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CALIFORNIA AMERICAN WATER

IN THE SUPERIOR COURT OF THE STATE OF CALIFORNIA

IN AND FOR THE COUNTY OF MONTEREY

CALIFORNIA AMERICAN WATER, Plaintiff, vs. CITY OF SEASIDE; CITY OF MONTEREY; CITY OF SAND CITY; CITY OF DEL REY OAKS; SECURITY NATIONAL GUARANTY, INC.; GRANITE ROCK COMPANY, INC.; D.B.O. DEVELOPMENT COMPANY NO. 27, INC.; MURIEL E. CALABRESE 1987 TRUST; ALDERWOODS GROUP (CALIFORNIA), INC.; PASADERA COUNTRY CLUB, LLC; LAGUNA SECA RESORT, INC; BISHOP MC INTOSH & MC INTOSH, a general partnership; THE YORK SCHOOL, INC.; and DOES 1 through 1,000, Inclusive, Defendants. MONTEREY PENINSULA WATER MANAGEMENT DISTRICT, Intervenor. MONTEREY COUNTY WATER RESOURCES AGENCY, Intervenor. AND RELATED CROSS-ACTIONS	Case No. M66343 **SEASIDE GROUNDWATER BASIN WATERMASTER 2007 ANNUAL REPORT** (Assigned to Hon. Roger D. Randall, Ret.)

//

At the request of the Seaside Groundwater Basin Watermaster, California American Water hereby submits the Seaside Groundwater Basin Watermaster 2007 Annual Report, a copy of which is contained on the compact disc attached hereto as Exhibit A.

Respectfully submitted,

SOMACH, SIMMONS & DUNN

Dated: November 14, 2007

By______________________
Nicholas A. Jacobs

Attorneys for California American Water

PROOF OF SERVICE

I am employed in the County of Sacramento; my business address is Hall of Justice Building, 813 Sixth Street, Third Floor, Sacramento, California; I am over the age of 18 years and not a party to the foregoing action.

On November 14, 2007, I served a true and correct copy of

SEASIDE GROUNDWATER BASIN WATERMASTER 2007 ANNUAL REPORT

X (by mail) on all parties in said action listed below, in accordance with Code of Civil Procedure §1013a(3), by placing a true copy thereof enclosed in a sealed envelope in a designated area for outgoing mail, addressed as set forth below. At Somach, Simmons & Dunn, mail placed in that designated area is given the correct amount of postage and is deposited that same day, in the ordinary course of business, in a United States mailbox in the City of Sacramento, California.

SEE ATTACHED SERVICE LIST

___ (by e-mail) to the persons at the email addresses set forth on the attached E-Mail Service List.

___ (by personal delivery) by personally delivering a true copy thereof to the person and at the address set forth below:

___ (by facsimile transmission) to the person at the address and phone number set forth below:

I declare under penalty of perjury that the foregoing is true and correct under the laws of the State of California. Executed on November 14, 2007, at Sacramento, California.

Susan Bentley

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SEASIDE GROUNDWATER BASIN
WATERMASTER

ANNUAL REPORT – 2007

Integral to the Superior Court Decision (Decision) rendered by Judge Roger D. Randall on March 27, 2006 is the requirement to file of an Annual Report. The ruling of the Court requires that the Annual Report be prepared and filed with the Court and mailed to all the parties on or before the 15th day of November every year for the preceding Water Year. This 2007 Annual Report is being filed on or before November 15, 2007, consistent with the provisions of the Decision. This Annual Report addresses the specific Watermaster functions set forth in Section III. L. 3. x. of the Decision. In addition this Annual Report includes a section pertaining to Water Quality Monitoring and Basin Management.

A. Groundwater Extractions

The schedule summarizing the 2007 Water Year (WY 2007) groundwater production from all the producers allocated a Production Allocation in the Seaside Groundwater Basin is provided in Attachment 1, "Seaside Groundwater Basin Watermaster, Reported Quarterly and Annual Water Production From the Seaside Groundwater Basin for all Producers Included in the Seaside Basin Adjudication During Water Year 2007." For the purposes of this Annual Report the Water Year is defined as beginning October 1, 2006 and ending on September 30, 2007.

B. Groundwater Storage

Monterey Peninsula Water Management District (MPWMD), in cooperation with California American Water (CAW), operated the Seaside Basin Aquifer Storage and Recovery (ASR) testing program during Water Year (WY) 2007. During WY 2007, a total of 12 acre-feet (AF) of water was diverted by CAW from its Carmel River sources during periods of flow in excess of NOAA-Fisheries' recommended bypass flows, transported through the existing CAW distribution system for injection and storage in the Seaside Basin at the MPWMD's ASR Well No. 1 (formerly known as the Santa Margarita Test Injection Well) located on former Fort Ord property. This is the only reported storage of non-native groundwater into the Seaside Basin in WY 2007.

During WY 2007, the MPWMD has moved forward with planning and construction of a second well, ASR Well No. 2, as part of the Phase 1 ASR Project. This well was drilled in Spring 2007 and on-site infrastructure improvements are expected to be installed to allow injection testing at this new facility during WY 2008. State Water Resources Control Board (SWRCB) authorization for a jointly-held water right by MPWMD and CAW for the Phase 1 ASR Project is expected in December 2007.

Based upon production reported for WY 2007, the following Standard Producers are entitled to a Carryover Credit in accordance with the Decision, Section III. H. 5. for WY 2008:

DBO Development	49.3 acre-feet
Granite Rock	27.1 acre-feet

C. Amount of Artificial Replenishment, if any, performed by Watermaster

No Artificial Replenishment of water was performed by the Watermaster for the WY 2007.

D. Leases or sales of Production Allocation

There have been no water leases or sales during the WY 2007.

E. Use of imported, reclaimed, or desalinated Water as a source of Water for Storage or as a water supply for lands overlying the Seaside Basin

Other than the water imported from the Carmel Basin for the ASR program described in **Section B** above, no imported, reclaimed or desalinated water use (either direct or for storage in the groundwater basin) has been reported to the Watermaster during the WY 2007.

F. Violations of the Decision and any corrective actions taken

Section III. D. of the Decision enjoins all Producers from any Over-Production beyond the Operating Yield in any Water Year in which the Watermaster declares that Artificial Replenishment is not available or possible. Section III. L. 3. j. iii. requires that the Watermaster declare the unavailability of Artificial Replenishment prior to the beginning of the Water Year so that the Producers are informed of the prohibition against pumping in excess of the Operating Yield.

The Watermaster made this declaration regarding the unavailability of Artificial Replenishment for WY 2007 at its Board meeting of March 2007. A copy of this declaration is contained in Attachment 2.

Total pumping for WY 2007 did not exceed the Operating Yield for the Seaside Basin; however, CAW and the City of Seaside reported annual pumping quantities that exceeded their Standard Productions by 69.6 and 0.5 acre-feet, respectively. The Watermaster has assessed CAW and the City of Seaside a Replenishment Assessment for the Operating Yield Over Production, as further described in **Section H**, below.

G. Watermaster administrative costs

The total estimated Administrative costs for Fiscal Year 2007 amounted to $103,800.00. This included the cost of maintaining an office and paying a part time administrator and some part time staff to take and transcribe minutes of the Watermaster Board meetings during 2007. "Fiscal Year 2007 Administrative Fund Report" is provided as Attachment 3.

H. Replenishment Assessments

A Replenishment Assessment of $1,132 per acre-foot was established by the Watermaster Board at its October, 2006 meeting for use against Water Year 2007 pumping. At its meeting of October, 2007 the Watermaster Board established a Replenishment Assessment of $2,485 per acre-foot for use against Water Year 2008 pumping.

Based upon the reported production for WY 2007, CAW's Replenishment Assessment for production over the natural safe yield is $2,594,166.34 and its Replenishment Assessment for Operating Yield Over Production is $78,837.77. The City of Seaside's Replenishment Assessment for production over the natural safe yield is $181,671.87 and its Replenishment Assessment for Operating Yield Over Production is $510.78. A summary of the calculations for Replenishment Assessment for Water Year 2007 is contained in Attachment 4.

I. All components of the Watermaster budget

The Watermaster budget has four separate funds: Administrative Fund; Monitoring & Management–Operations; Monitoring and Management–Capital Fund and; Replenishment Fund. A copy of the Fiscal Year 2008 adopted budget is contained in Attachment 5. The Chief Executive Officer provides monthly financial status reports to the Watermaster Board on all financial activities for each month with year to date totals.

J. Water Quality Monitoring and Basin Management

Water Quality Analytical Results

Groundwater quality data were collected on a quarterly basis during WY 2007 from the existing network of Monterey Peninsula Water Management District (MPWMD) monitor wells in and near the coastal subareas of the Seaside Basin. Copies of the sampling results are contained in Attachment 6.

Analysis of the results indicate no evidence of water quality changes indicative of seawater intrusion at the locations and depths sampled in the coastal areas of the basin.

In addition to the monitoring at existing coastal wells, new coastal sentinel wells were installed for the Watermaster at four locations in and near the basin in WY 2007. These new wells are described below under the heading "Construction of Sentinel Monitoring Wells". Sampling results from these monitoring wells indicate no presence of seawater intrusion into the primary aquifer systems of the Seaside Basin. However, saline water from past seawater intrusion on the former Fort Ord was observed in the sediments above the primary aquifers at the most northerly site. At the other three sites to the south, saline intrusion was limited to the shallow dune and beach sand deposits.

Construction of Sentinel Monitoring Wells

At its January 2007 meeting the Watermaster Board adopted a work plan pertaining to the location and construction of additional water quality monitoring wells. These are referred to as the Seawater Sentinel Monitoring Wells and were to be located along the coastline in the former Fort Ord. Construction of these four wells was completed in early September 2007, and shortly thereafter the first set of water quality samples from each of the wells was taken and analyzed. The October 2007 report titled *"Seaside Groundwater Basin Watermaster Seawater Sentinel Wells Project"* describes the construction, hydrogeologic findings, and initial water quality sampling results of this project. The report is lengthy, but an Executive Summary of the report is contained in Attachment 7. A complete copy of the report may be viewed and downloaded from the Watermaster's website at: http://www.seasidebasinwatermaster.org/.

The following are the principle conclusions and recommendations in that report:

1. No evidence of seawater intrusion was detected in the Paso Robles, Santa Margarita, or Purisima formations at the locations where the new wells were installed.
2. Seawater intrusion was detected in the shallow aquifer at all four of the well sites. Seawater intrusion into this aquifer in the vicinity of the most northerly well site (SBWM #1) has been known for decades.
3. The information gained from installing these new wells should be used in conjunction with performing further hydrogeologic analysis of the Seaside basin to refine/revise the overall hydrogeologic structure/stratigraphy of the basin to determine whether this information will affect management of the basin.
4. It does not appear necessary to install any more monitoring wells during 2008. However, after the 2008 data has been obtained and analyzed, this decision should be revisited to determine if putting in an additional well(s) in 2009 would be beneficial.
5. The new Sentinel Wells should be induction logged quarterly, and water quality samples should be collected as part of the induction logging activity using the same down-hole equipment. In subsequent years, it may be feasible to reduce the sampling frequency if a good correlation between the induction logging data and the sampling data is found to exist.
6. Continuous water level data-loggers should be installed on all of the new Sentinel Wells.
7. For the new Sentinel Wells it may be more cost-effective to contract-out the induction logging and sample collection work as a negotiated annual contract.

At its meeting in October 2007 the Watermaster Board authorized the installation of the data-loggers which were recommended in item 7 in the preceding paragraph. Data-loggers are instruments that continuously record water level in the wells and allow this data to be stored for periodic downloading to a computerized database. The data-loggers were installed in early November 2007. Data from these wells is now being incorporated into the Basin Management Database which was developed during 2007, and is described below.

Basin Management Database

Groundwater resource monitoring within the Seaside Basin is currently being conducted by numerous entities. The programs consist of: Groundwater Production Monitoring; Groundwater Level Monitoring; Groundwater Quality Monitoring; Surface Water Monitoring; and Precipitation Monitoring.

For successful implementation of the Seaside Basin Monitoring Program, pertinent historical basic groundwater resource data obtained from the above-mentioned programs needs to be consolidated into a database to allow more efficient organization and data retrieval. The consolidated database will allow for simple identification of differences and discrepancies of datasets compiled by the numerous entities, and to identify data gaps. In addition, a consolidated database is needed to allow pertinent groundwater data to be efficiently organized, managed and housed in a single location to facilitate:

- Ongoing data collection
- Data storage and retrieval
- Distribution of basic data to Watermaster members and interested parties
- Preparation of annual and periodic reports to the Watermaster.

Characteristics of both existing wells and wells proposed as part of the Seaside Basin Monitoring Program should be notated in the database, including type, location, construction details and other pertinent information.

The Watermaster retained RBF Consulting to develop the Basin Management Database called for under Task 1.2.a of the Seaside Basin Monitoring and Management Program. Through a complex series of steps, including regular input from members of the Watermaster's Technical Advisory Committee, the Basin Management Database was prepared. An overview of the Database is contained in Attachment 8.

This database will be used to compile the monitoring data that is acquired and to present it in a variety of ways for use in analyzing and interpreting the data for Basin management purposes.

Enhanced Monitoring Well Network

Task I.2.g of the Seaside Basin Monitoring and Management Program calls for the development of an Enhanced Monitoring Well Network. The objective of the enhanced network would be to fill in data gaps in the existing monitoring well network in use by the Monterey Peninsula Water Management District (MPWMD), and others, in order to improve the Basin management capabilities of the Watermaster.

Attachment 9 contains the report prepared by Joe Oliver of MPWMD describing the recommended enhanced monitoring well network. The report also includes information regarding historical groundwater quality data sources in and near the Laguna Seca subarea, and Mr. Oliver's evaluation of these sources as part of an enhanced water quality monitoring program for this subarea.
As the Conclusions and Recommendations of the report indicate:

1. Required water level and water quality data has not been provided by some of the water producers in the basin, as required by the Court order. Action to remedy this situation should be taken as soon as possible.
2. At least one existing well in the Dune Sand/Aromas Sand aquifer in the Northern Coastal Subarea should be added to the monitoring well network. There are several candidate wells that would be suitable for this purpose.
3. Two additional existing wells elsewhere in the basin should be added to the monitoring network for water level data only. These are the MW-BW-09-180 well and the CAW Granite Construction test well.
4. Seven additional wells in the Laguna Seca Subarea should be added to the monitoring well network to increase the database of water quality information from this area. These are the York School, Laguna Seca Driving Range, CAW East Fence, Laguna Seca County Park No. 4, CAW Ryan Ranch No. 7, Laguna Seca Golf No. 12, and Pasadera Main Gate wells.
5. Costs to outfit these wells for water level and/or water quality sampling, and to perform the level measurements and sampling/analytical activities, are being incorporated into the M&MP 2008 Operations Budget discussed under Agenda Item No. 3 in today's agenda packet.

The Watermaster Board approved Fiscal Year 2008 Budgets that will fund implementation of all of these recommendations, so that the enhanced monitoring well network will be put into place during Water Year 2008.

Supplemental Water Supplies

Task I.3.a of the Seaside Basin Monitoring and Management Program calls for the preparation of a report reviewing supplemental water supplies that could be used to augment the Basin's current sources of supply. The Watermaster retained RBF Consulting to prepare this report, which is contained in Attachment 10.

The Report is informational only and provides a description of each of the potential supplemental water projects and the current status of each project. These projects were included in the development of the Replenishment Assessment which is discussed under paragraph H of this Annual Report.

Durbin Model Documentation

One of the requirements of the adjudication judgment entered into on March 27, 2006 is that that Watermaster "…develop a suitable groundwater model of the Seaside Basin and appropriate adjacent areas." Although a groundwater model of the basin was developed by California American Water as part of the court proceedings, this modeling effort was the source of some controversy between interested parties. Because of this controversy, the Watermaster Board determined to convene a panel of technical experts to discuss the modeling efforts and provide guidance for the development of the required model.

Mr. Martin Feeney was retained by the Watermaster to oversee the work of the panel and to moderate the panel's meeting in late November 2006. A copy of Mr. Feeney's *"Report on Groundwater Modeling Meeting and Recommended Approach"* is contained in Attachment 11. Mr. Feeney's report documents the efforts and discussions of the technical experts and presents a recommended approach to fulfilling the demands of the Court and the needs of the Watermaster.

Mr. Feeney's report concluded that, with minor refinements, the California American Water model (referred to as the Durbin model) could serve the Watermaster's immediate needs and meet the requirements of the Judgment. One of Mr. Feeney's recommendations was that the Watermaster fund documentation of the model, to provide guidance to model users, provide closure to the existing model effort, and provide a basis for future review and revision.

Under its contract with the Watermaster, RBF Consulting obtained the computer model documentation for the Durbin Model from Mr. Tim Durbin, the creator of the model. This documentation is contained in the *"Groundwater Flow and Transport Model"* report dated October 1, 2007. This documentation report was reviewed by Mr. Derrik Williams of Hydrometrics, the groundwater modeler on the RBF Consulting team. Hydrometrics has the expertise and capability to run the model and interpret its results. Because Mr. Durbin is retiring, the Durbin Model will be transferred to Hydrometrics for future analysis requirements. The model is capable of being enhanced with new data being developed in the Seaside Groundwater Basin Database if desired in the future.

The documentation report is quite voluminous and is therefore not attached to this Annual Report. A complete copy of the report may be viewed and downloaded from the Watermaster's website at: http://www.seasidebasinwatermaster.org/.

Included in Attachment 11 are two sections excerpted from the documentation report which indicate:

1. The model simulation run assuming 2002 groundwater pumping rates continued to 2015 (average annual pumping of 6,300 AFY compared to the 5,600 AFY assumed in the Court Order), and historical groundwater recharge rates found that:
   a. Groundwater levels will decline within the Seaside area, but
   b. Seawater intrusion will not occur
2. The model simulation run using the same assumptions as for the previous simulation, but with the CAW Paralta Well pumping of 2,000 AFY relocated to the northeast by 10,000 feet found that:
   a. Groundwater levels will recover within the Seaside area, and
   b. Seawater intrusion will not occur

Hydrometrics provided a memorandum concerning the Groundwater Flow and Transport Model report, discussing the model and improvements that should be made to it before it is used for basin management purposes. A copy of that memorandum is contained in Attachment 11. Subsequently, in conjunction with discussions of the documentation document at the September 28, 2007 Watermaster Technical Advisory Committee meeting, Mr. Williams provided the following written clarification with regard to the issue of whether or not the model needed to be modified and/or updated at this time:

> *"We are NOT proposing that work be done right away. What we are saying is that before the model is used to answer ANY question, there are some checks and updates that should be done. Let's call these "general model checks". Additionally, depending on the question and availability of data, there may be specific changes in addition to the general model checks. So, for example, no matter what the question, we will need to revisit the calibration before we use the model (a general model check). In addition, if new geologic interpretations are available, we would want to include them in the model (a data specific update). Effectively, we don't need to do anything until we want to use the model. Once we decide to use the model, there are things we know we want to do, and there are optional things that may be necessary depending on how the model is to be used."*

It was the consensus of the Technical Advisory Committee that use of the model is not warranted unless there were questions that would be answered by the model, and that another reason for delaying any work on the model would be to provide time to gather data from the new Sentinel wells. It was agreed that this issue will be reexamined after Water Year 2008 is complete and the data acquired during that time has been analyzed and interpreted.

Seawater Intrusion Analysis

The Watermaster retained RBF Consulting to prepare the Seawater Intrusion Analysis report required under Task 1.4.g of the Seaside Basin Monitoring and Management Program. RBF Consulting's subconsultant, Hydrometrics, prepared the report. The report is lengthy, so only the Conclusions and Recommendations from it are contained in Attachment 12. A complete copy of the report may be viewed and downloaded from the Watermaster's website at: http://www.seasidebasinwatermaster.org/.

The Conclusions and Recommendations of the Report indicate that water levels in a small localized area of the basin are below sea level, but that groundwater levels in the Southern Coastal subarea and elsewhere in the basin are well above sea level. No seawater intrusion has thus far been detected in any of the production aquifers of the basin. Several possible explanations for this are provided in the Report, which also recommends that the Watermaster expand the monitoring network and also analyze the expanded amount of data that is being gathered at the various monitoring sites to keep a close watch on the conditions within the basin. Both of these recommendations are currently being pursued and implemented, as discussed under the "Enhanced Monitoring Well Network" heading above.

K. Recommendations

The Seaside Basin Watermaster Board has taken an aggressive approach to meet all of the Court's established deadline dates. All of the Phase 1 Scope of Work activities, which are described in the *"Implementation Plan for the Seaside Basin Monitoring and Management Program"* dated March 7, 2007, have essentially been completed as of the date of preparation of this Annual Report. At the Watermaster Board meeting held on October 17, 2007, the Board adopted an updated Phase 2 Scope of Work which describes the activities that will be conducted during Water Year 2008. A copy of this updated Phase 2 Scope of Work is contained in Attachment 13. This updated Phase 2 Scope of Work supersedes the preliminary Phase 2 Scope of Work contained in the *"Implementation Plan for the Seaside Basin Monitoring and Management Program"* mentioned above. All elements of this updated Phase 2 Scope of Work will be funded in the 2008 budget that was adopted by the Board at that same meeting (copies of which are included in Attachment 5). As described in **Section J** above, information from the Enhanced Monitoring Well Network will be utilized to detect any seawater intrusion.

ATTACHMENT 1

GROUNDWATER EXTRACTIONS

Seaside Groundwater Basin Watermaster
Reported Quarterly and Annual Water Production (in Acre Feet) From the Seaside Groundwater Basin
For All Producers Inclued in the Seaside Basin Adjudication -- Water Year 2007
(All Values in Acre-Feet ([AF])

Producer	Category of Producer	Quarters				Annual Reported Total	Base Operating Yield Allocation	Carryover Credit to Water Year 2008
		Oct-Dec 2006	Jan-Mar 2007	Apr-Jun 2007	Jul-Sep 2007			
Coastal Subareas								
CAW (Coastal Subareas)	Standard	1,051.3	88.4	1,345.2	1,140.1	3,625.0	3,504.2	0.0
Seaside (Municipal)	Standard	67.0	58.3	74.3	88.2	287.8	287.4	0.0
Granite Rock Company	Standard	-	0.0	0.0	0.0	0.0	27.1	27.1
DBO Development No. 27	Standard	0.0	0.0	0.0	0.0	0.0	49.3	49.3
City of Seaside (Golf Courses)	Alternative	76.9	27.8	170.1	198.2	473.0	540.0	N/A
Sand City	Alternative	-	0.2	1.0	1.0	2.2	9.0	N/A
Security National Guaranty	Alternative	2.1	2.3	2.4	2.4	9.2	149.0	N/A
M.E. Calabrese 1987 Trust	Alternative	0.0	0.0	0.0	0.0	0.0	14.0	N/A
Alderwoods Group (Mission Memorial Park)	Alternative	3.1	2.8	10.3	10.0	26.2	31.0	N/A
Coastal Subarea Totals						4,423.4	4,611.0	N/A
Laguna Seca Subareas								
CAW (Inland Subareas)	Standard	91.8	61.2	120.1	161.8	434.9	345.0	0.0
Pasadera Country Club	Alternative	15.0	33.2	77.6	89.0	214.8	251.0	N/A
Laguna Seca/Bishop	Alternative	30.2	5.2	114.0	104.9	254.3	320.0	N/A
York School	Alternative	4.8	3.3	7.5	8.4	24.0	32.0	N/A
Laguna Seca Park (County)	Alternative	5.3	3.7	11.2	13.0	33.2	41.0	N/A
Laguna Seca Subarea Totals						961.2	989.0	N/A
Seaside Basin Production Totals =						**5,384.6**	**5,600.0**	**N/A**
Total Production by Alternative Producers =						**1,036.9**		
Total Production by Standard Producers =						**4,347.7**		

Notes:

1. The water year begins October 1 and ends September 30 of the following calendar year. For example, WY 2007 began on October 1, 2006, and will end on September 30, 2007.
2. Values shown in the table are based on reports to the Watermaster as received by the MPWMD by October 12, 2007.
3. All values are rounded to the nearest tenth of an acre-foot. Where required, reported data were converted to acre-feet utilizing the relationship: 325,851 gallons = 1 acre-foot.
4. "Operating Yield" values based on Seaside Basin Adjudication decision as amended, signed February 9, 2007 (Monterey County Superior Court Case No. M66343).
5. Any minor discrepancies in totals are attributable to rounding. CAW = California American Water.
6. Carryover Credits are as defined in the amended Seaside Basin Adjudication decision, and apply only to Standard Producers. Since the Storage Capacity of the Basin has not yet been established (this will be done during 2008), it is assumed that the Carryover Credits shown above will not exceed the any of the Standard Producer's Storage Allocations, and are therefore applicable toward Water Year 2008.
7. Pasadera County Club meter readings: Oct-Dec 06 Qtr: 344.326 - 359.319 = 14.993 AF; Jan-Mar 07 Qtr: 359.319 - 392.522 = 33.203 AF.
8. The Base Operating Yield Allocations are derived directly from the Decision, and do not include any Carryover Credits from the previous Water Year. Carryover credits are included in determining whether or not a Standard Producer exceeded its Natural Safe Yield and/or its Operating Yield allocations.

ATTACHMENT 2

WATERMASTER DECLARATION OF NON-AVAILABILITY OF ARTIFICIAL REPLENISHMENT WATER

March 9, 2007

NOTICE TO ALL SEASIDE GROUNDWATER PRODUCERS:

The Watermaster has declared for Water Year 2007 that **NO** Artificial Replenishment Water is available to offset Over-Production in excess of the Operating Yield for the Seaside Groundwater Basin. Pursuant to the Amended Decision entered in the Seaside Adjudication, **NO** production over the Operating Yield may occur during the 2007 Water Year. All producers are limited in production to the following quantities of water:

Coastal Subarea Alternative Producers:

Seaside (Golf)	540 acre-feet
SNG	149 acre-feet
Calabrese	14 acre-feet
Mission Memorial (Alderwood)	31 acre-feet
Sand City	9 acre-feet

Laguna Seca Subarea Alternative Producers:

Pasadera	251 acre-feet
Bishop	320 acre-feet
York School	32 acre-feet
Laguna Seca County Park	41 acre-feet

Coastal Subarea Standard Producers:

California American Water	3,645 acre-feet[1]
Seaside (Municipal)	287 acre-feet
Granite Rock	54 acre-feet[2]
D.B.O. Development 27	98 acre-feet[3]

Laguna Seca Subarea Standard Producers:

California American Water	345 acre-feet

---

[1] Includes base allocation of 3,504 acre-feet plus an additional 141 acre-feet of carry-over from WY 2006.

[2] Includes base allocation of 27 acre-feet plus an additional 27 acre-feet of carry-over from WY 2006.

[3] Includes base allocation of 49 acre-feet plus an additional 49 acre-feet of carry-over from WY 2006.

ATTACHMENT 3

WATERMASTER ADMINISTRATAIVE COSTS

Seaside Groundwater Basin Watermaster

Fiscal Year 2007 Administrative Fund Report

	2007 Income & Actual / Estimated Expenses*	2007 Budget	Variance	% of Budget
Assessment				
Administrative Fund	64,000.00			
Additional Assessment 4/18/2007	27,150.00			
Rollover From 2006	58,866.47			
Total Income	150,016.47	91,150.00	58,866.47	164.58%
Expense				
Administrative				
Computer Maint. & Supplies	1,000.00	3,000.00	-2,000.00	33.33%
Contract Staff	73,000.00	73,000.00	0.00	100.0%
Meetings, Travel & Membership	500.00	2,000.00	-1,500.00	25.0%
Mileage Reimbursement	-	1,500.00	-1,500.00	0.0%
Office Consumables & Other	3,000.00	6,000.00	-3,000.00	50.0%
Office Equip. Maint. & Rental	500.00	1,000.00	-500.00	50.0%
Office Rental	3,500.00	3,500.00	0.00	100.0%
Administrative Support	21,000.00	22,150.00	-1,150.00	94.81%
Legal	-	10,000.00	-10,000.00	0.0%
Utilities	1,300.00	1,000.00	300.00	130.0%
Total Administrative	103,800.00	123,150.00	-19,350.00	84.29%
Dedicated Reserve	25,000.00			
Rollover to 2008	21,216.47			

*Prepared 11/1/07 using actual expenses through 9/30/07 and estimated expenses 10/01/07-12/31/07

ATTACHMENT 4

REPLENISHMENT ASSESSMENT CALCULATIONS

SEASIDE BASIN WATERMASTER PRODUCER ALLOCATIONS

Initial Basin-Wide Operating Yield[1]	**5600**	**Coastal Operating Yield[1]**	**4611**
Natural Safe Yield (NSY)[2]	**3000**	**Laguna Seca Operating Yield[1]**	**989**

ALTERNATIVE PRODUCER ALLOCATIONS

Coastal Subarea[3]	Acre-Feet	Laguna Seca Subarea[3]	Acre-Feet
Seaside (Golf)	540	Pasadera	251
SNG	149	Bishop	320
Calabrese	14	York School	32
Mission Memorial (Alderwood)	31	Laguna Seca County Park	41
Sand City	9		
Total[1]	**743**	**Total[1]**	**644**

STANDARD PRODUCER ALLOCATIONS

Coastal Operating Yield Available to Standard Producers (AFY)			**3,868**	**Laguna Seca Operating Yield Available to Standard Producers (AFY)**			**345**
Coastal Subarea	**Standard Producer Allocations**		**AFY Available to This Producer**	**Laguna Seca Subarea**	**Standard Producer Allocations**		**AFY Available to This Producer**
	Base Water Right %[4]	**Weighted %[5]**			**Base Water Right %[4]**	**Weighted %[5]**	
California American Water	77.55%	90.60%	3,504.2	California American Water	100.00%	100.00%	345.0
Seaside (Municipal)	6.36%	7.43%	287.4				
Granite Rock	0.60%	0.70%	27.1				
D.B.O. Development No. 27	1.09%	1.27%	49.3				
Total	**85.60%**	**100.00%**	**3,868.0**	**Total**	**100.00%**	**100.00%**	**345.0**

Allocation of Available Operating Yield Among Standard Producers	Base Water Right Avaliable to this Producer (AF)	Carryover Credits from Prior Water Year (AF)	Total Available to this Producer in This Water Year (AF)	% of Total Operating Yield Allocation Available to Standard Producers in This Water Year
California American Water	3,849.2	141	3,990.2	90.07%
Seaside (Municipal)	287.4	0	287.4	6.49%
Granite Rock	27.1	49	76.1	1.72%
D.B.O. Development No. 27	49.3	27	76.3	1.72%
Total	**4,213.0**	**217.0**	**4,430.0**	**100.00%**

Footnotes:
(1) From page 17 of Exhibit A (Amended Decision)of Court Order filed February 9, 2007.
(2) From page 14 of Exhibit A (Amended Decision)of Court Order filed February 9, 2007.
(3) From page 21 of Exhibit A (Amended Decision)of Court Order filed February 9, 2007.
(4) From Table 1 on page 19 of Exhibit A (Amended Decision)of Court Order filed February 9, 2007.

CALCULATION OF REPLENISHMENT ASSESSMENTS

Using the Basin-wide methodology approved by the Court on January 12, 2007, and as shown in detail on the spreadsheet contained in this Attachment, Watermaster calculated the Water Year 2007 Replenishment Assessments as follows:

2007 Replenishment Assessment Unit Charge = $1,132.00

NSY Available to Standard Producers for WY 2007 (AF) = 1963.1

Standard Producers	WY 2007 Production (AF)	% of NSY Available	Volume of NSY Available (AF)	NSY Overproduction (AF)	NSY Overproduction Assessment	Operating Yield Available (AF)	Operating Yield Overproduction (AF)	Operating Yield Overproduction Assessment	Total Assessment
California American Water	4059.9	90.07%	1,768.2	2,291.7	$2,594,166.34	3,990.2	69.6	$78,837.77	$2,673,004.11
Seaside (Municipal)	287.8	6.49%	127.4	160.5	$181,671.87	287.4	0.5	$510.78	$182,182.65
Granite Rock	0.0	1.72%	33.7	0.0	$0.00	76.1	0.0	$0.00	$0.00
D.B.O. Development No. 27	0.0	1.72%	33.8	0.0	$0.00	76.3	0.0	$0.00	$0.00
Total Production	**4347.7**	**100.00%**	**1963.1**	**2452.2**	**$2,775,838.21**	**4,430.0**	**70.1**	**$79,348.55**	**$2,855,186.76**

<u>ATTACHMENT 5</u>

WATERMASTER BUDGETS

Seaside Groundwater Basin Watermaster
Administrative Fund

Adopted FY 2007 Budget,
Estimated FY 2007 Expenses,
and Fiscal Years 2008 & 2009
Proposed Budget

	2007 Adopted Budget	2007 Estimated Expenses	2008 Proposed Budget	2009 Proposed Budget
Ordinary Income/Expense				
Income				
Assessment				
Dedicated Reserve	25,000	-	25,000	25,000.00
FY Rollover	33,867	-	21,216	216
Administrative Fund	64,000	-	87,000	108,000
Additional Assessment	27,150	-	0	0
Total Assessment	150,017	-	133,216	133,216
Expense				
Administrative				
Computer Maint. & Supplies	3,000	1,000	1,000	1,000
Contract Staff	73,000	73,000	72,000	72,000
Meetings, Travel & Membership	2,000	500	500	500
Mileage Reimbursement	1,500	0	0	
Office Consumables & Other	6,000	3,000	3,500	3,500
Office Equip. Maint. & Rental	1,000	500	500	500
Office Rental	3,500	3,500	4,000	4,000
Administrative Support	22,150	21,000	24,000	24,000
Legal	10,000	0	1,000	1,000
Utilities	1,000	1,300	1,500	1,500
Total Administrative	123,150	103,800	108,000	108,000
Total Available	26,867		25,216	25,216
Dedicated Reserve	25,000		25,000	25,000
Net Available	1,867		216	216

Monitoring and Management Plan Operations Budget
For Phase 2 Tasks to be Undertaken in 2008
(Updated October 10, 2007)

Task	Subtask	Sub-Subtask	Cost Description	CONSULTANTS & CONTRACTORS[3] MPWMD	MCWRA	Private Consultants	Contractors	Total
Labor								
			Technical Project Manager (TPM)*	$0	$0	$100,000	$0	$100,000
M.1 Program Administration								
	M.1.a		Project Budget and Controls	$0	$0	$2,000	$0	$2,000
	M.1.b		Assist with Board and TAC Agendas	$0	$0	$0	$0	$0
	M.1.c		Preparation and Attendance of Meetings	$0	$0	$4,000	$0	$4,000
	M.1.d		Prepare Board/ TAC Status Updates and Reports	$0	$0	$4,000	$0	$4,000
	M.1.e		Peer Review of Documents and Reports	$0	$0	$2,000	$0	$2,000
I.1 Monitor Well Construction (Task Completed in Phase 1)				$0	$0	$0		$0
I.2 Production, Water Level and Quality Monitoring								
	I. 2. a.		Conduct ongoing data entry/ database maintenance	$2,000	$1,000	$9,000	$0	$12,000
	I. 2. b.		Data Collection Program Enhancements					
		I. 2. b. 1.	Site Representation and Selection	$1,600	$0	$2,000	$0	$3,600
		I. 2. b. 2.	Collect Monthly Water Levels[6]	$3,400	$0	$0	$0	$3,400
		I. 2. b. 3.	Collect Quarterly Water Quality Samples[1](5)	$52,000	$0	$0	$26,000	$78,000
		I. 2. b. 4.	Update Program Schedule and Standard Operating Procedures.	$1,000	$1,000	$1,000		$3,000
	I. 2. c.		Reports	$5,700	$500	$1,000		$7,200
I.3 Basin Management								
	I. 3. a.		Enhanced Seaside Basin Groundwater Model	$0	$0	$0		$0
	I. 3. b.		Prepare Basin Management and Action Plan	$5,000	$1,000	$100,000		$106,000
		I. 3. b. 1	Supplemental Water Supplies	(Costs Included Under I.3.b)				
		I. 3. b. 2	Pumping Redistribution Strategies	(Costs Included Under I.3.b)				
		I. 3. b. 3	Basin Capacity and Yield Analyses	(Costs Included Under I.3.b)				
	I. 3. c.		Plan Preparation	(Costs Included Under I.3.b)				
I.4 Seawater Intrusion Contingency Plan								
	I. 4. a.		Oversight of Seawater Intrusion Detection and Tracking	$3,000	$3,000	$35,000	$0	$41,000
	I. 4. b.		Analyze and Map Water Quality from Coastal Monitoring Wells	(Costs Included Under I.4.a)				
	I. 4. c.		Annual Report- Seawater Intrusion Analysis	(Costs Included Under I.4.a)				
	I. 4. d.		Prepare Response Plan[2]	$3,000	$1,000	$5,000	$0	$9,000
			TOTALS CONSULTANTS & CONTRACTORS	$76,700	$7,500	$265,000	$26,000	
							SUBTOTAL not including *TPM =	$275,200
							Contingency not including *TPM @ 20%[4]=	$55,040
							*TPM	$100,000
							TOTAL=	**$430,240**

Footnotes:

(1) An outside contractor would be used to perform the induction logging, and potentially to also collect some water quality samples in conjunction with doing the induction logging. MPWMD is expected to perform portions of the work of this Subtask, and would likely be the party that contracts with the Contractor to perform the induction logging and sample collection work on certain of the wells.

(2) The reponse plan would only be implemented in the event sea water intrusion is determined to be occurring.

(3) Within the context of this document the term "Consultant" refers either to a Private Consultant providing professional engineering or other types of technical services, or to the Monterey Peninsula Water Management District (MPWMD), or to the Monterey County Water Resources Agency (MCWRA). The term "Contractor" refers to a firm providing construction or field services such as well drilling or induction logging.

(4) Due to the uncertainties of the exact scopes of some of the Tasks listed above at the time of preparation of this Budget, e.g. Tasks I.3.b and I.4.a, it is recommended that a 20% Contingency be included in the Budget.

(5) Includes an additional 10 wells to be monitored as recommended in the Enhanced Monitoring Well Network Evaluation, and approximately $20,000 in potential well site retrofitting costs that may be necessary in order to make some of these wells available for use as monitoring wells.

(6) MPWMD's costs for this Subtask had initially included $10,000 for the one-time purchase and installation of data-loggers for the four new Sentinel Wells, as recommended in Mr. Feeney's Report. However, at the 10-9-07 TAC meeting it was found that Mr. Feeney's 2007 contract will have sufficient unused funds in it to perform this work (through a contract amendment), and the TAC felt this was a preferable approach, so the $10,000 was removed from this line item in MPWMD's budget, on the assumption that the work will be done in 2007 under Mr. Feeney's contract.

Seaside Groundwater Basin Watermaster
Proposed Budgets
Monitoring and Management—Capital Fund
Fiscal Years 2008 and 2009

Fiscal Year (January 1, 2008 through December 31, 2008)

No Capital projects or expenditures are anticipated to be necessary in FY 2008

Fiscal Year (January 1, 2009 through December 31, 2009)

The Capital projects and expenditures that may be necessary in FY 2009 are:

"Possible need to install two additional monitoring wells at an estimated cost of $200,000 Each (including consultant costs and well contractor costs), for a total well construction cost of $400,000."

Seaside Groundwater Basin Watermaster

Proposed Budgets

Replenishment Fund

Fiscal Years 2008 and 2009

Fiscal Year (January 1, 2008 through December 31, 2008)

Total Estimated Assessments	$1,000,000
Total Estimated Appropriations	0
Total Estimated Assessment Available	$1,000,000

Fiscal Year (January 1, 2009 through December 31, 2009)

Total Estimated Assessments	$1,000,000
Total Estimated Appropriations	0
Total Estimated Assessment Available	$1,000,000

ATTACHMENT 6

WATER QUALITY ANALYTICAL RESULTS

MONTEREY PENINSULA
WATER MANAGEMENT DISTRICT

5 HARRIS COURT, BLDG. G
POST OFFICE BOX 85
MONTEREY, CA 93942-0085 • (831) 658-5600
FAX (831) 644-9560 • http://www.mpwmd.dst.ca.us

SEASIDE BASIN WATERMASTER MEMORANDUM 2007-01

Date:	**February 2, 2007**
To:	**Seaside Basin Watermaster**
From:	**Joe Oliver, PG, CHg, Senior Hydrogeologist** **Tom Lindberg, Associate Hydrologist**
Subject:	**Results of Ground Water Quality Samples Collected in Fall 2006 from MWPMD Coastal Monitor Wells in and Near the Seaside Ground Water Basin**

Summary

This memorandum transmits and summarizes ground water quality data collected in Fall 2006 by the Monterey Peninsula Water Management District (MPWMD) from its network of coastal monitor wells in and near the Seaside Ground Water Basin. This information is being provided to the Seaside Basin Watermaster Board for information purposes, and is in compliance with the monitoring protocols described in the Watermaster's *Seaside Basin Monitoring and Management Program* (revised September 5, 2006), which was prepared in response to the March 27, 2006 court decision in the Seaside Basin adjudication case. The chemical data from the Fall 2006 sampling of MPWMD's existing monitor well network do not indicate evidence of seawater intrusion at the locations monitored in and near the coastal area of the Seaside Basin.

MPWMD Seaside Basin Coastal Monitor Well Network

The MPWMD initiated a ground water quality monitoring program in the coastal portion of the Seaside Basin in 1990, and the network has been expanded since that time. The water quality data collected from the monitor wells are utilized for the purposes of: (1) characterizing the chemical nature of the ground water, (2) establishing long-term ground water quality trends, and (3) monitoring of seawater intrusion potential into the Seaside Basin. The chemical data reported herein provide information about present water quality conditions in the coastal portion of the basin, and serve as background water quality data for comparison in future studies. Currently, the MPWMD collects water quality data annually from 12 monitor wells at 6 separate sites, as shown on **Figure 1**. At each site, a "shallow" and "deep" monitor well have been installed (either in separate boreholes or as multiple completions in a single borehole), generally corresponding to well completions within the two principal aquifer units in the Seaside Basin, known as the Paso Robles Formation (QTp) and Santa Margarita Sandstone (Tsm), respectively. The Pliocene/Pleistocene-Age QTp is a continental formation comprised of a fluvial mix of clay, silt, sand and gravel, deposited as ancestral valley fill sediments. The Miocene-Age Tsm is a marine and brackish-marine, fine- to coarse-grained arkosic sandstone, which overlies the shales of the Monterey Formation. The monitor wells are constructed of 2-inch PVC casing, with screens isolated in sand "packages" within each aquifer unit. The aquifer units are separated from each other in the wells by cement strata isolation seals. A summary of the monitor well completion data is provided in **Table 1**.

Water Sample Collection

Water sample collection is accomplished by "air-lift" pumping. The method utilizes a 3/4-inch PVC dedicated airline in the well, which is coupled to an air compressor. The wellhead configuration is fashioned after that shown in **Figure 2**. Due to the small diameter of the monitor wells, the well casing is used as the "eductor" pipe, rather than a separate eductor pipe inside the well. Through experience, it has been determined that acceptable pumping results can be achieved if the bottom of the airline is placed at a depth that gives approximately 50 percent pumping submergence (i.e., the ratio of the length of the airline below the pumping water level to the total length of the airline). The air-lift method can be inappropriate for certain water quality constituents due to chemistry changes brought about by air entrainment in the purged water; however, it is considered appropriate for the suite of inorganic constituents that are currently analyzed from the collected samples.

The volume of water removed from each well prior to sampling is generally three casing volumes, consistent with standard sampling protocol. Sampling is supplemented by field measurement of several indicator parameters that are collected during pumping, which ensures that water quality has stabilized prior to sample collection. An example of the recordation of field data is provided on the field ground water sampling form in **Figure 3**. Once the samples are collected, they are taken to a State-certified laboratory for analysis.

Fall 2006 Water Quality Results

Water chemistry analytical results for the ground water samples collected from the MPWMD's existing coastal monitor wells on October 24 and 25, 2006, are provided in **Table 2**. Historical water chemistry analytical results from samples collected at each monitor well are provided in the tables in **Appendix A**. The chemical data from the depth intervals sampled at these monitor wells do not indicate evidence of present or past seawater intrusion at these locations in and near the coastal area of the Seaside Basin. This is most clearly expressed by review of graphs showing Specific Electrical Conductance (SEC) and Chloride (Cl^-) concentration for the period of record at each well, as shown on the long-term plots provided in **Figures 4, 5 and 6**, for the three sites that are closest to the coastline: PCA West, MSC, and FO-09. These two parameters were selected because identification of saline water intrusion is always associated with an increase in SEC (which is an indicator of Total Dissolved Solids concentration) and Cl^- concentration (which is the most-used tracer for seawater intrusion analysis). For all three graphs, the scales are similar to facilitate relative comparisons from each aquifer unit and well location. As shown in these figures, ground water sampled from the shallower QTp aquifer unit is generally less mineralized than the deeper Tsm aquifer unit, but water quality for both aquifer units is well below the typical seawater concentration of approximately 50,000 micromhos per centimeter for SEC, and 19,000 milligrams per liter for Cl^-. Most importantly, little overall change has occurred in terms of any trends in increasing SEC or Cl^- concentration in the zones monitored at these coastal locations. It should be noted that the data plots shown in **Figures 4, 5 and 6** do not include the first water quality sample results collected at each well after construction. These initial data were not included based upon the poor comparison of these early data with subsequent analyses. It has been our experience that even though each well undergoes rigorous development subsequent to construction and before initial sample collection, the results are not representative of the native aquifer chemistry, presumably due to the limited ability in these small-diameter monitor wells to completely flush residual drilling fluids in the vicinity of the borehole. Additional information regarding assessment of the ground water quality analytical results from the coastal monitor wells is available from the MPWMD.

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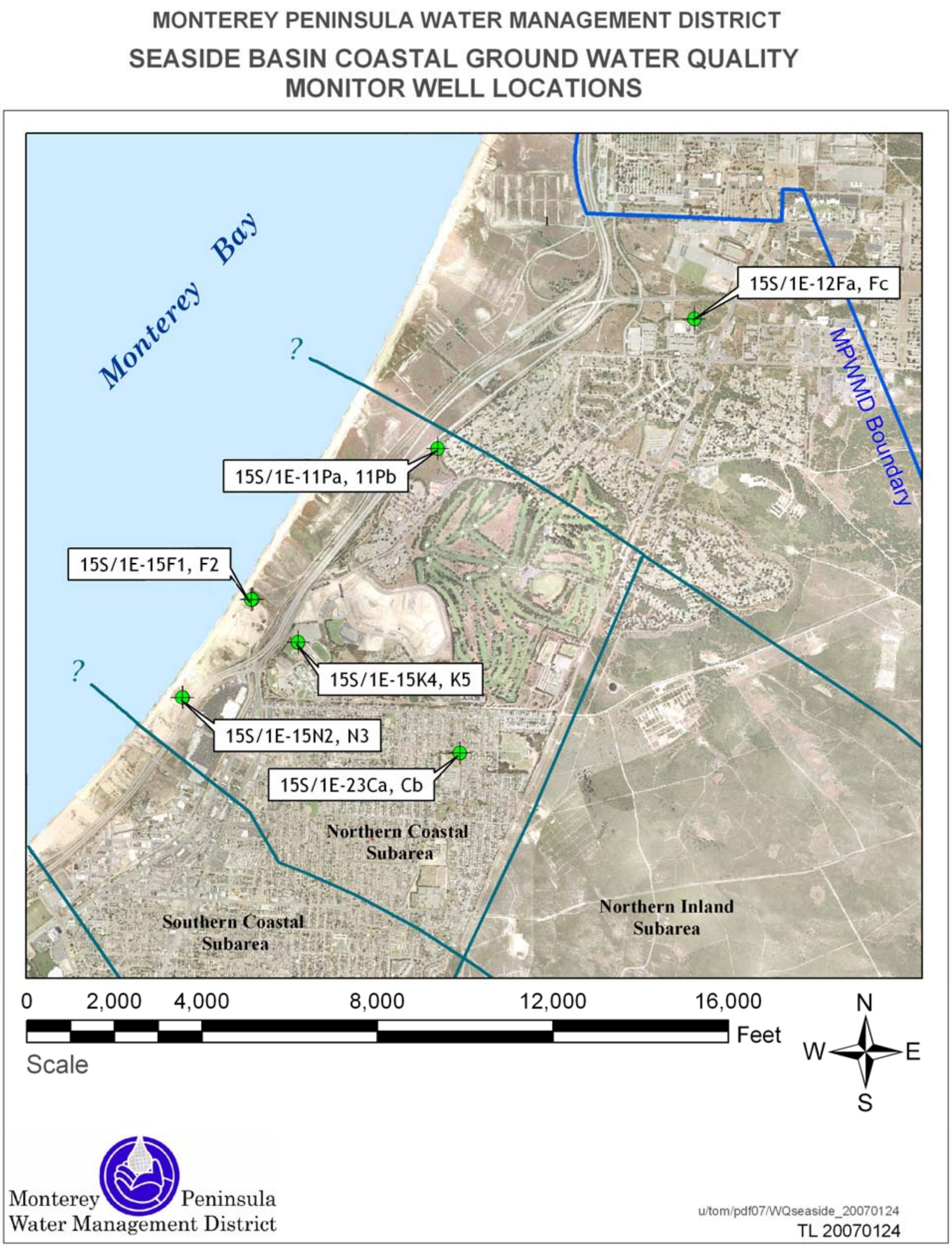

Figure 1. Seaside Basin Coastal Ground Water Quality Monitor Well Locations.

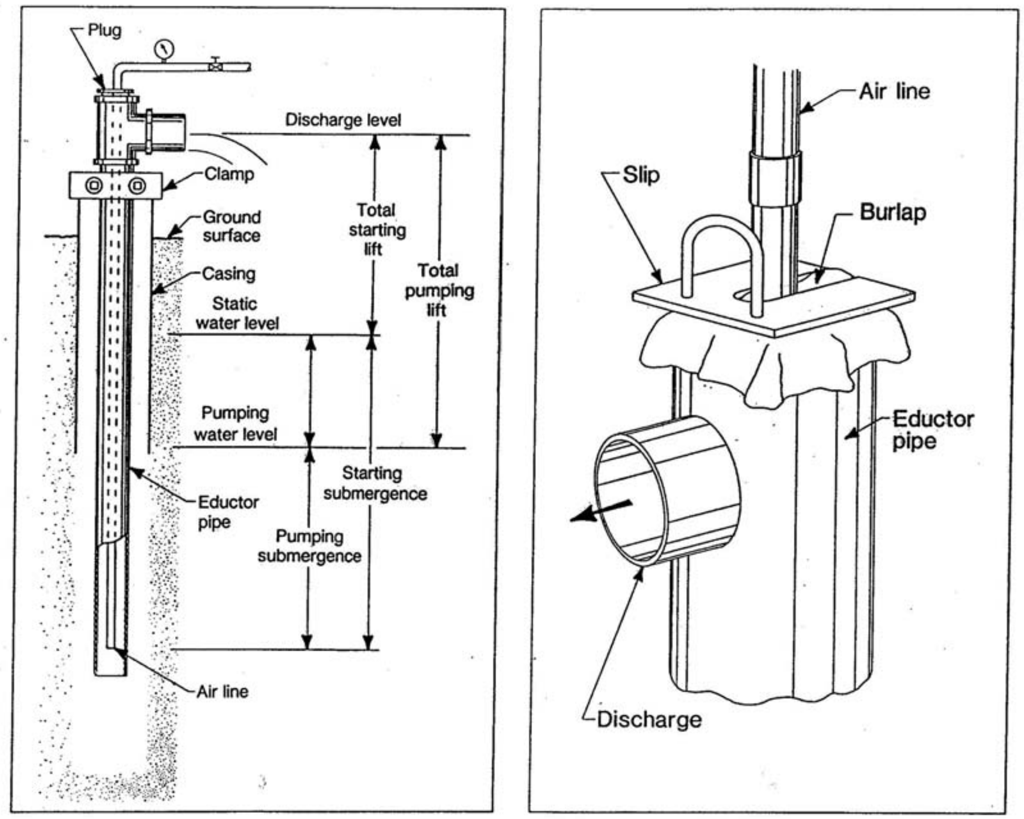

Figure 2. Diagrams iillustrating the airlift–pumping method for water sample collection (from Driscoll, 1986, Figure 15.10)

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

Recorded by Joe Ol. (Signature)

GROUND-WATER SAMPLING FORM

Well No. PCA East - Deep 15S/1E-15K4

Well Type: ☑ Monitor ☐ Extraction ☐ Other

Well Material: ☑ PVC ☐ St. Steel ☐ Other

Date 10/24/2006 Time 1310 hr

Sampled by JWO, TLL, TTC (Initials)

WELL PURGING

PURGE VOLUME

Casing Diameter (D in inches):

☑ 2-inch ☐ 4-inch ☐ 6-inch ☐ Other

Total Depth of Casing (TD in feet BTOC): 710

Water Level Depth (WL in feet BTOC): 89.95

Number of Well Volumes to be purged (# Vols)

☑ 3 ☐ 4 ☐ 5 ☐ 10 ☐ Other

PURGE VOLUME CALCULATION

(710 TD (feet) − 90 WL (feet)) X 2² D (inches) X 3 # Vols X 0.0408 = 304 Calculated Purge Volume gallons

PURGE METHOD

☐ Bailer - Type:

☐ Submersible ☐ Centrifugal ☐ Bladder; Pump No.:

☑ Other - Type: air lift - 185 H Sullair compressor

PUMP INTAKE SETTING

☐ Near Bottom ☐ Near Top ☑ Other bottom of airline

Depth in feet (BTOC): Screen Interval in feet (BTOC): from 650 to 700

PURGE TIME

1320 Start 1411 Stop 51 Elapsed

PURGE RATE

Initial 6+ gpm Final 6+ gpm

ACTUAL PURGE VOLUME

306+. gallons

FIELD PARAMETER MEASUREMENT

Minutes Since Pumping Began		pH	Cond. (µmhos/cm)	T ☐°C ☑°F	Other #gal	
1321	1	—	651	66	clr	6
1335	15		614	72	"	90
1345	25		577	74	"	150
1400	40		710	76	"	240
1411	51		714	76	"	306

Minutes Since Pumping Began	pH	Cond. (µmhos/cm)	T ☐°C ☐°F	Other
Meter Nos.				

Observations During Purging (Well Condition, Turbidity, Color, Odor): slight H_2S odor after 90 gal pumped.

Discharge Water Disposal: ☐ Sanitary Sewer ☐ Storm Sewer ☑ Other directed to swale away from wellhead.

WELL SAMPLING

SAMPLING METHOD

☐ Bailer - Type:

☐ Submersible ☐ Centrifugal ☐ Bladder; Pump No.:

☑ Same As Above

☐ Grab - Type:

☐ Other - Type:

SAMPLE DISTRIBUTION Sample Series:

Sample No.	Volume/Cont.	Analysis Requested	Preservatives	Lab	Comments
— see chain-of-custody record sheet —					

QUALITY CONTROL SAMPLES

Duplicate Samples		Blank Samples		Other Samples	
Original Sample No.	Duplicate Sample No.	Type	Sample No.	Type	Sample No.

Figure 3. Example Ground Water Data Collection Form, Fall 2006 Water Quality Sampling.

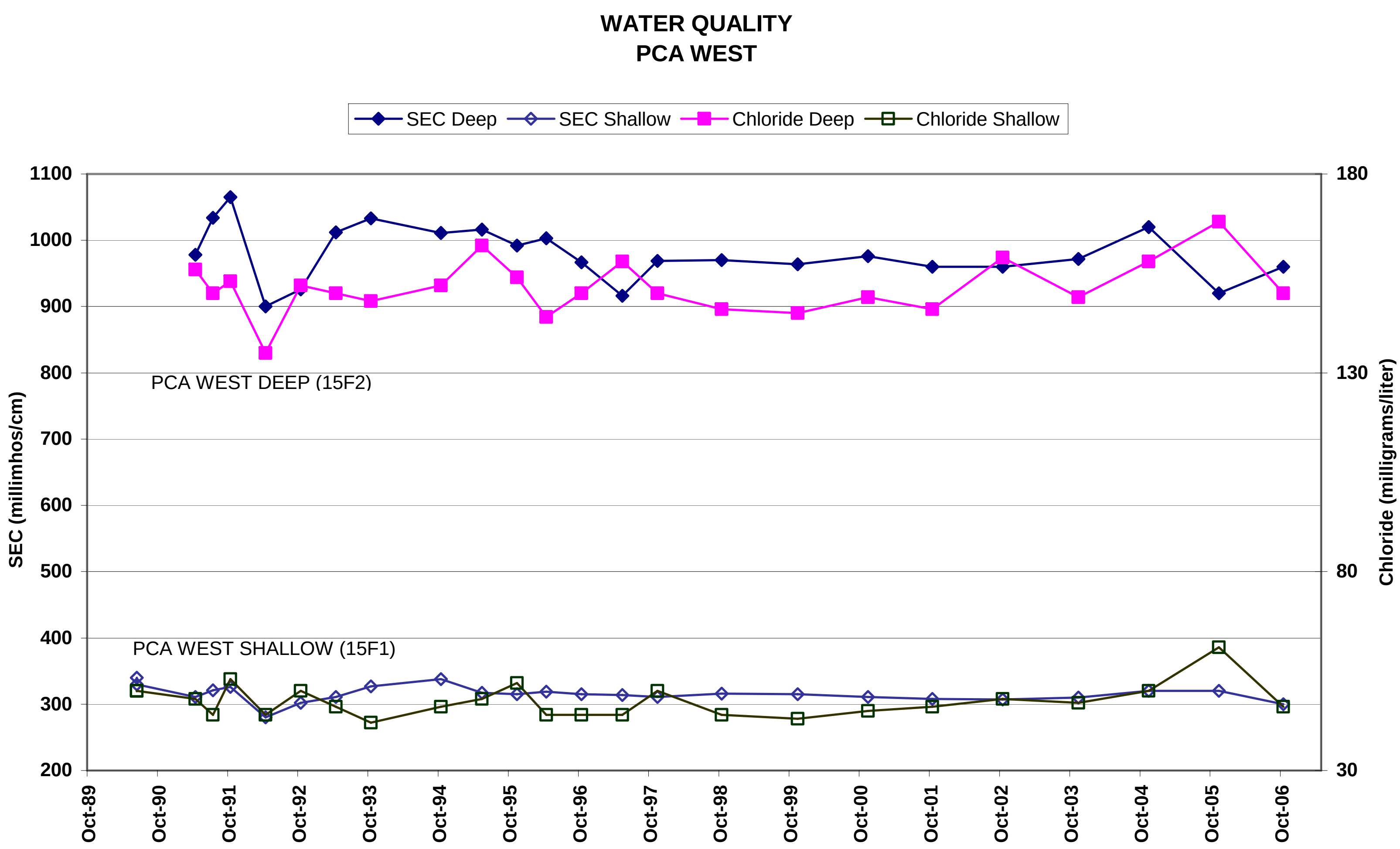

Figure 4. MPWMD PCA West Monitor Well Site: Historical Specific Electrical Conductance and Chloride Concentration.

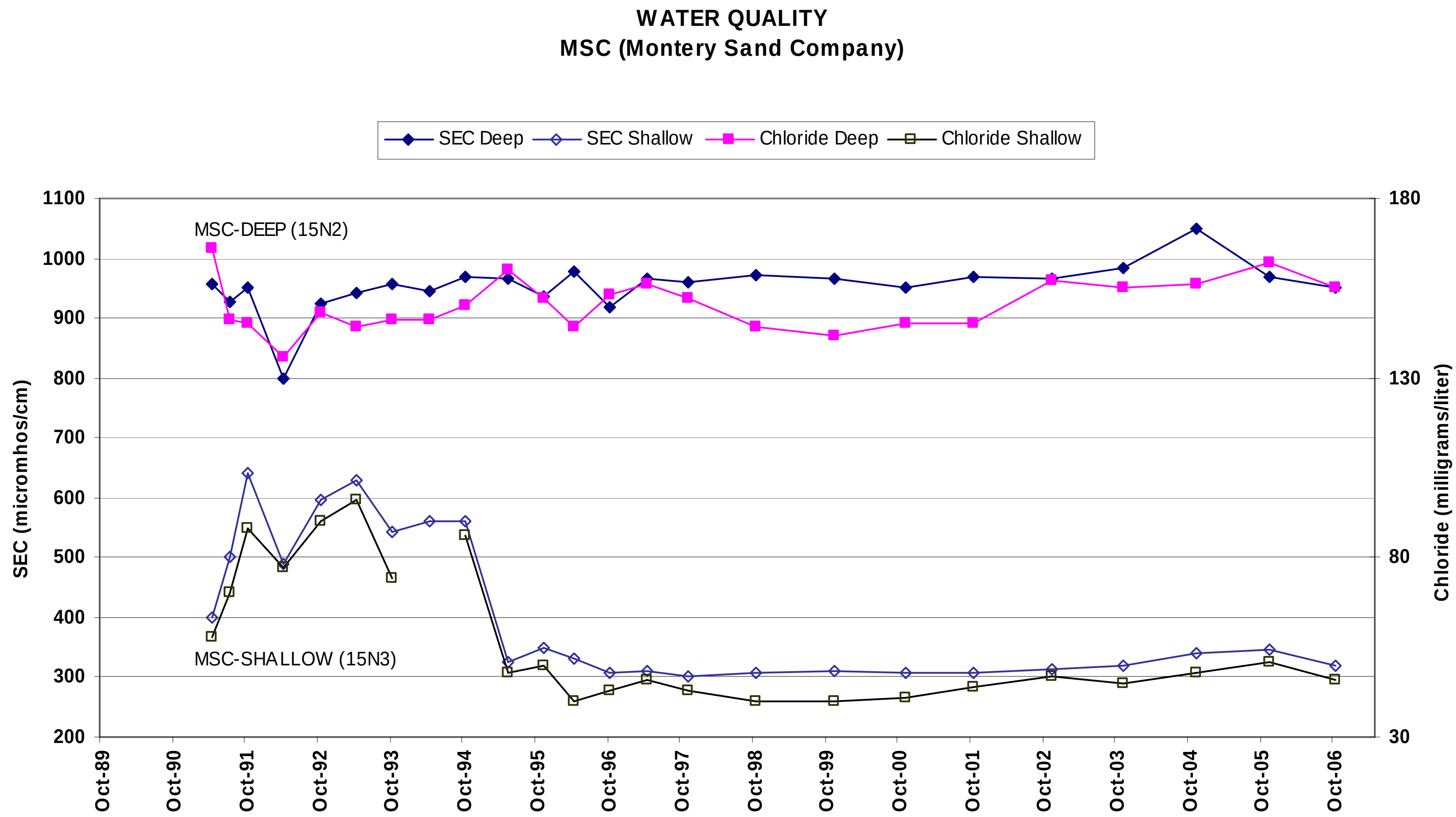

Figure 5. MPWMD MSC Monitor Well Site: Historical Specific Electrical Conductance and Chloride Concentration.

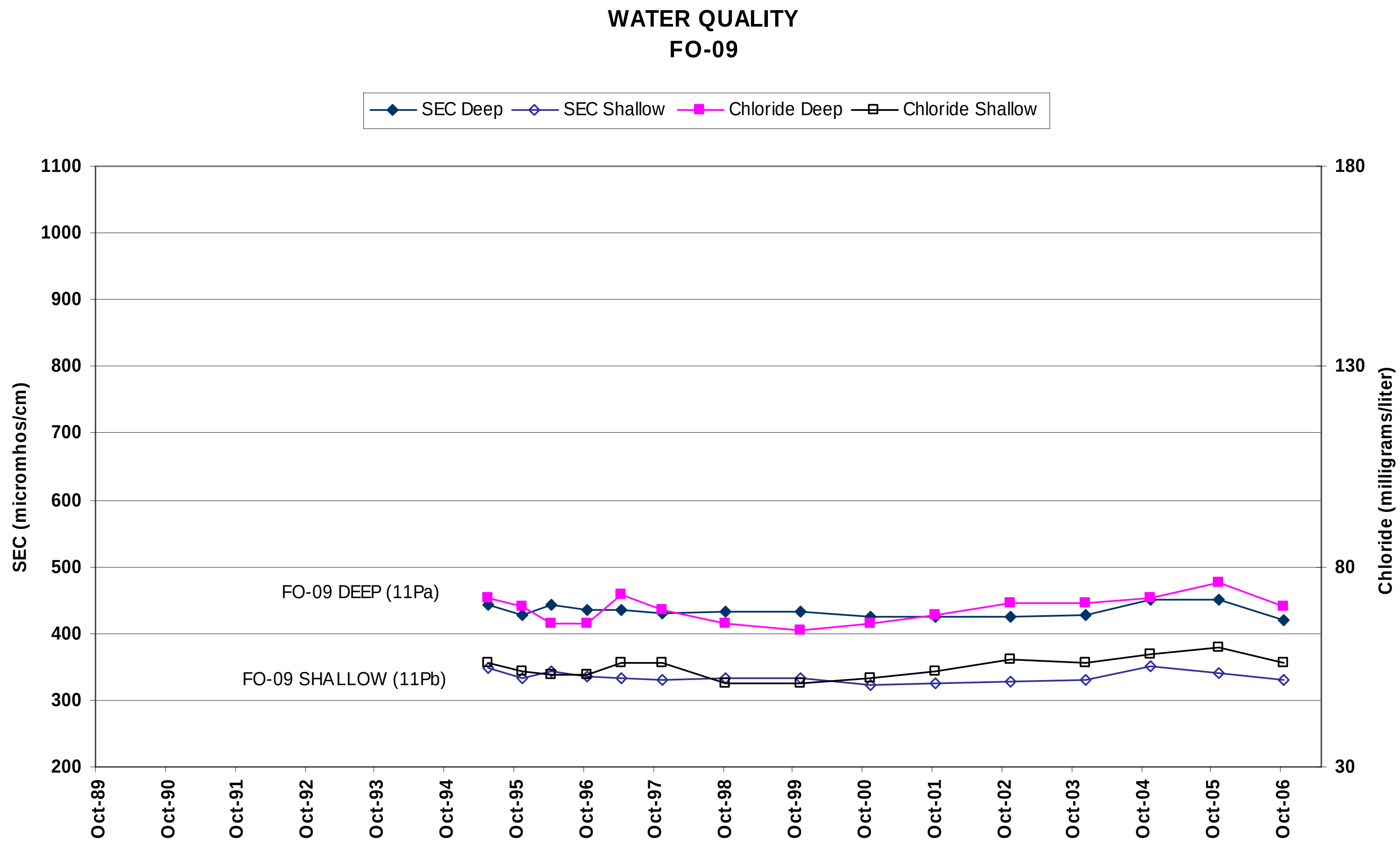

Figure 6. MPWMD FO-09 Monitor Well Site: Historical Specific Electrical Conductance and Chloride Concentration.

Table 1.

SUMMARY OF MPWMD COASTAL SEASIDE BASIN GROUND WATER QUALITY MONITOR WELLS													
Site	Well Name	Location Description	Well Number	Date Drilled	DWR Drillers Log	Hole Depth (feet)	Well Depth (feet)	Screened Interval (feet)	Strata Seal (feet)	Casing Type	Geologic Unit	E-Log	Elevation (feet AMSL)
MSC		***former MSC mine north of Playa Ave. and west of Hwy. 1***											
	MSC-Shallow	approx. 10' S of north property line	15S/1E-15N3	5/25/1990	338413	720	695	490 - - 680	95 - 275	2" pvc	QTp	- - -	80.58 (s1)
	MSC-Deep	approx. 7' E of MSC-Shallow	15S/1E-15N2	5/25/1990	338425	920	865	810 - 850	725 - 775	2" pvc	Tsm	yes	80.78 (s1)
PCA WEST		***former PCA mine W of Hwy. 1***											
	PCA-W Shallow	approx. 200' SE of ocean bluff	15S/1E-15F1	3/28/1990	338400	600	585	525 - 575	120 - 150	2"pvc	QTp	- - -	64.64 (s1)
	PCA-W Deep	approx. 50' E of PCA-W Shallow	15S/1E-15F2	3/90	338401	900	885	825 - 875	760 - 790	2" pvc	Tsm	yes	65.60 (s1)
PCA EAST		***vacant lot NE of Seaside High baseball field***											
	PCA-E Shallow	approx. 300' E Monterey Rd, 50" N fence	15S/1E-15K5	4/16/1990	338402	863	410	350 - 400	110 - 150	2" pvc	QTp	- - -	69.31 (s1)
	PCA-E Deep	(same borehole as shallow well)	15S/1E-15K4	4/16/1990	338402	863	710	650 - 700	580 - 620	2" pvc	Tsm	yes	69.31 (s1)
ORD TERRACE		***Ord Terrace School property south of Ord Grove Ave.***											
	OT-Shallow	1700 block Ord Grove Ave.	15S/1E-23Ca	8/5/1999	- - -	530	340	280 - 330	0 - 260	2" pvc	upper Tsm	- - -	230 (e)
	OT-Deep	(same borehole as shallow well)	15S/1E-23Cb	8/5/1999	- - -	530	450	390 - 440	350 - 377	2" pvc	lower Tsm	yes	230 (e)
MPWMD #FO-09		***E of Hwy.1, SE of Okinawa Rd.***											
	#9-Shallow	50' east of utility service rd.	15S/1E-11Pa	8/16/1994	- - -	1,110	660	610 - 650	500 - 540	2" pvc	QTp	- - -	119.11 (s2)
	#9-Deep	(same borehole as shallow well)	15S/1E-11Pb	8/16/1994	- - -	1,110	840	790 - 830	700 - 765	2" pvc	Tsm	yes	119.15 (s2)
MPWMD #FO-10		***south of Light Fighter Drive, behind Barker Theater Building***											
	#10-Shallow	20' north of access road curb	15S/1E-12Fa	9/3/1996	- - -	1,500	650	620 - 640	480 - 500	2" pvc	QTp	- - -	201.19 (s2)
	#10-Deep	(same borehole as shallow well)	15S/1E-12Fc	9/3/1996	- - -	1,500	1,420	1380 - 1410	1280 - 1300	2" pvc	Tsm (?)	yes	201.10 (s2)

NOTES:
1. Official State well numbers end with a numeral; unofficial MPWMD well numbers end with a small case letter.
2. Geologic Unit refers to the unit adjacent to the screened interval: QTp = Paso Robles Formation; Tsm = Santa Margarita Sandstone.
3. Elevation refers to the reference point elevation: (s1) = surveyed by Land Data Services (1990 and 1992); (s2) = surveyed by Sandis Humber Jones (1995); (e) = altimeter estimate.
4. Well completion data at site MSC are documented in "Installation of Monitoring Well Cluster, Monterey Sand Company", Staal, Gardner & Dunne, Inc. (SGD), July 1990.
5. Well completion data at sites PCA West and PCA East are documented in "Hydrogeologic Investigation, PCA Well Aquifer Test", SGD, July 1990.
6. Well completion data at site MPWMD FO-09 are documented in "Summary of 1994 Fort Ord Monitor Well Installations", MPWMD Tech. Mem. 94-07.
7. Well completion data at site MPWMD FO-10 are documented in "Summary of 1996 Seaside Basin Monitor Well Installations", MPWMD Tech. Mem. 97-04.
8. Two dashes (i.e., "- -") indicate multiple screened intervals.
9. Three dashes (i.e., "- - -") indicate not applicable or not available.

Table 2.

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

Seaside Basin Sample Collection Date: October 24 and October 25, 2006

Units are milligrams per liter unless otherwise noted.

Water Quality Constituent	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH	Chloride	Sulfate	Ammonia Nitrogen (as NH3)	Nitrate Nitrogen (as NO3)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophosphate	Boron
Drinking Water Standard (1)	900 1600 2200 (2)	NA	NA	250 500 600 (2)	250 500 600 (2)	NA	45	NA	NA	NA	NA	NA	0.3	0.05	NA	NA
Sampling Location																
15S/1E-15N3 (shal)	320	72	7.8	46	17	0.06	<1	<0.20	17	39	4.8	3.8	<0.10	<0.0005	0.04	0.39
15S/1E-15N2 (deep)	950	240	8.2	155	45	0.09	<1	<0.20	73	105	16	5.0	<0.10	0.051	<0.03	0.29
15S/1E-23Ca (shal)	800	212	8.3	106	37	<0.05	6	0.35	68	79	17	4.4	1.080	0.077	<0.03	0.29
15S/1E-23Cb (deep)	1280	318	8.2	181	89	0.47	<1	0.84	107	132	26	7.1	0.169	0.026	<0.03	0.58
15S/1E-15F1 (shal)	300	68	7.8	46	10	<0.05	4	<0.20	19	33	5.6	2.5	<0.10	<0.0005	<0.03	0.32
15S/1E-15F2 (deep)	960	246	7.7	150	42	0.08	<1	0.27	77	109	18	5.4	0.541	0.085	<0.03	0.34
15S/1E-15K5 (shal)	330	68	7.9	50	10	<0.05	3	<0.20	20	39	6.2	2.9	2.390	0.068	<0.03	0.28
15S/1E-15K4 (deep)	790	208	8.2	109	35	<0.05	<1	<0.20	57	93	12	4.2	0.216	0.092	<0.03	0.33
15S/1E-11Pa (shal)	330	64	7.8	56	12	<0.05	<1	0.42	22	34	4.5	4.1	<0.10	<0.0005	0.04	0.28
15S/1E-11Pb (deep)	420	92	7.9	70	14	<0.05	<1	0.31	26	53	3.7	3.7	<0.10	<0.0005	<0.03	0.31
15S/1E-12Fa (shal)	350	76	7.9	53	19	<0.05	<1	<0.20	22	40	5.7	2.2	<0.10	<0.0005	<0.03	0.23
15S/1E-12Fc (deep)	360	78	7.8	55	17	<0.05	<1	<0.20	22	40	5.5	2.8	<0.10	0.034	<0.03	0.32

NOTES:

(1) Maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

(2) The three values listed for certain constituents refer to the "recommended" level, the "upper" level, and "short-term use" level, respectively.

SEASIDE BASIN WATERMASTER
MEMORANDUM 2007-01

APPENDIX A

Historical Ground Water Quality Monitoring Results
Seaside Coastal Monitor Wells

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

WELL NO.: T15S/R1E-15N2 WELL NAME: MSC - Deep

Units are milligrams per liter unless otherwise noted.

Date	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH (pH units)	Chloride	Sulfate	Ammonia Nitrogen (as NO3)	Nitrate Nitrogen (as NO3)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate	Boron
DWS [1]	900 1600 2200 [2]	NA	NA	250 500 600	250 500 600	NA	45	NA	NA	NA	NA	NA	0.3	0.05	NA	NA
5/31/1990	2500	488	7.3	420	371		<0.4		179	260	84		<0.05	<0.02		
4/26/1991	958	180	7.8	166	58	<0.5	0.5	2.6	58	121	9.4	5.9				
7/24/1991	928	186	7.9	146					55	112	10	5.6	<0.10	<0.03		
10/23/1991	952	200	7.5	145					57	116						
4/28/1992	800	216	7.2	136	40				70	116	12	5.2	<0.03			
6/3/1992				122	46		1.4		64	98	13	4.7	<0.01			
10/20/1992	925	216	8.4	148	46	<0.10	<0.05	0.4	69	112	11	5.0	<0.10	0.07		
4/28/1993	943	212	8.3	144	42	<0.10	<0.05	0.5	59	110	12	5.1	<0.10	<0.05		
10/28/1993	957	186	8.2	146	34	<0.01	<1.0	0.3	54	108	11	4.9	<0.10	0.09		
4/29/1994	944	150	8.2	146	38	<0.05	<1.0	1.7	66	121	13	5.1	<0.10	<0.03		
10/28/1994	968	218	8.2	150	70	<0.05	<1.0	0.4	70	109	12	5.0	<0.01	0.05		
5/3/1995	966	210	8.4	160	40	0.13	<1.0	0.8	70	112	12	4.7	<0.01	0.05		
11/30/1995	935	202	8.3	152	38	0.12	<1.0	1.3	62	105	13	4.9	<0.10	0.08	<0.03	
4/25/1996	978	219	7.8	144	45	<0.05	<1.0	0.7	62	107	14	4.8	<0.10	0.07	<0.03	
10/11/1996	917	205	7.8	153	43	0.28	1.0	1.5	57	109	13	5.1	<0.10	0.08	0.04	
4/24/1997	965	229	8.0	156	43	0.13	<1	0.4	54	107	13	4.9	<0.1	<0.03	<0.03	
11/19/1997	960	234	7.6	152	47	0.14	<1	1.3	72	104	16	4.9	<0.1	0.09	<0.03	
10/27/1998	972	234	7.8	144	42	0.08	<1	<0.2	73	112	15	5.2	<0.1	0.08	<0.03	
11/2/1999	967	236	8.4	142	42	0.11	<1	na	69	103	15	4.8	<0.1	0.06	<0.03	
11/1/2000	950	219	7.9	145	41	0.16	<1	1.0	75	105	15	4.7	<0.1	0.07	0.22	
10/26/2001	968	238	8.4	145	43	<0.05	<1	0.4	86	103	15	4.7	0.03	0.07	<0.03	
11/1/2002	965	238	8.3	157	45	0.10	<1	0.7	69	100	15	3.7	<0.1	0.07	<0.03	
11/6/2003	985	242	7.7	155	43	0.10	<1	0.5	75	103	14	4.8	0.13	0.05	<0.03	
11/8/2004	1050	221	7.9	156	45	0.15	<1	0.5	73	106	15	4.4	0.11	0.072	<0.03	0.28
11/2/2005	970	252	8.0	162	43	0.13	<1	0.5	76	111	15	4.6	<0.05	0.054	<0.03	0.51
10/25/2006	950	240	8.2	155	45	0.09	<1	<0.2	73	105	16	5.0	<0.10	0.051	<0.03	0.29

NOTES:

1 DWS = Drinking Water Standard; maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

2 The three values for each constituent refer to the "recommended" level, the "upper" level and the "short-term use" level, respectively.

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

WELL NO.: T15S/R1E-15N3 WELL NAME: MSC - Shallow

Units are milligrams per liter unless otherwise noted.

Date	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH (pH units)	Chloride	Sulfate	Ammonia Nitrogen (as NO3)	Nitrate Nitrogen (as NO3)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate	Boron
DWS [1]	900 1600 2200 [2]	NA	NA	250 500 600	250 500 600	NA	45	NA	NA	NA	NA	NA	0.3	0.05	NA	NA
5/31/1990	1190	96	7.2	210	271		<0.4		34	138	62	7.8	<0.05	<0.02		
4/26/1991	400	97	7.9	58	22	<0.5	0.5	0.3	25	44	6.8	3.7				
7/24/1991	500	108	8.0	70					31	55	8.0	4.5	<0.10	<0.03		
10/23/1991	642	146	7.7	88					36	74						
4/27/1992	490	130	7.4	77	23		1.0		36	68	9.2	5.5	<0.01			
6/4/1992									40	77	10.4	6.2	<0.01			
10/20/1992	595	140	8.4	90	57	<0.10	<0.5	0.2	37	72	9.0	5.6	<0.1	<0.05		
4/28/1993	630	150	8.3	96	26	<0.10	<0.5	0.1	37	74	10.0	5.8	<0.1	<0.05		
10/28/1993	542	118	8.1	74	29	<0.10	2.0	0.2	30	59	8.0	4.9	1.1	0.09		
4/29/1994	560	128	8.2	230	28	<0.05	2.0	0.1	33	65	9.0	5.3	0.8	0.04		
10/28/1994	560	128	8.2	86	28	<0.05	2.0	0.2	36	68	9.0	5.2	0.4	0.04		
5/3/1995	325	66	8.3	48	10	<0.05	2.0	0.3	21	35	5.0	2.7	0.24	<0.03		
11/30/1995	350	78	7.7	50	14	<0.05	1.0	1.0	18	39	6.0	3.3	0.40	0.08	0.03	
4/25/1996	331	65	7.1	40	21	<0.05	1.0	1.1	16	39	5.0	3.1	0.19	0.07	0.03	
10/11/1996	306	61	7.8	43	19	<0.05	1.0	0.4	15	38	4.0	3.1	0.10	<0.03	0.11	
4/24/1997	311	63	8.0	46	14	<0.05	2.0	0.2	17	34	5.0	2.9	0.20	<0.03	<0.03	
11/19/1997	301	64	7.9	43	17	<0.05	<1	0.3	18	33	53	2.9	0.21	<0.03	<0.03	
10/27/1998	306	64	7.7	40	18	<0.05	<1	<0.2	17	36	5.0	3.5	<0.1	<0.03	0.03	
11/2/1999	309	63	8.1	40	17	0.07	<1	na	16	35	5.0	3.3	<0.1	<0.03	<0.03	
11/1/2000	308	64	8.0	41	16	0.11	<1	<0.2	16	36	5.0	3.4	<0.1	<0.03	0.24	
10/26/2001	308	66	8.1	44	17	0.06	<1	<0.2	21	37	4.0	3.8	0.05	<0.03	<0.03	
11/1/2002	313	70	8.0	47	18	0.08	<1	0.3	16	35	5.0	2.5	<0.1	<0.03	<0.03	
11/6/2003	318	66	7.2	45	17	0.10	<1	0.5	17	36	4.6	3.3	<0.05	<0.0005	0.03	
11/8/2004	340	71	7.9	48	18	0.11	<1	<0.2	17	36	4.0	3.1	<0.05	<0.0005	<0.03	0.21
11/2/2005	345	74	7.9	51	18	0.09	<1	<0.2	17	40	4.6	3.5	<0.05	<0.0005	0.04	0.32
10/25/2006	320	72	7.8	46	17	0.06	<1	<0.2	17	39	4.8	3.8	<0.10	<0.0005	0.04	0.39

NOTES:

1 DWS = Drinking Water Standard; maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

2 The three values for each constituent refer to the "recommended" level, the "upper" level and the "short-term use" level, respectively.

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

WELL NO.: T15S/R1E-15F2 WELL NAME: PCA West - Deep

Units are milligrams per liter unless otherwise noted.

Date	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH (pH units)	Chloride	Sulfate	Ammonia Nitrogen (as NO3)	Nitrate Nitrogen (as NO3)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate	Boron
DWS [1]	900 1600 2200 [2]	NA	NA	250 500 600	250 500 600	NA	45	NA	NA	NA	NA	NA	0.3	0.05	NA	NA
4/26/1990	1080	200	7.2	144	214		<0.40		51	81	64	24.0	0.08	0.06		
4/26/1991	978	236	7.7	156	60	<0.5	1.3	1.2	63	114	17	6.8				
7/24/1991	1034	244	7.9	150					57	110	18	6.7	<0.10	<0.03		
10/21/1991	1065	252	7.9	153					68	114						
4/29/1992	900	247	7.5	135	38		0.5		76	117	18	5.9				
6/2/1992									73	113	18	6.1	<0.01			
10/20/1992	926	204	8.1	152	68	<0.1	<0.5	0.6	66	113	17	5.9	<0.1	<0.05		
4/28/1993	1012	238	8.0	150	42	<0.1	<0.5	0.6	64	108	19	6.0	<0.1	<0.05		
10/28/1993	1033	202	7.8	148	41	<0.1	<1.0	0.3	65	108	17	5.5	0.2	0.07		
10/28/1994	1011	238	7.9	152	71	<0.05	<1	0.5	72	107	17	5.6	0.8	0.11		
5/3/1995	1016	186	7.9	162	44	0.12	<1	0.4	73	112	18	5.3	0.98	0.14		
11/30/1995	992	228	8.0	154	42	0.10	<1	0.6	68	102	18	5.4	0.40	0.10	0.05	
4/25/1996	1003	247	7.8	144	46	<0.05	<1	1.0	66	107	18	5.3	0.11	0.08	<0.03	
10/11/1996	967	232	7.6	150	39	0.08	<1	0.5	63	107	17	5.6	<0.10	0.07	0.34	
5/21/1997	916	251	6.9	158	42	<0.05	<1	0.5	64	109	17	5.4	0.20	0.06	0.04	
11/19/1997	969	256	7.7	150	46	0.10	<1	0.3	71	106	20	5.3	0.18	0.05	<0.03	
10/30/1998	970	237	7.7	146	42	0.06	<1	0.4	79	109	18	5.4	<0.1	0.08	<0.03	
11/2/1999	964	234	8.0	145	43	0.13	4	na	75	105	12	5.8	0.49	0.11	<0.03	
11/1/2000	976	241	7.9	149	43	0.09	<1	<0.2	76	103	18	5.1	<0.1	0.09	0.21	
10/25/2001	960	224	8.2	146	42	<0.05	<1	0.5	90	103	17	5.2	1.25	0.11	<0.03	
10/31/2002	960	252	7.9	159	44	0.12	<1	0.7	75	98	17	4.1	0.88	0.11	<0.03	
11/6/2003	972	242	7.8	149	43	0.14	<1	1.1	75	102	16	5.3	0.49	0.08	0.23	
11/9/2004	1020	266	7.9	158	44	0.10	<1	0.90	78	104	16	5.0	1.192	0.131	0.47	0.28
11/3/2005	920	240	7.9	168	43	0.11	<1	0.54	76	111	17	4.9	0.200	0.088	<0.03	0.41
10/24/2006	960	246	7.7	150	42	0.08	<1	0.27	77	109	18	5.4	0.541	0.085	<0.03	0.34

NOTES:

1 DWS = Drinking Water Standard; maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

2 The three values for each constituent refer to the "recommended" level, the "upper" level and the "short-term use" level, respectively.

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

WELL NO.: T15S/R1E-15F1 WELL NAME: PCA West - Shallow

Units are milligrams per liter unless otherwise noted.

Date	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH (pH units)	Chloride	Sulfate	Ammonia Nitrogen (as NO3)	Nitrate Nitrogen (as NO3)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate	Boron
DWS [1]	900 1600 2200 [2]	NA	NA	250 500 600	250 500 600	NA	45	NA	NA	NA	NA	NA	0.3	0.05	NA	NA
4/26/1990	340	28	7.3	68	57		4.0		19	16	23.0	7.7	<0.05	<0.01		
6/14/1990	340			50												
6/17/1990	330			50												
4/26/1991	311	68	7.8	48	21	>.5	4.0	>0.2	19	33	5.4	2.7				
7/24/1991	321	66	7.9	44					21	33	5.2	2.5	<0.10	<0.03		
10/21/1991	326	66	8.2	53					19	36						
4/29/1992	280	65	7.7	44	11		4.4		20	35	5.1	2.4	<0.01			
6/3/1992									20	35	5.2	2.3	<0.01			
10/20/1992	302	66	8.2	50	16	<0.10	4.6		20	36	5.0	2.3	<0.10	<0.05		
4/28/1993	311	68	8.2	46	13	<0.10	4.6	0.3	19	34	5.0	2.2	<0.10	<0.05		
10/28/1993	327	64	8.2	42	20	<0.10	6.0	0.2	19	32	5.0	2.3	1.1	<0.05		
10/28/1994	338	66	8.2	46	20	<0.05	5.0	0.3	23	35	5.0	2.0	<0.10	<0.03		
5/3/1995	317	68	8.6	48	12	0.12	6.0	0.3	21	34	5.0	2.7	1.1	<0.03		
11/30/1995	315	64	8.3	52	6	<0.05	4.0	1.0	20	33	5.0	2.2	0.20	<0.03	<0.03	
4/25/1996	319	61	7.9	44	11	<0.05	5.0	1.3	19	33	5.0	2.2	0.11	<0.03	<0.03	
10/11/1996	315	63	7.8	44	9	<0.05	4.0	0.5	17	32	4.0	2.2	<0.10	<0.03	0.04	
5/21/1997	314	65	6.3	44	10	<0.05	4.0	0.3	18	34	5.0	2.1	<0.1	<0.03	<0.03	
11/19/1997	311	65	8.0	50	12	<0.05	4.0	0.2	20	33	6.0	2.2	<0.1	<0.03	<0.03	
10/30/1998	316	68	8.0	44	13	0.06	4.0	<0.2	20	35	5.0	2.3	<0.1	<0.03	0.04	
11/2/1999	315	66	8.2	43	11	<0.05	4	na	20	33	5.0	2.3	<0.1	<0.03	<0.03	
11/1/2000	311	63	8.2	45	10	<0.05	4.0	<0.2	19	34	5.0	2.2	<0.1	<0.03	0.19	
10/25/2001	308	66	8.1	46	11	<0.05	4.0	0.3	24	34	5.0	2.7	<0.1	<0.03	<0.03	
10/31/2002	307	66	8.0	48	11	0.12	<1	0.4	18	28	5.0	1.6	<0.1	<0.03	<0.03	
11/6/2003	310	64	7.3	47	11	0.36	4	0.6	20	31	5	2.2	<0.05	<0.0005	<0.03	
11/9/2004	320	70	8.1	50	11	<0.05	5	<0.2	19	32	5	2.1	0.107	<0.0005	<0.03	0.29
11/3/2005	320	72	8.1	61	11	<0.05	4	<0.2	19	34	5.0	2.3	<0.05	<0.0005	<0.03	0.23
10/24/2006	300	68	7.8	46	10	<0.05	4	<0.20	19	33	5.6	2.5	<0.10	<0.0005	<0.03	0.32

NOTES:
1 DWS = Drinking Water Standard; maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.
2 The three values for each constituent refer to the "recommended" level, the "upper" level and the "short-term use" level, respectively.

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

WELL NO.: T15S/R1E-11Pb WELL NAME: FO-09 - Deep

Units are milligrams per liter unless otherwise noted.

Date	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH (pH units)	Chloride	Sulfate	Ammonia Nitrogen (as NO3)	Nitrate Nitrogen (as NO3)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate	Boron
DWS [1]	900 1600 2200 [2]	NA	NA	250 500 600	250 500 600	NA	45	NA	NA	NA	NA	NA	0.3	0.05	NA	NA
8/19/1994	822	190	8.1	102	62	<0.05	6.0		51	88	10.0	4.5	0.57	0.07	0.05	
5/3/1995	442	103	8.3	72	12	<0.05	<1.0	0.3	27	52	4.0	3.4	<0.10	<0.03		
11/30/1995	427	80	8.3	70	17	<0.05	<1.0	1.1	27	51	4.0	3.6	0.30	<0.03	0.03	
4/25/1996	443	89	8.0	66	15	<0.05	<1.0	0.6	25	51	4.0	3.5	0.63	<0.03	0.03	
10/11/1996	436	91	7.7	66	13	<0.05	<1.0	1.3	27	53	4.0	3.9	0.29	<0.03	0.35	
4/21/1997	436	91	7.3	73	15	<0.05	<1.0	0.3	26	51	4.0	3.5	0.19	<0.03	0.05	
11/19/1997	429	90	8.0	69	15	<0.05	<1.0	0.1	28	50	4.0	3.6	<0.10	<0.03	<0.03	
10/27/1998	432	88	7.4	66	16	<0.05	<1.0	<0.2	27	49	4.0	3.6	<0.10	<0.03	0.04	
11/2/1999	432	92	8.2	64	14	<0.05	<1.0	na	26	50	4.0	3.5	<0.10	<0.03	<0.03	
11/2/2000	425	87	8.1	66	14	<0.05	1.0	<0.2	26	50	4.0	3.5	<0.10	<0.03	0.18	
10/25/2001	425	92	8.2	68	14	<0.05	<1.0	0.2	32	49	4.0	3.8	<0.10	<0.03	<0.03	
11/1/2002	426	92	8.1	71	15	0.06	<1.0	0.4	25	45	4.0	2.7	<0.10	<0.03	<0.03	
12/6/2003	428	88	8.4	71	15	<0.05	<1	0.5	26	50	4.5	3.4	<0.05	<0.0005	<0.03	
11/8/2004	450	94	8.1	72	15	<0.05	<1	<0.2	25	50	3.0	3.3	0.100	<0.0005	<0.03	0.19
11/2/2005	450	94	8.2	76	15	<0.05	<1	0.29	27	54	3.7	3.6	<0.05	<0.0005	0.06	0.35
10/25/2006	420	92	7.9	70	14	<0.05	<1	0.31	26	53	3.7	3.7	<0.10	<0.0005	<0.03	0.31

NOTES:

1 DWS = Drinking Water Standard; maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

2 The three values for each constituent refer to the "recommended" level, the "upper" level and the "short-term use" level, respectively.

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

WELL NO.: T15S/R1E-11Pa WELL NAME: FO-09 - Shallow

Units are milligrams per liter unless otherwise noted.

Date	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH (pH units)	Chloride	Sulfate	Ammonia Nitrogen (as NO3)	Nitrate Nitrogen (as NO3)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate	Boron
DWS [1]	900 1600 2200 [2]	NA	NA	250 500 600	250 500 600	NA	45	NA	NA	NA	NA	NA	0.3	0.05	NA	NA
8/19/1994	315	154	9.5	55	47	0.11	2.0		12	57	4.0	5.8	0.31	<0.03	<0.03	
5/3/1995	348	62	8.4	56	19	0.08	<1.0	0.3	23	34	4.0	3.6	<0.10	<0.30		
11/30/1995	334	62	8.4	54	12	0.05	<1.0	0.8	23	35	4.0	3.7	<0.10	<0.03	0.07	
4/25/1996	343	63	7.9	53	11	<0.05	<1.0	0.5	22	33	4.0	3.7	<0.10	<0.03	0.05	
10/11/1996	336	61	7.8	53	13	<0.05	<1.0	0.4	22	35	4.0	4.0	<0.10	<0.03	0.29	
4/21/1997	333	59	6.9	56	13	<0.05	<1.0	0.4	22	35	4.0	3.7	<0.10	<0.03	0.06	
11/19/1997	330	60	8.0	56	13	<0.05	<1.0	0.2	23	33	5.0	3.7	<0.10	<0.03	0.05	
10/27/1998	334	60	7.4	51	16	<0.05	<1.0	0.2	23	36	4.0	3.9	<0.10	<0.03	0.03	
11/2/1999	333	61	8.1	51	13	<0.05	<1.0	na	21	32	4.0	3.6	<0.10	<0.03	0.05	
11/2/2000	322	59	8.1	52	12	<0.05	<1.0	<0.2	22	34	4.0	3.7	<0.10	<0.03	0.28	
10/25/2001	325	64	8.1	54	12	<0.05	<1.0	0.3	23	40	4.0	3.6	<0.10	<0.03	0.05	
11/1/2002	328	66	8.1	57	13	0.12	<1.0	0.4	21	30	4.0	2.9	<0.10	<0.03	0.04	
12/6/2003	330	62	7.6	56	13	0.06	<1	0.5	22	33	4.2	3.7	<0.05	<0.0005	<0.03	
11/8/2004	350	67	7.9	58	13	0.08	<1	0.20	21	33	4.0	3.4	<0.05	<0.0005	<0.03	0.24
11/2/2005	340	66	8.1	60	12	<0.05	<1	0.29	23	36	4.4	3.7	<0.05	<0.0005	0.05	0.31
10/25/2006	330	64	7.8	56	12	<0.05	<1	0.42	22	34	4.5	4.1	<0.10	<0.0005	0.04	0.28

NOTES:

1 DWS = Drinking Water Standard; maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

2 The three values for each constituent refer to the "recommended" level, the "upper" level and the "short-term use" level, respectively.

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

WELL NO.: T15S/R1E-12Fc WELL NAME: FO-10 - Deep

Units are milligrams per liter unless otherwise noted.

Date	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH (pH units)	Chloride	Sulfate	Ammonia Nitrogen (as NO3)	Nitrate Nitrogen (as NO3)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate	Boron
DWS [1]	900 1600 2200 [2]	NA	NA	250 500 600	250 500 600	NA	45	NA	NA	NA	NA	NA	0.3	0.05	NA	NA
9/20/1996	1447	467	7.8	136	27	0.12	<1		148	107	25	7.2	1.22	0.84	0.04	
4/24/1997	652	165	7.7	78	12	0.77	<1	1.1	41	55	8	4.2	<0.10	0.20	<0.03	
11/19/1997	469	130	7.9	70	12	0.31	<1	0.5	36	46	10	3.1	0.76	0.15	0.03	
10/27/1998	442	108	7.5	66	46	0.09	<1	0.3	30	46	8	4.2	<0.10	0.20	<0.03	
11/2/1999	394	84	8.2	61	11	0.10	<1	na	24	39	6	2.6	0.97	0.09	0.04	
11/2/2000	380	77	8.1	60	16	0.09	1	0.5	23	41	6	2.6	0.84	0.04	0.20	
10/26/2001	372	80	8.2	60	13	<0.05	1	0.4	25	46	6	2.6	0.48	0.09	0.04	
11/1/2002	372	78	8.2	64	13	0.17	<1	0.7	21	36	6	1.8	0.33	0.04	<0.03	
12/16/2003	374	74	8.2	63	13	<0.05	<1	0.6	22	40	5.9	2.6	0.41	0.11	<0.03	
11/8/2004	400	86	8.0	62	15	0.07	<1	0.50	23	40	6.0	2.4	0.573	0.139	<0.03	0.33
11/3/2005	380	80	8.1	66	13	0.06	<1	0.41	23	42	5.6	3.0	0.560	0.053	0.05	0.33
10/25/2006	360	78	7.8	55	17	<0.05	<1	<0.20	22	40	5.5	2.8	<0.10	0.034	<0.03	0.32

NOTES:

(1) Maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

(2) The three values listed for certain constituents refer to the "recommended" level, the "upper" level, and "short-term use" level, respectively.

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

WELL NO.: T15S/R1E-12Fa WELL NAME: FO-10 - Shallow

Units are milligrams per liter unless otherwise noted.

Date	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH (pH units)	Chloride	Sulfate	Ammonia Nitrogen (as NO3)	Nitrate Nitrogen (as NO3)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate	Boron
DWS [1]	900 1600 2200 [2]	NA	NA	250 500 600	250 500 600	NA	45	NA	NA	NA	NA	NA	0.3	0.05	NA	NA
9/20/1996	910	303	7.7	73	9	<0.05	<1		91	45	18	4.4	4.69	1.01	0.41	
4/24/1997	430	95	7.5	71	25	0.13	<1	0.7	28	43	8	2.4	0.15	0.06	<0.03	
11/19/1997	386	74	7.9	72	14	<0.05	1	0.5	24	40	8	2.2	<0.1	<0.03	<0.03	
10/27/1998	389	74	7.5	64	14	<0.05	<1	0.2	24	40	7	2.3	<0.1	<0.03	<0.03	
11/2/1999	387	72	8.1	64	13	<0.05	1	na	23	38	7	2.2	<0.1	<0.03	<0.03	
11/2/2000	375	69	8.1	62	12	<0.05	2	<0.2	23	40	7	2.3	<0.1	<0.03	0.16	
10/26/2001	365	72	8.1	57	16	<0.05	1	0.2	24	44	6	2.0	<0.1	<0.03	<0.03	
11/1/2002	353	72	8.2	58	17	<0.05	1	0.5	20	34	5	2.1	<0.1	<0.03	<0.03	
12/16/2003	340	62	8.2	58	13	<0.05	1	0.5	22	35	5.8	2.6	<0.05	<0.0005	<0.03	
11/8/2004	370	75	7.9	57	17	0.06	<1	0.20	21	38	5.0	1.8	0.108	<0.0005	<0.03	0.39
11/3/2005	350	70	8.1	65	12	<0.05	<1	0.20	21	39	5.2	2.0	<0.05	<0.0005	<0.03	0.27
10/25/2006	350	76	7.9	53	19	<0.05	<1	<0.20	22	40	5.7	2.2	<0.10	<0.0005	<0.03	0.23

NOTES:

(1) Maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

(2) The three values listed for certain constituents refer to the "recommended" level, the "upper" level, and "short-term use" level, respectively.

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

WELL NO.: T15S/R1E-15K4 WELL NAME: PCA East - Deep

Units are milligrams per liter unless otherwise noted.

Date	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH (pH units)	Chloride	Sulfate	Ammonia Nitrogen (as NO3)	Nitrate Nitrogen (as NO3)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate	Boron
DWS [1]	900 1600 2200 [2]	NA	NA	250 500 600	250 500 600	NA	45	NA	NA	NA	NA	NA	0.3	0.05	NA	NA
4/27/1990	1080	216	7.4	142	214		<0.4		59	81	60	24.0	<0.05	0.30		
4/28/1992	900	241	7.2	135	41		0.3		77	114	16	5.0	<0.08			
6/2/1992									75	110	15	4.9				
6/4/1992				134	40		<0.1		74	114	16	5.3	<0.08			
11/30/1995	968	236	8.0	142	45	0.05	<1.0	2.5	65	105	15	4.7	0.10	0.11	0.07	
4/21/1997	*no access*															
11/19/1997	*no access*															
10/27/1998	*no access*															
11/2/1999	941	230	8.1	132	44	0.06	<1	na	73	103	15	4.8	0.50	0.15	<0.03	
11/1/2000	900	225	8.0	130	42	0.08	<1	<0.2	72	102	14	4.6	0.87	0.13	0.22	
10/26/2001	880	224	8.3	126	43	<0.05	<1	0.4	78	99	13	4.6	0.46	0.12	<0.03	
10/31/2002	*not sampled Fall 2002*															
11/6/2003	845	224	7.6	118	40	0.06	<1	1.7	64	93	12	4.6	1.13	0.06	0.32	
11/9/2004	880	236	8.1	115	40	0.06	<1	0.70	60	93	12	4.1	0.812	0.124	0.13	0.28
11/2/2005	800	222	8.2	126	38	0.07	<1	0.57	59	97	12	4.2	0.240	0.090	0.04	0.42
10/24/2006	790	208	8.2	109	35	<0.05	<1	<0.20	57	93	12	4.2	0.216	0.092	<0.03	0.33

NOTES:
1 DWS = Drinking Water Standard; maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.
2 The three values for each constituent refer to the "recommended" level, the "upper" level and the "short-term use" level, respectively.

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

WELL NO.: T15S/R1E-15K5 WELL NAME: PCA East - Shallow

Units are milligrams per liter unless otherwise noted.

Date	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH (pH units)	Chloride	Sulfate	Ammonia Nitrogen (as NO3)	Nitrate Nitrogen (as NO3)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate	Boron
DWS [1]	900 1600 2200 [2]	NA	NA	250 500 600	250 500 600	NA	45	NA	NA	NA	NA	NA	0.3	0.05	NA	NA
4/27/1990	350	48	7.3	62	71		2.2		27	16	19.0	8.0	<0.05	<0.01		
4/28/1992	290	61	7.9	46	8		2.1		16	39	3.8	1.9	<0.02			
6/1/1992				45	8		2.0		16	39	3.8	2.3	<0.02			
11/30/1995	306	74	8.5	46	<5	<0.05	3.0	0.4	17	40	4.0	1.8	0.10	<0.03	0.04	
4/21/1997	*no access*															
11/19/1997	*no access*															
10/27/1998	*no access*															
11/2/1999	384	92	8.2	51	14	<0.05	<1	na	40	40	10.0	3.1	4.8	0.26	0.05	
11/1/2000	314	79	8.2	49	8	<0.05	2.0	0.6	20	40	4.0	2.1	38	0.74	0.22	
10/26/2001	302	64	8.1	49	8	<0.05	2.0	<0.2	22	38	5.0	2.7	2.07	0.06	0.03	
10/31/2002	*not sampled Fall 2002*															
11/6/2003	307	68	7.7	50	8	0.06	2	0.6	20	35	6	1.8	3.27	0.13	0.88	
11/9/2004	370	89	7.7	56	13	<0.05	<1	2.50	27	40	7	2.7	4.071	0.213	0.44	0.15
11/2/2005	330	70	8.0	56	9	<0.05	2	0.53	26	40	9.7	3.5	2.760	0.229	0.08	0.30
10/24/2006	330	68	7.9	50	10	<0.05	3	<0.20	20	39	6.2	2.9	2.390	0.068	<0.03	0.28

NOTES:

1 DWS = Drinking Water Standard; maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

2 The three values for each constituent refer to the "recommended" level, the "upper" level and the "short-term use" level, respectively.

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

WELL NO.: T15S/R1E-23Cb WELL NAME: Ord Terrace - Deep

Units are milligrams per liter unless otherwise noted.

Date	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH (pH units)	Chloride	Sulfate	Ammonia Nitrogen (as NO3)	Nitrate Nitrogen (as NO3)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate	Boron
DWS [1]	900 1600 2200 [2]	NA	NA	250 500 600	250 500 600	NA	45	NA	NA	NA	NA	NA	0.3	0.05	NA	NA
11/2/1999	1255	294	8.3	147	123	0.21	<1	na	105	118	23	7.2	<0.1	0.09	<0.03	
11/2/2000	1241	303	8.3	156	115	0.82	<1	1.3	109	118	24	6.8	<0.1	0.09	0.21	
10/25/2001	1240	310	8.4	163	115	<0.05	<1	1.2	108	111	25	7.1	<0.1	0.09	<0.03	
11/1/2002	1235	300	8.2	170	122	0.52	<1	1.5	103	111	24	5.3	0.12	0.09	<0.03	
12/16/2003	1243	296	8.1	170	116	0.53	<1	1.3	104	113	24	6.4	0.12	0.08	<0.03	
11/9/2004	1300	298	8.2	178	107	0.45	<1	1.1	106	120	23	6.3	0.155	0.082	<0.03	0.38
11/2/2005	1230	326	8.2	194	95	0.57	<1	1.2	113	138	25	7.0	<0.05	0.055	<0.03	0.67
10/24/2006	1280	318	8.2	181	89	0.47	<1	0.84	107	132	26	7.1	0.169	0.026	<0.03	0.58

NOTES:

(1) Maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

(2) The three values listed for certain constituents refer to the "recommended" level, the "upper" level, and "short-term use" level, respectively.

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

WELL NO.: T15S/R1E-23Ca WELL NAME: Ord Terrace - Shallow

Units are milligrams per liter unless otherwise noted.

Date	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH (pH units)	Chloride	Sulfate	Ammonia Nitrogen (as NO3)	Nitrate Nitrogen (as NO3)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate	Boron
DWS [1]	900 1600 2200 [2]	NA	NA	250 500 600	250 500 600	NA	45	NA	NA	NA	NA	NA	0.3	0.05	NA	NA
11/2/1999	824	220	8.5	100	43	<0.05	3	na	65	94	12	5.0	0.68	0.08	<0.03	
11/2/2000	848	233	8.4	112	40	0.05	<1	1.5	73	86	15	4.3	0.99	0.10	0.36	
10/25/2001	780	220	8.6	106	39	<0.05	5	0.6	106	74	15	4.6	0.75	0.11	<0.03	
11/1/2002	798	222	8.4	111	41	0.07	6	0.6	66	72	16	3.3	1.84	0.23	<0.03	
12/16/2003	917	240	8.3	130	45	<0.05	<1	1.0	77	85	18	4.5	0.79	<0.0005	<0.03	
11/9/2004	990	248	8.3	127	51	<0.05	<1	1.50	85	90	18	4.2	0.556	0.185	0.35	0.18
11/2/2005	805	236	8.2	125	42	<0.05	6	0.82	82	86	20	5.6	1.080	0.280	<0.03	0.60
10/24/2006	800	212	8.3	106	37	<0.05	6	0.35	68	79	17	4.4	1.080	0.077	<0.03	0.29

NOTES:

(1) Maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

(2) The three values listed for certain constituents refer to the "recommended" level, the "upper" level, and "short-term use" level, respectively.

MONTEREY PENINSULA
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SEASIDE BASIN WATERMASTER
MEMORANDUM 2007-02

Date: **April 11, 2007**
To: **Seaside Basin Watermaster**
From: **Joe Oliver, PG, CHg, Senior Hydrogeologist**
Tom Lindberg, Associate Hydrologist
Subject: **Results of Quarterly Ground Water Quality Samples Collected in Winter 2007 from MPWMD Seaside Ground Water Basin Coastal Monitor Wells**

Summary

This memorandum transmits and summarizes quarterly ground water quality data collected in Winter 2007 by the Monterey Peninsula Water Management District (MPWMD or District) from its network of Seaside Ground Water Basin coastal monitor wells. This information is being provided to the Seaside Basin Watermaster Board for information purposes, and is in compliance with the monitoring protocols described in the Watermaster's *Seaside Basin Monitoring and Management Program* (revised September 5, 2006), which was prepared in response to the March 27, 2006 court decision in the Seaside Basin adjudication case. The chemical data from the Winter 2007 sampling of the District's existing coastal "sentinel" monitor wells do not indicate evidence of seawater intrusion at these locations in the Seaside Basin.

MPWMD Seaside Basin Coastal Monitor Well Network

The District initiated a ground water quality monitoring program in the coastal area of the Seaside Basin in 1990, and the network has been expanded since that time. The water quality data collected from the monitor wells are utilized for the purposes of: (1) characterizing the chemical nature of the ground water, (2) establishing long-term ground water quality trends, and (3) monitoring of seawater intrusion potential into the Seaside Basin. The chemical data reported herein provide information about present water quality conditions in the coastal portion of the basin, and serve as background water quality data for comparison in future studies. The District collects ground water quality data *annually* in the Fall from its network of 12 monitor wells at 6 separate sites in and near the coastal area of the Seaside Basin. In addition to this annual sampling, the District is currently collecting *quarterly* samples from the six monitor wells that are part of this network, which are located at the 3 sites closest to the coastline. These sites, described herein as the "MPWMD coastal sentinel wells", are shown on **Figure 1**. At each of these 3 sites, a "shallow" and "deep" monitor well have been installed (either in separate boreholes or as multiple completions in a single borehole), generally corresponding to well completions within the two principal aquifer units in the Seaside Basin, known as the Paso Robles Formation (QTp) and Santa Margarita Sandstone (Tsm), respectively. The Pliocene/Pleistocene-Age QTp is a continental formation comprised of a fluvial mix of clay, silt, sand and gravel, deposited as ancestral valley fill sediments. The Miocene-Age Tsm is a marine and brackish-marine, fine- to coarse-grained arkosic sandstone, which overlies the shales of the Monterey Formation. The monitor wells are constructed of 2-inch PVC casing, with screens isolated in sand "packages" within each aquifer unit. The aquifer units are separated from each other in the wells by cement strata isolation seals.

Water Sample Collection

Water sample collection is accomplished by "air-lift" pumping. The method utilizes a 3/4-inch PVC dedicated airline in the well, which is coupled to an air compressor. The wellhead configuration is fashioned after that shown in **Figure 2**. Due to the small diameter of the monitor wells, the well casing is used as the "eductor" pipe, rather than a separate eductor pipe inside the well. Through experience, it has been determined that acceptable pumping results can be achieved if the bottom of the airline is placed at a depth that gives approximately 50 percent pumping submergence (i.e., the ratio of the length of the airline below the pumping water level to the total length of the airline). The air-lift method can be inappropriate for certain water quality constituents due to chemistry changes brought about by air entrainment in the purged water; however, it is considered appropriate for the suite of inorganic constituents that are currently analyzed from the collected samples.

The volume of water removed from each well prior to sampling is generally three casing volumes, consistent with standard sampling protocol. Sampling is supplemented by field measurement of several indicator parameters that are collected during pumping, which ensures that water quality has stabilized prior to sample collection. Once the samples are collected, they are taken to a State-certified laboratory for analysis.

Winter 2007 Quarter Water Quality Results

Water chemistry analytical results for the quarterly ground water samples collected from the District's six existing coastal "sentinel" monitor wells on January 30, 2007, are provided in **Table 1**. For comparison, the analytical results from the previous sampling of these same wells in Fall 2006 are provided in **Table 2**. Note that **Table 2** also includes the chemical data for six additional monitor wells that are sampled annually from locations that are farther from the coastline.

The chemical data from the depth intervals sampled at these monitor wells do not indicate evidence of water quality changes indicative of seawater intrusion at these locations in the coastal area of the Seaside Basin. Additional descriptions of the ground water quality results from the District's Seaside Basin coastal monitor wells can be found in *MPWMD Seaside Basin Watermaster Memorandum 2007-01*, as well as *MPWMD Technical Memorandum 97-02*. Both of these documents are available at the District office for review.

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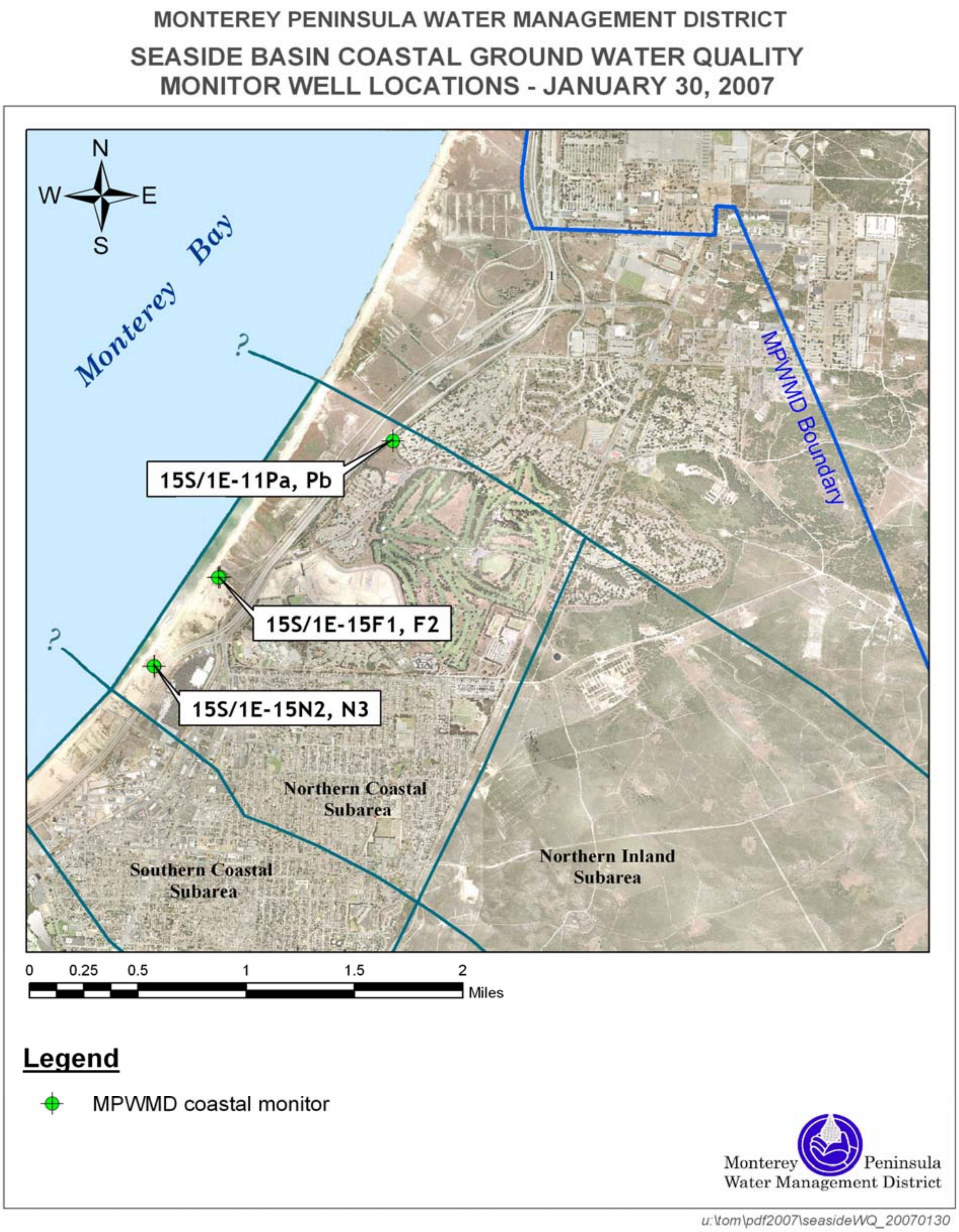

Figure 1. MPWMD Seaside Basin Coastal "Sentinel" Monitor Well Locations.

Ground Water Quality Monitoring Results

Tables

Table 1

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

Seaside Basin Sample Collection Date: January 30, 2007

Units are milligrams per liter unless otherwise noted.

Water Quality Constituent	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH	Chloride	Sulfate	Ammonia Nitrogen (as NH3)	Nitrate Nitrogen (as NO3)	Nitrate (as NO3-N)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate
Drinking Water Standard (1)	900 1600 2200 (2)	NA	NA	250 500 600 (2)	250 500 600 (2)	NA	45	NA	NA	NA	NA	NA	NA	0.3	0.05	NA
Sampling Location																
15S/1E-15N3 (shal)	325	69	8.1	47	18	0.07	<1	<0.05	0.26	19	38	5	3.5	<0.10	0.031	<0.05
15S/1E-15N2 (deep)	1005	238	8.2	150	45	0.09	<1	<0.05	0.45	80	102	15	4.6	<0.10	0.072	<0.05
15S/1E-15F1 (shal)	311	69	8.1	47	11	<0.05	4	0.97	0.41	20	33	5	2.2	<0.10	<0.02	<0.05
15S/1E-15F2 (deep)	993	224	7.9	152	43	0.10	<1	<0.05	0.65	83	105	16	4.9	0.199	0.101	<0.05
15S/1E-11Pa (shal)	323	62	8.1	56	13	<0.05	1	0.14	0.35	23	33	4	3.6	<0.10	<0.02	<0.05
15S/1E-11Pb (deep)	433	82	8.2	71	15	<0.05	1	0.14	0.29	28	50	3	3.4	<0.10	<0.02	<0.05

Water Quality Constituent	Total Dissolved Solids	Hardness (as CaC03)	Boron	Bromide	Fluoride
Drinking Water Standard (1)	NA	NA	NA	NA	NA
Sampling Location					
15S/1E-15N3 (shal)	234	68	0.24	0.15	0.15
15S/1E-15N2 (deep)	581	262	0.26	0.44	0.25
15S/1E-15F1 (shal)	198	71	0.12	0.15	<0.10
15S/1E-15F2 (deep)	576	273	0.20	0.43	0.28
15S/1E-11Pa (shal)	232	74	0.18	0.18	<0.10
15S/1E-11Pb (deep)	262	82	0.18	0.22	0.12

NOTES:

(1) Maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

(2) The three values listed for certain constituents refer to the "recommended" level, the "upper" level, and "short-term use" level, respectively.

Table 2

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

Seaside Basin Sample Collection Date: October 24 and October 25, 2006

Units are milligrams per liter unless otherwise noted.

Water Quality Constituent	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH	Chloride	Sulfate	Ammonia Nitrogen (as NH3)	Nitrate Nitrogen (as NO3)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophosphate	Boron
Drinking Water Standard (1)	900 1600 2200 (2)	NA	NA	250 500 600 (2)	250 500 600 (2)	NA	45	NA	NA	NA	NA	NA	0.3	0.05	NA	NA
Sampling Location																
15S/1E-15N3 (shal)	320	72	7.8	46	17	0.06	<1	<0.20	17	39	4.8	3.8	<0.10	<0.0005	0.04	0.39
15S/1E-15N2 (deep)	950	240	8.2	155	45	0.09	<1	<0.20	73	105	16	5.0	<0.10	0.051	<0.03	0.29
15S/1E-23Ca (shal)	800	212	8.3	106	37	<0.05	6	0.35	68	79	17	4.4	1.080	0.077	<0.03	0.29
15S/1E-23Cb (deep)	1280	318	8.2	181	89	0.47	<1	0.84	107	132	26	7.1	0.169	0.026	<0.03	0.58
15S/1E-15F1 (shal)	300	68	7.8	46	10	<0.05	4	<0.20	19	33	5.6	2.5	<0.10	<0.0005	<0.03	0.32
15S/1E-15F2 (deep)	960	246	7.7	150	42	0.08	<1	0.27	77	109	18	5.4	0.541	0.085	<0.03	0.34
15S/1E-15K5 (shal)	330	68	7.9	50	10	<0.05	3	<0.20	20	39	6.2	2.9	2.390	0.068	<0.03	0.28
15S/1E-15K4 (deep)	790	208	8.2	109	35	<0.05	<1	<0.20	57	93	12	4.2	0.216	0.092	<0.03	0.33
15S/1E-11Pa (shal)	330	64	7.8	56	12	<0.05	<1	0.42	22	34	4.5	4.1	<0.10	<0.0005	0.04	0.28
15S/1E-11Pb (deep)	420	92	7.9	70	14	<0.05	<1	0.31	26	53	3.7	3.7	<0.10	<0.0005	<0.03	0.31
15S/1E-12Fa (shal)	350	76	7.9	53	19	<0.05	<1	<0.20	22	40	5.7	2.2	<0.10	<0.0005	<0.03	0.23
15S/1E-12Fc (deep)	360	78	7.8	55	17	<0.05	<1	<0.20	22	40	5.5	2.8	<0.10	0.034	<0.03	0.32

NOTES:

(1) Maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

(2) The three values listed for certain constituents refer to the "recommended" level, the "upper" level, and "short-term use" level, respectively.

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SEASIDE BASIN WATERMASTER
MEMORANDUM 2007-03

Date:	**July 5, 2007**
To:	**Seaside Basin Watermaster**
From:	**Joe Oliver, PG, CHg, Senior Hydrogeologist**
	Tom Lindberg, Associate Hydrologist
Subject:	**Results of Quarterly Ground Water Quality Samples Collected in Spring 2007 from MPWMD Seaside Ground Water Basin Coastal Monitor Wells**

Summary

This memorandum transmits and summarizes quarterly ground water quality data collected in Spring 2007 by the Monterey Peninsula Water Management District (MPWMD or District) from its network of Seaside Ground Water Basin coastal monitor wells. This information is being provided to the Seaside Basin Watermaster Board for information purposes, and is in compliance with the monitoring protocols described in the Watermaster's *Seaside Basin Monitoring and Management Program* (revised September 5, 2006), which was prepared in response to the March 27, 2006 court decision in the Seaside Basin adjudication case. The chemical data from the Spring 2007 sampling of the District's existing coastal "sentinel" monitor wells do not indicate evidence of seawater intrusion at these locations and depths monitored in the Seaside Basin.

MPWMD Seaside Basin Coastal Monitor Well Network

The District initiated a ground water quality monitoring program in the coastal area of the Seaside Basin in 1990, and the network has been expanded since that time. The water chemistry data collected from the monitor wells are utilized for the purposes of: (1) characterizing the chemical nature of the ground water, (2) establishing long-term ground water quality trends, and (3) monitoring of seawater intrusion potential into the Seaside Basin. The chemical data reported herein provide information about present ground water quality conditions in the coastal portion of the basin, and serve as background ground water quality data for comparison with future analyses. The District collects ground water quality data *annually* in the Fall from its network of 12 monitor wells at 6 separate sites in and near the coastal area of the Seaside Basin. In addition to this annual sampling, the District is currently collecting *quarterly* samples from six of these wells (at three locations) that are closest to the coastline. These sites, described herein as the "MPWMD coastal sentinel wells", are shown on **Figure 1**. At each of these three sites, a "shallow" and "deep" monitor well have been installed (either in separate boreholes or as multiple completions in a single borehole), generally corresponding to well completions within the two principal aquifer units in the Seaside Basin, known as the Paso Robles Formation (QTp) and Santa Margarita Sandstone (Tsm), respectively. The Pliocene/Pleistocene-Age QTp is a continental formation generally comprised of a fluvial mix of clay, silt, sand and gravel, deposited as ancestral valley fill sediments. The Miocene-Age Tsm is generally described as a marine and brackish-marine, fine- to coarse-grained arkosic sandstone, which overlies the shales of the Monterey Formation. The monitor wells are constructed of 2-inch PVC casing, with screens isolated in sand "packages" within each aquifer unit. The aquifer units are separated from each other in the wells by cement strata isolation seals.

Water Sample Collection

Water sample collection is accomplished by "air-lift" pumping. The method utilizes a 3/4-inch PVC dedicated airline in the well, which is coupled to an air compressor. The wellhead configuration is fashioned after that shown in **Figure 2**. Due to the small diameter of the monitor wells, the well casing is used as the "eductor" pipe, rather than a separate eductor pipe inside the well. Through experience, it has been determined that acceptable pumping results can be achieved if the bottom of the airline is placed at a depth that gives approximately 50 percent pumping submergence (i.e., the ratio of the length of the airline below the pumping water level to the total length of the airline). The air-lift method can be inappropriate for certain ground water quality constituents due to chemical changes brought about by air entrainment in the purged water; however, it is considered appropriate for the suite of inorganic constituents that are currently analyzed from the collected samples.

The volume of water removed from each well prior to sampling is generally three casing volumes, consistent with standard sampling protocol. Sampling is supplemented by field measurement of several indicator parameters that are collected during pumping, which ensures that the ground water quality has stabilized prior to sample collection. Upon collection of the samples, they are taken to a State-certified laboratory for analysis.

Spring 2007 Quarter Water Quality Results

Water chemistry analytical results for the quarterly ground water samples collected from the District's six existing coastal "sentinel" monitor wells on April 30, 2007, are provided in **Table 1**. For comparison, the analytical results from the previous sampling of these same wells in Winter 2007 (i.e., January 30, 2007) are provided in **Table 2**.

The chemical data from the depth intervals sampled at these monitor wells do not indicate evidence of water quality changes indicative of seawater intrusion at these locations in the coastal area of the Seaside Basin. Additional descriptions of the ground water quality results from the District's Seaside Basin coastal monitor wells can be found in *MPWMD Seaside Basin Watermaster Memoranda 2007-01 and -02*, as well as *MPWMD Technical Memorandum 97-02*. These documents are available at the District office for review.

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MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

SEASIDE BASIN COASTAL GROUND WATER QUALITY

SENTINEL WELL LOCATIONS

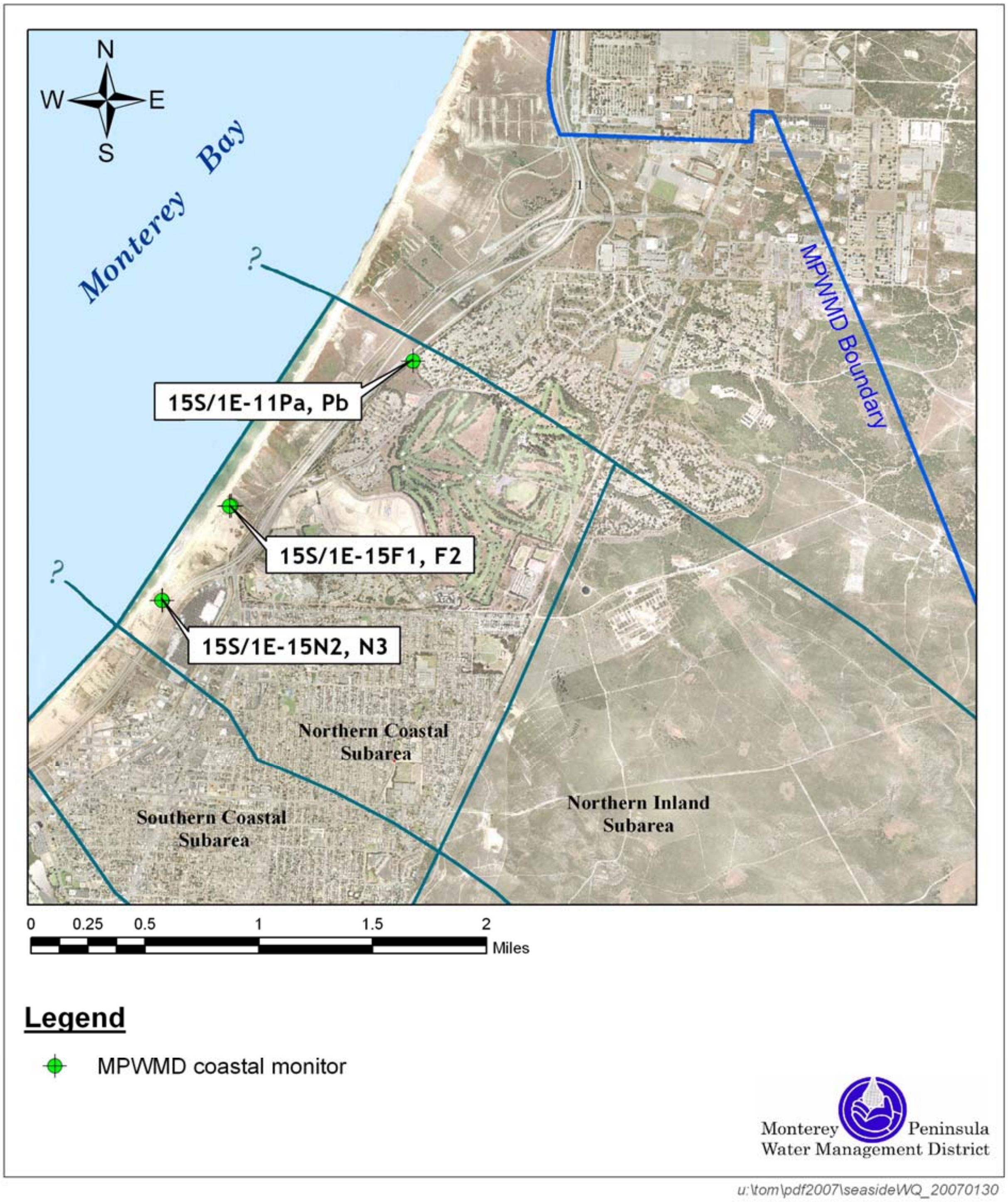

Figure 1. MPWMD Seaside Basin Coastal "Sentinel" Monitor Well Locations.

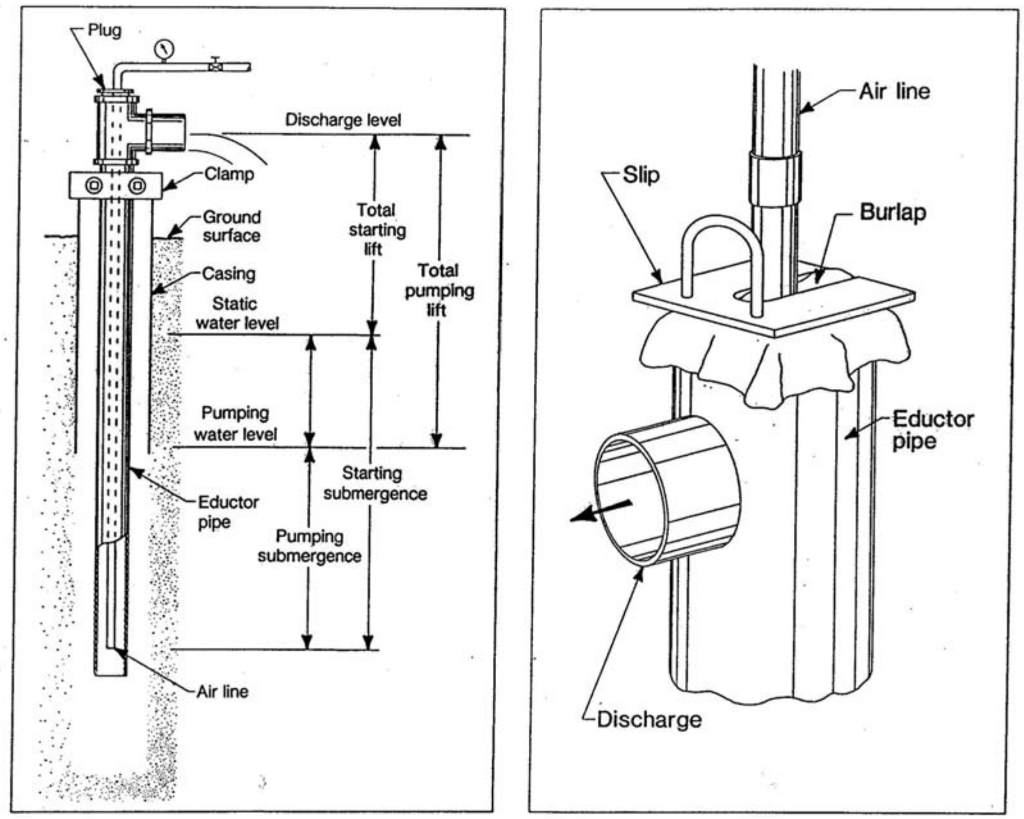

Figure 2. Diagrams iillustrating the airlift–pumping method for water sample collection (from Driscoll, 1986, Figure 15.10)

Ground Water Quality Monitoring Results

Tables

Table 1

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

Seaside Basin Sample Collection Date: April 30, 2007

Units are milligrams per liter unless otherwise noted.

Water Quality Constituent	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH	Chloride	Sulfate	Ammonia Nitrogen (as NH3)	Nitrate Nitrogen (as NO3)	Nitrate (as NO3-N)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate	Total Dissolved Solids	Hardness (as CaC03)	Boron	Bromide	Flouride
Drinking Water Standard (1)	900 1600 2200 (2)	NA	NA	250 500 600 (2)	250 500 600 (2)	NA	45	NA	NA	NA	NA	NA	NA	0.3	0.05	NA	NA	NA	NA	NA	NA
Sampling Location																					
15S/1E-15N3 (shal)	326	73	8.1	43	18	<0.05	<1	<0.05	<0.20	18	38	5	3.3	<0.10	<0.02	<0.05	215	66	0.12	<0.10	0.14
15S/1E-15N2 (deep)	960	209	8.2	153	46	0.06	<1	<0.05	0.44	76	106	15	4.5	<0.10	0.064	<0.05	537	252	0.16	0.46	0.23
15S/1E-15F1 (shal)	300	66	8.1	42	11	<0.05	4	0.97	<0.20	19	33	5	2.1	<0.10	<0.02	<0.05	201	68	0.08	0.13	<0.10
15S/1E-15F2 (deep)	928	223	7.8	155	44	0.05	<1	<0.05	0.32	78	101	16	4.8	0.141	0.098	<0.05	509	261	0.18	0.44	0.27
15S/1E-11Pa (shal)	320	61	8.1	50	16	<0.05	1	0.15	<0.20	22	33	4	3.6	<0.10	<0.02	<0.05	226	71	0.32	<0.10	<0.10
15S/1E-11Pb (deep)	421	89	8.2	65	15	<0.05	1	0.14	<0.20	27	51	4	3.3	<0.10	<0.02	<0.05	245	84	0.14	0.20	<0.10

NOTES:

(1) Maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

(2) The three values listed for certain constituents refer to the "recommended" level, the "upper" level, and "short-term use" level, respectively.

Table 2

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

Seaside Basin Sample Collection Date: January 30, 2007

Units are milligrams per liter unless otherwise noted.

Water Quality Constituent	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH	Chloride	Sulfate	Ammonia Nitrogen (as NH3)	Nitrate Nitrogen (as NO3)	Nitrate (as NO3-N)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate	Total Dissolved Solids	Hardness (as CaC03)	Boron	Bromide	Flouride
Drinking Water Standard (1)	900 1600 2200 (2)	NA	NA	250 500 600 (2)	250 500 600 (2)	NA	45	NA	NA	NA	NA	NA	NA	0.3	0.05	NA	NA	NA	NA	NA	NA
Sampling Location																					
15S/1E-15N3 (shal)	325	69	8.1	47	18	0.07	<1	<0.05	0.26	19	38	5	3.5	<0.10	0.031	<0.05	234	68	0.24	0.15	0.15
15S/1E-15N2 (deep)	1005	238	8.2	150	45	0.09	<1	<0.05	0.45	80	102	15	4.6	<0.10	0.072	<0.05	581	262	0.26	0.44	0.25
15S/1E-15F1 (shal)	311	69	8.1	47	11	<0.05	4	0.97	0.41	20	33	5	2.2	<0.10	<0.02	<0.05	198	71	0.12	0.15	<0.10
15S/1E-15F2 (deep)	993	224	7.9	152	43	0.10	<1	<0.05	0.65	83	105	16	4.9	0.199	0.101	<0.05	576	273	0.20	0.43	0.28
15S/1E-11Pa (shal)	323	62	8.1	56	13	<0.05	1	0.14	0.35	23	33	4	3.6	<0.10	<0.02	<0.05	232	74	0.18	0.18	<0.10
15S/1E-11Pb (deep)	433	82	8.2	71	15	<0.05	1	0.14	0.29	28	50	3	3.4	<0.10	<0.02	<0.05	262	82	0.18	0.22	0.12

NOTES:

(1) Maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

(2) The three values listed for certain constituents refer to the "recommended" level, the "upper" level, and "short-term use" level, respectively.

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SEASIDE BASIN WATERMASTER
MEMORANDUM 2007-05

Date: **October 27, 2007**
To: **Seaside Basin Watermaster**
From: **Joe Oliver, PG, CHg, Senior Hydrogeologist**
Tom Lindberg, Associate Hydrologist
Subject: **Results of Quarterly Groundwater Quality Samples Collected in Summer 2007 from MPWMD Seaside Groundwater Basin Coastal Monitor Wells**

Summary

This memorandum transmits and summarizes quarterly groundwater quality data collected in Summer 2007 by the Monterey Peninsula Water Management District (MPWMD or District) from its network of Seaside Groundwater Basin coastal monitor wells. This information is being provided to the Seaside Basin Watermaster Board (Watermaster) for information purposes, and is in compliance with the monitoring protocols described in the Watermaster's *Seaside Basin Monitoring and Management Program* (revised September 5, 2006), which was prepared in response to the March 27, 2006 court decision in the Seaside Basin adjudication case. The chemical data from the Summer 2007 sampling of the District's existing coastal "sentinel" monitor wells do not indicate evidence of seawater intrusion at these locations and depths monitored in the Seaside Basin.

MPWMD Seaside Basin Coastal Monitor Well Network

The District initiated a groundwater quality monitoring program in the coastal area of the Seaside Basin in 1990, and the network has been expanded since that time. The water chemistry data collected from the monitor wells are utilized for the purposes of: (1) characterizing the chemical nature of the groundwater, (2) establishing long-term groundwater quality trends, and (3) monitoring of seawater intrusion potential into the Seaside Basin. The chemical data reported herein provide information about present groundwater quality conditions in the coastal portion of the basin, and serve as background groundwater quality data for comparison with future analyses.

Under the current monitoring program conducted for the Watermaster, the District is collecting *quarterly* samples from six monitor wells (at three locations) that are closest to the coastline. These sites, described herein as the "MPWMD coastal sentinel wells", are shown on **Figure 1**. In addition to these MPWMD coastal sentinel well sites, groundwater quality data are also collected *annually* in the Fall from six additional MPWMD monitor wells at other locations farther from the coastline in and near the coastal subareas of the basin. At each site, a "shallow" and "deep" monitor well have been installed (either in separate boreholes or as multiple completions in a single borehole), generally corresponding to well completions within the two principal aquifer units in the Seaside Basin, known as the Paso Robles Formation (QTp) and Santa Margarita Sandstone (Tsm), respectively. The Pliocene/Pleistocene-Age QTp is a continental formation generally comprised of a fluvial mix of clay, silt, sand and gravel, deposited as ancestral valley fill sediments. The Miocene-Age Tsm is generally described as a marine and brackish-marine, fine- to coarse-grained arkosic sandstone, which overlies the shales of the Monterey Formation. In and near the coastal subareas of the basin, the QTp deposits can be up to about 600 feet thick; the Tsm deposits are generally 200 to 300 feet thick. The monitor wells are constructed of 2-inch PVC casing, with screens isolated in the more permeable (based on lithologic and geophysical logging analyses) sand "packages" within each aquifer unit. The aquifer units are separated from each other in the wells by cement strata isolation seals. In other recent documents prepared for the Watermaster, wells completed in the QTp sediments have been assigned to the "shallow aquifer zone", and wells completed in the Tsm sediments have been assigned to the "deep aquifer zone" of the Seaside Basin.

It should also be noted that in 2007, four new coastal sentinel monitor wells were installed for the Watermaster at other locations in and near the coastal subareas. Results from these new Watemaster sentinel monitor wells are not included in this memorandum. Initial results from these new monitor wells are reported in a separate report recently prepared for the Watermaster by Martin Feeney, titled *Seaside Groundwater Basin Watermaster Seawater Sentinel Wells Project*, dated October 2007. It is planned to incorporate these new monitor wells into Watermaster monitoring program on an ongoing basis.

<u>Water Sample Collection</u>

Water sample collection is accomplished by "air-lift" pumping. The method utilizes a 3/4-inch PVC dedicated airline in the well, which is coupled to an air compressor. The wellhead configuration is fashioned after that shown in **Figure 2**. Due to the small diameter of the monitor wells, the well casing is used as the "eductor" pipe, rather than a separate eductor pipe inside the well. Through experience, it has been determined that acceptable pumping results can be achieved if the bottom of the airline is placed at a depth that gives approximately 50 percent pumping submergence (i.e., the ratio of the length of the airline below the pumping water level to the total length of the airline). The air-lift method can be inappropriate for certain groundwater quality constituents due to chemical changes brought about by air entrainment in the purged water; however, it is considered appropriate for the suite of inorganic constituents that are currently analyzed from the collected samples.

The volume of water removed from each well prior to sampling is generally three casing volumes, consistent with standard sampling protocol. Sampling is supplemented by field measurement of several indicator parameters that are collected during pumping, which ensures that the groundwater quality has stabilized prior to sample collection. Upon collection of the samples, they are taken to a State-certified laboratory for analysis.

Summer 2007 Quarter Water Quality Results

Water chemistry analytical results for the quarterly groundwater samples collected from the District's six existing coastal "sentinel" monitor wells in Summer 2007 (i.e., July 31, 2007), are provided in **Table 1**. For comparison, the analytical results from the previous sampling of these same wells in Spring 2007 (i.e., April 30, 2007) are provided in **Table 2**.

The chemical data from the Summer 2007 sampling of these monitor wells do not show significant changes relative to the previous sampling, and do not indicate evidence of water quality changes indicative of seawater intrusion at these locations and depths in the coastal area of the Seaside Basin. It should be cautioned that the ability to characterize groundwater quality conditions over the entire thicknesses of the QTp and Tsm aquifer zones at these locations is limited in that the monitor wells from which these samples were collected have limited screened intervals, generally 40 to 50 feet in total length. Therefore, the sampled intervals represent only a small portion of the total aquifer thicknesses at the locations sampled.

Additional descriptions of the groundwater quality results from the District's Seaside Basin coastal monitor wells can be found in *MPWMD Seaside Basin Watermaster Memoranda 2007-01, -02 and -03*, as well as *MPWMD Technical Memorandum 97-02*. These documents are available at the District office for review.

U:\Joe\wp\SBWatermaster\2007\WQ\Summer2007WQresults_memo_27oct07.doc

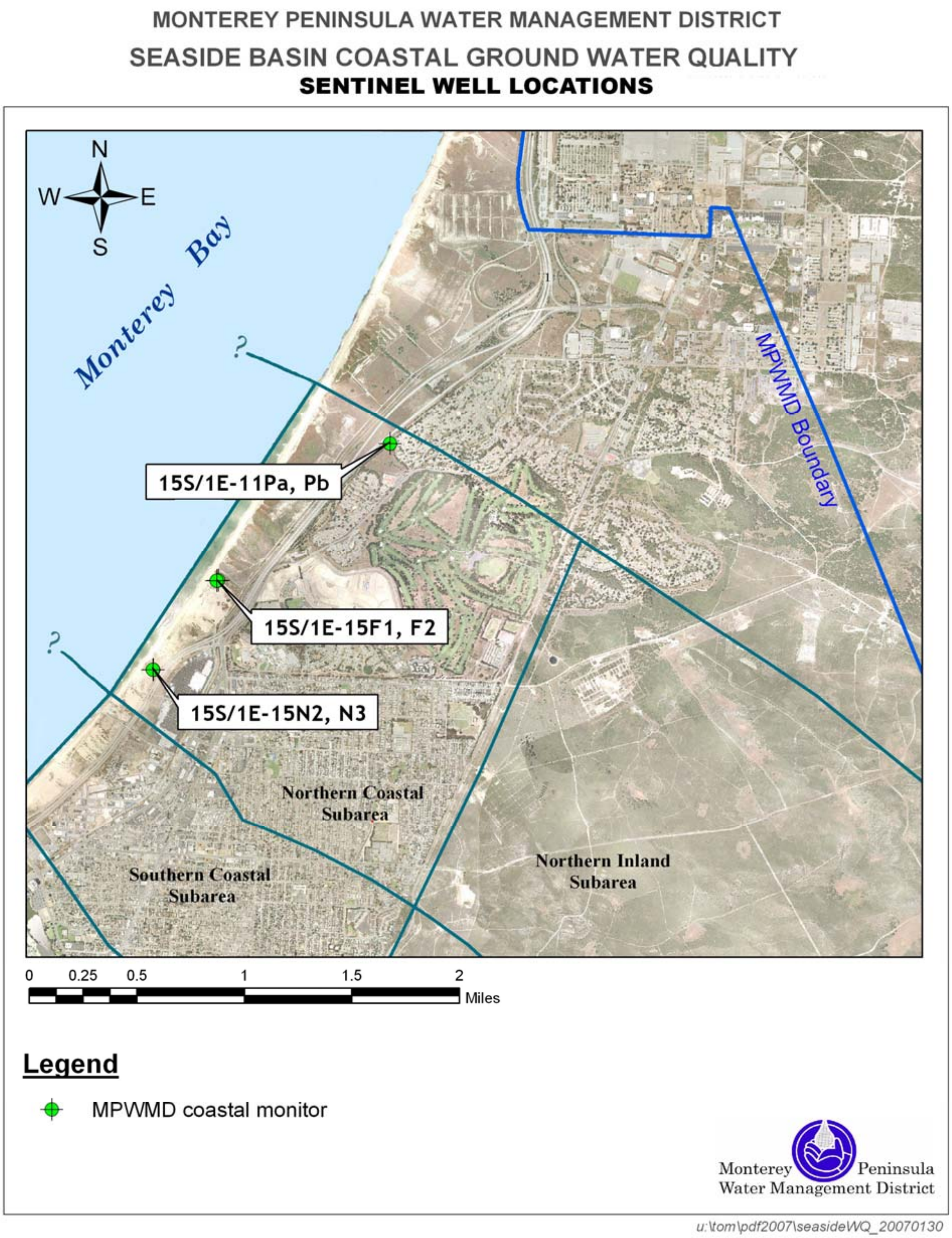


Figure 1. MPWMD Seaside Basin Coastal "Sentinel" Monitor Well Locations.

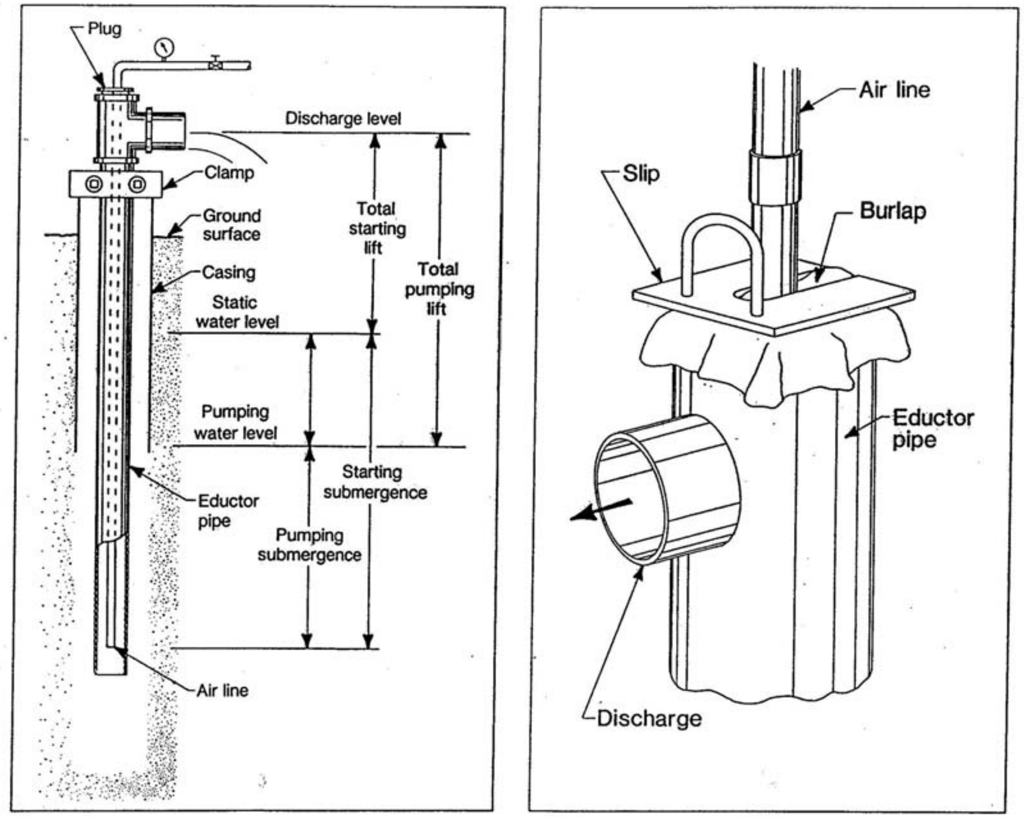


Figure 2. Diagrams iillustrating the airlift–pumping method for water sample collection (from Driscoll, 1986, Figure 15.10)

Groundwater Quality Monitoring Results

TABLES

Table 1

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

Seaside Basin Sample Collection Date: July 31, 2007

Units are milligrams per liter unless otherwise noted.

Water Quality Constituent	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH	Chloride	Sulfate	Ammonia Nitrogen (as NH3)	Nitrate Nitrogen (as NO3)	Nitrate (as NO3-N)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate	Total Dissolved Solids	Hardness (as CaC03)	Boron	Bromide	Fluoride
Drinking Water Standard (1)	900 1600 2200 (2)	NA	NA	250 500 600 (2)	250 500 600 (2)	NA	45	NA	NA	NA	NA	NA	NA	0.3	0.05	NA	NA	NA	NA	NA	NA
Sampling Location																					
15S/1E-15N3 (shal)	324	74	8.2	42	16	<0.05	<1	- -	<0.20	19	38	5	3.7	<0.100	<0.020	<0.05	- -	- -	0.32	- -	0.15
15S/1E-15N2 (deep)	947	215	8.3	148	41	0.08	<1	- -	0.2	79	105	14	4.9	<0.100	0.064	<0.05	- -	- -	0.46		0.21
15S/1E-15F1 (shal)	291	66	8.0	41	10	<0.05	4	- -	<0.20	20	32	5	2.3	<0.100	<0.020	<0.05	- -	- -	0.22	- -	0.14
15S/1E-15F2 (deep)	927	209	8.0	150	39	0.05	<1	- -	0.41	80	100	14	5.3	0.133	0.097	<0.05	- -	- -	0.30	- -	0.24
15S/1E-11Pa (shal)	320	72	8.2	50	12	<0.05	<1	- -	0.31	23	32	4	3.9	<0.100	<0.020	<0.05	- -	- -	0.38	- -	0.11
15S/1E-11Pb (deep)	418	90	8.3	63	13	<0.05	<1	- -	<0.20	28	51	4	3.7	<0.100	<0.020	<0.05	- -	- -	0.50	- -	0.10

NOTES:

(1) Maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

(2) The three values listed for certain constituents refer to the "recommended" level, the "upper" level, and "short-term use" level, respectively.

Table 2

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

GROUND WATER QUALITY MONITORING RESULTS

Seaside Basin Sample Collection Date: April 30, 2007

Units are milligrams per liter unless otherwise noted.

Water Quality Constituent	Specific Conductance (micromhos/cm)	Total Alkalinity (as CACO3)	pH	Chloride	Sulfate	Ammonia Nitrogen (as NH3)	Nitrate Nitrogen (as NO3)	Nitrate (as NO3-N)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Iron	Manganese	Orthophos-phate	Total Dissolved Solids	Hardness (as CaC03)	Boron	Bromide	Flouride
Drinking Water Standard (1)	900 1600 2200 (2)	NA	NA	250 500 600 (2)	250 500 600 (2)	NA	45	NA	NA	NA	NA	NA	NA	0.3	0.05	NA	NA	NA	NA	NA	NA
Sampling Location																					
15S/1E-15N3 (shal)	326	73	8.1	43	18	<0.05	<1	<0.05	<0.20	18	38	5	3.3	<0.10	<0.02	<0.05	215	66	0.12	<0.10	0.14
15S/1E-15N2 (deep)	960	209	8.2	153	46	0.06	<1	<0.05	0.44	76	106	15	4.5	<0.10	0.064	<0.05	537	252	0.16	0.46	0.23
15S/1E-15F1 (shal)	300	66	8.1	42	11	<0.05	4	0.97	<0.20	19	33	5	2.1	<0.10	<0.02	<0.05	201	68	0.08	0.13	<0.10
15S/1E-15F2 (deep)	928	223	7.8	155	44	0.05	<1	<0.05	0.32	78	101	16	4.8	0.141	0.098	<0.05	509	261	0.18	0.44	0.27
15S/1E-11Pa (shal)	320	61	8.1	50	16	<0.05	1	0.15	<0.20	22	33	4	3.6	<0.10	<0.02	<0.05	226	71	0.32	<0.10	<0.10
15S/1E-11Pb (deep)	421	89	8.2	65	15	<0.05	1	0.14	<0.20	27	51	4	3.3	<0.10	<0.02	<0.05	245	84	0.14	0.20	<0.10

NOTES:

(1) Maximum contaminant levels are from California Domestic Water Quality and Monitoring Regulations, Title 22, 1977.

(2) The three values listed for certain constituents refer to the "recommended" level, the "upper" level, and "short-term use" level, respectively.

ATTACHMENT 7

CONSTRUCTION OF SENTINEL MONITORING WELLS

Martin B. Feeney
Consulting Hydrogeologist

P.G. 4634
C.E.G. 1454
C.Hg 145

SEASIDE GROUNDWATER BASIN WATERMASTER
SEAWATER SENTINEL WELLS PROJECT
Summary of Operations

----Executive Summary----

For
Seaside Groundwater Basin Watermaster

Prepared by

Martin B. Feeney PG, CHg
with assistance from Pueblo Water Resources, Inc.

October 2007

P.O. Box 23240, Ventura, CA 93002 ♦ **Phone: 805/643-7710** ♦ e-mail mfeeney@ix.netcom.com

Executive Summary

As part of the overall management strategy for the Seaside Groundwater Basin, the Seaside Groundwater Basin Watermaster was required to install additional monitoring wells to assist in the ability to detect seawater intrusion into the Seaside Groundwater Basin. These wells, as a result of their purpose and location near the coastline, were designated as Sentinel Wells.

Purpose and Design

The Sentinel Wells project was designed to allow monitoring for seawater intrusion throughout the entire section of saturated sediments at four locations in the northern coastal portion of the Seaside Groundwater Basin. Seawater intrusion would be detected due to changes in conductivity of the sediments as measured by down-hole geophysical methods. Wells are also designed to provide for collection of water level data from the lower aquifer system in the Seaside Basin – the aquifer system that provides the majority of the water supply from the basin.

Permitting

The wells are located on the west side of US. Highway 1 on land formerly part of Fort Ord Military Reservation. The land now is being developed into Fort Ord Dunes State Park. Construction of the wells required both CEQA review and a permit from the California Coastal Commission. Well construction also required permits from Monterey County Environmental Health Department.

Field Activities

Wells were constructed during July through September 2007 utilizing conventional rotary drilling methods. Wells are constructed of 3-inch diameter PVC casing and extend to as deep as 1,500 feet. The wells, depending on location, penetrate geologic materials assigned to Quaternary Beach/Dune Sand Deposits, Aromas Sand, Paso Robles Formation, Purisima Formation and/or Santa Margarita Sandstone. The three most southerly wells reach the Monterey Formation – the adopted effective base of freshwater water for the Seaside Basin. The Santa Margarita Sandstone was only encountered in the most southerly location.

After completion of the wells, geophysical logging and water quality sampling were performed. Each of the wells was induction logged to measure the conductivity of the fluids contained within the sediments. Water quality samples were collected by air-lifting and through down-hole sampling techniques. Induction logging identified zones of saline intrusion in the upper portion of each of the wells. Intrusion was limited to the Dune/Beach Sand Deposits and Aromas Sand. No evidence of seawater intrusion was detected in the upper aquifer or lower aquifer units that comprise the useable aquifers of the Seaside Basin. Water quality sampling revealed significant difference in water chemistry both spatially and vertically. The quality of water in the Purisima Formation is substantially less mineralized than the Santa Margarita Sandstone.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The geologic, geophysical and hydrogeologic data from the Sentinel Wells have provided significant additional understanding of the hydrogeology of the southern Fort Ord area of the Seaside Groundwater Basin.

- The most significant geologic finding was the absence of the Santa Margarita Sandstone at three of the four monitoring wells, and the extremely limited thickness of the Santa Margarita Sandstone at the most southerly site. The most northerly well encountered Pliocene-aged Purisima Formation to total depth (1,500 feet). Moving farther south, the monitoring wells encountered Purisima Formation overlying shales of the Monterey Formation. At the most southerly site, the lithologic and water quality data suggest that there is a 30- to 40-foot thick section of Santa Margarita Sandstone underlying the Purisima and overlying the Monterey Formation shales.

- The data reveal that the Purisima Formation extends much farther south into the Seaside Groundwater Basin than had previously been believed. Additionally, the recent data suggest that interpretation of geologic data from some of the previous monitoring wells in southern Fort Ord may have erroneously identified the Purisima Formation as the Santa Margarita Sandstone.

- The absence of the Santa Margarita Sandstone complicates the hydrogeologic understanding of the Seaside Basin, but it may have limited impacts on basin management. The Purisima Formation is water-bearing and is used for municipal supply by Marina Coast Water District. The Purisima Formation is less permeable than the Santa Margarita Sandstone, however, the Purisima is substantially thicker and, as such, may have similar transmissivities. Additional analysis will be required to determine whether the occurrence of the Purisima Formation in place of the Santa Margarita Sandstone has relevance to basin storage volumes, susceptibility to seawater intrusion, opportunities for ASR, and basin management.

- Water level data from the Sentinel Wells reveal water levels in the lower aquifer system at the location of the wells to be approximately 20 feet below sea level.

- Water quality data from the Sentinel Wells reveal water quality to vary spatially and with depth. Down-hole sampling techniques have revealed differences in salinity of more than two fold within the same well that was masked when a composite sample was collected. This needs to be considered when designing a sampling program.

- Water from the wells completed in the Purisima Formation is significantly less saline than water from the Santa Margarita Sandstone in the Seaside Basin. This difference will complicate spatial analysis of water quality trends. Comparison of chloride concentrations between waters from Santa Margarita Sandstone and water from the Purisima Formation need to be considered carefully. Naturally occurring chloride concentrations in the Santa Margarita Sandstone are several times higher than the chloride concentrations in the Purisima Formation and therefore intrusion detection "triggers" will need to be specific to the geologic unit.

- No evidence of seawater intrusion was detected in either of the primary aquifer systems of the Seaside Basin: the Paso Robles Formation or the Santa Margarita Sandstone/Purisima Formation.

- Geophysical data reveal significant seawater intrusion in the upper portions of SBWM #1 borehole to depths of approximately 350 feet. The existence of seawater intrusion in the shallow aquifer units in this area has been known for decades.

- Evidence for seawater intrusion at the other 3 locations was limited to saline intrusion into the shallow Dune/Beach Sand Deposits.

RECOMMENDATIONS

- The data from the Sentinel Wells, taken together with existing data from previous monitoring wells, raise some hydrogeologic questions and suggest that additional hydrogeologic analysis is required. Some of the hydrogeologic questions are relevant to basin management while others are relatively academic. The hydrogeologic analysis should include, as necessary, the refinement and revision of the overall hydrogeologic structure/stratigraphy of the Basin, but focus on the ramifications, if any, these refinements may have on the management of the basin.

Additional Monitoring Wells:

- While more borehole data are almost always useful, it is not believed at this time to be necessary or cost-effective to install additional monitoring wells solely for the purpose of achieving a better understanding of the basin hydrogeology or to manage the basin.

- The need for additional monitoring wells may change over time as data accumulates. If changes in conductivity are detected over several induction logging cycles, monitoring well(s) should be installed as appropriate to allow sampling of the locations and zones of interest. These changes will occur gradually and will need to be confirmed over time before initiating well construction. As such, it is unlikely that Watermaster will need to budget for construction of additional monitoring wells for the coming year. The Watermaster, however, might include in the budget for 2009, a contingency for installing monitoring wells in response to the detection of significant changes in conductivity, as measured by induction logging, in the Sentinel Wells. An appropriate budget for permitting, construction and hydrogeologic oversight of a new monitoring well would be approximately $150,000.

Data Collection:

- The Sentinel Wells represent a significant addition to the monitoring network of the Seaside Groundwater Basin. The Sentinel Wells should be induction logged quarterly. Successive induction logs should be overlaid on previous logs for comparison. Water samples should be collected concurrently for comparison and calibration of induction logs. If possible, water quality samples should be collected from top and bottom of screened intervals. After the first year of data collection, the data should be reviewed with the intent of determining the appropriate sampling frequency.
- The Sentinel Wells are located in the newly-created Fort Ord State Park. This park is soon to be open to the public. Given the park's visitor-serving purposes, there is a motivation to minimize the disruption of park uses that periodic data collection activities will create. As such, it is recommended that data collection methods be utilized that result in minimum disruption. Data collection techniques should have a limited footprint and should be able to be performed quickly.

- Consistent with the recommendation to minimize data collection impacts, it is recommended that periodic water quality sampling be performed utilizing down-hole capture methods. This will avoid well purging activities which would require mobilization of pumping equipment and the containment and disposal of purge water. The use of down-hole sampling capitalizes on the induction logging program as the down-hole sampling can be performed utilizing the same wire-line equipment on site for induction logging.

- Down-hole wire-line water quality sampling also provides the ability to get relatively discrete water quality samples from differing depths within the perforated interval. Additionally, down-hole sampling, performed concurrently with the induction logging, is much less expensive in terms of labor costs than conventional sampling methods.

- Again, to minimize disruption to Park activities and uses, the Sentinel Wells should be equipped with continuous water-level data loggers to record water level fluctuations. Continuous water level data collection will allow characterization of both tidal fluctuations and the pumping stresses imposed by regional extractions. These data will assist in understanding: (1) the nature and degree of connectivity to the ocean; (2) the influence of pumping/injection stresses at these locations; (3) the regional gradients and groundwater flow directions; and (4) long-term trends in ground water levels along this section of the coastline.

- At the most northerly and southerly sites, there are nearby shallow monitor wells that were installed as part of previous investigations. Consideration should be given to adding these wells to the monitor well network for regular water level monitoring as this information could supplement the data from the new Sentinel Wells for future hydrogeologic analyses.

- It is estimated that each induction logging and water quality sample collection event can be performed for approximately $6,500 inclusive of laboratory analysis. This would include 4 induction logs, the collection of 2 water samples from each well and laboratory analysis for general mineral constituents. Technical staff time would be in addition to this cost. It may be possible to acquire the logging and sampling services as part of negotiated annual contract. This could reduce costs significantly.

<u>ATTACHMENT 8</u>

BASIN MANAGEMENT DATABASE

Seaside Groundwater Basin Management and Monitoring Program
Comprehensive Basin Production, Water Level and Water Quality Program
Phase 1 Implementation

The Seaside Basin Monitoring and Management Program (MMP) was developed by the Seaside Basin Watermaster Technical Advisory Committee (TAC) and adopted on May 17, 2006, and revised on September 5, 2006, to comply with the decision entered in the Seaside Groundwater Basin Adjudication (California American Water v. City of Seaside, Monterey County Superior Court, Case Number M66343) (hereinafter referred to as Decision). The MMP contains several primary tasks: 1) Basin Monitoring Well Construction Program; 2) Comprehensive Basin Production, Water Level and Water Quality Program; 3) Basin Management Program; and 4) Seawater Intrusion Program. As part of the Phase 1 MMP Implementation, RBF Consulting has developed a comprehensive database to be utilized for on going monitoring of groundwater well production, water levels, and water quality monitoring as prescribed by the decision.

For successful implementation of the Seaside Basin Monitoring Program, pertinent basic historical groundwater resource data is being consolidated into a secured online database to allow more efficient organization and data retrieval. The newly developed database combines the existing MPWMD database with a database developed for groundwater studies on the former Fort Ord. Characteristics of existing wells and wells proposed as part of the Seaside Basin Monitoring Program are notated in the database. Attributes stored include well type, location, construction details and other pertinent information based on well construction logs and permits. The consolidated database allows pertinent groundwater data to be efficiently organized, managed and housed in a single location to facilitate:

→ Ongoing data collection;
→ Data storage and retrieval;
→ Distribution of basic data to Watermaster members and interested parties; and,
→ Preparation of annual and periodic reports to the Watermaster

Database features

The database has been developed using SQL Server, an industry standard for relational database management systems, and the data is made accessible through the web via the ASP.net standard programming language. Both of these are common open technologies and can be built upon for future increased capacity and added functionality as desired in the future. Hosting of this web-based application is managed at a secure collocation site to assure data security, backup, and 24/7 accessibility. By using a centralized “client/server” approach to this application, we have eliminated the need to install and maintain any specialized software at any of the user’s sites. This database application requires only an Internet Browser to gain access to the database and to provide the query, mapping, and reporting functionality.

Further, updates and modification to the system can be accomplished centrally and avoid the pitfalls of an end user application that must be updated and maintained each time modifications are made. This approach also provides for central storage of the data for simplified backup and to assure the end user that they are viewing the most current information at all time.

The database attributes will be made more accessible through the use of an Interactive Mapping function that uses ESRI's ArcGIS Server. ArcGIS Server is a Geographic Information System (GIS) application that allows stakeholders to view well locations in the Seaside Basin from the database window online and ask for relevant reference information based on its geographic location. Zoom levels are restricted with some levels of access to meet the security requirements relative to the exact location of some well information. This interactive map is connected to the consolidated database, so users can view reports, run queries, and input data.

Accessibility

Due to the sensitive nature of some of the project information, the online database incorporates advanced online security features to meet data security requirements and protect the safety of the public and customers within the Watermaster's service area while still allowing easy access for the public and stakeholder agencies.

To provide specific access to those authorized to view and edit the information, the database has built in permission levels according for specific users. These permission levels are based on their security clearance level as defined by the Watermaster board. Each person who is authorized to login to the database and interactive mapping application is assigned their own individual user name and password, and can therefore only view and/or edit data that is allowed by their specific user security level.

Database Content

The data for the wells in the Seaside Basin were gathered from various agencies, both at the local and state levels. Participating agencies include the Monterey Peninsula Water Management District (MPWMD), Monterey County Water Resources Agency (MCWRA), Monterey County Health Department, City of Seaside, the California Department of Water Resources, and the Former Fort Ord.

After reviewing and crosschecking the data, and getting feedback and approval from the various agencies, the database structure was custom developed to meet the needs of the Water Master for reporting, data retrieval, and water quality analysis. An important design feature of the database is that it allows for flexibility and expandability for the future. A master list of ninety-six wells was compiled based on the data collected. Pertinent information such as State Well number, well type, location, construction/material specifications and dimensions are included in the master well listing inside the database. An additional data table of the water systems within Seaside Basin links to the main well information table and will allow the database users to find wells for a given water system. Further, by determining the water system and the “type” of water system, the database will reference a table of acceptable values to assist both in the data validation process at the time of data entry and to generate email alerts and reports when values fall outside the norm or the legislated limits. As more data is obtained for the wells, it is input to the centralized and consolidated database through the secure web application.

In addition to physical characteristics of the wells in the Seaside Basin, data for water quality, water production, and water level have also been incorporated into the database. Currently water quality data is limited to monitoring wells from the MPWMD. This available water quality information ranges from 1990 to April 2007 while the water depth table information ranges from 1987 to 2007. Production data is in the process of being obtained from the various stakeholders and state and local agencies and will be input along with remaining water quality and water level information into the database on an on-going basis.

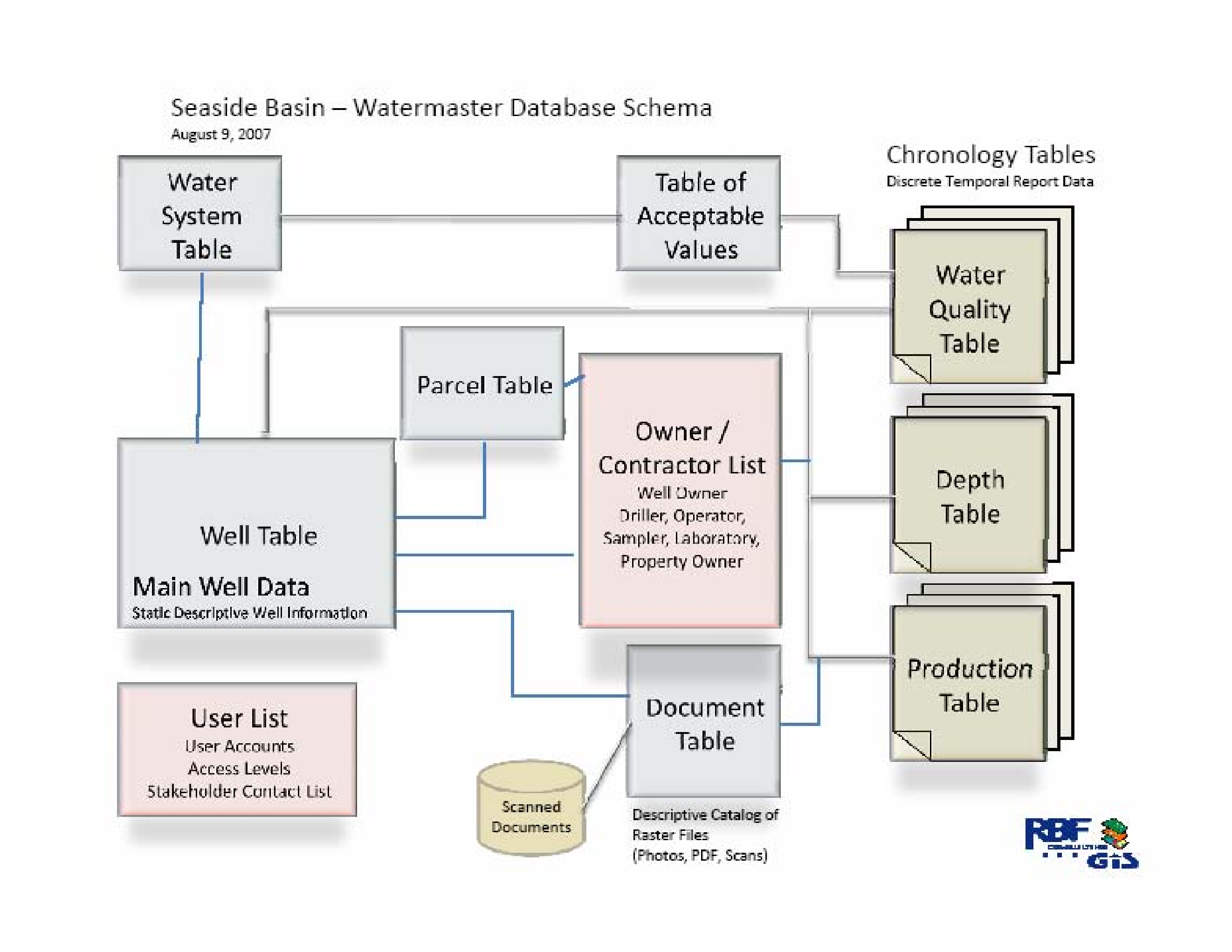
Another feature of the database is an automated data entry quality control and data validation tool which will compare water quality data that being input to federal and state water quality standard levels for pH, alkalinity, and 20 other constituent levels. If readings fall slightly outside the mandated standards, users of the online database will be warned and appropriate staff and agencies will be notified by an email alert that such a variation has been recorded. Should an entry be made which falls well outside the range of possible values, the user will be warned to check their data entry and re-enter the value before alerts are sent. By catching errors in data entry rather than waiting for later reports, the corrections can be made immediately and greatly improve the quality and reliability of the database applications.

Another integral part of the database includes a detailed contact list. This consolidated list of contact information includes accommodation for well owners, well operators, well drillers, property owners, water quality laboratories, and water quality samplers. This comprehensive approach will allow the administrators of the database to update contact information in one location and eliminate the common mistake of updates to one record and not to others leading to confusion and conflicting information thus lowering the value of the database application. Using the query functionality of the database, users will be able to quickly find an individual well or group of wells based on contact criteria, including ownership, driller, operator or even the laboratory or sampler which collected or processed the water sample.

The online database will also act as a document storage and retrieval system by storing scanned documents and photographs which are linked to respective wells, water quality reports, production records, or depth measurements. The design of the online interface will allow users to pick from a list of many documents and photographs related to a well and bring them up for viewing. Example documents include construction/destruction reports, site plans, permits, driller logs, capacity test reports, and site photos. Other types of documents can be accommodated as needed.

Appendix:

Database Schema/Diagram



View of editing page of online database

Data Tables for Seaside Basin Wells and Project Contact List

Microsoft SQL Server Management Studio — Table - dbo.tb_well

MPWMD Assign…	RBFWell ID	Well Name	APN	Sub Area	Water Use
T15S/R1E/15N3	101	MSC-Shallow	NULL	Northern Coastal	NULL
T15S/R1E/15N2	102	MSC-Deep	NULL	Northern Coastal	NULL
T15S/R1E/15F1	103	PCA-W Shallow	NULL	Northern Coastal	NULL
T15S/R1E/15F2	104	PCA-W Deep	NULL	Northern Coastal	NULL
T15S/R1E/15K5	105	PCA-E (Multiple) Shallow	NULL	Northern Coastal	NULL
T15S/R1E/15K4	106	PCA-E (Multiple) Deep	NULL	Northern Coastal	NULL
T15S/R1E/23B1	107	Ord Grove Test	NULL	Northern Coastal	NULL
T15S/R1E/14R1	108	Paralta Test	NULL	Northern Coastal	NULL
T15S/R1E/23Ca	109	Ord Terrace-Shallow	011-061-015	Northern Coastal	Monitoring
T15S/R1E/23Cb	110	Ord Terrace-Deep	011-061-015	Northern Coastal	Monitoring
T15S/R1E/11Pa	111	MPWMD #FO-09-Shallow	NULL	Northern Coastal	NULL
T15S/R1E/11Pb	112	MPWMD #FO-09-Deep	NULL	Northern Coastal	NULL
T15S/R1E/12Fa	113	MPWMD #FO-10-Shallow	NULL	Northern Coastal	NULL
T15S/R1E/12Fc	114	MPWMD #FO-10-Deep	NULL	Northern Coastal	NULL
T15S/R1E/26Ba	115	MPWMD #FO-01-Shallow	NULL	Northern Inland	NULL
T15S/R1E/26Bb	116	MPWMD #FO-01-Deep	NULL	Northern Inland	NULL
NULL	117	MPWMD #FO-01-Neutron Tube	NULL	Northern Inland	NULL
T15S/R1E/13La	118	MPWMD #FO-07-Shallow	NULL	Northern Inland	NULL
T15S/R1E/13Lb	119	MPWMD #FO-07-Deep	NULL	Northern Inland	NULL
T15S/R1E/12Qa	120	MPWMD #FO-08-Shallow	NULL	Northern Inland	NULL

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Microsoft SQL Server Management Studio — Table - dbo.tb...wnercontractor*

OwnerID	Company Name	Contact Person	email address	address	city	state	zip
601	MPWMD	Joe Oliver	joe@mpwmd.dst…	5 Harris Court B…	Monterey	CA	93942
602	Laguna Seca Resorts	Bob Costa	NULL	10520 York Road	Monterey	CA	93940
603	Monterey Sand & Gravel	NULL	NULL	PO Box 3055	Monterey	CA	93940
604	King Venture	NULL	NULL	290 Pismo St	San Luis Obispo	CA	93401
605	City of Sand City	NULL	NULL	1 Sylan Park	SAND CITY	CA	93955
606	Pacific Cement & Aggregates, Inc.	NULL	NULL	400 Alabama St.	San Francisco	CA	NULL
607	Granite Rock	NULL	NULL	PO Box 151	Watsonville	CA	95076
608	City of Seaside	NULL	NULL	440 Harcourt Ave	Seaside	CA	93955
610	BSI Golf of California	NULL	NULL	1 McClure Way	Seaside	CA	93955
611	Whitney L. Stolich	NULL	NULL	1014 Monterey Rd	Salinas	CA	93908
612	Monterey County Parks	NULL	NULL	1025 Monterey-…	Salinas	CA	93908
613	Shoreline Church	NULL	NULL	1200 Pidmont A…	Facific Grove	CA	93950
614	Bishop Water Co.	NULL	NULL	9599 Hwy 68	Monterey	CA	93940
615	York School	NULL	NULL	9501 York Rd.	Monterey	CA	93940
616	Wilson Street Enterprises LLC	NULL	NULL	100 Wilson Rd., …	Monterey	CA	93940
617	Hidden Hills Land Company	NULL	NULL	24700 Bit Rd.	Monterey	CA	93940
702	California American Water	NULL	NULL	303 H ST STE 250	Chula Vista	CA	NULL

1 of 19 — Cell is Read Only.

ATTACHMENT 9

ENHANCED MONITORING WELL NETWORK

MONTEREY PENINSULA
WATER MANAGEMENT DISTRICT

5 HARRIS COURT, BLDG. G
POST OFFICE BOX 85
MONTEREY, CA 93942-0085 • (831) 658-5600
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SEASIDE BASIN WATERMASTER
MEMORANDUM 2007-04

Date: October 23, 2007
To: Seaside Basin Watermaster
From: Joe Oliver, PG, CHg, Senior Hydrogeologist

Subject: Enhancement of Seaside Groundwater Basin Monitor Well Network

INTRODUCTION

Purpose

It was recognized by experts that testified at the Seaside Basin adjudication trial and by the presiding judge that the existing groundwater monitoring network needed to be enhanced in order to more effectively monitor for the presence and/or potential future occurrence of seawater intrusion into the basin. This recognition also led to the Court Decision[1] requirement that the Watermaster install additional monitor wells (i.e., Sentinel Wells) "along the shoreline and northern boundary of the basin". In addition, the court decision directed that the Watermaster develop a "Monitoring and Management Plan" that would include "periodic review of the monitoring information and the use of this information to guide near-term and long-term groundwater pumping". In response to the court decision's directives, the Watermaster prepared the "Seaside Basin Monitoring and Management Program" (SBMMP) document, which was adopted by the Watermaster Board in May 2006, and revised in September 2006 to comply with certain court-required amendments[2]. The SBMMP describes the historical and current monitoring network in the basin, as well as the planned expansion with the addition of the new coastal Sentinel Wells. Readers are referred to the SBMMP document for additional background.

Notwithstanding the current groundwater monitoring efforts in place, the SBMMP noted that there are deficiencies in the monitor well network coverage, both in spatial and depth control within the basin. This includes the Laguna Seca and Southern Coastal Subareas, where additional monitoring data are

[1] Monterey County Superior Court Case No. M66343. *California American Water vs. City of Seaside, et al.* Decision filed March 27, 2006; amended decision filed February 9, 2007.
[2] Amended SBMMP document is included in the January 12, 2007 *Watermaster's Post-Judgment Petition to: (a) Request Approval of the Revised Basin Monitoring and Management Plan; (b) Request Specific Clarifications and Amendments to the Court's Final Decision; and (c) Update the Court on Various Watermaster Tasks and Activities*, submitted to Monterey County Superior Court.

desired to fill in data gaps and allow improved hydrogeologic understanding and ultimate groundwater management in these areas of the basin. Accordingly, this memorandum describes the potential locations, types of data collection, and costs for enhancing the existing Seaside Basin groundwater monitoring network to improve on its effectiveness into the future. This work was conducted under Tasks I.2.g and h of the SBMMP-Phase 1 Implementation Plan[3].

Methods

Information compiled for this monitor well enhancement effort was compiled from previously prepared hydrogeologic investigations as well as from Monterey Peninsula Water Management District (MPWMD) and local water agency files. In addition, Martin Feeney provided information for several wells scattered throughout the basin, and for monitor wells in the area of the former Fort Ord Main Garrison, just north of the Northern Coastal Subarea. The recommendations provided herein for enhancement of the monitor well network included consideration of: (a) well depths, (b) well locations, (c) well perforations, and (d) well ownership and access logistics. Particular focus was given to the potential to utilize, to the extent feasible and practical, existing wells as opposed to newly-constructed wells, to enhance the existing monitor well network, to avoid unnecessary expenditures for construction of new wells. Maps prepared for this task were generated from the MPWMD's Geographic Information System with graphics support provided by Eric Sandoval.

Seaside Basin Aquifer System

As described in this document, there are two aquifer "zones" of primary interest in terms of the production of freshwater supplies in the Seaside Basin:

> the "***Shallow Zone***" consisting of the sand, silt and clay mix of continentally-derived, sedimentary deposits known by their geologic name as "Continental Deposits", and commonly known by local hydrogeologists as the "Paso Robles aquifer", and
>
> the "***Deep Zone***" consisting primarily of the marine-derived, sedimentary sandstone deposits known by their geologic name as "Santa Margarita Sandstone", and commonly known by local hydrogeologists as the "Santa Margarita aquifer". In addition, as recognized in part through the recent exploratory drilling associated with the new coastal Sentinel Wells, it is now believed that parts of the deep zone in and near the Northern Coastal and Inland Subareas are comprised of generally finer-grained sediments assigned to the Purisima Formation (i.e., Purisima aquifer).

It should be noted that the terms "Shallow Zone" and "Deep Zone" are relative. Shallow zone sediments can occur at depths of about 100 feet or less and can be up to about 600 feet in thickness in portions of the basin. Deep zone sediments occur stratigraphically below the shallow zone. Sediments associated with the Santa Margarita aquifer are generally on the order of 200 to 300 feet thick; sediments associated with the Purisima aquifer may be considerably thicker, although this understanding has not yet been well established in the basin.

It should also be noted that there is an additional groundwater zone, stratigraphically above the shallow zone, which occurs only where the near-surface sediments are saturated in and near the coastal areas of

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[3] Included in the March 13, 2007 *Report on Status of Consultant to Oversee Implementation of the Monitoring and Management Program,* submitted to Monterey County Superior Court.

the basin. This zone is commonly referred to as the "Dune Sands / Aromas Sand" aquifer, after the geologic names of these sediments, which are often difficult to distinguish in outcrops or drill cuttings. The Dune Sands / Aromas Sand aquifer is generally less than 70 feet thick where present in the coastal subareas, but can be over 300 feet north of the basin. This aquifer zone is generally not relied upon for the production of freshwater supplies in the basin, but an understanding of the extent and character of groundwater in this zone has significance with regard to potential water quality influences on the shallow and deep zones.

CURRENT MONITOR WELL NETWORK

The current monitor well network in the Seaside Basin is described in detail in the SBMMP, beginning on page 2 of that document. That detail is not be repeated here, but for convenience, a summary is provided as follows.

MPWMD

The Monterey Peninsula Water Management District is currently conducting periodic monitoring from a total of 41 wells in and near the Seaside Basin. These wells are listed on **Table 1**, ***Attribute Data for MPWMD Monitor Wells in and near the Seaside Basin***.

Watermaster

Within the last several months, four new dedicated coastal Sentinel monitor wells were installed and monitoring was initiated under the direction of Martin Feeney, on behalf of the Watermaster.

Other entities

California American Water (CAW) regularly measures water levels at 13 of their coastal and six of their inland production wells in the Seaside Basin. Groundwater quality data are also periodically collected from selected CAW wells, but the sampling schedule, including distribution and frequency for particular parameters of interest to ongoing basin management, is believed to have been intermittent.

The City of Seaside also collects some groundwater-level and quality data from their four municipal wells and two golf-course irrigation supply wells; similarly, the sampling schedule is believed to have been intermittent.

DISCUSSION OF POTENTIAL WELLS TO ENHANCE NETWORK

During the effort to compile a listing of potential wells to enhance the existing monitor well network, particular emphasis was placed on identifying existing wells that have completions primarily in a single aquifer zone, as opposed to multiple aquifer zone completions. The data collected from multiple completion wells often result in "composite" water level readings and water quality analyses, which tend to complicate analysis and interpretation of these data. A table listing potential wells that could be added to the network is provided as **Table 2**, ***Attribute Data for Wells in and near the Seaside Basin that Could Be Used to Enhance Monitor Well Network***. This listing is broken down by basin subarea and includes wells that appear to have the greatest potential value as monitor wells for inclusion in the network (i.e., shaded rows), and wells that were considered but do not appear to have as much potential value as monitor wells (i.e., unshaded rows), primarily because those wells did not meet the single-aquifer zone completion criterion. On the basis of the information in **Table 2**, four base maps were prepared to illustrate the spatial distribution of existing monitor wells and potential network-addition wells meeting the single-well completion criterion. These wells are highlighted on the four maps that display the following information:

- **Figure 1** – Existing and proposed shallow zone water level monitor wells
- **Figure 2** – Existing and proposed shallow zone water quality monitor wells
- **Figure 3** – Existing and proposed deep zone water level monitor wells
- **Figure 4** – Existing and proposed deep zone water quality monitor wells.

Presented in this way, these maps allow separate visual assessments of the spatial distribution of wells intended for the collection of water level and water quality data in the shallow and deep aquifer zones of the basin. This is consistent with the way data from these wells will ideally be displayed on future groundwater level contour maps and water quality contour maps of the basin. These figures are referenced more specifically in the discussions under each subarea below.

Northern Coastal Subarea

Dune Sands / Aromas Sand **–** As stated previously, this aquifer zone is not important for freshwater supply production in the basin. There are correspondingly few existing monitor wells, therefore, separate base maps depicting the distribution of existing and potentially available monitor wells completed in this aquifer zone are not included in this memorandum. Nonetheless, although this aquifer zone is not an important freshwater supply production source, several well locations have been identified at which it would be beneficial to collect water level and/or water quality data. These data will help in determining the vertical gradients between this aquifer zone and deeper zones, as well as assist in assessing the potential for vertical migration of poorer quality water that is present at some locations in this zone, particularly north of the Northern Coastal Subarea. The most significant area in which poorer quality water exists is the Main Garrison area of the former Fort Ord, where historical pumping resulted in seawater intrusion into this aquifer zone. There are several existing monitor wells that were installed by the Army as part of a surface-source contamination cleanup program in this area that have recorded Specific Conductance measurements of greater than 20,000 micromhos/cm (µmhos/cm). For reference, freshwater in the Seaside Basin is generally 1,000 µmhos/cm or less; pure seawater is on the order of 50,000 µmhos/cm. It is recommended that a minimum of one representative monitor well from this zone be added to the network to allow ongoing monitoring of any trends that might emerge. Three likely candidate wells are shown in **Table 2**. Additional discussion with Fort Ord Base Realignment and Closure (BRAC) staff and consultants needs to take place before selecting the most appropriate of these wells to add to the network. As a means to reduce groundwater-quality sampling costs, water samples from a well in this aquifer zone could be collected at the same time that discrete depth samples are being collected at the nearby Sentinel Wells during planned quarterly induction logging. It may also be possible to select a suitable monitor well from this area that is planned for continued sampling by the Army, therefore reducing potential cost to the Watermaster. In addition to the above, there are two existing wells located near Sentinel Wells 1 and 4 that are recommended for groundwater-level measurement on the same schedule as the Sentinel Wells (see wells CDM MW-1 and -2 on **Table 2**).

Shallow Zone **–** As shown on **Figure 1** and **Figure 2**, there is relatively good spatial coverage of water level and water quality monitor wells in the shallow zone in and near the Northern Coastal Subarea. However, maintenance of this level of coverage depends in part on the assumption that Watermaster member producers will collect and report water quality and/or level data from their production wells in accordance with the requirements contained in the court-approved SBMMP[4], which has now become the template for the Phase 1 SBMMP implementation effort currently underway. Specifically, the SBMMP (page 10) requires that:

(a) "All active and inactive production wells **in the basin** [*emphasis added*] owned and/or operated by a Watermaster member shall have static (i.e., non-pumping) water levels collected and recorded a minimum of once per month", and
(b) "All active production wells **in the coastal subareas of the basin** [*emphasis added*] owned and/or operated by a Watermaster member shall have a water quality sample from each well collected and analyzed by a state-approved laboratory for the full general inorganic mineral suite a minimum of once per year".

Based on the recent data gathering effort conducted in support of the seawater intrusion (SWI) analysis being conducted on behalf of the Watermaster by Hydrometrics (under contract from RBF Consulting), it appears that not all of these required data have been collected by Watermaster members. This lack of sufficient data has compromised the SWI analysis by limiting the current characterization of both water levels and water quality by aquifer zone. Accordingly, Watermaster members need to be reminded of their obligations under the SBMMP. To be consistent with the timing established for generating annual water level and quality contour maps as part of the recent SWI analysis effort, these data should be collected in the Fall of each year, preferably in the month of October. As an incentive, a Board policy could be adopted to allow Watermaster members to be charged for the completion of this work if the required elements are not performed by Watermaster members on their own.

In addition, several individual wells in the Northern Coastal Subarea have been identified at key locations that will improve the network coverage in this area. These wells are shown with highlighted red circles on **Figure 1** and **Figure 2**, and are listed below:

CAW Del Monte Observation Well. This inactive well was originally installed by CAW in 1975 as an early detection well for potential SWI, but has not been monitored for water quality purposes for a number of years. This well has a pump and motor but it is not known if these are operable for the purpose of sample collection.

Seaside – Coe Ave. Golf Course Well. This active well is being used to supply irrigation water to the Bayonet and Blackhorse golf courses. Collection of water samples will need to be coordinated with the well's operator.

Paso Robles Test Injection Well (PRTIW). This active well was originally installed in 1998 by the MPWMD as part of the basin groundwater injection testing program, on property owned by Mission Memorial Park (MMP). The well is now in active use by MMP for landscape irrigation at the cemetery. Collection of water samples will need to be coordinated with the well's operator.

[4] Included in the January 12, 2007 *Watermaster's Post-Judgment Petition to: (a) Request Approval of the Revised Basin Monitoring and Management Plan; (b) Request Specific Clarifications and Amendments to the Court's Final Decision; and (c) Update the Court on Various Watermaster Tasks and Activities*, submitted to Monterey County Superior Court.

Deep Zone -- Deep zone water level and quality monitor wells are depicted on **Figure 3** and **Figure 4**, respectively. Existing well water level and quality data coverage, with the inclusion of the recently completed coastal Sentinel Monitor wells, is considered adequate in the coastal portion and north of the Northern Coastal Subarea, but a data gap exists farther away from the coast. This is primarily due to the fact that most of the available wells in this subarea are CAW production wells that are either completed solely in the shallow zone, or have multiple completions in both the shallow and deep zones. One key area to fill in the data gap is at the location of the City of Seaside's Well Nos. 3 and 4 near the eastern side of the Northern Coastal Subarea, as listed below:

Seaside Wells 3 and 4. Both these wells have completions primarily in the deep zone, and are active wells with operable pumps and motors. Well No. 4 appears to be the current baseload well for the Seaside municipal supply system, so it has been selected for addition to the network. Collection of water samples will need to be coordinated with the well's operator.

Northern Inland Subarea

Shallow Zone **–** As shown on **Figure 1** and **Figure 2**, there are very few existing shallow zone production or monitor wells in the Northern Inland Subarea. Much of this subarea is within the inland firing ranges and other restricted areas of the former Fort Ord; consequently few wells have been drilled in this area over time. Based on the well data research conducted for this task, there are currently no additional existing, single-completion, shallow-zone wells that could be used to enhance the monitor well network in this subarea.

Deep Zone **–** Similarly, as shown on **Figure 3** and **Figure 4**, there are few existing deep zone production or monitor wells in the Northern Inland Subarea. The only additional well identified to add to the monitor well network is:

MPWMD Aquifer Storage and Recovery Monitor Well No. 1 (ASR MW-1). This dedicated monitor well was constructed in early 2007 to provide data support for the Phase 1 ASR Project. This well has a single completion in the Santa Margarita aquifer. This well is not required to report groundwater level or quality data as per the SBMMP; however, such data are planned to be collected by the MPWMD as part of the ongoing ASR program, so no additional costs to the Watermaster are anticipated.

Additional monitor wells were proposed along the northern boundary of the Northern Inland Subarea in response to the directive described in Appendix A of the Court Decision, as a means to better characterize hydrogeologic conditions in this area of the basin[5]. Such wells at or near these locations, if added in the future, would significantly enhance the understanding of hydrogeologic conditions in this area of the basin, and would provide improved basin management benefits, as well as support existing and planned water supply augmentation projects, such as ASR expansion and recycled water recharge (i.e., Groundwater Replenishment Project under investigation by the Monterey Regional Water Pollution Control Agency).

[5] See Proposed Monitor Well Sites #7 and #8 on Figure 4 of the SBMMP, included in the January 12, 2007 *Watermaster's Post-Judgment Petition to: (a) Request Approval of the Revised Basin Monitoring and Management Plan; (b) Request Specific Clarifications and Amendments to the Court's Final Decision; and (c) Update the Court on Various Watermaster Tasks and Activities*, submitted to Monterey County Superior Court.

Southern Coastal Subarea

Dune Sands / Aromas Sand **–** There are two existing monitor wells located near the coastline that are recommended for a minimum of annual water level collection (see wells CDM MW-3 and -4 on **Table 2**).

Shallow Zone **–** Existing water-level and water-quality monitor well coverage is relatively sparse in the Southern Coastal Subarea, as shown on **Figure 1** and **Figure 2**, respectively. This is due in part to the nature of the hydrogeology of this area of the basin, where the primary aquifer zones of interest have limited saturated thickness and correspondingly lower individual well production capacity. Therefore, there are fewer active producing wells in this subarea of the basin. Accordingly, conditions in this area are less conducive to regional SWI, compared to the Northern Coastal Subarea. Regardless, it is important from a basin management perspective, to maintain some level of monitor well control in this area to characterize the system and allow assessment of potential groundwater flow interchange with the Northern Coastal Subarea, as has been postulated previously, and of any variability or long-term trends in groundwater conditions. For these purposes, several additional wells at key locations have been identified for addition to the monitor well network, as listed below:

Calabrese (Cypress Pacific). This active well is currently pumped for industrial uses, and has an operable pump and motor. Collection of water samples will need to be coordinated with the well's operator.

Sand City Design Center. This active well is currently pumped for supplemental irrigation uses, and has an operable pump and motor. Collection of water samples will need to be coordinated with the well's operator.

MW-BW-09-180. This is a monitor well installed as part of the basewide hydrogeologic investigation conducted by the Army in the early 1990's. This well, and a shallower well next to it (MW-BW-08-A), should be monitored for water levels only, on a minimum of a quarterly basis. Coordination with Army Range control is needed prior to initiating monitoring at this location.

Deep Zone **–** There are relatively few existing monitor wells completed in the deep zone in the Southern Coastal Subarea, for similar reasons as discussed above under the shallow zone. Currently, there are no suitable existing deep zone, single-completion wells that could be readily and inexpensively added to the network. Additional shallow and/or deep zone production wells have been proposed in previous reports for possible addition to CAW's coastal Seaside Basin production well system (including CAW's Harcourt and MGT properties), as a means to better disperse coastal production. However, to date no steps have been taken to add production wells in this subarea of the basin. Such wells, if added in the future, would improve monitoring control in this area of the basin.

Southern Inland (Laguna Seca) Subarea

Shallow Zone – As shown on **Figure 1** and **Figure 2**, existing monitor well coverage in the shallow zone within the Laguna Seca Subarea is relatively sparse, compared with the coastal subareas, particularly with regard to the availability of suitable wells for the collection of groundwater quality data. Recognition of the need for better spatial distribution of monitor wells in this subarea has been described in previous reports, most recently in the *Laguna Seca Subarea Phase III Hydrogeologic*

Update[6]. In that report, it was opined that "Because the spatial variability in the groundwater system appears to be high, a large number of measurement locations would provide a better estimate of 'average' conditions and would allow unusual wells to be identified more confidently." Accordingly, several single-completion, shallow-zone wells were identified for better spatial coverage in the Laguna Seca Subarea, as listed below:

York School. This active well, located on the southern flank of the Laguna Seca Anticline, is ideally suited to fill in an existing data gap in the shallow zone coverage. It is currently used for irrigation supply and is equipped with an operable pump and motor. Collection of annual water samples will need to be coordinated with the well's operator.

Laguna Seca Driving Range (SCS-Deep). This is an existing monitor well near the entry to the Laguna Seca golf course driving range that is ideally located to fill in a groundwater quality data gap in the central portion of the Laguna Seca Subarea. This well does not currently have a pump and motor for sample collection, and would need to be equipped for airlift sampling unless another non-purge collection system can be utilized. Collection of annual water samples will need to be coordinated with the golf course operator.

CAW East Fence. This is a standby production well, also in an area of deficient data coverage. It is currently not in active use, and will need assessment with CAW operators to determine any work required to activate the well for annual water quality sampling purposes.

Laguna Seca County Park No. 4. This is an active production well, equipped with an operable pump and motor. It is the farthest easterly well available for water-quality sample collection from the shallow zone in the Laguna Seca Subarea. If this well is not suitable for monitoring, the nearby No. 3 well, if similarly completed, would be suitable. Collection of annual water samples will need to be coordinated with the well's operator.

Deep Zone -- As shown on **Figure 3** and **Figure 4**, existing monitor well coverage in the deep aquifer zone within the Laguna Seca Subarea is not well distributed and is particularly sparse with regard to the availability of suitable wells for the collection of groundwater quality data. Based on the well data review, there are several potential deep-zone wells that should be added to enhance the Laguna Seca Subarea coverage, as listed below:

CAW Granite Construction. This is a test well that was recently installed by CAW on Granite Construction Company property at Ryan Ranch. The well was installed to test the production capability in this area of CAW's Ryan Ranch Unit. The well is inactive and does not currently have an installed pump and motor. At this time, it is recommended that this well be added for quarterly water-level monitoring purposes only. Because the well is not near an active production well, its water level measurements would be well suited for tracking long-term groundwater level trends in this portion of the subarea. The well will need minor wellhead modifications to convert it to a monitor well. If adequate groundwater quality data coverage is not attainable from other nearby Ryan Ranch Unit wells, then consideration should be given to equipping this well for groundwater-quality sample collection.

Ryan Ranch No. 7 (RR-7). This is an active well that currently supplies the baseload production from CAW's Ryan Ranch Unit. The well has an operable pump and motor to facilitate

[6] Yates, Feeney and Rosenberg, November 2002. Report prepared for MPMWD. See page 65.

collection of groundwater quality samples. Annual water quality sample collection should be coordinated with CAW staff.

Laguna Seca Golf No. 12 (LS Golf #12). There are two wells in close proximity at this site that would be suitable additions to the monitor well network. An inactive well, known as "Laguna Seca_Old No. 12" has been converted to monitor well status, and regular (i.e., monthly) groundwater-level measurements have been conducted by golf-course staff since the well was deactivated in 2003, but the well's location and historical data have not yet been formally added to the Watermaster database. This task should be done as part of the pending finalization of the database. Nearby, there is a similarly completed replacement production well for golf course irrigation, known as "Laguna Seca_New No. 12". This well is ideally located and equipped to collect groundwater-quality samples. Collection of annual water samples will need to be coordinated with the well's operator.

Pasadera Main Gate. This is an active production well for irrigation and landscape use at the Pasadera golf course. It is also ideally located and equipped to supplement both groundwater-level and groundwater-quality coverage from the deep zone in the Laguna Seca Subarea. Collection of annual groundwater-quality samples will need to be coordinated with the well's operator.

CONCLUSIONS

- There are significant data gaps in the current monitor well distribution network, particularly with regard to groundwater-quality monitor wells needed to improve the understanding and characterization of groundwater-quality variability, both spatially and vertically within the basin.
- Based on the review of available well data, there are existing wells that could be utilized to help fill in the existing data gaps. To the extent possible, existing wells in key locations were identified; where groundwater-quality coverage was needed, wells that are currently active with pumps and motors were selected to minimize costs associated with retrieving groundwater-quality samples. Utilization of existing wells will result in significantly less cost to the Watermaster, compared to the installation of new, dedicated monitor wells.
- Existing provisions in the court-approved Seaside Basin Monitoring and Management Program (SBMMP) require certain groundwater-level and groundwater-quality data collection and reporting from Watermaster member production wells for incorporation into the Watermaster's consolidated groundwater-resources database. It appears that at least some of the required data collection have not been conducted by Watermaster members as prescribed in the SBMMP. If these required data had been available they would have significantly benefited the groundwater-level and quality analyses recently undertaken as part of the Phase 1 implementation of the SBMMP.
- The monitor well enhancements recommended in this memorandum are consistent with conclusions reached about the need for additional monitor well coverage as described in the document being prepared by Hydrometrics LLC and RBF Consulting for the Watermaster under the Phase 1 implementation of the SBMMP, titled *Seawater Intrusion Analysis Report, Seaside Basin, Monterey County California* (October 2007).
- Costs associated with the monitor well enhancements described herein have been developed and are in the process of being incorporated into the preliminary budget for Phase 2 of the SBMMP, which has been reviewed by the Watermaster Technical Advisory Committee and recommended to the Watermaster Board. The cost assumptions include that Watermaster

members will fulfill their obligations for collecting and reporting monitoring data from their production wells, to support the Watermaster *Production, Water Level and Quality Monitoring Program*, as per the SBMMP.

RECOMMENDATIONS

- Beginning as soon as possible, all Watermaster members need to be reminded of their obligations to collect water resources data, as specified in the SBMMP. This includes monthly collection of groundwater-level data from all active and inactive production wells basinwide, and annual (Fall) collection and analysis of general mineral (inorganic) groundwater-quality data from all active production wells in the coastal subareas of the basin. These data are to be reported annually for inclusion in the Watermaster's groundwater-resources database. Notice of this obligation should be provided by the Watermaster. The Watermaster should consider a policy to allow Watermaster members to be charged for the completion of this work if the required elements are not performed by Watermaster members on their own.
- At least one representative monitor well from the Dune Sand / Aromas Sands aquifer zone north of the Northern Coastal Subarea should be added to the basin monitor-well network. There are several possible existing monitor wells on former Fort Ord property that would be suitable for this purpose. Monitoring can be combined with planned induction logging of the Watermaster's new coastal Sentinel Wells for cost efficiency.
- There are seven (7) wells recommended for either quarterly or annual groundwater-level monitoring elsewhere in the basin, which are not otherwise obligated for monitoring by Watermaster members, as per the SBMMP. Costs associated with collecting and recording these data will need to be borne by the Watermaster. Costs for this work have been estimated and are being incorporated into the preliminary budget for Phase 2 of the SBMMP. These wells are listed as follows:

    1. CDM MW-1
    2. CDM MW-2
    3. CDM MW-3
    4. CDM MW-4
    5. MW-BW-08-A
    6. MW-BW-09-180
    7. CAW Granite Construction test (CAW Granite Constr.)

- There are seven (7) wells recommended for addition of annual groundwater-quality sampling in the Laguna Seca Subarea of the basin, which are not otherwise obligated for monitoring by Watermaster members, as per the SBMMP. Costs associated with equipping, collecting and analyzing the water quality samples from these seven wells will need to be borne by the Watermaster. Costs for this work have been estimated and are being incorporated into the preliminary budget for Phase 2 of the SBMMP. These seven wells are listed as follows:

    1. York School
    2. Laguna Seca Driving Range (SCS Deep)
    3. CAW East Fence
    4. Laguna Seca County Park No. 4
    5. CAW Ryan Ranch No. 7

6. Laguna Seca Golf New No. 12
7. Pasadera Main Gate

- A summary list showing all wells recommended for addition to the existing monitor well network is provided below, along with its location, depth zone, data collection type, and Watermaster member obligation, as per the SBMMP.

Well Name	Subarea Location (in or near)	Depth Zone	Data Collection Type	Watermaster Member Obligation
Fort Ord monitor (TBD)	Northern Coastal	Dune/Aromas	WL, WQ	No
CDM MW-1 and -2	Northern Coastal	Dune/Aromas	WL	No
CAW Del Monte Observ.	Northern Coastal	Shallow	WL, WQ	Yes (WL only)
Coe Ave. Golf Course	Northern Coastal	Shallow	WL, WQ	Yes
PRTIW (Mission Mem.)	Northern Coastal	Shallow	WL, WQ	Yes
Seaside #4	Northern Coastal	Deep	WL, WQ	Yes
MPWMD ASR MW-1	Northern Inland	Deep	WL, WQ	No
CDM MW-3 and -4	Southern Coastal	Dune/Aromas	WL	No
Calabrese (Cypress Pacific)	Southern Coastal	Shallow	WL, WQ	Yes
Sand City Design Center	Southern Coastal	Shallow	WL, WQ	Yes
MW-BW-08-A	Southern Coastal	Dune/Aromas	WL	No
MW-BW-09-180	Southern Coastal	Shallow	WL	No
York School	Laguna Seca	Shallow	WL, WQ	Yes (WL only)
LS Drvng Rng (SCS-Deep)	Laguna Seca	Shallow	WL, WQ	No
CAW East Fence	Laguna Seca	Shallow	WL, WQ	Yes (WL only)
LS County Park #4	Laguna Seca	Shallow	WL, WQ	Yes (WL only)
CAW Granite Constr.	Laguna Seca	Deep	WL	No
CAW Ryan Ranch (RR) #7	Laguna Seca	Deep	WL, WQ	Yes (WL only)
LS Golf Old #12	Laguna Seca	Deep	WL	Yes
LS Golf New #12	Laguna Seca	Deep	WQ	No
Pasadera Main Gate	Laguna Seca	Deep	WL, WQ	Yes (WL only)

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SEASIDE BASIN WATERMASTER
MEMORANDUM 2007-04

TABLES

Table 1.

ATTRIBUTE DATA FOR MPWMD MONITOR WELLS IN AND NEAR THE SEASIDE BASIN

Well Name	State Well No.	Date Drilled	DWR Well Drillers Report	MCHD Permit	Data Type	Hole Depth (feet)	Well Depth (feet)	Screened Interval (feet)	Strata Seal (feet)	Casing Type	Geologic Unit	Elevation (feet AMSL)
Northern Coastal Subarea (and vicinity)												
MSC-Shallow	15S/1E-15N3	5/25/1990	338413		wl, wq	720	695	490 - - 680	95 - 275	2" pvc	QTc	80.58 (s1)
MSC-Deep	15S/1E-15N2	5/25/1990	338425		wl, wq	920	865	810 - 850	725 - 775	2" pvc	Tsm	80.78 (s1)
PCA-W Shallow	15S/1E-15F1	3/28/1990	338400		wl, wq	600	585	525 - 575	120 - 150	2"pvc	QTc	64.64 (s1)
PCA-W Deep	15S/1E-15F2	3/28/1990	338401		wl, wq	900	885	825 - 875	760 - 790	2" pvc	Tsm	65.60 (s1)
PCA-E (Multiple) Shallow	15S/1E-15K5	4/16/1990	338402		wl, wq	863	410	350 - 400	110 - 150	2" pvc	QTc	69.31 (s1)
PCA-E (Multiple) Deep	15S/1E-15K4	4/16/1990	338402		wl, wq	863	710	650 - 700	580 - 620	2" pvc	Tsm	69.31 (s1)
Ord Grove Test	15S/1E-23B1	8/15/1968	30695		wl	495	483	355 - - 480	- -	14" steel	QTc/Tsm	288.62 (s2)
Paralta Test	15S/1E-14R1	3/13/1990	338424		wl	960	810	430 - - 800	- -	6" pvc	QTc/Tsm	331.25 (s2)
Ord Terrace-Shallow	15S/1E-23Ca	8/5/1999	- -		wl, wq	530	340	280 - 330	- -	2" pvc	Tsm (upper)	230 (e1)
Ord Terrace-Deep	15S/1E-23Cb	8/5/1999	- -		wl, wq	530	450	390 - 440	350 - 377	2" pvc	Tsm (lower)	230 (e1)
MPWMD #FO-09-Shallow	15S/1E-11Pa	8/16/1994	- -		wl, wq	1,110	660	610 - 650	500 - 540	2" pvc	QTc/Tp	119.11 (s3)
MPWMD #FO-09-Deep	15S/1E-11Pb	8/16/1994	- -		wl, wq	1,110	840	790 - 830	700 - 765	2" pvc	Tsm	119.15 (s3)
MPWMD #FO-10-Shallow	15S/1E-12Fa	9/3/1996	442738	WSAL 96-118	wl, wq	1,500	650	620 - 640	480 - 500	2" pvc	QTc	201.19 (s3)
MPWMD #FO-10-Deep	15S/1E-12Fc	9/3/1996	442738	WSAL 96-118	wl, wq	1,500	1,420	1,380 - 1,410	1,280 - 1,300	2" pvc	Tp	201.10 (s3)
Northern Inland Subarea (and vicinity)												
MPWMD #FO-01-Shallow	15S/1E-26Ba	12/10/1986	?		wl	490	325	310 - 320	- -	2" pvc	QTc	362.95 (s4)
MPWMD #FO-01-Deep	15S/1E-26Bb	12/10/1986	?		wl	490	465	450 - 460	330 - 350	2" pvc	Tm	362.88 (s4)
MPWMD #FO-01-Neutron Tube	- -	8/87	- -		- -	30	28	none	- -	2" alum.	- -	- -
MPWMD #FO-07-Shallow	15S/1E-13La	7/12/1994	- -		wl	940	650	600 - 640	520 - 540	2" pvc	QTc	473.94 (s3)
MPWMD #FO-07-Deep	15S/1E-13Lb	7/12/1994	- -		wl	940	850	800 - 840	700 - 750	2" pvc	Tsm	473.97 (s3)
MPWMD #FO-08-Shallow	15S/1E-12Qa	7/25/1994	- -		wl	1,110	790	740 - 780	640 - 690	2" pvc	QTc	378.53 (s3)
MPWMD #FO-08-Deep	15S/1E-12Qb	7/25/1994	- -		wl	1,110	950	900 - 940	830 - 850	2" pvc	Tsm	378.54 (s3)
MPWMD #FO-11-Shallow	15S/2E-7Ba	10/28/1996	442739	WSAL 96-119	wl	1,175	740	700 - 730	500 - 540	2" pvc	QTc	333.39 (s3)
MPWMD #FO-11-Deep	15S/2E-7Bb	10/28/1996	442739	WSAL 96-119	wl	1,175	1,130	1,090 - 1,120	700 - 765	2" pvc	Tp	333.39 (s3)
Southern Coastal Subarea (and vicinity)												
Plumas '90 Test	15S/1E-27J6	4/25/1990	338414		wl	550	485	430 - 470	- -	2" pvc	Tsm	158.41 (s2)
K-Mart	15S/1E-21Re	1976	- -		wl	114	- -	40 - 60	- -	8" pvc	Qod/Qar	31.41 (s5)
Laguna Seca Subarea (and vicinity)												
MPWMD #FO-03-Shallow	- -	- -	- -		wl	- -	QTc not saturated -- no shallow well completed at this site					
MPWMD #FO-03-Deep	15S/2E-33Ca	12/19/1986	- -		wl	715	645	630 - 640	390 - 410	2" pvc	Tsm	775.47 (s4)
MPWMD #FO-03-Neutron Tube	- -	8/87	- -		- -	25	24	none	- -	2" alum.	- -	- -
MPWMD #FO-04-Shallow (E)	15S/1E-26Na	10/26/1988	192669		wl	320	320	260 - 300	- -	2" pvc	QTc	168.95 (s4)
MPWMD #FO-04-Deep (W)	15S/1E-26Nb	10/24/1988	192670		wl	640	580	500 - 560	340 - 345	2" pvc	Tsm	168.27 (s4)
MPWMD #FO-05-Shallow	16S/2E-04Ha	6/7/1991	- -		wl	1,200	740	690 - 730	- -	2" pvc	QTc	477 (e2)
MPWMD #FO-05-Deep	16S/2E-04Hb	6/7/1991	- -		wl	1,200	1,187	1,147 - 1,187	890 - 1,025	2" pvc	Tsm	477 (e2)
MPWMD #FO-06-Shallow	16S/2E-04Fa	6/14/1991	- -		wl	1,200	700	650 - 690	- -	2" pvc	QTc	470 (e2)
MPWMD #FO-06-Deep	16S/2E-04Fb	6/14/1991	- -		wl	1,200	1,100	1,050 - 1,090	870 - 1,005	2" pvc	Tsm	470 (e2)
Justin Court (RR M2S)	15S/1E-35Jb	6/1981	- -		wl	160	160	135 - 155	- -	2" pvc	QTc	240.80 (s2)
LS Pistol Range (Mo Co TH-1)	15S/2E-32Ra	5/27/1988	- -		wl	560	490	430 - 470	- -	2" pvc	Tsm	480 (e1)
York Rd-West (Mo Co MW-1 D)	15S/1E-36Rb	6/8/1988	- -		wl	620	620	560 - 600	- -	2" pvc	Tsm	505 (e1)
Seca Place (Mo Co MW-2)	16S/2E-04Lc	6/22/1988	- -		wl	1,000	1,000	930 - 980	- -	2" pvc	Tsm	430 (e1)
Robley Shallow (North) (Mo Co MW-3S)	16S/2E-09Bb	6/29/1988	- -		wl	430	430	380 - 420	- -	2" pvc	QTc	540 (e1)
Robley Deep (South) (Mo Co MW-3D)	16S/2E-09Bc	6/29/1988	- -		wl	1,000	820	750 - 800	- -	2" pvc	Tsm	540 (e1)
LS Driving Range (SCS Deep)	16S/2E-06C2	- -	- -		wl	- -	460	- -	- -	pvc	QTp	491 (e1)
LS No. 1 Subdivision	16S/2E-06M1	- -	- -		wl	- -	404	- -	- -	steel	Tsm	285 (e1)
Blue Larkspur-East End	16S/1E-01Hx	- -	- -		wl	- -	- -	- -	- -	steel	- -	255 (e1)
Laguna Seca_Old No. 12	16S/2E-06G4	5/2/1997	461400		wl	520	500	120 - 480	- -	12" pvc	Tsm	340 (e1)

NOTES:
1. Well Numbers are unofficial designations; not verified with DWR-assigned well numbers.
2. Geologic Unit refers to the unit adjacent to the screened interval: Qod/Qar = Quaternary "Older Dunes and Aromas Sand" (Dune aquifer); QTc = Tertiary and Quaternary "continental deposits" (Paso Robles aquifer); Tsm = Tertiary "Santa Margarita Sandstone" (Santa Margarita aquifer); Tp = "Purisima Formation"; and Tm = "Monterey Formation".
3. Elevation = reference point elevation at the wellhead: (e1) = estimated with Paulin altimeter; (e2) = estimated from topo map; (s1) = surveyed by Land Data Services (LDS) (Jul 20, 1990); (s2) = surveyed by LDS (Aug 27, 1992); (s3) = surveyed by Sandis Humber Jones (1995 and 1997); (s4) = surveyed, source uncertain; (s5) = surveyed by MPWMD (Jun 6, 1997).
4. "- -" in a blank cell means not applicable or not available. "- -" in a Screened Interval cell indicates multiple screen intervals.
5. Data Type refers to MPWMD data collected: wl = water level; wq = water quality.
6. Well completion data at sites MPWMD #FO-01, 2, and 3 are documented in "Fort Ord Ground Water Monitoring Well Project", Staal, Gardner & Dunne, Inc. (SGD), Jan 1987.
7. Well completion data at site MPWMD #FO-04 are documented in "Supplemental Hydrogeologic Assessment, Monterey Research Park, Laguna Sca Subarea", SGD, Nov 1988.
8. Well completion data at site MPWMD #FO-05 and 6 are documented in "Laguna Seca Ranch, Supplemental Hydrogeologic Assessment", SGD, Jul 12, 1991.
9. Well completion data for MSC, PCA-W, PCA-E, Plumas '90 Test and Paralta Test sites are documented in individual reports for each of these sites, SGD, Jul 1990.
10. Well completion data for Justin Court site are documented in "Additional Investigations of Ryan Ranch's Water Supply", John Logan, Jun 27, 1981.
11. Well completion data for LS Pistol Range, York Rd-West, Seca Place, and Robley Rd sites are documented in "Phase II Hydrogeologic Investigation, Laguna Seca Subarea", SGD, Sep 1988.
13. Well completion data for LS Driving Range (SCS Deep) and LS No. 1 Subdivision sites are listed in Appendix B of "Phase II Hydrogeologic Investigation, Laguna Seca Subarea", SGD, Sep 1988.
14. Geologic unit picks for MPWMD FO-09 and FO-10 sites from Feeney and Rosenberg, Mar 31, 2003 (Figure 4).
15. The well at the location of "Blue Larkspur-East End" has been described in LSS Phase II and III reports as "LSR '59 Pond Test". However, based on information and notes from DWR Log #43668, it appears that "LSR '59 Pond Test" well has been misinterpreted to be located at the east end of Blue Larkspur Lane. Accordingly, well completion data for "Blue Larkspur-East End" are not known.
16. In addition to the wells shown in this table, the MPWMD utilizes water level data from selected CAW production wells as part of its monthly groundwater storage tracking program in the coastal subareas of the basin.

Table 2.

ATTRIBUTE DATA FOR WELLS IN AND NEAR THE SEASIDE BASIN THAT COULD BE USED TO ENHANCE MONITOR WELL NETWORK

Well Name	State Well No.	Date Drilled	DWR Well Drillers Report	MCHD Permit	Data Type	Hole Depth (feet)	Well Depth (feet)	Top of Screen (feet)	Bot of Screen (feet)	Screened Interval (feet)	Elevation - Top of Screen (feet AMSL)	Elevation - Bottom of Screen (feet AMSL)	Surface Seal Bottom (feet)	Top of Strata Seal (feet)	Bot of Strata Seal (feet)	Casing Type	Screened Geologic Formation	Elevation (feet AMSL)
Northern Coastal Subarea (and vicinity)																		
MW-02-04-180 (closest to WM-1)					wl, wq			90	110	90-110	9	-11		70	80	4" pvc	Qod/Qar ?	99.3
MW-02-11-180 (closest to WM-1)					wl, wq			80	100	80-100	16	-4				4" pvc	Qod/Qar ?	95.67
CDM MW-1 (at WM-1 site)	15S/1E-02Pa	11/12/2003			wl	161.5	140	129.5	139.5	129-139	-33	-43	120			2" pvc	Qod/Qar ?	96.5
CDM MW-2 (at WM-4 site)	15S/1E-15Ga	11/17/2003			wl	106.5	96	81	91	81-91	-14	-24	71			2" pvc	Qod/Qar	66.8
MW-B-23-180 (nr FO Main Entr.)					wl			90	140	90 - 140								
CAW Del Monte Observation	15S/1E-22Cd	11/22/1975	146381		wl, wq	194	178	155	175	155-175	-122	-142				8" steel	QTc	32.97
Seaside - Coe Ave. Golf	15S/1E-14Ma	5/31/1965	107527		wl, wq	545	208	170	200	170-200	-55	-85	118			8" steel	QTc	115
PRTIW	15S/1E-23Ac	5/8/1998	520448	WSAL-024	wl, wq	463	460	345	445	345-445	-18	-118	295			12" steel	QTc	327
Seaside - Muni #4	15S/1E-23Gc	3/29/2001	742178	00-307	wl, wq	590	560	330	550	330 -- 550	-22	-242	300			12" steel	Tsm	308
Northern Inland Subarea (and vicinity)																		
MPWMD ASR MW-1	15S/1E-23Ae	1/1/2007		06-10985	wl, wq	806	740	500	730	500 - - 730	-159	-389	450			2" pvc	Tsm	341.5
Seaside Golf - Reservoir Well	15S/1E-13Na	8/7/1998	701787	98-111	wl, wq	695	630	460	620	460 -- 620						16" steel	QTc/Tsm	
CWP Bayonet Site	not drilled																	
Fort Ord Camp Huffman	not drilled																	
Southern Coastal Subarea (and vicinity)																		
CDM MW-3 (nr end Tioga Ave.)	15S/1E-22De	11/20/2003			wl	82	60	50	60	50-60	-16	-26				2" pvc	Qod/Qar	33.8
CDM MW-4 (in Beach parking lot)	15S/1E-21Ka	11/18/2003			wl	67	54	44	54	44-54	-23	-33				2" pvc	Qod/Qar	20.3
Calabrese (Cypress Pacific)	15S/1E-22Dd	6/1/2001	748975	00-021	wl, wq	595	360	240	340	240-340	-190	-290	160			8" pvc	QTc ?	50
Sand City Corp. Yard	15S/1E-22Ed	12/21/1992	490449	W6966	wl, wq	140	140	60	140	60-140	0	-80	50				Qod/Qar/QTc?	60
Sand City Design Center	15S/1E-22Mc	8/13/1999		99-113	wl, wq	130	115	60	110	60-110	-40	-90	50			6.25" pvc	QTc?	20
DRO #1 Test	15S/1E-26Mc	10/11/1990	338403	W5824?	wl, wq	580	484	405	480	405-480	-227	-302	50	310	350	6" pvc	Tsm	178.5
MW-BW-08-A (entr to FO Range 23 M)	15S/1E-26Fb	4/21/1992			wl			56.5	91.5	56.5 - 91.5	150	115				4"	Qod/Qar ?	206.72
MW-BW-09-180 (entr to FO Range 23 M)	15S/1E-26Fa	3/23/1992			wl			190	210	190 - 210	16	-4				5"	QTc ?	205.62
942 Hilby Ave.	15S/1E-27Ea																QTc ?	
CAW Harcourt site	not drilled																QTc ?	
CAW MGT site	not drilled																Tsm ?	
Laguna Seca Subarea (and vicinity)																		
CAW Granite Construction test	15S/1E-35Jc	11/3/2006			wl	390	384	242	372	242-372	18	-112	65			6" pvc	Tsm	260
CAW Ryan Ranch #7	15S/1E-36Nb	1/17/1981	82916		wl, wq	500	480	350	470	350 -- 470	-56	-176	50			8" pvc	Tsm	294.32
York School	15S/1E-36Qa	5/14/2002	768995	01-349	wl, wq	500	500	160	480	160 -- 480	220	-100	130			6" pvc	QTc?	380
LS Driving Range (SCS Deep)	16S/2E-06C2	- -	- -		wl, wq	- -	460			- -						pvc	QTp	491
Laguna Seca_Old No. 12	16S/2E-06G4	5/2/1997	461400	WSAL 97-048	wl	520	500	120	480	120 - 480	220	-140	110			12" pvc	Tsm	340
Laguna Seca _New No. 12	16S/2E-06Hb	4/17/2003	796328	03-01188	wq	500	490	260	480	260-480			240			14" steel	Tsm	
Pasadera Main Gate	16S/2E-05Mg				wl, wq	714 ?											Tsm	331
CAW LSR East Fence	16S/2E-05Fa	11/6/1987	176969	4578	wl, wq	610	600	350	600	350 -- 600	65	-185	50	450	470		QTc	415
CAW Bay Ridge	16S/2E-09Cd	3/1/1995		WSAL 94-0240	wq	800	800	480	780	480-780						12" steel	QTc/Tsm	
Laguna Seca County Park #4	16S/2E-05Ge	11/9/1992	498010	W6886	wl, wq	700	670	330	650	330-650	60	-260	300			8" steel	QTc	390

NOTES:
1. Well Numbers are unofficial designations; not verified with DWR-assigned well numbers.
2. Geologic Unit refers to the unit adjacent to the screened interval: Qod/Qar = Quaternary "Older Dunes and Aromas Sand" (Dune aquifer); QTc = Tertiary and Quaternary "continental deposits" (Paso Robles aquifer); Tsm = Tertiary "Santa Margarita Sandstone" (Santa Margarita aquifer).
3. Elevation reference points have been derived from various previous documents; decimal point precision generally indicates surveyed elevation; whole number precision generally indicates altimeter or topo map estimate.
4. "- -" in a Screened Interval cell indicates multiple screen intervals.
5. Data Type refers to typpe of data collected: wl = water level; wq = water quality.
6. Shaded rows indicate monitor wells under consideration for addition to the Seaside Basin Monitor Well Network.

SEASIDE BASIN WATERMASTER
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FIGURES

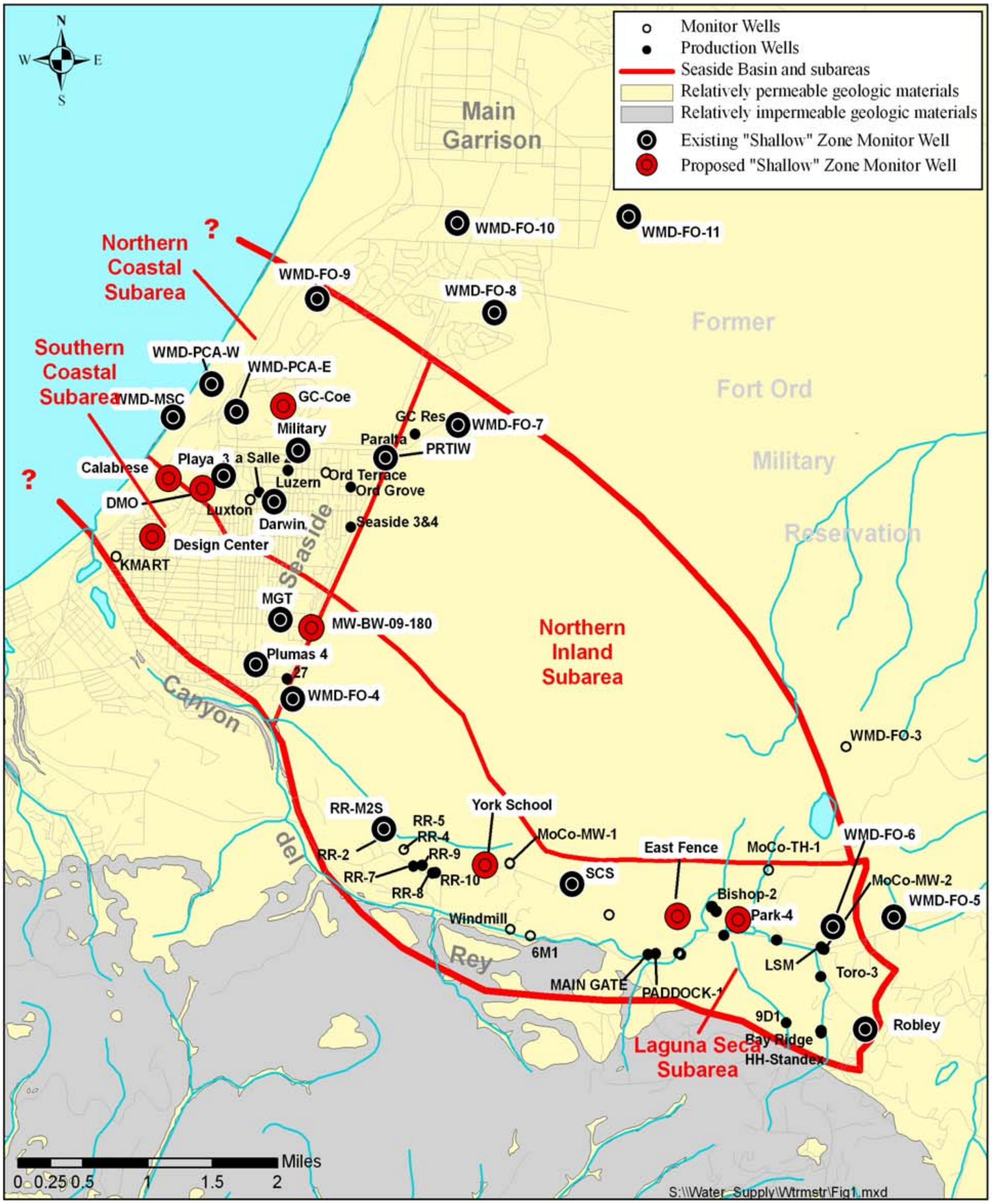


Figure 1. Locations of Existing and Proposed "Shallow" Zone Water Level Monitor Wells in and near the Seaside Basin

Figure 2. Locations of Existing and Proposed "Shallow" Zone Water Quality Monitor Wells in and near the Seaside Basin

Figure 3. Locations of Existing and Proposed "Deep" Zone Water Level Monitor Wells in and near the Seaside Basin

Figure 4. Locations of Existing and Proposed "Deep" Zone Water Quality Monitor Wells in and near the Seaside Basin

ATTACHMENT 10

SUPPLEMENTAL WATER SUPPLIES

SEASIDE GROUNDWATER BASIN
SUPPLEMENTAL WATER SUPPLY PROJECTS OVERVIEW

October 30, 2007

SECTION 1

1.1 Introduction

The purpose of this memorandum is to provide an overview of supplemental water supply projects for the Seaside Groundwater Basin (SGB), which is the subject of a Judgment entered in the Seaside Groundwater Basin Adjudication (California American Water v. City of Seaside, Monterey County Superior Court, Case Number M66343). Several projects are identified here to recognize these efforts as important and significant steps towards achieving the goals of the Seaside Groundwater Basin Adjudication (hereafter referred to as the "Adjudication"), in particular to be able to reduce pumping in the basin to achieve the maximum perennial yield (safe yield) in the basin.

In 1995, the State Water Resources Control Board (SWRCB) adopted Order 95-10 restricting California American Water's (CAW) use of the Carmel Valley Aquifer and requiring CAW to reduce its withdrawal from the Carmel Valley Aquifer by 10,730 acre-feet per year (AFY). Order 95-10 requires CAW to find a new source of water to replace the Carmel River overdraft. The Order further stipulated a maximum production of 11,285 AFY from the Carmel River and 4,000 AFY from the Seaside Basin aquifer. As a result, CAW increased its production from the Seaside Basin to 4,000 AFY in order to reduce its diversion from the Carmel River. Soon after CAW increased it production from the Seaside Basin, it became apparent that the combined demands of all the groundwater users of the Seaside Basin appeared greater than the Basin's sustainable yield, and the threat of seawater intrusion has become worrisome.

One of the major implications of the Adjudication is the triennial 10-percent decrease of the Operating Yield until the Operating Yield is equivalent to the Natural Safe Yield, unless steps are taken to decrease the production of native water, or the Watermaster determines that the aquifer is safeguarded against seawater intrusion. The Watermaster levies and collects replenishment assessments for each acre-foot of over-production for each party who over-produced in the previous year. The Watermaster bases the assessment on the estimated cost of providing non-native water to offset a party's over-production and to replenish the Basin. Projects proposed within the Seaside Basin or that may alleviate pumping within the Seaside Basin are used to calculate the anticipated costs.

The Adjudication Decision calls for "Artificial Replenishment" to add non-native water to the SGB groundwater supply. Additional water supplies in the SGB can contribute to the efficient and equitable management of Groundwater resources within the Seaside Basin, as prescribed by the Decision. Several projects are currently proposed within the

Seaside Basin, and are being reviewed and considered in several public input processes, described in section 1.2 below. The projects identified in the 2007 Replenishment Assessment for the Seaside Watermaster include:

Table 1-1 Supplemental Supply Projects

Agency	Project	Proposed Yield (AF)
1. Monterey Peninsula Water Management District (MPWMD)	ASR Phase 1*	920
2. California American Water (CAW)	Coastal Water Project (CWP)	
	• Desalination Component (SWRCB Order 95-10 Carmel River replacement supply)**	10,430
	• Aquifer Storage and Recovery (ASR) component (Seaside Basin supply)	1,300
3. Monterey Peninsula Water Management District (MPWMD)	Sand City Desalination Project	8,400
4. Monterey Regional Water Pollution Control Agency (MRWPCA)	Groundwater Replenishment Project	2,400
5. Marina Coast Water District/MRWPCA	Regional Urban Water Augmentation Project – Recycled Water for Irrigation	700
6. City of Sand City	Desalination Project	300

* Carmel River Aquifer water rights for 2,400 AFY of wintertime supplies have been obtained that are in addition to rights defined by SWRCB Order 95-10. MPWMD ASR Phase 1 estimated that in most years, 920 AFY will be available but up to 2,400 AFY could be diverted. While this project is intended to offset SWRCB Order 95-10 through temporary storage in the SGB, California American Water may choose to recover only a portion of water injected in wet years, to accumulate additional storage in the Seaside Basin.

** Although the desalination proposals are primarily to replace current withdrawals from the Carmel River, a desalination supplemental supply will have an indirect benefit to the SGB. SWRCB Order 95-10 directed California American Water to supplement Carmel River supplies by increasing pumping in the Seaside Basin. Therefore, when supplemental supplies come on line to satisfy Order 95-10, pumping can also be reduced in the Seaside Basin due the availability of desalination plus legal pumping limits of 3,376 AFY in the Carmel River Aquifer.

1.2 Public Review of Water Supply Projects to Benefit the SGB

At this time, several public input processes are occurring to review proposed water supply projects to serve the Monterey Peninsula and the region. These public review efforts are both educational for the public as well as an opportunity for local agencies and leaders to assess the level of public support for each project.

1.2.1 Monterey Peninsula Water Management District Matrix of Water Supply Solutions/Community Advisory Committee Project Review

The MPWMD has been maintaining a comparative matrix of proposed water supply projects within the District for the past several years. During the spring and summer of 2007, the MPWMD conducted a review process with the MPWMD Community Advisory Committee (CAC), which submitted a report to the MPWMD Board at their September 17, 2007 meeting that outlines the merits and drawbacks of the seven water supply projects proposed for the Monterey Peninsula that are summarized in the MPWMD Matrix of Water Supply Alternatives. The full text of this report can be found at the following link:

http://www.mpwmd.dst.ca.us/asd/board/boardpacket/2007/20070917/19/item19.htm

The projects reviewed by the CAC report include:

- MPWMD - *Aquifer Storage and Recovery in the Seaside Basin*
- MCWD/MRWPCA - *Regional Urban Water Augmentation Project*
- MRWPCA - *Groundwater Replenishment Project*
- MPWMD - *Long-Term Water Supply Desalination Project in Sand City*
- CAW - *Coastal Water Project*
- Pajaro/Sunny Mesa Community Services District - *North Monterey County Desalination Project*
- Water Standard Company - *Seawater Conversion Vessel (Desalination)*

Monterey Peninsula, Carmel Bay, and South Monterey Bay Integrated Regional Water Management Plan

The MPWMD has also prepared the **Monterey Peninsula, Carmel Bay, and South Monterey Bay Integrated Regional Water Management Plan**. This report documents the Integrated Regional Water Management (IRWM) planning effort undertaken in the region encompassing the groundwater basins and watersheds of the Monterey Peninsula, Carmel Bay and South Monterey Bay. According to this report:

> "The Monterey Peninsula Water Resource System (MPWRS) contains the majority of water resources within the planning Region. The MPWRS includes surface water in the Carmel River and Los Padres and San Clemente Reservoirs and groundwater in the Carmel Valley Aquifer, which are in the Carmel River

> Basin (CRB), and groundwater in the coastal subareas of the Seaside Groundwater Basins.
>
> Total known usable storage in the Region, including surface and groundwater, is estimated to be about 37,500 AF. This consists of an estimated maximum of about 6,200 AF in the Seaside Groundwater Basin with the remainder in the Carmel River Basin within the Carmel Valley Aquifer and at Los Padres Reservoir on the main stem of the Carmel River. Groundwater storage capacity in areas outside of the MPWRS (primarily in the Tularcitos Creek and Cachagua Creek watersheds in Carmel Valley) has not been determined. Usable surface storage at the two main stem reservoirs on the Carmel River represents less than 5% of total storage. Usable storage at the San Clemente Reservoir is currently nearly zero during dry periods as the pool of water is lowered by order of the California Division of Safety of Dams to reduce the potential for failure during a seismic event. Usable storage at the Los Padres Reservoir is projected to decrease from about 1,400 AF currently to zero within 40 to 50 years due to the relatively high sediment yields in the contributing watersheds."

The stated water supply objectives of this plan are:

- Meet water supply replacement targets set by MPWMD that satisfy existing water demand and meet the following current requirements: State Water Resources Control Board Order No. WR 95-10 (and subsequent orders); Seaside Groundwater Basin Final Decision (Case No. M66343). This is currently estimated to be approximately 12,500 acre-feet (AF) annually (note that total municipal use in 2006 was 18,830 AF).
- Once existing demand is met (e.g., through implementation of water supply projects), achieve water supply targets set by MPWMD to meet estimated long term future demand, based on General Plan Build-Out estimates. This is currently estimated to be approximately 4,550 acre-feet annually.
- Maintain the quantity and quality of water in the Seaside Groundwater Basin as specified in the Final Decision setting forth the adjudicated rights in the Groundwater Basin.
- Minimize the impacts to sensitive species and habitats from diversions (surface and groundwater) by optimizing the use of groundwater storage and conjunctive use options.
- Maximize use of recycled water.
- Optimize conjunctive use of surface and groundwater.
- Optimize the use of groundwater
- Evaluate, advance, and create water conservation efforts throughout the Region.
- Minimize fiscal impacts to ratepayers and taxpayers.

1.2.2 California Public Utilities Commission Division of Ratepayer Advocates

The California Public Utilities Commission (CPUC) Division of Ratepayer Advocates (DRA) has been facilitating a public process to identify and evaluate the feasibility of a regional project alternative to the Coastal Water Project proposed by California American Water. The CWP application was submitted to the CPUC in July 2005, and the

Environmental Impact Report process began in the spring of 2006. Subsequent to the Notice of Preparation for the CWP EIR, the DRA initiated a regional dialogue to explore alternatives to CAW's proposed Project. This process has included identification of potential water supply projects and determining the viability and priority of each of the projects. A Regional Plan Technical Work Group presented this work to the Monterey Regional Plenary Oversight Group during its September meeting. Information on the DRA's process and proposed alternative can be found at:

http://ciwr.ucsc.edu/monterey/index.html

The proposed regional alternative presented on September 26, 2007 includes a combination of projects, including the MRWPCA's projects with recycled water for irrigation and the groundwater replenishment project, the MPWMD ASR project, the Monterey County Water Resources Agency's Salinas Valley Water Project (expanded to serve the Monterey Peninsula), as well as desalination.

Currently, several desalination projects are proposed in the Monterey Bay region, including the CAW CWP, Sand City's 300 AFY project, the MCWD desalination to supply future Fort Ord demands, as well as the MPWMD Sand City Project (currently on hold) and a regional desalination facility by the Pajaro-Sunny Mesa Community Services District (PSMCSD). The CAW CWP, MPWMD, and PSMCSD proposed projects have each identified providing the required supplemental supplies to replace CAW's Carmel River aquifer withdrawals as required by SWRCB Order 95-10.

By providing this replacement supply, CAW's system demands to pump in the SGB will be reduced, and any project to solve SWRCB Order 95-10 will have incidental benefits to the SGB. SWRCB Order 95-10 directed California American Water to supplement Carmel River supplies by increasing pumping in the Seaside Basin. When supplemental supplies come on line to satisfy Order 95-10, pumping can also be reduced in the Seaside Basin due the availability of desalination plus legal pumping limits of 3,376 AFY in the Carmel River Aquifer. The Association of Monterey Bay Area Governments prepared a "Desalination Feasibility Study for the Monterey Bay Region" on November 8, 2006, which acknowledges the potential environmental benefits of desalination in this region.

Concurrent with the DRA's regional processes, the affected local agencies have developed and signed a Memorandum of Understanding to form the Monterey Bay Regional Water Supply Solutions Task Force. Through this MOU, each signing agency has contributed $5,000 to fund a consultant to identify a regional alternative that would be evaluated in the CWP EIR.

SECTION 2 SUPPLEMENTAL SUPPLY PROJECTS OVERVIEW

2.1 Monterey Peninsula Water Management District ASR Phase 1 Project

The MPWMD Aquifer Storage and Recovery Project diverts "excess" flow from the Carmel River in west periods, as defined by state and federal resource agencies, which would then be treated and transmitted via the CAW distribution system to special injection/recovery wells in the Seaside Groundwater Basin on the former Fort Ord.

Available storage capacity in the Seaside Basin Coastal Subareas serves as an underground reservoir for the diverted water for use during dry periods. ASR can help improve environmental conditions in the Carmel River and Seaside Basins by reducing Carmel River diversions in dry periods, when the river environment is most vulnerable, and helping to replenish the Seaside Basin in wet periods.

As part of the MPWMD Phase 1 ASR project, MPWMD and California American Water have jointly applied for and obtained Carmel River Aquifer water rights for 2,400 AFY of wintertime supplies, in addition to rights defined by SWRCB Order 95-10. MPWMD ASR Phase 1 estimated that, based on nearly fifty years of historical record of winter flows on the Carmel River, in most years at least 920 AFY will be available. However, up to 2,400 AFY could be diverted, and winter river flow amounts above the estimated average flows would be available for diversion to ASR in the Seaside Basin in wet years. While this project is intended to offset SWRCB Order 95-10 through temporary storage in the SGB, California American Water may choose to recover only a portion of water injected in wet years, to accumulate additional storage in the Seaside Basin in accordance with the Adjudication.

MPWMD already owns and operates one set of successful two wells, which, along with additional transmission pipeline and other minor structures, is known as the Phase 1 ASR Project. The Phase 1 project allows a maximum annual Carmel River diversion and injection of up to 2,420 AFY into the Seaside Basin. The maximum annual extraction from the Seaside Basin would be 1,500 AFY. Average values would be lower and depend on long-term weather conditions. The long-term project yield is estimated to be about 920 AFY with operations that maximize use of Seaside Basin water to offset Carmel River pumping in dry periods. Additional project facilities, some being considered in conjunction with CAW's Coastal Water Project, could significantly expand the project yield.

During 2006, the MPWMD prepared its draft and final Environmental Impact Report (EIR) and obtained permits for the project. Construction of a second ASR well, in addition to the existing test well, was completed in April 2007. Design and construction of appurtenances for the ASR facility are underway. A total of 6,700 linear feet of 16-inch temporary aboveground pipeline has already been constructed for conveyance to the ASR wells through the California American Water system, until such time as the CWP conveyance facilities are constructed. The State Water Resources Control Board is expected to approve long-term water rights by the end of 2007. The EIR demonstrated benefits to the Carmel River Basin to partially comply with SWRCB Order 95-10, as well as incidental benefits to the Seaside Groundwater Basin. A link to the staff report on the Final EIR Certification, from the August 21, 2006 MPWMD Board meeting, can be found at:

http://www.mpwmd.dst.ca.us/asd/board/boardpacket/2006/20060821/10/item10.htm

The following link is to a status update on this project given at the September 17, 2007 MPWMD Board meeting:

http://www.mpwmd.dst.ca.us/asd/board/boardpacket/2007/20070917/ppt/12_files/frame.htm

2.2 California American Water Coastal Water Project

California American Water (CAW) submitted an application for the Coastal Water Project (CWP) to the California Public Utilities Commission (CPUC) in July 2005. The Proposed Project would be implemented by CAW to provide 11,730 acre-feet per year (AFY) of water for CAW to replace a portion of its Carmel Valley Aquifer withdrawals and 1,000 AFY of what CAW presently withdraws from the over drafted Seaside Basin. The project would respond directly to the directive of the State Water Resources Control Board (SWRCB) Order 95-10 that CAW secure a water supply to replace 10,730 acre-feet per year of withdrawals from the Carmel Valley Aquifer, and is consistent with the CPUC's previous Plan B alternative long-term water supply studies. The Proposed Project is considered a refinement of and preferable to the CPUC's 2002 Plan B concept, which was an analysis of more than sixty water supply project alternatives for the CAW Monterey District. The SGB Adjudication proceedings took place subsequent to the CWP application to the CPUC in late 2006.

The CPUC is currently preparing the Environmental Impact Report (EIR) for the CWP and is expected to release the draft report in Spring 2008. The background and description of the Coastal Water Project (CWP) is available in the CWP Proponents Environmental Assessment (July 2005). This document can be found at:

http://www.coastalwaterproject.com/inc_environmentalanalysis.asp

Information on the CWP EIR can be found at:

http://www.cwp-eir.com/

The CWP includes a 10,430 AFY seawater desalination plant (capacity of 10 million gallons per day [mgd]) and a 1,300 AFY ASR system to provide supply to meet the replacement target of 11,730 AFY. The CWP ASR component is intended to supplement SGB supplies in the CAW Monterey District. ASR is the storage of water in an aquifer during times when water is available, and recovery of the stored water from the same aquifer when it is needed. ASR provides a cost-effective storage solution for the Project, storing water during times of excess Carmel River flow, and recovering it later to meet peak summer water demands when the excess flow is not available. Water is stored in an existing groundwater aquifer, reducing or eliminating the need to construct large and expensive surface reservoirs.

In this case, the proposed storage zone is the Seaside Groundwater Basin, which has experienced long-term declines in water levels due to pumping by a number of parties. Groundwater levels can be restored if the aquifer is sufficiently recharged. In wet years, California American Water may inject more into the ASR wells than is withdrawn, thereby banking the water in storage for use during dry periods or solely to recharge the aquifer.

As described above, the MPWMD is pursuing a separate independent ASR project at the same general location contemplated for the Project ASR facilities. CAW has coordinated with MPWMD on its ASR project design and permitting to ensure that the two systems are compatible. It is possible that the MPWMD ASR system, if constructed in a suitable and timely fashion, could be used to satisfy all or a portion of the CWP ASR system requirements.

The CWP facilities are listed in the following table.

Table 2-2.1 Project Facilities Summary

Facility	Quantity	Size and Characteristics
Desalination Plant:		
Source Water Pipeline	7,000 LF	54-inch diameter
Return Flow Pipeline	8,000 LF	24-inch diameter
Equalization Basin	1	4.8 MG
Plant Inlet Pump Station	1	23.5 mgd, 200 HP (installed)
Pretreatment System	1	22 mgd, submerged media membrane filtration
Reverse Osmosis System	1	10 mgd, membranes
Post Treatment System	1	Lime and carbon dioxide
Desalinated Water Conveyance:		
Clear Well	2	1.5 MG (each)
Desalinated Water Pump Station	1	7,000 gpm, 1,200 HP (installed)
Desalinated Water Pipeline	96,000 LF	30-inch diameter
Terminal Reservoir	2	3 MG (each)
Tarpy Flats Pump Station	1	10,200 gpm, 1,000 HP (installed)
ASR Systems:		
ASR Pipeline	10,000 LF	30-inch diameter
ASR Pump Station	1	4,400 gpm, 150 HP (installed)
ASR Wells	3	800-foot depth, 2.1-mgd injection/ 4.3-mgd extraction
Segunda Standby Pump	1	2,300 gpm, 200 HP
Segunda Pipeline	28,000 LF	30-inch and 36-inch diameter
LF = linear feet; MG = million gallons; mgd = million gallons per day; HP = horsepower; gpm = gallons per minute.		

2.3 MRWPCA Groundwater Replenishment

MRWPCA operates the regional wastewater treatment plant located two miles north of Marina. It also maintains 25 pump stations connected to the treatment plant. Secondary treatment discharge is 2.1 miles into Monterey Bay. MRWPCA member communities are Pacific Grove, Monterey, Del Rey Oaks, Seaside, Sand City, Fort Ord, Marina, Castroville, Moss Landing, Boronda, Salinas and some unincorporated areas in northern Monterey County. Additionally, MRWPCA operates the water recycling facility at the Regional Treatment Plant and manages the distribution system under contract from the Monterey County Water Resources Agency. Sixty percent of incoming effluent is recycled and paid for by Salinas Valley agricultural growers and property owners. The recycling operations provide irrigation water to 12,000 acres of Castroville farmland.

The Monterey Regional Water Pollution Control Agency (MRWPCA) proposes to develop and implement a Groundwater Replenishment Project (GRP) for the Seaside groundwater basin by injecting (or percolating) advanced-treated recycled water from its Salinas Valley Reclamation Plant (SVRP) into the Seaside Basin. Similar to the ASR project described above, the purified, recycled water source would be available in winter, when it is not used by food crops such as artichokes, and could be put to a beneficial use rather than be discharged into the ocean. After meeting State DHS treatment and migration standards, this supplemental source of water could be made available for recovery and potable reuse.

An advanced treatment system would be constructed at the MRWPCA’s SVRP and would produce purified water from the SVRP. The highly treated recycled water would be conveyed to the Seaside area for groundwater recharge, in conformance with the latest Guidelines for Recharge of Groundwater with Recycled Water. Existing potable water wells would capture the injected (or percolated) water, thus augmenting the overall groundwater basin yield for local potable water supply. Similar technology has been very successful in Orange County in Southern California for many years by operation of the Water Factory 21 plant, which creates recycled water for injection into its groundwater basin as a seawater intrusion barrier. Ultimately, the MRWPCA projects that it could provide up to approximately 2,800 acre-feet per year (AFY) of recycled water for recharge during the winter months.

Direct injection into the Santa Margarita sandstone will probably result in groundwater replenishment the soonest. With the experience of MPWMD's ASR project, no pilot testing would be required for direct injection so no potable water would be needed for pilot testing. If it was later determined that direct injection was not the optimal option, it would be relatively easy to switch to Vadose Zone Injection into the Paso Robles Formation below the level of the thick clay layer. A pilot test would be necessary but pilot duration would be only a few months. Water for the pilot testing may be available from either the City of Seaside or from Marina Coast Water District. Those two sources, and others, will be considered as a source of dilution water that may be required during the first five years of operation.

The MRWPCA indicates an estimated capital treatment plant cost of $37.9 million, and annual operation and maintenance treatment plant costs are estimated to total $1,325,000 per year (August 2006 dollars). The estimated capital cost of the injection wells is $3.543 million plus land costs, if any. O&M costs for transmission and well maintenance are not yet determined.

2.4 Marina Coast Water District/MRWPCA Regional Urban Water Augmentation Project

The Marina Coast Water District and the MRWPCA have jointly proposed the Regional Urban Recycled Water Augmentation Project (RURWAP) to supplement water supplies on the former Fort Ord. The RURWAP involves two major water augmentation supply projects: seawater desalination and recycled water. The RURWAP project goal is to provide 2,400 AFY of water to the former Fort Ord area to meet redevelopment requirements described in the Fort Ord Reuse Plan. The EIR for the project was certified in October 2004; the MCWD and FORA boards of directors endorsed the "Hybrid Alternative" in 2005. The "Hybrid Alternative" includes a water supply of up to 1,500 AFY from an expansion of MCWD's seawater desalination plant (including replacement of the existing 300 AFY capacity plant) and the production and distribution of up to 1,427 AFY of recycled water for landscape irrigation.

The feature of the RUWAP that may benefit the SGB is that it proposes to deliver and make available approximately 400 acre-feet to irrigate golf courses in the Seaside Basin, and 300 acre-feet per year of recycled water for parks, golf courses, athletic fields and other large landscaped areas in the California American Water (CAW) service area. This recycled water use would substitute potable water currently irrigating those facilities. The MPWMD Board has held initial discussions and provided early policy direction and process guidance concerning future consideration of potential incentives to public and private owners of outdoor facilities that MRWPCA has identified as potential customers for the recycled water.

The MRWPCA presented this project to the MPWMD Board at their September 17, 2007 meeting. Further information can be found at:

http://www.mpwmd.dst.ca.us/asd/board/boardpacket/2007/20070917/0917agenda.htm

2.5 Sand City Desalination Project

In 2005, the City of Sand City certified the Final EIR for the Sand City Water Supply Project. In September 2007, an addendum was prepared to analyze interconnections with the CAW system and other project modifications subsequent to the FEIR. The Sand City Water Supply Project is construction and operation of a 300 AFY reverse osmosis/desalination facility and potable water system to serve customers in Sand City.

Under existing conditions, the water demand in Sand City is approximately one-third of the capacity of the approved RO/desalination facility. The City of Sand City is now proposing that the full production capacity of 300 AFY be made available to the regional water purveyor, CAW. In the near-term, water produced at the RO/desalination facility will be used as current water replacement within the regional system to reduce pumping from the Seaside Groundwater Basin. The amount of water available for current water replacement will decrease slowly over time, as future development allowed under the Sand City General Plan will increase water demand over current usage. The City of Sand City anticipates in-fill growth in Sand City to occur over the next 10 to 20 years.

Facilities included a reverse osmosis desalination plant that would treat water from the shallow, brackish Aromas Sands Formation, a 7,000-foot pipeline loop system to deliver water to parcels within the City, two water storage tanks, and an emergency intertie to the Marina Coast Water District (MCWD). It is noted that the Superior Court's Final Decision on the Seaside Basin Adjudication in March 2006 granted the City the right to produce brackish water from the Aromas Sands Formation as the source for its desalination project, so long as there is no "Material Injury" to the aquifer.

The MPWMD approved a water entitlement for an additional 206 AFY from water produced by this facility on October 15, 2007. The current MPWMD water allocations of CAW water will not be retired and replaced by 300 AFY from the City's desalinated water system. Instead, existing CAW water allocations will remain in place, including the 94 AFY existing CAW water use by the City. Of the 300 AFY to be produced from the desalination project, 206 AFY would be slated for eventual use by new construction and redevelopment projects as a water entitlement via adoption of an Ordinance by the MPWMD. The 206 AFY amount for new uses is derived from 300 AFY total desalination project production minus 94 AFY existing use. The CAW system Seaside Basin well pumping would experience near-term benefits under both scenarios due to the existence of a new source of supply available for use by the CAW system. The net near-term benefit is reduced from 300 AFY under the City-supplied water system to 206 AFY under the revised proposal where CAW serves the City.

ATTACHMENT 11

DURBIN MODEL DOCUMENTATION

Martin B. Feeney
Consulting Hydrogeologist

P.G. 4634
C.E.G. 1454
C.Hg 145

January 12, 2007

Seaside Groundwater Basin Watermaster
c/o Diana Ingersoll
City of Seaside
440 Harcourt Avenue
Seaside, CA 93955

Subject: Seaside Groundwater Basin Watermaster, Seaside Basin Monitoring and Management Program: Groundwater Modeling Component – Report on Groundwater Modeling Meeting and Recommended Approach

Dear Ms. Ingersoll:

One of the many conditions of the Seaside Groundwater Basin Adjudication judgment requires the Seaside Groundwater Basin Watermaster (Watermaster) to develop a groundwater model of the Seaside Basin. Although a groundwater model of the basin was developed by one of the parties as part of the court proceedings, this modeling effort was the source of some controversy between interested parties. Because of this controversy, the Watermaster Board determined to convene a panel of technical experts to discuss the modeling efforts and provide guidance for the development of the required model. This letter documents the efforts and discussions of the technical experts and presents a recommended approach to fulfilling the demands of the court and the needs of the Watermaster.

BACKGROUND

The court decision entered into on March 27, 2006 provides for the adjudication of the Seaside Groundwater Basin and sets up the Watermaster to manage the groundwater resources of the Seaside Basin. One of the requirements of the judgment is that that Watermaster, within one year of the judgment, "*develop a suitable groundwater model of the Seaside Basin and appropriate adjacent areas.*" A groundwater model of the basin was developed for the plaintiff (California-American Water Company) for use in the trial; however, there was criticism of this model from other experts participating in the trial. Although there are some identified shortcomings of the model, much of this criticism arose from the lack of documentation; documentation that was not prepared due to the tight time constraints of the trial schedule. The criticism and trial environment created an aura of controversy around this model. The convening of the panel of modeling experts is an attempt to get past the controversy and move forward with the required modeling.

PANEL PROCEEDINGS

Technical Panel

A panel of technical experts was convened to discuss previous and future groundwater modeling of the Seaside Basin. The technical panel was comprised of experts who had previously represented a party in the trial, or experts invited at the suggestion of a party to the judgment. The panel members were compensated by the Watermaster for their participation and were not there as representatives of their prior clients.

The Panel included:

Mr. Terry Foreman
Mr. Joe Scalmanini
Mr. John Fio
Mr. Tim Durbin
Mr. Gus Yates
Mr. Martin Feeney (moderator)

In addition, the panel was joined by Mr. Derrik Williams. Mr. Williams is a groundwater modeler and a member of the RBF Consulting Team selected to move forward with implementing the technical portions of the Seaside Basin Management Plan. As a member of the RBF Team, Mr. Williams's role is intended lead future modeling work, regardless of the direction or scope of these modeling efforts.

Prior to the meeting, the committee members were provided with review materials summarizing previous modeling efforts in and adjacent to the Seaside Basin modeling efforts as well as limited details on the model utilized at the trial. This background memorandum is included in Appendix A.

The meeting was held in Seaside in late November 2006. The meeting agenda is included in Appendix B – Meeting Agenda and Minutes. The meeting was moderated by the undersigned and minutes were taken and prepared by Mr. Mark Dias. Following the meeting, minutes were circulated to all attendees for correction and comments. The corrected minutes are attached.

The attached minutes are very complete and capture most of the relevant discussions. Presented below is a summary of the points and comments expressed by the panel.

Need For Model/Approach to Modeling

The question of the need for a model was discussed at some length. The following relevant comments were offered:

- Given that the basin is 30 to 40 percent out of balance and the water budget of the basin is the critical issue, a simple model may be the best approach.
- If the primary goal is to address the basin's water imbalance, then a model may not be strictly needed.
- A simple model could be useful to evaluate the impacts of moving pumping, but the water budget could be addressed independently.
- A state of the art groundwater model is not necessary to answer the fundamental water management questions in the near term.
- A groundwater model cannot improve the water balance. It can only help with optimizing management actions.

Why Model

The above comments aside, it was mutually agreed that groundwater models can have great utility and can provide the following benefits:

- Models provide for an objective, intellectually honest evaluation of water management issues.
- Models allow better resolution of spatial variations, such as water levels in multi-layered aquifer systems, as compared to more simple water budget approaches.
- Models can be useful to estimate/calibrate water budget components.
- Models can be used to develop a better understanding of leakance, boundary conditions and basin geometry.
- Models allow the optimization of different management alternatives.
- Models provide a test of the understanding of a system.

Potential Uses for Model (Or Modeling)

During the discussion, uses that a groundwater model of the Seaside Basin might have in managing the basin were outlined. These included:

- Evaluation of Management Alternatives
    - Impacts and effectiveness of moving pumping inland.
    - Optimization of moving pumping as in how much? And how far?
    - Impacts of continued mining for specified periods of time, 3 years, 5 years, etc…
    - Effectiveness of ASR or other artificial recharge projects.
- Potential seawater intrusion pathway/travel time investigations.

During these discussions a distinction developed between use of "The Model" and modeling. It was acknowledged that evaluation of some of these alternatives might require a differing modeling approach and more detailed modeling than would be available in the regional model.

Limitations of Models in the Seaside Basin

Compared to most groundwater basins, the understanding of the hydrogeology of much of the basin is poor. The poor understanding is the result of the surficial geology which masks the underlying geologic structure. This masking is compounded due to the past land use (Fort Ord) of most of the basin which has resulted in limited wells and boreholes and resultant subsurface data. Additionally, the understanding of the offshore geology is relatively poor, providing little guidance in modeling a critical boundary condition. Regardless of model integrity and robustness, a groundwater model's utility in the basin will be limited by the lack of hydrogeologic understanding.

Additionally, this relatively poor understanding of the basin structure, boundaries and the heterogeneity of the aquifer systems will limit the utility of any model of the basin to the evaluation of intermediate and large scale scenarios (like moving pumping). Smaller-scale questions could be subject to significant errors. Expectations for the model should be limited and openly expressed.

Groundwater models, even models with large assumptions regarding the hydrogeologic conditions, are good for evaluating management alternatives. However, the hydrogeologic management alternatives for Seaside are limited, and the feasible alternatives, at least in the short term, are even more limited. A groundwater model of the basin, while useful for evaluating the alternatives, may not be necessary, if options are few.

Existing Models of the Seaside Basin

Multiple groundwater modeling efforts have been undertaken in the Seaside Basin over the last couple of decades. One of the possible approaches to modeling the basin was considered to be the "enhancement" of one of several existing models of the basin. The previous modeling efforts in the basin are summarized below. The models are more fully described in the Model Memo contained in Appendix A.

	Project	Author	Focus Area of Modeling
1	MPWMD desalination	Staal, Gardner & Dunne, Inc. (1992)	Coastal area near Sand City
2	Monterey Bay Shores	Feeney (1999)	Coastal area near SNG project site
3	Sand City desalination	Feeney & Williams (2002)	Coastal area near Sand City
4	Laguna Seca Phase III report	Yates and others (2002)	Laguna Seca subarea
5	MPWMD desalination	CDM (2004)	Coastal area near Sand City
6	Cal-Am Coastal Water Project, ASR	ASR Systems (2005)	Coastal and inland area near ASR wellfield
7	Seaside Basin adjudication trial	Durbin (2005)	Basinwide area

Most of these models were developed to evaluate the impacts of proposed projects within the basin and are not of regional scale. However, the existing smaller-scale models can still provide useful data that will facilitate the refinement of larger-scale models.

Of these previous modeling efforts only the Durbin model includes the entire Seaside Basin and the "appropriate adjacent areas" as specified in the judgment. The Durbin model was used in court and several parties to the case had some criticism of the model results. However, some of the criticism was simply the result of a poor understanding of the modeling approach as the model was undocumented.

Limitations of Existing Model

Based on review of the material presented in court and the materials provided by Mr. Durbin for the meeting, the following limitations were identified:

- *Poor calibration for Santa Margarita Aquifer.* The predicted hydrographs for the Santa Margarita Aquifer do not adequately replicate the historical trends in this aquifer system.
- *Domain does not exactly match mapped boundaries and geology.* While relatively minor, the model domain does not follow the trace of the Chupines Fault, the most defined boundary of the basin.
- *Some structural features need refinement.* Some structural features appear not to be implemented in a manner consistent with the current understanding of the hydrogeology. This may be a function of the lack of documentation.
- *No documentation.* This limitation has been the source of much of the controversy. Presentation of a model development narrative, hydrostratigraphy, model assumptions, and calibration results will allow for peer review and provide a basis for future refinement and possible re-platforming at a later date.

- *The model utilizes the FEMWATER3D numerical code.* This USGS code, while fully documented and in the public domain, is in limited use and has less third party support than other codes such as the USGS's MODFLOW code.

Possible Approaches

The panel discussed the various approaches for moving forward with the modeling effort. Much discussion was devoted to geologic, hydrogeologic and boundary conditions specific to the hydrogeologic conceptual model. Additional discussions were focused on differing approaches to developing a suitable model of the basin. Several differing approaches were discussed and are summarized below:

Use Existing Model. This approach would adopt and refine the existing model (Durbin) to become an interim model of the basin. The Watermaster could utilize the interim model to evaluate management scenarios, as necessary, while allowing concurrent exploration activities to develop data improving the understanding of the basin. This approach would reduce costs over development of a new model because much of the development, calibration, testing and peer review has been completed. More importantly, the use of the existing model would result in the completion of a model with the period specified by the court. When required or desired in the future, the model could be revised to include new hydrogeologic data and possibly be re-platformed to a more commonly-used code.

Develop New Model This approach would develop a new model of the Seaside Basin. It is assumed that this model would be developed utilizing the MODFLOW code, perhaps increasing its usability. The model would derive its conceptual framework from existing documents and previous modeling efforts. As such, the conceptual hydrogeologic model would be similar to that used in the existing model. This model would also need to be refined and updated at a later date to include new hydrogeologic data.

Return to Court. Although not universally supported, there was discussion regarding approaching the court with a request to have the modeling requirement removed, or extended, as the model is not considered necessary to move forward with the initial steps of managing the basin. While it is acknowledged that the model could be a useful tool, the need for the model is premature.

Continue Modeling Panel It was suggested that the technical panel be continued to review future modeling efforts. This idea might be particularly useful if the selected approach is to move forward with refining the existing model.

All of the above approaches have pros and cons. However, when considering the non-technical issues such as funding, schedule and jurisdiction hurdles, and balancing these with the utility and limitations of even the best possible model, it was generally conceded by the panel that the goals of the Watermaster would likely best be served by refining the existing model. This model could be utilized for an interim period until the need and uses of an improved model are more apparent.

RECOMMENDATION

While the above discussion attempted to capture all the voices of the panel, the follow section is the opinion of the undersigned, and not necessarily shared by all panel members.

Discussion

The judgment language requires within a year of the date of the judgment the Watermaster to *"develop a suitable groundwater model of the basin and appropriate adjacent areas."* This is the only reference to the groundwater model in the entire judgment. The requirement begs several questions. What does suitable mean? Suitable for what? It is interpreted that the model would be used to evaluate management alternatives that might be considered by the Watermaster.

Although the judgment requires the Watermaster to develop a groundwater model of the basin, it is instructive to consider the factors that might be weighed in deciding, in the absence of the requirement, whether to develop a groundwater model of the basin. Before undertaking the development of a groundwater model several fundamental questions need to be evaluated to guide the decision to, and if, how to model the basin. These questions are interrelated and iterative, and are presented below:

- The adequacy of the understanding of the hydrogeology and the availability of supporting data needs to be evaluated within the context of the questions that the modeling effort is helping to answer.
- The potential questions that the model will be expected to help answer need to be clarified prior to developing the model. This allows selection of the appropriate modeling approach, consistent with the understanding of the basin and the availability of data. Simple problems might be answered easily with less complicated tools. Complex questions might not be adequately answered with a more sophisticated tool which, due to limited hydrogeologic understanding, incorporates numerous assumptions. One modeling approach does not fit all potential questions. The appropriate model for one question might not be the best for others.
- Is the development of a model a cost-effective way of providing answers to the relevant questions? A groundwater model may help illuminate the best technical solution. However, are the potential solutions so constrained by non-technical issues that the best technical answer is not relevant?

In a perfect case, the above questions should be considered and would allow the balancing of political, jurisdictional, financial and technical issues in deciding to, and how to model a groundwater basin.

The requirement to develop a model within the judgment presupposes the adequacy of the current understanding of the basin and also forces the development of a modeling approach that may or may not be appropriate to assist in answering the management questions that will later emerge. In absence of the judgment, and in consideration of the current understanding of the basin, the Watermaster might be better off waiting to develop a model that fully captures the data from Watermaster's exploration efforts and that is most appropriate for evaluating the management alternatives that emerge.

Recommended Approach

However, given the requirement of the judgment, the Watermaster does not have the flexibility to wait until there is a better understanding of the basin and the relevant water management questions. Fortunately, there exists a *"suitable groundwater model of basin and appropriate adjacent areas."* It is believed that, with minor refinements, the existing groundwater model (Durbin) can serve the Watermaster's immediate needs and meet the requirements of the judgment. After completing these refinements, the Durbin model could be adopted as the "interim groundwater model." The recommended course of action to modify the existing model into the "interim groundwater model" and meet the requirements of the court are as follows:

- Fund limited refinement to the model to resolve currently identified limitations.
- Fund documentation of the model This will provide guidance to model users, provide closure to the existing model effort, and provide a basis for future review and revision.
- Fund Peer Review of Model Refinements Panel. This panel could meet by teleconference thereby significantly reducing the costs of meeting.
- Fund completion of model. After refinement of the model, completion of the documentation and peer review, the model would be "completed" for use as the interim model.

Based on discussions with Mr. Durbin and considering other costs associated with peer review and management, it is estimated that the above work could be completed for under $50,000. If the Watermaster can move quickly, it is possible that the model could be completed by the required deadline – March 27, 2007.

Adoption of the revised Durbin Model as an interim model serves many purposes and meets the goals of the Watermaster. The rationale, advantages and limitations of the adoption of the Durbin Model as the "interim" model are as follows:

- The model can be quickly completed to the point where it is a useful tool for a relatively minor expenditure of money. It is therefore a cost-effective solution while meeting project goals. The Watermaster can report to the court that the requirement to develop the model has been met.
- The Watermaster can use the freed up funds to move forward with more critical management activities.
- With use, the limitations of the interim model will become evident. These limitations will provide guidance for revision of the model at a later date. Some of these limitations will point to the limited understanding of the hydrogeology of the basin. Other limitations will identify specific data gaps that might be cost-effectively filled. Concurrently, exploration and data collection within the basin will improve the understanding of the hydrogeology, allowing updating of the conceptual hydrogeologic model. At some latter date, when deemed necessary and cost-effective, the groundwater model can be revised to incorporate the accumulated data and improved understanding.
- All groundwater models are works-in-progress. The models are progressively revised as understanding of the hydrogeology of an area improves. Utilizing the existing model for an interim period allows moving forward with other management efforts until sufficient new hydrogeologic data are developed to justify the reworking of the model.
- Currently, the understanding of the Seaside Basin is such that boundary conditions of 3 of the 4 sides of the model are poorly understood and are represented by assumptions. Until these boundary conditions are better understood, all modeling efforts will simply reflect these assumptions. Regardless of The Model's numerical integrity and robustness, the model's utility is limited by the lack of hydrogeologic understanding.
- "The Model" vs. Modeling. While development of a regional groundwater model is an appropriate long-term goal, a regional groundwater model is not always the best tool for modeling specific hydrogeologic problems. For example, given the variety of assumptions regarding the geometry of the sea floor and aquifer outcrop patterns, the analysis of the seawater-aquifer interface is better performed with 2-D slices. The use of the Durbin Model as an interim model would free-up funds for more relevant specific hydrogeologic modeling.

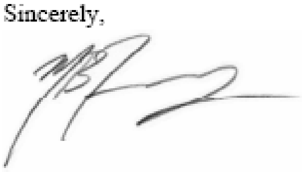
- The questions and issues that will need to be evaluated by modeling or the model have likely not yet emerged. These will change over time. It may be more appropriate to update the model when there is a better understanding of the relevant questions. The management options that might be evaluated will likely be determined by primarily non-hydrogeologic considerations.
- Finishing the Durbin Model into the interim model is a good balance of effort and expenditure with the utility of a groundwater model in the basin. Spending more time and money on the modeling effort would suggest an importance to the model above its utility.
- Groundwater models, even simple or limited models, are good for comparing management alternatives. However, the hydrogeologic management alternatives for Seaside Basin are limited and the basin is out of balance by 30 to 40%. Additionally, the feasible alternatives, at least in the short term, are even more limited. It is unlikely that any model would significantly assist with the evaluation of the potential short-term solutions for the basin.

Alternative Approach

An alternative approach, one consistent with the conclusions presented in this document, should also be considered. A groundwater model of the basin is not a critical path need in order for the Watermaster to perform the initial steps toward basin management. A reasonable and defensible alternative would be to return to the judge and make the case that, given the limited number of management alternatives, the model is not really necessary at this time.

I trust the above is useful. I look forward to meeting with the TAC to discuss these recommendations.

Sincerely,



Martin B. Feeney

Attachments:

Appendix A – Model Memo Background Materials
Appendix B – Agenda and Minutes

APPENDIX A

Martin B. Feeney
Consulting Hydrogeologist

P.G. 4634
C.E.G. 1454
C.Hg 145

November 15, 2006

Seaside Model Panel Attendees:

In anticipation of our meeting, I have prepared this memo summarizing the existing modeling efforts of the Seaside Basin and suggesting topics to be discussed at our meeting. The intent of this document is to generate consideration of the issues and provide a basis for discussion.

MODEL PURPOSE

As an outcome of the adjudication judgment, the Seaside Groundwater Basin Watermaster Board is tasked with developing a groundwater model of the Seaside Groundwater Basin. Although it is not specified what the model use will be it is assumed that its use would include evaluation of various management and augmentation schemes.

It is hoped that the proposed model could be developed from existing modeling efforts. Whether this would be by enhancing an existing model or using bits and pieces of existing modeling efforts as templates is yet to be determined. The intent of the process is to review the previous modeling efforts and evaluate the appropriateness of any of the previous efforts to be used as a starting point for the development of "the groundwater model" of the Seaside Basin.

MODEL INVENTORY

Multiple groundwater modeling efforts have been undertaken in the Seaside Basin over the last couple of decades. Most of these models were developed to evaluate the impacts of proposed projects within the basin and are not of regional scale. However, even if one of the existing models is not "enhanced" to become the new model, the existing models provide useful data that will facilitate the development of a new model if that is the more appropriate approach.
The previous modeling efforts in the basin are summarized on the attached table and shown on the attached map.

Seaside Basin Adjudication Model

Attached please find the graphics documenting the Seaside Basin Adjudication Model (Durbin). These are presented not necessarily for critical review but rather to form a basis for discussion of modeling issues. Modeling issues that should be discussed include those summarized below.

MODEL DISCUSSION ITEMS

Hydrostratigraphy

- Literature – established hydrogeologic units
- Sequence stratigraphy
- Number of model layers?
- Base of fresh water aquifer system
- Offshore stratigraphy

Geologic Features to be included

- Faulting – other structural features? Which ones? Basis?
- Consistent with current mapping?
- Greene vs. Clark/Rosenberg vs. Wagner

P.O. Box 23240, Ventura, CA 93002 ♦ **Phone: 805/643-7710** ♦ e-mail mfeeney@ix.netcom.com

Aquifer Parameters
- Sources
- Conductivity, Storage, Leakage, Porosity, Dispersivity

Boundary Conditions
- Constant Heads – Density and Depth Corrections?
- Specified/General Heads – Tied to historical records?
- No-Flow – Where appropriate?
- Ocean Boundary
    - Sensitivity to geometry
    - Tidal fluctuation data
- Salinas Valley Boundary

Seawater Intrusion
- Location of seawater in model scenarios
- In QTp overlying Tsm?
- In Tsm as in never flushed?

Pumpage
- Seaside proper MPWMD records
- What about in Marina? MCWD records?
- Laguna Seca, El Toro
- Salinas Valley Pumpage – reflected in specific heads?

Recharge
- Appropriate methods of estimating
- Soil Moisture?
- MODFLOW Farm package?
- Calibration?

Calibration
- Sources and Distribution of Observed Data
- Uniqueness of solution
- Sensitivity

Model Code
- Defensible/Proven
- Public Domain
- Acceptability
- Portability between technical users
- Compatibility with GIS systems
- Interface with SVIGSM
- Flow? Flow and Transport?

Potential Model Uses
- ASR Programs
- Relocating Pumpage – Impacts on safe yield
- Inverse modeling of seawater interface?
- Develop better estimates of recharge
- Develop better estimates of groundwater storage

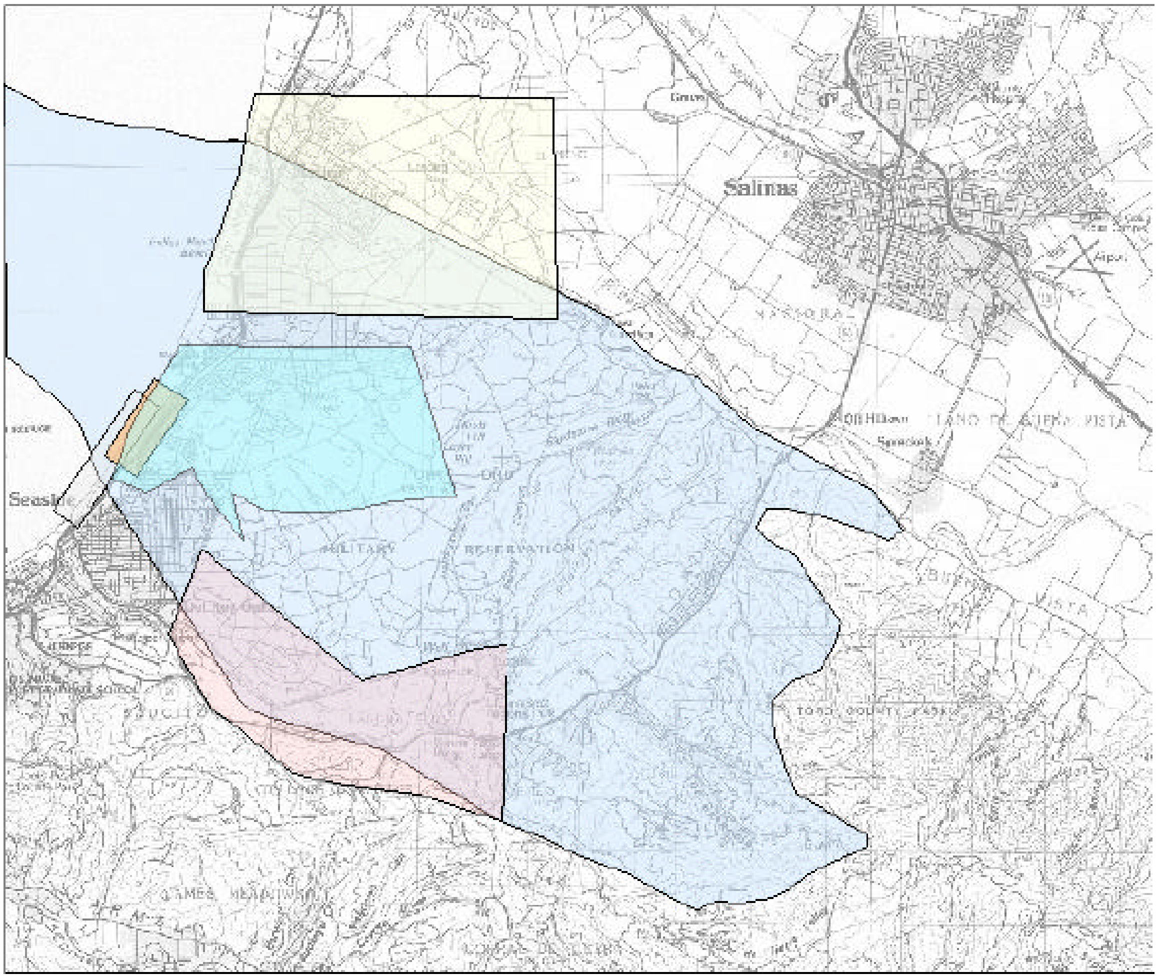
Previous Efforts at Numerical Ground Water Flow Modeling in the Seaside Basin

	Project	Focus Area of Modeling	CODE	Modeled Units	Model Layers	Source of Hydrostratigraphy /Geology	Source of Aquifer Parameters	Boundaries north	Boundaries south	Boundaries east	Boundaries west	Recharge Rates (ft/yr)
1	MPWMD Desalination	Coastal area near Sand City	MODFLOW/MT3D	Qa/Qal	1	Project	Project	NF	NF	CH	CH	0
2	Monterey Bay Shores	Coastal area near SNG project site	MODFLOW	QTp	1	SGD, Kaiser, HLA	SGD, MPWMD	NF	NF	GH	CH	0
3	Sand City Desalination	Coastal area near Sand City	SWIFT	Qa/Qal	1	SGD	SGD, Project	NF	NF	CH	CH	0
4	Laguna Seca Phase III report	Laguna Seca subarea	MODFLOW	QTp, Tsm	2	SGD, Rosenberg/Clark	SGD	NF	NF	CH	GH	0.16 (avg)
5	MPWMD Desalination	Coastal area near Sand City	MODFLOW	Qa/Qal	1	SGD, Project	SGD, Project	NF	NF	CH	CH	0.33
6	Cal-Am Coastal Water Project, ASR	Coastal and inland area near ASR wellfield	MODFLOW	QTp, Tsm	2	Fugro West, Padre	Fugro West, Padre	CH (L1) NF (L2)	CH (L1) NF (L2)	CH (L1) NF (L2)	CH (L1) NF (L2)	0
7	Seaside Basin Adjudication Trial	Basinwide area	FEMFLOW3D	Qal/Qa, Qtp, Tp/Tsm	3	CH2MHill, Feeney/Rosenberg, Greene	CH2MHill, SGD	SP	NF	NF	SH	0.3
8	Fort Ord Model	Fort Ord, North of GW Divide	MODFLOW	Qal, U180, L180, 400	4	HLA, SGD	HLA, SGD	CH/NF	CH/NF	CH/NF	CH	0.39
9	MPWMD ASR	Fort Ord area near ASR wellfield	MODFLOW	Qa/QTp, Tsm	4	Fugro West, Padre	Fugro West, Padre	NF	NF	CH	CH	0

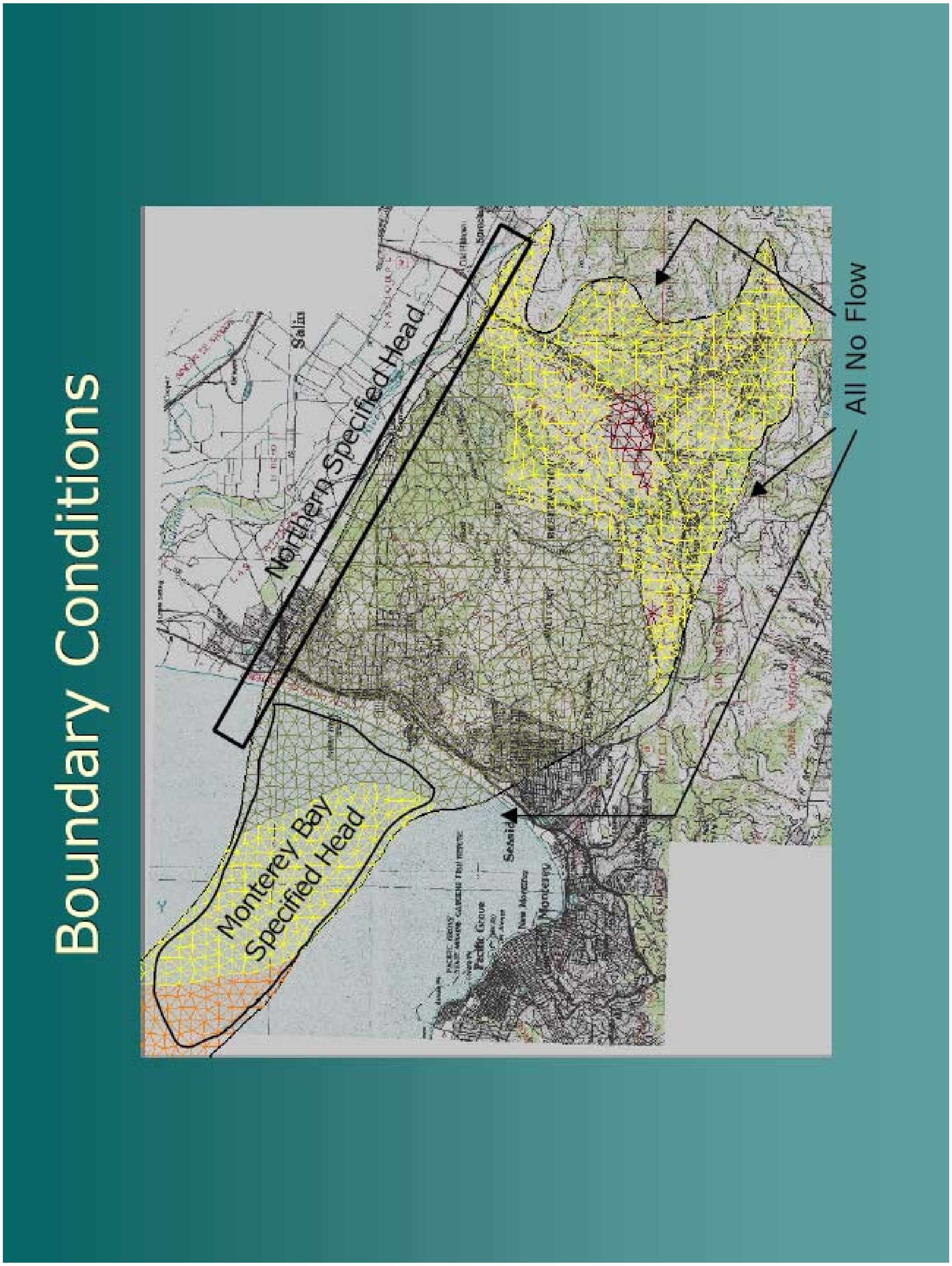
SOURCE DOCUMENTS:

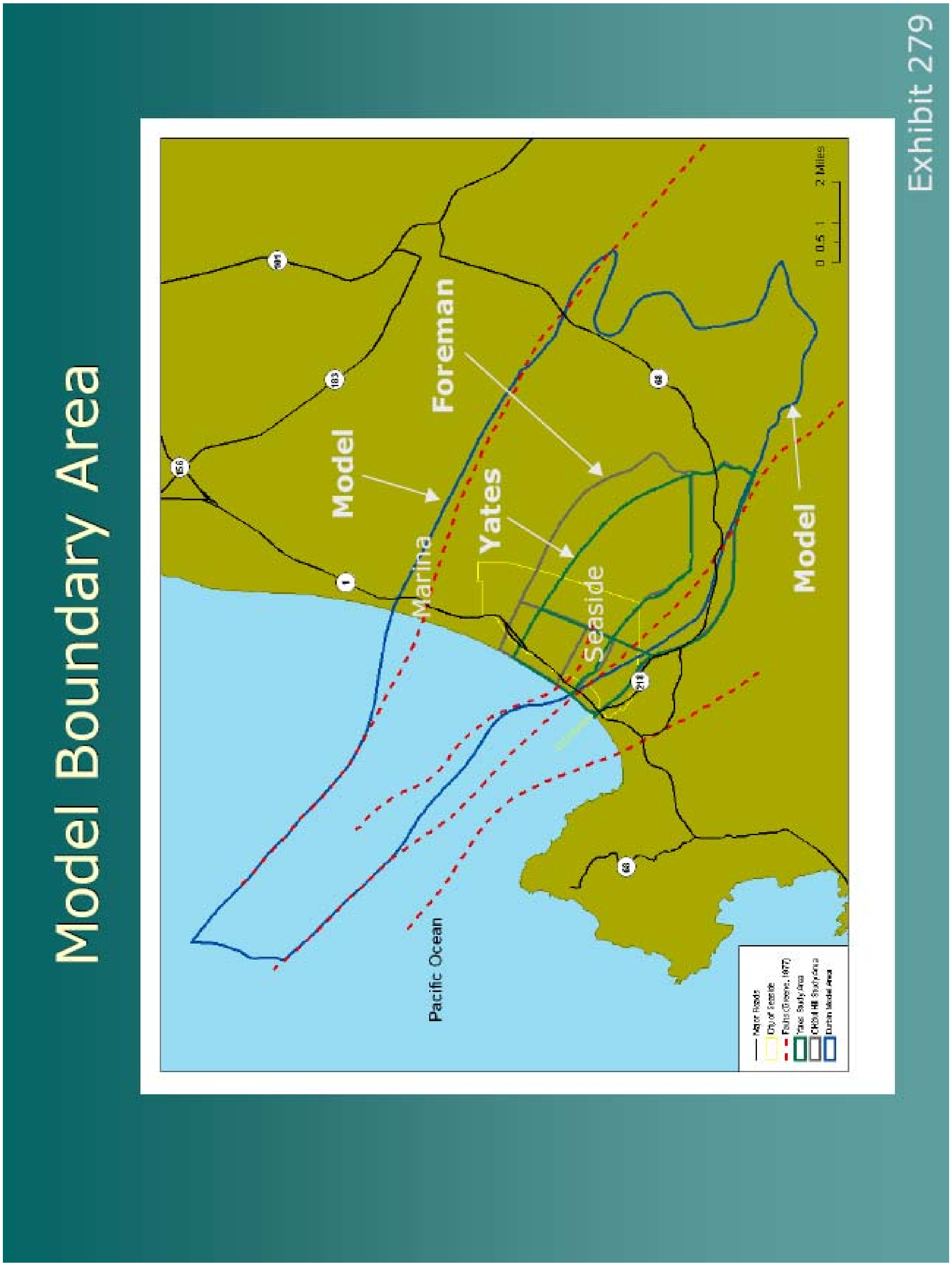
1. Staal, Gardner & Dunne, Inc., 1992. *Feasibility Study, Saline Ground Water Intake/Disposal System, Sand City, California* . Prepared for MPWMD, September 1992 (see Appendix G).
2. Feeney, Martin, 1999. *Ground Water Operations and Monitoring Plan, Monterey Bay Shores Resort.* Prepared for SNG Development Company, August 1999.
3. Feeney, Martin, and Derrik Williams, 2002. Desalination Feedwater/Concentrate Disposal System, Sand City, California. Prepared for City of Sand City, July 2002 (see Appendix C of Sand City Water Supply Project Environmental Impact Report, June 2004).
4. Yates, Eugene, Martin Feeney, and Lewis Rosenberg, 2002. *Laguna Seca Subarea Phase III Hydrogeologic Update* . Prepared for MPWMD, November 2002 (see Appendix 2).
5. CDM, 2004. *MPWMD Sand City Desalination Project Feasibility Study* . Prepared for MPWMD, April 16, 2004 (see Appendix G).
6. ASR Systems, LLC, 2005. *Technical Memorandum, ASR Wellfield Conceptual Design, Modeling Analysis and Preliminary Environmental Assessment for California-American Water Company Coastal Water Project* . Prepared for California American Water, April 30, 2005.
7. Timothy J. Durbin, Inc., 2005. *Declaration of Timothy J. Durbin in Support of Motion for Entry of Stipulated Judgment* . Prepared for Somach, Simmons & Dunn and California American Water, submitted October 27, 2005.
8. Harding Lawson Associates, *Fort Ord Groundwater Model,* in *Draft Final Basewide Hydrogeologic Characterization, Vol. II Appendix D, 1994.* Periodic updates by MACTEC, 1999, 2003.
9. CDM, 2003. Monterey Peninsula Water Supply Project Phase 1 Technical Memorandum. Appendix D: Technical Memorandum – Part 3: Aquifer Storage and Recovery for Seaside Basin – Plan B. March 17, 2003.

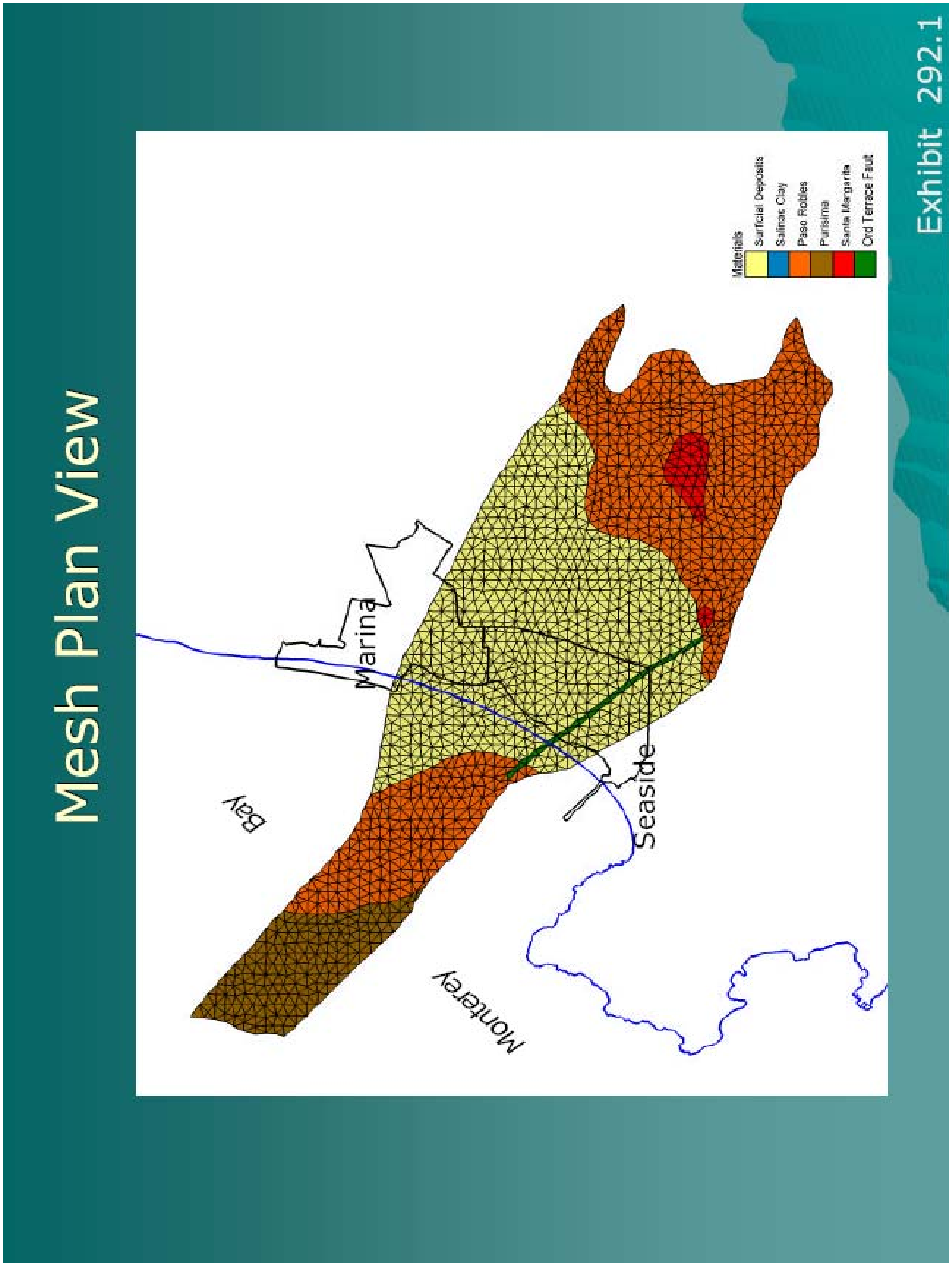
Location of Ground Water Modeling Efforts in Seaside Basin



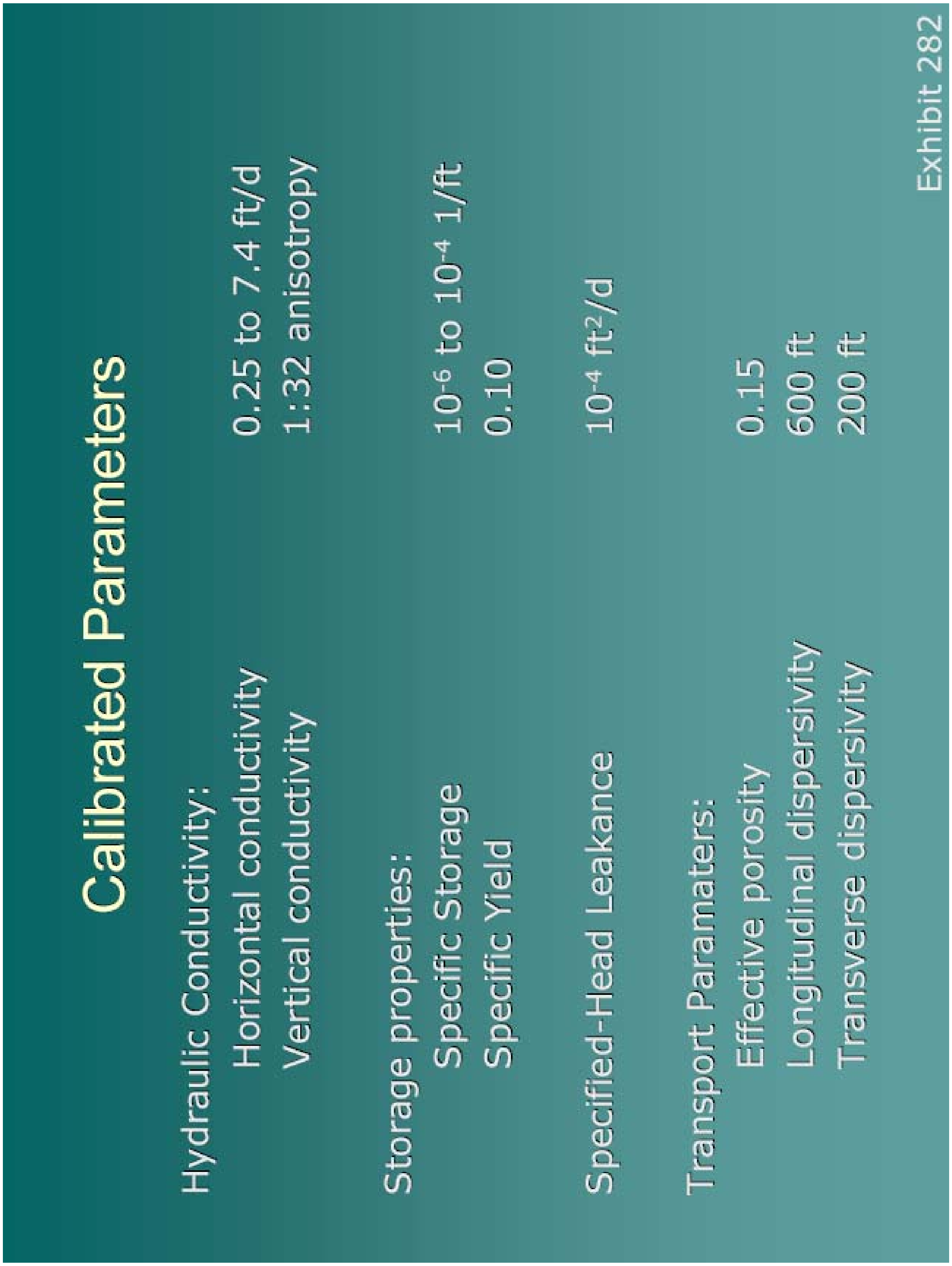
- HLA (8)
- Yates (4)
- Durbin (7)
- D. Williams and Feeney (3) CDM (5), SGD (1)
- D. Williams (6)
- Feeney (2)


Boundary Conditions
Northern Specified Head
All No Flow
Monterey Bay
Specified Head


Model Boundary Area
Exhibit 279
Model
Foreman
Yates
Marina
Seaside
Model
Pacific Ocean


Mesh Plan View
Materials
Surficial Deposits
Salinas Clay
Paso Robles
Purisima
Santa Margarita
Ord Terrace Fault
Marina
Seaside
Bay
Monterey
Exhibit 292.1


Recharge and Pumping
Recharge:
Terry Forman 0.31 ft/yr
Gus Yates 0.29 ft/yr
Used 1956-2002 0.3 ft/yr
Pumping:
Used 1956-2002 Terry Foreman
Exhibit 285


Calibrated Parameters
Hydraulic Conductivity:
Horizontal conductivity 0.25 to 7.4 ft/d
Vertical conductivity 1:32 anisotropy
Storage properties:
Specific Storage 10-6 to 10-4 1/ft
Specific Yield 0.10
Specified-Head Leakance 10-4 ft2/d
Transport Paramaters:
Effective porosity 0.15
Longitudinal dispersivity 600 ft
Transverse dispersivity 200 ft
Exhibit 282

APPENDIX B

SEASIDE GROUNDWATER BASIN WATERMASTER

Groundwater Modeling Approach Meeting

Tuesday, November 28, 2006 - 11:00 to 2:00
Bayonet Room -- Oldemeyer Multi-Use Center
986 Hilby Avenue, Seaside CA 93955 (map attached)

~AGENDA~

Introductions

Purpose
- Discuss modeling issues and approaches relevant to Seaside Basin
- Receive input toward selection of an appropriate approach

Previous Modeling Efforts
- Review previous efforts

Potential Model Uses
- Need for and use of model

Moving Forward
- **Hydrogeologic Issues**
  - Geology – Relevant Features, Sources
  - Hydrostraitigraphy
  - Boundary Conditions – Ocean/Salinas Valley/"bedrock"
  - Data Sources/Gaps – Critical Gaps

- **Modeling Issues**
  - Code
  - Layers/Domain
  - Boundaries
  - Uncertainty
  - Critical Data Gaps – Approaches to "bracketing"
  - Ease of Use/Multiple Users
  - Ability to Link to Solute Transport Co

Recap
- **Critical Hydrogeologic issues**
- **Critical Modeling Issues**

Recommended Approaches

- Recommended Improvements over Previous Approaches

Adjournment

SEASIDE GROUNDWATER BASIN WATERMASTER
Groundwater Modeling Approach Meeting

November 28, 2006
Oldemeyer Multi-Use Center, Seaside CA

MINUTES

Attendees:
Martin Feeney (MF)
Tim Durbin (TD)
John Fio (JF)
Terry Foreman (TF)
Joe Scalmanini (JS)
Derrik Williams (DW)
Gus Yates (GY)

Introduction

Introductions were made, with each attendee giving a brief summary of their previous roles in the adjudication proceedings and/or their current role as a group participant.

Background

MF emphasized that following the court decision today's attendees were no longer necessarily representing individual clients, and instead everyone is essentially working for the Water Master (WM). Therefore the group can focus on developing the best model possible.

Regarding the reason for the mornings meeting, MF stated that the specific purposes are not clear, but in his opinion the court proceedings had created a sense of controversy about the existing model and the WM board believed that this should be defused prior to moving forward with complying with the courts requirement for a new model. MF stated that it was his belief that much of the perceived controversy was the result of TD not having enough time to both build *and* document the model which led to a perception of less transparency.

Regarding the administration of the new modeling effort, MF said that the WM issued a two-part RFP, with three responders. WM chose to give the "management" component to the County/MPWMD team, with "implementation" component to RBF team of which Derrik Williams is a part. Initially, MF's task was to first develop a document that would be used as a direction for the modeler(s), but given the court mandated timelines, the WM has already hired RBF and DW is now engaged in today's process.

TD asked about the role of County/District team given they are both stakeholders *and* a consultant to the WM. MF responded that it is not clear what their role is, and they have not been specifically tasked with anything yet; but since the WM does not have any staff, this will probably continue. The WM's RFP was prepared in a short amount of time and is a collection of individual scopes written by different parties and quickly assembled. MF's contract is with the Water Master (WM) which has been established as an "entity." The WM's Executive Officer is Dewey Evans, who was the previous CFO/risk manager for City of Monterey.

Purpose

MF said the purpose of this meeting was to receive input on how the model should be built, why a model was needed and where the model should go from here. MF highlighted that the only reference in the judgment was a single line of text which reads, "*Develop suitable groundwater model of Seaside Basin and appropriate adjacent areas.*"

DW emphasized that the model development process is open ended and is still wide open to suggestions and that he did not have preconceived notions about what needs to be done. DW said he is seeking input from this group.

Model Uses
MF asked the group what the purpose of the model should be and why build a model and opened the discussion to the group for their thoughts.

TD suggested that because the water budget is the critical issue, a simple model, such as the existing model would be appropriate with focus on determining how to maintain a positive gradient at the coast. As long as pumping stays near the coast it will be difficult to figure out what the impacts will be given the lack of data of offshore. It was anticipated that pumping may be moved inland. Model should be focused on improving and helping understand the water budget, and therefore encouraged a more minimal modeling approach.

MF generally agreed given the poor understanding offshore geologic data and boundary conditions. TD added that there will likely *always* be poor offshore data. JS agreed, adding that if the goal is to manage the basins water balance, a model might not even be needed. A simple review of hydrographs shows the basin is out of balance and that if he worked for the water master he would find a way go back to court and lobby to have the need for a model removed. Even moving the pumping inland will not improve the water budget. TD partially countered that even if there was a positive water budget, continued pumping at the coast could still cause a problem. JS generally agreed saying some kind of a model could be a useful tool to show impacts of moving pumping, but that a water budget could be addressed independently of a model. Inland conditions are not well known either. Therefore JS encouraged more discussion by the group to first figure determine "why," before jumping into a modeling effort

GY discussed six shortcomings of solely implementing a water budget approach: 1) a water balance is too "lumped," i.e., that a positive water balance could show a positive flow to the ocean, yet there could still be intrusion because a budget can not analyze localized hydraulics next to boundaries. 2) A water budget can not address spatial variations such as different water levels in the Santa Margarita and Paso Robles. 3) A model could be useful for estimating/calibrating recharge estimates especially to match up actual recharge and rainfall patterns. 4) A model could also be useful for determining alternative scenarios such as how *far* and how *much* pumping should be moved inland. 5) A model could also be used to quantify leakance, by using vertical conductivities and use onshore data and extrapolating offshore, and, 6) a model could refine estimates of where the aquifers are effectively connected to the ocean.

Regarding leakance, TD responded that when trying to model leakance near the coast that the materials are fairly heterogeneous, especially horizontal conductivities. TD cited a week long pumping test for MPWMD wells in the area where the responses in different monitoring wells were very different, even at that smaller scale. Models are good at estimating averages, but estimating responses at individual wells can be off by a great extent. Because it is not likely this can be resolved, the expectations for the model will have to be lowered to only being able to predict intermediate and large scale scenarios (like moving pumping), but not small scales. For example, for a specific well near the coast, the model will not be able to predict specific timelines and estimates for when that well would be intruded. Therefore we should limit expectations for model.

GY basically agreed, but noted that the heterogeneity might be addressed by using probability fields to estimate the presence of preferred pathways. An alternative approach could be to assume that the pumping will be moved far enough inland so that local heterogeneity at the coast is effectively "dissolved" at that larger scale. Gus suggested the model could be used for scenarios where the pumping is moved inland and some target water level is established at the coast. Then again, this could be problematic because it may not be possible to establish 15 feet of head at the coast anywhere in the basin. TD offered that 15 feet of head may not be needed since salt water is not likely present as a single large wedge just offshore, but as a series of little wedges in the upper layer. GY partially agreed that layering and anisotrophy can "trump" the Hertzberg Relationship, but that leakance estimates would still be needed near the coast. TD noted that he prepared cross sectional models using a model simulating density effects and came to conclusion that density effects were small and that most of the water would be fresh. The modeling assumed steady-state, predevelopment conditions. TD listed/described other assumptions used in that modeling. Before discussing density effects further, the group agreed more discussion was needed on *why* a model would be developed.

TF recommended modeling in that a model was a useful tool for four reasons: 1) for the same reasons that GY listed. 2) Even if only to tie together issues such as water level fluctuations in two the different aquifer units. 3) It will help to bring to light, think about and determine the significance of inconsistent observations. 4) The need to model different management scenarios.

JF agreed models are extremely useful for testing whether you understand the system or not. He encouraged providing a lot of context for users so they understand the limitations and expectations of the model. This included explaining what the sensitivity analysis means in terms of limitations.

Level of Modeling

DW asked that if it was agreed the model was a good tool, the next question was what guidance did the group have on the *level* of modeling needed? MF again highlighted the quoted judgment text. JS emphasized that the underlying reason for the adjudication was due to declining water levels. This was/is a chronic condition occurring decades before the Paralta well. Given that pumping exceeds estimates of recharge by 40-50 percent, the general goal should be to stop declining water levels. Therefore the objectives become: 1) how to (re)distribute pumping and keep water levels at the coast at some given level on an interim basis, and then, 2) how to get new water into the basin and/or reduce pumping to stop the declining groundwater levels. While the model is a good intellectual tool, the court has mandated a 15% decrease in three years if no solution is implemented. So, the model should focus on becoming a useful tool for analyzing scenarios to achieve the preceding objectives.

TF suggested the model could be useful in modeling sub-scenarios for optimizing interim steps. The court may want to know the implications of allowing interim steps to continue for say, 3, 5 or 10 years, and how the WM came to that conclusion. It could also be useful in assessing impacts from moving capture zones to edge of basin near other jurisdictions.

TD added that there are a very large combinations of recharge values, gradients and transmissivities from inland, through the basin, and down to the coast that would yield the same results, and that the model will not be able to discriminate between these combinations. Therefore he suggested that if investigations are done to refine/improve earlier work, this should be independent of the modeling effort.

JS recommended a conclusion statement on "why model." MF and the group agreed this was appropriate. The following collective statement of the purposes of model were listed:

- To test the understanding of basin. Any model should include upfront statement of caveats re: level of discrimination, sensitivity and limitations of model.
- To allow evaluation of impacts of alternative management scenarios/schemes (at a larger scale)
- To evaluate/coordinate data collection and analysis, especially to track how future data which may change/conflict with current data. Allow prioritization of data collection efforts such that data critical to understanding and management are collected. Models can provide consistent tool for interpretation of collected data.

Discussion

Regarding moving pumping inland, MF acknowledged that moving pumping inland may be institutionally very difficult due to land ownership by BLM, however he thought that this effort should focus on the most hydrogeologically viable solution. Discussion turned to model time-frame given that drilling new wells inland would generate significant new information. MF would consider whether a model for the long term was be premature and if an interim modeling effort might be more appropriate until that new information was available. Derrik noted that WM may very well want to consider *other* management options (other than moving pumping inland) such as mining for a given amount of time, recharge, ASR, plus model will help with local/spatial water budgets. TD recommended that until new data is developed, to just update the existing model and "sit with it" for a few years, and use it until we have new data and then decide whether to start a new model. This would be a less expensive approach and could meet the court requirements. The group agreed this was a possible approach should be discussed further.

JS reemphasized his standing concern that the model did not adequately replicate *historical* trends therefore could not be relied upon to predict *future* trends (within Santa Margarita). TD suggested that this could be corrected with a minimal effort by this team and thought it was a fixable problem. JS also emphasized that it is very unlikely that any kind of drilling/testing and/or shifting of pumping could occur within a three year time frame especially given that one year has already passed. JS doesn't feel that the WM "needs" a model to address interim scenarios.

Regarding adjacent modeling efforts, the western "boundary" of the SVISGM in the Fort Ord area did not truly model boundary conditions but was only a placeholder used as an accounting cell and the geology is completely lumped. TD noted that some of the water recharging the SV basin was from the Seaside/Marina basin into the pressure area of the SV and suggested that the interconnection was reason to consider moving more water from the SR diversion into the pressure area. Discussion ensued on the political difficulties of doing this within the timeframe and thoughts on how shifting pumping inland may or may not will shift GW divide and alter capture area.

MF stated that a lot of good ideas had been offered and suggested that the second half of the meeting focus on the old model.

Lunch Break

Previous Modeling Efforts and Geology

JS asked about the extent of the next model. MF responded that model would definitely cover the entire basin and the "appropriate adjacent areas," which needs to be discussed. There would not be a need to further subdivide the basin. It was noted that there were structural features (anticlines) that need to be accounted for. Terry noted that LS sub-area had a yield of its own, and perhaps should be addressed separately. Brief discussion of whether water at the coastal end of the Southern Seaside sub-area would otherwise flow north. MF noted the saturated area above the shale was only 30-40 feet, with groundwater surfacing at shallow coastal lakes and then migrating through dune sands to ocean.

Regarding the geology, MF stated there are a number of sources for geology data and therefore need to agree and whether the geology matters such as faulting and some inconsistencies. JS asked whether it will matter to DW since he will be doing the modeling. DW responded he was more interested in hydrostratigraphy. MF noted that given the lack of real boundaries on three sides, it makes sense to use the boundaries where known. DW also emphasized that it was more important to ensure the model was internally consistent. JS suggested that there are a range of ideas how to set up conceptual model, so discuss that first and *then* discuss geology. TF noted that when his team did their report they did not try to recreate the geology and had no major disagreements with previous interpretations. TD suggested that the approach should be to label each unit and then develop maps, which show the geographic extent of each unit and generate contour maps for each unit relying on existing data; then by committee review them to try and come up with a consensus.

Hydrostratigraphy

MF shifted the discussion to hydrostratigraphy. GY noted that since the Paso Robles unit was very thick that the model might still need to have additional layers versus actual two units. GY asked TD about coarse- and fine-mesh modeling efforts. Tim responded that in terms of groundwater flow it did not make any difference and that he did not learn much from testing two versions of layering. TD thought either approach could be used.

DW asked if there was a lot of depth dependent (i.e. production zone) data that could result in a 'layer' in a model to help identify the source and type of data. MF responded that given the Paso Robles depositional environment there is too much variability. Data is also more variable here due to various completion depths of wells. Following discussion, group generally agreed there would probably not be enough data to generate a separate layer. MF suggested that model might emphasize likely depths were new wells would typically be screened.

TD asked if there will be additional geophysical data collected. Group discussed evolution of specific judgment language in the monitoring plan and that specifies studies along the northern boundary of basin and requirements to be calibrated against test borehole data. It was noted that while required and useful the data will not be available in time to complete this model in the expected time frame. DW questioned whether the geophysical work was within the current RBF scope.

Boundary Conditions

MF shifted discussion to boundary conditions, which are problematic given that only one boundary is actually mapped (Chupines Fault on southern boundary). There is some kind of unknown interface with the Salinas Valley.

TD noted that a flow boundary can also be changed *vertically* (not just north/south) and change outflows, therefore it is more important to determine area of influence of relocated wells. GY suggested setting model boundary far enough on the other side of an estimated flow boundary divide to let the model determine where effective divide is located. MF asked TD about his boundary assumptions. MF summarized that both north and east divide will actually be modeled with focus being on monitoring water level data. DW said he liked the way the existing model worked since it modeled the groundwater divide. The model could be tied to MCWRA water level data and/or the Ft. Ord 'accounting unit' of SVIGM.

JS noted that goals of stakeholders on either side of model the flow divide may be different with Salinas Valley stakeholders wanting to raise water levels, and this group wanting to just balance the Seaside basin by shifting pumping. But this may change the SV baseline/GW levels. This may be another reason to extend this model to the SV boundary. TD suggested that perhaps two models (SVIGSM and his FEMFLOW3D model) could be run alternatively/iteratively. JS cautioned against suggesting scenarios that induced changes in gradients away from Salinas Valley.

MF said the ocean boundary is critical given that seawater intrusion is a driving factor behind adjudication. DW said to not even try to suggest that we can answer the question of when intrusion will occur since it will be very difficult to predict its timing. There are better questions to ask such as what kind of water level would be needed onshore to keep SW intrusion at a given distance from the shore. This would be possible by using cross-sectional models of shoreline/ocean interface.

TD summarized some alternative assumptions used in his model which depended on three key questions: 1) whether there is a "skin" on the bottom of the Bay, and 2) the unknown vert/horz transmissitivities; 3) the geometry of the units offshore. His modeling suggested that what happens far offshore does not affect near shore intrusion. Since salt water heads are higher far offshore this tends to set up little shallow vertical circulation cells due to undulating bottom surface. The last/closest cell near the beach shows some SWI leakance but model suggests that there is essentially fresh water in the aquifer. GY asked TD about changing his model's leakance and other variables during the adjudication process. TD responded that there was not much effect from the changes and that the only way to test for that is by doing a sensitivity analysis. DW asked whether that TD used equivalent fresh water heads. GY commented that this would be the expected result in 'short-circuiting' between layers of cells… [inaudible…multiple conversations]. TD said that if there is pumping right near the coast there could be shallow intrusion depending on assumption. Team generally agreed that if this approach was used, the only practical approach is to do a sensitivity analysis.

Discussion

TD said that conceptually the projection of the series of faults offshore need to be agreed upon. GY said we might need to reconsider offshore projections.

DW reiterated that the questions should not be where the intrusion front is and when will it get here. This cannot be answered with any accuracy. DW asked whether a series of small density dependent models based on cross-sections right at the coast might be useful since using a regional density depend model will not work due to short circuiting offshore. An approach could be to have two models; one being inland and one starting at some point off the shore and just using a series of 2-D cross-sections to analyze the front. MF thought this had some merit.

GY noted that known differences in water levels onshore in the two units can be used to bracket a range of leakance values in water level differences offshore areas.
GY asked if the existing model could be adapted to include changes in geologic unit surfaces surface elevations and footprint. TD replied that this could be done relatively easily.

JS noted that given that 5,000 AFY is pumped from a small number of wells in a small basin, and that the range of alternatives to balance basin is small, maybe only 2-3 options, it is therefore appropriate that the model should focus on how to model the options. Basic purpose should be to test scenarios of practical solutions, which should cover future decisions from 5-20 years. He therefore urged the group to focus on potential immediate utility of the existing model.

Regarding the timing of the model, MF noted that a most basic MODFLOW model might be running within a week assuming all factors were known. DW responded that since a more complex model will be needed in the future it seems appropriate to start moving in that direction sooner rather than later. MF noted that the court timeline is a key, driving factor. DW said that missing factor is input from client. DW said that although this group provides good technical basis for the model, the model must also be based on non-technical issues that come from but the WM Board is not able to provide a high level of technical input. MF needs to balance time, cost, effort and results. JS offered that in the short term the highest priority should be to test alternative management schemes. Evaluating data, technical assumptions and other items will be of lesser importance to court and therefore recommended using existing model. MF noted that cost and time will be lost replatforming to a new model. Plus by modifying the existing model it also saves time and costs since that it also does not need a round of review by a technical review committee like a new model would.
TD agreed that that 80%+ of the effort is the water budget, with the rest being modifying existing mode1 after resolving questions/issues with its calibration, most notably the replication of historical groundwater levels in the Santa Margarita Fm.

CONCLUSIONS AND RECOMMENDATIONS

MF suggested that there appears to be a consensus within the group toward using, at least in the short-term, the Durbin model after refinement/recalibration efforts to resolve the questions/issues, real or perceived, as discussed above. TD suggested that that a recommendation be given to the WM Board to keep this group going to review the model.

JS urged a second recommendation be made to the WM Board, especially those with technical knowledge of modeling efforts. Specifically to encourage them to understand that while the shorter-term aspects of the court order could be met by modifying the existing model, there will also be a need for a focused effort to have a non-political, scientific group/person to assess the impacts of importation projects to resolve bigger issues like how to actually manage the basin. MF generally agreed that was the direction the model was moving.

JS also urged that at some point there be a deliverable (report) that collects all information about how model was assembled and calibrated and how the conceptual model was put together. This will help in making the information accessible for future users. TD also suggested that the report include a collection/appendix of all data (and the interpretations) put into model so future

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EXCERPTS FROM THE DURBIN MODEL DOCUMENTATION REPORT

4.0 Model Simulations of Future Conditions

To assess the potential for future seawater intrusion within the Seaside area, the model was used to simulate groundwater conditions in 2015. For this simulation, the annual groundwater pumping during 13-year period 2003-2015 was set equal to the 2002 pumping from the Seaside groundwater basin. The groundwater recharge was set equal to the 1956-2002 average annual rate. The 2002 pumping is 6,300 acre-ft/yr, and the average annual recharge is 11,900 acre-ft/yr.

The simulation indicates that groundwater levels will decline within the Seaside area but seawater intrusion will not occur. Figure 4.1 shows contours of computed heads within Paso Robles and Santa Margarita formations for 2015. The computed heads are as much as 5 ft lower in the Paso Robles Formation than in 2002, and they are as much as 10 ft lower in the Santa Margarita Formation. However, sizes of the regions within the Paso Robles and Santa Margarita formations with groundwater levels below sea level increase from 2002 to 2015. Figure 4.2 shows contours of computed salinity within the Paso Robles and Santa Margarita formations for 2015. For both the Paso Robles and Santa Margarita formations, the computed salinity is similar to that simulated for 2002. The water budget for the simulation is listed in Table 4.1.

To evaluate the potential benefits of relocating some of the pumping, the model was used to simulate the groundwater conditions with relocated pumping. The basic configuration of the simulation was the same as for the first. However, the pumping from the Paralta well (Table 2.1) was transferred to a new well located 10,000 ft northeast from the Paralta well. The relocated pumping represented a pumping rate of 2,000 acre-ft/yr.

The simulation indicates that groundwater levels will recover within the Seaside area and seawater intrusion will not occur. Figure 4.3 shows contours of computed heads within Paso Robles and Santa Margarita formations for 2015. Within the vicinity of the Paralta well, the computed heads are as much as 20 ft higher in the Paso Robles Formation than in 2002, and they are as much as 30 ft higher in the Santa Margarita Formation. Figure 4.4 shows contours of computed salinity within the Paso Robles and Santa Margarita formations for 2015. For both the Paso Robles and Santa Margarita formations, the computed salinity is similar to that simulated for 2002. The water budget for the simulation is listed in Table 4.2.

5.0 Conclusions

A groundwater model has been constructed for the Seaside groundwater basin, using the basin boundaries as defined by the California Department of Water Resources (2003). The model simulates groundwater flow and solute transport using the groundwater-modeling software *FEMFLOW3D*, which is a variant of the modeling software *FEMFLOW3D* (Durbin and Bond, 1998). The development of the model for the Seaside basin is based mostly on the hydrogeologic interpretation and data tabulations developed by CH2M/Hill (2005). The resulting model is a generalized representation of the groundwater system. Simulation results derived from the model can be interpreted to phenomena with spatial scales several thousand feet or more and temporal scale of a year or more.

The model was used to make two simulation scenarios involving future conditions. The first scenario assumes that the 2002 pumping would be continued until 2015, and the second scenario assumes that the pumping from the Paralta well would be relocated inland. For the first scenario, the simulation results are that groundwater levels will decline relative to the 2002 conditions, but seawater intrusion will not occur within the landward part of the Seaside basin. For the second scenario, the simulation results are that groundwater levels near Monterey Bay will increase, and seawater intrusion will not occur within the landward part of the Seaside basin.

HYDROMETRICS MEMO

HydroMetrics LLC

1611 Telegraph Avenue, Suite 404
Oakland, CA 94612

October 4, 2007

Subject: Ongoing status of the Seaside Basin groundwater model

Members of the Seaside Basin Watermaster Technical Advisory Committee:

Hydrometrics LLC has obtained and reviewed the Seaside basin groundwater model developed by Timothy J. Durbin. We have familiarized ourselves with the model, and are confident with our ability to use the model to guide future groundwater management decisions. We have been supplied with all of the data and input files that constitute the model, as well as user manuals for the model codes.

The current model is logically constructed, based on the data available to Mr. Durbin, as well as the time constraints placed on him. During our review of the model documentation, however, we concluded that the model requires some checks and updates before it is used to guide groundwater management decisions and, depending on what the model will be used to simulate, or on the availability of new data and interpretations of the groundwater system, there may be specific modifications that will be necessary. These checks, updates, and potential modifications to the model that are described in this memo do not need to be done immediately; they only need to be done before the model is used to simulate the groundwater basin.

The checks and updates that should be made before using the model include further refining the conceptual model and further developing the numerical model, including a more thorough calibration of the model. This further development of the model should include:

- Developing an *a priori* water budget of the basin that can be used to check the model results. The groundwater flows across model boundaries should be estimated and checked against model results. This will fill a gap in the current model documentation in which only estimates of the recharge and pumping components have been presented.

- Investigating the effect of faults on groundwater flow should be investigated. Currently there are two faults in the model through which groundwater can flow. These faults have been assumed to act as barriers to groundwater flow. The evidence or lack of evidence regarding the impact of these faults on groundwater flow should be documented.
- Modifying recharge in the model to represent the known spatial variation of recharge. In the current model recharge is the same everywhere in the model. Differences between a spatially homogeneous recharge and the naturally varying recharge distribution will cause the calibration process to rely on altering aquifer parameters to match measured water levels.
- Conducting a more thorough calibration. Calibration should compare model results against existing hydrographs and vertical gradients in addition to the limited water level data and contour maps described in the model documentation. Additionally, the calibrated model should reflect our current understanding of groundwater flow conditions. For example, groundwater flow in the model appears to be from the Seaside Basin, towards the Salinas Valley. Simulating our understanding of the groundwater divide between the Seaside and Salinas Basins, and simulating the path of seawater intrusion in the Marina area, would require modification of the boundary conditions of both the flow and transport models.

These checks and updates will force the model to more completely represent our understanding of the groundwater system.

Additional modifications to the model will be driven either by new data and interpretations of the groundwater system, or by the requirements of the particular scenarios that are to be simulated. Examples of potential modifications to the model are listed below:

- Increasing the spatial and temporal discretization if necessary for a particular problem. This may also include refinement of input data (e.g. replace annual recharge and pumping rates and with monthly rates)
- Calibrating the model to new water level data as it becomes available
- Reconfiguring the finite element mesh to incorporate new geological information such as extent of the formations and elevations of geologic contacts
- Reconfiguring boundary conditions in the flow and/or transport models.

HydroMetrics LLC is prepared to assist the Watermaster Board of Directors with any groundwater modeling that will help with groundwater management decisions. Do not hesitate to contact us if you have any questions.

Sincerely,

Derrik Williams

David Van Brocklin

ATTACHMENT 12

SEAWATER INTRUSION ANALYSIS

Conclusions

Depressed groundwater levels, continued pumping in excess of recharge and fresh water inflows, and ongoing seawater intrusion in the nearby Salinas Valley all suggest that seawater intrusion could occur in the Seaside Basin. In spite of these factors, no seawater intrusion is currently observed in existing monitoring wells. Analyses that suggest no seawater intrusion include:

- All water samples plot in a single cluster on Piper diagrams, with no apparent geochemical evolution towards seawater

- No water samples result in Stiff diagrams indicative of incipient seawater intrusion

- The only well displaying increasing chloride levels is the deep Ord Terrace well. The increasing chloride levels do not appear to be the result of seawater intrusion

- No wells display decreasing sodium/chloride ratios

- Maps of chloride concentrations do not show chlorides increasing towards the coast. To the contrary, chloride concentrations appear to increase inland in response to other sources of chloride.

In spite of the definitive geochemical data, the water level and pumping data suggest that a potential for seawater intrusion exists. Coastal water levels in the deep zone remain above sea level in the Southern Coastal Subarea, but are significantly below sea level in one localized area of the Northern Coastal subarea (Figure 1). Two potential processes may explain why no seawater intrusion has been observed in the deep coastal wells:

- The seawater/fresh water interface is sufficiently far offshore in the deep zone that it has not reached the coastal monitoring wells yet. A seawater interface may be moving towards the coast, but may take many years to arrive. Before the interface arrives, pumping will mine much of the fresh water stored beneath the ocean in the lower aquifer.

- Overlying aquifers and aquitards limit or prevent seawater from percolating into the lower aquifer. Water level data suggest that this process is almost certainly occurring. Coastal water levels in aquifers that are in close hydraulic communication with the ocean remain near sea level because the ocean acts as a constant-pressure reservoir. Coastal water levels in the deep aquifer are more than 20 feet below sea level (Figure 1), suggesting that this aquifer is not in close communication with the ocean. This is further evidence that groundwater in the deep aquifer is being mined rather than replaced by seawater.

These two processes are displayed in Figure 2. The two processes are not independent, and it is likely that some combination of both factors is occurring.

An expanded data collection effort could improve our understanding of water quality in the Seaside Basin, and provide better early warning of seawater intrusion. Data deficiencies in the current analyses include:

- Incomplete water level data;
- Limited general mineral analyses;
- A limited number of wells with chloride data;
- An incomplete conceptual model of the basin hydrostratigraphy.

Actions to remedy these data deficiencies are included in the recommendations section of this report.

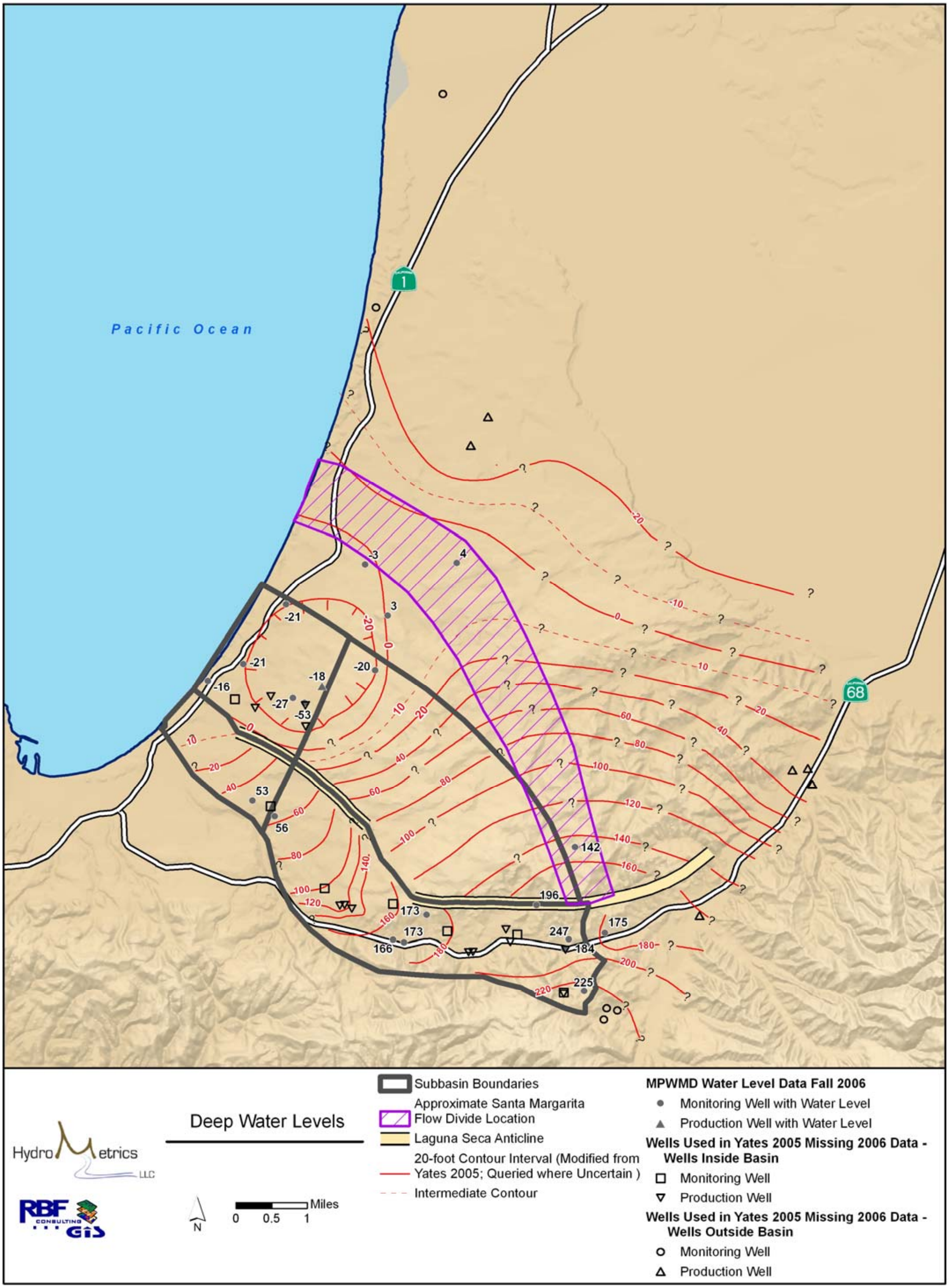

Figure 1: Deep Zone Water Level Map

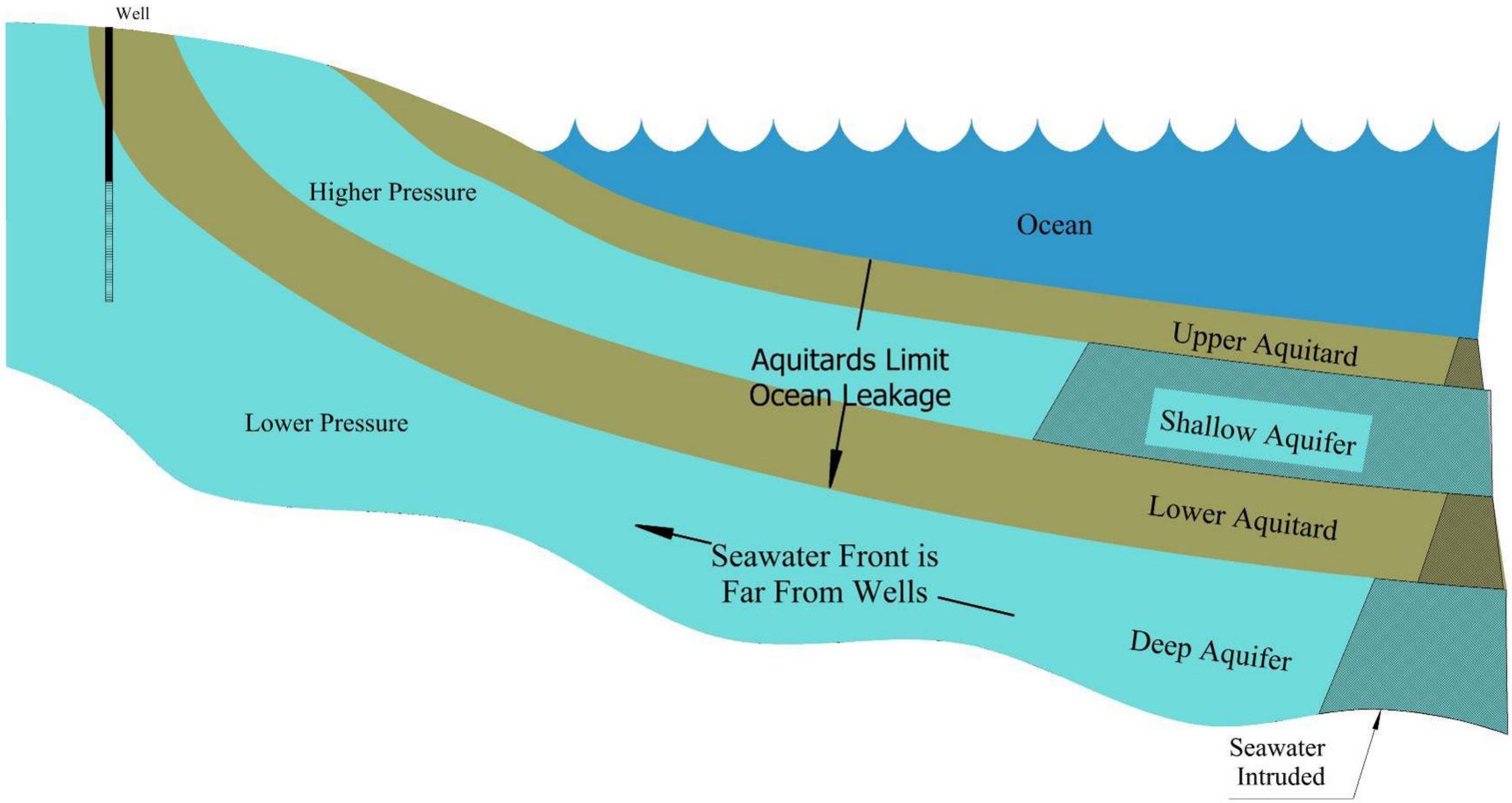

Figure 2: Possible Processes Limiting Seawater Intrusion

Recommendations
The analyses presented previously in this report are based on existing data. While informative, the data are spatially incomplete and temporally sporadic. A much more complete analysis of seawater intrusion should be developed. The following recommendations should be implemented to monitor and track seawater intrusion.

Develop an improved and systematic monitoring plan

An improved monitoring plan should be put in place that provides adequate data for identifying seawater intrusion and managing the groundwater basin. The improved monitoring plan should include the following:

- Identify wells in the monitoring program.
- Identifies data needs.
- Implement a regular water level monitoring schedule and protocol that follows the guidelines in the Seaside Basin Monitoring and Management Program (SBMMP) (Seaside Basin Watermaster, 2006). The water level monitoring program should produce data sufficient for developing depth-specific piezometric (water level) maps of the Seaside Basin.
- Implement a methodical water quality monitoring program capable of identifying seawater intrusion. The water quality monitoring program should build on the guidelines described in the SBMMP, and address all water quality parameters needed for analyses. Parameters might include general minerals, iodide, bromide, and isotope data, as needed to characterize water quality and better define sources of water quality variability in each aquifer zone. Electromagnetic logging of the new coastal monitoring wells should be conducted and analyzed annually as part of this water quality monitoring program.

Add additional monitoring locations as necessary

To the extent possible, existing wells should be incorporated into the monitoring plan. A review of existing wells is currently being conducted as part of the Watermaster activities. This review should provide a basis for screening wells that can be incorporated into the monitoring program. Screening criteria for wells may include the following:

- Depth of well
- Well location
- Length of well screen
- Ease of access
- Well ownership
- Ease of sample collection
- Water quality believed to be representative of aquifer conditions.

It is possible that existing wells either do not exist at the desired locations and depths, or the existing wells are not completed to provide representative water samples of the various formations. As an example, some of the existing coastal monitoring wells are perforated in short, depth-specific zones. Complete sections of the various formations are not currently being monitored. If existing wells cannot provide the necessary water quality data, dedicated monitoring wells should be installed that can provide early detection of seawater intrusion.

The most important location for detecting seawater intrusion is adjacent to the coast. The Watermaster recently installed four deep borings and monitoring wells along the coast to address seawater intrusion. Based on what is learned from data collected from these four wells, it may be necessary at some date to install shallow monitoring wells at the same locations.

Analyze and report on water quality annually.

Seawater intrusion is an ongoing and constant threat, and data must be analyzed regularly to identify incipient intrusion. Maps, graphs, and analyses similar to what is found above should be developed every year.

ATTACHMENT 13

UPDATED PHASE 2 SCOPE OF WORK

Seaside Groundwater Basin Management and Monitoring Program
Updated Anticipated Phase 2 Scope of Work

(Updated September 26, 2007)

The tasks outlined below are those that are not anticipated to be completed as a part of Phase 1 of the Seaside Basin Monitoring and Management Program. It has been determined that the Tasks listed below are either dependent on results of the initial phase of the Program (and therefore subject to scope refinement); or, they are recommended for Phase 2 because Tasks in the initial phase must be completed before the tasks below can commence. By phasing implementation of the MMP, the Watermaster can better understand the Basin's baseline condition through the Phase 1 work effort before determining the exact scope and budget for Phase 2.

Some Tasks listed below are also depicted in the Initial Phase Scope of Work. This is because some Tasks recur throughout the program. For instance, data collection and database entry are continuous activities that will occur throughout the program. Program Administration Tasks will also occur on a day-to-day, as needed basis throughout the program.

M.1 Program Administration

M. 1. a. Project Budget and Controls	Contractors will provide monthly or bimonthly invoices to the Watermaster for work performed under their contracts with the Watermaster. Contractors will perform maintenance of their internal budgets and schedules, and management of their subconsultants. The Watermaster will perform management of its Contractors.
M. 1. b. Assist with Board and TAC Agendas	Watermaster staff will prepare Board and TAC meeting agenda materials. No assistance from Contractors is expected to be necessary to accomplish this Task.
M. 1. c. Preparation and Attendance of Meetings	The Contractors' work will require meetings both internally and with outside governmental agencies, and possibly with the public. For meetings with outside agencies, other Contractors, or any other parties which are necessary for the conduct of the work of their contracts, the Contractors will set up the meetings and prepare agendas and meeting minutes to facilitate the meetings. These may include planning and review meetings with Watermaster staff. The costs for these meetings will be included in their contracts, under the specific Tasks and/or subtasks to which the meetings relate. The only meeting costs that will be incurred under Task M.1.c will be: • Those associated with attendance at TAC meetings, and • From time-to-time when Watermaster staff asks Contractors to make presentations to the Watermaster Board and/or TAC. • For TAC meetings appropriate Contractor representatives will attend the TAC meetings, but will not be asked to prepare agendas or meeting minutes. As necessary, Contractors may provide oral updates to their progress reports (prepared under Task M.1.b) at the TAC meetings.
M. 1. d. Prepare Board/ TAC Status Updates and Reports	Contractors will provide written monthly progress reports to the Watermaster for inclusion in the agenda packets for the TAC meetings. These progress reports will typically include project progress that has been made, and problem identification and resolution.
M. 1. e. Peer Review of Documents and Reports	When requested by the Watermaster staff, Contractors may be asked to assist the TAC and the Watermaster staff with peer reviews of documents and reports prepared by various Watermaster entities.

M. 1. f. **QA/QC**	MPWMD will provide general QA/QC support over the Seaside Basin Monitoring and Management Program.
Deliverables	• Monthly Status Reports • Technical Data as required for Meetings

I. 2 Comprehensive Basin Production, Water Level and Water Quality Monitoring Program	
I. 2. a. **Conduct ongoing data entry/ database maintenance**	The database will be maintained by a Contractor performing this work for the Watermaster. Either the Contractor or the Watermaster staff will enter new data into the consolidated database. Such data will include water production volumes, water quality, and water levels.
I. 2. b. Data Collection Program Enhancements	
I. 2. b. 1. **Site Representation and Selection.**	The monitoring well network will be reviewed, and if warranted, addition monitoring well sites will be identified to fill data gaps or to develop additional data that would be beneficial to the management of the basin.
I. 2. b. 2. **Collect Monthly Manual Water Levels.**	Each of the monitoring wells will be visited on a monthly basis. Water levels will be determined by either taking manual water levels using an electric sounder, or by dataloggers, if it is determined that dataloggers are appropriate. It is expected that dataloggers, if used, will only be installed on the Coastal Sentinel monitoring wells, and that the other wills will be manually measured.
I. 2. b. 3. **Collect Quarterly Water Quality Samples.**	Water quality data will be collected quarterly from certain of the monitoring wells. This data may come from water quality samples that are taken from these wells and submitted to a State Certified analytic laboratory for general mineral and physical suite of analyses, or the data may come from induction logging of these wells and/or other data gathering techniques. A decision on the most cost-effective method of obtaining the desired data will be made early in the 2008 Water Year.
I. 2. b. 4. **Update Program Schedule and Standard Operating Procedures.**	The TAC will conduct periodic reviews of the data collection program and will recommend to the Watermaster improvements as warranted.
I. 2. c. **Reports**	The groundwater level and quality monitoring will be conducted on a monthly, quarterly, and annual basis, as described herein. Reports summarizing data collected and analyzed will be submitted to the Watermaster on a schedule to be established. Reports would include: • Water Quality and Water Level Quarterly Reports • Annual Reports
	I. 3 Basin Management
I. 3. a. **Enhanced Seaside Basin Groundwater Model**	As a result of the data obtained during Phase 1, including constructing new coastal sentinel monitoring wells and developing a consolidated database of groundwater production, water levels, and water quality, it is no longer recommended that a new model be developed. The basis for this decision was included in the Phase 1 documents submitted with the November 15, 2007 Annual Report.
I. 3. b. **Prepare Basin Management and Action Plan**	Watermaster staff will prepare and distribute a Request for Proposals (RFP) to qualified Contractors to perform certain subtasks of Task I.3.c, as indicated below.
I. 3. b. 1. **Supplemental Water Supplies**	The Supplemental Water Supplies analysis performed in Phase 1 will be updated by a Contractor, and a Technical Memorandum on this issue will be prepared. This update may address the following: Updated status and review Of Monterey Peninsula Water Supply Projects Distribution and Delivery System/ End Use Consumer Improvements and Mandatory Conservation Efforts Non-Potable Water Resources Out-of-Basin Imports

I. 3. b. 2. Pumping Redistribution Strategies	Based on the work performed during Phase 1, a Contractor will develop additional pumping redistribution strategies, and a Technical Memorandum on this issue will be prepared. This work may include addressing the following: • Basin overdraft, mandatory GW reduction • Salinity detection, mandatory GW reduction • Reduced GW delivery impacts and solutions • In Lieu, Voluntary pumping reductions • Water Banking • Salinity barrier system • Develop TM on pumping variability • Storage capacity of the basin
I. 3. c. Plan Preparation	A Contractor will prepare a detailed Basin Management Plan, summarizing results of Tasks I.3.a through I.3.c.

I. 4 Seawater Intrusion Contingency Plan

I. 4. a. Oversight of Seawater Intrusion Detection and Tracking	A Contractor will provide general oversight over the Seawater Intrusion detection program.
I. 4. b. Analyze and Map Water Quality from Coastal Monitoring Wells	Annual chloride concentration maps will be produced incorporating the data from the coastal wells. During Phase 2, water quality data from the Phase 1 coastal sentinel wells will be used to develop time series graphs that are not included in the Phase 1 water quality graphs.
I. 4. c. Annual Report-Seawater Intrusion Analysis	At the end of each water year, a Contractor will reanalyze all water quality data. Semi-annual chloride concentration maps will be produced for each aquifer in the basin. Time series graphs, trilinear graphs, and stiff diagram comparisons will be updated with new data. The annual EM logs will be analyzed to identify changes in seawater wedge locations. All analyses will be incorporated into an annual report that follows the format of the initial, historical data report. Potential seawater intrusion will be highlighted in the report, and if necessary, recommendations will be included. The annual report will be submitted for review by the TAC and the Board. Modifications to the report will be incorporated based on input from these bodies, as well as Watermaster staff.
I. 4. d. Develop Contingency Response Plan	If seawater intrusion is identified, the Watermaster, with assistance from a Contractor and the TAC, will develop a response plan to ensure adequate water supplies for reasonable beneficial uses. This will include implementing the measures detailed in Exhibit A of the Decision, devising a pumping redistribution plan, and securing alternative water sources if necessary.