

REALM

Engineering

1767 Market Street, Suite C, Redding, CA 96001



For:
Planning
Commission

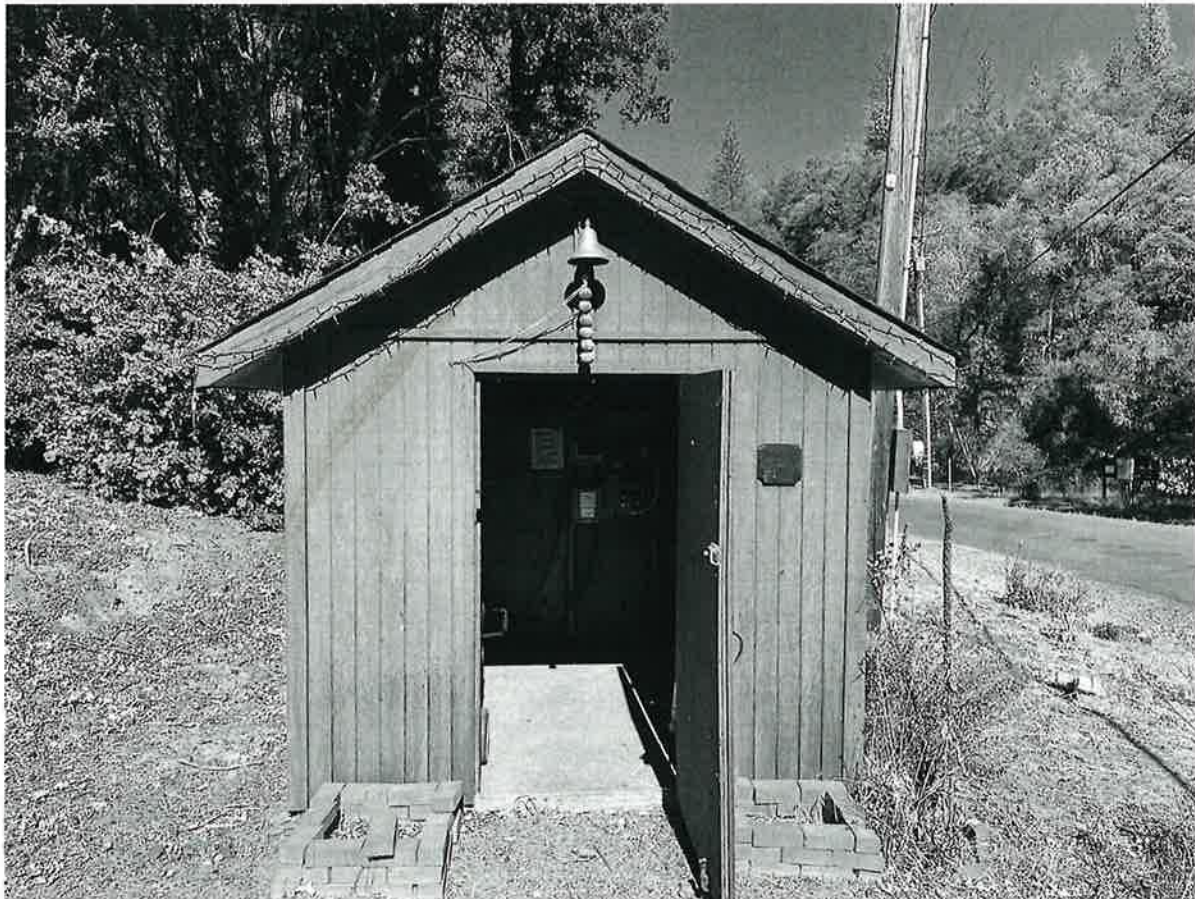
From:
Joan Moss

HYDROLOGY REPORT

9261 WILDCAT ROAD, KELSEYVILLE, CA

NOVEMBER 18, 2021

-AWA
3/23/2022





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INTRODUCTION

The purpose of this Hydrology Study/Report is to provide adequate information regarding the water usage for a proposed cannabis cultivation operation and its impacts to surrounding areas. This report was written to meet the requirements of an Urgency Ordinance requiring land use applicants to provide enhanced water analysis during a declared drought emergency, approved by the Lake County Board of Supervisors on July 27th, 2021 (Attachment A – Urgency Ordinance No. 3106).

PROJECT DESCRIPTION

Mombacho Mountain Organics, LLC (MMO) is seeking a Major Use Permit from the County of Lake for a proposed A-Type 3 "Medium Outdoor" commercial cannabis cultivation operation at 9261 Wildcat Road in Kelseyville, CA on Lake County APNs 011-044-17 and 011-044-18 (Project Property). The proposed cultivation operation would be composed of a 43,200 ft² fenced outdoor cultivation/canopy area, a 2,304 ft² immature plant area/greenhouse, a 2,500 ft² Processing Facility, and 400 ft² Pesticides & Agricultural Chemicals Storage Area (**Attachment B: Existing and Proposed Conditions Site Plans**).

The 20-acre rural residential-zoned Project Property is located just north of Mt Hannah, within the Cole Creek Watershed (HUC 12), and approximately 6 miles southeast of Kelseyville, CA (Figure 1 – Site Location Map). An unnamed intermittent Class II watercourse and tributary to Cole Creek, flows from southwest to northeast through the southeastern corner of the Project Property. The Project Property is accessed from Wildcat Road and Mombacho Road via a private gravel access road/driveway, that runs from east to west through the Project Property, connecting Wildcat Road (east) and Mombacho Road (west). The Project Property has been improved with a residence, a garage, a carport, and a groundwater well. *always been there not new*

The proposed outdoor cultivation/canopy area would be enclosed with 6-foot tall galvanized woven wire fences with locking metal gates, to control access to the proposed cultivation/canopy area. The growing medium of the proposed cultivation/canopy area would be amended native soil in full sun, with drip and micro-spray irrigation systems (to conserve water resources). The proposed immature plant area will be composed of a 24' X 96' greenhouse made of steel frames with 6-mil polyethylene film coverings and polycarbonate covered end walls. The growing medium of the proposed immature plant area will be an imported organic soil mixture in plastic nursery pots, with drip and micro-spray irrigation systems. All water for MMO's proposed cultivation operation will come from an existing groundwater well located at Latitude 38.90131° and Longitude -122.75927°. Water from the onsite groundwater well would be pumped to two 5,000-gallon water storage tanks located upslope and immediately west of the proposed cultivation operation. Irrigation water would be gravity fed from the water tanks to the irrigation systems of the proposed cultivation areas.

The cultivation season for the proposed outdoor cultivation operation would begin in April and end in November of each year. All cannabis waste generated from the proposed cultivation operation would be chipped and composted onsite. Composted cannabis waste would be stored in a designated composting area, until it is incorporated into the growing medium of the cultivation/canopy area as an organic soil amendment. All agricultural chemicals (fertilizers, amendments, pesticides, and petroleum products) would be stored within the existing metal carport



(proposed Pesticide & Agricultural Chemicals Storage Area) located adjacent to the proposed cultivation/canopy areas.



Figure 1 – Site Location Map

WATER USAGE

Cannabis has often been characterized as a high-water-use plant. Bauer et al. (2015)¹ and Carah et al (2015)² estimate that cannabis plants can consume up to approximately 6 gallons per plant per day, whereas grapes consume approximately 3.5 gallons per plant per day in the North Coast region of California. Other authors, however, have reported that water use requirement for cannabis plants are similar to those of other agricultural crops, such as corn and hops, with an estimated water use requirement of 25-35 inches per year (Hammon et al. 2015³). According to a recent study published in the Journal of Environmental Management (Dillis et al. 2020⁴), outdoor and mixed-light cannabis cultivation uses the most water during the months of August, with an estimated water use of approximately 58,704 gallons per acre during the month of August.

per acre



According to MMO's Property Management Plan, the proposed cultivation operation is expected to have a total annual water use requirement of 710,355 gallons, with the greatest daily water usage during the months of July, August, and September (approximately 4,345 gallons per day). Using the water use requirements outlined in Hammon et al. 2015³, we estimate that the proposed cultivation operation would have an annual water use requirement between 2.2 and 3.0 acre-feet. The following table presents the expected water use of the proposed cultivation operation in gallons by month during the cultivation season (April through November).

	Apr	May	June	July	Aug	Sept	Oct	Nov
Low (25" per year)	30,000	60,000	90,000	150,000	150,000	150,000	60,000	30,000
High (35" per year)	40,000	80,000	120,000	210,000	210,000	210,000	80,000	40,000

Based on the water use estimates above, we estimate that the proposed cultivation operation would have a maximum daily water use requirement of approximately 7,000 gallons per day.

7,000 gallons
per day

WATER AVAILABILITY

All water for the proposed cultivation operation will come from the existing onsite groundwater well located at Latitude: 38.90131° and Longitude: -122.75927°. The onsite groundwater well was drilled to a depth of 99 feet below ground surface (bgs) in April of 1977. The Project Property is located within the Clear Lake Pliocene Volcanic Ar. groundwater basin/Clear Lake Volcanics Groundwater Source Area as identified in the 2006 Lake County Groundwater Management Plan⁵. The Clear Lake Volcanics consist of basalt, andesite, and other volcanic rocks in a complex sequence. Groundwater in the Clear Lake Volcanics occurs primarily in fractures, joints, and within weathered zones that formed in between volcanic eruptions. The amount of groundwater available to a well in the formation is highly dependent on the size, openness, frequency, and interconnection of fractures and joints encountered in the well⁵.

On July 25th, 2019, JAK Drilling & Pump (License No.: 1013957) conducted a test of the onsite groundwater well using a Well Watch 670 sonic water level monitor and mechanical totalizing meter that were previously installed on the well (**Attachment C: Onsite Well Completion and Test Reports**). During this test, 1,100 gallons of water were pumped from the onsite groundwater well, and the water level in the well dropped less than twelve inches (47.43 feet to 47.67 feet). On November 4th, 2021, Realm Engineering conducted a 7-hour pump test of the onsite groundwater well with MMO's assistance. Before, during, and after the pump test, the water level in the onsite groundwater well was monitored using the previously installed Well Watch 670 sonic water level monitor. The static water level in the onsite groundwater well was approximately 51.4 feet bgs prior to the start of the pump test, and the totalizing water meter installed on the discharge line read 891,390 gallons. Pumping of the onsite groundwater well started at 3:15 pm on November 4th and ended at 10:15 pm. At the end of the pump test the totalizing water meter read 895,520 gallons. With this information we can calculate that well was pumped at an average of 9.8 gpm over the course of the seven-hour pump test $((895,520 \text{ gallons} - 891,390 \text{ gallons}) / (7 \text{ hours} \times 60 \text{ minutes})) = 9.8 \text{ gpm}$. The water level in the onsite groundwater well stabilized at approximately 70.7 feet bgs over the second half (3.5 hours) of the seven-hour pump test (Figure 2 – Water Level Readings



During 7-Hour Pump Test). With the data from the November 4th pump test, we calculate the Specific Capacity of the onsite groundwater well to be 0.51 gpm/foot of drawdown (i.e., 9.8 gpm / 19.3 feet). The water level within the onsite groundwater well rebounded to 51.8 feet bgs in less than two hours after pumping ceased (98 percent recovery/recharge).

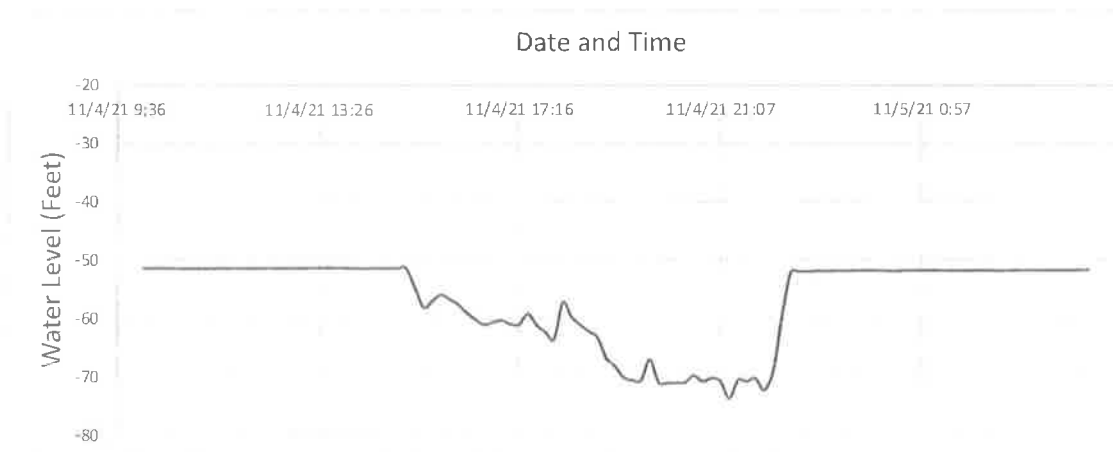


Figure 2 – Water Level Readings During 7-Hour Pump Test

The pump test data suggests that the onsite groundwater well can produce approximately 0.51 gpm for every foot of drawdown in the well. The peak anticipated daily demand for water of the proposed cultivation operation is approximately 7,000 gallons per day, which the onsite well could produce in less than 12 hours at 9.8 gpm. The well recovery observations demonstrate that the well may be able to produce this water without causing overdraft conditions. With the site aquifer extending to approximately 99 feet bgs, that calculates to approximately 47 feet of available drawdown (99 feet (aquifer depth) - 52 feet (static water level) = 47 feet of available drawdown). This further suggests that the onsite groundwater well has ample capacity to meet the water demands of the proposed cultivation operation. Additionally, MMO proposes to establish at least 10,000 gallons of water storage capacity on the property. Based on data from the two pump tests performed of the onsite groundwater well, and the estimated water use requirements of the proposed cultivation operation, it appears that the existing onsite groundwater well could sustainably produce the water needed to meet the project demands.

AQUIFER/GROUNDWATER RECHARGE

Groundwater recharge is the replenishment of an aquifer with water from the land surface. It is usually expressed as an average rate of inches of water per year, similar to precipitation. Thus, the volume of recharge is the rate times the land area under consideration times the time period, and is usually expressed as acre-ft per year. In addition to precipitation, other sources of recharge to an aquifer are stream and lake or pond seepage, irrigation return flow (both from canals and fields), inter-aquifer flows, and urban recharge (from water mains, septic tanks, sewers, and drainage ditches).

For this site, the volcanic aquifer is considered to be unconfined. Drainage features that intersect and boarder the site have likely eroded through some of the overlying layers and are contributing

to the recharge of the site's aquifer through the stream bottom. However, it is also likely that a portion of the rain water falling directly on the site infiltrates the ground surface and migrates downward through the soil matrix until it recharges the aquifer. In addition, flow in the intermittent watercourses to the east and north of the Project Property may contribute to recharge of the aquifer near the site.

To estimate the groundwater recharge at the site, we first must assume that the recharge to the aquifer is primarily through rainfall across the 20-acre Project Property (Lake County APNs 011-044-17 & 18). Therefore, the annual precipitation available for recharge onsite can initially be estimated using the following data and equation.

$$20 \text{ acres} \times 2.8 \text{ feet (Average Annual Precipitation for Lakeport, CA)} = 56 \text{ acre-feet}$$

Estimated Annual Precipitation Onsite = 56 acre-feet/year

However, this estimate does not account for surface run-off, stream underflow, and evapotranspiration that occurs in all watersheds. According to the USGS, the long-term average precipitation that recharges groundwater in the northern California region is approximately 15 percent. Since the Project Property is covered in well-drained very gravelly loam soils and vegetation, we estimate that the long-term average precipitation that recharges groundwater within the entire site is near the regional average of 15%. With this data and the precipitation data presented above, we can estimate the groundwater recharge of the Project Property by using the following equation.

$$56 \text{ acre-feet/year (annual precipitation onsite)} \times 0.15 \text{ (long term average recharge)} =$$

Estimated Groundwater Recharge = 8.4 acre-feet/year

Based on the estimated average annual recharge to the aquifer of the Project Property (approximately 8.4 acre-feet/year) and the estimated annual water usage of the proposed cultivation operation (2.2 to 3.0 acre-feet/year), it appears that the MMO will have enough water to meet their demands without causing overdraft conditions.

POTENTIAL IMPACTS TO STREAMS & NEIGHBORING WELLS

Urgency Ordinance 3106 requires analysis of the "Cumulative impact of water use to surrounding areas due to project" implementation. To do this, we must first identify surrounding areas and uses that could be impacted from the project's well pumping/water usage. As outlined in previous sections of this report, all water for the proposed cultivation operation would come from an existing onsite groundwater well located at Latitude: 38.90131° and Longitude: -122.75927°, and the proposed cultivation operation would have an annual water use requirement between 720,000 to 990,000 gallons per year.

To evaluate potential well pumping impacts to surrounding areas and uses, the potential lateral extent of pumping from the onsite groundwater well was estimated. Using general relationships discussed in Groundwater and Wells, Second Edition (Driscoll 1986⁷), we estimated the lateral pumping influence using information from the November 4th, 2021 pump test. An approximate relationship between specific capacity and aquifer transmissivity was used to obtain aquifer characteristics and estimate a potential radius of pumping influence. Transmissivity was estimated for an unconfined aquifer, using the relationship of Specific Capacity (yield/drawdown) multiplied

by the coefficient of 1,500 (unconfined). To develop the slope of the drawdown curve from the pumping well, the value of Δs (drawdown over on log graph cycle) was calculated for a distance-drawdown relationship, where $T = 528Q/\Delta s$ (Driscoll 1986, equation 9.11⁷). The analysis is shown on the attached semi-log plot for the onsite groundwater well (**Attachment D – Radius of Influence Analysis**).

Using data from the November 4th, 2021 pump test and the general relationships outlined above, we calculated a zone of pumping influence extending approximately 400 feet from the onsite groundwater well. The calculated zone of pumping influence extends onto/under Lake County APNs 011-044-15, 011-058-06, and 011-058-14 (9210, 9291, and 9301 Wildcat Road). The onsite groundwater well is located near the border between Sections 8 and 9 of Township 12N and Range 08W. The California Department of Water Resources' Well Completion Report Map Application indicates that there are 13 groundwater wells in Section 8 and 33 groundwater wells in Section 9. We reviewed the well completion reports for the 46 wells identified as being within Sections 8 and 9, and did not identify any that indicated the presence of a groundwater well on Lake County APNs 011-044-15, 011-058-06, or 011-058-14. Additionally, the Lake County Environmental Health Department does not have any records that indicate the presence of a groundwater well on Lake County APNs 011-044-15, 011-058-06, or 011-058-14. Given that there is no evidence of a neighboring well within the calculated zoning of pumping influence, it does not appear that pumping for the proposed cultivation operation will result in well interference.

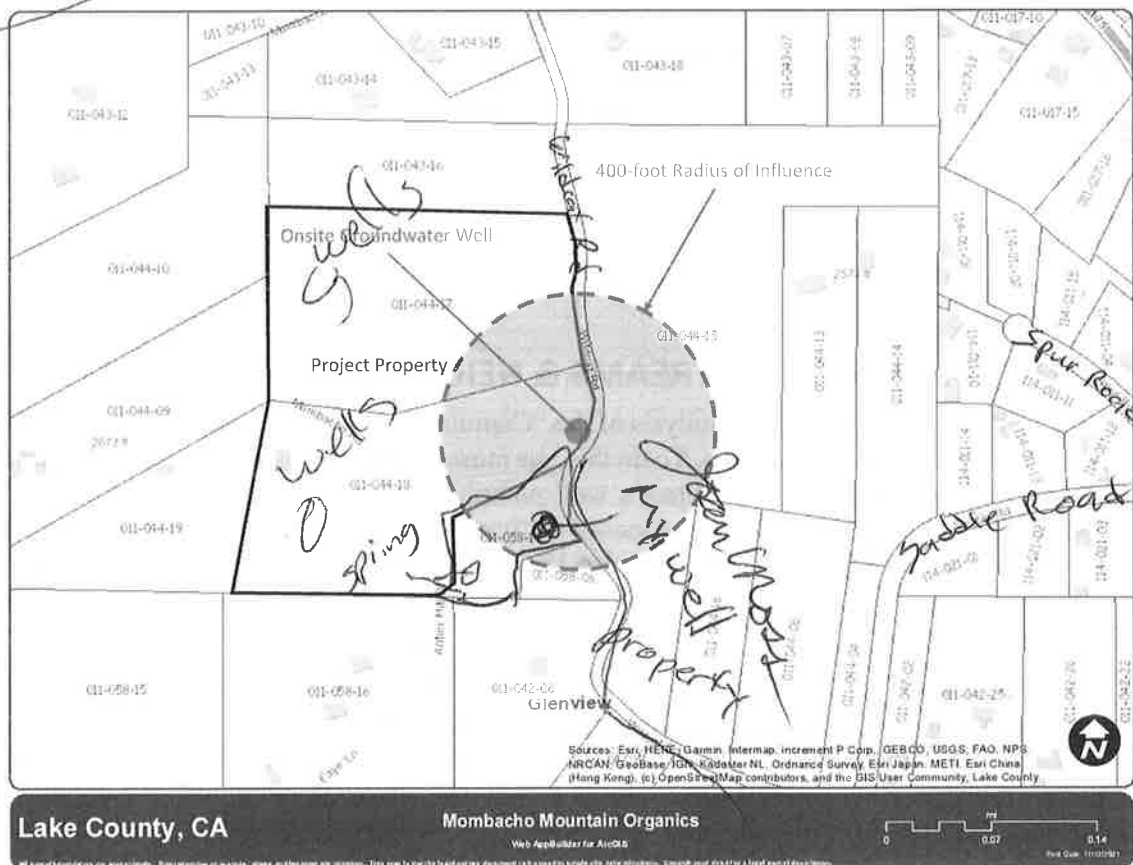


Figure 3 – Area of Influence Diagram

copy

watercourse dry has been for last years since 2015 Valley Ave

An unnamed intermittent Class II watercourse (NHD/DFG Water ID: 116953978) flows from southwest to northeast through the southeastern corner of the Project Property, then north along the eastern boundary of the Project Property. The unnamed intermittent Class II watercourse flows within 400 feet of the onsite groundwater well. However, the unnamed intermittent Class II watercourse does not support aquatic habitat year-round, and is typically dry by May/June of each year, when pumping of the onsite groundwater well for the proposed cultivation operation would reach potentially significant levels. Therefore, the potential for stream depletion as a result of the proposed onsite groundwater usage is not considered a concern to this assessment.

no water flow for last 5-6 years

stream already dry for last 5-6 years

DROUGHT MANAGEMENT PLAN

The Urgency Ordinance approved by the Lake County Board of Supervisors on July 27th, 2021 (Ordinance No. 3106) requires applicants to provide a plan depicting how the applicants plan to reduce water use during a declared drought emergency. The proposed cannabis cultivation operation would have up to 43,200 ft² of outdoor canopy area, with a total combined estimated annual water use requirement between 720,000 to 990,000 gallons per year. The proposed outdoor canopy area would be planted on or around June 1st of each year (depending on climatic conditions). Per the Water Conservation and Use requirements outlined in the State Water Resources Control Board's Cannabis General Order, the Applicant shall implement the following Best Practical Treatment and Control (BPTC) measures to conserve water resources:

- Regularly inspect their entire water delivery system for leaks and immediately repair any leaky faucets, pipes, connectors, or other leaks;
- Apply weed-free mulch in cultivation areas that do not have ground cover to conserve soil moisture and minimize evaporative loss;
- Implement water conserving irrigation methods (drip or trickle and micro-spray irrigation);
- Maintain daily records of all water used for irrigation of cannabis. Daily records will be calculated by using a measuring device (inline water meter) installed on the main irrigation supply line between the water storage area and cultivation area(s);
- Install float valves on all water storage tanks to keep them from overflowing onto the ground.

With the Water Conservation and Use requirements outlined above, the proposed cultivation operation would efficiently use water resources at all times.

To ensure both success and decreased impacts to the surrounding areas, MMO plans to reduce their outdoor canopy area and water usage by 10 percent, when a drought emergency has been declared for their region. To reduce their water usage by 10 percent, MMO will not plant 4,320 ft² or more of the proposed canopy area. By implementing the Drought Management Plan outlined above, MMO would reduce their estimated annual water demand from 720,000 - 990,000 gallons, to 648,000 - 891,000 gallons (10 percent), during periods of drought.

how many plants?



CONCLUSIONS

All water for the proposed cultivation operation will come from the existing onsite groundwater well located at Latitude: 38.90131° and Longitude: -122.75927°. The onsite groundwater well was drilled to a depth of 99 feet below ground surface (bgs) in April of 1977. A recent pump test performed in November of 2021, indicates that the onsite groundwater well can sustainably produce at least 9.8 gallons per minute. From the pump test data we can calculate a Specific Capacity of approximately 0.51 gpm/foot for the onsite groundwater well. The total estimated annual water use requirement for the proposed cultivation operation is between 720,000 and 990,000 gallons per year.

Based on data from the recent pump test and the estimated water use requirement(s) for the proposed cultivation operation, it appears that the onsite groundwater well is a sufficient water source for the proposed cultivation operation. Based on the estimated average annual recharge to the aquifer of the Project Property (approximately 8.4 acre-feet/year) and the estimated annual water usage of the proposed cultivation operation (2.2 to 3.0 acre-feet/year), it appears that the aquifer storage and recharge area are sufficient to provide for sustainable annual water use at the site and on the Project Property.

The calculated a zone of pumping influence for the proposed cultivation operation extends approximately 400 feet from the onsite groundwater well. It does not appear that pumping for the proposed cultivation operation will impact neighboring wells, given the horizontal and vertical separations between the onsite groundwater well and neighboring wells. An unnamed intermittent Class II watercourse flows within 400 feet of the onsite groundwater well. However, the unnamed intermittent Class II watercourse does not support aquatic habitat year-round, and is typically dry by May/June of each year, when pumping of the onsite groundwater well for the proposed cultivation operation would reach potentially significant levels. Therefore, the potential for stream depletion as a result of the proposed onsite groundwater usage is not considered a concern to this assessment.

LIMITATIONS

Realm Engineering is not responsible for the independent conclusions, opinions or recommendations made by others based on the records review, site inspection, field exploration, and interpretations presented in this report.

Groundwater systems of Lake County are typically complex, and available data rarely allows for more than general assessment of groundwater conditions and delineation of aquifers. Hydrologic interpretations are based on Well Completion Reports made available to us through the California Department of Water Resources, available geologic maps and hydrological studies and professional judgment. This analysis is based on limited available data and relies significantly on interpretation of data from disparate sources of disparate quality.

It should be noted that hydrological assessments are inherently limited in the sense that conclusions are drawn and recommendations developed from information obtained from limited research and site evaluation. Additionally, the passage of time may result in a change in the environmental characteristics at this site and surrounding properties. This report does not warrant against future operations or conditions, nor does this warrant operations or conditions present or a type or at a location not investigated.

This report is for the exclusive use of Mombacho Mountain Organics, LLC, their affiliates, designates and assignees, and no other party shall have any right to rely on any service provided by Realm Engineering without prior written consent.

Please feel free to contact me with any questions that you may have regarding this Hydrology Study/Report.

Sincerely,
Jason Vine, P.E. 67800



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REFERENCES

¹Bauer, S., Olson, J., Cockrill, A., et al. 2015. Impacts of surface water diversions for marijuana cultivation on aquatic habitat in four northwestern California watersheds. PLOS ONE, 10(9): e0137935

²Carah, J.K., Howard, J.K., Thompson, S.E., et al. 2015. High time for conservation: adding the environment to the debate on marijuana liberalization. Bioscience, 65, pp.822-829

³Hammon, B., Rizza, J. and Dean, D. 2015. Current impacts of outdoor growth of cannabis in Colorado. Colorado State University Extension, Fact Sheet No. 0.308

⁴Dillis, C.R., Grantham, T.E., McIntee, C., McFadin, B., Grady, K.V. 2020. Water storage and irrigation practices for cannabis drive seasonal patterns of water extraction and use in Northern California. Journal of Environmental Management, Volume 272, 15 October 2020, 110955

⁵Lake County Watershed Protection District, Lake County Groundwater Management Plan, 2006

⁶Scotts Creek Watershed Council, Scotts Creek Watershed Assessment, 2010

⁷Driscoll, Fletcher G., 1986, Groundwater and Wells, Second Edition, Johnson Division, St. Paul Minnesota, 1089p.

water
courses
dry

Before

before
valley
fire

before
valley
fire

7 7

ATTACHEMENT A

URGENCY ORDINANCE NO. 3106

after
2004
2006
2010

BOARD OF SUPERVISORS, COUNTY OF LAKE, STATE OF CALIFORNIA

ORDINANCE NO. 3106

AN URGENCY ORDINANCE REQUIRING LAND USE APPLICANTS TO PROVIDE ENHANCED WATER ANALYSIS DURING A DECLARED DROUGHT EMERGENCY

WHEREAS, the Sheriff, acting as the OES Director of Lake County, declared a local emergency due to drought conditions on May 6, 2021; and

WHEREAS, the Lake County Board of Supervisors approved the ratification of the declaration of a local emergency due to drought conditions on May 11, 2021; and

WHEREAS, the Board of Supervisors wish to ensure continued access to drinking water from private wells or from water purveyors throughout the county; and

WHEREAS, the Board of Supervisors wish to ensure that all current agricultural activities and projects find success during this declared drought emergency; and

WHEREAS, the Board of Supervisors of the County of Lake finds that additional information is critical to ensuring that the Planning Commission approves projects based on evidence of water use and water impacts and the analysis of the impacts to the surrounding areas.

NOW THEREFORE, the Board of Supervisors of the County of Lake hereby ordains as follows:

Section One: Due to the exceptional drought that we are experiencing and the declaration of a drought emergency, any land use approvals are required to provide adequate information regarding water usage for the project being considered and its impacts to surrounding areas. All projects that require a CEQA analysis of water use must include these additional items:

- not done*
- A. Hydrology report prepared by a California licensed civil engineer, hydro-geologist, hydrologist, or geologist experienced in water resources
 - a. Approximate amount of water available for the project's identified water source
 - b. Approximate recharge rate for the project's identified water source
 - c. Cumulative impact of water use to surrounding areas due to project
 - B. Drought Management Plan
 - a. Provide a plan depicting how the applicants plan to reduce water use during a declared drought emergency, to ensure both success and decreased impacts to the surrounding areas
- did not use data that described by creeks*

Section Two: This urgency ordinance, if approved, shall take effect on all future Planning Commission considerations until the declared drought emergency has expired or if the Board of Supervisors revokes the ordinance.

Section Three: It can be seen with certainty that there is no possibility that this urgency Ordinance may have a significant effect on the environment.

Section Four: All ordinances or parts of ordinances or resolutions or parts of resolutions in conflict herewith are hereby repealed to the extent of such conflict and no further.

Section Five: This ordinance shall go into effect immediately, and before the expiration of fifteen days after its passage, it shall be published at least once in a newspaper of general circulation printed and published in the County of Lake.

Section Six: This Ordinance is adopted as an urgency Ordinance pursuant to the provisions of Government Code sections 25123 and 25131 and shall be effective immediately upon adoption. Based on the declaration of purpose and facts constituting the urgency set forth above in Section One of this Ordinance, the Board of Supervisors finds and determines that the adoption of this Ordinance as an urgency Ordinance is necessary for the immediate preservation of the public peace, health and safety to address critical groundwater conditions in Lake County.

The Foregoing Ordinance was introduced before the Board of Supervisors on the 27th day of July, 2021, and passed by the following vote on the 7th day of July, 2021.

AYES: Supervisors Simon, Crandell, Scott, Pyska, and Sabatier

NOES: None

ABSENT OR NOT VOTING: None

COUNTY OF LAKE



Chair, Board of Supervisors

ATTEST: CAROL J. HUCHINGSON
Clerk of the Board of Supervisors

By: _____
Deputy

APPROVED AS TO FORM:

ANITA L. GRANT
County Counsel

By: _____

