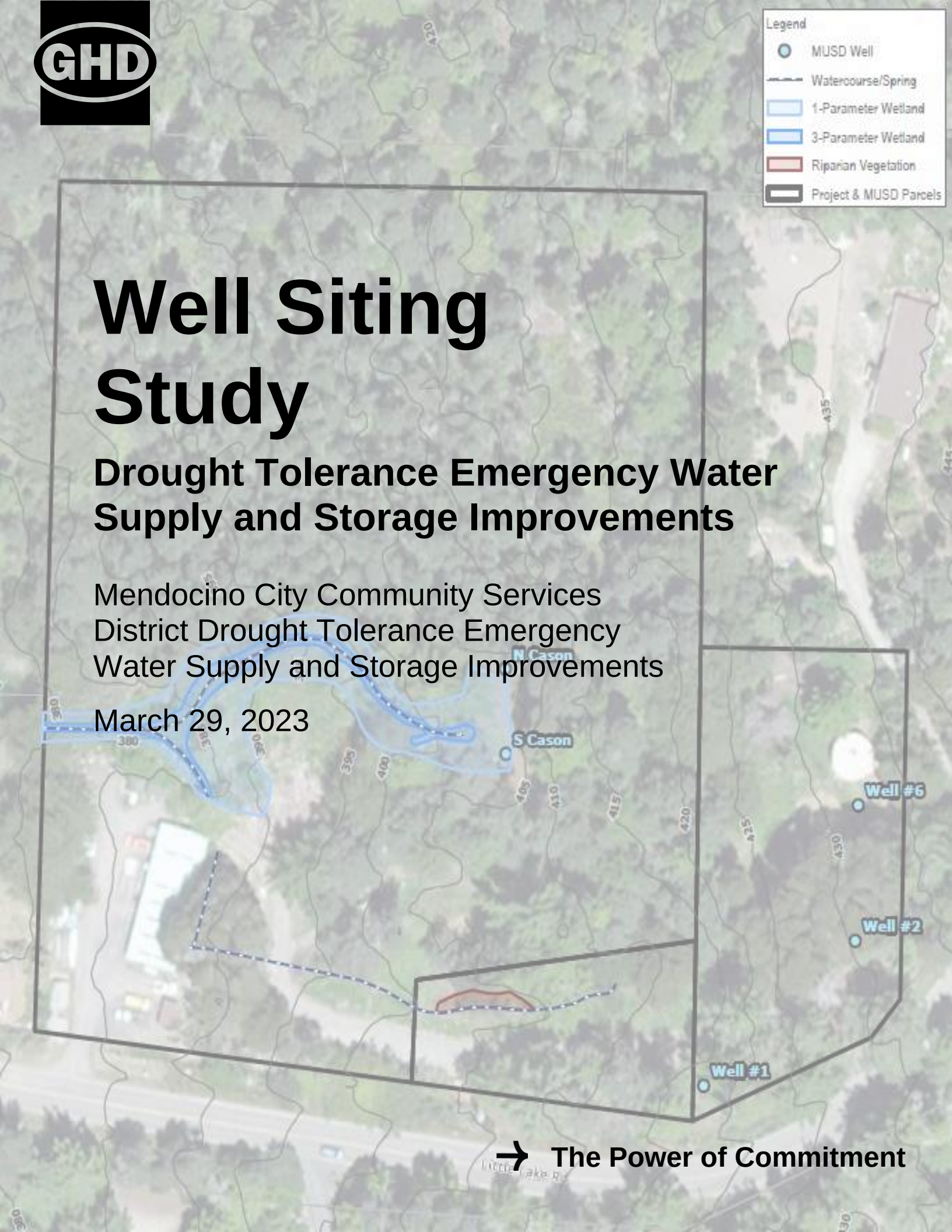
Well Siting Study

Drought Tolerance Emergency Water Supply and Storage Improvements

Mendocino City Community Services District Drought Tolerance Emergency Water Supply and Storage Improvements

March 29, 2023



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NOTE: This study was developed utilizing common engineering and hydrogeologic resources and with information provided by the Mendocino City Community Services District, the Mendocino Unified School District and from previous studies. Engineering judgment was applied where appropriate. Future conditions may vary from those predicted in this study. All recommendations should be validated and adjusted as appropriate during the design and construction process. Due to periodic changes to regulations, procedures, design guides, and policies, the potential solutions and recommendations contained herein may be subject to revision.

1. Introduction

1.1 Purpose of this report

GHD Inc. (GHD) was engaged by the Mendocino City Community Services District (MCCSD) to prepare this well siting study, which follows up on the conclusions and recommendations of a hydrogeological investigation of groundwater availability prepared by GHD in January 2023 (GHD, 2023) and previous studies published by GHD in 2019 and others for the Mendocino Unified School District (MUSD) wellfield and the immediate vicinity. Additionally, this study reviews and summarizes a previous MUSD Well Siting Study (GHD, 2019) and brings it into the context of this project's goals and objectives. The purpose of the information provided herein is to ultimately support the environmental review, siting, and final design of a new well field consisting of up to ten water supply wells within the MUSD property accessed from Little Lake Road. This scope of work supports the Drought Tolerance Emergency Water Supply and Storage Improvements project that is jointly supported by the MCCSD and MUSD and funded by the California Department of Water Resources Urban and Multibenefit Drought Relief Grant program and California Water Resources Control Board Proposition 1 Drinking Water State Revolving Fund Planning and Construction Grants.

The project Site is located on a MUSD owned parcels located north of the K-8 School campus. The wells are located on one parcel (APN 119-100-03) that is accessed from Little Lake Road and located west of the school's existing supply wells and storage tanks, shown in Appendix A, Figure A. The Site consists of only the single parcel and does not include the adjacent parcel to the east where the construction of replacement water tanks and a treatment and control building is planned. The proposed locations of the well field are shown in Appendix A, Figure A.

The project proposes to develop additional water supply and provide additional water storage to assist the Village of Mendocino in meeting daily water demands during drought conditions and minimize the need to import water from outside the area. Water would be stored in and accessed from the MUSD water system, which serves the K-8 School, Mendocino High School, Friendship Park and the Mendocino Community Center. The purpose of this study is to review potential locations for a secure, reliable, high-quality potable water supply to add to the MUSD system as a new emergency and back-up water source during drought conditions and for long-term water source resiliency for the Village of Mendocino. This study includes a review of:

- **Current Groundwater Conceptual Model.** – Local aquifers.
- **Site Conditions**. A summary evaluation was developed based largely on existing/previous studies and regional information.
- **Existing Well Construction**. Summarizing the existing potable water sources (MUSD Wells #1, #2, & #6) construction, repairs, and water quality data was reviewed to understand deficiencies of the system and how new supply wells could be feasibly sited, constructed, and integrated into the system.
- **Historical Water Usage**. Timeline records were reviewed and summarized to determine the need for a new well.
- **Site Screening Criteria**. Opportunities for Site locations were evaluated.
- **General Findings** and **Conclusions and Recommendations** were developed based on this and previous studies of the Site and area.

1.2 Scope and limitations

This report has been prepared by GHD for the Mendocino City Community Services District Drought Tolerance Emergency Water Supply and Storage Improvements and the Mendocino Unified School District and may only be used and relied on by Mendocino City Community Services District Drought Tolerance Emergency Water Supply and Storage Improvements and the Mendocino Unified School District for the purpose agreed between GHD and Mendocino City Community Services District Drought Tolerance

Emergency Water Supply and Storage Improvements and the Mendocino Unified School District as set out in Section 1 of this report.

GHD otherwise disclaims responsibility to any person other than Mendocino City Community Services District Drought Tolerance Emergency Water Supply and Storage Improvements and the Mendocino Unified School District arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

1.3 Assumptions

This report summarizes information from the MCCSD, the MUSD, and previous studies by GHD and other information about a new well field proposed to be located on MUSD property which will be subject to review by the MCCSD, the MUSD, the County, State, and others.

Changes to the report will be made in part based on comments and feedback from reviews.

Recommendations for the new well field are preliminary and final locations may be updated based on additional data collected during test well installation anticipated in 2023, and feedback received from MCCSD, MUSD and other stakeholders.

2. Desktop Review

2.1 Previous results/conclusions of GHD 2019 MUSD Well Siting

GHD previously conducted a series of studies for MUSD for future additional production capacity and source water supply resiliency. These included a source water well inspection and specific capacity testing study (GHD, 2019b), a well siting study (GHD, 2019c), a test well drinking water source assessment and protection and water quality study (GHD, 2020), and constructed of a new test well (MUSD Well #6) with pump and specific capacity testing (GHD, 2021). The MUSD currently operates two active wells (Well #1 and Well #2) at the Site that will remain operational during the construction and implementation of the proposed well field.

In addition to previous GHD studies, numerous hydrological studies were performed in the 1980s through at least the early 2000s by Don Clark Engineering and Hydrology, and other regional firms. Hard copies were reviewed by GHD as provided by several domestic well owners downgradient to the MUSD.

2.1.1 Summary of MUSD 2019 Well Siting Study

GHD previously prepared a Well Siting Study (2019) supporting the construction of MUSD Well #6. The study included two areas that are located within the project boundaries of this project Site A and Site B with Well #6 being located inside Site B, as shown in Figure 1 below.

Figure 1 GHD 2019 Well Siting Study - Figure 3

A summary of Site A and B screening results for Well #6 are provided below:

Site A

- The anticipated shallow marine terrace materials here would be comparable to, and slightly thinner than, that of the Well #1 and Well #2 locations, resulting in an above average water yield for the area (based on available well completion reports in the vicinity);
- Water quality (relatively good) is anticipated to be comparable to that of Well #1 and #2, however, it is unclear how close the residential septic system to the west would be to the final well Site here and how much temporary noise mitigation would need to be considered;
- There is ample room to move around to the exact location of the test well (Well #6) away from any potential wetlands, springs, or other CEQA considerations;
- The property is owned by MUSD and access to a location here would be good; and,
- The Site is generally clear of overhead power lines and is relatively close to the existing and future water supply lines, the water treatment and control building, and storage tanks. Overall, this is a good potential Site for consideration of a test well. Although there are no major issues, temporary noise mitigation measures for adjacent residences and wetland setbacks may be necessary.

Site B

- The anticipated shallow marine terrace materials here would be comparable/equivalent to that of Well #1 and Well #2, resulting in an above average water yield for the area (based on available well completion reports, Appendix B); water quality (relatively good) is anticipated to be comparable to that of Well #1 and Well #2;
- There is decent room to move around the exact location of the test well (Well #6) away from any potential wetlands, springs, or other CEQA considerations;
- The property is owned by MUSD and access to a location here would be good; and,
- The Site may need some tree limb work prior to well construction, but is generally clear of overhead power lines and is very close to the existing and future water supply lines, the water treatment and control building, and storage tanks.

2.2 Background Summary

2.2.1 Site Conditions

The Site is located approximately 1 mile east of the Pacific Ocean on the Mendocino Headlands, on the outskirts of the Village of Mendocino. The Mendocino Headlands consist of a series of relatively flat terraces that form benches into the surrounding bedrock. The headlands protrude approximately 1/5 mile into the Pacific Ocean and terminate with nearly vertical cliff faces that generally extend between 40 and 60 feet above sea level.

The Site is situated on the north side of Little Lake Road, approximately 0.7 miles east of the intersection of Little Lake Road and State Route 1 at an elevation ranging from 385- to 425- feet NAD88. The Site slopes to the west at a consistent 10 percent grade and is heavily forested throughout with exception to the southwest corner where there is an existing MUSD maintenance building and driveway that leads east to the existing MUSD wells and water tanks.

The Site is located on Pleistocene aged marine terrace deposits that are underlain by Franciscan Complex Coastal Belt (Franciscan bedrock). A relatively shallow organic soil horizon overlays the terrace deposits that range from 1- to 4-feet in depth. Marine terraces represent former beach and near shore environments and consist of silty sand that form essentially flat stratigraphic surfaces that cover the underlying Franciscan bedrock (DWR, 1985). There are four primary marine terraces that have been documented by Todd and others that constitute the Mendocino Headlands marine terrace aquifers aquifer:

- **Casper Point**: Occurs between elevation of 40- to 80-feet elevation and is the youngest marine terrace (approximately 100,000 years old). The terrace is composed of medium-grained loose sand with few fines and is generally about 10 feet thick.
- **Jughandle Terrace**: Occurs between 80- to 160-feet elevation and is the second youngest marine terrace (about 200,000 years old). The terrace is composed of fine-grained silty sand and is generally about 20 feet thick with a maximum thickness of 35 feet.
- **Railroad Terrace**: Occurs between 160- to 200-feet elevation and is the third youngest terrace (about 300,000 years old). The terrace is composed of fine-grained sand with a higher percentage of silt and clay than the younger terraces.
- **Fern Creek Terrace**: Occurs between 300- to 400-feet elevation and is the oldest documented marine terrace (about 400,000 years old). The terrace is composed of fine-grained silt and clayey sand and is generally up to 15 feet thick.

Franciscan bedrock consists of interbedded greywacke sandstone and shale that is pervasively fractured. The bedrock holds very little potential for water storage however the fractures allow for groundwater storage and transmissivity and generally understood to decrease with depth and distance from the coastline (DWR, 1985).

The Site is located beyond the traditionally mapped extent of the Fern Creek Terrace, located approximately ¼ mile southwest. Nearby well completion reports indicate that the alluvial thickness on the western half of the Site is similar to that of the Fern Creek Terrance (around 15 feet) however there is a grade break that increases the elevation by approximately 30 feet which directly translates to increase of the marine terrace thickness to approximately 50 feet. This increase may be an extension of the Fern Creek Terrace or part of an unknown older and unmapped marine terrace.

The primary method of recharge for the aquifer is precipitation infiltration with excess surface runoff flowing into creeks and ultimately the Pacific Ocean to the west. Areas that have exposed bedrock tend to have poor infiltration rates resulting in the alluvial and marine terraces being primary recharge and storage areas. Due to the topographic setting of the Mendocino Headlands, a major portion of the annual groundwater outflow is through shallow springs along the surrounding cliffs resulting in the shallow aquifer(s) having reduced long-term storage capacity and influenced by the annual weather patterns much more than typical California inland valley alluvial aquifers.

Topography and groundwater flow indicate that surface and groundwater flow is northwest towards Slaughterhouse Gulch and is hydraulically disconnected from the Big River Watershed located south of the Village of Mendocino.

2.2.2 Current Groundwater Conceptual Model – Local Aquifers

Briefly developed here from this study and review of previous studies, is a general hydrogeological conceptual model (HCM) for groundwater underlying the Project Site and the immediate vicinity aquifers downslope. This is intended to aid in the siting and design of the proposed well field and for future surface and groundwater monitoring protocols. This should be considered preliminary and should be updated as future groundwater monitoring data is collected. Directly below the study area (MUSD) and to the west are three principal aquifer types – marine terrace aquifers, alluvial aquifers, and Franciscan bedrock aquifers.

Marine Terraces - An older marine terrace of up to 50-feet thick occupies the MUSD parcel and transmits relatively shallow groundwater within an unconfined aquifer with water levels ranging in depth of approximately 15 to 30-feet (seasonally and precipitation dependent) that flows to the west. Three existing MUSD wells are constructed up to 50-feet deep and have the highest relative specific capacities and long-term yields in the nearby area, ranging from approximately 6 to 9-gpm. These wells also have the most potential to hydraulically interfere with each other if pumped simultaneously.

The old marine terrace thins to the west and a few springs and wetlands emerge downslope where the marine terrace has been naturally eroded from surface water incision and bedrock is correspondingly encountered at shallower depths. Bedrock seasonally forces groundwater to the surface of the marine terrace, as evident in the springs located west of the MUSD water tanks and east of the MUSD maintenance building. These springs represent a portion of the Slaughterhouse Gulch headwaters and its first seasonal surface flows in the immediate area. Another distinct spring fed branch to Slaughterhouse Gulch begins offsite approximately 1,000-feet to the northwest on the northeast portion of Gurley Lane. The two spring systems flow westerly downslope and converge near Calypso Lane to form the defined Slaughterhouse Gulch stream, with year-round surface flows even during periods of drought.

Alluvial (creek) Deposits – Creek deposits are generally less than 20-feet in thickness and have formed from overland flow incising and eroding the various marine terraces. This is shown in neighboring large diameter (3-feet) concrete caisson wells, downgradient of the Site installed adjacent to Slaughterhouse Gulch, which are generally less that 20-feet deep and used for both irrigation and domestic supply purposes. The relatively thin and shallow alluvial aquifers have developed from the deposition, erosion, and redepositing cycle of those sediments along the creek banks and gulches as the surface water has migrated westerly to the Pacific Ocean over time. Creek alluvial groundwater flow is generally directly connected with the surface water in Slaughterhouse Gulch and thus this groundwater type is most vulnerable to seasonal variations in precipitation and droughts. The alluvial groundwater is a very shallow; near the ground surface unconfined aquifer that ranges from approximately 5 to 15-feet in thickness.

Bedrock - The Site and lower elevation marine terraces and alluvial terraces are underlain by Franciscan hard rocks of graywacke to slatey materials of relatively low to very low permeability and transmissivity and contain variable groundwater aquifers that move via fracture flow. The Franciscan rocks have variable long-term yields in wells, ranging 0.1 to 3-gpm in near vicinity wells (up to 10 gpm in the wider Mendocino Headlands area), have variable to unknown total depths of groundwater, have a relatively low storage potential, and are recharged much more slowly by the overlying marine and alluvial terraces over longer periods of time. Bedrock completed wells generally range from 100 to 300-feet or more in depth, and likely exhibit mostly confined to semi-confined conditions.

2.2.3 Existing Well Conditions

Previous manual depth-to-water measurements were taken from top of casing (TOC) of surrounding public and private wells (GHD, 2023). The TOC varied for each well but in general were less than 2 feet above the ground surface. Figure 2 shows the depth-to-water measurements relative to the total depth of each well.

Water levels around the project area range from 4 feet to 40 feet below ground surface with wells in the shallow terrace deposits having water levels around 5 to 10 feet below TOC and bedrock wells having water levels around 15 to 20 feet below TOC. The exceptions to this are the three MUSD wells (Well #1, Well #2, and Well #6) which have water levels between 20 and 40 feet below their respective TOC. This could be due to their much more active use compared to the other wells and within a higher elevation marine terrace that is not directly hydraulically connected to

the lower elevation wells within different formational types (alluvium and bedrock). Transducer recordings from September 29th to November 24th are shown in Figure 3.

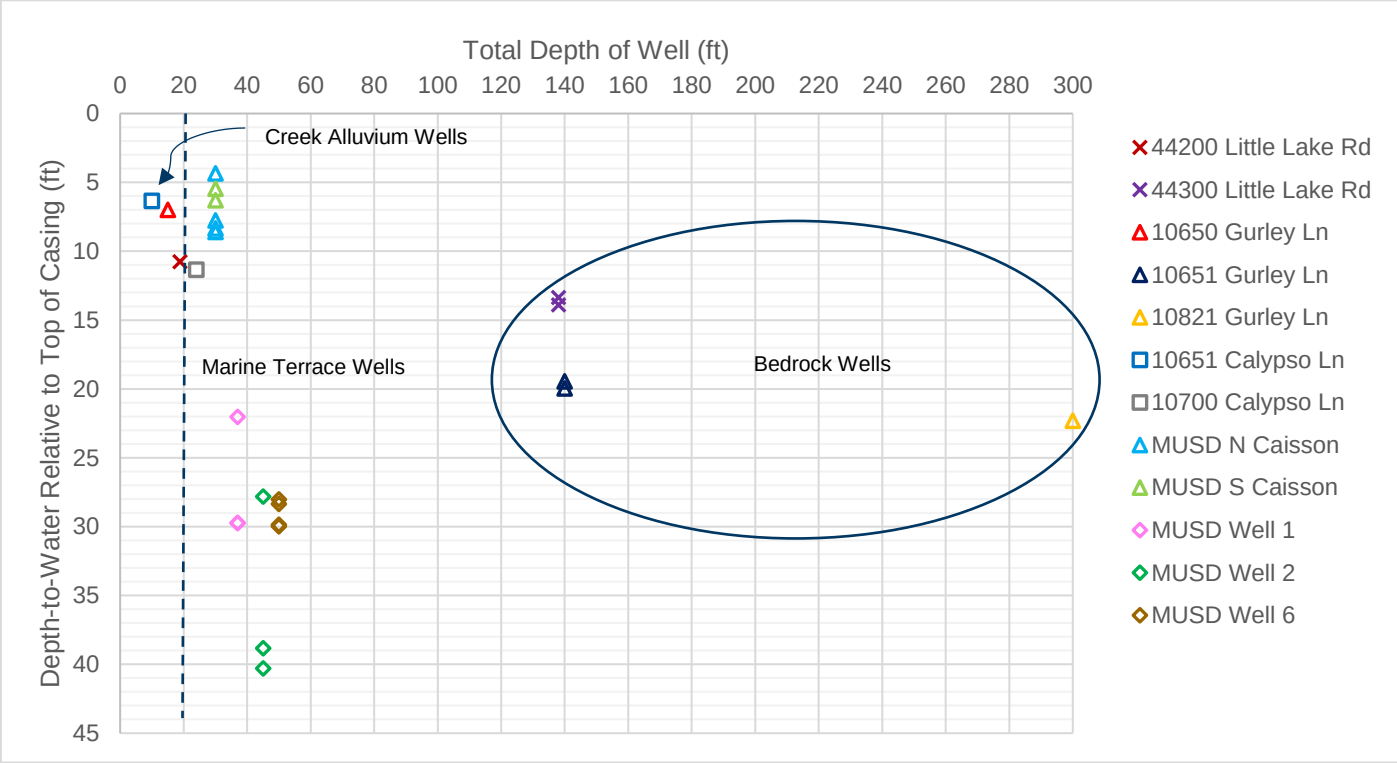

Figure 2 ***Depth-to-Water vs Total Well Depth of Nearby Wells***

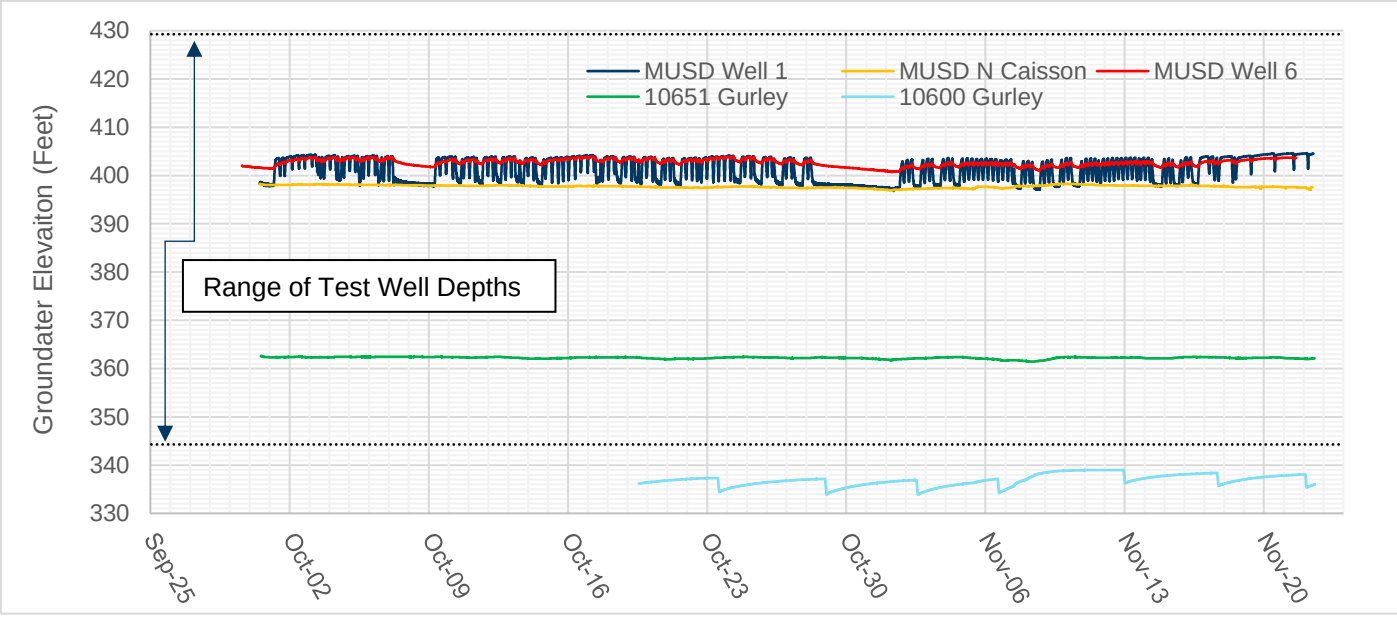

Figure 3 ***Well Transducer Data September 29th – November 24th 2022***

Based on the collected transducer data the total range of the proposed well field would potentially only draw from the same aquifer as the MUSD wells since the 10651 Gurley well is a bedrock well and the bottom elevation of the lowest potential new well is above the recorded water surface elevation of the 10600 Gurley well.

2.2.4 Historical Water Use

Pumping data provided by MUSD is shown in Figure 4 and dates to 2017, showing the stable combined average flow rate from the wells. Production from Well #1 and Well #2 ranges from 6 to 8 gallons per minute with an average of 6.8 gallons per minute. Well run times for Well #1 and Well #2 are generally synchronized and are operational for an average 4-5 hours per day with Well #1 being run for slightly less time than Well #2.

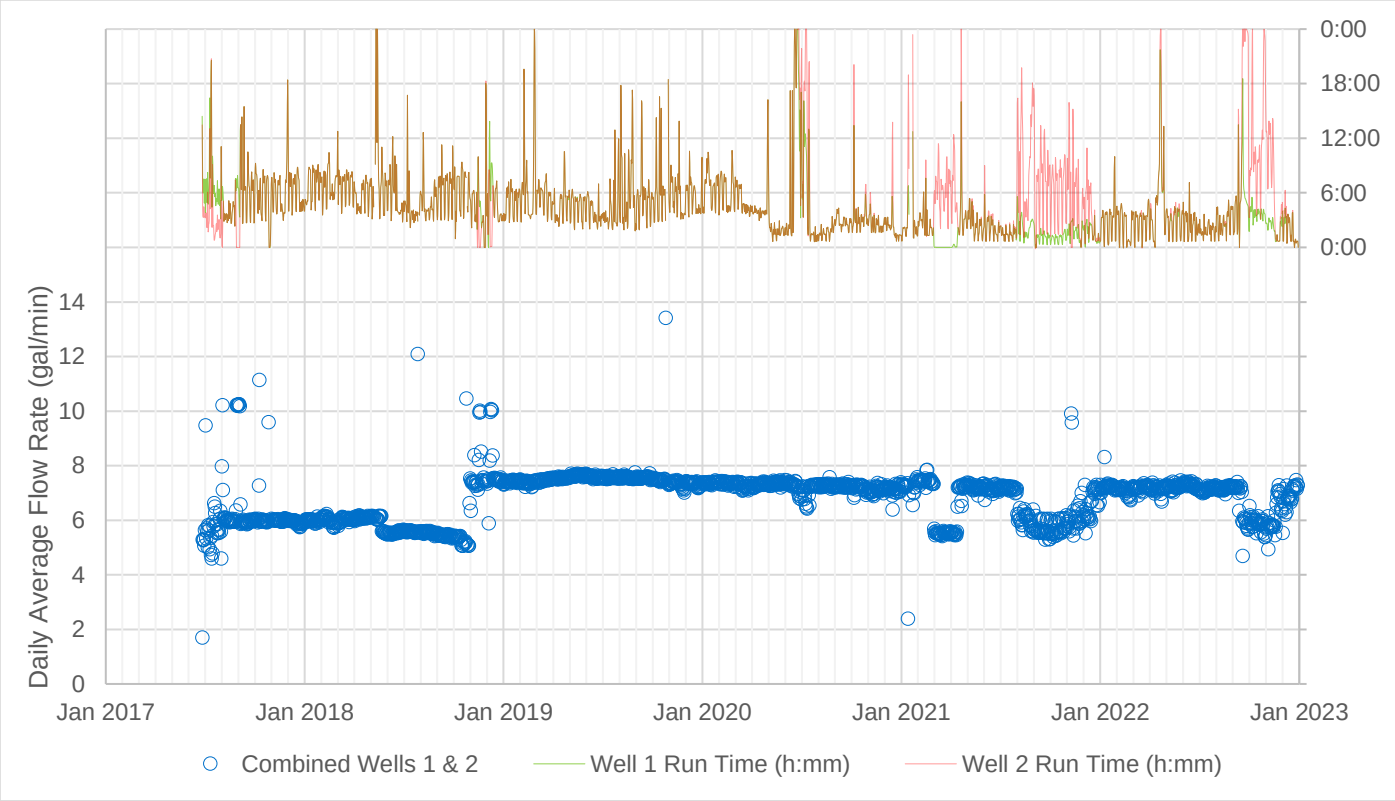

Figure 4 ***Pumping Statistics from MUSD combined Well #1 and Well #2***

3. Site Screening Criteria

The project Site consists of a single parcel, shown in Appendix A, Figure C. Based on the variable aquifer thickness across the Site, the parcel has been divided into three zones based on surface elevation. Surface elevations across the Site range from 430 feet to 380 feet: Zone A is for elevations above 420 feet, Zone B is for elevations between 420 feet and above 400 feet and Zone C is for elevations below 400 feet.

The current Site uses were reviewed through previous and recent discussions with MUSD, site visits, review of surrounding parcels available information. All areas within the parcels were considered as part of this well siting study. Improvements on the parcels include the maintenance building, water supply wells, water storage tanks, the treatment and control building, and the gravel/dirt driveway. Additional improvements include a radio antennae attached to a tree and a small communications shed used for the student radio station, along with various wood and maintenance equipment storage and staging areas.

Ranking of potential well locations considered hydrogeological details as well as surrounding land use, proximity to existing infrastructure, property availability, restrictions, environmental issues, accessibility and public concerns.

Available data together with GHD's professional judgement were used evaluate then rank the sites with the highest potential to yield a reliable, redundant, long-term water supply by using the screening criteria. The potential sites were scored with respect to five screening criteria as outlined in the section below. The resultant scores for each of the criteria were totaled to generate a ranking of potential locations relative to each other. MCCSD generally expects to test drill at the best candidate sites and potentially convert those borings into a series of wells in an overall wellfield at the Site.

3.1 General Findings Criteria

This section briefly describes the criteria and general findings used to rank potential sites. Information was reviewed to support this well siting with these criteria:

1. **Water Quantity (Anticipated Yield) 30 points –** Since this particular area is generally considered a low yielding water production area, water quantity is the most heavily weighted and important selection criteria. Subsurface hydrogeology has significant influence on the quantities of water that can produced on any given location.

2. **Water Quality 20 points –** Included in this criterion is naturally occurring constituents like iron, arsenic, manganese, and human related constituents like gasoline, motor oil, septic by-products, and nitrates. Minimized treatment of high-quality water prior to conveyance is preferred.

3. **Environmental Considerations 20 points –** Potential impacts to the environment from well drilling and conveyance piping construction, effects on vicinity wells and California Environmental Quality Act (CEQA) considerations are included in this criterion.

4. **Well Construction Logistics and Engineering Feasibility 15 points –** This criterion includes available accessibility, lateral and overhead drilling space, ease of water discharge during well development and pump testing.

5. **Cost 15 points –** Relative costs to develop a well at each potential site were considered in this criterion including site proximity to the treatment building and storage tanks, pipeline lengths to conveyance connections, construction mitigation considerations, public perception, and aesthetics.

3.2 Water Quantity

This section summarizes the information in record searches and from GHD's institutional knowledge and previous work conducted in the project area to summarize potential groundwater development based on local geology, hydrogeology, groundwater yields, and available site data. A high-ranking site for groundwater quantity should be situated on a relatively productive groundwater aquifer(s), have a significant area of groundwater recharge, and located away from other supply wells in the area to avoid well interference problems.

The site is located in the Fort Brag Terrace Area Groundwater Basin 1-021 and the hydrogeology of the immediate vicinity can generally be broken into two categories: first water bearing zone/aquifer of near surface (from approximately 0-50 feet below the ground surface) sediments consisting primarily of marine terrace deposits that have a wide range of reported yield (1-100 gpm); and, Franciscan Formation bedrock (from approximately 0-30,000 feet below the ground surface) aquifer consisting of fractured (variably) greywacke sandstone and turbidite sandstone (often called shale by drillers) sequences, with localized serpentinite. The Franciscan bedrock in the area is considered a very low to low yielding aquifer media in the area (0.1-10 gpm).

The marine terrace deposits on MUSD property range from 0 to 50-feet bgs and are likely thickest in the eastern portion of property and tapers down going west across the property (See Appendix A, Figure C). MUSD water supply data and drillers well completion reports in the vicinity indicate this aquifer is relatively stable over time and throughout the annual hydrological cycle compared to the shallow alluvium wells and deeper bedrock completed wells.

3.3 Water Quality

This section summarizes the information in record searches, site data, and studies in the project vicinity to summarize the groundwater quality. A high ranked site would not be proximal to private well septic systems, gasoline service stations, nor contain elevated concentrations of minerals and elements, or in such an area that would be susceptible to saltwater intrusion.

Groundwater quality in the Fort Bragg Groundwater Basin 1-021 is variable. Seawater intrusion is generally not common in the marine terrace aquifers unless in direct contact with the ocean or beach and dune deposits. The majority of marine deposit aquifers in the Fort Brag Groundwater Basin are not in direct contact with beach deposits, including that of the MUSD property, as it is well above sea level (±400-feet MSL).

High iron and sulfur reduced constituents are common in well water in the Fort Bragg Groundwater Basin area. This process of reducing iron and sulfur from the marine terrace materials generally requires various species of bacteria present and organic matter inputs. The majority of well water in the area most commonly has some resultant ferric hydroxide and less commonly and more isolated incidents of hydrogen sulfide precipitates. High concentrations of either constituent requires water treatment via filtration, settlement, or aeration processes prior to drinking.

Since the targeted aquifer here is shallow (<50 feet below the ground surface) there is a higher risk of surface contamination from septic systems, environmental spills, and fuel leaks. There are private septic systems in the vicinity, therefore; treatment via chlorine is most commonly used.

Although there is limited water quality data in the vicinity from deep bedrock wells, it is generally known that variable to elevated concentrations of manganese and iron, among other minor constituents, are encountered in irrigation, domestic and municipal wells completed into these rocks and often require additional treatment prior to consumption.

3.4 Environmental Impacts

For the proposed new supply wells, potential environmental impacts considered were based on proximity to nearby private wells, anticipated water levels, potential adverse effects to wetlands, critical habitats, creeks, or any biological resources. This study reviewed the location of new supply wells together with Site studies and habitat mapping, zoning and land use maps, coastal commission zoning, State environmental cleanup site databases and cultural or visual impacts.

Depending on the preferred well sites, some-short term noise effects may need mitigation depending on the drilling methods used and how close and how many neighbors are proximal to the construction. Shallow wells with boreholes up to 12-inches in diameter within unconsolidated materials can generally use the smaller, more agile, and quieter auger type drill rigs. Deeper boreholes that are constructing wells into hard rock generally require larger, less mobile, larger footprint to mobilize and towering-up (removing additional trees and limbs), louder rotary type drill rigs.

3.5 Well Construction Logistics and Engineering Feasibility

Several logistical and engineering factors were considered here when drilling, constructing, and preparing the new well site. The new well site should be accessible for drilling construction and for long term maintenance. The location should not be located below overhead power lines, but should have electricity nearby. The location should not be in close proximity to existing sewer lines or septic systems, excessive tree limbs (drill tower), steep slopes, or unstable ground conditions. New well sites are more economically feasible if located near existing water conveyance piping, treatment facilities. and storage tanks (discussed below).

3.6 Cost

The considerations above in the drilling feasibility and logistics also effect the overall construction costs. As stated above, if the new wells are located relatively far from existing water supply lines, treatment facilities or storage tanks this will cause pumping supply water uphill or large distances and will require significantly more power over time and pipeline construction costs to tie into existing facilities may be cost prohibitive. Other factors that may control overall costs of constructing new wells at the Site are CEQA considerations, required Site grading / preparation / improvements.

The drilling depths and conditions encountered at the time of well construction can greatly affect the overall cost and drilling methodology. For example, using 2023 dollars, a 5” diameter well casing constructed (including well development and pump testing) in unconsolidated sediments (alluvium, marine terrace, fluvial sand/gravel) is approximately $300-400 per foot using an auger drill rig; while a deep bedrock well, constructed using larger rotary type drilling rig methods is typically in the range of $600-800 per foot of well depth.

3.7 Well Site Screening Results

Three potential zones for wells using two types of drilling methods on the Site property on Little Lake Road were considered in this study for well siting analysis. The Sites has been visited and worked on (well drilling and geotechnical evaluations) extensively by GHD and other consultants prior and is further evaluated here using the above described criteria.

A summary of results of the scoring for Site Zones A, B, and C using shallow construction drilling methods (hollow stem auger) and deeper bedrock drilling methods (rotary) are provided below in Tables 1 and 2, respectively.

Table 1 Well Site Ranking Summary

Potential Well Site	Water Quantity	Water Quality	Environmental Impacts	Logistics & Engineering	Cost	Score	Ranking
Maximum Potential Points	**30**	**20**	**20**	**15**	**15**	**100**	
Shallow Well Construction (Auger Drilling)							
Zone A	25	15	18	12	12	82	2
Zone B	30	15	18	15	15	93	1
Zone C	10	15	18	12	15	70	3
Deep Well Construction (Rotary Drilling)							
Zone A/B/C	15	15	15	10	10	65	4

3.7.1 Shallow Well Construction

Zone A

Zone A (ranked #2 here) is located in the northeastern most portion of the Site and contains two preliminary well locations (Well #9 and Well #10). This zone contains all three of the existing MUSD Wells (#1, #2 and #6) and is the most explored. Land use is primarily forested and is bordered by three residential properties (two to the north and one to the east). Specific well siting in this area together with analyzing and addressing potential impacts would be coordinated with MUSD staff. The main benefits and highlights of this zone are:

- The anticipated shallow marine terrace materials here are anticipated to be the thickest, resulting in an above average yield (based on the existing hydrogeologic conceptual model of the Site);
- Water quality (relatively good) is anticipated to be comparable to that of existing MUSD wells, however, it is unclear how close the residential septic systems to the north would be to the final well site here and how much noise mitigation would need to be considered;
- There is ample room to adjust the exact location of the test wells to provide required setbacks from any potential wetlands, springs, or other environmental considerations;
- The property is owned by MUSD and access to Zone A would require developing a new access road; and,
- The site will likely need some tree removal, and is clear of overhead power lines and is relatively close to the existing and future water supply lines, the water treatment facility, and supply tanks.

Overall, this is a good potential site for consideration of well locations. This area has the potential to include thicker marine terrace deposits compared with other areas and a saturated water bearing zone. Although there are no major issues, noise mitigation measures for adjacent residences and wetland/watercourse setbacks may be necessary.

Zone B

Zone B (ranked #1 here) starts roughly in the center of the property runs southeast across the length of the parcel. Zone B contains five preliminary well locations (Wells #7, #8, #11, #12, and #13) with Wells #7 and #8 are located on the southern half of the property and Wells #11, #12, and #13 on the northern half of the property. Land use in this zone currently includes access roads and the very topmost portion of the delineated wetlands (shown in Appendix A Figure B), and contains heavy brush and tree cover in the northern portions of the zone. Additionally located in this zone are two abandoned concrete caisson wells and the student run radio transmission facilities. The nearest private wells are located approximately 225-feet north in creek deposits, and approximately 175-feet to the east screened in bedrock. Specific well siting in this area and analyzing and addressing impacts would be coordinated with MUSD staff. The main benefits and highlights of this site are:

- The anticipated shallow marine terrace materials here would range from a size comparable/equivalent to that of MUSD Wells #1 and #2 and the caisson wells (22 feet), resulting in an above average water yield for the area (based on available site well completion reports, attached in Appendix B.
- Water quality (relatively good) is anticipated to be comparable to that of MUSD Wells #1 and #2;
- There is sufficient room to adjust the exact location of the test well away from any potential wetlands, springs, or other environmental considerations;
- The property is owned by MUSD and access to a location would require developing a new access road to access the northern three wells; and,

- The site will likely need some tree removal, and is clear of overhead power lines and has well locations relatively close to the existing and future water supply lines, and storage tanks.

Overall, this is the most suitable and broadest area for potential site test wells. This area likely includes the thickest marine terrace deposits and saturated water bearing zone and enough space to accommodate wetland setbacks and other CEQA considerations. Although there are no major issues, noise mitigation measures for adjacent residences may be necessary.

Zone C

Zone C (ranked #3 here) is located along the western portion of the property and contains two potential well locations (Well #14 and #15). Zone C likely has the thinnest marine terrace deposits and has the most uncertainty about water quantity. Land use at this site is currently unused and covered in heavy brush. The nearest private wells are is located 150 feet to the west and 225 feet to the north and is screened in bedrock. Specific well siting in this area and analyzing and addressing impacts would be coordinated with MUSD staff. The main benefits and highlights of this site are:

- There is decent room to move around the exact location of the test well away from any potential wetlands, springs, or other environmental considerations;
- The property is owned by MUSD and access to a location would require developing a new access road; and,
- The site will likely need some tree removal, and is clear of overhead power lines.

Overall, this is the most challenging location for the consideration of a test wells with the majority of the area covered in heavy brush and the potential for shallow bedrock and poor yielding wells. Additional construction considerations may include noise mitigation measures for adjacent residences and drilling rig access.

3.7.2 Deeper Well Construction Zones A/B/C

Bedrock wells (ranked #4 here) could potentially be located anywhere on the parcel due to the separation of the marine terrace aquifer and the bedrock aquifer (via a constructed well seal) and it would not hydraulicly interfere with the wells screened in the marine terrace. Ideally a bedrock well would be located as practicably far away from the nearest private well that is screened in bedrock, approximately 350 feet northeast and 440 feet northwest). However consideration needs to be made for constructability due to the size of drill rig required to drill a bedrock borehole being is significantly larger than one required for a shallow marine terrace borehole. Therefore, drill rig and construction access prioritize the location of a potential bedrock well to areas with enough room for a bedrock capable drill rig to operate. Currently the most accessible area is the southwestern corner of the property and a potentially suitable bedrock boring location is shown on Appendix A, Figure C. This area of the property is currently used for maintenance vehicle fleet parking, the maintenance shop, and access roads. Specific well siting in this area would be coordinated with MUSD staff. The main benefits and highlights of this site are:

- There is ample room to adjust the exact location of the test well away from any potential wetlands, springs, or other environmental considerations;
- The property is owned by MUSD and access to a location here would be good; and,
- The site is generally clear of overhead power lines and trees.

Overall, the Site is a relatively poor site for consideration of a bedrock test well location. The major issues include relatively poor yielding bedrock wells on adjacent properties with relatively low typical yields and much greater construction cost for a deeper, larger diameter casing, bedrock well relative to the shallow marine terrace wells. Since

it is currently unknown if a larger diameter deeper cased well could produce comparable water supply to the known marine terrace wells, it is considered here to be risky from a cost-benefit point of view.

4. General Findings and Conclusions and Recommendations

In completing the well siting study, areas around the existing properties were screened for potential yield, major flaws, and evaluated using the criteria described in Section 3.0. Site visits and Site data, well logs, and discussions with MUSD staff were part of developing the ranking scores indicated above in Table 1.

Based on the information collected during this study, and in the professional judgement of GHD's hydrogeologist, the two zones with the highest rankings for potential test well sites (Zone A and B) are the most likely to provide productive water supply wells. Zone C and bedrock well have a lower likelihood of providing a high producing water supply well, however exploratory test wells would provide more information regarding well feasibility in these areas.

These two sites scored comparably for most of the criteria with some differences in logistics and engineering (distances to pump water to the treatment facility and storage tanks, and longer distance to bring power).

5. Recommendations

Based on data collected during this study and previous reports GHD recommends the following:

1. That a total of up to ten (10) new test wells be constructed, shown in Appendix A, Figure C. A total of nine (9) shallow marine terrace test wells are recommended, which should maintain an approximately 120-foot spacing to reduce the potential of well interference from neighboring wells in the anticipated radii of influence. These wells should be constructed similar to the design of MUSD Well #6 terminating at the bedrock interface. One (1) bedrock test well may be constructed where ease of access and construction considerations dictate and be constructed such that the upper marine terrace aquifer is sealed off from the lower screened sections of the well.
2. An initial operational plan of the new well field, in coordination with the existing MUSD wells (Well #1, Well #2 and Well #6), should maintain that no more than half of the well field (Wells #6 - #7) should operate at one time and ideally no adjacent wellfield wells be pumping at the same time to reduce the potential for adverse drawdown and hydraulic interference effects. Additionally, pumping of any one well should not exceed 12 hours in a day to allow for time for aquifer recharge in the immediate areas of the pumped wells the well field. The well pumping schedule may be revised from this initial recommendation based on the actual capacity of individual wells, monitoring data, measured aquifer response, and actual future emergency water supply needs.
3. The proposed well field should be pump tested during the MCCSD hydrological testing period, and in accordance with, MCCSD Ordinance 2020-1 which begins after August 20th and before a total of 6-inches of rainfall has been recorded.
4. Based on the relatively shallow aquifer thickness, it is recommended that wells be constructed with a reduced surface seal (20-feet in depth) with approval from the Division of Drinking Water. This reduction may result in a review from the Division of Drinking Water to determine if well water is considered Groundwater Under Direct Influence of Surface Water (GWUDI). Other wells near the Site that have a reduced surface seal are not currently considered GWUDI, however, wells considered GWUDI are required to meet surface water standards and may require additional treatment.

6. References

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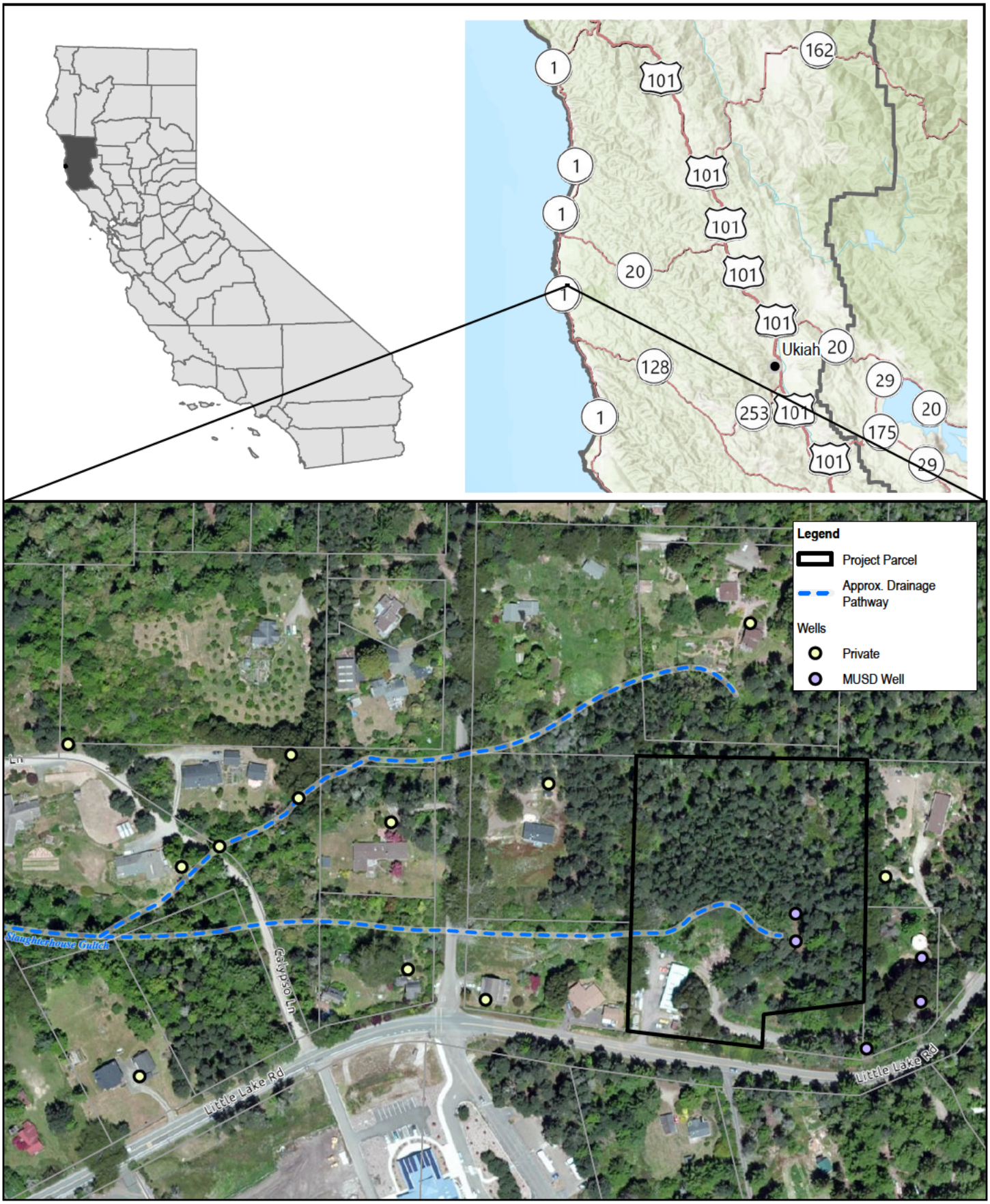
Appendices

Appendix A

Figures



Paper Size ANSI A

0 100 200 300

Feet

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

GHD

Mendocino City CSD
PW Drought Tolerance Supply and Storage Improvements

Project No. **12584992**
Revision No. **-**
Date **12/16/2022**

Vicinity Map

FIGURE A

\\ghdnet\ghd\US\Santa Rosa\Projects\561\12584992\GIS\Maps\Deliverables\12584992_MCCSD_WaterSupplyStorage.aprx - 12584992_11_Vicinity Print date: 16 Dec 2022 - 15:51

Paper Size ANSI A

0 20 40 60 80 100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

N

GHD

Mendocino City CSD
PW Drought Tolerance Supply and Storage Improvements

Project No. **12584992**
Revision No. **-**
Date **12/16/2022**

Site Plan

FIGURE B

\\ghdnet\ghd\US\Santa Rosa\Projects\561\12584992\GIS\Maps\Deliverables\12584992_MCCSD_WaterSupplyStorage.aprx
Print date: 16 Dec 2022 - 15:31

Filename: \\ghdnet\ghd\US\Santa Rosa\Projects\561\12584992\Digital_Design\ACAD\Figures\12584992-GHD-FIG-WELL SITING-WELL LAYOUT.dwg
Plot Date: 24 February 2023 10:43 AM

Appendix B

Well Completion Reports

State of California

Well Completion Report

Form DWR 188 Auto-Completed 4/19/2021

WCR2021-001445

Owner's Well Number: WW-6 | Date Work Began: 12/10/2020 | Date Work Ended: 12/11/2020

Local Permit Agency: Environmental Health Division - Fort Bragg Office

Secondary Permit Agency: | Permit Number: WW23932 | Permit Date: 12/02/2020

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

Name: XXXXXXXXXXXXXXXXXXXX

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: 44020 Little Lake RD

City: Mendodcino | Zip: 95460 | County: Mendocino

Latitude: 39 Deg. 18 Min. 45.9035 Sec. N | Longitude: -123 Deg. 46 Min. 54.1397 Sec. W

Dec. Lat.: 39.312751 | Dec. Long.: -123.7817055

Vertical Datum: | Horizontal Datum: WGS84

Location Accuracy: Unknown | Location Determination Method: Unknown

APN: 119-100-23

Township: 17 N

Range: 17 W

Section: 29

Baseline Meridian: Mount Diablo

Ground Surface Elevation:

Elevation Accuracy:

Elevation Determination Method:

Borehole Information

Orientation: Vertical | Specify:

Drilling Method: Auger | Drilling Fluid: None

Total Depth of Boring: 45 Feet

Total Depth of Completed Well: 45 Feet

Water Level and Yield of Completed Well

Depth to first water: 16 (Feet below surface)

Depth to Static Water Level: 26.5 (Feet) | Date Measured: 12/11/2020

Estimated Yield*: 6 (GPM) | Test Type: Pump

Test Length: 8 (Hours) | Total Drawdown: 10.5 (feet)

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

Geologic Log - Free Form

Depth from Surface Feet to Feet		Description
0	5	Silty clay with sand (dry-soft)
5	10	Silty sand yellowish (dry-loose)
10	15	Poorly graded sand, fine sand mix
15	20	Graded sand light gray, fine sand
20	25	Well graded sand, yellowish (wet) fine-coarse sand
25	30	Yellowish silty sand
30	35	Poorly graded sand, coarse sand (wet)
35	40	Dark brown wethered bed rock
40	45	Solid bed rock

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	25	Blank	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563			Sch 40 Blank
2	25	40	Screen	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563	Milled Slots	0.04	SCH 80 SCREEN
3	40	45	Blank	PVC	OD: 5.563 in. | SDR: 21 | Thickness: 0.265 in.	0.265	5.563			Sch 40 Blank

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	18	Cement	Portland Cement/Neat Cement		Grout
18	20	Bentonite	Non Hydrated Bentonite		Pellets/Time Release
20	45	Filter Pack	Other Gravel Pack	#8	Sand

Other Observations:

Borehole Specifications

Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	45	13

Certification Statement

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

Name: CLEAR HEART DRILLING INC (Person, Firm or Corporation)

555 B W COLLEGE AVENUE (Address) | SANTA ROSA (City) | CA (State) | 95401 (Zip)

Signed: *electronic signature received* (C-57 Licensed Water Well Contractor) | 02/04/2021 (Date Signed) | 780357 (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

Page 1 of 1

RECEIVED
MAR 03 1993

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 407185

DWR USE ONLY — DO NOT FILL IN
17N17W29L01M
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. ____
Date Work Began 11-30-92 Ended 12-3-92
Local Permit Agency CO Health Dept
Permit No. 10442 Permit Date 10-30-92

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0 4	Light Brown Clay
4 11	Orange Sandy Clay
11 22	Tan Sandy Clay
22 38	orange Sandy Clay
38 47	Gravel 1/16 To 1/2"
47 150	Franciscan

TOTAL DEPTH OF BORING 150 (Feet)
TOTAL DEPTH OF COMPLETED WELL 150 (Feet)

WELL LOCATION

Address 44000 Little Lake Rd
City Mendocino
County Mendo.
APN Book 119 Page 10 Parcel 05
or Township 17N Range 17W Section 29 L
or Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH

NORTH / WEST / EAST / SOUTH

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

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

PLANNED USE(S) (✓)

___ MONITORING
WATER SUPPLY
✓ Domestic
___ Public
___ Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Air Rotary FLUID ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___
ESTIMATED YIELD 6+ (GPM) & TEST TYPE Air Lift
TEST LENGTH 1 (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 50	9	✓				PVC	5	Cl 200	
50 150	7		✓			11	11	11	.032

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0 33	✓			
33 150				Gravel 8X16

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 THRA Drilling INC (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 12251 Redwood 3Parks Dr CITY Fort Bragg STATE Ca ZIP 95437
Signed Todd (WELL DRILLER/AUTHORIZED REPRESENTATIVE)
DATE SIGNED 12-5-92
C-57 LICENSE NUMBER 583316

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

1676

17N/17W - 29

ORIGINAL
File with DWR

CONFIDENTIAL LOG
Water Code Sec. 13752

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do Not Fill In

No 141427

State Well No.
Other Well No.

CONFIDENTIAL LOG
Water Code Sec. 13752

(1) OWNER:

Name
Addre

(2) LOCATION OF WELL:

County Mendocino Owner's number, if any

Township, Range, and Section

Distance from cities, roads, railroads, etc. MUSD Watershed on north side of Little Lake Road, Mendocino

(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 [ ] Industrial [ ] Municipal [ ]
Irrigation [ ] Test Well [ ] Other [X]

(5) EQUIPMENT:

Rotary [ ]
Cable [ ]
Other Bucket [X]

(6) CASING INSTALLED:

STEEL: (OTHER:)
SINGLE [ ] DOUBLE [ ] Plastic

From ft.	To ft.	Diam.	Gage or Wall	Diameter of Bore	From ft.	To ft.
0	36	8	160 PSI	30"		

If gravel packed

Size of shoe or well ring: none
Size of gravel: pea
Describe joint Bell & glue joint

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen sawn

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
21	36	5	2	1/8 x 4

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes [X] No [ ] To what depth 20 ft.

Were any strata sealed against pollution? Yes [ ] No [X] If yes, note depth of strata

From ft. to ft.

From ft. to ft.

Method of sealing cement on gravel pack

(9) WATER LEVELS:

Depth at which water was first found, if known ft.

Standing level before perforating, if known ft.

Standing level after perforating and developing 9 ft.

(10) WELL TESTS:

Was pump test made? Yes [ ] No [X] If yes, by whom? bail

Yield: 30 gal./min. with 22 ft. drawdown after hrs.

Temperature of water cold Was a chemical analysis made? Yes [ ] No [X]

Was electric log made of well? Yes [ ] No [X] If yes, attach copy

(11) WELL LOG:

Total depth 35 ft. Depth of completed well 35 ft.

Formation: *Describe by color, character, size of material, and structure*

ft. to ft.	
0 - 1	Brown top soil
1 - 8	Brown sandy clay
8 - 15	Gray sand
15 - 20	Brown and gray sandy clay
20 - 25	Birds eye gravel making water
25 - 35	Brown clay and shale

Work started 3/23/76 19 , Completed 3/23/76 19

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 Weeks Drilling and Pump Co.
(Person, firm, or corporation) (Typed or printed)

Address Sebastopol Road
Sebastopol, California 95470

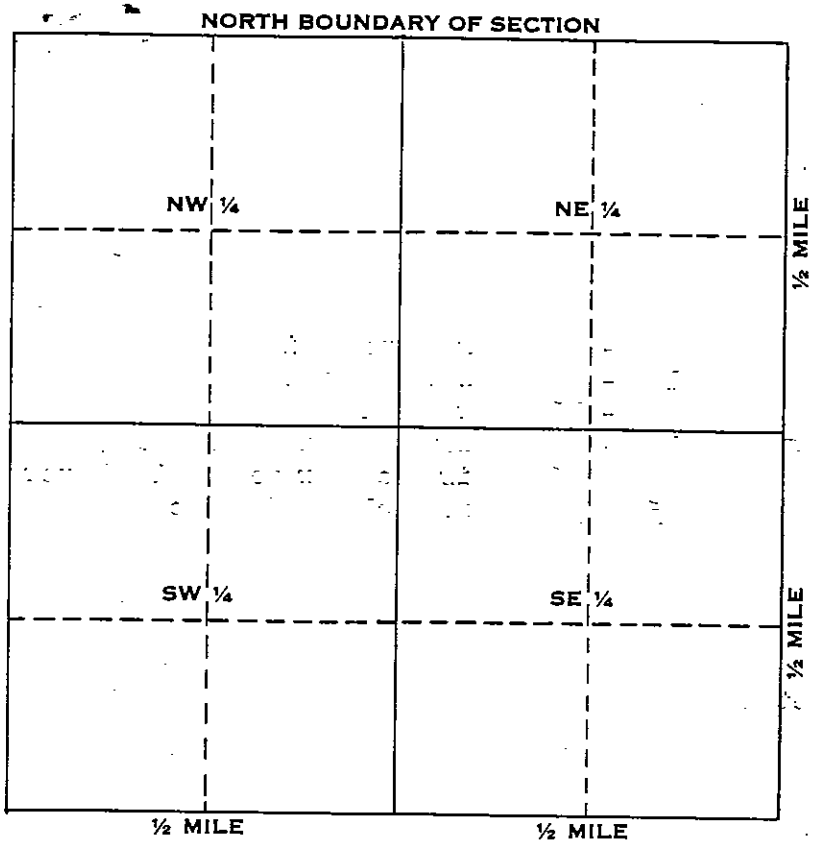
[SIGNED] Gerald Thompson
By: Mary E. Thompson (Well Driller) Mary E. Thompson

License No. 177681 Dated March 24, 19 76

SKETCH LOCATION OF WELL ON REVERSE SIDE

WELL LOCATION SKETCH

141427

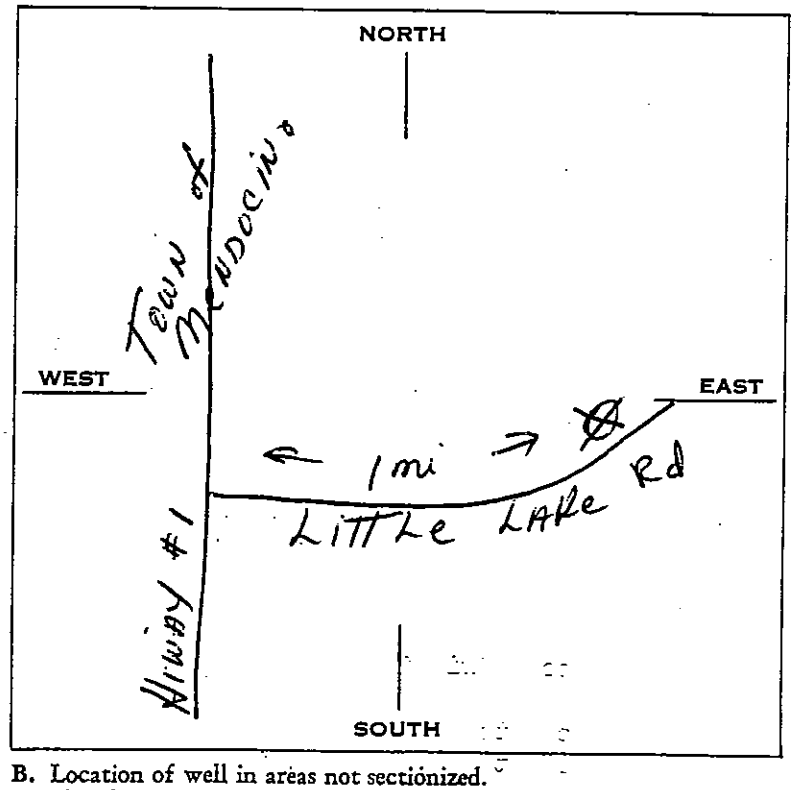


Township 17 N/S

Range 17 E/W

Section No. 29C

A. Location of well in sectionized areas.
Sketch roads, railroads, streams, or other features as necessary.



B. Location of well in areas not sectionized.
Sketch roads, railroads, streams, or other features as necessary.
Indicate distances.

1976 APR 1 AM 11 15

DEPT. OF WATER RESOURCES

ORIGINAL
File Original, Duplicate and Triplicate with the REGIONAL WATER POLLUTION CONTROL BOARD No. 1
(Insert appropriate number)

WATER WELL DRILLERS REPORT
(Sections 7076, 7077, 7078, Water Code)

THE RESOURCES AGENCY OF CALIFORNIA

430

Do Not Fill In
No 112963

State Well No.
Other Well No. 17N/17W29F

(1) OWNER:
Name
Address

(2) LOCATION OF WELL:
County Mendocino Owner's number, if any—
R. F. D. or Street No. map attached

(3) TYPE OF WORK (check):
New well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:
Rotary ☒
Cable ☐
Dug Well ☐

(6) CASING INSTALLED:
SINGLE ☐ DOUBLE ☐

From ft. to ft.	Diam.	Gage or Wall
36" concrete casing		

Type and size of shoe or well ring none
Describe joint slip

If gravel packed

Diameter of Bore	from ft.	to ft.
60"	0	30'

Size of gravel: 1½ inch

(7) PERFORATIONS:
Type of perforator used round ½ x ½ inch
Size of perforations in., length, by in.

From ft. to ft.	Perf. per row	Rows per ft.
bottom 6'		

(8) CONSTRUCTION:
Was a surface sanitary seal provided? ☒ Yes ☐ No To what depth 12 ft.
Were any strata sealed against pollution? ☐ Yes ☒ No If yes, note depth of strata

From ft. to ft.

Method of Sealing

(9) WATER LEVELS:
Depth at which water was first found 12 ft.
Standing level before perforating 12 ft.
Standing level after perforating 12 ft.

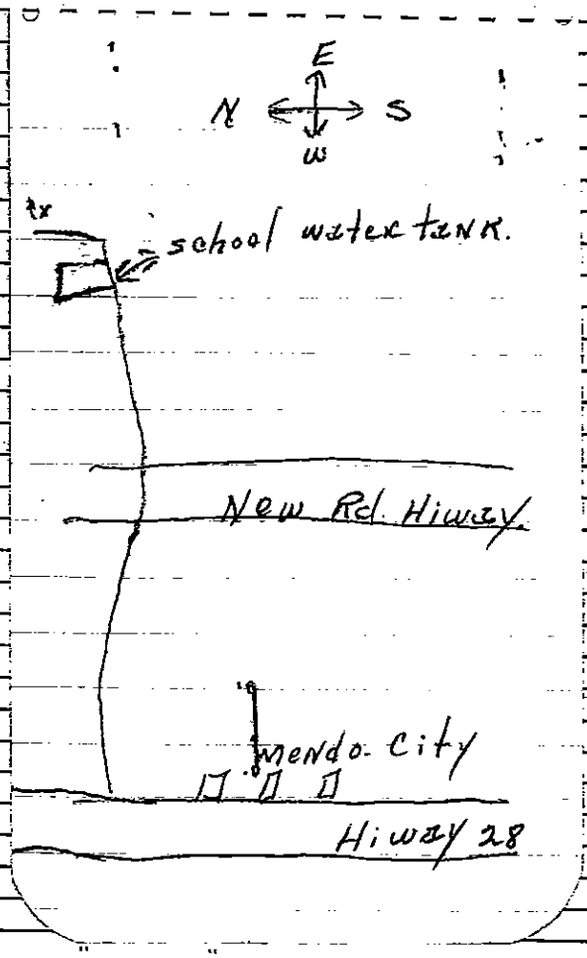
(10) WELL TESTS:
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. draw down after hrs.
Temperature of water Was a chemical analysis made? ☐ Yes ☒ No
Was electric log made of well? ☐ Yes ☒ No

(11) WELL LOG:
CONFIDENTIAL LOG
Water Code Sec. 13752

Total depth 29 ft. Depth of completed well 29 ft.
Formation: *Describe by color, character, size of material, and structure.*

0	ft. to	12	ft. spongey clay
12	"	13	" gravel
13	"	22	" yellow clay
22	"	29	" shale and rock

Two identical wells side by side



FOR OFFICIAL USE ONLY

Work started 10/14/63 19 , Completed 10/18/63 19

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 R & B Drilling (Person, firm, or corporation) *(Typed or printed)*
Address RT. 1 Box 617-H
Ukiah, California

[SIGNED] Ralph Braun *Well Driller*

License No. 197854 Dated 11/12/63, 19

87649 5-63 25M QUIN ① △ SPO

DWR 188 (REV. 3-54)

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 140367

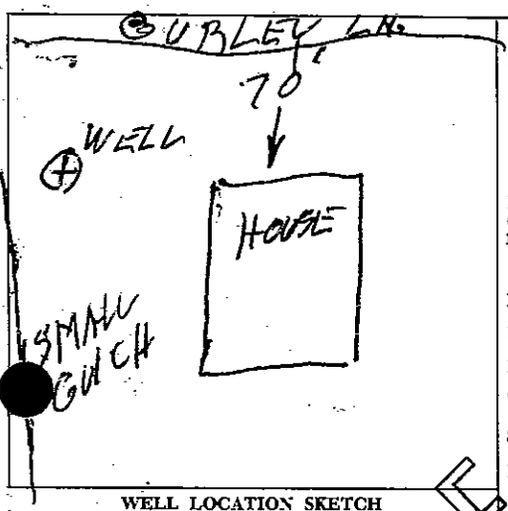
[redacted] of Intent No.
Local Permit No. or Date 8002 replaces #7721

119-090-004

State Well No.
Other Well No. 17N17W29D

(1)
Addre
City

(2) LOCATION OF WELL (See instructions):
County Mendocino Owner's Well Number AP 119-090-04
Well address if different from above 10650 Gurley Lane
Township Mendocino, CA 95460 Range Section
Distance from cities, roads, railroads, fences, etc.



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well [X] Deepening [ ]
Reconstruction [ ]
Reconditioning [ ]
Horizontal Well [ ]
Destruction [ ] (Describe destruction materials and procedures in Item 12)

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

(5) EQUIPMENT:
Rotary [ ] Reverse [ ]
Cable [X] Air [ ]
Other [ ] Bucket [X]

(6) GRAVEL PACK:
Yes [X] No [ ] Size 1/4"
Diameter of bore 26 and 10
Packed from 20 to 59 ft.

(7) CASING INSTALLED:
Steel [ ] Plastic [X] Concrete [ ]

From ft.	To ft.	Dia. in.	Gage or Wall
1 ft.	above grd.		
	59	5	1/4"

(8) PERFORATIONS:
Type of perforation or size of screen

From ft.	To ft.	Slot size
20	59	1/8"

(9) WELL SEAL:
Was surface sanitary seal provided? Yes [X] No [ ] If yes, to depth 17 ft.
Were strata sealed against pollution? Yes [ ] No [X] Interval ft.
Method of sealing Concrete

(10) WATER LEVELS:
Depth of first water, if known 20 ft.
Standing level after well completion ft.

(11) WELL TESTS:
Was well test made? Yes [X] No [ ] If yes, by whom? Driller
Type of test Pump [ ] Bailer [X] Air lift [ ]
Depth to water at start of test ft. At end of test ft
Charge 4 1/2 gal/min after 3 hours Water temperature
Chemical analysis made? Yes [ ] No [X] If yes, by whom?
Was electric log made? Yes [ ] No [X] If yes, attach copy to this report

(12) WELL LOG: Total depth 59 ft. Depth of completed well 60 ft.

from ft.	to	ft. Formation (Describe by color, character, size or material)
0	-	12 Brown Clay
12	-	15 White sandy clay
15	-	20 Blue rock
20	-	29 Black rock
29	-	59 Blue and black rock

Work started May 16, 1988 Completed May 25, 1988

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief

SIGNED John W Murray (Well Driller)
NAME Murray Well Drilling (Person, firm, or corporation) (Typed or printed)
Address 30520 Sherwood Rd.
City Fort Bragg, Ca. Zip 95437
License No. 268792 Date of this report June 25, 1988

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

STATE OF CALIFORNIA

WELL COMPLETION REPORT

No. 807026

DWR USE ONLY — DO NOT FILL IN

17M/17W20W

STATE WELL NO. STATION NO.

LATITUDE LONGITUDE

APN / TRS / OTHER

OWNER'S WELL No. 4796

Date Work Began 8/19/02 Ended 8/19/02

Local Permit Agency Mendocino

Permit No. 15481 Permit Date 7-22-2002

GEOLOGIC LOG

ORIENTATION Vertical Degree of Angle _____

DEPTH FROM SURFACE DEPTH TO FIRST WATER _____(ft.) BELOW SURFACE

Ft.	Ft.	DESCRIPTION
0	2	topsoil
2	20	brown clay
20	30	weathered sandstone
30	140	sandstone
140	160	shale w/clay

WELL OWNER

WELL LOCATION

Address same as above

City _____ County Mendocino

Apn Book 119 Page 050 Parcel 43

or

Township _____ Range _____ Section _____ 1/4 _____ 1/4

or

Latitude _____ NORTH Longitude _____ WEST

Deg. Min. Sec. Deg. Min. Sec.

LOCATION SKETCH

ACTIVITY NEW WELL PLANNED USE(S) Domestic Water

DRILLING METHOD ROTARY AIR FLUID

DEPTH OF STATIC WATER LEVEL 20 (Ft.) & DATE MEASURED Aug 19, 2002

ESTIMATED YIELD * 2 (G.P.M.) & TEST TYPE Airlift

TEST LENGTH. 2 (Hrs.) TOTAL DRAWDOWN 150 (FT.)

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

TOTAL DEPTH OF BORING 160 (Feet)

TOTAL DEPTH OF COMPLETED WELL 160 (Feet)

CASING

DEPTH FROM SURFACE Ft.	To Ft.	BORE-HOLE DIA.	TYPE	Material / Grade	Dia.	Gauge	Slot size
0	30	10 5/8	Blank	F480 PVC	5	160	
30	160	7.5	Perfs	F480 PVC	5	160	1/8

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	To Ft.	Seal Material	Filter Pack (Type / Size)
0	20	Bentonite	
20	160		Pea Gravel

Attachments

no Geologic Log

Well Construction Diagram

no Geophysical Logs

no Soil Water Chemical Analyses

no Other

CERTIFICATION STATEMENT

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

NAME Fisch Bros. Drilling, Inc.

(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

5001 Gravenstein Hwy No. Sebastopol CA 95472

Signed Dale Theiss Carol Hughes 8-20-02 399226

WELL DRILLER / AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

ORIGINAL
File with DWR

Page 1 of 1

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

DWR USE ONLY — DO NOT FILL IN
17N17W29
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. 2
Date Work Began 11/15/00 Ended 11/22/00 No. 703136
Local Permit Agency Mendocino Co. Environmental Health
Permit No. 12895 Permit Date 10/17/00

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID None

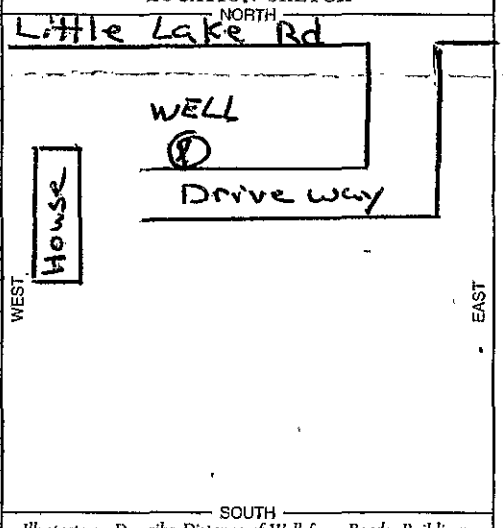
DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0 1	DRIFT
1 27	SAND FINE BROWN
27 29	CLAY GRAY
29 235	SANDSTONE GRAY

TOTAL DEPTH OF BORING 235 (Feet)
TOTAL DEPTH OF COMPLETED WELL 217 (Feet)

WELL LOCATION

Address 43755 Little Lake Road
City Mendocino
County Mendocino
APN Book 119 Page 390 Parcel 13
Township ___ Range ___ Section ___
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 (✓)

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

PLANNED USES (✓)

WATER SUPPLY
✓ 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 17 (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 14 (Ft.) & DATE MEASURED 11/22/00
ESTIMATED YIELD * 2 (GPM) & TEST TYPE AIRLIFT
TEST LENGTH 3 (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)
1 60	10"	X				PVC	5"	CL200	
60 235	10"		X			PVC	5"	CL200	.032

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0 27	X			
27 235			X	#3 LONE STAR

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 West Star Drilling Co., Inc
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 32960 Pearl Drive CITY Fort Bragg STATE CA ZIP 95437
Signed [signature] WELL DRILLER/AUTHORIZED REPRESENTATIVE
DATE SIGNED 12/14/00
C-57 LICENSE NUMBER 784181

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

STATE OF CALIFORNIA

WELL COMPLETION REPORT

No. 762471

DWR USE ONLY — DO NOT FILL IN

17N/17W31

STATE WELL NO. STATION NO.

LATITUDE LONGITUDE

APN / TRS / OTHER

OWNER'S WELL No. 4510

Date Work Began 7/3/01 Ended 7/3/01

Local Permit Agency Mendocino

Permit No. 12378 Permit Date 6/15/2001

GEOLOGIC LOG

ORIENTATION Vertical Degree of Angle .....

DEPTH TO FIRST WATER .....(ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	Ft.	DESCRIPTION
0	2	topsoil
2	25	brown sandy clay
25	120	soft sandstone
120	190	hard sandstone
190	220	shale & clay

WELL LOCATION

Address 9301 N. Hwy 1

City Mendocino County Mendocino

Apn Book 119 Page 340 Parcel 16

or

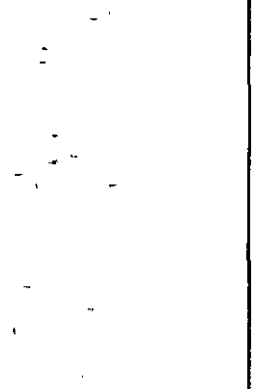
Township ..... Range ..... Section ..... 1/4 ..... 1/4

or

Latitude ..... NORTH Longitude ..... WEST

Deg. Min. Sec. Deg. Min. Sec.

LOCATION SKETCH



ACTIVITY NEW WELL PLANNED USE(S) Domestic Water

DRILLING METHOD ROTARY AIR FLUID

DEPTH OF STATIC WATER LEVEL 26 (Ft.) & DATE MEASURED Jul 3, 2001

ESTIMATED YIELD * 15 (G.P.M.) & TEST TYPE Airlift

TEST LENGTH. 2 (Hrs.) TOTAL DRAWDOWN 210 (FT.)

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

TOTAL DEPTH OF BORING 220 (Feet)

TOTAL DEPTH OF COMPLETED WELL 220 (Feet)

CASING

DEPTH FROM SURFACE Ft.	To Ft.	BORE-HOLE DIA.	TYPE	Material / Grade	Dia.	Gauge	Slot size
0	20	10 5/8	Blank	F480 PVC	5	160	
20	40	7.5	Blank	F480 PVC	5	160	
40	220	7.5	Perfs	F480 PVC	5	160	1/8

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	To Ft.	Seal Material	Filter Pack (Type / Size)
0	20	Bentonite	
20	220		Pea Gravel

Attachments

- no Geologic Log
- no Well Construction Diagram
- Geophysical Logs
- no Soil Water Chemical Analyses
- no Other

CERTIFICATION STATEMENT

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

NAME Fisch Bros. Drilling, Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

5001 Gravenstein Hwy No. Sebastopol CA. 95472

Signed Dale Theiss Carol Hughes 7-5-01 399226

WELL DRILLER / AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

STATE OF CALIFORNIA

WELL COMPLETION REPORT

No. 0924893

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO. STATION NO.

LATITUDE LONGITUDE

APN / TRS / OTHER

Work Began 9/9/05 Ended 9/9/05

Local Permit Agency MENDOCINO

Permit No. WN20432 Permit Date 8-16-2005

GEOLOGIC LOG

ORIENTATION Vertical Degree of Angle .....

DEPTH FROM SURFACE Ft. | DEPTH TO FIRST WATER ..... (ft.) BELOW SURFACE Ft. | DESCRIPTION

Ft.	Ft.	DESCRIPTION
0	2	topsoil
2	20	brown clay
20	25	weathered greenstone
25	140	greenstone w/ shale

TOTAL DEPTH OF BORING 140 (Feet)

TOTAL DEPTH OF COMPLETED WELL 140 (Feet)

WELL OWNER

[redacted] CA 94942

LOCATION

Address 10651 GURLEY LANE

City MENDOCINO County MENDOCINO

Apn Book 119 Page 100 Parcel 01

or Township ..... Range ..... Section ..... 1/4 ..... 1/4

or Latitude ..... Deg. Min. Sec. NORTH Longitude ..... Deg. Min. Sec. WEST

LOCATION SKETCH

ACTIVITY NEW WELL PLANNED USE(S) Domestic Water

DRILLING METHOD ROTARY AIR FLUID Bentonite

DEPTH OF STATIC WATER LEVEL 20 (Ft.) & DATE MEASURED Sep 9 2005

ESTIMATED YIELD * 1.5 (G.P.M.) & TEST TYPE Airlift

TEST LENGTH. 2 (Hrs.) TOTAL DRAWDOWN 135 (FT.)

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

CASING

DEPTH FROM SURFACE Ft.	To Ft.	BORE HOLE DIA.	TYPE	Material / Grade	Dia.	Gauge	Slot size
0	20	10 5/8	Blank	F480 PVC	5	160	
20	40	8 3/4	Blank	F480 PVC	5	160	
40	140	7 1/2	Perfs	F480 PVC	5	200	Factor

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	To Ft.	Seal Material	Filter Pack (Type / Size)
0	20	Bentonite	
20	140		Pea Gravel

Attachments

no Geologic Log

no Well Construction Diagram

no Geophysical Logs

no Soil Water Chemical Analyses

no Other

CERTIFICATION STATEMENT

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

NAME FISCH BROS. DRILLING, INC.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

5001 Gravenstein Hwy No. Sebastopol CA 9547

Signed Dale Theiss 09/30/05
WELL DRILLER / AUTHORIZED REPRESENTATIVE DATE SIGNED

399226
C-57 LICENSE NUMBER


GHD