EXHIBIT 20-E

TECHNICAL MEMORANDUM
Pueblo Water Resources, Inc.
4478 Market St., Suite 705 Tel: 805.644.0470
Ventura, CA 93003 Fax: 805.644.0480

PUEBLO water resources

To:	MPWMD	Date:	August 19, 2009
Attention:	Joe Oliver, P.G., C.Hg, Water Resources Manager	Project No:	06-0014
Copy to:	Henrietta Stern Matthew Sundt		
From:	Robert Marks, P.G., C.Hg		
Subject:	Review of Well Source and Pumping Impact Assessment for Greek Orthodox Church Well, Project APN ~~187-131-009~~ 259-021-013		

INTRODUCTION

Presented in this Technical Memorandum is a summary of our findings and conclusions based on our review of the above-referenced assessment report. The assessment report, dated June 24, 2009, was prepared for Greek Orthodox Church by Bierman Hydrogeologic (Bierman) in support of a Water Distribution System (WDS) permit application for a project at the above-referenced property. Our review focused on evaluating the assessment report for compliance with the MPWMD Procedures for Preparation of Well Source and Pumping Impact Assessments (MPWMD Procedures), dated September 2005 (revised May 2006). A summary of our findings is presented below.

FINDINGS

General Description of Proposed WDS

An existing well, identified as the Greek Orthodox Church (GOC) Replacement Well, is proposed to be utilized to supply potable and exterior landscape irrigation water for existing and expanded Church facilities on the parcel. The subject well (GOC Replacement Well) is a replacement for the existing well (GOC Original Well) which has experienced casing failure and is planned to be destroyed. The proposed WDS has an estimated average annual demand of 1.65 acre-feet per year (afy).

Hydrogeologic Setting

The subject well is located in the Highway 68 corridor area, near the Monterey Airport. The well is greater than 1,000 feet from the mapped boundary of

the Carmel Valley Alluvial Aquifer (CVAA), and is completed with perforations within fractured bedrock units of the Monterey Formation; therefore, Hydrogeologic 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 subject well as documented on its Well Completion Report:

Table 1. Well Construction Summary

Construction Feature	GOC Replacement Well
Total Cased Depth (ft bgs[1])	1,000
Borehole Diameter (inches)	10
Casing Inside Diameter (inches)	5
Perforated Intervals (ft bgs)	Various intervals between 180 to 980
Static Water Level[2] (ft bgs)	125
Date Drilled	9/18/08
DWR Well Completion Report No.	e069122
Date Signed	9/22/08
MCHD Permit No.	08-11325
Date Issued	6/16/08

Notes:
1 – feet below ground surface (ft bgs)
2 – following well construction

General Testing Methods

MPWMD Procedures specify eight general testing methods which apply to all pumping tests, regardless of the hydrogeologic setting. The testing methods are described in the assessment report and were reviewed for compliance with MPWMD Procedures, as summarized in Table 2 below:

Table 2. General Testing Methods Summary

Test Method	Compliance	Comments
1 - Witnessed by MCHD[1]	Yes	MCHD personnel present at startup
2 - Well Testing Method	Yes	Bierman performed test

Test Method	Compliance	Comments
3 - Timing of Test	Yes	Test performed in October 2008
4 - Discharge Rate	Yes	Test average approximately 13.18 gpm
5 – Control of Well Discharge	Yes	To land through 200 ft of closed hose
6 - Wells Monitored	Yes	Two offsite wells monitored during test
7 - Data Collection	Yes	Documented in Appendix C
8 - Water Level Monitoring	Yes	Pressure transducer/datalogger used

Notes:
1 – Monterey County Health Department (MCHD)

As shown above, the general testing methods complied with MPWMD Procedures with no variations.

Well Testing Data Summary

Bierman conducted a 72-hour constant-rate pumping and recovery test on the subject well during the period October 7 through 13, 2008. Presented below is a summary of the well performance data developed from the testing program:

Table 3. Pumping Test Data Summary

Test Parameter	GOC Replacement Well
Static Water Level (feet bgs)	117.45
Total Volume Pumped (gallons)	56,967
Average Pumping Rate (gpm)[1]	13.19
24-hour Pumping Level (ft bgs)	153.17
24-hour Drawdown (ft)	35.72
24-hour Specific Capacity (gpm/ft)[2]	**0.37**

Notes:
1 - gallons per minute (gpm)
2 - gallons per minute per foot of drawdown (gpm/ft)

Well Yield Calculations

According to MPWMD Procedures, the yield of a well in Setting #2 is calculated by multiplying the 24-hour specific capacity by the available drawdown. Available drawdown for Setting #2 is defined as one-third of the saturated thickness penetrated by the well.

The available drawdown calculations for the GOC Replacement Well are as shown in Table 4 below:

Table 4. Available Drawdown Calculations

Parameter	GOC Replacement Well
Depth to Static Water Level (ft)	117.45
Depth to Bottom of Perforations (ft)	980.00
Saturated Thickness (ft)	862.55
Available Drawdown (ft)	**287.52**

It is noted that the above available drawdown value differs slightly from that presented in the assessment (284.64 ft) due to minor differences in the calculation method[1].

MPWMD Procedures further require consideration of any shifts in the apparent transmissivity during the test, as well as water-level recovery data to determine if any adjustments to the calculated 24-hour specific capacity and/or well yield should be made. A summary of these adjustment considerations is presented below:

Drawdown Curve and Apparent Transmissivity

MPWMD Procedures require that if the apparent transmissivity decreases between the first half and end of the test, the 24-hour specific capacity shall be adjusted by multiplying it by the ratio of late-time to early-time transmissivities. The assessment report presents calculated transmissivity values ranging between approximately 187 to 409 gallons per day per foot (gpd/ft), depending on the portion of the curve analyzed and analytic method utilized. The transmissivity calculations take into account casing-storage effects during the initial portion of the drawdown curve (calculated to have expired within approximately 19 minutes[2] of pumping).

The drawdown curve did display a slight decrease in the apparent transmissivity between the first half and the end of the test; therefore, an adjustment to the 24-hour specific capacity was made by multiplying the ratio of late- to early-time transmissivity values as shown in Table 5 below.

[1] The value in Table 4 was calculated by dividing total saturated thickness by 3 (i.e., 1/3), whereas the assessment calculated available drawdown by multiplying saturated thickness by a factor of 0.33.
[2] Based on an equation presented by Schafer, in The Johnson Well Journal (1978).

Recovery Data

MPWMD Procedures also require that if 95% recovery is not achieved within two times the amount of time as the pumping period (i.e., 144 hours/6 days), the calculated well-yield should be reduced. Water-level recovery data were collected for only 72 hours/3 days following termination of the pumping test, and the water level recovered to approximately 90.8 percent within this time (residual drawdown of 4.08 feet compared to 44.46 feet of total drawdown). Bierman projected the recovery curve out to 6 days, which indicated an approximate 94.6% recovery level; therefore, consistent with previous practice, the calculated well-yield was adjusted slightly by the amount of water level recovery less than 95% (i.e., 0.4%), as shown in Table 5 below.

Calculated Well Yield

Based on the above, the final well-yield calculations in accordance with MPWMD Procedures for the subject well are summarized in Table 5 below:

Table 5. Well Yield Calculations Summary

Parameter	GOC Replacement Well
24-Hour Specific Capacity (gpm/ft)	0.37
Ratio of Late to Early Time Transmissivities	0.46
Adjusted 24-Hour Specific Capacity (gpm/ft)	0.17
Available Drawdown (ft)	287.52
Calculated Well Yield (gpm)	48.83
Recovery Adjustment (%)	0.4%
Recovery Adjustment (gpm)	0.20
Final Calculated Well Yield (gpm)	**48.63**

Notes:
"NA" = Not Applicable

It is noted that the assessment presents an adjusted calculated well-yield value of 48.19 gpm; the slight difference between this value and that presented in Table 5 is due primarily to the previously-noted differences in the available drawdown calculation.

Water Demand Estimate

The subject well is proposed to provide both potable and irrigation supply to the proposed WDS with an estimated average annual demand of 1.65 afy[3]. Presented below is a summary of the instantaneous pumping-demand calculations prescribed by MPWMD Procedures[4] based on the average annual demand for the subject WDS:

Table 6. Demand Calculations Summary

Demand Category	GOC Replacement Well
Average Annual Demand (afy)	1.65
Average Day (gpm)	1.02
Dry Season (gpm)	1.23
Maximum Day (gpm)	1.53
12-hour Maximum Day (gpm)	**3.07**

Due to water-quality considerations (discussed below), Bierman suggested that a treatment system may be required for this source and WDS, and estimated treatment and distribution system losses of 15 and 7 percent, respectively, and a correspondingly greater 12-hour maximum day demand value of 3.88 gpm. It is noted that Bierman presents an equivalent average annual demand value of 3.13 afy; however, this value apparently assumes pumping at the adjusted maximum day demand rate continuously 365 days per year, and does not account for the 1.5 peaking factor applied to the average day demand to determine the maximum day demand. The correct average annual demand equivalent to account for treatment and distribution system losses in this case is 2.09 afy.

Confirmation of Well Capacity

As presented above, the calculated well-yield for the GOC Replacement Well is approximately 48.63 gpm, which is significantly greater than the 12-hour maximum day demand value of 3.07 gpm; therefore, based on MPWMD Procedures the well capacity is considered sufficient for the proposed WDS demand. We also note that the calculated well-yield of 48.63 gpm exceeds the 12-hour maximum day value of 3.88 gpm as calculated by Bierman to account for treatment and distribution system losses.

[3] It is our understanding that this demand estimate has been reviewed by MPWMD staff; therefore, it was not independently verified as part of this review.
[4] Refer to MPWMD Procedures for the derivation of these calculations.

It is important to note that the above well-yield calculations are theoretical maximum sustained pumping rates based on calculations prescribed by MPWMD Procedures. The actual maximum rate achievable by any given well is practically 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.

Water Quality

A water-quality sample was collected from the well at the end of pumping and was analyzed at a State Certified Laboratory for Title 22 primary inorganics[5] and secondary compounds[6], general mineral and general physical parameters, coliform bacteria, radiological, SOC and VOC constituents. The results indicate that the water met all of the Maximum Contaminant Level (MCL) drinking-water standards[7] for the primary inorganic constituents analyzed; however, the water did exceed the MCLs for several secondary "consumer acceptance" constituents, as summarized in the table below:

Table 7. Water Quality MCL Exceedance Summary

Constituent	Unit	MCL	GOC Replacement Well
Manganese	mg/L	0.050	0.079
Specific Conductance	umhos/cm	900	1,745
Total Dissolved Solids	mg/L	500	1,020
Turbidity	NTU	5.0	5.3

In addition to the above-noted constituents, the sample tested positive for total coliform bacteria, indicating the need for disinfection of the well and/or piping system. As previously noted, given the water-quality results the assessment report indicated a treatment system may be required; however, the MCHD should be consulted for treatment recommendations and/or requirements for this WDS.

Analysis of Offsite Impacts

MPWMD Procedures for Setting #2 require an evaluation of the potential well-pumping drawdown effects at existing offsite wells or any Sensitive Environmental Receptors (SERs) within 1,000 feet of the subject well. Projected drawdown impacts were calculated utilizing the Modified Theis Nonequilibrium

[5] It is noted that perchlorate was not analyzed.
[6] It is noted that thiobencarb was not analyzed.
[7] Updated January 1, 2009.

Equation[8]. The calculations assumed continuous pumping for 183 days at a dry-season demand pumping rate of 1.21 gpm[9]. The recovery curve-derived transmissivity value of 200 gpd/ft and a range of storage coefficient values of 2.5 x 10^{-3} to 10^{-5}(dimensionless) were utilized in the calculations.

Potential Impacts on Existing Wells

One existing offsite well (Calvary Chappell) was identified within 1,000 feet of the subject well at a distance of approximately 428 feet. This well was monitored during the pumping test; however, no discernable response to pumping was observed. The analysis of projected drawdown indicates a range of approximately 2.2 to 5.4 feet of projected-drawdown impact is calculated at the offsite well (depending on the storage coefficient utilized), as a result of pumping the subject well at the above-noted rate and duration for this WDS.

Based on records of well construction and water level for the Calvary Chappell Well, it has an estimated saturated thickness of approximately 258 feet; therefore, the range of projected drawdown impact of 2.2 to 5.4 feet at this well represents an approximate 0.9% to 2.1% reduction in its estimated saturated thickness. Assuming a 5% reduction in saturated thickness as an initial reasonable significance "threshold", the calculated drawdown impacts are considered less than significant.

Potential Impacts on SERs

The mapped boundary of the CVAA is located greater than 1,000 feet from the subject well, and there are no other SERs identified within 1,000 feet of the subject well; therefore, analysis of potential impacts on SERs is not required by MPWMD Procedures.

[8] The projected drawdown calculations were verified as part of our review.
[9] Bierman's dry-season demand value is slightly lower than that presented in Table 6 due to numerical rounding differences. Also, the report text incorrectly cites a dry season pumping rate of 1.96 gpm.

CONCLUSIONS

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

Well Capacity

The 12-hour maximum day demand for the subject WDS was calculated according to MPWMD Procedures to be approximately 3.07 gpm. Due to water-quality considerations, the assessment report also calculated a 12-hour maximum day demand value of 3.88 gpm, accounting for treatment and distribution system losses. The range of pumping demands are significantly less than the calculated well-yield for the GOC Replacement Well of 48.63 gpm; therefore, based on MPWMD Procedures the well capacity is considered **sufficient** for the **1.65 to 2.09 afy** annual demand for this WDS.

Water Quality

The water-quality results indicate that the water from the well met all of the Maximum Contaminant Level (MCL) drinking-water standards for primary inorganic constituents; however, the water exceeded the MCLs for several secondary "consumer acceptance" constituents; therefore, the MCHD should be consulted regarding treatment requirements for this source and WDS. In addition, the sample collected tested positive for total coliform bacteria, indicating the need for disinfection of the well and/or piping system prior to consumptive use.

Analysis of Offsite Impacts

Analysis of projected drawdown impacts at existing offsite wells as a result of pumping the subject well to meet the demands of the subject WDS indicates that the impacts should not be significant. There are no SERs identified within 1,000 feet of the subject well.

CLOSURE

This memorandum has been prepared exclusively for the Monterey Peninsula Water Management District for the specific application to the processing of a Water Distribution System permit. The findings and conclusions presented herein were based on our review of the subject assessment for compliance with MPWMD Procedures and were prepared in accordance with generally accepted hydrogeologic practices. No other warranty, express or implied, is made.

It is noted that the long-term sustainable capacity and offsite impacts 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 pumping tests and application of conventional aquifer analysis. 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 and projecting impacts of wells that are completed in fractured-bedrock settings.