

TO:	Carp Bluff, LLC c/o Matthew Goodwin
FROM:	Kear Groundwater P.O. Box 2601 Santa Barbara, CA 93120-2601
DATE:	November 18, 2021
SUBJECT:	Groundwater Supply Development and Geothermal Capacity The Farm Hotel, Carpinteria, Santa Barbara County, California

Dear Mr. Goodwin,

This memorandum provides a summary of Kear Groundwater's (KG) recommendations for groundwater supply development and geothermal capacity potential at the proposed Farm Hotel, Carpinteria ("The Farm Carpinteria"), comprised of the 23.40-acre parcel (Assessor Parcel Number [APN] 001-170-013) at 5885 Carpinteria Avenue and the 4.13-acre parcel (APN 001-170-010) at 5669 Carpinteria Avenue, in southeastern Santa Barbara County, California.

Under these tasks, conducted at your request, we reviewed available hydrogeologic information, including nearby water well construction details, oil exploration borehole drillers' reports, and published maps/reports to assess potential future new well locations and designs.

Our recommended approach for groundwater development is to drill two exploratory boreholes along the northern property border by Carpinteria Avenue. Each borehole would penetrate through the entire thickness of the Santa Barbara Formation to total recommended exploration depths of up to 550 feet below ground surface (bgs), unless the underlying tar-laden Monterey Shale is encountered at shallower depths (potentially as shallow as 150 ft, to be confirmed with exploration to 250 ft bgs). When equipped with 8-inch-diameter PVC or stainless steel casings, pumps, and power, the "Primary Well" and "Backup Well" locations and depths would each appear to be capable of producing on the order of tens of gallons per minute (gpm), with higher production rates if the Santa Barbara Formation is present to the greater depth and vice versa. The raw quality from these proposed wells will likely require treatment prior to domestic usage.



Per the State Water Resources Control Board (SWRCB), a "public water system" provides water for human consumption either (a) to 15 or more service connections or (b) by regularly serving at least 25 individuals daily at least 60 days out of the year. Of the three legal distinctions between public water systems based on how often people consume the water, the proposed system at the Farm Carpinteria is likely considered to be a *transient non-community* system. Regulatory requirements for public water systems include a redundant water supply source (e.g., two groundwater wells). Additionally, a preliminary technical report must be submitted to the SWRCB at least six months before any water-related construction for a new public water system. Once established, an appropriately-classified distribution/treatment system operator is required for the system.

If the exploratory bores do not reveal adequate conditions for well completion, the possibility exists to incorporate the bores (or the knowledge/logs gained from them) into a larger hole network for a vertical closed-loop geothermal heat pump/exchange system to serve on-site building heating and cooling.

A summary of our efforts, findings, conclusions, and more detailed recommendations follows.

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Public Water System Requirements

The three main public water system types are as follows:

1. *Community*: Serves 15 or more service connections used by yearlong residents or regularly serves at least 25 yearlong residents (e.g., mobile home parks).

2. *Transient non-community*: Serves at least 25 individuals daily at least 60 days of the year, but no more than 24 yearlong residents (e.g., restaurants, campgrounds, motels).

3. *Non-transient non-community*: Serves at least 25 of the same persons over 6 months of the year (e.g., schools and larger places of employment).

Title 22 regulatory requirements for public water systems include a redundant source (22 CCR § 64554c). Community water systems using only groundwater shall have a minimum of two approved sources before being granted an initial permit, and the system shall be capable of meeting maximum day demand (MDD) with the highest-capacity source offline. Water Supply Permits/Numbers are provided by the SWRCB's Division of Drinking Water.

Senate Bill 1263 (SB 1263), effective January 1, 2017, stipulates that before a permit application is submitted for a proposed new public water system, a preliminary technical report must first be submitted to the SWRCB at least six months before initiating construction of any water-related improvement. The preliminary technical report is encouraged, but is not required, to submitted no later than seven days after submission of a building permit application for any water-related improvement. The report must include an analysis that demonstrates the projected water demand of a proposed new public water system can be met by the total projected water supplies available during normal, single dry, or multiple dry water years over a 20-year forecast.

Additionally, the California Environmental Quality Act (CEQA) includes a list of classes of projects that have been determined not to have a significant effect on the environment and therefore be exempt from the provisions of CEQA. **Class 3 (14 CCR § 15303)** applies directly to the proposed water wells and infrastructure constructions herein, as it "consists of construction and location of limited numbers of new, small facilities or structures; installation of small new equipment and facilities in small structures." Provided examples for Class 3 exemptions include water main extensions.

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The Farm Carpinteria property is situated within the Carpinteria Valley just south of U.S. Route 101 within the delineated Carpinteria Groundwater Basin ("Carpinteria Basin," Number 3-18, Department of Water Resources [DWR], Bulletin 118). Following its 2018 boundary modification, the Carpinteria Basin is bounded in the north and east by the contact between the Quaternary unconsolidated/semi-consolidated sediment and the Tertiary consolidated rocks of the Santa Ynez Mountains, in the south and southwest by the Pacific Ocean, and in the west now by the jurisdictional boundary between local water purveyors (Carpinteria Valley Water District [CVWD] and Montecito Water District [MWD]). Figure 1 presents the aerial location map.

Local groundwater aquifers are primarily stored within the unconsolidated sediment of the recent, Holocene-aged alluvium and the semi-consolidated Pleistocene-aged Carpinteria, Casitas, and Santa Barbara Formations. The contact between Quaternary sediment and the Tertiary sedimentary bedrock formations generally occurs as unconformable depositional contacts or along local faults, including the Carpinteria Fault that cuts through the northern -013 parcel.

Sustainable Groundwater Management Act

The Sustainable Groundwater Management Act (SGMA) of 2014 is a three-bill package (AB 1739, SB 1168, and SB 1319) that sets the framework for statewide long-term sustainable groundwater management by local authorities. SGMA requires the formation of new groundwater sustainability agencies (GSAs) tasked with assessing the conditions in their local basins and adopting locally-based sustainable management plans. SGMA provides local GSAs with tools and authority to (1) require registration of groundwater wells, (2) measure and manage extractions (including limiting the amount of water pumped by individual well owners), (3) require reports and assess fees, and (4) request revisions of basin boundaries, including establishing new sub-basins. GSAs responsible for high- and medium-priority basins must adopt long-term groundwater sustainability plans (GSPs) by 2022 (or 2020 if in overdraft). Plans will be evaluated every five years. GSAs have until 2040 to achieve groundwater sustainability.

DWR designated the Carpinteria Basin as a high priority basin, largely due to groundwater level

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declines observed by long-term hydrographs, as part of its 2018 re-prioritization. The Carpinteria GSA (CGSA) formed in February 2020 by a Joint Powers Authority between the CVWD, the City of Carpinteria, the Santa Barbara County Water Agency, and Ventura County.

CVWD, established in 1941, provides potable water to residential, commercial and agricultural customers in the basin. The District receives about half of its supply via a 10.94% entitlement of the Cachuma Project (stored surface water of the Santa Ynez River) for an average of 2813 acreft per year; CVWD also has an entitlement of 2000 acre-ft per year (plus additional 200 acre-ft drought buffer) from the State Water Project/California Aqueduct, of which deliveries range from 5 to 100% of the entitlement in any given year (per CVWD: https://cvwd.net/your-water/supply-facilities/water-sources-and-supply/). Finally, the District also pumps on average 1460 acre-ft per year of groundwater from the basin.

To fund the GSA and implementation of the GSP, the Carpinteria GSA will establish a groundwater extraction fee (excluding from *de minimus* users). Along with payment, groundwater extractors may also be required to submit a form detailing their extractions. Accordingly, the responsible entity (*e.g.*, owner, pumper, farm manager) will need to file the appropriate water use estimate forms for any existing wells, new wells, and nonexempt wells. The GSP is expected to be implemented in 2024.

Hydrostratigraphy

The Carpinteria Basin and its local low-lying valleys are filled with Quaternary-aged alluvium of fluvial origin, with sediment derived from the weathering and erosion of the surrounding mountains. The alluvium and stream channel deposits are comprised of unconsolidated mixture of gravels, sands, silts, and clays of various thicknesses. Accessible groundwater is stored in coarser-grained aquifers separated by finer-grained aquitards. Alluvium is generally separated into recent, active (Holocene-aged; Qa) deposits and older, dissected (Pleistocene-aged; Qoa) deposits. The alluvial deposits reach a maximum thickness of about 250 ft in the basin, but contain thick beds of clay in the coastal plain that confines the underlying groundwater aquifers (DWR, 2004).

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Unconsolidated sediments are underlain by the weakly- to semi-consolidated Pleistocene-aged terrestrial deposits (Carpinteria Formation, Casitas Formation [Qca]) and late Pliocene/early Pleistocene-aged marine deposits (Santa Barbara Formation [Qsb]). The primary aquifers in the basin are contained in the coarser-grained strata of the Casitas Formation, comprised of lenticular deposits of poorly sorted clay, silt, sand, and gravel, with interspersed cobbles and boulders (Upson and Thomasson, 1951); the Casitas Formation is typically not present south of the Rincon Creek Thrust Fault and is thus not accessible for groundwater development at the Farm Carpinteria property.

The underlying Santa Barbara Formation, comprised of clay, silt, and sand that is locally fossiliferous, is the principal aquifer in the Goleta Basin to the west; the formation is generally present too deep for economic groundwater development in the main Carpinteria Basin area, except in the fault block between the Rincon Creek and Carpinteria Faults. Significant volumes of groundwater are available within the older sedimentary formations, especially where partially cemented, unconsolidated, or highly fractured, which increases porosity and permeability.

The Carpinteria Basin is generally separated into two groundwater storage units, Storage Unit No. 1 (SU-1) and No. 2 (SU-2); the units are separated by the Rincon Creek Fault, which acts as a barrier to subsurface flow (e.g., Geotechnical Consultants, Inc., 1976; SBCWA, 2009; Pueblo, 2012). All existing CVWD municipal wells are within the much larger SU-1. The principal aquifers in this unit occur within unconsolidated sediments of the Carpinteria and Casitas Formations, with four designated aquifer zones that are each about 50 to 100 ft thick and separated by laterally extensive aquitards that create confining conditions in the coastal plain (Pueblo, 2012).

Aquifers in SU-2 (south of the fault) are contained within the Santa Barbara Formation (e.g., Fugro, 2008; SBCWA, 2009). Boring logs from Hoover and Associates (1982) reported the top of the formation to be around 25 to 30 ft bgs near Carpinteria Avenue. Pueblo (2012, Figure 13) map the base of the formation (or the top of the consolidated bedrock formations) to be around 550 ft bgs along Carpinteria Avenue in SU-2. DWR (2004) reports a total thickness up to 500 ft

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of freshwater-bearing sediments south of the Rincon Creek Fault. However, one Hoover and Associates (1982) boring (B-14) in the northwestern portion of the parcel reportedly encountered the Monterey Shale as shallow as 53 ft, while the slightly more northern boring (B-15) did not encounter the shale to its total depths of 70 ft bgs. Thus, it is possible that the recommended new well locations (located about 100 ft down-dip from B-14) encounter the shale as shallow as about 150 ft bgs.

SBCWA (2009) reports on the order of 1000 acre-ft of *usable* groundwater storage in SU-2 with average well production of 250 gpm, as compared with 15,000 acre-ft in SU-1 with average well production between 500 to 1000 gpm.

Figure 2 presents the geologic map.

Groundwater Recharge, Levels, and Quality

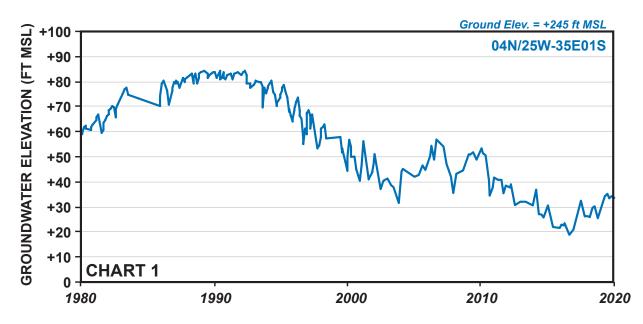
Carpinteria Basin receives natural recharge primarily by infiltration of precipitation streamflow seepage in addition to artificial/manmade recharge primarily by percolation of excess irrigation waters (Upson and Thomasson, 1951; DWR, 2004; Pueblo, 2012). The principal recharge zone occurs within the porous unconsolidated deposits along the southern base of the mountains (Padre, 2005), referred to as the Recharge Area. Within the coastal plain of the basin, surface water percolation to the main groundwater system is assumed to be insignificant due to the presence of fine-grained low-permeability materials (Pueblo, 2012), referred to as the Confined Area. The mean annual rainfall at the Carpinteria Fire Station is 19.8 inches (Pueblo, 2012).

The long-term sustainable annual yield of the Carpinteria Basin is around 4000 acre-ft (based on the updated model of the groundwater basin [Pueblo, 2012]); CVWD pumps 1460 acre-ft per year on average and the remaining is generally pumped by agricultural users. Total groundwater production reached as high as 6790 acre-ft in Water Year 2018, the highest annual total over the 1985 through 2019 period (Pueblo, 2021). CVWD has proposed the Carpinteria Advanced Purification Project (CAPP) to create an additional about 1100 acre-ft per year of artificial recharge to the basin via direct injection of recycled wastewater.

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In general, water levels in the Carpinteria Basin decline during extended drought years, reaching their lowest elevation in 2017 during the 2012 to 2018 drought (SBCWA, 2021), but also recover following wet years. The 2017 nadir is observed at the 385-ft-deep key well in basin's SU-2 (*State Well Number [SWN] 04N/25W-35E01S*, see Figure 2 for location), with about 15 ft of subsequent recovery. The current water level remains about 50 ft below its high elevation mark in the late 1980s. Chart 1 presents the 1980 through 2020 hydrograph at the key well.



Groundwater quality within SU-2 (south of Rincon Creek Fault) is typically of poorer quality than in SU-1 (north of the fault), and will likely require treatment for prior to domestic use (e.g., Padre, 2005). Total dissolved solids (TDS) concentrations range widely but generally exceed 1000 mg/L in SU-2 (Geotechnical Consultants, Inc., 1976), as compared with an average of 570 mg/L at the CVWD public supply wells in SU-1 per the most recent (2020) consumer confidence report. The SU-1 groundwater averaged 382 mg/L (as CaCO₃) demonstrating very hard water but no iron. Historic (1970s) quality results from the SU-2 key well (*-35E01S*) reveal TDS concentrations between 1210 and 1830 mg/L, but comparatively softer water of between 39 to 58 mg/L total hardness as CaCO₃. The SU-2 well did have an iron concentration of 0.9 mg/L (above the secondary Maximum Contaminant Level [sMCL] of 0.3 mg/L).

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Concentrations exceeding sMCLs may adversely affect the taste, odor, or appearance of drinking water but are not directly health related. Manganese concentrations may also exceed secondary drinking water standards, and hydrogen sulfide (common in deep marine sedimentary aquifers) or petroliferous odors may be present. Nitrate concentrations are variable, generally higher in shallow units under agricultural areas.

Saltwater Intrusion

CVWD completed construction of a cluster monitoring wells along the coast to evaluate the stratified aquifers for signs of seawater intrusion in 2019. The clustered wells are equipped with water level dataloggers/pressure transducers to record changes over time, and are sampled for various constituents on biyearly or quarterly basis to determine if salinity is increasing or decreasing from the baseline condition. While the pumping depression in the central portion of the basin could induce seawater intrusion, there had been no documented evidence of seawater intrusion prior to the recently-ended drought; local faults (Rincon Creek and Carpinteria) act as barriers to this intrusion, as do the clay confining layers near the coast (SBCWA, 2009).

Structural Geology

The Santa Ynez Mountains are part of the Transverse Ranges geomorphic province. Rocks in this region have been folded into a series of predominantly east-west-trending anticlines and synclines associated with thrust and reverse faults. Regional deformation was caused by north-south compression. In general, the faulting and seismicity of southern California are dominated by the compressionary regime associated with the "Big Bend" of the San Andreas Fault Zone.

Regional crustal shortening due to this compression is largely taken up locally by faults and associated folds, the most significant of which are the Carpinteria Fault and the Rincon Creek Thrust Fault, which forms an impermeable barrier between the two storage units of the groundwater basin (e.g., Padre, 2005; SBCWA, 2009). The Rincon Creek Fault dips by about 50 degrees from horizontal to the south, impeding both horizontal and vertical flow in the subsurface (Pueblo, 2012). The Carpinteria Basin is bracketed by the larger Arroyo Parida Fault to the north and the Red Mountain Fault zone offshore to the south.

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Per the State's Geologic Energy Management Division's (CalGEM, formerly DOGGR) Well Finder database, the vast majority of the cluster of now-abandoned historic (early to mid-20th Century) oil exploration wells in the area are situated south of the Carpinteria Fault, where the Miocene-aged shale units are uplifted to ground surface. Available lithologic and electric logs from the handful of oil wells situated in the structural block between the Carpinteria and Rincon Creek faults indicate the base of the Santa Barbara Formation between depths of around 600 to 850 ft (see Figure 1). These wells did not encounter commercial shows of oil or gas, but tar shows were occasionally present.

Hoover and Associates (1982) report petroliferous odors in some boreholes that penetrate sandy strata of the Santa Barbara Formation, in addition to abundant sea shells.

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Geothermal Resource Potential

The term "geothermal" is used to describe both electric power plants and heat pumps that use underground heat as its source of energy. Typically, geothermal power plants provide electricity for a city or region, while geothermal heat pumps provide heating and cooling for single homes or commercial buildings (and do not produce electricity). Heat pumps do not require a hot water reservoir or steam geyser; instead, the systems rely on the relatively consistent subterranean temperatures to serve as the heat source (during winter) or sink (during summer).

The potential for geothermal electrical generation or hot spring development is considered to be very remote at the property. No steam geysers have been identified in Santa Barbara County (per the County Strategic Energy Plan, 2019). There are six documented hot springs, all across the southern County region, but are not at high enough temperatures for viable generation. Higher temperature reservoirs have more heat to be extracted and therefore a greater electricity potential. The hot springs are generally located within the Santa Ynez Mountains, the closest of which is above Toro Canyon to the northwest of the Carpinteria Valley and is a mild 72 degrees Fahrenheit (shown on Figure 2).

Alternatively, geothermal heat pumps appear to be potentially feasible at the property, pending sufficient capital investment. Most geothermal heat pumps circulate fluid through a closed loop (plastic or copper tubing) that is buried in the ground (ground-source) or submerged in water (water-source); a heat exchanger transfers heat between the refrigerant in the heat pump and the antifreeze solution in the closed loop. Vertical closed-loop systems are common for larger facilities (as less land is required than horizontal systems) and involve a network of boreholes drilled to typical depths of 100 to 400 ft. DWR standards define these systems as "geothermal heat exchange wells." These wells are not intended to produce water or steam, and the ambient ground temperature is 86 degrees Fahrenheit or less. The standing groundwater is the heat exchange medium. Construction cannot degrade local groundwater quality.

Renovations to the Santa Barbara County Courthouse in 2003 included the construction of a new vertical closed-loop heat pump system, with a network of 32 wells that are each 5.25-inches

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diameter, about 400 ft deep, and separated by 18 lateral ft (per the Montecito Journal, 2020). The underground temperature at that depth is a constant 69 to 70 degrees Fahrenheit, and the circulating fluid is heated or cooled to that constant temperature. The reported cost of the system at that time was around \$250,000 (per the Air Conditioning, Heating, Refrigeration News, 2005).

Thus, the cost for a similar system at the Farm Carpinteria is likely at least \$500,000 today. There is also the potential risk of encountering tar-laden sand strata, and the size/quantity of the borehole network increases the possibility of seepage to ground surface.

Alternatively, open-loop geothermal heat pumps draw groundwater in at the source well, circulate the fluid through the system (to either remove or add heat from the water depending on the season), and then discharge the fluid back into a separate recharge well. Elevated total hardness (>100 mg/L of calcium and magnesium salts; Rafferty, 1999) and iron content can negatively impact heat exchanger and clog return wells. Regulations regarding groundwater discharge must also be met. Due to the anticipated raw groundwater quality and the discharge compliance, an open-loop heat pump system is not recommended at the property.



CONCLUSIONS AND GROUNDWATER DEVELOPMENT RECOMMENDATIONS

KG understands that the project goal is to create a truly sustainable development with a symbiotic relationship between environment, community, and economy. Relying on local groundwater that underlies the property is an important step towards that sustainability. Depending on the hydrologic conditions in Northern California, the local water district can source up to 100% of its water supply from imported surface water via the State Water Project. Further, a geothermal vertical closed-loop exchange system could be installed to provide heating to larger building facilities, likely in place of natural gas for heating.

Following new well construction permit issuances by the County Environmental Health Services, KG has determined that the best approach for new groundwater development is to drill two new exploratory boreholes, designated as the Primary Well and Backup Well, in the northernmost portions of the Farm Carpinteria property. The boreholes would penetrate through a thin veneer of unconsolidated alluvium before advancing entirely through its weakly-consolidated Santa Barbara Formation. The northern well location allow for the greatest possible thickness of the targeted formation, and therefore the greatest potential future well production (increased saturated thickness and available drawdown). The total recommended exploration depths are 250 and 550 ft bgs. The application for a new well construction permit should be submitted to the County agency as soon as practical. Subsurface utilities should be adequately located as part of a standard utility clearance operations. Temporary noise attenuation barriers could be used to minimize any potential disturbances to neighboring properties.

Figure 3 presents the conceptual geologic cross section across the property and Carpinteria Basin.

The exploration pilot boreholes should be advanced via mud rotary methods to allow for collection of drill cuttings, to maintain borehole stabilities, and to provide a fluid to facilitate geophysical logging, including electric logging, deviation, and sonic/variable density logging. The geophysical logs would inform well design, ultimately preventing casing the well in poor quality zones. Should the exploration bores indicate viable conditions for well completions and designs agreed upon, the same drilling rig could then ream the pilot boreholes out to a larger

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diameters, as needed, in order to accommodate the well casings and permanent annular materials.

The final well completions would be designed, if advisable, after geologist's review of the drilling data, geologic information, and any down-hole geophysical surveys completed in the pilot boreholes. The boreholes would be reamed out to 16 inches (minimum) diameter in order to accommodate the 8-inch-diameter PVC or stainless steel casings. The casings would be assembled and constructed with perforated intervals at designed depths.

Following casing installations, gravel packs would be emplaced in the annular spaces and minimum 50-ft cement sanitary seals emplaced above the gravel packs and, if necessary, adjacent to any poor quality zones. Mechanical development and test pumping, collection and analysis of water quality samples, and equipping the wells with appropriate infrastructure would follow.

Qualified hydrogeologic personnel should be present during key periods of drilling to assist in the decision processes toward well completions. After initial testing, permanent pumps, power and infrastructure would be designed and installed at the wells. Water Supply Permits/Numbers for the future transient non-community public water system would be provided by the SWRCB's Division of Drinking Water.

Separately, the information and data gained during exploratory well drilling could also guide placement and feasibility of the vertical borings for a geothermal heat pump system. KG recommends discussion with a qualified contractor to further explore this possibility.

We look forward to our continued involvement with the Farm Carpinteria property: our subsequent tasks may include permitting and field support during for the drilling, construction, development, production testing, and quality sampling of the new wells.

Please do not hesitate to contact us with any questions.

KG21-0629



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Timothy Becker Professional Geologist No. 9589

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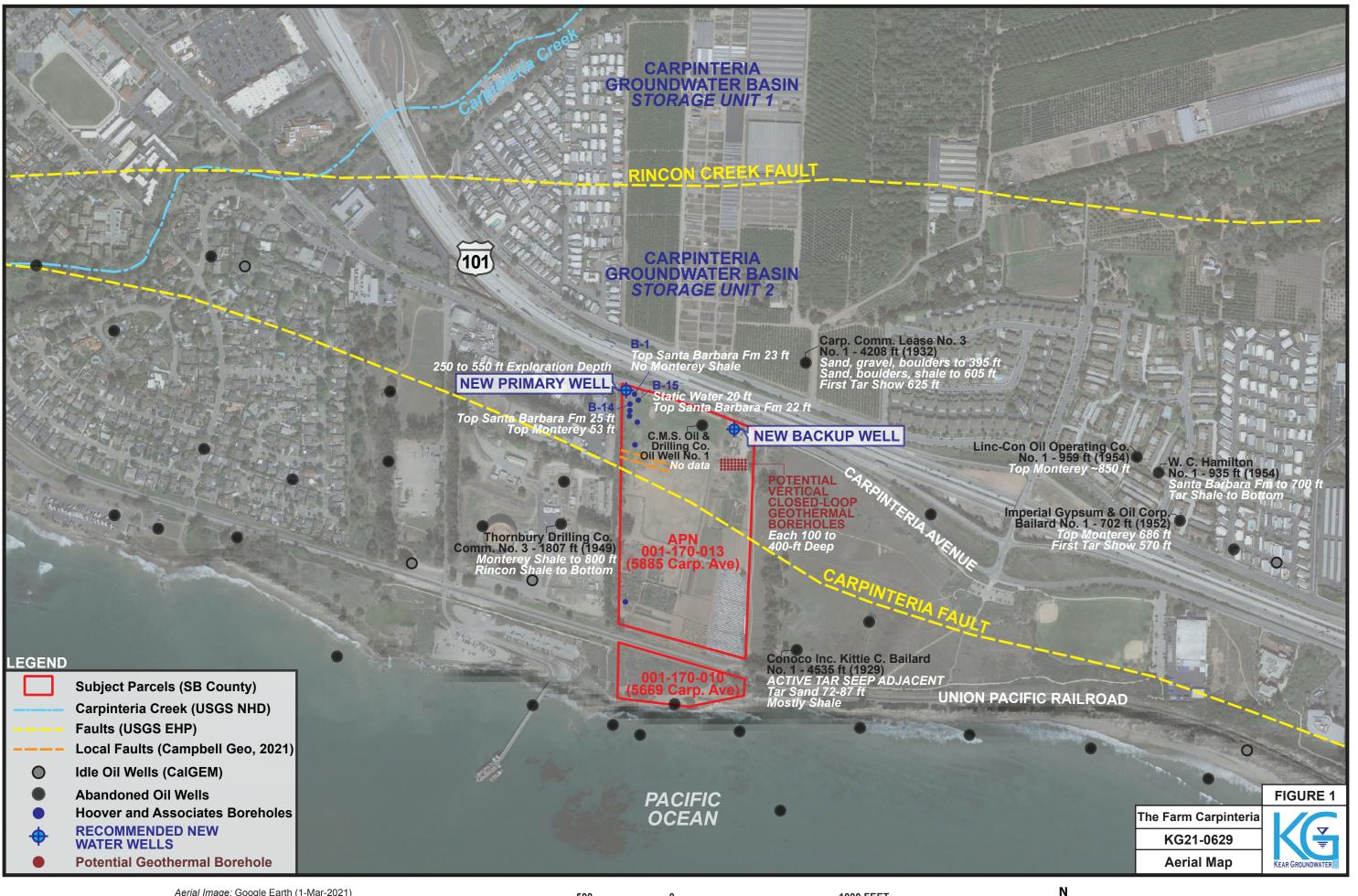
Statement of Limitations

The services described in this report were performed in a manner consistent with our agreement with the client and in accordance with generally accepted professional consulting principles and practices. Opinions and recommendations contained in this report apply to conditions existing at certain locations when services were performed and are intended only for the specific purposes, locations, time frames, and project parameters indicated. We cannot be responsible for the impact of any changes in standards, practices, or regulations after performance of services.

Hydrogeologic analyses for this report relied solely on available background data obtained from the property owner, Santa Barbara County, Carpinteria Valley Water District, the State of California, and/or published geologic reports. No independent subsurface exploration or geophysical surveying was conducted by our firm for this study. No guarantee of water quantity or quality from an attempted well, nor sustained production from an existing well, can be offered. Because the efforts to implement recommendations contained herein rely on the skill of outside contractors, our liability is limited to the dollar value of our professional efforts. Professional hydrogeologic review of water well data is imperative to implementing the recommendations of this report.

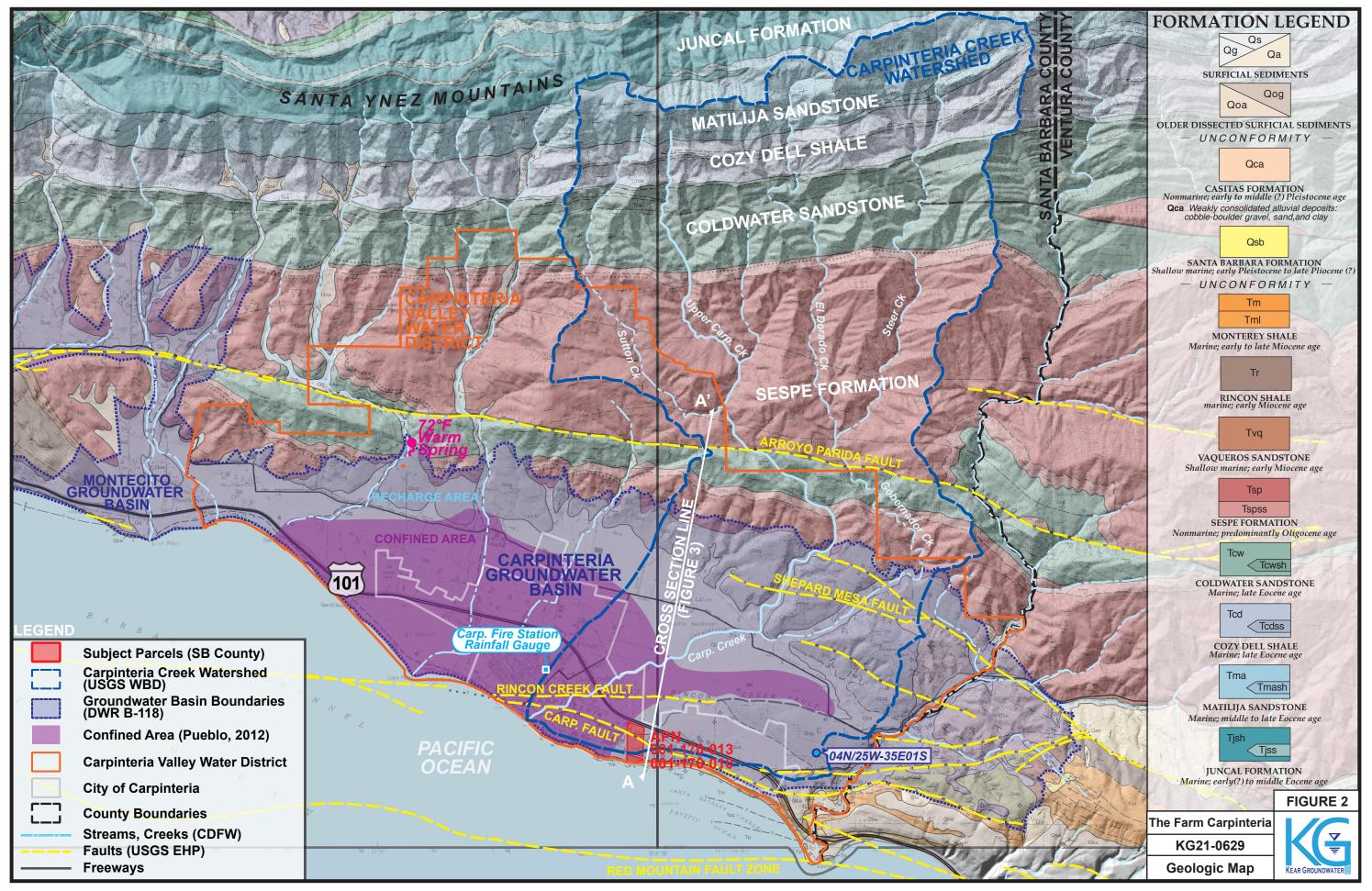
Any discussions of fault activity herein are offered as they relate to groundwater resource development only. This report does not substitute a geotechnical analysis to support earthwork or construction. Any discussions of water rights presented herein are provided for general information and do not constitute a legal opinion, for which a qualified attorney specializing in water rights should be retained.

Any use of this report by a third party is expressly prohibited without a written, specific authorization from the client. Such authorization will require a signed waiver and release agreement.



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Geologic Basemaps: Dibblee (1986, 1987) Shaded Relief: Modified from USGS NED

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