Attachment #4

NORTHPOINT
CONSULTING GROUP, INC.

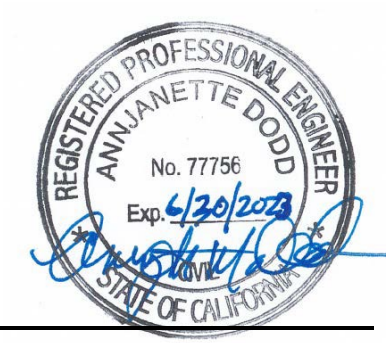
TECHNICAL MEMORANDUM

To: Humboldt County Planning Department

From: Annjanette Dodd, PhD, CA PE #77756 Exp. 6/30/2023

Date: March 24, 2023

Subject: Groundwater Well Evaluation – ECD Holdings Inc.
2260 Hooven Rd., McKinleyville, CA 95519 (APN: 511-141-015)



BACKGROUND AND PURPOSE

ECD Holdings, Inc. is proposing to permit commercial cannabis cultivation activities in accordance with the County of Humboldt's (County) Commercial Cannabis Land Use Ordinance (CCLUO), aka "Ordinance 2.0". The project requires a Conditional Use Permit to expand the current mixed light cannabis cultivation from 10,000 sq. ft. to 43,560 sq. ft.

The proposed irrigation water source would replace an existing surface water diversion with a combination of reclaimed water from dehumidification and air conditioning (A/C) units, rainwater collection, and an existing groundwater well. With the approval of the proposed cultivation expansion, the existing, permitted surface water diversion of 120,000 gallons per year for cannabis use would cease.

Since the project proposes the use of a well for irrigation, the County of Humboldt Planning and Building Department, in a letter to the applicant dated August 10, 2022, requested the applicant submit a hydrogeologic analysis. The purpose of the analysis is to determine whether use of the well would have a significant impact on the surrounding area.

The purpose of this Technical Memorandum (TM) is to provide an assessment to evaluate the potential impacts associated with the use of the existing well, in combination with reclaimed water and rainwater collection, for irrigation of the proposed cannabis project.

PROJECT LOCATION AND SITE INFORMATION

The project is located at 2260 Hooven Rd., McKinleyville, CA 95519 (APN: 511-141-015) within the McKinleyville Community Planning Area (CPA).

The well is located within the Norton Creek watershed, a tributary to the Mad River which flows into the Pacific Ocean approximately 2-miles to the west of the project site. The Norton Creek watershed is within the California Department of Water Resources (DWR) Bulletin 118 Mad River Groundwater Basin – Dows Prairie Subbasin (Basin Number 1-8.02) referred to herein as the Dows Prairie Subbasin (DWR, 2004 – Attachment 1).

The subject property has historically been used for residential, agricultural, and cannabis cultivation.

Existing buildings include a residence, two (2) two-story buildings, 10,000 sq. ft. of mixed light cultivation greenhouses, on-site ancillary nursery greenhouse, a 90,000-gallon water tank, and four (4) 5,000-gallon water tanks. Existing permitted cultivation activities include 4,400 sq. ft. of indoor cultivation, 10,000 sq. ft. of mixed light cultivation, and an ancillary nursery (ECD Holdings, Inc. Cultivation and Operations Manual and Development Plans, 2023).

EXISTING AND PROPOSED WATER DEMAND

The existing cultivation operation has an annual irrigation use of 120,000 gallons (ECD Holdings, Inc. Cultivation and Operations Manual, 2023) and is sourced from an authorized, existing, onsite surface water diversion. The existing diversion is an approved water source for the existing cultivation and has a Small Irrigation Use Registration (SIUR). The proposed project would cease use of this diversion for irrigation upon approval of the expansion. The proposed expansion would increase annual cultivation water use to 610,000 gallons (14 gallons/sf), for an increase of 490,000 gallons compared to existing demand (Table 1).

Table 1: Estimated irrigation water use.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Irrigation (1,000 gallons)	35	35	40	40	60	60	75	75	60	60	35	35	**610**

WATER STORAGE

The existing onsite irrigation water storage infrastructure is comprised of a permitted 90,000-gallon metal tank and four (4) 5,000-gallon tanks, for a total storage capacity of 110,000 gallons.

WATER SUPPLY PLAN

The proposed irrigation water source is a combination of reclaimed water from the dehumidification and air conditioning (A/C) units, rainwater collection, and an existing groundwater well (ECD Holdings, Inc. Cultivation and Operations Manual, 2023).

Reclaimed Water

The dehumidifier units and A/C units will serve a dual purpose of climate control and capturing condensed water. Condensed water will be plumbed to the irrigation water storage tanks to be reclaimed and reused for irrigation.

The applicant proposes to use eight (8) 5000W Anden 710 high-efficiency dehumidifier units and four (4) A/C units for indoor cultivation and eight (8) 5000W Anden 710 high-efficiency dehumidifier units for mixed light cultivation. All dehumidifier and A/C units would be operated year-round. Each dehumidifier has a maximum recapture rate of approximately 710 pints (88.75 gallons) per day. Each A/C unit has the potential to capture up to 12.5 gallons of water per day. For conservativeness, a capture efficiency of 60% was assumed (ECD Holdings, Inc. Cultivation and Operations Manual, 2023). Thus, the dehumidifiers and A/C units have the potential to reclaim approximately 321,930 gallons of water annually to reuse for irrigation.

Rainwater Collection

The potential rainwater collection volume was estimated based on the rainwater catchment surface area (existing and proposed buildings) and historic rainfall data. Historic rainfall data was sourced from PRISM

Climate Group (https://prism.oregonstate.edu/explorer/). The PRISM Climate Group gathers climate observations from a wide range of monitoring networks and provides time series values of precipitation for individual locations based on topography and historic precipitation values from 1985 through 2021. Using annual rainfall from 2000-2021, which is less than the average over the period of record, the average rainfall for the project area is 49.5 inches. The lowest rainfall year was 2013 and totaled 24.2 inches. The total annual rainfall over the 16-acre project parcel is 10.5 and 21.5 million gallons during the lowest and average rainfall years, respectively.

Roof areas on which rainwater catchment is proposed to be implemented are summarized in Table 2. It was assumed that 50% of the proposed greenhouse surface area would be the effective catchment area and the existing buildings would provide the remaining catchment area. The low annual rainfall is the lowest rainfall year in the PRISM record in the vicinity of the site and represents the dry year.

The average monthly rainfall distribution was obtained from PRISM and used to distribute the annual rainfall for an average year and a dry year. The rainfall distribution along with the potential rainwater collection volume and estimated actual rainwater collection volume are illustrated in Figure 1 and Figure 2. It is assumed that the actual rainwater collection efficiency is 85% of the potential rainwater volume. Using an efficiency of 85%, the total annual rainwater collection during an average year and a dry year are 720,503 gallons and 352,249 gallons, respectively.

Table 2: Estimated rainwater catchment area and potential collection volumes during average and dry rainfall years.

Catchment Surface	Roof Area (sq. ft.)	Catchment Area (sq. ft.)	Average Annual Rainfall (in)	Low Rainfall Year (in)	Potential Rainwater Collection Volume Average Year (gallons)*	Potential Rainwater Collection Volume Dry Year (gallons)*
<P>155.5'x280' Greenhouse	43,560	21,770	49.5	24.2	671,760	328,420
<E> 2,400 sf Building	2,400	2,400	49.5	24.2	74,060	36,210
<E> 50'x66' Building	3,300	3,300	49.5	24.2	101,830	49,780
Total		**27,470**			**847,650**	**414,410**
*1-inch of rainfall over 27,470 sq. ft. produces 17,124 gallons; 85% of this is 14,555 gallons.						

Well Water

Well water would be used to offset reclaimed water and rainwater collection during the summer months when rainfall is low. The monthly water balance, using actual rainfall collection (Figure 1 and Figure 2), is summarized in *Table 4* and *Table 5*, for an average and dry year, respectively. Approximately 127,300 gallons and 171,800 gallons of well water would be needed to offset reclaimed water and rainwater during an average and dry year, respectively, representing less than 30% of the overall irrigation demand annually (Table 3). The maximum daily pumping rate, to keep the tank storage full, is less than 3.1 gallons per minute (gpm) over an 8-hour pumping period, during daylight hours, as the pump is solar powered.

Table 3: Irrigation demand (in percent) by water source.

Source	Average Year	Dry Year
Reclaimed	53%	53%
Rainwater	26%	19%
Well Water	21%	28%

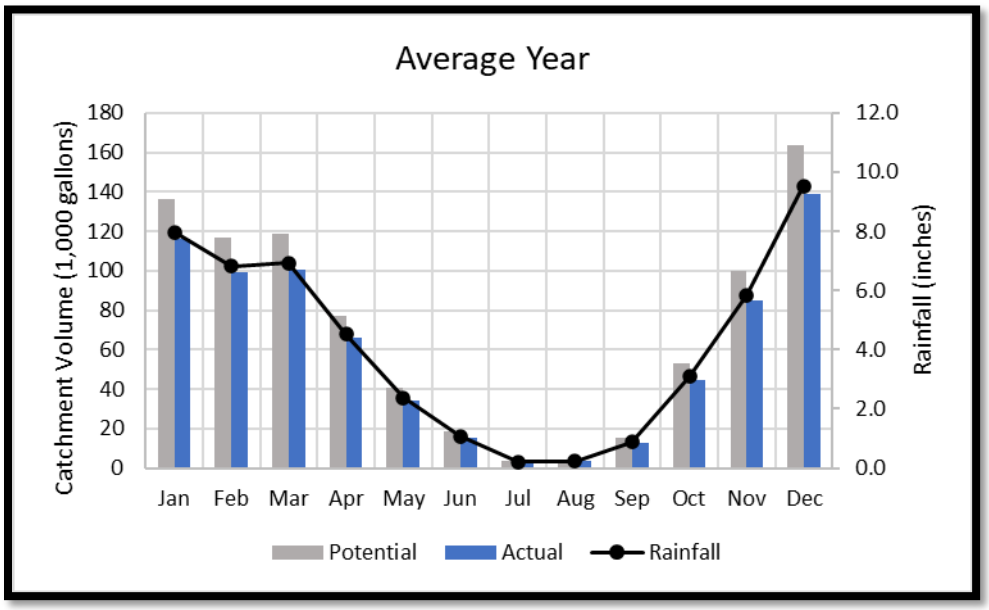


Figure 1. Rainfall distribution and rainwater catchment volume for an average year.

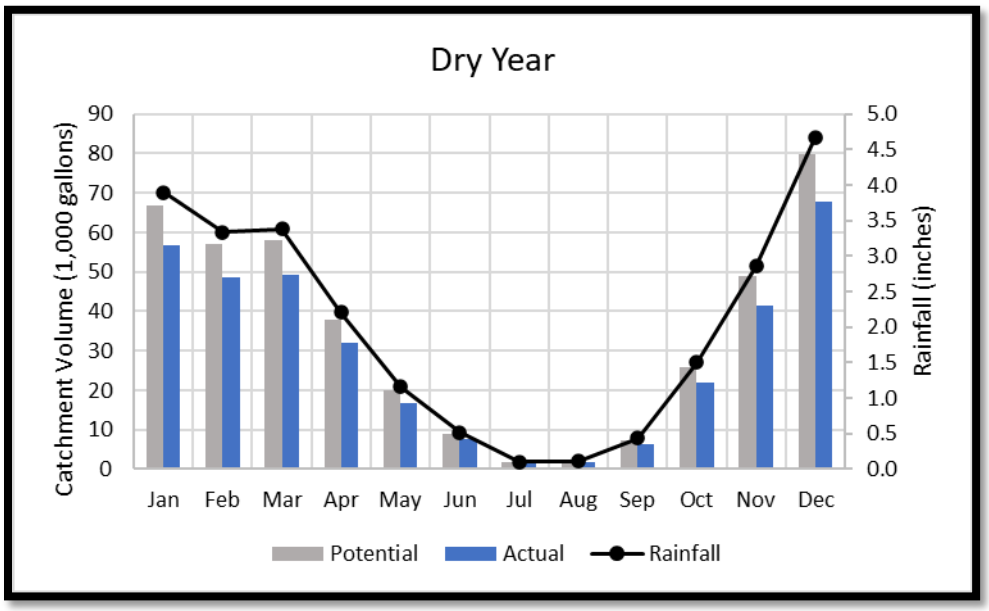


Figure 2. Rainfall distribution and rainwater catchment volume for a dry year.

Table 4: Monthly water use and storage during an average year (1,000 gallons).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Total
Water in storage at beginning of month	110	110	110	110	110	110	110	110	110	110	110	110	110	N/A
Water demand for irrigation	-35	-35	-40	-40	-60	-60	-75	-75	-60	-60	-35	-35	-35	-610
Reclaimed water	27.3	24.7	27.3	26.5	27.3	26.5	27.3	27.3	26.5	27.3	26.5	27.3	27.3	321.9
Water needed to fill tank by end of month	7.7	10.3	12.7	13.5	32.7	33.5	47.7	47.7	33.5	32.7	8.5	7.7	7.7	N/A
Rainfall to storage	7.7	10.3	12.7	13.5	32.7	15.6	3.1	3.4	13.0	32.7	8.5	7.7	7.7	160.7
Storage at end of month (reclaimed water plus rainwater collection)	110	110	110	110	110	92	65	66	89	110	110	110	110	N/A
Well water to fill tank	0	0	0	0	0	18	45	44	21	0	0	0	0	127.3
Daily well pumping rate (gpm) – 8-hr daylight period	0	0	0	0	0	1.2	3.0	3.0	1.4	0	0	0	0	N/A

Table 5. Monthly water use and storage during an average year (1,000 gallons).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Total
Water in storage at beginning of month	110	110	110	110	110	110	110	110	110	110	110	110	110	N/A
Water demand for irrigation	-35	-35	-40	-40	-60	-60	-75	-75	-60	-60	-35	-35	-35	-610
Reclaimed water	27.3	24.7	27.3	26.5	27.3	26.5	27.3	27.3	26.5	27.3	26.5	27.3	27.3	321.9
Water needed to fill tank by end of month	7.7	10.3	12.7	13.5	32.7	33.5	47.7	47.7	33.5	32.7	8.5	7.7	7.7	N/A
Rainfall to storage	7.7	10.3	12.7	13.5	16.9	7.6	1.5	1.7	6.3	21.9	8.5	7.7	7.7	116.3
Storage at end of month (reclaimed water plus rainwater collection)	110	110	110	110	94	84	64	64	83	99	110	110	110	N/A
Well water to fill tank	0	0	0	0	16	26	46	46	27	11	0	0	0	171.8
Daily well pumping rate (gpm) – 8-hr daylight period					1.1	1.8	3.1	3.1	1.9	0.7				N/A

GROUNDWATER SOURCE WELL INFORMATION

The proposed well water source to augment reclaimed water and rainwater collection is an existing groundwater well (WCR2021-004045, Lat/Long: 40.967690, -124.084773, Attachment 2, Figure 3). The well was drilled to a depth of 400 feet BGS by Fisch Drilling on March 9th, 2021. The well geologic log within the well completion report (WCR) reported overburden surface soil, silt, clay, and organics from 0-28 ft below ground surface (BGS), shale clay from 28-34 ft BGS, various interbeds of brown silty clays, and sands from 34-389 ft BGS, shale clay from 389-393 ft BGS, and 'blue clay and Tree' (presumable organics) from 292-400 ft BGS. As per the WCR, the well was cased with a 5.563-inch (outer diameter) blank PVC casing from 0-100 ft BGS, and screened PVC casing from 100-400 ft BGS. Depth to first water was recorded as 16 ft BGS, a static water level of 260 ft BGS, and an estimated well yield of 15 gpm after a 4-hour air lift test. The existing well pump is a solar powered Grundfos 6SQF3 pump with a maximum capacity of 5.9 gpm.

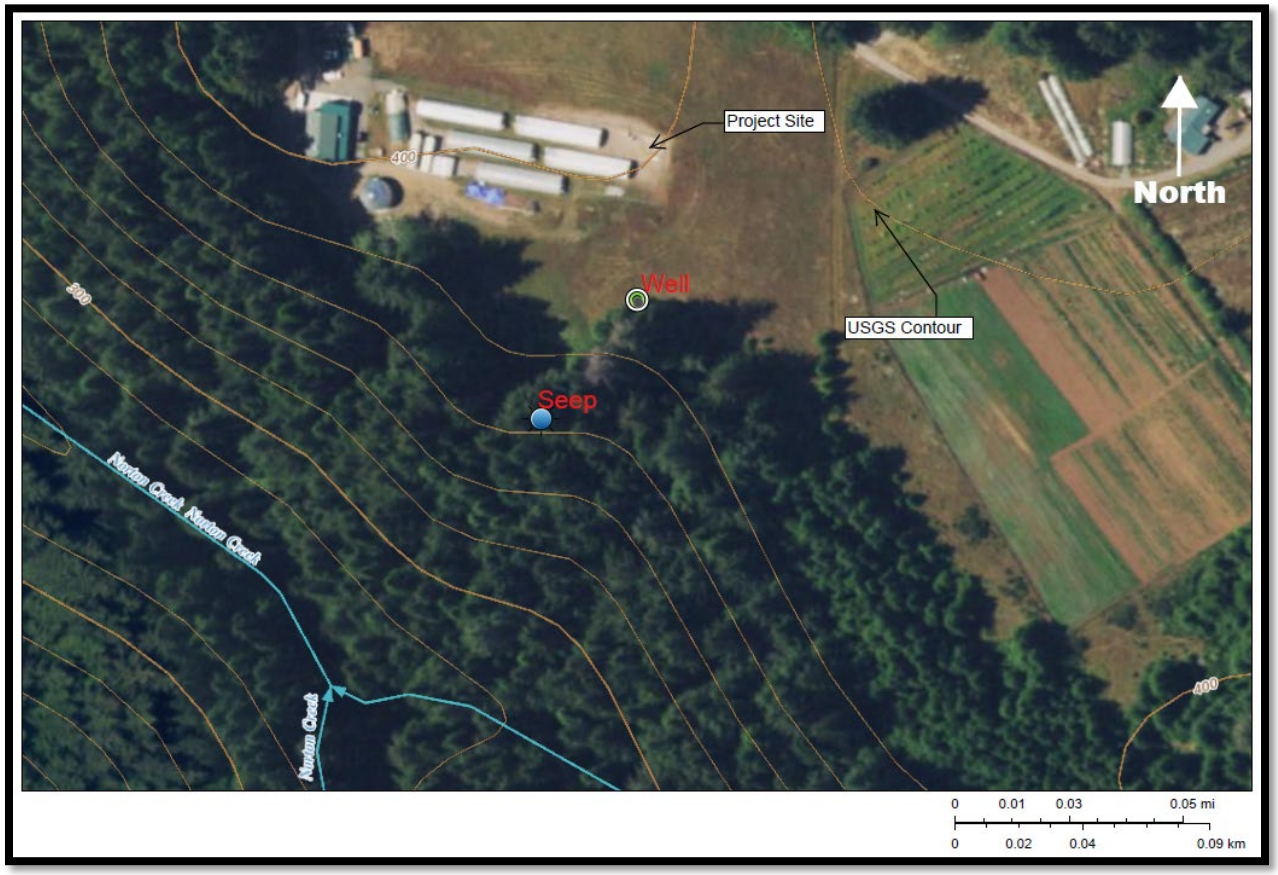


Figure 3. Project well with mapped surface water features.

GROUNDWATER BASIN

The project is located in the Mad River Groundwater Basin – Dows Prairie Subbasin (Basin Number 1-8.02, Attachment 1). The Dows Prairie Subbasin covers an area of 14,000 acres (21.9 square miles) and is bounded by Little River to the north, Mad River to the south, the Pacific Ocean to the west, and Franciscan Formation to the east (Figure 4). The Quaternary Hookton Formation is the water-bearing formation in

the subbasin and is comprised of clay, sand, and thin gravel beds. The formation is at least 150 feet thick and may be over 200 feet thick in other areas. The Hookton Formation is known to have moderately low permeability and supplies unconfined groundwater to the region. Recharge occurs by rainfall infiltration. DWR reports an estimated usable storage capacity of 10,500 acre-feet based on a saturated depth interval of 10- to 150-feet BGS, a surface area of 6,500 acres, and a specific yield of 11- to 12-percent. The Bulletin 118 basin description Groundwater Budget (Type B) was conducted in 1996 and estimated groundwater extraction for agricultural and municipal/industrial uses are 2,100 and 80 acre-feet, respectively, and deep percolation from applied water to be 500 acre-feet per year.

The Mad River Groundwater Basin has not been identified by the California Department of Water Resources (DWR) as a critically overdrafted basin. Critically overdrafted is defined by DWR as, "A basin subject to critical overdraft when continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts." In addition, as part of the California Statewide Groundwater Elevation Monitoring (CASGEM) program, DWR created the CASGEM Groundwater Basin Prioritization statewide ranking system to prioritize California groundwater basins to identify, evaluate, and determine the need for additional groundwater level monitoring. California's groundwater basins were classified into one of four categories: high-, medium-, low-, or very low-priority. The Mad River Groundwater Basin was ranked as a very low priority basin by the CASGEM ranking system (DWR, 2021).

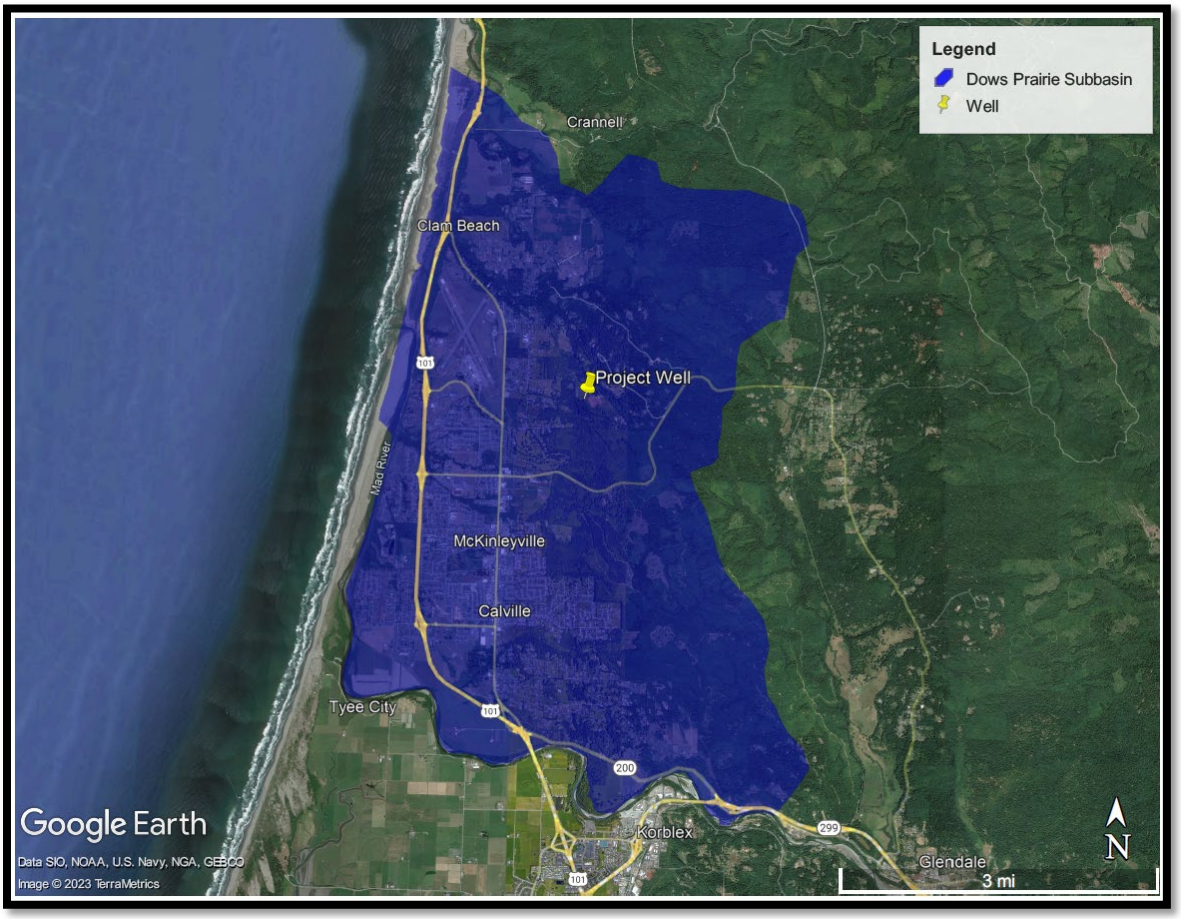


Figure 4. Dows Prairie Subbasin Groundwater Basin

REGIONAL AND LOCAL GEOLOGY

The 30x60-minute Eureka Quadrangle geologic map (1:100,000 scale) mapped the project parcel on geologic units *Qm* and *QTw* (Figure 5). *Qm* is described as 'undeformed marine shoreline and aeolian deposits of the Holocene and Late-Pleistocene, consisting of gravels and sands and *QTw* is described as marine and nonmarine overlap deposits from the late Pleistocene to middle Miocene, comprised of thinly bedded to massive, weakly lithified siltstone, medium-grained sandstone, and locally soft, scaly mudstone (McLaughlin et al, 2000). The parcel is located within the Mad River Fault Zone (MRFZ) region, a northwest striking belt of en-echelon thrust faults and folds that dip predominantly northeast, approximately 80-km-long and 15- to 25-km wide (Carver and Burke, 1992). The project well is located near the contact of geologic units *Qm* and *QTw* (Figure 5). The WCR geologic log for the project's well is consistent with the geologic unit descriptions described by McLaughlin et al (2000).

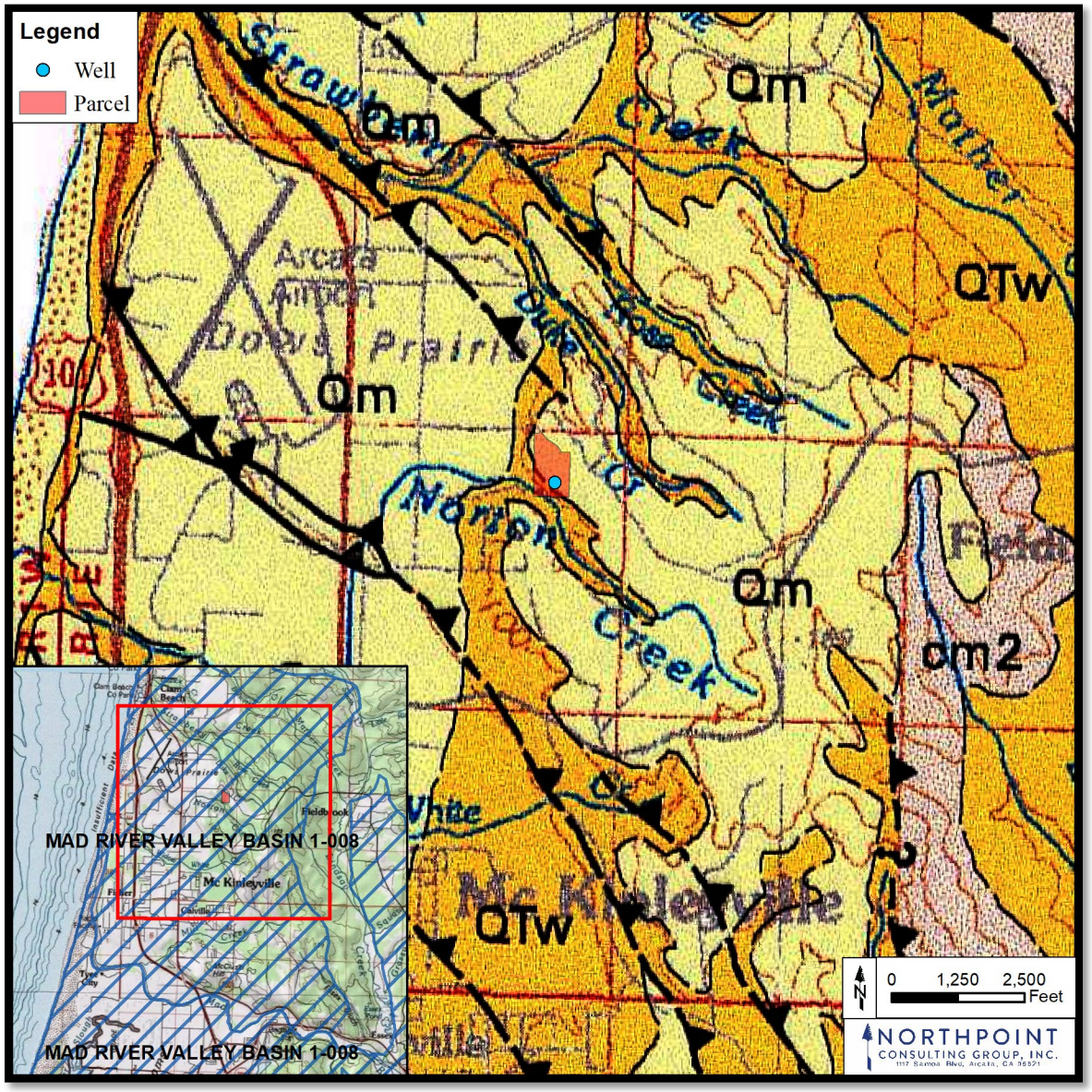


Figure 5. Geologic Map (inset identifies mapped area, source: McLaughlin et al, 2000).

NEARBY SURFACE WATER AND GROUNDWATER

Surface Water

A site visit was conducted on October 10, 2022 to identify surface water features near the project's well. There is a seep on the subject parcel, located approximately 150 feet southwest of the well (Lat/Long: 40.967315, -124.085177, Figure 3 and Figure 6). The nearest mapped surface waterbody is an unnamed tributary to Norton Creek, approximately 520 feet to the southwest. Flowing water was observed in this tributary and in Norton Creek on the day of the site visit.

The existing surface water diversion is located approximately 800 feet to the northeast (Figure 8). With the approval of the proposed cultivation expansion, surface water diversion for cannabis use would cease.

The seep occurs at an approximate elevation of 365 ft, as per the USGS 3DEP digital elevation model (DEM). The seep occurs at a hollow/channel head cut into *Qm* material and was discharging at approximately 1-3 gpm at the time of the site visit. The seep is located beneath a forested canopy comprised primarily of coastal conifer species. Surface water from the seep infiltrates directly into the ground within few feet towards the southwest, away from the well. Due to lack of scouring and surficial erosional features, there is no evidence of frequent or significant local surface water flow in the hollow due to the seep.

Groundwater

No wells were identified by the WCR Map Application website within 1,000 ft of the project well. The project well is located with the Public Land System survey (PLSS) Section H07N01E29 and is one of 6 domestic wells in the Section on DWR's Well Completion Report (WCR) Map Application website (Figure 7). The nearby PLSS Sections, PLSS Sections H07N01E20, H07N01E21, and H07N01E28 have 26, 9, and 5 well completion reports, respectively. No wells were identified by the WCR Map Application website within 1,000 ft of the project well; the two closest wells are over 1,000 feet away (Figure 8). WCRs in the PLSS sections all had geologic logs reporting silty clay soil overlying interbeds of sand, clay, and gravel, often occurring between 20 and 400 ft BGS. Static water levels and well yields vary between wells, suggesting spatial heterogeneity in groundwater distribution and aquitard features. Well test yields reported 4 gpm–150 gpm, and two of the 18 WCRs within the immediate surrounding PLSS sections marked as dry holes. The spatial heterogeneity of well yields in the reviewed WCRs is not unusual in volcanic deposition, which can show marked differences in groundwater yields due to differences in the continuity of Coast Range geologic units and possible confining/aquitard layers, such as shale.

Figure 6. Picture of nearby seep.

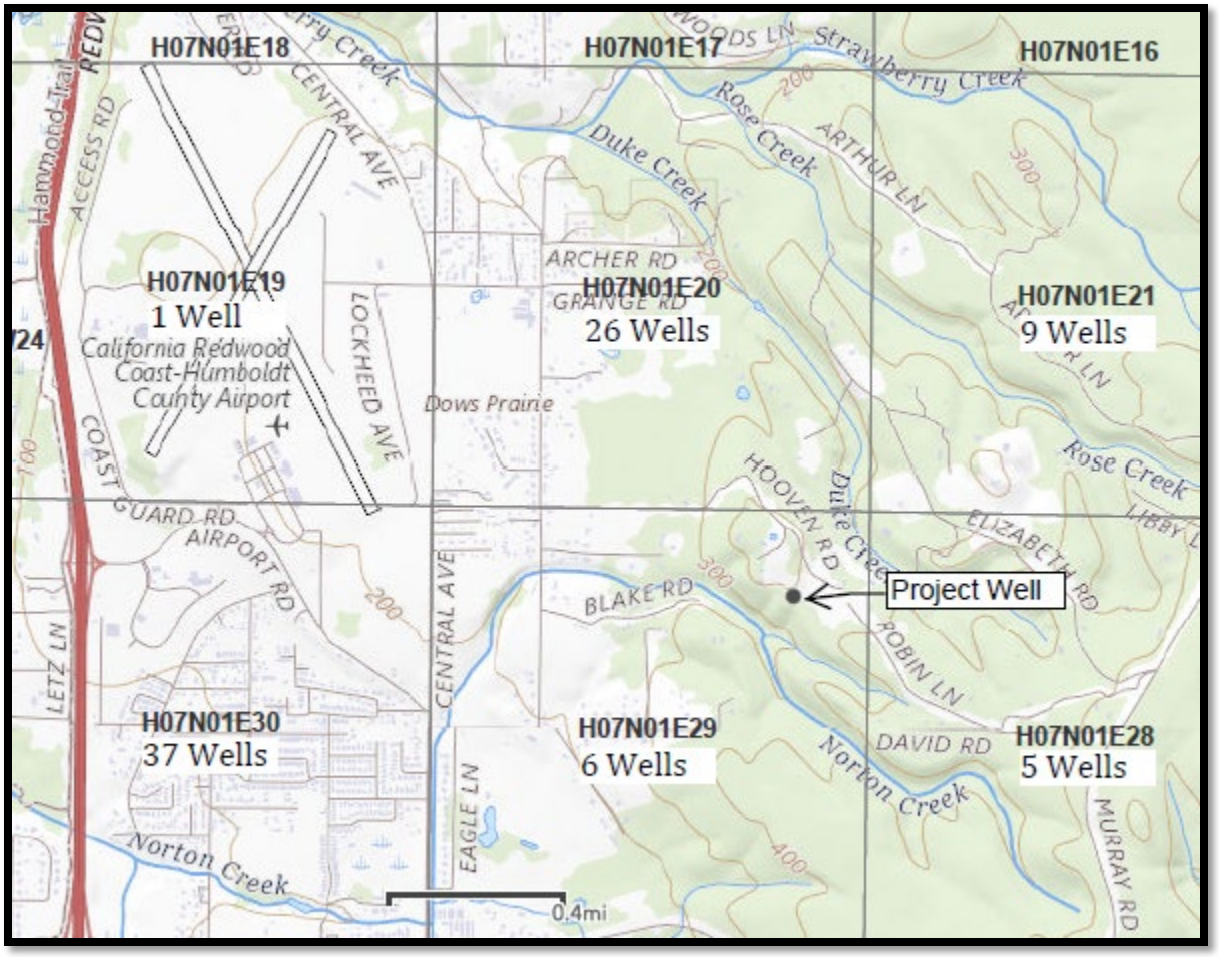


Figure 7. Department of Water Resources Well Completion Report Map Application nearby domestic well counts.

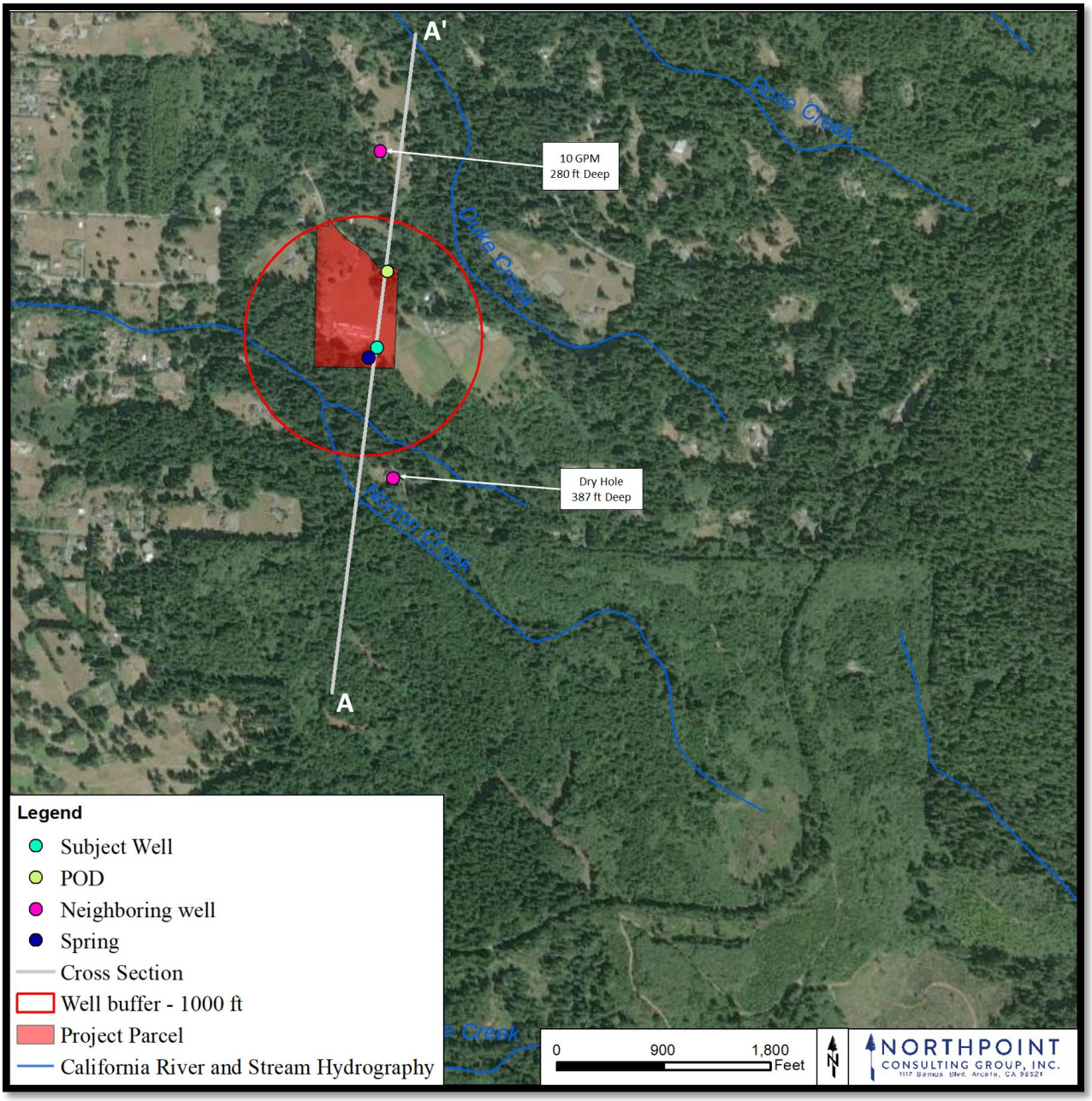


Figure 8: The Project Parcel (red polygon) shown on the with hydrogeologic cross section, nearby wells, and water features (POD = existing point of diversion).

HYDROGEOLOGIC CONCEPTUAL MODEL

To evaluate the surface water connectivity of the project's well, a conceptual hydrogeologic model (Figure 9) for cross section A-A' (Figure 8) was developed using the available information from the WCRs for the project well and two closest neighboring wells; local geology; and nearby surface water and groundwater information. WCRs for the project's well and the closest neighboring wells are provided in Attachment 2. Groundwater recharge to the large, unconfined aquifer occurs by rainfall infiltration (DWR, 2004).

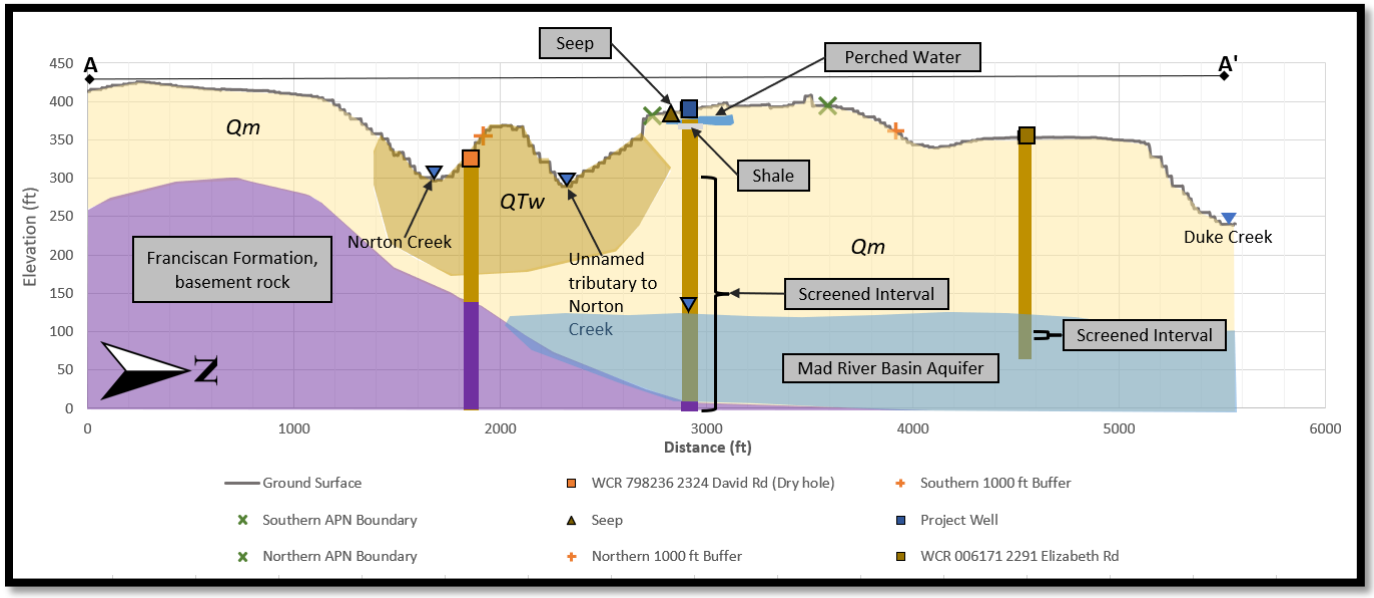


Figure 9: Hydrogeologic conceptual cross-section of the transect shown in Figure 8.

IMPACTS TO SURFACE WATER AND ADJACENT WATER USERS

Based on the available hydrogeologic information, there is evidence that the project's water source is likely not directly connected to the unnamed tributary to Norton Creek. The nearby seep appears to be perched water that is disconnected from the well due to the overlying shale layer reported in the geologic log and due to the fact that the well is sealed to 20 ft BGS, cased to 100 ft BGS, and screened below 100 ft BGS. To support this conclusion, water quality samples were taken from the well and seep in high-density polyethylene bottles (pre-cleaned of trace metals) on October 24, 2022. The well pump was allowed to run for approximately 10-minutes prior to the collection of the water sample. The water was sampled directly from the well head, prior to any in-line filtration of groundwater. Water from the seep was sampled via the collection of dripping water directly from the seep. Water samples were sent to A&L Laboratories (Modesto, California, Attachment 3). The water quality results were mapped on a Piper Diagram for comparison (Figure 10). The water quality results provide evidence supporting that the samples are from different water sources. Therefore, the well is unlikely drawing water from this perched layer.

As demonstrated in this TM, with the proposed expansion, approximately 127,300 gallons and 171,800 gallons of well water would be needed to offset reclaimed water and rainwater collection during an average and dry year, respectively and would replace the existing surface water diversion of 120,000 gallons per year. Thus, only a net increase of 7,300 gallons and 51,800 gallons of groundwater extraction during an average year and a dry year, respectively (*Table 4* and *Table 5*); which is less than 0.001% of

the usable storage capacity, 10,500 acre-feet (DWR, 2004), of the groundwater basin and less than 0.5% of the annual precipitation (10,500,000 gallons), over the 16-acre project parcel, during a dry year.

Reclaimed water and rainwater collection would supply the majority of the projected irrigation demand; approximately 72%–79% (Table 3). Well water would be needed to offset the irrigation demand during the summer months at a rate of approximately 0.7–3.1 gpm (*Table 4* and *Table 5*), assuming the well is pumped over an 8-hour pumping period, during daylight hours, as the pump is solar powered (the pump has a maximum capacity of 5.9 gpm). The greatest demand from the well would be expected to occur in July through August. The California Department of Water Resources (DWR, 2004) provided an estimate of the annual groundwater extraction in the groundwater basin to be 2,180 acre-feet for agricultural and industrial uses. The project projects up to 171,800 gallons (0.53 acre-feet) of well water use, which is only 0.024% of the overall extraction for agricultural and industrial uses and proposes a net increase of only 51,800 gallons (0.16 acre-feet), which is only 0.007% of the overall groundwater basin extraction.

Although determined for humid basins in the east, the USGS (USGS Fact Sheet 2007-3007) estimated long-term average recharge to be between 10 and 66 percent of precipitation. Over the 16-acre project parcel area this would equate to 3.2 – 21.3 acre-feet per year (AFY) during a dry year and 6.6 –43.6 AFY during an average year. The project's groundwater demand is only 12% of the lowest long-term average recharge estimate of 3.2 AFY (1,042,700 gallons) over the 16-acre project parcel.

No wells were identified in the WCR documents within 1,000 ft of the project well that would likely be impacted from groundwater extraction for the proposed project. Additionally, this region receives substantial annual rainfall, which, given the relatively low local density of wells, is expected to recharge the groundwater aquifer, even during dry years as evidenced during the site visit in October 2022, which occurred during a period of extreme drought. During these site visits, surface water features demonstrated flowing water in the absence of significant rainfall events.

Since there is sufficient groundwater supply and annual recharge to meet the project's demand during average and dry years; there is sufficient groundwater storage; there is evidence that the project's well is likely not connected to surface water; the project is situated in an area of low population and well densities; there is little to no impact to surrounding wells; and with the proposed use of a combination of reclaimed water and rainfall collection; the proposed project well water use would have a less than significant impact on groundwater, surface water, or water users in the vicinity of the proposed project.

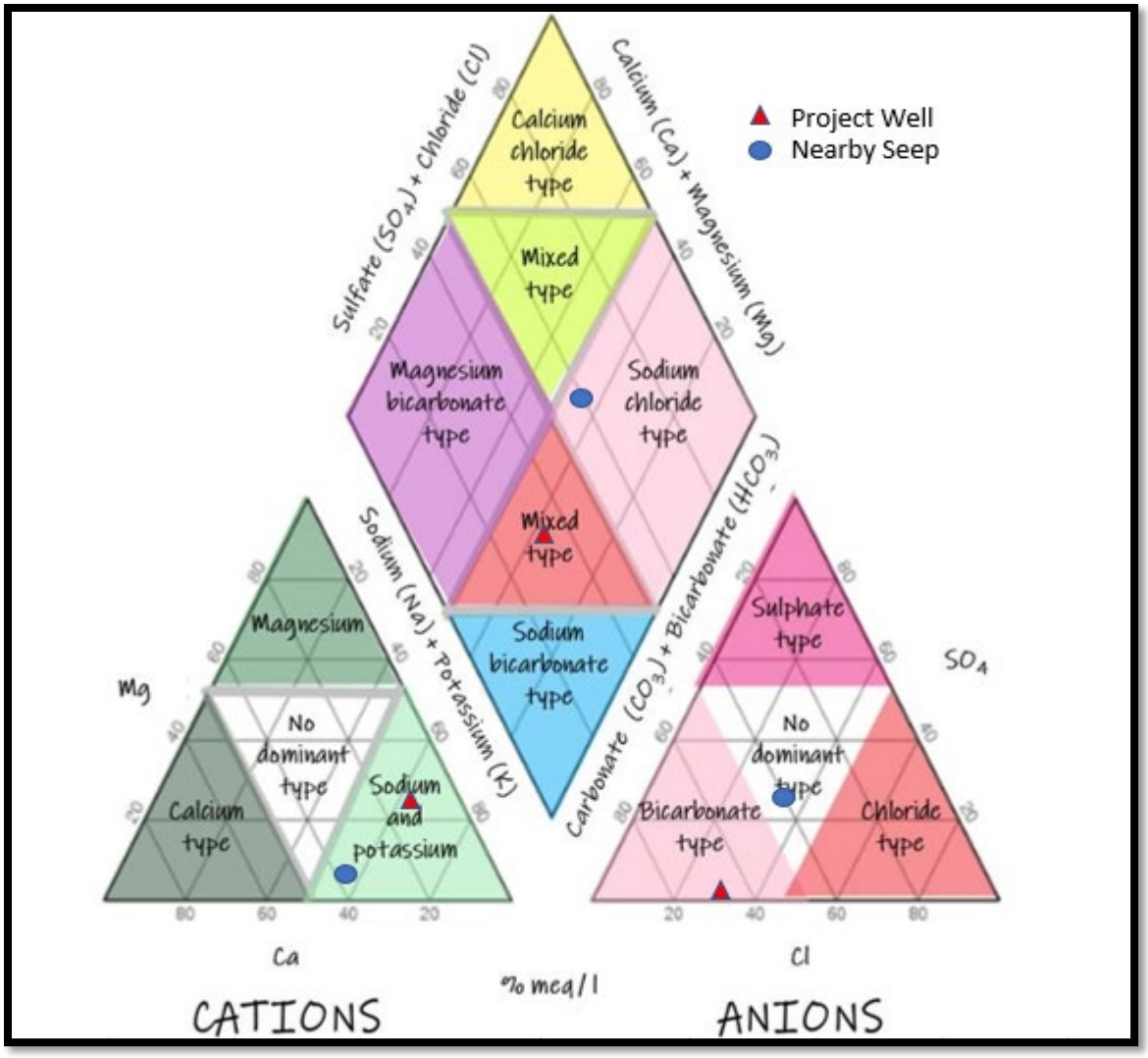


Figure 10. Piper Diagram of water quality analysis results.

QUALIFICATIONS OF AUTHORS

Dr. Dodd has a PhD in Water Resources Engineering. In addition, Dr. Dodd is registered Professional Engineer with the State of California with 30-years of experience practicing and teaching Water Resources Engineering, including over 15 years of teaching, practicing, and modeling surface and groundwater hydrology.

LIMITATIONS

The study of groundwater hydrology is very complex and often relies on limited data, especially in rural areas. Recommendations and conclusions provided herein are based on professional judgment made using information of the groundwater systems and geology in Humboldt County, which is limited and allows only for a general assessment of groundwater aquifer conditions and recharge. NorthPoint Consulting Group, Inc. is making analyses, recommendations, and conclusions based on readily available

data, including studies and reports conducted by other professionals, Humboldt County, the State of California, and other consultants hired by the project proponent to prepare technical studies for the proposed project. If additional information or data becomes available for the project area, the recommendations and conclusions presented herein may be subject to change. This report has been prepared solely for the client and any reliance on this report by third parties shall be at such party's sole risk.

ATTACHMENTS:

1. Mad River Groundwater Basin, Dows Prairie Subbasin, Bulletin 118 (DWR, 2004)
2. Well Completion Reports
3. Water Quality Test Results

REFERENCES

ECD Holdings, Inc. Cultivation and Operations Manual prepared by NorthPoint Consulting Group, Inc., March 2023.

ECD Holdings, Inc. Development Plans prepared by NorthPoint Consulting Group, Inc. dated March 2023.

California DWR (2003). California's Groundwater Bulletin 118 Update 2003. October 2003. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin-118/Files/Statewide-Reports/Bulletin_118_Update_2003.pdf

California DWR (2003). California's Groundwater Bulletin 18, Update 2003. October 2003.

California DWR (2004). California's Groundwater Bulleting 118. North Coast Hydrologic Region Dows Prairie Groundwater Basin, Last Update 2/27/2004.

California DWR (2021). California's Groundwater. https://water.ca.gov/programs/groundwater-management/bulletin-118

Carver, G. A. and Burke, R. M., (1992). Late Cenozoic Deformation on the Cascadia Subduction Zone in the Region of the Mendocino Triple Junction. Pacific Cell, Friends of the Pleistocene, Guidebook for the Field Trip to Northern Coastal California. p. 31-63.

Fetter, C.W. 2001. Applied Hydrogeology. Fourth Edition.

Gupta, R.S. (2008). Hydrology and Hydraulic Systems, 3rd Edition. Waveland Press, Long Grove IL.

McLaughlin, R.J., S.D. Ellen, M.C. Blake, Jr., A.S. Jayko, W.P. Irwin, K.R. Aalto, G.A. Carver, and S.H. Clarke, Jr. 2000. Geology of the Cape Mendocino, Eureka, Garberville, and Southwestern part of the Hayfork 30 x 60 Minute Quadrangles and Adjacent Offshore Area, Northern California. USGS Pamphlet to accompany Miscellaneous Field Studies MF-2336.

USGS. 2007. USGS Fact Sheet 2007-3007. https://pubs.usgs.gov/fs/2007/3007/

Attachment 1:
Dows Prairie Subbasin, Bulletin 118

Mad River Groundwater Basin, Dows Prairie Subbasin

- Groundwater Basin Number: 1-8.02
- County: Humbolt
- Surface Area: 14,000 acres (square miles)

Basin Boundaries and Hydrology

The Dows Prairie Subbasin is located on the coast north of the Mad River Lowland Subbasin and is bounded by Little River to the north and Mad River to the south. The subbasin is bounded to the east by the Franciscan Formation (Strand 1962). The region is an elevated terrace drained by Mill Creek, Strawberry Creek, and White Creek. Development of groundwater is primarily in the western portion of the subbasin. The Hookton Formation is the main geologic unit in the area. The Franciscan Formation underlies the Hookton Formation and is essentially nonwater-bearing.

Annual precipitation in the basin ranges from 39- to 53-inches, increasing to the northeast.

Hydrogeologic Information

The following information is taken from DWR (1965) unless noted otherwise.

Water-Bearing Formations

The Quaternary Hookton Formation is the water-bearing formation in the subbasin.

Pleistocene Hookton Formation. The Hookton Formation consists of clay, sand, and thin gravel beds. Near McKinleyville, the formation is at least 150 feet thick and may be over 200 feet thick in other areas. The formation has moderately low permeability and supplies unconfined groundwater to many domestic wells. Sanding is a problem in most wells. Little information is available regarding groundwater in the eastern portion of the subbasin.

Recharge Areas

Recharge occurs by rainfall infiltration.

Groundwater Level Trends

Seasonal fluctuations of groundwater levels in the subbasin range from 9 to 11-feet.

Groundwater Storage

Groundwater Storage Capacity.
The usable storage capacity for the western portion of the basin is estimated to be 10,500 acre-feet. This estimate is based on a saturated depth interval of 10 to 150-feet, a surface area of 6,500 acres, and a specific yield of 11 to 12-percent.

Groundwater Budget (Type B)

Estimates of groundwater extraction are based on a survey conducted by the California Department of Water Resources in 1996. The survey included land use and sources of water. Estimates of groundwater extraction for agricultural and municipal/industrial uses are 2,100 and 80 acre-feet respectively. Deep percolation from applied water is estimated to be 500 acre-feet.

Groundwater Quality

Characterization. The major water types in the basin is calcium-magnesium bicarbonate and magnesium-sodium bicarbonate waters. Total dissolved solids range from 55- to 145-mg/L (DWR unpublished data).

Water Quality in Public Supply Wells

Constituent Group[1]	Number of wells sampled[2]	Number of wells with a concentration above an MCL[3]
Inorganics – Primary	2	0
Radiological	2	0
Nitrates	3	0
Pesticides	1	0
VOCs and SVOCs	1	0
Inorganics – Secondary	2	2

[1] A description of each member in the constituent groups and a generalized discussion of the relevance of these groups are included in *California's Groundwater – Bulletin 118* by DWR (2003).
[2] Represents distinct number of wells sampled as required under DHS Title 22 program from 1994 through 2000.
[3] Each well reported with a concentration above an MCL was confirmed with a second detection above an MCL. This information is intended as an indicator of the types of activities that cause contamination in a given basin. It represents the water quality at the sample location. It does not indicate the water quality delivered to the consumer. More detailed drinking water quality information can be obtained from the local water purveyor and its annual Consumer Confidence Report.

Well Characteristics

	Well yields (gal/min)	
Irrigation	NKD	
	Total depths (ft)	
Domestic	Range: 19 - 455	Average: 78 (289 Well Completion Reports)
Municipal/Irrigation	Range: 36 - 300	Average: 104 (6 Well Completion Reports)

NKD – No known data.

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
DWR	Groundwater levels	
DWR	Miscellaneous water quality	3 wells biennially
Department of Health Services and cooperators	Miscellaneous water quality	

Basin Management

Groundwater management:	No known groundwater management plans, groundwater ordinances, or basin adjudications.
Water agencies	
Public	Fieldbrook CSD, McKinleyville CSD, Humboldt Bay MWD, Manila CSD
Private	

Selected References

California Department of Water Resources (DWR). 1965. Water Resources and Future Requirements. North Coastal Hydrographic Area. Volume 1: Southern Portion. Bulletin 142-1.

Clark, Samuel H. Jr. 1990. Map Showing Geologic Structures of the Northern California Continental Margin. United States Geological Survey.

Strand RG. 1977. Geologic Map of California [Redding Sheet]. Scale 1:250,000. California Division of Mines and Geology.

Bibliography

Bailey EH. 1966. Geology of Northern California. California Division of Mines and Geology. Bulletin 190.

California Department of Water Resources. 1958. Ground Water Conditions in Central and Northern California 1957-58. California Department of Water Resources. Bulletin 77-58.

California Department of Water Resources. 1958. Preliminary Investigation of Mad River. California Department of Water Resources. Office Report.

California Department of Water Resources. 1960. Northeastern Counties Investigation. California Department of Water Resources. Bulletin 58.

California Department of Water Resources. 1964. Quality of Ground Water in California 1961-62, Part 1: Northern and Central California. California Department of Water Resources. Bulletin 66-62.

California Department of Water Resources. 1973. Sea Water Intrusion and Ground Water Monitoring Programs in the Eureka Area. California Department of Water Resources, Northern District.

California Department of Water Resources. 1975. California's Ground Water. California Department of Water Resources. Bulletin 118.

California Department of Water Resources. 1980. Ground Water Basins in California. California Department of Water Resources. Bulletin 118-80.

California Department of Water Resources. 1981. 1981 Monitoring Program Priority 1 Groundwater Basins, Report to State Water Resources Control Board, Division of Planning. California Department of Water Resources.

California Department of Water Resources. 1982. Mad River Watershed Erosion Investigation. California Department of Water Resources, Northern District.

California Department of Water Resources. 1998. California Water Plan Update. California Department of Water Resources. Bulletin 160-98, Volumes 1 and 2.

California State-Federal Interagency Group. 1961. Eel and Mad River Basin Master Plan: Hydrology. Sacramento: California State-Federal Interagency Group.

California State-Federal Interagency Group. 1968. Eel and Mad River Basins Master Plan: Plan of Study. Sacramento: California State-Federal Interagency Group.

California State-Federal Interagency Group, United States Army Corps of Engineers. 1969. Eel and Mad River Basins Master Plan: Hydrology. Sacramento: California State-Federal Interagency Group and United States Army Corps of Engineers.

Dickinson WR, Ingersoll RV, Grahm SA. 1979. Paleogene Sediment Dispersal and Paleotectonics in Northern California. Geological Society of America Bulletin 90:1458-1528.

Dupre WR, Morrison RB, Clifton HE, Lajoie KR, Ponti DJ. 1991. Quaternary Geology of the Pacific Margin. USGS.

Evenson, R.E. 1959. Geology and Groundwater Features of Eureka Area, Humboldt County, California. USGS Water Supply Paper 1470.

Fuller, R.H. 1975. Water Quality in the Mad River Basin, Humboldt and Trinity Counties, California. USGS Water Resources Investigations 44-75.

Fraticelli LA, Albers JP, Irwin WP, Blake MC. 1987. Geologic Map of the Redding 1 x 2 Degree Quadrangle, Shasta, Tehama, Humboldt, and Trintity Counties, California. USGS. OF-87-257.

Johnson MJ. 1978. Ground-Water Conditions in the Eureka Area, Humboldt County, California, 1975. USGS. WRI 78-127.

Planert M, Williams JS. 1995. Ground Water Atlas of the United States, Segment 1, California, Nevada. USGS. HA-730-B.

Rantz SE. 1964. Surface-water Hydrology of Coastal Basins of Northern California. USGS. 1758.

Todd DK. 1992. Groundwater Reconnaissance of the Humboldt Bay Area (For Humboldt Bay Municipal Water District, Eureka, CA.). Consulting Engineers, Inc.

United States Army Corps of Engineers. 1968. Interim Report for Water Resources Development on Mad River, California. United States Army Corps of Engineers.

United States Bureau of Reclamation. 1960. Natural Resources of Northwestern California. Report Appendix-Plans of Water Development. United States Bureau of Reclamation.

Errata

Changes made to the basin description will be noted here.

Attachment 2:
Well Completion Reports

State of California

Well Completion Report

Form DWR 188 Submitted 3/31/2021

WCR2021-004045

Project's Well Report

Owner's Well Number W2215 Date Work Began 03/09/2021 Date Work Ended 03/16/2021

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

Secondary Permit Agency Permit Number 20/21-0650 Permit Date 01/15/2021

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

Name

Mailing Address

City State Zip

Planned Use and Activity

Activity New Well

Planned Use Water Supply Irrigation - Agriculture

Well Location

Address

City McKinleyville Zip 95519 County Humboldt

Latitude 40 Deg. 58 Min. 4.9079 Sec. N Longitude -124 Deg. 5 Min. 5.82 Sec. W

Dec. Lat. 40.96803 Dec. Long. -124.08495

Vertical Datum Horizontal Datum WGS84

Location Accuracy Location Determination Method

APN 511-141-015

Township

Range

Section

Baseline Meridian

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 16 (Feet below surface)

Depth to Static Water Level 260 (Feet) Date Measured 03/16/2021

Estimated Yield* 15 (GPM) Test Type Air Lift

Test Length 4 (Hours) Total Drawdown 140 (feet)

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

Geologic Log - Free Form

Depth from Surface Feet to Feet		Description
0	1	top soil/grass
1	21	brown silty clay
21	28	brown sand & Tree
28	34	shale clay
34	71	brown silty clay
71	76	brown sand & Tree
76	96	brown silty clay
96	121	brown sand (clean)
121	223	brown silty clay
223	261	brown sand(clean)
261	294	brown silty clay
294	318	large brown birds eye sand
318	389	brown silty clay
389	393	shale clay

RECEIVED

APR 1 2021

HUMBOLDT CO. DIVISION OF ENVIRONMENTAL HEALTH

393	400	blue clay & Tree

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	100	Blank	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563			
1	100	400	Screen	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563	Milled Slots	0.032	

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	20	Bentonite	Other Bentonite		Sanitary Seal
20	400	Filter Pack	Other Gravel Pack		#3 Well Sand

Other Observations:

Borehole Specifications

Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	400	10

Certification Statement

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

Name: FISCH DRILLING
Person, Firm or Corporation

3150 JOHNSON ROAD | HYDESVILLE | CA | 95547
Address | City | State | Zip

Signed: *electronic signature received* | 03/31/2021 | 683865
C-57 Licensed Water Well Contractor | Date Signed | C-57 License Number

Attachments

Location Map.pdf - 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:

State of California

Well Completion Report

Form DWR 188 Auto-Completed 7/26/2021

WCR2021-006171

2291 Elizabeth Road
McKinleyville, CA 95521

Owner's Well Number | Date Work Began: 05/10/2021 | Date Work Ended: 05/11/2021

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

Secondary Permit Agency | Permit Number: 20/21-0961 | Permit Date: 04/07/2021

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

Name: XXXXXXXXXXXXXXXXXXX

Mailing Address: XXXXXXXXXXXXXXXXXXX

XXXXXXXXXXXXXXXXXXX

City: XXXXXXXXXXXXXXXXXXX | State: XX | Zip: XXXXX

Planned Use and Activity

Activity: New Well

Planned Use: Water Supply Domestic

Well Location

Address: 2291 Elizabeth

City: McKinleyville | Zip: 95519 | County: Humboldt

Latitude: 40 Deg. 58 Min. 20.1691 Sec. N | Longitude: -124 Deg. 5 Min. 4.4483 Sec. W

Dec. Lat.: 40.9722692 | Dec. Long.: -124.084569

Vertical Datum | Horizontal Datum: WGS84

Location Accuracy | Location Determination Method

APN: 511-491-005

Township: 07 N

Range: 01 E

Section: 20

Baseline Meridian: Humboldt

Ground Surface Elevation

Elevation Accuracy

Elevation Determination Method

Borehole Information

Orientation: Vertical | Specify

Drilling Method: Direct Rotary | Drilling Fluid: Bentonite

Total Depth of Boring: 280 Feet

Total Depth of Completed Well: 280 Feet

Water Level and Yield of Completed Well

Depth to first water: 100 (Feet below surface)

Depth to Static Water Level: 50 (Feet) | Date Measured: 05/12/2021

Estimated Yield*: 10 (GPM) | Test Type: Pump

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	3	Brown Top Soil
3	15	Yellow Clay
15	55	yellow Sand W/ Wood
55	65	Wood W/ Yellow Sandy Clay
65	100	Yellow Sandy Clay
100	110	Birds Eye Gravel
110	130	Yellow Clay
130	165	Blue Clay
165	190	Yellow Sandy Clay
190	225	Blue Clay
225	246	Yellow Sandy Clay
246	255	Birds Eye w/ Sand
255	280	Sandy Yellow Clay

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	250	Blank	PVC	OD: 5.563 in. | SDR: 17 | Thickness: 0.327 in.	0.327	5.563			
1	250	260	Screen	PVC	OD: 5.563 in. | SDR: 17 | Thickness: 0.327 in.	0.327	5.563	Bridge Slot	0.032	
1	260	280	Blank	PVC	OD: 5.563 in. | SDR: 17 | Thickness: 0.327 in.	0.327	5.563			

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	20	Bentonite	Other Bentonite	3/8	3/8 Hole Plug
20	280	Filter Pack	Other Gravel Pack		Pea Gravel

Other Observations:

Borehole Specifications

Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	280	10

Certification Statement

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

Name: RICH WELL DRILLING & PUMP SERVICE INC (Person, Firm or Corporation)

1251 RAILROAD DRIVE (Address) | MC (City) | CA (State) | 95519 (Zip)

Signed: *electronic signature received* (C-57 Licensed Water Well Contractor) | 05/21/2021 (Date Signed) | 902702 (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:

ORIGINAL
File with DWR

FEB 18 2004

Page 1 of 1

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 798236

DWR USE ONLY — DO NOT FILL IN
07N/01E-29K
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. WW-1

Date Work Began 10-15-03, Ended 10-22-03

Local Permit Agency Humboldt County Environmental Health

Permit No. 03/04-0116 Permit Date 8-11-03

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD air rotary FLUID none

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	17	Silty clayey sand
17	185	Silty sands
185	190	Silty clay
190	205	Coarse sand
205	238	Sand w/some gravels
238	252	Sand and gravels
252	263	Weathered shale
263	387	Shale w/clay seams
		Boring was abandoned with bentonite chips and Smooth Grout 30 (a grout mix of 30% solids bentonite) from total depth to surface.

TOTAL DEPTH OF BORING 387 (Feet)

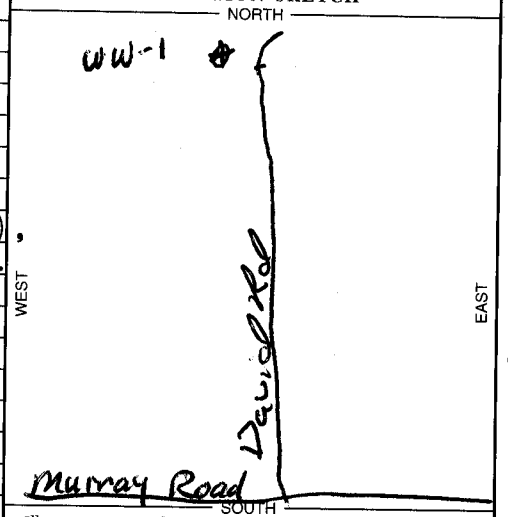
TOTAL DEPTH OF COMPLETED WELL 0 (Feet)

2324 David Road
McKineleyville, CA 95521

WELL LOCATION

Address 2324 David Road
City McKinleyville
County Humboldt
APN Book 511 Page 171 Parcel 061
Township 07N Range 01E Section 29
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH
Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
X DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USES (✓)

WATER SUPPLY
X Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER dry (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

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

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	22	10	X				Steel	6	.188	
22	240	7½	X				Steel	6	.188	
240	260	7½		X			Steel	6	.188	1/8
260	263	7½	X				Steel	6	.188	
263	387	6¼					Open hole			

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
387	0		X		

APR 23 2004

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

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

NAME Diamond Core Drilling, Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS P.O. Box 491925 CITY Redding STATE CA ZIP 96049

Signed [signature] WELL DRILLER/AUTHORIZED REPRESENTATIVE

DATE SIGNED 2-06-04

C-57 LICENSE NUMBER 512406

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

07N01E-29H McKinleyville ?

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do Not Fill In
No 73932
CONFIDENTIAL LOG
State Well No. Water Code Sec. 13752
Other Well No.

Well APN is Project Parcel APN, but well no longer exists per property owner

(1) WELL LOG:
Total depth 700 ft. Depth of completed well 200 ft.
Formation: Describe by color, character, size of material, and structure

ft. to	ft.	
Clay	0	45
Yellow Sand	45	95
wood		
Clay	95	100
Sand & Gravel	100	145
Sand	145	180
180 - 200 water sand & Gravel		

(2) LOCATION OF WELL:
County Humboldt Owner's number, if any
Township, Range and Section
Distance from cities, roads, railroads, etc.
APN 511-141-15

(3) TYPE OF WORK (check):
New Well [X] Deepening [ ] Reconditioning [ ] Destroying [ ]
If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic [X] Industrial [ ] Municipal [ ]
Irrigation [ ] Test Well [ ] Other [ ]

(5) EQUIPMENT:
Rotary [ ]
Cable [X]
Other [ ]

(6) CASING INSTALLED:
STEEL: OTHER:
SINGLE [X] DOUBLE [ ]

From ft.	To ft.	Diam.	Gage or Wall
0	200	8	12

If gravel packed

Diameter of Bore	From ft.	To ft.

Size of shoe or well ring:
Size of gravel:
Describe joint: welded

(7) PERFORATIONS OR SCREEN:
Type of perforation or mesh of screen: mills

From ft.	To ft.	Perf. per row	Rows per ft.	Size in x in.
190	195	6	1	5/16

(8) CONSTRUCTION:
Was a surface sanitary seal provided? Yes [X] No [ ] To what depth? 45 ft.
Were any strata sealed against pollution? Yes [ ] No [ ] If yes, note depth of strata
From ft. to ft.
From ft. to ft.
Method of sealing puddle Clay

(9) WATER LEVELS:
Depth at which water was first found, if known 182 ft.
Standing level before perforating, if known ft.
Standing level after perforating and developing 180 ft.

(10) WELL TESTS:
Was pump test made? Yes [X] No [ ] If yes, by whom? Rich
Yield: 1½ gal./min. with total ft. drawdown after 4 hrs.
Temperature of water Was a chemical analysis made? Yes [ ] No [ ]
Was electric log made of well? Yes [ ] No [ ] If yes, attach copy

CONFIDENTIAL LOG
Water Code Sec. 13752

Work started Nov. 19 74 Completed Nov. 19 74

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME Rich Drilling Pump (Typed or printed)
Address 125 Railroad ave mckinleyville Calif
[SIGNED] (Well Driller)
License No. 246499 Dated Nov. 19 74

SKETCH LOCATION OF WELL ON REVERSE SIDE

Attachment 3:
Water Quality Test Results

A & L Western Laboratories, Inc.
1311 Woodland Avenue, Modesto CA 95351 209-529-4080
10220 SW Nimbus Avenue Bldg. K-9, Portland OR 97223 503-968-9225

Ag Suitability Water Analysis

WYETH WUNDERLICH
NORTHPOINT CONSULTING GROUP INC
1117 SAMOA BLVD
ARCATA, CA 95521

P.O. #: CHECK #3319

Order Number: 38575
Lab Number: W38575-01
Submitted Date: 10/26/2022
Report Date: 11/2/2022
Submitted By: WYETH WUNDERLICH

Grower: NORTHERN EMERALDS WELL & SURFACE

Description: NE SPRING

mg/L = milligrams/liter = part per million = ppm
meq/L = milliequivalents/liter
dS/m = deciSiemen/meter = mmhos/cm
lbs/ac-ft = pounds/acre-foot

Analytes				Normal Values	Problem Values
pH (pH)		6.2	pH units	6.5 to 8.0	<6.5 or >8.0
Electrical Conductivity (EC)		0.05	dS/m	0.5 to 3.0	<0.5 or >3.0
Boron (B)		<0.01	mg/L	<0.5	>0.5
Iron (Fe)		<0.01	mg/L		
Copper (Cu)		<0.01	mg/L		
Manganese (Mn)		<0.01	mg/L		
Cations	**mg/L**	**meq/L**	**lbs/ac-ft**	**Normal Values mg/L**	**Problem Values mg/L**
Calcium (Ca)	3.5	0.18	9.5	30 to 400	<30
Magnesium (Mg)	0.7	0.06	1.9	1 to 60	[Mg]>[Ca]
Sodium (Na)	4.7	0.21	12.7	<70	>70
Potassium (K)	0.5	0.01	1.3		
Anions	**mg/L**	**meq/L**	**lbs/ac-ft**	**Normal Values mg/L**	**Problem Values mg/L**
Bicarbonate (HCO_3)	5.3	0.09	14.2	<150	>300
Chloride (Cl)	4.6	0.13	12.5	<150	>200
Nitrate - Nitrogen (NO_3-N)	1.6	0.11	4.3	<10	>10
Sulfate - Sulfur (SO_4-S)	3.3	0.10	9.0		
Calculated Values				**Normal Values**	**Problem Values**
Total Dissolved Solids (TDS)		35	mg/L	1 to 1,500	>1,900
Sodium Absorption Ratio (SAR)		0.6		<6.0	>6.0
SAR/EC Ratio (SEC)		11.9		<5.0	>10.0
pHc (pHc)		10.3		<8.4 may add Ca	>8.4 may remove Ca

Gypsum Requirements	100% gypsum equivalent (lbs/ac-ft)
Eatons Gypsum Requirement (EGR)	50
Residual Sodium Carbonate (RSC)	0

pH Titration Results	Volume of Concentrated Sulfuric Acid (fl-oz/100gal)
Target pH (7.0)	
Target pH (6.5)	
Target pH (6.0)	0.02

Sam Modesitt - Chemist

contact@vtaglab.com

RED = Value of Concern

A & L Western Laboratories, Inc.

1311 Woodland Avenue, Modesto CA 95351 209-529-4080
10220 SW Nimbus Avenue Bldg. K-9, Portland OR 97223 503-968-9225

Ag Suitability Water Analysis

WYETH WUNDERLICH
NORTHPOINT CONSULTING GROUP INC
1117 SAMOA BLVD
ARCATA, CA 95521

Order Number: 38575
Lab Number: W38575-02
Submitted Date: 10/26/2022
Report Date: 11/2/2022
Submitted By: WYETH WUNDERLICH

P.O. #: CHECK #3319

Grower: NORTHERN EMERALDS WELL & SURFACE

Description: NE WELL

mg/L = milligrams/liter = part per million = ppm
meq/L = milliequivalents/liter
dS/m = deciSiemen/meter = mmhos/cm
lbs/ac-ft = pounds/acre-foot

Analytes				Normal Values	Problem Values
pH (pH)		6.5	pH units	6.5 to 8.0	<6.5 or >8.0
Electrical Conductivity (EC)		0.13	dS/m	0.5 to 3.0	<0.5 or >3.0
Boron (B)		<0.01	mg/L	<0.5	>0.5
Iron (Fe)		<0.01	mg/L		
Copper (Cu)		<0.01	mg/L		
Manganese (Mn)		<0.01	mg/L		
Cations	**mg/L**	**meq/L**	**lbs/ac-ft**	**Normal Values mg/L**	**Problem Values mg/L**
Calcium (Ca)	5.2	0.26	14.1	30 to 400	<30
Magnesium (Mg)	3.2	0.27	8.6	1 to 60	[Mg]>[Ca]
Sodium (Na)	13.3	0.58	36.0	<70	>70
Potassium (K)	0.5	0.01	1.2		
Anions	**mg/L**	**meq/L**	**lbs/ac-ft**	**Normal Values mg/L**	**Problem Values mg/L**
Bicarbonate (HCO_3)	33.1	0.54	89.3	<150	>300
Chloride (Cl)	15.0	0.42	40.4	<150	>200
Nitrate - Nitrogen (NO_3-N)	1.1	0.08	2.9	<10	>10
Sulfate - Sulfur (SO_4-S)	1.7	0.05	4.6		
Calculated Values				**Normal Values**	**Problem Values**
Total Dissolved Solids (TDS)		90	mg/L	1 to 1,500	>1,900
Sodium Absorption Ratio (SAR)		1.1		<6.0	>6.0
SAR/EC Ratio (SEC)		8.6		<5.0	>10.0
pHc (pHc)		9.0		<8.4 may add Ca	>8.4 may remove Ca

Gypsum Requirements	100% gypsum equivalent (lbs/ac-ft)
Eatons Gypsum Requirement (EGR)	94
Residual Sodium Carbonate (RSC)	3

pH Titration Results	Volume of Concentrated Sulfuric Acid (fl-oz/100gal)
Target pH (7.0)	
Target pH (6.5)	
Target pH (6.0)	0.16

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RED = Value of Concern