TECHNICAL MEMORANDUM

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To:	Joe Oliver, P.G., C.Hg, Senior Hydrogeologist	Date:	December 5, 2007
From:	Robert Marks, P.G., C.Hg	Project No:	06-0012
Copy to:	Henrietta Stern		
Subject:	Review of Well Pumping Test Report for SLCSD Well N-31, APN 239-131-022		

Presented in this Technical Memorandum is a summary of our findings and comments based on our review of the above-referenced report. The subject report was prepared for Santa Lucia Preserve by Geoconsultants, Inc. (GCI), dated August 22, 2001, and documents the drilling, construction, and testing of the subject well. The report was submitted by the Santa Lucia Community Services District (SLCSD) in support of a MPWMD Water Distribution System (WDS) permit application for the well.

Well N-31 is one of several wells connected to an existing distribution system operated by the SLCSD. As part of a larger interconnected system, there is no specific demand value associated with the subject well. As such, our review focused on evaluating the pumping test report to determine the calculated well yield consistent with MPWMD Procedures for Preparation of Well Source and Pumping Impact Assessments (MPWMD Procedures), dated September 2005 (revised May 2006).

Hydrogeologic Setting

The subject well is located in the Carmel Valley Uplands, more than 1,000 feet from the mapped boundary of the Carmel River Alluvial Aquifer (CVAA), and is completed with perforations entirely in fractured granitic bedrock. As such, Setting #2 of the MPWMD Procedures is applicable to this well.

Well Construction Summary

Presented below is a summary of the as-built construction of the well:

Construction Feature	Well N-31
Date Drilled	May 25, 2001
Total Cased Depth (ft bgs[1])	600

Construction Feature	Well N-31
Borehole Diameter (inches)	10
Casing Inside Diameter (inches)	5
Perforated Intervals (ft bgs)	390 to 590
DWR Well Completion Report No.	782821
Date Signed	May 29, 2001
MCEHD Permit No.	00-390
Date Issued	November 20, 2000

Notes:
1 – feet below ground surface

Well Testing Data Summary

A 72-hour constant rate pumping and recovery test was conducted by Salinas Pump Company during the period May 29 through June 4, 2001. Presented below is a summary of the well performance data developed from the testing program:

- Static Water Level: 284.5 feet bgs
- Total Volume Pumped: Not Provided
- Test Average Pumping Rate: 40.0 gallons per minute (gpm)
- 24-Hour Specific Capacity:
  - Average Pumping Rate = 40.0 gpm
  - Pumping Level = 362.9 ft bgs
  - Drawdown = 78.4 feet
  - Calculated Specific Capacity:
    40 gpm / 78.4 ft = 0.51 gpm/ft

Well Yield Calculations

According to MPWMD Procedures, Well Yield is calculated by multiplying the 24-hour specific capacity by the available drawdown, as summarized below:

Available Drawdown

Available drawdown for Setting #2 is defined by MPWMD Procedures as:

One-third of the vertical distance from the static water level to the bottom of the well perforations.

Therefore, the available drawdown for Well N-31 is:

Available Drawdown = 0.333 x (depth to bottom of perforations - static water level)
Available Drawdown = 0.333 (590 ft – 284.5 ft)
Available Drawdown = 101.7 ft

We note that the GCI report utilized an available drawdown value of 70.7 feet, based on two-thirds of the vertical distance from the static water level to the top of the well perforations. While this method is consistent with an earlier version of the MPWMD Procedures, our review assumes that current MPWMD Procedures shall apply to determining the calculated well yield for the current application.

Calculated Well Yield

Utilizing current MPWMD Procedures results in a calculated well yield of:

Well Yield = Specific Capacity x Available Drawdown
Well Yield = 0.51 gpm/ft x 101.7 ft = 51.9 gpm

Drawdown Curves and Transmissivity

The report presents calculated transmissivity values based on analysis of the late-time drawdown and recovery curves of 159 and 147 gallons per day per foot (gpd/ft), respectively. Based on our review of the drawdown curve, there is a decrease in the apparent transmissivity between the first half and the end of the test, with the early-time drawdown curve having an apparent transmissivity of approximately 307 gpd/ft. Consistent with MPWMD Procedures, an adjustment to the 24-hour specific capacity is made utilizing the ratio of the late-time transmissivity estimate to the early-time transmissivity estimate of 0.52, yielding an adjusted specific capacity of 0.27 gpm/ft and a corresponding adjusted well yield of 27.5 gpm.

Recovery Data

Water level recovery data were collected for only 3 days following termination of pumping, and the water level recovered to approximately 66 percent of the pre-test static water level (residual drawdown was 33.5 feet). MPWMD Procedures require collection of recovery water levels until 95 percent recovery is achieved or two times the pumping duration has elapsed (i.e., 6 days). Projection of the recovery curve suggests that the water level would have likely recovered to approximately 77 percent after 6 days of recovery. Based on procedures utilized for previous assessments that had less than 95 percent recovery, the calculated well yield is further adjusted by an amount equal to the percentage of recovery less than 95 percent, i.e., 18 percent in this case (4.9 gpm). Utilizing this procedure, the adjusted calculated well yield is **22.6 gpm** (27.5 gpm – 4.9 gpm).

It should be noted, however, that the well yield calculation is a theoretical maximum sustained pumping rate. The actual maximum rate achievable is limited

by other factors, including: (a) the size of the selected pump and motor, (b) the pump (and intake) setting, (c) well casing diameter, and (d) discharge piping diameter. In addition, the long-term sustainable capacity of wells completed in fractured-bedrock settings is dependant on a variety of factors that cannot be fully evaluated through analysis of relatively short-duration (i.e., 72 hours or less) pumping tests. The movement and long-term availability of groundwater in these materials is controlled by the occurrence, connectedness, and distribution of fractures. The distribution and connectedness of fractures to sources of recharge are essentially random, and the volume of groundwater in storage in these systems is often limited. The low volume of groundwater in storage can limit long-term supply, particularly during periods of deficient recharge. The implications of these factors should, therefore, be taken into consideration when planning long-term use of wells that are completed in fractured-bedrock settings.

Annual Yield Capacity

As presented above, the adjusted calculated well yield for the SLCSD Well N-31 is approximately 22.6 gpm. Based the instantaneous pumping capacity (i.e., calculated well yield) of the well, the annual demand that can theoretically be supported by the subject well consistent with MPWMD Procedures can be determined, as summarized below:

- Maximum Day 12-hour Demand instantaneous capacity = 22.6 gpm
- Maximum Day Demand capacity (instantaneous capacity x 12 hours pumping): 22.6 gpm x 12 hours = 16,272 gallons per day (gpd)
- Average Day Demand capacity (Maximum Day Demand ÷ 1.5): 16,272 gpd ÷ 1.5 = 10,848 gpd
- Annual Demand capacity (Average Day Demand x 365 days): 10,848 gpd x 365 days = **12.15** acre-feet per year (afy).

It should be noted that the above calculations are based on results from a relatively short duration, 72-hour test in 2001. Any future modifications to the well capacity calculations should rely on additional well testing and/or empirical results from long-term operation of the well.

Water Quality

A water quality sample was collected from the well on June 17, 2005 and submitted to a State Certified Laboratory for Title 22 primary inorganic and secondary compounds. The results showed that the water was below all primary inorganic Maximum Contaminant Levels (MCLs); however, the water did exceed the MCL for manganese of 0.05 milligrams per liter (mg/L), with a level of 0.411 mg/l. In addition, the water sample was not tested for Coliform bacteria. The Monterey

County and State Health Departments should be consulted regarding treatment and/or additional sampling requirements for this well.

Analysis of Offsite Impacts

MPWMD Procedures require an evaluation of the potential well pumping drawdown effects at existing wells or other Sensitive Environmental Receptors (SER) within 1,000 feet of the subject well. In this case, there are no existing wells or SERs within 1,000 feet of the well; therefore, no analysis of offsite impacts is required.

CONCLUSIONS

Based on our review of the subject report, we offer the following conclusions:

Well Capacity

Based on MPWMD Procedures, the adjusted calculated well yield for Well N-31 is 22.6 gpm, which corresponds to an Average Annual Demand capacity of approximately **12.15 afy**.

Analysis of Offsite Impacts

There are no existing wells or other SERs within 1,000 of the subject well; therefore, analysis of offsite impacts is not required by MPWMD Procedures.