**EXHIBIT 19-E**

**TECHNICAL MEMORANDUM**
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| To: | MPWMD | Date: | February 20, 2009 |
| Attention: | Joe Oliver, P.G., C.Hg,<br>Water Resources Manager | Project No: | 06-0013 |
| Copy to: | Henrietta Stern<br>Matthew Sundt | | |
| From: | Robert Marks, P.G., C.Hg | | |
| Subject: | Review of Well Source and Pumping Impact Assessment for DMC Construction Well, APN 013-321-004 | | |

## 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 January 16, 2009, was prepared for Dan McAweeney (c/o DMC Construction) by Bierman Hydrogeologic (Bierman) in support of a Water Distribution System (WDS) permit application for the above-referenced property. An existing well located on the parcel, identified as the DMC Construction Well, is proposed to be utilized to supply potable and exterior landscape irrigation water for an approximate 30,000 square-feet commercial office building to be constructed on the subject parcel. An existing California American Water connection will also be retained to provide supplemental irrigation supply on the parcel.

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

### Hydrogeologic Setting

The proposed WDS and subject well are located on Garden Road adjacent the Monterey Municipal 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 in fractured shale bedrock of the Monterey Formation. As such, 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 the Well Completion Report:

**Table 1. Well Construction Summary**

| Construction Feature | DMC Construction Well |
|---|---|
| Date Drilled | 5/7/08 |
| Total Cased Depth (ft bgs[1]) | 770 |
| Borehole Diameter (inches) | 10 |
| Casing Inside Diameter (inches) | 5 |
| Perforated Intervals (ft bgs) | Intermittent from 190 to 750 |
| Static Water Level[2] (ft bgs) | 130 |
| DWR Well Completion Report No. | e069114 |
| Date Signed | 6/2/08 |
| MCHD Permit No. | 08-11304 |
| Date Issued | 4/14/08 |

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 the table 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 | Author performed test |
| 3 - Timing of Test | Yes | Test performed in August 2008 |
| 4 - Discharge Rate | Yes | Test average 24.5 gpm |
| 5 - Control of Well Discharge | Yes | To sanitary sewer through closed hose |
| 6 - Wells Monitored | Yes | One existing offsite well monitored |

| Test Method | Compliance | Comments |
|---|---|---|
| 7 - Data Collection | Yes | Documented in Appendix C |
| 8 - Water Level Monitoring | Yes | Pressure transducer/datalogger used |

Notes:
1 – Monterey County Health Department

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

## Well Testing Data Summary

A 72-hour constant rate pumping and recovery test was conducted by Bierman during the period August 5 through 12, 2008. Presented below is a summary of the well performance data developed from the testing program:

**Table 3. Pumping Test Data Summary**

| Test Parameter | DMC Construction Well |
|---|---|
| Static Water Level (feet bgs) | 129.34 |
| Total Volume Pumped (gallons) | 106,272 |
| Average Pumping Rate (gpm)[1] | 24.6 |
| 24-hour Pumping Level (ft bgs) | 224.35 |
| 24-hour Drawdown (ft) | 95.01 |
| **24-hour Specific Capacity (gpm/ft)[2]** | **0.26** |

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

## Well Yield Calculations

According to MPWMD Procedures, the yield of a well 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 vertical distance from the static water level to the bottom of the well perforations.*

Therefore, the available drawdown for the DMC Construction Well is calculated as shown in the table below:

**Table 4. Available Drawdown Calculations**

| Parameter | DMC Construction Well |
|---|---|
| Depth to Bottom of Perforations (ft) | 750.00 |
| Depth to Static Water Level (ft) | 129.34 |
| Saturated Thickness (ft) | 620.66 |
| **Available Drawdown (ft)** | **206.89** |

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 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 the ratio of late-time to early-time transmissivity. The assessment report presents calculated transmissivity values ranging between approximately 224 to 283 gallons per day per foot (gpd/ft), depending on the 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 25 minutes[1] of pumping), after which the drawdown curve displayed a conventional response. The apparent transmissivity did not decrease between the first half and end of the test; therefore, no specific capacity adjustment is required.

Recovery Data

MPWMD Procedures also require that if 95 percent recovery is not achieved within two times the pumping period having elapsed (i.e., 6 days), the calculated yield should be reduced. Water level recovery data were collected for approximately 4 days following termination of pumping, at which point the water level had recovered to approximately 98 percent (residual drawdown was approximately 1.96 feet compared with 110.26 feet of total drawdown at the end of the test); therefore, no recovery adjustment is required.

[1] Based on an equation presented by Schafer, in The Johnson Well Journal (1978).

Calculated Well Yield

Based on the above adjustment considerations, the final well yield calculations for the DMC Construction Well are summarized below:

**Table 5. Well Yield Calculations Summary**

| Parameter | DMC Construction Well |
|---|---|
| 24-Hour Specific Capacity (gpm/ft) | 0.26 |
| Ratio of Late to Early Time Transmissivity | NA |
| Adjusted 24-Hour Specific Capacity (gpm/ft) | 0.26 |
| Available Drawdown (ft) | 206.89 |
| Calculated Well Yield (gpm) | 53.57 |
| Recovery Adjustment (gpm) | NA |
| **Final Calculated Well Yield[1] (gpm)** | **53.57** |

Notes:
"NA" = Not Applicable
1 - Final Calculated Well Yield Value differs slightly from that presented in the report due to numerical rounding differences.

## 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 2.79 acre-feet per year[2] (afy). Presented below is a summary of the instantaneous pumping demand calculations based on the average annual demand for the subject WDS:

**Table 6. Demand Calculations Summary**

| Demand Category | DMC Construction WDS |
|---|---|
| Average Annual Demand (afy) | 2.79 |
| Average Day (gpm) | 1.73 |
| Dry Season (gpm) | 2.08 |
| Maximum Day (gpm) | 2.59 |
| **12-hour Maximum Day (gpm)** | **5.19** |

[2] It is our understanding that this demand estimate was based on MPWMD Water Use Factors and has been reviewed by MPWMD staff. The demand estimate was not, therefore, independently verified as part of this review.

We note that Bierman estimated the maximum day demand utilizing an average day peaking factor of 2.25 (based on California Department of Public Health Waterworks Standards, 2008), corresponding to a 12-hour maximum day demand value of 7.77 gpm.

**Confirmation of Well Capacity**

As presented above, the calculated well-yield for the DMC Construction Well is approximately 53.57 gpm, which is significantly greater than the maximum day 12-hour demand value of 5.19 gpm; therefore, based on MPWMD Procedures the well capacity is considered sufficient for the proposed WDS demand.

It is important to note that the above well-yield calculation is a theoretical maximum sustained pumping rate based on calculations prescribed by MPWMD Procedures. The actual maximum rate achievable by the 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 general mineral, general physical and inorganic chemical parameters, as well as an expanded list of Title 22 constituents (organic and synthetic organic compounds, asbestos, etc.). The results indicate that the water met all of the Maximum Contaminant Level (MCL) drinking-water standards[3] for primary inorganic constituents. However, the water did exceed the recommended MCLs for several secondary (aesthetic consumer acceptance-based) constituents, as summarized in the table below[4]:

**Table 7. Water Quality MCL Exceedance Summary**

| Constituents | Unit | Recommended MCL | Result |
|---|---|---|---|
| Manganese | ug/L | 50 | 52 |
| Specific Conductance | mg/L | 900 | 1,735 |
| Total Dissolved Solids | mg/L | 500 | 1,050 |

[3] Updated October 11, 2007.

[4] It is noted that there is a discrepancy between the assessment report text on pg. 16 (under the heading Water Quality Summary), which lists chloride as being above drinking water standards, and the laboratory report in Appendix F, which shows chloride below the MCL and manganese above the MCL. Also, the footnote at the bottom of pg. 16 infers that chloride, specific conductance, and total dissolved solids are primary constituent standards; however, these constituents are listed in Title 22 as secondary standards.

As a commercial office facility, treatment of the produced well water prior to consumption may be required. Although a treatment system has not been designed, the assessment report estimated system and treatment losses of 7 and 15 percent, respectively, and a correspondingly greater maximum day 12-hour demand value of 9.83 gpm (equivalent to an average annual demand of approximately 3.53 afy, assuming a peaking factor of 2.25). In addition, the sample tested positive for Total Coliform bacteria, indicating the need for redisinfection of the well and/or piping system. The MCHD should be consulted for treatment recommendations and/or requirements for this WDS.

**Analysis of Offsite Impacts**

MPWMD Procedures require an evaluation of the potential well-pumping drawdown effects at existing wells or other Sensitive Environmental Receptors (SERs) within 1,000 feet of the subject well. Projected drawdown impacts were calculated utilizing the Modified Theis Nonequilibrium Equation. The calculations assumed continuous pumping for 183 days at a dry-season demand rate of 2.05 gpm. The recovery curve-derived transmissivity value of 283 gpd/ft and a storage coefficient value of 0.0067 (dimensionless) were utilized in the calculations.

Potential Impacts on Existing Wells

One existing well (Dunnion Well) is located within 1,000 feet of the subject well at a distance of approximately 250 feet. This well was monitored during the 72-hour pumping test and displayed approximately 4.2 feet of drawdown influence; however, the test pumping rate was significantly greater than the WDS demand pumping rate (i.e., 24.6 gpm versus 2.05 gpm, respectively). The analysis of projected drawdown[5] indicates approximately 3.0 feet of drawdown impacts are calculated at the existing offsite well as a result of pumping the subject well at the above-noted rate and duration for this WDS.

Based on MPWMD records of well construction and water levels, the Dunnion Well has an estimated saturated thickness of approximately 490 ft (590 ft – 100 ft) The projected drawdown impact of 3.0 feet at this well represents an approximate 0.6 percent reduction in its estimated saturated thickness. Assuming a 5 percent reduction in saturated thickness as a reasonable significance "threshold", the calculated drawdown impacts are considered less than significant.

Potential Impacts on SERs

There are no SERs as defined by the MPWMD within 1,000 feet of the well.

[5] The projected drawdown calculations were verified as part of our review utilizing the Theis Equation.

## CONCLUSIONS

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

### Well Capacity

The maximum day 12-hour demand for the subject WDS was calculated according to MPWMD Procedures to be approximately 5.19 gpm. Due to water quality considerations, the assessment report also calculated a maximum day 12-hour demand value of 9.83 gpm to account for treatment losses. The range of pumping demands are significantly less than the calculated well yield of 53.57 gpm; therefore, based on MPWMD Procedures the well capacity is considered **sufficient** for the **2.79 to 3.53 afy** annual demand for this WDS.

### Water Quality

The water quality results indicate that the water met all of the Maximum Contaminant Level (MCL) drinking-water standards for primary inorganic constituents. However, the water did exceed the recommended MCLs for several secondary (aesthetic consumer acceptance-based) constituents; therefore, the MCHD should be consulted regarding treatment recommendations and/or requirements for this source and WDS.

### Analysis of Offsite Impacts

Analysis of projected drawdown at 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 located 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. 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. 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.