge on the east side of Estero Lane. Ground surface elevation at the Solar Well is about 310 ft.; the elevation at the Proposed Well (PWell on Plate 1) is about 90 feet lower at elevation 220 ft. High gradient seasonal drainages border the ridge to the north and south, and there is a small stock pond in a small ravine located between the two well sites. It is my understanding that the Solar Well and the Proposed Well (if successful) will be used to supply water for up to 200 head of cattle.

The annual rainfall at the site averages about 35-inches year (SCWA, 2005), however year-to-year precipitation can vary widely from this average. Precipitation is highly season with nearly all rainfall occurring between about mid-October to May. Summers are cool and dry with the site subject to a strong marine influence, most notably a frequent sea breeze and summer fog.

The area is used for cattle grazing and the vegetation is primarily annual grass with minor amounts of brush.

Well Characteristics and Aquifer Description

The Solar Well was drilled to a depth of 400 feet in late August of 2022. The water level depth was 120 feet and a discharge rate of 1gpm was recorded at the time of drilling. "Sandy clay and sandstone stringers" of the Wilson Grove Formation (Twg) extended to a depth of 280 feet where "sandstone and shale" of the Franciscan bedrock (KJfs) was encountered. It is assuming that the principal source of well water is derived from the 160 feet of Wilson Grove Fm. between the water level depth (120 ft.) and the base of the Wilson Grove (280 ft.). This 160 ft. interval defines the aquifer's saturated thickness during the dry season of August 2022. The water level at 120 ft. and well discharge of 1gpm, measured in late summer following two years of below normal rainfall, suggest that these groundwater conditions represent something approximating a "worst case" scenario. Assuming the 160 feet of saturated Wilson Grove yields 1gpm and the water level was lowered to the level of bedrock, then the well's specific capacity is 0.006gpm per foot of drawdown (1gpm/160 ft = 0.006gpm/ft.).

The Proposed Well is located 1195 feet south of the Solar Well at a ground surface elevation of 220 feet. Assuming the depth to the water level is the same at both locations (120 ft.), then the water level at the propose well (Elevation 220 ft.- 120 ft.)) would be at elev. 100 ft.

Franciscan bedrock underlying the Wilson Grove Formation was eroded as a planar, wave-cut surface by the inland advance of the ocean just prior to deposition of the shallow, marine sediments that now comprise the Wilson Grove Fm. It is therefore assumed that bedrock is the same elevation at both well locations (although there can certainly be localized deviations from this planar condition). At the Solar Well bedrock was at depth 280 ft, equivalent to elevation +30. Elevation +30 at the Proposed Well location would be equivalent to a bedrock depth of 190 ft. (+220 g.s elev. - +30 bedrock elev. = 190 ft). With a water level at the same depth as the Solar well (120 ft.) the saturated thickness of the aquifer at the Proposed well would be 70 ft. (190 ft – 120 ft. = 70ft.). The yield from a 70 ft. saturated thickness with a specific capacity of 0.006gpm/ft. would be 0.42gpm.

The pump at the Solar powered and the water system includes a water storage tank that supplies the trough. At the time of the site visit (February 14, 2023) the well was visually estimated to be discharging into the tank at about 3gpm or so.

Well Interference

It is of course uncertain if the new well will be successful because it has not yet been drilled and, as demonstrated by other wells drilled previously in the general vicinity, the occurrence of groundwater in the Wilson Grove can be irregular. However, the horizontal distance between the Solar Well and the Proposed Well is 1195 feet, a distance that is greater than the 500 feet of separation that requires a well interference analysis. Therefore, the site wells are exempt from the well interference analysis.

Water Use Assessment

The volume of water needed for 200 cattle was compared to the estimated water available from the Solar well plus the Proposed Well. Additionally, an estimate of annual average groundwater recharge is made.

Water Demand

Ten gallons per day per cow is the amount of water need (Campanile, pers. comm.), therefore the anticipated 200 head of cattle would require 2000 gallons of water per day which is equivalent to the following:

2000gpd (**1.39gpm**)
730,000g/year
97,594 cf/year
2.24acre-ft.

The discharge from the Solar Well in August was 1gpm, the discharge in Feb., 2023 was visually estimated at about 3gpm.

To supply the 1.39gpm in the summer when the Solar Well is discharging 1gpm would require an additional 0.39gpm from the Proposed Well assuming no additional water storage is provided.

Estimate of Groundwater Potentially Available from the Proposed New Well

As calculated above, by applying the specific capacity of 0.006 calculated from the Solar well to the 70-foot saturated thickness of the aquifer at the Proposed Well (0.006gpm/ft x 70 ft) a well discharge of 0.42gpm is obtained for the Proposed Well. Combining 0.42gpm at the Proposed well with the 1gpm from the Solar Well yields a total combined discharge of 1.42gpm. This exceeds the 1.39gpm needed to supply the 200 cattle. These discharge rates are estimated from a late summer condition. Discharge observations of about 3gpm made in February of 2023 suggest some of the water from the higher winter discharge rates could be stored in tanks, if needed.

Groundwater Recharge

Groundwater recharge results from infiltration of seasonal rainfall between about mid-October to May. For purposes of this estimate, it is assumed that most of the water available for groundwater recharge would be rain falling on the broad ridge area between the two wells. Refer to Plate 1. The gently sloping ground of the ridge area is about 700-feet wide and with the wells locations 1195 feet apart the recharge area is 19.2 acres. The annual rain falling onto this 19.2 acres is 35-inches (2.92 ft.) an amount that totals 56 acre-ft. of precipitation (19.2acres x 2.92 ft.). The estimated demand is 2.24 acre-ft. (see Water Demand section above) or the equivalent of 4.0% of the total volume of rainfall. An infiltration rate of only 4% is a relatively low (conservative) rate of infiltration considering the relatively sandy composition of the Wilson Grove and the permeable soils that develop on it.

Conclusions

- A well interference analysis was not required due to well separation of 1195 feet, a distance greater than the 500-foot criteria.

- The combined yield of 1gpm measured from the Solar Well and 0.42gpm calculated for the proposed well exceeds the 1.39gpm needed to supply the maximum of 200 head of cattle. The seasonal fluctuation of water levels and discharge rates suggests that water storage, particularly during the rainy season when excess groundwater appears to be available, could substitute for some of the dry season water demand, if needed.

- Water demand is only 4% of the estimated average groundwater recharge of 56 acre-ft. for an area between the well locations. This indicate that sufficient groundwater should be available to supply the demand.

I trust this letter provides you with the information you need at this time.

Respectfully,

Michael S. Malone
CHG – No. 374

REGISTERED GEOLOGIST
MICHAEL S. MALONE
No. HG 374
CERTIFIED
HYDROGEOLOGIST
4/30/23
STATE OF CALIFORNIA

Attachments:

Plate 1 – General Geology showing the Locations of the Solar Well and Proposed Well

Well Completion Report WCR2022-010054 (Solar Well)

Plate 1 Explanation

Qal –alluvium along streams; may include some alluvial fan deposits
Twg – Wilson Grove Formation; fine-grained silty marine sandstone with occ. shells, clay, clayey sandstone, minor gravel and occasional beds of cemented tuffaceous sandstone
KJfs – Franciscan Complex (bedrock); highly deformed and sheared rocks. Predominantly fine-grained non water-bearing sheared shale with scattered inclusions of sandstone and various other hard rock types

geologic contact; dashed where approx. located

MICHAEL S. MALONE **Consulting Geologist** 321 S. Main St. No. 66 Sebastopol, CA 95472 (707) 508-7722	SON23- Job No: 468 Date: 3/14/23 Appr: MSMalone	GENERAL GEOLOGY SHOWING THE LOCATIONS OF THE SOLAR WELL & PROPOSED WELL 400 ESTERO LANE BODEGA BAY, CALIFORNIA	PLATE 1

Solar Well

State of California

Well Completion Report

Form DWR 188 Submitted 8/29/2022

WCR2022-010054

Owner's Well Number 08252022 Date Work Began 08/24/2022 Date Work Ended 08/25/2022

Local Permit Agency Sonoma County Permit & Resource Management Department

Secondary Permit Agency Permit Number WEL21-0168 Permit Date 08/04/2021

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

Name JIM & MARCIA MICKELSON, TRUST

Mailing Address P.O BOX 2689

City PETALUMA State CA Zip 94953

Planned Use and Activity

Activity New Well

Planned Use Water Supply Domestic

Well Location

Address 400 ESTERO LN

City BODEGA BAY Zip 94923 County Sonoma

	Deg.	Min.	Sec.		Deg.	Min.	Sec.	
Latitude	38	19	28.5959	N				
Longitude					-122	59	5.7839	W

Dec. Lat. 38.32461 Dec. Long. -122.98494

Vertical Datum Horizontal Datum WGS84

Location Accuracy Location Determination Method

APN 103-030-003

Township 06 N

Range 10 W

Section 32

Baseline Meridian Mount Diablo

Ground Surface Elevation

Elevation Accuracy

Elevation Determination Method

Borehole Information

Orientation Vertical Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite

Total Depth of Boring 400 Feet

Total Depth of Completed Well 400 Feet

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level 120 (Feet) Date Measured 08/25/2022

Estimated Yield* 1 (GPM) Test Type Air Lift

Test Length 2 (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	19	BROWN AND BLUE SANDY CLAY
19	280	BLUE SANDY CLAY WITH SANDSTONE STRINGERS
280	400	SANDSTONE AND SHALE

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	220	Blank	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563			
1	220	400	Screen	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563	Milled Slots	0.032	WITH CAP

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	20	Bentonite	High Solids		
20	400	Other Fill	See description.		#6 SAND

Other Observations:
RECOMMENDED PUMP SETTING: 360'
WATER WELL DRILLER: ZACH PELTON

Borehole Specifications

Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	400	11

Certification Statement

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

Name: MICKELSON ENTERPRISES INC (Person, Firm or Corporation)

P O BOX 2689 (Address) | PETALUMA (City) | CA (State) | 94953 (Zip)

Signed: *electronic signature received* (C-57 Licensed Water Well Contractor) | 08/29/2022 (Date Signed) | 424778 (C-57 License Number)

Attachments

ESTERO ROAD 400-2.jpg - Location Map

DWR Use Only

CSG #	State Well Number	Site Code	Local Well Number

N — Latitude Deg/Min/Sec

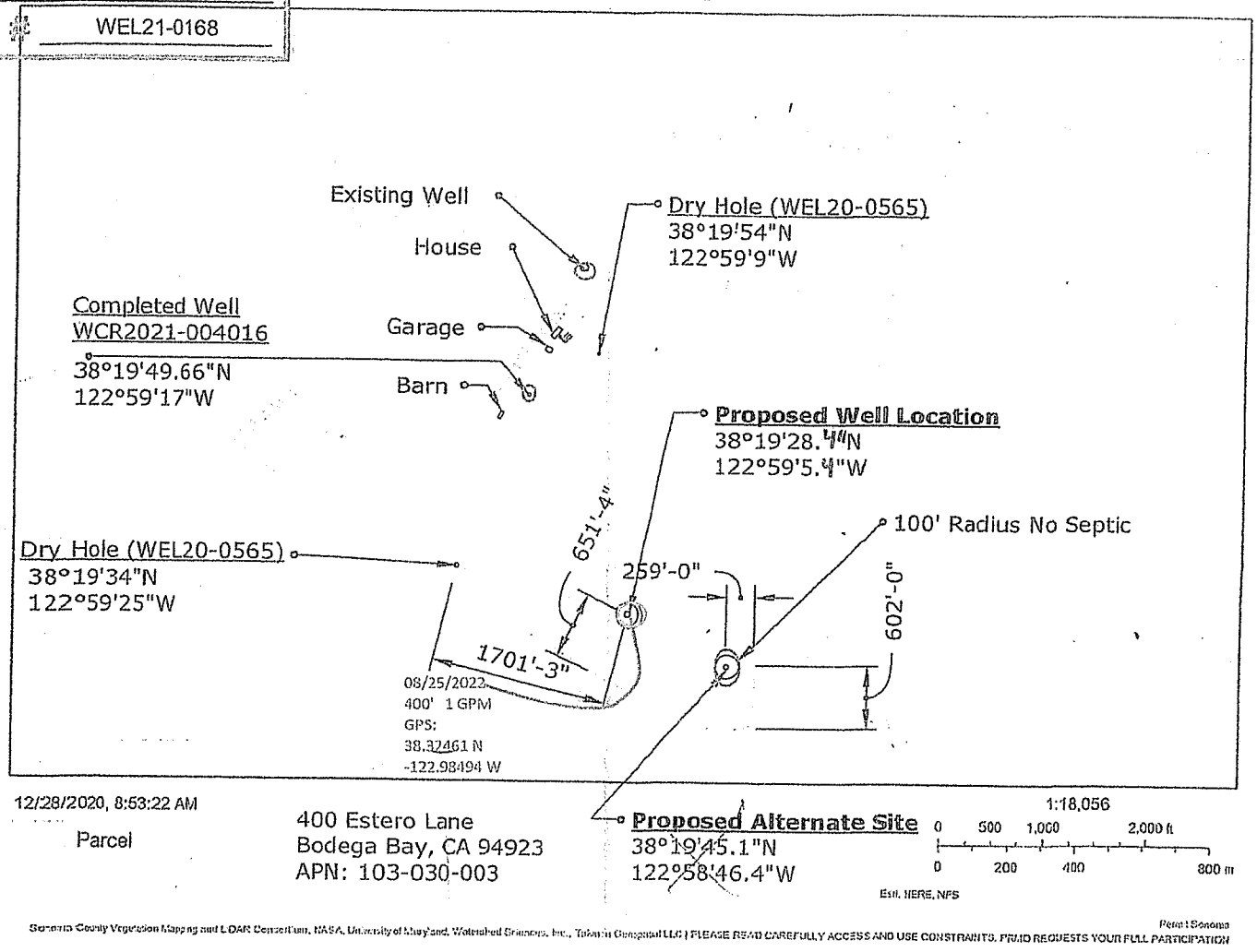
W — Longitude Deg/Min/Sec

TRS:

APN:

APPROVED
PERMIT SONOMA
WELL AND SEPTIC SECTION
APPROVED BY Becky Ver Meer
DATE August 4, 2021
PERMIT # WEL21-0168

Permit Sonoma: Zoning & Land Use



N

12/28/2020, 8:53:22 AM

Parcel

400 Estero Lane
Bodega Bay, CA 94923
APN: 103-030-003

1:18,056

0 500 1,000 2,000 ft
0 200 400 800 m

Esri, HERE, NPS

Sonoma County Vegetation Mapping and LiDAR Consortium, NASA, University of Maryland, Watershed Sciences, Inc., Tolavin Geospatial LLC | PLEASE READ CAREFULLY ACCESS AND USE CONSTRAINTS. PRMD REQUESTS YOUR FULL PARTICIPATION

Permit Sonoma