GROUNDWATER INVESTIGATION REPORT

TULE WIND FARM EAST SAN DIEGO COUNTY, CALIFORNIA

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Figure 6 Conceptual hydrogeologic Cross-Section – Thing Valley Study

Area

Figure 7 Geologic Map – Rough Acres Ranch Aquifer Test Site

Figure 8 Conceptual Hydrogeologic Cross-Section – Rough Acres

Ranch Study Area

APPENDIXES

Appendix A Observations and Analyses of Aquifer Characteristics – Ewiiaapaayp Reservation, Thing Valley

Appendix B Observations and Analyses of Aquifer Characteristics – Rough Acres Ranch, McCain Valley

Appendix C Cumulative Impact Analysis

GLOSSARY OF TERMS, ACRONYMS, AND ABBREVIATIONS

af Acre feet

APN Assessor's Parcel Number

CIMIS California Irrigation Management Information System

DWR Department of Water Resources

ETo Evapotranspiration

Ft Feet

gpd Gallons per day gpm gallons per minute msl mean sea level

SCS Soil Conservation Survey

t/t' Time since pumping started divided by time since pumping stopped



EXECUTIVE SUMMARY

A groundwater investigation was conducted to evaluate the groundwater resources within Thing Valley on the Ewiiaapaayp Reservation and Rough Acres Ranch in McCain Valley. The purpose of the investigation was to assess the availability of groundwater as a resource in support of the Tule Wind Farm construction project, which proposes to be extracted at these locations over a nine-month construction period. The groundwater investigation included long-term 72-hour constant rate pumping tests and subsequent analysis of the data to assess the hydraulic properties of the aquifer at each of these locations.

Results of the groundwater investigation suggest that both locations provide viable groundwater resources in support of project construction. Although groundwater resources on Tribal land are not within the jurisdiction of the County, pumping test results indicate that the Reservation well appears to be somewhat limited at the test pumping rate of 80 gallons per minute (gpm). Based on a boundary condition identified during the course of the aquifer pumping test, it is recommended that a reduced pumping rate and a reduced frequency be used at this well. However, pumping from other Reservation wells may be used to supplement pumping from the test well.

At the Rough Acres Ranch, pumping at 50 gpm showed no evidence of well interference, or significant depletion of the groundwater in storage within the pumping well. In fact, analysis of the data suggests that pumping could be doubled without any significant impact. Based on the results of the aquifer test, no significant impacts to this groundwater resource are anticipated associated with pumping at the Rough Acres Ranch test well.



1.0 INTRODUCTION

1.1 Purpose of the Report

This groundwater investigation report describes field conditions, and presents the results of field and analytical procedures used to evaluate groundwater resource availability within the Thing Valley area of the Ewiiaapaayp Reservation and the Rough Acres Ranch area of McCain Valley to support construction of the proposed Tule Wind Project. The Tule Wind Project will include the construction of 134 wind turbines, and associated service roads, transmission lines and ancillary structures over a period of approximately nine months during which time groundwater will be extracted from the underlying aquifers to support construction activities. This investigation also addresses the sustainability of groundwater withdrawal from the aquifers with respect to the existing and proposed future uses. Construction is slated to begin in the third quarter 2011, and the wind turbine facility is scheduled to come on line in the fourth quarter 2012.

Engineering estimates indicate that construction, and associated groundwater extraction, is expected to last approximately nine months. According to the project developer, groundwater demand for the project is expected to occur in four phases. Initially the project will require approximately 120,000 gallons of water per day (gpd) during road building (60 gallons per minute [gpm]), increasing to 250,000 gpd (equivalent to a constant rate of 124 gpm) while both road and turbine foundation construction and construction-related dust suppression. Water demand will then decrease to approximately 130,000 gpd (a constant rate of 65 gpm) following completion of the 72-day road construction portion of the project, while turbine foundation construction continues, and finally decrease to 100,000 gpd (50 gpm) for dust control during the remainder of the project. Subsequent site work is not expected to require additional groundwater supply. The total volume of extracted groundwater to support the project is anticipated to be approximately 65 to 125 acre-feet.

When the Tule Wind Project turbines become operational, only a limited quantity of water will be required, estimated at 2,500 gallons per day to supply the operations and maintenance building services and support staff.

1.2 Project Location and Description

The Tule Wind Farm will be developed on 15,350 acres in eastern San Diego County. The project area is located approximately one mile north in Interstate 8 (I-8), generally between La Posta Truck Trail on the west and McCain Valley Road on the east (Figure 1). Given the large size of the project area and the need for water throughout, two sites were identified for water production: Thing Valley and McCain Valley (Rough Acres Ranch). These areas are described in more detail in the following sections.

1.2.1 Thing Valley Water Production Area

The Thing Valley Water Production Area is located approximately 10 miles north of I-8 off La Posta Truck Trail/Thing Valley Road on the Ewiiaapaayp Reservation (Figure 2A). The reservation is located in an isolated, triangular-shaped, southeasterly-draining



valley near the headwaters of La Posta Creek. Ground surface elevations range from 5000 to 5100 feet on the valley floor, but rise to over 6200 feet along the surrounding ridgelines. Reservation structures dot the valley floor, and include a fire station, an abandoned water bottling facility, and several abandoned, vacant, or partially-occupied residential structures. Two groundwater production wells ("north well" and "south well") were constructed in August 1980 near the center of the valley. The "south well" is connected to a series of solar panels that power an electric submersible pump. This well pumps water to a storage tank at the northwestern end of the valley, and the stored water supplies the Reservation. The "north well" is located approximately 60 feet northeast of the "south well". It is equipped with an electric submersible pump, but it is not currently used for water production. According to personal communications with the tribal representative and review of the tribal website, there are no permanent inhabitants within the valley, through tribal members visit the location periodically. The nearest residence is approximately 4 miles south of the subject valley in the larger Thing Valley. The "north well" and "south well" occupy Assessor's Parcel Number (APN) 4130800300, and the remainder of the valley spans APNs 4131503000, 4130800100, and 4130800200. The "far field" observation well is located within APN 4131503200.

1.2.2 Rough Acres Ranch Water Production Area

The Rough Acres Ranch Water Production Area is located approximately one mile north of I-8 between Ribbonwood Road on the west and McCain Valley Road on the east (Figure 2B). This site occupies the broad alluviated, southeasterly-draining McCain Valley that, within the project area, is bounded on the north and south by low-relief granitic hills. Ground surface elevations in the valley range from approximately 3600 feet above mean sea level at the northwestern corner of the project area and along the northern bounding hills to about 3450 feet above mean sea level at the southeastern corner of the project area. Within the project area, Rough Acres Ranch is surrounded by scattered residences on the west and south, a low-security detention facility and landing strip on the east, and open space on the north. The valley floor is used for livestock grazing. The Rough Acres Ranch property is crossed by a series of graded dirt roads, and contains a number of active and idle groundwater production wells that are used for domestic and agricultural supply. The area of the aquifer test spans APNs 6110600300, 6110700100, 6110900200, 6110900300, 6110900400, 6110901800, and 6111100100.

1.2.3 Project Description

The Tule Wind Farm project will include the construction of up to 134 wind turbines and associated roads, transmission lines and support facilities. Based on information provided by the project developer, IBR, the following water requirements have been estimated for the project construction (all work is anticipated to be performed over fiveday work weeks):

1. Road Construction – Up to 120,000 gallons per work day will be required over a 72-day construction period. This translates to an average pumping rate of approximately 60 gpm assuming sufficient storage is available to allow for pumping seven days a week (83 gpm if the pumps are only active during work days).



- 2. Turbine Foundation Concrete Mixing Turbine foundation construction is estimated to require 7,500 to 15,000 gallons of water per foundation. With 134 foundations to build, water demand will be approximately 15,000 and 30,000 gpd (assuming that two foundations are constructed each day in accordance with the 72-day work schedule). This much water use equals an average maximum pumping rate of approximately 15 gpm. The maximum continuous pumping rate (24-hours per day, seven days per week), required to support concrete mixing for three turbine foundations per day (45,000 gallons) is equivalent to 31 gpm.
- 3. Dust Control During subsequent construction activities, approximately 50,000 to 100,000 gallons of water per working day will be required for dust control on project roads. The average continuous pumping rate required during these activities would be 50 gpm for an estimated nine-month construction period.

The pumping rates stipulated above are based on the assumption that there will be sufficient storage space to allow for groundwater extraction 24 hours per day, seven days per week. If there is insufficient water storage capacity to allow for continuous pump operation, higher incremental pumping rates would be required. Based on the aquifer testing performed for this report, the wells may not be able to pump at higher incremental pumping rates for peak demand.

1.3 Applicable Groundwater Regulations

Groundwater utilization for projects within the County of San Diego must address the requirements in the *County of San Diego Groundwater Ordinance No. 9826*, which stipulates that development and utilization of groundwater will not affect those who are dependent upon groundwater unless it can be demonstrated that there is an adequate supply to provide both the project and the existing users. In addition, since the project is proposing to use more than 20,000 gallons per day, it is considered a water intensive project according to the Groundwater Ordinance, and requires an evaluation of the cumulative groundwater impacts. The Ordinance provides for methods of analysis to determine potential impacts to the groundwater resource, and this investigation endeavors to address those potential impacts following the Ordinance-prescribed guidelines.

This project will result in groundwater extraction and utilization that may affect the local environment, a unique resource, and groundwater-dependent habitats. As a result, the California Environmental Quality Act (CEQA) requires an evaluation of environmental impacts associated with groundwater extraction, as well as other components of the project.

2.0 EXISTING CONDITIONS

This section of the water investigation report describes the existing conditions of the project areas, including topography, climate, geology and hydrogeology, surrounding land use, hydrology, and water quality.



2.1 Topographic Setting

2.1.1 Thing Valley Water Production Area

The Thing Valley Production area is situated in a triangular shaped valley near the headwaters of La Posta Creek. Ground surface elevations range from approximately 5100 feet above mean sea level (amsl) at the north end of the valley floor to about 5000 feet amsl at the south end of the valley floor (Figures 3A). Bounding ridgelines rise to over 6300 feet amsl. The watershed for the production area is approximately 2310 acres, draining the area to the northwest that includes the eastern flanks of the Laguna Mountains to the west and the southwestern flanks of the Sawtooth Mountains to the northeast.

2.1.2 Rough Acres Ranch Water Production Area

The Rough Acres Ranch Water Production Area is situated in McCain Valley, a broad south- to southeasterly trending valley that is generally bounded by the eastern flanks of the Laguna Mountains to the west and the In-Ko-Pah Mountains to the north and east. The valley is over 13 miles long, extending from the In-Ko-Pah Mountains to the north, and draining into Tule Canyon and Carrizo Gorge at the southeast. McCain Valley includes a large number of tributaries, including Tule Creek that passes through the Rough Acres Ranch study area as a dry wash at most times of the year. Because of the vast expanse of the drainage area, for purposes of this investigation and following guidance from the County Hydrogeologist, the watershed area is defined as an area of one-half mile radius surrounding the proposed production well (Figure 3B).

2.2 Climate

For purposes of this water supply study, the climate factors of most concern include precipitation and evapotranspiration. Data provided in this section comes from the County of San Diego Department of Planning and Land Use General Plan Update – Groundwater Study, State of California Department of Water Resources, and the California Irrigation Management System (CIMIS) databases.

2.2.1 Climate of the Thing Valley Water Production Area

At elevations of over 5000 feet, the Thing Valley WPA has a relatively mild climate. The site is located just east of the Laguna Mountains, and as a result, it sits in the rain shadow of these mountains. Historical climate data from the Campo area were used to conservatively represent conditions at this site. Based on information available from the California Department of Water Resources, the area receives an average of 15.6 inches of rainfall per year, with 80 percent of the rainfall occurring between November and March of each year. According to the State of California Reference Evapotranspiration Map developed by CIMIS, the site is located in Evapotranspiration Zone 16, with an average of 62.5 inches of evapotranspiration per year.



2.2.2 Climate of the Rough Acres Ranch Water Production Area

While 2000 feet lower in elevation, and about 10 miles east of the Thing Valley WPA, the Rough Acres Ranch WPA has similar values for rainfall and evapotranspiration. Using historical precipitation records from a monitoring station in Boulevard, California (approximately 2 miles south of the site), the average annual precipitation for the area is approximately 15.8 inches. The Rough Acres and Thing Valley WPAs are located in the same Evapotranspiration Zone, which indicates an average annual evapotranspiration of 62.5 inches.

2.3 Land Use

2.3.1 <u>Land Use Surrounding the Thing Valley WPA</u>

The Thing Valley WPA is located within the Ewiiaapaayp Reservation. According to the San Diego County General Plan, the site is located within the Mountain Area Community Planning Area with a land use designation as Indian Reservation. The highlands of the watershed area are located within the Cleveland National Forest, and the San Diego County General Plan identifies this area as the Central Mountain Community Planning Area, with an open space forest designation.

There are no full-time residents or industries within the Reservation limits, though the Reservation includes several abandoned structures and structures that are used periodically, as well as a fire station and a structure that was to be used as a water bottling plant. Aside from these structures, the surrounding land is undeveloped mountain and valley terrain. The nearest residents are located approximately 3 miles south of the WPA at Thing Valley Ranch.

2.3.2 Land Use Surrounding the Rough Acres Ranch WPA

The Rough Acres Ranch WPA is located in a sparsely populated region of the county. According to the San Diego County General Plan, the site is located within the Mountain Area Community Planning Area and has a land use designation as general agricultural. Properties surrounding the site are designated as general rural, and one parcel to the east is designated as National Forest/State Parks.

Consistent with the designated land uses, the Rough Acres Ranch is used for livestock grazing, and this property is surrounded by large lot residences to the west and south, a low-security detention center and rural air field to the east, and high desert open space to the north and east.

2.4 Water Demand

Because there are no residents or uses for groundwater within the Thing Valley WPA, and the County has no jurisdiction over groundwater use on tribal lands, there is no requirement to evaluate water demands in this area.



For the Rough Acres Ranch WPA, a conservative approach was used to ensure that the proposed project would not affect adjacent groundwater users. It is assumed that all groundwater for this project will be derived from the Rough Acres Ranch WPA even though the project will also utilize water from the Thing Valley WPA.

As recommended by the County Groundwater Geologist, the water production area was restricted to a one-half mile radius surrounding the production wells (the estimated maximum area of interference from the pumping well). However, to evaluate other groundwater uses, the evaluation radius was extended in some instances to about three quarters of a mile. Within this evaluation area, seven single family residences were identified, including one residence that operates an apparent poultry farm. In addition to the residences, the Rough Acres Ranch property is utilized for free-range livestock grazing, with an estimated head count of 100 animals. Using residential water demand values provided by the County's Guidelines for Determining Significance and published values for livestock water usage, the groundwater demand for the project is estimated in the following table:

Water Use	Demand (Acre-Feet per Year)	Demand (Acre-Feet per Month)
Proposed Project Construction (9 month duration)	60	6.7
Post-Project Maintenance	2.8	0.23
Residential Water Use (7 residential properties; 0.5 acre-feet per year per residence)	3.5	0.29
Livestock Grazing (100 head; 19 gallons per day per animal)	2.13	0.18
Poultry Raising (500 birds; 770 liters per 1000 birds per day)	0.11	0.01
Totals:	65.74	7.18

2.5 Geology and Soils

The Thing Valley and Rough Acres Ranch WPAs are situated within batholithic rocks of the Peninsular Ranges Geomorphic Province. Batholithic rocks were generally emplaced in the late Mesozoic to early Cenozoic eras. Post-emplacement uplift, weathering, and erosion has resulted in formation of surficial soils and alluvial deposits that mantle the crystalline bedrock. Due to the remote locations and paucity of mineral resources, neither site has been studied in detail, and most of the available geologic information comes from regional geologic studies, including the "Preliminary Geologic Map of the 30' x 60' El Cajon Quadrangle" (Todd, 2004) and "Mineral Resources of the Sawtooth Mountains and Carrizo Gorge/Eastern McCain Valley Wilderness Study Areas (Todd, et al., 1987). Soils information is provided by the United Sates Department of Agriculture - Soil Conservation Service and Forest Service. Geologic and soils conditions specific to each WPA and its watershed are described below.



2.5.1 Geology and Soils of the Thing Valley WPA

The Thing Valley WPA is flanked by the Laguna Mountains to the west and the Sawtooth Mountains to the north and east. Based on the available geologic information, in the vicinity of the WPA, the two mountain ranges are geologically similar, and are composed of the early Cretaceous-age Las Bancas Tonalite, an assemblage of lightly foliated tonalite, granodiorite, and quartz diorite. In addition, at the northernmost portion of the watershed, the Sawtooth Mountains are also underlain by a variety of Triassic and Jurassic-age metasedimentary rock units.

Along the valley floor, the crystalline bedrock is overlain by recent alluvium. Based on the logs of the groundwater production wells, the thickness of alluvium is estimated to be approximately 30 to 50 feet.

Based on maps prepared by the Soil Conservation Service (now Natural Resources Conservation Service), and presented on Figure 4A the following table presents the soil types and their properties within the Thing Valley WPA watershed area:

Soil Type	Moisture Holding Capacity (in)	Runoff Potential	Maximum Runoff Percentage	Area (acres)
Acid Igneous Rock Land (AcG)	0.10	Rapid	100%	250
Bancas Stony Loam (BbG)	3-5.5	Rapid to Very Rapid	81%	1000
Crouch Coarse Sandy Loam (CtE)	4.5-7	Medium	71%	50
Crouch Coarse Sandy Loam (CtF)	4-6	Rapid	74%	40
Crouch Rocky Coarse Sandy Loam (CuE)	3.5-5	Medium	78%	30
Crouch Rocky Coarse Sandy Loam (CuG)	3.5-5	Rapid to Very Rapid	78%	100
Mottsville Loamy Coarse Sand (MvC)	4-5	Slow to medium	74%	40
Mottsville Loamy Coarse Sand (MvD)	4-5	Medium	74%	30
Sheephead Rocky Fine Sandy Loam (SpG2)	2-3	Rapid to Very Rapid	87%	750
Steep Gullied Land (StG)	Not Available	Rapid	100%	10

2.5.2 Geology and Soils of the Rough Acres Ranch WPA

The Rough Acres Ranch WPA is located at the eastern edge of the Peninsular Ranges. Available geologic information in the vicinity of the WPA indicates that the area is underlain by the early to late Cretaceous era La Posta Tonalite, an assemblage of horneblende-biotite trondhjemite and granodiorite that is exposed on the low-relief highlands surrounding and within McCain Valley. Along the valley floor, the crystalline bedrock is overlain by recent alluvium. Based on the logs of the groundwater production wells in the valley, the thickness of alluvium is estimated to be 30 and 70 feet.

Based on maps prepared by the Soil Conservation Service (now Natural Resources Conservation Service), presented on Figure 4B, the following table presents the soil types and their properties within the Rough Acres Ranch WPA watershed area:



Soil Type	Moisture Holding Capacity (in)	Runoff Potential	Maximum Runoff Percentage	Area (acres)
Acid Igneous Rock Land (AcG)	0.1	Rapid	100%	10
Calpine Coarse Sandy Loam (CaC)	4.5-6.5	Slow to medium	72%	5
La Posta Loamy Coarse Sand (LaE2)	2-3	Medium	87%	60
La Posta Rocky Loamy Coarse Sand (LcE2)	1-2	Medium	94%	150
Loamy Alluvial Land (Lu)	6-9	Slow	62%	120
Mottsville Loamy Coarse Sand (MvC)	4-5	Slow to medium	75%	110
Tollhouse Rocky Coarse Sandy Loam (ToE2)	1-2	Medium to rapid	94%	50

2.6 Hydrogeologic Units

This section of the water investigation report describes the water-bearing units at each site and their general hydraulic properties.

2.6.1 Hydrogeologic Units of the Thing Valley WPA

The hydrogeologic units of the Thing Valley WPA include the recent alluvial soils and the underlying fractured Las Bancas Tonalite. The alluvium is restricted to the lowest portion of the valley floor; based on available geologic maps and Soil Conservation Service surveys, it underlies less than 10 percent of the watershed. In contrast, the Las Bancas Tonalite underlies the entire watershed area, either directly or beneath the alluvium.

A California State Department of Water Resources well completion report (no. 058539) is available for the "south" well that was used as the observation well for the aquifer testing in this study. Drilling logs for the "north" aquifer pumping test well and far-field observation wells were not available. Based on the log for the south well, the alluvium at this location is approximately 12 feet thick. Relatively weathered "granitic" bedrock extends from 12 to 50 feet below ground surface, and relatively unweathered "granitic" rock was encountered from 50 feet to the bottom of the hole at 400 feet. The geologic conditions at the north and far-field wells would be expected to be generally similar based on inspection of the surface geology.

A static water level was measured at each of the three test wells prior to the start of the step-drawdown test (Section 2.7). The static water levels in each well were sufficiently deep, and is likely below the base of alluvium. This suggests that alluvium groundwater is ephemeral, and does not contribute significantly to the available groundwater resource at this site.

The fractured Las Bancas Tonalite appears to be the most significant aquifer within the Thing Valley WPA. Using the recommendations from the County Groundwater



Geologist, a specific yield of 0.1 percent has been established for this unit. Figure 6 presents a conceptual hydrogeologic cross section through the Thing Valley WPA.

2.6.2 Hydrogeologic Units of the Rough Acres Ranch WPA

The hydrogeologic units of the Rough Acres Ranch WPA include the recent alluvial soils and the underlying weathered and fractured La Posta Tonalite. As shown on Figure 7, the alluvium covers the broad valley floor, and based on available geologic maps and Soil Conservation Service surveys (Figure 4B), it underlies approximately 50 to 60 percent of the watershed. The alluvium is directly underlain by the Las Bancas Tonalite, which is also exposed as outcroppings throughout the watershed. Figure 8 depicts a conceptual hydrogeologic cross section through this WPA.

While seven wells were used for the aquifer test in this study area, only the pumping well and two observation wells are within the prescribed one-half mile radius watershed. A California State Department of Water Resources well completion report (no. 1089956) is available for the pumping well. Geologic information suggests that the alluvium in the center of the valley is approximately 70 to 80 feet thick. Weathered bedrock extends to a depth of about 230 feet, and below that depth to the total depth of boring (420 feet), the crystalline rock is relatively unweathered. Static water levels measured in the pumping and observation well suggest that the lower 45 to 50 feet of alluvium is saturated. Little alluvium is noted on the logs for other observation wells in the test area, and well depths typically range from 400 to 900 feet, indicating that the fractured La Posta Tonalite is the primary source of groundwater for production wells in the area.

The fractured La Posta Tonalite appears to be the most significant aquifer within the Rough Acres Ranch WPA, with the alluvium providing at least seasonal recharge to the subjacent bedrock aquifer. Using the recommendations from the County Groundwater Geologist, a specific yield of 0.1 percent has been established for this bedrock aquifer. Published specific yield values for mixed sand and gravel aquifers (Driscoll, 1986) indicate a range of 10 to 25 percent.

2.7 Hydrologic Inventory and Groundwater Levels

2.7.1 Thing Valley WPA Hydrologic Inventory

As described in Section 2.6.1, two groundwater production wells are located within the Thing Valley WPA watershed. The wells are owned by the Ewiiaapaayp Tribe. The "south" well is currently used for as-needed water supply and pumps water to a storage tank. The "north" well was constructed to supply water to a proposed water bottling facility, but it is not currently used. Outside of the project watershed area, approximately one mile south of the north and south wells, is the "Thing Valley" observation well that is located near the confluence of La Posta Creek and an unnamed tributary. No other wells are known to exist within the watershed area. Well construction information and static water levels are provided in the following table.



Well Name	Total Depth (ft)	Seal Depth (ft)	Production Rate (gpm)	Water Level – August 2010 (feet below top of casing)
"North" Well	400	22	Idle	54.81
"South" Well	Unknown	Unknown	Up to 30 gpm	49.34
"Thing Valley" Well	Unknown	Unknown	Idle – No Pump	77.62

Locations for these wells are shown on Figure 5. The locations and elevations of these wells are not surveyed; however, using approximate ground surface elevations to establish an approximate groundwater elevation, a hydraulic gradient of 0.05 feet per foot is estimated. The approximated groundwater elevations suggest a southeasterly flow direction down Thing Valley.

According to a report provided by the Ewiiaapaayp Tribe, the "South" well has the potential to produce water at a rate of about 30 gpm. It is used to provide water to a storage tank that supplies water to tribal members at the residences and the fire station. Since there are no permanent residents in the reservation, the south well only pumps occasionally to maintain the water level in the tank.

The North well is capable of producing groundwater at up to 90 gpm, and a pumping test conducted on the well following its construction indicates a specific yield of 55 gpm. The North well was constructed to provide water to a commercial water bottling facility constructed adjacent to the tribal fire station, though the bottling facility never opened and the North well remains idle.

The Thing Valley well is located approximately one mile south of the north and south wells and is not equipped with a pump or power. The well has no cap, and is open to the atmosphere and needs to be secured to be in compliance with California State Well Standards (Bulletin 74-90).

Surface water bodies within the Thing Valley WPA watershed include the ephemeral La Posta Creek and its unnamed, ephemeral tributaries. La Posta Creek passes within approximately 400 feet to the west of the south well. There are no reservoirs or ponds within the watershed, and no springs have been mapped in the area.

2.7.2 Rough Acres Ranch WPA Hydrologic Inventory

While only two wells (Wells 6 and 6a) are located within the prescribed 502-acre watershed area, seven wells surrounding the project area were evaluated during this project. Of these, four are equipped with pumps and are actively used for municipal water supply or to provide water to livestock. The remaining three well are either equipped with pumps and are not currently used, or have not been equipped with pumps. Well construction, current estimated production, and static water levels are provided on the following table.



Well Name	Total Depth (ft)	Seal Depth (ft)	Production Rate (gpm)	Water Level – August 2010 (feet below top of casing)
Well No. 6a "North" Well	385	75	1	28.0
Well No. 6 "South" Well	Unknown	Unknown	1	27.80
Walker Residence Well	Unknown	Unknown	< 0.5	54.78
Well No. 9 Livestock Supply Well	Unknown	Unknown	< 0.5	29.45
Well No. 2	185	24	No Power	23.92
Well No. 4	185	91	No Pump	10.98
Well No. 8	970	50	Pump	17.95

Locations for these wells are shown on Figure 7. The locations and elevations of these wells are not surveyed; however, using approximate ground surface elevations to establish an approximate groundwater elevation, a hydraulic gradient of 0.01 feet per foot is estimated. The approximated groundwater elevations suggest convergent flow toward McCain Valley, with a general southeasterly flow within the valley.

Based on aquifer testing conducted as part of this investigation and well testing conducted during construction, Well No. 6 and No. 6a are capable of producing groundwater at 50 to 60 gpm. The well test conducted on well No. 6a after construction indicates a specific yield of 60 gpm. Currently these wells are principally used to supply water to grazing livestock, and are estimated to provide water at a rate of about 1500 gallons per day, or 1.05 gpm on average.

Well logs were not available for the Walker residence well, which provides potable water for a single-family residence. Using recommendations provided by the County Groundwater Geologist for a typical residential well, it is estimated that this well produces about one-half acre-foot per year, or about 0.5 gpm on average.

Well logs were also not available for the "Livestock" Well No. 9 located between the Walker residential well and Wells No. 6 and No. 6a. This well provides water for grazing livestock in troughs located throughout the ranch. It is estimated that this well produces water at a rate of about 500 gallons per day, or about one third of a gpm on average.

Well No. 2 is located approximately one mile northeast of Wells No. 6 and No. 6a. First groundwater was encountered at a depth of 70 feet below ground surface in "black and white rock" interpreted to be the La Posta tonalite. Well tests conducted during construction indicate a specific yield of 10 gpm over a three hour test period. Currently, the well is idle.

Well No. 4 is located approximately one mile north of Wells No. 6 and No. 6a. First groundwater was encountered at a depth of 35 feet in "decomposed granite". Well tests conducted during construction indicate a specific yield of 15 gpm over a one hour test period. There is no pump in this well.



Well No. 8 is located about 3 miles east of Wells No. 6 and No. 6a, just east of McCain Valley Road. First groundwater was encountered at a depth of 30 feet in "weathered granitic rock". A specific yield was not achieved during the post-construction well test, which pumped the well at 50 gpm for 8 hours and recorded 800 feet of drawdown.

In addition to the wells within the prescribed watershed and those used as observation wells during the aquifer testing conducted as part of this study, there are seven residences within three-quarters of a mile of the project site, and each has its own water supply well. It is estimated that each of the seven additional residences utilizes about one-half acrefoot of water per year, and one of the residences has a small poultry farm with an estimated 500 birds that utilizes an additional 0.11 acre-foot of water per year. In total, the additional water use in the vicinity of the site is estimated to be about 3.61 acre-feet per year, or about 2.25 gpm on average.

Surface water bodies within the Rough Acres Ranch WPA watershed include the ephemeral Tule Creek. Although the USGS topographic map of the area identifies a small reservoir near the northwestern portion of the watershed, that feature was not observed within the study area. Rough Acres Ranch discharges water from Wells No. 6 and No. 6a to a small livestock watering reservoir about 2000 feet north of these wells. The reservoir is not lined, and as a result, water infiltrates rapidly into the ground. A groundwater spring was observed on the canyon wall adjacent to Well No. 4. The estimated flow rate from the spring is less than 1 gpm. No other surface water bodies are present within the watershed or surrounding study area.

2.8 Water Quality

Because this water development project is intended to provide water for construction rather than for potable use, no water quality evaluation has been conducted.

3.0 WATER QUANTITY IMPACT ANALYSIS

Water quantity impact analyses were performed in accordance with the County of San Diego *Groundwater Ordinance*, the County's *Guidelines for Determining Significance* and Report Format and Content Requirements – Groundwater Resources and the approved Groundwater Investigation Workplan and Well Test Plan developed for the Tule Wind Project. Based on the County guidelines for determining significance and correspondence with the County, the water quantity analysis section must address well interference, and 50 percent reduction of groundwater in storage associated with groundwater extraction for construction. In addition, in accordance with the County's Groundwater Ordinance, because it is anticipated that groundwater extraction will exceed 20,000 gpd, which is considered a water intensive use, a cumulative groundwater evaluation is required.

This section provides an analysis of the groundwater conditions and a determination of significant impacts to the groundwater resources, based on CEQA guidelines. It should be noted however that the County does not have jurisdiction over water use on tribal lands, including the wells in Thing Valley on the Ewiiaapaayp Reservation. Aquifer testing on



the Reservation was performed to assess available water for the project construction and a summary of these results is included herein.

Because the Thing Valley WPA is located within the Ewiiaapaayp Reservation, there is no regional authority governing the use of this water. As a result, the water quantity impact analysis has been limited to performance of a 72-hour aquifer pumping test from the North Well at a rate of 80 gpm followed by measurements of recovery back to static conditions. Over the test, the water level was drawn down approximately 80 feet in the pumping well, and about 17 feet in the nearest observation well, and less than one quarter of a foot in the Thing Valley observation well about one mile downgradient of the pumping well. Analysis of the test data as presented in Appendix A.

Thing Valley Water Quantity Impact Analysis. Thing Valley test data were recorded by Solinst Levelogger Gold pressure transducer data loggers placed in the pumping well and two observation wells. The aquifer transmissivity (the capacity of the well to transmit water) was calculated by a variety of methods using AquiferTest Pro, Version 3.5, numerical modeling software (Röhrich and Waterloo Hydrogeologic, 2002) and ranges from about 100 to 835 ft²/day depending on the data (early, middle, late portions of the test) obtained during pumping and recovery; the average transmissivity was calculated to be 393 ft²/day. A summary of the calculated transmissivity values and additional calculated values from the pumping test are provided in Appendix A.

A plot of time versus drawdown was developed from the aquifer pumping test data. Based on the data, a projected total drawdown in the pumping well of 190 feet is expected. A negative boundary condition occurs after 1700 minutes (about 28 hours) and pumping of 136,000 gallons of water. During the intial 1700 minutes of the pumping test, the drawdown cone around the pumping well was likely pulling water from the portion of the fractured rock within Thing Valley. As the cone developed further, the cone is interpreted to have intercepted less fractured bedrock (most likely along the canyon walls) resulting in diminished production (the negative boundary effect).

Considering that the pump has been inoperable for some time prior to the aquifer pumping test, it may be beneficial to remove the pump and conduct an inspection of the well casing and pump for corrosion damage and encrustation to ensure that the well(s) are optimally operable for the duration of the construction program.

3.1 Guidelines for Determination of Significance

For groundwater extraction projects in this fractured rock basin such as the Tule Wind Project, the County Guidelines state:

"groundwater impacts will be considered significant if a soil moisture balance, or equivalent analysis, conducted using a minimum of 30 years of precipitation data, including drought periods, concludes that at any time groundwater in storage is reduced to a level of 50 percent or less as a result of groundwater extraction. Groundwater impacts are considered significant if a soil moisture balance or equivalent analysis conducted using a minimum of 30 years of precipitation data,



including drought periods, concludes that at any time groundwater in storage is reduced to a level of 50 percent or less as a result of the project groundwater demands."

The Guidelines also state:

"As an initial screening tool, offsite well interference will be considered a significant impact if after a five year projection of drawdown, the results indicate a decrease in water level of 20 feet or more in the offsite wells. If site-specific data indicates water bearing fractures exist which substantiate an interval of more than 400 feet between the static water level in each offsite well and the deepest major water bearing fracture in the well(s), a decrease in saturated thickness of 5% or more in the offsite wells would be considered a significant impact."

In addition, based on conversations with the County Groundwater Geologist, a basin-wide cumulative analysis is not required because the project's groundwater extraction period is limited to approximately 9 months. For purposes of the cumulative analysis, with the approval of the County Groundwater Geologist, the Rough Acres Ranch Water Production Area boundary has been defined as an area with a one-half mile radius surrounding the projected ranch groundwater extraction well No. 6a.

3.2 Methodology

In accordance with the approved well test plan for the Tule Wind Project, a step test followed by a 72-hour constant rate aquifer pumping test was conducted at Well No. 6a at the Rough Acres Ranch to evaluate hydraulic characteristics in this proposed construction supply well. Prior to initiating the pumping test, area residents were contacted to request their participation in the test. In order to participate, the resident was asked to discontinue pumping and allow measurement of changes in water levels in their supply well over the testing period. The following residents listed with their Assessor's Parcel Number (APN) were contacted:

Resident	APN	Response
Dave and Linda Shannon	611-091-14	No domestic water storage on site
Dennis and Celeste Wilson	611-091-15	No domestic water storage on site
York Heimerdinger	611-091-02	Has storage but refused the test
Jeff and Peggy Garber	611-090-15	Has storage but refused the test
Lynn Wilson	611-050-24	No domestic water storage on site
Wayne and Frankie Thibodeau	611-091-07	No return call

As presented in this table, none of the surrounding residents agreed to participate in the test. However, because the well pumping test was being performed on the Rough Acres Ranch, most of the available wells on the ranch were made available for monitoring. In addition, the Ranch Manager, Mr. Walker, made his residential supply well available for the duration of the test. A Solinst Levelogger Gold data logger was placed in each of the



available ranch wells prior to the long-term constant rate pumping test. These well locations are presented on Figure 7.

The 72-hour aquifer pumping test was conducted between August 24, and 27, 2010, followed by measurement of well recovery to static conditions. Direct water level measurements could not be performed in 4-inch diameter cased pumping well No. 6a, because of limited access through the well head, with only sufficient room to place the levelogger pressure transducer into the well to a depth of 114 feet below the water level for measurements of the water level in this well. Because of limited access through the wellhead at Well No. 6, located approximately 36 feet from the pumping well, water levels in this observation well were measured manually with an electric water level meter. Flow from the pumping well (at about 50 gpm) was measured with an in-line flow meter and water was discharged to a stock pond location approximately 2000 feet northeast of the pumping well. In addition, barometric pressure was measured with the Solinst Barologger Gold transducer, placed in the pumping well pump house adjacent to the pumping well. The pumping well static water level at the start of the test was about 28 feet below ground surface (bgs) and the pump depth was reportedly positioned at an estimated depth of 350 feet, though the pump depth could not be verified. During the pumping test, the maximum drawdown in the pumping well was 77.5 feet. In the nearest observation Well No. 6, the water level was drawn down a maximum of 3.7 feet. An estimated 216,000 gallons of water was pumped to the stock pond.

Results of the pumping and recover tests were plotted on semilog plots to evaluate the data. County Guidelines were reviewed and incorporated into the analysis. In addition, the long-term aquifer test data were analyzed using AquiferTest Pro, Version 3.5, numerical modeling software (Röhrich and Waterloo Hydrogeologic, 2002) to calculate aquifer hydraulic properties.

3.3 Well Test Results

As required by the County Guidelines, a plot of the pumping test time versus drawdown curve in the pumping well was used to estimate the drawdown in the pumping well after five years (2,600,000 minutes) of pumping at an average of 50 gpm as performed during the pumping test. From the graphed pumping data, the projected draw down is 87 feet after five years (Figure 3; Appendix B). Recognizing the project water requirements are needed over an estimated 9-month construction period, 84 feet of drawdown is predicted. In the event that during the construction, a higher pumping rate is needed, using proportions, doubling the pumping rate to 100 gpm would produce a drawdown of 174 feet after five years.

Using the plot of the drawdown plotted against time presented logarithmically since pumping started (Figure 3; Appendix B), aquifer transmissivity can be calculated using the Cooper-Jacobs approximation to the Theis equation:



$$T = \frac{2.3Q}{4\pi\Delta s}$$

where,

T = transmissivity in square feet per day

Q = average pumping rate in ft^3 / day (e.g., 50 gpm multiplied by $193 = 9650 ft^3$ / day)

 $\pi = 3.14$

 Δs = change in drawdown over one logarithm of time (3.13 ft. from Appendix B, Figure 3)

Based on this equation, a transmissivity of 563 square feet per day is calculated from the pumping data. Using Aquifer Test Pro numerical modeling software, curve matching methods were used on the time versus drawdown plots to calculate transmissivity, hydraulic conductivity, and storativity by different methods. The transmissivity values obtained from the pumping well ranged from between 26.9 and 630 square feet per day. The analytical results show higher transmissivity (and hydraulic conductivity values) for curves matched to the observation well No. 6 and range from 0.375 to 3750 square feet per day. It is believed that the relatively thick alluvial section in this area of McCain Valley acts as a reservoir recharging the underlying fractured bedrock system. If the fractures in the bedrock are limited, the actual volume of groundwater available may be controlled by these thicker sections of alluvium and the more highly fractured bedrock. A summary of the calculated hydraulic properties from the aquifer tests, are presented in Table 1 included in Appendix B.

The recovery data were evaluated to assess long-term affects on the groundwater aquifer. The plot of residual drawdown versus t/t' (the ratio of time to time since pumping stopped) plotted on a logarithmic scale was used to evaluate aquifer storage. At t/t' equal to 1, a residual drawdown would indicate permanent dewatering of the aquifer and greater than 2 feet of residual drawdown would indicate a failed pumping test. As shown on Figure 4 in Appendix B, when the resultant recovery curve is projected back to t/t' equals 1, a residual drawdown of 0.33 feet is obtained indicating a successful test.

Based on the lack of significant drawdown (3.7 feet) in the nearest observation well 36 feet away, and no evidence of an effect in more distal observation wells suggests that the there is significant water within this water production area. Interference with the nearest off-site wells approximately one half mile from the pumping well are not anticipated from the level of pumping proposed during project construction.

3.4 Cumulative Impacts Analysis

Because the project water needs exceed 20,000 gallons of water per day, a cumulative basin analysis is required. To address these cumulative requires, GLA worked directly with the County's Groundwater Geologist, Mr. Jim Bennett, to develop a reasonable approach. Because the McCain Valley is an extensive groundwater basin and pumping is proposed from a limited area of the basin, it was agreed that the cumulative analysis would be limited to a ½ mile radius about the pumping Well No. 6A. The cumulative analysis was performed using spreadsheets and calculations initially developed by Mr. Bennett.



Initially, project groundwater extraction at 50 gpm (72,000 gpd) and area residential and operational water demands were evaluated against monthly groundwater recharge during a drought condition to determine if project extraction will exceed 50 percent of the total storage capacity within an effective area of McCain Valley defined as approximately within one half mile of the proposed pumping Well No. 6a. A second analysis was performed with double the pumping (100 gpm) to further evaluate increased water utilization at this well. Using drought year precipitation data from the Boulevard gauging station (July 1998 through June 2005), when groundwater recharge is minimal and water is extracted from storage, a conservative assessment of possible groundwater impacts was developed.

3.4.1 Groundwater Recharge

In the spreadsheet, groundwater recharge was estimated from available precipitation data for the Boulevard gauging station over a seven year drought period from July 1998 through June 2005, provided by the County Groundwater Geologist. The recharge area was considered to be an area encompassing the ½-mile radius surrounding the pumping well, equivalent to 502 acres. The groundwater recharge also accounts for evapotranspiration based on an average of 62.5 inches per month as established by California Reference CIMIS ETo map, Zone 16.

3.4.2 Groundwater Demand

For the groundwater demand, the project water needs were incorporated with standard assumptions of water needs for other known potential groundwater users including residents, livestock, and other users identified within approximately ½ of the pumping well. To be conservative some land uses within 34 mile of the pumping well were included into the overall area groundwater demand calculations. The groundwater demand calculation assumed that there were seven residents using 0.5 acre feet of water per year in accordance with County Guidelines. From literature (The Ohio State University Extension, 2002), an estimated 100 head of cattle graze on the Rough Acres Ranch, would require an estimated daily intake of 19 gallons per animal per day (the maximum estimated daily water intake required for a bull in 90 degree temperatures), equivalent to 2.13 acre feet of water. It should be noted that slightly lower water consumption values (up to 15 gallons per day) are estimated for various classes of horses that may also be grazing on the Ranch lands. A poultry farm, estimated to include 500 poultry, is located to the south of Rough Acres Ranch and based on available literature from Pennsylvania State University (2002), a conservative estimate of 100 gallons per day or 0.11 acre feet of water consumption each year is assumed to support these animals.

These water quantities in combination with the estimated 9-month construction schedule of water demand from the pumping well on Rough Acres Ranch of 50 gpm resulted in an overall groundwater demand of 7.18 acre-feet per month, or 65.74 acre-feet per year. The groundwater demand would increase to 13.88 acre-feet per month and 125.74 acre-feet per year with a corresponding doubling of the production from the pumping well to 100 gpm.



3.4.3 Groundwater in Storage

The groundwater storage capacity was calculated using conservative estimated of the saturated thickness of each of the hydrogeologic units underlying the water production area as observed in boring logs within the McCain Valley. For this analysis, it is assumed that the saturated thicknesses include 20 feet of alluvium, 10 feet of residuum, and 500 feet of fractured bedrock. Assuming that these materials are continuous over the 502 acre water production area, conservative estimates of the specific yield for each unit was obtained from the County. As summarized in Table 1 in Appendix C, the greatest specific yield is associated with the alluvium at 10%, the specific yield for the residuum is 5%, and because the fractured bedrock yields water only within the fractures, the specific yield for this unit is 0.10%.

By multiplying the 502 acres by the specific yield and by the saturated thickness for each hydrogeologic unit, the total groundwater in storage within the ½-mile water production area is 1002 acre feet of water.

3.4.4 <u>Long-Term Groundwater Availability</u>

Based on the proposed 9-month construction period and the project groundwater demand along with adjacent water users, subtracted from the existing groundwater in storage, in combination with the anticipated groundwater recharge generated over a seven year drought cycle, there will be no long-term groundwater requirements in support of the project. As shown on Table 2 in Appendix C, the maximum drawdown within the subject area is about 66 acre-feet, well above the 50% basin depletion level of 500 acre-feet. Even if project pumping were to be increased to 100 gpm, a maximum of 136 acre-feet of drawdown is calculated within the basin (Table 3; Appendix C). In fact, until pumping is increased by eight times to 54 acre-feet per month or nearly 486 acre-feet per year would the basin approach the 50% depletion level of 500 acre-feet (Table 4; Appendix C).

Based on these analyses, the long-term result of pumping at 50 gpm reduces the groundwater in storage to 94% and a maximum reduction to 92% of the total groundwater in storage during the 7-year drought period. Under an increased (100 gpm) pumping scenario, the groundwater in storage is reduced to 86% of the total with an average of 89%.

Following the project construction phase, the estimated water demand for the project site is estimated to be 2500 gallons per business day or about 2 acre-feet per year, associated with the operations and maintenance facility for the wind turbines. Based on the calculations of groundwater availability this level of use would have no significant impact on the groundwater in storage within McCain Valley.

3.5 Significance of Impacts Prior to Mitigation

Based on the results of the aquifer pumping test at the Rough Acres Ranch well No. 6a, the criteria for well interference and 50% depletion of groundwater in storage associated



with the proposed project will not be met. No significant impacts to groundwater are anticipated associated with the project.

3.6 Mitigation Measures and Design Considerations

Based on the lack of significant impacts to groundwater associated with the proposed project, no groundwater mitigation measures are proposed for the project.

3.7 Conclusions

Based upon the analyses performed, well interference is not anticipated to be a significant impact for the Tule Wind Farm construction project. During the pumping test, a maximum of 3.7 feet of drawdown was observed in the nearest observation well 36 feet away from the pumping well. No observed drawdown was identified in wells located within one third and one half mile of the pumping well.

The potential for depletion of groundwater in storage within the McCain Valley is not anticipated. Results of the groundwater demand during a drought period indicate that eight times the anticipated groundwater pumping would be required to drawn groundwater to the 50% depletion level.

4.0 SUMMARY OF PROJECT IMPACTS AND MITIGATION

Based on the results of pumping tests and analysis of the data, there is sufficient groundwater to meet the project demands. Review of cumulative analyses performed within a ½ mile radial area of McCain Valley about the aquifer pumping test well indicates based on the available groundwater storage within McCain Valley, it is possible to increase pumping at the Rough Acres Ranch aquifer test well significantly without well interference or significant groundwater depletion.

Although there are no requirements for analysis of groundwater use on tribal lands, the aquifer pumping test and analyses indicate that there is sufficient storage for use of groundwater within Thing Valley and no significant impacts to groundwater storage are anticipated. However, the pumping test data and the noted boundary condition identified during the test after 1700 minutes suggests that to support the project water needs, it may be necessary to pump at a lesser rate or lesser frequency at the aquifer pumping test well, and supplement the water from this well with water from another well within Thing Valley such as the observation well. In addition, because the well has been inoperable for some time, it is recommended that this well and pump be inspected and rehabilitated as necessary to ensure that the well operates optimally for the duration of the construction project.



5.0 CLOSURE

This report was prepared in general accordance with acceptable professional geotechnical and hydrogeologic principles and practices. This report makes no other warranties, either expressed or implied as to the professional advice or information included herein. Although the groundwater investigation performed included constant rate pumping over a 72-hour period, it is not possible to fully anticipate an aquifer's behavior over the proposed 9-month construction period. It is understood that the project intends to obtain will serve letters to purchase water from off-site vendors if it is needed. The use of off-site water suppliers is recommended in the event that groundwater supplies are not fully supportive of the project. Our firm should be notified of any pertinent change in the project, or if conditions are found to differ from those described herein, because this may require a reevaluation of the conclusions. This report has not been prepared for use by parties or projects other than those named or described herein. It may not contain sufficient information for other parties or purposes.

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7.0 LIST OF PREPARERS AND PERSONS AND ORGANIZATIONS CONTACTED

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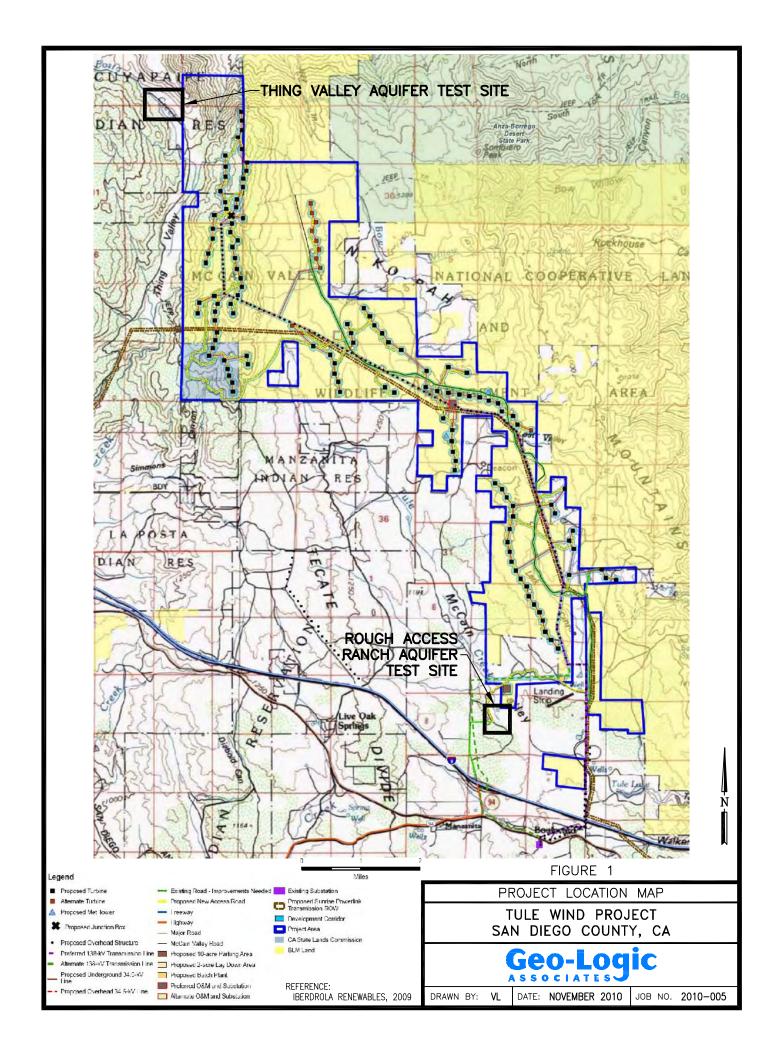
Mr. Robert Walker Rough Acres Ranch Manager

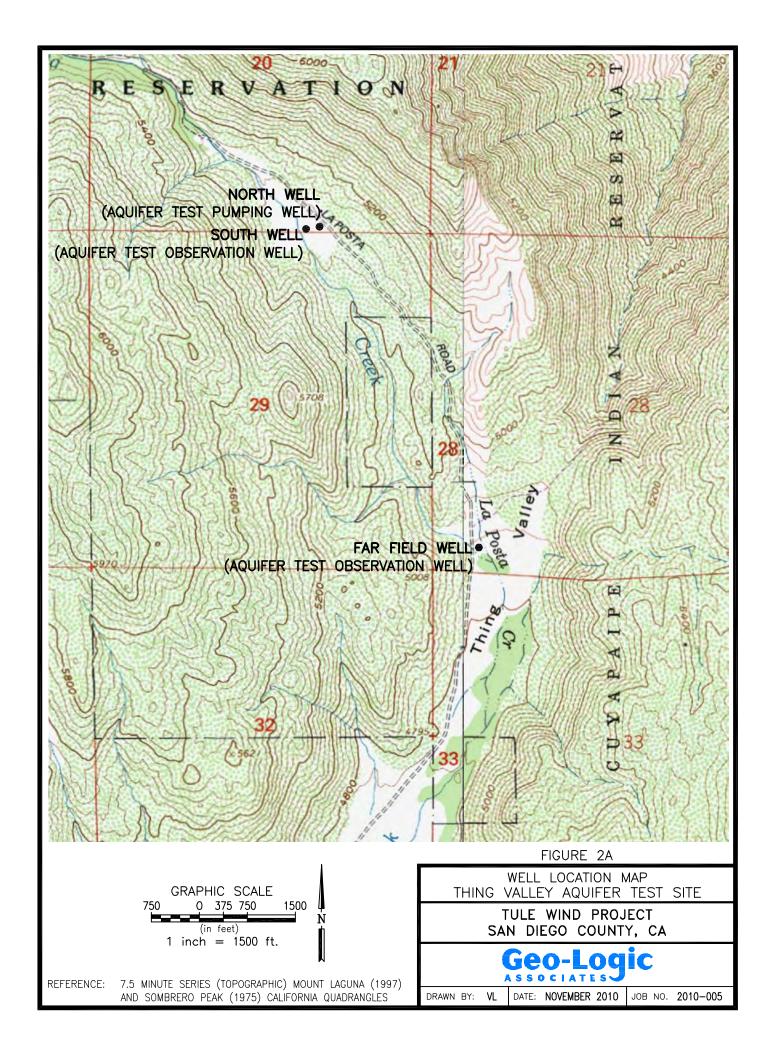
Desi Vela Field Technician, Ewiiaapaayp Band of Kumeyaay Indian

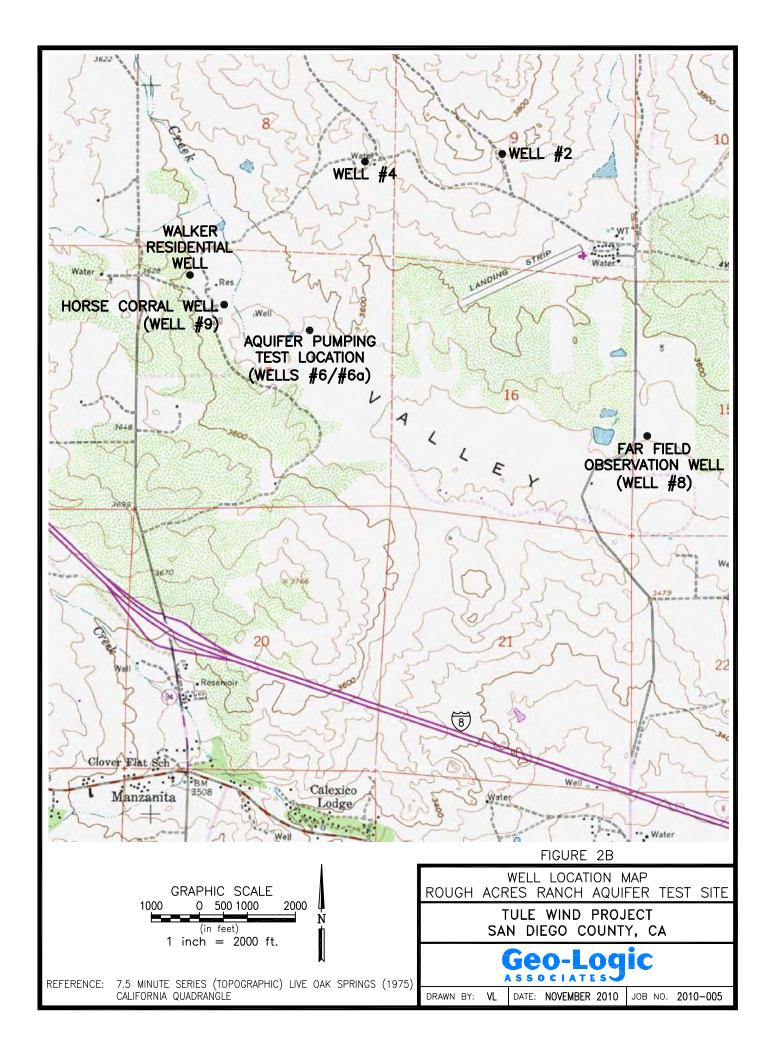


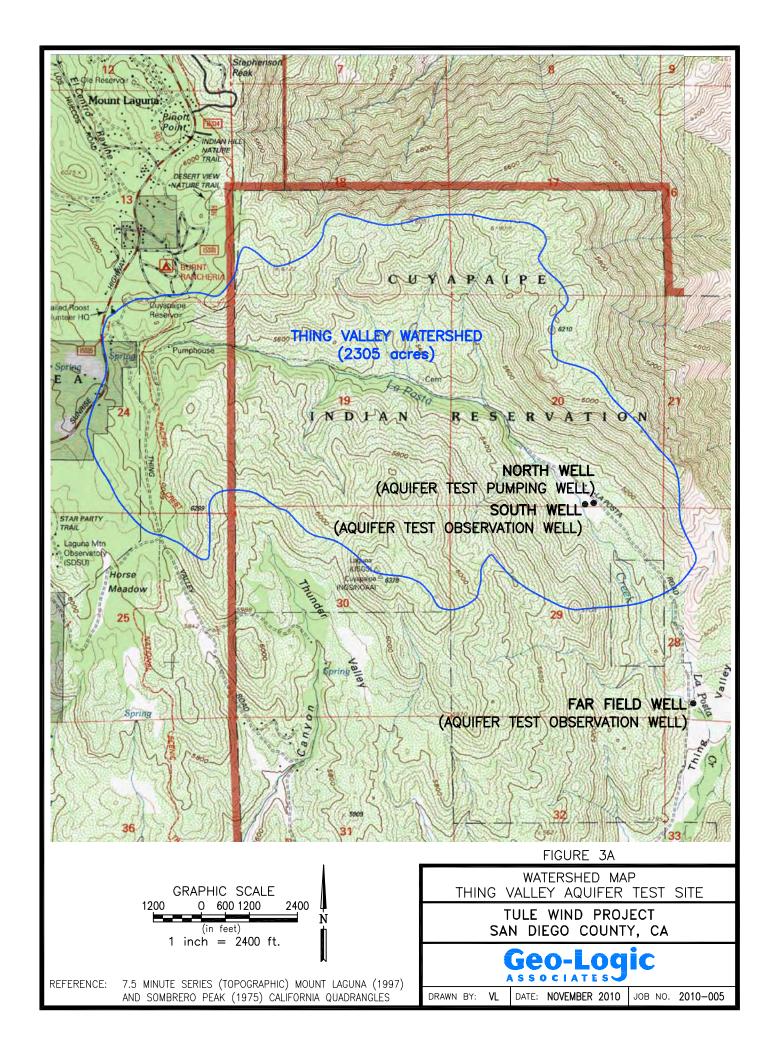
FIGURES

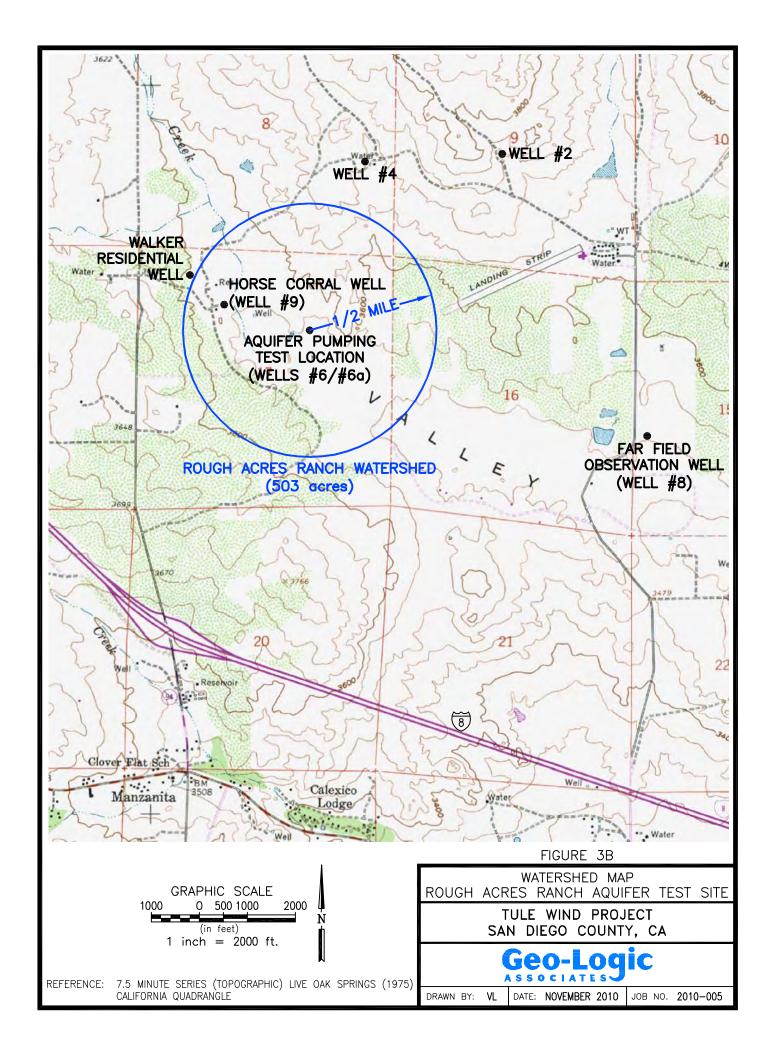


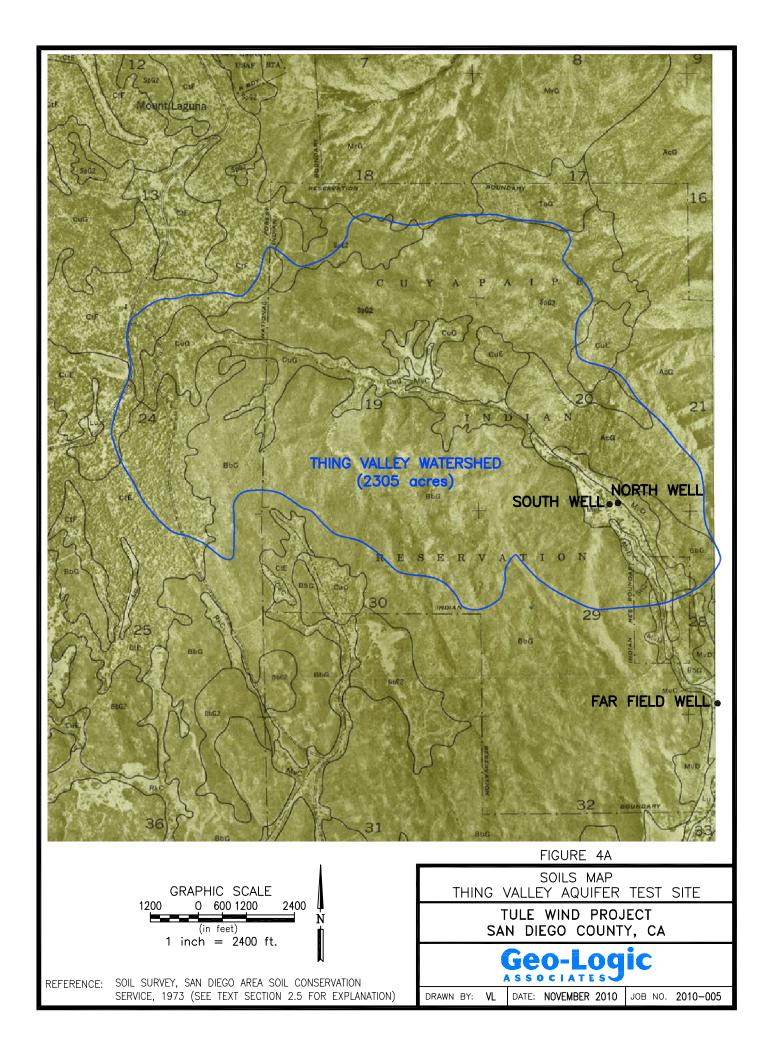


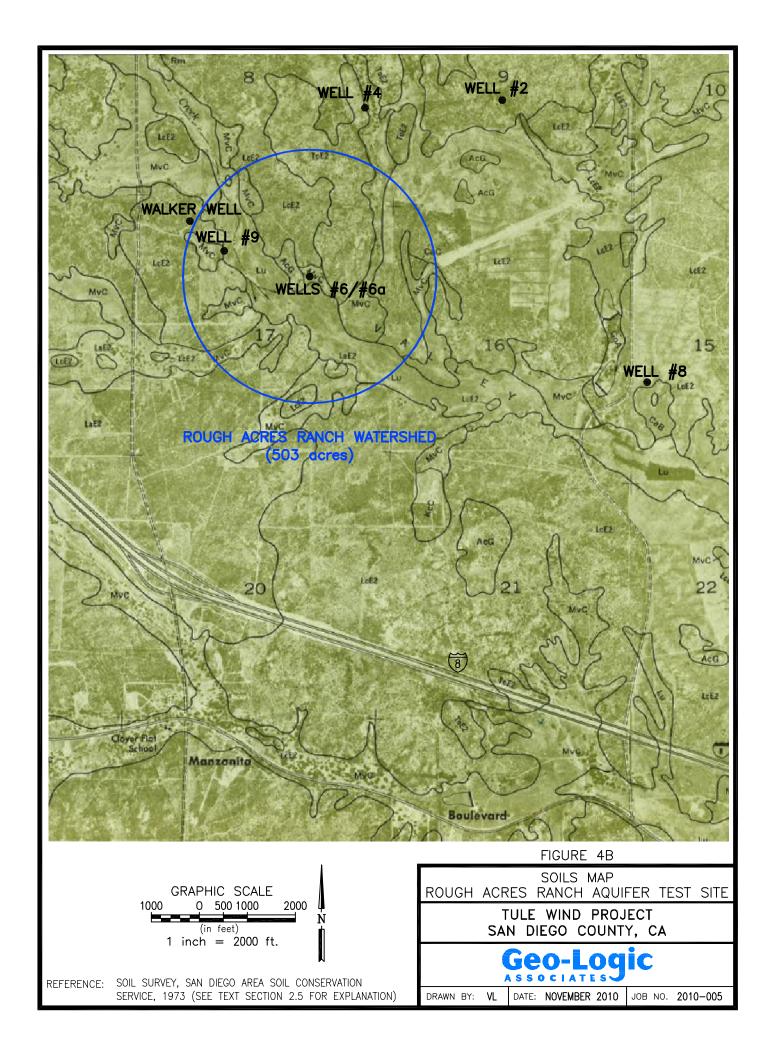


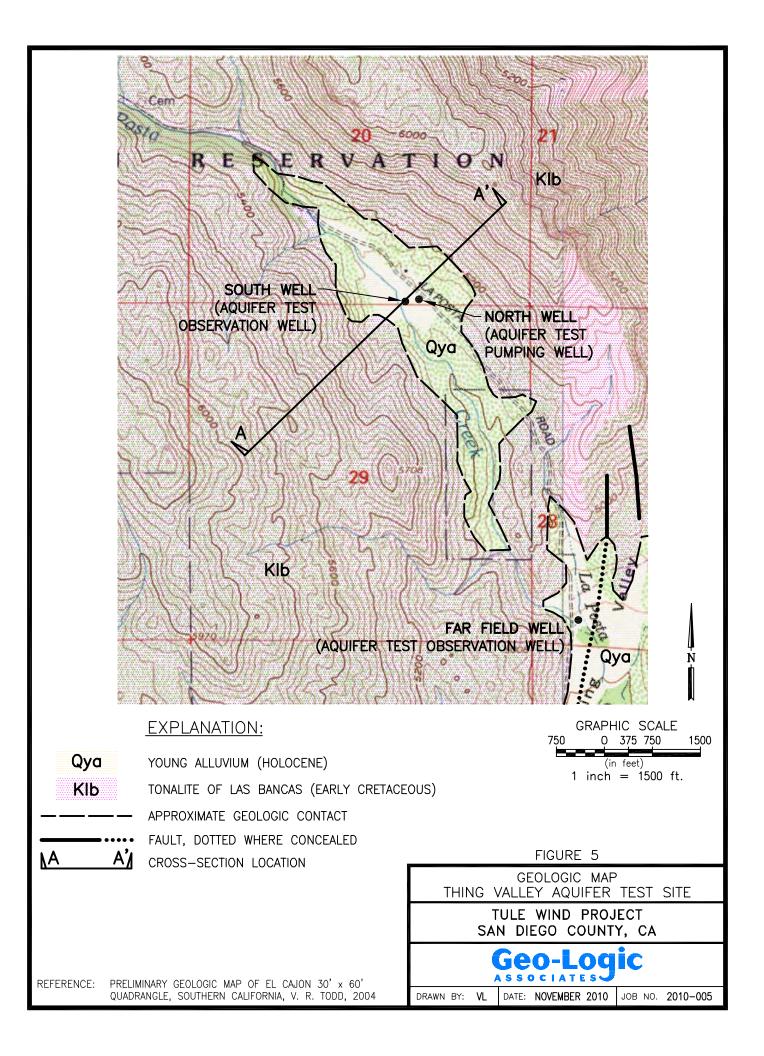


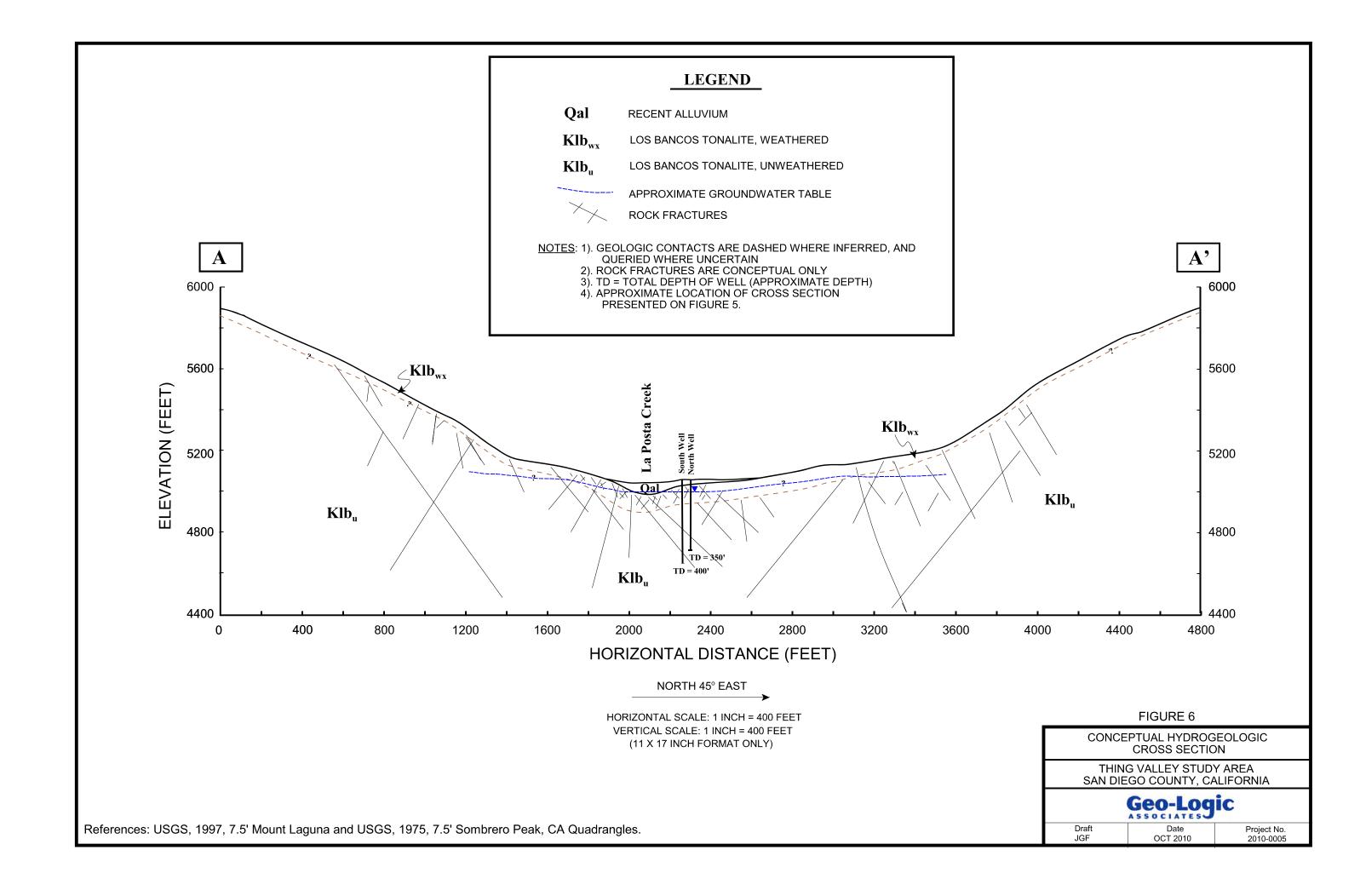


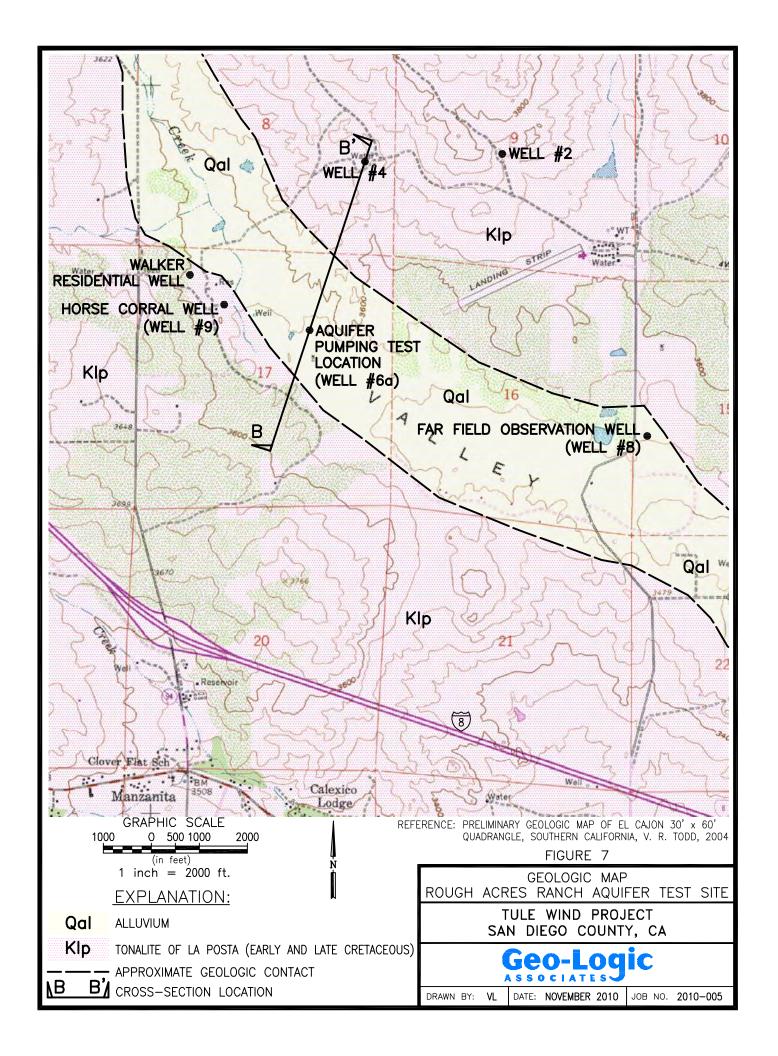


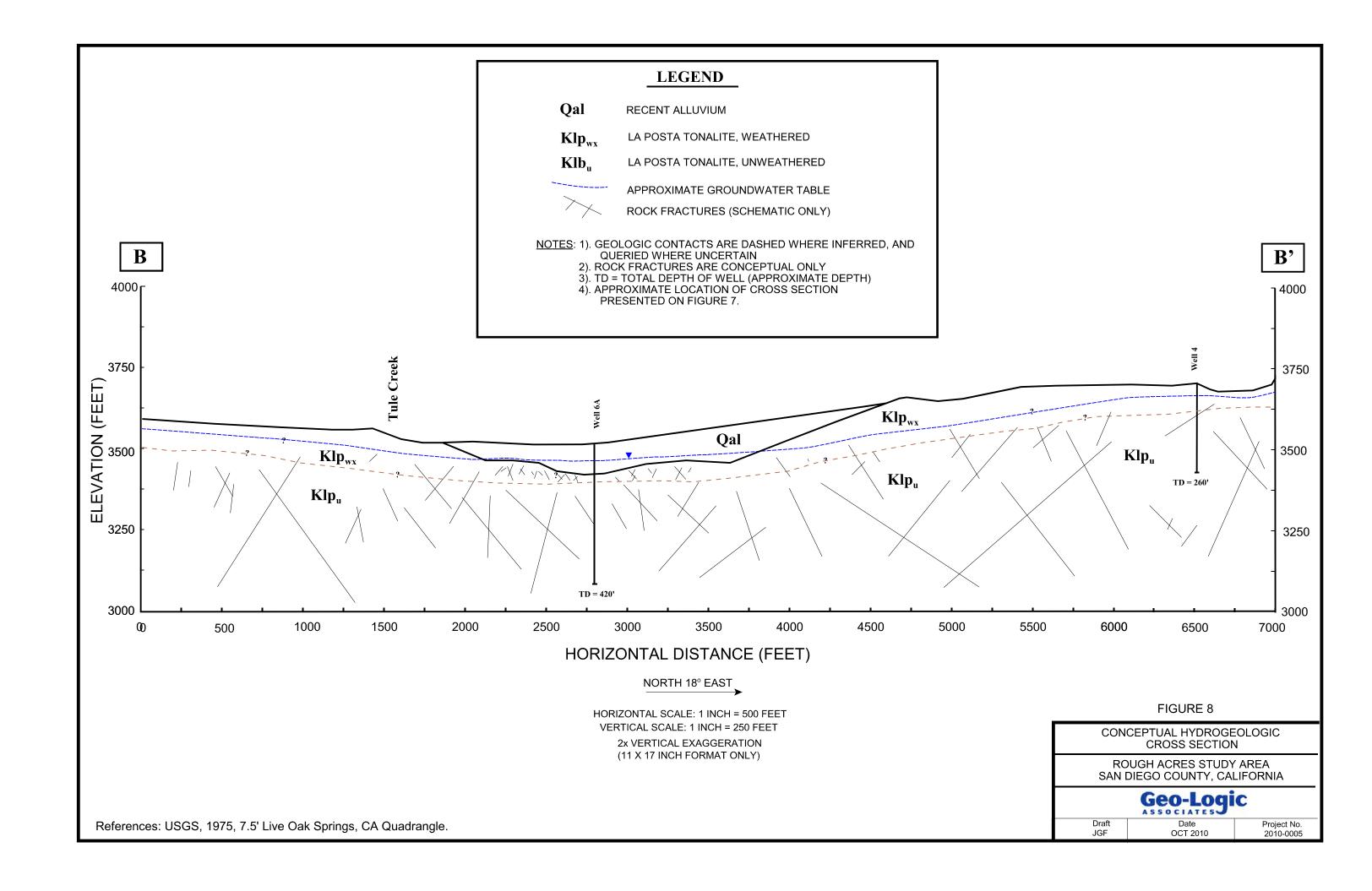












APPENDIX A

OBSERVATIONS AND ANALYSIS OF AQUIFER CHARACERISTICS

EWIIAAPAAYP RESERVATION

THING VALLEY, EAST SAN DIEGO COUNTY, CALIFORNIA





Date: November 8, 2010

Project No.: 2010-0005

To: John Hower, CEG

Sarah Battelle, CHG

From: Mark Vincent, CHG

Regarding: Observations and Analyses of Aquifer Characteristics

Thing Valley, San Diego County, California

INTRODUCTION

This memo presents a summary of observations and analyses made following a stepped and a constant rate aquifer pumping and recovery test in wells located in Thing Valley located approximately 10 miles north of I-8 off La Posta Truck Trail/Thing Valley Road in the Ewiiaapaayp Reservation, in eastern San Diego County, California. The tests were performed to determine whether sufficient volumes of water are available for the Tule Wind Farm construction projects. Analyses performed included calculation of transmissivity, hydraulic conductivity, and storativity for a pumping well and observation wells.

WELL AND AQUIFER CONDITIONS

A well labeled as South Well was used as the pumping well for this test. Another well labeled as North Well is located 61.5 feet to the west of the pumping well and was monitored and analyzed as an observation well. A third well identified as Thing Valley Well is located approximately 5,517 feet south-southeast of the pumping well and was also used as an observation well (Figure 1).

Records for drilling and construction of the wells used for these pumping tests are incomplete or nonexistent. A well identified on Department of Water Resources (DWR) records as the "Cuyapaipe Community Well" (identified as Form No. 058539) is believed to be the log for South Well. No records are available for North Well or Thing Valley Well.

Although DWR records indicate that slotted well casing was installed to a depth of 122 feet, they do not indicate whether or not casing exists below that depth or if the casing was installed prior to drilling the well to a total depth of 400 feet. The North and South Wells used in this pumping test have existing electric submersible pumps installed in them. Based on the production rates achieved during the tests performed, the wells are likely to be outfitted with four-inch diameter electric submersible pumps. Based on the depth and pressure head on the transducers installed in the wells for the test, it was assumed that all of the boreholes are 400 feet deep and are 10-inches in diameter. It was

further assumed that the wells were constructed with 6-inch diameter well casing and that they are perforated or screened over the entire saturated thickness. Details of well construction could not be verified in the field because of the presence of pumps, discharge pipes, electrical wires, and surface sanitary seals.

The area immediately around North Well and South Well is underlain by alluvium comprised of poorly sorted sand, gravel, and silt derived from the crystalline basement rock exposed on the adjacent canyon sidewalls. The crystalline basement rocks are classified as tonalite and yield groundwater from fractures. The well log reportedly recorded for South Well indicates that there are about 12 to 15 feet of alluvium overlying the tonalite. An alternative interpretation of the log is that some of the materials described in the log to a depth of 50 feet could also be coarse-grained alluvium locally derived from the surrounding tonalite. Groundwater was measured at a depth of 54.81 feet below the top of sanitary seal on North Well (approximately 8-inches above ground surface) and was measured at a depth of 49.34 feet below the sanitary seal in South Well (also about 8-inches above ground surface). Groundwater was measure at a depth of 77.62 feet below the top of the conductor casing on Thing Valley Well (the conductor casing extends approximately 6-inches above ground surface).

TEST METHODS

Observations of groundwater elevation were recorded in a pumping well and two observation wells in Thing Valley. Data was collected using pressure transducers connected to data loggers. Barometric pressure changes were recorded during the test and corrections were made to the pressure head data collected during the tests.

A stepped aquifer pumping test was performed using North Well to determine the optimum pumping rate for a longer duration test. The pressure transducers were deployed and began recording data on August 12, 2010 to perform the stepped pumping test. The stepped pumping test was performed at pumping rates of 72 gallons per minute (gpm), 88 gpm, and 90 gpm. The pump could not be throttled down below 72 gpm without water exiting a by-pass / check valve and had a maximum yield of 90 gpm. A semi-logarithmic plot of elapsed time versus drawdown for the stepped pumping test is shown on Figure 2.

The constant rate pumping and recovery test was performed from August 16 through 19, 2010. The pump was powered-down on August 19, 2010 and allowed to recover until August 23, 2010 when the pressure transducers were removed from the wells. South Well was initially pumped at an average rate of 88 gpm and was corrected to 80 gpm during a period from about 1 to 2 hours into the test. Recovery tests were performed by turning off the pumps and recording the increasing head levels over time.

DATA ANALYSIS

Changes in groundwater level data recorded during this test were corrected for barometric pressure changes and used to generate a file containing tabulated time and changes in pressure head. The data was used to generate time-drawdown graphs for the pumping



and observation wells and imported into computer software used to calculate the transmissivity and storativity of the fractured tonalite.

The stepped pump test analysis consists of plotting the drawdown versus time for each pumping rate on a time versus drawdown plot with time plotted on a logarithmic scale. Forward projections of each segment representing a different pumping rate can be used to predict the likely drawdown for the pumping well during for the selected duration of the test. A pumping rate of 80 gpm was selected as the target pumping rate because it would allow for ample drawdown without the well running dry during the test.

The method of Schafer (1978) was employed to determine how much of the data set for North Well was impacted by casing storage effects. The method is a simplification of the method first developed by Papadopulos and Cooper (1967) but does not require prior knowledge of the transmissivity or well efficiency. The point at which casing storage effects are overcome was calculated to occur approximately 12 to 14 minutes into the test based on the assumptions about well construction practices, pumping rates, and drawdown. Very early pumping data was ignored in the analyses described below due to casing storage effects and the non-uniform drawdown curve caused by the change in the pumping rate from 88 to 80 gpm.

Time versus drawdown plots were prepared for the pumping and observation wells for the pumping and recovery portions of the test. The plots are shown with the time axis plotted on a logarithmic scale and drawdown on a linear scale.

Figure 3 shows the time-drawdown plot for North Well during pumping. The first 12 to 14 minutes of the test show the effects of attempting to establish a constant pumping rate and casing storage effects. A slight recovery in the drawdown is noted from around 14 minutes to approximately 33 minutes due to a reduction in the pumping rate from 88 to 80 gpm. The North Well drawdown plots as a straight line on the time-drawdown chart representing constant aquifer properties during that portion of the drawdown cone development. A sudden change in the drawdown curve starts at approximately 1,700 minutes and changes again at approximately 3,000 minutes. The steepening of the time drawdown curve noted at approximately 1,700 and 3,000 minutes likely indicates a negative boundary effect.

A residual drawdown plot for the North Well is shown on Figure 4. The plot shows the change in drawdown versus the ratio of the time since the pump test started divided by the time since the recovery portion of the test started (t/t`). An inflection point is noted at approximately t/t`=100 possibly due to some type of boundary effect. The residual drawdown at a t/t` ratio of 1 extends through the origin and there is no discernable change in storage noted in the pumping well over the course of the pumping and recovery portions of the aquifer stress test.

A time-drawdown plot of South Well located 61.5 feet away from the pumping well shows a sharp decrease in drawdown from approximately 51 minutes to approximately 65 minutes which is considered to be the result of the decrease in pumping rate from 88 to 80 gpm (Figure 5). The South Well plot shows a slight increasing slope to the semi-logarithmic plot but shows a very strong inflection point at approximately 1,700 minutes



into the test. This is interpreted to be the result of a negative boundary effect similar to that observed on the time-drawdown plot from North Well (compare Figures 3 and 5).

The South Well recovery portion of the test is plotted as the residual drawdown versus t/t` shows a concave upwards curvature to the semi-logarithmic plot (Figure 6) indicative of changing aquifer conditions from a t/t` ratio of about 10 to 200 into the recovery test period. The line segment from a t/t` ratio of 200 the end of the test is a straight line plot indicative of constant aquifer conditions. The residual drawdown value measured for a t/t' ratio of 1 is about -3.5 feet. Though this value is not within about one half of a foot as would be expected from a successful test, it may not be especially significant for an observation well when the pumping well shows no changes in storage effect.

The Thing Valley Well located approximately 5,517 feet south of the pumping well was monitored for changes in head. A possible cumulative drawdown of approximately 0.25 feet was observed from approximately 400 minutes until the end of the test (Figure 7). The recovery portion of the well is shown on Figure 8 and is shows a large sudden change in measured head near the end of the monitoring period. This is interpreted as a slippage of the transducer cable and is probably not a valid recovery curve.

Water level drawdown data were evaluated using the computer software program AquiferTest version 3.5 (Waterloo Hydrogeologic, 2002). The program performs curve matching of the time drawdown data to calculate transmissivity, hydraulic conductivity, and storativity using different methods. The methods employed included Cooper-Jacob (1946), Moench (1993), Neuman (1975), and Theis (1935).

DISCUSSION

As shown on Table 1, the calculated hydraulic conductivity values for all of the analytical methods employed ranged from a low of 0.285 feet/day for data collected from North Well using Neuman's method for the data collected from the end of the data set to a high of 2.39 feet/day for the early time recovery phase of South Well using the Theis Recovery method. An average conductivity of 1.122 feet/day was calculated from all methods from both South Well and North Well. The Storativity values range from a low of 3.33E-09 for North Well middle to late time data and a high of 4.19E+01 for a match to the very late time data recorded in South Well.

All of the analytical results show a higher transmissivity and hydraulic conductivity value for matches to the early time drawdown data and show lower values for matches to late time drawdown data. This is most likely the result of a higher degree of fracturing in the rock around the wells. North Well and South Well are located in a portion of Thing Valley which is entirely covered in up to 50 feet of alluvium (Figure 9). Inspection of aerial photographs from Google Earth show the local canyons and drainages are controlled by large scale joint sets. Areas of maximum fracturing will have higher transmissivity and hydraulic conductivity associated with them and also will be more prone to erosion.

During the pumping test, a cone of depression developed radially around the well until the cone intercepted lower transmissivity/less fractured rock at the canyon side walls (the



negative boundary effect observed approximately 1,700 minutes into the test). After that time, the majority of the water entering the wells is coming from directly up and down canyon. A later stage negative boundary effect near the 3,000 minute mark observed in North Well may be a secondary negative boundary effect associated with translation of the cone of depression outside the portions of the canyon overlain by alluvium. Although the alluvium was not thought to be saturated during the test it is likely to act like a sponge slowing the downgradient flow of groundwater.

Because the fractures in the bedrock appear to be of aerially limited extent, the actual volume of groundwater available may be limited with larger volumes of groundwater available within the canyon areas where fracturing may be most prevalent.

CLOSURE

This summary of observations and analyses has been prepared in general accordance with accepted professional geotechnical and hydrogeologic principles and practices. This report makes no other warranties, either expressed or implied as to the professional advice or information included in it. Our firm should be notified of any pertinent change in the project, or if conditions are found to differ from those described herein, because this may require a reevaluation of the conclusions. This report has not been prepared for use by parties or projects other than those named or described herein. It may not contain sufficient information for other parties or purposes.

Geo-Logic Associates

Mark W. Vincent, PG 5767, CEG 1873, CHg 865

Mark W Vinent

Senior Geologist

Attachments: Table 1 - Aquifer Stress Test Results

Figure 1 - Well Location Plan

Figure 2 - Step Test Time Drawdown Plot

Figure 3 - North Well Time Drawdown Plot Pumping

Figure 4 - North Well Time Drawdown Plot Recovery

Figure 5 - South Well Time Drawdown Plot Pumping

Figure 6 - South Well Time Drawdown Plot Recovery

Figure 7 - Thing Valley Well Time Drawdown Pumping

Figure 8 - Thing Valley Well Time Drawdown Recovery

Figure 9 - Geologic Map

Appendix A - Analytical Results from Aquifer Test Program



REFERENCES

- Cooper, H.H., Jr. and Jacob, C.E., 1946, A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Well Field History, *Transactions*, *American Geophysical Union*, Vol. 27, No. 4.
- Driscoll, D.G., 1986, <u>Groundwater and Wells</u>, Johnson Filtration Systems Inc., St. Paul, Minnesota.
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- Papadopulos, I.S. and Cooper, H.H., Jr., 1967, Drawdown in a well of large diameter, *Water Resources Research*, vol. 3, pp 241-244.
- Schafer, D.C., 1978, Casing Storage Can Affect Pumping Test Data, *Johnson Drillers' Journal*, Jan/Feb, Johnson Division, UOP Inc., St. Paul, Minnesota.
- Theis, C.V., 1935, The Relation Between the Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well Using Groundwater Storage, *American Geophysical Union Transactions*, Vol. 16, pp. 519-524.
- Waterloo Hydrogeologic (co-developed with Thomas Roerich), 2002, AquiferTest version 3.5, Advanced Pumping Test and Slug Test Analytical Software.



Table 1
Aquifer Stress Test Results
Thing Valley

Well Designation	Condition	Distance From Pumping Well (feet)	Groundwater Depth from TOC (feet)	Groundwater Depth from Ground Surface (feet)	Assumed Aquifer Thickness (feet)	Average Pumping Rate (gpm)	Analytical Method	Transmissivity (feet^2/day)	Conductivity (feet/day)	Storativity	Comments
North Well	Pumping	1	54.81	54.14	350	81	Cooper-Jacob	488	1.390	3.33E-09	Match to mid-late data.
North Well	Pumping	1	54.81	54.14	350	81	Cooper-Jacob	176	0.502	3.05E-02	Match to late data.
North Well	Pumping	1	54.81	54.14	350	81	Moench	261	0.741	4.45E-04	Match to late data.
North Well	Pumping	1	54.81	54.14	350	81	Neuman	99.8 Minimum	0.285 Minimum	3.82E-04	Match to late data.
North Well	Pumping	1	54.81	54.14	350	81	Theis	256	0.733	3.57E-04	Match to late data.
North Well	Pumping	1	54.81	54.14	350	81	Walton	115	0.327	2.41E-02	Match to late data.
North Well	Recovery	1	54.81	54.14	350	81	Theis Recovery	669	1.910	NA	Match to early data.
North Well	Recovery	1	54.81	54.14	350	81	Theis Recovery	473	1.350	NA	Match to middle data.
North Well	Recovery	1	54.81	54.14	350	81	Theis Recovery	337	0.963	NA	Match to late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Cooper-Jacob	513	1.470	8.29E+00	Match to late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Cooper-Jacob	294	0.841	4.19E+01	Match to very late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Moench	467	1.330	1.35E-05	Match to late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Neuman	469	1.340	9.12E-04	Match to late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Theis	477	1.360	2.10E-03	Match to late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Walton	477	1.360	8.76E+00	Match to late data.
South Well	Recovery	61.5	49.34	48.67	350	81	Theis Recovery	835 Maximum	2.39 Maximum	NA	Match to early data.
South Well	Recovery	61.5	49.34	48.67	350	81	Theis Recovery	508	1.450	NA	Match to middle data.
South Well	Recovery	61.5	49.34	48.67	350	81	Theis Recovery	311	0.888	NA	Match to late data.
<u> </u>				<u> </u>			Average Values	393	1.122	3.88E-03	

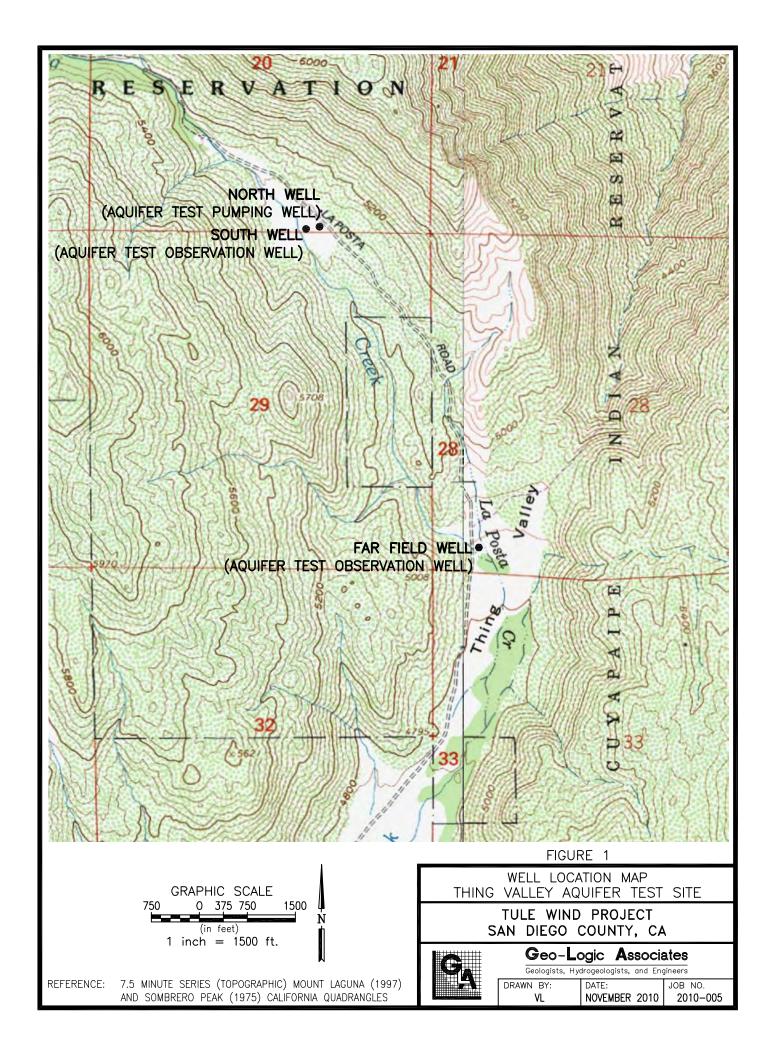


Figure 2
North Well
(Pumping Well)
Time Drawdown Plot for Stepped Pump Test

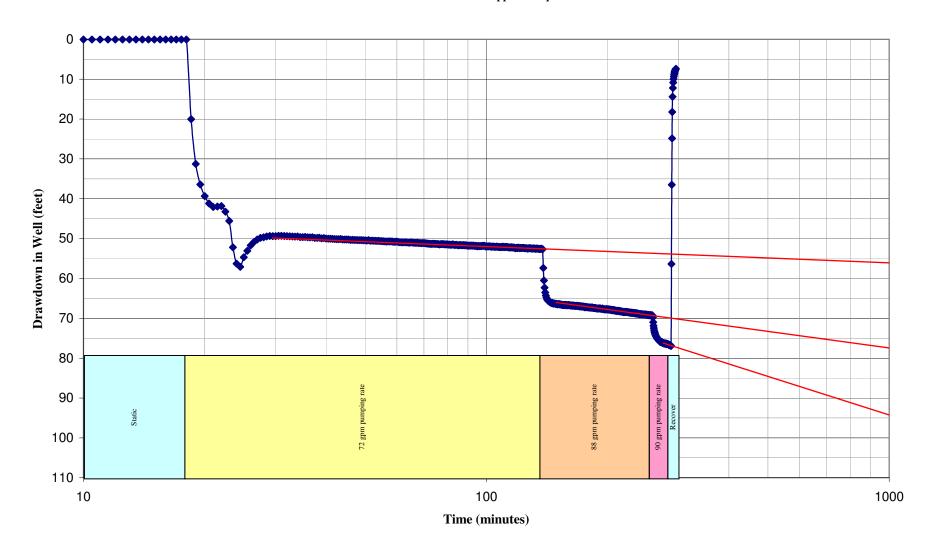


Figure 3 North Well (Pumping Well) Time-Drawdown Plot

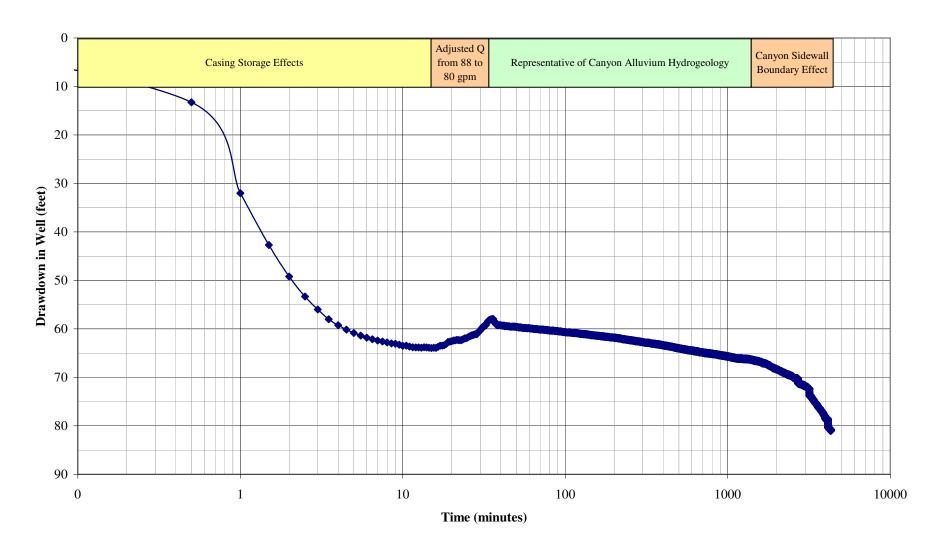


Figure 4 North Well Recovery Time-Drawdown Plot

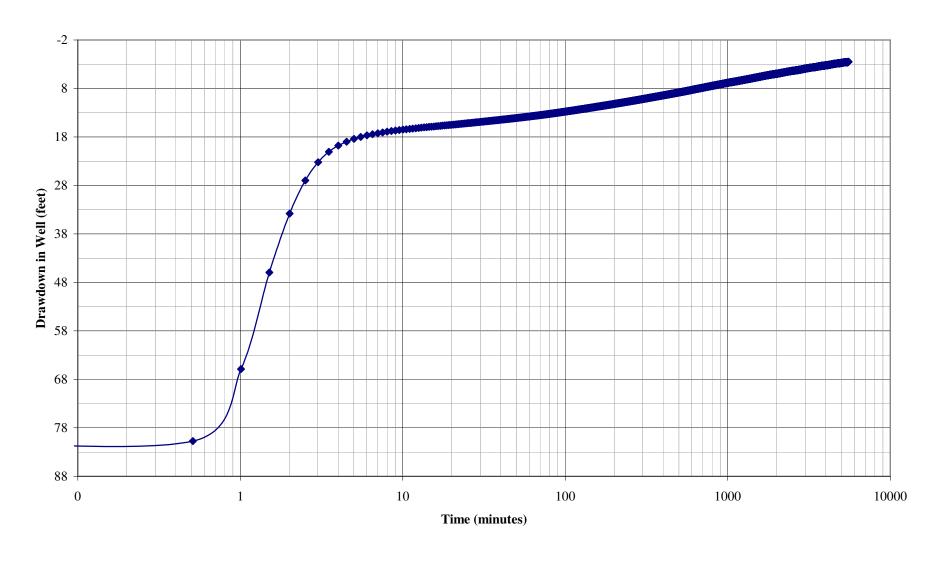


Figure 5 South Well (Observation Well) Time-Drawdown Plot

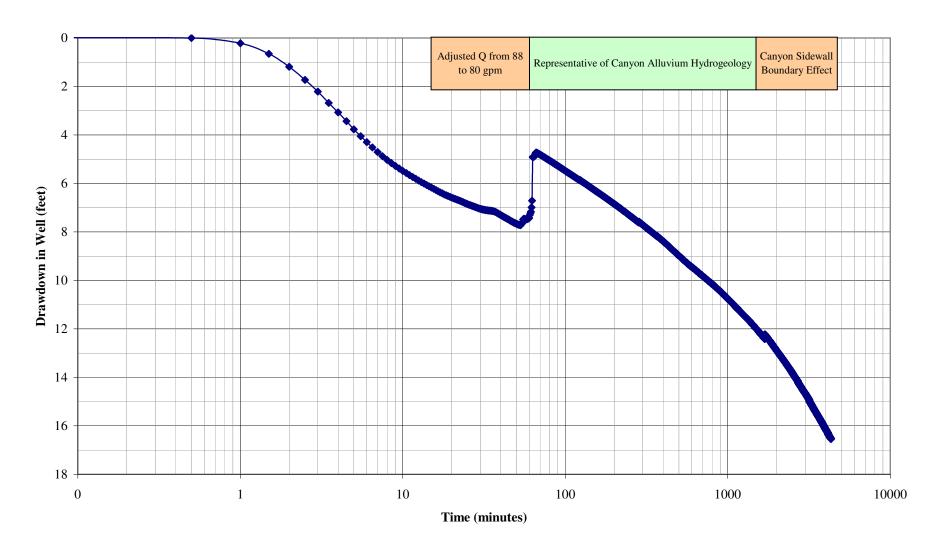


Figure 6 South Well (Observation Well) Recovery Time-Drawdown Plot

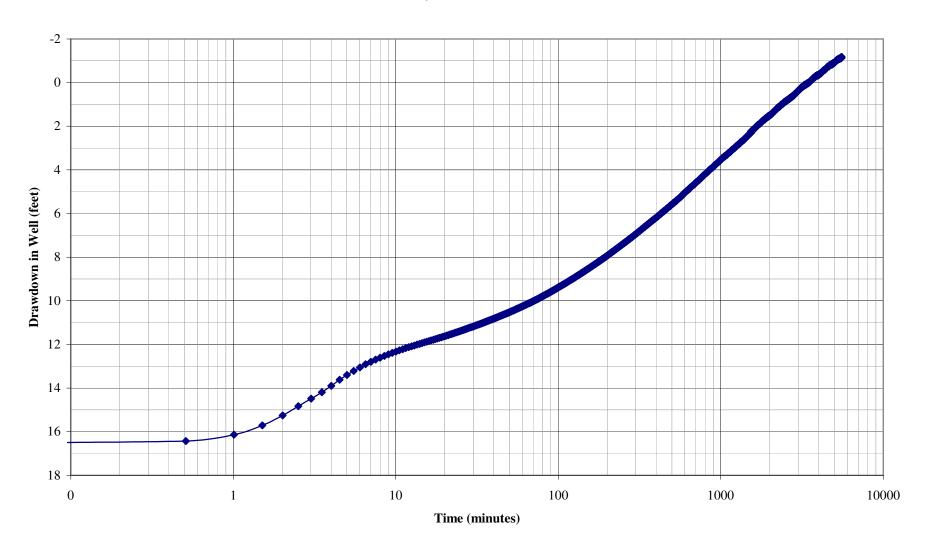


Figure 7
Thing Valley Well
(Observation Well)
Time-Drawdown Plot

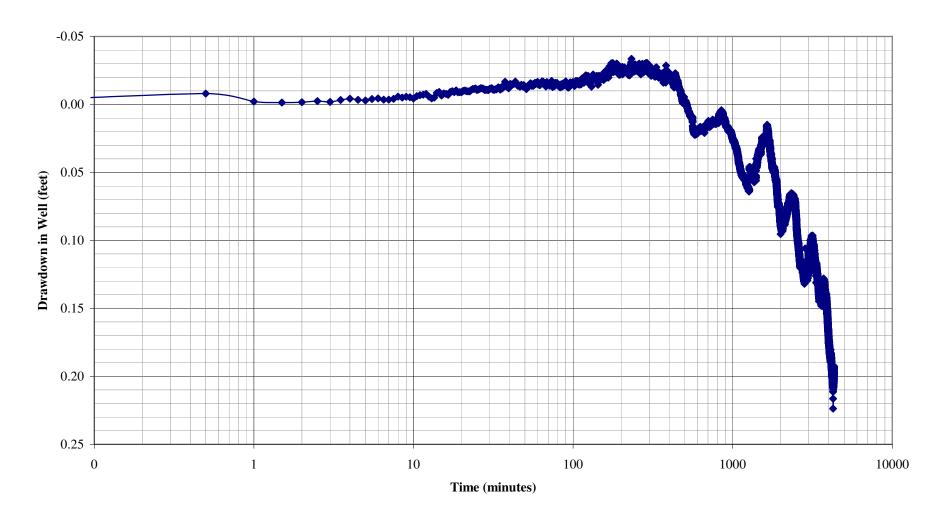
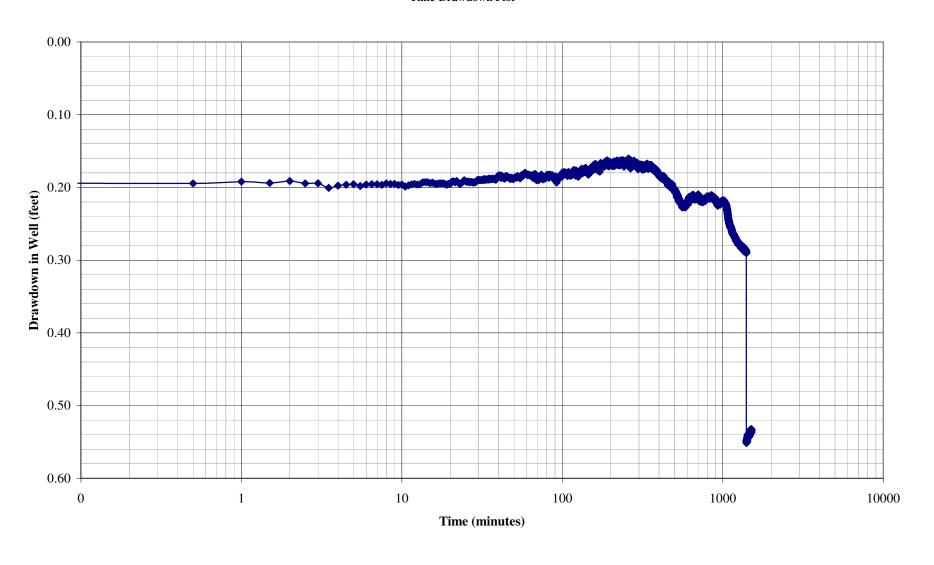
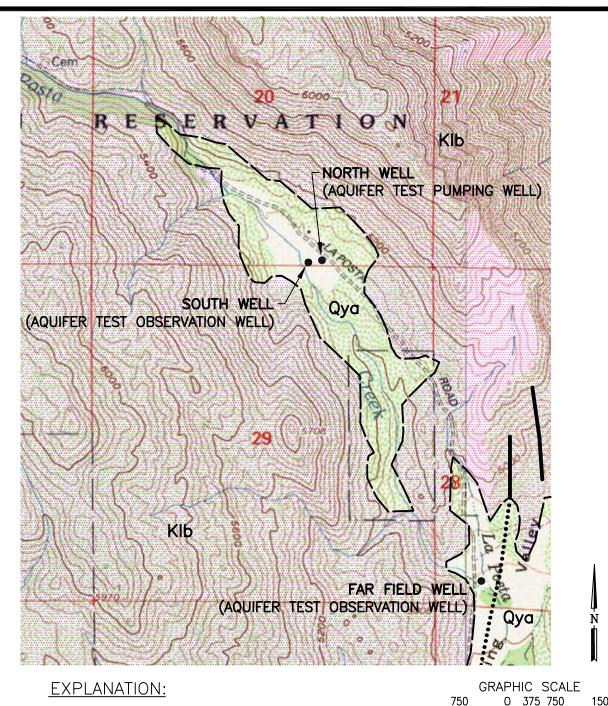


Figure 8
Thing Valley Well
Recovery
Time-Drawdown Plot





Qya

YOUNG ALLUVIUM (HOLOCENE)

Klb

TONALITE OF LAS BANCAS (EARLY CRETACEOUS)

APPROXIMATE GEOLOGIC CONTACT

FAULT, DOTTED WHERE CONCEALED

GRAPHIC SCALE
750 0 375 750 1500

(in feet)
1 inch = 1500 ft.

FIGURE 9

GEOLOGIC MAP
THING VALLEY AQUIFER TEST SITE

TULE WIND PROJECT SAN DIEGO COUNTY, CA



Geo-Logic Associates

Geologists, Hydrogeologists, and Engineers

DRAWN BY: DATE:
VL NOVEMBER 2010

JOB NO. 0 2010-005

REFERENCE: PRELIMINARY GEOLOGIC MAP OF EL CAJON 30' x 60'
QUADRANGLE, SOUTHERN CALIFORNIA, V. R. TODD, 2004

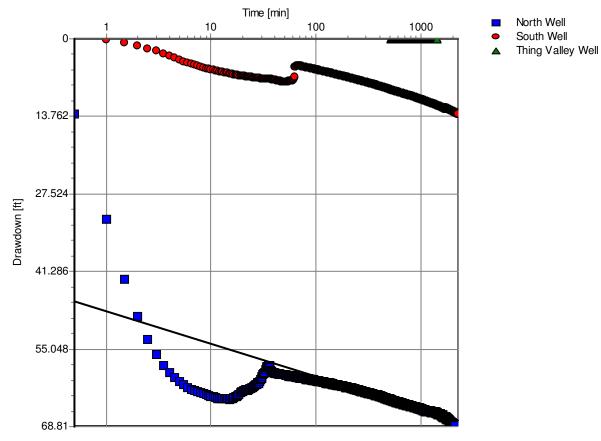


460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798 **Pumping Test Analysis Report**

Project: Thing Valley
Number: 2010-0005

Client:





Pumping Test: Thing Valley Wells

Analysis Method: Cooper-Jacob Time-Drawdown

Analysis Results: Transmissivity: 4.88E+2 [ft²/d] Conductivity: 1.39E+0 [ft/d]

Storativity: 3.33E-9

Test parameters: Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

Casing radius: 0.25 [ft] Confined Aquifer

Screen length: 350 [ft]
Boring radius: 0.42 [ft]

Discharge Rate: 80.111574 [U.S. gal/min]

Comments: North Well Match to mid-late data.



460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798 **Pumping Test Analysis Report**

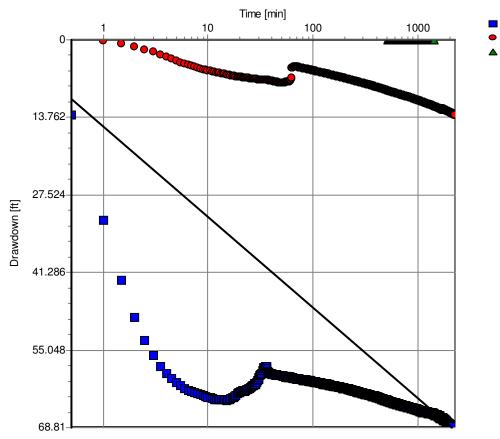
North Well

South Well Thing Valley Well

Project: Thing Valley
Number: 2010-0005

Client:





Pumping Test: Thing Valley Wells

Analysis Method: Cooper-Jacob Time-Drawdown

Analysis Results: Transmissivity: 1.76E+2 [ft²/d] Conductivity: 5.02E-1 [ft/d]

Storativity: 3.05E-2

<u>Test parameters:</u> Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

Casing radius: 0.25 [ft] Confined Aquifer

Screen length: 350 [ft]
Boring radius: 0.42 [ft]

Discharge Rate: 80.111574 [U.S. gal/min]

Comments: North Well match to late data.

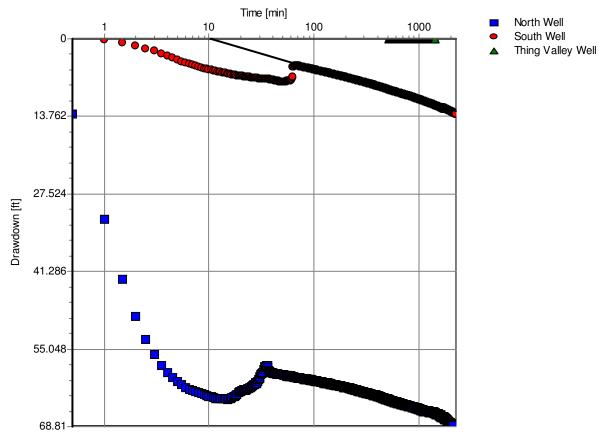


460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798 **Pumping Test Analysis Report**

Project: Thing Valley
Number: 2010-0005

Client:





Pumping Test: Thing Valley Wells

Analysis Method: Cooper-Jacob Time-Drawdown

Analysis Results: Transmissivity: 5.13E+2 [ft²/d] Conductivity: 1.47E+0 [ft/d]

Storativity: 8.29E+0

<u>Test parameters:</u> Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

Casing radius: 0.25 [ft] Confined Aquifer

Screen length: 350 [ft]
Boring radius: 0.42 [ft]

Discharge Rate: 80.111574 [U.S. gal/min]

<u>Comments:</u> South Well match to late data.



460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798 **Pumping Test Analysis Report**

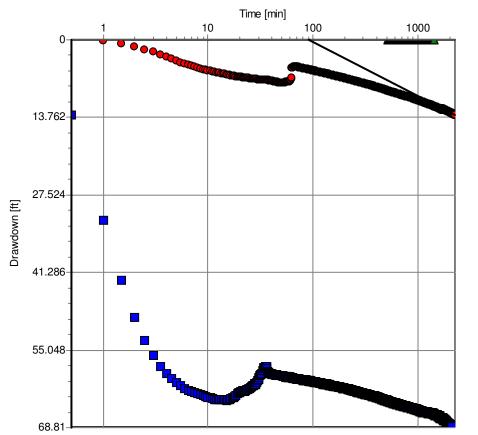
North Well

South Well Thing Valley Well

Project: Thing Valley
Number: 2010-0005

Client:





Pumping Test: Thing Valley Wells

Analysis Method: Cooper-Jacob Time-Drawdown

Analysis Results: Transmissivity: 2.94E+2 [ft²/d] Conductivity: 8.41E-1 [ft/d]

Storativity: 4.19E+1

<u>Test parameters:</u> Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

Casing radius: 0.25 [ft] Confined Aquifer

Screen length: 350 [ft]
Boring radius: 0.42 [ft]

Discharge Rate: 80.111574 [U.S. gal/min]

<u>Comments:</u> South Well match to very late data.



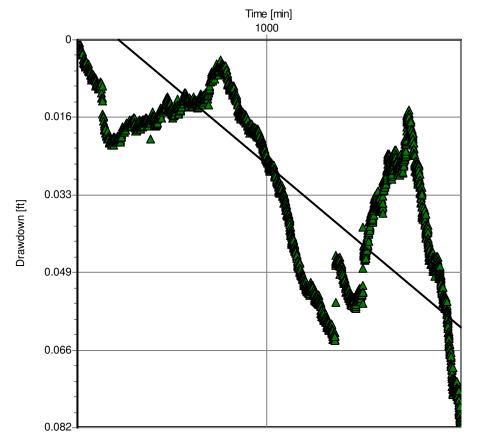
460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798 **Pumping Test Analysis Report**

Thing Valley Well

Project: Thing Valley
Number: 2010-0005

Client:





Pumping Test: Thing Valley Wells

Analysis Method: Cooper-Jacob Time-Drawdown

Analysis Results: Transmissivity: 2.41E+4 [ft²/d] Conductivity: 6.88E+1 [ft/d]

Storativity: 7.34E-4

<u>Test parameters:</u> Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

Casing radius: 0.25 [ft] Confined Aquifer

Screen length: 350 [ft]
Boring radius: 0.42 [ft]

Discharge Rate: 80.111574 [U.S. gal/min]

<u>Comments:</u> Thing Valley program best fit match.



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Pumping Test Analysis Report

Thing Valley Well

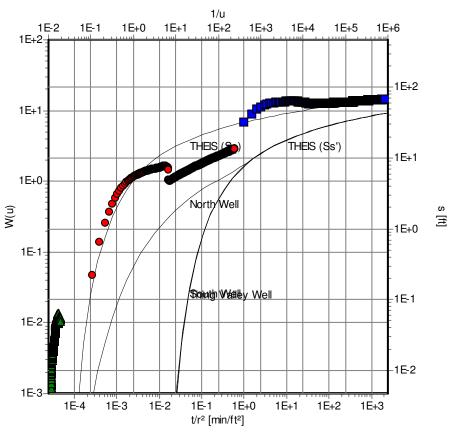
North Well

South Well

Project: Thing Valley
Number: 2010-0005

Client:





<u>Pumping Test:</u> Thing Valley Wells

Analysis Method: Moench Fracture Flow

<u>Analysis Results:</u> Transmissivity: 2.61E+2 [ft²/d] Conductivity: 7.47E-1 [ft/d]

Storativity: 4.45E-4

Test parameters: Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

Casing radius: 0.25 [ft] b: 350 [ft]

Screen length: 350 [ft] Kv/Kh: 0.1

Boring radius: 0.42 [ft] C: 0.554

Discharge Rate: 80.111574 [U.S. gal/miiK(block)/K(Skin): 0.1

Ss(blk)/Ss(fract): 200 K(block)/K(fracture): 0.1

Comments: North Well match to late data.



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Pumping Test Analysis Report

Thing Valley Well

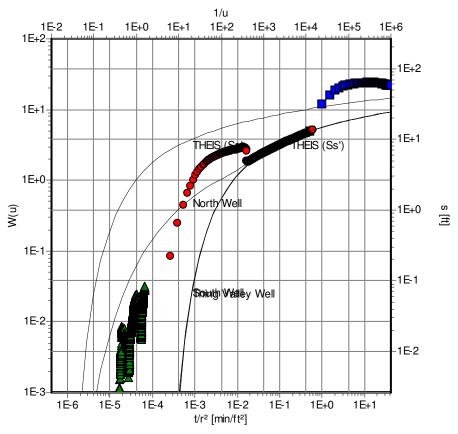
North Well

South Well

Project: Thing Valley
Number: 2010-0005

Client:





<u>Pumping Test:</u> Thing Valley Wells

Analysis Method: Moench Fracture Flow

Analysis Results: Transmissivity: 4.67E+2 [ft²/d] Conductivity: 1.33E+0 [ft/d]

Storativity: 1.35E-5

Test parameters: Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

Casing radius: 0.25 [ft] b: 350 [ft]

Screen length: 350 [ft] Kv/Kh: 0.1

Boring radius: 0.42 [ft] C: 0.554

Discharge Rate: 80.111574 [U.S. gal/miiK(block)/K(Skin): 0.1

Ss(blk)/Ss(fract): 200 K(block)/K(fracture): 0.1

<u>Comments:</u> South Well match to late data.



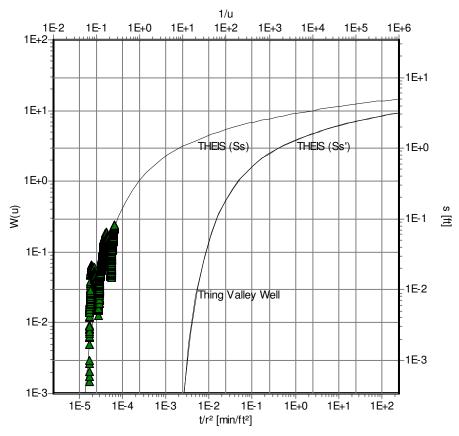
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Project: Thing Valley Number: 2010-0005

Client:





Thing Valley Well

Pumping Test: Thing Valley Wells

Analysis Method: **Moench Fracture Flow**

Analysis Results: Transmissivity: 3.61E+3 [ft²/d] Conductivity: 1.03E+1 [ft/d]

> Storativity: 6.28E-4

Test parameters: Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

> Casing radius: 0.25 [ft] b: 350 [ft]

Screen length: 350 [ft] Kv/Kh: 0.1

Boring radius: 0.42 [ft] C: 0.554

80.111574 [U.S. gal/mirK(block)/K(Skin): Discharge Rate: 0.1

Ss(blk)/Ss(fract): 200 K(block)/K(fracture): 0.1

Moench match to Thing Valley Well data. Comments:



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Pumping Test Analysis Report

Thing Valley Well

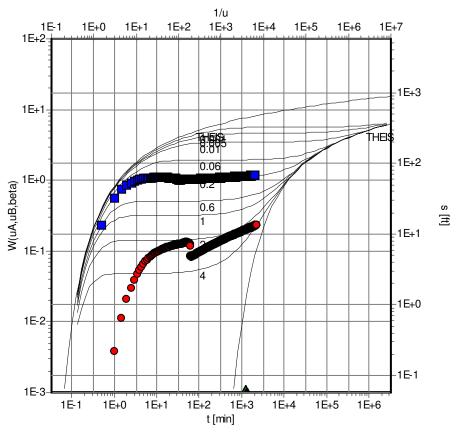
North Well

South Well

Project: Thing Valley
Number: 2010-0005

Client:





Pumping Test: Thing Valley Wells

Analysis Method: Neuman

<u>Analysis Results:</u> Transmissivity: 2.13E+1 [ft²/d] Conductivity: 6.09E-2 [ft/d]

Storativity: 1.96E-2 Specific Yield: 1.96E+2

Test parameters: Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

Casing radius: 0.25 [ft] Beta: 0.005

Screen length: 350 [ft]
Boring radius: 0.42 [ft]

Discharge Rate: 80.111574 [U.S. gal/min]

LOG(Sy/S): 4

Comments: North Well match to all data.



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Pumping Test Analysis Report

Thing Valley Well

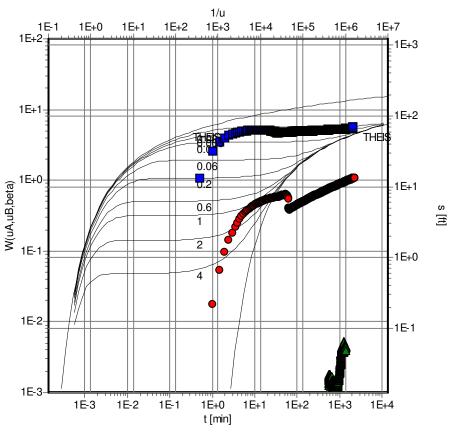
North Well

South Well

Project: Thing Valley
Number: 2010-0005

Client:





Pumping Test: Thing Valley Wells

Analysis Method: Neuman

<u>Analysis Results:</u> Transmissivity: 9.98E+1 [ft²/d] Conductivity: 2.85E-1 [ft/d]

Storativity: 3.82E-4 Specific Yield: 3.82E+0

Test parameters: Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

Casing radius: 0.25 [ft] Beta: 0.005

Screen length: 350 [ft]
Boring radius: 0.42 [ft]

Discharge Rate: 80.111574 [U.S. gal/min]

LOG(Sy/S): 4

Comments: North Well match to late data.



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Pumping Test Analysis Report

Thing Valley Well

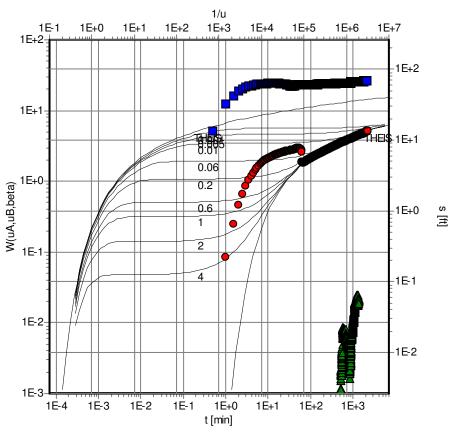
North Well

South Well

Project: Thing Valley
Number: 2010-0005

Client:





Pumping Test: Thing Valley Wells

Analysis Method: Neuman

<u>Analysis Results:</u> Transmissivity: 4.69E+2 [ft²/d] Conductivity: 1.34E+0 [ft/d]

Storativity: 9.12E-4 Specific Yield: 9.12E+0

Test parameters: Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

Casing radius: 0.25 [ft] Beta: 0.005

Screen length: 350 [ft]
Boring radius: 0.42 [ft]

Discharge Rate: 80.111574 [U.S. gal/min]

LOG(Sy/S): 4

<u>Comments:</u> South Well match to late data.

Evaluated by: MWV

Evaluation Date: 10/29/2010



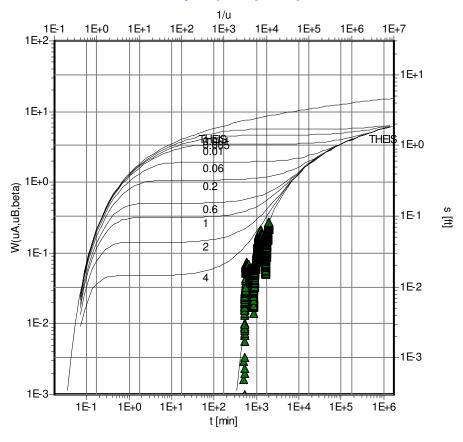
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Pumping Test Analysis Report

Project: Thing Valley Number: 2010-0005

Client:

Thing Valley Wells [Neuman]



Thing Valley Well

Pumping Test: Thing Valley Wells

Analysis Method: Neuman

Analysis Results: Conductivity: 1.16E+1 [ft/d] Transmissivity: 4.06E+3 [ft²/d]

Test parameters: Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

> 0.25 [ft] 0.005 Casing radius: Beta:

Screen length: 350 [ft] Boring radius: 0.42 [ft]

Discharge Rate: 80.111574 [U.S. gal/min]

LOG(Sy/S): 4

Thing Valley data Comments:

> Evaluated by: MWV Evaluation Date: 11/4/2010



460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798

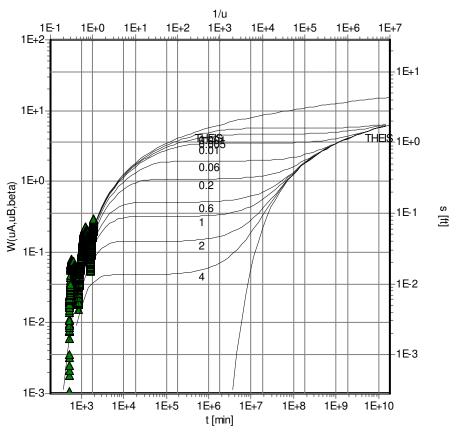
Pumping Test Analysis Report

Thing Valley Well

Project: Thing Valley
Number: 2010-0005

Client:





Pumping Test: Thing Valley Wells

Analysis Method: Neuman

Analysis Results: Transmissivity: 4.35E+3 [ft²/d] Conductivity: 1.24E+1 [ft/d]

<u>Test parameters:</u> Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

Casing radius: 0.25 [ft] Beta: 0.005

Screen length: 350 [ft]
Boring radius: 0.42 [ft]

Discharge Rate: 80.111574 [U.S. gal/min]

LOG(Sy/S): 4

Comments: Thing Valley data

Evaluated by: MWV

Evaluation Date: 11/4/2010



460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798

Pumping Test Analysis Report

North Well

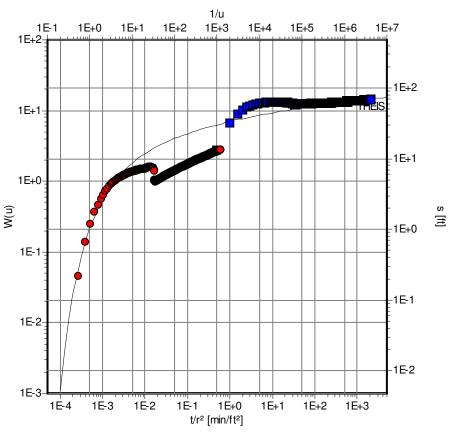
South Well

Thing Valley Well

Project: Thing Valley Number: 2010-0005







Pumping Test: Thing Valley Wells

Analysis Method: **Theis**

Analysis Results: Transmissivity: 2.56E+2 [ft2/d] Conductivity: 7.33E-1 [ft/d]

> Storativity: 3.57E-4

Test parameters: Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

> Casing radius: 0.25 [ft] Confined Aquifer

Screen length: 350 [ft] Boring radius: 0.42 [ft]

Discharge Rate: 80.111574 [U.S. gal/min]

North Well match to late data. Comments: South Well match to early data.

> Evaluated by: MWVEvaluation Date: 10/29/2010



460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798

Pumping Test Analysis Report

North Well

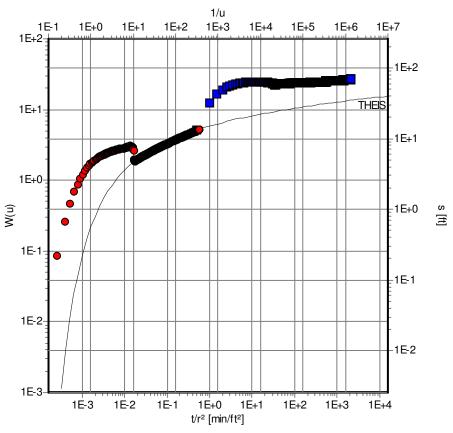
South Well

Thing Valley Well

Project: Thing Valley Number: 2010-0005







Pumping Test: Thing Valley Wells

Analysis Method: **Theis**

Analysis Results: 1.36E+0 [ft/d] Transmissivity: 4.77E+2 [ft²/d] Conductivity:

> Storativity: 2.10E-3

Test parameters: Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

> 0.25 [ft] Casing radius: Confined Aquifer

Screen length: 350 [ft] Boring radius: 0.42 [ft]

Discharge Rate: 80.111574 [U.S. gal/min]

Match to South Well late data. Comments:

> Evaluated by: MWVEvaluation Date: 10/29/2010

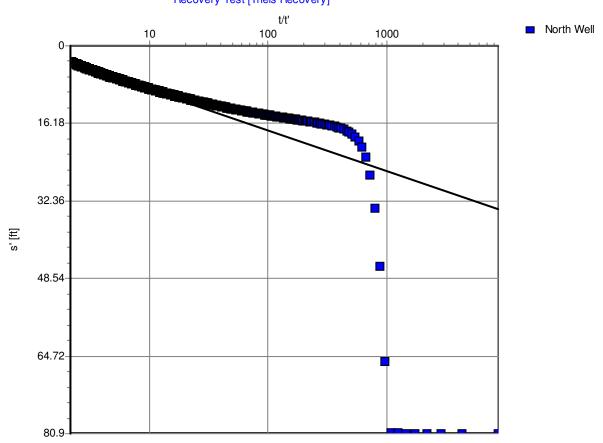


460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798 **Pumping Test Analysis Report**

Project: Thing Valley
Number: 2010-0005

Client:





Pumping Test: Recovery Test

Analysis Method: Theis Recovery

Analysis Results: Transmissivity: 3.37E+2 [ft²/d] Conductivity: 9.63E-1 [ft/d]

<u>Test parameters:</u> Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

Casing radius: 0.25 [ft] Confined Aquifer

Screen length: 350 [ft]

Boring radius: 0.42 [ft]

Discharge Rate: 81 [U.S. gal/min]

Pumping Time 4320 [min]

Comments: North Well recovery match to late data.

Evaluated by: MWV

Evaluation Date: 11/2/2010

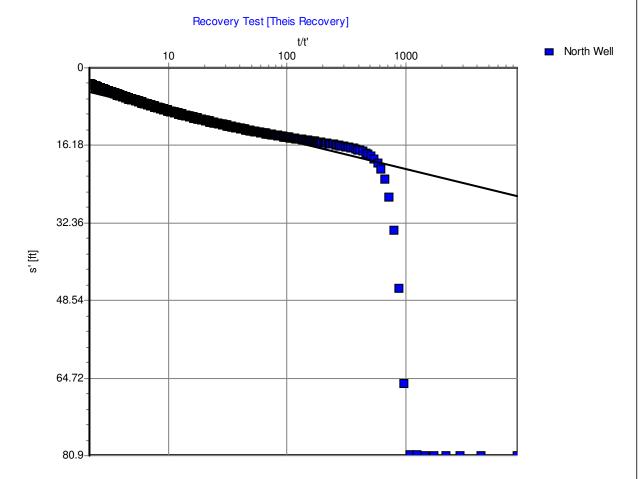


460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798 **Pumping Test Analysis Report**

Project: Thing Valley
Number: 2010-0005

Client:





<u>Pumping Test:</u> Recovery Test

<u>Analysis Method:</u> Theis Recovery

Analysis Results: Transmissivity: 4.73E+2 [ft²/d] Conductivity: 1.35E+0 [ft/d]

Test parameters: Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

Casing radius: 0.25 [ft] Confined Aquifer

Screen length: 350 [ft]

0.42 [ft]

Discharge Rate: 81 [U.S. gal/min]

Pumping Time 4320 [min]

Boring radius:

Comments:

Evaluated by:

Evaluation Date: 11/2/2010

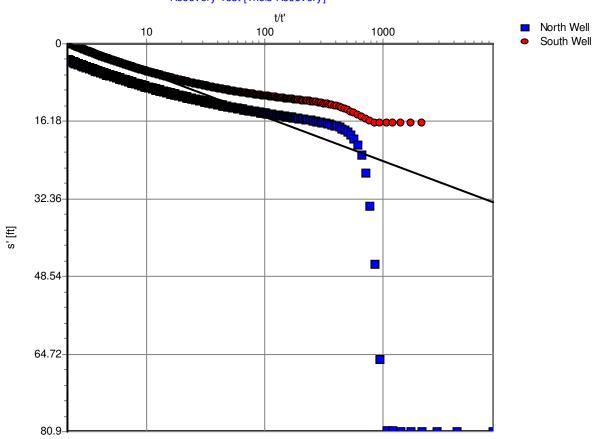


460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798 **Pumping Test Analysis Report**

Project: Thing Valley
Number: 2010-0005

Client:





<u>Pumping Test:</u> Recovery Test

<u>Analysis Method:</u> Theis Recovery

Analysis Results: Transmissivity: 3.11E+2 [ft²/d] Conductivity: 8.88E-1 [ft/d]

Test parameters: Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

Casing radius: 0.25 [ft] Confined Aquifer

Screen length: 350 [ft]

81 [U.S. gal/min]

Boring radius: 0.42 [ft]

Pumping Time 4320 [min]

<u>Comments:</u> South Well Recovery match to late data.

Discharge Rate:

Evaluated by: MWV

Evaluation Date: 11/2/2010

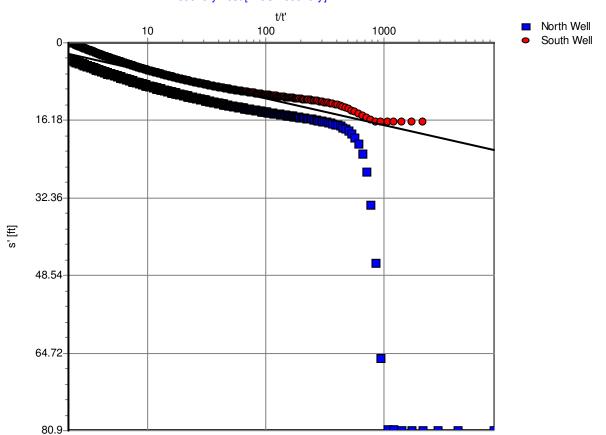


460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798 **Pumping Test Analysis Report**

Project: Thing Valley
Number: 2010-0005

Client:





Pumping Test: Recovery Test

Analysis Method: Theis Recovery

Analysis Results: Transmissivity: 5.08E+2 [ft²/d] Conductivity: 1.45E+0 [ft/d]

Test parameters: Pumping Well: Pumping Well Aquifer Thickness: 350 [ft]

Casing radius: 0.25 [ft] Confined Aquifer

Screen length: 350 [ft]

Boring radius: 0.42 [ft]

Discharge Rate: 81 [U.S. gal/min]
Pumping Time 4320 [min]

<u>Comments:</u> South Well Recovery match to middle data.

Evaluated by: MWV

Evaluation Date: 11/2/2010

Too close to
560 tie truk

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mon quell No bener prupeo this worker Just East OF シャトアチャラオ storage



COUNTY OF SAN DIEGO

DEPARTMENT OF ENVIRONMENTAL HEALTH 1255 Imperial Ave San Diego, CA 92101 619-338-2222



INVOICE

ERMIT TYPE & NUMBER: LWEL 16225

ERMIT OWNER:

CONTACT:

INVOICE DATE: 16 SEP 2004

\$390.00

TOTAL AMOUNT DUE

IANOS DRILLING & PUMP 6052 LAWSON VALLEY RD.

AMUL

CA 91935

611-060-03

APPLICANT:

\PN: 611-070-03-09 611-070-01

FADEM ROBERT S&MARY O TRUST B1

SITE ADDRESS: 2750 MCCAIN VALLEY RD

OCATION DESCRIPTION: 2750 MCCAIN VALLEY RD JACUMBA 92036 -

PROJECT DESCRIPTION/SCOPE

Jumber of Wells on Permit Application: 1

Description of Work: well drilling

Type of Use for Each Well: domestic

EE/DEPOSIT DE	TAILS			
FEE CODE	DESCRIPTION	TIME ACCT.	ACCT. CODE	AMOUNT
6LE01EHO	WATER WELL PERMIT	429E01	9773-773	390.00
			0 %-16- 03 21137 21137 2173 767 8178 13-16-1828	



COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH WELL PERMIT APPLICATION

DEN OSE ONC	٠.
PERMIT#W/レスセン	-
WELL COMPUTER #	12 de 1
FEE:	

Parcel Har 120 acres WATER DIST:

, m	
Property Owner: Hinch Companies	Phone: (11/0 - 7/24
1110 Hiner William Address City Balance	6/2020
Mailing Address City 611-06	60-03 ^{z_{ip}}
Well Location - Assessors Parcel Number // / 611-0	
McCain Ily Jane	BouLEVARD ZID
. Well Contractor - Well Driller Company I	to Madago Briller
	7/93 C
Mailing Address City	Σp
Phone#:	sh Deposit 🛛 Bond Posted
Use: ☐ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other	
Type of Work: ☐ New ☐ Reconstruction ☐ Destruction Time Ex	xtension: 🔾 1st 🔾 2nd
Type of Equipment: A 111 1/10 1/10 1/10 1/10 1/10 1/10 1/1	
Depth of Well: Proposed:	Existing:
Proposed:	
Casing Conductor Casing Filter/Filler Material	Perforations
Type: □ Yes □ No □ Yes □ No	_ •
	From: To:
Diameterin, Diameterin, Type:	
Wall/Gauge: Wall/Gauge: Wall/Gauge:	-
Annular Seal: Depth: 50 ft. Sealing Material: 600 Material	
Borehole diameter: / /in. Conductor diameter:in. An	inular i nickness <u></u> in
), Date of Work: Start: 100 / 100 / 100 Com	plete:
On sites served by public water, contact the local water agency for meter pro I hereby agree to comply with all regulations of the Department of Environmental Health, ar 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.	nd with all ordinances and laws of modification and destruction. In with a complete and accurate lo
DISPOSITION OF APPLICATION (Department of Environmental Approved □ Denied Special Conditions: Grading and clearing associate construction, maintenance or destruction of water wells, may require additional processing and/or other agencies.	ed with access to, or the permits from the County of
Specialist: Date:	9/16/04
Page 1 of 2	

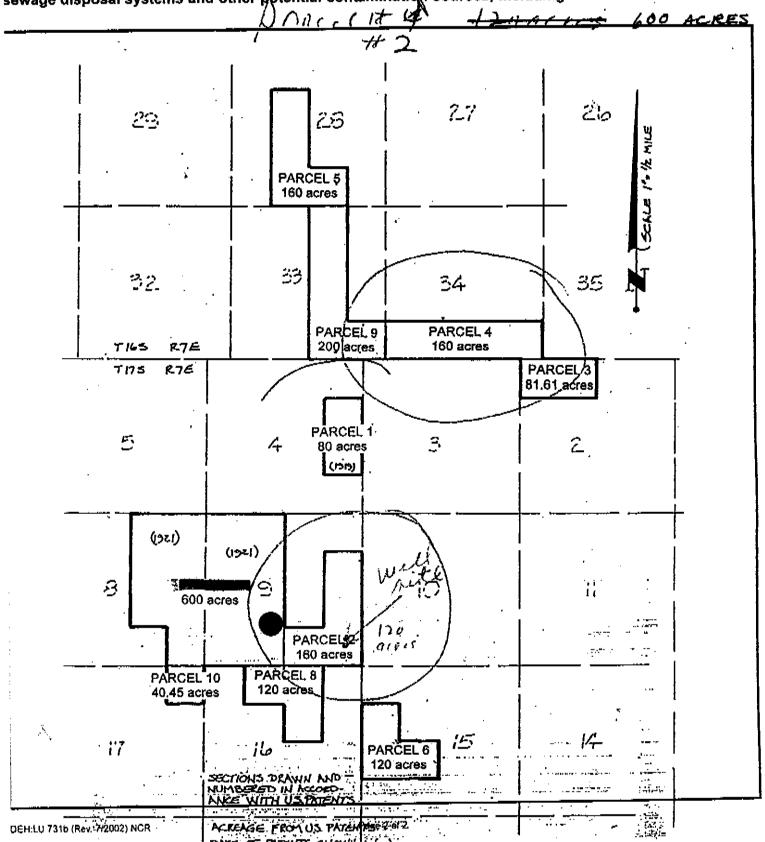
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: <u>トルドレール 2でら</u> Assessor's Parcel Number:<u>ゲール・クフか・C</u>

> 611-060-03 611-070-01

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.



County Mail Station -A-21

FIRST CARBON COPY

COUNTY OF SAN DIEGO

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DEPART	TMENT	OF HE	ALTH	SERVI	CES
1700 PA	CIFIC HIC	HWAY,	SAN DIE	10, CA 9	2101-241

ocal Permit No. or Cate (INS	ERT under ORIGINAL P	AGE w/carbon of State Form) Other Well No.				
1) OWNER: Name John Gibson #		(12) WELL LOG: Total depth 600ft, Depth of completed well 185.2 ft. from ft. to ft. Formation (Describe by color, character, size or material)				
2ry		O-2. ~ Lanse Sort				
2) LOCATION OF WELL (See instructional)		2-15- D.B. GRAN				
County Owner's	· ·					
Netl address if different from above		70-71- SOMEN / 2 GM /				
Township Range		"11- 90 - RUNCH! COHLET ROCK				
Distance from cities, roods, reliroads, fences, etc.		90-92 - SOFTEL CAMPOL (2 CAM')				
Sirgince from either, respir remoter, secon, sur		97 -1154 - BLACK WHITE BACK SOME BOATS				
		ARGAS				
		158-118 - UPRY SONTE / 6 GP4)				
	/A T/44 A4 WARY.					
DEPARTMENT USE ONLY	(3) TYPE OF WORKS					
Completed Well Construction:	New Well @ Deepening C					
Data	Reconstruction C					
		The second secon				
Data (napected						
Comments	Destruction (I (Describe destruction materials and					
Contribute	procedures in item (12)					
	(4) PROPOSED USE:					
Weter Sample Taken?						
Weter Sample Lakent/						
Sanitsrian's Approval:	Industrial - C					
6/4	•					
	Pedu Neeks Io 🗷 Size					
	· · ·					
	f aboveft.					
		* *				
(7) Casing Installed: (8) Perfor	· ·					
Stant 🔼 Plantic 🗆 Concrete 🗀 🔒 Type of pe	rforetion or size of screen					
From To Dia, Gage or From	To Slot					
re, et. in Wall et.	ft. Size					
9 - 24 7" 156						
(9) WELL SEAL:	•	Work Started 19 Completed 19				
Was surface minimy seel provided? Yes 🗷 No 🚨 🗓	yes, to depth/	PELL DRILLERS STATEMENT: I hereby declare under penalty of perjury that the information provided				
Were strata sealed against pollution? Yet 🔘 No 🛱	Interval	t in this report is true. This water well was installed				
Method of sealing _ RENTONITE -CEMEN-	<u> </u>	in compliance with San Diego County Code and State				
		of California, Department of Water Resources, Bulletin				
(10) WATER LEVELS:		1				
Depth of first water, if known		signed Dun A. Car Branch				
Standing level after well completion		L (Fell Driller)				
(11) WELL TESTS:		NAME				
Wax well test made? Yes Gr. No C If yes, by	WHOM? DRILLER	(Person, firm, or Corporation) (Type or Print)				
Type of test Pump Bailer	Air lift @*					
Depth to water at start of testft_	At end of test	ADDRESS				
Discharge 10 gal/min after 3 hours	Water temperatureCetsC	ZIP				
Chemical analysis made? Yes 🗆 No 🛍 If yes, b	y whom?					
Was electric tog made? Yes 🖸 No 🕸 If yes, a	reach copy to this report	LICENSE NO. DATE THIS REPORT				

DUPLICA Driller's (Сору						WELL		OF CALIF	Ó1	N REPOR	۲۲				_1 1	NOT FILL IN
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COUNTY OF SAN DIEGO

DEPARTMENT OF ENVIRONMENTAL HEALTH 1255 Imperial Ave San Diego, CA 92101 619-338-2222



INVOICE DATE: 16 SEP 2004

INVOICE

PERMIT TYPE & NUMBER: LWEL 16223

PERMIT OWNER:

CONTACT:

MANOS DRILLING & PUMP

16052 LAWSON VALLEY RD.

JAMUL

CA 91935

611-060-03

APPLICANT:

APN: 529-150-01-00 611-070-01

FADEM ROBERT S&MARY O TRUST B1

SITE ADDRESS: 8057 MCCAIN VALLEY RD

BOULEVARD 91905

LOCATION DESCRIPTION:0057 MCCAIN VALLEY RD. CL CAUCH 02020-

PROJECT DESCRIPTION/SCOPE

Number of Wells on Permit Application: 1

Description of Work: well drilling Type of Use for Each Well: domestic

FEE/DEPOSIT DETAILS							
FEE CODE	DESCRIPTION	TIME ACCT.	ACCT. CODE	AMOUNT			
6LE01EHO	WATER WELL PERMIT	429E01	9773-773	390.00			
			09-14-04 55029 9773 773 4296 CHECK	gu 25 - 1 8 24 28 0 30 34 508 Q			
		TOTAL	AMOUNT DUE	\$390.00			



7.10.1. 12.7.5. Sec. 34 COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH WELL PERMIT APPLICATION

PARCE ITE \$ 1600 ACRES

DEH US	416223
WELL COMPU	TER#
FEE:	***
WATER DIST:	

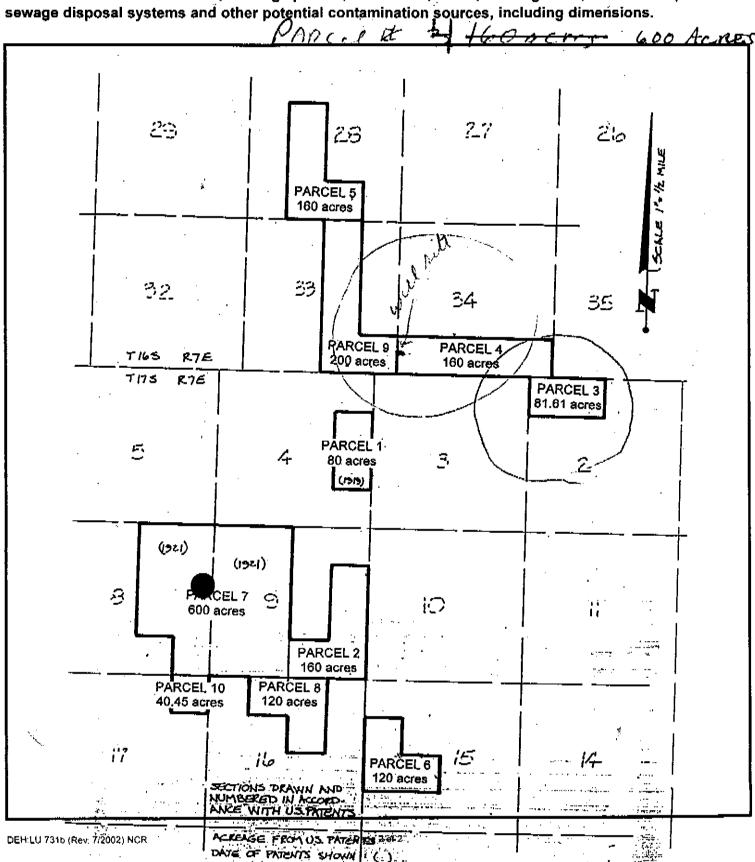
	, í	
1.	Property Owner: AMANA COMPANIES 1000 F. Drace Log City Mailing Address Y City	Phone // / / / / / /
	1000 FORECCE TOOL CONTIN	62020
	Well Location - Assessors Parcel Number 673 475 57	611-060-03 611-070-01 BOULEVARD 91905
	Site Address , City ,	Zip
3.	Well Contractor - Well Driller 111 // // Company Na // Company Na // Company Na // City	0/1935
	Malling Address City	Žip
	Phone#: 445-1926- C-57#06720 B Cash	Deposit U Bond Posted
4.	Use: ☑Private □ Public □ Industrial □ Cathodic □ Other _	
5.	Type of Work: ☐ New ☐ Reconstruction ☐ Destruction Time Extended	
6.	Type of Equipment: And Romanic Proposed: 3 cm	el'
7,	Depth of Well: Proposed:	Existing:
8.	Proposed:	•
	Casing Conductor Casing Filter/Filler Material Type: S / C /	From: To: From: To: From: To:
9.	Annular Seal: Depth: 200 ft. Sealing Material: 1900 100 100 Co	C Mark All
	Borehote diameter:in. Conductor diameter:in. Annu	lar Thicknessin.
10	Date of Work: Start: 27269 Comple	ite: <u>(7 30+94</u>
Co	On sites served by public water, contact the local water agency for meter prote I hereby agree to comply with all regulations of the Department of Environmental Health, and with the County of San Diego and the State of California pertaining to well construction, repair, mo Immediately upon completion of work, I will furnish the Department of Environmental Health work of the well. I accept responsibility for all work done as part of this permit and all work will be persupervision. Ontractor's Signature:	with all ordinances and laws of diffication and destruction. ith a complete and accurate log
	DISPOSITION OF APPLICATION (Department of Environmental He	ealth Use only)
C	Approved Denied Special Conditions: Grading and clearing associated onstruction, maintenance or destruction of water wells, may require additional person Diego and/or other agencies.	
s	Specialist: Date: 9	116/04
DE	H-LU-731a (Rev. 4/02) NCR	

COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: <u>LINF(16723</u>
Assessor's Parcel Number: 611-060-03
611-070-01

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.



FIRST CARBON COPY

COUNTY OF SAN DIEGO DEPARTMENT OF HEALTH SERVICES 1700 PACIFIC HIGHWAY, SAN DIEGO, CA 92101-2417

WATER WELL DRILLERS REPORT

•		0	
500	re Well No.		

ASSESSORS PARCEL NUMBER:

Josef Perm	it No. or	Carte _	<u>.</u>	(INS	ERT under	ORIGINAL	PAC	GE w/carbon of State Form) Other Well No.				
1) OWN	ER: N	.me _	-	ibsen	#5			(12) WELL LOG: Total depth 2007t. Depth of completed well 2007t. from ft. to ft. Formation (Describe by color, character, size or material)				
						Zio	\Box	O-2 - SAMOY TOPSAIL				
				structions):				2-102 - BLACK? WHITE ORANGE OFFI				
2) LUW	A LIGHT	OF ME		(Decrees)	t Mell Nambe		_[ALLAS, LEDIS BOLKS, SOLID (DRIA)				
-aunty								102 -110 - REACE WHITE BACK				
MAN TOGER	M 11 (7)(14	Ireat He	Manage Manage	··· <u>·</u>	Section		П	110-112 - SEFTER (& GOW) SAWD				
								112 - 348 - Reach (Just Pock				
Distance fr	on atte	r, rotal	Litticarca" Li	HCM, 1944				349 -247 - ROFTE (1966 GRA)				
								249 - 900 - BLACK WHITE ROCK SOME				
			•		· · · · · · · · · · · · · · · · · · ·			SCHETTEL PROPE				
					/72 TV-	OF WORK						
			TMENT USE	ONLY		© Deepening	۱,					
Completed	Mai Co	nstructi	oni		· ·		_					
Date					Reconstru		ם					
					Recondition			And the second s				
Outs Inspe	⊂œd —				Horizontal							
Comment	,					ń 🕽 (Describe n meterials and						
Commerci					procedura	in tem (12	,					
<u> </u>				·	1	OSED USE:	•					
		- 1			Domestic							
Weter Seri	ipie lake	m/			irrigation							
Senitarian	's Appro	ratz			Industrial		0					
					Test Well	. •	٥					
					Stock		6					
		•		<u> </u>	Municipal	•	0					
53/4					Other		_					
			·····	(6) Grave	1		_					
(5) Equip		_		•	No @ Size.	2 <i>ep</i> \$						
Retary	፟ .		werse C									
Cipie	<u> </u>	A	_		of above	<u></u>						
Other	<u> </u>	Bu	icket 🗆	Packed M	MR(C	·	_	*				
(7) Casing	Irecalle	d:		(8) Perfor								
Steel 😘	Plantic	Con Con	narete 🚨 ୍	Type of p	erforetion or :	ize of screen						
	7-	Dia.	Gage or	From	Te	Şot		·				
From ft	To ft.	ir.	Wal	化	ft.	Size	•					
	364	6 1/2	138			-	<u> </u>					
							_					
			<u> </u>	,		<u> </u>	`	: Work Started 19 Completed 19				
(9) WEL	L SEAL	. .			•			TS COMPLETE				
Was surfer	Se sanita	ry seel p	rovided?Ye	e Œ No □	If yes, to dept	h	"ft.	WELL DRILLERS STATEMENT: I hereby declars under penalty of perjury that the information provided				
				'es 🗆 No C			, tt.	I in this report is true. This water well was installed				
Method o		/GL	ENTOWITE	-CE44RA	<i>></i>			I in compliance with San Diego County Code and State				
					•	-	-	of California, Department of Mater Resources, Bulletin No. 74.				
(10) WATER LEVELS:							No. 79.					
Depth of first water, if knownft_							SIGNED					
Smoding.	level afte	r well ¢	empletion	35			, ft.	(Well Oriller)				
(11) WE	L TEST	S:		,				NAME				
Was well test made? Yes & No C If yes, by whom? DRILLER						DRILLER	(Person, firm, or Corporation) (Type or Print)					
Type of test Pumo C Bailer C Air lift E								-manufer				
Depth to		start of	Test	ft.	At end of 1		<u>.</u> ft.	ADDRESS				
Discharge				<u></u> hours	Water temp	ereture , CPO	_	CITY ZIP				
Chemical			Yes 🗆 N	a 🔁 If yes.				LICENSE NO. DATE THIS REPORT				
Was elect			Yes O N	o 🗹 if yes,	attach copy to	this report		LICENSE NO. DATE THIS REPORT				
			_									

DUPLICATE Driller's Copy						WELL.		OF CALIF		RNIA DE REPOI	r	DWR_US	E ONL	<u>у. —</u> І	00 N	OT FILL IN		
Page 1 of 1						WELL	Refer to I	nstruction	Pa	rd'phlet	1 1	s	TATE W	ELL N)./STATI	ON NO.		
Owner's Well No Date Work Began			_					· 09	0/	9443		LATITUDI	ساليا	Ľ		NGITUDE		
Local Permit A										•			T T	Ti	i i	1111		
Permit No					.,		it Date <u>"9 -</u>	16-04	4		_		AP	N/TRS/	<u>OTHER</u>			
						LOG —		 		<u> </u>		— (where o						
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102:110	- prac	.k:	<u>R.</u>	₩ ¹	7	La xosk		1	- 1	Township 114	1-	Range <u>/ 🎨</u> N	Section			7 , W		
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749 34G	- co £	M.	T.		7		77		F	1.0	CAT	ION SKETCH -				TIV(TY (エ) KEW WELL		
349 900	blac	$\widetilde{\mathbf{k}}$	کع		<u>i</u>	th thek	some	<u> </u>	_							ICATION/REPAIR		
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	-									(₂ ,)	E.J.R. S.	4				DIC PROTECTION		
	<u>i </u>								4	•	Name of Street	3.4				HEAT EXCHANGE		
1	1								4	. /		•				INJECTION		
	I I								-						VAF	OR EXTRACTION		
 	!								SPARGING REMEDIATION									
<u> </u>	1					•			+	Illustrate or Describe Fences, Rivers, etc. a	Dista nd att	nce of Well from Roa ich a map. Use additt	ds, Build Ional pap	ings, er if		OTHER (SPECIFY)		
· · · · · · · · · · · · · · · · · · ·	†								Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.									
,	1					,			WATER LEVEL & YIELD OF COMPLETED WELL									
												₹ <u>-50</u> (Ft.) BI						
	· ·						·		DEPTH OF STATIC WATER LEVEL 3.5 (Ft.) & DATE MEASURED 9-39-04									
· · · · · · · · · · · · · · · · · · ·	<u>i</u>						•			ESTIMATED YIELD	· <u>2</u>	(GPM) &	TE\$T TY	/PE3	irl	<u>ift</u>		
TOTAL DEPTH OF							1					(Hrs.) TOTAL DRAW			(Ft.)			
TOTAL DEPTH OF	COMPLET	ΈD	WE	CLL	_	<u> </u>	:)			* May not be rep	esent	ative of a well's los	rg-term	yield.				
DEPTH	·						CASING (S	3)			1	DEPTH		ANN	ULAR	MATERIAL		
FROM SURFACE	BORE- HOLE	Ţ		Ę (<u>-</u>							F	ROM SURFACE			ΤΥ	PE		
	DIA.	BLANK	9	\$ 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	PPE	MATERIAL / GRADE		a ORWA	ALL		╟┈		MENT	BEN- TONITE	FILL	FILTER PACK (TYPE/SIZE)		
Ft. to ft.		æ	8	정	E		(Inches)	THICKN	IE85	3 (Inches)	╙	Ft. to Ft.	(≍)	(<u>~</u>)	(∠)	(TTPEGIZE)		
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ATTAC	HMENTS	(~	<u>. </u>	1	ļ			1		CERTIFIC	ATTO	N STATEMENT	· '		•			
Geolog		,				I, the u	ndersigned, d	ertify that	thi	s report is comple	te an	d accurate to the	best o	f my k	nowled	ge and belief.		
_	onstruction D)iagra	т			NAME_	JIM MZ	MOS I	ΩF	RILLING 8	P	JMP						
	ysical Log(s)					(P	ERSON, FIRM, OR	N) ((TYPED OR PRINTED)									
	ter Chemica		ilyse	3	;	ADDRESS	16052	LAWS	<u>ON</u>	VLY RD.	Ţ	AMUL, CA	919	35	STATE	ZIP		
Other .				··-		- []	ノベラス	7-V	11	ou			2, - 2	, ,, 7				
ATTACH ADDITIONAL	INFORMATI	ΦN, I	F N	r Ex	(ISTS	Signed C	-57 LICENSED WA	WER WELL CO	MTR/	ACTOR		DA DA	Z, ()		C-57 LICENSE NUMBER		

世4 11900 pt 13000 no bowb Lands Fedral = BATUROOM S Mapping TRace water was roiscolored & hence quit using



COUNTY OF SAN DIEGO

DEPARTMENT OF ENVIRONMENTAL HEALTH 1255 Imperial Ave San Diego, CA 92101 619-338-2222 ##

INVOICE DATE: 16 SEP 2004

INVOICE

ERMIT TYPE & NUMBER: LWEL 16226

ERMIT OWNER:

CONTACT:

ADEM ROBERT S&MARY O TRUST B1

53 OCEAN ST

92008

611-060-03

APPLICANT:

PN: 611-110-01-90 611-070-01

FADEM ROBERT S&MARY O TRUST B1

ITE ADDRESS: 2533 MCCAIN VALLEY RD

OCATION DESCRIPTION: 2533 MCCAIN VALLEY RD,

ROJECT DESCRIPTION/SCOPE

umber of Wells on Permit Application:1

escription of Work:new

ype of Use for Each Well:private

EE/DEPOSIT DE	FAILS			
FEE CODE	DESCRIPTION	TIME ACCT.	ACCT. CODE	TAUOMA
6LE01EHO	WATER WELL PERMIT	429E01	9773-773	390.00
			39-16-64 11130 7773 773 43/6 ○ 神色石米	1500 (1500) (1500) (1500)
,				
		TOTAL	AMOUNT DUE	\$390.00

COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH

PARCE 1 12 600

DEH USE ONLY PERMIT # W しいこし	162
WELL COMPUTER #	
FEE:	
WATER DIST:	

	· · · · · · · · · · · · · · · · · · ·
Name Conpain	<u> </u>
1	CCC1714 (1)02
Mailing Address	City
Well Location - Assessors Parcel Number	= 611-060-03 = 611-070-01
NC(n) . The 1	BOULEVARD 91905
Site Address	Company Name: 4 10 (1/1)
Well Contractor - Well Driller 11M May 18	
/ Mailing Address	
Phone#: 4.75 1926 C-	.57#:) <u>^7.) </u>
Ose. Allinate a toolis -	Cathodic Other
. 1700 01 110111	Destruction Time Extension: 1st 2nd
. Type of Equipment:	· · · · · · · · · · · · · · · · · · ·
. Depth of Well: Proposed:	Existing:
. Proposed:	
Casing Conductor Casing	Filter/Filler Material Perforations
Type: Yes No	Yes O No
Depth: Depth: ft. Ft	rom: To: From: To: vpe: From: To:
Diditioto!	ype: From: To: /all/Gauge: From: To:

Annular Seal: Depth:ft. Sealing Material:	1 Charles Children
Borehole diameter in Conductor diameter	ern. Annoral mickress
0. Date of Work: Start:	Complete:
On sites served by public water, contact the local water I hereby agree to comply with all regulations of the Department of the County of San Diego and the State of California pertaining the Immediately upon completion of work, I will furnish the Department of the well. I accept responsibility for all work done as part of this supervision.	of Environmental Health, and with all ordinances and laws of well construction, repair, modification and destruction, ent of Environmental Health with a complete and accurate keep spermit and all work will be performed under my direct
Contractor's Signature:	Date:
DISPOSITION OF APPLICATION (Departme	ent of Environmental Health Use only)
Managed Denied Special Conditions: Grading	and clearing associated with access to, or the pay require additional permits from the County of
Approved Denied Special Conditions: Grading construction, maintenance or destruction of water wells, maintenance or destruction or destruction or destruction of water wells, maintenance or destruction or destructi	nay require additional permits from the County or
Approved Denied Special Conditions: Grading construction, maintenance or destruction of water wells, m	Date: (1/16/04)

COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH

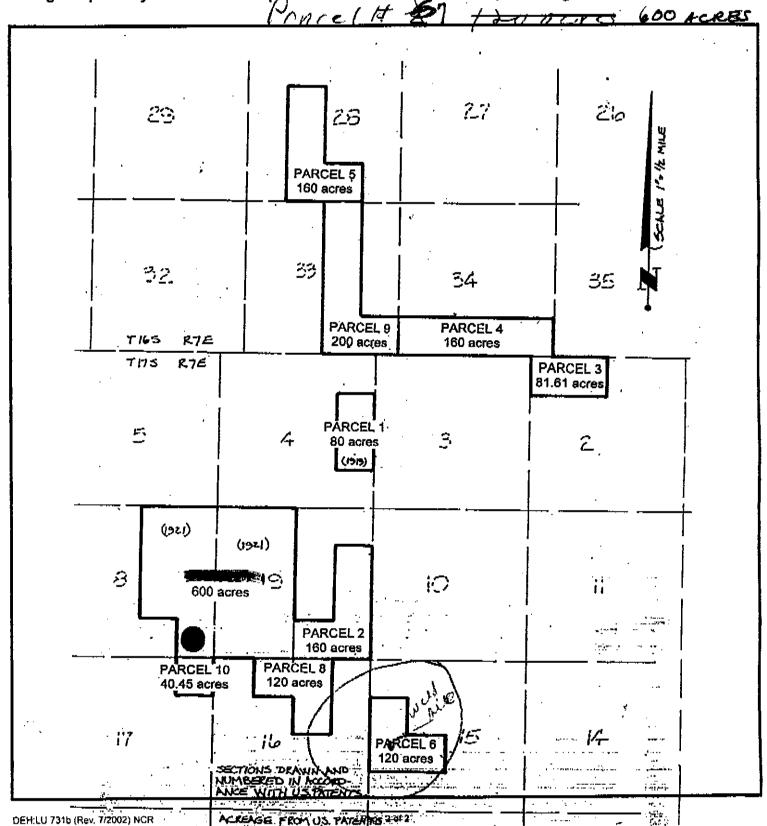
Control #: LUCL 16226

Assessor's Parcel Number: (7/1 - 7/17 - 67

611-060-03 611-070-01

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.



County Mail Systion - A-21

FIRST CARBON COPY

ASSESSORS	PARCEL	NUMBER:

Notice of Intent No ocal Permit No. or Cate	(INS			LLERS REPORT State Well No GE w/carbon of State Form) Other Well No
1) OWNER: Name JOHN L	near	ა <u>ი</u> ՝ 2. '		(12) WELL LOG: Total depth 260ft. Depth of completed well 15 ft. from ft. to ft. Formation (Describe by color, character, size or meterial)
				0-91 - 3 may , D.G.
2) LOCATION OF WELL (See Inet	netionsii	•		130 -130 - SOFT, ORANGE, WHITE I BROWD
County				133-185- CONT DRIVER, WHITE BLACK
Neil address if different from above Fown-ship	: :			195-190- LOOKE MACKE (20 GPL)
			• •	190 - 200 - SOFT ! HARD
Distance from cities, roads, railroads, fan	CM, FCC			
				•
		•		
		/71 TV00	OF WORK:	
DEPARTMENT USE	SNLT		ST Deepening 🗆	
Completed Well Constructions		Reconstruc	· _	
Osta		•	·	
		Reconditio Horizontal		
Date Inspected			n (I) (Describe	
Comments			u wetstjej i svo	
		procedural	rin bern (12)	
		(4) PROP	OSED USE:	
Water Semole Taken?		Comertic		
		intigation		
Sanitarian's Approval:		Industrial		
		Test Well	. [
		Stock	9	
		Municipal		
Jetter 8	<u> </u>	Other .		<u> </u>
(\$) Equipment	(6) Grayel	Pecks 1	3/9/13	
Rozery & Reverse C		Yo 🚨 Size.		
Cipi a Air Ci	Diameter (if above		
Other G Bucket G	Packed fro	<u>m _ Q19</u>	<u> 1885 ft.</u>	
(7) Casing Installed:	(8) Perfor	rdone '		
Steel SY Plantic C Concrete C	Type of pe	information or s	ize of असम्बर्ग	
- 1 - 1 - 1	From	To	Stot	·
From To Dis. Gegs or to ft. in. Well	t.	7	Size ·	
0 91 678 (89	0	185	3/3242	
	_		<u> </u>	10
(9) WELL SEAL		,	/	Work Started 19 Completed 19 WELL DRILLERS STATEMENT: I hereby declare under
Was surface sanitary seel provided? Yes	aar Na □ I	f yes, to dept	, <u>97 </u>	YELL DRILLERS STATEMENT: I hereby declare under penalty of perjury that the information provided
Were strata seeled against pollution? Ye	4 🗆 No 🖪	Indianal	tr	. I in this report is true. This water well was installed
Method of sealing BEUTOWAN .	-cener	٣٢		in Compliance with San Diego County Code and State of California, Department of Water Resources, Bulletin
				Ko. 74.
(10) WATER LEVELS:	boʻ			1 90 12
Depth of first wetter, it known	35			STENED (Vell peller)
Standing level after well completion				-
(11) WELL TESTS:			م ماند ماند	MAME (Person, fire, or Corporation) (Type or Print)
****] yes, by	wisom?	Inicer	(Person, firm, or Corporation) (Type or Print)
19040.	aller C	Airlift 🗇		ADDRESS
Depth to water at start of test		At end of t	م سال م	
Discharge 15 gal/min after 1	hours	Weter tamp	444/414	
Criemical analyzis made? Yes Cl. No.	CEL IT YES, S		a ship secore	LICENSE NODATE THIS REPORT
Was electric log made? Yes O No	C ITYES,	track copy to	A diri (EDO) r	

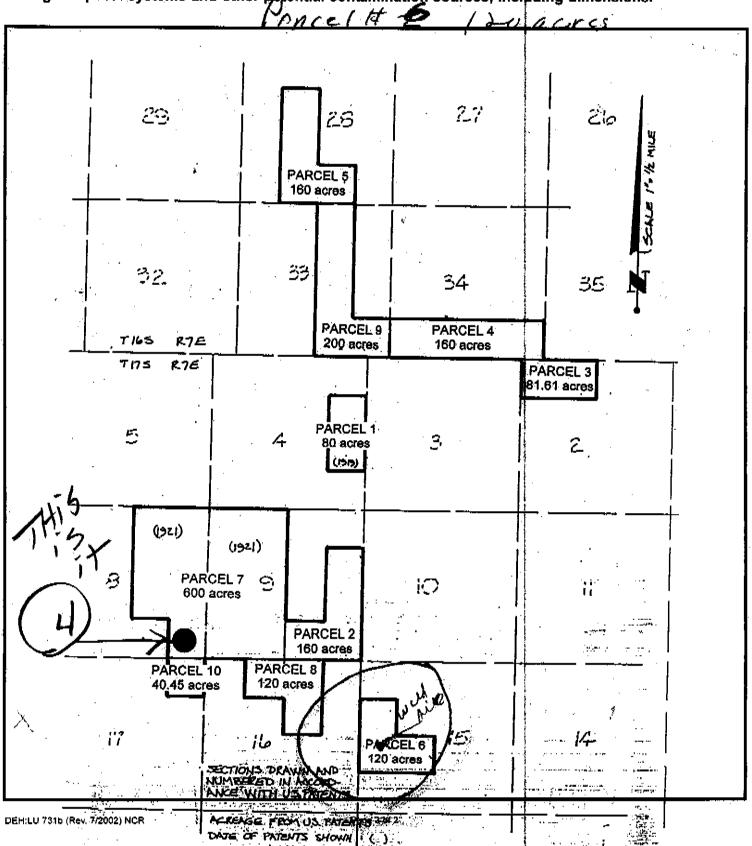
UNITED STORY WELL COMPLETION REPORT Page 1 of 1.	DUPLICATE Driller's Copy						. \	ATT T			OF CALIF			ıΛ'n	<u></u> [[<u> </u>	SE ONL	<u> Y —</u>	<u>00 r</u>	NOT FILL IN
Owner's Well No	- •	_					· •	, ELL	Refer (to Is	struction	Par	mphlet	Οĸ	~ -		STATE V	VELL NO	J./STATI	ION NO.
Date Work Began 9 32 04 Ended 9 23 14 4	, -	- 	<u> </u>						Ņ	.Ne	- 090	DS	9442		- 17	1 I I	Li) [1 1
Permit No. LUELIA. 2.24 Permit Pate Q. 14.4.44 CROLOGIC LOG ONE-NATION (2)	Date Work Began	9 25	<u> </u>)4			, En	ded 9	27 0							LATITUO	E		Li	ONGITUDE
ORBERTATION (2) ORBERTATION (2) ORBERTATION (2) ORBERTATION (2) ORBERTATION (3) ORBERTATION (4) ORBERTATION (5) ORBERT					OJ.	0 4	Ö.	F.H.S					•		_	_11	11.	بال	. 1	1
ORIENTATION (2) ORIENT	Permit No. 4	WEL16						Permi	t Batc .	9	16-04	1		- (;)		$\overline{}$	***		OTHER	
DESCRIPTION DESCRI					1			29				Т	~ (G ²	10/2	$\overline{}$	\ \				
DESCRIPTION P. B. D. Describe material grain state, color, etc. 9 1 Sanday, 4g 9 1 Sanday, 4g 9 1 Sanday, 4g 9 1 Sanday, 4g 133 185 665t, O'TERISON White Sanday 133 185 665t, O'TERISON White Sanday 145 190 1869 1 Section 155 190 1869 1 Section 156 190 1869 1 Section 157 1869 1 Section 158 190 1869 1 Secti	ORIENTATION (∠)	DEĞÜLINE	ATIC G	AL	_					_	-, ,			3	Ham					
R	DEPTH FROM] METHO) X	Ω	1 23					ir	`~~~(\(\)	· · · · · · · · · · · · · · · · · · ·								
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130 133 195 coeft prents of the prents of th	0 91	Sanc	ν.,		da					Źζ	5)~_	Į,	Addrass 🛆		Wac.				į.	
198 10.0 10.00 10.	91, 130	soft	7	0	rá	nq	۰,	whit		br	\sim	16		$\overline{\mathcal{V}}$	Jack	in a		, ,,,,		
TOWNSHIP OF SOCIAL CONFIDENCE	130; 133	¦very	_6	0	£ŧ			_(() -	77	$\overline{\ }$	$\langle \rangle$	γò			7 7 7		<u> </u>			
DEC. MIN. SEC. LOGATION SECTED ACTIVITY (2) DEC. MIN. SEC. ACTIVITY (2) ANNOTE: LOGATION SECTED ACTIVITY (2) DESTROY (General) DESTROY (G	133; 185	¦ so£ t	,	0	ra	ng	96	METE		Þ f;	Park_	ďλ	7 00 000		, -				1.0	
DEC. MICH. SECT. SETTING. LOCATION SECTCH ACTUITI () NORTH MORTH DESCRIPTION SETTING ACTUITI () NORTH DESCRIPTION DESTROY (Description DESTROY	185; 190	lcoc	e .	T (99	ks	1/2/	$-\frac{1}{2}$	+	77				3	4 Ran	ge <u> </u>			1.7	
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COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LUCL 16220
Assessor's Parcel Number: (411 - 110 - 01

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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COUNTY OF SAN DIEGO

DEPARTMENT OF ENVIRONMENTAL HEALTH 1255 Imperial Ave San Diego, CA 92101 619-338-2222



\$390.00

TOTAL AMOUNT DUE

INVOICE DATE: 16 SEP 2004

INVOICE

PERMIT TYPE & NUMBER: LWEL 16224

PERMIT OWNER:

CONTACT:

APN: 611-030-01-00

MANOS DRILLING & PUMP 16052 LAWSON VALLEY RD.

JAMUL

CA 91935

APPLICANT: HAMANN ROBERT D FAMILY TRUST 04

LOCATION DESCRIPTION: 3041 MCCAIN VALLEY RD. JACUMBA 91935

SITE ADDRESS: 3041 MCCAIN VALLEY RD

PROJECT DESCRIPTION/SCOPE

Number of Wells on Permit Application: 1

Description of Work: well drilling Type of Use for Each Well: domestic

FEE/DEPOSIT DE	TAILS			
FEE CODE	DESCRIPTION	TIME ACCT.	ACCT. CODE	AMOUNT
6LE01EHO	WATER WELL PERMIT	429E01	9773-773	390.00
			09-16-04 11132 9773-773-429 0 (3 日刊巨〇代	08-900 明 880 8岁亡 。



COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT LWEL 16224
WELL COMPUTER #
FEE:
WATER DIST:

Parcel #1 Property Owner: 2. Well Location - Assessors Parcel Number_ Company Name: 3. Well Contractor - Well Driller ₩ 100 Phone#: Use: ☐ Private Public Industrial □ Cathodic Other Time Extension: 1st 2nd □ New □ Reconstruction □ Destruction Type of Work: Type of Equipment: Existing: 7. Depth of Well: Proposed: 8. Proposed: **Perforations** Conductor Casing Filter/Filler Material ☐ Yes □ No ☐ Yes From; To: From: _____ To:____ Depth: Depth: From: _____ Diameter Diameter From: To: Wall/Gauge: Wall/Gauge: Wall/Gauge: Conductor diameter: ____in. Annular Thickness in. Borehole diameter: Complete: 10. Date of Work: Start: 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. 1/1/2 1/2 1/2 Date: 1/6/04 **DISPOSITION OF APPLICATION** (Department of Environmental Health Use only) Special Conditions: Grading and clearing associated with access to, or the

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

San Diego and/or other agencies.

M Approved

Specialist:

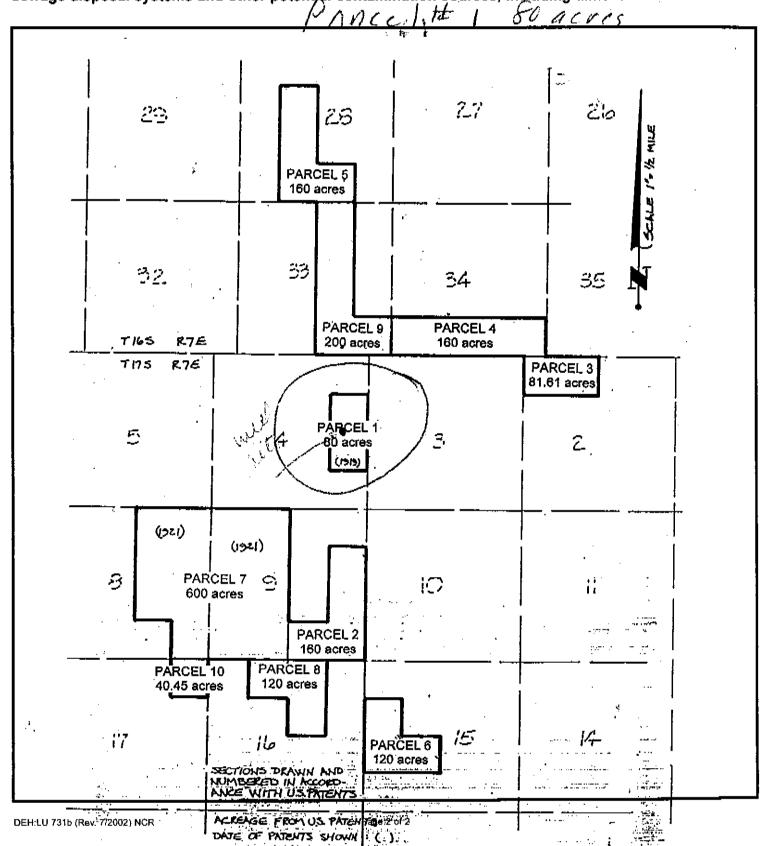
construction, maintenance or destruction of water wells, may require additional permits from the County of

COUNTY OF SAN DIEGO DEPÁRTMENT OF ENVIRONMENTAL HEALTH

Control #: LULL 16774
Assessor's Parcel Number: 611-030-08

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.





ASSESSORS		A21 13.4 (2)	
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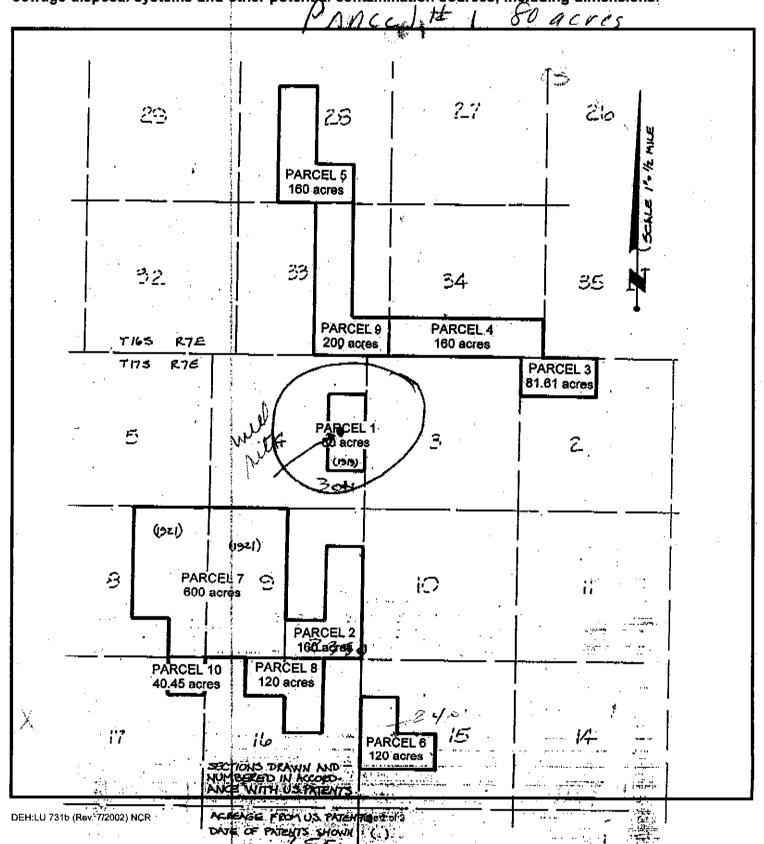
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Assessor's Parcel Number: <u>6//-030-08</u>

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Fain Drilling & Pump Co. Inc., . .

12029 Old Castle Rd. Valley Center, CA 92082 Phone (760) 749-0701 Fax (760) 749-6380

who with the same of the same

Invoice

Date	invoice #
2/15/2005	8049

Bill To

HAMANN COMPANIES **1000 PIONEER WAY** EL CAJON, CA 92020

	P.O. No.	Terms	Project	
		Due on receipt		
Description	Qty	Rate	Amount	
WELL DRILLING (TEST HOLE) APN 611 090 03 PARCEL # 10 40.45 ACRES MOVE IN AND SET UP 1ST. TIME DRILLING 6.5" DIA HOLE BACKFILL TEST HOLE AND CEMENT TOP MOVE BACK TO TEST HOLE AND SET UP 2ND TIME DRILL OUT AND CLEAN OUT EXISTING 400 FT. DRILLING FROM 400-850 FT. 6.5" DIA HOLE BACKFILL AND DESTROY TEST HOLE WELL PERMIT AND FILING FEES	1 400 1 1 1 450 1 1	500.00 12.00 400.00 500.00 400.00 400.00 490.00	500.00 4,800.00 400.00 500.00 400.00 400.00 490.00	
		Total	\$13,790.00	
<u> </u>		Payments/Credits	\$0.00	
		Balance Due	\$13,790.00	

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DWR 188 REV. 05-03

STATE OF CALIFORNIA

WELL COMPETION REPORT

₹#(ge of	wefer to instruction Pamphiet
	№ 0909548
Owner's Well No. Toot Well Par 10	···· 0303340
Date Work Began, Ended,	-/1//OF

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APN/TRS/OTHER										

Local I	Permit Ag	ency DEH	APN/TRS/OTHER
Perm	nit No	16457 GEOLOGIC LOG Permit Date 2/7/05	<u> </u>
DEPTH SURI		DESCRIPTION Describe material, grain size, color, etc.	Name Hamann Companies Mailing Address 1986 Pioneer Way OHEL Cajon, Castate 9202Qp
Ft. 1	o Ft.	Denotine material, grant mae, more, etc.	Address WELL LOCATION
0	6	Slope wash * sand and silt brown color	City Boulevard
6	62	Weathered, decomposed rock	County San Diego APN Book 611 Page 090 Parcel 03 Township Range Section
62	 	1st water - seepage	Lat 32 14/1 735 N Long 1/6 1/14 61.2 w DEG. MIN. SEC. LOCATION SKETCH DEG. MIN. SEC.
62	112	quarez distite	NORTH NEW WELL
112	114	Fracture - seepage of water	/320 Deepen Other (Specify)
114	274	Quartz diorite, soft weathered	— DESTROY (Describe - Procedures and Materials Under "GEOLOGIC LOG")
274	,	Fracture - Water	PAR. 10 USES (¥) WATER SUPPLY
275	654	Quartz diwrite, soft weathered	40.45 AC WATER SUPPLY — Domestic — Public — Irrigation — Industrial MONITORING —
654	<u> </u> 	Fracture - seepage of water	CATHODIC PROTECTION
654	720	Quartz diorite	HEAT EXCHANGE — DIRECT PUSH — INJECTION — VAPOR EXTRACTION —
720	 	Seepage of water	SPARGING
720	850	Quartz diorite	SOUTH SHEEDIATION BILLIARY OF DISTANCE OF Well from Roads, Buildings, Finites, etc. and attach a map. Use additional paper if necessary, PLEASE BE ACCURATE & COMPLETE.
	! ! !	Backfill and destroy bore hole	WATER LEVEL & YIELD OF COMPLETED WELL
		(DEPTH TO FIRST WATER 62 (Ft.) BELOW SURFACE
	i	<u>;</u>	DEPTH OF STATIC WATER LEVEL 28 (FL) & DATE MEASURED 2/14/05
		t t	TEST LENGTH 4 (Hrs.) TOTAL DRAWDOWN 500 (Ft.)
		BORING <u>850</u> (Feet) COMPLETED WELL <u>O</u> (Feet)	TEST LENGTH 4 (His.) TOTAL DRAWDOWN 500 (Ft.) * May not be representative of a well's long-term yield.
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ATTACHMENTS (±)	I, the undersigned, certify that this report is complete and	accurate to the best of my knowledge and belief.
Welt Construction Diagram Geophysical Log(s) Soil/Water Chemical Analyses	NAME (PERSON, FIRM, OR CORPORATION) TYPED OR PRINTED CO. 1111 12029 Old Castle Rd. Valley Co.	
Cother Side MAP	ADDRESS Jak R Jan	city STATE 719 2-14-05 328287
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS. 📙	C-52 MCENSED WATER WELL CONTRACTOR	DATE SIGNED C-57 LICENSE NUMBER

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No pump or power

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POWER EXSENSET



Fain Drilling & Pump Co. Inc.

12029 Old Castle Rd. Valley Center, CA 92082 Phone (760) 749-0701 Fax (760) 749-6380



Invoice

Date	Invoice #
2/11/2005	8048

Bill To

THE HAMANN COMPANIES 1000 PIONEER WAY EL CAJON, CA 92020

	P.Ö. No.	Terms	Project	
		Due on receipt		
Description	Qty	Rate	Amount	
DRILLING 970 FT DEEP WELL APN 611 110 01				
PARÇEL 6 120 AC				
EQUIPMENT SET UP	1	500.00	500.00	
DRILLING 6.5" DIA HOLE	400	12.00	4,800.00	
DRILLING 400-800' 6.5" DIA HÖLE	400	14.00	5,600.00	
DRILLING 800 - 970' 6.5" DIA HOLE	170	16.00	2,720.00	
REAMING 6" TO 10" DIA HOLE	226	12.00	2,712.00	
FURNISH AND INSTALL 6" WELL CASING	228	13.00	2,964.00	
INSTALL 50 FT. SURFACE SEAL WELL PERMIT AND FILING FEES		1,500.00 490.00	1,500.00 490.00	
		Fotal Payments/Credits	\$21,286.00	
		Balance Due 521,		

TRIPLICATE Owner's Copy Parc 1 of 1

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

Owner's Well No	Par. 6 -120	·	№ 090954
Date Work Began	-2/1/05 - 1	Ended 2/9/05	

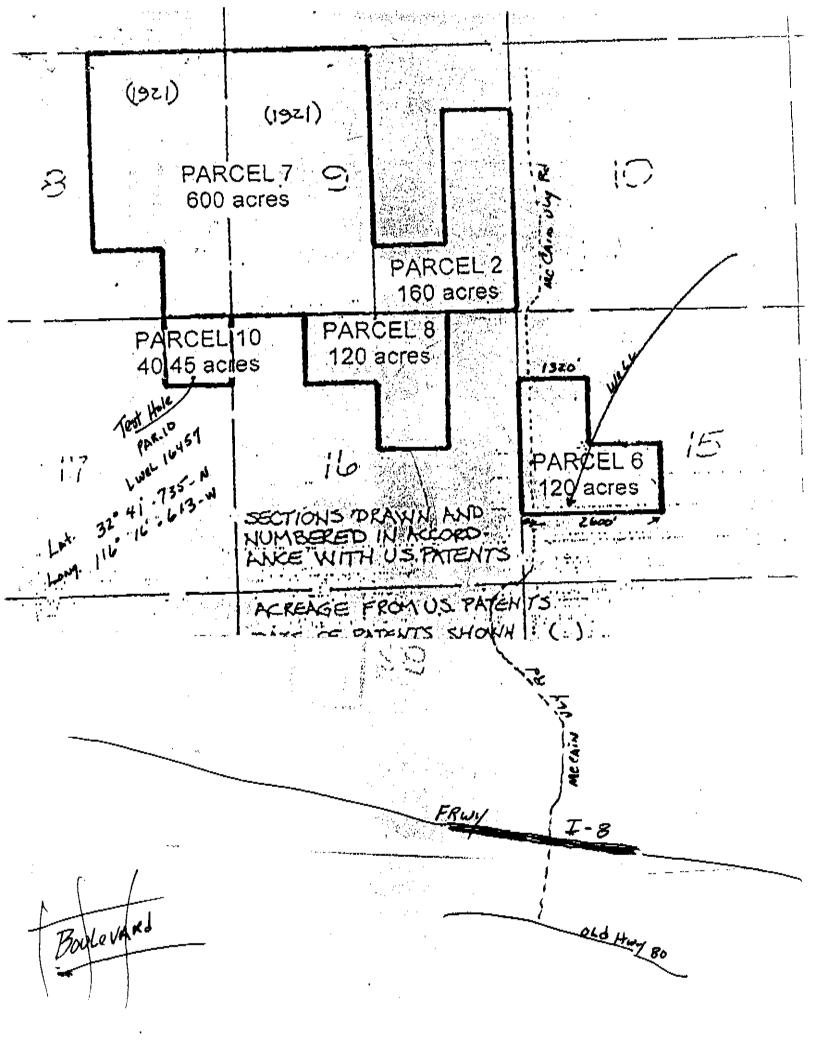
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Permit No. 16456 CEOLOGIC LOC Permit Date: 2/1/05 - WELL OWNER PRICEING PAGE Name The Hamaph Companies ORIENTATION (🗠), Rotary Mailing Address 1000 Pioneer Way Air FLUID, METHOD DEPTH FROM SURFACE El Caion DESCRIPTION Describe material, grain size, color, etc. - WELL LOCATION Address Rough Acres Ranch McCain Valley Rd <u> Slope wash - sandy decomposed</u> <u>granite - brown color</u> City ____ **Boulevara** County San Diego 212 APN Book 611 Page 110 Parcel 61 Weathered Granitic Rock Township 17S Range 7E _Section 15. Lat 36 16 772 N 212 225 Broken Rock Long -MIN. SEC. LOCATION SKETCH ACTIVITY (∠) Westhered granific rock - NORTH NEW WELL mostly white quarra MODIFICATION/REPAIR 320 _ Deepen Other (Specify) 310 ынкаг 8 грп DESTROY (Describe Under "GEOLOGIC LOG" 310 <u>Granitic rock large crystals</u> USES (∠) of white quertz WATER SUPPLY 120 - Domestic : Public 1320 AC. 961 Water 40+ gpm frigation _____ industrial MONITORING . TEST WELL 970 Fractured granitic rock CATHODIC PROTECTION <u>large quart* crystals</u> HEAT EXCHANGE DIRECT PUSH . INJECTION 300 VAPOR EXTRACTION ZL061 SPARGING - SOUTH REMEDIATION . Illustrate or Describe Distance of Well from Ruals, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE. OTHER (SPECIFY) WATER LEVEL & YIELD OF COMPLETED WELL DEPTH TO FIRST WATER __30___ (Ft.) BELOW SURFACE DEPTH OF STATIC 18 _ (Ft.) & DATE MEASURED . WATER LEVEL _ ESTIMATED YIELD * _50 (GPM) & TEST TYPE ___ TOTAL DEPTH OF BORING 970 (Feet) TEST LENGTH 3. (Hrs.) TOTAL DRAWDOWN 800 (Ft.) * May not be representative of a well's long-term yield.

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	Geologic Log Well Construction Diagram	NAME Fain Drilling & Pump Co. 1:
	Geophysical Log(s)	(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED) 12029 Old Castle Rd. Volle:
	Soil/Water Chemical Analyses	ADDRESS
	ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.	Signed C 57 HICKNET WHITE WELL CONTRACTOR

l, the	undersigne	ed, certify	that thi	s report is	comple	te and	accurate	to ti	ne be:	stofmykr	owledge	e and belief.	
NAME	Fain	Drill	ing	& Pump	Co.	in	2 .						
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APPENDIX B

OBSERVATIONS AND ANALYSIS OF AQUIFER CHARACERISTICS

ROUGH ACRES RANCH

MCCAIN VALLEY, EAST SAN DIEGO COUNTY, CALIFORNIA





Date: December 1, 2010

Project No.: 2010-0005

To: John Hower, CEG

Sarah Battelle, CHG

From: Mark Vincent, CHG

Regarding: Observations and Analyses of Aquifer Characteristics

Rough Acres Ranch, San Diego County, California

INTRODUCTION

This memo presents a summary of observations and analyses made following a stepped and a constant rate aquifer pumping and recovery test in wells located at Rough Acres Ranch located approximately in McCain Valley in eastern San Diego County, California. The tests were performed to determine whether sufficient volumes of water are available for the Tule Wind Farm construction projects. Analyses performed included calculation of transmissivity, hydraulic conductivity, and storativity for a pumping well and observation wells.

WELL AND AQUIFER CONDITIONS

A well labeled as Well #6a was used as the pumping well for this test. Another well labeled as Well #6 (also referred to as South Well) is located 36 feet away from the pumping well and was monitored and analyzed as an observation well. More distant observation wells were monitored including Well #9 (Horse Corral Well), Walker Residence Well, Well #4 (RV Well), Well #2, and Well #8 (Far Field Well) (Figure 1).

Records for drilling and construction of the wells used for these pumping tests are incomplete or nonexistent. A well identified on Department of Water Resources (DWR) records as being owned by Harmony Grove Partners (identified as Form No. 1089956) is believed to be the log for Well #6a. Logs for Well #4 (RV Well) and Well #8 (Far Field Well) were also obtained. No records are available for Well #6 (South Well), The Walker Residence Well, Well #9 (Horse Corral Well), or Well #2.

Although DWR records indicate the borehole for Well #6a was drilled to a total depth of 420 feet, the bottom of the well is recorded to be at a depth of 385 feet below ground surface. Records are incomplete but it was assumed that the well screen extends from a depth of 75 to 385 feet below ground surface. A cement sanitary seal is reported to extend from ground surface to a depth of 56 feet. Wells #6 and #6a used in this pumping test have existing electric submersible pumps installed in them. Based on the production rates achieved during the tests performed, the wells are likely to be outfitted with four-inch diameter electric submersible pumps. Based on the depth and pressure head on the

transducers installed in the wells for the test, it was assumed that both of the boreholes are 385 feet deep and are 6.5-inches in diameter. It was further assumed that the wells were constructed with 4-inch diameter well casing and that they are perforated or screened from a depth of 75 feet below ground surface. Details of well construction could not be verified in the field because of the presence of pumps, discharge pipes, electrical wires, and surface sanitary seals. Available well logs are included at the back of this document.

The area immediately around Well #6 and #6a is underlain by alluvium comprised of poorly sorted sand, gravel, and silt derived from the crystalline basement rock exposed on the adjacent canyon sidewalls. The crystalline basement rocks are classified as tonalite and yield groundwater from fractures. The well log reportedly recorded for Well #6a indicates that there is about 70 to 85 feet of alluvium overlying the tonalite. Groundwater was measured at a depth of 27.81 feet below the top of sanitary seal on Well #6a.

TEST METHODS

Observations of groundwater elevation were recorded in a pumping well and six observation wells in McCain Valley. Data was collected using pressure transducers connected to data loggers. Barometric pressure changes were recorded during the test and corrections were made to the pressure head data collected during the tests.

A stepped aquifer pumping test was performed using Well #6a to determine the optimum pumping rate for a longer duration test. The pressure transducers were deployed and began recording data on August 20, 2010 to perform the stepped pumping test. The stepped pumping test was performed at pumping rates of 28 gallons per minute (gpm), 38 gpm, 55 gpm and 60 gpm. A semi-logarithmic plot of elapsed time versus drawdown for the stepped pumping test is shown on Figure 2.

The constant rate pumping and recovery test was performed from August 24 through 27, 2010. The pump was powered-down on August 27, 2010 and allowed to recover for 10 hours when the pressure transducers were removed from the wells. A recovery test was performed by turning off the pumps and recording the increasing head levels over time.

DATA ANALYSIS

Changes in groundwater level data recorded during this test were corrected for barometric pressure changes and used to generate a file containing tabulated time and changes in pressure head. The data was used to generate time-drawdown graphs for the pumping and observation wells and imported into computer software used to calculate the transmissivity and storativity of the fractured tonalite.

The stepped pump test analysis consists of plotting the drawdown versus time for each pumping rate on a time versus drawdown plot with time plotted on a logarithmic scale. Forward projections of each segment representing a different pumping rate can be used to predict the likely drawdown for the pumping well during for the selected duration of the test. A pumping rate of 50 gpm was selected as the target pumping rate because it would allow for ample drawdown without the well running dry during the test.



The method of Schafer (1978) was employed to determine how much of the data set for Well #6a was impacted by casing storage effects. The method is a simplification of the method first developed by Papadopulos and Cooper (1967) but does not require prior knowledge of the transmissivity or well efficiency. The point at which casing storage effects are overcome was calculated to occur approximately 23 to 25 minutes into the test based on the assumptions about well construction practices, pumping rates, and drawdown. Very early pumping data was ignored in the analyses described below due to casing storage effects.

Time versus drawdown plots were prepared for the pumping and observation wells for the pumping and recovery portions of the test. The plots are shown with the time axis plotted on a logarithmic scale and drawdown on a linear scale.

Figure 3 shows the time-drawdown plot for Well #6a during pumping. The first 23 to 25 minutes of the test show the casing storage effects. Well #6a drawdown plots as a straight line on the time-drawdown chart representing constant aquifer properties during that portion of the drawdown cone development. A sudden change in the drawdown curve starts at approximately 11 or 12 minutes; which may reflect leakage from the alluvium above the fractured bedrock.

A residual drawdown plot for Well #6a is shown on Figure 4. The plot shows the change in drawdown versus the ratio of the time since the pump test started divided by the time since the recovery portion of the test started (t/t`). The residual drawdown at a t/t` ratio of 1 is shown to be about 0.33 feet (a less than significant change in storage noted in the pumping well over the course of the pumping and recovery portions of the aquifer stress test).

A time-drawdown plot of Well #6 (the observation well also referred to as South Well) located 36 feet away from the pumping well shows a decrease in drawdown from approximately 30 minutes to approximately 400 minutes which may result from leakage from the alluvium above the fractured bedrock (Figure 5). The Well #6 plot shows even less drawdown versus time after 400 minutes possibly reflecting the fractured bedrock aquifer.

The Well #6 recovery portion of the test is plotted as the residual drawdown versus t/t` shows a flat line on the semi-logarithmic plot (Figure 6) indicative of uniform aquifer conditions from a t/t` ratio of about 8 to 110 into the recovery test period. The residual drawdown value measured for a t/t' ratio of 1 is about -0.22 feet. It is not regarded to be significant compared to the County standard maximum change of 0.5 feet.

The Well #9 (Horse Corral Well) was monitored and the time-drawdown plot reflects that the well pump cycled on and off five times during the test (Figure 7). No analyses were performed for this well because the changes in drawdown versus time due to the pump activating are far greater than any drawdown likely to be induced by the pumping test at Well #6a.



Well #2 (Pond Well) and Well #9 (Far Field Well) were monitored for changes in head during the pumping test. Figure 8 and 9 show the time-drawdown plots for Wells #2 and #9. Both plots show similar small, cyclic, barometric changes in head but are not likely to have resulted from the pumping test. No analyses were performed using the data from these wells.

Water level drawdown data were evaluated using the computer software program AquiferTest version 3.5 (Waterloo Hydrogeologic, 2002). The program performs curve matching of the time drawdown data to calculate transmissivity, hydraulic conductivity, and storativity using different methods. The methods employed included Cooper-Jacob (1946), Moench (1993), Neuman (1975), and Theis (1935).

DISCUSSION

As shown on Table 1, the calculated hydraulic conductivity values for all of the analytical methods employed ranged from a low of 7.50E-04 feet/day for data collected from Well #6 (South Well) using the Theis method for the data collected from the end of the recovery test to a high of 7.50E+00 feet/day using the Cooper Jacob method with late time data for Well #6 (South Well). An average conductivity of 1.85 feet/day was calculated from all methods from both Well #6 and #6a. The Storativity values range from a low of 4.48E-06 for Well #6 late time data calculated using the Moench Fracture Flow method and a high of 7.87E-01 for a match to the late time data recorded in Well #6 using the Moench method with the vertical hydraulic conductivity set at one-tenth the horizontal hydraulic conductivity.

All of the analytical results show a higher transmissivity and hydraulic conductivity value for matches to the observation Well #6. The pumping well and observation well used for these analyses are located in a portion of McCain Valley which is entirely covered in up to 75 to 80 feet of alluvium (Figure 10). Based on the measured depth to groundwater in Well #6 and #6a, approximately 47 to 52 of saturated alluvium overlies the fractured bedrock at the test site (Figure 11). The saturated alluvium is likely to act like a reservoir recharging the fractures in the bedrock. The aerial extent of the fractured bedrock aquifer and the amount of storage in the fractures is likely controlled in part by the presence of the alluvial aquifer. Because the fractures in the bedrock appear to be of aerially limited extent, the actual volume of groundwater available may be limited with larger volumes of groundwater available within the canyon areas where fracturing may be most prevalent and alluvium is saturated.



CLOSURE

This summary of observations and analyses has been prepared in general accordance with accepted professional geotechnical and hydrogeologic principles and practices. This report makes no other warranties, either expressed or implied as to the professional advice or information included in it. Our firm should be notified of any pertinent change in the project, or if conditions are found to differ from those described herein, because this may require a reevaluation of the conclusions. This report has not been prepared for use by parties or projects other than those named or described herein. It may not contain sufficient information for other parties or purposes.

Geo-Logic Associates

Mark W. Vincent, PG 5767, CEG 1873, CHg 865

Mark W Vinent

Senior Geologist

Attachments: Table 1 - Aquifer Stress Test Results

Figure 1 - Well Location Plan

Figure 2 - Step Test Time Drawdown Plot

Figure 3 - North Well Time Drawdown Plot Pumping

Figure 4 - North Well Time Drawdown Plot Recovery

Figure 5 - South Well Time Drawdown Plot Pumping

Figure 6 - South Well Time Drawdown Plot Recovery

Figure 7 - Thing Valley Well Time Drawdown Pumping

Figure 8 - Thing Valley Well Time Drawdown Recovery

Figure 9 - Geologic Map

Appendix A - Analytical Results from Aquifer Test Program

Appendix B - Department of Water Resources Well Completion Reports



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- Cooper, H.H., Jr. and Jacob, C.E., 1946, A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Well Field History, *Transactions*, *American Geophysical Union*, Vol. 27, No. 4.
- Driscoll, D.G., 1986, <u>Groundwater and Wells</u>, Johnson Filtration Systems Inc., St. Paul, Minnesota.
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- Theis, C.V., 1935, The Relation Between the Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well Using Groundwater Storage, *American Geophysical Union Transactions*, Vol. 16, pp. 519-524.
- Waterloo Hydrogeologic (co-developed with Thomas Roerich), 2002, AquiferTest version 3.5, Advanced Pumping Test and Slug Test Analytical Software.



Table 1 **Aquifer Stress Test Results** Rough Acres Ranch - McCain Valley

Well	a wa	Distance From Pumping Well (feet)	Groundwater Depth from Ground Surface (feet)	Assumed Aquifer Thickness (feet)	Average Pumping Rate		Transmissivity (feet^2/day)	Conductivity (feet/day)		
Designation	Condition	(leet)		` '	(gpm)	Analytical Method	, ,	, ,,	Storativity	Comments
Well #6a	Pumping	1	28	500	50	Cooper-Jacob	6.30E+02	1.26E+00	NA	Match to late data.
Well #6a	Pumping	1	28	500	50	Moench Fracture Flow	1.12E+02	2.25E-01	2.70E-04	Match to late data.
Well #6a	Pumping	1	28	500	50	Moench	1.21E+02	2.43E-01	1.72E-01	Match to late data.
Well #6a	Pumping	1	28	500	50	Neuman	5.69E+01	1.14E-01	1.62E-02	Spec Yld. = $1.62E+02$
Well #6a	Pumping	1	28	500	50	Theis	2.69E+01	5.39E-02	1.64E-01	Match to early data.
Well #6a	Pumping	1	28	500	50	Theis	1.51E+02	3.03E-01	3.19E-05	Match to late data.
Well #6a	Pumping	1	28	500	50	Walton	1.11E+02	2.21E-01	7.08E-04	Match to late data.
Well #6a	Recovery	1	28	500	0	Theis Recovery	2.17E-02	4.35E-05	NA	Match to early data.
Well #6a	Recovery	1	28	500	0	Theis Recovery	7.27E+00	1.45E-02	NA	Match to late data.
South Well #6	Pumping	36	27.81	500	50	Cooper-Jacob	2.14E+03	4.28E+00	NA	Match to middle data.
South Well #6	Pumping	36	27.81	500	50	Cooper-Jacob	3.75E+03	7.50E+00	NA	Match to late data.
South Well #7	Pumping	36	27.81	500	50	Moench Fracture Flow	2.95E+03	5.91E+00	4.48E-06	Match to late data.
South Well #6	Pumping	36	27.81	500	50	Moench	1.30E+03	2.60E+00	7.87E-01	Kv=1/10 Kh
South Well #6	Pumping	36	27.81	500	50	Neuman	9.67E+02	1.93E+00	NA	Match to all data.
South Well #6	Pumping	36	27.81	500	50	Theis	3.18E+03	6.36E+00	3.29E-06	Match to late data.
South Well #6	Pumping	36	27.81	500	50	Walton	1.13E+03	2.26E+00	1.47E-03	Match to early data.
South Well #6	Recovery	36	27.81	500	0	Theis Recovery	3.75E-01	7.50E-04	NA	Match to early data.
South Well #6	Recovery	36	27.81	500	0	Theis Recovery	2.23E+00	4.47E-03	NA	Match to late data.
-						Average Values	9.24E+02	1.85E+00	1.14E-01	_

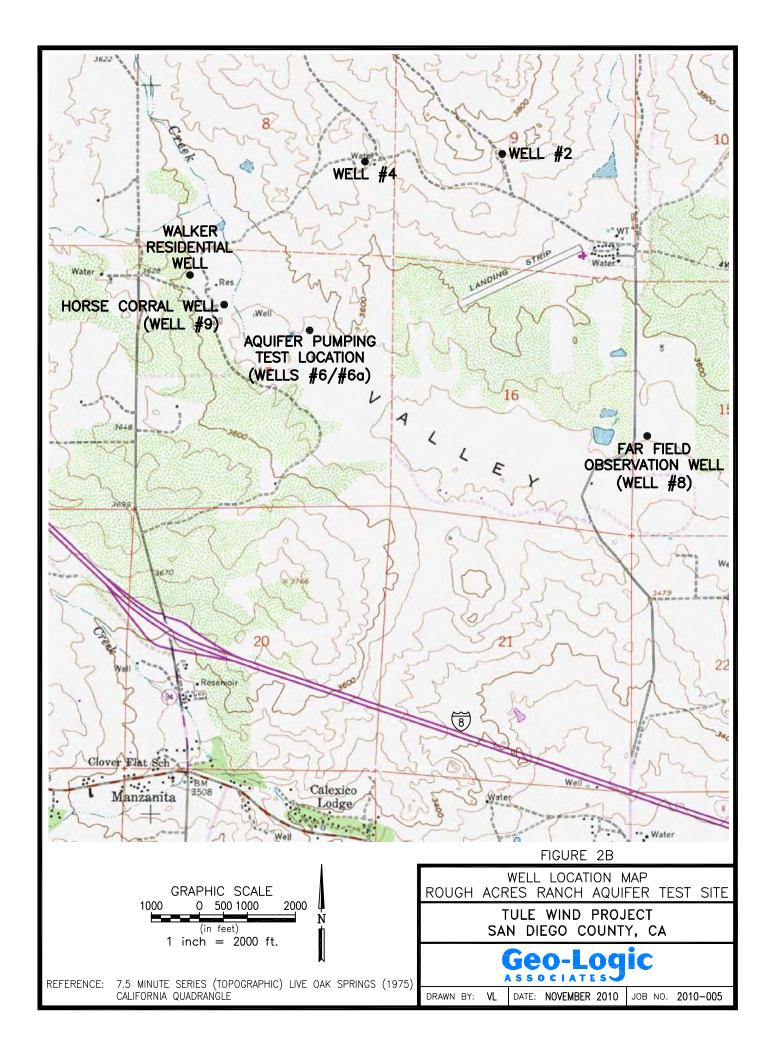


Figure 2 Step Drawdown Test Well #6a - Pumping Well Rough Acres Ranch, McCain Valley

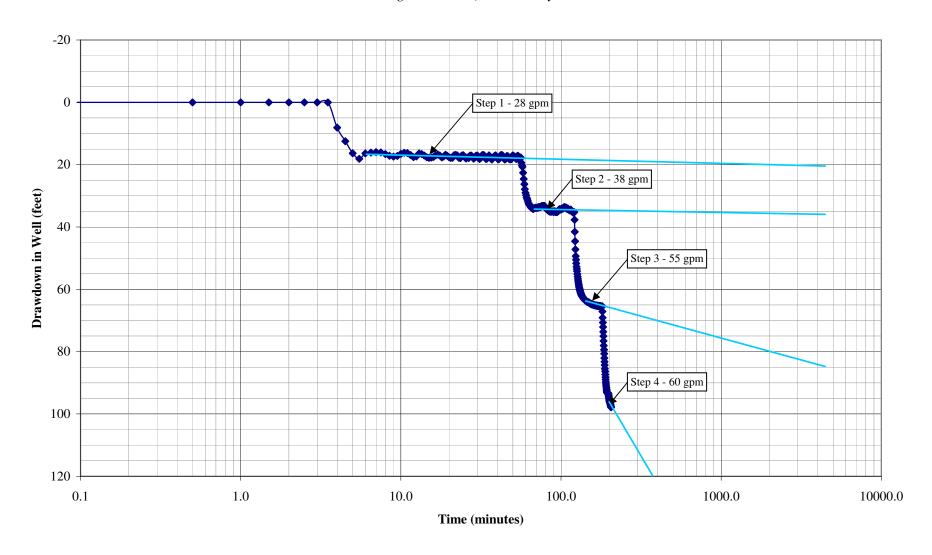


Figure 3
Drawdown in Pumping Well during 72-hour Pumping Test at 50 gpm
North Well at Rough Acres Ranch

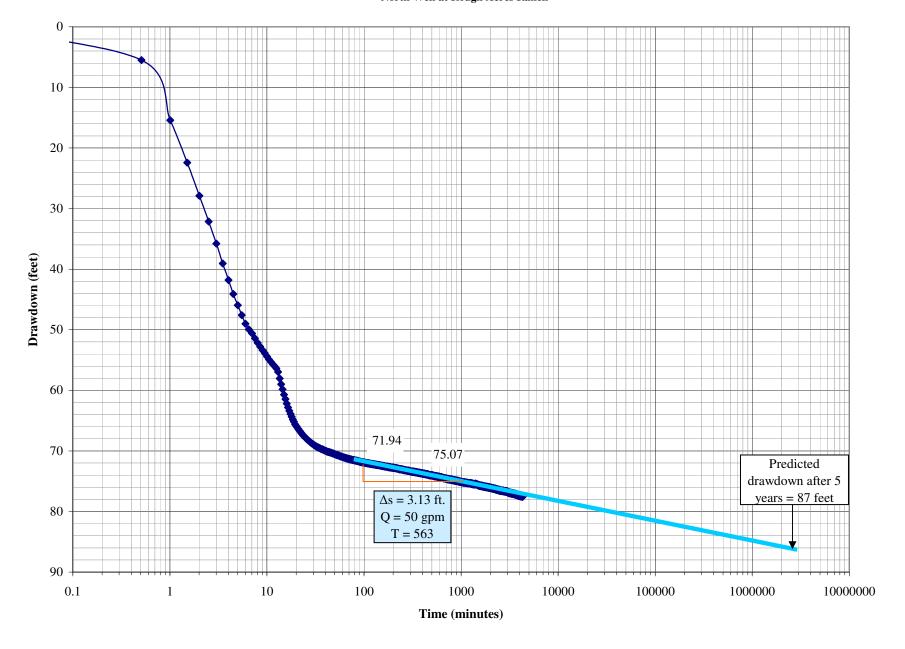


Figure 4 Residual Drawdown Plot Pumping Well #6a

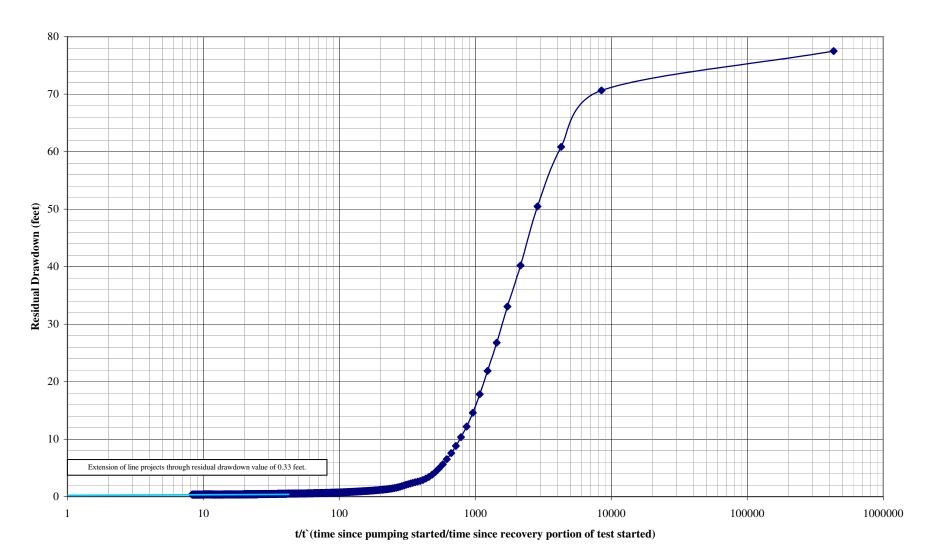


Figure 5 Well #6 - Observation Well Time-Drawdown Plot Rough Acres Ranch

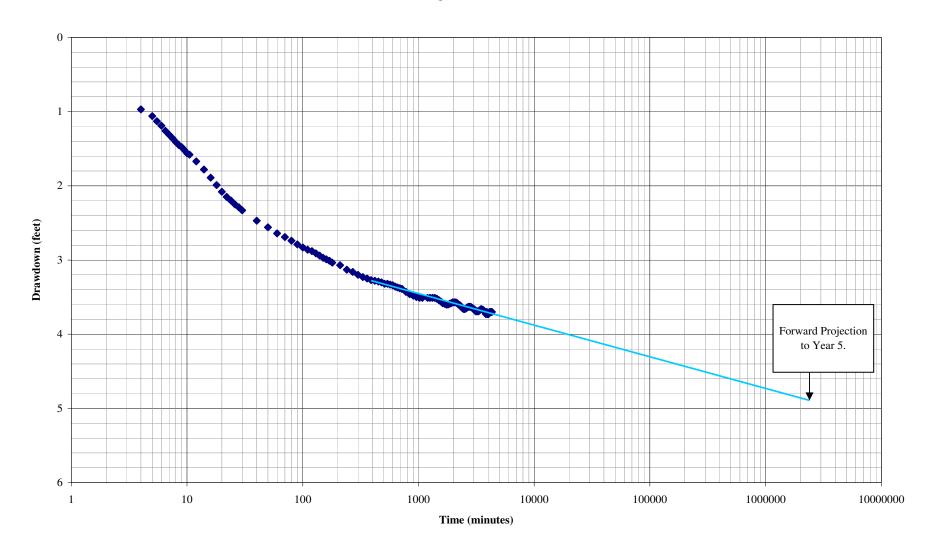


Figure 6 South Well - Observation Well Residual Drawdown Plot Rough Acres Ranch

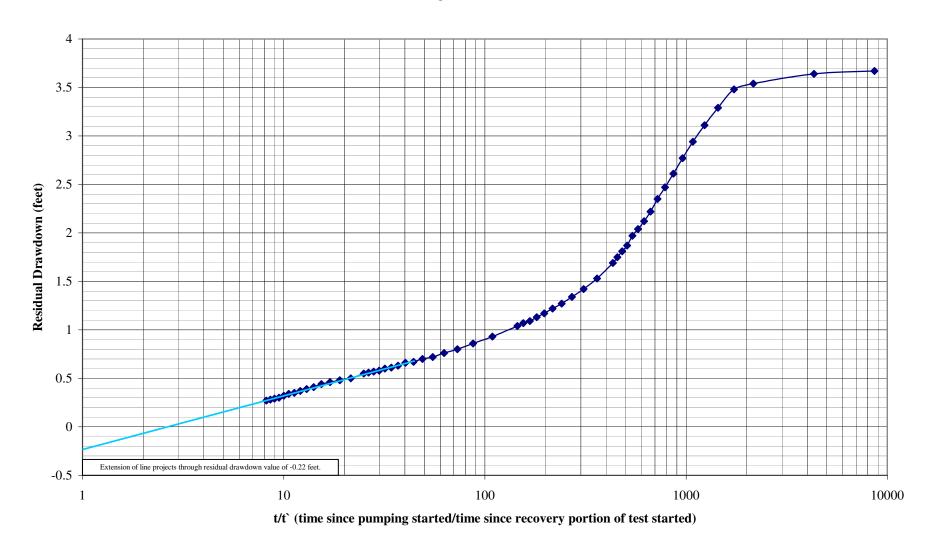


Figure 7 Horse Corral Well (Observation Well) Time-Drawdown Plot

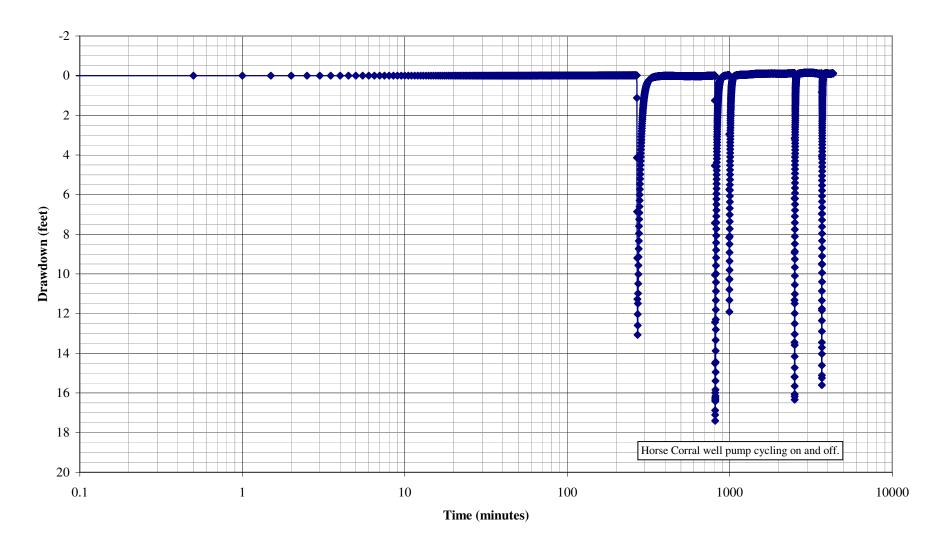


Figure 8 Well #2 - Observation Well Distance-Drawdown Plot Rough Acres Ranch

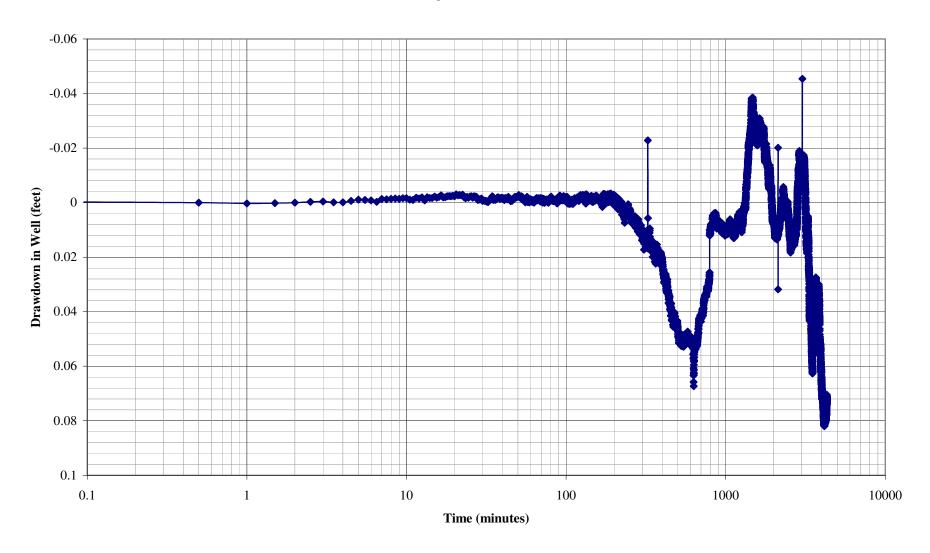
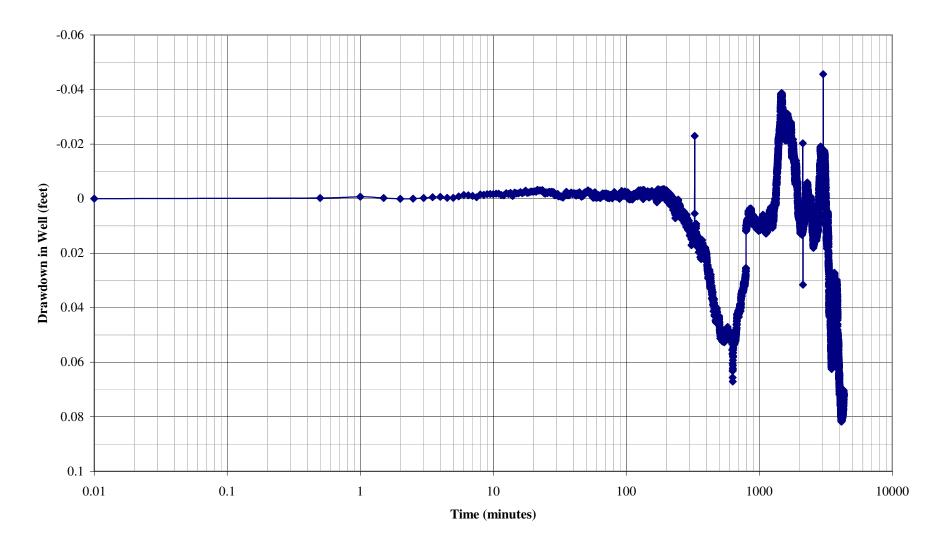
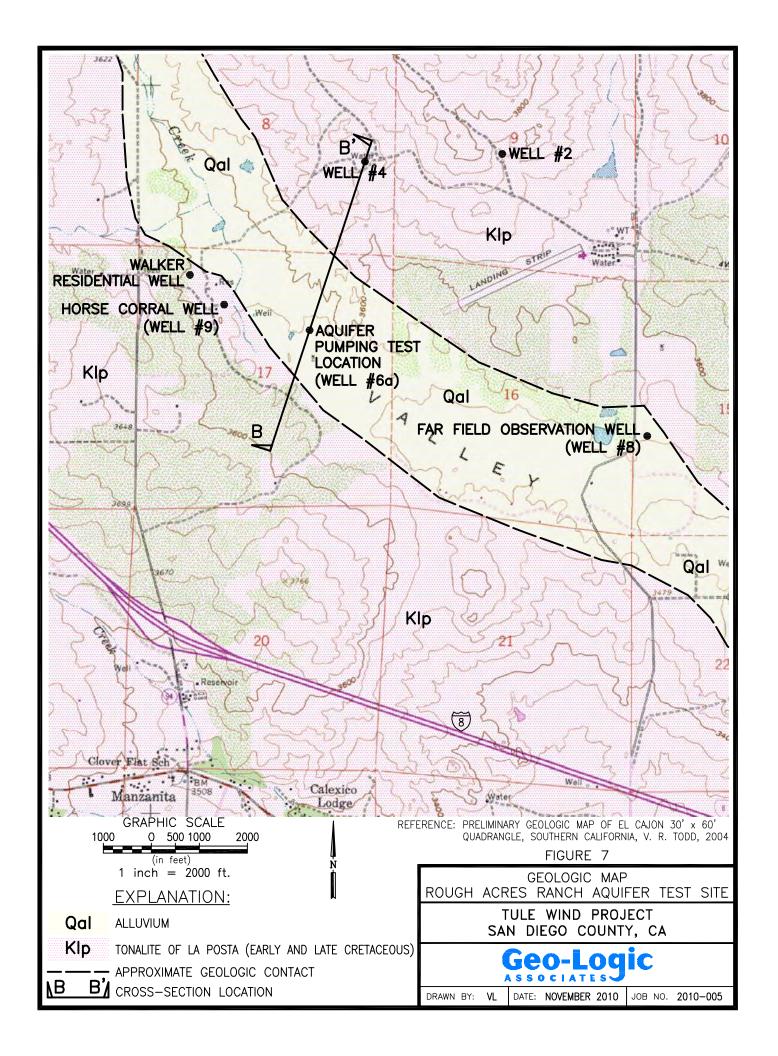
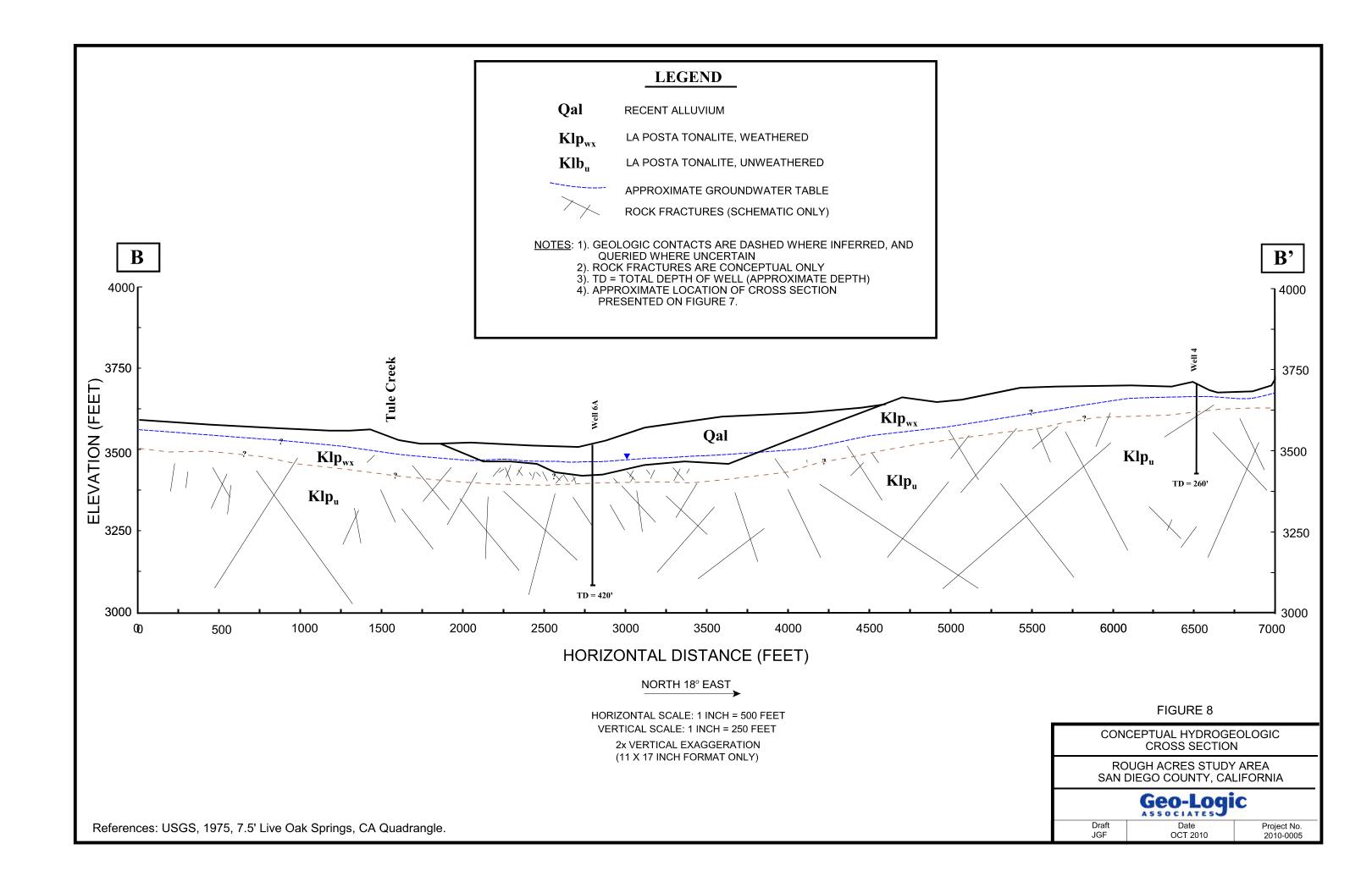


Figure 9 Well #8 Far Field - Observation Well Time-Drawdown Plot Rough Acres Ranch







Appendix A Analytical Results from Aquifer Test Program



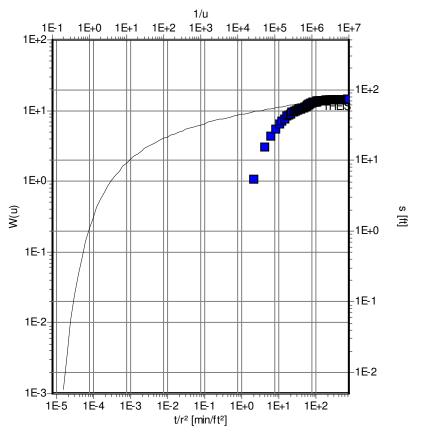
Waterloo Hydrogeologic, Inc.

460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798

Pumping Test Analysis Report						
Project:	Rough Acres					
Number:						
Client:						

Well #6a - Pumping Well

Pumping Test Name [Theis]



Pumping Test: Pumping Test Name

Analysis Method: Theis

Analysis Results: Transmissivity: 1.51E+2 [ft²/d] Conductivity: 3.03E-1 [ft/d]

Storativity: 3.19E-5

<u>Test parameters:</u> Pumping Well: Well #6a Aquifer Thickness: 500 [ft]

Casing radius: 0.167 [ft] Confined Aquifer

Screen length: 310 [ft]

Boring radius: 0.271 [ft]

Discharge Rate: 50 [U.S. gal/min]

<u>Comments:</u> Match to late time data. Pumping Well.

Evaluated by: MWV

Evaluation Date: 11/18/2010

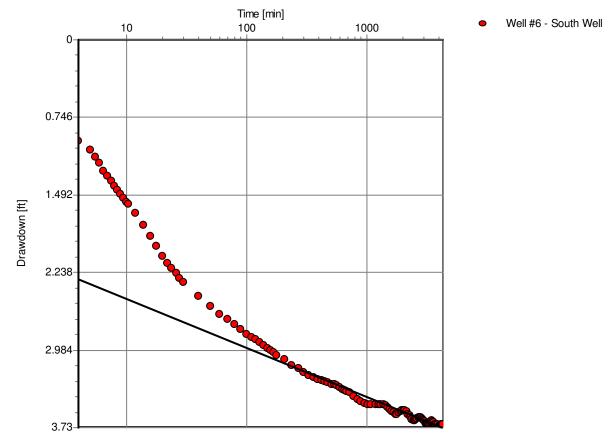


Waterloo Hydrogeologic, Inc.

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Pumping Test Analysis Report							
Project:	Rough Acres						
Number:							
Client:							

Pumping Test Name [Cooper-Jacob Time-Draw dow n]



<u>Pumping Test:</u> Pumping Test Name

Analysis Method: Cooper-Jacob Time-Drawdown

Analysis Results: Transmissivity: 3.75E+3 [ft²/d] Conductivity: 7.50E+0 [ft/d]

Storativity: 2.28E-7

<u>Test parameters:</u> Pumping Well: Well #6a Aquifer Thickness: 500 [ft]

Casing radius: 0.167 [ft] Confined Aquifer

Screen length: 310 [ft]
Boring radius: 0.271 [ft]

Discharge Rate: 50 [U.S. gal/min]

<u>Comments:</u> Match to latest time data. Observation Well.

Evaluated by: MWV

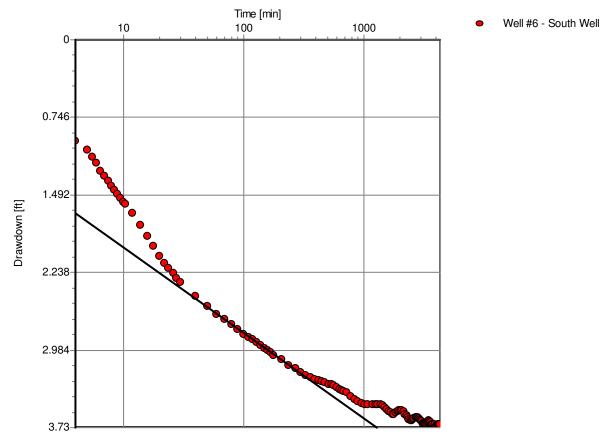
Evaluation Date: 11/18/2010



460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798

Pumping Test Analysis Report
Project: Rough Acres
Number:

Pumping Test Name [Cooper-Jacob Time-Draw dow n]



Client:

<u>Pumping Test:</u> Pumping Test Name

Analysis Method: Cooper-Jacob Time-Drawdown

Analysis Results: Transmissivity: 2.14E+3 [ft²/d] Conductivity: 4.28E+0 [ft/d]

Storativity: 1.01E-4

<u>Test parameters:</u> Pumping Well: Well #6a Aquifer Thickness: 500 [ft]

Casing radius: 0.167 [ft] Confined Aquifer

Screen length: 310 [ft]

Boring radius: 0.271 [ft]

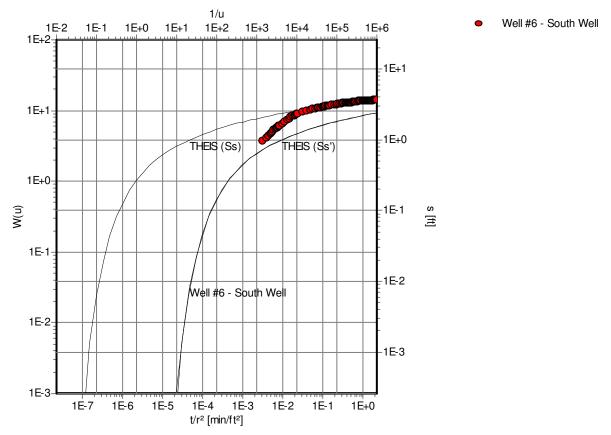
Discharge Rate: 50 [U.S. gal/min]

<u>Comments:</u> Match to middle time data. Observation Well.

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Pumpin	g Test Analysis Report
Project:	Rough Acres
Number:	
Client:	

Pumping Test Name [Moench Fracture Flow]



Pumping Test: Pumping Test Name

Analysis Method: Moench Fracture Flow

Analysis Results:	Transmissivity:	2.95E+3 [ft²/d]	Conductivity:	5.91E+0 [ft/d]
	Storativity:	4.48E-6		
Test parameters:	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	b:	357 [ft]
	Screen length:	310 [ft]	Kv/Kh:	0.1
	Boring radius:	0.271 [ft]	C:	0.231
	Discharge Rate:	50 [U.S. gal/min]	K(block)/K(Skin):	0.1
	Ss(blk)/Ss(fract):	200	K(block)/K(fracture):	0.1

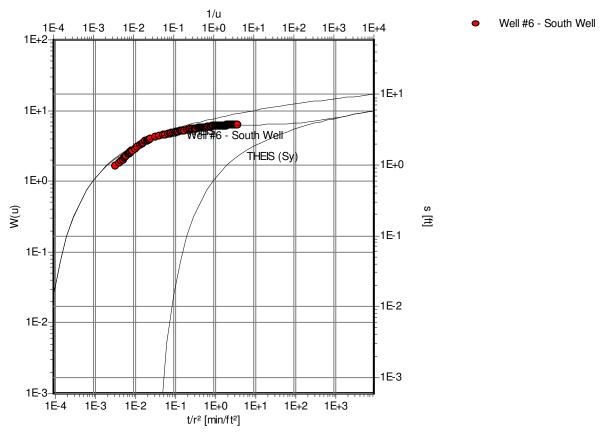
Comments: Match to late time data.



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Pumping	g Test Analysis Report
Project:	Rough Acres
Number:	
Client:	

Pumping Test Name [Moench]



Pumping Test: Pumping Test Name

Analysis Method: Moench

Analysis Results:	Transmissivity:	1.30E+3 [ft²/d]	Conductivity:	2.60E+0 [ft/d]
	Storativity:	7.87E-1	Conductivity (vertical):	2.60E-1 [ft/d]
Test parameters:	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	Unconfined Aquifer	
	Screen length:	310 [ft]	S/Sy:	0.001
	Boring radius:	0.271 [ft]	Kv/Kh:	0.1
	Discharge Rate:	50 [U.S. gal/min]	Gamma:	1E9
	b:	357 [ft]		

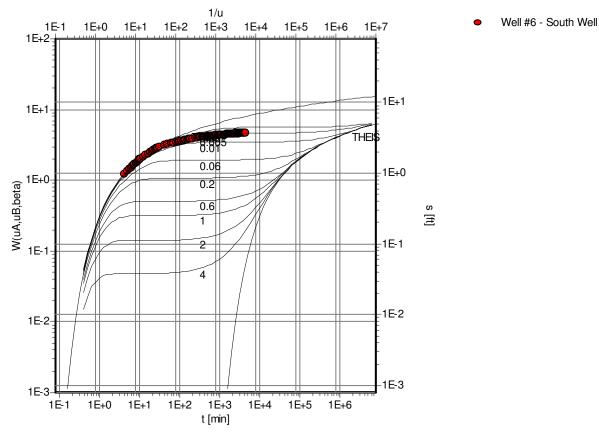
Comments: Match to late time data.



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Pumpin	g Test Analysis Report
Project:	Rough Acres
Number:	
Client:	

Pumping Test Name [Neuman]



Pumping Test: Pumping Test Name

Analysis Method: Neuman

Analysis Results: 9.67E+2 [ft²/d] Conductivity: 1.93E+0 [ft/d]

<u>Test parameters:</u> Pumping Well: Well #6a Aquifer Thickness: 500 [ft]

Casing radius: 0.167 [ft] Beta: 0.005

Screen length: 310 [ft]

Boring radius: 0.271 [ft]

Discharge Rate: 50 [U.S. gal/min]

LOG(Sy/S): 4

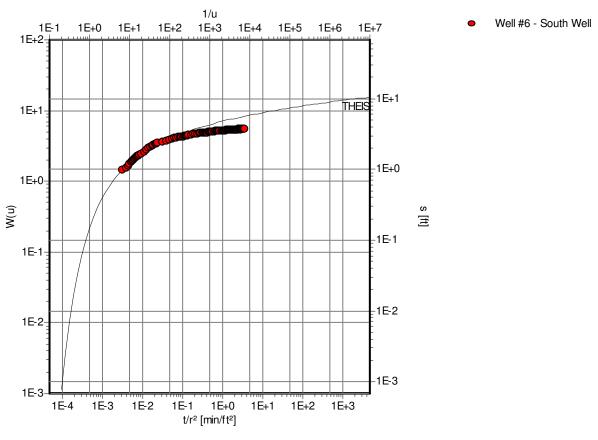
<u>Comments:</u> Match to entire data set.



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Pumpin	g Test Analysis Report
Project:	Rough Acres
Number:	
Client:	

Pumping Test Name [Theis]



Pumping Test: Pumping Test Name

Analysis Method: Theis

Analysis Results: Transmissivity: 1.13E+3 [ft²/d] Conductivity: 2.26E+0 [ft/d]

Storativity: 1.47E-3

<u>Test parameters:</u> Pumping Well: Well #6a Aquifer Thickness: 500 [ft]

Casing radius: 0.167 [ft] Confined Aquifer

Screen length: 310 [ft]

Boring radius: 0.271 [ft]

Discharge Rate: 50 [U.S. gal/min]

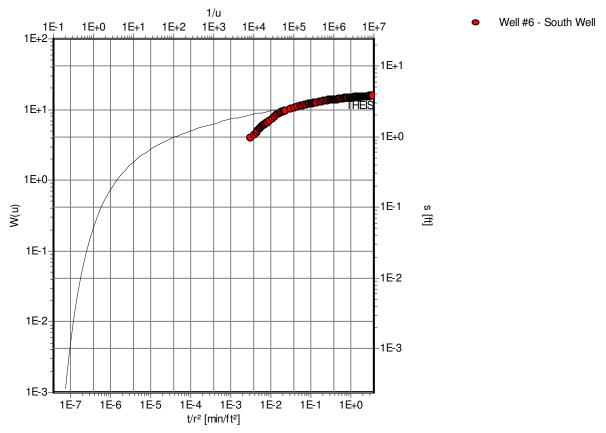
Comments: Match to early time data. Observation Well.



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Pumping	g Test Analysis Report
Project:	Rough Acres
Number:	
Client:	





Pumping Test: Pumping Test Name

Analysis Method: Theis

Analysis Results: Transmissivity: 3.18E+3 [ft²/d] Conductivity: 6.36E+0 [ft/d]

Storativity: 3.29E-6

<u>Test parameters:</u> Pumping Well: Well #6a Aquifer Thickness: 500 [ft]

Casing radius: 0.167 [ft] Confined Aquifer

Screen length: 310 [ft]

Boring radius: 0.271 [ft]

Discharge Rate: 50 [U.S. gal/min]

Comments: Match to late time data.



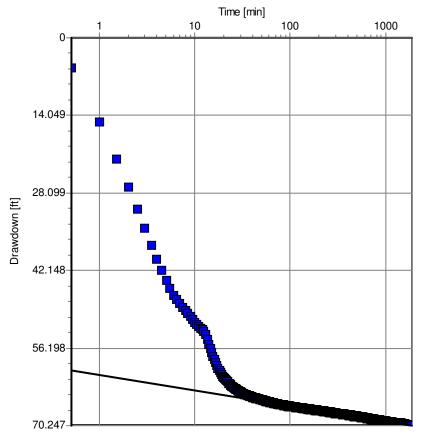
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Pumping	g Test Analysis Report	
Project:	Rough Acres	

Number:

Client:

Pumping Test Name [Cooper-Jacob Time-Draw dow n]



Well #6a - Pumping Well

Pumping Test: Pumping Test Name

Analysis Method: Cooper-Jacob Time-Drawdown

Analysis Results: Transmissivity: 6.30E+2 [ft²/d] Conductivity: 1.26E+0 [ft/d]

<u>Test parameters:</u> Pumping Well: Well #6a Aquifer Thickness: 500 [ft]

Casing radius: 0.167 [ft] Unconfined Aquifer

Screen length: 310 [ft]
Boring radius: 0.271 [ft]

Discharge Rate: 50 [U.S. gal/min]

<u>Comments:</u> Match to late time data.

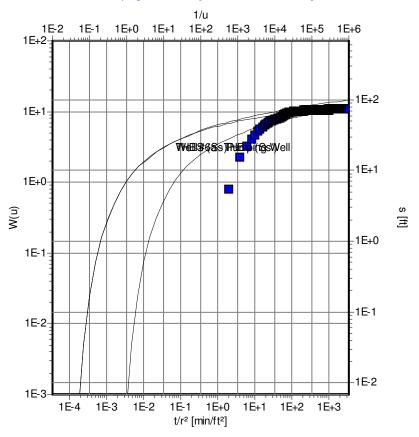


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Pumping Test Analysis Report
Project: Rough Acres
Number:
Client:

Well #6a - Pumping Well

Pumping Test Name [Moench Fracture Flow]



Pumping Test: Pumping Test Name

Analysis Method: Moench Fracture Flow

	Storativity:	2.70E-4		
Test parameters:	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	b:	357 [ft]

1.12E+2 [ft²/d]

Screen length:	310 [ft]	Kv/Kh:	1
Boring radius:	0.271 [ft]	C:	0.231
Discharge Rate:	50 [U.S. gal/min]	K(block)/K(Skin):	0.1

Conductivity:

Ss(blk)/Ss(fract): 20 K(block)/K(fracture): 0.1

Comments: Match to late time data.

Analysis Results: Transmissivity:

Evaluated by: MWV

Evaluation Date: 11/17/2010

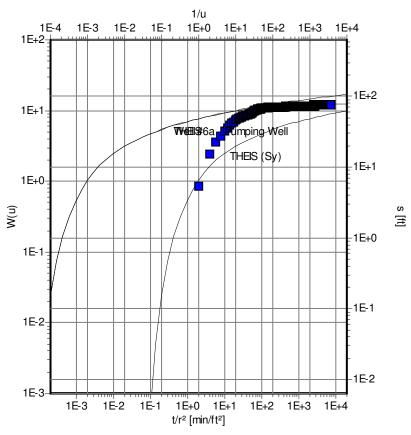
2.25E-1 [ft/d]



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Pumping Test Analysis Report					
Project: Rough Acres					
Number:					
Client:					

Pumping Test Name [Moench]



■ Well #6a - Pumping Well

Pumping Test: Pumping Test Name

Analysis Method: Moench

Analysis Results:	Transmissivity:	1.21E+2 [ft²/d]	Conductivity:	2.43E-1 [ft/d]
	Storativity:	1.72E-1	Conductivity (vertical):	2.43E-1 [ft/d]
Test parameters:	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	Unconfined Aquifer	
	Screen length:	310 [ft]	S/Sy:	0.001
	Boring radius:	0.271 [ft]	Kv/Kh:	1
	Discharge Rate:	50 [U.S. gal/min]	Gamma:	1E9
	b:	357 [ft]		

Comments:

Evaluated by:

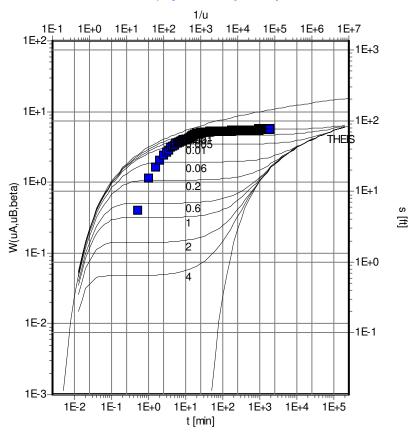
Evaluation Date: 11/17/2010



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Pumping Test Analysis Report					
Project:	Rough Acres				
Number:					
Client:					

Pumping Test Name [Neuman]



Well #6a - Pumping Well

Pumping Test: Pumping Test Name

Analysis Method: Neuman

Analysis Results:	Transmissivity:	5.69E+1 [ft²/d]	Conductivity:	1.14E-1 [ft/d]
	Storativity:	1.62E-2	Specific Yield:	1.62E+2
Test parameters:	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	Beta:	0.005
	Screen length:	310 [ft]		
	Boring radius:	0.271 [ft]		
	Discharge Rate:	50 [U.S. gal/min]		
	LOG(Sy/S):	4		

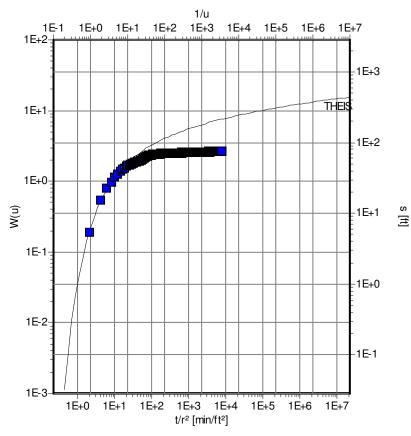
<u>Comments:</u> Match to late time drawdown data.



460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798

Pumping Test Analysis Report					
Project:	Rough Acres				
Number:					
Client:					

Pumping Test Name [Theis]



Well #6a - Pumping Well

Pumping Test: Pumping Test Name

Analysis Method: **Theis**

Comments:

Analysis Results: Conductivity: 5.39E-2 [ft/d] Transmissivity: 2.69E+1 [ft²/d]

> Storativity: 1.64E-1

Test parameters: Pumping Well: Well #6a Aquifer Thickness: 500 [ft]

> 0.167 [ft] Confined Aquifer Casing radius:

> > 0.271 [ft]

Screen length: 310 [ft]

50 [U.S. gal/min] Discharge Rate:

Match to early time data.

Boring radius:

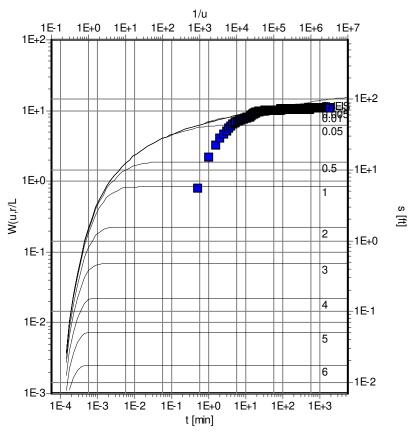
Evaluated by: MWV Evaluation Date: 11/18/2010



460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798

Pumping Test Analysis Report					
Project:	Rough Acres				
Number:					
Client:					

Pumping Test Name [Walton]



Well #6a - Pumping Well

Pumping Test: Pumping Test Name

Analysis Method: Walton

Analysis Results: Transmissivity: 1.11E+2 [ft²/d] Conductivity: 2.21E-1 [ft/d]

Storativity: 7.08E-4 c: 1.30E+5 [min]

Test parameters: Pumping Well: Well #6a Aquifer Thickness: 500 [ft]

Casing radius: 0.167 [ft] r/L: 0.005

Screen length: 310 [ft]

Boring radius: 0.271 [ft]

Discharge Rate: 50 [U.S. gal/min]

Comments:

Appendix B Department of Water Resources Well Completion Reports

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COUNTY OF SAN DIEGO

DEPARTMENT OF ENVIRONMENTAL HEALTH 1255 Imperial Ave San Diego, CA 92101 619-338-2222



INVOICE

ERMIT TYPE & NUMBER: LWEL 16226

ERMIT OWNER:

CONTACT:

ADEM ROBERT S&MARY O TRUST B1

153 OCEAN ST

INVOICE DATE: 16 SEP 2004

92008

611-060-03

APPLICANT:

PN: 611-110-01-00 611-070-01

FADEM ROBERT S&MARY O TRUST B1

ITE ADDRESS: 2533 MCCAIN VALLEY RD

OCATION DESCRIPTION: 2533 MCCAIN VALLEY RD.

ROJECT DESCRIPTION/SCOPE

umber of Wells on Permit Application:1

escription of Work:new

ype of Use for Each Well:private

EE/DEPOSIT DE	The second secon		7	
FEE CODE	DESCRIPTION	TIME ACCT.	ACCT. CODE	AMOUNT
6LE01EHO	WATER WELL PERMIT	429E01	9773-773	390.00
			39-14-64 11130 9773 773 4396() CHE研究	in the state of th
	- to-	TOTAL	AMOUNT DUE	\$390.

COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH

PARCE 1 1 100

DEH USE ONLY PERMIT #W しいとし	162
WELL COMPUTER #	. 1
FEE:	
WATER DIST:	11

	Hansan.	· CLAN	mniec		_Phone: 🗸 🗸	10-74.
Property Owner:	lamani				/L	90020
+ CCD	Mailing Address	u (100)		City		Žip
Well Location - Asses	sors Parcel Number	er 611-11	0-01	611-060 611-070	-01	
Tron Education 1 1 1 1 1 1	NOV	11		×	BOULE	VARD 91905
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Well Contractor - Wel				Company I	Name:	1.4.2
10053 69	Mailing Address	1 hill		City		Zip Zip
Phone#: V//5	-192C		C-57#:	7)2 O-Cas	h Deposit 🛛	Bond Posted
Use: Q Private	□ Public	☐ Industrial	☐ Cathodic	Other		
Type of Work:		Reconstruction	Destruction	Time Ex	dension: . 🗖	1st 🔾 2nd
Type of Equipment:			11.4			
Depth of Well:		3/4			Existing:	1 = 1
	Floposed					
Proposed:	Conc	ductor Casing	Filter/Fille	r Material	Perf	orations
Casing Type:		□ No				
Depth:	Depth:	ft.		To:		To:
Diameter		in.			From:	To:
		ıge:				To:
Wall/Gauge:/	.,				مر د د سرم	
Annular Seal: Dent	h:ft.	Sealing Materia	al:	in An	aular Thickne	i
Amula Seal, Dept		Conductor dia	meter:	ID,AD	nular Thickne	33
Borehole diameter:	in.		-			1 -7 7
Borehole diameter: . Date of Work: Star	in. rt:in.	(C. V		Com		
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Date of Work: Star On sites served I hereby agree to a the County of San Immediately upon of the well. I accept supervision.	by public water, comply with all regula Diego and the State	contact the local	water agency for	Compore meter properties the components of the c	ntection required with all ordinal modification and with a complete performed under	rements. nces and laws of destruction. and accurate k
Borehole diameter: Date of Work: Star On sites served I hereby agree to o the County of San Immediately upon of the well. I accep supervision. Intractor's Signature:	by public water, comply with all regula Diego and the State completion of work, i or responsibility for al	contact the local ations of the Departn of California pertain I will furnish the Dep Il work done as part	water agency for nent of Environmer ning to well constru- artment of Environ of this permit and a	Com- or meter pro- ntal Health, ar action, repair, mental Health all work will be	ntection required with all ordinal modification and with a complete performed under Date:	rements, nces and laws of destruction, and accurate k ar my direct
Borehole diameter: Date of Work: Star On sites served I hereby agree to o the County of San Immediately upon of the well. I accep supervision.	by public water, comply with all regular Diego and the State completion of work, let responsibility for all the completions of the completion of work, let the complete the comple	contact the local ations of the Departn of California pertain I will furnish the Dep Il work done as part	water agency for nent of Environment ing to well constru- artment of Environ of this permit and a ctment of Envir	Compore meter proposed in the least of the l	ntection required with all ordinal modification and with a complete performed under Date:	rements. Inces and laws of destruction. Is and accurate to a my direct
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Borehole diameter: Date of Work: Star On sites served I hereby agree to a the County of San Immediately upon of the well. I accep supervision. Intractor's Signature: DISPOSITI	by public water, comply with all regular completion of work, of responsibility for all completion of work, or responsibility for all completions of the completion of work, or responsibility for all completions of the completion of the	contact the local ations of the Departm of California pertain will furnish the Departm of Work done as part of Cation (Department of Cation (Department)	water agency for ment of Environment ing to well constru- entment of Environ of this permit and a ctment of Environ ding and clearly	Compore meter proposed in the least of the l	ntection required with all ordinal modification and with a complete performed under Date: Health Use one with accessed with acc	rements. Inces and laws of destruction. In and accurate to a my direct Only) Is to, or the

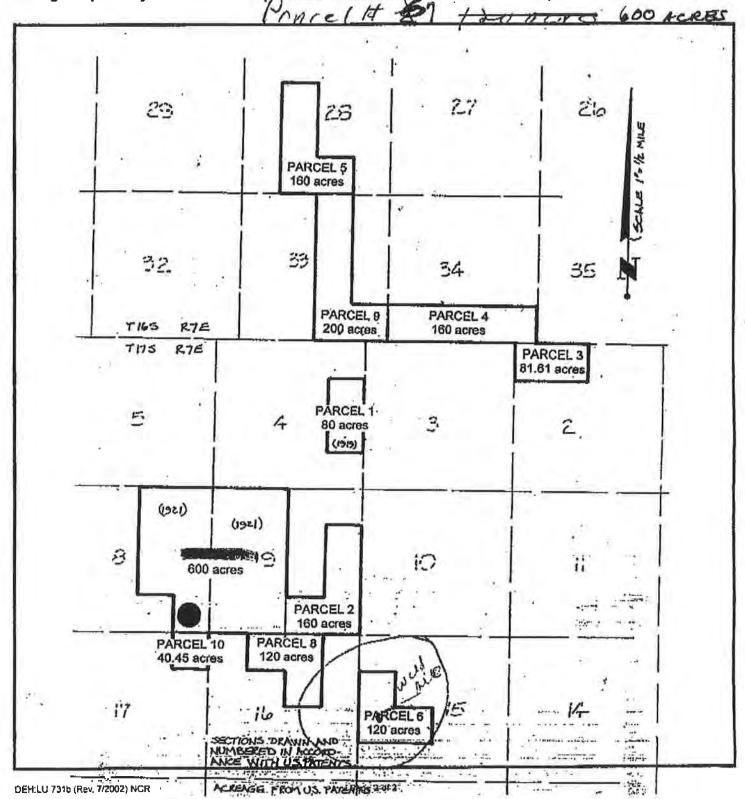
COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LUCL 16226 Assessor's Parcel Number: (7/1 - 7/7) 611-060-03

LOCATION

611-070-01

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.



County Mail Systian - A-21

FIRST CARBON COPY

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES
1700 PACIFIC HIGHWAY, SAN DIEGO, CA 92101-241

ASSESSORS	PARCEL	NUMBER:

Votiles of Local Pern	-			(INS				LERS REPORT State Well No. Ge w/carbon of State Form) Other Well No.	_	
(1) OWNER: Name JOHN WELL NO' 2.							(12) WELL LOG: Total depth 260ft. Depth of completed well 196 from it. to it. Formation (Describe by color, character, size or meter)			
2 ty						Zio		0-91 - 3 may : D.G.		
	ATION	OF WE	LL (See in	รใชกฝระบบรา				at-140- SOFT, ORANGE, WHITE & BROWD	_	
Caunty		•		Owner's	Well Numbe	r		130-132 - URLY CONT (& GPM)		
ates added	an lé at th	enent from	m above			1 100		133-185- CON DRUGE, WHITE BLACK	-	
					Section			195-190- LOOSE MOCKE (20 GPL)		
				nesi, ITL			_	190 - 200 - SOFT ; HARD	10.	
	1.7		•					All the state of t		
		-					+ 1	- was		
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Date Insp	herma	(*)	4	• • •	Horizon		0	The state of the s	_	
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Jet	Con #	ś			Other		a			
(5) Equip	. 77	0		(6) Gravel	1000	3/8/12			naw-y-s	
Racary		R.	D serev	The second secon	No Q Size	785			-	
Cable		Ale				411				
Other	_		cket		m_O_10	195 1				
(7) Casing	Installe	d :		(8) Perfor	rtions '	size of screen			_	
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Fram	TA No.	lo.	Gaga or Well	Front	Ta	Size		*	_	
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Were strat	se sanita ta seeled	ry seel Di aglifnat p	Y Snotzulla	M No C	fyes, to dept	91'	_ft. _ft_	Work Started 19 Completed 19 WELL DRILLERS STATEMENT: I hereby declare under penalty of perjury that the information provided in this report is true. This water well was installed in compliance with San Diego County Code and State		
Mathad o						===	=	of California, Department of Yater Resources, Buildein		
(10) W	ATER L	EVELS	:	. /				No. 74.		
Depth of first water, if known 180						4497	STENED BUNK-Carbon			
Sanding	eval atra	well co	mptetion_	35			. ft.	(Well Driller)		
(11) WEI				*****				NAME		
Was well t			et No	0 11 yes, by	whom?	Inicial		(Person, firm, or Corporation) (Type or Print)	2	
Type of t		Pum		Bailer ()	Alclift 🖾				مرسك	
Depth to	Watar at		brit		At end of t		, it.	ADDRESS		
Discharge	15	min/ليو _	itter	hours		enture Lec	2	CITY ZIP		
Crimmical	analytis	mudel	Yes 🖸 ' Na	o 🕮 Ifym, t	A Myoury			LICENSE NO. DATE THIS REPORT		
u James	de los m	acto?	Yes O' No	O If yet, a	reach copy to	Trocur city		LICENSE NO. DATE THIS REPORT	_	

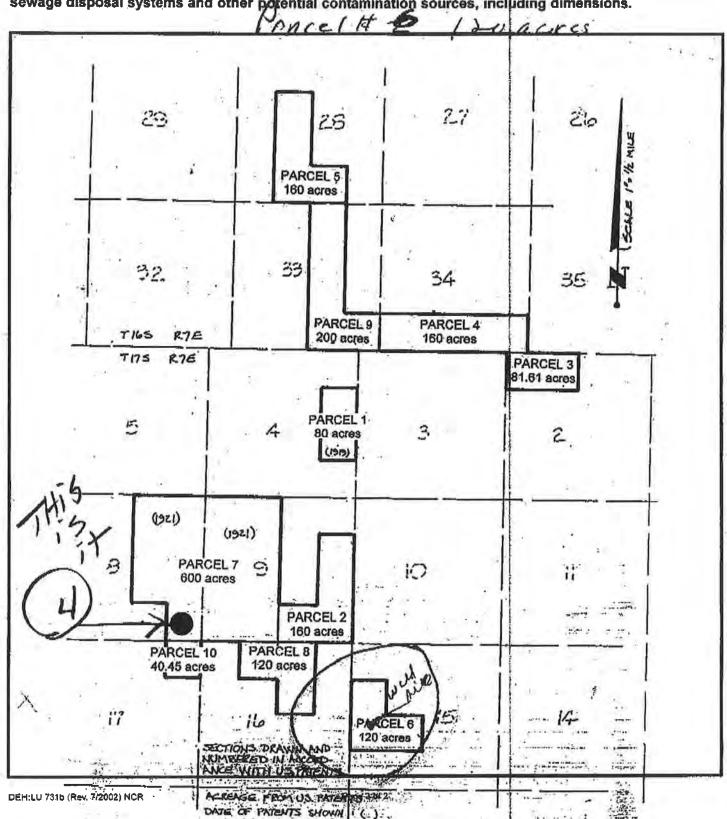
DUPLICATE Driller's Copy Page _1_ of _1_ Owner's Well No Date Work Began Local Permit A	9 2 gency	Sar	24	D-1	ر م	, Ended _ q.	COM!	Instruction	ON REPO		STATE	WELL N	O./STA	NOT FILL IN
Local Permit A Permit No. 1 ORIENTATION (∠) DEPTH FROM SURFACE FL to FL Q 91 91 130 130 133 133 185 185 190 190 260	WEL1	GI CI VERTICA VIG DO X	AL CO	to tra	GIO	C LOG Perm	ANGLE	_ (BPECIFY)	Name Malling Addres Address City Opunty APN Book 61 Township 19	The Rion Wart L	OWNI	nie War 921 ION— Y Ro	s y 0.20 \$	
				(A)						SOUTH Distance of Well from Rout attach a map. Use adults SR ACCURATE & COM			USE WATE	NEW WELL IFICATION/REPAIR Despen Other (Specify) DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG") S () R SUPPLY Domestic Public Irrigation Industrial MONITORING TEST WELL ODIC PROTECTION HEAT EXCHANGE DIRECT PUGH INJECTION SPARGING REMEDIATION OTHER (SPECIFY)
TOTAL DEPTH OF TOTAL DEPTH OF PROM SURFACE FL. to Ft.		י מצח	WE		-	1.85 (Feet)	CASING (S	GAUGE OR WALL THICKNES	WATE DEPTH TO FIRST V DEPTH OF STATIC WATER LEVEL ESTIMATED VIELD TEST LENGTH 1 * May not be repri	R LEVEL & YIELD VATER1_3 (L. (Ft.) B 3.5	OF CE-	OMPI, SURFACE URED Q YPE_A	- 27 irl (Ft) ULAR	1-04 ift
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— Geologic — Well Cor — Geophys	struction D load Log(s) or Chemical	lagran I Anal)	n yses	-	878	NAME (PER	TTM MA	NOS DI	RTT.T.TATC & (TYPED OR PRINTED)	TION STATEMENT e and accurate to the PUMP JAMUL, CA	best o	35		ge and belief.

COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH

Assessor's Parcel Number: 411-110-01

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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PROM S	SURFACE to Ft 56 75 085	BORE-HOLE DIA. (Incres)	TYI TORK	HONOR X	MATERIAL/ GRADE Steel Steel	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	F ANY (inches) CERTIFICA report is complete	FROM SURFACE FL. bo FL. 0 75 0 75 1 365 TION STATEMENT and accurate to the	MENT (≥)	TONITE (∠) CONTE	(<u>∠)</u> ant	WAS DO
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PROM S	SURFACE to Ft 75 865 ATTACE Geologic Well Con Geophysic	BORE-HOLE DIA. (Incree)	TYI XWAZ S	Macos X	MATERIAL/ GRADE Steel DVC I, the und NAME (PER	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	CERTIFICA report is complete	FROM SURFACE FL. bo FL. 0 175 0 175 1 365 TION STATEMENT and accurate to the	MENT (∠)	TONITE (∠) CONTE	(<u>×</u>)	WRS DU
PROM S	SURFACE to Ft 75 865 ATTACE Geologic Well Con Geophysic	BORE-HOLE DIA. (Incree) 12 MENTS Log struction Dia cal Log(s) or Chemical	TYI XWAZ S	Macos X	MATERIAL/ GRADE Steel DVC I, the und NAME (PER	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	CERTIFICA report is complete	FROM SURFACE FL. bo FL. 0 75 0 75 1 365 TION STATEMENT and accurate to the	MENT (∠)	TONITE (∠) CONTE	(<u>∠)</u> ant	WAS DU

8

This WELL HAS

HE PUMP OF POWER

REEDS to be

RELOCATED CAST

OUTSIDE OF

THUSMISSION LINE

POWER EASEMENT



Fain Drilling & Pump Co. Inc.

12029 Old Castle Rd. Valley Center, CA 92082 Phone (760) 749-0701 Fax (760) 749-6380



Invoice

Date	Invoice #
2/11/2005	8048

Bill To

THE HAMANN COMPANIES 1000 PIONEER WAY EL CAJON, CA 92020

P.Ó. No.	Terms	Project
	Due on receipt	

Description	Qty	Rate	Amount
DRILLING 970 FT DEEP WELL APN 611 110 01 PARCEL 6 120 AC EQUIPMENT SET UP DRILLING 6.5" DIA HOLE DRILLING 400-800' 6.5" DIA HOLE DRILLING 800 - 970' 6.5" DIA HOLE REAMING 6" TO 10" DIA HOLE FURNISH AND INSTALL 6" WELL CASING INSTALL 50 FT. SURFACE SEAL WELL PERMIT AND FILING FEES	1 400 400 170 226 228 1	500.00 12.00 14.00 16.00 12.00 13.00 1,500.00 490.00	500.00 4,800.00 5,600.00 2,720.00 2,712.00 2,964.00 1,500.00 490.00

Total \$21,286.00

Payments/Credits \$0.00

Balance Due \$21,286.00

TRIPLIC	CAT	Æ	
Owner'	3 C	opy	1
Page_	1	of_	1

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphist

Owner's Well No	Par. 6	-120	
- Water & 11 mar 1 mm			
Data Worls Bassa		Ended .	

Date Work Began _ . Ended --- 2/9/05

STATE WELL NO STATION NO. No. 0909549 LONGITUDE

Perm	it No. 1	6456 CEOLOGIC LOC Permit Date 2/1/03	WELL OWNER
DEPTH	FROM	DESCRIPTION Describe material, grain size, color, etc.	Name The Hamann Companies Mailing Address 1000 Pioneer Way El Cajon Ca 92020 STATE ZIP
Ft. 1			
0	12	Slope wash - sandy decomposed granite - brown color	Address Rough Acres Rauch McCain Valley Rd. City Boulevard County San Diego
12	212	Weathered Granitic Rock	APN Book 611 Page 110 Parcel 61 Township 17S Range 7E Section 15
212	22.5	Broken Rock	Lat 36 16 772 N Long 1/5 69 465 W DEG. MIN. SEC. LOCATION SKETCH ACTIVITY (\(\xext{\xi}\))
226	310	Weathered graniffs rock mostly white quart:	NORTH — New WELL MODIFICATION/REPAIR — Despen — Other (Specify)
310		Water 8 gpm	
310	961	Granitic rock large crystals of white quartz	Procedures and Materials Under "GEOLOGIO LOG") USES (△) WATER SUPPLY — Domestic: Public
961		Water 40+ gpm	1 11 1/2 1 1/2/0 1
961	970	Fractured granitic coek large quarre crystals	Trigation industrial MONITORING TEST WELL CATHODIC PROTECTION HEAT EXCHANGE DIRECT PUSH INJECTION HADDEN FROM THE PROTECTION HAD THE PROTECTION HADDEN FROM THE PROTECTION HAD THE PROTECTI
	-		ZL-06' SPARTION SPARTION
			Illustrate or Describe Distance of Well from Rnuls, Buildings, Fonces, Rivers, etc. and attach a map. Use additional paper if necessary, PLEASE BE ACCURATE & COMPLETE.
	0		WATER LEVEL & YIELD OF COMPLETED WELL, DEPTH TO FIRST WATER 30 (FL) BELOW SURFACE
	i lat		DEPTH OF STATIC WATER LEVEL 18 (Ft.) & DATE MEASURED
		BORING 970 (Feet)	ESTIMATED VIELD • (GPM) & TEST TYPE AIT LIFT TEST LENGTH (Hrs.) TOTAL DRAWDOWN (Ft.)
TOTAL D	epth of	COMPLETED WELL(Feet)	* May not be representative of a well's long-term yield.

DEPTH FROM SURFACE	BORE-	_		CASING (S)		DEPTH FROM SURFACE			ANNULAR MATERIAL TYPE					
Ft. 10 Ft.	BORE- HOLE DIA. (Inches)			FLL PIPE (7)	MAYERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)	Ft.	to Ft.	CE- MENT ()	BEN- TONITE (ニ)		FILTER PACK (TYPE/SIZE)
0 226	10	x			Steel	6	.188		050	50 226	х		х	
- 1							-			1				
	-	⊢	-	-									-	

— ATTACHMENTS (±)	٦Г
Geologic Log	11
Well Construction Diagram	\mathbf{H}
Geophyaical Log(s)	11
Soll/Water Chemical Analyses	11.
Other	-140

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

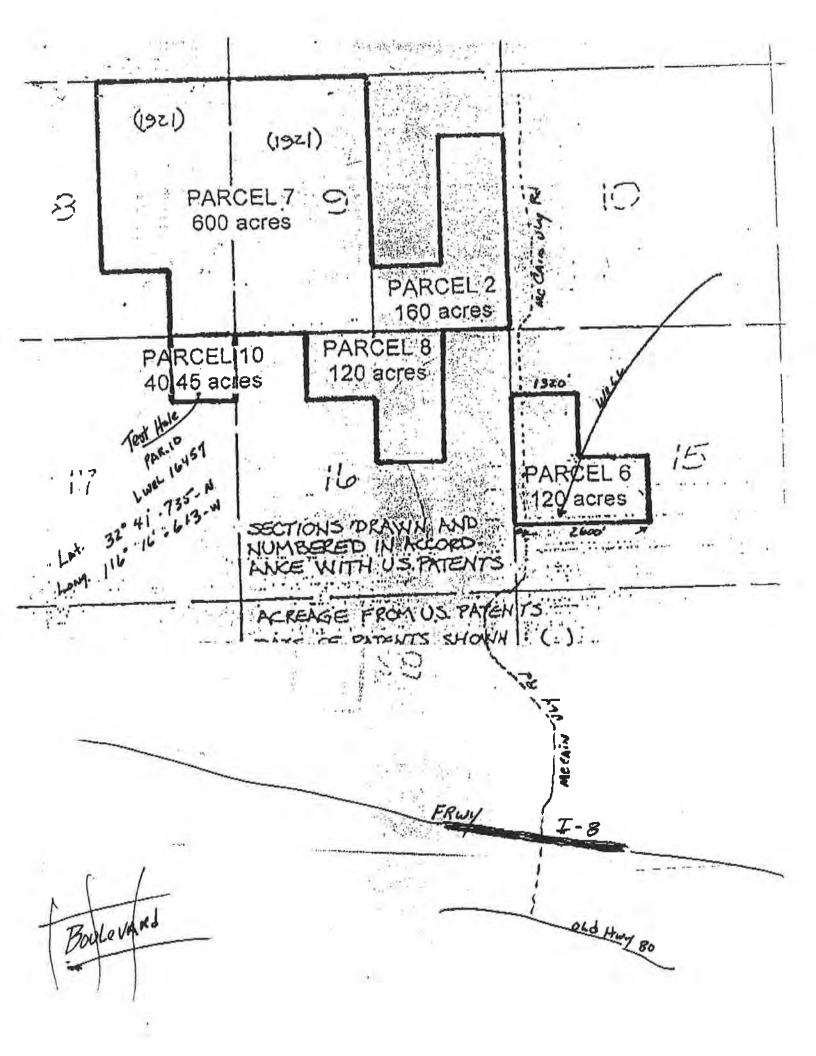
CERTIFICATION STATEMENT I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

Fain Drilling & Pump Co. inc.

NAME FAIR DELITION (TYPED OR PRINTED)
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
12029 Old Castle Rd. Volley Center, Ca 92082

ADDRESS

STATE 328287 2/11/05 DATE SIGNED C-S/ LICENSE NUMBER



P#

COLY OPENTIONAL

OLD USEN

NO THO

PROBABLY 5-10 GPM

SHALLOW

APPENDIX C

CUMULATIVE WATER QUANTITY IMPACTS ANALYSIS ROUGH ACRES RANCH WATER PRODUCTION AREA MCCAIN VALLEY, EAST SAN DIEGO COUNTY, CALIFORNIA



Table 1
Estimated Groundwater Demand - Rough Acres Ranch Water Production Area

se Family Residential Livestock Free-Range Grazing ad)	Quantity 7	Water Demand per Unit (afy) 0.5	Total Demand (afy) 3.5	
Family Residential Livestock Free-Range Grazing ad)	Quantity 7			
ivestock Free-Range Grazing ad)	7	0.5	3.5	
ad)				
· · · · · · · · · · · · · · · · · · ·				
	1	2.13	2.13	
ns)	1	0.11	0.11	
Total Water Demand (Existing Conditions) 5.74				
Family Residential	7	0.5	3.5	
ivestock Free-Range Grazing				
ad)	1	2.13	2.13	
ns)	1	0.11	0.11	
9-month Construction (50 gpm)	1	60	60	
Total Water Demand (Existing C	Conditions P	Plus 9-Month Construction at 50 gpm)	65.74	
Family Residential	7	0.5	3.5	
ivestock Free-Range Grazing				
ad)	1	2.13	2.13	
ns)	1	0.11	0.11	
9-month Construction (50 gpm)	1	120	120	
	9-month Construction (50 gpm) Total Water Demand (Existing Camily Residential ivestock Free-Range Grazing and)	9-month Construction (50 gpm) Total Water Demand (Existing Conditions Pamily Residential ivestock Free-Range Grazing ad) 1 1	9-month Construction (50 gpm) 1 60 Total Water Demand (Existing Conditions Plus 9-Month Construction at 50 gpm) Tamily Residential 7 0.5 ivestock Free-Range Grazing ad) 1 2.13	

Note: afy - acre feet per year; gpm - gallons per minute

Table 2
Groundwater in Storage Calculation - Effects of Pumping at 50 GPM
Rough Acres Ranch Water Production Area

Hydrogeologic Unit	Area (acres)	Specific Yield (%)	Saturated Thickness (ft)	GW in Storage (af)
Fractured Rock	502	0.10%	500	251
Residuum	502	5%	10	251
Alluvium	250	10%	20	500
Total				1002

Change in Groundwater in Storage (50 gpm)

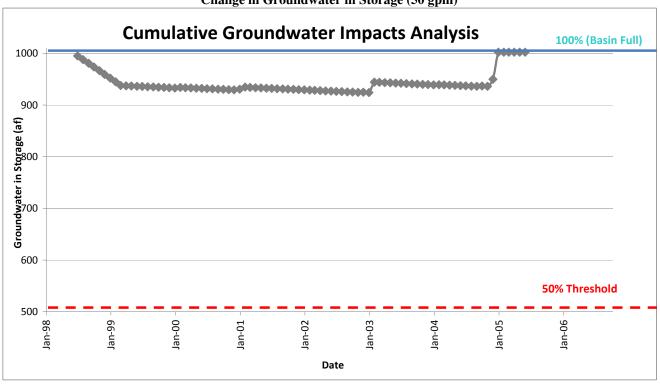


Table 3
Groundwater in Storage Calculation - Effects of Pumping at 100 GPM
Rough Acres Ranch Water Production Area

Hydrogeologic Unit	Area (acres)	Specific Yield (%)	Saturated Thickness (ft)	GW in Storage (af)
Fractured Rock	502	0.10%	500	251
Residuum	502	5%	10	251
Alluvium	250	10%	20	500
Total				1002

Change in Groundwater in Storage (100 gpm)

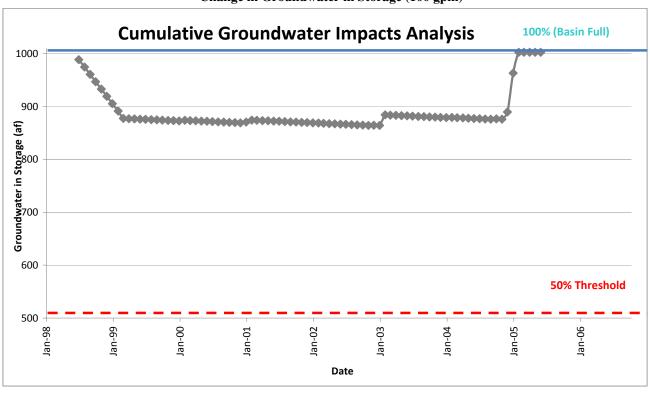


Table 4
Groundwater in Storage Calculation - Effects of Pumping at 400 GPM
Rough Acres Ranch Water Production Area

Hydrogeologic Unit	Area (acres)	Specific Yield (%)	Saturated Thickness (ft)	GW in Storage (af)
Fractured Rock	502	0.10%	500	251
Residuum	502	5%	10	251
Alluvium	250	10%	20	500
Total				1002

Change in Groundwater in Storage (400 gpm)

