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SAN PASQUAL HYDROLOGIC SUBAREA

Geology

The San Pasqual hydrologic subarea lies entirely within the Peninsular Range Province. Crystalline rocks of the southern California batholith are exposed in or underlie the entire subarea (fig. 23).

The most extensive rocks are granodiorites which cover slightly over 50 percent of the subarea. These rocks are resistant to weathering and form prominent hills and ridgetops.

Green Valley Tonalite is exposed in approximately 30 percent of the subarea. Green Valley Tonalite is not resistant to erosion and forms deeply weathered lowlands and hilly topography, especially in the vicinity of faults. Green Valley Tonalite may weather to several hundred feet in depth, forming a material known locally as residuum, or decomposed granite (DG). These deeply weathered exposures occupy 1,550 acres, or slightly over 8 percent of the subarea.

Small exposures of gabbro and diorite and metamorphic rock occur as scattered remnants or roof pendants within the more extensive crystalline rocks of the subarea. In some instances these rocks, particularly the gabbro, are deeply weathered and resemble weathered outcrops of Green Valley Tonalite.

Quaternary alluvium stretches across the southern half of the San Pasqual hydrologic subarea. Three smaller alluvium-filled valleys join the main valley from the northwest, northeast, and south. In total, alluvium covers almost 15 percent of the subarea.

Soils

There are three major soil associations within the San Pasqual hydrologic subarea. Fallbrook-Vista and Cienba-Fallbrook soils are found in upland areas. Visalia-Tujunga soils are found in the valley floor (fig. 24).

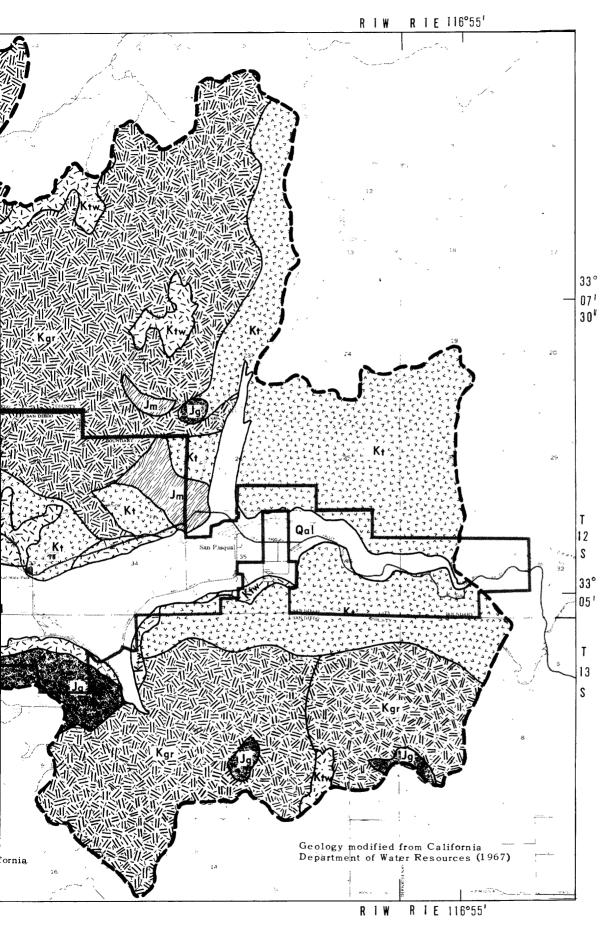
Soils of the Fallbrook-Vista association have developed along the western edge of the subarea and near San Diego Wild Animal Park. association is characterized by Fallbrook and Vista soils, between 1.5 to 4 feet thick, and shallow Cienba soils, generally less than 1.5 feet thick. Deep soils are atypical of this association and only small areas of Ramona soils, developed over weathered tonalite, attain thicknesses greater than 5 feet. Infiltration capacities are high to moderate throughout most of the Fallbrook-Vista association, ranging from 0.6 to 2.0 in/h for Fallbrook soils, to 20 in/h for Cienba soils. Ramona soils are characterized by a clay hardpan at a depth of 1.5 feet; consequently, infiltration rates for Ramona soils are poor and range between 0.2 to 0.6 in/h.

117°00' EXPLANATION QUATERNARY Allu vium (Holocene) Qal CRETACEOUS Undifferentiated grano-diorites and Leuco-Kgr granodiorites Green Valley tonalite Green Valley tonalite, deeply weathered JURASSIC Undifferentiated gabbros and diorites Hybrid and undifferentiated metamorphic rocks HYDROLOGIC SUB-AREA BOUNDARY CONTACT 339 07 T 12 05 T 13 2 MILES 3 KILOMETERS FIGURE 23.--Generalized geology of the San Pasqual Base from county map, San Diego, Cal hydrologic subarea.

R 2 W

R 1 W

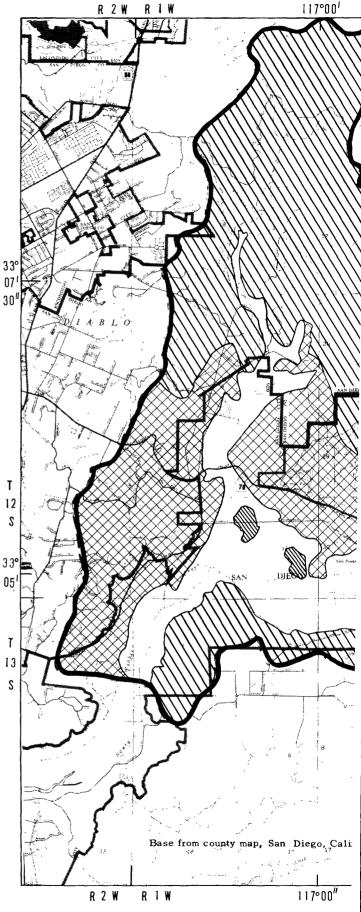
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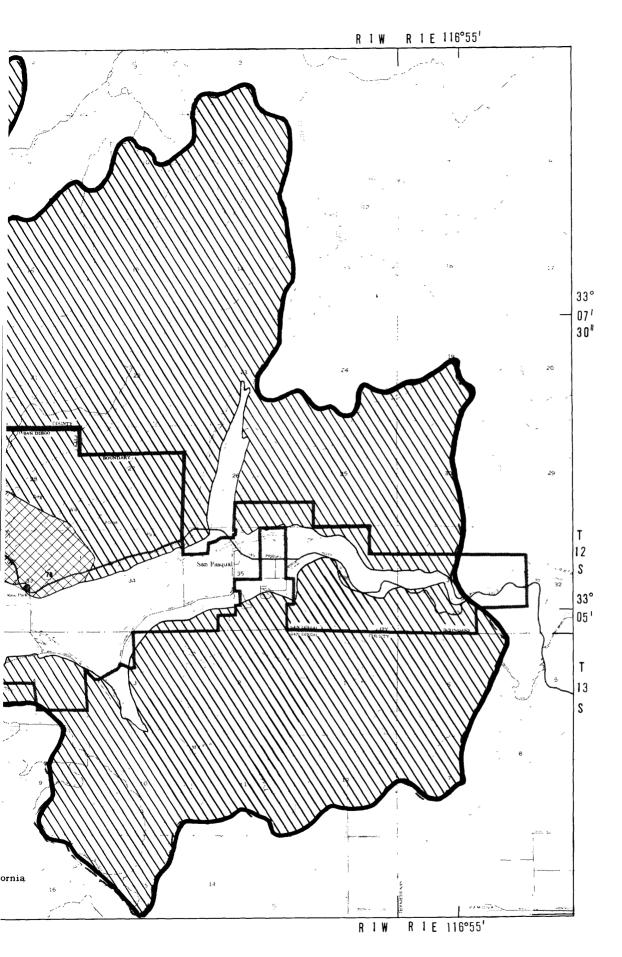


San Pasqual Hydrologic Subarea 75

EXPLANATION CIENBA-FALLBROOK-Thin steep soils with high infiltration rates FALLBROOK - VISTA -- Variable thicknesses, steep to sloping soils with generally high to moderate infiltration rates, the underlying geology may not be able to accept and transmit large quantities of water VISALIA-TUJUNGA--Thick soils with high infiltration rates, may have a seasonal high water table RAMONA SOILS WITHIN THE VISALIA-TUJUNGA SOIL ASSOCIATION HYDROLOCIC SUBAREA BOUNDARY CONTACT 2 MILES 3 KILOMETERS

FIGURE 24.—Soil association in the San Pasqual hydrologic subarea. Modified from U. S. Soil Conservation Service (1973).





The Cienba-Fallbrook association has many of the same soils as the Fallbrook-Vista association, but in different proportions. Shallow Cienba soils developed over granodiorite dominate this association. However, small areas of Fallbrook and Vista soils have developed over exposures of tonalite and gabbro.

Limitations on applying reclaimed water to upland soils are soil thickness and the ability of the underlying soil profile and geology to accept, filter, and transmit water. Presently, many agricultural areas in the uplands are able to transmit irrigation return water from hillside avocado groves only through shallow circulation and subsurface discharge to springs. If this were reclaimed water, there could be health hazards associated with viruses not killed by wastewater treatment processes or removed by limited soil contact. Proper choice of application sites, methods, rates, and amounts should minimize shallow circulation and surface discharge of reclaimed water, thus minimizing health concerns associated with reclaimed water use on upland soils.

Soils of the Visalia-Tujunga association have developed over the alluvium. All soils within this association are greater than 5 feet thick. In general, infiltration capacities are high and range from 2.0 to 6.3 in/h for Visalia soils, to greater than 20 in/h for Tujunga soils. Small areas of Ramona soils are also present in the Visalia-Tujunga association, particularly where alluvial fill is thin. The primary limitation on application of reclaimed water to soils of the Visalia-Tujunga association is a high water table, within several feet of land surface much of the year.

Surface Water

Streamflow Characteristics

Streamflow data are summarized in table 7, and the locations of stream gages are shown in figure 25. Streamflow into the San Pasqual hydrologic subarea is from Santa Ysabel, Guejito, Santa Maria, and Cloverdale Creeks. A small amount of streamflow originates as springs in uplands of the hydrologic subarea. All surface-water flow leaves the hydrologic subarea through the San Dieguito River at San Pasqual Narrows.

Santa Ysabel Creek is the largest stream, draining 128 mi² of largely undeveloped land above the San Pasqual hydrologic subarea. Large parts of its watershed are within Cleveland National Forest and several Indian reservations. Streamflow in Santa Ysabel Creek has been regulated since July 1954 by Sutherland Reservoir, which has a capacity of 29,680 acre-ft, and may further be controlled by the proposed Palmo Dam, which will have a capacity of 30,000 acre-ft and an average annual yield of 8,500 acre-ft.

Station name	USGS No.	Period of record	Drainage area (mi ²)	average	lischarge median re-ft)	Median number of days with flow greater than 0.1 ft ³ /s	f	of record
						, , , , , , , , , , , , , , , , , , ,		
Santa Ysabel Creek near Ramona ¹	11025500	02-1912 to 02-192 10-1943 to 09-198		14,900	3,912	180	28,400	149,000
Santa Ysabel Creek near San Pasqual ¹	11026000	12-1905 to 09-191 03-1911 to 09-191 ² 04-1947 to 11-195 04-1956 to 03-198	2 5	5,000	507	102	12,500	29,700
Guejito Creek near San Pasqual	11027000	12-1946 to 09-198	1 22	2,110	290	148	3,940	23,900
Santa Maria Creek near Ramona	11028500	11-1912 to 09-192 10-1946 to 09-198		4,050	145	53	15,200	43,500
San Dieguito River near San Pasqual ¹	11029000	² 04-1947 to 04-195 05-1956 to 09-196		³ 1,610	0	0	³ 3,600	³ 14,500

¹Flow in stream has been regulated since July 1954 by Sutherland Reservoir which has a capacity of 29,680 acre-ft. There are additional small diversions above the station.

²Records compiled for irrigation season only.

³Based on one flow event in 1958.

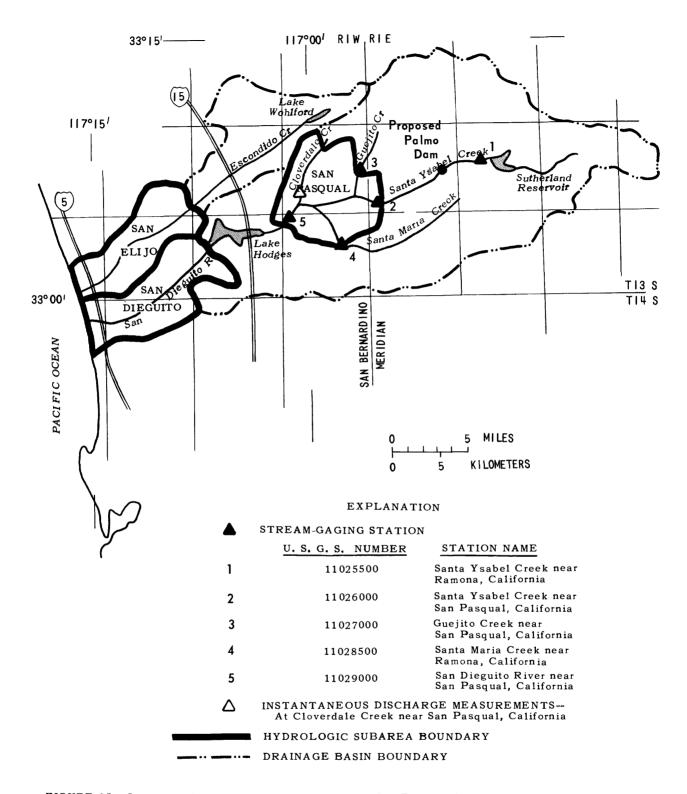


FIGURE 25.-- Location of stream-gaging stations in the San Pasqual hydrologic subarea.

Santa Ysabel Creek near San Pasqual typically flows 102 days during the year and median annual discharge is 510 acre-ft. Maximum annual flow in Santa Ysabel Creek was 29,700 acre-ft in 1979. Data for Santa Ysabel Creek near Ramona (table 7) indicate Santa Ysabel Creek may actually flow for a much longer period each year, and may discharge as much as 3,900 acre-ft of water annually. However, these data reflect natural flow regime before completion of Sutherland Dam, and a generally wetter period of record.

With respect to median annual discharge, Guejito Creek is the second largest stream in the hydrologic subarea. Guejito Creek near San Pasqual drains a largely undeveloped watershed of 22 mi², with flow unregulated except for several small diversions. This stream flows about 148 days each year (median value) and has a median annual discharge of 290 acre-ft. Maximum annual flow from Guejito Creek was 23,900 acre-ft in 1978, almost as much as the maximum annual flow from Santa Ysabel Creek.

Santa Maria Creek drains a largely agricultural watershed of 58 mi². Streamflow is unregulated except for several small diversions. Although the drainage area is much larger than that of Guejito Creek, flows in Santa Maria Creek are dampened by another ground-water basin farther upstream. Santa Maria Creek near Ramona flows about 53 days each year (median value) and in many years it does not flow at all. Median annual flow from Santa Maria Creek is 145 acre-ft and the maximum annual flow was 43,500 acre-ft in 1916.

Cloverdale Creek drains an 18 mi² agricultural watershed. Streamflow is unregulated and ungaged. Irrigation return water from hillside avocado groves has turned Cloverdale Creek into a perennial stream. Instantaneous discharge measured on November 24, 1981, and March 25, 1982, was 2.0 and 3.6 ft³/s, respectively. This water was primarily irrigation return water, and will be discussed in the section on recharge.

Median annual surface-water flow into the hydrologic subarea, excluding Cloverdale Creek, is about 940 acre-ft. In a typical year, no surface-water flow leaves the subarea. In wet years and during floods, enough surface water is available to provide flow in the San Dieguito River at San Pasqual Narrows. Because the period of record includes years 1946-77, the driest period in the last 400 years (Larry Michaels, San Diego County Water Authority, written commun., 1982), estimates of streamflow characteristics may be low.

Surface-Water Quality

Historical water-quality data for Santa Ysabel Creek below Sutherland Dam from 1956-81 are summarized in table 8. No discharge data are available to determine the relation between water quality and discharge, and to separate baseflow from stormflow. However, minimum concentrations given in table 8 probably reflect quality of stormflow, and maximum concentrations probably reflect quality of baseflow. Throughout the period of record, water in Santa Ysabel Creek has been a mixed type, dominated by bicarbonate on the anionic side; relative concentrations of dissolved species have remained constant. Historical water-quality data are not available for Guejito, Santa Maria, or Cloverdale Creeks.

Surface-water-quality data for the San Pasqual hydrologic subarea were collected in 1981-82. Two samples were collected from Santa Maria, Guejito, and Cloverdale Creeks, one in autumn to reflect baseflow, and another during the recessional flow of a late spring storm. Only one sample was collected from Santa Maria Creek, as there was no flow in autumn 1981. Dissolved-solids concentrations were lowest in Santa Ysabel and Guejito Creeks, 321 and 366 mg/L, respectively, and were highest in Cloverdale Creek, 1,040 mg/L. Santa Maria Creek had an intermediate dissolved-solids concentration of 734 mg/L. Water was a mixed type in all streams. However, water from Cloverdale and Santa Maria Creeks was dominated by sodium chloride and bore a strong resemblance to imported water. Water from Santa Ysabel and Guejito Creeks was well mixed on the cationic side, but dominated by bicarbonate on the anionic side. No stream seems to contribute large amounts of sulfate to the hydrologic subarea. Water-quality analyses are listed in appendix A.

TABLE 8.--Summary of water-quality data for Santa Ysabel Creek

below Sutherland Dam, 1956-81

[<, less than; --, no data]

	Number of observations	Minimum	Median	Maximum
Instantaneous				
dischargeft ³ /s	0			
Specific conductance				
μmho/cm at 25°C	41	260	480	642
pH	40	7.0	8.4	10
Dissolved solidsmg/L	39	180	306	406
Sodiummg/L	41	17	38	160
Calciummg/L	41	22	32	100
Magnesiummg/L	41	5	15	31
Chloridemg/L	41	19	49	140
Sulfatemg/L	41	5	36	360
Alkalinity as CaCO ₃ mg/L	36	85	130	157
Boronμg/L	10	<10	90	220

Ground Water

Crystalline Rocks

Granodiorite and much of the Green Valley Tonalite are weathered to only a shallow depth, but may have fractures which can yield small quantities of water to wells. In the San Pasqual area, well yields from fractured crystalline rocks are as high as 15 gal/min, but typically less than 2 gal/min. Specific capacities for wells in fractured crystalline rocks of the San Pasqual subarea are less than 0.04 (gal/min)/ft of drawdown.

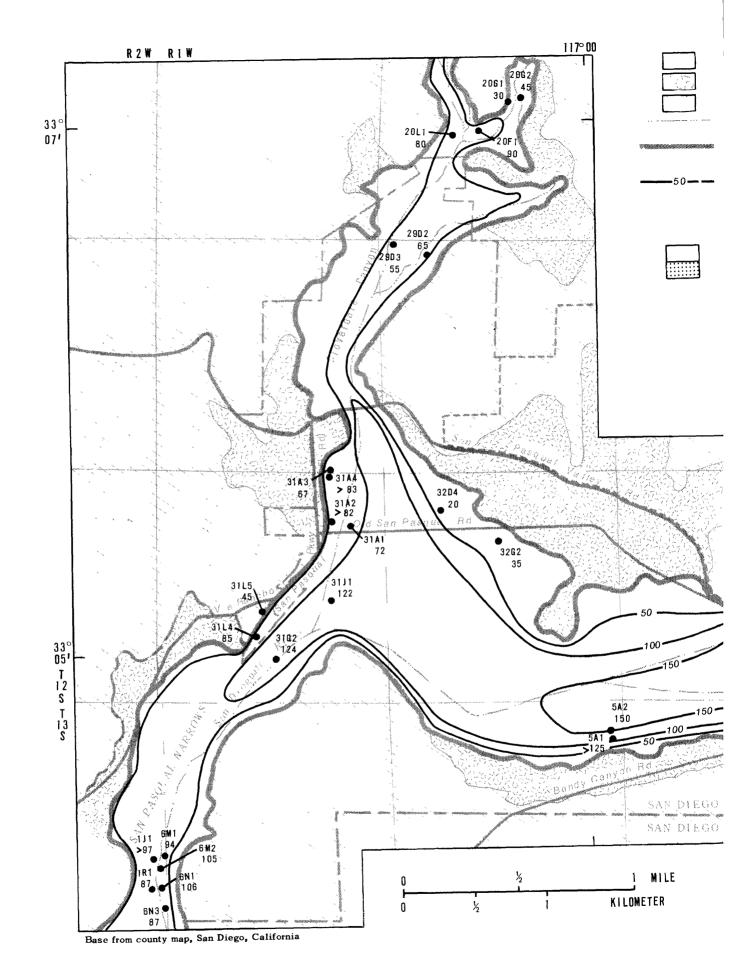
Residual Aquifer

Deeply weathered exposures of Green Valley Tonalite form the residual aquifer. Water-yielding characteristics are summarized in table 9. In the San Pasqual subarea, well yields are as high as 600 gal/min and the median yield is 40 gal/min. Specific capacities for wells in weathered tonalite are as high as 0.7 (gal/min)/ft of drawdown with a median value of 0.4 (gal/min)/ft of drawdown. In addition to surface exposures, drillers' logs reveal considerable weathered tonalite buried beneath alluvial fill. If this material is accounted for and the average depth of weathered material is assumed to be 100 feet, by using an average specific yield of 0.01 (Ramsahoye and Lang, 1961) the total storage in the residual aquifer is estimated to be less than 5,000 acre-ft.

Water generally moves from the residual aquifer downgradient into the alluvial fill. Movement between the two is accelerated during periods of low ground-water levels in the alluvium. Although the residual aquifer contains only a small quantity of water, it may be locally important during such times.

Alluvial Aquifer

Alluvial fill covers 3,410 acres or almost 15 percent of the San Pasqual subarea. Alluvial thickness exceeds 120 feet in San Pasqual Narrows and increases to over 200 feet in the upper part of the basin (fig. 26). The alluvial aquifer contains 364,000 acre-ft of fill. Drillers' logs and specific-capacity data indicate alluvial fill in the San Pasqual subarea has better water-yielding characteristics than the San Dieguito subarea farther downstream, therefore an average specific yield of 0.16 was used to estimate storage. Total ground-water storage in the alluvial aquifer is approximately 58,000 acre-ft. The alluvial fill is a water-table aquifer and ground water is not confined.



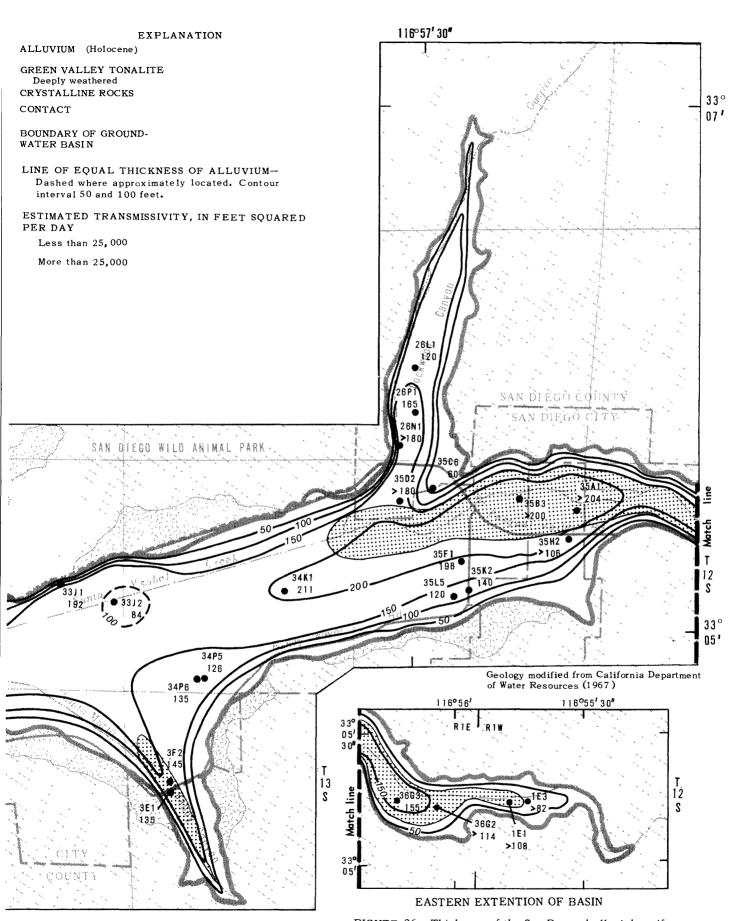


FIGURE 26.-Thickness of the San Pasqual alluvial aquifer.

TABLE 9.--Water-yielding characteristics of aquifers

[Data from drillers' information.

Geologic unit	Map symbol	Exposure in subarea (acres)	Maximum thickness (feet)	Description
Alluvium	Qa1	3,410	>200	River and stream deposits of gravel, sand, silt, and clay.
Crystalline rocks of the southern California batholith	Kgr, Kt, Jm	·	Basement complex	Primarily unweathered granodiorite and tonalite.
Deeply weathered exposures of Green Valley Tonalite	l Kt ₁	1,550	Plus or minus 100, variable	Deeply weathered Green Valley Tonalite, frequently covered by a thin layer of alluvium.

Wells in the alluvium yield as much as 1,600 gal/min. Although highest yields are in the upper part of the basin, wells yielding almost 1,000 gal/min are found throughout the main canyon and Rockwood and Bandy Canyons.

Well logs show a mixture of clean sand, gravel, and silt throughout the alluvium. In general, well logs indicate a greater percentage of clean sand and gravel in the upper basin and a greater percentage of silt in the lower basin and San Pasqual Narrows (Kohler and Miller, 1982).

Specific-capacity data reflect generalized distribution of sand, gravel, and silt within the aquifer. Several wells, most located in a line along the northern edge of the upper basin from the mouth of Rockwood Canyon east to the inflow of Santa Ysabel Creek, have specific capacities

>, greater than; --, no data]

	Water-yielding	characteristics Specific	
General	Well yield (gal/min)	capacity ((gal/min)/ft of drawdown)	Transmissivity (ft ² /d)
Yields water freely to wells.	As much as 1,600.	Typically 16, but may exceed 100.	Typically 4,000, but may exceed 25,000.
Yields small quantities of water to wells from fractures.	Less than 2, but may be as much as	Less than 0.1.	
Yields water to wells from weathered granite matrix and fractures.	Typically les than 40, bu may be as much as 600	as much as 0.7.	

greater than 100 (gal/min)/ft of drawdown. One well in Bandy Canyon also has a specific capacity greater than 100 (gal/min)/ft of drawdown. Specific-capacity data from wells in the remainder of the aquifer average 16 (gal/min)/ft of drawdown with a maximum of 75 (gal/min)/ft.

Estimates of transmissivity can be obtained by multiplying specific capacity by 250. This value is based on statistical correlations done by Thomasson and others (1960) in California's Central Valley, and has been routinely extended to California's coastal and desert basins. Using this method, aquifer transmissivities along the northern edge of the upper San Pasqual basin and Bandy Canyon exceed 25,000 ft²/d (fig. 26). In the remainder of the alluvium, transmissivities are less than 20,000 ft 2 /d and average 4,000 ft 2 /d.

Recharge. -- Recharge to the alluvial aguifer originates primarily outside the hydrologic subarea as flow in Santa Ysabel, Guejito, and Santa Maria Creeks. In a typical year no flow leaves the subarea and all surface water becomes ground-water recharge, about 940 acre-ft/yr. During wet years flow may be great enough to fill the alluvial aquifer, with the excess leaving the subarea as flow in the San Dieguito River. Additional recharge is provided by water imported to the subarea for agricultural use. Streamflow originating inside the subarea, leakage from the surrounding residual aquifer, and precipitation contribute small amounts of recharge that may be locally important.

Imported water use in the San Pasqual subarea has grown in recent years. In 1970, 2.140 acre-ft of water was imported to the subarea and in 1980, 3,560 acre-ft of imported water was used. Currently, imported water is used primarily in San Diego Wild Animal Park and hillside avocado groves west of Cloverdale Canyon.

Based on calculations by the California Department of Water Resouces (California Department of Water Resources, 1983), 710 acre-ft of imported water used for irrigation was available for deep percolation and recharge to the alluvial aquifer in 1970. By 1980 this figure increased to 1,160 acre-ft. This was sufficient to turn Cloverdale Creek into a perennial stream in 1977 and to maintain water levels in Cloverdale Canyon near land surface. At that time, water levels throughout the remainder of the alluvial aquifer were generally greater than 40 feet, and occasionally as deep as 85 feet below land surface.

Occurrence and movement. -- Movement of ground water is from the major source of recharge at the inflow of Santa Ysabel Creek and from smaller recharge areas in Rockwood, Bandy, and Cloverdale Canyons, downgradient to the discharge area in San Pasqual Narrows. With the exception of evapotranspiration losses, all water entering the alluvial aquifer exits through San Pasqual Narrows.

In the early 1900's before the beginning of extensive ground-water development, water levels were very near land surface throughout much of the alluvial aquifer (fig. 27 and 28). Water levels remained high throughout the 1930's, and declined only gradually during the 1940's and 1950's. Rate of water-level decline increased in the early 1960's and historically low water levels occurred in 1965 and 1977.

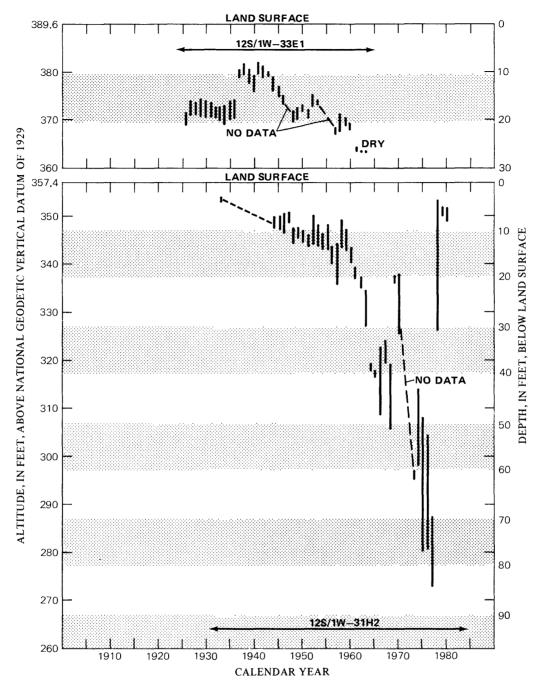


FIGURE 27. — Hydrographs for wells in the lower part of the San Pasqual basin. Vertical bar indicates range of water—level fluctuation during year. (Location of wells shown in appendix C.).

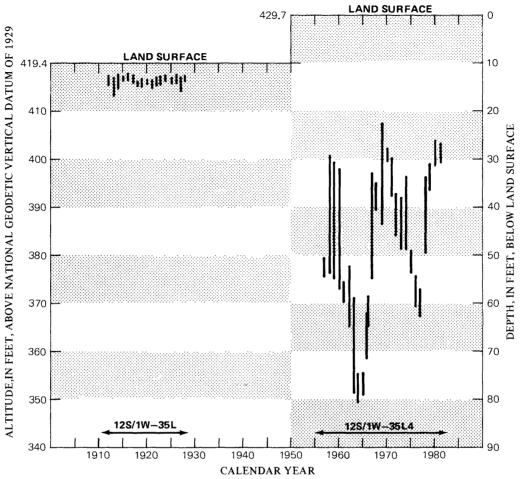


FIGURE 28. — Hydrographs for wells in the upper part of the San Pasqual basin. Vertical bar indicates range of water—level fluctuation during year. (Location of wells shown in appendix C.).

Figure 29 is a water-level-contour map for spring 1977. At that time, water levels in the San Pasqual alluvium were the lowest ever recorded prior to the beginning of an irrigation season. The hydraulic gradient through San Pasqual Narrows was reversed, and ground water was moving into the basin from outside the hydrologic subarea. The only discharge from the San Pasqual subarea was through evapotranspiration of agricultural crops. Depth to water was greater than 40 feet throughout most of the alluvium and exceeded 80 feet in some places. This represented a reduction in storage of 23,800 acre-ft. Storage remaining in the basin was 34,200 acre-ft, or 60 percent capacity.

Water levels rose rapidly in 1978 in response to a wet year. The alluvial aquifer filled, and ground-water movement returned to normal.

Figure 30 is a spring 1982 water-level-contour map. Ground-water movement was again downgradient from major sources of recharge at Santa Ysabel Creek, Rockwood Canyon, and Bandy Canyon to the discharge area in San Pasqual Narrows. A new source of recharge was irrigation return from avocado groves along the western edge of the lower basin and Cloverdale Canyon. Irrigation return moves from hillsides through the residual aquifer, surfacing as springs in many places, eventually entering the alluvial aquifer. In only a small part of the alluvium were depths to water greater than 10 feet, and nowhere was depth to water greater than 30 feet (fig. 30). The aquifer was full in spring 1982.

Ground-Water Quality

Crystalline Rocks

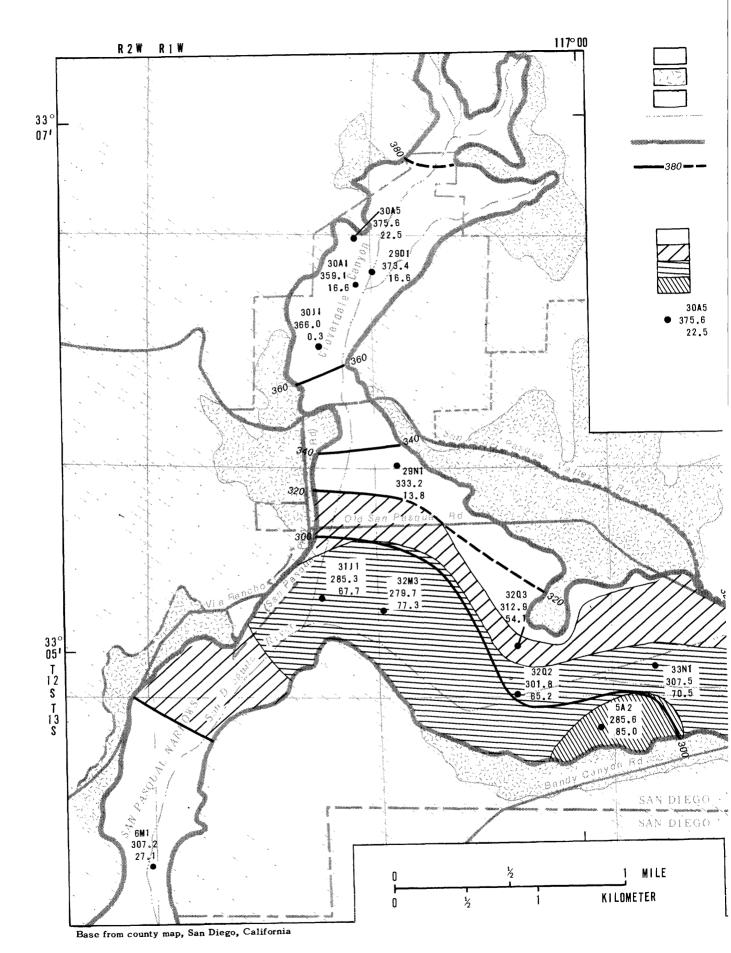
Water from wells in fractured crystalline rocks in San Diego County has a median dissolved-solids concentration less than 500 mg/L (California Department of Water Resources, 1967). However, because wells in this material yield water from fractures which have little ability to adsorb or filter pollutants, quality of the water is easily degraded. Little information is available on current water-quality problems in crystalline areas of the San Pasqual hydrologic subarea.

Residual Aquifer

Prior to 1967, water from weathered granite aquifers in San Diego County had a median dissolved-solids concentration between 500 and 600 mg/L (California Department of Water Resources, 1967). In the San Pasqual subarea, dissolved-solids concentrations in 1981 and 1982, estimated from specific conductance, were as high as 1,430 mg/L, with a median concentration of 1,040 mg/L. In the residual aquifer dissolved solids (as reflected by specific conductance) tend to be higher downgradient from agricultural land.

Dissolved-solids concentrations in water from the residual aquifer are on the average somewhat lower than dissolved-solids concentrations in water from the alluvium in Cloverdale Canyon and the lower part of the basin. Several wells in shallow alluvial fill (12S/1W-20M1 and 12S/1W-30A5) which were completed in the residual aquifer yield water lower in dissolved solids than nearby wells completed only in the surrounding alluvium (fig. 33). When ground-water levels are low in Cloverdale Canyon and the lower basin, the residual aquifer contributes water with a lower average dissolved-solids concentration to the alluvial aquifer, and may actually improve water quality (with respect to dissolvedsolids concentration) in some wells.

Water in some areas of the residual aquifer has elevated concentrations of nitrate that could move into the alluvium when ground-water levels are low, particularly in the vicinity of San Diego Wild Animal Park.



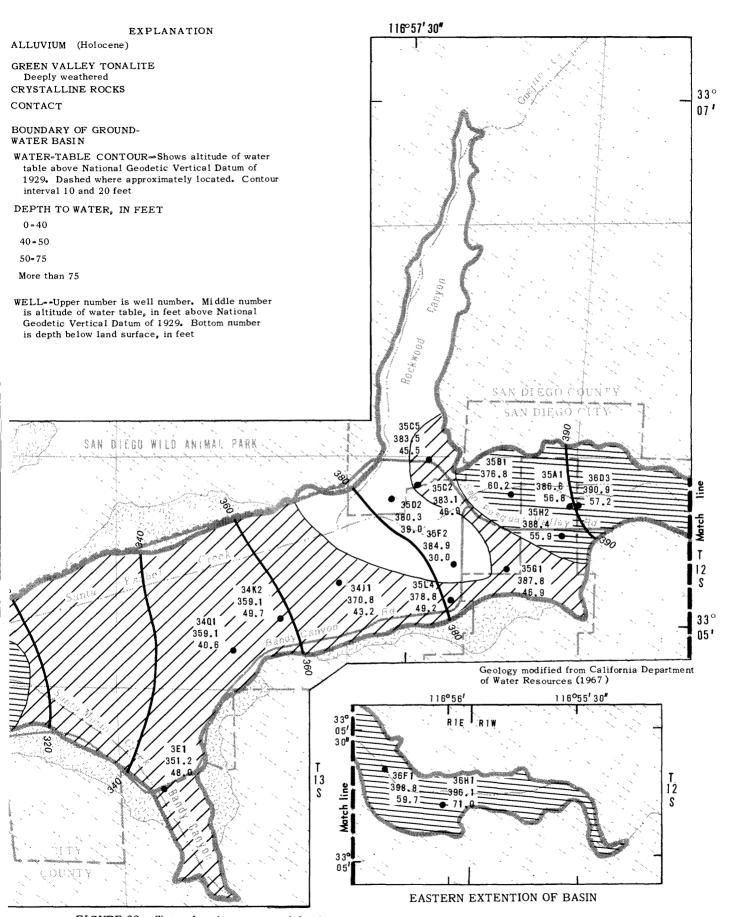
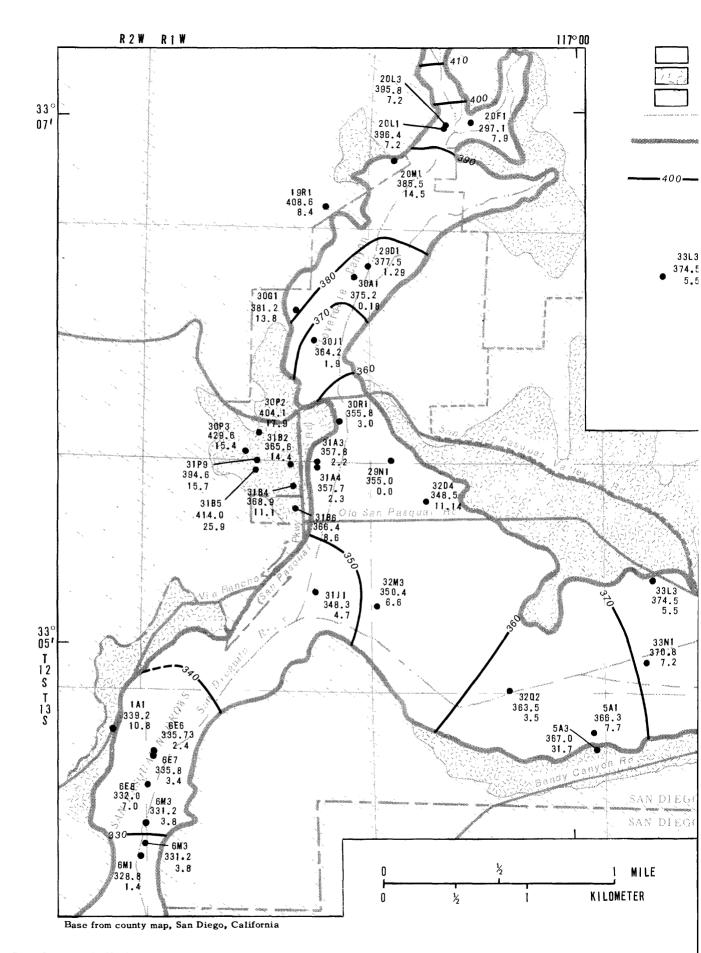


FIGURE 29.-Water-level contours and depth to water in the San Pasqual alluvial aquifer, spring 1977.



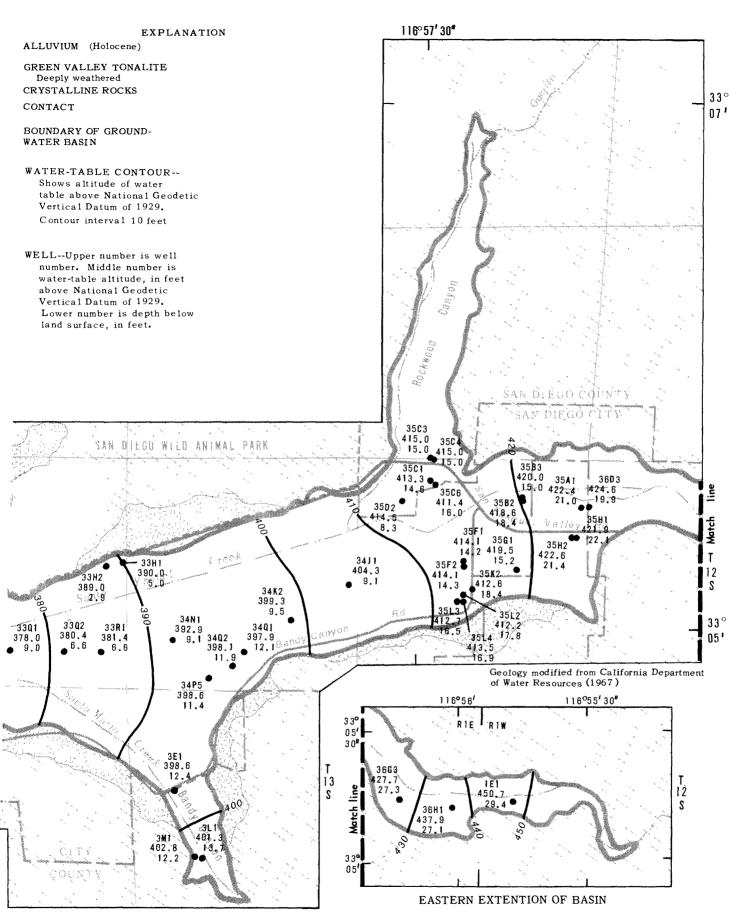


FIGURE 30.-- Water-level contours and depth to water in the San Pasqual alluvial aquifer, spring 1982.

Alluvial Aquifer

Historical water quality.--Figure 31 is a ground-water-quality map of the alluvial aquifer in spring 1957, prior to the increased water-level declines of the 1960's. At that time, only one of the sampled wells (12S/1W-30R1) yielded water with dissolved-solids concentrations greater than 1,000 mg/L. Dissolved-solids concentrations from highly transmissive areas in the upper basin were less than 500 mg/L.

During spring 1957, ground water in the alluvium was generally a mixed type. Calcium and sodium were the predominant cations. Calcium predominanted in the highly transmissive areas of the upper basin and sodium predominanted downgradient. Bicarbonate was the predominant anion and sulfate was of minor importance throughout the aquifer.

Water from upper reaches of Cloverdale Canyon was a sodium chloride bicarbonate type. Sodium and chloride increased as water moved downgradient through Cloverdale Canyon, becoming a sodium chloride type as it left the canyon to enter the main body of the aquifer.

By the time ground water left the subarea at San Pasqual Narrows, dissolved solids increased but did not exceed 1,000 mg/L. The percentage of sulfate also increased and ground water was again a mixed type.

Historically, nitrate has been a problem in the alluvial aquifer. Figure 32 shows wells which have yielded water with nitrate concentrations greater than EPA drinking water limits of 10 mg/L as N. Most of the wells are located in the upper part of the basin and may be associated with dairy and poultry operations in that area.

Present water quality.--Present water quality in the alluvium is variable (fig. 33). Lowest dissolved-solids concentrations are found in highly transmissive parts of the upper basin and Rockwood Canyon. Ground water from these areas generally has less than 500 mg/L dissolved solids. Downgradient from highly transmissive parts of the upper basin dissolved-solids concentrations increase, but generally remain below the basin objective of 1,000 mg/L. Dissolved-solids concentrations in water in the lower basin and San Pasqual Narrows are generally above 1,000 mg/L and are as high as 1,550 mg/L. Dissolved-solids concentrations in Cloverdale Canyon and in parts of the upper basin also exceed 1,000 mg/L. Increasing dissolved-solids concentrations in these areas may be related to land use. Irrigation return water appears to contribute to high concentrations of dissolved solids in ground water from Cloverdale Canyon.

Field measurements of specific conductance were converted to dissolved-solids concentration using the following relation:

DS=0.7SC-40,

where

DS is dissolved-solids concentration, in milligrams per liter; and SC is specific conductance, in micromhos per centimeter at 25°C.

This relation was developed using linear regression on data collected by the U.S. Geological Survey and the city of San Diego between autumn 1981 and spring 1982. Twenty-three samples with dissolved-solids concentrations ranging from 414 to 2,480 mg/L were used and an R² of 0.96 was obtained. This relation is basin specific and care should be used when extrapolating to other areas.

Chloride and sulfate exceed the EPA suggested limit for drinking water of 250 mg/L in ground water from San Pasqual Narrows and Cloverdale Canyon.

Ground water in highly transmissive areas of the alluvial aquifer is a mixed type and resembles recharge water from Santa Ysabel and Guejito Creeks. Cations are well mixed and the percent difference between calcium, sodium, and magnesium is only a few milliequivalents. Bicarbonate and chloride are the dominant anions in the upper basin. Sulfate is relatively unimportant in ground water from highly transmissive areas of the upper basin. Downgradient, the relative importance of sulfate increases. This is probably due to agricultural water use. soil amendments (particularly calcium sulfate, used when irrigating with water high in sodium), and irrigation return water. Increasing importance of sulfate does not seem to be related to recharge water from Santa Maria Creek.

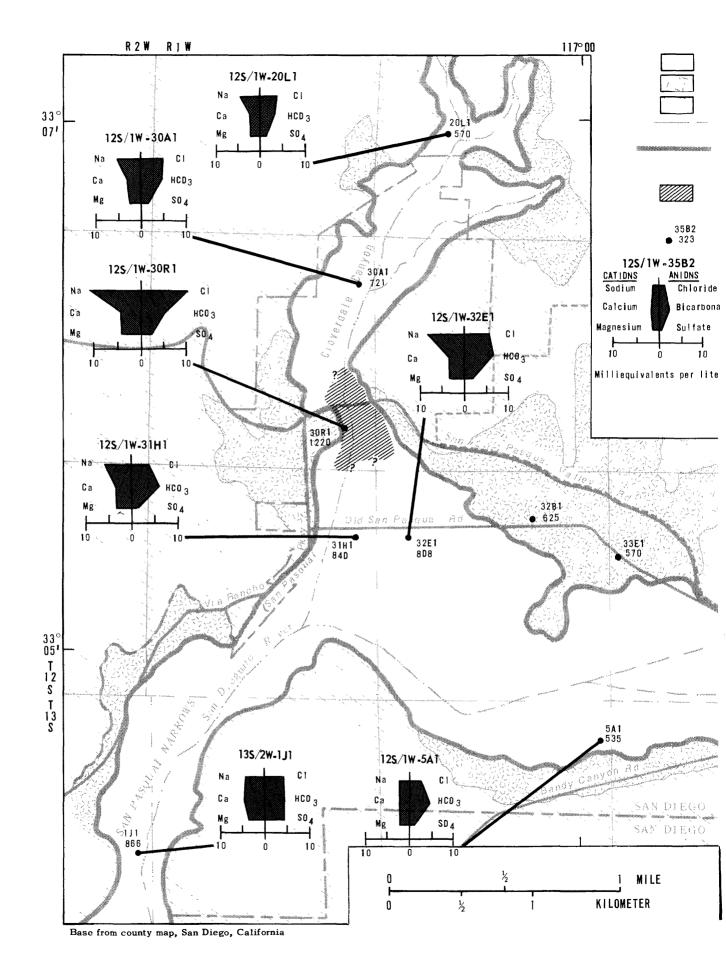
When ground water leaves the subarea at San Pasqual Narrows, it is different from its original composition. Ground water in the Narrows is a sodium chloride sulfate type and reflects agricultural water use in the San Pasqual subarea, and mixing of native water with irrigation return water imported from the Colorado River and northern California.

In 1981 and 1982, only two wells for which chemical analyses were available (12S/1W-34K2 and 12S/1W-35H2) yielded water with nitrate concentrations greater than the EPA recommended limit for drinking water of 10 mg/L nitrate as nitrogen (45 mg/L nitrate as nitrate). Both wells are in the upper part of the basin where dissolved-solids concentrations are below 1,000 mg/L. High nitrate levels in these wells indicate there is still a nitrate problem in the alluvial aquifer, particularly the upper basin, despite the recent filling of the aquifer after floods in 1978.

Impact of Reclaimed Water Use

The impact of reclaimed water use in the San Pasqual hydrologic subarea will depend greatly upon the reclaimed-water management scheme ultimately used. To be properly evaluated, the impact of reclaimed water use should be compared to and contrasted with possible future trends in water quantity and quality for the San Pasqual hydrologic subarea.

If reclaimed water is not used, the amount of ground water in storage in the alluvial aquifer will follow historic patterns of filling and subsequent depletion that are closely associated with long-term trends in precipitation (fig. 27 and 28). During prolonged dry spells, such as occurred prior to 1966 and 1978, ground-water levels will decline and many wells will go dry. The value of the ground-water resource will be greatly diminished when needed most.



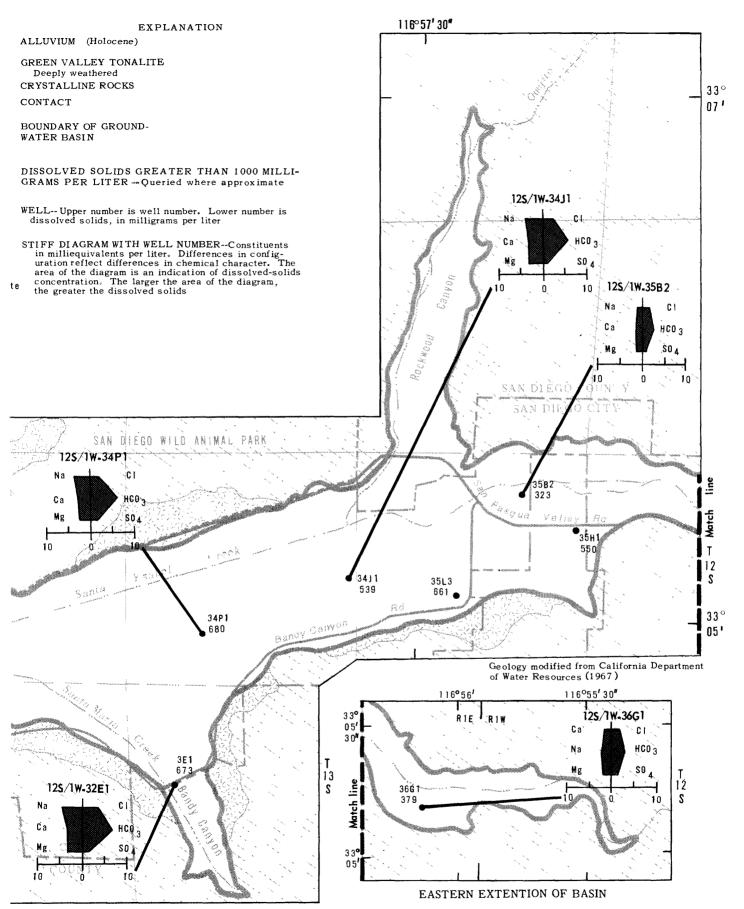
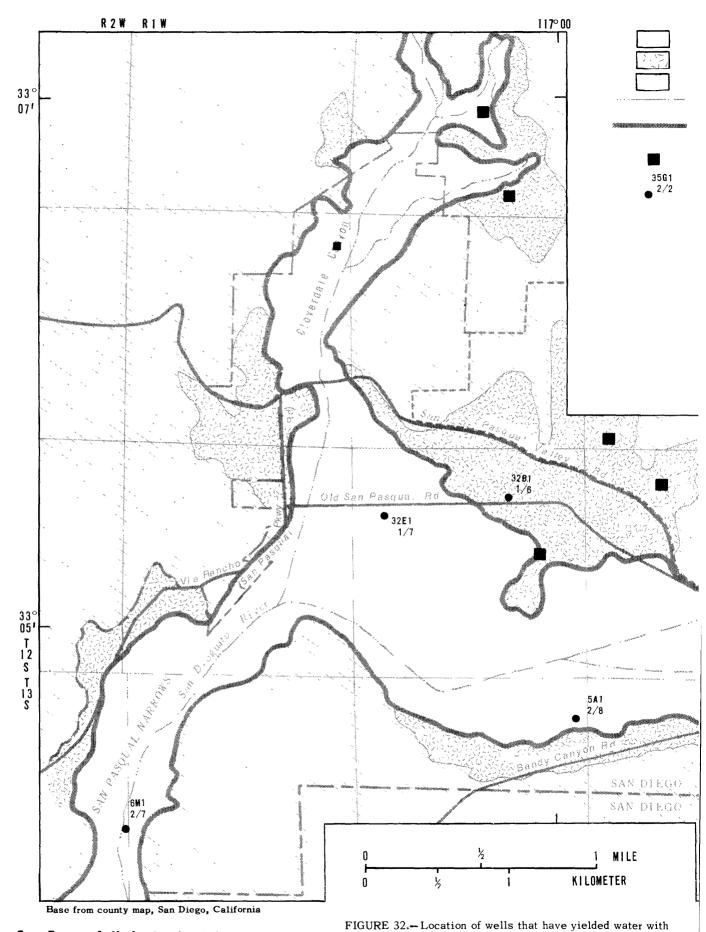
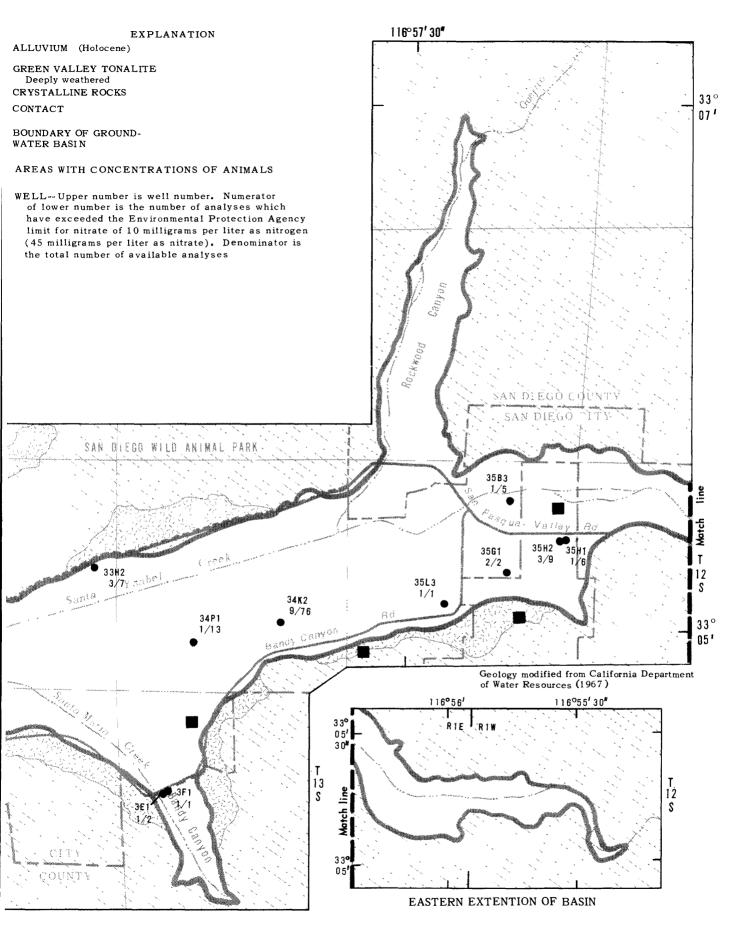
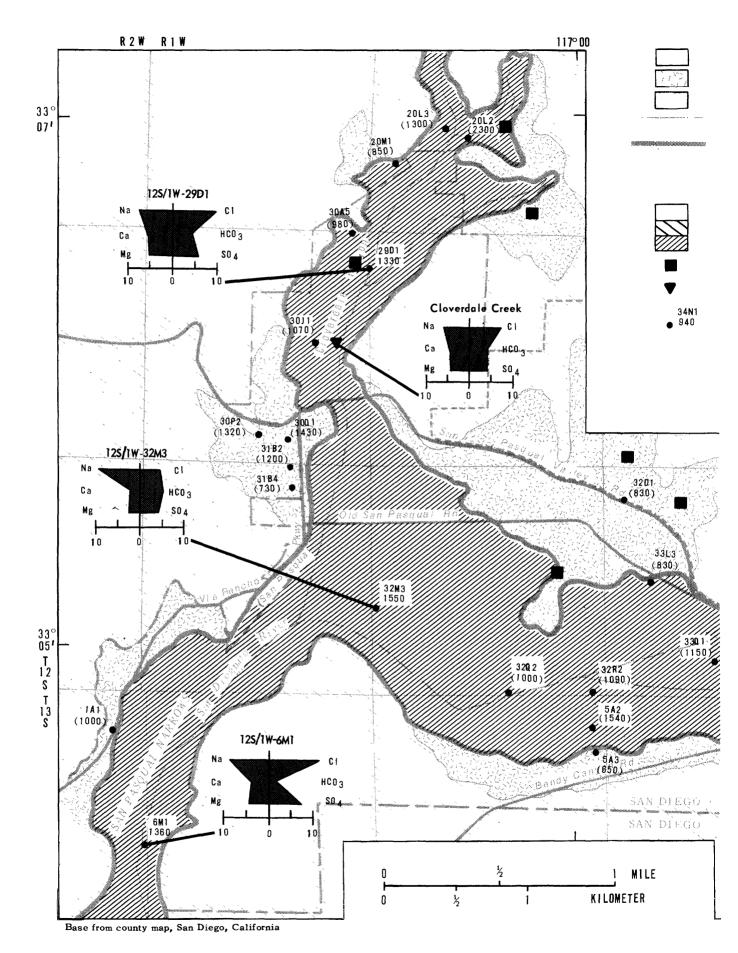


FIGURE 31.-- Water quality in the San Pasqual alluvial aquifer, spring 1957.





high concentrations of nitrate, San Pasqual alluvial aquifer, 1950-81.



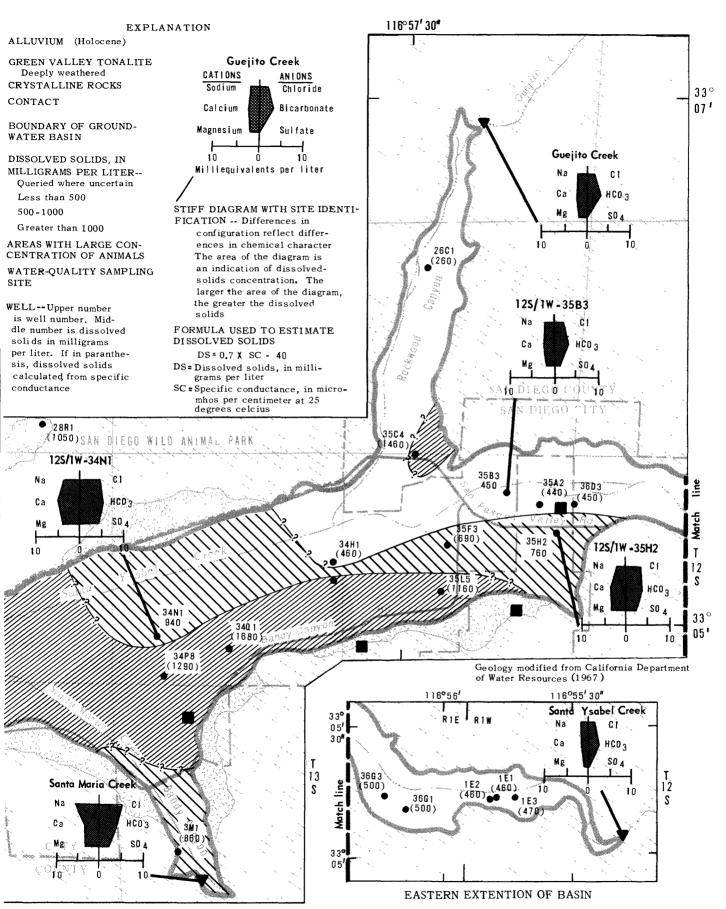


FIGURE 33. - Water quality in the San Pasqual alluvial aquifer, spring 1982.

The quality of the water in the alluvial aquifer has deteriorated since 1957. Changes in ground-water quality are evident when comparing ground-water-quality maps for 1957 and 1982 (fig. 31 and 33). During this period, dissolved-solids concentrations increased in much of the aquifer and now exceed the basin objective of 1,000 mg/L. Sulfate and chloride concentrations also increased and now exceed the EPA suggested limit of 250 mg/L for public water supplies by the time ground water leaves the subarea at San Pasqual Narrows. Ground-water types in Cloverdale Canyon and the lower part of the basin have changed and now resemble irrigation return water that comprises a significant part of the recharge. Water quality in the alluvium will probably continue to deteriorate through agricultural water use.

Changes in agricultural practices may further degrade ground-water quality. Currently, slopes surrounding the upper part of the basin are not used for agriculture. However, many of these slopes, particularly in the neighborhood of Bandy and Rockwood Canyons and the northeastern edge of the upper basin, are being converted to avocado groves and are being irrigated with imported water. Springs and seeps below these groves now flow year round and ground-water quality in the Rockwood Canyon area has already been affected (fig. 33). If this trend continues, water quality throughout the alluvial aquifer may deteriorate and begin to resemble ground-water quality now found in Cloverdale Canyon.

Further development of surface-water resources along Santa Ysabel Creek at Palmo Dam may affect the quantity of recharge available to the alluvial aquifer, particularly during dry years. This may affect water quality and ground-water movement in the upper part of the basin.

Reclaimed Water Quality

Reclaimed water will be secondary treated sewage effluent from the Hale Avenue Wastewater Treatment Plant in Escondido. Reclaimed water has an average dissolved-solids concentration ranging from 650 to 950 mg/L, and is a sodium chloride type, chemically resembling imported water rather than native ground water (California Department of Water Resources, 1983). Nitrate concentrations in the reclaimed water would not exceed EPA limits of 10 mg/L as nitrogen (45 mg/L as nitrate) (Larry Michaels, San Diego County Water Authority, oral commun., 1982).

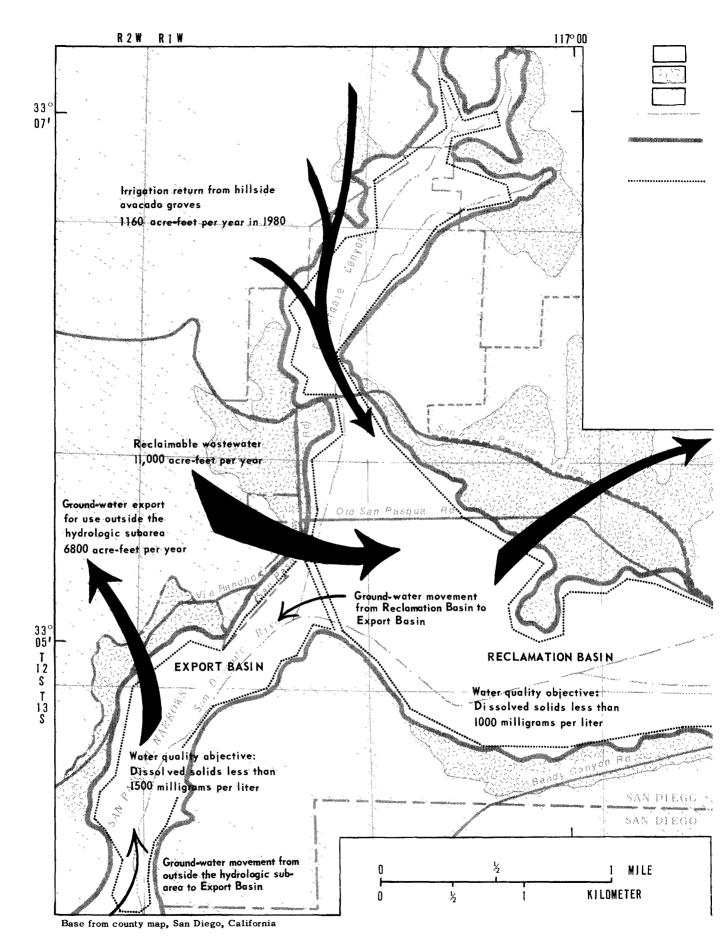
Reclaimed Water Use Plans

Use of reclaimed water in upland areas surrounding Cloverdale Canyon and the lower part of the basin as a substitute for irrigation with imported water has been proposed by the California Department of Water Resources (1983). Upland soils may be suitable for reclaimed water use if application rates and techniques are selected on a sitespecific basis so that shallow circulation and discharge of water to surface seeps can be avoided. In many upland areas where reclaimed water use is possible, the underlying residual aquifer has already been impacted by agricultural irrigation return and would not be further degraded by applications of reclaimed water unless application techniques are used that allow evaporative and transpirative concentration to become excessive.

Reclaimed water applied to upland areas in the San Pasqual hydrologic subarea will eventually enter the alluvial aquifer.

Current reclaimed water use plans for the alluvial aquifer, proposed by the San Diego County Water Authority, divide the aquifer into three subareas (fig. 34) (Larry Michaels, San Diego County Water Authority, written commun., 1982). The upper part of the basin will not receive reclaimed water. The lower basin will be managed as a reclamation basin and will receive large quantities (up to 11,000 acre-ft/yr) of reclaimed water. San Pasqual Narrows will be managed as an export basin. Groundwater discharge through the narrows will be intercepted and exported for use outside the hydrologic subarea to prevent reclaimed water from entering Lake Hodges, a public water-supply reservoir.

Objectives of this management plan are to obtain ground water having dissolved-solids concentrations less than 1,000 mg/L in the lower part of the basin. The plan also tries to maintain high ground-water quality in the upper part of the basin. Irrigation return water from Cloverdale Canyon and hills along the western edge of the lower basin, and possible future reclaimed water use in those areas will be important considerations in successful management.



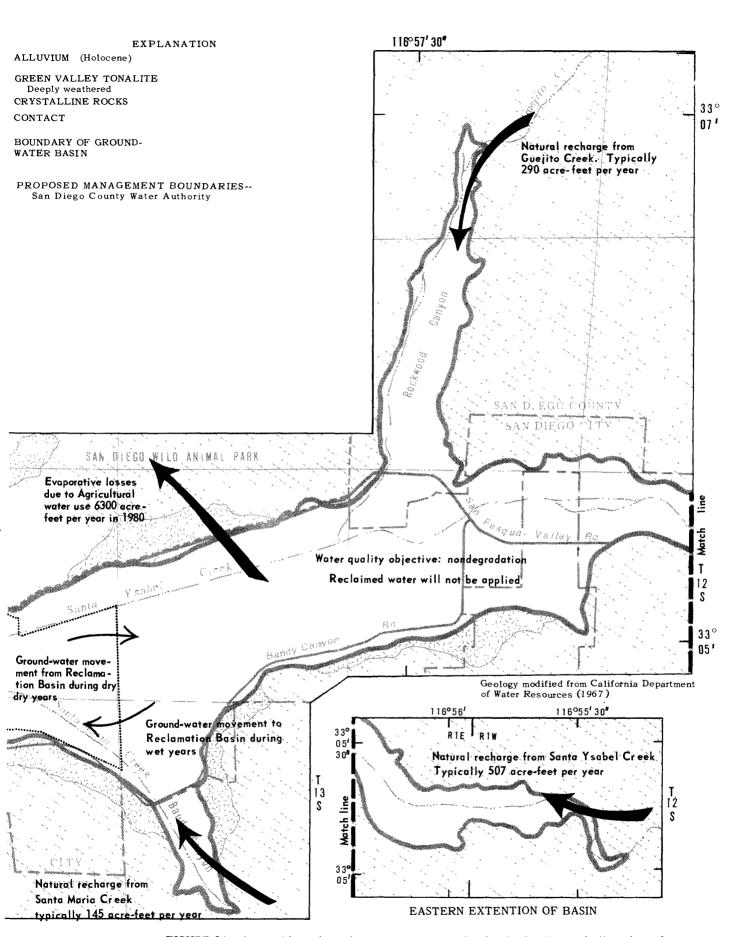


FIGURE 34.-- A possible reclaimed water management plan for the San Pasqual alluvial aquifer.

In 1982, water levels in the alluvial aquifer were near land surface and little additional storage capacity was available for reclaimed water. If reclaimed water is applied during a wet cycle when ground-water levels are high, waterlogging of the soil and surface runoff could occur. To combat this problem, the reclaimed water use plan proposes to lower water levels by pumping ground water presently stored in the lower part of the basin. This water would then be exported for use outside the hydrologic subarea. Ground water presently in storage has dissolved-solids concentrations greater than 1,000 mg/L. Under current management proposals, this water would be replaced by reclaimed water with dissolved-solids concentrations between 650 and 950 mg/L. Therefore, transfer of ground water from the hydrologic subarea also represents a net transfer of dissolved solids. Water quality, with respect to dissolved solids, may improve with time. Salt-balance calculations by the San Diego County Water Authority indicate dissolved-solids concentrations may be reduced to below 1,000 mg/L (Larry Michaels, San Diego County Water Authority, 1982).

Because storage in the alluvial aquifer is small (58,000 acre-ft) when compared to the maximum annual streamflow into the subarea of 110,000 acre-ft², the alluvial aquifer could fill in one rainy season (as it did in 1978), and despite intensive management efforts, there may not always be sufficient storage available to accept reclaimed water. Reclaimed water use would have to be adjusted accordingly.

In dry years such as 1977, there would be ample available storage in the lower part of the basin to accept reclaimed water (fig. 27). However, during dry periods, ground-water levels would be low throughout the entire aquifer except where reclaimed water is being applied. Applied water would create a local ground-water high, with some reclaimed water flowing to the export area in San Pasqual Narrows and some flowing to the upper part of the basin. Because ground-water movement is slow, only a small potential exists for reclaimed water to move from the reclamation basin to the upper part of the basin where it could contaminate potable water supplies, except during periods of extended drought. During drought periods, movement of reclaimed water and ground-water quality could be monitored to protect water quality in the upper part of the basin.

The current reclaimed water use plan proposed by the San Diego County Water Authority does not incorporate changes in land use practices and surface-water development which may alter the hydrologic system. However, changes in water quality will occur with or without reclaimed water use and reclaimed water may act to partly alleviate future waterquality problems.

²Calculated as the sum of maximum measured annual recharge from Santa Ysabel, Guejito, and Santa Maria Creeks (table 7).

SUMMARY

Reclaimed water could be used to augment water supplies in the San Diego area. Of the three hydrologic subareas studied, San Elijo has the least opportunities for reclaimed water use, and San Pasqual the most. The San Dieguito hydrologic subarea has possibilities for reclaimed water use, but presents several difficulties to effective implementation of reclaimed water use plans.

In the San Dieguito hydrologic subarea the greatest possibility for reclaimed water use is in the alluvial aquifer (52,000 acre-ft of storage). Ground-water quality within the alluvium has deteriorated as a result of seawater intrusion, intrusion of ground water from surrounding marine sedimentary rock, and changes in natural recharge patterns. Currently, the aquifer is of limited value as a water supply, and dissolved-solids concentrations typically exceed the basin objective of 1,000 mg/L and may exceed 5,000 mg/L. Application of large quantities of reclaimed water may, in time, improve water quality within the aquifer and increase its usefulness.

During dry years, considerable storage would be available to accept reclaimed water. During wet years when recharge is available from the San Dieguito River, ground-water levels and storage would have to be manipulated to avoid waterlogging of soils and surface runoff of applied reclaimed water. If ground-water levels are lowered below sea level, seawater intrusion would have to be controlled. It will not be possible to eliminate intrusion of ground water from surrounding marine sedimentary rock.

Limited use of reclaimed water may be made in upland areas of the San Dieguito hydrologic subarea.

Reclaimed water use possibilities in the San Elijo hydrologic subarea are confined primarily to upland areas of the Pacific Coastal Plain having deep soils, high infiltration rates, and a gently rolling topography. In some areas reclaimed water applied to upland areas may enter the alluvial aquifer.

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Final September 2021

Exhibit 13

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Final September 2021

Estimated Infiltration, Percolation, and Recharge Rates at the Rillito Creek Focused Recharge Investigation Site, Pima County, Arizona

By John P. Hoffmann, Kyle W. Blasch, Don R. Pool, Matthew A. Bailey, and James B. Callegary

Abstract

A large fraction of ground water stored in the alluvial aquifers in the Southwest is recharged by water that percolates through ephemeral stream-channel deposits. The amount of water currently recharging many of these aquifers is insufficient to meet current and future demands. Improving the understanding of streambed infiltration and the subsequent redistribution of water within the unsaturated zone is fundamental to quantifying and forming an accurate description of streambed recharge. In addition, improved estimates of recharge from ephemeral-stream channels will reduce uncertainties in water-budget components used in current ground-water models.

This chapter presents a summary of findings related to a focused recharge investigation along Rillito Creek in Tucson, Arizona. A variety of approaches used to estimate infiltration, percolation, and recharge fluxes are presented that provide a wide range of temporal- and spatial-scale measurements of recharge beneath Rillito Creek. The approaches discussed include analyses of (1) cores and cuttings for hydraulic and textural properties, (2) environmental tracers from the water extracted from the cores and cuttings, (3) seepage measurements made during sustained streamflow, (4) heat as a tracer and numerical simulations of the movement of heat through the streambed sediments, (5) water-content variations, (6) water-level responses to streamflow in piezometers within the stream channel, and (7) gravity changes in response to recharge events. Hydraulic properties of the materials underlying Rillito Creek were used to estimate long-term potential recharge rates. Seepage measurements and analyses of temperature and water content were used to estimate infiltration rates, and environmental tracers were used to estimate percolation rates through the thick unsaturated zone. The presence or lack of tritium in the water was used to determine whether or not water in the unsaturated zone infiltrated within the past 40 years. Analysis of water-level and temporal-gravity data were used to estimate recharge volumes. Data presented in this chapter were collected from 1999 though 2002. Precipitation and streamflow during this period were less than the longterm average; however, two periods of significant streamflow

resulted in recharge—one in the summer of 1999 and the other in the fall/winter of 2000.

Flux estimates of infiltration and recharge vary from less than 0.1 to 1.0 cubic meter per second per kilometer of streamflow. Recharge-flux estimates are larger than infiltration estimates. Larger recharge fluxes than infiltration fluxes are explained by the scale of measurements. Methods used to estimate recharge rates incorporate the largest volumetric and temporal scales and are likely to have fluxes from other nearby sources, such as unmeasured tributaries, whereas the methods used to estimate infiltration incorporate the smallest scales, reflecting infiltration rates at individual measurement sites.

Introduction

The city of Tucson and surrounding areas obtain most of their municipal, agricultural, and industrial water from ground water that is withdrawn from thick, alluvial-basin aquifers. The amount of water currently recharging the aquifers within the Tucson area is insufficient to meet current and future demands. Resultant ground-water deficits are manifested in water-level declines of more than 60 m since the middle of the 20th century. These declines are largest where ground-water withdrawals are greatest.

The alluvial aquifers are recharged by infiltration from irrigation and industrial returns and by seepage losses through stream channels. In the Tucson area, where the climate is semiarid, diffuse recharge through the basin sediments from precipitation is considered a negligible component of total recharge owing to low precipitation rates and high evapotranspiration (ET) rates (Scott and others, 2000). For instance, annual precipitation averages 31.5 cm on the valley floor, and annual potential ET ranges from 90 to 190 cm (Yitayew, 1990). Additionally, depth to ground water in the underlying alluvial basin can be tens of meters, providing opportunity for ample storage of infiltrated water. Because of these conditions, concentrated infiltration repeated over time, such as infiltration from irrigation and industrial returns, is necessary for recharge to occur. A large fraction of ground water stored in the allu-

vial aquifer was recharged by water that percolated through ephemeral stream-channel deposits (Davidson, 1973; Hanson and Benedict, 1994).

Rillito Creek, located in the Upper Santa Cruz Basin in southern Arizona (fig. 1), is typical of a large, ephemeral stream in the Southwest. In many basins of the Southwest, such as in the Upper Santa Cruz Basin, streams originating at higher elevations coalesce downstream to form larger ephemeral streams. Streams originating near mountain fronts typically flow over thick, alluvial valleys, lose hydraulic connection with the underlying aquifer, and are ephemeral in their lower reaches. Underlying many of these ephemeral streams is a coarse-grained stream-channel deposit that overlies a basin-fill deposit. The coarse-grained stream-channel deposit typically has high permeability and infiltration rates (Anderson and others, 1992; Hanson and Benedict, 1994).

Although recharge from infiltration of streamflow is known to occur in ephemeral-stream channels in the Southwest, such as Rillito Creek, the processes that control the spatial distribution and volume of infiltration that recharges the underlying aquifers are poorly understood. The Rillito Creek focused recharge investigation site was selected as one of six sites to study recharge processes in the Southwest (see chapter C) as part of the U.S. Geological Survey (USGS) Ground-Water Resources Program and generally is representative of ephemeral washes within the Sonoran Desert. Improving the understanding of streambed infiltration and the subsequent redistribution of water within the unsaturated zone is fundamental to quantifying and forming an accurate description of streambed recharge. Improved estimates of recharge from ephemeral stream channels will reduce uncertainties in water-budget components used in current ground-water models. In addition, recharge augmentation has been proposed along several reaches of ephemeral streams in the Tucson area, including Rillito Creek, and understanding processes that control recharge is important to the construction of recharge facilities.

Purpose and Scope

The purpose of this chapter is to present a summary of findings related to a focused recharge investigation along Rillito Creek, Pima County, Arizona. One of the challenges of quantitatively studying recharge beneath ephemeral streams is the need to integrate measurements made over a wide range of spatial and temporal scales. No single method of measurement or analysis can resolve the complex physical processes that contribute to infiltration, percolation, and recharge beneath ephemeral streams; therefore, a variety of approaches are presented that provide a wide range of temporal- and spatial-scale measurements of recharge beneath Rillito Creek.

Six approaches were used to evaluate infiltration, percolation, and recharge to the aquifer beneath Rillito Creek.

Cores and cuttings were collected during the drilling of five boreholes. Laboratory measurements used to determine physical and hydraulic properties of these cored subsurface materials (Hoffmann and others, 2002) represent the smallest spatial scale in this investigation. The core-based data typically are on the order of several centimeters, but are scaled up to meters in this report. Water content extracted from the cores, and environmental tracers measured in these waters, represent a temporal scale that is a function of the thickness and hydraulic properties of the unsaturated zone: in general, these data represent a time scale of less than 2 years in this investigation. Seepage measurements made during sustained streamflow represent portions of a streamflow event and typically have time scales of a few hours to several days. Measurements of temperature and water content in vertical (one-dimensional) and two-dimensional profiles represent spatial scales that are typically less than 5 m and have temporal scales that vary from seconds to several days. Vertically nested piezometers were installed in the boreholes drilled in the stream channel to monitor water-level responses to streamflow. These measurements also represent a temporal scale that is a function of the thickness and hydraulic properties of the unsaturated zone and, in general, represents a time scale of weeks to several months in this investigation. Measurements of ground-water storage changes using temporal-gravity measurements have the largest spatial and temporal scales spanning several square kilometers and a period of record of several months to years. Data presented in this chapter were collected from 1999 through 2002.

Previous Investigations

Smith (1910) probably was the first investigator to examine recharge along Rillito Creek. He concluded there was a difference in infiltration rates between the flashy, silt-laden summer flows, and the steady, long-duration flows of the winter snowmelt runoff. This conclusion was based partly on seasonal well hydrographs and ground-water temperature data. Investigators to follow, such as Schwalen and Shaw (1957) and Matlock (1965), also concluded that winter streamflow was the most effective source of recharge to the Tucson Basin. Burkham (1970) developed an empirical formula to estimate infiltration along a 15-km reach of Rillito Creek on the basis of streamflow losses between discharge measurement points. Davidson (1973) suggested that at least 90 percent of the amount of infiltrated water results in recharge. The remaining 10 percent is lost to ET. Although not necessarily specific to Rillito Creek, the work of Wallace and Lane (1978) related infiltration potential to stream-channel order. Wallace and Lane concluded that the greatest infiltration potential occurs in the large-order streams because these streams contain the greatest volume of alluvium. Hanson and Benedict (1994) summarized previous estimates of recharge and developed new estimates on the basis of work by previous investigators and numerical simulation.

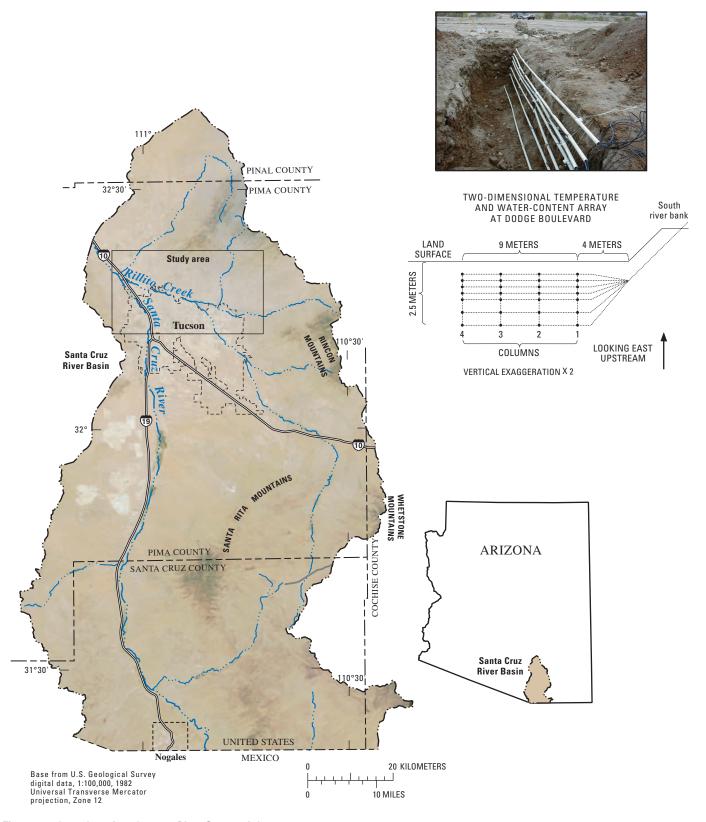


Figure 1. Location of study area, Pima County, Arizona.

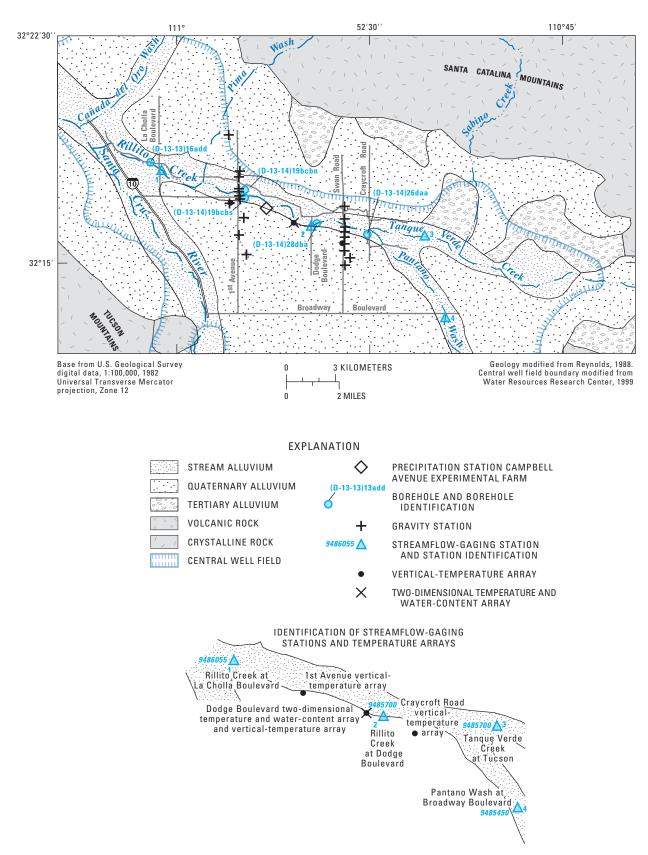


Figure 1.—Continued.

Hydrologic Setting

The climate of the study area is semiarid; annual rainfall averages 315 mm on the valley floor (fig. 2). There are two distinct seasons that account for most of the total precipitation; one (generally from July through September) is characterized by large summer convection and the other (generally from November through February) is characterized by frontal storms (fig. 2). The mean temperatures in January and July are 10°C and 29.6°C, respectively. To a lesser extent, there is a fall season of precipitation associated with tropical storms and climatic oscillations.

Rillito Creek is a tributary of the Santa Cruz River, which drains the Upper Santa Cruz Basin in southern Arizona. The Upper Santa Cruz Basin is in the Basin and Range Physiographic Province, which is characterized by block-faulted mountains separated by basins filled with alluvial sediments. The block-faulted mountains comprise Precambrian through Tertiary granitic, metamorphic, volcanic, and consolidated sedimentary rocks. The sediments that fill the basins are collectively termed alluvial basin-fill deposits and are composed of gravel, sand, silt, clay, and minor amounts of anhydrous sediments of Tertiary to Quaternary age. The basin-fill deposits generally are coarse grained along the basin margins and grade into finer-grained deposits and anhydrite deposits in the central parts of the basins. In the Upper Santa Cruz River Basin, thickness of the alluvium ranges from a thin veneer (a few meters) along the mountain fronts to as much as 3,400 m in the central parts of the basin (Davidson, 1973; Anderson, 1987, 1988; Hanson and Benedict, 1994).

Recent stream-channel deposits and basin-fill deposits underlie Rillito Creek. The recent stream-channel deposits, consisting of fine- to coarse-grained alluvium, are about 10 m thick and are detritus from the surrounding mountain ranges. The basin-fill deposits, which underlie the stream-channel deposits, are regionally extensive sedimentary units that form the regional aquifer system. Previous investigators have divided the basinfill deposits into upper and lower basin-fill units on the basis of their general hydrogeologic characteristics (Pool, 1986; Hanson and Benedict, 1994). The upper basin-fill unit can be as much as 300 m thick. It consists mostly of unconsolidated to semiconsolidated gravel, sands, and clayey silt and is correlated to the upper Tinaja beds and the Fort Lowell Formation described by Anderson (1987, 1988). The lower basin-fill unit is a few thousand meters thick and consists of conglomerates, gravels, sands, silts, anhydritic clayey silts, and mudstones (Anderson, 1988). The lower basin-fill unit is represented by the Pantano Formation and the lower and middle Tinaja beds described by Anderson (1987, 1988).

Stream-channel infiltration is the predominant mechanism of recharge to the regional aquifer in the basin-fill deposits and, combined with contributions from other sources of recharge for the area, is less than the amount of water withdrawn to support the growing metropolitan population. As a result, water-level declines and related land subsidence have occurred in some areas. Depth to ground water immediately beneath Rillito Creek ranges from

less than 6 m in the upper reach (near the mountain front) to 45 m near the Santa Cruz River (Hoffmann and others, 2002). Flow of ground water generally is northwestward; water-table elevations range from about 760 m in the southeast to 640 m in the northwest (Tucson Water, 2000). Ground water flows southwestward near the upper reach of Rillito Creek toward the major pumping center within the city of Tucson.

Rillito Creek has a drainage area of 2,256 km². It is ephemeral and most flows occur during the summer monsoon (July–September) and winter frontal storms (December–March; fig. 2). Characteristic monsoon streamflows result from localized short-duration convective storms, whereas winter streamflows are produced by longer-duration frontal storms and accumulated snowmelt. To a lesser extent, there also is a fall season in which tropical storms and climatic oscillations often result in streamflow.

The creek has two major tributaries, Tanque Verde Creek and Pantano Wash; Rillito Creek begins at the confluence of these two tributaries. Tanque Verde Creek drains a 702 km² area from the Santa Catalina and Rincon Mountains; Pantano Wash drains a 1,554 km² area between the Rincon, Santa Rita, and Whetstone Mountains. Several small washes divert runoff from the northeastern suburbs of Tucson into Rillito Creek. Rainfall runoff and snowmelt runoff from the Santa Catalina and Rincon Mountains contribute most of the flow to Rillito Creek. The creek flows westward to the Santa Cruz River from an elevation of 762 m at the confluence of Tanque Verde Creek and Pantano Wash to 657 m at its confluence with the Santa Cruz River. The creek is about 100 m wide and the channel slopes toward the Santa Cruz River at approximately 5.2 m/km with little variation in the slope. Flows in Rillito Creek typically are less than 28 m³/s; the maximum recorded discharge was 680 m³/s during the 1993 El Niño season (Tadayon and others, 2000). On average, Rillito Creek flows about 36 days per year at the streamflowgaging station Rillito Creek at Dodge Boulevard (09485700). The average annual flow is approximately 33.3×10^6 m³; about 44 percent of the flow occurs from the summer monsoonal storms, whereas about 56 percent of the flow occurs from the winter frontal storms.

The amount of water flowing in Rillito Creek, and therefore the amount available for recharge, is primarily related to precipitation frequency, distribution, and intensity, as well as to basin/channel runoff characteristics. The temporal distribution of flow in ephemeral streams is highly variable with observed decadal oscillations (Webb and Betancourt, 1992; Don Pool, Hydrologist, U.S. Geological Survey, written commun., 2003). Because of this, it is particularly difficult to estimate or predict recharge rates for ephemeral-stream channels on the basis of limited temporal observations. During the period of investigation there were two significant streamflow periods (fig. 3); one occurred in the summer of 1999 and the other in the fall of 2000 (mostly after September 30, or during water year 2001). Annual streamflow in Rillito Creek for the period of study was somewhat less frequent and smaller in volume than the long-term average (table 1). Prior to this study, a significant streamflow period occurred in the winter

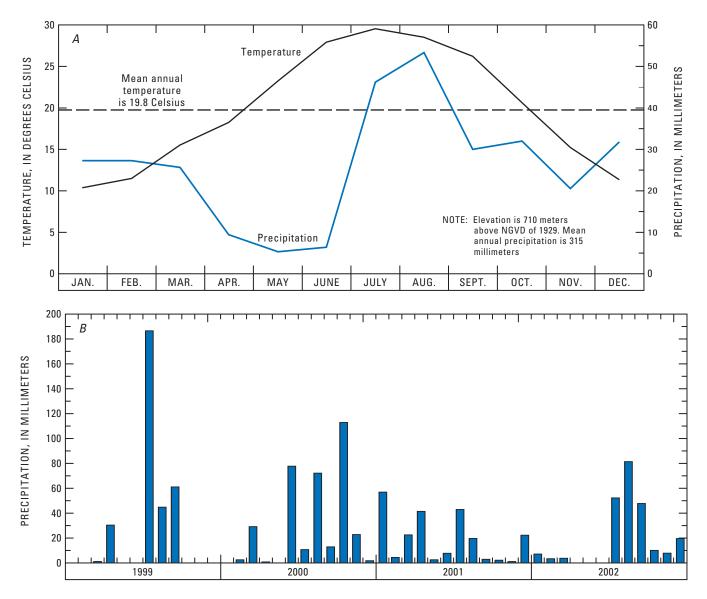


Figure 2. A, Monthly average temperature and precipitation, 1972–2002, at National Weather Service Station Campell Avenue Experimental Farm near Rillito Creek, Pima County, Arizona; B, monthly precipitation near Rillito Creek during period of study, 1999–2002.

and spring of 1998 (water year 1998) that was associated with El Niño precipitation and snowmelt. From February through April 1998, a total of 28.7×10^6 m³ flowed past the streamflow-gaging station at Dodge Boulevard.

Infiltration, Percolation, and Recharge Rates

Physical and Hydraulic Properties of Stream-Channel and Basin-Fill Deposits

In March and April 1999, five boreholes were drilled at four sites in the active channel of Rillito Creek (fig. 1)

to determine the physical and hydraulic properties of the stream-channel and basin-fill sediments down to about 10 m below the water table (Hoffmann and others, 2002). Each borehole was drilled using the ODEX air-hammer method, which is also known as the under-reamer method (Driscoll, 1986; Hammermeister and others, 1986). The ODEX method was used because it does not use fluids, thereby minimizing disturbance of the subsurface materials. At each hole, cuttings were collected about every 0.3 m. Fifty-one cores also were collected from these boreholes at 2- to 6-m intervals. The cores and cuttings were analyzed for physical properties, such as particle-size distribution, bulk density, particle density, porosity, volumetric water content, and percent saturation, and for hydraulic properties, such as saturated and unsaturated hydraulic conductivity, matric potential, and water-retention fitting terms. The detailed findings of these analyses are

described in Hoffmann and others (2002). This section of the chapter focuses on the hydraulic properties of the sediments and their role in infiltration rates, velocity of the wetting front, and potential recharge.

In order for ephemeral streamflow within Rillito Creek to recharge the underlying aquifer, the water must first infiltrate into the stream-channel deposits and percolate downward through the underlying deposits. The ability of water to infiltrate and percolate through these deposits is primarily a function of stream discharge and hydraulic properties of the deposits. One-dimensional steady-state vertical flow through a homogeneous, isotropic medium can be described by a form of Darcy's Law as:

$$q = -K(\theta) \left(\frac{\partial \psi}{\partial z} + 1 \right) , \qquad (1)$$

where

q is the flux [L/T],

 θ is the volumetric water content,

 $K(\theta)$ is the hydraulic conductivity [*L/T*] as a function of the volumetric water content,

 ψ is the pressure head of the water phase [L], and

z is the vertical dimension [L].

Determination of the rate of flow requires knowledge of the hydraulic conductivity and saturation of the porous media, and the head gradient. Water continues to move within the unsaturated zone after it has infiltrated across the ground surface. This subsurface redistribution is described by the unsaturated-flow equation:

$$\partial \theta / \partial t = \nabla q \,, \tag{2}$$

with the flux, q, as defined above. Because redistribution is inherently transient and multidimensional, fewer simplifying

Table 1. Annual streamflow measured at Rillito Creek at Dodge Boulevard (streamflow-gaging station 09485700), Pima County, Arizona, during period of study.

Water year ¹	Total annual streamflow, in cubic meters	Annual flow as a percentage of long-term annual streamflow	Percentage of annual stream- flow that occurred in summer	Percentage of annual stream- flow that occurred in winter	
1999	11×10^{6}	33	98	2	
2000	3.5×10^6	10.5	100	0	
2001	19.6×10^{6}	59	5	95	
2002	2×10^{6}	6	99	1	

¹Water year extends from October 1 through September 30 and is designated by the calendar year in which it ends.

assumptions can be applied in the analysis of redistribution than can be applied to infiltration. To fully characterize subsurface redistribution, measurements of both water flux and changes in subsurface water storage must be made repeatedly throughout the unsaturated zone.

As shown in the section titled "Temperature and Water Content," vertical infiltration rates at the onset of infiltration were as high as 22 mm/s because of high hydraulic permeability, low antecedent water content, and resulting large capillary gradients. Two-dimensional flow is also evident, and lateral velocities were about the same as vertical velocities. Shortly after the onset of infiltration, however, the near-surface stream-channel deposits are saturated, and large capillary gradients decline. Flow of water becomes predominantly vertical, as gravity is the dominant process controlling the

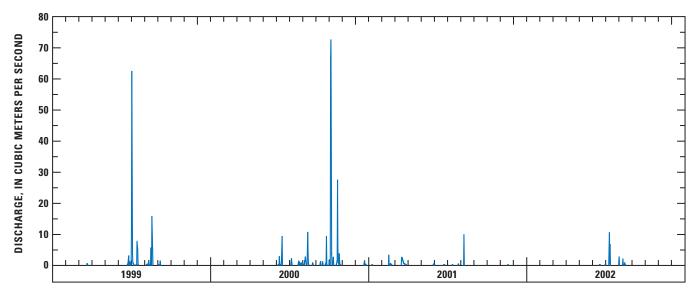


Figure 3. Mean discharge at Rillito Creek at Dodge Boulevard (streamflow-gaging station 09485700), 1999–2002, Pima County, Arizona.

direction of flow. From Darcy's Law, the flow rate through the sediments under saturated conditions is equal to the product of the hydraulic conductivity and the hydraulic gradient. If both hydraulic conductivity and gradient are known, then the flow rate can be calculated. This method of flow-rate estimation can be used for saturated and unsaturated conditions. Assuming properties of the pore water are constant, saturated hydraulic conductivity (K_{sat}) is a constant and is related to the texture and structure of the sediment. Unsaturated hydraulic conductivity is not a constant as it decreases rapidly as water content decreases. As surface flow proceeds, the infiltrated water moves farther below the surface of the streambed, capillary forces become less significant, and the hydraulic gradient approaches unity. If a unit gradient is assumed, the rate of infiltration becomes equivalent to the saturated hydraulic conductivity of the channel deposits.

On the basis of findings from the cuttings and cores, the stream-channel deposits beneath Rillito Creek are coarse grained, typically consisting of more than 95 percent gravel and sand. The underlying basin-fill deposits also are sandy gravels or gravelly sands, but typically contain more silt and clay than the stream-channel deposits.

Saturated vertical hydraulic conductivity of the deposits positively correlates with grain size (fig. 4). Values for the stream-channel deposits range from 0.3 to 2.5 m/d, whereas values for the basin-fill deposits tend to be less than about 0.6 m/d and in places are as low as 0.012 m/d. For heterogeneous media, such as the deposits beneath Rillito Creek, the

equivalent vertical hydraulic conductivity is calculated as the harmonic mean of the K_{sat} for each layer within the deposits and is always less than the arithmetic mean (Freeze and Cherry, 1979). Although differing at each borehole, the overall average equivalent hydraulic conductivity of the streamchannel deposits is 1.2 m/d; the overall average equivalent hydraulic conductivity of the basin-fill deposits is 0.19 m/d; and the equivalent hydraulic conductivity of the combined sediments (stream-channel and basin-fill deposits) is 0.23 m/d. The calculated average vertical hydraulic conductivity for the basin-fill sediments reported by Hoffmann and others (2002) includes values associated with a fine-grained unit found in a lower reach of Rillito Creek near the Santa Cruz River. These values typically are as low as 0.012 m/d and may not be representative of the hydraulic conductivity in upstream reaches. Excluding the hydraulic-conductivity values for the basin-fill sediments in the lower reaches where the fine-grained unit was present, the average vertical hydraulic conductivity of the study area is 0.3 m/d. Assuming a unit gradient, equivalent vertical hydraulic conductivity values are equivalent to the rate of infiltration and provide an estimate of potential recharge rates under saturated conditions.

Saturated conditions will exist only after sustained periods of streamflow infiltration at a rate that enables water to fully saturate the underlying sediments from the streambed to the aquifer. Once a saturated hydraulic connection is achieved between the stream and underlying aquifer, the system behaves as though the stream were perennial. Unsaturated hydraulic-

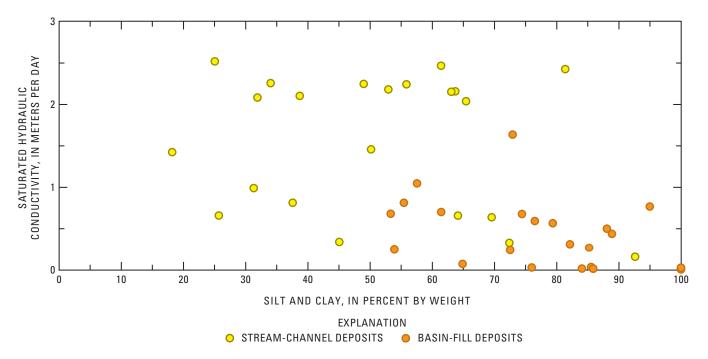


Figure 4. Relation of saturated hydraulic conductivity to sand, silt, and clay content for cores collected from boreholes drilled along Rillito Creek, Pima County, Arizona.

conductivity values need to be considered when estimating potential recharge rates for conditions prior to full saturation. Unsaturated hydraulic conductivity of the deposits beneath Rillito Creek varies by several orders of magnitude as a function of water content. For water-content conditions at the time of core collection, the unsaturated hydraulic conductivity was generally two or more orders of magnitude less than the saturated hydraulic conductivity (Hoffmann and others, 2002).

Antecedent pore water underlying Rillito Creek derives from streamflow infiltration and subsequent percolation. In this study, cores were collected in late March 1999; therefore, antecedent pore water was derived from streamflows prior to March 1999. Several flow events prior to 1999 could have been sources of the antecedent water. On the basis of streamflow records at the streamflow-gaging station at Dodge Boulevard, the most recent flow prior to core collection occurred in November 1998 and lasted for 2 days (average streamflow was less than 0.82 m³/s). The last recorded flow prior to November 1998 occurred in the summer of 1998 and lasted for about 1 day. The most voluminous and long-lasting flow within a few years of the core collection was the sustained flow from February to April 1998, which was related to the 1998 El Niño precipitation.

Volumetric water content in the unsaturated zone ranged from 0.02 to 0.46 at the time of core collection (fig. 5). Variability in water content primarily is controlled by differences in sediment texture and is positively correlated with the percentage of fine-grained material (fig. 5). The stream-channel deposits averaged 17.8 percent water content and 57.6 percent saturation; the basin-fill deposits averaged 24 percent water content

and 69.3 percent saturation. Integrating the water content over the thickness of the unsaturated zone, cumulatively, the unsaturated sediments beneath Rillito Creek contained 0.5 to 12.2 m of water. The smallest amount of water was in the upstream area at the borehole ((D-13-14)26daa) near Craycroft Road where the unsaturated zone was about 3 m thick; the largest amount of water was in the downstream area at the borehole ((D-12-14)26add) near La Cholla Boulevard where a 12-m thick fine-grained unit lies above the water table. The sites probably most representative of the unsaturated zone beneath Rillito Creek are in the middle reaches where the unsaturated zone was 30 to 40 m thick and had 6.1 m of water (boreholes (D-13-14)19bcbn, (D-13-14)19bcbs, and (D-13-14)28dba). The large amount of water stored in the unsaturated zone indicates that much of this water probably originated from the sustained flows prior to the summer of 1998, that the stored water is likely to be from several different streamflow and infiltration events, and that the sediments beneath Rillito Creek drain slowly.

Environmental Tracers

Environmental tracers of tritium (³H), oxygen-18 (¹⁸O), deuterium (²H or D), and chloride from the pore waters in the unsaturated and saturated zones were analyzed to evaluate spatial variations in infiltration and recharge patterns along Rillito Creek. Tritium is a naturally occurring radioactive isotope of hydrogen with a half life of 12.43 years. Large concentrations of tritium were introduced into the atmosphere beginning in 1952 as a result of the atmospheric testing of nuclear

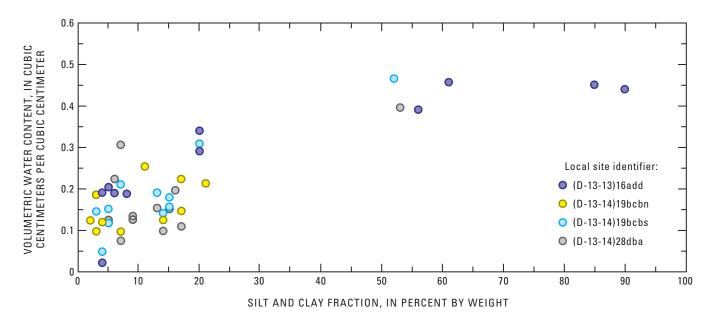


Figure 5. Relation of volumetric water content to sand, silt, and clay content for cores collected from boreholes drilled along Rillito Creek, Pima County, Arizona.

weapons. The input of tritium into the atmosphere related to nuclear weapon testing peaked at nearly 6,000 tritium units (TU) in 1963–64 prior to a ban on the tests. Atmospheric tritium concentrations returned to natural conditions by 1992 (Dr. Chris Eastoe, geochemist, University of Arizona, written commun., 2003), and the concentration of tritium in precipitation today is about 5 to 7 TU. Tritium concentrations are often used for dating ground water and to detect events, such as the 1963–64 peak. In this study, tritium was measured in water vacuum extracted from cores and analyzed by liquid scintillation with electrolytic enrichment (Thatcher and others, 1977) at the USGS laboratory in Menlo Park, California. Tritium was detected in pore water extracted from each core sample and ranged in concentration from 2 to 11 TU (fig. 6). The precision of individual measurements was ± 0.3 TU. For the purposes of this study, waters having tritium concentrations in this range are interpreted as having infiltrated within the past 40 years. Tritium concentrations within a given profile could not be used to identify an event marker, such as the 1963 peak.

Given the presence of tritium in the unsaturated zone, the locally high vertical hydraulic conductivity values of more than 1 m/d in the stream-channel deposits, and depths to the water table of generally less than 40 m, it is likely that most of the pore water extracted from the cores was derived from runoff events during the few years prior to 1999.

Assuming negligible mixing of infiltrated waters, variations in isotopic signatures and chloride concentrations can be used to identify individual runoff and infiltration events. These unique signatures remain intact during infiltration and allow direct identification of runoff events as the infiltrated water migrates through the unsaturated profile. Sampling through the unsaturated zone at a point in time provides a snapshot of the isotopic and chemical signatures throughout the profile. This snapshot represents the composition of the water that infiltrated into the sediment over a period of time—the deepest water representing the beginning of the period. The downward rate of water movement at a particular site is calculated using the time elapsed between the runoff event and depth of infiltration of the water in the profile.

Oxygen and hydrogen isotopic compositions were determined for water extracted from cores by azeotropic distillation (Revesz and Woods, 1990) with toluene at the USGS laboratory in Reston, Virginia, using analytical methods described by Epstein and Mayeda (1953). Isotopic variations in water are expressed as a per mil ratio (δ value), which is a ratio of ¹⁸O/¹⁶O and D/¹H in a sample relative to the ratio in an ocean water standard (Clark and Fritz, 1997). The delta symbol in this report is followed by the chemical symbol for the heavier isotope measured during isotopic analysis. Isotopic values are described as lighter or heavier in relation to each other. Lighter isotopic values are smaller or more negative per mil values, and heavier isotopic values are larger or more positive per mil values.

The source of precipitation is evaporation of seawater; therefore, the $\delta^{18}O$ and δD composition of precipitation is linearly correlated, which is known as the meteoric water line

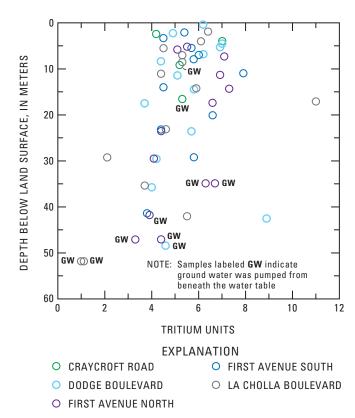


Figure 6. Profile of tritium content in water collected from boreholes drilled along Rillito Creek, Pima County, Arizona.

(MWL; Craig, 1961). Values of $\delta^{18}O$ and δD in precipitation vary from event to event and also seasonally. Many variables influence the isotopic signature of a precipitation event, including the origin, travel path, and duration of the storm, and the elevation and temperature of condensation prior to rainfall. In general, however, variations in isotopic signature are predominately temperature dependent. The cool, high-altitude precipitation events produce water having lighter isotopic ratios than water from the warm precipitation events. In addition, evaporation will result in $\delta^{18}O$ – δD data for the remaining water that plot to the right of the MWL. A more detailed discussion on variations of isotopic ratios can be found in Clark and Fritz (1997).

Values of $\delta^{18}O$ and δD in waters extracted from the unsaturated zone range from about -12 to -6 per mil, and -80 to -37 per mil, respectively (fig. 7). Data for many of the samples indicate the effect of evaporation (fig. 7). Isotopic compositions from the Dodge Boulevard site generally indicate the greatest amount of evaporation, and isotopic data from a sample collected at First Avenue North from a depth of less than 1 m indicated the greatest amount of evaporation for any sample (fig. 7). Variations in isotopic compositions of water from the unsaturated zone beneath Rillito Creek are, therefore, attributed to both changes in the isotopic signatures of the source water and to evaporation. Those samples that lack an evaporative signal indicate that percolating waters were not exposed to significant evaporation prior to infiltration.

Several trends were evident in the isotopic ratios of Rillito Creek pore water. One trend is related to the location in the stream reach where the samples were collected. The water-weighted mean isotopic signature of the pore water in the unsaturated zone generally becomes lighter in the downstream direction (fig. 8). The water weighted mean uses the water content of the core as a weight that is multiplied by the isotopic ratio

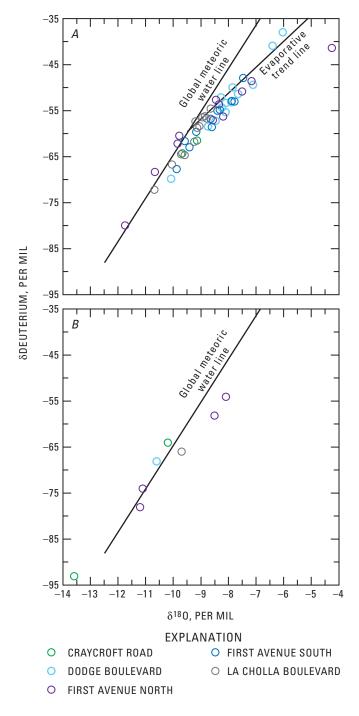


Figure 7. Stable isotope data of pore water collected from cores collected from boreholes drilled along Rillito Creek, Pima County, Arizona. *A*, unsaturated zone; *B*, below the water table.

of the extracted water. Pore water in the borehole near Dodge Boulevard ((D-13-14)28dba) had $\delta^{18}O$ and δD values of -8.0 of -55.0 per mil, respectively, whereas pore water downstream in the borehole near LaCholla ((D-13-13)16add) had δ^{18} O and δD values of -9.5 and -64.0 per mil, respectively. At the intermediate boreholes near First Avenue ((D-13-14)bcbn and (D-13-14)19bcbs), δ^{18} O and δ D values were -8.8 of -60.3 per mil, respectively. These variations are larger than the analytical precision (2-sigma values of 0.2 and 2 for δ^{18} O and δ D, respectively; thus, in 95 percent of repeat analyses the same sample would result in δ^{18} O within 0.2 per mil of the originally reported value and the δD values would be within 2 per mil of the originally reported value). Evaporative effects would cause a trend opposite to the observed data; therefore, the trend is likely a function of the origin and season of precipitation events that resulted in streamflow and subsequent infiltration at the downstream sites. Specifically, for the time period represented by the unsaturated zone pore water, it is the longer duration and isotopically lighter winter storms that were more important contributors to infiltration in the downstream reaches than in the upstream reaches. The exception to this trend is at the uppermost borehole near Craycroft Road ((D-13-14)26daa) where the lightest values, a δ^{18} O of -10 per mil, and a δD of -65 per mil, were measured. Depth to water at this site, however, is commonly only a few meters below the streambed; therefore, water in the unsaturated zone at the time of core collection probably is representative of infiltration only from the most recent streamflows.

Another trend in the isotopic data is that water from the saturated zone has $\delta^{18}O$ and δD values that are consistently lighter than those in water from the unsaturated zone and do not reflect evaporation effects as do those in water from the

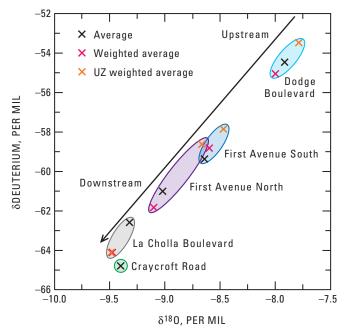


Figure 8. Weighted average of stable isotope values from pore water collected from boreholes along Rillito Creek Pima County, Arizona.

unsaturated zone (fig. 8). This lighter isotopic composition in the ground water from beneath the water table indicates a greater influence of winter and (or) higher elevation precipitation in the ground water than for the water in the unsaturated zone at the time of collection. The lack of an evaporative signal indicates that water that reaches the water table is exposed to minimal evaporation.

Oxygen-18 (δ^{18} O) and δD data for precipitation in the Tucson Basin collected prior to the study period were analyzed to define a possible isotopic input function to the system. Isotopic compositions for precipitation in the Tucson Basin that resulted in Rillito Creek streamflow indicate that

light compositions are associated with the winter 1998 El Niño weather pattern, whereas compositions are varied for the summer precipitation events of 1997 and 1998 (fig. 9).

A substantially heavy isotopic signal was associated with precipitation in April and August 1998. Assuming conservative behavior, isotopic compositions measured in the precipitation are possible event markers that might be identified in the unsaturated zone. In order to identify event markers in the unsaturated zone, vertical profiles of $\delta^{18}O$ and δD were compared to $\delta^{18}O$ and δD in samples of runoff (fig. 10). This analysis was done for the borehole near Dodge Boulevard because it is near the streamflow-gaging station at Dodge

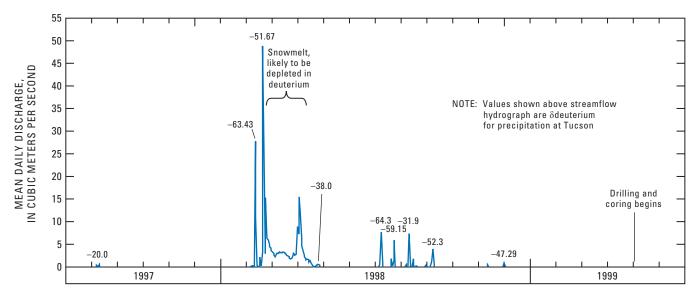


Figure 9. Hydrograph of streamflow gaging station 09485700 Rillito Creek near Dodge Boulevard (09485700) and associated stable isotope values determined for precipitation.

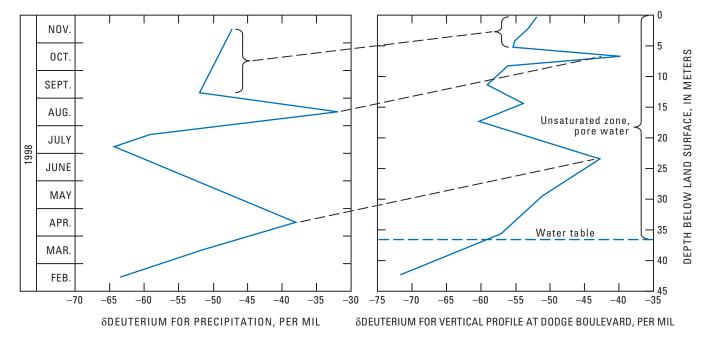


Figure 10. Comparison of stable isotope values in vertical profile to stable isotopic values of precipitation.

Boulevard (09485700). The hydrograph for this gaging station was used to determine timing of streamflow prior to drilling and coring. The trends in isotopic compositions measured in the pore-water cores approximately match the pattern of signatures in the basin precipitation from particular storms that occurred from February to November 1998. For instance, the heavy isotopic compositions in precipitation in April and August 1998 are possibly identified in pore water from depths of 6.5 and 23 m, respectively (fig. 10). Below 23 m, the compositions become lighter and are similar to those of the El Niño precipitation events about 14 months prior to the drilling and coring. If this interpretation is correct, water in the unsaturated zone below about 23 m is likely to have originated from sustained flows related to 1998 El Niño precipitation. Discrete pore-water sampling and minor mixing of pore water within the unsaturated zone can explain why the values for precipitation tend to have a wider range (-32 to -65 δ D) than values for the unsaturated zone pore water (-40 to -61 δD). Correlation between the precipitation events and depths of infiltration, on the basis of corresponding isotopic signatures, indicates an average vertical linear velocity of approximately 0.049 m/d at the borehole near Dodge Boulevard. This velocity represents the downward percolation rate of water. Percolation is defined here as the flow of water that has infiltrated and is moving downward or lateral toward the water table. Note that infiltration connotes movement of water into sediments, in contrast to percolation, which connotes movement through sediments. Owing to the decrease in hydraulic conductivity with decreasing water content, the percolation rate is less than the measured saturated hydraulic conductivity.

Chloride concentrations in pore-water leachate were determined from drill cuttings at 0.3-m depth intervals. To derive the leachate, 50 mL of distilled water was mixed with 50 g of sieved cuttings having a particle size of less than 1 mm. The mixture was stirred and the specific conductance measured. An ion-specific probe was used to measure the chloride concentration after the specific conductance stabilized. Chloride concentrations are reported for the boreholes near Dodge Boulevard and near First Avenue (fig. 11).

Chloride concentrations at the borehole near La Cholla Boulevard between about 10 and 30 m are not presented because the fine-grained unit at this depth made leaching and sieving difficult, and therefore the results were suspect. Chloride concentrations are not presented for the borehole near Craycroft Road because of the shallow water table there.

Chloride concentration in runoff varies as a function of the precipitation location and the runoff travel path and surface-contact time. Chloride concentrations measured in the profile varied substantially through the upper 18 m at all sites (fig. 11). Below about 18 m, the variation in concentration declined considerably. On the basis of $\delta^{18}O$ and δD data discussed previously, this zone of smaller variation corresponds to the infiltration depth of the 1998 El Niño water. The small variation and low mean chloride concentration are attributed to infiltration from sustained streamflow having a low chloride concentration. In addition, the low chloride concentration indi-

cates the water had little exposure to evaporation. The greater variation and higher concentration observed in post-El Niño pore water are likely due to mobilization of chloride from evaporative concentrates and dry fallout on the streambed and tributaries deposited between precipitation events. Calculation of a downward percolation rate using an event marker in the chloride profile at Dodge Boulevard yields an average linear velocity of 0.055 m/d, and corresponds closely to the rate calculated using the stable-isotope data. On the basis of the environmental tracers measured at the borehole near Dodge Boulevard, pore water in the unsaturated zone represents water that infiltrated into the sediments within the 12 to 14 months prior to drilling, and approximately half of the water (water in the deeper half of the unsaturated zone) infiltrated from the previous El Niño runoff event.

Multiplying the downward percolation rate by the volumetric water content results in the flux of recharge that reaches the water table. Using a percolation-rate estimate of 0.05 m/d, an average volumetric water content of 13 percent measured in the cores from the borehole near Dodge Boulevard borehole (Hoffmann and others, 2002), and a wetted perimeter of 25 m, results in a flux across the water table of 0.002 cubic meters per second per linear kilometer of streamflow (m³/s/km).

Seepage Measurements

Seepage measurements were made at several sites along Rillito Creek during the El Niño-related sustained flows of March through April 1998 to determine infiltration rates for different stream reaches (Don Pool, hydrologist, U.S. Geological Survey, written commun., 2003). Findings from the 1998 seepage measurements are summarized here because, on the basis of stable-isotope ratios and chlorideconcentration profiles, infiltration from the sustained El Niño flow is likely to have provided most of the water stored in the unsaturated zone at the time of borehole drilling and core collection. Streamflow losses owing to infiltration along Rillito Creek ranged from 0.07 to 0.9 m³/s/km and were largest downstream from Swan Road (fig. 1). The small streamflow losses in the upstream area were attributed to rejected recharge; depth to ground water upstream from Swan Road was near land surface after several days of sustained flow, whereas the depth downstream from Swan Road was typically greater than 30 m.

Seepage measurements were made again at four sites along Rillito Creek during an 8-hr period on October 24, 2000. Unlike the 1998 seepage measurements, the October 2000 seepage measurements did not isolate streamflow-infiltration rates relative to Swan Road; however, measured streamflow-infiltration rates generally agreed with those measured in 1998, as they ranged from 0.09 to 0.4 m³/s/km and averaged 0.22 m³/s/km (fig. 12). The October 2000 seepage measurements were made during an 8-hr period along a 14-km reach having an average wetted perimeter of about 25 m. Using a wetted perimeter of 25 m results in an average infiltration rate of 0.75 m/d, which is

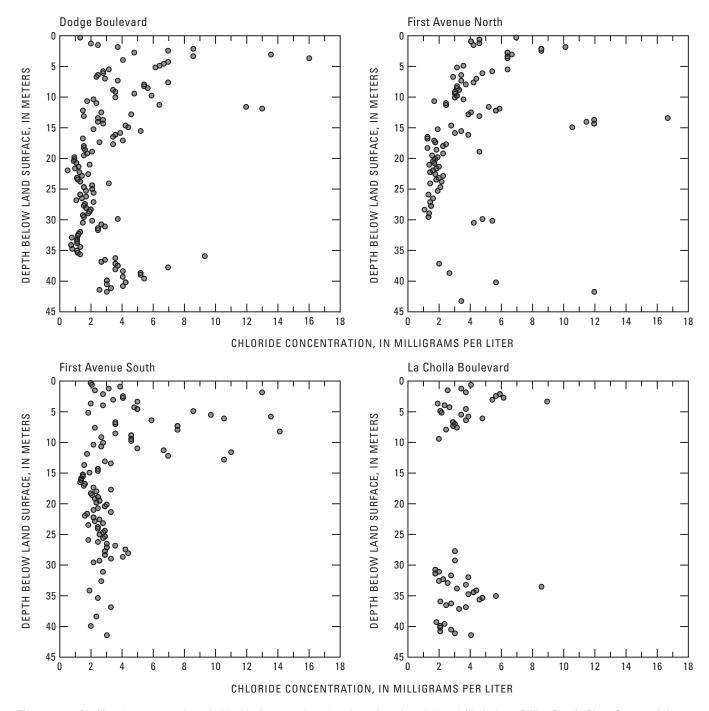


Figure 11. Profile of concentration of chloride from cuttings leachate from boreholes drilled along Rillito Creek, Pima County, Arizona.

similar to the measured saturated hydraulic conductivity of the stream-channel deposits (1.2 m/d), but more than an order of magnitude greater than percolation rates determined by tracers. The difference between the estimated infiltration and percolation rates probably is due to several factors, such as (1) the variably saturated nature of the sediments—the near-surface stream-channel deposits are likely to be nearly saturated during streamflow and, therefore, are approaching their saturated hydraulic conductivity, whereas the deeper sediments are less than fully saturated and will, therefore,

have a lower hydraulic conductivity; (2) some water will spread laterally reducing the downward flux, and (3) percolation rates determined by tracers reflect average rates over longer periods of time than infiltration rates, including periods when the creek is not flowing.

Assuming 6 m of water in storage in the unsaturated zone beneath the creek (as determined by volumetric water-content measurements made on the cores; fig. 5) and a stream width of 100 m, the amount of pore water beneath every kilometer of the creek at the time of drilling and

coring was 6×10^5 m³. There was less water in the upper reach where the unsaturated zone is shallower and more water in the downstream reach where there is an 18-m-thick fine-grained unit having high water content. Assuming an average streamflow loss rate of 0.22 m³/s/km, about 33 days of streamflow infiltration would be needed to infiltrate the amount of water stored in the unsaturated zone. There were about 31 days of cumulative flow in the creek in the 12 months prior to drilling and coring; about two-thirds of the flow days were associated with the El Niño snowmelt runoff that occurred about 1 year before the drilling and coring. Assuming the water in the bottom two-thirds of the unsaturated zone collected in 1999 originated from surface water flowing a year earlier, the average downward percolation rate would be about 0.04 to 0.09 m/d, which brackets the percolation rate estimated by environmental tracers. This analysis of seepage and cumulative streamflow duration required to provide the amount of water held in storage in the unsaturated zone provides an independent method of estimating the age of water in the unsaturated zone, estimating infiltration and percolation rates, and substantiates the interpretation made on the basis of the environmental tracers.

Temperature and Water Content

One-Dimensional Temperature Monitoring and Modeling

Heat can be transferred through sediments by a combination of advection and conduction. Although both advective and conductive heat transport occur during infiltration, advective heat transport is more prevalent in high water-flux settings, whereas conductive heat transport is more prevalent in very low or no water-flux conditions. For most hydrologic applications related to infiltration through alluvial sediments, advection is the primary mechanism for the transport of heat by flowing water, and conductive heat transport is regarded as a negligible component of heat transfer (Constantz and others, 2003).

In this study, heat as a tracer was used to estimate onedimensional vertical infiltration by inversely determining the vertical saturated hydraulic-conductivity profiles beneath the streambed. Stream-channel deposits were instrumented with vertical nests of thermistors at three sites along Rillito Creek (fig. 1). Thermographs predicted by numerical simulations were fitted to measured thermographs from the field by adjusting model parameters within appropriate ranges until the least error (best match) was found between simulated and measured thermographs. The three vertical-temperature arrays are buried in the stream-channel deposits near the boreholes (fig. 1). One array is near Craycroft Road in the upper reach of the study area; one is near Dodge Boulevard in the middle reach of the study area; and the other is near First Avenue also in the middle reach of the study area.

The simulation domains for the Rillito Creek models were represented numerically in one dimension, oriented vertically. The upper boundary and datum of the simulation

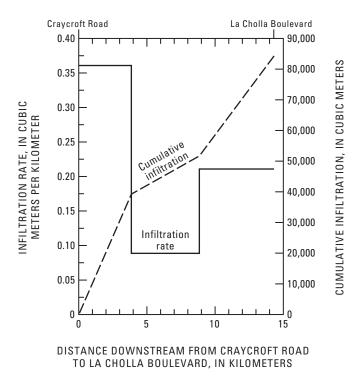


Figure 12. Seepage loses during October 8, 2000 streamflow in Rillito Creek, Pima County, Arizona.

domains was the streambed. The lower boundary was at or near the depth of the deepest measurements of temperature or pressure, or both. For the simulations, time-varying hydraulic and temperature potentials were defined at the upper- and lower-domain boundaries.

The hydraulic head at the streambed is equivalent to the stream stage. USGS streamflow-gaging stations provided measurements of stage after correction for the datum elevation. Streambed temperatures were measured by thermistors buried about 0.2 m below the streambed in the most active part of the channel. Pressure-head measurements from piezometers were used to define heads at the lower boundary of the three study sites. The lower-boundary temperatures for the Craycroft Road site were inferred from thermistor measurements near the lower-boundary depth. The lowerboundary temperatures coinciding with the water table for the Dodge Boulevard and First Avenue sites were approximated from ground-water temperatures measured within 5 meters of the water table at those sites. The inverse simulations were made with a numerical coupled water-flow and heat-transport model, VS2DH (Healy and Ronan, 1996), that was linked with parameter estimation software (PEST). A detailed description of the theory, modeling approach, and findings of this investigation is documented in Bailey (2002).

Infiltration at Craycroft Road Site

Infiltration for two periods of sustained streamflow were modeled for the upstream-most site (near Craycroft

Road). The first model period extends from July 20, 1999, to July 27, 1999. The second modeled period extends from July 29, 1999, to August 2, 1999. Streamflow and stage at the nearby streamflow-gaging station (Tanque Verde Creek at Tucson) fluctuated between 2.23 and 0.33 m³/s, and between 0.26 and 0.11 m, respectively, during the first modeled flow period. Streamflow decreased from 1.11 to 0.05 m³/s and stage decreased from 0.20 to 0.03 m during the second modeled flow period. The wetted perimeter of the streambed near the Craycroft Road site during these periods was about 10 m.

The measured thermograph at a depth of 1.2 m for the first modeled period shows a characteristic sinusoidal pattern that varies between about 24 and 26.5°C, whereas the thermograph for the second modeled period is generally flat and varies only between 25 and 25.5°C. Model simulation at the Craycroft Road site approximately reproduced the thermograph of the observed data for both model periods (fig. 13). Model simulations were optimized on vertical saturated hydraulic conductivity. Simulated vertical saturated hydraulic-conductivity values were in general agreement with those measured in the laboratory (Bailey, 2002; Hoffmann and others, 2002). A physical change within the streambed between flow periods at this site required the addition of a thin surface layer having a low vertical hydraulic conductivity within the model domain. The addition of this surface layer resulted in a lowering of the simulated equivalent saturated hydraulic conductivity by four orders of magnitude, from about 4 m/d to 3×10^{-4} m/d. The four orders of magnitude change in hydraulic conductivity is too large to result solely from changes in water viscosity owing to temperature changes. Given the tranquil flow conditions during the first flow period, it is possible that the change was the deposition of a fine-grained layer at the streambed surface. In fact, a thin layer of fine-grained material commonly was observed at the Craycroft Road site after small streamflow events.

Flow in the creek typically resulted in hydraulic connection between streamflows and ground water (see section titled "Water-Level Responses"). Thus, vertical gradients measured at the vertically nested piezometer at the borehole near Craycroft Road enabled estimation of infiltration rates using simulated equivalent vertical saturated hydraulic conductivity. Vertical hydraulic gradients measured from these piezometers typically ranged from 0.06 to 0.2 m/m and averaged 0.1 m/m. The highest gradients occurred during and shortly after streamflow. Assuming a typical gradient during and shortly after streamflow (0.2 m/m) and a wetted perimeter of 10 m, estimated infiltration rates ranged from 0.09 m³/s/km during the first modeled period to 8×10^{-6} m³/s/km during the second modeled period. The first modeled period is probably most representative of the typical ephemeral-streamflow conditions; the second period of streamflow modeled is probably most representative of small flows that occur after a layer of fine-grained deposits has been deposited. The infiltration rate of 0.09 m³/s/km for the first modeled period is about half of that estimated by seepage measurements (average of 0.21 m³/s/km).

Infiltration at Dodge Boulevard and First Avenue sites

Infiltration also was modeled for two time periods at the Dodge Boulevard and First Avenue sites: the first modeled period extends from July 14, 1999, to July 17, 1999, and the second modeled period extends from July 25, 1999, to July 29, 1999. The proximity of the thermistors to the streamflow-gaging station 09485700 at Dodge Boulevard allowed direct use of the gaging-station measurements to define the hydraulic head at the upper boundary within the Dodge Boulevard model domain. These boundary conditions also were used for the First Avenue model domain. Discharge and stage for these two periods reached maximums of 254 m³/s and 2.7 m, respectively. The wetted perimeter for these flows was about 10 m. An important difference between these sites and the site near Craycroft Road is that the depth to the water table near the Dodge Boulevard and First Avenue sites is greater than 30 m; therefore, ephemeral flow in the stream channel at these sites may never result in hydraulic connection between the stream and the aquifer.

Thermographs from a depth of 0.8 m at the Dodge Boulevard site for the two modeled periods have contrasting signals. The thermograph for the first period shows a decline in temperature associated with streamflow from about 29.5 to 20.5°C that is followed by a gradual increase to 26°C; the thermograph for the second period shows a rapid increase in temperature associated with streamflow from about 29 to 32°C that is followed by a gradual decrease to 27°C (fig. 14). The most accurate prediction of the observed thermograph for the first modeled time period at the Dodge Boulevard site resulted in an equivalent vertical saturated hydraulic conductivity of about 5 m/d, which is similar to, yet slightly higher than, the equivalent vertical saturated hydraulic conductivity simulated at the Craycroft Road site. Vertical hydraulic gradients were not measured at the Dodge Boulevard site, thus, infiltration rates can not be estimated; however, by assuming a vertical gradient of 0.2 m/m (on the basis of the measured gradient at the Craycroft Road site), an equivalent vertical hydraulic conductivity of 5 m/d, and a wetted perimeter of 10 m, the infiltration flux was calculated as 0.12 m³/s/km.

To match the simulated thermograph to the measured thermograph for the second modeled period, a thin surface layer having a low-vertical hydraulic conductivity needed to be added during the modeled period. During the first part of the second simulation, the equivalent vertical saturated hydraulic conductivity was 0.7 mm/s, which, if sustained, would equate to 66 m/d. After about 3 hours of streamflow, the addition of the low-conductivity surface layer reduced the equivalent vertical hydraulic conductivity to about 0.25 m/d. The decrease in hydraulic conductivity during a flow event is consistent with the deposition and accumulation of fine sediments on the receding limb of a hydrograph.

Model simulations for the site near First Avenue relied on stage data from the streamflow gaging-station 09485700 at Dodge Boulevard (Bailey, 2002). Simulations for this site covered the same two time periods and resulted in equivalent

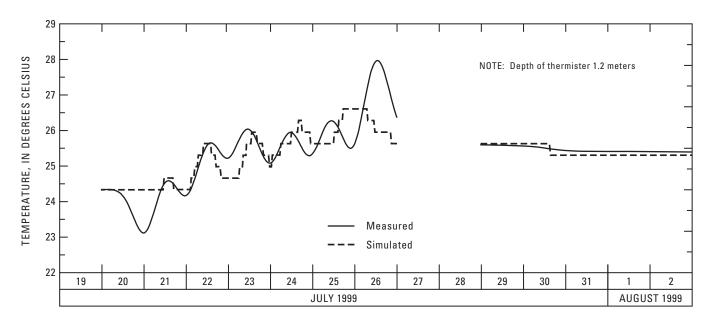


Figure 13. Measured and simulated thermographs in Rillito Creek near Craycroft Road, Pima County, Arizona.

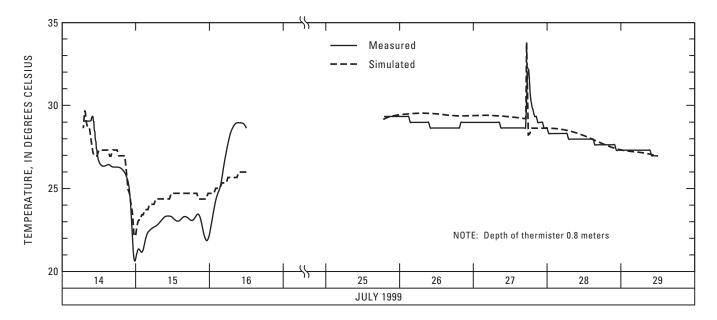


Figure 14. Measured and simulated thermographs in Rillito Creek near Dodge Boulevard, Pima County, Arizona.

vertical hydraulic conductivity values that were similar to those estimated for the site near Dodge Boulevard. In addition, the simulation for the second modeled period required the addition of a low vertical hydraulic conductivity surficial layer during the latter part of the period. The model simulations for the site near First Avenue, however, were less successful in matching the observed data than the simulations for the site near Dodge Boulevard. The inability of the simulations to match the magnitude and changes in the temperature measured at the site near First Avenue indicates the numerical model likely is not representing some of the infiltration processes, such as multidimensional flow beneath the streambed, the

model has poorly constrained sediment and hydraulic parameters, or a combination of these factors.

Results of this investigation indicate that, under well-constrained conditions where predominantly vertical infiltration can be assumed, a one-dimensional inverse numerical model can be used to estimate infiltration rates. One-dimensional modeling, however, assumes lateral spreading does not occur. If lateral spreading does occur, the estimated rates predicted by one-dimensional modeling will be smaller than actual rates. The results also indicate that streambed hydraulic conductivity can limit infiltration and that hydraulic conductivity can vary significantly between and during flow events. Erosion

and deposition associated with low-frequency, high-intensity ephemeral streamflow can result in large variations in the hydraulic conductivity of the streambed surface owing to an accumulation or removal of fine-grained sediments. This variability affects the cumulative infiltration, which could vary greatly as a function of the amount of streamflow and a function of the nature of the streamflow and the accumulation or removal of fine-grained sediments. Additionally, these results indicate that simulation of streambed infiltration should allow for temporal variation of the streambed hydraulic conductivity or should be done using short time periods to account for rapid changes in the streambed hydraulic conductivity.

Two-Dimensional Temperature and Water-Content Monitoring

For the purpose of measuring infiltration fluxes at the onset and throughout the duration of streamflow events, Blasch and others (2003) instrumented the stream-channel deposits beneath Rillito Creek near Dodge Boulevard with a two-dimensional vertical array of 28 paired thermocouples, temperature probes, and time-domain reflectometry (TDR) water-content probes placed perpendicular to flow (fig. 1). The paired probes were arranged in four columns (profiles C1, C2, C3, and C4 in figure 1) spaced 3 m apart. There are seven rows (depths) within the array at depths of about 0.50, 0.75, 1.0, 1.25, 1.50, 2.0, and 2.5 m below the streambed. Depths of the probes varied by as much as 0.25 m owing to deposition and

erosion during flow events. A near-surface temperature sensor also was placed adjacent to the paired two-dimensional array at a depth of 0.05 m.

The highly transient conditions that exist during the onset of streamflow are more difficult to simulate using temperature measurements exclusively than the saturated conditions presented in the previous section because of the rapid changes in water fluxes and increased multidimensional infiltration. Combined water-content and temperature measurements are needed to simulate initial transient infiltration rates in unsaturated sediments. Additionally, infiltration rates can be estimated using wetting-front arrival times and changes in water content at successive TDR probes.

Water-content data show rapid changes shortly after the onset of streamflow (fig. 15). Volumetric water content increases throughout the measured profiles from about 20 percent to 40 percent within minutes of the onset of streamflow. Initial infiltration rates measured as the change in volumetric water content over time per unit area were as high as 2 mm/s, which if sustained would be equivalent to 166 m/d. The high rates are likely to include vertical and lateral flow components. Temperature and water-content data for a September 2000 event indicate that infiltration occurs in both the horizontal and vertical directions at the onset of streamflow (figs. 16 and 17). Measured lateral wetting-front velocities between profiles were similar in magnitude to vertical velocities. The similar velocities measured at the onset of streamflow probably were due to tension gradients being much larger than the gravitational gradient. Water traveled laterally almost the entire 9-m

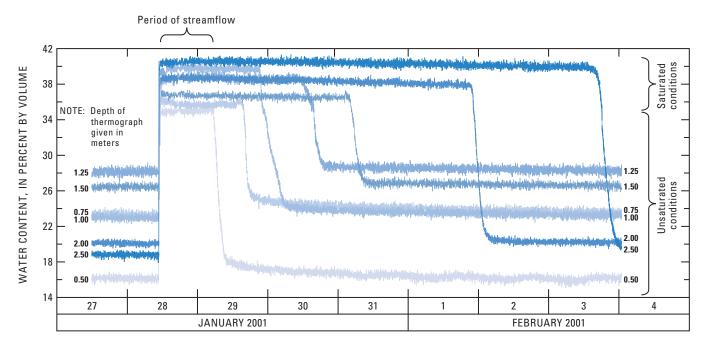


Figure 15. Water content of stream-channel sediments for duration of a streamflow event including onset and cessation, from within two-dimensional array in Rillito Creek near Dodge Boulevard, Pima County, Arizona.

distance between profiles within the first few minutes of the onset of streamflow.

Multidimensional-flow simulations are required to accurately represent the full volume of water infiltrating into a porous, heterogeneous medium near the margins of the advancing wetting front where capillary flow dominates. Infiltration, however, is increasingly vertical near the center of streamflow in a homogeneous medium, and lateral flow diminishes as capillary gradients decline with distance from the boundary of the wetted perimeter. The time from the onset of flow required for vertical infiltration to dominate varies depending on streamflow conditions and the texture of the streambed material. For instance, small braided-ribbon flows over fine material may never result in predominantly vertical infiltration, whereas large bank-to-bank flows over coarse material may produce predominantly vertical infiltration beneath the streambed within minutes on the basis of the large wetted perimeter and conductivity of the sediments.

A typical set of measured Rillito Creek thermographs from an April 2001 event and from a November 2000 event were simulated using a variably saturated heat and mass transport model, VS2DH (Healy and Ronan, 1996). The thermographs for the 0.5- and 2.5-m depths were used as boundary conditions, and the thermographs for the remaining five depths were used as observation points. One-dimensional models were created. Parameter optimization software, PEST, was used to calibrate thermal and hydraulic properties. Numerical simulations shown for data from the two-dimensional array are for a 10-m wide flow event starting on April 6, 2001 (fig. 18). The assumption of vertical one-dimensional flow was considered valid because temperature changes were predominantly in the vertical direction. The simulated infiltration rates varied from about 0.35 to 0.39 m/d throughout the initial 2 days of flow (fig. 19) and average 0.37 m/d. This represents a variation in predicted infiltration rates of less than 10 percent among the four columns, indicating that infiltration was uniform and predominantly vertical. Although the simulated and measured thermographs are in general agreement, departures do exist. Simulated temperatures differ from measured temperatures for several reasons, such as error in the measured boundary conditions, error in hydraulic and thermal property assignments, or an inability of the models to fully represent multidimensional infiltration.

The infiltration rate generally declines as the streamflow event proceeds. The declining infiltration rate is attributed to a declining pressure head and (or) development of a thin, fine-grained surface layer. Infiltration rates continued to decline during the flow event and averaged 0.32 m/d for the 12 days measured. By converting to flux units that are comparable with those estimates made at the vertical temperature nests described above and using a wetted perimeter of 10 m, an average infiltration rate of 0.32 m/d equates to a flux of 0.04 m³/s/km. There are two important differences between these estimates and estimates made at the one-dimensional temperature-array sites near Craycroft Road and Dodge Boulevard. First, the estimated infiltration rates at the vertical-array sites near Craycroft Road and Dodge Boulevard are about twice

that of the infiltration estimates made at the two-dimensional array. Second, the infiltration rates at the vertical-array sites required a low-hydraulic conductivity layer be incorporated into the model in the later stages of infiltration. The addition of a low-conductivity layer resulted in significantly reduced infiltration rates during the later stages of streamflow. The two-dimensional array was at the lowest part of the cross section, whereas the vertical nest was near a depositional fringe within the streambed, which may account for the deposition of the low-conductivity layer at the vertical nests.

An estimated sustained infiltration rate of about 0.32 m/d for the April 2000 streamflow event agrees with simulation results for a November 2000 event lasting 10 days. An average infiltration rate of 0.37 m/d was simulated for the November event. These rates show general agreement with infiltration rates of 0.41 to 0.50 m/d estimated by other investigators along Rillito Creek (Burkham, 1970; Katz, 1987). Simulations were also extended about 2 days beyond the periods of streamflow to estimate the redistribution of water in the subsurface. Redistribution rates, similar to infiltration rates, are determined from the elapsed time between sharp decreases in water content at each depth (fig. 15). After the cessation of streamflow, temperature measurements indicated the simulated dewatering flux was 0.33 and 0.30 m/d for the April and November events, respectively. Estimated redistribution rates using water-content changes were 0.08 and 0.1 m/d for the April and November events, respectively. Thus, redistribution rates were slightly less than infiltration fluxes during steady-state flow, and estimates of dewatering using water-content measurements were less than the simulated fluxes using temperature methods.

The variety of physical and chemical methods presented in this chapter (and elsewhere) are used to estimate rates of infiltration and percolation under steady-state conditions. For long-duration events (several days to months) steady-state conditions may be an accurate assumption, but for short-duration events (less than 24 hrs) typical of those in Rillito Creek and other streams in southern Arizona, infiltration fluxes that occur shortly after the onset of flow may differ substantially in magnitude from those throughout the duration of the event. For detailed water-budget analyses and hydrologic models dependent on infiltration flux estimates, the infiltration flux has to be estimated more accurately than is possible when using the assumption of steady-state conditions. Infiltration fluxes through the first 2 m of unsaturated sediments at the onset of streamflow calculated for 20 events ranged from 13 to 166 m/d. Variability in antecedent water content and fluid temperature were examined as possible factors contributing to the range in onset fluxes. Onset infiltration rates were inversely correlated to antecedent water content with a log-linear relation (fig. 20). Measured onset infiltration fluxes differed from those of the steady-state infiltration fluxes by four orders of magnitude. Infiltration rates after onset declined more quickly for events in which the antecedent water content was high; events starting with higher antecedent water content required 3.7 hours to achieve near steady-state conditions, whereas events with lower antecedent water content required 6.8 hrs.

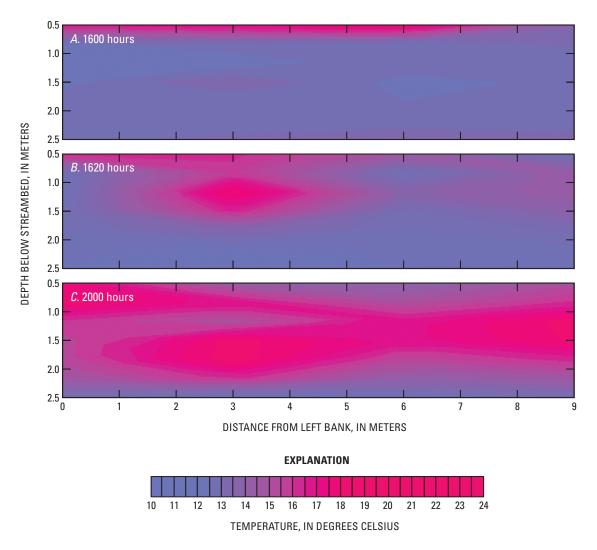


Figure 16. Two-dimensional distribution of temperature during different streamflow conditions in Rillito Creek on September 10, 2000, near Dodge Boulevard, Pima County, Arizona. *A*, Thermal transport through conduction before the onset of streamflow; *B*, thermal transport through a combination of advection and conduction at the onset of streamflow exhibiting multidimensional flow through the sediments; *C*, combined advection and conduction thermal transport to the deeper sediments several hours after the onset of streamflow.

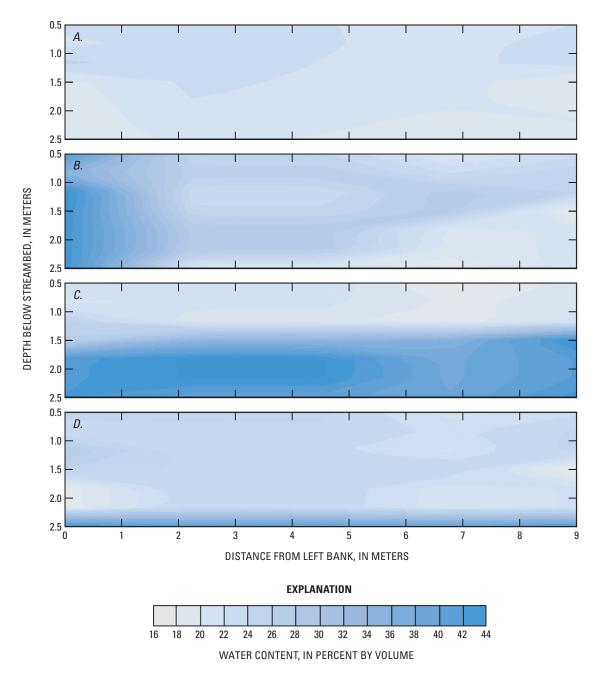


Figure 17. Two-dimensional plot of soil-water content during different streamflow conditions in Rillito Creek near Dodge Boulevard, Pima County, Arizona; *A*, Before the onset of streamflow, September 10, 2000, at 1600; *B*, five minutes after the onset of streamflow, September 10, 2000, at 1605; *C*, immediately after the cessation of streamflow September 12, 2000; *D*, approximately 2 days after the cessation of streamflow, September 14, 2000.

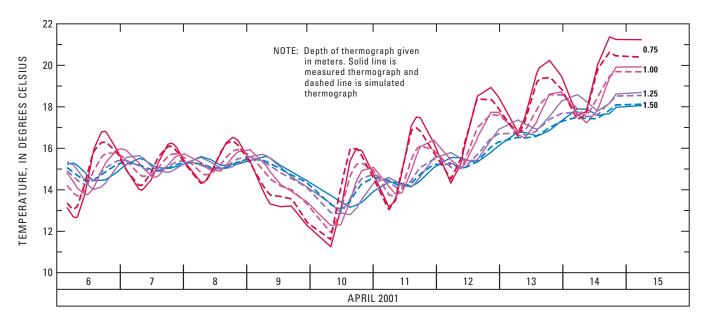


Figure 18. Typical measured and simulated thermographs from two-dimensional temperature array from column 1 (see fig. 1 for column location) in Rillito Creek near Dodge Boulevard, Pima County, Arizona.

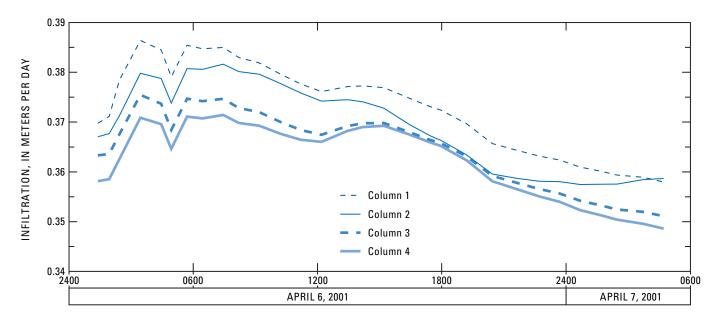


Figure 19. Simulated infiltration rates during period of flow at the two-dimensional temperature array near Dodge Boulevard, Pima County, Arizona.

The general agreement in infiltration estimates among these independent temperature and water-content methods indicates that these methods provide accurate estimates of infiltration. As such, vertical arrays of temperature probes can be located along stream reaches to estimate the potential for in-stream recharge and to provide guidance on citing recharge facilities. High infiltration rates at shallow depths, however, are not sufficient to ensure that water will percolate to deeper depths and recharge the deep aquifer at a high rate. Infiltration rates determined from shallow measurements

should be considered an upper limit of the potential recharge rate for a particular site.

Water-Level Responses

Piezometer nests were installed in the stream-channel boreholes and monitored for water-level variations in response to streamflow. Nested piezometers included one shallow piezometer completed in what is usually the unsaturated zone,

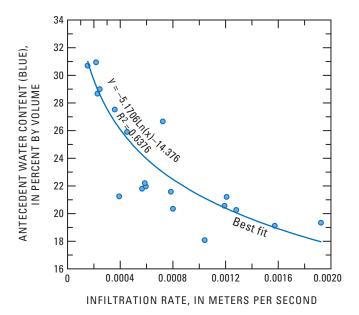


Figure 20. Correlation of onset infiltration rate to antecedent water content.

near the contact between the recent stream-channel alluvium and the basin-fill deposits, and a pair of deep piezometers one near the water table and one about 10 m below the water table. With the exception of the piezometer near Craycroft Road, the shallow piezometers generally were dry except shortly after streamflow (fig. 21) and contained water for periods of days to several weeks. The magnitude of water-level variation and the period of time the shallow wells contained water varied. For instance, the water level in the shallow piezometer near Dodge Boulevard varied the least (usually less than 1 m), whereas the water level in the shallow piezometer near La Cholla Boulevard varied the most (usually between 6 and 7 m); water-level variations in the shallow piezometer near First Avenue were usually between 2 and 6 m. Duration in which the water level remained above the bottom of the piezometer was longest in the piezometer near La Cholla Boulevard where saturation persisted for 6 months after the summer 1999 streamflow and 12 months after the winter 2000 streamflow; saturation time was shortest at the shallow piezometer near Dodge Boulevard where it was typically less than 2 months (fig. 21). The long duration of saturation at the shallow piezometer near La Cholla Boulevard probably was due to the fine-grained unit at depth of about 12 to 30 m (Hoffmann and others, 2002).

Water levels in each of the pairs of deep piezometers responded several days to weeks later than the shallow piezometers and generally after the shallow piezometers became dry. There were little to no vertical gradients measured in the pairs of deep piezometers. These responses suggest gravity flow predominates, and that no hydraulic connection is established between streamflow and the underlying deep aquifer. Given the low-permeability of the basin-fill deposits,

relative to that of the stream-channel deposits, it also is likely that temporary perched conditions existed near the contact between these two units for a period of several days to weeks after cessation of streamflow.

Water levels in the deep piezometers showed an overall decline during the period of investigation. Water-level declines between spring 1999 and summer 2002 ranged from about 2 m at the deep piezometer near Craycroft Road, to 8 m at the deep piezometer near Dodge Boulevard (fig. 21). The declines probably are related to ground-water pumpage from the basin-fill aquifer. Superimposed on the declines are a series of rises that range from about 0.5 to 3.9 m. These rises are in response to the two most significant streamflow periods that occurred in summer 1999 and fall/winter 2000.

The initial response of the water table in the deep piezometers lags the onset of streamflow by about 2 weeks at the piezometer nests near Dodge Boulevard and near First Avenue, whereas the initial response of the water table at the piezometer nests near Craycroft Road and near La Cholla Boulevard is more rapid—within about a day of streamflow in summer 1999. Lag time for the initial response at the piezometers near Dodge Boulevard and near First Avenue is related to the presence of a thick unsaturated zone at these sites. The short lag time between the onset of streamflow and the initial water-table response could be related to factors such as preferential flow and uniformly high water content throughout the unsaturated zone (Hoffmann and others, 2002). The occurrence of preferential flow is supported by the rapid response of the water table to streamflow despite the presence of the fine-grained unit.

Timing of the water-level peak also varies with location, and the peak occurs several weeks to months after the onset of streamflow. The longest lag time for the peak occurs near La Cholla Boulevard where it was about 7 months. Dissipation to prerecharge-event water levels also required several months at each site (fig. 21).

The magnitude of the water-table response in the deep piezometers is greatest at the piezometer nests near Dodge Boulevard and First Avenue. The water-table response in the piezometer nest near Craycroft Road is reduced relative to the water-table responses near Dodge Boulevard and First Avenue. Shallow piezometers near Craycroft Road indicate the water table often reaches land surface during streamflow events; therefore, the reduced water-level response probably is related to rejected recharge. The magnitude of the watertable response at the piezometer nest near La Cholla is the smallest and is related to a smaller recharge rate related to less frequent and smaller streamflows near La Cholla, relative to the other sites, and the presence of the fine-grained layer in the unsaturated zone. The lack of vertical gradients between the middle and deep piezometers at each nest indicates flow is predominantly horizontal in the saturated zone, except in the piezometer nest near Craycroft Road where the vertical gradient averages about 0.1m/m.

A series of recharge estimates were calculated on the basis of the water-level responses using an analyti-

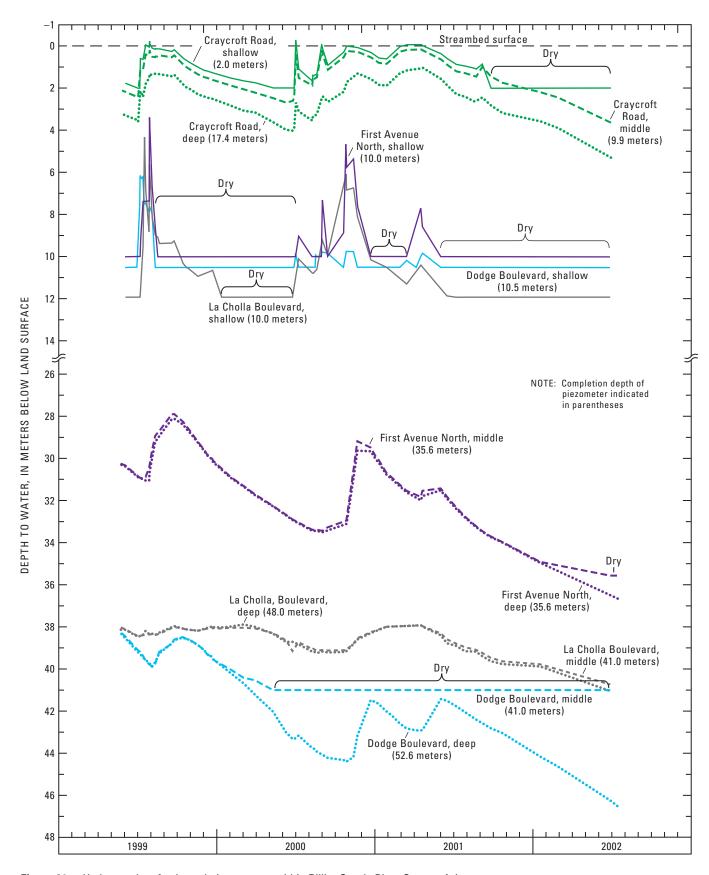


Figure 21. Hydrographs of selected piezometers within Rillito Creek, Pima County, Arizona.

cal approach developed by Moench and Kisiel (1970). In this analytical model, changes in water levels over time near an ephemeral-stream channel are assumed to reflect actual recharge. This is advantageous in that no information or assumptions regarding unsaturated-zone processes are required in order to make the calculations.

For any given streamflow event, a certain amount of water may recharge the aquifer and thereby cause water levels in nearby wells to rise. The water-level rise results in a mound that slowly dissipates normal to the line source. Subsurface sediments will act to slow the dispersal. The variation in rate and duration of recharge can thus be viewed as an input function, the aquifer as a filter or impulse-response function, and the water levels as output. The variation in the rate and duration of recharge can be calculated from a combination of water-level data and the impulse-response function, which is derived from parameters of aquifer geometry, aquifer storage, and hydraulic properties, using the groundwater flow equations. By summing these rates of recharge for the time period being studied, the volume of water recharged can be determined.

Various assumptions about the aquifer flow-system are required to implement the analytical model deveolpoed by Moench and Kisiel (1970). Flow is assumed to be one dimensional and horizontal. The aquifer is assumed to be homogeneous and isotropic, to be infinite in horizontal extent, and to receive recharge from a finite width source. Aquifer characteristics are assumed to be invariant with time and water-level fluctuations.

Input to the model includes temporal variations in water levels, channel width, distance of the well from the center of the stream channel, specific yield, and transmissivity. The output is recharge calculated as cubic meters per second per linear kilometer of stream channel (m³/s/km) over the period of record. Variations in measured water levels were assumed to be recharge events superimposed upon a generally declining water table. In order to find the amount of water recharged without the bias of the decline, the data were detrended (fig. 22). Detrending consisted, first, of calculating the trend in the data using a linear regression. This trend was then removed from the data under the assumption that all other deviations from a constant water level were caused by recharge. The period of record for the recharge calculations was based on the time required for the waterlevel response to return to prerecharge levels; therefore, the period of record includes both the rise in water level associated with recharge and the dissipation of the water level. A specific yield of 0.15 was used on the basis of measurements made by Pool and Schmidt (1997). Bounding transmissivities of 1.6×10^{-3} and 6.5×10^{-3} m²/s estimated from Hanson and Benedict (1994) were used to show the uncertainty in the recharge values. The only difference between input data for the various sites was the individual water-level records and the distance of the well from the stream channel (to which the model showed little sensitivity in comparison with its sensitivity to transmissivity).

Recharge estimates were calculated for the sites near Dodge Boulevard, First Avenue, and La Cholla Boulevard for the recharge events of 1999 and 2000. The recharge event in 1999 was caused by summer streamflows, whereas the recharge event in 2000 was due predominantly to fall and winter streamflows and only partly to summer flows (table 1). The site near Craycroft Road was excluded from this analysis because the presence of vertical water-level gradients violated the assumptions of the analytical model. The largest cumulative recharge estimates for the 1999 event at the site near First Avenue range from 3.0×10^5 to 6.0×10⁵ m³/km, which is about two to three times larger than those from the other two sites (near Dodge Boulevard, 1.7×10^5 to 3.4×10^5 m³/km; near La Cholla Boulevard, 1.3×10^5 to 2.5×10^5 m³/km; table 2). Cumulative recharge estimates for the 2000 recharge event were greatest at the site near Dodge Boulevard and decreased in the downstream direction. At the site near Dodge Boulevard, recharge estimates range from 7.1×10^5 to 1.4×106 m³/km, which are slightly larger than those estimated at the site near First Avenue $(5.3 \times 10^5 \text{ to } 1.1 \times 10^6 \text{ m}^3/\text{km})$ and about three times larger than those estimated at the site near La Cholla Boulevard (2.2×10^5 to 4.3×10^5 m³/km). The recharge estimates for the 2000 event at the sites near First Avenue and near La Cholla Boulevard were about twice those for the 1999 event at these sites and were more than five times that of the 1999 event at the site near Dodge Boulevard. The trends revealed in this analysis are consistent with the fact that the winter 2000 streamflows were more voluminous and longer in duration than the summer 1999 streamflows (table 1), and that water levels in the piezometers rose higher in response to the winter 2000 streamflows than to the summer 1999 flows (fig. 21).

Volumetric recharge rates were estimated by dividing the cumulative-recharge estimates by the cumulative duration of streamflow at each site during the period of record. Streamflow duration at the streamflow-gaging station at Dodge Boulevard totaled about 9 days between July 1, 1999 and September 30, 1999, whereas streamflow duration at streamflow-gaging station 09486055, near La Cholla Boulevard, for the same period totaled about 4.5 days. No streamflow-gaging station existed near First Avenue; however, in this analysis, a total of about 7 days of cumulative flow was assumed to have occurred at the site near First Avenue during 1999—a duration less than that at the upstream gage, at Dodge Boulevard, and greater than that at the downstream gage, near La Cholla Boulevard. Using the values of estimated cumulative-recharge determined using the Moench and Kisiel (1970) method and of cumulative-streamflow duration, recharge rates range from 0.2 to 1.0 m³/s/km for 1999 (table 2). During the period of June 15 to December 31, 2000, a span that includes most of the streamflow for the second recharge period, cumulative-streamflow duration ranged from a high of 43 days at the streamflow-gaging station at Dodge Boulevard, to a low of 14 days at the streamflow-gaging station near La Cholla Boulevard. In this analysis, a flow duration of 30 days was assumed to have occurred at the site near First Avenue. Using these values, volumetric-recharge rates range from 0.2 to 0.4 m³/s/km for 2000 (table 2). These rates are generally greater than volumetric-infiltration estimates

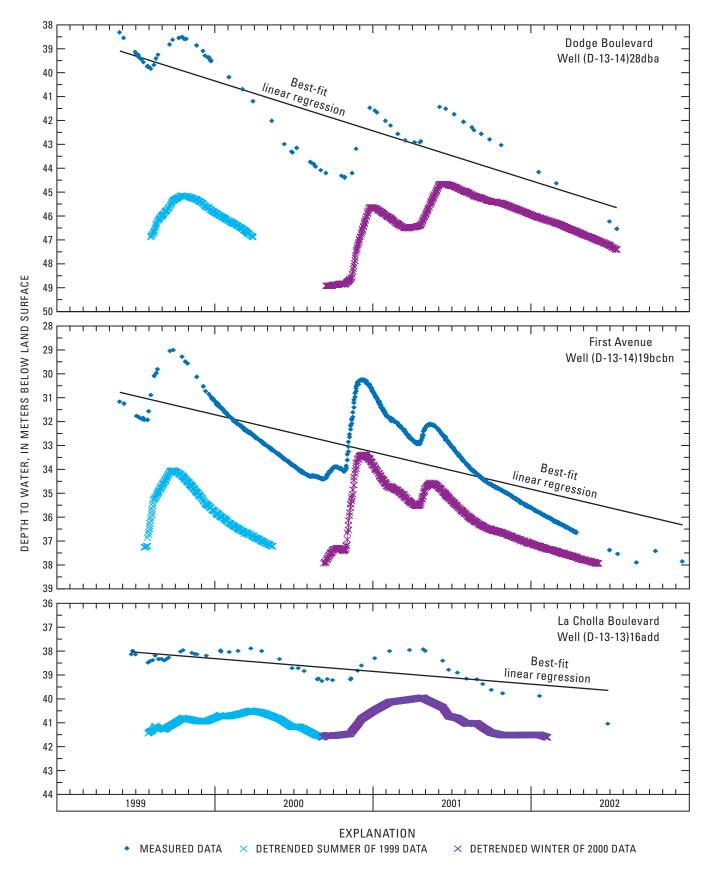


Figure 22. Measured and detrended hydrographs of selected piezometers within Rillito Creek, Pima County, Arizona.

Table 2. Recharge estimates for sites in Rillito Creek, Pima County, Arizona, using the Moench and Kisiel (1970) analytical-model method. [m²/sec, square meters per second; m³/km, cubic meters per kilometer; m³/s/km, cubic meters per second per kilometer]

	Distance of well		1999		2000	
Site location	from center of Ril- lito Creek channel, in meters	Recharge	Transmissivity = 1.6×10 ⁻³ m ² /s	Transmissivity = 6.5×10 ⁻³ m ² /s	Transmissivity = 1.6×10 ⁻³ m ² /s	Transmissivity = 6.5×10 ⁻³ m ² /s
Dodge Boulevard	3	Length of recharge period, in days ¹	9		43	
		Total, in m ³ /km	1.7×10^{5}	3.4×10^{5}	7.1×10^{5}	1.4×10^{6}
		Rate, in m ³ /s/km	0.2	0.4	0.2	0.4
First Avenue	45.7	Length of recharge period, in days ¹	7		30	
		Total, in m ³ /km	3.0×10^{5}	6.0×10^{5}	5.3 × 10 ⁵	1.1×10^6
		Rate, in m ³ /s/km	0.5	1	0.2	0.4
La Cholla Boulevard	3	Length of recharge period, in days ¹	4.5		4.5	
		Total, in m ³ /km	1.3×10^{5}	2.5×10^{5}	2.2×10^{5}	4.3×10^{5}
		Rate, in m ³ /s/km	0.3	0.7	0.2	0.4

¹Refers to the cumulative time streamflow existed in Rillito Creek. Streamflow durations were calculated using data from the streamflow-gaging stations near Dodge and La Cholla Boulevards.

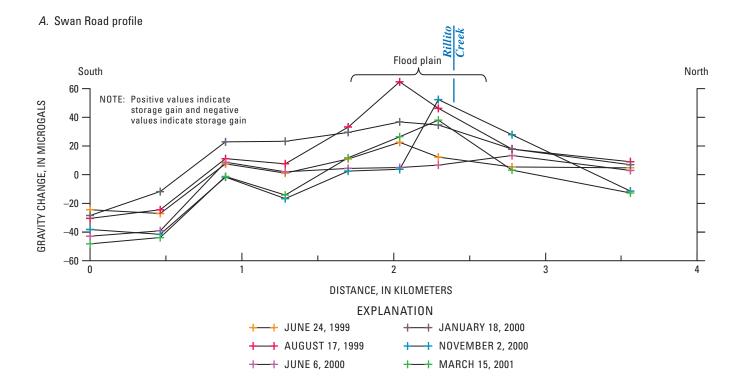
made using temperature, water-content, and seepage-loss methods. Because infiltrated water can be stored in the shallow subsurface it is available for subsequent evaporation and (or) transpiration; therefore, infiltration rates typically provide an upper bound for recharge rates. Estimated recharge rates in excess of infiltration rates indicate unaccounted sources of water. These unaccounted sources likely are inputs from adjacent tributaries, many of which drain the pediment north of Rillito Creek.

Temporal Gravity Measurements

Ground-water storage was monitored along two gravity profiles across Rillito Creek at Swan Road (5-km length) and First Avenue (6.4-km length). The profiles included 11 gravity stations that are closely spaced near Rillito Creek and at wells where water levels are monitored (fig. 1). Gravity changes along both profiles after summer 1999 show that increases in ground-water storage were primarily within the flood plain coincident with the stream alluvium (fig. 23). Gravity increases on the First Avenue profile were largest between these measurement dateswere at the station nearest Rillito Creek. The largest increase between June 199 and August 1999 was 48 microgals, which is equivalent to about 1.1 m of water, assuming the mass change occurs within a horizontal slab of infinite extent. Gravity increase on the Swan Road profile also was largest between the June 1999 and August 1999 measurements at the station about 0.5 km south of Rillito Creek. The greatest change between these measurement dates was 42 microgals (equivalent to about 1 m of water). The gravity changes and associated water-level rises indicate that the highly permeable stream-channel and flood-plain deposits act as a ground-water reservoir that readily accepts infiltrated streamflow.

Estimates of recharge through infiltration along Rillito Creek were made by assuming the storage changes measured by gravity at each profile were equivalent to recharge and by integrating the two-dimensional gravity change for the length of the creek. Similar to that shown with water-level trends, the overall storage-change estimates during the period of study steadily declined with two periods of recharge superimposed on the longer-term rate of decline (fig. 24). The long-term storage decline shown in figure 24 is related to the dissipation of a water-table mound produced in 1998, from sustained flows related to the El Niño precipitation, and to ground-water pumpage from nearby public and private wells. The periods of increased storage that reduce the rate of longterm declines were associated with the summer 1999 and fall/winter 2000 streamflows (figs. 3 and 24). The increase in storage for the summer 1999 period is about 7.5×10^6 m³; for the fall/winter 2000–2001 period it is about 11.1×10^6 m³ for the 14-km reach between Craycroft Road and La Cholla Boulevard. Although measurable, these seasonal storage increases are small compared to the storage increases associated with the 1998 El Niño event, which were about 5×10^7 m³ (fig. 24).

Assuming that the increases in storage measured in summer 1999 and fall/winter 2000–2001 were uniform throughout the 14-km reach between Craycroft Road and La Cholla Boulevard, they would equate to 5×10^5 m³/km and



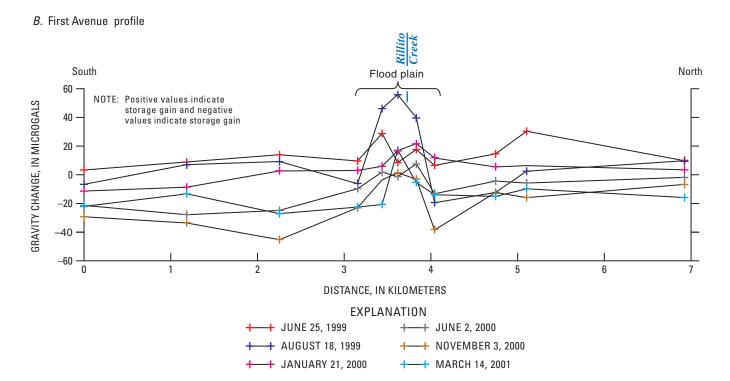


Figure 23. Gravity changes along profiles crossing Rillito Creek, Pima County, Arizona, since December 1997. A, Swan Road; B, First Avenue.

 8×10^5 m³/km, respectively. Using 7 days of flow (as estimated at First Avenue; table 2) for the summer 1999 event and 30 days of flow for the fall/winter 2000-2001 event, these recharge volumes equate to 0.9 m³/s/km in the 1999 event, and 0.3 m³/s/km in the 2000–2001 event.

These rates are generally similar to those estimated using water-level methods, yet greater than volumetric-infiltration estimates made using temperature, water-content, and seepage-loss methods. As discussed previously, recharge-rate estimates in excess of infiltration-rate estimates indicate unaccounted sources of water. These unaccounted sources likely are inputs from adjacent tributaries, many of which drain the mountain-front area north of Rillito Creek.

Two-dimensional simulations of the change in water distribution in the subsurface required to produce the change in gravity for the period June 24, 1999 to August 18, 1999, along both profiles are shown in figure 25. Simulations used GM-SYS software (version 4.6) developed by Northwest Geophysical Associates, Inc. The software calculates the gravity field response of polygonal features of variable subsurface density using the theory and algorithms of Talwani and others (1959), and Won and Bevis (1987). Simulation of the two-dimensional vertical polygons requires simplifying assumptions about the distribution of storage change in the third dimension, in this case along the stream channel, and at the margin of the simulated region. This application assumed the two-dimensional polygons of storage change extended in infinite length along the stream channel. Storage change in the crystalline rocks adjacent to the northern boundary of the aquifer was assumed to be insignificant. Storage change in the aquifer adjacent to the southern end of the profiles was assumed to extend laterally to an infinite distance. Each of these assumptions likely contributes little to no errors in the simulation. Available water-level

data and gravity-derived estimates of specific yield were used to constrain the vertical distribution of saturated storage change at many gravity-station wells. Gravity changes along the First Avenue profile are explained by a combination of higher water levels and increases in water content in the unsaturated zone. A 10-percent increase in unsaturated water content was required to match the observed gravity change at gravity stations near the channel. The resulting model (fig. 25A) resulted in simulation errors of less than 1 microgal at each station.

Simulation of gravity change along the Swan Road profile could be explained by storage change within the zone of water-level change: no changes in water content in the unsaturated zone were required. Increases in gravity at all stations along the Swan Road profile during June 24, 1999, to August 17, 1999, (fig. 25*B*) indicated that infiltration and recharge during the intervening period between gravity surveys resulted in storage increases within about 2 km of the stream channel. The greatest increases in gravity occurred at the two stations within about 0.5 km south of the channel. Gravity increases at stations farther from the channel ranged from 2 to 23 microgal. The resulting model (fig. 25*B*) resulted in simulation errors of generally less than 1 microgal at each station.

Summary and Conclusions

The amount of water currently recharging the aquifers within the Tucson area is insufficient to meet current and future demands. Resultant ground-water deficits are manifested in water-level declines of more than 60 m since the middle of the twentieth century. The accurate determination of recharge is critical to establishing a sustainable water budget on the basin scale. In semiarid regions, recharge beneath ephemeral-stream

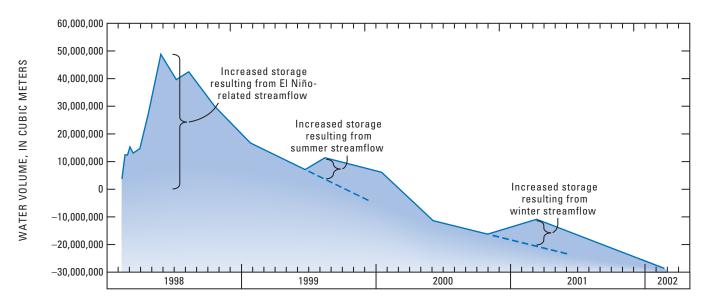


Figure 24. Storage changes measured along Rillito Creek, Pima County, Arizona, from Craycroft Road to La Cholla Boulevard relative to a measurement made in December 1997.

channels typically represents a major component of the total recharge. Improved understanding of streambed infiltration and the subsequent redistribution of water within the unsaturated zone is fundamental to quantifying and forming an accurate

description of streambed recharge.

One of the challenges of quantitatively studying recharge beneath ephemeral-stream channels is the need to integrate measurements made over a wide range of spatial and temporal scales. No single method of measurement or analysis can resolve the complex physical processes that contribute to infiltration, percolation, and recharge beneath these channels; therefore, various approaches that provide a wide range of temporal and spatial scale measurements of recharge beneath Rillito Creek were used in this study. The approaches discussed in this chapter included analyses of cores and cuttings for hydraulic and textural properties, environmental tracers from the water extracted from the cores and cuttings, seepage measurements made during sustained streamflow, heat as a tracer and numerical simulations of the movement of heat through the streambed sediments, water-content variations within a two-dimensional array, water-level responses to streamflow in piezometers within the stream channel, and gravity changes in response to recharge.

The amount of water flowing in Rillito Creek, and therefore the amount available for ground-water recharge, is primarily related to precipitation frequency, distribution, and intensity, as well as to streamflow and basin/channel runoff characteristics. The temporal distribution of flow in ephemeral streams is highly varied. Because of this, estimating or predicting recharge rates for ephemeral-stream channels on the basis of limited temporal observations is particularly difficult. This investigation extended from 1999 through most of 2002 and represented a time of lower than average precipitation and streamflow on the basis of data from the previous 30 years. Estimates of cumulative infiltration and recharge during this study period may differ from long-term averages; however, estimates of infiltration and recharge rates for streamflow events during the study period can be extrapolated to a variety of climatic conditions.

In order for ephemeral streamflow within Rillito Creek to recharge the underlying aquifer, the water must first infiltrate into the stream-channel deposits and percolate downward through the underlying deposits. The ability of water to infiltrate and percolate through these deposits is a function of the availability of streamflow and the hydraulic properties of the deposits. Study results indicate that the ver-

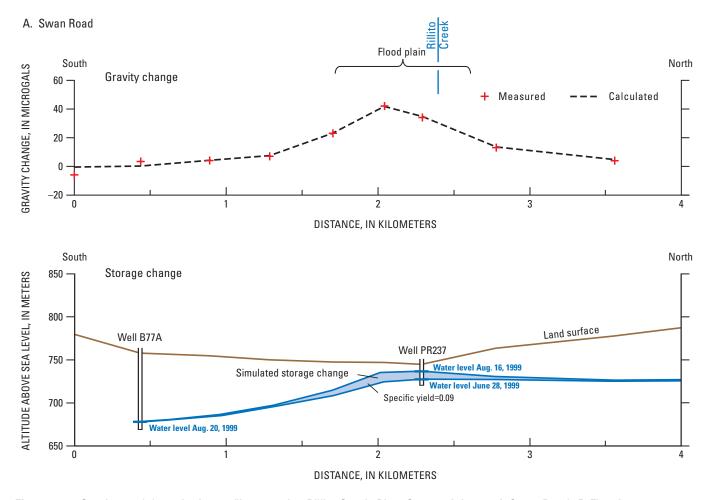


Figure 25. Gravity-model results for profiles crossing Rillito Creek, Pima County, Arizona. A, Swan Road; B, First Avenue.

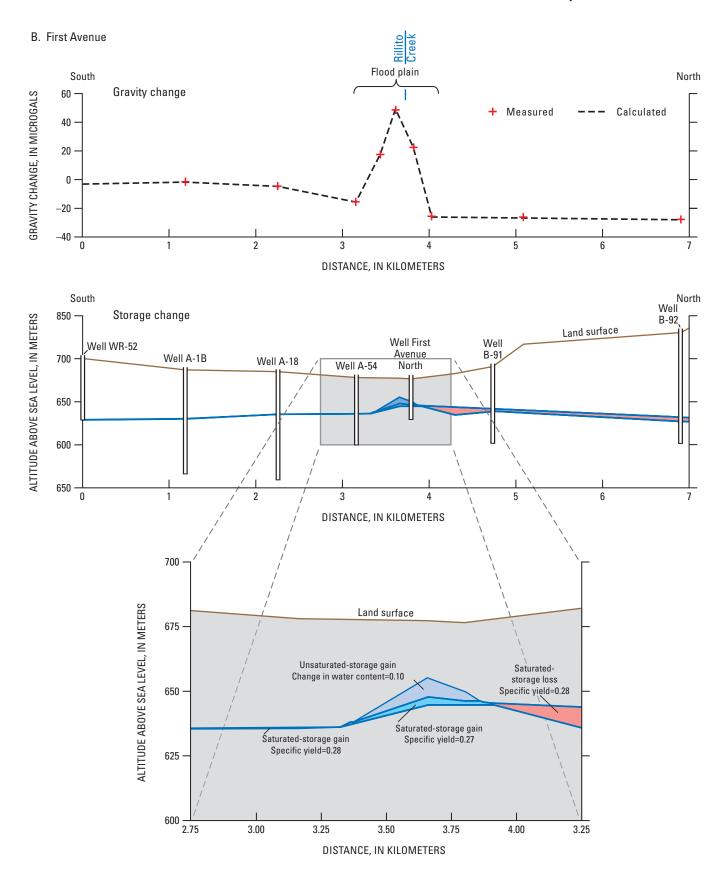


Figure 25.—Continued.

tical hydraulic conductivity of the stream-channel deposits ranges from 0.3 to 2.5 m/d, whereas hydraulic conductivity of the the basin-fill deposits ranges from 0.012 to 0.61 m/d. For heterogeneous media, such as the deposits beneath Rillito Creek, the equivalent vertical hydraulic conductivity is calculated as the harmonic mean of the Ksat for each textural layer within the deposits. Although differing at each borehole, the overall average equivalent saturated hydraulic conductivity of the stream-channel deposits is 1.2 m/d; the overall average equivalent saturated hydraulic conductivity of the basin-fill deposits is 0.19 m/d; and the equivalent hydraulic conductivity of the stream-channel and basin-fill deposits together is about 0.23 m/d (table 3). Assuming no preferential flow occurs and unit gradient conditions, these equivalent vertical hydraulic conductivity values provide an estimate of long-term potential recharge rates under saturated conditions. To convert these values into potential recharge volumes, assumptions of flow duration and average wetted perimeter and length must be made. For example, using an annual cumulative flow duration of 36 days per year for Rillito Creek, an average wetted perimeter of 20 m and a wetted length of 20 km, yields an annual volumetric recharge of 4.3×10^6 m³/y, which is about two-thirds of the commonly reported long-term average recharge of 6 × 10⁶ m³/y (Hanson and Benedict, 1994).

Environmental tracers were used to evaluate spatial variations in infiltration and recharge patterns along Rillito Creek and estimate percolation rates through the unsaturated zone. Tritium was detected in pore water extracted from all core samples and ranged from 2 to 11 TU, indicating that water in the unsaturated zone infiltrated during the past 40 years. Given the presence of tritium in the unsaturated zone, the locally high vertical hydraulic conductivity values greater than 1 m/d in the stream-channel deposits, and a depth to the water table of generally less than 40 m, it is likely that most of the pore water extracted from the cores infiltrated during runoff events in the past few years. Variations in isotopic compositions of ground water beneath Rillito Creek are attributed to changes in the compositions of the source water and to evaporation. The lack of an evaporative signal for some samples indicates that percolating water was exposed to minimal evaporation.

Isotopic ratios measured in the pore water during the study are representative of the isotopic ratios in the infiltrating waters of the recent past. Isotopic ratios in Rillito Creek pore water become lighter in the downstream direction indicating that for the time period represented by the unsaturated-zone pore water, the longer duration and isotopically lighter winter storms were more important contributors to infiltration in the downstream reaches than in the upstream reaches. The trends in isotopic ratios measured in the pore-water cores approximately match the trends in ratios in the basin precipitation from particular storms during the year prior to drilling. Correlation between the precipitation events and depths of infiltration, on the basis of corresponding isotopic signatures, indicates an average vertical-

percolation rate of approximately 0.049 m/d at the Dodge Boulevard borehole site (table 3). Chloride concentrations in pore-water leachate determined from drill cuttings varied substantially through the upper 18 m at all sites. Below about 18 m, variation in chloride concentration declined considerably. This zone of smaller variation is interpreted as corresponding to the infiltration depth of the 1998 El Niño water. The low variability and low mean value of chloride concentration is attributed to a constant supply of runoff having a low chloride concentration. In addition, the low chloride concentration indicates the water had little exposure to evaporation. The higher variability and concentration observed in post-El Niño pore water above 18 m likely is due to mobilization of chloride from evaporative concentrates and dry fallout deposited between precipitation events that resulted in runoff along a variety of surface-water flow paths. Calculation of a downward percolation rate using the El Niño event marker in the chloride profile yields an average percolation rate of 0.055 m/d (table 3). Although the estimates of recharge determined by hydraulic properties and environmental tracers required the assumption of no preferential flow, the water-level responses measured in the deep piezometers indicate that factors such as preferential flow likely influence recharge rates. Estimates made using these techniques, therefore, are likely representative of minimum values.

Infiltration rates are typically assumed to provide an upper bound for recharge rates. Infiltration rates were estimated using seepage-loss, temperature, and water-content methods. Seepage measurements made at several sites along Rillito Creek during the El Niño-related sustained flows of March through April 1998 and again on October 24, 2000, indicate that streamflow losses owing to infiltration along Rillito Creek ranged from 0.07 to 0.9 m³/s/km and averaged 0.21 m³/s/km (table 3). Streamflow losses were smallest in the upstream reaches. The losses in these reaches were attributed to a shallow water table and rejected recharge. Using a wetted perimeter of 25 m, which was the average width of the flow that occurred during October 2000, the calculated average infiltration rate is 0.7 m/d, (table 3) which is similar to the measured saturated hydraulic conductivity of the stream-channel deposits but more than an order of magnitude greater than percolation rates determined by tracers. The difference between the estimated infiltration and percolation rates probably is due to the variably saturated nature of the sediments. The near-surface stream-channel deposits are likely to be nearly saturated during streamflow and therefore are approaching their saturated hydraulic conductivity, whereas the deeper sediments are less saturated and will therefore have a lower hydraulic conductivity.

Infiltration-rate estimates made using temperature and water-content methods in this study are one dimensional; information on stream width and length are required to estimate volumetric rates from the infiltration estimates. Model simulations using streambed-temperature data indicate the likelihood of a thin surface layer having a low vertical

hydraulic conductivity at the site near Craycroft Road. The addition of this surface layer to the model domain resulted in a lowering of the simulated equivalent saturated hydraulic conductivity by four orders of magnitude from about 4 m/d to 3×10^{-4} m/d. The four orders of magnitude change is too large to result solely from changes in water viscosity owing to temperature changes. Given the tranquil flow conditions during the first modeled flow period near Craycroft Road, it is possible that the change resulted from the deposition of a fine-grained layer of sediment on the streambed surface. In fact, a thin layer of fine-grained material commonly was observed at the sites after small streamflows. Vertical hydraulic gradients measured in the nested piezometers at the site near Craycroft Road allowed for estimation of infiltration rates using simulated equivalent vertical saturated hydraulic conductivity. Vertical hydraulic gradients during and shortly after streamflow were typically 0.1 m/m. Estimated infiltration rates ranged from 0.09 m³/s/km during the period probably most representative of ephemeralstreamflow conditions. The infiltration rate of 0.09 m³/s/ km (table 3) is about half of that estimated using seepagemeasurement data. The difference between these methods is primarily the wetted-perimeter value used in the calculation. The seepage-measurement estimates used a wetted perimeter of 25 m that was based on measured stream width, whereas a wetted perimeter of 10 m was used for flows during the period modeled with the temperature method because flows during this period were smaller than those during the seepage measurements. If hydraulic conductivity and vertical gradient are assumed not to change with increasing wetted perimeter and these rates are extrapolated to a wetted perimeter of 25 m, infiltration rates estimated with the temperature method are 0.23 m³/s/km—virtually the same that measured by the seepage-loss method.

Two-dimensional arrays of temperature and watercontent sensors indicated that water-content measurements enable better estimates of rapid-infiltration rates associated with the onset of streamflow. Infiltration rates within the first few minutes after the onset of streamflow were as large as 166 m/d; however, saturation within the relatively homogeneous stream-channel deposits of Rillito Creek was established in less than 10 minutes and subsequent infiltration rates declined significantly. Simplified one-dimensional model simulations used to estimate infiltration as soon as the sediments were saturated indicate infiltration rates declined as streamflow duration increased and averaged 0.32 m/d for the 12-day event in April 2000 and 0.37 m/d for the 10-day event in November (table 3). The declining infiltration rate is attributed to a declining pressure head and (or) development of a thin fine-grained surface layer. On the basis of a wetted

perimeter of 10 m, an average infiltration rate of 0.32 m/d equates to a flux of 0.04 m³/s/km (table 3).

Water levels in the stream-channel piezometers showed an overall decline during the period of investigation in relation to long-term records. The water-level decline probably is related to ground-water pumpage from the basin-fill deposits. Superimposed on the water-level decline is a series of water-level rises that range from about 0.5 to 3.9 m. These rises were in response to the two periods of greatest streamflow occurring in the summer of 1999 and the fall/winter of 2000. The water-level responses to streamflow were followed by gradual water-level dissipation.

Water-level responses were analyzed by using an analytical model to simulate cumulative recharge for the water-level rises measured in 1999 and 2000. The largest cumulative-recharge estimates for the 1999 event were for a piezometer site near the middle of the study reach and range from 3.0×10^5 to 6.0×10^5 m³/km. This range is about two to three times as large as that for the other two sites. Estimates of recharge for 2000 were about two- to five-times that of the estimates for 1999. The trends revealed in this analysis are consistent with streamflow volumes and duration, and the magnitude of water-level changes that occurred in the piezometers in response to the streamflow. Cumulative-recharge estimates for the 2000 recharge event were greatest at the upstream-most site and decreased in the downstream direction. Recharge estimates for the upstream-most site range from 7.1×10^5 to 1.4×10^6 m³/km; these values are slightly larger than those estimated for the middle-reach site and about three times greater than that estimated for the site farthest downstream. Recharge rates, estimated by dividing the cumulativerecharge estimates by the cumulative duration of streamflow, resulted in rates that range from 0.2 to 1.0 m³/s/km for 1999 and from 0.2 to 0.4 m³/s/km for 2000 (table 3).

Gravity methods used to estimate recharge through infiltration along Rillito Creek provide values similar to those made by using the water-level method. Both gravity- and water level-derived estimates, however, are higher than the infiltration-rate estimates made by using seepage, temperature, or water-content change methods. Typically, infiltrationrate estimates provide an upper bound for recharge-rate estimates as some of the infiltrated water is stored in the shallow subsurface and used by vegetation, or is subsequently evaporated. The relatively high estimates of recharge determined by the gravity and water-level methods compared to estimates of infiltration determined by use of the seepage, temperature, and water-content methods probably is due to recharge from ungaged tributaries. The ungaged tributaries provide additional wetted perimeter and channel length not accounted for in the recharge estimates made by using the seepage, temperature, and water-content methods.

Table 3. Summary of methods used and estimated rates of infiltration, percolation, and recharge along Rillito Creek, Pima County, Tucson, Arizona.

[m/d, meters per day; m³/s, cubic meters per second; m³/yr, cubic meters per year]

Method	One-dimensional infiltration rate, m/d	Vertical percola- tion rate, m/d	Volumetric rate, m³/s per kilometer of streamflow (wetted perimeter of 25 meters is used for temperature- method estimates)	Potential annual average recharge; assumes 36 days of flow in the 20 kilome- ter reach, m³/yr	Comments
Physical: equiva- lent saturated hydraulic conductivity	0.23	Not calculated	Not calculated	4.1×10 ⁶	From Darcy's Law the flow rate through the sediments under saturated conditions is equal to the product of the hydraulic conductivity and the hydraulic gradient. This method uses the average vertical equivalent saturated hydraulic conductivity of the combined stream-channel and basin-fill deposits multiplied by a unit gradient to estimate a recharge rate in meters per day.
Stable-isotope profiles	Not calculated	0.049	Not calculated	Not calculated	Method uses isotopic signatures associated with specific streamflow events and correlates pore water at depth with timing of introduction of water to unsaturated zone.
Chloride profiles	Not calculated	0.055	Not calculated	Not calculated	Method uses chloride concentrations associated with streamflow seasons and correlates pore water at depth with season (timing) water was introduced to unsaturated zone.
Seepage losses	0.75	Not calculated	0.07 to 0.9; average of 0.21	13.7×10 ⁶	Method uses differences in streamflow measurements to calculate streamflow losses. Seepage losses represent infiltration rates in cubic meters per kilometer per second of streamflow. The one-dimensional rate (0.75 meter per day) was calculated by using the average (0.21 cubic meters per kilometer per second).
One-dimensional temperature modeling	0.8 to 1.0	Not calculated	0.23	14.3×10 ⁶	Rates shown are representative of infiltration rates prior to the reduced rates simulated to occur owing to the accumulation of fine sediments on the streambed surface. One-dimensional rates are based on a modeled hydraulic conductivity of 4 to 5 meters per day and a measured vertical hydraulic gradient of 0.2.
Temperature data from two-dimen- sional trench	0.32 (April 2000) 0.37 (November 2001)	Not calculated	0.09	5.8 ×10 ⁶	Temperature modeling results in vertical infiltration rates of 0.32 to 0.37 meters per day; drainage-rate measurements after cessation of streamflow result in a vertical velocity of 0.46 meters per day.
Water level	Not calculated	Not calculated	0.2 to 1.0 for 1999; 0.2 to 0.4 for 2000–2001	Not calculated	Method uses an analytical solution to simulate recharge on the basis of a hydrograph response. Volumet- ric rates represent recharge rates for the period of streamflow in respective years.
Gravity integrated from Craycroft Road to La Cholla Boulevard	Not calculated	Not calculated	0.8 for 1999; 0.3 for 2000–2001	Not calculated	Method uses ground-water storage changes measured at Swan Road and First Avenue, and extents the storage changes upstream to Craycroft Road and downstream to La Cholla Boulevard. An average flow duration listed in table 2 is used to estimate the rate.

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Exhibit 14

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Final September 2021

San Pasqual Groundwater Management

State of the Basin Report Update







WT0205151016KCO

City of San Diego

September 2015

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Final September 2021

San Pasqual Groundwater Management State of the Basin Report Update

Prepared for City of San Diego

Public Utilities Department Long Range Planning and Water Resources 525 B Street, Suite 300, MS906 San Diego, CA 92101-4409

September 2015

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Final September 2021

Figure 2-4 CASGEM Depth to Groundwater Levels

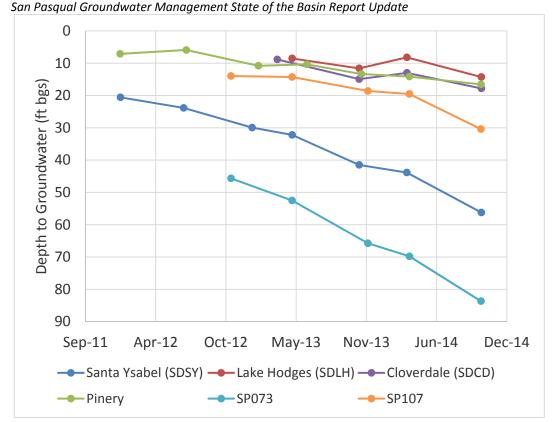


Figure 2-4 shows the depth-to-water measurements of the monitoring wells included in the CASGEM Program. The deepest groundwater is in the eastern part of the Basin, east of the confluence of Guejito Creek. Groundwater in this area is as deep as 83 feet below ground surface (bgs) (at SP073). The shallowest groundwater measured was adjacent to Lake Hodges (14 feet bgs at SDLH).

2.2.2 Groundwater Elevations

Figure 2-5 shows groundwater elevations for the City monitoring network measured between 2010 and 2014. Groundwater generally flows from the east to the west through the Basin. The highest groundwater elevation was measured to be 440 feet msl, at SP093. The lowest groundwater elevation was measured at 318 feet msl, at SP106.

2.3 Water Quality

The City has measured and monitored groundwater quality in the Basin for decades, including as part of the SPGMP. Groundwater monitoring is ongoing at several locations, because total dissolved solids (TDS) and nitrogen (as nitrate [NO₃]) concentrations have been of particular concern.

2.3.1 Groundwater Quality

Water quality objectives (WQO) for the Basin were established by the San Diego Regional Water Quality Control Board (RWQCB) as part of the Water Quality Control Plan for the San Diego Basin (RWQCB, 1994), which is available online (http://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/). Groundwater quality in some areas of the Basin does not meet the objective and include chloride, nitrate (as NO₃), sulfate, TDS, iron, and manganese, as noted in Table 2-1. The groundwater WQOs are protective of beneficial uses that are consistent with the Basin management objectives and Basin utilization goals of the City.

WBG120114222946SDO 2-5

The City attempts to collect and analyze groundwater samples quarterly; however, often only one or two sampling events occur in a year. The samples are analyzed for a variety of inorganics, organics, and metals. Because TDS and NO₃ have been evaluated as the constituents of interest, the most recent concentrations in groundwater have been graphed (see Figures 2-6 and 2-7). The overall trend shows that nitrate increases from east to west, and TDS is highest toward the middle of the Basin, which can be attributed to the variety of land uses in the Basin and general movement of groundwater through the aquifer. However, the westernmost sampling location, SP010, has much lower concentrations than the other western groundwater sites. Table 2-1 presents a summary of groundwater quality in the Basin.

2.3.1.1 Total Dissolved Solids

TDS concentrations is one way to quantify groundwater salinity within the Basin. More salts are currently entering the aquifer than are being removed, which has resulted in an overall increase in groundwater concentrations of TDS over time. Evapoconcentration of groundwater salts from irrigation pumping and passive use by riparian vegetation is a significant factor contributing to elevated TDS concentrations in groundwater. In addition, with more than 90 percent of the total nitrogen (TN) contributions to the Basin coming from fertilizer and manure use, and given the historical elevated nitrate concentrations in groundwater, effective nutrient management across agricultural and urban landscapes has been identified as an important component of Basin water quality management.

TDS concentrations in the westernmost well (SP010) range from 604 to 1,050 milligrams per liter (mg/L), which indicates that groundwater is leaving the Basin with TDS concentrations that exceed the recommended secondary maximum contaminant level (MCL) of 500 mg/L and in some instances exceed the WQO of 1,000 mg/L. An analysis of existing historical data indicates that TDS concentrations in the western portion of the Basin have generally increased since 1950; however, constituent concentration trends seem to have become more constant in the western portion of the Basin over approximately the last decade.

2.3.1.2 Nitrates

Although the most recent nitrate concentrations in well SP010 are relatively low, average NO_3 concentrations in the western Basin are 40 mg/L, with a maximum concentration of 174 mg/L; thus, the primary MCL for nitrate (as NO_3) of 45 mg/L as well as the WQO of 10 mg/L is exceeded in some areas. Historical data show that the general trend for nitrate concentrations has increased, with the exception of wells SP089 and SP061, which have decreased.

2-6 WBG120114222946SDO



State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
South Coast Region
3883 Ruffin Road
San Diego, CA 92123
(858) 467-4201

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

August 12, 2021

Via Electronic Mail and Online Submission

Ms. Karina Danek
Public Utilities Department
City of San Diego
525 B Street
San Diego, CA 92101
KDanek@sandiego.gov

Subject: Comments on the San Pasqual Valley Basin Groundwater Sustainability Plan

Dear Ms. Danek:

The California Department of Fish and Wildlife (CDFW) is providing comments on the draft San Pasqual Valley Basin Groundwater Sustainability Plan (SPV-GSP). As Trustee Agency for the State's fish and wildlife resources, CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of such species [Fish & Game Code Sections §§ 711.7 and 1802]. CDFW has an interest in the sustainable management of groundwater, as many sensitive ecosystems and public trust resources depend on groundwater and interconnected surface waters.

The San Pasqual Valley Groundwater Sustainability Agency (SPV GSA) was developed through a Memorandum of Understanding (MOU) between the City of San Diego (City) and the County of San Diego (County) and developed to comply with California's Sustainable Groundwater Management Act (SGMA) and its requirement to sustainably manage the San Pasqual Valley Groundwater Basin (Basin). SGMA, which became effective January 1, 2015, provides a framework to regulate groundwater by requiring local agencies to form Groundwater Sustainability Agencies (GSAs) and providing those GSAs with the necessary tools to manage groundwater use (California Water Code [CWC] Section 10720, et seq.)

COMMENT OVERVIEW

CDFW is writing to support ecosystem preservation and enhancement under SGMA implementation in the context of the following SGMA statutory mandates and CDFW ecological and biological expertise.

SGMA affords ecosystems specific statutory and regulatory consideration:

- GSPs must consider **impacts to groundwater dependent ecosystems** [Water Code §10727.4(I)].
- GSPs must identify potential **effects on all beneficial uses and users of groundwater**, including fish and wildlife preservation and enhancement [Title 23 California Code of Regulations § 666], that may occur from undesirable results [Title 23 California Code of Regulations § 354.26(b)(3)].

Ms. Karina Danek City of San Diego August 12, 2021 Page 2 of 10

- GSPs must account for groundwater extraction for all Water Use Sectors including managed wetlands, managed recharge, and native vegetation [Title 23 California Code of Regulations § 351(al), § 356.2(b)(4)].

Furthermore, the Public Trust Doctrine imposes a related but distinct obligation to consider how groundwater management affects public trust resources, including navigable surface waters and fisheries. Groundwater hydrologically connected to surface waters are also subject to the Public Trust Doctrine to the extent that groundwater extractions or diversions affect or may affect public trust uses (*Environmental Law Foundation v. State Water Resources Control Board* (2018), 26 Cal. App. 5th 844; *National Audubon Society v. Superior Court* (1983), 33 Cal. 3d 419). Accordingly, groundwater plans should consider potential impacts to and appropriate protections for interconnected surface waters and their tributaries, and interconnected surface waters that support fisheries, including the level of groundwater contribution to those waters.

In the context of SGMA statutes and regulations, and Public Trust Doctrine considerations, groundwater planning should carefully consider and protect environmental beneficial uses and users of groundwater, including fish and wildlife and their habitats, groundwater dependent ecosystems, and interconnected surface waters. CDFW supports ecosystem preservation and enhancement in compliance with SGMA and its implementing regulations based on CDFW expertise and best available information and science. CDFW offers the following comments and recommendations to assist SPV GSA in evaluating effects to GDEs.

COMMENTS AND RECOMMENDATIONS

Groundwater Dependent Ecosystems

Comment #1: Assessment of Interconnected Streams and Groundwater Dependent Ecosystems (GDEs). (SPV-GSP Volume 1 Section 4.6, SPV-GSP Volume 2 Appendices J and L, page 4-42)

Issue: The SPV-GSP conclusion that streams and wetlands in the eastern portion of the Basin (eastern Basin) are disconnected from the Basin's aquifer (i.e., not GDEs) is not fully supported by the data provided in the SPV-GSP or in Appendices J and L. Readily available scientific data indicates that the riparian and wetland vegetation in the eastern Basin likely maintain some connectivity to groundwater and should still be considered GDEs. Under SGMA, a GSP is required to avoid unreasonable adverse impacts on the beneficial uses of interconnected surface waters, defined as, "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer, and the overlying surface water is not completely depleted" (Water Code §§ 10721(x)(6) and 10727.2(b); 23 CCR § 351(o).).

Concern: The SPV-GSP's reliance on the 2015 to 2019 baseline analysis to identify disconnected portions of the Basin and eliminate potential GDEs with a depth to groundwater greater than 30 feet is not representative of current climate conditions. The 2015 to 2019 baseline analysis begins several years into a historic drought when groundwater levels throughout the Basin were trending lower than usual due to reduced surface water availability. As such, this period of groundwater elevations does not account for GDEs that can survive a finite period without groundwater access (Naumburg et al. 2005). The following are additional factors which support the need to further analyze GDEs and groundwater levels:

a. The distance to groundwater within the riparian/wetland habitat may be less than the distance to groundwater at the well location, given that riparian and wetlands are located in

Ms. Karina Danek City of San Diego August 12, 2021 Page 3 of 10

topographical depressions compared to adjacent well locations; therefore, calculations for GDE's should be corrected for actual ground surface elevation (The Nature Conservancy 2019). The corrected distance to groundwater elevation should be used in the GDE analysis.

- b. As shown in Appendix L, some hydrographs in the eastern Basin show measurement at or around 30 feet in 2019, yet the SPV-GSP categorized streams in the eastern Basin as disconnected due to depth to groundwater being greater than 30 feet since 2015. Wells in the eastern reaches show recent connection to groundwater and should be considered GDEs.
- c. Appendix J notes that, "[t]he major drainages in the San Pasqual Valley have significant riparian or wetland vegetative communities with an abundance of woody phreatophytes such as willows (Salix spp.), salt cedar (Tamarisk ramosissima), Fremont cottonwood (Populus fremontii), California sycamore (Platanus racemosa), and California fan palm (Washingtonia filifera)" (pg. 14). Some of these trees, such salt cedar, can have a rooting depth up to 70 feet (Gries et al. 2003). These species, while not native to southern California, provide habitat for the California Endangered Species Act (CESA)-listed least Bell's vireo (Vireo bellii pusillus).
- d. Riparian areas in the eastern Basin remain functional without perennial surface flow and were able to persist through drought conditions; for these reasons, they are likely connected to groundwater. The GDE Pulse tool by The Nature Conservancy (TNC) also identifies the eastern Basin's riparian and wetland habitats as GDEs (Klausmeyer et al. 2019). Naumburg et al. (2005) presents several models that evaluate how GDEs rely on fluctuating groundwater elevations for long-term survival. GDEs have been sustained by groundwater, despite the depth of the groundwater table being greater than 30 feet below ground surface (bgs), due to these fluctuating groundwater elevations. Figure 3-25 shows that the Santa Ysabel catchment, which is in the watershed furthest east, provided more than 20 acre-feet of groundwater recharge even at the height of the drought in 2014. This surface to groundwater connection sustains the riparian vegetation that is habitat for various endangered species, such as the CESA-listed least Bell's vireo and CESA-listed tricolored blackbird (*Agelaius tricolor*). This should be identified as a beneficial use.
- e. Riparian areas that are considered gaining reaches may be considered GDEs even if groundwater levels are greater than 30 feet bgs. Further guidance on riparian vegetation as GDEs can be found in Groundwater Dependent Ecosystems Under the Sustainable Groundwater Management Act Guidance for Preparing Groundwater Sustainability Plans and Identifying GDEs Under SGMA Best Practices for Using the NC Dataset. (The Nature Conservancy 2018 and 2019 respectively).

Recommendation: The SPV GSA should clarify depth to groundwater for GDEs in the eastern Basin and conduct additional studies as recommended in Appendix J. CDFW also recommends including areas classified as wetland and riparian habitats as GDEs. This includes areas where groundwater depth is greater than 30 feet bgs but habitat is still sustained by groundwater. CDFW suggests these habitat areas be identified as GDEs in the final GDE map in the SPV-GSP.

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Water Budgets

Comment #2: Water Budgets and Projected Deficits and Sustainability Goals (SPV-GSP Section 5.5.3, page 5-15)

Issue: Figure 5-5 of Appendix H shows that project groundwater surface levels at the representative wells in the eastern Basin will hit their planning or minimum threshold by 2035, which is prior to the sustainable planning horizon of 2040 required under SGMA. Additionally, the SPV-GSP already has identified a small deficit in groundwater storage. The model seems to indicate that diminishing groundwater storages may be a long-term trend based on projected data.

Concern: The SPV-GSP fails to identify specific actions which will determine if the deficit is a trend, and potential management actions which will be implemented if the deficit is determined to be a trend.

Recommendation: Thresholds should be revised to provide an earlier indicator of undesirable reductions in groundwater storage. Management actions may need to be implemented to prevent undesirable results both for chronic lowering of groundwater storage and potential impacts to interconnected surface waters and GDEs.

Comment #3: Water Budgets and Impacts to GDEs (GSP Section 5.5.3, page 5-15)

Issue: The Average Annual Surface Water System Water Budget (Table 5-4) shows that during SPV-GSP implementation, groundwater discharge to streams will decrease significantly, while stream inflow from adjacent areas will double due to a few large storms. Fay et al. (2000) found that, "[a]boveground net primary productivity, soil carbon dioxide flux, and flowering duration were reduced by the increased inter rainfall intervals and were mostly unaffected by reduced rainfall quantity" (pg. 308). It is unclear in the SPV-GSP how the change in water timing and type will affect beneficial uses in the stream, such as vegetative growth and blooming periods, especially during drought conditions.

Concern: Changes in water inputs that may impact GDE health should be monitored as part of the SPV-GSP. This monitoring data will help to inform future water budgets.

Recommendation: Annual monitoring of GDE health, the use of Normalized Derived Vegetation Index (NDVI) which estimates greenness, and Normalized Derived Moisture Index (NDMI) which estimates vegetation moisture, should be used as metrics for interconnected surface water and GDE impacts.

Undesirable Results

Comment #4: Groundwater Level as a Proxy for Interconnected Surface Waters and GDE's. (SPV-GSP Section 6.3.6, page 6-7)

Issue: Although groundwater levels are a simple proxy for many sustainability indicators, it is not sensitive to changes in ecosystem health and noticeable changes to groundwater levels as representative wells may lag real time impacts to GDEs due to relative location to the groundwater surface.

Ms. Karina Danek City of San Diego August 12, 2021 Page 5 of 10

Concern: Current sustainability indicators will not detect changes, which will affect other beneficial uses and GDEs.

Recommendation: NDVI and NDMI should be used as early indicators of water stress on GDEs. NDVI and NDMI are remotely sensed color data that can be used as a refined proxy for vegetation health in the Basin. The TNC GDE Pulse tool provides both a web viewer and access to the raw data to analyze these metrics over different periods of time (Klausmeyer et al. 2019).

Comment #5: Degraded Water Quality (SPV-GSP Section ES, 4.1.6, 6.3.4, pages ES-4, 4-16, 6-5)

Issue: Water quality within the Basin is being impacted by land use practices adjacent to the Basin.

Concern: The SPV-GSP notes that the SPV GSA only has authority over issues related to groundwater pumping in the Basin. Although nitrogen and Total Dissolved Solids sources are outside of the Basin, CDFW is concerned that there are downstream impacts to water quality in the Basin that could be addressed by managing entities outside of the MOU for the SPV GSA.

Recommendation: Although the SPV GSA only has authority over issues pertaining to groundwater pumping, both the City and the County have planery authority and can address water quality issues within their management areas, including upstream watersheds. CDFW recommends that the SPV GSA coordinate with relevant municipal jurisdictions and landowners on potential water quality projects to ameliorate the water quality issues upstream of the Basin.

Minimum Thresholds

Comment #6: Minimum Thresholds Are Set Lower Than Historic Baseline (SPV-GSP Section 8.2.1, page 8-2)

Issue: Minimum thresholds are set well below historic minimums and are not protective of beneficial uses. Setting minimum and planning thresholds at 50 to 100 percent lower than historic minimums does not account for how current conditions may already be trending towards a groundwater storage deficit (Comment #3). Additionally, the future range of groundwater levels may fall within or near the historic range, which also included severe drought conditions.

Concern: Setting the minimum and planning thresholds below the historic range may not be enough to allow for protection against undesirable results. Furthermore, as presented in the SPV-GSP, the planning threshold for wells adjacent to GDEs is less protective than the threshold set for wells that are further from GDEs. Given CDFW's concern that riparian and wetland vegetation in the eastern Basin may also be GDEs, the absence of established protective thresholds is of particular concern. Although the SPV GSA is not currently experiencing an overdraft, trends of overdraft conditions, if they persist, may cause undesirable results prior to reaching either the proposed planning or minimum threshold.

Recommendation: CDFW recommends following TNC's guidance by setting minimum thresholds at levels that prevent adverse impacts to GDEs (TNC 2018). The planning and minimum thresholds for wells closer to GDEs should also be more protective of the GDEs than

Ms. Karina Danek City of San Diego August 12, 2021 Page 6 of 10

wells that are further, and the planning threshold should be closer to the measurable objective rather than the minimum threshold in areas adjacent to GDEs.

Comment #7: Monitor GDEs Should Be A Tier 0 Project (SPV-GSP Figure 9-2, page 9-3)

Issue: Section 9 of the SPV-GSP includes monitoring of GDEs as a Tier 1 project that would be implemented once the planning threshold is reached.

Concern: Given CDFW's many concerns pertaining to interconnected surface waters and GDEs for the Basin, we are concerned that undesirable results may occur well before Tier 1 projects are implemented, particularly given that planning and minimum thresholds set for the representative wells is not protective of GDEs and beneficial uses.

Recommendation: Additional studies and monitoring pertaining to GDE's should be implemented, as identified in Appendix J, as a Tier 0 project that can be implemented at any time after plan adoption. Again, NDVI and NDMI should be used to assess habitat health on an annual basis and should inform the revision of both the planning and minimum thresholds for the representative wells to within or near the historic baseline.

Comment #8: Use of CNDDB Data to Presume Absence (SPV-GSP Volume 2 Appendix J Groundwater Dependent Ecosystems Technical Memo Table 1, page 6)

Issue: Appendix J notes that presence and/or absence of sensitive species is based on California Natural Diversity Database (CNDDB) occurrence data. CNDDB only provides positive occurrence data where studies have been conducted and cannot be relied upon to presume absence due to lack of data in a specific location.

Concern: Species-specific studies conducted in suitable habitat according to species-specific protocols are required to determine species absence from a particular area. Only presence can be assumed and should be assumed in suitable habitat where species-specific surveys have not been conducted.

Recommendation: In the absence of species-specific protocol surveys, the GSP should assume presence for sensitive species in areas where suitable habitat exists.

Comment #9: Species Dependence on Groundwater and Mischaracterization as Not Applicable (SPV-GSP Volume 2 Appendix J Groundwater Dependent Ecosystems Technical Memo Table 1, page 6)

Issue: Table 1 of Appendix J states that the reliance of many of the sensitive plants and invertebrates on groundwater is Not Applicable (NA) based on omission from the Critical Species LookBook (Rohde et al. 2019). The Critical Species LookBook Appendix I *Other Threatened or Endangered Species Relevant to SGMA* includes many of the species noted as NA. Although groundwater relationships may be less apparent and not fully discussed in the LookBook, groundwater relationships between plants and vernal pool habitats do exist and have been described in the scientific literature. In one study in the Central Valley, "[p]erched groundwater discharge accounted for 30–60% of the inflow to the vernal pools during and immediately following storm events. (Rains et al. 2006, pg. 1157). Endangered plants such as the threadleaf brodiaea (*Brodiaea filifolia*) which CNDDB notes as potentially present in the eastern Basin may also be impacted by changes to groundwater.

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Concern: Although these groundwater relationships are not well understood for the Basin, CDFW is concerned that additional monitoring of known sensitive populations have not been included in the SPV-GSP.

Recommendation: Sensitive plants and invertebrates should be included in Appendix I of the Critical Species LookBook as having a potential reliance on groundwater rather than 'NA.' The SPV GSA should also coordinate with the City and County to include periodic monitoring of sensitive species populations within the Basin, beginning with baseline studies where suitable habitat exists.

Editorial Comments

Comment #10: Pictures Were Not Provided for Eastern Field Data Points That Were Determined to Not Be GDEs (GSP Volume 2 Appendix J Groundwater Dependent Ecosystems Technical Memo Attachment 1)

Issue: Appendix J does not include representative photos of field surveys in the eastern Basin. The SPV-GSP makes the conclusion that the riparian and wetland habitat in the eastern portion are not GDEs due to the depth of groundwater being greater than 30 feet.

Concern: Pictographic evidence regarding GDEs was not included to support the GDE analysis provided.

Recommendation: Representative photographs of the field surveys conducted in the eastern Basin should be included in Appendix J. The Final SPV-GSP should contain updated analysis in Appendix J to addressed issues discussed in this letter.

CONCLUSION

In conclusion, the SPV-GSP does not comply with all aspects of SGMA statute and regulations, and CDFW deems the SPV-GSP inadequate to protect fish and wildlife beneficial users of groundwater. CDFW recommends that the SPV-GSP consider CDFW's comments for the following reasons:

- the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are not reasonable and/or not supported by the best available information and best available science. [CCR § 355.4(b)(1)] (See Comments # 1, 2, and 6);
- 2. the SPV-GSP does not identify reasonable measures and schedules to eliminate data gaps. [CCR § 355.4(b)(2)] (See Comments # 1, 2, 8, and 9);
- the sustainable management criteria and projects and management actions are not commensurate with the level of understanding of the Basin setting, based on the level of uncertainty, as reflected in the SPV-GSP. [CCR § 355.4(b)(3)] (See Comments # 1, 2, and 7);
- 4. the interests of the beneficial uses that are potentially affected by the use of groundwater in the Basin have not been considered. [CCR § 355.4(b)(4)] (See Comments # 1, 8, and 9); and,

Ms. Karina Danek City of San Diego August 12, 2021 Page 8 of 10

5. the SPV-GSP does not include a reasonable assessment of overdraft conditions and includes reasonable means to mitigate overdraft if present. [CCR § 355.4(b)(6)] (See Comment # 2, 3, 4, and 6)

CDFW appreciates the opportunity to provide comments. Please contact Mary Ngo, Senior Environmental Scientist (Specialist) at Mary.Ngo@wildlife.ca.gov or (562) 477-0743 with any questions.

Sincerely,

DocuSigned by:

David Mayer Environmental Program Manager South Coast Region

Enclosures (Literature Cited)

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Ms. Karina Danek City of San Diego August 12, 2021 Page 9 of 10

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State Water Resources Control Board

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Literature Cited

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https://groundwaterresourcehub.org/public/uploads/pdfs/TNC_NCdataset_BestPracticesGuide_2019.pdf.

From: Alicia Appel <aappel@escondido.org>
Sent: Tuesday, August 17, 2021 10:54 AM
To: Danek, Karina <KDanek@sandiego.gov>
Subject: San Pasqual GSP comments

This email came from an external source. Be cautious about clicking on any links in this email or opening attachments.

Hi Karina,

My sincere apologies -something came up last week and I failed to send our comments on the Draft GSP. I hope they may still be considered for the final version.

Hope you're well!

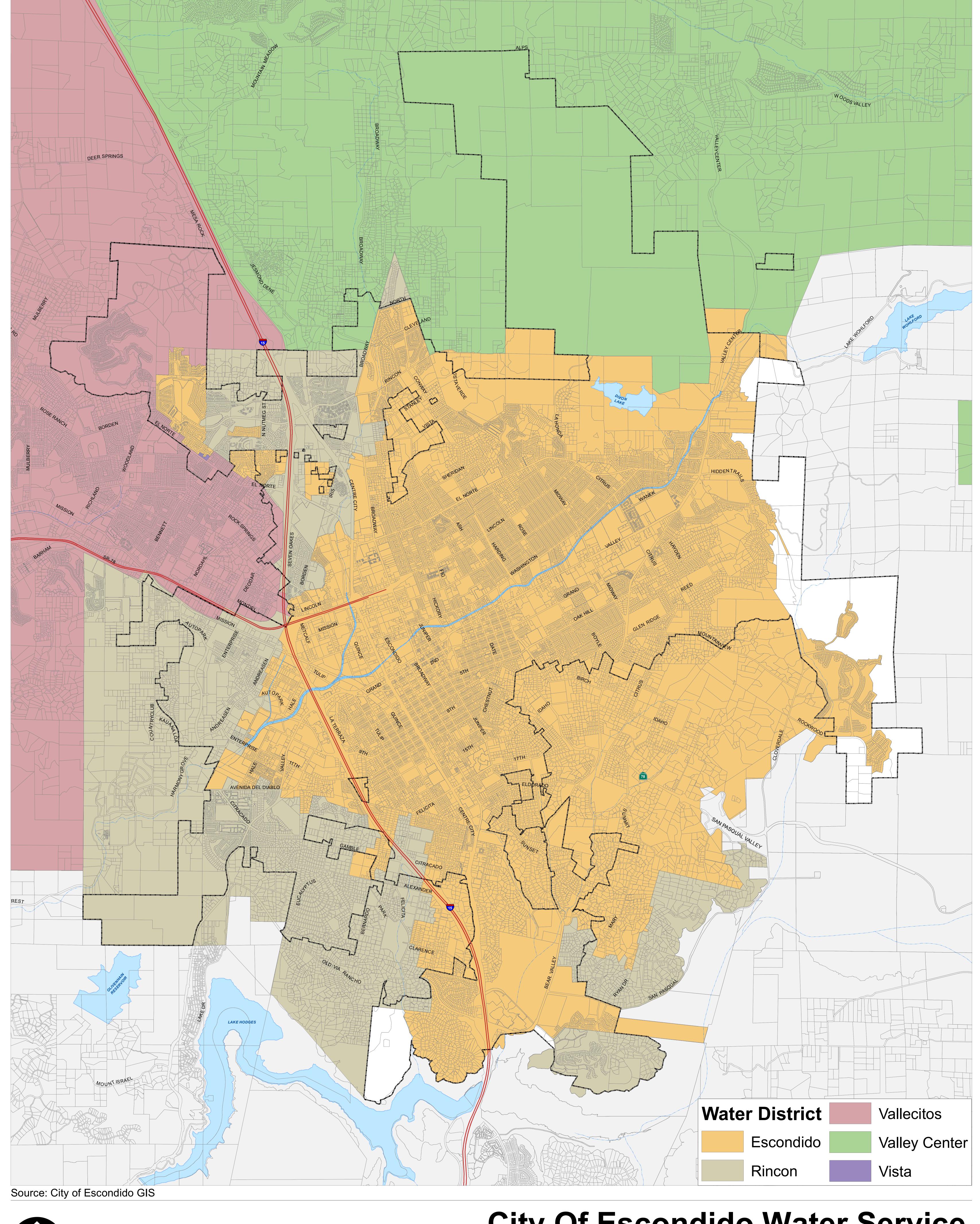
Alicia

Page #	Section	Figure/Table/ Paragraph	Comment
4-4	4.1.2	Fig 4-2	Update map or add footnote to denote errors on this map. Santa Ysabel should be named San Dieguito and San Dieguito River should read Cloverdale Creek. The map on the next page is correct.
5-3	5.1	Title	Approach (sp)
8-1	8	General	Is there a different term that can be used rather than "exceedance"? Exceedance is going "over" a limit but in the case of groundwater levels it would be falling below a threshold. This term is often used in stormwater compliance. It would make sense for the water quality metrics (e.g. nitrate and TDS)
9-7	9.5	Last paragraph	Delete repeated table reference (9-2)
Vol 2 Pdf Page 648		Figure 3-27	Water District Source map does not match the Escondido Water boundaries. See attached map and contact me if you want the GIS layer.



Alicia Appel
Environmental Programs Manager
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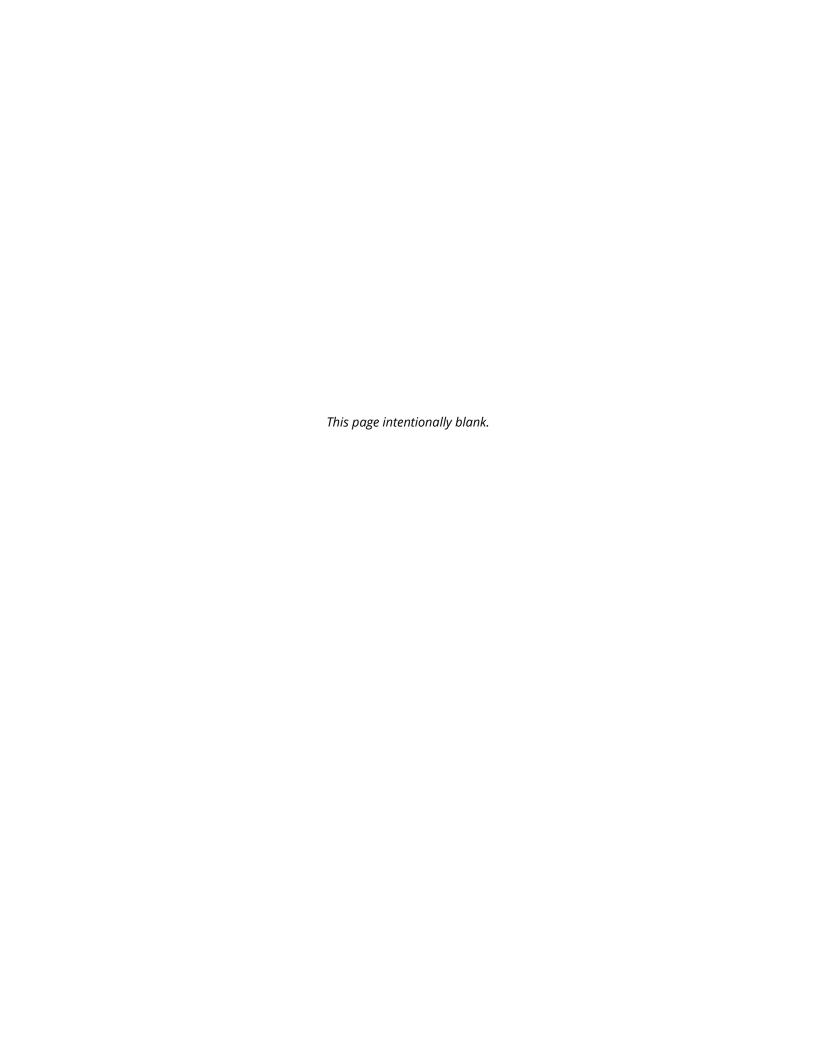
www.escondido.org



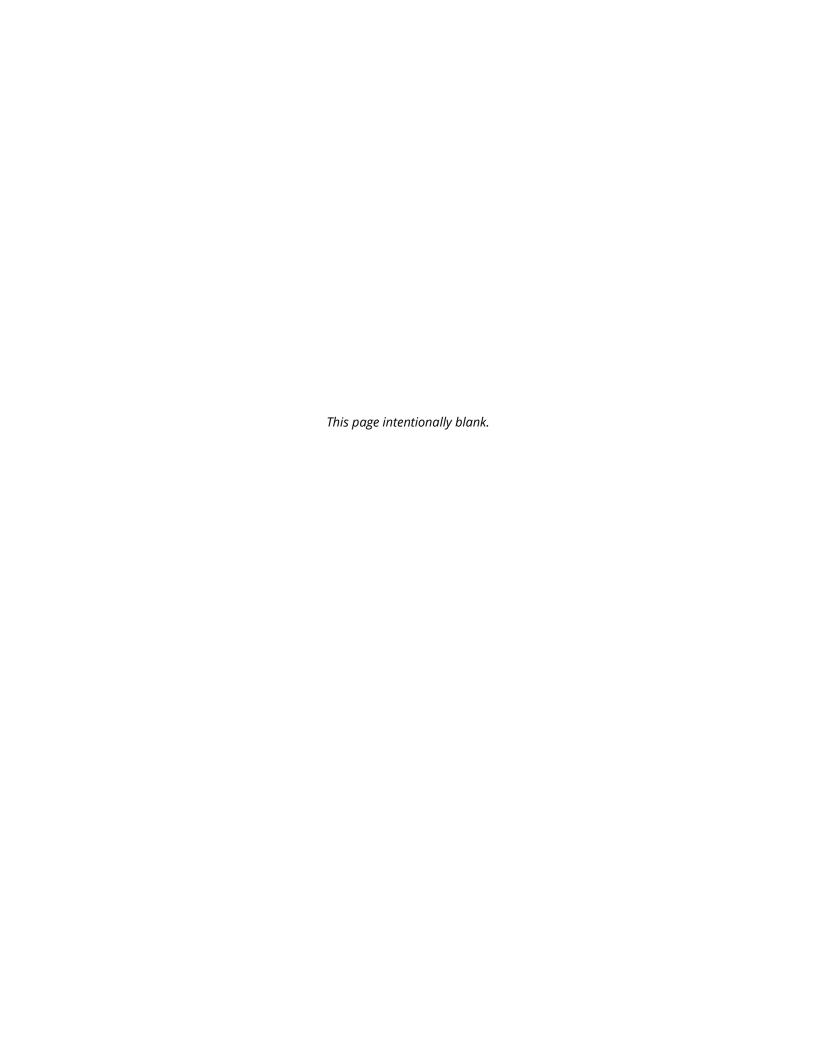
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City Of Escondido Water Service
District Operation Areas

Appendix G Well Completion Reports Used to Construct Geological Cross Sections



Appendix G Well Completion Reports Used to Construct Geological Cross Sections



COUNTY OF SAN DIEGO DEPARTMENT OF HEALTH SERVICES

MELL PERMIT

12183

APN 760 170 18

TYPE OF WORK (Check)		USE (Check)	EQUIPMENT (Check)
New Well Repair or Modification Time Extension Destruction	Individual Dome Agricultural Industrial		
PROPOSED WELL DEPTH Max. 200' Min. 175 (Feet)	Typo Stee	PROPOSED C	ASING r 12" Wall or Gage .375
PROPOSED SEALING ZONE(S)		SEALING	MATERIAL (Check)
From 0 to 20	Feet	Neat Cement Grout	Bentonite Clay
From to	Feet	Sand Cement Grout	Concrete X
Fromto	Feet	Other-Specify:	
PROPOSED PERFORATIONS OR SCR	EEN		22 42 5220
From 160 to 200	Feet	D	ATE OF WORK
From to	Feet	start Jan 2	7, 1992
From to	Feet	Completion Feb.	10, 1992
From to	Feet		
DISPOSITION OF APPLICATI (FOR HEALTH OFFICERS USE OF APPROVED WITH CONDITIONS Report Reason(s) for Denial or Necessary (FOR HEALTH OFFICERS USE OF APPROVED WITH CONDITIONS	ON MILT) DENIED y Conditions Here	BUSINESS ADDRESS 12029 Old Cas LICENSE NUMBER 32828 7	tle Rd. Valley Center Cash Daposit Bond Posted 1-22-92
water well Standards Bulletin	74-81.		pn
This well site is located in an area have high nitrate levels. Irrigation purposes only until it has as safe by this Department. Unless potable water standards can be met permit? cannot be issued. HEALTH OFFICER	PREY FOR hard groundmaker is head well ean us t head veel ean us t head seed and	Department of Heal nances and laws of the State of Callfortion, repair, modified wheely upon completed Department of Heal Spreaccurate log of the retid that	comply with all regulations of the ith Services and with all orditions the County of San Diego and of writing pertaining to well construction and destruction. Immedition of work I will furnish the th Services with a complete and well.
1 23 00			1-20-52

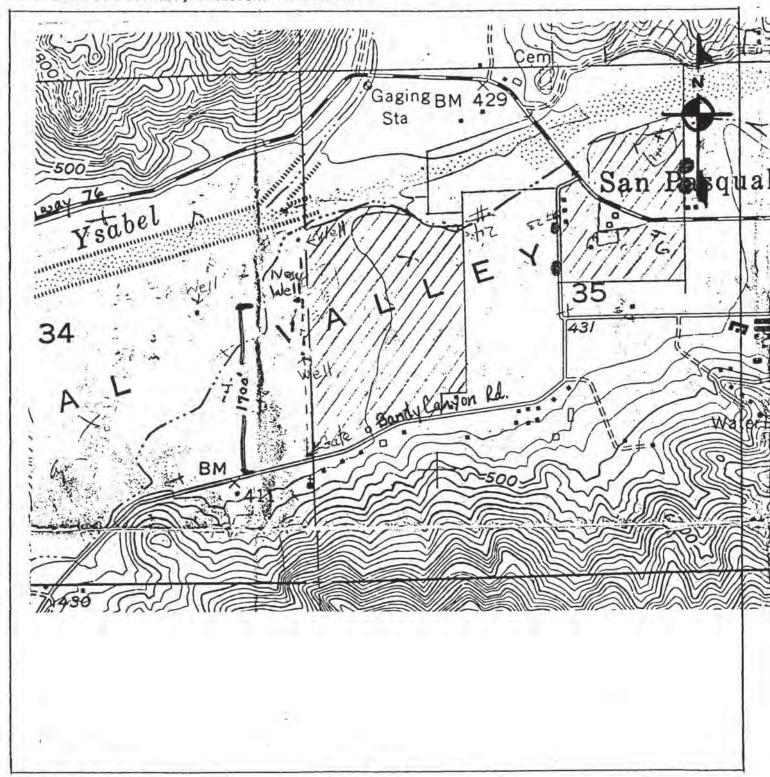
COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

Control # W6204/

Assessor's Parcel No. 760-170-18

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



age_		irement	S	3-10 A	pl	WELI	Refer in In	ustruction,	ON Pamp	REPOR	r		STATE	WELL N	IO./STAT	TION NO.	
ate Wor	k Began			37		Ended	24-92	46	512	809		LATITUDE				ONGITUDE	
	ermit Ag	gency	-		leg	County		Dept		-	- _	1-1-1-	L_L	APN/TR	S/OTHE	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
Pern	nit No	W62	0	dro	GIC	LOC Permit	Date	1-22-	92	100	7	WELL C	WNE	R —			
ORIENTAT	10N (≤)					RIZONTAL A	NGLE	(SPECIFY)				_ ,				locked from	
	FROM	DEPTH	то	FIRS		2943	BELOW SUI	RFACE								e Water Code otect persona	
Ft. t	o Ft.	1		Descr		ESCRIPTION terial, grain size, o	olor, etc.	U 1/2		rmation.		10000071	0. 0	,	το ρι	01001 p0100110	
		A	H	wia	1 1	il as follos	A TILO	1	Addr	ess 167	AO Hw	V.78	2	-	_		
0	45	Fine to coarse sand with some							City San Pasqual Rd San Diego								
		3	ma	II g	Pav	el - brow	n color		APN Book Page Parcel								
45	80	F	ine	9 80	CO	arse sand	with b	oulder	Town Latin	ship = 10	Rang	e NORTH	Section Longit	7	9	ı WE	
0.0	0.0	6	X			111	11/1	100	Cath	DEG.	MIN. SE		Longi	uue _	DEG.	MIN. SEC.	
80	90					- "old tul wood from					- NORT		1,-		X'	NEW WELL	
- 2		1 1	-	10	7	1 10	11/21	7		11.1	76			,	MÖDIF	Deepen	
90	190					arse sand ind grave			S. Charles				1			Other (Specify)	
		1	and the same	-	(0)	10		- 19	, 5 - mm	YSABO	EL C	REEK.	+	peto-		DESTROY (Describe	
190	202	10	4 00			d and we	ethered	rock	7	7		Hall La		35	1	Procedures and Mater Inder "GEOLOGIC LO	
	***	1/1/3	-	nite	-		2-	_	WEST	EL	*	NEW TO	10	EAST	- PLA	NNED USE(S	
			(Com	plete	ed Well Cons	struction	5 1		34	1	5 0	13	10	WATE	_ MONITORING R SUPPLY	
	-	0	ate		3-	24-92					101	Etwit -	100	C		Domestic	
	8,0	10	ato	Iner	ecte	d 3-2	4-92				1		-	or market		Public	
			****			-			BUNCH CYN RO POST Industrial								
			0		,	enidence	OF.	7	-				1	-	=	_ "TEST WELL" _ CATHODIC PROTI	
			n	nap		00	house		Illust	trate or Descri as Roads, Buil	be Distance	of Well from	n Lands	narks	1 =	TION OTHER (Specify)	
		1	0	-	Cu	ea			PLE	ASE BE ACC	URATE &	COMPLET	Ë		-		
-		W	ate	r Sa	mpie	Taken?	No		DRILL		tary		0.0	FLUID .	Ge		
				wec	-,-	m 8	66.		DEPTH	OF STATIC	LEVEL					24-92	
		1	3416	WE	р		7			IATED YIELD	1000	(GPM) &	TEST T	YPE _	air	11ft	
OTAL D	EPTH OF	BORING _ COMPLET	en i	205	_ (Fe	et) (Feet)			TEST	LENGTH	6 (Hrs.)	TOTAL DRA	WDOW	150	-	F1.)	
OTAL D	EI III OI	COMPLET	ED	WELL		102	LOINGIE		iriu	not be repre	·	u wen s ioi	1		TAD	MATERIAL	
FROM S	URFACE	BORE- HOLE	T	YPE (CASING(S)			za III Surandina		SURFACE				TYPE	
. Ft. 1	o Ft	(Inches)	BLANK	SCREEN CON-	DUCTOR FILL PIPE	MATERIAL / GRADE	DIAMETER (Inches)	OR WAL	LL	SLOT SIZE IF ANY (Inches)	Ft.	to Ft.	MACOUNT OF THE	BEN-	100	FILTER PACK (TYPE/SIZE)	
			8	35	티		, inches	15445.500	27	10.000		1	(2)	(2)	(=)	,107 = 31=3	
0	21	36	X			A-120	24	. 250			0	20	X				
92	92	24	X	X	+	A-120 SS304	12	.375	0 .060		20	202				5/16×4	
132		24		8	+	SS 304	12	.250									
172	100000	24		1		SS 304	12	. 250		.060		1	7.1		16		
		HMENTS	(=	-) -		I, the unde	ersigned, ce	ertify that t		ERTIFICA port is compl	and the second			st of m	y know	ledge and belie	
	Geologic	s Log Instruction Dis	agran	n						отрабо							
		sical Log(s)				(PERS				and the second					. 1		
1 7	_ Soil/Wa _ Other _	ter Chemica	Ana	lyses		ADDRESS	A	O Ca		nu.	Valle	y Cent	er,	Call	SAR	la 92,082	
			_					- A 1 100m									

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STATE OF CALIFORNIA THE RESOURCES AGENCY

Do not fill in

DEPARTMENT OF WATER RESOURCES WATER WELL DRILLERS REPORT

No. 341175

Notice of Intent No				State Well No.
	Γ.		Other Well No.	
(1) OWNER: Name Witman Ranch Address P.O. Box 1959	(12) WEL	L LOG	Total depth 98 ft. Completed depth 98 ft.	
- FSCORDIDO Calitornia	92025	from ft. t	o ft. F	ormation (Describe by color, character, size or material)
(2) LOCATION OF WELL (See instructions):		<u>o</u> -	20	fine to coarse sand - brown col
County San Diego Owner's Well Number At Well address if different from above Hwy 78 Ramona (City	20 -	27	sand & boulders	
Township 12S Range 1 E Section	31	27 -	- 51	fine to coarse sand
Distance from cities, roads, railroads, fences, etc. Approx 750	N.			MIC to coarse sailo
Hwy 78 and 1100' E. westerly border of		51 -	- 52	boulder
Approx 20 ft. from bank of Santa Ysabe	el		<u></u>	
Creek		52 -	- 80	fine to coarse sand
(3) TYPE OF WO	RK:			^ \ <u>`</u>
New Well [X Dee	pening 🔲	80 -	- 98	partly cemented
Reconstruction			-/}_	
Reconditioning			$\langle \gamma \rangle$	
Horizontal Well			- \	
	Describe			
destruction material cedures in Item 12)	is and pro-	172	}	
(4) PROPOSED	USE			
Domestic		`	- ~ (~	
Irrigation			- //-//	
Industrial	<u>``</u>	· · ·	, , , , , , , , , , , , , , , , , , , 	
Test Well	<i>、</i>	~ () ,	-///	
Municipal		(()()		2.2
Other	Y d	3, (3) 	- 	<u> </u>
WELL LOCATION SKETCH (Describe)		\ \ 		
	(\$\frac{1}{2}	7		
(5) EQUIPMENT: (6) GRAVEL RACK: Rotary X Reverse	7/0			
Cable Air Piameter of bore	//b×4			
	QR (ft.	(C)/V -	-	
Action non 20 to	88 ((-)	_	_	
(7) CASING INSTALLED: (8) PERFORATIONS:	\sim	.		
Steel Plastic Concrete Type of perforation or size of series			_	
From To Dia Gage or From To	\$16t	_	-	
ft. ft in Wall ft ft	√size [-	_	
0 20 18 .250 63 93	.050		-	
0 99 10 .365	·		-	
(0) WITH A OTHER		-	-	
(9) WELL SEAL:	,	-	-	
Wars starts could receive a Plant 2 No ☐ If yes, to depth	0 ft. ft.		<u> </u>	
Were strata sealed against pollution? Yes No X Interval	-			
Method of sealing -cemented (10) WATER LEVELS:	Work started_	Març		
Dorth of first water (f.)	WELL DR	uller's	S STATEMENT:	
Standing lovel after well	rt.	This well was	drilled u	nder my jurisdiction and this report is true to the
(11) WELL TESTS:		best of my kno	owinge at	na pengi.
Was well test made? Yes V No I If you have 2		Signed	72	(Well Driller)
ype of test Pump Bailer Air lift	X	NAME Fai	n Drill	ling & Pump Co. Inc.
	8ft.	Address 120)29 Old	Person, firm, or corporation) (Typed or printed)
Discharge		City Val	ley ce	nter, Calif. ZIP 92082
Was electric log made Yes No If yes, attach copy to this report		License No3	328287	Date of this report 4/10/90
				

THE

12501W 31J0025

ORIGINAL ≈ File with DWR WATER WELL DRILLERS REPORT

(Sections 7079, 7080, 7081, 7082, Water Code)

Do Not Fill In

		N_{\cdot}^{0} 39872
IE RESOURCES AGENCY OF CALIFORNIA		
DEPARTMENT OF WATER RESOURCES	1	State Well No. 125/01W-31JO
		Oal W II M -

									Other wen No.						
-									(11) WELL LOG:						
· P								Total depth 131 ft. Depth of completed well 731, ft.							
_									Formation: Describe by color, character, size of material, and structure						
<u>-</u>								=	ft. to						
(2) LOCATION OF WELL:									0 - 15 Sand, light browncolor - fine to						
County San Diego Owner's number, if any									medium size						
		_		wher o manipe	2, 12 412,		.		15 - 35 Sand, dark brown color - fine to						
Township, Range, and Section Distance from cities, roads, railroads, etc. Four miles from Escondido									medium size						
on Highway 78 East (San Pasqual Valley)									35 - 37 Silt. black color						
							\0	37 - luk Sand, grey color - fine to medium size							
(3) TYPE OF WORK (check): New Well ☑ Deepening □ Reconditioning □ Destroying □									44 - 45 Silt, black color						
-	•		and procedu		-		· -		45 - 55 Sand, grey color - fine to medium size						
			(check):			EQUI	IPMEN	IT:	55 - 63 "Toolie Bed" Fine black sands, old						
			Munici			ary -		\Box	logs						
Irrigation				her 🔲	Cab			<u>-</u>	63 - 73 Sand & gravel, fine to coerse 1/8"						
					Oth	ier	١		to 1 " round -						
(6) CAS	ING I	NSTAL	LED:						73 - 80 Sand dark grey color - fine to medium						
STEE			ER:	I	f grav	rel pacl	ked		size						
SINGLE (BLE 🔲 -							80 - 90 Sand brown color fine to medium size						
1	1	_		D	1				90 - 100 Sand, brown color fine to medium						
From	То		Gage	Diameter of		From	To	0	size						
ft.	ft.	Diam.	Wall	Воге		ft.	ft		100 - 105 Sand & Gravel Fine to coarse san d						
.0	50	72	250	2011		0	732	2	1/8" to 1" gravel round						
50 50	1.34	12	219						105 - 119 Sand, partly cemented - fine to						
							<u></u>		medium size						
Size of shoe or	well ring:	Non e		Size of grav	el: 3	<u>√8</u> _8√	ennd brue		119 - 124 Sand & gravel -1						
Describe joint	Wel	_ded				,			124 - 127 Sand, Brown, fine the medium						
(7) PER	FOR A	rions	OR SCR	EEN:					127- 132 Decomposed granite -						
Type of perform	tion or nar	ne of screen	Louvre	& John	nson	#100	0- <u>Sl</u> e) †.							
	l		Perf.	Rows											
From	1	Γo	per	per			Size \		Werage Sp. Yield = 20.2						
ft.	f	t,	row	ft.			. x in.								
50			8	125		1/8 2	x 23/	8							
_ 100		05 .	Johnson,	's wel	l se	reen		-	CONTRIBENITIAL NICH						
105	1.	19	8	堤		1/8 3	z 2 3	/8-	CONFIDENTIAL - NOT						
119			Johnson		sere	en			FOR PUBLIC RELEASE						
124		<u> 32 </u>	8	译	بلب	1/8 a	: 2 3	/8	, 10K 10Date 112-113						
(8) CON	ISTRU	CTION	I:				-		The state of the s						
Was a surface s	sanitary sea	l provided?	Yes 🔲 N		To what			ft.							
Were any strat	a sealed aga	inst pollutio		No CX	If	yes, note	depth of s	trata =	The state of the s						
From	ft.	to	ft.			-									
From	ft.	to	ft.			~			Work started Oct 30/19 67, Completed Nov 9 19 67 WELL DRILLER'S STATEMENT:						
Method of seal				*					This well was drilled under my jurisdiction and this report is true to the best						
(9) WA ?					ال. من د				of my knowledge and belief.						
Depth at whic				, i E		ft.+ 1			NAME Acme Drilling Company						
Standing level						ft, \ -ft.			(Person, firm, or corporation) (Typed or printed)						
Standing level			developing	<u>- · · · · · · · · · · · · · · · · · · ·</u>	iλ .	-11.			•						
(10) WE			. 🗂 🚭	t : 1	Y.F . 7	. 4 ***	,,,		Address P.O. Box 835						
Vas pump sess Vield: 12(-1-	yes, by whon			mp_C	-	Valley Center California 92082						
7		ıl./min. witl		ft. drawdo)	rs,	(Well Driller)						
Temperature of		mall2 17 - 1	Was a chemic				No CX		101080 OB 4 18						
Was electric lo	8 made of	wellt Its	□ No X	ıı yes,	attach c	OPA		License No/19 Dated Dated , 1960							

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c, ``	<u> </u>	. <u> "</u> i					क्ता अस्य सम्बद्धाः होत्। इतिहास
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	and the same of th	-				29.370	
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Balance - Majo			UTHOS	Market			(10) MELL TERIS
	-B. Location of v	vell in areas not see	ctionized.			will driedliness or each	A second tool engine it is a second s
	Sketch roads, Indicate dista	railroads, streams,	or other teatures	as necessary	715 January	CE TIT LOTE LABOURE LES LES	The commence of the Control of the C
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12501W31Q002S

ORIGINAL File with DWR

WATER WELL DRILLERS REPORT

(Sections 7079, 7080, 7081, 7082, Water Code)

DEPARTMENT OF WATER RESOURCES

Do Not Fill In

THE RESOURCES AGENCY OF CALIFORNIA

Nº 39875

State Well No. 125/01W-31002
Other Well No

<u>-</u> (_	(11) WELL LOG:
1							Total depth ft. Depth of completed well ft.
Ī						_	Formation: Describe by color, character, size of material, and structure
-						_	ft. to ft.
(2) LO	CATIO	N OF W	ZELL:				0 - 3023Sand. brown color, fine to coarse
County S				 Owner's numbe	r. if any	30 - 102 Sand, brown, fine to coarse	
			_		<u> Zacordi</u>		10 - 50 25 Sand. black color. fine
					from Es		50 - 6527Sand, dark grey, fine to medium size
				n Paso		i	65 - 7525Sand, dark grey, some small gravel
		WORK			uua i	1	1/8" to 1" size
New Well		epening [, ,	/• ditioning □	l Dantmorrin	P1	75 - 80 'Silt, black "Toolie Laver"
	_			ire in Item 1.		ıg LJ	80 - 85 Sand & gravel
(4) PRO						DMENIT.	, , , , , , , , , , , , , , , , , , ,
` '					(5) EQUI	LEMIEN I:	85 - 9027Sand, grey color, fine to medium size
Domestic					Rotary		90 - 1007/Sand, lighter color grey, fine to
Irrigation	ı <u>x</u> les	st wen _	_ O	ther 🔲	Cable Other	, 🔀	medium size
				<u>-</u>	Other		100 - 121 Sand, brown color, partly cemented
(6) CAS	SING I	NSTALI	LED:	ļ .	e 1	1 1	fine to medium size
STE	EL:	OTHE	ER:	1.	f gravel pac	кеа	124 - 135/ Decomposed granite
SINGLE K	guoa [BLE 📋 —		`			
	ì	1	Gage	Diameter	ı	1	* * * * * * * * * * * * * * * * * * * *
From	To		or	of	From	То	,
ft.	ft.	Diam.	Wall	Bore	ft.	ft.	· , , . ·
0	40	12	250	20#		1.35	<u> </u>
10	93	12	219				
93	138	12	-250				
Size of shoe o	e well ring:	None	· •	Size of grav	el: 3/811	round	
Describe joins		Lded				******	
Y			OR SCE	EEN.	100 Slot	Screen	
					vre-John		
Type of perio	HALION OF HA	me or screenz.		1	1 C-00011	5011	,
T		r.	Perf.	Rows		Size	CONFIDENTIAL NOT
From ft.		t.	<i>per</i> row	per ft.		. x in.	FOD BURNS -
1:0		70	8			7a∥ x 23	I/O FOR PUBLIC RELEASE
				lis_	<u>IL/O_&</u>	<u> </u>	<u>/0</u>
70				creen	- 10	2 2	10
75_		30	8	<u></u> <u> </u>	1/8	& ½ x 23	<u>/8</u>
80_			Well S	creen			
85	<u> </u>	35 L_	6	1 1	1_1_/8_	<u>& ≈4 x 23</u>	/8
(8) CO	NSTRU	CTION:	:				(
Was a surface	sanitary sea	l provided?	Yes 🔲 N	lo [5} ∵	To what depth	ft.	
Were any stra	ita sealed aga	inst pollution	? Yes	No 🔀	If yes, note	depth of strata	
From	ft.	to	ft.				
From	ft,	to	ft.				Work started NOV 9 19 67 Completed NOV 21 19 67
Method of sea	ling		-				WELL DRILLER'S STATEMENT:
(9) WA	TER L	EVELS:				 -	This well was drilled under my jurisdiction and this report is true to the best
` '		as first found	l, if known	55	ft.		of my knowledge and belief.
Standing leve	el before per	rforating, if	known	11.	ft.		NAME Acme Drilling Company
		orating and		أرار	ft.		(Person, firm, or corporation) (Typed or printed)
	ELL TI						Address P.O. Boy 835
` ′	st made? Y		□ Î	f yes, by whon	Webb Pu	mo Co.	Valley Center, Calif. 92082
rield: 50		l./min. with		Uhke Jrakde			[SIGNED] -11 7 Nam LE
Temperature				al analysis ma		No EX	S (Will Diller)
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	Sketch roads,	r <u>ailroads, stream</u> s,	or other features	as necessary.	The second contract of
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		WEEL COMI LETTE									L	┇ ┖┈┸┈┖┈	STATE	WELL N	O./STA	TION NO.
Page			·							·				\Box [, 1	
Owner's Well No. MW - 1 No. 44 Date Work Began 6/30/97 Ended 7/2/97							+ フ	1737		LATITUDE		ا لـــا	L(ONGITUDE		
	•	• -				nv. Health	•				_	1 1 1	1 1	1 1	 1	
						Permit		/27/97	,		_			APN/TR	S/OTH	8
						roc —			· · ·		····	WETT (W NI E	a		-
ORIENTATIO	ON (∠)	Y VER	TICA	L	_ но	RIZONTAL AN	GLE((SPECIFY)								
DEPTH (FROM	DEPTH	I TC	FIRST	WA	TER <u>ukn</u> (Ft)	BELOW SUI	RFACE								
SURF	ACE		DESCRIPTION													
Ft. to	Ft.	Al	Describe material, grain size, color, etc. Alluvial fill as follows:					١.,	dress Batt	le.	WELL LO Monument	ITAS & ba	ON _	7 78		
 						hed geolog	<u> </u>)	Ad	San Die	go	(San Pasq	ual	Val1	ev)	
		<u> </u>								ounty	San	Diego		-		
0	30	Fi	ne	gra	ain	ed silt wi	th som	e	AР	N Book 760	F	age 170	Parcel	03		
		CO	ar	se į	gra	ined sand	- brow	n colo	Ϋ́o	wnship 12S	 F	lange 1W	Section	33	}	
										titude						WEST
30 ;	60			<u> </u>		ined sand		ome		DEG.	MIN.	SEC. ON SKETCH			DEG.	MIN. SEC.
		si	<u>1t</u>	- 1	gre	y / brown	color		⊢			NORTH -			X	CTIVITY(ビ)ー
		! 													MODE	FICATION/REPAIR
60	70_	Me	d1	um	CO	coarse san	d									Deepen
		01	 -	, ,		1 1 1	1		ł							Other (Specify)
70	80	C1	ae	y s	LIE	- black c	olor		l						—	
80	110	F-4	200	to	110	ry coarce	eand	·····	ł						1 /	DESTROY (Describe Procedures and Materials
- 00	110		Fine to very coarse sand grey color					<u>.</u>							Under "GEOLOGIC LOG") ANNED USE(S) -	
 		6-	<u>- </u>	<u> </u>	LOL				WEST			33			1	(上) MONITORING
110	126	si	1t	V S	and	with some	rock		1-						1	ER SUPPLY
1			fragments				1	sāūtā T		1-= CR	LET	< -	WALE	Domestic		
							-	V. Atva	ַרַ <u>,</u>	REC ?		•		Public		
126 ;	158	Fi	ne	to	СО	arse sand	and si	1t	<u>ר</u>	, 2.2		Mer	L		l	Irrigation
		so	ome rock fragments - brown colo				r			•				Industrial		
														_	"TEST WELL"	
158	165		tonalite/quartz diorite					.			SOUTH				CATHODIC PROTEG-	
<u> </u>	·	gr	grey color						lustrate or Describ	be Dis	tance of Well from		narks	-	TION OTHER (Specify)	
							 	such as Roads, Buildings, Fences, Rivers, etc. PLEASE BE ACCURATE & COMPLETE.								
		! !								ILLING Date						1
- !		<u> </u>							ME	THOD ROTER		EL & YIELD		FLUID		el
-	. =	<u>'</u>								PTH OF STATIC						
		<u> </u>						· · · · ·	1	TIMATED YIELD.						
TOTAL DE	FPTH OF	BORING	16	5	(F					ST LENGTH3						
TOTAL DE					•	•				May not be repres	-	-				· · · · · ·
			_								$\overline{}$		-			
DEP		BORE-	L				ASING(S)			_ ا	DEPTH OM SURFACE		ANNU		MATERIAL
FROM SI	URFACE	HOLE DIA.	\vdash	YPE (MATERIAL/	INTERNAL	GAUG		SLOT SIZE		HUM SURFACE	CE-	BEN-	<u></u>	YPE
Ft. to	Ft.	(Inches)	BLANK	SCREEN		GRADE	DIAMETER (Inches)	OR WA		IF ANY (Inches)	Γ,	ft. to Ft.	MENT	TONITE		FILTER PACK (TYPE/SIZE)
		<u> </u>	╁	7	위 트						Ë	1	1	(∠)	<u>(∠)</u>	
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	ATTAC	IMENTS	. (1			<u> </u>		CERTIFICAT	TIO	N STATEMEN	T —			

NAME Fain Drilling & Pump Co Inc. (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

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

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

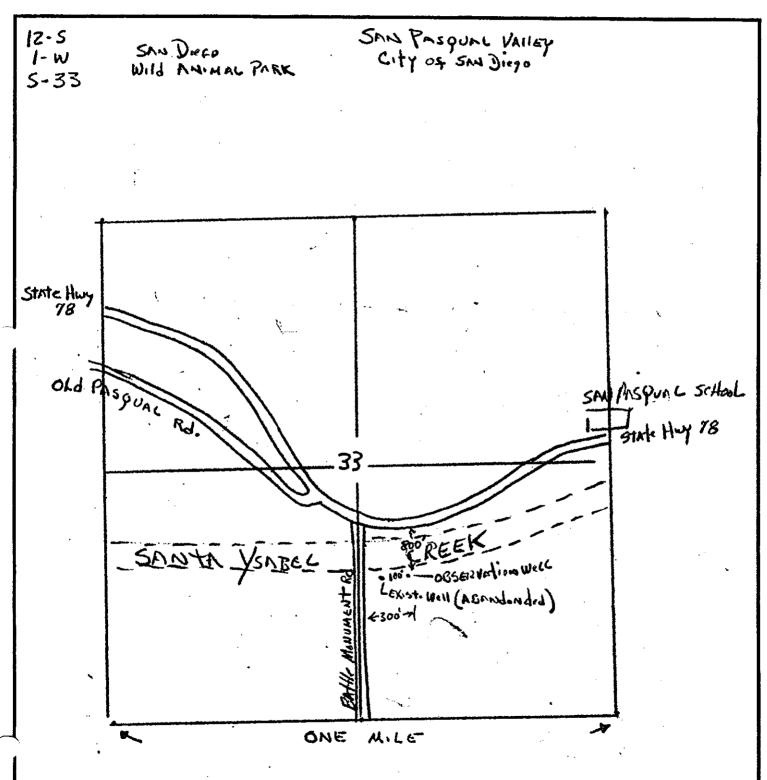
Control #: 11 6 3 3 9 1

Assessor's Parcel Number: 760-110-03

LOCATION

44919)

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



STATE OF CALIFORNIA THE RESOURCES AGENCY

Do not fill in

DEPARTMENT OF WATER RESOURCES WATER WELL DRILLERS REPORT

No. 341173

Notice of Intent No Local Permit No. or Date	State Well No
	(12) WELL LOG: Total depth 174 ft. Completed depth 174 ft.
	from ft. to ft. Formation (Describe by color, character, size or material)
	the state of the s
(2) LOCATION OF WELL (See instructions):	0 40 - fine to coarse sand
County San Diego Owner's Well Number	40 - 60 silty sand (black color)
Well address if different from above Same	- Jilly Sand (Black Color)
Township 12 S Range 1 W Section N Band	60 - 80 fine to coarse sand with some
Township Range Range Range Rection N. Band Distance from cities roads railroads fences Cyn Rd Bridge (on Bandy Cyn Rd.)	grave! Conses
behind dairy	
	80 - 90 fine black silt
(3) TYPE OF WORK:	90 - 105\ fine to coarse sand with some
NEW Well Deepening Reconstruction	90 105 find to coarse sand with some
Reconstruction	- Smarr Bodraci's
Reconditioning	105 V 123 sand and boulders
Horizontal Well	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
Destruction (Describe destruction materials and pro-	123 - 155 parth cemented sand and
cedures in Item 12)	boulders (i)
Horizontal Well Destruction (Describe destruction materials and procedures in Item 12) (4) PROPOSED USE:	155 - Ella fine to really and with
Domestic M	155 _ 154 fine to coope sand with grave
Irrigation Irrigation	164 decomposed granite and
Month Industrial Test Well	boulgers -
Municipal V	
Rd. BRidge Other	7/1) ~ S((2)
WELL LOCATION SKETCH (Describe)	\(\)
	7 2
(5) EQUIPMENT: Rotary OK Reverse Reverse Size Syllik I	
Cable Air Dignete of bore	
Other Bucket Backed from 20 to 174 ((()) -
(7) CASING INSTALLED: (8) PERFORATIONS:	<u> </u>
Steel A Plastic Concesse Straightest steet concesses	
From The Dia Gage or Right To Slot Size	_
0 21 24 250 110 170 060	_
0 176 12 375	-
	_
(9) WELL SEAL:	
Was surface sanitary seal provided? Yes No I If yes, to depth 20 ft.	
Were strata sealed against pollution? Yes No No Interval ft Method of sealing	Work started 9 19 19 Completed 2/11/ 19 00
(10) WATER LEVELS:	Work started 9/5/ 19 Completed 2/11/ 19 90 WELL DRILLER'S STATEMENT:
Depth of first water, if known	
Standing level after well completionft.	This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief
(11) WELL TESTS:	Signed He Ketain
Was well test made? Yes \(\bigcup \) No \(\Bigcup \) If yes, by whom? \(\bigcup \) Same \(\bigcup \) Air lift \(\Bigcup \)	(Well Driller)
Depth to water at start of test 35 ft. At end of test 90 ft.	(Person, firm, or corporation) (Typed or printed)
Discharge 700 gal/min after 6 hours Water temperature 11kn	Address 12029 Old Castle Rd. City Valley Center, California ZIP92082
Chemical analysis made? Yes No W If yes, by whom?	License No. 328287 Date of this report 3/10/90
	NEXT CONSECUTIVELY NUMBERED FORM 86 94333
	60 76333

STATE OF CALIFORNIA THE RESOURCES AGENCY

Do not fill in

DEPARTMENT OF WATER RESOURCES WATER WELL DRILLERS REPORT

No. 353081

ice of Intent No		State Well No
		(12) WELL LOG: Total depth 160 ft. Completed depth 160 ft. from ft. to ft. Formation (Describe by color, character, size or material)
(a) 1 0 C ((T) () () () () () () () () (Altuvial fill as follows:
(2) LOCATION OF WELL (See instructions): County _San_Diego Owner's Well Number	.,	0 _ 35 Fine to coarse sand and slit
Well address if different from above	34	_ Grey color
Distance from cities, roads, railroads, fences, etc. Approx. 5 South Hwy 76 off Bandy Cyn Rd. SWi se		35 _ 45 Reddish clay and gravel
Thos Bros map 28N-B-1		45 _ 75 fine to coarse sand with lens
(3) TYPE OF WOR New Well Ck Deep Reconstruction		_ of clax and silt - dark grey
Reconstruction Reconditioning		75 - 95 Partly cemented sand with
Horizontal Well Destruction (De	□. escribe	some soulders - dark grey
destruction materials cedures in Item 12)	and pro-	93 135 time to coarse sand with small
196 AC Domestic	USE.	rocks and bounders
Trigation Industrial	/ k /	coverted - dark grey color
Test Well Municipal		110000
Oll Cyu BRidge Other	~ ¤	
(5) EQUIPMENT: (A) GRAVEL RACK:	Q.	70-2
Rotary No Reverse 🗆 The No 🖸 Size 🕏	A SA	
Cable Air Planetes of bore South	160/%	(C) -
	(_
(7) CASING INSTALLED: (8) PERFORATIONS: SCreet Type of performion or size of series	(n) ss	<u> </u>
	77/	
from To Dia Gage or them To ft wall ft ft	Shot size	_
0 21 18 .250 100 (1500)	-060	
160 10 375		
(9) WELL SEAL:		_
Was surface sanitary seal provided? Yes Q No If yes, to depth	ft.	-
Were strata sealed against pollution? Yes 🗋 NoXO Interval	ft.	
Method of sealingCemented		Work started 8/6/ 19-91 Completed 8/13/ 19
(10) WATER LEVELS:		WELL DRILLER'S STATEMENT:
Depth of first water, if known	ft.	This well was drilled under my jurisdiction and this report is true to the
Standing level after well completion45	ft.	best of my knowledge and belief.
(11) WELL TESTS:	•	Signed (Well Driller)
Was well test made? Yes XI No □ If yes, by whom?	7	1 /
th to water at start of test 45. ft. At end of test 15		12020 (Person, firm, or corporation) (Typed or printed)
Dtscharge800+gal/min after _6 hours Water temperature	ukn	Address
Chemical analysis made? Yes No. 1 If yes, by whom?		City Valley Center, California ZIP 92082 License No. 22222 Date of this report
Was electric log made Yes No Ly If yes, attach copy to this report DWR 188 (REV. 12-86) IF ADDITIONAL SPACE IS NEED!	ED, USE	NEXT CONSECUTIVELY NUMBERED FORM 8/23/91 8/23/91

ORIGINAL File with DWR	STATE OF CALI WELL COMPLET		DWR USE OF	NLY — DO NOT FILL IN —						
Page _1_ of _1_	Refer to Instruction	n Pamphles	STAT	E WELL NO./STATION NO.						
Owner's Well No.	No. 4	85441								
Date Work Began		LATITUDE LONGITUDE								
Permit No	ency S. D. County Health Dept W61867	-		APN/TRS/OTHER						
7 01.1116 170.	W61867 Permit Date 7-29 9	1	WELL OWN	ER						
	X VERTICAL HORIZONTAL ANGLE (SPECIFY)		an Ranch							
DEPTH FROM	DEPTH TO FIRST WATERUKnfft.) BELOW SURFACE	Mailing Address	O. Box 1959							
SURFACE Ft. to Ft.	DESCRIPTION	Escondic	do, California	92025 STATE ZIP						
1	Describe material, grain size, color, etc.		WELL LOCAT	ION						
33	Alluvial fill as follows: fine	Address 18118 Bandy Canyon Rd								
	grained sand and silt brown color	City — San Diego — — — — — — — — — — — — — — — — — — —								
<u> </u>	1	APN Book 760	Page 170 Parce	el38						
35 70	Fine to coarse sand - brown color	Township 12 S	Range 1 W Section	on						
	with lenses of grey silt	Latitude	NORTH Long	itude <u> </u>						
70 115	Cino to	LOCAT	TION SKETCH —	ACTIVITY (∠)						
70 113	Fine to coarse sand with some boulders		NORTH	X NEW WELL						
<u> </u>	bodiaers			MODIFICATION/REPAIR Deepen						
115 165	coarse sand with lenses of gravel		10 0	Other (Specify)						
	and some boulders - grey color	HW4-1		,,						
4.0		SEI CE	LEEN LIZON	DESTROY (Describe Procedures and Materia						
165 180	Fine to coarse sand with some	L YSAB-	Under "GEOL							
	boulders - partly cemented	PLANNED USE((MONITORING WATER SUPPLY Domestic Public X Irrigation								
	grey color									
180 195	Hard decomposed granite	L. V	N NO	Domestic						
	granic	Public								
-		X. Irrigation								
				Industrial						
				"TEST WELL"						
1		Illustrate or Describe D	SOUTH ————————————————————————————————————	CATHODIC PROTEING TION OTHER (Specify)						
		such as Roads, Building PLEASE BE ACCURA	s, Fences, Rivers, etc.							
		DRILLING D	_							
1 1		METHOD KOATARY FLUID Gel								
		DEPTH OF STATIC WATER LEVEL & FIELD OF COMPLETED WELL DEPTH OF STATIC WATER LEVEL WATER LEVEL (Ft.) & DATE MEASURED 7-29-91								
		ESTIMATED YIELD 1500 (GPM) & TEST TYPE air lift								
TOTAL DEPTH OF I	• • • •	TEST LENGTH 8 (Hrs.) TOTAL DRAWDOWN 140 (Ft.)								
TOTAL DEPTH OF (COMPLETED WELL 195 (Feet)	* May not be representa	tive of a well's long-term	ı yield.						
DEPTH	CASING(S)			ANNULAR MATERIAL						
FROM SURFACE	BORE- HOLE TYPE (∠)		DEPTH FROM SURFACE	TYPE						
Ft. to Ft.	DIA. (Inches) B S S S S S S S S S S S S S S S S S S	LL IF ANY	CE-	BEN- TONITE FILL -FILTER PACK						
	B S S THICKNE	SS (Inches)	Ft. to Ft. (∠)	TYPE/SIZE)						
0 21	36" X A-120 23.5 .25	50	0 20 X							
0 100	24" X A-120 12 .375		20 195	X 5/16x4						
100 180 180 195	24" X SS 304 12 .250	- 060								
104 193	24 A-120 12 375									
ATTACH	MENTS (∠)	- CERTIFICATIO								
Geologic			and accurate to the be	st of my knowledge and belief.						
1	truction Diagram NAME Fain Drillin (PERSON, FIRM, OR CORPORATION)	OYPED OR PRINTED)	Inc.							
Geophysic	cai Log(s)		la.a. C							
Other	ADDRESS ADDRESS	Castle Rd. Val	ley Center, C	a 92982 zr						
	NFORMATION. IF IT EXISTS. Signed WELL ORILLER/AUTHORIZED REPRE	then		0/01						
DWR 188 REV. 7-90	IF ADDITIONAL SPACE IS NEEDED USE NEXT		DATY SKIN	257 GOERBE BUMBER						

Notice of Intent No.

13552

STATE OF CALIFORNIA

Do not fill in

State Well No.___

THE RESOURCES AGENCY **DEPARTMENT OF WATER RESOURCES** WATER WELL DRILLERS REPORT

No. 04702

Permit No. or Date	Other Well No
	(12) WELL LOG: Total depth/64.3ft. Depth of completed well/63ft.
	from ft. to ft. Formation (Describe by color, character, size or material)
	0 - 48 FINE SAND W/18 to 14 Blue GrAVE
(9) LOCATION OF WELL (9)	48 - 99 LAVETED OTANOL & SAND 1" to G! the
(2) LOCATION OF WELL (See instructions): County SWO EGO Owner's Well Number	99 - 155 FINE SAND W/ SMAIL AMOUNT ALVECTOR
Well address if different from above NONE	155 -158 Convite Door Dunder and related and
Township /25 Range /W Section 36	188 -164 popen no 1900 11 con 10
	155 TOT TICESE ROCK W/SIMPLET SAPO
Distance from cities, roads, railroads, fences, etc. 10 MILES E. 0F ESC. OFF HWY 78 (THOMAS BROS 404 E-Z)	- ///
LOC. OFF HALL TO (THOMAS BEDS TOF E-2)	- ^ \\\
(3) TYPE OF WORK: New Well M Deepening Reconstruction Reconditioning	Δ //
San Now Well M. D. C.	
New Well & Deepening	VH
Reconstruction	- 1
Reconditioning	~// _ C V
Horizontal Well	111-110
Destruction (Describe destruction materials and	110- 1111
destruction materials and procedures in Item 12	V - 60 / 60 / 60 / 60 / 60 / 60 / 60 / 60
DAY(4) PROPOSED WAS	
Domestic Domestic	
Irrigation	11-11
Industrial	(D) A
Test Well □	
Stock	11) - 2 (600
Municipal) \(\) \(
WELL LOCATION SKETCH Other	
(5) EQUIPMENT: (6) GRAVED PACK:	
Rotary Reverse No Size	
Cable Air Displayer of bore 34	(A) -
Other Bucket Real ed from box 6 / te	
(7) CASING INSTALLED: (8) PERFORATIONS:	<u></u>
Steel Plastic Concrete Type of perferation or size of screep	9
From To Dia Carse or From To Sico	
ft. ft Wall ft size	_
0 164 28 .219 201 164 16425"	**
	-
OW D	
(9) WELL SEAL:	=
Was surface sanitary seal provided? Yes M No □ If yes, to depth 20 ft.	
Were strata sealed against pollution? Yes No Intervalft.	_
Method of sealing	Work started 4-/9 19 77 Completed 4-24 19 77
(10) WATER LEVELS:	WELL DRILLER'S STATEMENT:
Depth of first water, if known ft.	This well was drilled ander my jurisdiction and this report is true to the best of my
Standing level after well completion 6.2 ft.	knowledge fand belief
(11) WELL TESTS: Was well test made? Yes No If yes, by whom? Mush with Sycker.	Signed (Well Driller)
Was well test made? Yes No I If yes, by whom? No III yes, by whom? No III yes, by whom? No III III III III III III III III III	NAME HOWARD PUMP INC.
Depth to water at start of test 65 ft. At end of test 65 ft	(Person, firm, or corporation) (Typed or printed)
Discharge 1000 gal/min after 32 hours Water temperature 60°	Address 28753 W. HWY 58
Chanical analysis made? Yes No X If yes, by whom?	City BARSTOW CAL. Tip 92811
electric log made? Yes No If yes, attach copy to this report.	License No. 1 28/8/4 Date of this report / -6 - 78
	EXT CONSECUTIVELY NUMBERED FORM 49816-950 7-76 50M QUAD (\$\text{U}\tau obp

Notice of Intent No ...

EEB 2 0 1978 THE RESOURCES AGENCY **DEPARTMENT OF WATER RESOURCES** 101406 WATER WELL DRILLERS REPORT

No. 04703

State Well No._

Permit No. or Date	Other Well No
	(19) WITH LOC. (2/~/
	(12) WELL LOG: Total depth/36-64t. Depth of completed well /35 ft.
	from ft. to ft. Formation (Describe by color, character, size or material)
	C - 9 FINE TOMED BROWN SAND
(2) LOCATION OF WELL (See instructions): County SAU 0/660 Owner's Well Number #2	9 - 33 Men To Henry Banua SANO
540.4	33 - 42 FINE SAND W/BLUE BLACK SHALL
Well address if different from above NONE	grand wester BROWN Chay
Township /2.5 Range / W Section 36	99 -97-6 LAYER OF TRY VI grave
Distance from crities, roads, railroads, fences, etc. 10 HILES EAST OF	99-6-114 Course SAND W/ Fine gravel
ESCONDIDO OFF HWY 78	-
	- \
(3) TYPE OF WORK:	
New Well Deepening	
Reconstruction	- \ \
Reconditioning	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~
Horizontal Well Destruction (Describe destruction materials and procedure in them.)	(S) - (M)
Destruction (Describe	1117- 1111
procedures in term pay	7-6
(4) PROPOSED USE	
Domestic Domestic	
SD 2 Irrigation	1-11 1450
10 Industrial	OL W
Tax Well	10,10)-
Stock	
Municipal CS	
WELL LOCATION SKETCH Other	
(5) EQUIPMENT: (6) GRAVED PACK:	
Rotary Reverse No Size	
Cable Air Dispeter of bore	
Other Bucket Rebest from	
(7) CASING INSTALLED: (8) PERFORATIONS:	\$ -
Steel A Plastic Conclete Type of performing or size of screen	
From To Dia Cancor From To Sion	
ft. ft(\Q'in, Wall ft. tt. \size	-
0 135 8 198 20 136 16	
(9) WELL SEAL:	
Was surface sanitary seal provided? Yes No If yes, to depth 20 ft.	
Were strata sealed against pollution? Yes No M Intervalft.	
Method of sealing	Work started 3-29 19.77 Completed 3-3/ 1977
(10) WATER LEVELS:	WELL DRILLER'S STATEMENT:
Depth of first water, if known 15. Standing level after well completion 7.5 ft.	This well was drilled under my jurisdiction and this report is true to the best of my knowledge and helief.
(11) WELL TESTS: Huth water Systems	SIGNED TOMM . SIGNED
Was well test made? Yes No I If yes, by whom?	(Well/Driller)
Type of test Pump Z Bailer [Air lift [NAME HOWARD PUMP INC.
Depth to water at start of test 75 ft. At end of test 97 ft	(Person, firm, or corporation) (Typed or printed) Address 28753 W: HWY 58
Discharge 350 gal/min after 16 hours Water temperature 6/6	Dieserve CAL - 97811
Chemical analysis made? Yes No X If yes, by whom?	1 70
electric log made? Yes Nov If yes, attach copy to this report	
LWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED. USE N	IEXT CONSECUTIVELY NUMBERED FORM 49816-950 7-76 50M QUAD (I)T OSP

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well #1

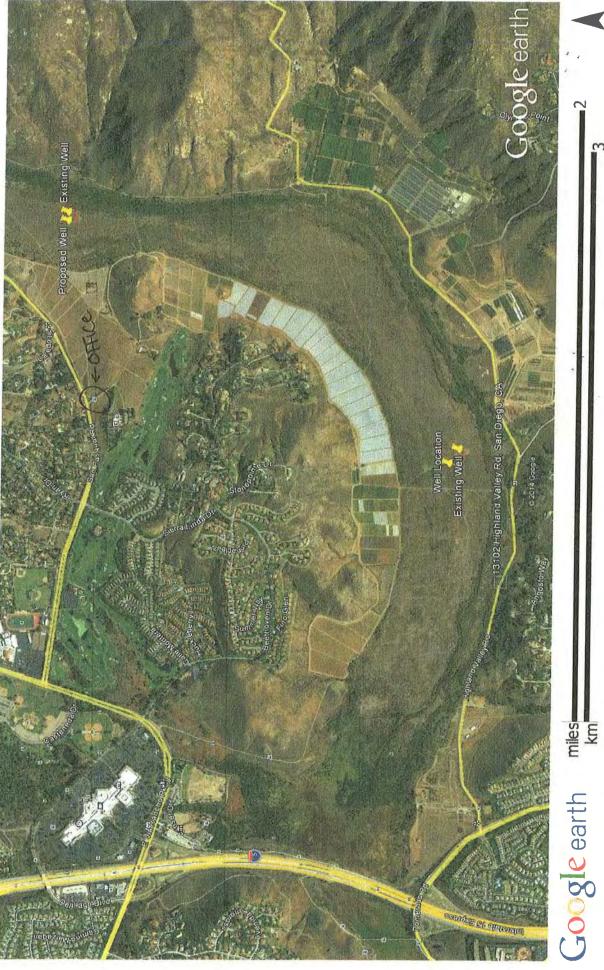
MT OF SANON	COUNTY
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	WATER

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY OUTSION
WATER WELL PERMIT APPLICATION

	DEH2014-LWELL-000675 PERMIT#_
1	FEE: 535.00
١	WATER DIST:

CATO	DATE: WATER WELL PERMIT APPLISATION FILE: 535.00 WATER DIST:
1.	Property Owner: BE WISE RANCH INC. Phone: BLLL 760-746-60006
	Mailing Address: 20505 SANDASQUAL VALLEY City: PSONDIOO State: CA Zip: 97076
2.	Well Location - Assessors Parcel Number: 760-170-82
	GPS Coordinates; (WGS-84 Decimal Degrees): 33.0727 / 117.0323
	Site Address: SANDASQUAL WALLEN PD. City: CSCOND DO State: CA Zip: 97076
3.	Well Contractor/Driller: DAVE WATTHEWS Company Name: FAIN DRILLING
	Mailing Address: 12029 OUDCASHORD City: VAlley Coulde State: CA Zip 92082
	Phone: 760 - 749 - 0701
4.	Use: & Private Public Industrial Other: RRIGATION WELL
5.	Type of Work: New □ Reconstruction □ Destruction □ Time Extension: □ 1 st □ 2 nd
6.	Type of Equipment: MOO, ROTARY
7.	Depth of Well: Proposed: 100 Ft - Existing:
8:	Proposed: Casing Conductor Casing Filter/Filler Material Perforations
	60 160
	Depth: 100 Depth: 20 From: 0 To: 100 From: To:
	Diameter: 14 in. Diameter: 24 in. Type: #6 From:To:
	Wall/Gauge: 1250 Wall/Gauge: 1250
9.	Annular Seal: Depth: 20 ft. Sealing Material: CEWENT
	Borehole Diameter: 30 in. Conductor Diameter: 24 in. Annular Thickness: 3 in.
10:	Best Management Plan for confining well drilling waste on the project site provided? Yes No
11.	Date of Work: Start: 10/14 Complete: 16/14
of Sar	es served by public water, contact the local water agency for meter protection requirements. by agree to comply with all regulations of the Department of Environmental Health, and will all ordinances and laws of the County n Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon etion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well (well driller's l. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.
Contra	actor's Signature: Date;
DISPO	OSITION OF APPLICATION (Department of Environmental Health Use Only)
Ap mainte	proved Denied Special Conditions: Grading and clearing associated with access to, or the construction of water wells, may require additional permits from the County of San Diego and/or other agencies.
_	alist: Date: 9-11-14

13 LWIN-000675





COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH LAND AND WATER QUALITY DIVISION WATER WELL PERMIT APPLICATION

2	DEH USE ON	LY
PERMI	2014-LWEL	1-00067
-	760-170-	- 23
APN:_	100-110-	02

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.





County of San Diego

STORMWATER & DISCHARGE MANAGEMENT PLAN FOR WATER WELLS

This form must be submitted with all Well Permit Applications

Department Use Only	en reminapproduced
Well Permit Application Number: <u>LWEUL-0</u> 00675 A	ssessor's Parcel Number: 760-170-82.
SECTION 1: Required Information from Contractor or Co	nsultant:
Longitude & Latitude: 33.0727 × 117.03 1. Are there any watercourses or water bodies within 50 feet of the 2. Does the plat show the project boundaries? (A "detail inset" is ac 3. Does the plat show footprints of any existing structures and facility. 4. Does the plat show locations where run-off may enter stormdrain its grading required to access site or install well? 5. Does the project conform to the local grading ordinance? 7. Will drilling additives be used to drill the well? 8. Are the Best Management Practices attached to this permit applies.	imits of soil disturbance? coeptable for a large parcel or lot.). les within 100 feet of the wellhead position? yes NO yes
SECTION 2. Best Management Practices	au spotos curpa-ju-s
The goal of stormwater and discharge control management planning pollution to the maximum extent practicable using Best Managematerials, sediments, chemical residues such as drilling foam, we property boundaries to similate transport from the site to nearby adjacent properties. It is the responsibility of the property owner as	ment Practices (BMPs). Construction related restes, and splits must be retained within the streets; drainage courses, receiving waters and
be used in order to ensure that all contaminants are retained on-site	
Examples of Best Management Practices to contain well installation of a sediment basin to contain run-off, using geotextile eliminating the use of drilling feam. (Website Information is available	fabric to contain sediments and drilling muo, or
SECTION 3. Certification	
I have read and understand the following: (Please check each box of Selected BMP's will be implemented so that water quality is not	effer concurrence. negatively impacted by well construction activities
I am aware the selected BMP's must be installed, maintained, i	monlicred and revised as necessary so they are
effective. Junderstand that non-compliance with the San Diego County	THE STATE OF THE S
enforcement actions by the County. These may include fines,	citations, stop-work orders, or other actions.
DEH inspectors and personnel from other regulatory agencies	are authorized to enter my property at any pine well is completed to the satisfaction of DEH.
a Should DEH determine during the field review that the well	Installation procedures contradict this discharge
Management Plan or the well permit application, the well drilling activity will require a new permit see and amendment to the extension of the	g permit may be suspended or revoked. Politila
Contractor \	Date 9/5/14
Property Owner This B	_ Date
Reviewed by DEH	Date. 9-11-14
A A A A A A A A A A A A A A A A A A A	

DUPLICATE, ORIGINAL DEPOSIY-LWELL-000675



THE CITY OF SAN DIEGO

WILLIAM BRAMMER d/b/a BRAMMER FARMS

Flat Rate Lease

DOCUMENT NO. M. 301867
FILED SEP 1 2 2036

OFFICE OF THE CITY CLERK SAN DIEGO, CALIFORNIA

CITY OF SAN DIEGO FLAT RATE LEASE

THIS LEASE AGREEMENT is executed between THE CITY OF SAN DIEGO, a municipal corporation, hereinafter called "CITY," and WILLIAM BRAMMER d.b.a. BRAMMER FARMS, hereinafter called "LESSEE."

SECTION 1: USES

- Premises. CITY hereby leases to LESSEE and LESSEE leases from CITY all of that certain real property situated in City of San Diego, County of San Diego, State of California, described as consisting of approximately 136.4 acres and forther described in Section 111, Exhibit A Premises attached hereto and by this reference made part of this agreement and four (4) wells, including the right to use the water which may be available underneath the Premises for the purposes. I provided for in Section 1.2 Uses, subject to Section 8.8, Water Rights, hereof. Said real property is hereinafter called the "premises" or "leased premises." It is further agreed that the leasehold has not been surveyed however CITY and LESSEE agree to approximate acreage.
- Uses. It is expressly agreed that the premises are leased to LESSEE solely and exclusively for the purposes of growing organic vegetables, related agricultural crops on an ongoing basis, business office, vegetable washing and packing area/building and for such other related or incidental purposes as may be first approved in writing by the City Manager and for no other purpose whatsoever.
 - The use of the premises for any unanthorized purpose shall constitute a substantial default and subject this lease to termination at the sole option of the CITY.
 - LESSEE covenants and agrees to use the premises for the above-specified purposes and to diligently pursue said purposes throughout the term hereof. Failure to continuously use the premises for said purposes, or the use thereof for purposes not expressly authorized herein, shall be grounds for termination by CITY.
- 1.3 Related Council Actions. By the granting of this lease, neither CITY nor the Council of CITY is obligating itself to any other governmental agent, board, commission, or agency with regard to any other discretionary action relating to development or operation of the premises. Discretionary action includes but is not limited to rezonings, variances, environmental clearances, or any other

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Page _ Owner Date W Local P	14 1	of 1 mber On 11/03/2	2014 DEH	Date	Work En	Refe No ided 11/	ompleti er to Instruction o. e02426 17/2014	on Repo	ort			te Well Nu	Tion	Site Number Longitude
Or Drillin	ientation g Method _E h from Si	● Vert	Geolo	ogic Log rizontal	OAngle	Spec	ify_ ntonite mud	- viewing	pursuant	t to sec	grayed au tion 137	52 of the	been Wate	blocked from public er Code and the ersonal information.
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			Compl	eted Well	Constant	ction			*	North			0	Modification/Repair O Deepen O Other Destroy
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			Comments Water Sa	emple Take	9717				SEE	South		Pr.	00000000	Domestic Public Irrigation Industrial Cathodic Protection Dewatering Heat Exchange Injection Monitoring Remediation Sparging Test Well Mapor Extraction
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									Level and		of Com	plated V		
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S	th from inface to Feet	Borehol Dlamete (Inches)	r Type	Mate	rial	Wall Thicknes (Inches)	s Diameter	Screen	If Any (Inches)	S	urface to Feet	FI	u	Description
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0	60	23	Blank	PVC F480		.750	12 3/4		0.000	0	100	Filter Pa	ck	#6
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BUUU	Geologic Well Cor Geophys Soil/Wat Other S	c Log nstruction sical Log(ter Chemi Site Map	Diagram s) cal Analyses		Name _	Fain Dri	Firm or Corpo estle Road Address	at this repor	t is comple pany, lac.	ete and a	accurate t	o the bes	A late 32828	y knowledge and belief 92082 Zip 7 cense Number
Name and Address of the Owner, where the Owner, which is the Owner, where the Owner, which is the Owner, where the Owner, which is the Owner, wh	REV. 1/200	And in case of the last of the			IF ADDITION			, USE NEXT CO	DNSECUTIVE	LY NUMBI				

3.	Property Owner: WIFMAM RANCH (Leasee) PMPhone: 760-644-6887 Mailing Address: PO BOX 1959 City: escondido State: CA zip: 97025 Well Location - Assessors Parcel Number: 37.0914 James II.G. 9559 GPS Coordinates: (WGS-84 Decimal Degrees): 37.0914 James II.G. 9559 Site Address: Hwy 78 W/O BANDY CANYON City: escondido State: CA zip: 97025 Well Contractor/Driller: DAVE WA-Hrows Company Name: FAIN NELLUNG Mailing Address: 12029 OLOCAS-ILE RD City: VALLEYBUR State: CA zip: 97082 Phone: 760-749-0701 C-57 License No: 328287 Cash Deposit ** Bond Posted
3.	Property Owner: WIF WAM RANCH (LEASER) Property Owner: 760-644-6887 Mailing Address: PO BOX 1959 City: ESCONDIDO State: CA zip: 97025 Well Location - Assessors Parcel Number: 37.0914 760-170-43 02 -247-130-37 GPS Coordinates: (WGS-84 Decimal Degrees): 37.0914 78 66 BANDY CANYON City: ESCONDIDO State: CA zip: 97025 Well Contractor/Driller: DAVE WATHOWS Company Name: FAIN DRILLING Mailing Address: 12029 OLD CASTLE RD City: VALLEYBUS State: CA zip: 97087
3.	Well Location - Assessors Parcel Number: 3500 770-43 or 2472-130-27 GPS Coordinates: (WGS-84 Decimal Degrees): 37.0914 / 24455 116.9559 Site Address: Hwy 78 W/O BANDY CANYON City: escon0100 state: CA zip: 97025 Well Contractor/Driller: DAVE WATHOWS Company Name: FAIN DELLING Wailing Address: 12029 OLOCAS-ILE RD City: VALLEYBUSK State: CA zip: 97082
3.	GPS Coordinates: (WGS-84 Decimal Degrees): 37.0914 Site Address: Hwy 78 W/O BANDY CANYON City: escondido state: CA zip: 97025 Well Contractor/Driller: DAVE MANHOWS Company Name: FAIN DRILLING Mailing Address: 12029 OLD CAS-HERD City: VALLEYBUS State: CA zip: 97087
3.	Site Address: Hwy 78 W/O BANDY CANYON City: esconDLDO State: CA zip: 97025 Well Contractor/Driller: DAVE WATHAWS Company Name: FAIN DELLING Wailing Address: 12029 OLD CASTLE RD City: VALLEYBUSK State: CA zip: 97082
3.	Well Contractor/Driller: DAVE WATHOWS Company Name: FAIN INCLLING Wailing Address: 12029 OLD CASTLE RD City: VALLEYBUSE State: CA zip: 97082
	Mailing Address: 12029 OLD CASTLE RD City: VALLEYBURG State: CA Zip: 97082
	Phone: 760-749-0701 C-57 License No: 328287 Cash Deposit Bond Posted
4.	
	Use: Private Public Industrial Scother 12/2/Carticon (+est-weight)
5.	Type of Work: New □ Reconstruction □ Destruction □ Time Extension: □ 1 st □ 2 nd
6.	Type of Equipment: WOD ROTARY
7.	Depth of Well: Proposed:
8: F	Proposed: test well to be Destroyed or Finished upon Pesults Casing Conductor Casing Filter/Filler Material Perforations
	Type:
	Depth: To:
	Diameter: in. Diameter: in. Type: From: To:
	Wall/Gauge: Wall/Gauge:
). <i>I</i>	Annular Seal: Depth:ft. Sealing Material:
E	Borehole Diameter: in. Conductor Diameter: in. Annular Thickness: in.
10; E	Best Management Plan for confining well drilling waste on the project site provided?
11. 0	Date of Work: Start: 1/13/15 Complete: 1/23/15
hereby a of San Di completion report). I	served by public water, contact the local water agency for meter protection requirements. gree to comply with all regulations of the Department of Environmental Health, and will all ordinances and laws of the County lego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well (well driller's accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision. S Signature: Date:
T. A. Z. S.	ION OF APPLICATION (Department of Environmental Health Use Only)



COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH LAND AND WATER QUALITY DIVISION WATER WELL PERMIT APPLICATION

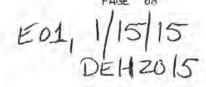
€01	4	15	15,	DEHZOIS
	PERMIT		USE O	NLY L-060 8017

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.

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	35.17 n	241.55 ft
- exist well	Well Location	
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ore III transaction	ा हो जिल्ले क ची जिल्ले ची जिल्ले	NAMA
	Grove	BANDU
		exist *
		1: 1,128 ;

Reviewed or DEH





County of San Biego

STORMWATER & DISCHARGE MANAGEMENT PLAN FOR WATER WELLS

This form must be submitted with all H'all Permit Applications Department Use Only Well Permit Application Number: 00080 Assessor's Parcel Number SECTION 1. Required information from Contractor or Consultant: 33 0914 Longitude & Latitude How obtained? GPS Are there any watercourses or water bodies within 50 feet of the limits of soil disturbance? 2. Does the plat show the project boundaries? (A "detail inset" is acceptable for a large parcel or lot.). 3. Does the plat show footprints of any existing structures and facilities within 100 feet of the wellhead position? Does the plat show locations where run-off may only stormorains drainage courses and/or receiving waters? 5. Is grading required to socess elte or inetall well? 6. Does the project conform to the local grading ordinance? . Will onling additives be used to drill the well? Must be Bust Management Practices affected to this permit application? /pits SECTION 2. Best Management Practices The goal of storniwater and discharge control management planning while drilling and installing wells is to reduce pollution to the maximum extent practicable using Best Management Practices (BMPs). Construction related materia's sediments, chemical realouse such as drilling foam, wastes, and spills must be retained within the properly boundaries to eliminate transport from the site to nearby streets; crainage courses. Acceiving waters and actiscent properties. It is the responsibility of the property owner and the contractor to determine which BMPs will be used in order to ensure that all conteminants are retained on-site. Examples of Best Management Practices to contain well installation run-off include but are not limited to installation of a sediment basin to contain run-off, using geotextile lebric to contain sediments and driving mud. or eliminating the use of drilling foam (Website Information is available at www.projectcleanwater.crg. SECTION 3. Certification I have read and understand the following: (Please check each pcx after concurrence.) Selected BMP's will be implemented so that water quality is not negatively impacted by well construction activities am aware the salected BMP's must be installed, maintained, monitored and revised as necessary so they are effective i understand that non-compliance with the San Diego County Watershed Protection Ordinance may result in renforcement actions by the County. These may include tines, citations, etop-work orders, or other actions DEH inspectors and personnel from other regulatory agencies are authorized to enter my property at any time for purposes associated with this well permit until such time the well is completed to the satisfaction of DEH. Should DEH determine during the field review that the well installation procedures contradict this Discharge Management Plan of the well permit application, the well drilling permit may be suspended or revoked. Further activity will require a new permit type and enjegialment to the existing permit.

Date

Pagé Owner Date W Local F Permit	1 s Well Nu Jork Bega Permit Age Number <u>I</u>	of _ mber _C n _01/14 ency _SD _WELL-	1 One 1/2015 DEH -000807	Permit Date	Vell Scene New 143 13115	ompleti er to Instruction o. e02550 2/2015	on Repo	ort		Sta Sta Sta	ate Well Nu	Imber/S	
O Drillin	rientation	O Ve	rtical O Ho	rizontal OAng Drillin Descriptio cribe material, grain s	jle Spec	ify	The inf	formation g pursuan	in this It to se	grayed ction 13	area ha 752 of tl	s bee he Wa	en blocked from publicater Code and the personal information
0 13 66 92 96 167 188	13 66 92 96 167 188 190		Silty Grey Sa Course Brown Grey Sand An Grey Silty Cla Course Grey Course Sand	nd n Sand nd Silt nd Well Constri Sand Grey / White			Address City Est Latitude	Deq.	Min. Dec. L	Sec.	N Longito	unty <u>s</u> ude _ Dec	San Diego
190			Weathered R Granite OWNESS WING G	Jector	2		Townsh (Sketch		ion SI	ge (etch after form is	printed.)	00	New Well Modification/Repair O Deepen O Other Destroy Describe procedures and materials under "650LOGIC LOG"
		5	ale Symple	8 dicko 114			EXIII	WEI	South of well from	exist well	BHUDY CANYES	000000000	Planned Uses Water Supply Domestic ☐ Public Irrigation ☐ Industrial Cathodic Protection Dewatering Heat Exchange Injection Monitoring Remediation Sparging Test Well Vapor Extraction Other
Total	Depth of	Boring	190		Feet		Depth to Depth to Water L	Level and offist water o Static evel 72 ed Yield *	500 4	of Com	pleted V et) Date M) Test	Well (Fe Meas	eet below surface) sured Air Lift
Dep	Depth of other to Feet	topode aut	ole Type	Casings (Wall	Outside s Diameter	*May no	Slot Size if Any (Inches)	Dep S	e of a we	ll's long te	erm yid lar Ma	vdown(Feet) eld. aterial Description
0 0 90	20 90 190	30 23" 23"	Conductor Blank Screen	Low Carbon Steel PVC F480 304 Stainless Steel	.250 .750 .250	24" 12 3/4" 12 3/4"	Wire Wrap	0.060	0	20 190	Cement Gravel P	_	#6
מחחחמ	Geophy	Log nstructio sical Log er Chem site Mar	n Diagram I(s) Iical Analyses		Person. ev Center	Atteres	et his repor		te and a	atement accurate to	to the bes	A tate	92082 Zip

DEPARTMENT OF HEALTH SERVICES

WELL PERMIT

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WITHAN RANCH INC.

APN 760-170-18

Control 1 N 02917

			CONTROL # 10 45 11
TYPE OF WORK (Check)	(Contact of	USE (Check)	EQUIPMENT (Check)
New Well	Individual Dome	estic	Rotary 🔀
Repair or Modification	Agricultural	Community	Cable Tool
Time Extension	Industrial	Other	Other
Destruction			
PROPOSED WELL DEPTH	A Linear	PROPOSED CASING	
Max. 160 Min. 150 (Feet)	Type STEEL	Depth 150 Diameter 12"	Wall or Gage 1365
PROPOSED SEALING ZONE(S)	19	SEALING MATERIA	L (Check)
From 0 to 20	Feet	Neat Cement Grout	Bentonite Clay
Fromto	Feet	Sand Cement Grout	Concrete
From to	Feet	Other-Specify:	2 1- 1- 1- 1- X-2
PROPOSED PERFORATIONS OR SCRE	EN		
From 100 to 160	Feet	DATE OF W	ORK
From to	Feet	Start 2-27-95	
From to		Completion $3-5-93$	
Fromto	Feet		
NAME OF WELL OWNER		NAME OF WELL DRILLER	
	,	Loe FAIN	
WITHAN RANCH, INC		COMPANY	
16789 SAN PAS QUAL VLY 1	P1-650		Person C. tun
1 6:01 HOU 1 43 YEAR VEG 1	0	FAIN DRICKING &	rump a the.
DISPOSITION OF APPLICATION (FOR HEALTH OFFICERS USE ON		12029 Old CAS	the RL- Valle CA
		LICENSE NUMBER	ne no mage
APPROVED	DENIED		h Deposit
APPROVED WITH CONDITIONS			d Posted
Report Reason(s) for Denial or Necessary	Conditions Here	: 40KW	1129TM
Well to be installed to all	State &	Fee paid on	0) (1)
			1
County water well standard	<u> </u>		
On sites served with public v	water,	I hereby agree to comply wi Department of Health Serv	
contact the local water agen	cy for	nances and laws of the Co	unty of San Diego and of
meter protection requirement		the State of California per tion, repair, modification	
- March historian sedan amen		ately upon completion of	work I will furnish the
		Department of Health Sory	ices with a complete and
			icos mini a compiono una
		accurate log of the well.	accountry and
	8		n
M. Sedgl		accurate log of the well.	Dan
M. Sedgl- HEALTH OFFICER 2-23-95			Daw SIGNATURE

WELL PERMIT APPLICATION

Control # WUZ917

Assessor's Parcel No. 760-170-18

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE NEWAGE DISPOSAL SYSTEMS AND OTENTIAL CONTRACTOR OF TARMS AND SOURCES, INCLUDING DIMENSIONS 27 28 SAN DIEGO DIEGO SAN PARK O WILD SAN PASQUAL 8 BATTLEFIELD STATE HISTORIC PARK SANTA YSAB CREEK 34 32 RD 1993 COPYRIGHT 3 HIGHLYNO RD

Page 4 Owner's Vo Date Wor Local P	JPLICAT al Requi of	Oreg W629 3/2/	17 195 En	اُن ج	4	WEL.	L GOM Refer to It . N	10. 4	ON Pan	REPORT	r [LATITUDE	STATE	WELL N	IO./STA	OT FILL IN — TION NO. DONGITUDE		
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	,00	1117 X	Completed Well Construction						WEST	Viencet	1300	La Care		AST	-PL	NNED USE(S (∠)		
	31	Co	mp	letec	IW	ell Construct	ion		3	CREEKES	p			M	WATE	MONITORING		
-14		Date _	.7	1-2	5.	-95									Domestic			
		Date In	cne	ortor		1-21-95			1	way GTM		-	/			Public		
		Date	Sp.	20101	2	1000			1							Irrigation		
		Commi	ent	5	19	Well	•					-7			1/4	"TEST WELL"		
		_	-								— sout	н			G-	_ CATHODIC PROTE		
		_	_		_				814	ustrate or Describ ch as Roads, Buil	dings, Fend	es, Rivers, et	c.	narks	-	_ OTHER (Specify)		
						PLEASE BE ACCURATE & COMPLETE.								_				
		Reviewed By In Salgh								METHOD ROLL FLUID GOL WATER LEVEL & YIELD OF COMPLETED WELL DEPTH OF STATIC WATER LEVEL 9 (Ft.) & DATE MEASURED 3/16/95								
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										MATED YIELD								
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TOTAL D	EPTH OF	COMPLET	ED	WELL	=		Lic officient out		_ N	lay not be repres	entative of	u wen s tor	_		. /			
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WELL PERMIT APPLICATION

Control # W 1917

Assessor's Parcel No. 760-170-18

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING THE PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXPETING WELLS, SEWERS AND PRIVATE NEWAGE DISPOSAL SYSTEMS AND OTHER POLLOWING TAKENATION SOURCES. INCLUDING DIMENSIONS 27 28 -SAN DIEGO DIEGO BATTLEFIELD STATE HISTORIC PARK Thomas Bros. Maps ® 34 COPYRIGHT 1993 HIGHL

WELL PERMIT

	760-170		į.
	EQUIPMENT (Rotary Cable Tool Other	Check)	
		-375 	-
DATE OF WORK 46-93 10-93	2-0701		DIVE OF
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comply with a eith Services of the County ornia pertain fication and tion of work lith Services e well.	and with all of San Diego ing to well co destruction. I will furni	and of nstruc- lmmedi- lsh the	

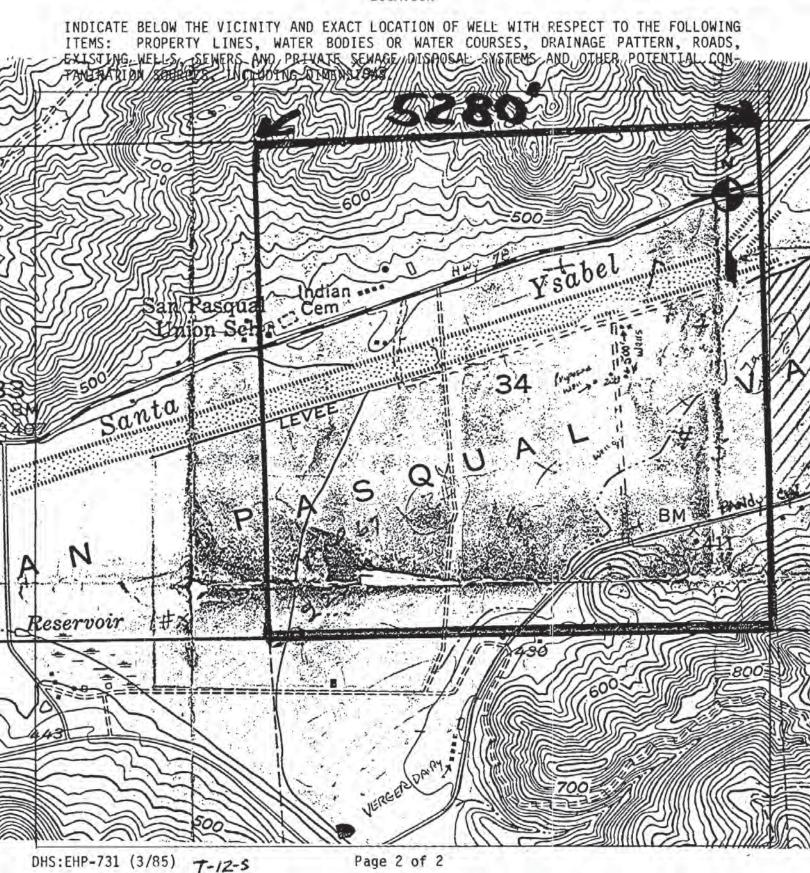
TYPE OF WORK (Check)	51	USE (Check)	EQUIPMENT (Check)
	teather and the		
New Well	Individual Dom		Rotary 🔀
Repair or Modification	Agricultural		Cable Tool
Time Extension	Industrial	Other	Other
Destruction			
PROPOSED WELL DEPTH		PROPOSED CASING	
Max. 200 Min. 180 (Fe	et) Type STEEC	Depth 200 Diameter 12	Wall or Gage -375
PROPOSED SEALING ZON	E(S)	SEALING MATERIAL	. (Check)
From 0 to 5	O Feet	Neat Cement Grout	Bentonite Clay
Fromto		Sand Cement Grout	Concrete X
			201101010
Fromto		Other-Specify:	
PROPOSED PERFORATIONS OF		DATE OF WO	RK
From 140 to 20	Peet Feet		
From to	Feet	Start 1-46-93	
From to	Feet	Completion <u>1-10-9</u>	3
Fromto	Feet		
NAME OF WELL OWNER .		NAME OF WELL DRILLER	
KAY Bis	HOP	Joe Fain	749-0701
		COMPANY	
BANGU CUN ROLLESCH	SHAPASOUND		2
DANGU CAN LALENCH	W1781)	FAIN Drilling & F	UMP CO, INC.
70 7Bandy CHAPOSITION OF APPLI	CATION (SAN Diego)	BUSINESS ADDRESS	0111. Ard-0
COC 9202 SFOR HEALTH OFFICERS U	SE OWLY)	12029 OLD CASTLE	KG- VAILEY CENTER
APPROVED	DENIED	LICENSE NUMBER	
4000000 1171 0010171010		00000	Deposit
APPROVED WITH CONDITIONS		Bond	Posted 🔀
Report Reason(s) for Denial or Nece	ssary Conditions Her	1 6235 Franks 1	1+04-93
1. Well is for	agricultural	The part on C	10110
use only.	V		
use ong.		to the second variable.	
		. I hereby agree to comply wit	
Ma city against we	AN THE WAR	Department of Health Servi nances and laws of the Cou	
and the same of the same			
tiolor protestion r	equiremente.	ately upon completion of w Department of Health Service	
		accurate log of the well.	22 (27 (27 (27) 27) 27 (27) 27 (27)
- 1			
Sittinks.		al Park	X
HEALTH OFFICER		APPLICANT'S S	IGNATURE
1_11-93			
1-7-10		12-24-	12
DATE		DATE	

> R-IW 5-34

WELL PERMIT APPLICATION CONTROL # W62322

Assessor's Parcel No. 760-170-18

LOCATION



age	of Well No.					Ruffin Per WELI	Refer to In		~		r L		STATE	WELL N	1	TION NO.
ate Wor	k Began	-1/0/	09			Ended	/22/93	_			- 1	LATITUDE	1 6	Li	L	ONGITUDE
Pern	nit No	Webs	Co	unt	y t	lealth Der	t Date	1/4/9				200	1		S/OTH	8
ODJENITAT	10 1 / / L	W623	GE	OLO	GIC	LOG	war i	ADE DE LA	The ir		in this gr		a has l	been b		ed from public
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				* N		Arrite A			37					all the	11	Under "GEOLOGIC LOG ANNED USE(S)
155	190	gravel and boulders - overall								MONITORING WATER SUPPLY						
***													100		1	Domestic
190	198	Hard Rock, granite							F				1			X Irrigation
	1	102				0			-		· · · · · · · · · · · · · · ·	12.37 3.			73	Industrial "TEST WELL"
	1	as the fresh of							Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc. PLEASE BE ACCURATE & COMPLETE.							
			U	. 25	_	101			DRILLI	NG -	75 -O-0		_	ELLUD	Cel	
1.90									METHOD ROTATY FLUID Gel WATER LEVEL & YIELD OF COMPLETED WELL — DEPTH OF STATIC							
:		15							WATER	ATED VIELD		_ (Ft.) & D				
		BORING _		198						LENGTH _6						
TOTAL D	EPTH OF	COMPLET	ED	WELL	=	195 (Feet)			* May	not be repres	emative of	a well's lor	ig-term	yield.		
	PTH	BORE-	T	YPE (71		CASING(S)					EPTH SURFACE	ANNULAR MATERIAL			
Ft. 1	o Fi.	HOLE DIA. (inches)	BLANK	_	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WAL THICKNES	L	SLOT SIZE IF ANY (Inches)	Ff.	to Ft.	CE- MENT (上)	BEN- TONITE (ど)	d.E.o.	FILTER PACK (TYPE/SIZE)
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17		c Log enstruction Di sical Log(s)	agrar	n		11 (100)	ersigned, ce						the be	st of m	y Knov	vledge and belief.
		ater Chemica	I Ana	lyses		ADDRESS	1		la c	astle Ro	d. Val	ley Ce	nter	_Ca	STATE	1082 ZIP

	mpleted Well Construction
Date _	3-16-93
Date In	spected 3-16-93
Comme	ints ag well /
evio	lence of annular Seal
alse	ryred
Water S	Sample Taken? NO
Roview	ed By M. Sedahi

DEPT OF HEALTH SERVICES!



COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH WELL PERMIT APPLICATION

DEH USE ONLY PERMIT # W 63475	
WELL COMPUTER # 114/97	333
WATER DIST:	7

	Property Owner: CHONGS FLOWERS	110-734-5
16		Phone: /// // // OC
1	5850 YSABET CREEK Ad- ESCON O	ido 92025
2.	Well Location - Assessors Parcel Number: 760-170-58	Lip.
	15850 VSABEL CREDE Rd ESC	92025
	10 /25	ma. Fara DRILLERS
3.	Well Contractor - Well Driller OF MIN Company Na	4 172 97c92
	Mailing Address	ity Zip
	Phone #: 160-149-0701 C-57 #: 328287 Cash Depos	it: Bond Posted: 🗆
4.	Use: Private □ Public □ Industrial □ Cathodic □ Othe	r
5.	Type of Work: Reconstruction Destruction Time Ex	tension: 1st: 🗅 2nd: 🗅
6.	Type of Equipment:	
7.	Depth of Well: Proposed: 150 Existing:	0
8.	Proposed: Casing Conductor Casing Filter/Filler Material	Perforations
	Type: Puc Yes No Yes No	10 1 15A
	Depth: 150' Depth: 20 ft. From: 20 To: 150	From: 10 To: 130
	Diameter: 12" in. Diameter 24 in. Type: Per Gravec	_ From: To:
	Wall/Gauge: 250 Wall/Gauge: 250	From: To:
9.	Annular Seal: Depth 20 Ft. Sealing Material: CACRETE	a francisco de la companya della companya della companya de la companya della com
	Borehole Diameter: 32 In. Conductor Diameter: In.	Annular Thickness: In.
10.	Date of Work: Start: NOU-ZY-97 Comple	nte: 100 Dec - 3-97
	On sites served by public water, contact the local water agency for meter pr	otection requirements.
	I hereby agree to comply with all regulations of the Department of Environmental Healt of the County of San Diego and the State of California pertaining to well construction, I immediately upon completion of work, I will furnish the Department of Environmental Healt the County of t	epair, modification and destruction. ealth with a complete and accurate
	log of the well. I accept responsibility for all work done as part of this permit and all wo supervision.	
Contra	actor's Signature:	Date: 100-14-9
	P	
	DISPOSITION OF APPLICATION (Department of Environmental Health	: Usa only)
v.		r was oray)
A Ap	proved Denied Special Conditions:	
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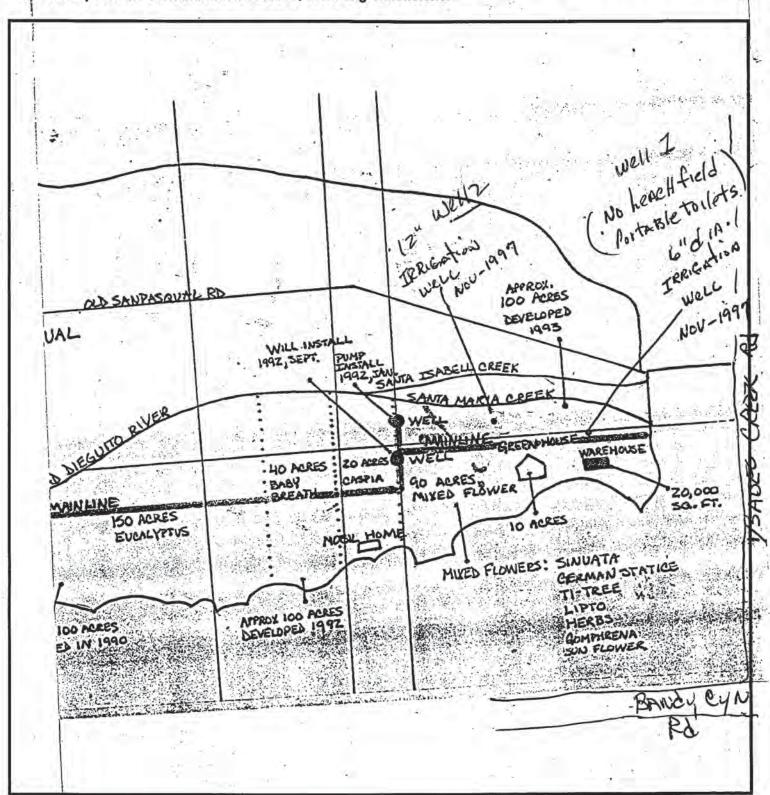
COUNTY OF SAN DIEGO

DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: <u>W63475</u>
Assessor's Parcel Number: <u>760-170-58</u>

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



or Loc	JPLICAT al Requi	E remen	ls :			STATE	OF CALIFO	Copy to F DRNIA DN REPOI		DWRUS	E ONL	Y - 1	1	T FILL IN
age L			7				nstruction .				STATE	VELL NO	D./STAT	ION NO.
Owner's Well No. 2-97 No. 44 Date Work Began 12-12-97, Ended 12-18-97								5735	4 ×	LATITUDE	للل	Ш		NGITUDE
										1 1	1 (1	136/	1 1	1 1 1
Perm	nit No. 🗱	63475	16D	OL	Env. Hea	rmit Date1	1-14-9	7				PN/TRS	OTHER	3
- / \	15 10 01			OLOG	ic roc —			100		WELL O			blook	ad from pub
DEPTH	ACE		н то	FIRST V	WATER 20 DESCRIPTI	9	M 1000	The information viewing pursue Information P	ant to sec ractice Act	tion 13752 of 1977,	of the	e Wate ect pe	er Coo	de and the
0 1	to Ft. Describe material, grain size, color, etc.							Address Same		WELL LO	CATIO	3N —		
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				00	niplete	d		DEPTH OF STAT		_ (Ft.) & D	ATE ME	ASURE	0_1	2-18-97
		20		-	poos			ESTIMATED YIEL		(GPM) &	TEST T	YPE E	iiri:	lft
OTAL D	EPTH OF	RORING	10	65	(Feet)			TEST LENGTH		TOTAL DRA			_ (Ft.)
OTAL D	EPTH OF (COMPLET	ED V	WELL .	165 (Fe	et)	-	* May not be rep	resentative o	a well's lon	ig-term	yield.		
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	ATTACE	MENTS	3 (2	7				- CERTIFIC						
	_ Geologic		, -		I, the u	indersigned, ce	ertify that th	nis report is com	plete and a	ccurate to	the bes	t of my	know	ledge and be
	_ Well Con	1	agram	1	NAME .	Fain Dri	lling	& Pump Co	Inc.					
		cal Log(s)				12029 01	d Cast	(TYPED OR PRINTED)	llev ce	nter. C	a g	208	2	W
	_ Geophysi									merchant.				
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		er Chemica	I Anal	yses	ĀDŪRESS	Out	R	Then		12419-	-97		328	287 ZIP

COUNTY OF SAN DIEGO DEPARTMENT OF PUBLIC HEALTH

Page 1 of 2 pages

# 10606	WELL PERMIT	APPLICATION SAN DIEGO, CA. 92101	Permit No. W.3002
TYPE OF WORK (Check) New Well Repair or Modification Time Extension Destruction	USE (Control of the control of the c	heck) Commercial Community Other	EQUIPMENT (Check) Rotary Cable Tool Other
PROPOSED WELL DEPTH	1.04.00	PROPOSED CASING	
Max. 400 Min. 100 (Feet) PROPOSED SEALING ZO From ZERO to FI From to From to PROPOSED PERFORATIONS From to From to From to From to From to From To From To From To DISPOSITION OF APPLICATION OF APPLICATION OF MEALTH OFFICERS U	ONE(S) Feet Connewilly Feet Connewilly Feet Feet OR SCREEN Feet Feet Feet Feet Feet ACLIEY RD.	SEALING M Neat Cement Cement Grout DATE Start Completion NAME OF WELL DRILLE JOHN KRATZ COMPANY MULTI WATER S	R S VSTEMS
☐ APPROVED APPROVED WITH COND	☐ DENIED	LICENSE NUMBER 355283 -A	Cash Deposit Bond Posted □
Report Reason(s) for Denial or Necessar	y Conditions Here:	6000 \$25 Fee paid on	
SEE COMMENTS ON PAGE 2 BOLOVI HEALTH OFFICER 30 MANCH	ST	tions of the D Health and with of the County State of Californ struction, repair, tion. Immediately	to comply with all regula- lepartment of the Public hall ordinances and laws of San Diego and of the hia pertaining to well conmodification and destruction of work the Department of Public complete and accurate log
o into		9 30	-07

DEPARTMENT OF PUBLIC HEALTH 1600 PACIFIC HIGHWAY SAN DIEGO' CALIF. 92101

WELL PERMIT APPLICATION

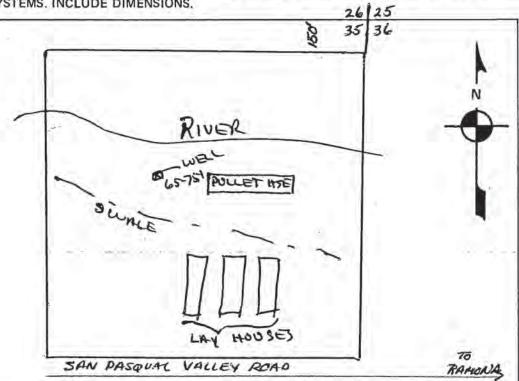
Page 2 of 2 pages

Permit No. W30021

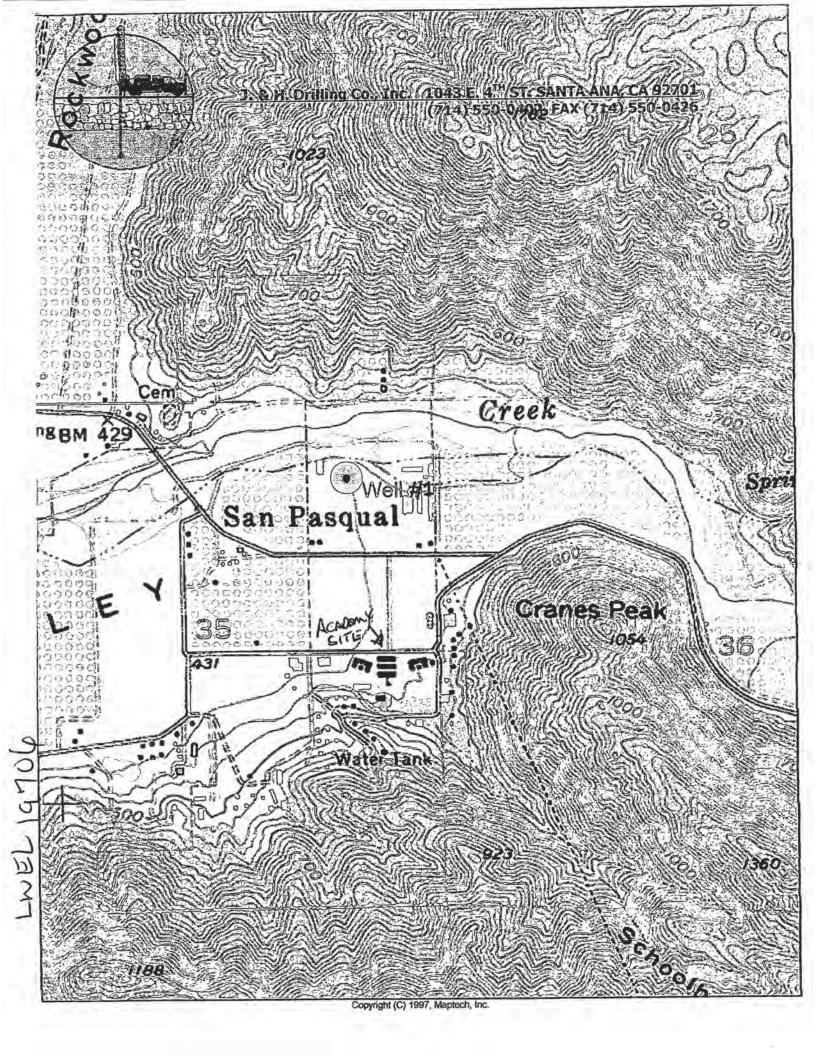
Assessor's Parcel No. 342-131-06

LOCATION

INDICATE BELOW THE EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS. INCLUDE DIMENSIONS.



- 1. Well to be constructed to community well standards with required fifty feet of casing and annular seal. If impervious strata is encountered within five feet of required annular seal depth, then casing and seal to be extended five feet into impervious strata.
- 2. Well to be minimum of 100 feet from all sources of pollution and contamination i.e. sewage plant effluent disposal, animal enclosures and manure. A BERM must be provided so as to prevent contamination from being within 100 feet of well.
- 3. The existing pullet house to be re-located within 18 months so as to be 100 feet from well.
- 4. Provide impervious seal for ground used for manure storage so as to prevent percolation into soil.
- 5. Provide water devices for chicken lay houses that will not discharge waste water to ground in area of manure storage. Water device conversion to be completed within one year.



FIRST CARBON COPY send to County Health Dept. Room 104

COUNTY OF SAN DIEGO DEPARTMENT OF HEALTH SERVICES 1700 PACIFIC HIGHWAY, SAN DIEGO, CA 92101

242	131	06
-74	1)1	00

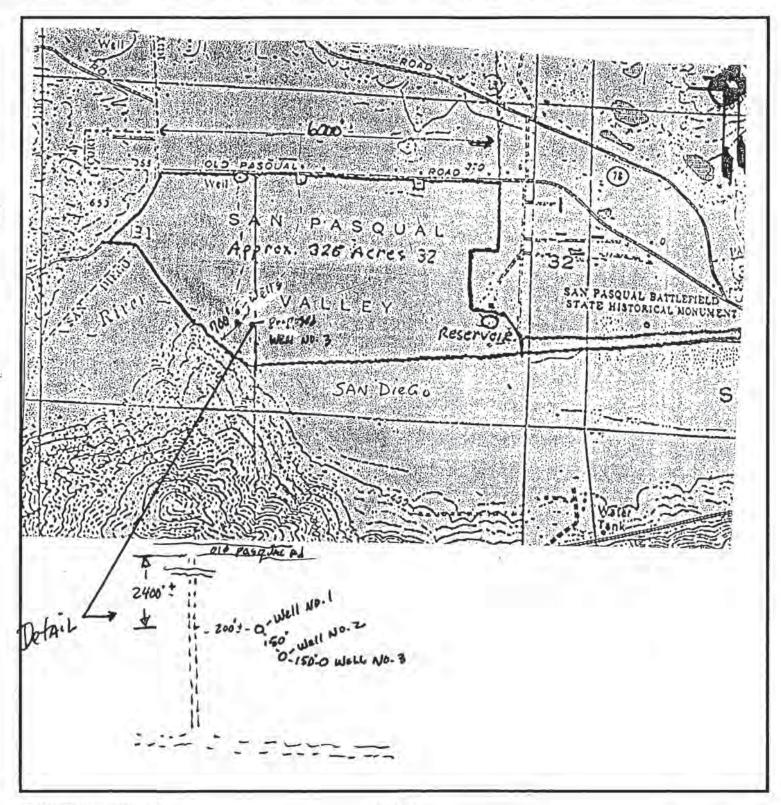
Notice of Intent No. 194101 Local Permit No. or Date 1930021	- (INS		ER WELL DRIL				te Well No		_
The information in this grayed a viewing pursuant to section 137 Information Practice Act of 1977	52 of the \	een blocke Nater Cod	d from public e and the		L LOG: To	otal depthft	Both of cor	mpleted well	183
Information Fractice Act of 1977	, to protec	ot personal	illioilliation.	Q	to ft.F	overbur			
Ver-ceet and realized a level				- 0		to fine			021699
(2) LOCATION OF WELL (See ins				15	40	conglome			nd-brn.
County	Owner's	Well Number		40	65	same	-Luoc ny	22110 00	314 0211.
Well address if different from above TownshipRange	1	Caratan	35	65	90		omerate	e to fin	ne sand
Distance from cities, roads, railroads, fer	at 97	Section	500 feet	0,		9 89'	OFFICE	2 00 2.11	ic cana
south of sec. 35/3	16 R 40			90	115	small la	wer of	ine gan	id-mey
property line	0 15 70	U ICCO	WOSE OF	115	740	fine ("			700
	ee 404	E-2		140	165		conf. ro:	serute 3	/ 1000
	***		OF WORK.	165	100	barder :	1	1001 /20	
FOR HEALTH DEPARTMENT, USE	53 360		OF WORK:	703		to very		102 / 10	C. Z Wast
Completed Well Construction:		Reconstruc				to tery		10:2	Jr 156
Date		Reconditio					14100	/ , , , ,	AP JUNE
1		Horizontal						7 24	115° 00
Date Inspected			(Describe		."	Y DELL	1	1	LENGE
Comments			materials and		10	Tool		1-41	15 CF , 11
0 4	20-4	procedures	in Item (2)			1		1 1/	w
R		(4) PROPO	OSED USE:		non	willia	4	. GAX	- 1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1
Water Sample Taken?		Domestic		1.6				1 1/1	
Sanitarian's Approval:	~	Irrigation				1113		1 1//	
0110		Industrial				(3 8)		VIII.	
L'Est of comming	sital	Test Well				1113 21		1 197%	
MOLOCIN STENDINGON	0	Stock				1112 6		VIIIA	
Mister Maraile		Municipal		1		1 1		Back -VIIIs	
		Other Co	ommunity.			ally a		1000 MV	10'
(5) Equipment:	(6) Gravel		5/16x4			1 1		3353	
Rotary 🗀 Reverse 🗆	Yes 🗗 N	o D Size	5/ 10%4			1 /		Caraci	
Cable Air	Diameter of	above 22	100					17,	
Other Bucket	Packed from	nto	18,3			191		13 ;	
(7) Casing Installed:	(8) Perfora	tions:		-		13	Mary Traffic	15	
Steel DX Plastic Concrete C	Type of per	foration or si	ze of screen			1 5	1111	151	
E Die Contes	Evans	To	Slot			18		11110-	
From To Dia. Gage or ft. ft. in. Wall	From ft.	To ft.	Size			1 2 1			
0 60 24 .250	blank					1 8			
	21					1	100		
0 103 14 .250	00	16	3 2213/3	5		1 1		1 8 1	
(9) WELL SEAL:			60		and the same	1 }	1 1 1	1	== 1==
Was surface sanitary seal provided? Yes I	□ 1/00 □ If	yes, to depth	ft.	1.00	STEEL	· · · · · ·	757	1 /	2011
Were strata sealed against pollution?			ft.			7 34	4		GUI
Method of sealing	. 0			Work starte	edbe	19	Completed	2/57	19
					73	STATEMENT!	110		
(10) WATER LEVELS:				Section 1997	1 1011	119% 6	- f		-1-10
Depth of first water, if known See	pelow		ft.	This well w	as drilled un	der my jurisdiction	on and this rep	ort is true to th	ne best of my
Standing level after well completion			drillern.	SIGNED	1	lti ater	Lougton		
(11) WELL TESTS:			a h	SIGNED	- "	(Well	Driller)		
, (MAN), (A. P.C.), (MAN) (100 MON), (100 MO	If yes, by			NAME	रर			10.14\r10.40	
	ailer 🗆	Air lift		252-01	(Perso	e. firm. Cacerpo	ation) (Typed	or printed)	025
Depth to water at start of test		At end of te		Address	35	5283		7/23/	Mark Will
Discharge gal/min after		Water tempe	rature	City		-	es af abis	Zip	
Chemical analysis made? Yes □ No			Amilian ma	thor 3			te of this repo	rt	4 3*
Was electricing made? 10Yes 10 No			mino report	1 v · w · · · · · · · · · · · · · · · · ·	4. cy . V		ereta a		7.0

DEPARTMENT OF ENVIRONMENTAL HEALTH WELL PERMIT APPLICATION OWNER- City of SAN Dieg County of San Diego NATER DIST: Property Owner: AM- Sod Mailing Address 24/-100-31	901
2. Well Location - Assessors Parcel Number 241 - 100 - 31	97-887
2. Well Location - Assessors Parcel Number 241 - 100 - 31	97-887 2027
2. Well Location - Assessors Parcel Number 241 - 100 - 31	2027
2. Well Location - Assessors Parcel Number 24/-100-31	2027
15023 OLD SAN PASQUAL PH SAN DIEgo	
3. Well Contractor - Well Driller Company Name: Ain	Dp. 11.
12029 OLD CASTLE RD 1/AUGY CENTER	92062
Mailing Address City	Zip
Phone#: 760-749-070/ C-57#:328287 🗆 Cash Deposit 🕱	Bond Posted
4. Use: APrivate ☐ Public ☐ Industrial ☐ Cathodic ☐ Other AG-Well	•
5. Type of Work: ☐ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1	lst 🗆 2nd
6. Type of Equipment: Rofally	
7. Depth of Well: Proposed: /30' Existing:	0
8. Proposed:	
Casing Conductor Casing Filter/Filler Material Perfo	orations
Type: XYes □ No X Yes □ No	
	To: /30
Diameter 16 in. Diameter 24 in. Type: 5/16 X 16 From: Wall/Gauge: .6/16 Wall/Gauge: _ 250 Wall/Gauge: _ N/A From:	
9. Annular Seal: Depth: 20 ft. Sealing Material: CEMENT	- 4
Borehole diameter: 32 in Conductor diameter: 24 in Annular Thickness	
10. Date of Work: Start: SEPT. 2004 Complete: SEPT.	2004
On sites served by public water, contact the local water agency for meter protection require	ments
I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinance	
the County of San Diego and the State of California pertaining to well construction, repair, modification and de Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete a	
of the well. I accept responsibility for all work done as part of this permit and all work will be performed under	
supervision.	
Contractor's Signature: Au R. Qui Date: Aug- 3	31- 200
3 3000 777	1000
DISPOSITION OF APPLICATION (Department of Environmental Health Lies or	
DISPOSITION OF APPLICATION (Department of Environmental Health Use or	ıly)
Approved Denied Special Conditions: Grading and clearing associated with access	to, or the
construction, maintenance or destruction of water wells, may require additional permits from the	
San Diego and/or other agencies.	W. Marie A.
Specialist: 1/ Section Date: 9/1/0	4
DEH-LU-731a (Rev. 4/02) NCR Page 1 of 2	-

Control #: LWGL 16208
Assessor's Parcel Number: 241-160-31

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



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Date Inc	pected	-/	10	2.5				-		Ridge			1,4		VAI	POR EXTRACTION SPARGING
Comme	nts_						1 1	97		Illustrate or Descrip	be Distance of V	Vell from Roy	erle Builr	linas		REMEDIATION
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	ince	aur	5	-		\dashv				DEPTH TO FIRST	WATER	N (Ft.) B	ELOW S	URFACE		
Vater S	imple Ta	icon?	1	V		1				WATER LEVEL_	c 36	(FL) & DAT	E MEASI	IRED _	10/	16/04
2.70			-	136						ESTIMATED YIELD						
TOTAL	EPTH OF	BORING	_		-	Feet)	(Feet)			* May not be re					(FL)	
tome o	-	I .	I		_					tras nos ac rep	TI TI	a activity por	1		ann de	0.6. 2.2.0.0.0.7
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		DIA. (Inches)	ž	N N	PUCTOR FILL PIPE	M	GRADE	INTERNAL	GAUGE OR WAL				CE-	BEN-		FILTER PACK
Ft t	n Ft.	(manasy)		SCR	S 1		CINDE.	(Inches)	THICKNES		Ft.	to FL	0.00	(=)	for home of	(TYPE/SIZE)
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78	138	24	X	X	+	-	F480 F480	15	.661	.125	20	136	-			11.8 : 25
	130	2.4	H	+	+	1	1400		1002	- 1123						
	ATTAC	HMENTE		1	1	2				CERTIFIC	CATION STA	TEMPSET	1			
		HMENTS	(=)	1			f, the und			nis report is compl	ete and accu	rate to the	best of	my kr	owled	ge and belief.
	Geologic Well Cor	s Log Instruction Di	iagran	n		- 11	NAME			& Pump Co	. Inc.	Vend 1				
-		sical Log(s)	Ü				(PE)	12029 C	CORPORATION)	(TYPED OR PRINTED)	lley Ce	nter.	Ca 9	2082		
10-	Soil/Wat	er Chemical					ADDRESS	-7	7						-	328/ZP
	▲ Other _ ADDITIONAL				YICT	_	Signed	115		ain						
ATTACH A		INFORKA III	JAN, IF			TIONA	C-5	UCENSED WAT		RACTOR T. CONSECUTIVE	V APPARE		HE SIGNE		- (C-57 LICENSE NUMBER



COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT #W 19769
WELL COMPUTER #
FEE:
WATER DIST:

1.	Property Owner: City of San Diego, Contact: Surraya R	asnid, P.E., Proj. Mgr Phone:	(619) 533-5306
	600 B Street, Suite 700, MS 906	San Diego, CA	92101
	Mailing Address 98	City	Zip
2.	Well Location - Assessors Parcel Number 272-131-94 (Well #4B)	
	Approx 280' North of 14103 Highland Valley Rd.	Escondido, CA	92025
	13102 HIGHLAND WALLEY	City	Zio
3.	Well Contractor - Well Driller Boart Longyear	Company Name: _E	
	12464 McCann Drive	Santa Fe Springs, CA	90670 Zip
	Phone#: (562) \$06-1960	C-57#; 694686 ☐ Cash Deposi Source wa	Bond Posted
4.	Use: Ma Private D Public D Industrial	☐ Cathodic ☐ Other RO demon	
5.	Type of Work: ☑ New □ Reconstruction	그는 마일이라면 되었습니다. 나를 걸린 하나 이 얼마에 살	☐ 1st ☐ 2nd
5.	Type of Equipment: Rotosonic Rig - Vertical Well		
7.	Depth of Well: Proposed: 75 feet BGL	Existi	ng:
В.			
	Casing Conductor Casing	Filter/Filler Material	Perforations
	Type: Steel	X Yes □ No	Citoraliona
	Depth: 0 to 30 Depth:ft.		30 To: 75
	Diameter 8.625 in. Diameter in.	Type: From:	To:
	Wall/Gauge: 0.188 in Wall/Gauge:	Wall/Gauge: From:	To:
	Annular Seal: Depth: 20 ft. Sealing Materia Borehole diameter: 12.625 in. Conductor diameter: Anticipated July 11, 2008	neter:in. Annular Thic	ckness 2 in.
(On sites served by public water, contact the local of the legal of the legal of the legal of the County of San Diego and the State of California pertaining Immediately upon completion of work, I will furnish the Department of the well. I accept responsibility for all work done as part of supervision. Intractor's Signature: ON A DEN AT 160 471-073 NNU AN SEATSO THAT WE MAY	ent of Environmental Health, and with all o ing to well construction, repair, modification ortment of Environmental Health with a con f this permit and all work will be performed	rdinances and laws of and destruction. Inplete and accurate log under my direct
_	DISPOSITION OF APPLICATION (Depart		19 (
	Approved Denied Special Conditions: Gradi	ing and clearing associated with ac	ccess to, or the
/	onstruction, maintenance or destruction of water wells,	, may require additional permits fro	m the County of
C	N. (1985) 1일 : 영화 10시 - 이 아이라는 전에 가장하는 사람이 되었다. 10시	, may require additional permits fro	m the County of

PAGE 03/06

07/03/2007 11:05 8586943105

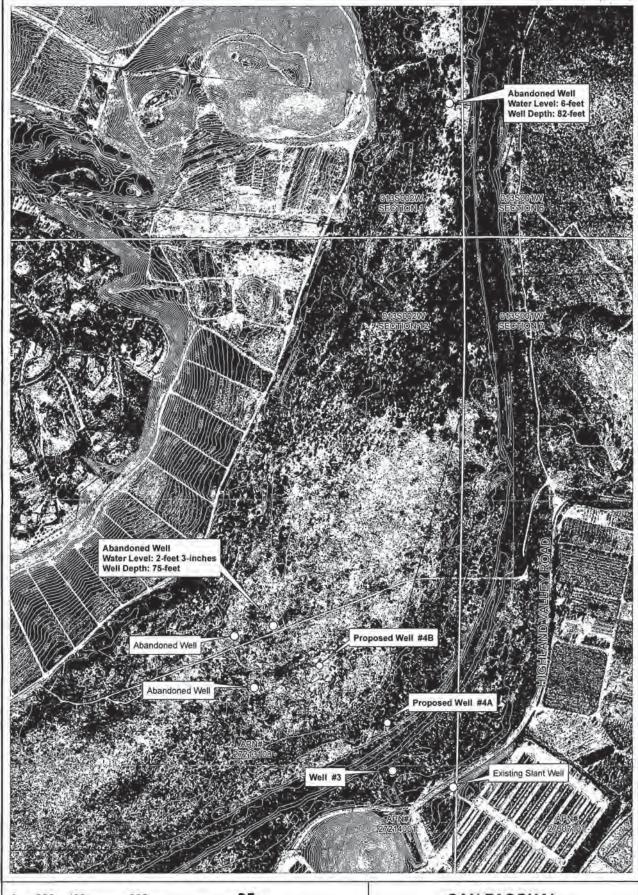
COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH Control #: LUEL 19769
Assessor's Parcel Number: 272-131-08

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

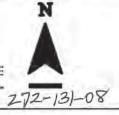
SEE ATTACHED FOR PROPOSED WELL #4B

LWEL 19769



0 200 400 800 Feet

Gî2



SAN PASQUAL BRACKISH GROUNDWATER DESALINATION DEMONSTRATION

ALTERNATIVE WATER SUPPLY ANALYSIS TECHNICAL MEMORANDUM FIGURE-1

80-151-202 6-0 SAN PASQUAL BRACKISH WATER TDDF PROJECT OFF-SITE VERTICAL WELL CONSTRUCTION SAMPLE PORT. SADDLE & BALL VALVE MATES 00000 ASSESSATE ENGINEER AUSTRAL BADA A TANSALTTER
A TANSALTTER
A TANSALTTER
A TO D. I. SPOOL

TVC FLG X SOC

TVC FLG X SOC 4" WAFER BUTTERFLY VALVE 6966173007 " 90" D.1. ELBOW DISCHARGE TO SPWRF SITE SEE FIGURE 4-6 CITY OF SAN DIEGO, CAUFORNIA SPEET OF XX SPEETS 4" PVC SCH. 80 THK. CONC. PAD HORIZ. SUPER-FLO LOUVERED SCREEN DETAIL FLOW METER Manager (Appendix Appendix App MECHANICAL PLAN SECTION (A) 00000000000 000000000000 EX 4" D. L. SPOOL SECTION A-A CHECK VALVE T" ARV-SUPPORT 3° COLUMN PIPE CONNECTED TO THD. COUPLING ON DISCH. HEAD 0 0,1, FLG DISCH, ELBOW W/3, FLG, 1 CONDUIT & 1 VENT CONNECTTOR CASING W. TOP FLO ELEC. J-BOX SADDLE & 1" BALL VALVE 3" X 4" D.1. RED. WATER DEPARTMENT -LEVEL TRANSDUCER FG. 326± TOP CASING EL. 3304 (ABOVE TOO YR. WELL EQUIPPING DETAIL 1153) (0-,89 ONILIES AND STATIC WATER 2 NAX. PUMPING V 3" DIA. THD. COLUMN PIPE WITH THD. COUPLING 5UBMERS 18LE PUMP 150 GPM @ 225, TOH-48DV. 3PH. 60HZ. 15HP B 1 8 CEMENT SANITARY SEAL CRAVEL/FILTER PACK 20° - 75° BGS. SIZE TO BE DETERMINED FROM INITIAL BORING WITH COMPACTED FILTER PACK MATERIAL 0 - 21 BGS CASING SPECIAL STREET, CANADA SERVICE STREET, SPECIAL STREET, SPECIAL STREET, SPECIAL 1234" BOREHOLE 0 - 75' BGS WELL CONSTRUCTION DETAIL END PLATE **8** ROSCDE MOSS 81/4 1.D. (E. 8%, 0.D. X 0.188 WALL) COPPER BEARING STEEL SUPER-FLDW LOUVERED SCREEN 21 75 86S. DRAWING STATUS

July10, 2008

Bob Geiseck County of San Diego Department of Environmental Health Land and Water Quality Division P.O. Box 129261 San Diego, CA 92112-9261

Dear Mr. Geiseck:

Subject: Property Owner Consent (POC)

The City of San Diego, owner of the property 14103 Highland Valley Road, San Diego, CA 92102, APN# 272-131-08, grants permission to Geoscience Support Services, Inc. (consulting company, contractor) and Boart Longyear, drilling company to enter Cityowned property to conduct drilling and install a 70' to 75' deep vertical well on or near the area indicated on the attached Drawing C-2, "Offsite Well Site Plan".

I understand that Dennis E. Williams registered professional of Geoscience Support Services, Inc. consulting company and an authorized signer for Boart Longyear, drilling company have submitted a signed application to the County of San Diego, Department of Environmental Health, in which they have agreed to complete the above-stated work according to the applicable ordinances and laws of the County of San Diego and the State of California pertaining to water well construction and destruction. I have arranged with Surraya Rashid, City of San Diego, project manager overseeing the wells/borings installed on this property, to ensure proper destruction of the well should it become no longer usable or is abandoned at the conclusion of our demonstration project.

Sincerely,

Marsi A. Steirer

Enclosure: Drawing, C-2, Offsite Well Site Plan



Page 2 Mr. Bob Geiseck June 16, 2008

bcc: Robert McCullough, Principal Water Resources Specialist, Water Resources & Planning Division

Surraya Rashid, Associate Civil Engineer, Water Resources & Planning Division Larry Aburtin, Assistant Engineer, Water Resources & Planning Division

Joel E. Bowdan III, Associate-Project Manager, RBF Consulting

Rec'd in SM on 10/29/08.

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form. File Original with DWR State of California DWR Use Only - Do Not Fill In Well Completion Report Page 1 of 1 Refer to Instruction Pemphiet Owner's Well Number BH-4B No. e0081241 N Date Work Began 07/11/2008 Date Work Ended 8/26/2008 Latitude Longitude Local Permit Agency County of San Diego Department of Environmental Health Permit Number LWEL 19769 Permit Date 7/16/08 Geologic Log Well Owner The information in this grayed area has been blocked from public Orientation O Vertical O Horizontal OAngle **Drilling Method Sonic** viewing pursuant to section 13752 of the Water Code and the **Drilling Fluid** Depth from Surface Description Information Practice Act of 1977, to protect personal information. Describe material, grain size, color, etc... 42 Ò Sand, fine, med., coarse Well Location 44 42 Silty sand Address 1,060' NW of entrance of 14103 Highland Valley Rd 49 44 Sand City Escondido County San Diego 49 55 Interbedded layers of sand and gravel Latitude 33 3362 N Longitude 117 02 069 ON 55 59 Sand Decimal Lat. 33.05889 Decimal Long. 117.03500 Datum NAD83 59 61 Gravel w/ sand Page 131 Parcel 08 APN Book 272 82 61 Sand w/ occasional gravel 2 W Township 13 S Section 12.J 82 84 Silty sand w/ gravel Activity 84 85 Cobbles Location Sketch (Sketch must be drawn by hand after form is printed.) O New Well 88 85 Sand w/ cobbles North O Modification/Repair 88 89 Clayey sand w/ cobbles O Deepen 89 90 Weak cemented rock O Other O Destroy 90 92 Silty sand Describe procedures and materials under "GEOLOGIC LOG" 92 95 Bedrock - granodiorite BH-4B Planned Uses Water Supply Domestic Public 1 ☐ Irrigation ☐ Industrial O Cathodic Protection O Dewatering O Heat Exchange O Injection O Monitorino O Remediation San Pasana O Sparging Vater Reclamat O Test Well O Vapor Extraction itustrate or describe distance of well from roads, buildings, far twers, etc. and attach a map. Use additional paper il necessa. Plesse be accurate and complete. O Other Water Level and Yield of Completed Well Depth to first water 8 (Feet below surface) Depth to Static (Feet) Date Measured 08/25/2008 Water Level 8 95 Estimated Yield * 150 Total Depth of Boring (GPM) Test Type Constant Rate Test Length 24.0 Total Depth of Completed Well 84 (Hours) Total Drawdown 31 "May not be representative of a well's long term yield. Casings Annular Material Depth from Borehole Wall Outside Depth from Slot Size Screen Material Diameter (Inches) Thickness Diameter Fill Description if Any (inches) Surface Тупе Surface Feet to Feet (Inches) (Inches) 0 25 12.625 Blank Copper bearing steel 0.188 8 5/8 20 Cement neat cement 0 25 41 12.625 Screen "So Copper bearing steel 0.188 8 5/8 Louver 0.080 20 84 Filter Pack 4x16 custom blend 45 41 12.625 Blank P Copper bearing steel 0.188 8 5/8 84 95 Native fill 45 84 12.625 Screen Copper bearing steel | 0.188 8 5/8 Louver 0.080 Attachments Certification Statement , the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief Geologic Log Name Boart Longyear Corporation ☐ Well Construction Diagram Person, Firm or Comoration Geophysical Log(s) McCann Dr. 12464 Santa Fe Sennos Soil/Water Chemical Analyses 694686 ☐ Other Attach additional Information, if it exists Date Signed C-57 License Number

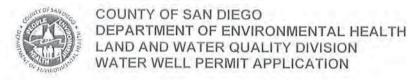
DEH2016-LWELL-001332



COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEACTH CO LAND AND WATER QUALITY DIVISION WATER WELL PERMIT APPLICATIONAR 28

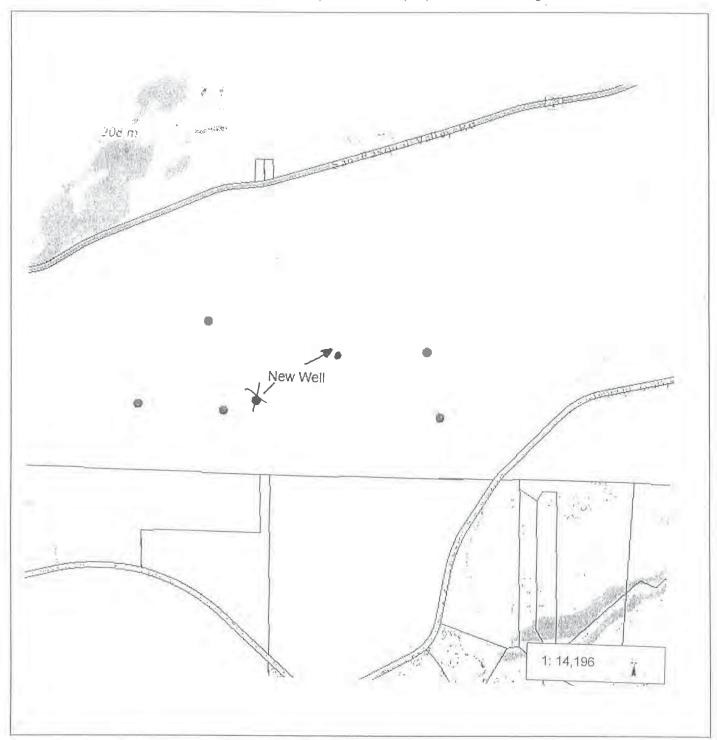
DE	H USE ONLY	T. C.
PERMIT #	٠.,	- 54
FEE: \$52	5.00	
WATER DIST:		

County of San Diego Dept. of Environmental Heal Land & Water Quality Div Property Owner: WHIMAN PAUL H Phone: W4H - 760-644-6887 1. Mailing Address: Po Rox City: ESCOUPIND State: C4 Zip: 92025 2. Well Location - Assessors Parcel Number: _____ 760-170-48 GPS Coordinates: (WGS-84 Decimal Degrees): 33050177N Site Address: O Hww 78 City: <u>CSCONDINO</u> State: CA. Zip: 92025 Well Contractor/Driller: _ DAVE WA 3. Company Name: JAN DAILING e 120. city: VALLEUCONER Mailing Address: 12029 State: CA C-57 License No: 328267 ☐ Cash Deposit Sond Posted Private Public Industrial Other: 5. Type of Work: New 🗆 Reconstruction 🗅 Destruction Time Extension: 1st 2nd Type of Equipment: Depth of Well: Proposed: Existing: 8: Proposed: Casing Conductor Casing Filter/Filler Material Perforations Type: 55/LCC ☑ Yes □ No Yes No From: (OOTo:) GO Depth: Depth: 20 From: 0 To: 160 Diameter: / 2 in. Diameter: 24 in. Type: RAVCHO From: _____To: Wall/Gauge: 375 Wall/Gauge: 750 Depth: 20 ft. 9. Annular Seal: Sealing Material: CPWPU Borehole Diameter: 32 in. Conductor Diameter: 24 in. Annular Thickness: 4 in. 10: Best Management Plan for confining, well drilling waste on the project site provided? ¥ Yes □ No 11. Date of Work: On sites served by public water, contact the local water agency for meter protection requirements. I hereby agree to comply with all regulations of the Department of Environmental Health, and will all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well (well driller's report). I accept responsibility for all-work done as part of this permit and all work will be performed under my direct supervision. Contractor's Signature: DISPØSITION OF APPLICATION (Department of Environmental Health Use Only) Approved Denied Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies. artrus Mua Specialist:



SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.







County of San Biego

STORMWATER & DISCHARGE MANAGEMENT PLAN FOR WATER WELLS

This form must be submitted with all Well Permit Applications

Department Use Only	
	Assessor's Parcel Number: 760 - 170 - 48
1	242-100-10
SECTION 1: Required Information from Contractor	or Consultant:
Longitude & Latitude: 1. Are there any watercourses or water bodies within 50 feet 2. Does the plat show the project boundaries? (A "detail inse 3. Does the plat show footprints of any existing structures an 4. Does the plat show locations where run-off may enter stor 5. Is grading required to access site or install well? 6. Does the project conform to the local grading ordinance? 7. Will drilling additives be used to drill the well? 8. Are the Best Management Practices attached to this perm SECTION 2. Best Management Practices	of the limits of soil disturbance? et is acceptable for a large parcel or lot.). ad facilities within 100 feet of the wellhead position? amdrains, drainage courses and/or receiving waters? The state of the limits of soil disturbance? The state of the wellhead position? The state of the wellhead position? The state of the wellhead position? The state of the limits of soil disturbance? The state of the limits of soil disturbance?
The goal of stomwater and discharge control management pollution to the maximum extent practicable using Best Materials, sediments, chemical residues such as drilling for property boundaries to eliminate transport from the site to nadjacent properties. It is the responsibility of the property be used in order to ensure that all contaminants are retained Examples of Best Management Practices to contain we installation of a sediment basin to contain run-off, using geo eliminating the use of drilling foam. (Website Information is a	Management Practices (BMPs). Construction related foam, wastes, and spills must be retained within the hearby streets; drainage courses, receiving waters and owner and the contractor to determine which BMPs will do not site. If installation run-off include, but are not limited to obtaxtile fabric to contain sediments and drilling must be contain.
SECTION 3. Certification I have read and understand the following: (Please check early Selected BMP's will be implemented so that water quality of I am aware the selected BMP's must be installed, mainly effective. I understand that non-compliance with the San Diego enforcement actions by the County. These may include DEH inspectors and personnel from other regulatory agriculture for purposes associated with this well permit until such Should DEH determine during the field review that the Management Plan or the well permit explication, the wascivity will require a new permit see and amondment to Contractor Property Owner Reviewed by DEH Reviewed by DEH	talled, monitored and revised as necessary so they are County Watershed Protection Ordinance may result in sitings, citations, stop-work orders, or other actions. gencies are authorized to enter my property at any time time the well is completed to the satisfaction of DEH. The well installation procedures contradict this Discharge in drilling permit may be suspended or revoked. Further

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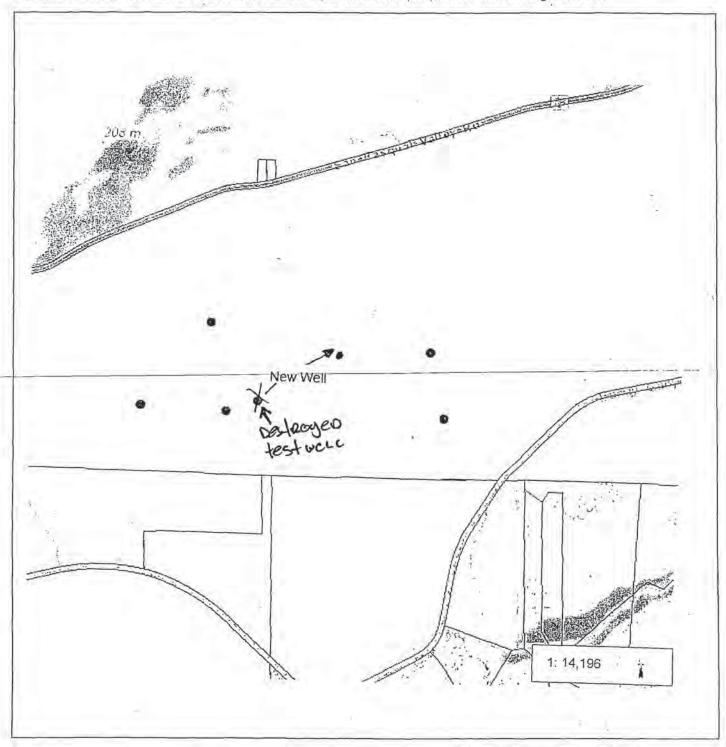
COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH LAND AND WATER QUALITY DIVISION WATER WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # _ LWELL - 601332

APN: _ 242 - 100 - (0)

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.



- 12183 APN 760 170 18

Control # W62041

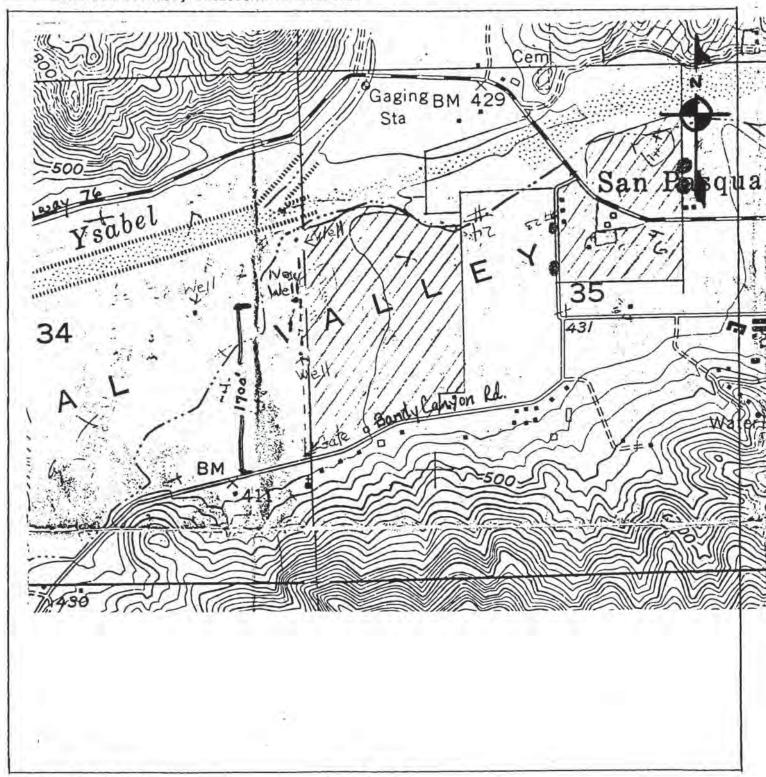
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Control # W6204/

Assessor's Parcel No. 760-170-18

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



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3.	Property Owner: WIFMAM RANCH (Leasee) PMPhone: 760-644-6887 Mailing Address: PO BOX 1959 City: escondido State: CA zip: 97025 Well Location - Assessors Parcel Number: 37.0914 James II.G. 9559 GPS Coordinates: (WGS-84 Decimal Degrees): 37.0914 James II.G. 9559 Site Address: Hwy 78 W/O BANDY CANYON City: escondido State: CA zip: 97025 Well Contractor/Driller: DAVE WA-Hrows Company Name: FAIN NELLUNG Mailing Address: 12029 OLOCAS-ILE RD City: VALLEYBUR State: CA zip: 97082 Phone: 760-749-0701 C-57 License No: 328287 Cash Deposit ** Bond Posted
3.	Property Owner: WIF WAM RANCH (LEASER) Property Owner: 760-644-6887 Mailing Address: PO BOX 1959 City: ESCONDIDO State: CA zip: 97025 Well Location - Assessors Parcel Number: 37.0914 760-170-43 02 -247-130-37 GPS Coordinates: (WGS-84 Decimal Degrees): 37.0914 78 66 BANDY CANYON City: ESCONDIDO State: CA zip: 97025 Well Contractor/Driller: DAVE WATHOWS Company Name: FAIN DRILLING Mailing Address: 12029 OLD CASTLE RD City: VALLEYBUS State: CA zip: 97087
3.	Well Location - Assessors Parcel Number: 3500 770-43 or 2472-130-27 GPS Coordinates: (WGS-84 Decimal Degrees): 37.0914 / 24455 116.9559 Site Address: Hwy 78 W/O BANDY CANYON City: escon0100 state: CA zip: 97025 Well Contractor/Driller: DAVE WATHOWS Company Name: FAIN DELLING Wailing Address: 12029 OLOCAS-ILE RD City: VALLEYBUSK State: CA zip: 97082
3.	GPS Coordinates: (WGS-84 Decimal Degrees): 37.0914 Site Address: Hwy 78 W/O BANDY CANYON City: escondido state: CA zip: 97025 Well Contractor/Driller: DAVE MANHOWS Company Name: FAIN DRILLING Mailing Address: 12029 OLD CAS-ILE RD City: VALLEYBUS State: CA zip: 97087
3.	Site Address: Hwy 78 W/O BANDY CANYON City: esconDLDO State: CA zip: 97025 Well Contractor/Driller: DAVE WATHAWS Company Name: FAIN DELLING Wailing Address: 12029 OLD CASTLE RD City: VALLEYBUSK State: CA zip: 97082
3.	Well Contractor/Driller: DAVE WATHOWS Company Name: FAIN INCLLING Wailing Address: 12029 OLD CASTLE RD City: VALLEYBUSE State: CA zip: 97082
	Mailing Address: 12029 OLD CASTLE RD City: VALLEYBURG State: CA Zip: 97082
	Phone: 760-749-0701 C-57 License No: 328287 Cash Deposit Bond Posted
4.	
	Use: Private Public Industrial Scother 12/2/Carticon (+est-weight)
5.	Type of Work: New □ Reconstruction □ Destruction □ Time Extension: □ 1 st □ 2 nd
6.	Type of Equipment: WOD ROTARY
7.	Depth of Well: Proposed:
8: F	Proposed: test well to be Destroyed or Finished upon Pesults Casing Conductor Casing Filter/Filler Material Perforations
	Type:
	Depth: To:
	Diameter: in. Diameter: in. Type: From: To:
	Wall/Gauge: Wall/Gauge:
). <i>I</i>	Annular Seal: Depth:ft. Sealing Material:
E	Borehole Diameter: in. Conductor Diameter: in. Annular Thickness: in.
10; E	Best Management Plan for confining well drilling waste on the project site provided?
11. 0	Date of Work: Start: 1/13/15 Complete: 1/23/15
hereby a of San Di completion report). I	served by public water, contact the local water agency for meter protection requirements. gree to comply with all regulations of the Department of Environmental Health, and will all ordinances and laws of the County lego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well (well driller's accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision. S Signature: Date:
T. A. Z. S.	ION OF APPLICATION (Department of Environmental Health Use Only)



COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH LAND AND WATER QUALITY DIVISION WATER WELL PERMIT APPLICATION

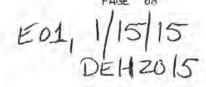
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	PERMIT		USE O	NLY L-060 8017

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.

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		exist *
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Reviewed or DEH





County of San Biego

STORMWATER & DISCHARGE MANAGEMENT PLAN FOR WATER WELLS

This form must be submitted with all H'all Permit Applications Department Use Only Well Permit Application Number: 00080 Assessor's Parcel Number SECTION 1. Required information from Contractor or Consultant: 33 0914 Longitude & Latitude How obtained? GPS Are there any watercourses or water bodies within 50 feet of the limits of soil disturbance? 2. Does the plat show the project boundaries? (A "detail inset" is acceptable for a large parcel or lot.). 3. Does the plat show footprints of any existing structures and facilities within 100 feet of the wellhead position? Does the plat show locations where run-off may only stormorains drainage courses and/or receiving waters? 5. Is grading required to socess elte or inetall well? 6. Does the project conform to the local grading ordinance? . Will onling additives be used to drill the well? Must be Bust Management Practices affected to this permit application? /pits SECTION 2. Best Management Practices The goal of storniwater and discharge control management planning while drilling and installing wells is to reduce pollution to the maximum extent practicable using Best Management Practices (BMPs). Construction related materia's sediments, chemical realouse such as drilling foam, wastes, and spills must be retained within the properly boundaries to eliminate transport from the site to nearby streets; crainage courses. Acceiving waters and actiscent properties. It is the responsibility of the property owner and the contractor to determine which BMPs will be used in order to ensure that all conteminants are retained on-site. Examples of Best Management Practices to contain well installation run-off include but are not limited to installation of a sediment basin to contain run-off, using geotextile lebric to contain sediments and driving mud. or eliminating the use of drilling foam (Website Information is available at www.projectcleanwater.crg. SECTION 3. Certification I have read and understand the following: (Please check each pcx after concurrence.) Selected BMP's will be implemented so that water quality is not negatively impacted by well construction activities am aware the salected BMP's must be installed, maintained, monitored and revised as necessary so they are effective i understand that non-compliance with the San Diego County Watershed Protection Ordinance may result in renforcement actions by the County. These may include fines, citations, etop-work orders, or other actions DEH inspectors and personnel from other regulatory agencies are authorized to enter my property at any time for purposes associated with this well permit until such time the well is completed to the satisfaction of DEH. Should DEH determine during the field review that the well installation procedures contradict this Discharge Management Plan of the well permit application, the well drilling permit may be suspended or revoked. Further activity will require a new permit type and enjegialment to the existing permit.

Date

Pagé Owner Date W Local F Permit	1 s Well Nu Jork Bega Permit Age Number <u>I</u>	of _ mber _C n _01/14 ency _SD _WELL-	1 One 1/2015 DEH -000807	Permit Date	Well Scene New 143 MEN 143 13115	ompleti er to Instruction o. e02550 2/2015	on Repo	ort		Sta Sta Latitude	ate Well Nu	Imber/S	
Orillin	rientation	O Ve	rtical O Ho	rizontal OAng Drillin Descriptio cribe material, grain s	jle Spec	ify	The inf	formation g pursuan	in this It to se	grayed ction 13	area ha 752 of tl	s bee he Wa	en blocked from publicater Code and the personal information
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190			Weathered R Granite OWNESS WING G	Jector	2		Townsh (Sketch		ion SI	ge (etch after form is	printed.)	00	New Well Modification/Repair O Deepen O Other Destroy Describe procedures and materials under "EGOLOGIC LOG"
		5	ale Symple	8 dicko 114			EXIII	WEI	South of well from	exist well	BHUDY CANYES	000000000	Planned Uses Water Supply Domestic ☐ Public Irrigation ☐ Industrial Cathodic Protection Dewatering Heat Exchange Injection Monitoring Remediation Sparging Test Well Vapor Extraction Other
Total	Depth of	Boring	190		Feet		Depth to Depth to Water L	Level and offist water o Static evel 72 ed Yield *	500 4	of Com	pléted V et) Date M) Test	Well (Fe Meas	eet below surface) sured Air Lift
Dep	Depth of other to Feet	topodes aut	ole Type	Casings (Wall	Outside s Diameter	*May no	Slot Size if Any (Inches)	Dep S	e of a we	ll's long te	erm yid lar Ma	vdown(Feet) eld. aterial Description
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מחחחמ	Geophy	Log nstructio sical Log er Chem site Mar	n Diagram I(s) Iical Analyses		Person. ev Center	Atteres	et his repor		te and a	atement accurate to	to the bes	A tate	92082 Zip

DEPARTMENT OF HEALTH SERVICES

WELL PERMIT

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WITHAN RANCH INC.

APN 760-170-18

Control 1 N 02917

			CONTROL # 10 45 11
TYPE OF WORK (Check)	(Charles	USE (Check)	EQUIPMENT (Check)
New Well	Individual Dome	estic	Rotary 🔀
Repair or Modification	Agricultural	Community	Cable Tool
Time Extension	Industrial	Other	Other
Destruction			
PROPOSED WELL DEPTH	A Linear	PROPOSED CASING	
Max. 160 Min. 150 (Feet)	Type STEEL	Depth 150 Diameter 12"	Wall or Gage 365
PROPOSED SEALING ZONE(S)	19	SEALING MATERIA	L (Check)
From 0 to 20	Feet	Neat Cement Grout	Bentonite Clay
Fromto	Feet	Sand Cement Grout	Concrete
From	Feet	Other-Specify:	2 1- 1- 1- 1- X-2
PROPOSED PERFORATIONS OR SCRE	EN		
From 100 to 160	Feet	DATE OF W	ORK
From to	Feet	Start 2-27-95	
From to		Completion $3-5-93$	
From to	Feet		
NAME OF WELL OWNER		NAME OF WELL DRILLER	
	,	Loe FAIN	
WITHAN RANCH, INC		COMPANY	
16789 SAN PAS QUAL VLY 1	P1-650		Person C. tun
1 6:01 HOU 1 43 YEAR VEG 1	0	FAIN DRICKING &	rump a the.
DISPOSITION OF APPLICATION (FOR HEALTH OFFICERS USE ON		12029 Old CAS	the RL- Valle CA
		LICENSE NUMBER	ne no mage
APPROVED	DENIED		h Deposit
APPROVED WITH CONDITIONS			d Posted
Report Reason(s) for Denial or Necessary	Conditions Here	: 40KW	1129TM
Well to be installed to all	State &	Fee paid on	0) (1)
			1
County water well standard	<u> </u>		
On sites served with public v	water,	I hereby agree to comply wi Department of Health Serv	
contact the local water agen	cy for	nances and laws of the Co	unty of San Diego and of
meter protection requirement		the State of California per tion, repair, modification	
- March historian sedan amen		ately upon completion of	work I will furnish the
		Department of Health Sory	ices with a complete and
			icos mini a compiere una
		accurate log of the well.	accountry and
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M. Sedgl		accurate log of the well.	Dan
M. Sedgl- HEALTH OFFICER 2-23-95			Daw SIGNATURE

WELL PERMIT APPLICATION

Control # WUZ917

Assessor's Parcel No. 760-170-18

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE NEWAGE DISPOSAL SYSTEMS AND OTENTIAL CONTRACTOR OF TARMS AND SOURCES, INCLUDING DIMENSIONS 27 28 SAN DIEGO DIEGO SAN PARK O WILD SAN PASQUAL 8 BATTLEFIELD STATE HISTORIC PARK SANTA YSAB CREEK 34 32 RD 1993 COPYRIGHT 3 HIGHLYNO RD

Page 4 Owner's Vo Date Wor Local P	JPLICAT al Requi of	Oreg W629 3/2/	17 195 En	اُن ج	4	WEL.	L GOM Refer to It . N	10. 4	ON Pan	REPORT	r [LATITUDE	STATE	WELL N	IO./STA	OT FILL IN — TION NO. DONGITUDE
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WELL PERMIT APPLICATION

Control # W 1917

Assessor's Parcel No. 760-170-18

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING THE PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXPETING WELLS, SEWERS AND PRIVATE NEWAGE DISPOSAL SYSTEMS AND OTHER POLLOWING TAKENATION SOURCES. INCLUDING DIMENSIONS 27 28 -SAN DIEGO DIEGO BATTLEFIELD STATE HISTORIC PARK Thomas Bros. Maps ® 34 COPYRIGHT 1993 HIGHL

WELL PERMIT

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	EQUIPMENT (Rotary Cable Tool Other	Check)	
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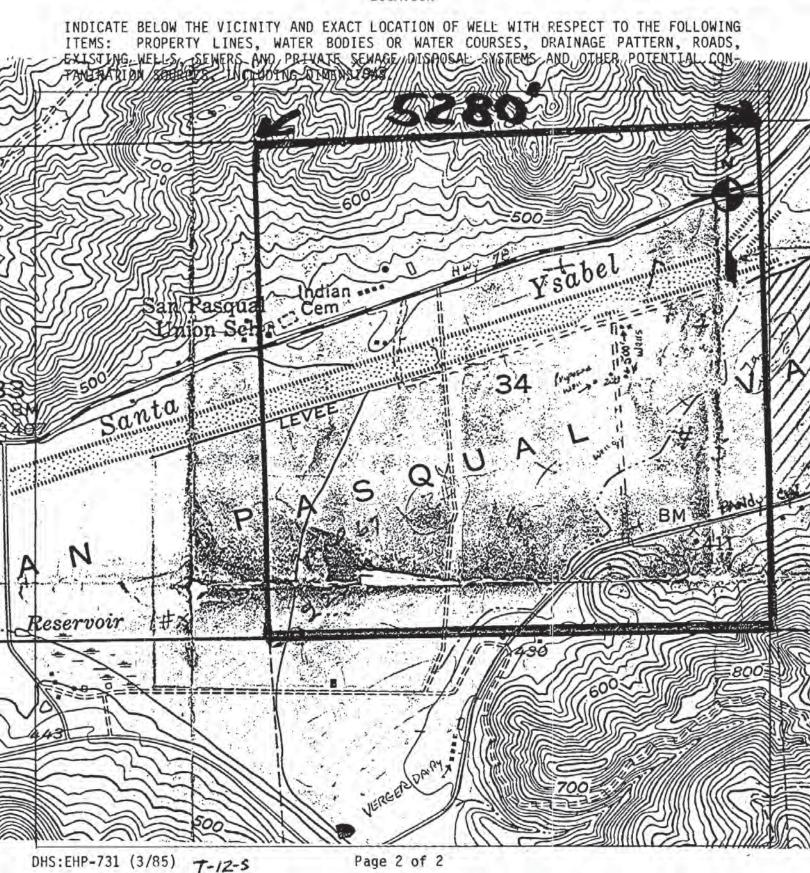
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New Well	Individual Don		Rotary 🔀
Repair or Modification	Agricultural		Cable Tool
Time Extension	Industrial	Other	Other
Destruction		100000000000000000000000000000000000000	
PROPOSED WELL DEPTH		PROPOSED CASING	Te service of the service of
Max. 200 Min. 180 (Fe	et) Type STEEC	Depth 200 Diameter 12	" Wall or Gage -375
PROPOSED SEALING ZON	E(S)	SEALING MATERIA	L (Check)
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NAME OF WELL OWNER .		NAME OF WELL DRILLER	
KAY Bis	HOP	Joe FAIN	749-0701
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BANGO CYN ROLLSC	SHAPASYON		2
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To Thandy CHAPOSITION OF APPLI	CATION (SAN Diego)	BUSINESS ADDRESS	2111. Ard-2
COC 9202 FOR HEALTH OFFICERS U	SE OWLY)	1/2029 OLD CASTIE	KA- VAILEY CENTER
APPROVED	DENIED	LICENSE NUMBER	
1500 ADDROVED WITH CONDITIONS		100000 D	h Deposit
APPROVED WITH CONDITIONS		Bon	d Posted
Report Reason(s) for Denial or Nece	ssary Conditions Her	e: 6235 For cold on 1	1/+04-93
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use only.			
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DATE		12-24-	12
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> R-IW 5-34

WELL PERMIT APPLICATION CONTROL # W62322

Assessor's Parcel No. 760-170-18

LOCATION



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11.15	Other _						1/24	1 1	an	1-				93		C-57 LICENSE NUMBER

10

	mpleted Well Construction
Date _	3-16-93
Date In	spected 3-16-93
Comme	ints ag well /
evio	lence of annular Seal
alse	ryred
Water S	Sample Taken? <u>NO</u>
Roview	ed By M. Sedahi

DEPT OF HEALTH SERVICES!



COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH WELL PERMIT APPLICATION

DEH USE ONLY PERMIT # W 63475	
WELL COMPUTER # 114/97	333
WATER DIST:	7

	Property Owner: CHONGS FLOWERS	110-131-5
16		Phone: /// // // OC
1	5850 YSABET CREEK Ad- ESCON O	180 92025
2.	Well Location - Assessors Parcel Number: 760-170-58	ty Zip
	15850 VSABEL CREDE Rd ESC	92025
	10 /25	ma. FATA DRILLERY
3.	Well Contractor - Well Driller OF MIN Company Na	4 17-W 97092
	Mailing Address	ty Zip
	Phone #: 160-149-0701 C-57 #: 328287 Cash Depos	it: 🕅 Bond Posted: 🗅
4.	Use: Private □ Public □ Industrial □ Cathodic □ Othe	
5.	Type of Work: Reconstruction Destruction Time Ex	tension: 1st: 🗅 2nd: 🗅
6.	Type of Equipment: 1501ARY	
7.	Depth of Well: Proposed: 150 Existing:	0
8.	Proposed: Casing Conductor Casing Filter/Filler Material	Perforations
	Type: Puc Yes No Wes No	do 1 1501
	Depth: 150' Depth: 20 ft. From: 20 To: 150	From: 10 To: 130
	Diameter: 12" in. Diameter 24 in. Type: Pet Gravec	From: To:
	Wall/Gauge: 250 Wall/Gauge: 250	From: To:
9.	Annular Seal: Depth 20 Ft. Sealing Material: CARRETE	A Transitive Value of the Control
	Borehole Diameter: 32 In. Conductor Diameter: In.	Annular Thickness: In.
10.	Date of Work: Start: NOU-ZY-97 Comple	nte: 100 Dec - 3-97
	On sites served by public water, contact the local water agency for meter pr	otection requirements.
	I hereby agree to comply with all regulations of the Department of Environmental Healt of the County of San Diego and the State of California pertaining to well construction, I Immediately upon completion of work, I will furnish the Department of Environmental Health and the County of the County	epair, modification and destruction. ealth with a complete and accurate
	log of the well. I accept responsibility for all work done as part of this permit and all work supervision.	
Contra	actor's Signature:	Date: 100-14-9
	P	
	DISPOSITION OF APPLICATION (Department of Environmental Health	i Usa nnivi
v .		i aso omj
A Ap	proved	
-		

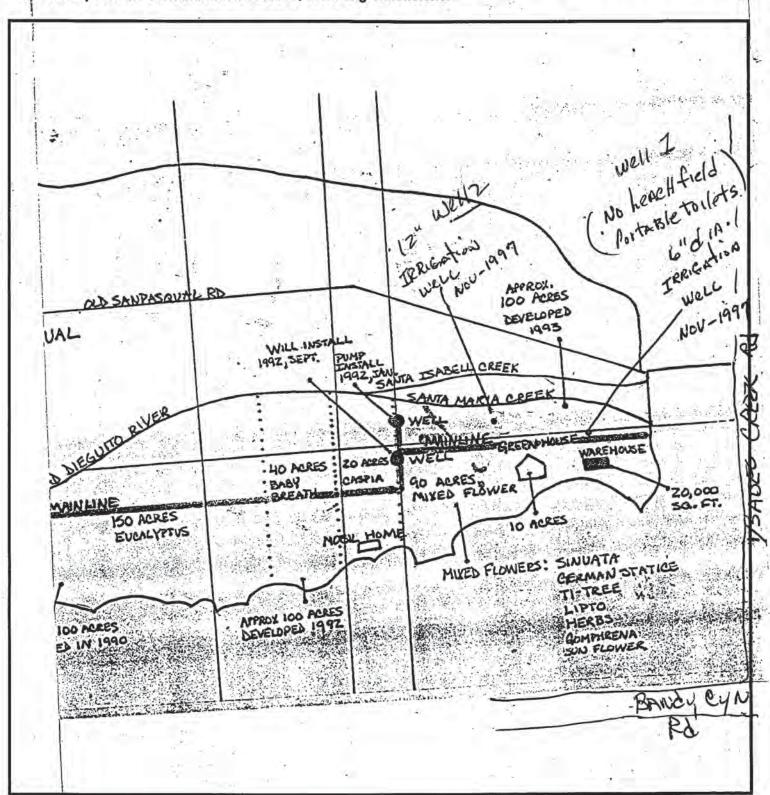
COUNTY OF SAN DIEGO

DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: <u>W63475</u>
Assessor's Parcel Number: <u>760-170-58</u>

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



OF LOCA	JPLICAT al Requi	E remen	ls :			STATE	OF CALIFO	Copy to R ON REPORT	DWR	SE ONL	Y - C	L	T FILL IN
Page of Refer to Instruct							LINE TO SERVICE			STATE	WELL NO)./STAT	ION NO.
	Vell No.				· 16.1.1.1	N.	• 44	5735	LATITU	IDE	ЦЦ		NGITUDE
					1 Ended 1					1 1	1.5	I b	1 1 1 1
Perm	nit No. 👪	63475	Jepi	OF	Env. Bea	mit Date1	1-14-9	1			APN/TRS	OTHER	
	15 9 0			OLOG	ic roc —		1	100 10	W. V.	OWNE		مامماد	ad from nub
DEPTH SURF	ACE		н то	FIRST V	WATER 20 DESCRIPTION	(Ft.) BELOW SUF	M 100 1	The information viewing pursuar Information Pra	nt to section 137 ctice Act of 197	52 of the 7, to prot	e Wate ect pe	er Coo	de and the
0 1	25	Alluvial fill as follows:						Address Same WELL LOCATION					
0	23				and cilt			Sity San Diego (San Pasqual Valley)					
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25	70	Pine	a &(2 60	erse sand	with som		APN Book 760		_ Parcel	-58		``
		- sms	11	eggr	egates -	brown col	40.00	Township /25	Range / L		-	3	- 10
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00		15	. N°	The state of	111	A COLE	3	,	NORTH 116	178		**	EW WELL
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155	160	Wan.	e ha		granite -	hearm an	100	- + W - 66	- 1.		a m	1	MONITORING
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160 165 rock								. 2	ić (-		Domesti
3		-	-	-					1		9		X Irrigation
										. 111.17	7		Industria
	-1	_	eV.				-		1	00			"TEST WELL"
	~ "	Completed Well Construction								· s provide			CATHODIC PR
- 1	Da	Date _ 8.10.98							e Distance of Well		narks	-	TION OTHER (Spec
Data Inspected 8					070			such as Roads, Buildings, Fences, Rivers, etc. PLEASE BE ACCURATE & COMPLETE.					
					8.7.7			DRILLING ROTARY			FLUID Gel		
					146			WATER LEVEL & YIELD OF COMP				LETED WELL -	
				00	niplete	0		DEPTH OF STATIC 13 (Ft.) & DATE MEASURED 12-18-97					
	7 1	-		-	Poos	13-70		ESTIMATED YIELD	1200 (GPM)	& TEST T	YPE 0	ITI:	Lft
OTAL DI	EPTH OF	BORING	10	65	(Feet)	15 1		TEST LENGTH 8	(Hrs.) TOTAL E			(t.)
OTAL DI	EPTH OF	COMPLET	ED V	WELL .	165 (Fe	et)		* May not be repres	entative of a well's	long-term	yield.		
DED		er Sam		Taker	1?	CASING(S)			DEPTH	4 14 6	NNU	LAR	MATERIA
FROM SURFACE BORE TYPE () DELLA CALLED						50.75	01.07.0170	FROM SURFAC		TYPE			
	A	(Inches)		2	MATERIAL	INTERNAL METER	OR WAL	L IF ANY	2	CE- MENT	BEN- TONITE	FILL	FILTER PA
Ft. to		Part of	-	SCR	<u> </u>	(Inches)	THICKNES		Ft. to Ft.	(=)	(4)	(=)	(TYPE/SI
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0	55	24	K		F480	12	C-20		20 155	pes	gra	vel	5/16 x7
55 : 75 :	75 95	24	-	X	F480	12	C-20		i	-			
95	155	24	X	x	F480	12	C-20						
,,		44	H	-	1400	12	U-20	-					
	ATTACE	MENTS	3 (2	7					TION STATEM				
	_ Geologic				I, the u	indersigned, ce	rtify that th	is report is compl	ete and accurate	to the bes	st of my	know	ledge and be
	_ Well Con		agran	1	NAME _	Fain Dri	lling	S Pump Co I	nc.				
		cal Log(s)			1	12029 01	d Cast	(TYPED OR PRINTED) 1e Rd. Vall	ev center.	Ca C	2082		**
1	Geophys												
1 0 12		er Chemica	I Anal	yses	Annerse		-						ON ZIP
			I Anal	yses	ADDRESS	Out	R	Flien		9-97		328	287 ZIP

COUNTY OF SAN DIEGO DEPARTMENT OF PUBLIC HEALTH

Page 1 of 2 pages

# 10606	WELL PERMIT	APPLICATION SAN DIEGO, CA. 92101	Permit No. W.3002
TYPE OF WORK (Check) New Well Repair or Modification Time Extension Destruction	USE (Control of the control of the c	check) Commercial Community Other	EQUIPMENT (Check) Rotary Cable Tool Other
PROPOSED WELL DEPTH	1.78111	PROPOSED CASING	
Max. 400 Min. 100 (Feet) PROPOSED SEALING ZO From ZERO to FI From to From to PROPOSED PERFORATIONS From to From to From to From to From to From To From To From To From To From To From To From To From To DISPOSITION OF APPLICATION OF APPLICATION OF MEALTH OFFICERS UNITED TO THE PARAGEMENT OF THE PARAGEMENT O	ONE(S) Feet Connewilly Feet Connewilly Feet Feet OR SCREEN Feet Feet Feet Feet Feet ACLIEY RD.	SEALING M Neat Cement Cement Grout DATE Start Completion NAME OF WELL DRILLE JOHN KRATZ COMPANY MULTI WATER S	R S VSTEMS
APPROVED WITH COND	☐ DENIED	LICENSE NUMBER 355283 -A	Cash Deposit 🔀 Bond Posted 🗆
Report Reason(s) for Denial or Necessar	y Conditions Here:	6000 \$25 Fee paid on	
SEE COMMENTS ON PAGE 2 BOLOVI HEALTH OFFICER 30 MANCH	ST	tions of the D Health and with of the County State of Californ struction, repair, tion. Immediately	to comply with all regula- lepartment of the Public of all ordinances and laws of San Diego and of the hia pertaining to well con- modification and destruction of work he Department of Public complete and accurate log
TI DITTO		3-30	-07

DEPARTMENT OF PUBLIC HEALTH 1600 PACIFIC HIGHWAY SAN DIEGO' CALIF. 92101

WELL PERMIT APPLICATION

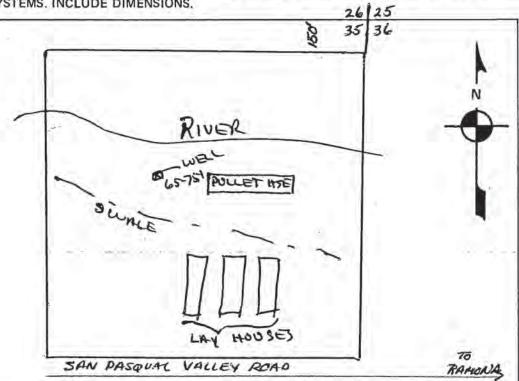
Page 2 of 2 pages

Permit No. W30021

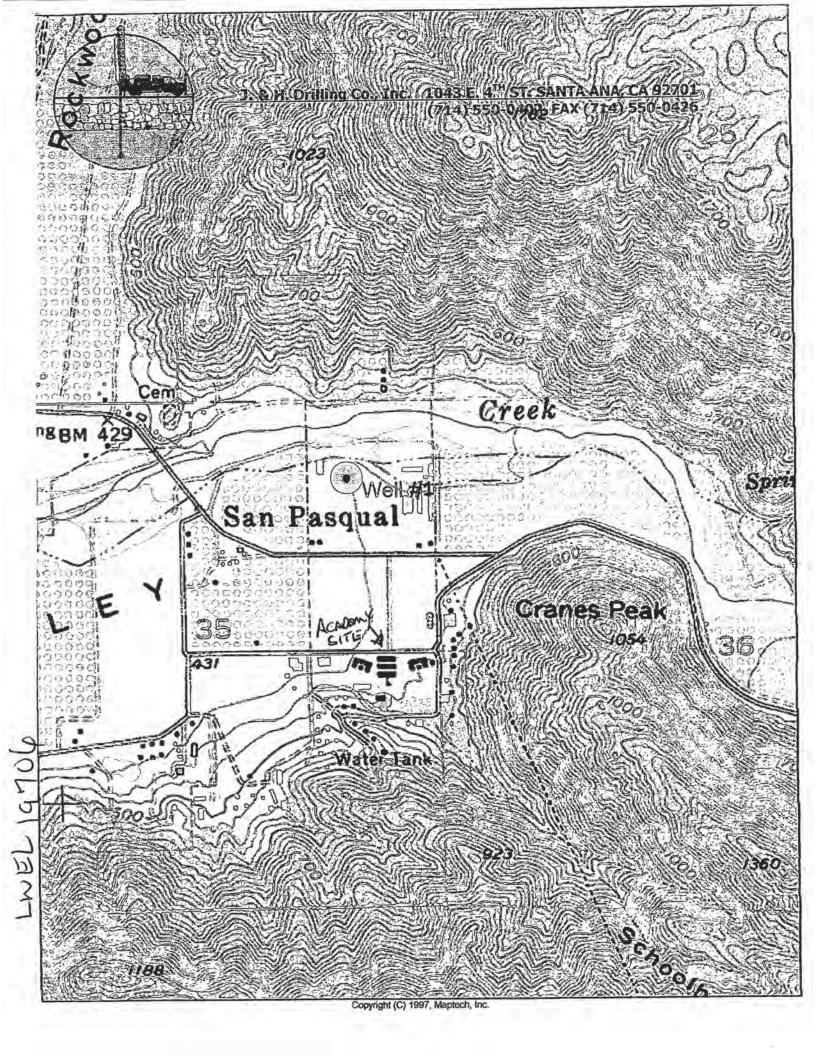
Assessor's Parcel No. 342-131-06

LOCATION

INDICATE BELOW THE EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS. INCLUDE DIMENSIONS.



- 1. Well to be constructed to community well standards with required fifty feet of casing and annular seal. If impervious strata is encountered within five feet of required annular seal depth, then casing and seal to be extended five feet into impervious strata.
- 2. Well to be minimum of 100 feet from all sources of pollution and contamination i.e. sewage plant effluent disposal, animal enclosures and manure. A BERM must be provided so as to prevent contamination from being within 100 feet of well.
- 3. The existing pullet house to be re-located within 18 months so as to be 100 feet from well.
- 4. Provide impervious seal for ground used for manure storage so as to prevent percolation into soil.
- 5. Provide water devices for chicken lay houses that will not discharge waste water to ground in area of manure storage. Water device conversion to be completed within one year.



FIRST CARBON COPY send to County Health Dept. Room 104

COUNTY OF SAN DIEGO DEPARTMENT OF HEALTH SERVICES 1700 PACIFIC HIGHWAY, SAN DIEGO, CA 92101

242	131	06
-74	1)1	00

Notice of Intent No. 194101 Local Permit No. or Date 1930021	- (INS		ER WELL DRIL				te Well No		_
The information in this grayed a viewing pursuant to section 137 Information Practice Act of 1977	52 of the \	een blocke Nater Cod	d from public e and the		L LOG: To	otal depthft	Both of cor	mpleted well	183
Information Fractice Act of 1977	, to protec	ot personal	illioilliation.	Q	to ft.F	overbur			
Ver-ceet and realization (e.g.				- 0		to fine			021699
(2) LOCATION OF WELL (See ins				15	40	conglome			nd-brn.
County	Owner's	Well Number		40	65	same	-Luoc ny	22110 00	314 0211.
Well address if different from above TownshipRange	1	Caratan	35	65	90		omerate	e to fin	ne sand
Distance from cities, roads, railroads, fer	at 97	Section	500 feet	0,		€ 89'	OFFICE	2 00 2.11	ic cana
south of sec. 35/3	16 R 40			90	115	small la	wer of	ine gan	id-mey
property line	0 15 70	U ICCO	WOSE OF	115	740	fine ("			700
	ee 404	E-2		140	165		conf.ro:	serute 3	/ 1000
	***		OF WORK.	165	100	barder :		1001 /20	
FOR HEALTH DEPARTMENT, USE	53 360		OF WORK:	703		to very		102 / 10	C. Z Was t
Completed Well Construction:		Reconstruc				to tery		10:2	Jr 156
Date		Reconditio					14100	/ , , , ,	AP JUNE
1		Horizontal						7 24	115° 00
Date Inspected			(Describe		."	Y DELL	1	1	LENGE
Comments			materials and		10	Tool		1-41	15 CF , 11
0 4	20-4	procedures	in Item (2)			1		1 1/	w
R		(4) PROPO	OSED USE:		non	willia	4	. GAX	- 1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1
Water Sample Taken?		Domestic		1.6				1 1/1	
Sanitarian's Approval:	~	Irrigation				1113		1 1//	
0110		Industrial				(3 8)		VIII.	
L'Est of comming	sital	Test Well				1113 21		1 197%	
MOLOCIN STENDINGON	0	Stock				1112 6		VIIIA	
Mister Maraile		Municipal		1		1 1		Back Willis	
		Other Co	ommunity.			ally a		1000 MV	10'
(5) Equipment:	(6) Gravel		5/16x4			1 1		3353	
Rotary 🗀 Reverse 🗆	Yes 🗗 N	o D Size	5/ 10%4			1 /		Caraci	
Cable Air	Diameter of	above 22	100					17,	
Other Bucket	Packed from	nto	18,3			191		13 ;	
(7) Casing Installed:	(8) Perfora	tions:		-		13	Mary Traffic	15	
Steel DX Plastic Concrete C	Type of per	foration or si	ze of screen			1 5	1111	151	
E Die Contes	Evans	To	Slot			18		11110-	
From To Dia. Gage or ft. ft. in. Wall	From ft.	To ft.	Size			1 2 1			
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	21					1	100		
0 103 14 .250	00	16	3 2213/3	5		- 1 1		1 8 1	
(9) WELL SEAL:			60		and the same of th	1 }	1 1 1	1	== 1==
Was surface sanitary seal provided? Yes I	□ 1/00 □ If	yes, to depth	ft.	1.00	STEEL	· · · · · ·	757	1 /	2011
Were strata sealed against pollution?			ft.			7 34	4		GUI
Method of sealing	. 0			Work starte	edbe	19	Completed	2/57	19
					73	STATEMENT!	110		-
(10) WATER LEVELS:				Section 1997	1 1011	119% 6	- f		-123
Depth of first water, if known See	pelow		ft.	This well w	as drilled un	der my jurisdiction	on and this rep	ort is true to th	ne best of my
Standing level after well completion			drillern.	SIGNED	1	lti ater	Lougton		
(11) WELL TESTS:			a h	SIGNED	- "	(Well	Driller)		
, (MAN), (A. P.C.), (MAN) (100 MON), (100 MO	If yes, by			NAME	रर			10.14\r10.40	
	ailer 🗆	Air lift		252-01	(Perso	e. firm. Cacerpo	ation) (Typed	or printed)	025
Depth to water at start of test		At end of te		Address	35	5283		7/23/	Mark Will
Discharge gal/min after		Water tempe	rature	City		-	es af abis	Zip	
Chemical analysis made? Yes □ No			Amilian ma	thor 3			te of this repo	rt	4 3*
Was electricing made? 10Yes 10 No			mino report	1 v · w · · · · · · · · · · · · · · · · ·	4. cy . V		ereta a	and the second	7.0



COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT #W 19769
WELL COMPUTER #
FEE:
WATER DIST:

1.	Property Owner: City of San Diego, Contact: Surraya R	asnid, P.E., Proj. Mgr Phone:	(619) 533-5306
	600 B Street, Suite 700, MS 906	San Diego, CA	92101
	Mailing Address 98	City	Zip
2.	Well Location - Assessors Parcel Number 272-131-94 (Well #4B)	
	Approx 280' North of 14103 Highland Valley Rd.	Escondido, CA	92025
	13102 HIGHLAND WALLEY	City	Zio
3.	Well Contractor - Well Driller Boart Longyear	Company Name: _E	
	12464 McCann Drive	Santa Fe Springs, CA	90670 Zip
	Phone#: (562) \$06-1960	C-57#; 694686 ☐ Cash Deposi Source wa	Bond Posted
4.	Use: Ma Private D Public D Industrial	☐ Cathodic ☐ Other RO demon	
5.	Type of Work: ☑ New □ Reconstruction	그는 마일이라면 되었습니다. 나를 걸린 하나 이 얼마에 살	☐ 1st ☐ 2nd
5.	Type of Equipment: Rotosonic Rig - Vertical Well		
7.	Depth of Well: Proposed: 75 feet BGL	Existi	ng:
В.			
	Casing Conductor Casing	Filter/Filler Material	Perforations
	Type: Steel	X Yes □ No	Citoraliona
	Depth: 0 to 30 Depth:ft.		30 To: 75
	Diameter 8.625 in. Diameter in.	Type: From:	To:
	Wall/Gauge: 0.188 in Wall/Gauge:	Wall/Gauge: From:	To:
	Annular Seal: Depth: 20 ft. Sealing Materia Borehole diameter: 12.625 in. Conductor diameter: Anticipated July 11, 2008	neter:in. Annular Thic	ckness 2 in.
(On sites served by public water, contact the local of the legal of the legal of the legal of the County of San Diego and the State of California pertaining Immediately upon completion of work, I will furnish the Department of the well. I accept responsibility for all work done as part of supervision. Intractor's Signature: ON A DEN AT 160 471-073 NNU AN SEATSO THAT WE MAY	ent of Environmental Health, and with all o ing to well construction, repair, modification ortment of Environmental Health with a con f this permit and all work will be performed	rdinances and laws of and destruction. Inplete and accurate log under my direct
_	DISPOSITION OF APPLICATION (Depart		19 (
	Approved Denied Special Conditions: Gradi	ing and clearing associated with ac	ccess to, or the
/	onstruction, maintenance or destruction of water wells,	, may require additional permits fro	m the County of
C	N. (1985) 1일 : 영화 10시 - 이 아이라는 전에 가장하는 사람이 되었다. 10시	, may require additional permits fro	m the County of

PAGE 03/06

07/03/2007 11:05 8586943105

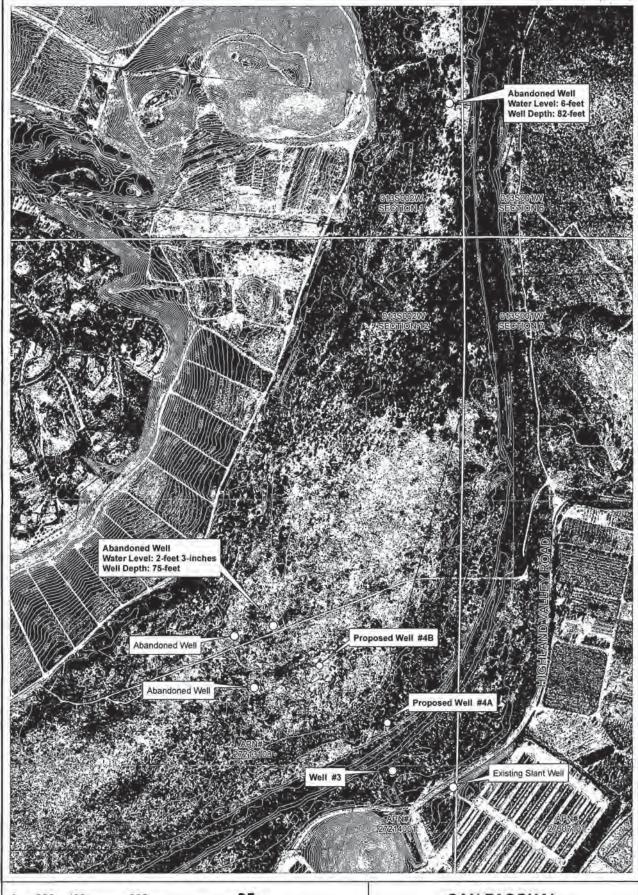
COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH Control #: LUEL 19769
Assessor's Parcel Number: 272-131-08

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

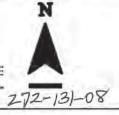
SEE ATTACHED FOR PROPOSED WELL #4B

LWEL 19769



0 200 400 800 Feet

Gî2



SAN PASQUAL BRACKISH GROUNDWATER DESALINATION DEMONSTRATION

ALTERNATIVE WATER SUPPLY ANALYSIS TECHNICAL MEMORANDUM FIGURE-1

80-151-202 6-0 SAN PASQUAL BRACKISH WATER TDDF PROJECT OFF-SITE VERTICAL WELL CONSTRUCTION SAMPLE PORT. SADDLE & BALL VALVE MATES 00000 ASSESSATE ENGINEER AUSTRAL BADA A TANSALTTER
A TANSALTTER
A TANSALTTER
A TO D. I. SPOOL

TVC FLG X SOC

TVC FLG X SOC 4" WAFER BUTTERFLY VALVE 6966173007 " 90" D.1. ELBOW DISCHARGE TO SPWRF SITE SEE FIGURE 4-6 CITY OF SAN DIEGO, CAUFORNIA SPEET OF XX SPEETS 4" PVC SCH. 80 THK. CONC. PAD HORIZ. SUPER-FLO LOUVERED SCREEN DETAIL FLOW METER Manager (Appendix Appendix App MECHANICAL PLAN SECTION (A) 00000000000 000000000000 EX 4" D. L. SPOOL SECTION A-A CHECK VALVE T" ARV-SUPPORT 3° COLUMN PIPE CONNECTED TO THD. COUPLING ON DISCH. HEAD 0 0,1, FLG DISCH, ELBOW W/3, FLG, 1 CONDUIT & 1 VENT CONNECTTOR CASING W. TOP FLO ELEC. J-BOX SADDLE & 1" BALL VALVE 3" X 4" D.1. RED. WATER DEPARTMENT -LEVEL TRANSDUCER FG. 326± TOP CASING EL. 3304 (ABOVE TOO YR. WELL EQUIPPING DETAIL 1153) (0-,89 ONILIES AND STATIC WATER 2 NAX. PUMPING V 3" DIA. THD. COLUMN PIPE WITH THD. COUPLING 5UBMERS 18LE PUMP 150 GPM @ 225, TOH-48DV. 3PH. 60HZ. 15HP B 1 8 CEMENT SANITARY SEAL CRAVEL/FILTER PACK 20° - 75° BGS. SIZE TO BE DETERMINED FROM INITIAL BORING WITH COMPACTED FILTER PACK MATERIAL 0 - 21 BGS CASING SPECIAL STREET, CANADA SERVICE STREET, SPECIAL STREET, SPECIAL STREET, SPECIAL 1234" BOREHOLE 0 - 75' BGS WELL CONSTRUCTION DETAIL END PLATE **8** ROSCDE MOSS 81/4 1.D. (E. 8%, 0.D. X 0.188 WALL) COPPER BEARING STEEL SUPER-FLDW LOUVERED SCREEN 21 75 86S. DRAWING STATUS

July10, 2008

Bob Geiseck County of San Diego Department of Environmental Health Land and Water Quality Division P.O. Box 129261 San Diego, CA 92112-9261

Dear Mr. Geiseck:

Subject: Property Owner Consent (POC)

The City of San Diego, owner of the property 14103 Highland Valley Road, San Diego, CA 92102, APN# 272-131-08, grants permission to Geoscience Support Services, Inc. (consulting company, contractor) and Boart Longyear, drilling company to enter Cityowned property to conduct drilling and install a 70' to 75' deep vertical well on or near the area indicated on the attached Drawing C-2, "Offsite Well Site Plan".

I understand that Dennis E. Williams registered professional of Geoscience Support Services, Inc. consulting company and an authorized signer for Boart Longyear, drilling company have submitted a signed application to the County of San Diego, Department of Environmental Health, in which they have agreed to complete the above-stated work according to the applicable ordinances and laws of the County of San Diego and the State of California pertaining to water well construction and destruction. I have arranged with Surraya Rashid, City of San Diego, project manager overseeing the wells/borings installed on this property, to ensure proper destruction of the well should it become no longer usable or is abandoned at the conclusion of our demonstration project.

Sincerely,

Marsi A. Steirer

Enclosure: Drawing, C-2, Offsite Well Site Plan



Page 2 Mr. Bob Geiseck June 16, 2008

bcc: Robert McCullough, Principal Water Resources Specialist, Water Resources & Planning Division

Surraya Rashid, Associate Civil Engineer, Water Resources & Planning Division Larry Aburtin, Assistant Engineer, Water Resources & Planning Division

Joel E. Bowdan III, Associate-Project Manager, RBF Consulting

Rec'd in SM on 10/29/08.

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form. File Original with DWR State of California DWR Use Only - Do Not Fill In Well Completion Report Page 1 of 1 Refer to Instruction Pemphiet Owner's Well Number BH-4B No. e0081241 N Date Work Began 07/11/2008 Date Work Ended 8/26/2008 Latitude Longitude Local Permit Agency County of San Diego Department of Environmental Health Permit Number LWEL 19769 Permit Date 7/16/08 Geologic Log Well Owner The information in this grayed area has been blocked from public Orientation O Vertical O Horizontal OAngle **Drilling Method Sonic** viewing pursuant to section 13752 of the Water Code and the **Drilling Fluid** Depth from Surface Description Information Practice Act of 1977, to protect personal information. Describe material, grain size, color, etc... 42 Ò Sand, fine, med., coarse Well Location 44 42 Silty sand Address 1,060' NW of entrance of 14103 Highland Valley Rd 49 44 Sand City Escondido County San Diego 49 55 Interbedded layers of sand and gravel Latitude 33 3362 N Longitude 117 02 069 ON 55 59 Sand Decimal Lat. 33.05889 Decimal Long. 117.03500 Datum NAD83 59 61 Gravel w/ sand Page 131 Parcel 08 APN Book 272 82 61 Sand w/ occasional gravel 2 W Township 13 S Section 12.J 82 84 Silty sand w/ gravel Activity 84 85 Cobbles Location Sketch (Sketch must be drawn by hand after form is printed.) O New Well 88 85 Sand w/ cobbles North O Modification/Repair 88 89 Clayey sand w/ cobbles O Deepen 89 90 Weak cemented rock O Other O Destroy 90 92 Silty sand Describe procedures and materials under "GEOLOGIC LOG" 92 95 Bedrock - granodiorite BH-4B Planned Uses Water Supply Domestic Public 1 ☐ Irrigation ☐ Industrial O Cathodic Protection O Dewatering O Heat Exchange O Injection O Monitorino O Remediation San Pasana O Sparging Vater Reclamat O Test Well O Vapor Extraction itustrate or describe distance of well from roads, buildings, far twers, etc. and attach a map. Use additional paper il necessa. Plesse be accurate and complete. O Other Water Level and Yield of Completed Well Depth to first water 8 (Feet below surface) Depth to Static (Feet) Date Measured 08/25/2008 Water Level 8 95 Estimated Yield * 150 Total Depth of Boring (GPM) Test Type Constant Rate Test Length 24.0 Total Depth of Completed Well 84 (Hours) Total Drawdown 31 "May not be representative of a well's long term yield. Casings Annular Material Depth from Borehole Wall Outside Depth from Slot Size Screen Material Diameter (Inches) Thickness Diameter Fill Description if Any (inches) Surface Тупе Surface Feet to Feet (Inches) (Inches) 0 25 12.625 Blank Copper bearing steel 0.188 8 5/8 20 Cement neat cement 0 25 41 12.625 Screen "So Copper bearing steel 0.188 8 5/8 Louver 0.080 20 84 Filter Pack 4x16 custom blend 45 41 12.625 Blank P Copper bearing steel 0.188 8 5/8 84 95 Native fill 45 84 12.625 Screen Copper bearing steel | 0.188 8 5/8 Louver 0.080 Attachments Certification Statement , the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief Geologic Log Name Boart Longyear Corporation ☐ Well Construction Diagram Person, Firm or Comoration Geophysical Log(s) McCann Dr. 12464 Santa Fe Sennos Soil/Water Chemical Analyses 694686 ☐ Other Attach additional Information, if it exists Date Signed C-57 License Number

JEH2016-LIVELL-001332

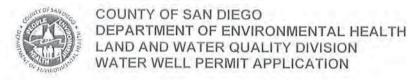


Specialist:

COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL BEAUTHOO LAND AND WATER QUALITY DIVISION WATER WELL PERMIT APPLICATION AR 28

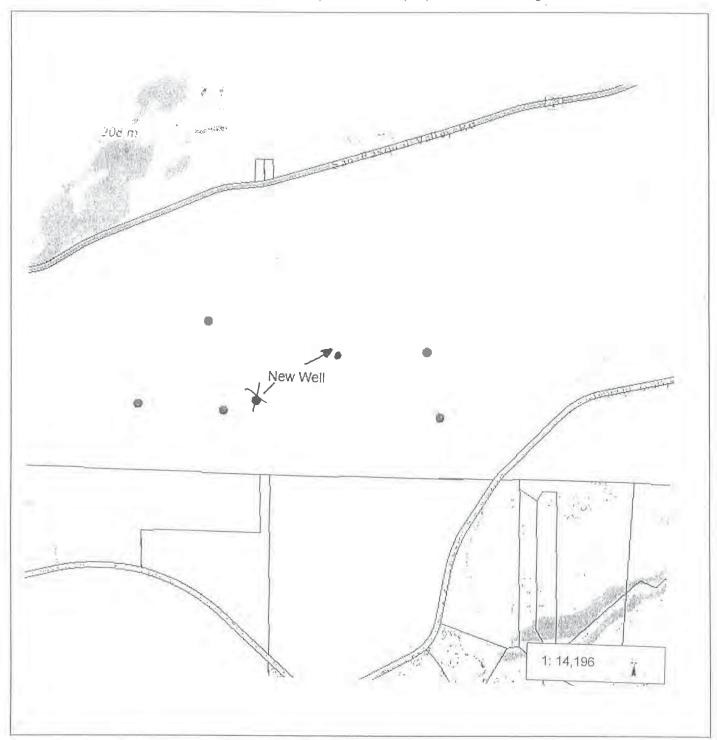
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PERMIT#		- 54
FEE: \$535	000	
WATER DIST:		-

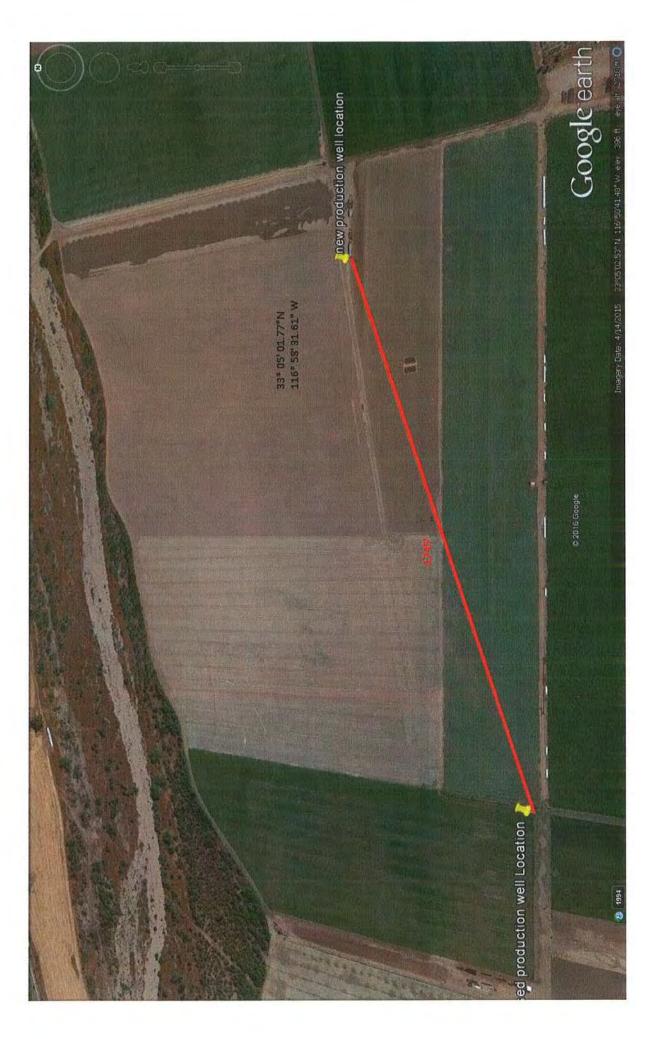
County of San Diego Dept. of Environmental Heal Land & Water Quality Div Property Owner: WHIMAU PAULL 1. M4H - 760-644-6887 Phone: Mailing Address: Po Rox City: Escaupino State: C4 Zip: 92025 2. Well Location - Assessors Parcel Number: _____ 760-170-48 GPS Coordinates: (WGS-84 Decimal Degrees): 33050177N Site Address: O Hwu 18 City: <u>CSCONDINO</u> State: CA. Zip: 92025 Well Contractor/Driller: _ DAVE WA 3. Company Name: JAN DELLING e 20. city: VALLEUCONER Mailing Address: 12029 State: CA C-57 License No: 328267 ☐ Cash Deposit Sond Posted Private Public Industrial Other: 5. Type of Work: New 🗆 Reconstruction 🗅 Destruction Time Extension: 1st 2nd Type of Equipment: Depth of Well: Proposed: Existing: 8: Proposed: Casing Conductor Casing Filter/Filler Material Perforations Type: 55/LCC ☑ Yes □ No Yes No From: 100 To: 6 Depth: Depth: 20 From: 0 To: 160 Diameter: 12 in. Diameter: 24 in. Type: RAVCHO From: _____ To: Wall/Gauge: 375 Wall/Gauge: (250) Depth: 20 ft. 9. Annular Seal: Sealing Material: ____ CPWPU Borehole Diameter: 32 in. Conductor Diameter: 24 in. Annular Thickness: 4 in. 10: Best Management Plan for confining, well drilling waste on the project site provided? ¥ Yes □ No 11. Date of Work: On sites served by public water, contact the local water agency for meter protection requirements. I hereby agree to comply with all regulations of the Department of Environmental Health, and will all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well (well driller's report). I accept responsibility for all-work done as part of this permit and all work will be performed under my direct supervision. Contractor's Signature: DISPØSITION OF APPLICATION (Department of Environmental Health Use Only) Approved Denied Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies. artrus Ma



SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.







County of San Biego

STORMWATER & DISCHARGE MANAGEMENT PLAN FOR WATER WELLS

This form must be submitted with all Well Permit Applications

Department Use Only	
	Assessor's Parcel Number: 760 - 170 - 48
1	242-100-10
SECTION 1: Required Information from Contractor	or Consultant:
Longitude & Latitude: 1. Are there any watercourses or water bodies within 50 feet 2. Does the plat show the project boundaries? (A "detail inse 3. Does the plat show footprints of any existing structures an 4. Does the plat show locations where run-off may enter stor 5. Is grading required to access site or install well? 6. Does the project conform to the local grading ordinance? 7. Will drilling additives be used to drill the well? 8. Are the Best Management Practices attached to this perm SECTION 2. Best Management Practices	of the limits of soil disturbance? et is acceptable for a large parcel or lot.). ad facilities within 100 feet of the wellhead position? amdrains, drainage courses and/or receiving waters? The state of the limits of soil disturbance? The state of the wellhead position? The state of the wellhead position? The state of the wellhead position? The state of the limits of soil disturbance? The state of the limits of soil disturbance?
The goal of stomwater and discharge control management pollution to the maximum extent practicable using Best Materials, sediments, chemical residues such as drilling for property boundaries to eliminate transport from the site to nadjacent properties. It is the responsibility of the property be used in order to ensure that all contaminants are retained Examples of Best Management Practices to contain we installation of a sediment basin to contain run-off, using geo eliminating the use of drilling foam. (Website Information is a	Management Practices (BMPs). Construction related foam, wastes, and spills must be retained within the hearby streets; drainage courses, receiving waters and owner and the contractor to determine which BMPs will do not site. If installation run-off include, but are not limited to obtaxtile fabric to contain sediments and drilling must be contain.
SECTION 3. Certification I have read and understand the following: (Please check early Selected BMP's will be implemented so that water quality of I am aware the selected BMP's must be installed, mainly effective. I understand that non-compliance with the San Diego enforcement actions by the County. These may include DEH inspectors and personnel from other regulatory agriculture for purposes associated with this well permit until such Should DEH determine during the field review that the Management Plan or the well permit explication, the wascivity will require a new permit see and amondment to Contractor Property Owner Reviewed by DEH Reviewed by DEH	talled, monitored and revised as necessary so they are County Watershed Protection Ordinance may result in sitings, citations, stop-work orders, or other actions. gencies are authorized to enter my property at any time time the well is completed to the satisfaction of DEH. The well installation procedures contradict this Discharge in the difficulty of the suspended or revoked. Further

	e Adobe Re ginal with		y be used to view	and complete this form	5	State of Cal	ifornia	1	lete, save		e a saved f NR Use On		Not Fill In
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	ermit Ager			Permit Date 3/2	8/16				Li	T I	APN/I	RS/Ot	her
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161	167	Date	gandered \	Vell Construction	1		-	must be draw	n by hand North	after form is	printed.)	ON	lew Well Modification/Repair O Deepen
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							Depth to Water L	Static evel 72		(Fee	et) Date	Measi	ured 04/05/2016
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0	95	24	Blank	Low Carbon Steel	.375	12.75		\$T	0	167	Filter Pac	k	Rancho
95	155	24	Screen	304 Stainless Steel	.250	12.75 -	Wire Wrap	0.060					
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	Well Con Geophys	struction ical Log		Name	Fain Dri	Iling & Pu	alo CoIncl		ey Cen		C	A	92082
1	Soil/Wate Other <u>S</u>	te Map		Signed	9	Address	Well Contractor	/	C	4/7/20 Date Si	16 3:	ale 28287	Zip



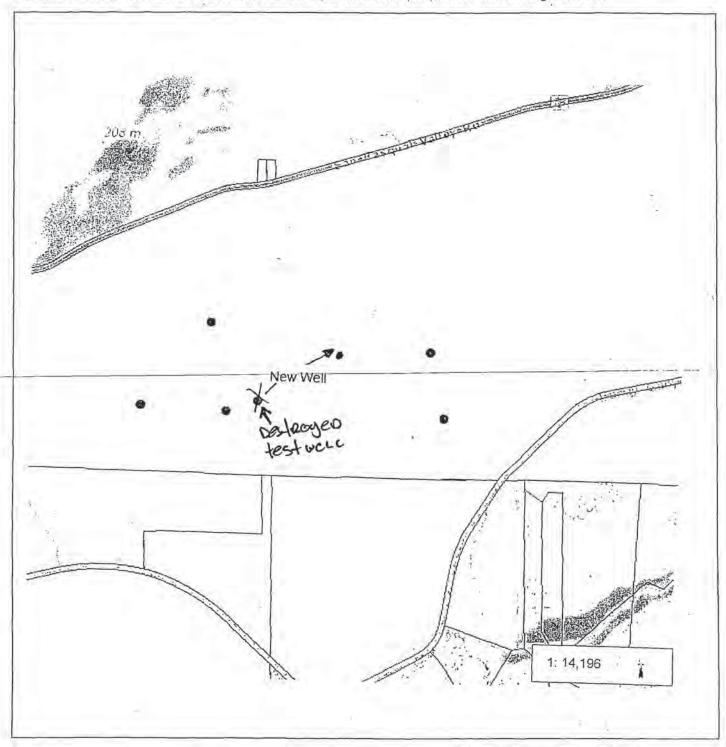
COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH LAND AND WATER QUALITY DIVISION WATER WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # _ LWELL - 601332

APN: _ 242 - 100 - (0)

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.



well #1

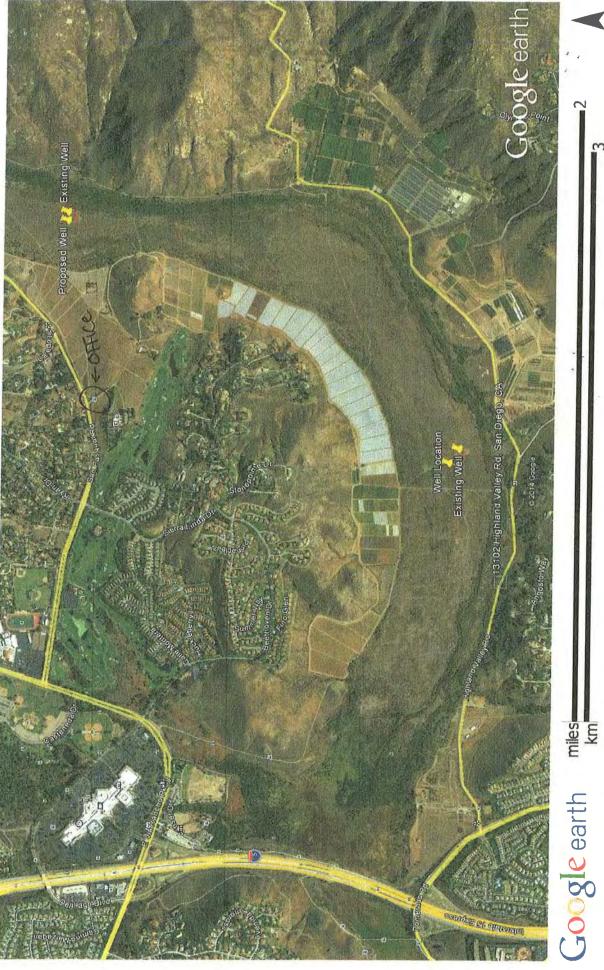
MT OF SANON	COUNTY
	DEPART LAND A
	WATER

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY OUTSION
WATER WELL PERMIT APPLICATION

	DEH2014-LWELL-000675 PERMIT#_
1	FEE: 535.00
١	WATER DIST:

CATO	DATE: WATER WELL PERMIT APPLISATION FILE: 535.00 WATER DIST:
1.	Property Owner: BE WISE RANCH INC. Phone: BLLL 760-746-60006
	Mailing Address: 20505 SANDASQUAL VALLEY City: PSONDIOO State: CA Zip: 97076
2.	Well Location - Assessors Parcel Number: 760-170-82
	GPS Coordinates; (WGS-84 Decimal Degrees): 33.0727 / 117.0323
	Site Address: SANDASQUAL WALLEN PD. City: CSCOND DO State: CA Zip: 97076
3.	Well Contractor/Driller: DAVE WATTHEWS Company Name: FAIN DRILLING
	Mailing Address: 12029 OUDCASHORD City: VAlley Coulde State: CA Zip 97082
	Phone: 760 - 749 - 0701
4.	Use: & Private Public Industrial Other: RRIGATION WELL
5.	Type of Work: New □ Reconstruction □ Destruction □ Time Extension: □ 1 st □ 2 nd
6.	Type of Equipment: MOO, ROTARY
7.	Depth of Well: Proposed: 100 Ft - Existing:
8:	Proposed: Casing Conductor Casing Filter/Filler Material Perforations
	60 160
	Depth: 100 Depth: 20 From: 0 To: 100 From: To:
	Diameter: 14 in. Diameter: 24 in. Type: #6 From:To:
	Wall/Gauge: 1250 Wall/Gauge: 1250
9.	Annular Seal: Depth: 20 ft. Sealing Material: CEWENT
	Borehole Diameter: 30 in. Conductor Diameter: 24 in. Annular Thickness: 3 in.
10:	Best Management Plan for confining well drilling waste on the project site provided?
11.	Date of Work: Start: 10/14 Complete: 16/14
of Sar	es served by public water, contact the local water agency for meter protection requirements. by agree to comply with all regulations of the Department of Environmental Health, and will all ordinances and laws of the County n Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon etion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well (well driller's l. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.
Contra	actor's Signature: Date;
DISPO	OSITION OF APPLICATION (Department of Environmental Health Use Only)
Ap mainte	proved Denied Special Conditions: Grading and clearing associated with access to, or the construction of water wells, may require additional permits from the County of San Diego and/or other agencies.
_	alist: Date: 9-11-14

13 LWIN-000675





COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH LAND AND WATER QUALITY DIVISION WATER WELL PERMIT APPLICATION

2	DEH USE ON	LY
PERMI	2014-LWEL	1-00067
-	760-170-	- 23
APN:_	100-110-	02

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.





County of San Diego

STORMWATER & DISCHARGE MANAGEMENT PLAN FOR WATER WELLS

This form must be submitted with all Well Permit Applications

Department Use Only	en reminapproduced
Well Permit Application Number: <u>LWEUL-0</u> 00675 A	ssessor's Parcel Number: 760-170-82.
SECTION 1: Required Information from Contractor or Co	nsultant:
Longitude & Latitude: 33.0727 × 117.03 1. Are there any watercourses or water bodies within 50 feet of the 2. Does the plat show the project boundaries? (A "detail inset" is ac 3. Does the plat show footprints of any existing structures and facility. 4. Does the plat show locations where run-off may enter stormdrain its grading required to access site or install well? 5. Does the project conform to the local grading ordinance? 7. Will drilling additives be used to drill the well? 8. Are the Best Management Practices attached to this permit applies.	imits of soil disturbance? coeptable for a large parcel or lot.). les within 100 feet of the wellhead position? yes NO yes
SECTION 2. Best Management Practices	au spotos orpa-ju-s
The goal of stormwater and discharge control management planning pollution to the maximum extent practicable using Best Managematerials, sediments, chemical residues such as drilling foam, we property boundaries to similate transport from the site to nearby adjacent properties. It is the responsibility of the property owner as	ment Practices (BMPs). Construction related restes, and splits must be retained within the streets; drainage courses, receiving waters and
be used in order to ensure that all contaminants are retained on-site	
Examples of Best Management Practices to contain well installation of a sediment basin to contain run-off, using geotextile eliminating the use of drilling feam. (Website Information is available	fabric to contain sediments and drilling muo, or
SECTION 3. Certification	
I have read and understand the following: (Please check each box of Selected BMP's will be implemented so that water quality is not	effer concurrence. negatively impacted by well construction activities
I am aware the selected BMP's must be installed, maintained, i	monlicred and revised as necessary so they are
effective. Junderstand that non-compliance with the San Diego County	THE SHOP STATE OF THE SAME OF
enforcement actions by the County. These may include fines,	citations, stop-work orders, or other actions.
DEH inspectors and personnel from other regulatory agencies	are authorized to enter my property at any pina well is completed to the satisfaction of DEH.
a Should DEH determine during the field review that the well	Installation procedures contradict this discharge
Management Plan or the well permit application, the well drilling activity will require a new permit see and amendment to the extension of the	g permit may be suspended or revoked. Politila
Contractor \	Date 9/5/14
Property Owner This B	_ Date
Reviewed by DEH	Date. 9-11-14
A A A A A A A A A A A A A A A A A A A	

DUPLICATE, ORIGINAL DEPOSIY-LWELL-000675



THE CITY OF SAN DIEGO

WILLIAM BRAMMER d/b/a BRAMMER FARMS

Flat Rate Lease

DOCUMENT NO. M. 301867
FILED SEP 1 2 2036

OFFICE OF THE CITY CLERK SAN DIEGO, CALIFORNIA

CITY OF SAN DIEGO FLAT RATE LEASE

THIS LEASE AGREEMENT is executed between THE CITY OF SAN DIEGO, a municipal corporation, hereinafter called "CITY," and WILLIAM BRAMMER d.b.a. BRAMMER FARMS, hereinafter called "LESSEE."

SECTION 1: USES

- Premises. CITY hereby leases to LESSEE and LESSEE leases from CITY all of that certain real property situated in City of San Diego, County of San Diego, State of California, described as consisting of approximately 136.4 acres and forther described in Section 111, Exhibit A Premises attached hereto and by this reference made part of this agreement and four (4) wells, including the right to use the water which may be available underneath the Premises for the purposes. I provided for in Section 1.2 Uses, subject to Section 8.8, Water Rights, hereof. Said real property is hereinafter called the "premises" or "leased premises." It is further agreed that the leasehold has not been surveyed however CITY and LESSEE agree to approximate acreage.
- Uses. It is expressly agreed that the premises are leased to LESSEE solely and exclusively for the purposes of growing organic vegetables, related agricultural crops on an ongoing basis, business office, vegetable washing and packing area/building and for such other related or incidental purposes as may be first approved in writing by the City Manager and for no other purpose whatsoever.
 - The use of the premises for any unanthorized purpose shall constitute a substantial default and subject this lease to termination at the sole option of the CITY.
 - LESSEE covenants and agrees to use the premises for the above-specified purposes and to diligently pursue said purposes throughout the term hereof. Failure to continuously use the premises for said purposes, or the use thereof for purposes not expressly authorized herein, shall be grounds for termination by CITY.
- 1.3 Related Council Actions. By the granting of this lease, neither CITY nor the Council of CITY is obligating itself to any other governmental agent, board, commission, or agency with regard to any other discretionary action relating to development or operation of the premises. Discretionary action includes but is not limited to rezonings, variances, environmental clearances, or any other

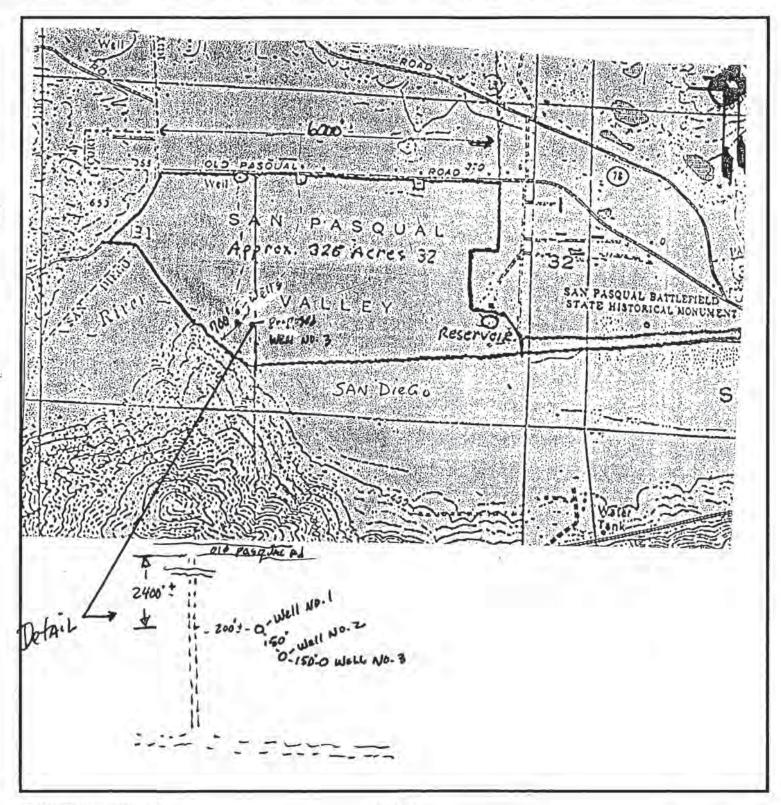
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Page _ Owner Date W Local P	14 1	of 1 mber On 11/03/2	2014 DEH	Date	Work En	Refe No ided 11/	ompleti er to Instruction o. e02426 17/2014	on Repo	ort			te Well Nu	Tion	Site Number Longitude
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									Level and		of Com	plated V		
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_		Attach	monte					_	Certificat	ion St	atomont			
BUUU	Geologic Well Cor Geophys Soil/Wat Other S	c Log nstruction sical Log(ter Chemi Site Map	Diagram s) cal Analyses		Name _	Fain Dri	Firm or Corpo estle Road Address	at this repor	t is comple pany, lac.	ete and a	accurate t	o the bes	A late 32828	y knowledge and belief 92082 Zip 7 cense Number
Name and Address of the Owner, where the Owner, which is the Owner, which is the Owner, where the Owner, which is the Owner, where the Owner, which is the O	REV. 1/200	And in case of the last of the			IF ADDITION			, USE NEXT CO	DNSECUTIVE	LY NUMBI				

DEPARTMENT OF ENVIRONMENTAL HEALTH WELL PERMIT APPLICATION OWNER- City of SAN Dieg County of San Diego NATER DIST: Property Owner: AM- Sod Mailing Address 24/-100-31	901
2. Well Location - Assessors Parcel Number 241 - 100 - 31	97-887
2. Well Location - Assessors Parcel Number 241 - 100 - 31	97-887 2027
2. Well Location - Assessors Parcel Number 241 - 100 - 31	2027
2. Well Location - Assessors Parcel Number 24/-100-31	2027
15023 OLD SAN PASQUAL PH SAN DIEgo	
3. Well Contractor - Well Driller Company Name: Ain	Dp. 11.
12029 OLD CASTLE RD 1/AUGY CENTER	92062
Mailing Address City	Zip
Phone#: 760-749-070/ C-57#:328287 🗆 Cash Deposit 🕱	Bond Posted
4. Use: APrivate ☐ Public ☐ Industrial ☐ Cathodic ☐ Other AG-Well	•
5. Type of Work: ☐ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1	lst 🗆 2nd
6. Type of Equipment: Rofally	
7. Depth of Well: Proposed: /30' Existing:	0
8. Proposed:	
Casing Conductor Casing Filter/Filler Material Perfo	orations
Type: XYes □ No X Yes □ No	
	To: /30
Diameter 16 in. Diameter 24 in. Type: 5/16 X 16 From: Wall/Gauge: .6/16 Wall/Gauge: _ 250 Wall/Gauge: _ N/A From:	
9. Annular Seal: Depth: 20 ft. Sealing Material: CEMENT	- 4
Borehole diameter: 32 in Conductor diameter: 24 in Annular Thickness	
10. Date of Work: Start: SEPT. 2004 Complete: SEPT.	2004
On sites served by public water, contact the local water agency for meter protection require	ments
I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinand	
the County of San Diego and the State of California pertaining to well construction, repair, modification and de Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete a	
of the well. I accept responsibility for all work done as part of this permit and all work will be performed under	
supervision.	
Contractor's Signature: Au R. Qui Date: Aug- 3	31- 200
3 3000 777	1000
DISPOSITION OF APPLICATION (Department of Environmental Health Lies or	
DISPOSITION OF APPLICATION (Department of Environmental Health Use or	ıly)
Approved Denied Special Conditions: Grading and clearing associated with access	to, or the
construction, maintenance or destruction of water wells, may require additional permits from the	
San Diego and/or other agencies.	W. Marie A.
Specialist: 1/ Section Date: 9/1/0	4
DEH-LU-731a (Rev. 4/02) NCR Page 1 of 2	-

Control #: LWGL 16208
Assessor's Parcel Number: 241-160-31

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



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Comme	nts_						1 1	97		Illustrate or Descrip	be Distance of V	Vell from Roy	erle Builr	linas		REMEDIATION
	2									Fences, Ricers, etc. necessary. PLEASE	and attach a m BE ACCURA	ap. Use addu TE & COM	ional por PLETE.	er if		OTHER (SPECIFY)
11	180	die	11	=	=			-			ER LEVEL					WELL
	ince	aur	5	-		\dashv				DEPTH TO FIRST	WATER	N (Ft.) B	ELOW S	URFACE		
Vater S	imple Ta	icon?	1	V		1				WATER LEVEL_	c 36	(FL) & DAT	E MEASI	IRED _	10/	16/04
2.70			-	136						ESTIMATED YIELD						
TOTAL	EPTH OF	BORING	_		-	Feet)	(Feet)			* May not be re					(FL)	
tome o	-	I .	I		_					tras nos ac rep	TI TI	a activity por	1		ann de	0.6. 2.2.0.0.0.
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		HMENTS	(=)	1			f, the und			nis report is compl	ete and accu	rate to the	best of	my kr	owled	ge and belief.
	Geologic Well Cor	s Log Instruction Di	iagran	n		- 11	NAME			& Pump Co	. Inc.	Vend 1				
-		sical Log(s)	Ü				(PE)	12029 C	CORPORATION)	(TYPED OR PRINTED)	lley Ce	nter.	Ca 9	2082		
10-	Soil/Wat	er Chemical					ADDRESS	-7	7						-	328/ZP
	▲ Other _ ADDITIONAL				YICT	_	Signed	115		ain						
ATTACH A		INFORKA III	JIV, IF			TIONA	C-5	UCENSED WAT		RACTOR T. CONSECUTIVE	V APPARE		HE SIGNE		- (C-57 LICENSE NUMBER

12501W 31J0025

ORIGINAL ≈ File with DWR WATER WELL DRILLERS REPORT

(Sections 7079, 7080, 7081, 7082, Water Code)

Do Not Fill In

39872 State Well No. 125/01W-31J02

THE	RESOURCES	A	GENCY	OF	CALIFORN	IΑ
DE	EPARTMENT (OF	WATER	RE	SOURCES	

,								Other Well No.
_ ((11) WELL LOG:
ì.								Total depth 13/1 ft. Depth of completed well 73), ft.
Ā								Formation: Describe by color, character, size of material, and structure
-							_	ft. to ft.
(2) LOC			-	<u> </u>				0 - 15 Sand, light browncolor - fine to
County Sa		_	0	wner's numbe	r, if any	7	·	medium size
Township, Ran								15 - 35 Sand, dark brown color - fine to
							condido	medium size
			ast (Sa		1al	Valle	- Υ	35 - 37 Silt, black color
			(check)		,			37 - hl Sand, grey color - fine to medium size
New Weli 🖟	~	pening [J Recond	litioning 🔲		Ocstroyin	g 🗀	
				e in item 1.		FOIII	PMENT:	
(4) PRO			(<i>check):</i> Municip		-		EMIEM I:	55 - 63 "Toolie Bed" Fine black sands, old logs
Irrigation		_		her 🗀	Cal	tary Ma	片	
IIIIgation	X res	c well [" L	Otl			63 - 73 Sand & gravel, fine to coerse 1/8"
(C) CAS	DIG II	NICTAT	LED.	l_		-	<u> </u>	
(6) CAS			i	τ-	f oran	vel pacl	ked	73 - 80 Sand dark grey color - fine to medium
STEE		отн	IER:	•	- 6	, or pac.		
SINGLE 🔀	HOOR	SLE [] -						80 - 90 Sand brown color fine to medium size 90 - 100 Sand, brown color fine to medium
_			Gage	Diameter		_	"	size
From ft.	To ft.	Diam.	or Wall	of Bore	'	From ft.	To ft.	100 - 105 Sand & Gravel Fine to coarse san d
0	50	72	- 			0	732	1/8" to 1" gravel round
15Ö	134	12	-250 -219	<u> 2011</u>	\dashv		1.32-	105 - 119 Sand. partly cemented - fine to
, <u>-</u>	,/	ے۔۔	<u> • ८ 1 ७</u>					medium size
Size of shoe or	well ring:	Non e		Size of grav		3/8 R	, , , , , ,	119 - 124 Sand & grayel -3
Describe joint		ded)/ ()	suna -	124 - 127 Sand, Brown, fine to medium
			OR SCR	EEN:				127-132 Decomposed granite
` '			Louvre			4500)-Slot-	
	1				1001	17.1.00	7-210€	2 NV
From	1 7	го	Perf. per	Rows per	}		Size \	- 1 Wilverage Sp. Yield= 20.2
ft.	1 .	t,	row	ft.	- 1	•	х in.	and the second of the second o
50	7	00	8	134	$\neg \neg$	1/8 3	23/8	
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105		19	8	1/2	~ ~ [reen 1/8 -	-0.2/8	CONFIDENTIAL - NOT
119	<u> </u>		Johnson		7020	_,	- 2)/0	FOR PUBLIC RELEASE
124		32	8	li j	3616		2 2/9	FOR PUBLIC RELEASE.
(8) CON			T :	4 ≈ "		/ U	- 4 770	
Was a surface :	sanitary sea	l provided?	Yes No	· X:	To what	t depth	ft.	
Were any strat:	sealed aga	inst pollutio	on? Yes 🗌	No 💢	If	yes, note	depth of strata-	\$ ************************************
From	ft.	to	ft.					
From	ft.	¢o	ft.					Work started Oct. 30 119 67 , Completed Nov 9 19 67
Method of seal	ing					-		WELL DRILLER'S, STATEMENT:
(9) WA				, is	(Š.Š.Š.	ft \	,	This well was drilled under! my jurisdiction and this report is true to the best of my knowledge and belief.
Standing level					9	• ft, 1		NAME Acme Drilling Company
Standing level						-ft.		(Person, firm, or corporation) (Typed or printed)
(10) WE								Address P.O. Box 835
√as pump test			o □ If	yes, by whon	i Wal	hh Pir	mp_Co.	Valley Center - California 92082
Yield: 120	20	ıl./min. with		ft. drawdo			hrs.	[SIGNED] W Thoush
Temperature of	water		Was a chemics	al analysis ma	de? Ye	<u>. U .</u>	lo [] x	Well Driller)
Was electric lo	g made of v	well? Yes [□ No 🔀	If yes,	attach	сору		License No/74287 Dated 453 4 , 1968
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Page 1	of1						** 11111	Refer to In	struction	n Pan	nphlet	• _		STATE	WELL	O./STA	ITION NO.
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ATTACH AL	-		ON.	IF IT I	EXIST	I	Signed	OE K	. <u> </u>	w	سر		7	/30/9 DATE SIGNI	3	<u> 3</u> 2	8287 C-57 LICENSE NUMBER
L							WIN	DRIELER/AUTH	URIZED KEP	RESENTA	MITTE			UNIE SIGNI			OUT LIVETION RUMBER

ORIGINAL File,with DWR	STÅ7E OF CALII WELL COMPLETI	I I	O NOT FILL IN
Page 1 of 1			/STATION NO.
Owner's Well No.		63737	
Date Work Began	6/17/94 , Ended 6/24/94	LATITUDE	LONGITUDE
Local Permit A	gency <u>County Health Dept</u>		
Permit No		94 APN/TRS/	OTHER
	GEOLOGIC LOG	WELL OWNER —	
ORIENTATION (∠)	XVERTICAL HORIZONTAL ANGLE (SPECIFY)	Name Am-Sod Floyd Wirthl	
DEPTH FROM	DEPTH TO FIRST WATER <u>uk</u> /ft.) below surface	Mailing Address 2606 Hollister	<u>Street</u>
SURFACE	DESCRIPTION	San Diego, Calif.	9 <u>2 1 5 4</u> STATE ZIP
Ft. to Ft.	Describe material, grain size, color, etc.	WELL LOCATION —	
0 15	fine grained sand - brown col		
15 40	11:	City San Diego	
15 :40	fine to coarse sand with smal		
	100010010	APN Book 241 Page 100 Parcel 31 Township 13S Range 2W Section 31	
40 68	Grey silty sand		west
	1	Latitude NORTH Longitude DEC. MIN. SEC. DE	
68 75	coarse sand and gravel		— ACTIVITY (∠) — Xnew well
İ	1		MODIFICATION/REPAIR
75 90	partly cemented sand	_	Deepen
i		1	Other (Specify)
90 131	fine to coarse sand with	-	
1	some boulders	Elist Wall	DESTROY (Describe Procedures and Materials
			Under "GEOLOGIC LOG"
ļ · · · · · · · · · · · · · · · · · · ·	1	LEAST CENTER AND A COLUMN AND A	PLANNED USE(S) (∠) MONITORING
	!	- ا	
1		50' NEW WELL	WATER SUPPLY
			Domestic
	1	5.0.6.4E	Public XIrrigation
;		S.D. G. &E POWER POLE	Industrial
		SEE AHACHED MAP	"TEST WELL"
			CATHODIC PROTEC
	1	SOUTH	TION OTHER (Specify)
1		such as Roads, Buildings, Fences, Rivers, etc. PLEASE BE ACCURATE & COMPLETE.	
	1	DRILLING	
- :	!	METHOD Rotary FLUID FLUID WATER LEVEL & YIELD OF COMPLE	Ge?
		DEPTH OF STATIC	
		WATER LEVEL 26 (Ft.) & DATE MEASURED	-6/24/94
TOTAL DEPTH OF	BORING 131 (Feet)	ESTIMATED YIELD * (GPM) & TEST TYPE TEST LENGTH (Hrs.) TOTAL DRAWDOWN 5	- pump
	BORING 131 (Feet) 28 (Feet)	* May not be representative of a well's long-term yield.	(Ft.)
		may not be representative of a west stong term steat.	
DEPTH FROM SURFACE	BORE- CASING(S)	I DEFIN	AR MATERIAL
PROM SURPACE	HOLE TYPE () DIA. S S MATERIAL INTERNAL GAUG		TYPE
Ft. to Ft.	DIA. (Inches) 명 등 기계 등	ESS (inches) Ft to Ft MENTITURITE F	FILTER PACK (TYPE/SIZE)
			∠) ((TFE/312E)
0 20	32 X A-53-B 23.5 .25	0 20 X	5/16:5
88 128	23 X 4 80 11:5 6:15	950 .094 20 128 Stave	5/16x7
		, , , , , , , , , , , , , , , , , , , ,	

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

WELL PERMIT APPLICATION

control # W62747

Assessor's Parcel No. 241-100-31

LOCATION

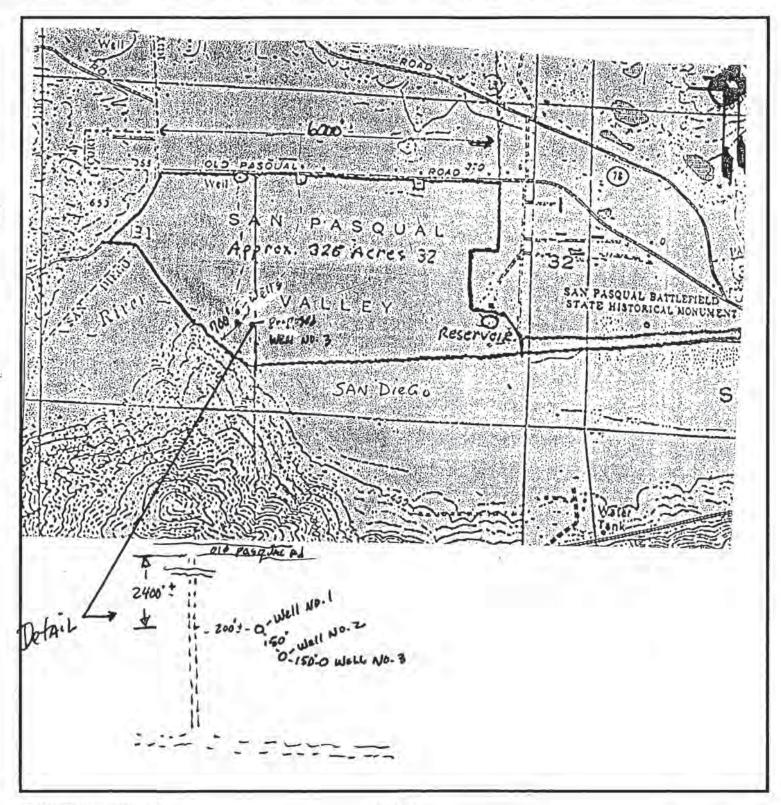
INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, LS SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CON-OLD PASOUAL SAN , PASQUAL Approx. 326 Acres 32 SAN PASQUAL BATTLEFIELD STATE HISTORICAL NONUNENT SAN DieGo

DEPARTMENT OF ENVIRONMENTAL HEALTH WELL PERMIT APPLICATION OWNER- City of SAN Dieg County of San Diego NATER DIST: Property Owner: AM- Sod Mailing Address 24/-100-31	901
2. Well Location - Assessors Parcel Number 241 - 100 - 31	97-887
2. Well Location - Assessors Parcel Number 241 - 100 - 31	97-887 2027
2. Well Location - Assessors Parcel Number 241 - 100 - 31	2027
2. Well Location - Assessors Parcel Number 24/-100-31	2027
15023 OLD SAN PASQUAL PH SAN DIEgo	
3. Well Contractor - Well Driller Company Name: Ain	Dp. 11.
12029 OLD CASTLE RD 1/AUGY CENTER	92062
Mailing Address City	Zip
Phone#: 760-749-070/ C-57#:328287 🗆 Cash Deposit 🕱	Bond Posted
4. Use: APrivate ☐ Public ☐ Industrial ☐ Cathodic ☐ Other AG-Well	•
5. Type of Work: ☐ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1	lst 🗆 2nd
6. Type of Equipment: Rofally	
7. Depth of Well: Proposed: /30' Existing:	0
8. Proposed:	
Casing Conductor Casing Filter/Filler Material Perfo	orations
Type: XYes □ No X Yes □ No	
	To: /30
Diameter 16 in. Diameter 24 in. Type: 5/16 X 16 From: Wall/Gauge: .6/16 Wall/Gauge: _ 250 Wall/Gauge: _ N/A From:	
9. Annular Seal: Depth: 20 ft. Sealing Material: CEMENT	- 4
Borehole diameter: 32 in Conductor diameter: 24 in Annular Thickness	
10. Date of Work: Start: SEPT. 2004 Complete: SEPT.	2004
On sites served by public water, contact the local water agency for meter protection require	ments
I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinand	
the County of San Diego and the State of California pertaining to well construction, repair, modification and de Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete a	
of the well. I accept responsibility for all work done as part of this permit and all work will be performed under	
supervision.	
Contractor's Signature: Au R. Qui Date: Aug- 3	31- 200
3 3000 777	1000
DISPOSITION OF APPLICATION (Department of Environmental Health Lies or	
DISPOSITION OF APPLICATION (Department of Environmental Health Use or	ıly)
Approved Denied Special Conditions: Grading and clearing associated with access	to, or the
construction, maintenance or destruction of water wells, may require additional permits from the	
San Diego and/or other agencies.	W. Marie A.
Specialist: 1/ Section Date: 9/1/0	4
DEH-LU-731a (Rev. 4/02) NCR Page 1 of 2	-

Control #: LWGL 16208
Assessor's Parcel Number: 241-160-31

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



	acta be			ï	w	41	lle	208		Kiva ent.	2/2/05	NY	F	le	24	1-100-31
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	Well No.	_				. End	ad a	10.15.0	.090	19563		LATITUDE	E	L	1	DNGITUDE
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	nit No	1620	19				The state of the same	Date 9-	1-04			1		NATESK	THER	
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		Abbl	WI	Bar.	200	1	S POLL	OLC:	35	Address City	5023 01	4-1-6	Sc	ON	DI	Do
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15	40						sand w	rith /	5 70.3	DEG.	MIN. SE	EFTCH	Long	DE		MIN. SEC.
4		sma.	11	bou	lde	ers				T	NORTH	- 11	12.5.	244	12	NEW WELL
40	69	Gres	, " A	111	4	and	-		- 2	1 014	PASPU	rt ald			MODIF	FICATION/REPAIR Deepen
7.0		11	7,		5 J 4	to/			3	4 40%	71	3		4.4		Other (Specity)
69	75	Coar	80	68	nd	- s	dae se	all gra	vel .	1		2		15		DESTROY (Describe
75	90	enh.	_			1	emente		/AX		. 24	,0		7		Procedures and Materials Under "GEOLOGIC LOG
13	30	-		, pa		Ly C	emente	u	7/47	B.	1 1				T	S(=) R SUPPLY
90	136	Fine	e to	0 0	BO	rse	sand w	ith sos	e e	.	4	WEST	3			Domestic Public irrigation Industria
		boul	de	rs						WEST	12000	wit.	10.0	EAS		MONITORING
Cor	pipleted	Well Co	netn	i kriti	on										CATHO	TEST WELL
Data	2/	2/05		uou	GHI			. 72		7.11	1 2	FR E	===			HEAT EXCHANGE
Date _	-	3/	-		-					/	2	- K	ed L			INJECTION
Date Inc	pected	-/	10	2.5				-		Ridge			1,4		VAI	POR EXTRACTION SPARGING
Comme	nts_						1 1	97		Illustrate or Descrip	be Distance of V	Vell from Roy	erle Builr	linas		REMEDIATION
	2									Fences, Ricers, etc. necessary. PLEASE	and attach a m BE ACCURA	ap. Use addu TE & COM	ional por PLETE.	er if		OTHER (SPECIFY)
11	180	die	11	=	=			-			ER LEVEL					WELL
	ince	aur	5	_		\dashv				DEPTH TO FIRST	WATER	N (Ft.) B	ELOW S	URFACE		
Vater S	imple Ta	icon?	1	V		1				WATER LEVEL	c 36	(FL) & DAT	E MEASI	IRED _	10/	16/04
2.70			-	136						ESTIMATED YIELD						
TOTAL	EPTH OF	BORING	_		-	Feet)	(Feet)			* May not be re					(FL)	
tome o	-	I .	I		_					tras nos ac rep	TI TI	a activity por	1		ann de	0.6. 2.2.0.0.0.7
	PTH	BORE- HOLE	D	(PE)	(=)	1		CASING (S))	1		PTH	-	ANN		MATERIAL
		DIA. (Inches)	ž	N N	PUCTOR FILL PIPE	M	GRADE	INTERNAL	GAUGE OR WAL				CE-	BEN-		FILTER PACK
Ft t	n Ft.	(manasy)		SCR	S 1		CINDE.	(Inches)	THICKNES		Ft.	to FL	0.00	(=)	for home of	(TYPE/SIZE)
	20	32	X		1		eE1	23.5	.375		1	20	X			
78	138	24	X	X	+	-	F480 F480	15	.661	.125	20	136	-			11.8 : 25
	130	2.4	H	+	+	1	1400		1002	- 1123						
	ATTAC	HMENTE		1	1	2				CERTIFIC	CATION STA	TEMPSET	1			
		HMENTS	(=)	1			f, the und			nis report is compl	ete and accu	rate to the	best of	my kr	owled	ge and belief.
	Geologic Well Cor	s Log Instruction Di	iagran	n		- 11	NAME			& Pump Co	. Inc.	Vend 1				
-		sical Log(s)	Ü				(PE)	12029 C	CORPORATION)	(TYPED OR PRINTED)	lley Ce	nter.	Ca 9	2082		
10-	Soil/Wat	er Chemical					ADDRESS	-7	7						-	328/ZP
	▲ Other _ ADDITIONAL				YICT	_	Signed	115		ain						
ATTACH A		INFORKA III	JIV, IF			TIONA	C-5	UCENSED WAT		RACTOR T. CONSECUTIVE	V APPARE		HE SIGNE		- (C-57 LICENSE NUMBER



COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH WELL PERMIT APPLICATION

	DEH USE ONLY
PER	MIT EWEL 18465
	L COMPUTER #
FEE	
WAT	ER DIST:

1. Property Owner: SIAN PASQUAL VALLEY RANCH	760 Phone: 743-2,377
2460 CLOUERDALE RD ESCOND	
2. Well Location - Assessors Parcel Number 841-081-08 SHME	Zip.
3. Well Contractor - Well Driller John H. WARDEN Company P.O. Box 177 Ramowa Mailing Address City	The second second
Phone#: 760-789-2539 C-57#: 681782 LCa	ash Deposit
4. Use: ☐ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other	AG.
5. Type of Work: ☐ New ☐ Reconstruction ☐ Destruction Time E	Extension: 🗆 1st 🗆 2nd
6. Type of Equipment: WUD ROTARY	
7. Depth of Well: Proposed:	Existing:
Depth: Depth: ft. From: To: Diameter in. Diameter in. Type: Wall/Gauge: Wall/Gauge: Wall/Gauge: Wall/Gauge: Sealing Material: ft. Sealing Material: Sealing Material: ft. Sealing Material:	
10. Date of Work: Start: 8-13-07 Com	plete: 8-16-07
On sites served by public water, contact the local water agency for meter properties of the properties of the Department of Environmental Health, and the County of San Diego and the State of California pertaining to well construction, repair, Immediately upon completion of work, I will furnish the Department of Environmental Health of the well. I accept responsibility for all work done as part of this permit and all work will be supervision. Contractor's Signature:	nd with all ordinances and laws of modification and destruction. In with a complete and accurate log
DISPOSITION OF APPLICATION (Department of Environmental	Health Use only)
Approved ☐ Denied Special Conditions: Grading and clearing associate construction, maintenance or destruction of water wells, may require additional posts and Diego and/or other agencies.	ed with access to, or the
Specialist: Date:	8/13/07
DEH-LU-731a (Rev. 4/02) NCR Page 1 of 2	

Assessor's Parcel Number: 241-081-08

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

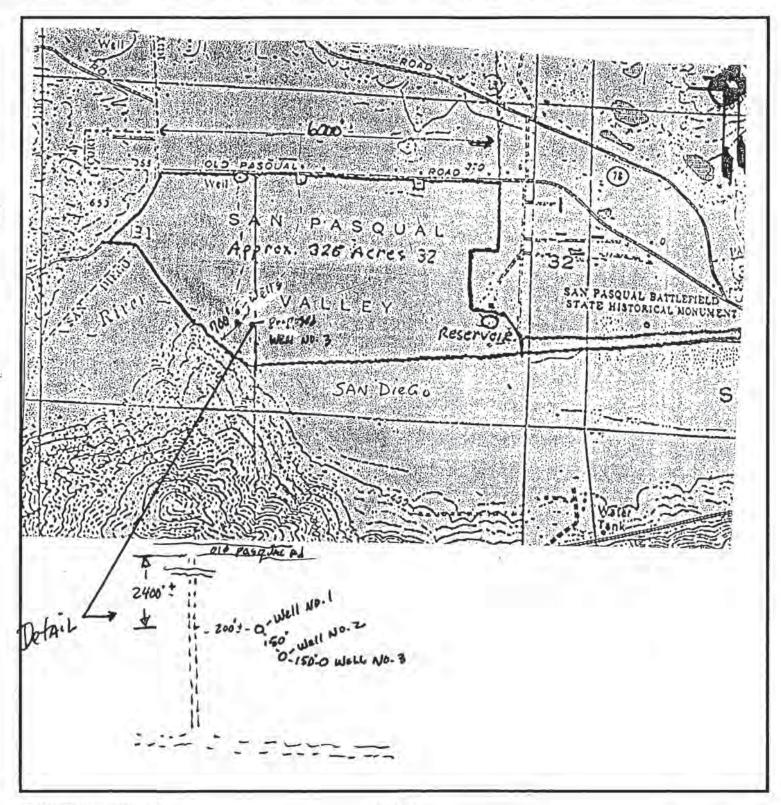
Date Inspected 1-9-14 Date Inspected 1-9-14 Comments Well Working PROPERLY Water Sample Taken? N33.09934 W117.02.1060	PROPOSED -> 00
SAN DALLEY DALE	Hw4 78

DEPARTMENT OF ENVIRONMENTAL HEALTH WELL PERMIT APPLICATION OWNER- City of SAN Dieg County of San Diego NATER DIST: Property Owner: AM- Sod Mailing Address 24/-100-31	901
2. Well Location - Assessors Parcel Number 241 - 100 - 31	97-887
2. Well Location - Assessors Parcel Number 241 - 100 - 31	97-887 2027
2. Well Location - Assessors Parcel Number 241 - 100 - 31	2027
2. Well Location - Assessors Parcel Number 24/-100-31	2027
15023 OLD SAN PASQUAL PH SAN DIEgo	
3. Well Contractor - Well Driller Company Name: Ain	Dp. 11.
12029 OLD CASTLE RD 1/AUGY CENTER	92062
Mailing Address City	Zip
Phone#: 760-749-070/ C-57#:328287	Bond Posted
4. Use: APrivate ☐ Public ☐ Industrial ☐ Cathodic ☐ Other AG-Well	•
5. Type of Work: ☐ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1	lst 🗆 2nd
6. Type of Equipment: Rofally	
7. Depth of Well: Proposed: /30' Existing:	0
8. Proposed:	
Casing Conductor Casing Filter/Filler Material Perfo	orations
Type: XYes □ No X Yes □ No	
	To: /30
Diameter 16 in. Diameter 24 in. Type: 5/16 X 16 From: Wall/Gauge: .6/16 Wall/Gauge: _ 250 Wall/Gauge: _ N/A From:	
9. Annular Seal: Depth: 20 ft. Sealing Material: CEMENT	- 4
Borehole diameter: 32 in Conductor diameter: 24 in Annular Thickness	
10. Date of Work: Start: SEPT. 2004 Complete: SEPT.	2004
On sites served by public water, contact the local water agency for meter protection require	ments
I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinance	
the County of San Diego and the State of California pertaining to well construction, repair, modification and de Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete a	
of the well. I accept responsibility for all work done as part of this permit and all work will be performed under	
supervision.	
Contractor's Signature: Au R. Qui Date: Aug- 3	31- 200
3 3000 777	1000
DISPOSITION OF APPLICATION (Department of Environmental Health Lies or	
DISPOSITION OF APPLICATION (Department of Environmental Health Use or	ıly)
Approved Denied Special Conditions: Grading and clearing associated with access	to, or the
construction, maintenance or destruction of water wells, may require additional permits from the	
San Diego and/or other agencies.	W. Marie A.
Specialist: 1/ Section Date: 9/1/0	4
DEH-LU-731a (Rev. 4/02) NCR Page 1 of 2	-

Control #: LWGL 16208
Assessor's Parcel Number: 241-160-31

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



	acta be			ï	w	41	lle	208		Kiva ent.	2/2/05	NY	F	le	24	1-100-31
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	Well No.	_				. End	ad a	10.15.0	.090	19563		LATITUDE	E	L	1	DNGITUDE
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	nit No	1620	19				The state of the same	Date 9-	1-04			1		NATESK	THER	
Consideration 1	330-1					LOC				The information			nas be	en blo		
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	FACE	METHOD		1	. (1	DESCI	RIPTION		1.00	IIIIOIIIIalioii I Ia	ictice Act o	1 1977, 10	protect	pers	oriai ii	normation.
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15	40						sand w	rith /	5 70.3	DEG.	MIN. SE	EFTCH	Long	DE		MIN. SEC.
4		sma.	11	bou	lde	ers				T	NORTH	- 11	12.5.	244	12	NEW WELL
40	69	Gres	, " A	111	W 4	and	-		- 2	1 014	PASPU	rt ald			MODIF	FICATION/REPAIR Deepen
7.0		11	7,		5 J 4	to/			3	4 40%	71	3		4.4		Other (Specity)
69	75	Coar	80	68	nd	- s	dae se	all gra	vel .	1		2		15		DESTROY (Describe
75	90	enh.	_			1	emente		/AX		. 24	,0		7		Procedures and Materials Under "GEOLOGIC LOG
13	30	-		, pa		Ly C	emente	u	7/47	B.	1 1				T	S(=) R SUPPLY
90	136	Fine	e to	0 0	BO	rse	sand w	ith sos	e e	.	4	WEST	3			Domestic Public irrigation Industria
		boul	de	rs						WEST	12000	wit.	10.0	EAS		MONITORING
Cor	pipleted	Well Co	netn	i kriti	on										CATHO	TEST WELL
Data	2/	2/05		uou	GHI			. 72		7.11	1 2	FR E	===			HEAT EXCHANGE
Date _	-	3/	-		-					/	2	- K	ed L			INJECTION
Date Inc	pected	-/	10	2.5				-		Ridge			1,4		VAI	POR EXTRACTION SPARGING
Comme	nts_						1 1	97		Illustrate or Descrip	be Distance of V	Vell from Roy	erle Builr	linas		REMEDIATION
	2									Fences, Ricers, etc. necessary. PLEASE	and attach a m BE ACCURA	ap. Use addu TE & COM	ional por	er if		OTHER (SPECIFY)
11	180	die	11	=	=			-			ER LEVEL					WELL
	ince	aur	5	-		\dashv				DEPTH TO FIRST	WATER _	N (Ft.) B	ELOW S	URFACE		
Vater S	imple Ta	icon?	1	V		1				WATER LEVEL_	c 36	(FL) & DAT	E MEASI	IRED _	10/	16/04
2.70			-	136						ESTIMATED YIELD						
TOTAL	EPTH OF	BORING	_		-	Feet)	(Feet)			* May not be re					(FL)	
tome o	-	I .	I		_					tras nos ac rep	TI TI	a activity por	1		on in the	0.6. 2.2.0.0.0.7
	PTH	BORE- HOLE	D	(PE)	(=)	1		CASING (S))	1		PTH	-	ANN		MATERIAL
		DIA. (Inches)	ž	N N	PUCTOR FILL PIPE	M	GRADE	INTERNAL	GAUGE OR WAL				CE-	BEN-		FILTER PACK
Ft t	n Ft.	(manasy)		SCR	S 1		CINDE.	(Inches)	THICKNES		Ft.	to FL	N 11.1 (3.2)	(=)	for home of	(TYPE/SIZE)
	20	32	X		1		eE1	23.5	.375		1	20	X			
78	138	24	X	X	+	-	F480 F480	15	.661	.125	20	136	-			11.8 : 25
	130	2.4	H	+	+	1	1400		1002	- 1123						
	ATTAC	HMENTE		1	1	2				CERTIFIC	CATION STA	TEMPSET	1			
		HMENTS	(=)	1			f, the und			nis report is compl	ete and accu	rate to the	best of	my kr	owled	ge and belief.
	Geologic Well Cor	s Log Instruction Di	iagran	n		- 11	NAME			& Pump Co	. Inc.	Vend 1				
-		sical Log(s)	Ü				(PE)	12029 C	CORPORATION)	(TYPED OR PRINTED)	lley Ce	nter.	Ca 9	2082		
10-	Soil/Wat	er Chemical					ADDRESS	-7	7						-	328/ZP
	▲ Other _ ADDITIONAL				YICT	_	Signed	115		ain						
ATTACH A		INFORKA III	JIV, IF			TIONA	C-5	LICENSED WAT		RACTOR T. CONSECUTIVE	V APPARE		HE SIGNE		- (C-57 LICENSE NUMBER



COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH WELL PERMIT APPLICATION

	DEH USE ONLY
PERM	IIT *WEL 18465
	COMPUTER #
FEE:	
WATE	R DIST:

1.	Property Owner: SAN PASQUAL VALLEY RANCH Phone: 743-2377
	2460 CLOVERDALE RD ESCONDINO 92007
2.	Well Location - Assessors Parcel Number 841-081-08 Site Address City Zip
3.	Well Contractor - Well Driller JOHN W. WARDEN Company Name: WARDEN DRILLI P.O. BOX 177 Mailing Address RAMON 92005 Zip
	Phone#:
4.5.6.	
7.	Depth of Well: Proposed: 200' Existing: 0
8.	Proposed:
9.	
10	Borehole diameter: 13 1/4" in. Conductor diameter: in. Annular Thickness 34 in. Date of Work: Start: 8-13-07 Complete: 8-16-07
Coi	On sites served by public water, contact the local water agency for meter protection requirements. I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision. Date: 8-13-07
	DISPOSITION OF APPLICATION (Department of Environmental Health Use only)
S	Approved Denied Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of an Diego and/or other agencies.
	pecialist:

Assessor's Parcel Number: 241-081-08

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

Date Inspected 1-9-14 Date Inspected 1-9-14 Comments Well Working PROPERLY Water Sample Taken? N33.09934 W117.02.1060	PROPOSED -> 00
SAN DALLEY DALE	Hw4 78

STATE OF CALIFORNIA

THE RESOURCES AGENCY Do not fill in

DEPARTMENT OF WATER RESOURCES WATER WELL DRILLERS REPORT

No. 341173

Notice of Intent No	State Well No
(1) OWNER: Name Bert Verger Dairy	(12) WELL LOG: Total depth 174 ft. Completed depth 174 ft.
Address 16777 Bandy Canyon Rd	from ft. to ft. Formation (Describe by color, character, size or material)
City Escondido, California ZIP 92025	0 - 40 fine to coarse sand
(2) LOCATION OF WELL (See instructions):	- To Title to coarse sand
(2) LOCATION OF WELL (See instructions): County — Owner's Well Number — Same Well address if different from above — Same	
1/5 TW 3/1	60 - 80 fine to coarse sand with some
Township Range approx Section N. Band Distance from cities roads, railroads, fences, etc. Cyn Rd Bridge (on Bandy Cyn Rd.)	y 60 - 80 fine to coarse sand with some gravel lenses
Cyn Rd Bridge (on Bandy Cyn Rd.)	graver letises
behind dairy	80 - 90 fine black silt
k	- 12.00.0011
(3) TYPE OF WORK:	90 - 105 fine to coarse sand with some
NEW Well Deepening Beconstruction	- small boulders
Reconstruction	- /
Reconditioning	105 123 sand and boulders
Horizontal Well	<u> </u>
Destruction (Describe destruction materials and pro-	123 - 155 partly cemented sand and
destruction materials and pro-	boulders
(4) PROPOSED USE:	
Domestic	155 164 fine to coarse sand with gravel
MOD Irrigation Industrial	Zian G. Amiri and S.
Man Andustrial	164 decomposed granite and
Month Industrial Test Well	boulders
Municipal	
Rd. BRIGE Other	
WELL LOCATION SKETCH (Describe)	
(5) EQUIPMENT: (6) GRAVEL RACK:	1/2- 52
Rotary X Reverse A Yes X No Size 5/16x	
Cable Air Diametex of bore 24	
Other Bucket Racked from 20 to 174 ft	
(7) CASING INSTALLED: (8) PERFORATIONS	
(7) CASING INSTALLED: (8) PERFORATIONS: Steel Plastic Concrete Stainless steeks screens	
	_
From To Dia Gage or From To Slot size	
	_
0 21 -24 .250 110 170 .060 0 176 12 375	
0 176 12 375	
(9) WELL SEAL:	_
Was surface sanitary seal provided? Yes No I If yes, to depth 20 ft.	_
Were strata sealed against pollution? Yes □ No ☑ Intervalft.	_
Method of sealingCemented	Work started 2/11/ 19 90
(10) WATER LEVELS:	WELL DRILLER'S STATEMENT:
Depth of first water, if knownft.	This well was drilled under my jurisdiction and this report is true to the
Standing level after well completion	best of my knowledge and belief
(11) WELL TESTS: Was well test made? YesM□ No □ If yes by whom? Same	Signed He Kan
Type of test Pump Bailer Air lift	(Well Driller)
Depth to water at start of test 35 ft. At end of test 90 ft.	(Person, firm, or corporation) (Typed or printed)
Discharge 700 gal/min after 6 hours Water temperature ukn	
Chemical analysis made? Yes No W If yes, by whom? Was electric log made Yes No W If yes, attach copy to this report	
Was electric log made Yes No If yes, attach copy to this report	License No. 328287 Date of this report 3/10/90

WELL PERMIT APPLICATION

wc#1785

APN 760-170-48

TYPE OF WORK (Check)		USE (Check)	EQUIPMENT (Check)
New Well	Individual Do	mestic	Rotary 🔀
Repair or Modification	Agricultural	Community	Cable Tool
Time Extension	Industrial	Other	Other
Destruction [
PROPOSED WELL DEPTH Max. 170 Min. 160 (Fe	eet) Type STEE	PROPOSED CASING Depth 160 Diameter 10	Wall or Gage . 375
PROPOSED SEALING ZON	VE(S)	SEALING MATERIAL	(Check)
From) Feet	Neat Cement Grout	Bentonite Clay
From to	Feet	Sand Cement Grout	Concrete
From to		Other-Specify:	
PROPOSED PERFORATIONS OR		A ST TO W	
From 120 to 13		DATE OF WOR	RK
		Start AUG-	1991
From to			1.11
From to		Completion Aug -	
Fromtoto	Feet	NAME OF WELL DRILLER JOE R. FA	
DISPOSITION OF APPLIERS IN APPROVED APPROVED WITH CONDITIONS Report Reason(s) for Denial or Neces I) Well To be anotalled To	DENIED DENIED Sessary Conditions He	BUSINESS ADDRESS 12029 Old CAST LICENSE NUMBER 328287 Cash Bond	Deposit Deposi
Tale water well stands	As Rallelin 74	1110	
	4		
1) This well will not their	The minimal	I hereby agree to comply with	h all regulations of the
standards of a public wa	ter supply neur	nances and laws of the Cour	nty of San Diego and of
and shall not be used as	a nurse of	the State of California pert	
water Dan user requiring	an approved pu	ately upon completion of w	
water supply.		Department of Health Service accurate log of the well.	es with a complete and
M - Jedgh		APPLICANT'S S	acci IGNATURE
8-19-91		Some a	leg - 7-91

DHS:EHP-731 (3/85)

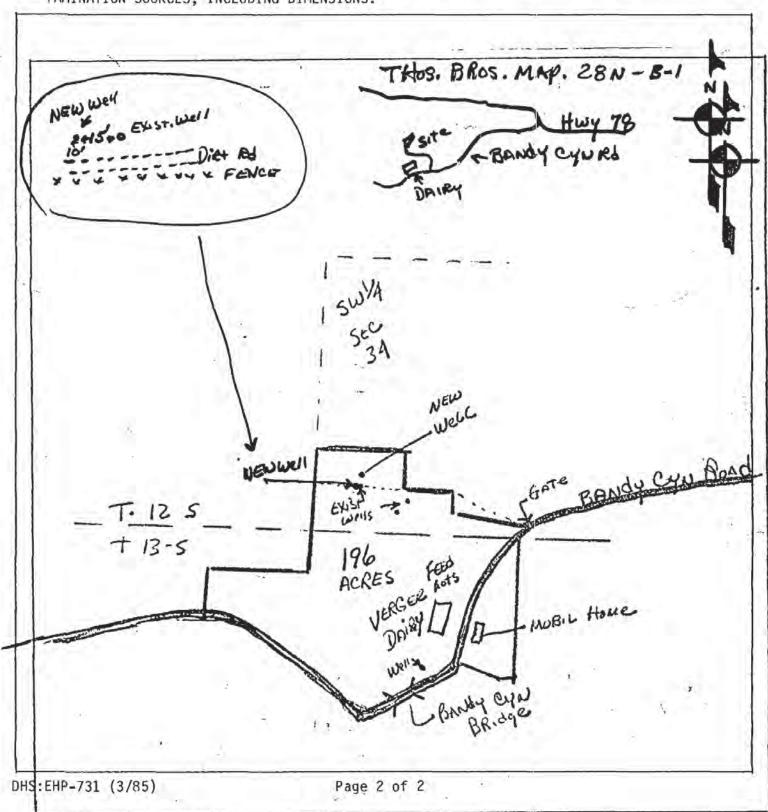
WELL PERMIT APPLICATION

Control # 6161888

Assessor's Parcel No. 760-170-48

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



WDR to 8

STATE OF CALIFORNIA

THE RESOURCES AGENCY

Do not fill in No. **353081**

QUADRUPLICATE
Use to comply with
local requirements

DWR 188 (REV. 12-86)

DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Notice of Intent No.	State Well No.
Local Permit No. or Date W6/888	Other Well No.
The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the	(12) WELL LOG: Total depth 160 ft. Completed depth 160 ft.
Information Practice Act of 1977, to protect personal information.	from ft. to ft. Formation (Describe by color, character, size or material)
(2) LOCATION OF WELL (See instructions):	Alluvial fill as follows:
County San Diego Owner's Well Number	
Well address if different from above Same	0 _ 35 Fine to coarse sand and silt
Township 12 S Range 1 W Section 36	_ Cirey color
Distance from cities, roads, railroads, fences, etc. Approx. 5 miles	72
South Hwy 76 off Bandy Cyn Rd. SW sec 34	35 45 Reddish clay and gravel
Thos Bros map 28N-8-1	- ^
	45 _ 75 fine to coarse sand with lense
5 Swift (3) TYPE OF WORK:	of clay and silt - dark grey
New Well Dx Deepening	_ (color)
(3) TYPE OF WORK: New Well 🔯 Deepening	- 1
Reconditioning	75 95 Partly cemented sand with
1 10 100 100 100 100 100 100 100 100 10	some boulders - dark grey
New Horizontal Well Destruction (Describe	Color V
destruction materials and pro- cedures in Item 12)	CH ME
cedures in Item 12)	95 135 The to coarse sand with small
196 (4) PROPOSED USE	> rocks and boulders
AC COLL Domestic	- 400 AUS
DA 17 Along Irrigation	135 6 160 fine to coasse sand - partly
Industrial 🗆	cemented - dark grey color
Test Well	1000
Note Con Municipal	00 110
RA BRIDGE Other	Completed Well Construction
WELL LOCATION SKETCH (Describe)	10 00 al
(5) EQUIPMENT: (6) CRAVEL RACK:	D- Date
Rotary 20 Reverse A Yes No Size 5 1763 4	(10 10 10 10 10 10 10 10 10 10 10 10 10
Cable Air Diameter of bore	Date Inspected _/O-28 9/
Other Bucket Ricked from 20 to 160 F	Comments ag. Well / enidence
(7) CASING INSTALLED: (8) PERFORATIONS. Steel X Plastic Type of perforation or size of serioes.) - of boundar Seal verified.
Steel A Plastic Soncease Type of perforation or size of series	
From To Dia Gage or French To Shot	Company of the Compan
ft. ft in Wall to the size	
0 21 18 .250 100 150 .060	Water Sample Taken?
0 160 10 375	Reviewed By M. Sedak
	THOMEWEODY TATE SECOND
(9) WELL SEAL:	
Was surface sanitary seal provided? Yes No 🗌 If yes, to depthft.	
Were strata sealed against pollution? Yes 🗋 No. Intervalft.	
Method of sealingC@mented	Work started 8/5/ 1994 Completed 8/13/ 19 91
(10) WATER LEVELS:	WELL DRILLER'S STATEMENT:
Depth of first water, if knownft_	This well-was drilled under my jurisdiction and this report is true to the
Standing level after well completionft.	best of my knowledge and belief.
(11) WELL TESTS:	Signed Signed
Was well test made? Yes No I If yes, by whom? Same Type of test Pump Bailer Air lift	(Well Driller)
Depth to water at start of test _85 ft. At end of test _150 ft.	NAME Fain Drilling & Pump (Co. Infined)
Discharge _800+ gal/min after _6 hours Water temperature ulcn	Address 12029 Old Castle Rd.
Chemical analysis made? Yes 🗆 No 11 yes, by whom?	City Valley Center, California ZIP 92082
Was electric log made Yes No 🔀 If yes, attach copy to this report	License No. 328287 Date of this report 8/23/91

JEH2016-LIVELL-001332

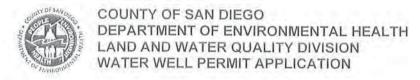


Specialist:

COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL BEAUTHOO LAND AND WATER QUALITY DIVISION WATER WELL PERMIT APPLICATION AR 28

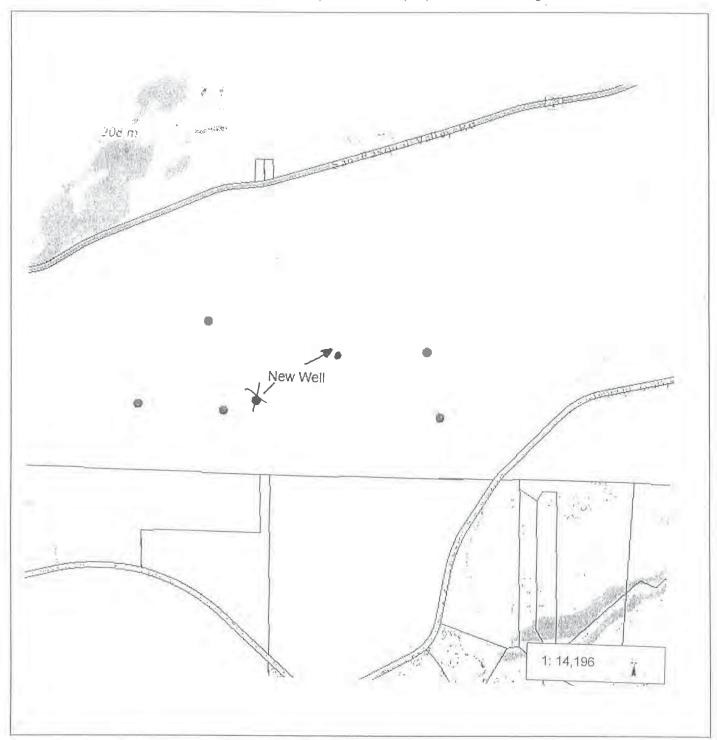
DEH U	DEH USE ONLY						
PERMIT#		- 54					
FEE: \$535	000						
WATER DIST:		-					

County of San Diego Dept. of Environmental Heal Land & Water Quality Div Property Owner: WHIMAU PAULL 1. M4H - 760-644-6887 Phone: Mailing Address: Po Rox City: Escaupino State: C4 Zip: 92025 2. Well Location - Assessors Parcel Number: _____ 760-170-48 GPS Coordinates: (WGS-84 Decimal Degrees): 33050177N Site Address: O Hwu 18 City: <u>CSCONDINO</u> State: CA. Zip: 92025 Well Contractor/Driller: _ DAVE WA 3. Company Name: JAN DELLING e 20. city: VALLEUCONER Mailing Address: 12029 State: CA C-57 License No: 328267 ☐ Cash Deposit Sond Posted Private Public Industrial Other: 5. Type of Work: New 🗆 Reconstruction 🗅 Destruction Time Extension: 1st 2nd Type of Equipment: Depth of Well: Proposed: Existing: 8: Proposed: Casing Conductor Casing Filter/Filler Material Perforations Type: 55/LCC ☑ Yes □ No Yes No From: (OOTo:) GO Depth: Depth: 20 From: 0 To: 160 Diameter: 12 in. Diameter: 24 in. Type: RAVCHO From: _____ To: Wall/Gauge: 375 Wall/Gauge: (250) Depth: 20 ft. 9. Annular Seal: Sealing Material: ____ CPWPU Borehole Diameter: 32 in. Conductor Diameter: 24 in. Annular Thickness: 4 in. 10: Best Management Plan for confining, well drilling waste on the project site provided? ¥ Yes □ No 11. Date of Work: On sites served by public water, contact the local water agency for meter protection requirements. I hereby agree to comply with all regulations of the Department of Environmental Health, and will all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well (well driller's report). I accept responsibility for all-work done as part of this permit and all work will be performed under my direct supervision. Contractor's Signature: DISPØSITION OF APPLICATION (Department of Environmental Health Use Only) Approved Denied Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies. artrus Ma



SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.







County of San Biego

STORMWATER & DISCHARGE MANAGEMENT PLAN FOR WATER WELLS

This form must be submitted with all Well Permit Applications

Department Use Only	
	Assessor's Parcel Number: 760 - 170 - 48
1	242-100-10
SECTION 1: Required Information from Contractor	or Consultant:
Longitude & Latitude: 1. Are there any watercourses or water bodies within 50 feet 2. Does the plat show the project boundaries? (A "detail inse 3. Does the plat show footprints of any existing structures an 4. Does the plat show locations where run-off may enter stor 5. Is grading required to access site or install well? 6. Does the project conform to the local grading ordinance? 7. Will drilling additives be used to drill the well? 8. Are the Best Management Practices attached to this perm SECTION 2. Best Management Practices	of the limits of soil disturbance? et is acceptable for a large parcel or lot.). ad facilities within 100 feet of the wellhead position? amdrains, drainage courses and/or receiving waters? The state of the limits of soil disturbance? The state of the wellhead position? The state of the wellhead position? The state of the wellhead position? The state of the limits of soil disturbance? The state of the limits of soil disturbance?
The goal of stomwater and discharge control management pollution to the maximum extent practicable using Best Materials, sediments, chemical residues such as drilling for property boundaries to eliminate transport from the site to nadjacent properties. It is the responsibility of the property be used in order to ensure that all contaminants are retained Examples of Best Management Practices to contain we installation of a sediment basin to contain run-off, using geo eliminating the use of drilling foam. (Website Information is a	Management Practices (BMPs). Construction related foam, wastes, and spills must be retained within the hearby streets; drainage courses, receiving waters and owner and the contractor to determine which BMPs will of on-site. If installation run-off include, but are not limited to obtaxtile fabric to contain sediments and drilling must, or
SECTION 3. Certification I have read and understand the following: (Please check early Selected BMP's will be implemented so that water quality of I am aware the selected BMP's must be installed, mainly effective. I understand that non-compliance with the San Diego enforcement actions by the County. These may include DEH inspectors and personnel from other regulatory agriculture for purposes associated with this well permit until such Should DEH determine during the field review that the Management Plan or the well permit explication, the wascivity will require a new permit see and amondment to Contractor Property Owner Reviewed by DEH Reviewed by DEH	talled, monitored and revised as necessary so they are County Watershed Protection Ordinance may result in sitines, citations, stop-work orders, or other actions. gencies are authorized to enter my property at any time time the well is completed to the satisfaction of DEH. The well installation procedures contradict this Discharge in drilling permit may be suspended or revoked. Further

	e Adobe Re ginal with		y be used to view	and complete this form	5	State of Cal	ifornia	1	lete, save		e a saved f NR Use On		Not Fill In
Owner's Date W	One Well Nur ork Began	03/29	332 /2016	Date Work E	N	o. e03062	on Repo	ort.		Sta	ate Well Nur	mber/S	ite Number Longitude
	ermit Ager			Permit Date 3/2	8/16				Li	T I	APN/I	RS/Ot	her
Citik	various 2			ogic Log	3/10					Wel	Owner		
Drilling	ientation Method D	irect Rot	CONTRACTOR OF THE PARTY OF THE		Fluid Ber	cify ntonite mud	public	viewing p	ursuar	grayed nt to sec	area has tion 1375	52 of	n blocked from the Water Code and ect personal
	t to F		Des	Description cribe material, grain size	e, color, et	c	informa		raotic	70 7 101 01	1077, 10	Piot	cot percenai
0	14		Grey Silty Sa					77.	550	Well	Location	1	
14	31			nd w/ Grey Clay				0 Hwy					24-2
31	46	-	Grey Clay	C1			City Es	scondido			Cou	inty S	San Diego
46 77	77 88	-	Course Grey	Sand			Latitude	Deg.	Min.	Con	N Longitu	ide _	Dea. Min. Sec.
88	127	\rightarrow	Grey Clay	Course Sand	-		Datum	Deq.					Long. 116.5831
127	129	_	Grey Clay & \				34						el 10
129	154		Compact Gre				Townsh			ge		Sect	
154	161								tion SI				Activity
161	167	Date	gandered \	Vell Construction	1		-	must be draw	n by hand North	after form is	printed.)	ON	lew Well Modification/Repair O Deepen
			Mul	prisent	5, h	use	Saloo		3			0	Other
		Con	VIa	generato	0			Destar 1		ar			Planned Uses
			fusi Mas	a seal			West	Dester	yeo	well	East		Vater Supply Domestic ☐Public Irrigation ☐Industria
		:Vale	W 116	197559°	el H	16	1				i	000	Cathodic Protection Dewatering Heat Exchange Injection
		Redi	ewed By		-		- Oev			> exc	is	OF	Monitoring Remediation Sparging
							Ilfustrate or o	describe distance nd attach a map. ccurate and con	South of well from Use addition	roads, building	gs, fences, cessary.	OV	est Well /apor Extraction Other
							P	Level and					
								o first wate				_	et below surface)
							Depth to Water L	Static evel 72		(Fee	et) Date	Measi	ured 04/05/2016
	Depth of B Depth of C		167 ed Well 165		Feet Feet		Test Le	ed Yield * ngth <u>10.0</u> of be repre		(Ho	M) Test urs) Total	Draw	down(Feet)
				Capinas			iviay no	v oe iebie	II .	e or a we			
Su	th from rface to Feet	Boreho Diamet	er Type	Casings Material	Wall Thicknes (Inches	Outside s Diameter (Inches)	Screen Type	Slot Size if Any (Inches)	S	oth from urface to Feet	Annula		Description
0	20	32	Conductor	Low Carbon Steel	.250	24			0	95	Cement		
0	95	24	Blank	Low Carbon Steel	.375	12.75		\$.T	0	167	Filter Pac	k	Rancho
95	155	24	Screen	304 Stainless Steel	.250	12.75	Wire Wrap	0.060					
_		A 44 c - 1	manta					Caldina.	los Cr	6		_	
	Geologic	_	ments	1. the u	ndersiane	d. certify th		Certificat				of my	knowledge and belief
	Well Con Geophys	struction ical Log		Name	Fain Dri	Iling & Pu	alo CoIncl		ey Cen		C	A	92082
1	Soil/Wate Other <u>S</u>	te Map		Signed	9	Address	Well Contractor	/	C	4/7/20 Date Si	16 3:	ale 28287	Zip



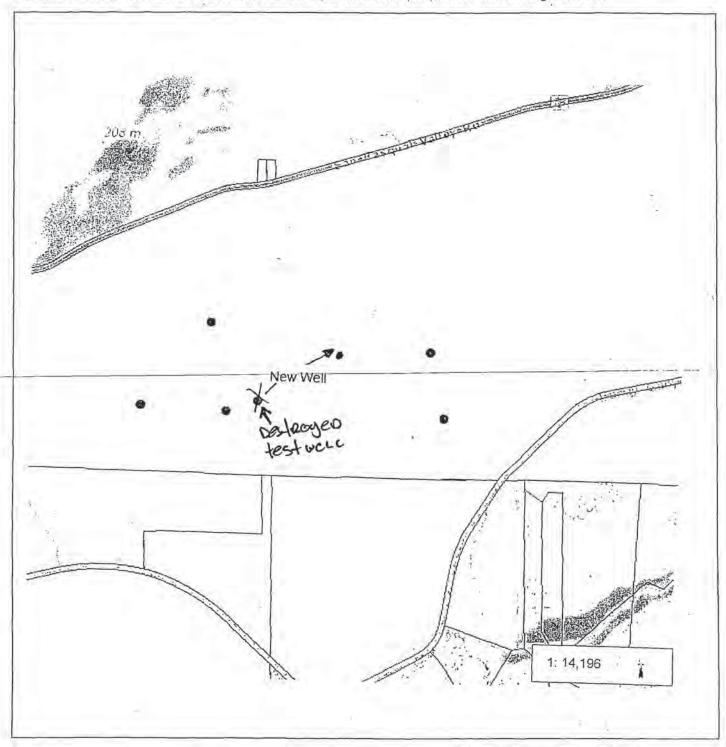
COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH LAND AND WATER QUALITY DIVISION WATER WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # _ LWELL - 601332

APN: _ 242 - 100 - (0)

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.





COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # 16216 WELL COMPUTER #

Property Owner: CHY OF San DIE	County of San Dieg	JO	10 07/10
Property Owner: UTY OF SUITE 1700	Py Environmental I	Woolsh - 11	1/1/17/100
12ND 3rd AID SUITE 1700		Phone:	14 00000
Totaling Atteress	Sand	rego	92101
Well Location - Assessors Parcel Number 276- C	4-001		2φ
16777 Bardy CVN Ra	ESCON	dido	92025
Well Contractor - Well Driller Art Widne A	Com	pany Name: Art	WIDWIDT
DA BOY 300497	ESCON	saido	92030
Phone#: 1(10) 7(49, 2(6,8))	C-57#: 5285 B	Cash Deposit	□ Bond Posted
Use: ☐ Private ☐ Public ☐ Industrial		1	ation
Type of Work:	☐ Destruction Tir	me Extension:	1 1st □ 2nd
Type of Equipment: RD+av			
Depth of Well: Proposed: 125'		Existing:	
Proposed:			
Type: Steel & Yes No Depth: 121 in. Diameter 24 in. Wall/Gauge: 250 Wall/Gauge: 25D Annular Seal: Depth: 22 ft. Sealing Mater	Xyes No From: O To: La Type: 4X8 Wall/Gauge: ial: CONCVET	25' From: 6 From: _ From: _	5 To:125 To: To:
Date of Work: Start: 9-13-04			less <u>9</u> in.
I hereby agree to comply with all regulations of the Departr the County of San Diego and the State of California pertai Immediately upon completion of work, I will furnish the Dep	ment of Environmental Hea ning to well construction, re partment of Environmental I	lth, and with all ordin epair, modification an Health with a comple will be performed und	ances and laws of d destruction. te and accurate log der my direct
	Well Contractor - Well Driller AV	Well Contractor - Well Driller Av	Well Contractor - Well Driller Art Widner Company Name: Art ESCANDID Phone#: 100 749 2008

Approved	☐ Denied	Special Condition	s: Grading and cl	earing assoc	ciated with access to	o, or the
					al permits from the	
San Diego and	l/or other ager	ncies.	. 6.3.73	74-7-7-9		
San Diego and	1/ Sen	ann		Date:	9/8/04	

DEH-LU-731a (Rev. 4/02) NCR

Page 1 of 2

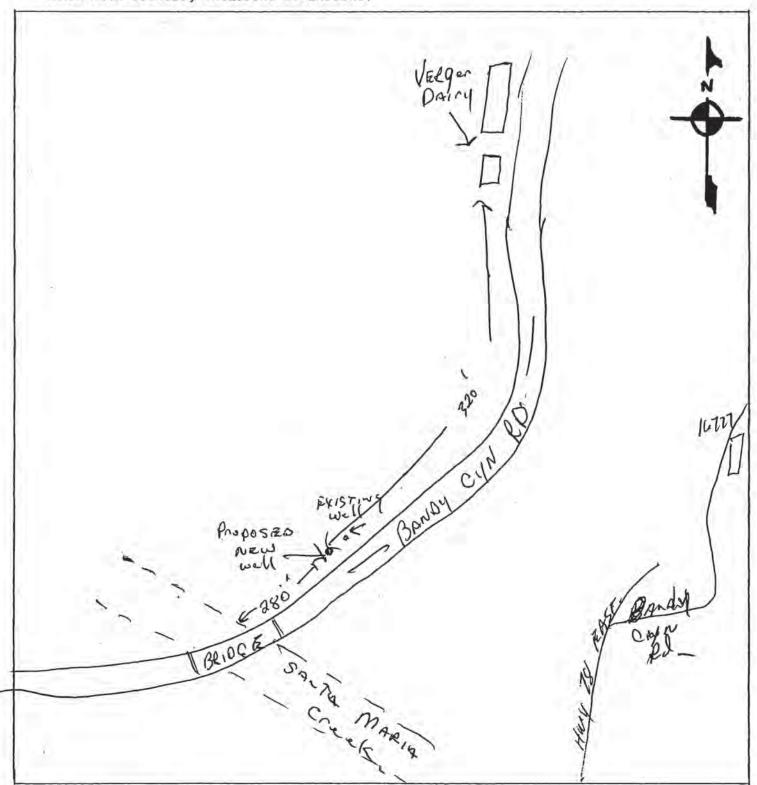
COUNTY OF SAN DIEGO WELL PERMIT APPLICATION DEPARTMENT OF HEALTH SERVICES

control #WEL 16216

Assessor's Parcel No. 276-09-00/

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CON-TAMINATION SOURCES, INCLUDING DIMENSIONS.



Page - Owner Date W	Permit Ag	WELL COMPLETI Refer to Instruction No. 741 9-8-04 PencSan Harcos	ON REPORT Pamphlet 2809	DWR USE ONLY — DO NOT FILL IN STATE WELL NO./STATION NO. LATITUDE LONGITUDE APN/TRS/OTHER
Per	rmit No	EL 16216 Permit Date 9-8-04		Alley Romand
DEP	TH FROM JRFACE		viewing pursuant to se Information Practice A	grayed area has been blocked from public oction 13752 of the Water Code and the ct of 1977, to protect personal information.
0	; 5	top soil sand	Address Samo as	WELL LOCATION—
6	17	sand, clay, boulders	City	
18	58	sand, clay, boulders	County	12
29	51	sand, clay, some boulders		age 040 Parcel 01-00
52		coarse gray sand&boulders	Township 13-s R	
111	120	granite	Latitude 33 OT	
e t	1		0 0	MODIFICATION/REPAIR

	H FROM RFAGE	METHOD MING TOCALY FLUID GITCOILES	Information Practice Act of 1977, to protect personal information.
Ft.	to FL	Describe material, grain size, color, etc.	The state of the s
0	5	top soil sand	Address Same as above
6	17	sand, clay, boulders	City
18	58	sand, clay, boulders	County
29	51	sand, clay, some boulders	APN Bool276 PageQ40 ParcelQ1-00
52	110	coarse gray sand&boulders	Township 13-s Range 1W Section 7
111	120	granite	Latitude 33 07545 Longitude IV- 97439
			Latitude 33 07545H Longitude 16 97439
A	1	3 - 1.955 - 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	LOCATION SKETCH ACTIVITY (\(\neq\)) -
	7		MODIFICATION/REPAIR
1		(6)	Roam Cual Deepen
-	1		— Other (Specify)
	1		KOAD / neerpov massing
1		The state of the s	DESTROY (Describe Procedures and Material Under "GEOLOGIC LOG
			DI ANNED HEER / -
	1		Unity Site - WATER SUPPLY
	1	1	- Domestic — Public Public Irrigation Industria
	1	ilia.	MONITORING
100		1 /	TEST WELL
	1	it.	CATHODIC PROTECTION
13	1	1	HEAT EXCHANGE
	1	1	HWY 78 DIRECT PUSH _
	4	I .	VAPOR EXTRACTION
		1	SPARGING
	1		SOUTH REMEDIATION
	1		Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Ricers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.
	1	The second second	
	J.	1	WATER LEVEL & YIELD OF COMPLETED WELL DEPTH TO FIRST WATER (Ft.) BELOW SURFACE
	î	Ava and a second a	DEPTH TO FIRST WATER (Ft.) BELOW SURFACE
	1		DEPTH OF STATIC 20 * WATER LEVEL
	1	NAT	ESTIMATED VIELD 1 (GPM) & TEST TYPE
TOTAL.	DEPTH OF	F BORING 120 (Feet)	TEST LENGTH (Hrs.) TOTAL DRAWDOWN (FL)
		F COMPLETED WELL 121 (Feet)	* May not be representative of a well's long-term yield.
			The state of the s

	EPTH	BORE-	L			ASING (S)			DEPTH FROM SURFACE		ANNULAR MATERIAL			
FHUM	SURFACE	HOLE DIA.	100	YPE (\		INTERNAL	GAUGE	SLOT SIZE			CE-	DCN	TY	TYPE
Ft.	to Ft.	(Inches)	BLANK	SCREEN CON: DUCTOR	MATERIAL / GRADE	DIAMETER (Inches)	OR WALL THICKNESS	IF ANY (Inches)	Ft.	to Ft.		BEN- TONITE	FILL	FILTER PACK (TYPE/SIZE)
)	22	32"	K	1 5	steel	24"	250	-	0	122	32			
)	152	24"	35		steel	10"	250			1				
52	1112	24"		K	et. stee	10"	250	.040		1			1	18 will
	1	-								1				
_	1			4			-			1			12.44	

— ATTACHMENTS (≤)		ON STATEMENT -						
0.0000000000000000000000000000000000000	I, the undersigned, certify that this report is complete ar	nd accurate to the best of my knowledge and belief.						
Geologic Log	Art Widner Drilling							
— Well Construction Diagram	NAME	NAME						
Geophysical Log(s)	P.O. BOX 300/197 Escondido ca 92030							
		Cd 32030						
DOMESTIC OF THE PARTY OF THE PA								
Soil/Water Chemical Analyses		CITY STATE 710						
Soll/Water Chemical Analyses Other	ADDRESS //	CITY 9-17-04 528518 ZIP						
		9-17-04 528518 ZIF						

STATE OF GALIFORNIA

WELL COMPLETION REPORT Refer to Instruction Promphlet

Owner's Well No. . Date Work Began 9-8-04 , Ended 9-15-04

No. 742809

Local Permit AgencySan Marcos Permit NoLWEL 16216

Pennit Date _

1	1 1	1.1			11	_1	
		STATE W	ELL NO	/STATIC	N NO.		
1	1-6-			-11	7.1	1	
	LATITUD	E		ro	NOITUD	E	Ξ

DEPT	H FROM	DRILLING mud rotary FLUIDbentonite DESCRIPTION	The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information
	to Ft.	Describe material, grain siza, color, etc.	WELL LOCATION
0_	5	top soil sand	Address same as above
6	17	sand, clay, boulders	City
18	28	sand, clay, boulders	County
29	51	sand, clay, some boulders	APN Book 276 Page 040 Parcel 01-00
52	110	coarse gray sand&boulders	Township 13-s Range 1w Section 7
111	120	granite	Latitude 33 01 VH SNORTH DEG. MIN. SEC. LOCATION SKETCH NORTH BALL CYN REW WELL MODIFICATION/REPAIR Deepen Other (Specify) Sithe MONITORING MONITORING MONITORING MONITORING MONITORING MEAT EXCHANGE CATHODIC PROTECTION HEAT EXCHANGE
			DIRECT PUBH INJECTION INJECTION VAPOR EXTRACTION VAPOR EXTRACTION SPARGING SPARGING PRIME OF Distance of Veil from Numbs, Buildings, Fonces, Ricers, atc. and attach o map. Use additional paper if increasing PLEASE BE ACCURATE & COMPLETE.
		BORING: 120' (Feet) COMPLETED WELL 112' (Feet)	WATER LEVEL & YIELD OF COMPLETED WELL DEPTH TO FIRST WATER UNKN (FI.) BELOW SURFACE DEPTH OF STATIC 20' WATER LEVEL (FI.) & DATE MEASURED

DEPTH	DODE.		C	ASING (S)			2	EPTH		ANNI	JLAR	MATERIAL	
ROM SURFACE	HOLE	TYPE (=)	W 10 10 10 10 10 10 10 10 10 10 10 10 10				FROM	FROM SURFACE		TYPE			
Ft. to Ft.	DIA. (Inches)	SCREEN CON DUCTOR		INTERNAL DIAMETER (Inches)	OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)	Ft.	to Ft	(\sigma CE-	TONITE	FILL (二)	FILTER PACK (TYPE/SIZE)	
22	32"	x	steel	24"	250		0	1 22	x	-1			
52	24"	x	steel	10"	250			i					
112	24"	x	st. stee	1 10"	250	.040	-	-				418 Will 1	
								+	1	-			
-21 1 2 2 4				E 5. E1				1	1				
ATTACH	IMENTS	(=)		I 9 . m.l		CERTIFICA	TION 5	TATEME	NT -	-			

Geologic Log

_ Other

Well Construction Diagram

Geophysical Log(s)

Soil/Water Chemical Analyses

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

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

NAME Art Widner Drilling

P.O. Box 300497 Escondido ca 92030

ADDRESS

9-17-04 528518 C-57 LICENSE NUMBER

STATE

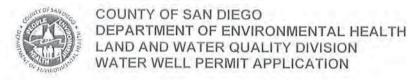
DEH2016-LWELL-001332



COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEACTH CO LAND AND WATER QUALITY DIVISION WATER WELL PERMIT APPLICATIONAR 28

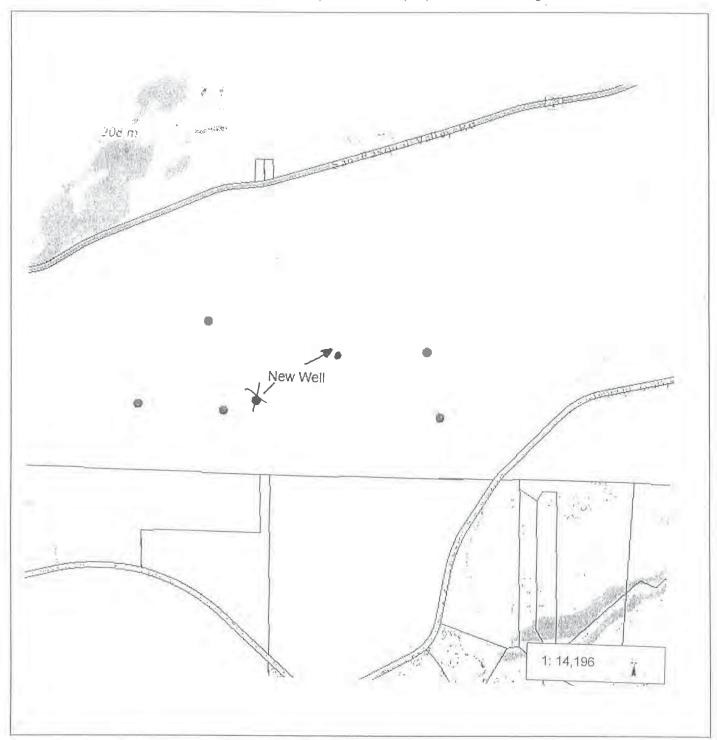
DE	H USE ONLY	T. C.
PERMIT #	٠.,	- 54
FEE: \$52	5.00	
WATER DIST:		

County of San Diego Dept. of Environmental Heal Land & Water Quality Div Property Owner: WHIMAN PAUL H Phone: W4H - 760-644-6887 1. Mailing Address: Po Rox City: ESCOUPIND State: C4 Zip: 92025 2. Well Location - Assessors Parcel Number: _____ 760-170-48 GPS Coordinates: (WGS-84 Decimal Degrees): 33050177N Site Address: O Hww 78 City: <u>CSCONDINO</u> State: CA. Zip: 92025 Well Contractor/Driller: _ DAVE WA 3. Company Name: JAN DAILING e 120. city: VALLEUCONER Mailing Address: 12029 State: CA C-57 License No: 328267 ☐ Cash Deposit Sond Posted Private Public Industrial Other: 5. Type of Work: New 🗆 Reconstruction 🗅 Destruction Time Extension: 1st 2nd Type of Equipment: Depth of Well: Proposed: Existing: 8: Proposed: Casing Conductor Casing Filter/Filler Material Perforations Type: 55/LCC ☑ Yes □ No Yes No From: (OOTo:) GO Depth: Depth: 20 From: 0 To: 160 Diameter: 12 in. Diameter: 24 in. Type: RAVCHO From: _____To: Wall/Gauge: 375 Wall/Gauge: 750 Depth: 20 ft. 9. Annular Seal: Sealing Material: CPWPU Borehole Diameter: 32 in. Conductor Diameter: 24 in. Annular Thickness: 4 in. 10: Best Management Plan for confining, well drilling waste on the project site provided? ¥ Yes □ No 11. Date of Work: On sites served by public water, contact the local water agency for meter protection requirements. I hereby agree to comply with all regulations of the Department of Environmental Health, and will all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well (well driller's report). I accept responsibility for all-work done as part of this permit and all work will be performed under my direct supervision. Contractor's Signature: DISPØSITION OF APPLICATION (Department of Environmental Health Use Only) Approved Denied Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies. artrus Mua Specialist:



SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.







County of San Biego

STORMWATER & DISCHARGE MANAGEMENT PLAN FOR WATER WELLS

This form must be submitted with all Well Permit Applications

Department Use Only	
	Assessor's Parcel Number: 760 - 170 - 48
1	242-100-10
SECTION 1: Required Information from Contractor	or Consultant:
Longitude & Latitude: 1. Are there any watercourses or water bodies within 50 feet 2. Does the plat show the project boundaries? (A "detail inse 3. Does the plat show footprints of any existing structures an 4. Does the plat show locations where run-off may enter stor 5. Is grading required to access site or install well? 6. Does the project conform to the local grading ordinance? 7. Will drilling additives be used to drill the well? 8. Are the Best Management Practices attached to this perm SECTION 2. Best Management Practices	of the limits of soil disturbance? et is acceptable for a large parcel or lot.). ad facilities within 100 feet of the wellhead position? amdrains, drainage courses and/or receiving waters? The state of the limits of soil disturbance? The state of the wellhead position? The state of the wellhead position? The state of the wellhead position? The state of the limits of soil disturbance? The state of the limits of soil disturbance?
The goal of stomwater and discharge control management pollution to the maximum extent practicable using Best Materials, sediments, chemical residues such as drilling for property boundaries to eliminate transport from the site to nadjacent properties. It is the responsibility of the property be used in order to ensure that all contaminants are retained Examples of Best Management Practices to contain we installation of a sediment basin to contain run-off, using geo eliminating the use of drilling foam. (Website Information is a	Management Practices (BMPs). Construction related foam, wastes, and spills must be retained within the hearby streets; drainage courses, receiving waters and owner and the contractor to determine which BMPs will of on-site. If installation run-off include, but are not limited to obtaxtile fabric to contain sediments and drilling must, or
SECTION 3. Certification I have read and understand the following: (Please check early Selected BMP's will be implemented so that water quality of I am aware the selected BMP's must be installed, mainly effective. I understand that non-compliance with the San Diego enforcement actions by the County. These may include DEH inspectors and personnel from other regulatory agriculture for purposes associated with this well permit until such Should DEH determine during the field review that the Management Plan or the well permit explication, the wascivity will require a new permit see and amondment to Contractor Property Owner Reviewed by DEH Reviewed by DEH	talled, monitored and revised as necessary so they are County Watershed Protection Ordinance may result in sitines, citations, stop-work orders, or other actions. gencies are authorized to enter my property at any time time the well is completed to the satisfaction of DEH. The well installation procedures contradict this Discharge in drilling permit may be suspended or revoked. Further

	e Adobe Re ginal with		y be used to view	and complete this form	5	State of Cal	ifornia	1	lete, save		e a saved f NR Use On		Not Fill In
Owner's Date W	One Well Nur ork Began	03/29	332 /2016	Date Work E	N	o. e03062	on Repo	ort.		Sta	ate Well Nur	mber/S	ite Number Longitude
	ermit Ager			Permit Date 3/2	8/16				Li	T I	APN/I	RS/Ot	her
Citik	various 2			ogic Log	3/10					Wel	Owner		
Drilling	ientation Method D	irect Rot	CONTRACTOR OF THE PARTY OF THE		Fluid Ber	cify ntonite mud	public	viewing p	ursuar	grayed nt to sec	area has tion 1375	52 of	n blocked from the Water Code and ect personal
	t to F		Des	Description cribe material, grain size	e, color, et	c	informa		raotic	70 7 101 01	1077, 10	Piot	cot percenai
0	14		Grey Silty Sa					77.	550	Well	Location	1	
14	31			nd w/ Grey Clay				0 Hwy					24-2
31	46	-	Grey Clay	C1			City Es	scondido			Cou	inty S	San Diego
46 77	77 88	-	Course Grey	Sand			Latitude	Deg.	Min.	Con	N Longitu	ide _	Dea. Min. Sec.
88	127	\rightarrow	Grey Clay	Course Sand	-		Datum	Deq.					Long. 116.5831
127	129	_	Grey Clay & \				34						el 10
129	154		Compact Gre				Townsh			ge		Sect	
154	161								tion SI				Activity
161	167	Date	gandered \	Vell Construction	1		-	must be draw	n by hand North	after form is	printed.)	ON	lew Well Modification/Repair O Deepen
			Mul	prisent	5, h	use	Saloo		3			0	Other
		Con	VIa	generato	0			Destar 1		ar			Planned Uses
			fusi Mas	a seal			West	Dester	yeo	well	East		Vater Supply Domestic ☐Public Irrigation ☐Industria
		:Vale	W 116	197559°	el H	16	1				i	000	Cathodic Protection Dewatering Heat Exchange Injection
		Redi	ewed By		-		- Oev			> exc	is	OF	Monitoring Remediation Sparging
							Ilfustrate or o	describe distance nd attach a map. ccurate and con	South of well from Use addition	roads, building	gs, fences, cessary.	OV	est Well /apor Extraction Other
							P	Level and					
								o first wate				_	et below surface)
							Depth to Water L	Static evel 72		(Fee	et) Date	Measi	ured 04/05/2016
	Depth of B Depth of C		167 ed Well 165		Feet Feet		Test Le	ed Yield * ngth <u>10.0</u> of be repre		(Ho	M) Test urs) Total	Draw	down(Feet)
				Capinas			iviay no	v oe iebie	II .	e or a we			
Su	th from rface to Feet	Boreho Diamet	er Type	Casings Material	Wall Thicknes (Inches	Outside s Diameter (Inches)	Screen Type	Slot Size if Any (Inches)	S	oth from urface to Feet	Annula		Description
0	20	32	Conductor	Low Carbon Steel	.250	24			0	95	Cement		
0	95	24	Blank	Low Carbon Steel	.375	12.75		\$.T	0	167	Filter Pac	k	Rancho
95	155	24	Screen	304 Stainless Steel	.250	12.75	Wire Wrap	0.060					
_		A 44 c - 1	manta					Caldina.	los Cr	6		_	
	Geologic	_	ments	1. the u	ndersiane	d. certify th		Certificat				of my	knowledge and belief
	Well Con Geophys	struction ical Log		Name	Fain Dri	Iling & Pu	alo CoIncl		ey Cen		C	A	92082
1	Soil/Wate Other <u>S</u>	te Map		Signed	9	Address	Well Contractor	/	C	4/7/20 Date Si	16 3:	ale 28287	Zip



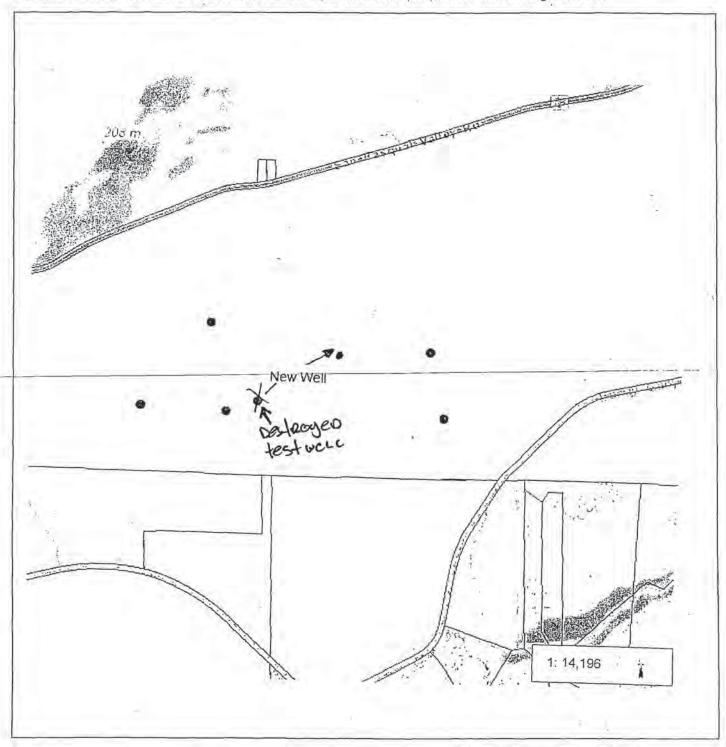
COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH LAND AND WATER QUALITY DIVISION WATER WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # _ LWELL - 601332

APN: _ 242 - 100 - (0)

SITE PLAN

Indicate below the vicinity and exact location of the well with respect to and including the following items: property lines, water bodies, water courses, drainage pattern, roads, existing wells, sewer laterals, septic systems, livestock enclosures, and other potential contamination sources. Please include lot dimensions, and please draw the plot plan to a standard engineers scale.



WELL PERMIT APPLICATION

wc#1785

APN 760-170-48

TYPE OF WORK (Check)		USE (Check)	EQUIPMENT (Check)
New Well	Individual Do	mestic	Rotary 🔀
Repair or Modification	Agricultural	Community	Cable Tool
Time Extension	Industrial	Other	Other
Destruction [
PROPOSED WELL DEPTH Max. 170 Min. 160 (Fe	eet) Type STEE	PROPOSED CASING Depth 160 Diameter 10	Wall or Gage . 375
PROPOSED SEALING ZON	VE(S)	SEALING MATERIAL	(Check)
From) Feet	Neat Cement Grout	Bentonite Clay
From to	Feet	Sand Cement Grout	Concrete
From to		Other-Specify:	
PROPOSED PERFORATIONS OR		A ST TO W	
From 120 to 13		DATE OF WOR	RK
		Start AUG-	1991
From to			1.11
From to		Completion Aug -	
Fromtoto	Feet	NAME OF WELL DRILLER JOE R. FA	
DISPOSITION OF APPLIERS IN APPROVED APPROVED WITH CONDITIONS Report Reason(s) for Denial or Neces I) Well To be anotalled To	DENIED DENIED Sessary Conditions He	BUSINESS ADDRESS 12029 Old CAST LICENSE NUMBER 328287 Cash Bond	Deposit Deposi
Tale water well stands	As Rallelin 74	1110	
	4		
1) This well will not their	The minimal	I hereby agree to comply with	h all regulations of the
standards of a public wa	ter supply neur	nances and laws of the Cour	nty of San Diego and of
and shall not be used as	a nurse of	the State of California pert	
water Dan user requiring	an approved pu	ately upon completion of w	
water supply.		Department of Health Service accurate log of the well.	es with a complete and
M - Jedgh		APPLICANT'S S	acci IGNATURE
8-19-91		Some a	leg - 7-91

DHS:EHP-731 (3/85)

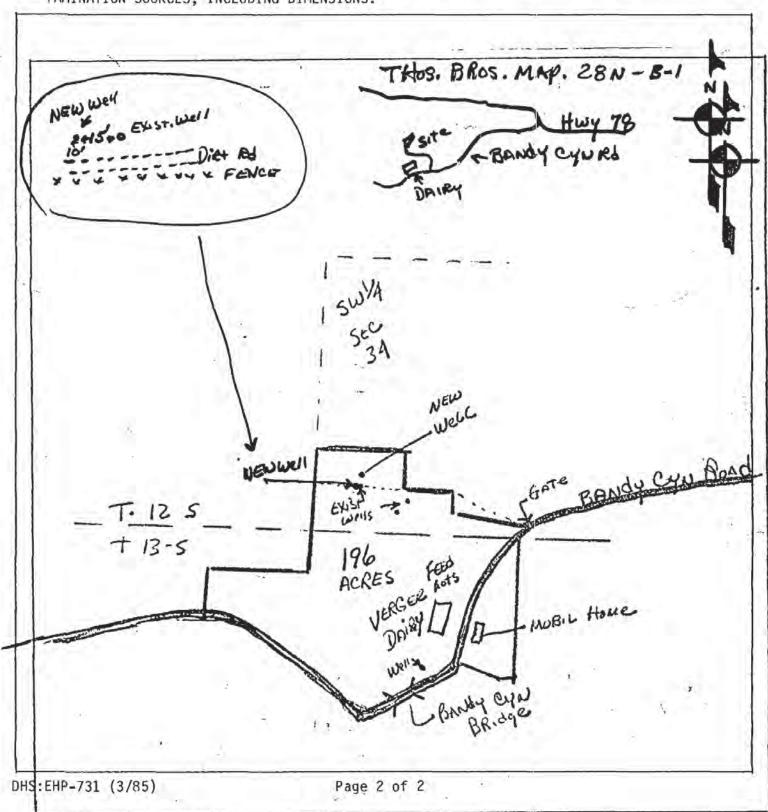
WELL PERMIT APPLICATION

Control # 6161888

Assessor's Parcel No. 760-170-48

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



WDR to 8

STATE OF CALIFORNIA

THE RESOURCES AGENCY

Do not fill in No. **353081**

QUADRUPLICATE
Use to comply with
local requirements

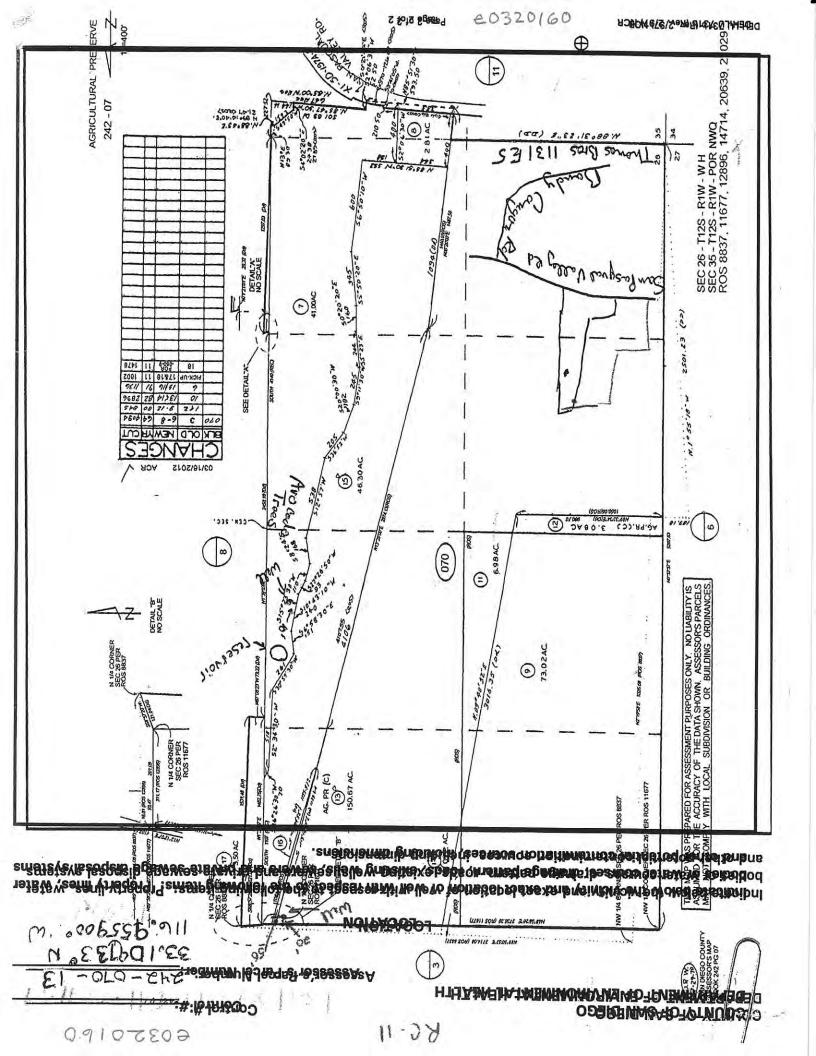
DWR 188 (REV. 12-86)

DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Notice of Intent No.	State Well No.
Local Permit No. or Date W6/888	Other Well No.
The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the	(12) WELL LOG: Total depth 160 ft. Completed depth 160 ft.
Information Practice Act of 1977, to protect personal information.	from ft. to ft. Formation (Describe by color, character, size or material)
(2) LOCATION OF WELL (See instructions):	Alluvial fill as follows:
County San Diego Owner's Well Number	
Well address if different from above Same	0 _ 35 Fine to coarse sand and silt
Township 12 S Range 1 W Section 36	_ Cirey color
Distance from cities, roads, railroads, fences, etc. Approx. 5 miles	72
South Hwy 76 off Bandy Cyn Rd. SW sec 34	35 45 Reddish clay and gravel
Thos Bros map 28N-8-1	- ^
	45 _ 75 fine to coarse sand with lense
5 Swift (3) TYPE OF WORK:	of clay and silt - dark grey
New Well Dx Deepening	_ (color)
(3) TYPE OF WORK: New Well 🔯 Deepening	- 1
Reconditioning	75 95 Partly cemented sand with
1 10 100 100 100 100 100 100 100 100 10	some boulders - dark grey
New Horizontal Well Destruction (Describe	Color V
destruction materials and pro- cedures in Item 12)	CH ME
cedures in Item 12)	95 135 The to coarse sand with small
196 (4) PROPOSED USE	> rocks and boulders
AC COLL Domestic	- 400 AUS
DA 17 Along Irrigation	135 6 160 fine to coasse sand - partly
Industrial 🗆	cemented - dark grey color
Test Well	1000
Note Con Municipal	00 110
RA BRIDGE Other	Completed Well Construction
WELL LOCATION SKETCH (Describe)	10 00 al
(5) EQUIPMENT: (6) CRAVEL RACK:	D- Date
Rotary 20 Reverse A Yes No Size 5 1763 4	(10 10 10 10 10 10 10 10 10 10 10 10 10
Cable Air Diameter of bore	Date Inspected _/O-28 9/
Other Bucket Ricked from 20 to 160 F	Comments ag. Well / enidence
(7) CASING INSTALLED: (8) PERFORATIONS. Steel X Plastic Type of perforation or size of serioes.) - of boundar Seal verified.
Steel A Plastic Soncease Type of perforation or size of series	
From To Dia Gage or French To Shot	Company of the Compan
ft. ft in Wall to the size	
0 21 18 .250 100 150 .060	Water Sample Taken?
0 160 10 375	Reviewed By M. Sedak
	THOMEWEODY TATE SECOND
(9) WELL SEAL:	
Was surface sanitary seal provided? Yes No 🗌 If yes, to depthft.	
Were strata sealed against pollution? Yes 🗋 No. Intervalft.	
Method of sealingC@mented	Work started 8/5/ 1994 Completed 8/13/ 19 91
(10) WATER LEVELS:	WELL DRILLER'S STATEMENT:
Depth of first water, if knownft_	This well-was drilled under my jurisdiction and this report is true to the
Standing level after well completionft.	best of my knowledge and belief.
(11) WELL TESTS:	Signed Signed
Was well test made? Yes No I If yes, by whom? Same Type of test Pump Bailer Air lift	(Well Driller)
Depth to water at start of test _85 ft. At end of test _150 ft.	NAME Fain Drilling & Pump (Co. Infined)
Discharge _800+ gal/min after _6 hours Water temperature ulcn	Address 12029 Old Castle Rd.
Chemical analysis made? Yes 🗆 No 11 yes, by whom?	City Valley Center, California ZIP 92082
Was electric log made Yes No 🔀 If yes, attach copy to this report	License No. 328287 Date of this report 8/23/91

*The free	Adobe Read	er may be used to view and com	plete this form. However, softw	are must be purchased to d	complete, save, and reuse a save	ed form.
	inal with D\			f California		Only - Do Not Fill In
Page 1		of 2	Well Comp	letion Report		
Owner's	Well Numb	of <u>2</u> er RK-11	Refer to Ins. No. e03	truction Pamphlet		Number/Site Number
		Control of the second	Date Work Ended 10/7/201		Latitude	Longitude
		County of San Diego				
Permit N	umber <u>LW</u>	EL 001137 Perm			AP	N/TRS/Other
		Geologic Lo			Well Own	er
1.27	entation Method Air	O Vertical O Horizontal Mud Rotary	OAngle Specify Drilling Fluid			
Depth	from Surf	ace	Description	-		
Feet 0	to Fee	Sand Describe mat	erial, grain size, color, etc			
20	90	D.G. Sand		470	Well Locati	
90	160	TEACH TRUE) and Brown Granite D.G		202San Pasqual Valley Ro	
160	225	B&W Granite	and brown Granite D.O	Only	ido (
225	250	Fractured B&W Gran	nite.	Latitude	eg. Min. Sec. N Long	gitude
250	260		ite and Brown Granite			Dec. Long. 116.955900
200	200	Water: 80 GPM	into and brown Granite		2 Page 070	
260	385	B&W Granite			S Range 1W	
385	390		nite Water: 100GPM Tot		ocation Sketch	Activity
390	415	B&W Granite Medi			drawn by hand after form is printed.)	New Well
415	420		nite Water: 120GPM Tot	al	North	O Modification/Repair
420	430	B&W Granite Medi				O Deepen O Other
430	440	B&W and Rose Gran				O Destroy
440	900	B&W Granite	200000000000000000000000000000000000000			Describe procedures and materials under "GEOLOGIC LOG"
900	940	Fractured B&W Gran	ite Medium Soft	Sin	attached	Planned Uses
940	1,050	B&W Granite		Sile	correct of	Water Supply
				t ti		Domestic Public
Jan.	2			West		Irrigation ☐ Industrial
-						O Cathodic Protection
						O Dewatering O Heat Exchange
						O Injection
						O Monitoring
		-				O Remediation
						O Sparging
				3 7	South	O Test Well
				Illustrate or describe di	istance of well from roads, buildings, fences, a map. Use additional paper if necessary.	O Vapor Extraction O Other
				Please be accurate ar	nd complete.	
					and Yield of Completed	
				Depth to first v	water <u>250</u> c	(Feet below surface)
_				Water Level	136 (Feet) Da	te Measured 10/08/2015
Total D	epth of Bor	ing 1050	Feet	Estimated Yie		st Type <u>Air Lift</u>
Total D	epth of Co	npleted Well 1050	Feet		(Hours) To	
-				"May not be re	epresentative of a well's long	
Denti	n from E	orehole	asings Wall Out	side Screen Slot		ular Material
Sur	face [liameter Type M	Thickness Diar	neter Type if A	Any Surface	Fill Description
0	F	and the second s	(Inches) (Inches) (Inches) (Inches)	hes) (Inch	nes) Feet to Feet 0 127 Ceme	nt
	1					
		ttachments			ication Statement	
	Geologic L	og ruction Diagram	Name Stehly Brothe	rs Drilling, Inc.	mplete and accurate to the b	est of my knowledge and belief
	ovell Const Geophysica	[일 : [] [] [] [] [] [] [] [] [] [Person Firm or	Corporation	Valley Center	CA 00000
		Chemical Analyses	13268 McNally Roa	eu _	Valley Center City	<u>CA</u> 92082 State Zip
7	Other Loc	ation Sketch	Signed Caul	JULY,	08/16/2016	709686
7	litional informat	on, if it exists.	C-57 Licensed	Nater Well Contractor	Date Signed	C-57 License Number

AUG 2 2 2016



ORIGINAL File with DWR	STATE OF CALI WELL COMPLET		DWR USE OF	NLY — DO NOT FILL IN —
Page _1_ of _1_	Refer to Instruction	n Pamphles	STAT	E WELL NO./STATION NO.
Owner's Well No.	No. 4	85441		
Date Work Began			LATITUDE	LONGITUDE
Permit No	ency S. D. County Health Dept W61867			APN/TRS/OTHER
7 01.1116 170.	W61867 Permit Date 7-29 9	1	WELL OWN	ER
	X VERTICAL HORIZONTAL ANGLE (SPECIFY)		an Ranch	
DEPTH FROM	DEPTH TO FIRST WATERUKnfft.) BELOW SURFACE	Mailing Address	O. Box 1959	
SURFACE Ft. to Ft.	DESCRIPTION	Escondic	do, California	92025 STATE ZIP
1	Describe material, grain size, color, etc.		WELL LOCAT	ION
33	Alluvial fill as follows: fine	Address 18118	Bandy Canyon	Rd
	grained sand and silt brown color	County San Di	ego	***************************************
<u> </u>	1	APN Book 760	Page 170 Parce	el38
35 70	Fine to coarse sand - brown color	Township 12 S	Range 1 W Section	on
	with lenses of grey silt	Latitude	NORTH Long	itude <u>ves</u>
70 115	Cino to	LOCAT	TION SKETCH —	ACTIVITY (∠)
70 113	Fine to coarse sand with some boulders		NORTH	X NEW WELL
<u> </u>	bodiaers			MODIFICATION/REPAIR Despen
115 165	coarse sand with lenses of gravel		10 0	Other (Specify)
	and some boulders - grey color	HW4-1		,,
4.0		SEI CE	Well 34/200	DESTROY (Describe Procedures and Materia
165 180	Fine to coarse sand with some	L YSAB-	WIN FILE	Under "GEOLOGIC LOG
	boulders - partly cemented	WEST	عنست	SY (土) MONITORING
	grey color	Í /	- Ol	WATER SUPPLY
180 195	Hard decomposed granite	BANdy LY	N NO	Domestic
	granic	Sandy "	•	Public
-		10r. 1		X. Irrigation
				Industrial
				"TEST WELL"
1		Illustrate or Describe D	SOUTH ————————————————————————————————————	CATHODIC PROTEING TION OTHER (Specify)
		such as Roads, Building PLEASE BE ACCURA	s, Fences, Rivers, etc.	
		DRILLING D	_	
1 1		METHOD KOA	UDY . BITTED OF	FLUID <u>Gel</u> COMPLETED WELL —
		DEPTH OF STATIC 48		EASURED 7-29-91
			1500 (GPM) & TEST	
TOTAL DEPTH OF I	• • • •		(Hrs.) TOTAL DRAWDOW	
TOTAL DEPTH OF (COMPLETED WELL 195 (Feet)	* May not be representa	tive of a well's long-term	ı yield.
DEPTH	CASING(S)			ANNULAR MATERIAL
FROM SURFACE	BORE- HOLE TYPE (∠)		DEPTH FROM SURFACE	TYPE
Ft. to Ft.	DIA. (Inches) B S S S S S S S S S S S S S S S S S S	LL IF ANY	CE-	BEN- TONITE FILL -FILTER PACK
	B S S THICKNE	SS (Inches)	Ft. to Ft. (∠)	TYPE/SIZE)
0 21	36" X A-120 23.5 .25	50	0 20 X	
0 100	24" X A-120 12 .375		20 195	X 5/16x4
100 180 180 195	24" X SS 304 12 .250	- 060		
104 193	24 A-120 12 375			
ATTACH	MENTS (∠)	- CERTIFICATIO		
Geologic			and accurate to the be	st of my knowledge and belief.
1	truction Diagram NAME Fain Drillin (PERSON, FIRM, OR CORPORATION)	OYPED OR PRINTED)	Inc.	
Geophysic	cai Log(s)		la.a. C	
Other	ADDRESS ADDRESS	Castle Rd. Val	ley Center, C	a 92982 zr
	NFORMATION. IF IT EXISTS. Signed WELL ORILLER/AUTHORIZED REPRE	then		0/01
DWR 188 REV. 7-90	IF ADDITIONAL SPACE IS NEEDED USE NEXT		DATY SKIN	257 GOERBE BUMBER

PARTMENT OF HEALTH SERVICES	AFLICATION SAN O	PN 242-070-6
New Well Repair or Modification Time Extension Destruction	USE (Check) Individual Domestic X Agricultural Community Industrial Other	Rotary Cable Tool Other
PROPOSED WELL DEPTH Max. 100 Min. 80 (Feet)	F480 PROPOSED CASING Type Puc Depth 100' Diameter 5"	.25
PROPOSED SEALING ZONE(S) From	Feet Sand Cement Grout Feet Other-Specify: DATE OF WO Feet Start Dec - 9-9	Bentonite Clay Concrete Concrete
NAME OF WELL OWNER 714. RON HANSEN - ROCKWOOD LOCATION OF WELL HWY 78 - SAN PASQUAL VLy RO	COMPANY	749-0701 Pump Co. INC.
DISPOSITION OF APPLICATION (FOR MEALTH OFFICERS USE ONL) APPROVED APPROVED WITH CONDITIONS Report Reason(s) for Denial or Necessary	12029 dd CAST/e DENIED LICENSE NUMBER 328287 Cash Bond	Deposit
Contact the local water age meter protection requirement the source for figh a Lin recommended that a 50 ft. * Final Pending on approved to	I hereby agree to comply with Department of Health Service nances and laws of the Cou	ces and with all ordinty of San Diego and oraining to well constructed destruction. Immeditork I will furnish the
M. Sedghine HEALTH OFFICER 12-7-94 DATE	APPLICANT'S S	I GNATURE

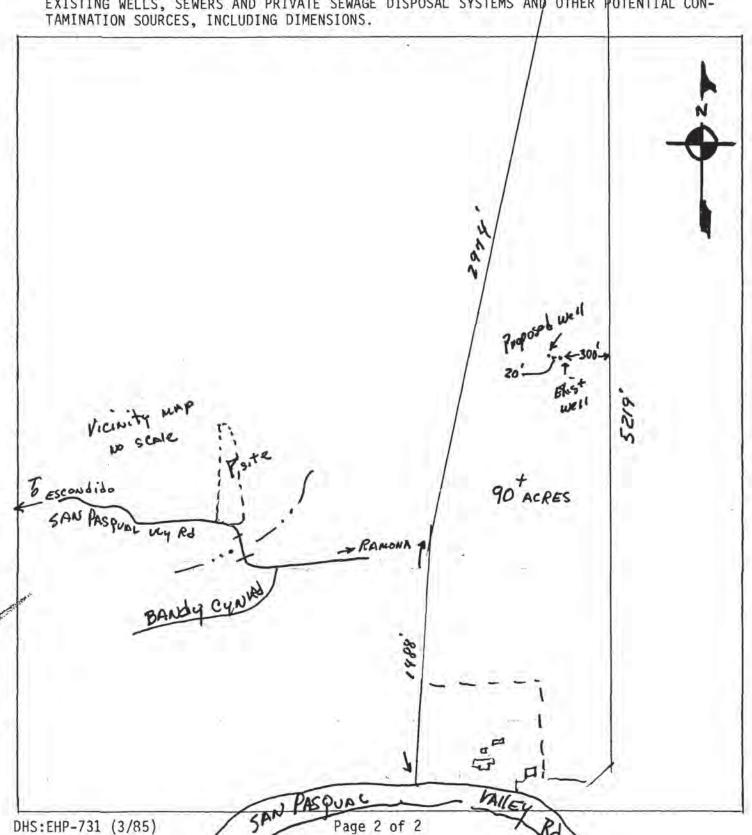
WELL PERMIT APPLICATION

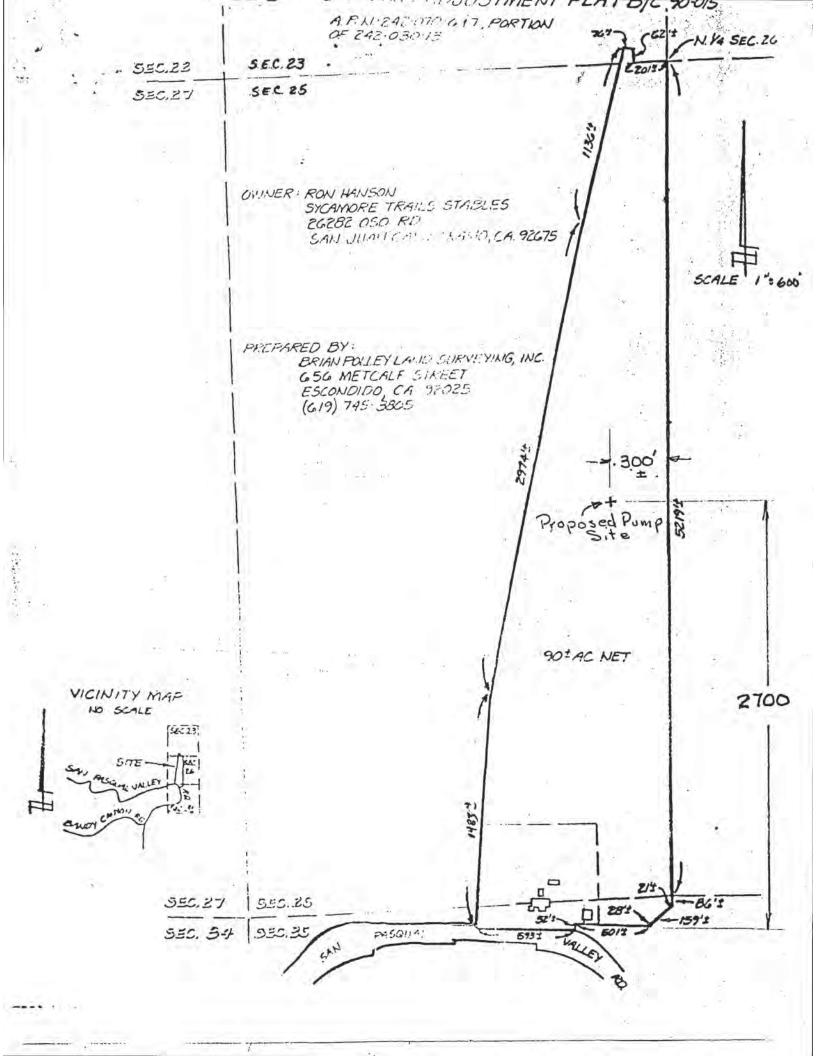
Control # W62874

LOCATION

Assessor's Parce No. 242-070-

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.





ige	of	irement	4	18-95		ustruction Pa	M REPORT		, É	STATE	WELL	VO./ST/	ATION NO.
and the second	Veil No.	Thru	00	W 1.1	. N	° 463	3662		LATITUDE	1		-1-	ONGITUDE
Lead D	k Began	ency 12-	14-94	_ , Ended	12-19-9		4	DI	1 14	1. 1	T		l l l l l
Perm	nit No	ency-	Enviro	nmental He					1 12	1 1	APN/TE	RS/OTH	ER
0.101		41628	Moroci	C LOG -	1 500 11 500	12-7-	Q4 _ C	in this grow	WELL (WNE	R —	blook	ed from public
RIENTAT	ON (Z)	4.0		HORIZONTAL		SPECIFY) vie	wing pursuan						
DEPTH	FROM	DEPTH		ATER(Ft									al information.
Ft. 10	ACE	1		DESCR AO TION maierial, grain size,			he information	n in	Sula car	ו או היי לעולי	in t	nis gr	
1	7.0		Describe	mistrary gravit stary	11/2	A.	ldress	w	ELL LO	OCAT)	10'	o hoo	hoon
0	45	ally	vial si	ll as foll	OULS 1			Same	2)				
				d, sand an	d silt	110	ounty						
-		dark	brown	color	- 1		PN BookS	an Pojeg	0	Parce	-	2 7	
45	74	Line	to con	rse sand -	nantfu	The second secon	00	Range	201			25	
43				brown colo		Lia Lia		MIN. SEC.		Longi	tude_	DEG.	MIN. SEC.
		11/11	780		· · ·	3	LOC	NORTH	KETCH				CTIVITY (≤)
74	116			rse sand w					*		· I		FICATION/REPAIR
				- partly	cemente	d						17	Deepen
- 1	-15	brow	n to gr	ey color	Nove -				1		1	ll s	Other (Specify)
			1	3100		V/F	26. Sec.	4	4				The second secon
	1, 6	1	- 21 L	T	VI MALLON CONTRACTOR	1 1	GLOVE					100	DESTROY (Describe Procedures and Materi Under "GEOLOGIC LO
		C	impleted '	Well Construc	tion	15	O.S.		-5-		15	nr.	ANNED USE(S
		Date _	5-4-	95		× ES	· # 200	mm3 e	, ,		EAST	-	_ MONITORING
	-					+	4.	4	100	9	F	WATE	R SUPPLY
		Date In	spected .	5-3-93		5	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	21.33	0.	4			* Domestic
i		Comm	ents F.	inal Pende	ing an				-10.5	4	de	1	Public
		Victoria de la composición dela composición de la composición de la composición de la composición dela composición dela composición dela composición de la c	coved o	water Do	Jole .			*	11	0			Industrial
					1		OSAME		. 6		-	1	"TEST WELL"
							-	- SOUTH			-	1 =	CATHODIC PROTE
- 1			. 7. 24. 7	. (-	1	\$1	llustrate or Describ uch as Roads, Buil	lings, Fences,	Rivers, et	C.	marks	-	OTHER (Specify)
		Water	Sample Ta	aken? N.C			LEASE BE ACC	URATE & C	OMPLET	Е.		10	
	133	Review	ed By	m. Sodal	-		THOD WATER	ahu			FLUID .		Gol
						DE	DTH OF STATIC						
	_			_		W	TER LEVEL	29	(Ft.) & D.	ATE ME	ASURE	D -1	2-17-94
OTAL D	EPTH OF	BORING	116	Feet)		TE	TIMATED YIELD ST LENGTH	50+ (Hrs.) TO	(GPM) &	WDOW	N 7	a	ittift
OTAL D	EPTH OF	COMPLETE	ED WELL	116 (Feet)		*/	May not be repres	entative of a	well's lon	ig-term	yield.		
	De				CASING(S)						ANNI	LAR	MATERIAL
FROM S		BORE- HOLE	TYPE (∠)			TEXANGE IN		FROM SL				20.00.00	/PE
77.74	7.7	DIA. (Inches)	BLANK SCREEN CON- DUCTOR	MATERIAL/ GRADE	DIAMETER	GAUGE OR WALL	SLOT SIZE IF ANY			CE-	BEN- TONITE	FILL	FILTER PACK
Ft. to	Ft.	150000	SCR SCR	a moe	(Inches)	THICKNESS	(Inches)	Ft. to	F1.	(三)	(∠)		(TYPE/SIZE)
	20	14	×	A-53		.188	11	0	20	X		1	
0	56	10	X	F480	5	.250		20	115	*	-		Pea Gravel
0		10	X	F480	5	.250		- 1	3367				5/16×7
0	116										1		
0 0 - 56	116			- X			Tare	A.		- 1		1	
0 0 - 56	116	<i>i</i>			Ib. make d	1 7 7 7 7 7 7 7 7	CERTIFICAT					W. 172	Malle van
. PT 18	38 × 11	IMENTS	(=)	0.00		ruly that this	report is comple	ere and acc	urate to t	ne bes	st of m	Know	ledge and belief.
. PT 18	38 × 11		(2)	I, the und	ersigned, ce								
. PT 18	ATTACI Geologic Well Con	Log struction Dia				Bleing, 8v	RumpinGo, T	nc.	-		-		
. PT 18	ATTACI Geologic Well Con Geophys	Log struction Dia ical Log(s)	gram	NAME (PER	airm Ori								
. PT 18	ATTACI Geologic Well Con Geophys	Log struction Dia ical Log(s) er Chemical	gram	NAME (PER	airm Ori		Rump Co 1 Rd. Vall		ter, C	a 92	2082	STATE	ZIP
. PT 18	ATTACH Geologic Well Con Geophys Soil/Wal	Log struction Dia ical Log(s)	gram	NAME (PER	airm Ori				tery (a 91	2082	STATE	ZIP

WELL PERMIT

WC#5915 APN 242 070 1300

atrois A

TYPE OF WORK (Check)		/ USE ¹ (Check)	EQUIPMENT (Check)
New Well	Individual Dome	estic	Rotary 🔀
Repair or Modification	Agricultural		Cable Tool
Time Extension	Industrial	Other	Other
Destruction		EXISTING WELL	_ Cilier
	AND INTEREST		
PROPOSED WELL DEPTH	0 -1	PROPOSED CASING	
Max. /000 Min. /50 (Feet)	Type STEEL	Depth /(a) Diameter /0	_ Wall or Gage 250
PROPOSED SEALING ZONE(S)		SEALING MATERIAL	(Check)
From 0 to 20	Feet	Neat Cement Grout	Bentonite Clay
From to	Feet	Sand Cement Grout	Concrete
Fromto	Feet	Other-Specify:	
PROPOSED PERFORATIONS OR SCR	.a.7		
		DATE OF WO	RK
From None. to	Feet	0 15 0 /	37
From to	Feet	Start 3.25-91	
From to	Feet	Completion 4-1-9/	
From to	Feet		
NAME OF WELL OWNER 745-45	948 call	NAME OF WELL DRILLER	
Bay Willahoent T	Gatunlacky	Art Widner	
LOCATION OF WELL	a d	COMPANY.	
17204 San Pasaval Valle	IRI	Hillen Valley Pun	PCOMP
ESCONDIOD CD	yiv.		
DISPOSITION OF APPLICATI		BUSINESS ADDRESS Alley Ce	nter Ro DC
(FOR HEALTH OFFICERS USE O		LIGHT MINNER	
APPROVED	DENIED	LICENSE NUMBER	Deposit 🔽
APPROVED WITH CONDITIONS		70/22	Posted
	u Candidiana Hana	180	
Report Reason(s) for Denial or Necessar 1. WOLL IS to be december	d per	Fee sald on DC	-21-91
Dulletin 74-81		- MRO	
	not meet		
the minimal standard			
not be used as a source	and shall	I hereby agree to comply with Department of Health Servi	
tor, usos reguiring a		d nances and laws of the Cou	nty of San Diego and of
- public unter supply	1	the State of California pert tion, repair, modification a	
		ately upon completion of w	ork I will furnish the
		Department of Health Service accurate log of the well.	es with a complete and
		Section 10g of The worth	
9	1	1201 1111	1
EUG MA	u	Cutt / Who	
HEALTH OFFICER		APPLICANT'S S	IGNATURE
3-25-91		3-21-9/	- A-
DATE		DATE	

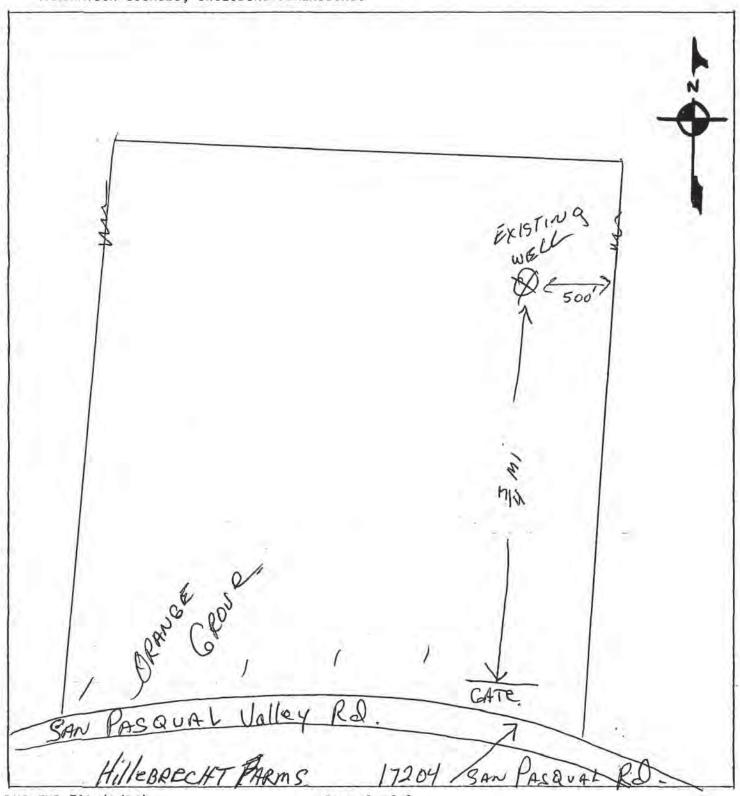
WELL PERMIT APPLICATION

Control # 66/6/5

LOCATION

Assessor's Parcel No. 242-070-1300

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



DHS:EHP-731 (3/85)

Page 2 of 2

FIRST CARBON COPY

WDR +0 500 A/29/91 Tob COUNTY OF SAN DIEGO DEPARTMENT OF HEALTH SERVICES 1700 PACIFIC HIGHWAY, SAN DIEGO, CA 92101-2417

242-070 - 13

lotion of Important	Na. or C	L was	طلعال	15 (INS	ERT under C	RIGINAL	AGE w/c	rbon of S	State Form) Other Well No.	
ursuant to	section	13752	of the Wat		ocked from p ad the Information.		(12) V	. 10	G: Total depth 638 ft. Depth of completed well 638 ft. Formation (Describe by color, character, size or materi	81)
			·				-	- 140		10
21 LOCA	TION O	FWEL	L (See inc	ructions):				- 149		
County	San	Dieg	0		Well Number	51	149	- 167		
Well address	If differe	me from	above	Va	lley Rd		117.1		hard granite	
Township_	1W		Range		_ Section	26	167	- 200		
Distance fro	m cities,	roads, n	ullroads, fer	CM, FCC				7.	170, 174, 183, 188, 193, 19	4
No.		M		March 1			200	- 240		
								-	colored rock.	_
-							240	- 275		_
	DI	EPARTA	MENT USE	ONLY	(3) TYPE	OF WORK:	275	- 278		_
Completed	Well Con	struction	n:	12 2 3	New Well C	Deepening	278	3.0:0		_
				30	Reconstruc	tion			clay at 289'	_
Datos	7	- 01	01		Recondition	ning	300	- 378		S,
Data Insper	cod_C	7-7	71		Horizontal	Well			grey clay layer at 377'.	
Comments	CIPA	model	is to	or .		□ (Describe			picked up 250 gpm in frac -	_
			1		destruction	in Item (12	378	- 490	at 377' hard B & W, fracs at 423',	
doop	MIN	9 On	114		and the second second	SED USE:	1 570	450		_
Weter Sen	No Taken	, 1	10		Domestic		D 100	- 491	449', 474'.	m 1
HEUST SMIT	ha take				Irrigation		190	-		
Senioriag'	& Approgra	el: 9	in		Industrial		0 491	- 63		53
	DU L	1.16	our		- Test Well				568, 575 Picked up 205 gp at 575'. More fracs at 582	m
		F. F.			Stock				610, hard B & W to 638'.	-
					Municipal				010, Haid B & W to 030 .	_
					Other				Deepened existing well 122'	+
(Si Equip	ment			(6) Grave	l Pack:				638'. Existing well had	
	ď .	Rev	D serse	Yes 🗆	No G Size				14" casing 0' to 122'.	_
Cable		Air		The state of the s	of above		1.0		14 0031119 0 00 122 .	
Other	a	Buc	cket []	Packed for	omto	ft				
(7) Casing	Installa	4.		(8) Perfo	redons		CI II			
Steel 🖰			Crette []	_ PART TO BOTH	erforation or	size of screen				
From	To	Dia	Gage or	From	To:	Slot				_
ft.	ft.	in.	Welt	t	ft.	Size				-
0	151	10	.188			-				_
		-					_			
(9) WEL	1 SEAL	-			-		Wor	k Starte	d 3/23 19 9 Completed 4/2 19 91	_
						- 20	VEL		RS STATEMENT: I hereby declare under	_
					If yes, to deci	1	pen.	alty of	perjury that the information provided	
			ollution	E U No	□ Interval _		-tt. in	this repo	ort is true. This water well was installed ce with San Diego County Code and State	
Method	of sealing						of	Californi	la. Department of Water Resources, Bulletin	
(10) W	ATER L	EVELS	5:	60				74.	1 . 0	
Depth of	first wat	er, if kno	nwo	60			_ft STG	NED	Wills Yours	
Standing	level atte	er well co	ompletion_	- 00			_ft.		(Well Dryller)	
(11) WE	LL TEST	S:					NAP	HID	DEN VALLEY PUMP SYSTEMS INC.	
Was well	test med	a? Ye	a O No	I If yes,	y whom?		rou	The second second	n, firm, or Corporation) (Type or Print)	
Type of	test	Pun	no 🗆	Bailer 🗆	Air lift C	1				
Depth to	water at	start of	tert	ft.	At end of	test	_ft. ADO	RESS	27932 Valley Center Road	
Discharg	—	_psi/mi	n after	hours	Water tem	perature	CI	Y	alley Center ZIP 92082	
Chemica	d analysis	made?			by whom?			-	197325 1/22/01	
Wes elec	tric log n	nede?	Yes []	to If yes	, attach copy	to this report	LIC	ENSE NO	487325 DATE THIS REPORT 4/23/91	

DHS:EHP-732 (83CONFIDENTIAL - NOT FOR PUBLIC USE - WATER CODE SEC. 13752)



COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH WELL PERMIT APPLICATION

DEH USE ONLY PERMIT # W CWYL 163 WELL COMPUTER #

33,555	1 . 12	2	181
FEE:	Lid	-30	10-
			-

	MAN DCCCL	E.	C CC13.	WATER DIS	τ:
1.	Property Owner: TysoN	0	C. 13 2004	Phone:	
	17331 / SAN Mailing Ado	PASQUAL W	Ly Rd. ESCO.	Valido	92027
2.	Well Location - Assessors Parcel	Number 242 -	110-10	7	
	17331 SAN PA.			did.	92027
	Sile Addition	033	City		Žip
3.	Well Contractor - Well Driller			any Name: PAIR	U) Pelling
	12029 OLD CAS	the Rd	VAlley Co	WHERE	92082
	Phone#: 760 - 749 - 6	701	_ C-57#:3 <u>28281</u> □	Cash Deposit	Bond Posted
4.	Use: Private D Publ	ic	□ Cathodic □ Oth	ner	
5.	Type of Work: New	☐ Reconstruction	☐ Destruction Tim	e Extension: 🗅	1st 🗆 2nd
6.	Type of Equipment:	POTARY			
7.	Depth of Well: Proposed	140-1	60	Existing:	0
8.	Proposed:				
	Depth: 140-160 De Diameter 8 in. Dia	Conductor Casing Yes □ No pth: 2 □ ft. ameter / 6 in. all/Gauge: .250	Filter/Filler Mater Yes No From: Zo To: _/ Type: PIA GRAVE Wall/Gauge:	140 From: 9	
9.	Annular Seal: Depth: 20	_ft. Sealing Materia	al: CEMENT		
	Borehole diameter: 22	_in. Conductor dia	meter: 16 in.	Annular Thickne	ss 3 + in.
10	Date of Work: Start: De	c - 2004	C	omplete: Dec -	- 2004
	On sites served by public was I hereby agree to comply with all the County of San Diego and the Immediately upon completion of the well. I accept responsibility supervision.	regulations of the Departm e State of California pertain work, I will furnish the Depa	ent of Environmental Health ing to well construction, rep artment of Environmental He	n, and with all ordinar air, modification and ealth with a complete	nces and laws of destruction. and accurate log
Co	ntractor's Signature	P. Jam		Date: _/2-	10-04
Z	DISPOSITION OF AP Approved Denied Special Denied De	ecial Conditions: Grad	ling and clearing assoc	iated with access	s to, or the
	an Diego and/or/other agencies	0 -	nay require additions	n pennils nom th	e County of

Specialist:

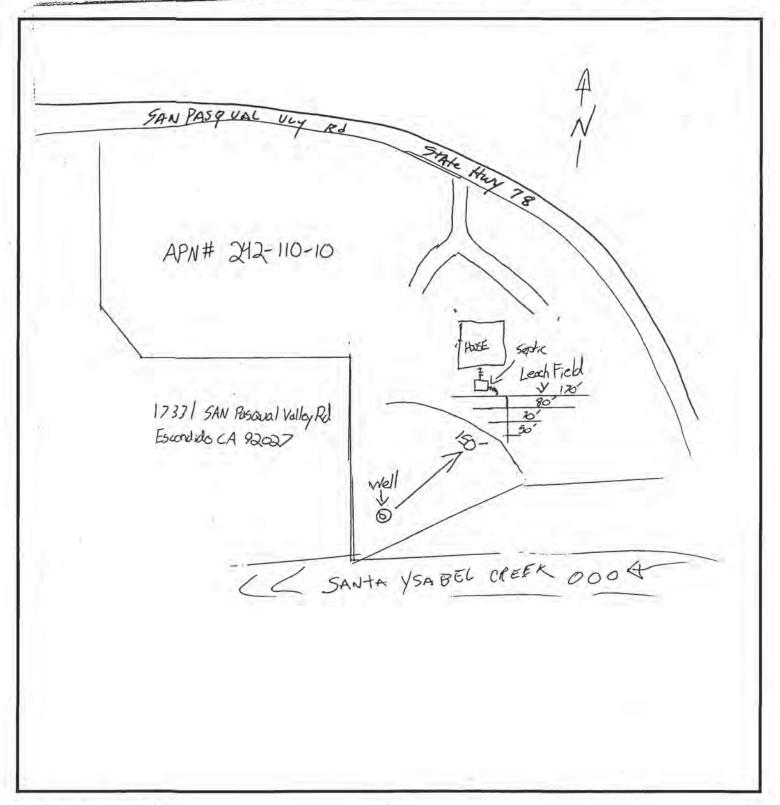
Date: 13 Dec 09

COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL H DEC 13 2004 HEALTH

Control #:

LWYL 16379 Assessor's Parcel Number: 242-110-10

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



								no cun	- 85		- Jaille Vie	a- 200 c			
QUADRU For Local						WELL C		FCALIFO	N REPO	RT [- DWH US	E ONL	1	1	OT FILL IN
Page						WELL ?	Refer to Ins	struction Pe	amphlet		S	TATE W	ELL NO	./STATI	ON NO.
Owner's \	Well No.	m					No	090	9553	1 1				LL	
Date Worl	k Began.	12/21				Ended	/05	_			LATITUDE	0.76	1 - 1	1 1	ONGITUDE
Local Pe			12.50			n		127101			1 1 1	AP	N/TRS/	OTHER	
Permi	it No. 1	6379	GE	OLO		LOG Permit I	Jate 12		The information	n in this o	rayed area	hae h	n Deen h	olocke	ed from public
ORIENTATI	ON (≤)	W VE	RTIC	AL _	_ H	ORIZONTALA	NGLE	(SPECIFY)	viewing pursua	ant to sect	tion 13752	of the	Wate	er Cod	le and the
DEPTH SURFA	ACE				. [DESCRIPTION erial, grain size,		111	illioilliation Fi					isona	i illioittiatiott.
#h 1	70	1					- Alegran		Address 17	338 Can	WELL LO	CATIO	NON-	मत	
	7.0		_	+11.4		g-same (1077°	11	City Bek				•		
i	- 4			-		- (a) 1	5 5	(1)	County Son	The second second				_	
70	110	-		pos		Sander F	1/ Por	1	APN Book 24						
+		Ber	14. PH	C 112		San Sanda	Coyby		Township 1						18 N
	1110	100	6	186			1//				SEC.	Long	DE	G,	MIN. SEC.
110	113	l S	T	2	3	P - 55-6-	100	100	I	- NORT	SKETCH -		-7	1000	CTIVITY (±) —
- 1	-	1 20	-3	~	(1///	TON	3		SON D				ALC: Y	IGATION/REPAIR
182	190	ch		del	3	2//	SO.			Son For	2.			T-S	Deepan Other (Specify)
-	-7.55			11,	17	100	9			-	The second				Stiller (Specify)
180	105	一一方	c	edice	-	10 2 10 g	mm		AUN		X	62		1	DESTROY (Describe Procedures and Materials
2 42 61	اعلم	1	-	1	115	11/15			242-110-1	0 .	11	11.	- 1	Landania	Inder "GEOLOGIC LOG"
103	350	- Commercial Commercia	-	<u>III</u>	900	ma, granid						1/3		WATE	S (∠) R SUPPLY
			- 1	min			1			3.6		11	8	47	Domestic Public rrigation Industrial
		1	14.	2007				-	NES.		KES	1	AST IN		MONITORING
360	385					2005	Totor				4		111	D. 17/10	TEST WELL
1	34.6	- SPI	pro	11	59	CPM obcain	ed her	4		1: 1	/=	-R	list	LAINC	HEAT EXCHANGE
205	410			dia		22			100	150	- 1	Acil	1	hi	DIRECT PUSH
363	410	1 62		G20	-1-			-	40	Mare	,	Thir		M. VA	INJECTION POR EXTRACTION
	-					· ·			1 4	b			_	1.	SPARGING
									Illustrate or Descr	ibe Distance o	Well from Roa	ds, Buile	lings,	10	REMEDIATION OTHER (SPECIFY)
-)	1	1	_						Fences, Rivers, etc necessary. PLEAS	E BE ACCUE	Map. Use addit RATE & COME	LETE.	жг ц		STREET (ST ESSIT 1)
		-	7)	-	-		WAT	ER LEVE	& YIELD	OF C	OMPL	ETED	WELL
	7	i	3			- (DEPTH TO FIRST	WATER	30_ (Ft.) BI	ELOW S	URFACE	E	
		1		1					DEPTH OF STAT	IC 68	(Ft) & DATI	F MEASI	IRED	1/6	/05
1							u.		ESTIMATED YIEL						
TOTAL DE	EPTH OF	BORING		10		'eet)			TEST LENGTH	6 (Hrs.)	TOTAL DRAW	DOWN_	300	(Ft.)	
TOTAL DE	EPTH OF	COMPLET	TED	WELL	43	(Feet)			* May not be re	presentative	of a well's lor	ng-term	yield.		*
DEP	TH	2.5	11			C	ASING (S)	1			DEPTH		ANN	ULAR	MATERIAL
FROM SU		BORE- HOLE	T	YPE (US 27 34 3	10.000	A Section	FROM	SURFACE			T	(PE
Ft. to	FI.	DIA. (Inches)	BLANK	SCREEN	PILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNES		Ft.	Io Ft.	The Street	BEN- TONITE (≤)	FILL (≤)	FILTER PACK (TYPE/SIZE)
0	20	2.2	X			steel	15.5	.250		0	20	X			
0	75	15	X			PYCF480	7.8	.500		20	113	1			5/1.62.7
	115	15	7	7	H	PWCF480	7.8	.500	.032	11053	T T				
	410	6.	5	2.3	1	Open Hole					- V				
- 1															
- 1	-		1		1			1	- Constitution	O LOUIS TO	TARREST AND A	_			L

ATTACHMENTS (∠)	CERTIFICATION STATEMENT —
Geologic Log Well Construction Diagram	I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief. Fair Drilling & Pump Co Inc
Geophysical Log(s)	(PERSON, FIRM OR CORPORATION) CHYPED OR PRINTED) Valley Center, Ca 92082
Soil/Water Chemical Analyses Other	ADDRESS A STATE ZIP
TACH ADDITIONAL INFORMATION, IF IT EXISTS.	Signed C-57 LICENSED WATER WELL CONTRACTOR DATE SIGNED C-57 LICENSE NUMBI

ORIGINAL		*****		OF CALIF		1	E ONLY	DO NOT FILL IN	
File with DWR		WELL		PLETION Struction	ON REPOI Pamphlet		TATE WELL NO	D./STATION NO.	
Page of Owner's Well No	- RWOB	•	43827						
Date Work Began		11/13	TOOL	LATITUDI	E .	LONGITUDE			
Local Permit Agency San Diego									
Permit No. CANEL COOLST Permit Date 4 11 13 WELL OWNER									
			. D	WELL O	OWNER —	. 0 . 1			
ORIENTATION (∠)	Z VERTICAL _ DRILLING A	HORIZONTAL	ANGLE	(SPECIFY)	Mailing Address 1722 Y San Payrial Valley Rd				
DESCRIPTION DESCRIPTION					Establida CA 92027				
Ft. Io Ft.	Describe	material, grain si		CITY)	ACATION —	STATE ZIP		
0 14	Top Soil	and Fine Si	y Du	k Brown	Address 1722 y San Parquel Valley Rd				
14 125	Coarse Sand Quartz				City Esemblish CA 92027				
	Conti Fagnisti				County San Diego				
23 133	Constitution of the Consti				APN Book 242 Page 870 Parcel 15 Township 128 Range 1W Section 26				
45 50	S:11-16	Sead Train	C.\		Township 125 Range 1W Section 26 Lat 33° 106 11, 63" N Long 116° 151' 135 91" w				
	Slight Planticity				DEG. MIN. SEC. DEG. MIN. SEC.				
50 75	411-112	Sand Sla	tist Clar	\	LO	NORTH —		NEW WELL	
22 +82	Course	SARA TER	<i>Ł.:</i> Ż:\$)		\bigcap		MODIFICATION/REPAIR	
85 90	1 2 1 1 1 1 K	e Jack wil	th Clay			/		Deepen Other (Specify)	
110 110	TACA D.	Pilli	<u>0</u>	2 Frage	١	/ \ /			
117 136	Grandin	The Guy	e Biot	2 112g	aundo,	84 \Jr.		DESTROY (Describe Procedures and Materials	
1			<u> </u>			3 33		Under "GEOLOGIC LOG") USES (∠)	
						1267		WATER SUPPLY	
	1	·	······································		۳	/ {	اً _	Domestic Public Industrial	
1	1				WEST	. []	EAST	MONITORING	
	1					7 (-	TEST WELL	
			······			[]		CATHODIC PROTECTION HEAT EXCHANGE	
	I					<u></u> ,		DIRECT PUSH	
ı					(0.59 Va	lley or	INJECTION	
1						Sads VAPOR EXTRACTION			
1						Illustrate or Describe Distance of Well Poir Though, Buildings,			
i					Fences, Rivers, etc. ar necessary. PLEASE 1	nd attach a map, Use addin BE ACCURATE & COMP.	bnal paper if LETE.	OTHER (SPECIFY)	
1 1					WATER LEVEL & YIELD OF COMPLETED WELL				
i i						VATER (FL) BE			
· · · · · · · · · · · · · · · · · · ·					DEPTH OF STATIC				
1 !			,			(,		A 1 11	
TOTAL DEPTH OF BORING 130 (Feet)					ESTIMATED YIELD				
TOTAL DEPTH OF COMPLETED WELL 110 (Feet)					* May not be representative of a well's long-term yield.				
DEPTH FROM SURFACE	BORE- HOLE TYPE(ビ)		CASING (S)			DEPTH FROM SURFACE	ANNULAR MATERIAL TYPE		
	DIA.	B 발 MATERIAL /	INTERNAL	GAUGE	SLOT SIZE		CE- BEN-		
Ft. to Ft.	BLANK SCREEN SCREEN	MATERIAL / GRADE	DIAMETER (inches)	OR WALE THICKNES		Ft. lo Ft.	MENT TONITE	TYPE/SIZE)	
0 52	15 V	Steel	10	,250		0 51		(-/	
0 50	10 1	PYC	5	5021T		ı			
50 90	10 1	b A C.	5	SDRI					
90 110	10 4	PYC	5	SORIT		1			
ATTACHMENTS (\(\perp\)) CERTIFICATION STATEMENT									
Geologic Log I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.								owledge and belief.	
Well Construction Diagram						In Inc			
Geophysical Log(s) (PERSON, FIRM, OR CORPORATION)					(TYPED OR PRINTED)	1 1 1	\	A	
Soil/Water Chemical Analyses \\ \\ \lambda \lambda \lambda \lambda \\ \lambda \lambda \lambda \\ \lambda \lambda \\ \					<u> </u>	Valley Cr	ter,	CA 92082	
Other ADDRESS ()						CITY	. m/s 179	STATE ZIP	
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS. Signed C-57 LICENSED WATER WELL CONTRACTOR DATE SIGNED C-57 LICENSED WATER WELL CONTRACTOR DATE SIGNED C-57 LICENSE NUMBER									
		······································						o or product troublett	

STEHLY BROTHERS DRILLING, INC.

License: C-57 #709686 13268 McNally Road Valley Center, California 92082 760-742-3668 / 760-742-4564 Fax

4/15/13

Rockwood Observation Well

Attn: Dudek Well Site: Guejito Ranch Well#RWOBS-1 (#16-2013)

Rodney Corporation APN: 242-070-15

605 Third Street 17224 San Pasqual Valley Road

Encinitas, CA 92024 Escondido, CA 92027

760-942-5147 Permit: LWEL000157 4/11/13

Guejito Ranch Well#RWOBS-1 – Rockwood Observation Well - (#16-2013) drilled for Rodney Co. N.V. at 17224 San Pasqual Valley Road in Escondido, CA 92027. Started Drilling 4/8/13 and Finished Well 4/11/13. APN: 242-070-15 Permit LWEL000157 4/11/13.

and Finished Well 4/11/13. APN: 242-070-15 Permit LWEL000157 4/11/13.

0-14 Top Soil and Fine Sand Dark Brown
14-25 Coarse Sand, Quartz, Granitic Fragments

25-45 Coarse Sand, Gravel with Some Silt

45-50 Silt-like Sand, Trace Clay, Slight Plasticity

50-75 Silt-like Sand, Slight Clay 75-85 Coarse Sand, Trace Silt

85-90 Silt-like Sand with Clay

90-110 Hard D.G.

110-117 Granite, Biotite and Quartz Fragments

117-130 Granodiorite, Quartz and Biotite

Comments:

Total Depth Drilled: 130' Total Well Depth: 110'

Hole Diameter: 10" Mud Hole 0-50' Solid Liner: 40' of 5" SDR17 Screen 50-90' Screen

70' of 5" SDR17 Solid 90-110' Solid

Gravel Pack: 2 cu yds
Surface Seal: Cement

Surface Seal: Cement Water: 25+ GPM

Well Development: