SEASIDE BASIN WATERMASTER

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ANNUAL REPORT – 2016

December 9, 2016

Table of Contents

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Integral to the Superior Court Decision (Decision) rendered by Judge Roger D. Randall on March 27, 2006 is the requirement to file an Annual Report. This 2016 Annual Report is being filed on or before December 15, 2016, consistent with the provisions of the Decision, as amended by the Annual Report Review and Order dated January 7, 2011. 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 Water Year 2016 (WY 2016) 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 2016." For the purposes of this Annual Report Water Year 2016 is defined as beginning October 1, 2015 and ending on September 30, 2016.

B. Groundwater Storage

Monterey Peninsula Water Management District (MPWMD), in cooperation with California American Water (CAW), operates the Seaside Basin Aquifer Storage and Recovery (ASR) program. Under the ASR program, CAW diverts water from its Carmel River sources during periods of flow in excess of NOAA-Fisheries' bypass flow requirements, and transports the water through the existing CAW distribution system for injection and storage in the Seaside Basin at the MPWMD's Santa Margarita ASR site and CAW's Seaside Middle School ASR site. During WY 2016, 699 AF was diverted and stored in the Seaside Basin under the ASR program. Rainfall in the area was about 105% of normal, but due to the rainfall distribution pattern throughout the season, Carmel River flow was only 67% of normal. WY 2016 was classified as "Below Normal" by MPWMD.

Based upon production reported for WY 2016, the following Standard Producers are entitled to Free and Not-Free Carryover Credits to 2017 in accordance with the Decision, Section III. H. 5:

Producer	Free Carryover Credit (Acre-feet)	Not-Free Carryover Credit (Acre-feet)
Granite Rock	151.43	83.89
DBO Development	293.06	161.66
Calabrese (Cypress)	7.26	1.22
CAW	00.00	430.99
City of Seaside Muni	00.00	00.00

C. Amount of Artificial Replenishment, If Any, Performed by Watermaster
Per the Decision, "Artificial Replenishment" means the act of the Watermaster, directly or indirectly, engaging in contracting for Non-Native Water to be added to the Groundwater supply of the Seaside Basin through Spreading or Direct Injection to offset the cumulative Over-Production from the Seaside Basin in any particular Water Year pursuant to Section III.L.3.j.iii. It also includes programs in which Producers agree to refrain, in whole or in part, from exercising their right to produce their full Production Allocation where the intent is to cause the replenishment of the Seaside Basin through forbearance in lieu of the injection or spreading of Non-Native Water (referred to herein as "In-lieu Replenishment").

During Water Year 2016 the Watermaster indirectly engaged in In-lieu Replenishment of the Basin. A minimal amount (0.06 acre-feet) of non-native water was made available to the Basin during Water Year 2016 under the Memorandum of Understanding and Agreement entered into by Watermaster with the City of Seaside for its golf course irrigation program creating in-lieu replenishment water. Currently, the City of Seaside is working to reconcile with Marina Coast Water District the balance remaining of the 2,500 acre-feet to be delivered under the program, estimated by the City of Seaside to be 89.94 acre-feet. Once reconciled, Watermaster will make any necessary adjustments to the acre-feet credited to the City of Seaside by the Watermaster under the terms of the Memorandum of Understanding and Agreement referred to above.

As reported in the 2014 Annual Report, this in-lieu replenishment program was extended by the Board in 2013 and made retroactive to January 1, 2013. The City of Seaside estimated that its remaining Marina Coast Water District entitlement would provide sufficient irrigation water to satisfy the irrigation demands of the golf courses through WY 2018. The extended MOU will continue until all of the City's remaining MCWD entitlement has been used within the Program, and all of the City's Replenishment Assessment Credit has either been used by the City or by another party if the City transfers its Replenishment Assessment Credit. A copy of the extended MOU was contained in Attachment 13 of the 2013 Annual Report.

D. Leases or Sales of Production Allocation and Administrative Actions
The City of Seaside transferred/assigned seven and one half acre-feet (7.50 AF) of its Standard Production Allocation within the Seaside Groundwater Basin to California American Water Company for the Water Year ending 2015 applied to Water Year 2016. The purpose of this transfer of water allocation was to offset the transfer of 7.50 AF of water from California American Water Company to the City due to the city's well failure that occurred within the Seaside Groundwater Basin between June 25, 2015 and July 20, 2015. Attachment 11 contains a copy of the notice from the City of Seaside of the requested transfer/assignment of water allocation via letter correspondence dated March 29, 2016.

During WY 2016 the Watermaster Board did not make any revisions to its *Rules and Regulations*.

During WY 2016 the Watermaster Board was comprised of the following Members and Alternates:

MEMBER	ALTERNATE	REPRESENTING
Director Paul Bruno	N/A	Coastal Subarea Landowner
Eric Sabolsice	Roger Hulbert	California American Water
Director Bob Costa	N/A	Laguna Seca Subarea Landowner
Director Bob Brower	Jeanne Byrne	MPWMD
Mayor Dave Pendergrass	Todd Bodem	City of Sand City
Supervisor Dave Potter	Jane Parker	Monterey County (MCWRA)
Mayor Jerry Edelen	Kristin Clark	City of Del Rey Oaks
Vice Mayor Libby Downey	Mayor Clyde Roberson	City of Monterey
Mayor Ralph Rubio	Dennis Alexander	City of Seaside

In January of 2016 the Watermaster received notice from the Court that the Honorable Leslie C. Nichols had been assigned to replace the Honorable Roger D. Randall who had previously been assigned to the Seaside Groundwater Basin Adjudication case. At its May 4, 2016 meeting the Board approved having Mr. Russ McGlothlin of the law firm of Brownstein, Hyatt, Farber, and Schreck file a Motion with the Court requesting a status conference to provide background information on the Adjucication Decision (for the benefit of the new Judge that had been assigned this Case) and to discuss several issues. These issues were (1) Updating the Court concerning recent regional water supply developments pertinent to the Seaside Basin, (2) Potentially at some future date requesting a stay of the 2018 Operating Yield reduction, and (3) Updating the Court concerning the modeling results and findings concerning the Laguna Seca Subarea (LSSA) and the Watermaster's intended work plan to address long-term water reliability for the subbasin. The motion was granted and a Status Conference with the Court was held on June 17, 2016. The transcript of the Status Conference Hearing is available for viewing on the Watermaster web site at http://www.seasidebasinwatermaster.org/ under Postings and Records on the June 16, 2016 date line in the Court Docs column.

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

The CAW/MPWMD ASR Program operated in WY 2016 and accordingly 699 acre-feet of water was injected into the Basin as Stored Water Credits and 609 acre-feet was extracted.

During WY 2016 0.06 acre-feet of imported water was used to irrigate golf courses owned by the City of Seaside overlying the Seaside Basin, as discussed above in **Section C**. The terms and conditions under which this in-lieu replenishment water was used to generate a credit to be applied against the City of Seaside's overproduction replenishment assessments is described in the "Memorandum of Understanding Between the Seaside Basin Watermaster and the City of Seaside" which was contained in Attachment 3 to the Watermaster's 2010 Annual Report.

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 in December of each year, so that the Producers are informed of the prohibition against pumping in excess of the Operating Yield.

The Watermaster made a declaration regarding the availability of Artificial Replenishment for WY 2017 at its Board meeting of December 7, 2016. A copy of this declaration is contained in Attachment 2. In WY 2016 the Watermaster continued the previously implemented 10% water production reductions required under Section III.B.2 of the Decision. No additional water production reductions were implemented in WY 2016.

Total pumping for WY 2016 did not exceed the Operating Yield (OY) or the Natural Safe Yield (NSY) of the Basin. This is a significant accomplishment. It is the first time this has been achieved since the creation of the Watermaster and reflects the beneficial effects of conservation efforts within the Basin.

The City of Seaside reported annual pumping quantities that exceeded their Standard Production NSY allocation by 37.87 acre-feet, and reported annual pumping quantities that exceeded Operating Yield allocation by 17.70 acre-feet. The City of Seaside did not exceed its Alternative Production NSY. The Watermaster will assess the City of Seaside a Replenishment Assessment for these over productions, as further described in Section H, below.

G. Watermaster Administrative Costs

The total estimated Administrative costs through the end of Fiscal Year 2016 amounted to $80,000 including a $25,000 dedicated reserve. Costs include the Chief Executive Officer and Administrative Officer salaries, and legal counsel fees. The "Fiscal Year 2016 Administrative Fund Report" is provided as Attachment 3.

H. Replenishment Assessments

At its meeting of October 5, 2016 the Watermaster Board determined that, based on updated cost information for the water supply projects used in calculating it, a new Replenishment Assessment unit cost of $2,872 per acre-foot should be adopted for use beginning in WY 2017. This replaces the unit cost of $2,702 which had been used since

WY 2014. The Agenda transmittal from that meeting discussing this determination is contained in Attachment 4.

Alternative and Standard Producers report their production amounts from the Basin to the Watermaster on a quarterly basis. Based upon the reported production for WY 2016, the City of Seaside's Replenishment Assessment for its Municipal System for Overproduction in excess of its share of the Natural Safe Yield is $102,330.46, and for overproduction in excess of its share of the Operating Yield is $11,959.38. The City of Seaside did not exceed its Alternative Production Allocation for its Golf Course System production. A summary of the calculations for Replenishment Assessments for WY 2016 is contained in Attachment 5.

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. Copies of the budgets for Fiscal Year 2017 are contained in Attachment 6. The Fiscal Year 2017 Monitoring & Management Plan Operations Budget contained in Attachment 6 reflects budget revisions approved at the December 7, 2016 Board meeting associated with carrying out the recommendations in the 2016 SIAR for verification resampling and associated work. The 2016 SIAR was received after the budget was originally adopted in October 2016. The recommendations in the 2016 SIAR are discussed below in Section J.

The Watermaster Board is provided monthly financial status reports 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 continued to be collected and analyzed on a quarterly basis during WY 2016 from the enhanced network of monitoring wells. The low-flow sampling method implemented in 2009 continued to be used in 2016 and is expected to continue to be used in the future to improve the efficiency of sample collection. As discussed in the 2013 Annual Report, the Watermaster reduced the frequency of water quality sampling at SBWM-MW5 to once every 3 years.

No modifications to the quarterly data collection frequency from the enhanced network of monitoring wells were made during WY 2016. One modification is being made for WY 2017. This is to revert back to sampling the Sand City Public Works well on an annual basis rather than a quarterly basis. The rationale for making this modification is described below under Task I.2.b.3 in the section titled "Management and Monitoring Program Work Plan," and is discussed in detail in Attachment 10.

Up until WY 2010 quarterly geophysical (induction) logging was performed at the four coastal Watermaster Sentinel wells that were installed in 2007. The induction logging results showed very little variations and trends were steady since that monitoring began, indicating that the coastal water quality conditions were not changing at this sample

frequency. Therefore, beginning in WY 2010 the Court approved reducing the induction logging frequency to semi-annually at these wells. Water samples from these wells continue to be collected on an annual basis.

The expanded water quality analyses begun in WY 2012 were continued in WY 2016, and will be continued in WY 2017, for the four coastal Watermaster Sentinel wells (SBWM-1, SBWM-2, SBWM-3, and SBWM-4), and also for the 3 most coastal MPWMD monitoring wells (MSC, PCA, and FO-09).

Copies of the sampling results are contained in the report in Attachment 7.

Management and Monitoring Program Work Plan

The Management and Monitoring Program (M&MP) 2017 Work Plan contained in Attachment 9 includes the types of basin management activities conducted in prior years as well as revisions approved by the Board at its October 5, and December 7, 2016 meetings. The major changes from the 2017 M&MP Work Plan are:

The major changes from the 2016 M&MP Work Plan are:

Task M.1.e (Peer Review of Documents and Reports): This Task has not been used in recent years. Its budget amount was reduced, but not eliminated, in case some work of this type is necessary in 2017.

Task M.1.g (Prepare Documents for SGMA Reporting): This Task is new this year and is a result of the implementation by the State of the Sustainable Groundwater Management Act.

Task I.2.a.2 (Verify Accuracy of Production Well Meters): This task was completed in 2015 and no further work on this Task is expected to be required in 2017.

Task I.2.b.3 (Collect Quarterly Water Quality Samples): In 2012 a concern was identified through monitoring data that there was something different about the City of Sand City's Public Works Well that was causing it to exhibit different water quality characteristics than other wells in the same general vicinity within the Seaside Basin. As a result the Watermaster had MPWMD perform an analysis to try to determine the cause of these differences, and also increased the water quality sampling frequency of this well from annually to quarterly.

Due to a lack of historical data, MPWMD was not able to reach a definitive conclusion as to the cause of the differences. However, several years of quarterly data on this well have now been acquired. The well does not appear to be showing any indications of seawater intrusion, and its water quality is generally staying within a reasonable range of variation. This is confirmed in the 2015 Seawater Intrusion Analysis Report. Task I.2.b.3 reflects reverting the monitoring frequency for the Sand City Public Works Well back to annually beginning in 2017.

In WY 2017 the BLM monitoring well site (SBWM-5) is to again be sampled. It was previously determined that this site would be sampled every 3 years, and WY 2014 was the last year it was sampled it. The cost for this sampling work is included under Task I.2.b.3.

MPWMD recommended that the Watermaster directly contract with the contractor that performs induction logging to obtain some of the water quality data under this Task.

This recommendation was made due to a reduction in available staff at MPWMD to manage that work, and because it would result in a cost savings to the Watermaster. The Watermaster contacted the induction logging contractor and his cost for performing this work under a contract directly with the Watermaster is included in this Task. This Task also reflects a reduced cost by MPWMD due to not having to manage the contract for that portion of the work.

Comprehensive review and evaluation of the water quality and water level monitoring data that is collected and compiled by MPWMD is now being performed by HydroMetrics and is reported upon in the annual Seawater Intrusion Analysis Reports which they prepare for the Watermaster. To minimize duplication of effort and expense associated with analysis and interpretation of the collected data by MPWMD, MPWMD will no longer prepare Q1/Q2 and Q3/Q4 reports on water quality and water levels, and will instead have all of that data summarized and reported on in a single annual report that will be provided to the Watermaster by MPWMD in November. During the course of the year, MPWMD will promptly notify the Watermaster if its review of the quarterly data identifies any issues of concern.

In its annual report MPWMD will include summaries of all of the data and a brief cover letter report describing any missing data or data collection irregularities that are encountered during the reporting period. These data summaries will be in a format suitable for posting to the Watermaster's website for the public's access, similar to the previous water quality and water level reports.

The 2016 SIAR recommended verification resampling of certain wells, and also the installation of a datalogger in one of the wells. This work has been included under this Task.

The net result in these changes is a small increase in the budget for this Task in 2017.

Task I.2.b.6 (Reports): MPWMD reported they no longer have the staff to prepare one of the reports that was originally listed under this Task in the 2016 M&MP Budget. That report was described as follows: "One report containing a compilation of the available water level records for monitor wells that are part of the Seaside Basin Monitoring & Management Plan (M&MP) in a format to allow assessment of the long-term trends in water levels in each of the wells. This report will contain a table showing pertinent well construction data, existing average annual water level changes, and projected future water level changes. This will be accompanied by a brief description and recommendations regarding those monitor wells for which future monitoring complications may arise due to falling water levels."

In view of this situation the Watermaster decided not perform this work at all. This would have been a "nice to do" evaluation to provide a "heads-up" on the possible need to purchase new higher head sampling pumps if some more wells had their levels drop too far. However, $2,000 has already been included in this Task to purchase one new sample pump if necessary. If more are found to be needed during the year, funding the purchase of additional pumps can be done from the Contingency line-item that is set up in the M&MP Operations Budget. Handling this matter in this way will avoid the expense of having one of the Watermaster's other consultants perform this evaluation.

This results in a decrease in the budget for this Task in 2017.

Task I.2.b.7 (CASGEM Data Submittal): Submitting groundwater data to the State's California Statewide Groundwater Elevation Monitoring (CASGEM) Program is a new

Task this year and is a result of the implementation by the State of the Sustainable Groundwater Management Act.

Task I.3.a.1 (Update the Existing Model Groundwater Model of the Seaside Basin): Updating of the Watermaster's groundwater model of the Seaside Basin is not expected to be necessary in 2017.

Task I.4.c (Annual Report- Seawater Intrusion Analysis): In 2016 the amount budgeted for this Task was $28,678. However, when the cost for HydroMetrics to prepare the 2016 Seawater Intrusion Analysis Report (SIAR) was being negotiated they found that they always had considerable unspent budget left over in prior years. Consequently, their 2016 RFS was reduced accordingly and the actual amount spent on this Task in 2016 was considerably lower than the budgeted amount.

For 2017 the budget for this Task was increased slightly to reflect an increase in the hourly rate for one of HydroMetrics' staff members who works on this assignment. However, the budget was also decreased to reflect (1) fewer hours needed by MPWMD to interface with HydroMetrics in the preparation of the SIAR, and (2) needing fewer hard copies of the SIAR than previously budgeted. Thus, the overall result is a reduction in the budget for this Task compared to 2016.

Contingency: The Contingency line items in the 2017 and 2018 M&MP Operations Budgets reflect a reduction from 20% to approximately 10% as recommended by the Budget and Finance Committee.

The 2017 Budget is $57,657 lower than the 2016 Budget, for the reasons described above.

No new monitoring wells are planned for installation in 2017. Consequently no monies are budgeted in the M&MP Capital Budget for 2017.

Basin Management Database

Pertinent groundwater resource data obtained from a number of sources has been consolidated into the Watermaster's database to allow more efficient organization and data retrieval. No modifications or enhancements to the database are planned in FY 2017.

Enhanced Monitoring Well Network

The Seaside Basin M&MP uses an Enhanced Monitoring Well Network to fill in data gaps in the previous monitoring well network used by the Monterey Peninsula Water Management District (MPWMD), and others, in order to improve the Basin management capabilities of the Watermaster. The Enhanced Monitoring Well Network has been described in detail in previous Watermaster Annual Reports. It continues to be used to obtain additional data that is useful to the Watermaster in managing the Basin.

Basin Management Action Plan (BMAP)

HydroMetrics LLC was hired by the Watermaster to prepare the BMAP which contains these Sections:

- Executive Summary
- The Background and Purpose of the Plan

- The State of the Basin
- Supplemental Water Supplies (long-term water supply solutions)
- Groundwater Management Actions (to be taken as interim measures while long-term supplies are being developed)
- Recommended Management Strategies
- References

The Final BMAP was approved by the Watermaster Board at its February 2009 meeting, and the Executive Summary from the BMAP was contained in Attachment 9 of the 2009 Annual Report. The complete document may be viewed and downloaded from the Watermaster's website at: http://www.seasidebasinwatermaster.org/.

Updating of the BMAP may be performed in FY 2017, but only if new data or other information warrants doing so. It is Task I.3.c in the M&MP Work Plan contained in Attachment 9.

Seawater Intrusion Response Plan

HydroMetrics LLC was hired by the Watermaster to prepare a long-term Seawater Intrusion Response Plan (SIRP), as required in the M&MP.

The Final SIRP was approved by the Watermaster Board in 2009 and a summary of the Seawater Intrusion Contingency Actions from the SIRP were contained in Attachment 10 of the 2009 Annual Report. The complete document may be viewed and downloaded from the Watermaster's website at: http://www.seasidebasinwatermaster.org/. No modifications to the SIRP are planned in 2017.

Seawater Intrusion Analysis Report

The Watermaster retained HydroMetrics LLC to prepare the WY 2016 Seawater Intrusion Analysis Report (SIAR) required by the M&MP. The WY 2016 SIAR provides an analysis of data collected during this Water Year.

The SIAR examines the "health" of the Basin with regard to whether or not there are any indications that seawater intrusion is either occurring or is imminent. Previous SIARs have stated that 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 Groundwater Basin. However, up until this water year, all of the monitoring data from the existing monitoring and production wells in the Seaside Basin have indicated that seawater intrusion has not occurred. This year for the first time there is conflicting data from two of the Watermaster's sentinel wells. Some of the data are suggestive of the initial onset of seawater intrusion, while other data indicate seawater intrusion is not occurring.

Because of the conflicting data no conclusions with regard to the initial onset of seawater intrusion can be drawn at this time. Verification resampling, as contained in the Recommendations section of the SIAR, will be necessary in order to reach a conclusion.

The SIAR is lengthy, but the full *Executive Summary Section* from it is provided in Attachment 8. A complete copy of the document is posted for viewing and downloading from the Watermaster's website at: http://www.seasidebasinwatermaster.org/. All recommendations contained in the SIAR are being or will be carried out and are included in the budgeted activities contained in Attachment 6 and described in Attachment 9.

The 2016 SIAR contains recommendations pertaining to the conflicting seawater intrusion data in some of the coastal monitoring wells, as well as other recommendations pertaining to other basin management issues. The first of the recommendations, to perform verification water quality sampling and analysis for Sentinel Well SBWM-2, Sentinel Well SBWM-4, and the Ord Terrace Shallow Monitoring Well, have been included in the scopes of work and costs for the contractors who will be performing work for the Watermaster (under Task I.2.b.3 in Attachment 9). It is anticipated that the verification sampling of those wells will be performed in December 2016. After the data from the verification sampling has been received the Watermaster will determine what additional steps, if any, should be taken.

The Watermaster continues to analyze the data that is being gathered at the various monitoring sites in order to keep a close watch on the conditions within the Basin, as discussed under the "Enhanced Monitoring Well Network" heading above.

Groundwater Modeling

During FY 2009 the previous Groundwater Model of the Basin was updated and a separate Groundwater Model was developed to determine protective water levels within the Basin. The modeling work was performed by HydroMetrics LLC. This Model development work was described in the 2009 Annual Report.

Updating and Evaluating the Accuracy of the Groundwater Model

Evaluating the accuracy of the Groundwater Model was performed in 2015 and is reported on in the 2015 Annual Report. That evaluation concluded that the model is a reasonable representation of the Seaside Basin groundwater flow system, and that it should be used for estimating the operational safe yield of the basin and subareas, and for simulating the effects of possible management measures. Therefore, updating of the model was not necessary in 2016.

Modeling of the Laguna Seca Subarea

As reported in the 2015 Annual Report, in response to questions and concerns raised about the steady decline in water levels in the Laguna Seca Subarea (LSSA) in 2014 the Watermaster Board performed modeling of the LSSA relating to the natural safe yield and operating yield of the LSSA. Although there appeared to be no indication of any immediate substantial adverse physical impact to the Basin or the LSSA, the initial results of the modeling work indicated the natural safe yield and operating yield of the LSSA may be significantly less than that set forth in the Decision. A copy of the draft Technical Memorandum describing the modeling work and initial results was contained in Attachment 11 of the 2014 Annual Report. Because of the significance of these initial

results, in December 2014 the Watermaster had a technical peer review of the modeling work performed in order to ensure that the modeling and final results were as accurate as possible. The Peer Review Technical Memorandum is contained in Attachment 11 of the 2015 Annual Report. The peer review concluded that the Groundwater Model is satisfactory for estimating the operational safe yield of the basin and its subareas, and for simulating the effects of groundwater management measures that might be considered in the future.

As a result of the peer review and recommendations from its Technical Advisory Committee, the Watermaster Board made several determinations which are discussed in the 2015 Annual Report. One of those was that it would be desirable to more accurately determine the location of the southeastern boundary of the Seaside Groundwater Basin. In mid-2015 the Watermaster authorized having HydroMetrics use the Groundwater Model to try to establish the location of the flow divide between the LSSA and the El Toro Subarea. This is discussed in the section below.

Estimation of Flow Divide Locations Near the Easterly Adjudication Boundary of the Laguna Seca Subarea

Subsequent to receiving a presentation on the Laguna Seca modeling Peer Review, the Watermaster Board concluded it would be beneficial to perform modeling in order to determine the locations of the hydrogeologic flow divides between the Laguna Seca Subarea (LSSA) and the areas to the east of the Adjudication Decision boundary of the Seaside Basin. This work was started in 2015 and finished in 2016.

The principle conclusions from that work were:

- Under anticipated future pumping conditions, groundwater elevations in the LSSA will continue to decline. The eastern portion of the LSSA will suffer the greatest and most persistent declines. Pumping groundwater elevations are predicted to fall below the top of the well screens prior to 2041 in 3 of the wells in this part of the LSSA.
- The locations of the groundwater flow divides will remain relatively stable under currently anticipated pumping conditions out to 2041, which is the end of the modeling period.
- Groundwater flow through the eastern portion of the LSSA is both westwards towards the Southern Coastal Subarea and northward into the Northern Inland Subarea. The Laguna Seca Anticline is a structural feature that causes groundwater flow to split into these directions.
- Under a hypothetical scenario, if pumping within the LSSA were to be discontinued the groundwater flow divide located in the eastern portion of the LSSA would migrate westward. This movement would be caused by relative increases in groundwater elevations in the LSSA due to this reduction in pumping, compared to east of the LSSA where pumping was assumed not to be reduced. Under this hypothetical scenario the groundwater flow direction in the easterly portion of the LSSA would shift towards the northeast and east by 2041 of the scenario, resulting in groundwater flowing out of the LSSA and into the Corral de Tierra subbasin.
- In all of the modeled scenarios, groundwater in the Santa Margarita Aquifer in the most northeastern portion of the LSSA flows north and northeast out of the LSSA and

into the Northern Inland Subarea and Corral de Tierra subbasin. This northeastern portion of the LSSA is more heavily influenced by pumping outside of the LSSA than by pumping within the subarea, and this part of the LSSA is hydrogeologically connected to the Corral de Tierra subbasin, as well as the Northern Inland Subarea.

- Cal Am's Toro-1 and Toro-2 production wells draw water directly from the LSSA in the Paso Robles Aquifer, and thus have a direct influence on groundwater levels within the LSSA. The impact of these two wells was not compared to the cumulative impact of the other production wells located further east. Those more easterly wells indirectly affect the LSSA by withdrawing groundwater which would otherwise flow into, and thus recharge, the LSSA. This results in lowering groundwater levels in the LSSA.
- The net flow of groundwater across the eastern LSSA boundary for the aggregation of the Paso Robles and Santa Margarita aquifers is currently from the Corral de Tierra subbasin into the LSSA. However, the model predicts that under anticipated pumping conditions there will be a net flow of groundwater out of the LSSA into the Corral de Tierra subbasin by around 2030. Under a hypothetical scenario, if pumping within the LSSA were to have been discontinued in 2009 (the start of the modeling period), flow would have begun to go out of the LSSA and into the Corral de Tierra subbasin much earlier (by around 2012).
- The groundwater model results are based upon an incomplete understanding of the hydrogeologic conditions in the Corral de Tierra subbasin, and it would be beneficial to improve the geologic and hydrogeologic understanding of this area. A typical hydrogeological study to improve hydrogeologic understanding would involve first examining existing well data and studies, followed by, if necessary, field work to drill new wells and determine aquifer properties to provide data where hydrogeological data does not exist.

A copy of the Technical Memorandum describing this work is contained in Attachment 12.

Coordination of Watermaster's Seaside Groundwater Model with Salinas River Basin Model

As reported in the 2015 Annual Report, in May 2015 the Monterey County Resource Management Agency convened a Technical Advisory Committee (TAC) to develop a new Salinas River Basin model, and asked the Watermaster to join their TAC for this work. The County asked for information regarding the Watermaster's model of the Seaside Basin to ensure that the Salinas River Basin model coordinates properly with the Watermaster's model, and the Watermaster provided its model to the County.

In late 2015 because of problems encountered with its original consultant on this work (Brown and Caldwell) the County switched to having the work performed by the United States Geological Survey (USGS), representatives of which had already been participating in the TAC meetings and were intimately familiar with issues involving the Salinas River Basin. This change in consultants resulted in some delay in the work, but work resumed in early 2016, and during 2016 there were several meetings of the County's TAC.

At the time of preparation of this 2016 Annual Report the status of the new Salinas River Basin model, termed the Salinas Valley Integrated Hydraulic Model (SVIHM), was as follows:

- Model construction was ongoing throughout most of the year and continued into late 2016.
- Calibration was performed in October and November.
- Model analysis and integration of the reservoir operations module was expected to occur in December.
- Agricultural stakeholder meetings were held and more meetings are planned to get additional input and data.
- The County will be running the Watermaster's model for the Seaside Basin portion of the SVIHM model area. The Seaside Basin will not be included in the SVIHM. Rather, the SVIHM will use the Watermaster model's findings to interface with the new SVIHM, so it will not be necessary to "remodel" the adjudicated Seaside Basin area that has already been modeled by the Watermaster. The objective is to have the SVIHM and the Watermaster's model match as closely as possible along the boundary between the two models.
- There will be ongoing meetings of the TAC to discuss progress on the development of the model.

Sustainable Groundwater Management Act

As reported in the 2015 Annual Report the Watermaster Board determined that the Watermaster should monitor the development of the Salinas Valley Groundwater Basin Sustainability Agency and the State Department of Water Resources' (DWR) development of regulations pertaining to requesting boundary revisions, with the intent to collaborate with these entities as appropriate.

At the State Level

In late 2016 DWR released the final 2016 modifications to California's groundwater basin boundaries. Of the 54 requests for changes to basin boundaries, DWR approved 39, denied 12, and three were deemed incomplete. Most of the modifications were made to basins in the Central Valley and included refinements reflecting waterways, county lines and geologic information. The boundary modification request submitted by the Monterey Peninsula Water Management District (MPWMD) to remove some areas near Monterey from the Salinas Valley Groundwater Basin, and to recognize the boundaries of the Adjudicated Seaside Basin, was approved. These modifications are reflected in the basin boundary map that is now posted on the DWR website.

DWR will include the new basin boundaries in its interim update of Bulletin 118, which is due out by January 1, 2017. Another basin boundary modification request period may be held in 2018 based on demand from local agencies and/or GSAs. Other important upcoming dates on the SGMA timeline include:

- December 31, 2016 –DWR will post a report on Water Available for Replenishment on its website.
- January 1, 2017 – DWR will post Best Management Practices on its website.

- June 30, 2017 – Date by which local agencies in high- and medium-priority basins must form Groundwater Sustainability Agencies (GSAs) that cover the entire basin in order to avoid potential intervention by the State Water Resources Control Board.

At the Monterey County level:
Meetings of Monterey County's Collaborative Work Group (CWG) and Stakeholders Groups began in March of 2016. Several Stakeholder Group meetings were held in 2016, and in 2016 the CWG met on a generally semi-monthly basis. Watermaster staff attended the May 19, 2016 meeting of the CWG to become familiar with the makeup of the group and the types of issues the group was discussing. Most of the group's focus at that point in time was on building consensus on how to form a GSA, how its governing body should be made up, voting issues, and other very preliminary and general topics. Although more meetings of the CWG have been held since then, it does not appear that the group will start getting into issues of direct interest or concern to the Watermaster for some months to come. Watermaster staff continues monitoring the progress of the group and provides regular ongoing updates to the Watermaster TAC and Board. At an appropriate point in time Watermaster staff will resume attending the CWG meetings to provide input on issues of concern to the Watermaster.

It appears that by the June 2017 DWR deadline for the establishment of GSAs, Monterey County is hopeful of establishing one or more GSAs for the portions of the Salinas Valley Groundwater Basin that do not lie within the Adjudicated Seaside Basin. However, on September 15, 2016 Marina Coast Water District (MCWD) filed a Notification with DWR that it wished to serve as the GSA for the portion of the Salinas Valley Groundwater Basin that lies within their service area, and which does not lie within the Adjudicated Seaside Basin. If by December 28, 2016 no other entity applies to be the GSA for that same portion of the Salinas Valley Basin, DWR will approve MCWD's Notification and MCWD will become the exclusive GSA for that portion of the basin. As of the date of preparation of this 2016 Annual Report Monterey County had not indicated whether it, too, would file a notification to become the GSA for these same areas, in which case DWR would apparently work with those two entities to make a determination as to which entity should be the GSA.

K. Conclusions and Recommendations
The Seaside Basin Watermaster Board has worked diligently 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 been completed. At the Watermaster Board meeting held on October 5, 2016 the Board adopted the FY 2017 budgets contained in Attachment 6, which support carrying out all elements of the "Seaside Groundwater Basin Management and Monitoring Program Anticipated 2017 Work Plan." That Work Plan describes the M&MP activities that will be conducted during Fiscal Year 2017. A copy of this Work Plan is contained in Attachment 9.

As described in Section J above, information from the Enhanced Monitoring Well Network is being utilized to detect any seawater intrusion. The response actions described in the Watermaster's Seawater Intrusion Response Plan, which was contained in the 2009 Annual Report, will be implemented if seawater intrusion is detected within the Basin.

In March of 2017 the Watermaster anticipates holding another status conference with the Court to provide an update on certain of the Watermaster's activities.

ATTACHMENT 1

GROUNDWATER EXTRACTIONS

SEASIDE GROUNDWATER BASIN WATERMASTER

Reported Quarterly and Annual Water Production From the Seaside Groundwater Basin
For All Producers Included in the Seaside Basin Adjudication -- Water Year 2016

(All Values in Acre-Feet [AF])

	Type	Oct	Nov	Dec	Oct-Dec 15	Jan	Feb	Mar	Jan-Mar 16	Apr	May	Jun	Apr-Jun 16	Jul	Aug	Sep	Jul-Sep 16	Reported Total	Yield Allocation	from WY 2015	for WY 2016
Coastal Subareas																					
CAW - Coastal Subareas	SPA	257.59	165.72	97.15	**520.46**	68.73	24.90	119.32	**212.95**	28.99	68.07	132.39	**229.45**	105.93	191.17	299.36	**596.46**	**1,559.32**	2,254.40	0.00	2,254.40
City of Seaside (Municipal)	SPA	16.53	13.67	13.04	**43.24**	13.55	13.67	14.99	**42.22**	16.79	18.55	17.89	**53.23**	18.50	19.76	18.22	**56.48**	**195.16**	184.96	0.00	184.96
Granite Rock Company	SPA	- -	- -	- -	**0.00**	- -	- -	- -	**0.00**	- -	- -	- -	**0.00**	- -	- -	- -	**0.00**	**0.00**	17.45	217.87	235.32
DBO Development No. 30	SPA	- -	- -	- -	**0.00**	- -	- -	- -	**0.00**	- -	- -	- -	**0.00**	- -	- -	- -	**0.00**	**0.00**	31.66	423.06	454.72
Calabrese (Cypress Pacific Inv.)	SPA	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	**0.00**	4.24	4.24	8.48
City of Seaside (Golf Courses)	APA	39.90	6.77	0.07	**46.75**	0.00	7.43	15.13	**22.56**	57.31	64.40	70.53	**192.23**	78.13	59.75	59.03	**196.90**	**458.44**	540.00		540.00
Sand City	APA	0.07	0.06	0.07	**0.20**	0.04	0.06	0.07	**0.17**	0.01	0.05	0.05	**0.11**	0.04	0.03	0.04	**0.10**	**0.58**	9.00		9.00
SNG (Security National Guaranty)	APA	- -	- -	- -		- -	- -	- -		- -	- -	- -		- -	- -	- -	**0.00**	**0.00**	149.00		149.00
Calabrese (Cypress Pacific Inv.)	APA	0.00	0.00	0.00	**0.00**	0.00	0.00	0.06	**0.07**	0.00	0.00	0.06	**0.06**	0.00	0.00	0.07	**0.07**	**0.19**	6.00		6.00
Mission Memorial (Alderwoods)	APA	1.67	0.45	0.01	**2.13**	0.01	0.05	0.04	**0.11**	0.81	1.70	1.91	**4.41**	2.39	2.76	1.87	**7.02**	**13.67**	31.00		31.00
Coastal Subareas Totals					**612.77**				**278.07**				**479.50**				**857.03**	**2,227.37**	**3,227.70**	**645.17**	**3,872.87**
Laguna Seca Subarea																					
CAW - Laguna Seca Subarea	SPA	30.62	20.97	19.70	**71.29**	18.69	18.71	19.21	**56.61**	24.79	29.77	32.88	**87.44**	35.41	34.03	31.95	**101.39**	**316.73**	48.30		48.30
Ryan Ranch Unit		5.12	3.46	3.36	11.94	3.51	4.77	5.06	13.34	4.66	5.62	5.38	**15.66**	5.14	5.60	5.05	15.79	56.73			
Hidden Hills Unit		12.34	8.69	7.85	28.88	7.11	7.43	7.36	21.90	10.12	11.11	12.54	**33.77**	14.43	13.46	13.02	40.91	125.46			
Bishop Unit		13.16	8.82	8.49	30.47	8.07	6.51	6.79	21.37	10.01	13.04	14.96	**38.01**	15.84	14.97	13.88	44.69	134.54			
Nicklaus Club Monterey	APA	3.67	0.00	0.00	**3.67**	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	18.90	57.00	32.00	**107.90**	**111.57**	251.00		251.00
Laguna Seca Golf Resort (Bishop)	APA	20.89	0.83	0.00	**21.72**	0.00	0.00	0.00	**0.00**	13.74	27.94	43.27	**84.96**	48.29	36.32	32.53	**117.14**	**223.82**	320.00		320.00
York School	APA	1.12	0.20	0.17	**1.49**	0.01	0.01	0.32	**0.33**	1.58	1.95	2.11	**5.63**	2.89	1.83	1.72	**6.43**	**13.89**	32.00		32.00
Laguna Seca County Park	APA	0.91	1.29	0.65	**2.85**	0.51	0.80	0.70	**2.01**	1.73	2.27	1.79	**5.79**	2.45	2.45	1.39	**6.29**	**16.94**	41.00		41.00
Laguna Seca Subarea Totals					**101.01**				**58.96**				**183.83**				**339.15**	**682.95**	**692.30**	**0.00**	**692.30**
Total Production by WM Producer					**713.78**				**337.03**				**663.33**				**1,196.18**	**2,910.32**	**3,920.00**	**645.17**	**4,565.17**
									Annual Production from APA Producers									839.11	1,379.00		
									Annual Production from SPA Producers									2,071.21	3,186.17		
City of Seaside Golf Courses In-Lieu (MCWD source water)																					
MCWD delivery		0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	0.00	0.03	0.03	0.06	**0.06**			
CAW / MPWMD ASR (Carmel River Basin source water)																					
(Injection)		0.00	0.00	0.00	**0.00**	-210.60	-59.64	-376.78	**-647.02**	-52.16	0.00	0.00	**-52.16**	0.00	0.00	0.00	0.00	**-699.18**			
Recovery		0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	**0.00**	0.00	0.00	149.45	**149.45**	155.00	155.00	150.00	460.00	**609.45**			
Net ASR		0.00	0.00	0.00	**0.00**	-210.60	-59.64	-376.78	**-647.02**	-52.16	0.00	149.45	**97.29**	155.00	155.00	150.00	**460.00**	**-89.73**			

Notes:

1. The Water Year (WY) begins October 1 and ends September 30 of the following calendar year. For example, WY 2016 begins on October 1, 2015, and ends on September 30, 2016.
2. "Type" refers to water right as described in Seaside Basin Adjudication decision as amended, signed February 9, 2007 (Monterey County Superior Court Case No. M66343).
3. Values shown in the table are based on reports to the Watermaster as received by MPWMD by January 15, 2016.
4. All values are rounded to the nearest hundredth of an acre-foot. Where required, reported data were converted to acre-feet utilizing the relationships: 325,851 gallons = 43,560 cubic feet = 1 acre-foot.
5. "Base Operating Yield Allocation" values are based on Seaside Basin Adjudication decision. These values are consistent with the *Watermaster Producer Allocations Water Year 2016* (see Item IX B. in 12/2/2015 Board packet).
6. Any minor discrepancies in totals are attributable to rounding.
7. APA = Alternative Producer Allocation; SPA = Standard Producer Allocation; CAW = California American Water.
8. It should be noted that CAW/MPWMD ASR "Injection" and "Recovery" amounts are not expected to "balance" within each Water Year. This is due to the injection recovery "rules" that are part of SWRCB water rights permits and/or separate agreements with state and federal

<u>ATTACHMENT 2</u>

WATERMASTER DECLARATION
OF
NON-AVAILABILITY
OF
ARTIFICIAL REPLENISHMENT WATER

NOTICE TO ALL SEASIDE GROUNDWATER PRODUCERS:

Case No. M66343 Amended Decision Section III.B.2.

Commencing with the fourth Water Year, and triennially thereafter, the Operating Yield for both Subareas will be decreased by ten percent (10%) until Operating Yield is the equivalent of the Natural Safe Yield unless:

a. *The Watermaster has secured and is adding an equivalent amount of Non-Native water to the Basin on an annual basis; or*
b. *The Watermaster has secured reclaimed water in an equivalent amount and has contracted with one or more of the Producers to utilize said water in lieu of their Production Allocation, with the Producer agreeing to forego their right to claim a Stored Water Credit for such forbearance; or*
c. *Any combination of a and b above which results in the decrease in Production of Native Water required by this Decision; or*
d. *The Watermaster has determined that Groundwater levels within the Santa Margarita and Paso Robles aquifers are at sufficient levels to ensure a positive offshore gradient to prevent seawater intrusion.*

The Watermaster has determined that the conditions necessary to avoid the ten percent Operating Yield reduction have not been met as follows:

1. Watermaster has not secured water for adding an equivalent amount of Non-Native water to the Basin on an annual basis. The Watermaster and the City of Seaside have, however, entered into a Memorandum of Understanding for Seaside's In-lieu Replenishment Program which may, in future water years, provide sufficient water to avoid an Operating Yield reduction.
2. The Watermaster has not secured reclaimed water in an equivalent amount.
3. The Watermaster has not secured Non-Native water or reclaimed water which results in the decrease in Production of Native Water required by the Decision.
4. The firm contracted by Watermaster for technical analyses continued to report in 2013 that Groundwater levels within the Santa Margarita and Paso Robles aquifers are not at sufficient levels to ensure a positive offshore gradient to prevent seawater intrusion, so the requirement for this item continues to not be met.

Section III.L.3.j.iii: Watermaster declares that for Water Year 2017 Artificial Replenishment Water is not available to offset Operating Yield Over-Production and producers are limited in production to the following quantities of water:

Coastal Subarea Alternative Producers:	
Seaside (Golf)	540.00 acre-feet
SNG	149.00 acre-feet
Cypress (Calabrese)	6.00 acre-feet
Mission Memorial (Alderwood)	31.00 acre-feet
Sand City	9.00 acre-feet

Laguna Seca Subarea Alternative Producers:

Nicklaus Club Monterey	251.00 acre-feet
Bishop	320.00 acre-feet
York School	32.00 acre-feet
Laguna Seca County Park	41.00 acre-feet

Coastal Subarea Standard Producers:

California American Water.....	2,685.39 acre-feet*
Seaside (Municipal)	184.96 acre-feet**
Granite Rock	252.77 acre-feet***
D.B.O. Development 30	486.38 acre-feet****
Cypress (Calabrese).....	12.72 acre-feet*****

Laguna Seca Subarea Standard Producers:

California American Water.....	48.30 acre-feet

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* Total includes 430.99 acre-feet of "not free" carryover credit from the previous water year, plus the 2017 base allocation of 2,254.40 acre-feet plus.
California American Water has a negative balance of 19.85 acre-feet of stored water credit at WY-end 2016 from Basin extractions exceeding injections since WY 2010 under the CAW/MPWMD ASR Program, formalized through a Storage Agreement in 2012.

** Total is the 2017 base allocation of 184.96 acre-feet.

*** Total includes 151.43 acre-feet of "free" carryover and 83.89 acre-feet of "not-free" carryover credit from previous water years, plus the 2017 base allocation of 17.45 acre-feet.

**** Total includes 293.06 acre-feet of "free" carryover and 161.66 acre-feet of "not-free" carryover credit from previous water years, plus the 2017 base allocation of 31.66 acre-feet.

***** Cypress (Calabrese) converted 8 acre-feet of APA to SPA in January 2015; total includes 7.26 acre-feet of "free" carryover and 1.22 acre-feet of "not-free" carryover credit from water year 2016, plus the 2017 base allocation of 4.24 acre-feet.

ATTACHMENT 3

WATERMASTER ADMINISTRATIVE COSTS

Seaside Groundwater Basin Watermaster

Budget vs. Actual Administrative Fund

Fiscal Year (January 1 - December 31, 2015)

Balance through September 30, 2016

	2016 Adopted Budget	Contract Amount	Year to Date Revenue / Expenses
Available Balances & Assessments			
Dedicated Reserve	-		-
FY (Rollover)	32,000.00		32,000.00
Admin Assessments	58,000.00		58,000.00
Available	**90,000.00**		**90,000.00**
Expenses			
Contract Staff	65,000.00	65,000.00	32,653.19
Legal Advisor	-	25,000.00	22,324.74
Total Expenses	**65,000.00**	**90,000.00**	**54,977.93**
Total Available	25,000.00		
Dedicated Reserve	25,000.00		25,000.00
Net Available	**-**		**10,022.07**

ATTACHMENT 4

REPLENISHMENT ASSESSMENT UNIT COST DETERMINATION FOR WATER YEAR 2016

ITEM X.A.1.b.
10/5/16

SEASIDE GROUNDWATER BASIN
WATERMASTER

TO: Board of Directors

FROM: Robert S. Jaques, Technical Program Manager

REVIEWED BY: Laura Dadiw, Administrative Officer

DATE: October 15, 2016

SUBJECT: Consider Approval of Unit Cost for Water Year 2016/17 Over Production Replenishment Assessment

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RECOMMENDATION:
Adopt a Replenishment Assessment Unit Cost of $2,872/AF for Water Year 2017 which begins on October 1, 2016 and ends on September 30, 2017.

BACKGROUND:
Per page 33 of the Decision, "The per acre-foot (AF) amount of the Replenishment Assessments shall be determined and declared by Watermaster in October of each Water Year in order to provide Parties with advance knowledge of the cost of Over-Production in that Water Year." Thus, the per acre-foot amount determined by the Board on or before October of 2016 will be used to calculate Replenishment Assessments for pumping that occurs during Water Year 2017 which begins on October 1, 2016 and ends on September 30, 2017.

For each of the past three Water Years (2014, 2015, and 2016) the Board has adopted a Replenishment Assessment Unit Cost of $2,702/AF. This unit cost was developed starting with Water Year 2014 by taking the average of the Base Unit Cost ($/AF) of the four potential water supply projects that the Board felt were the most likely to be implemented. The Water Year 2014 unit cost was carried over to the two subsequent Water Years because no updated cost data was available for those projects, and no other viable projects could be identified.

DISCUSSION:
The attached Table presents the most recent cost data for each of these same four projects. In that Table a blended unit cost value is provided for the Monterey Peninsula Water Supply Project based on a reduced size desalination plant offset by water to be provided by the Pure Water Monterey Project. The blended unit cost for that combined project is $4,591/AF. Since using both desalination and groundwater replenishment together is the current plan being pursued by Cal Am, it would seem reasonable to use the blended unit cost rather than the individual unit costs for those two sources of water.

The updated Unit Cost would therefore be $2,872/AF, calculated as: ($4,591+$2,025+$2,000)/3. These are the three **bold-faced** unit costs in the attached Table.

ATTACHMENTS:
Updated Unit Cost Data

WATER YEAR 2017 (October 1, 2016-September 30, 2017)

ANTICIPATED UNIT COSTS OF WATER COULD POTENTIALLY BE USED FOR REPLENISHMENT OF THE SEASIDE BASIN

POTENTIAL SOURCE OF REPLENISHMENT WATER	POTENTIAL DATE REPLENISH-MENT WATER COULD BECOME AVAILABLE	POTENTIAL VOLUME OF WATER THAT COULD BE SUPPLIED BY THE PROJECT (AFY) (1)	BASE UNIT COST ($/AF)	BASE UNIT COST YEAR
Regional Desalination(2)	2020	6,250	$6,147	2019
Groundwater Replenishment Project (Pure Water Monterey)(2)	2018	3,500	$1,811	2018
Monterey Peninsula Water Supply Project (Combined Regional Desalination with Groundwater Replenishment Project)	GWRP in 2018 Regional Desalination in 2020	9,750	**$4,591**(3)	2018-2019
Seaside Basin ASR Expansion (4)	2020	1,000	**$2,025**	2016
Regional Urban Water Augmentation Project (5)	2018	1,400-1,700	**$2,000**	2018

FOOTNOTES:

(1) For the Regional Desalination Project this is the total amount of water from this source which could potentially come to the CAW distribution system, based on the desalination plant having a 6.4 MGD capacity which is equivalent to 7,169 AFY. Only a portion of this amount might be available as initially unused capacity that could be used to help replenish the Seaside Basin. For the RUWAP this is the total amount of non-potable water from this source. Only a portion of this amount might be used for in-lieu replenishment of the Seaside Basin. For the ASR Expansion Project this is the additional amount of water that could potentially be provided by this project (see footnote 4). For the GWRP this is the quantity of water that is being planned at this time by CAW for inclusion in its Monterey Peninsula Water Supply Project.

(2) Base unit cost data based on PUC filing documents and provided by Dave Stoldt of MPWMD .

(3) Flow-weighted average unit cost of the combined desalination and groundwater replenishment projects, calculated as:

(6,250x$6,147 + 3,500x$1,811)/9,750 = **$4,591**.

(4) Base unit cost data provided by MPWMD. The 1,000 AFY of potential water that this project could supply would be in addition to the 1,300 AFY included as part of the Monterey Peninsula Water Supply Project, and would be an annual average taking into account river flow and hydrologic conditions that change from year to year.

(5) Project data provided by MCWD.

ATTACHMENT 5

REPLENISHMENT ASSESSMENT CALCULATIONS FOR WY 2016

WATERMASTER PRODUCER ALLOCATIONS WATER YEAR 2016 IN ACRE-FEET (AF)

INCLUDING A 10% TRIENNIEL REDUCTION FOR 100% OF THIS WATER YEAR

Initial Basin-Wide Operating Yield[1]	3920.00	Coastal Operating Yield[1]	3227.70
Natural Safe Yield (NSY)[2]	3000.00	Laguna Seca Operating Yield[1]	692.30

ALTERNATIVE PRODUCER ALLOCATIONS

Coastal Subarea[3]	AF	Laguna Seca Subarea[3]	AF
Seaside (Golf)	540.00	Nicklaus Club Monterey	251.00
SNG	149.00	Bishop	320.00
Calabrese	6.00	York School	32.00
Mission Memorial (Alderwood)	31.00	Laguna Seca County Park	41.00
Sand City	9.00		
Total[1]	735.00	Total[1]	644.00

ALTERNATIVE PRODUCER AMOUNT PUMPED WY 2016

Coastal Subarea[3]	AF	Laguna Seca Subarea[3]	AF	Total Alternative Producer WY 2016 Production
Seaside (Golf)	458.44	Nicklaus Club Monterey	111.57	
SNG	0.00	Bishop	223.82	
Calabrese	0.19	York School	13.89	
Mission Memorial (Alderwood)	13.67	Laguna Seca County Park	16.94	
Sand City	0.58			
Total[1]	472.88	Total[1]	366.22	839.10

STANDARD PRODUCER ALLOCATIONS

Coastal Operating Yield Available to Standard Producers (AF)			2492.70	Laguna Seca Operating Yield Available to Standard Producers (AF)			48.30
	Standard Producer Allocations				Standard Producer Allocations		
Coastal Subarea	Base Water Right %[4]	Weighted %[5]	AF Available to This Producer	Laguna Seca Subarea	Base Water Right %[4]	Weighted %[5]	AF Available to This Producer
California American Water (CAW)	77.55%	90.44%	2254.40	CAW	45.13%	100.00%	48.30
Seaside (Municipal)	6.36%	7.42%	184.96				
Granite Rock	0.60%	0.70%	17.45				
D.B.O. Development No. 30	1.09%	1.27%	31.66				
Calabrese (Cypress Pacific Investors LLC)	0.15%	0.17%	4.24				
Total	85.75%	100.0%	2492.70	Total	45.13%	100.0%	48.30

Allocation of Available Operating Yield Among Standard Producers	Base Water Right Available to this Producer (AF)	% NSY to SPA (Base Water Right ./. Total Water Right)	NSY Available to Producers (AF) Current Water Year	Free Carryover Credits from Prior Water Year	Not-Free Carryover Credits from Prior Water Year	Water Rights Transferred / Sold	Total Producer NSY (AF) (NSY Available + Free Carryover Credits)	Total Authorized Production in Current Water Year (Base Water Right Plus All Carryover)[6]	Actual AF Pumped by Producer in WY 2016	Free Carryover Credits to WY 2017	Not-Free Carryover Credits to WY 2017	Stored Water Credits to WY 2017
		NSY 3000 - 839.10 AF =	WY 2016 APA Pumped 839.10 AF 2160.90									
California American Water	2302.70	90.62%	1958.24	0.00	0.00	7.50	1965.74	2310.20	1876.05	0.00	434.15	(19.85)
Seaside (Municipal)	184.96	7.28%	157.29	0.00	0.00	(7.50)	149.79	177.46	195.16	0.00	0.00	0.00
Granite Rock	17.45	0.69%	14.84	136.59	81.28	0.00	151.43	235.32	0.00	151.43	83.89	0.00
D.B.O. Development No. 30	31.66	1.25%	26.92	266.14	156.92	0.00	293.06	454.72	0.00	293.06	161.66	0.00
Calabrese (Cypress Pacific Investors LLC)	4.24	0.17%	3.61	3.65	0.59	0.00	7.26	8.48	0.00	7.26	1.22	0.00
Total	2541.01	100.00%	2160.90	406.38	238.79	0.00	2567.28	3186.17	2071.21	451.75	680.91	(19.85)

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.
(5) Calculated from the Base Water Right percentages in the adjacent column.
(6) Base Water Right plus Free and Not Free Carryover Credit = 2016 Production Allocation (see 2016 Declaration from 12/2/2015 Watermaster board meeting)
Note: Calabrese (Cypress Pacific Investors LLC) opted to convert 8AF of its 14AF Alternative Production Allocation to Standard Production Allocation on January 22, 2015 (notice filed by Cypress with Superior Court).

CALCULATION OF REPLENISHMENT ASSESSMENTS WATER YEAR 2016

Using the Basin-wide methodology approved by the Court on January 12, 2007, and as shown in detail on the spreadsheet contained in this attachement, Watermaster calculated the Water Year (WY) (October 1st through September 30th) 2016 Replenisment Assessments as follows:

	2016 Replenishment Assessment NSYO Unit Charge =					$2,702.00			
	2016 Replenishment Assessment OSYO Unit Charge =					$675.50			
	2016 Natural Safe Yield (NSY) Available to Standard Producers =					2,160.90	AF (3,000 AF NSY - 839.10 Alternative Producers 2016 Production)		
Standard Producers	**WY 2016 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	1,876.05	90.62%	1,958.24	-	$ -	2,310.20	-	$ -	$ -
Seaside (Municipal)	195.16	7.28%	157.29	37.87	102,330.46	177.46	17.70	11,959.38	114,289.84
Granite Rock	-	0.69%	14.84	-	-	235.32	-	-	-
D.B.O. Development No. 30	-	1.25%	26.92	-	-	454.72	-	-	-
Calabrese (Cypress Pacific Inv.)	-	0.17%	3.61	-	-	8.48	-	-	-
Total Production	**2,071.21**	**100.00%**	2,160.90	**37.87**	**$ 102,330.46**	**3,186.17**	**17.70**	**$ 11,959.38**	**$ 114,289.84**
Alternative Producers	**WY 2016 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**
City of Seaside (Golf Courses)	458.44	N/A	540.00	0.00	$ -	540.00	0.00	$ -	$0
City of Sand City	0.58	N/A	9.00	0.00	-	9.00	0.00	-	-
Security National Guaranty	-	N/A	149.00	0.00	-	149.00	0.00	-	-
Calabrese (Cypress Pacific Inv.)	0.19	N/A	6.00	0.00	-	6.00	0.00	-	-
Mission Memorial (Alderwoods)	13.67	N/A	31.00	0.00	-	31.00	0.00	-	-
Nicklaus Club Monterey	111.57	N/A	251.00	0.00	-	251.00	0.00	-	-
Laguna Seca Golf Resort (Bishop)	223.82	N/A	320.00	0.00	-	320.00	0.00	-	-
York School	13.89	N/A	32.00	0.00	-	32.00	0.00	-	-
Laguna Seca County Park	16.94	N/A	41.00	0.00	-	41.00	0.00	-	-
Total Production	**839.10**	**N/A**	**1,379.00**	**0.00**	**$ -**	**1,379.00**	**0.00**	**$ -**	**$0**

ATTACHMENT 6

WATERMASTER BUDGETS FOR 2017

Seaside Groundwater Basin Watermaster
Fiscal Year 2017 Administrative Fund Budget

Seaside Groundwater Basin Watermaster Administrative Fund Adopted Budget Administrative Year 2017			
	2016 Adopted Amended Budget	2016 Estimated Total	2017 Proposed Budget
Assessment Income			
Reserve/Rollover*	$ 57,000	$ 47,000	$ 47,000
Administrative Assessment	58,000	58,000	52,000
Totals	115,000	105,000	99,000
Expenditures			
Contractual Services - Administrativ	65,000	55,000	60,000
Legal Services**	25,000	25,000	14,000
Total Expenses	90,000	80,000	74,000
Total Available	25,000	25,000	25,000
Less Reserve	25,000	25,000	25,000
Net Available	$ -	$ -	$ -

** Note: The reserve balance of $47,000 was determined upon completion by Watermaster staff of a detailed reconciliation from 2006 through July 2016 of the Administrative Fund financial records held at the Watermaster office against the Administrative Fund financial records held by the City of Seaside - the Watermaster fiscal agent.*

*** December 3, 2014 board action to amend 2015 Administrative Fund Budget to include $25,000 for legal services expended in 2015 and 2016*

Seaside Groundwater Basin Watermaster
Fiscal Year 2017 Monitoring & Management Plan
Operations Budget

Management and Monitoring Plan Operations Budget
For Tasks to be Undertaken in 2017

Task	Subtask	Sub-Subtask	Cost Description	CONSULTANTS & CONTRACTORS[3]			Total
				MPWMD	Private Consultants	Contractors	
Labor							
			Technical Project Manager	$0	$60,000	$0	$60,000
M.1 Program Administration							
	M.1.a		Project Budget and Controls	$0	$0	$0	$0
	M.1.b		Assist with Board and TAC Agendas	$0	$0	$0	$0
	M.1.c & M.1.d		Preparation for and Attendance at Meetings[8]	$0	$7,000	$0	$7,000
	M.1.e		Peer Review of Documents and Reports[8]	$0	$7,376	$0	$7,376
	M.1.f		QA/QC	$0	$0	$0	$0
	M.1.g		SGMA Documentation Preparation	$0	$1,900	$0	$1,900
I.1 Initial Phase 1 Monitoring Well Construction (Task Completed in Phase 1)							
I.2 Production, Water Level and Quality Monitoring							
	I. 2. a.		Database Management				
		I. 2. a. 1.	Conduct Ongoing Data Entry/ Database Maintenance/Enhancement	$11,052	$2,400	$0	$13,452
		I. 2. a. 2.	Verify Accuracy of Production Well Meters	$0	$0	$0	$0
	I. 2. b.		Data Collection Program				
		I. 2. b. 1.	Site Representation and Selection[7]	$0	$0	$0	$0
		I. 2. b. 2.	Collect Monthly Water Levels[6]	$7,192	$0	$0	$7,192
		I. 2. b. 3.	Collect Quarterly Water Quality Samples[1][5][6]	$29,834	$0	$25,686	$55,520
		I. 2. b. 4.	Update Program Schedule and Standard Operating Procedures.	$0	$0	$0	$0
		I. 2. b. 5.	Monitor Well Construction[7]	$0	$0	$0	$0
		I. 2. b. 6.	Reports	$2,688	$0	$0	$2,688
		I. 2. b. 7.	CASGEM Data Submittal for Watermaster's Voluntary Wells	$1,792	$0	$0	$1,792
I.3 Basin Management							
	I. 3. a.		Enhanced Seaside Basin Groundwater Model	(Costs Shown in Subtasks Below)			
		I. 3. a. 1	Update the Existing Model	$0	$0	$0	$0
		I. 3. a. 2	Develop Protective Water Levels	$0	$0	$0	$0
		I. 3. a. 3	Evaluate Replenishment Scenarios and Develop Answers to Basin Management Questions[10]	$0	$40,000	$0	$40,000
	I. 3. b.		Complete Preparation of Basin Management Action Plan	$0	$0	$0	$0
	I. 3. c.		Refine and/or Update the Basin Management Action Plan [11]	$0	$25,000	$0	$25,000
	I. 3. d		Evaluate Coastal Wells for Cross-Aquifer Contamination Potential	$0	$0	$0	$0
I.4 Seawater Intrusion Contingency Plan							
	I. 4. a.		Oversight of Seawater Intrusion Detection and Tracking	$0	$0	$0	$0
	I. 4. b.		Provide focused area hydrogeologic investigation for Sand City Public Works	$0	$0	$0	$0
	I. 4. c.		Annual Report- Seawater Intrusion Analysis	$896	$20,890	$0	$21,786
	I. 4. d.		Complete Preparation of Seawater Intrusion Response Plan[2]	$0	$0	$0	$0
	I. 4. e.		Refine and/or Update the Seawater Intrusion Response Plan[2][9]	$0	$0	$0	$0
	I. 4. f.		If Seawater Intrusion is Determined to be Occurring, Implement Contingency Response Plan[2]	(No Costs are Included for This Task, as This Task Will Likely Not be Necessary During 2017. If it Does Become Necessary, Use of Contingency Funds or a Budget Modification Will Likely be Necessary)			
		TOTALS CONSULTANTS & CONTRACTORS		**$53,454**	**$164,566**	**$25,686**	
						SUBTOTAL not including Technical Program Manager =	$183,706
						Contingency (not including Technical Program Manager) @ approximately 10%[4]=	$12,091
						Technical Program Manager =	$60,000
						TOTAL=	**$255,797**

Footnotes:

(1) Under this Subtask the Watermaster will directly contract with an outside contractor to perform the Sentinel Well induction logging work, and to also collect and analyze water quality samples in conjunction with doing the induction logging. MPWMD will perform the other portions of the work of this Subtask.

(2) The response 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). The term "Contractor" refers to a firm providing construction or field services such as well drilling, induction logging, or meter calibration.

(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.a.3 and I.3.c, it is recommended that a Contingency of approximately 10% be included in the Budget.

(5) Includes $1,000 to maintain equipment previously installed for this purpose. Also includes lab costs to analyze for barium and iodide ions in certain of these wells as was done in preceding years beginning in 2012.

(6) Does not include costs for MPWMD to collect water level data or water quality samples from wells other than those that are part of the basic monitoring well network, i.e. for private well owners who have requested that the Watermaster obtain this data for them. Costs to obtain that data are to be reimbursed to the Watermaster by those well owners, so there should be no net cost to the Watermaster for that portion of the work under these Tasks. Includes the purchase and installation of four new and/or replacement dataloggers at a price of $680, plus $50 for installation parts, for each datalogger.

(7) No additional monitoring well is expected to be constructed in 2016.

(8) For HydroMetrics and Todd Groundwater to provide hydrogeologic consulting assistance to the Watermaster, beyond that associated with performing other specified Tasks, when requested to do so by the Technical Program Manager.

(9) If work under this Task is found to be necessary, it will be funded through the Contingency line item in this Budget.

(10) If requested by the Board.

(11) If necessary to reflect knowledge gained from modeling work or other data sources.

Seaside Groundwater Basin Watermaster
Fiscal Year 2017 Monitoring & Management Plan
Capital Fund Budget

Management and Monitoring Plan Capital Budget								
For Tasks to be Undertaken in 2017								
No Capital projects are anticipated to be undertaken in 2017, so this budget is $0.								

ATTACHMENT 7

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

November 11, 2016

Bob Jaques
Technical Program Manager
Seaside Groundwater Basin Watermaster
83 Via Encanto
Monterey, CA 93940

Subject: Water Year 2016 Data Transmittal

Dear: Mr. Jaques

This letter transmits the groundwater-quality and groundwater-level data collected for the Seaside Groundwater Basin Watermaster (Watermaster) during Water Year (WY) 2016. The attached data transferal incorporates the data that were collected and reported for each quarter during the period from October 1, 2015 through September 30, 2016. This data was collected and is being provided to the Watermaster for information purposes, and is in compliance with the monitoring protocols described in the Watermaster's *Seaside Basin Monitoring and Management Program* (SBMMP, revision date September 5, 2006), which was prepared in response to the court decision filed March 27, 2006 (as amended by February 9, 2007 filing) in the Seaside Basin adjudication case. This data has been prepared by the Monterey Peninsula Water Management District (District) on behalf of the Watermaster.

Water-sample collection from the MPWMD coastal monitor wells for WY 2016 was accomplished by the Low-Flow Method. After the monitor wells were purged, water samples for laboratory analyses were collected before water had passed through the flow-through cell and all sample containers were filled by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence. During purging and sampling, the tubing remained filled with water to minimize possible changes in water chemistry upon contact with the atmosphere. When portable systems were used, they were placed carefully into the well and lowered into the screen zone as slowly as possible. Placement of the portable pump can disturb the groundwater flow conditions resulting in non-equilibrium conditions. As a result, longer purge times and greater purge volumes are necessary to achieve indicator parameter stabilization. In general, this may require that after installation, the portable pump remain in place for a minimum of 1-2 hours to allow settling of solids and re-establishment of horizontal flow through the screen zone. If initial turbidity readings were excessive (>50 NTU), pumping was halted and the well was allowed to rest for another 1-2 hours before initiating pumping again. Water levels were monitored during sampling to insure excessive drawdowns were not occurring to verify the sample volume was being collected from the aquifer and not the water stored in the casing. The devices used are capable of measuring water

levels to 0.01-foot precision.

Static, non-pumping, water-level measurements were taken for basin monitor wells and basin producer active and inactive wells during WY 2016 and are also included in this data transmittal. Static water levels are collected so these measurements will more closely approximate ambient groundwater-level conditions, and facilitate the plotting and trend analysis of well water-level hydrographs. Occasionally, water-level measurements have been collected and reported while the well was in operation. In some cases, this may be due to the fact that the well cannot be taken offline in order to collect a static water-level measurement because of pumping demand requirements. These occurrences have been recorded in the comments section the data transmittal. These water-level data were collected primarily with manual water-level sounding devices by producers or by the MPWMD on behalf of the Watermaster. Some monitor wells are equipped with continuous water level recording transducers. In these cases, the transducer files were downloaded and provided to Hydrometrics, LLC for inclusion in their Seawater Intrusion Analysis Report for WY 2016.

All data transmitted in this letter have been through the QA/QC process and entered into the Watermaster's database according the protocols outlined in the RFS between the District and the Watermaster. The enclosed data are an export from the Watermaster database.

In WY 2016, water quality data was not collected from FO09 Shallow and Deep in the second and third quarters because the seal around the well monument leaked during the rains and the pneumatic pumps became water locked. Following the winter, MPWMD repaired the seal on the well monument and rehabbed the sample pumps. Water quality data was successfully collected from FO09 Shallow and Deep during the fourth quarter of WY 2016. All lab results submitted to the Watermaster are included in this data transfer. The exceptions are Laguna Seca County Park well No. 1 and California American Water Ord Grove well. Please note that fourth quarter water quality results for PCA West, MSC, and FO09 have not been received from the lab and will be entered into the database upon receipt.

Please accept this letter and enclosure as a summary and transfer of data collected by MPWMD and Watermaster Producers for WY 2016. The District will also forward an electronic version of this report so that it can be posted to the Watermaster website.

Sincerely,

Jonathan Lear

Jonathan Lear PG, CHg

Senior Hydrogeologist

Enclosures: WY 2016 Water Quality and Water Level Data

Seaside Basin Monitoring Water Quality Data for WY 2016

<0.1 = Not detected above detection limit of 0.1 mg/L all values in mg/L unless otherwise noted

Cypress Pacific Production — WM No. 150

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB50017	7/11/16	53	74	17	4	195	49	<0.4	101	<4	0.057	0.047	<0.4	0.09	<0.4	7.4	451	736

Del Monte Test — WM No. 231

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
CALAM	7/21/16	24	46	8.1	3.3	120	13	0.13	56	1.1	0.47	0.065	<0.2	<0.1	0.21		240	420

FO-09-Deep — WM No. 112

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB35848	9/23/15	25	37	4	3.9	94	4	0.1	51	<1	5.772	0.051	<0.1	<0.05	0.2	6.9	240	341

FO-09-Shallow — WM No. 111

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB35847	9/23/15	24	49	3	3.3	71	<1	<0.1	66	<1	0.107	<0.010	<0.1	0.07	1.5	6.1	326	360

FO-10-Deep — WM No. 114

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB51156	8/1/16	17	37	2	2	66	12	<0.4	46	<4	1.42	0.026	<0.4	<0.05	<0.4	7.6	186	319

<0.1 = Not detected above detection limit of 0.1 mg/L all values in mg/L unless otherwise noted

FO-10-Shallow — WM No. 113

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB51155	8/1/16	15	37	2	2.4	65	10	<0.4	46	<4	0.567	0.01	<0.4	<0.05	<0.4	7.4	180	326

LS Golf New #12 — WM No. 203

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB50408	7/18/16	150	158	35	5.9	296	196	0.4	249	<4	0.487	0.047	<0.4	0.11	0.5	6.9	1014	1557

LSRA #2 — WM No. 196

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB50409	7/18/16	20	107	12	2.7	123	20	<0.4	134	4	0.25	0.011	0.8	0.09	<0.4	6.6	423	686

Mission Memorial — WM No. 156

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB49953	7/8/16	38	66	12	3	143	45	<0.4	88	12	0.199	<0.01	<0.4	<0.05	<0.1	7.3	389	627

MSC-Deep — WM No. 102

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB49465	6/28/16	84	97	16	4.2	318	30	<0.1	156	<1	0.022	0.079	<0.1	0.11	<0.4	6.8	594	1010
AB44694	3/31/16	76	115	16	4.9	348	9	0.4	149	<1	0.016	0.072	<0.1	0.12	0.5	7.3	608	1002
AB35850	9/23/15	72	107	15	4.5	326	26	0.3	146	<1	0.094	0.029	<0.1	0.11	0.4	7.4	600	1006

<0.1 = Not detected above detection limit of 0.1 mg/L all values in mg/L unless otherwise noted

MSC-Shallow — WM No. 101

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB49464	6/28/16	19	34	5	2.8	81	15	0.2	46	1	<0.01	<0.01	<0.1	<0.05	<0.1	7.4	200	317
AB44693	3/31/16	20	36	5	2.9	82	14	0.2	44	1	0.032	<0.01	<0.1	<0.05	0.2	6.2	226	314
AB35849	9/23/15	18	35	5	3.9	81	13	0.1	43	<1	<0.010	<0.010	<0.1	<0.05	0.2	6.1	208	317

Ord Terrace-Shallow — WM No. 109

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB51154	8/1/16	96	92	20	4.6	321	59	<0.4	155	<4	0.242	0.133	<0.4	0.08	<0.4	7.2	628	1248

Paralta — WM No. 169

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
CALAM	7/25/16	66	83	15	4.3	250	66	0.31	94	<1	<0.03	0.021	<0.2	0.11	0.32		490	810

Pasadera Golf - Main Gate — WM No. 208

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB50396	7/15/16	116	183	34	15	293	194	0.4	218	8	0.315	2.09	<0.4	0.29	0.4	6.7	969	1466

PCA East Deep — WM No. 106

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB50921	7/26/16	38	72	8	3.4	181	22	0.4	82	<4	0.017	<0.01	<0.4	0.06	<0.4	7.4	368	587
AB50923	7/26/16	41	79	8	3.5	181	22	0.6	82	<4	<0.01	<0.01	<0.4	0.06	<0.4	7.5	360	594

<0.1 = Not detected above detection limit of 0.1 mg/L all values in mg/L unless otherwise noted

PCA-E Shallow — WM No. 105

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB50922	7/26/16	16	39	4	2	78	8	<0.4	51	<4	0.224	<0.01	<0.4	<0.05	<0.4	7.7	214	304

PCA-W Deep — WM No. 104

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB49463	6/28/16	91	93	17	4.2	376	43	0.3	167	<1	3.604	0.189	<0.1	0.11	<0.4	6.4	660	1138
AB44696	3/31/16	89	118	20	5.4	376	40	0.2	165	<1	0.735	0.187	<0.1	0.13	0.5	6.3	711	1147
AB35852	9/24/15	86	108	18	4.9	366	39	0.2	168	<1	0.048	0.16	<0.1	0.12	0.4	6	674	1148

PCA-W Shallow — WM No. 103

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB49462	6/28/16	21	39	6	2.6	88	11	0.2	47	1	2.107	0.015	<0.1	<0.05	<0.1	6.8	209	321
AB44695	3/31/16	20	35	5	2.4	89	10	0.1	45	1	1.366	0.016	<0.1	<0.05	0.2	6.9	243	318
AB35851	9/24/15	20	37	5	2.4	87	10	<0.1	44	1	<0.010	<0.010	<0.1	<0.05	0.2	6.8	223	337

Playa #3 — WM No. 162

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
CALAM	7/25/16	56	87	16	4.6	140	88	0.12	120	26	<0.03	<0.01	<0.2	0.14	0.43		520	830

Plumas #4 — WM No. 177

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
CALAM	7/25/16	51	120	22	4.4	140	81	0.18	200	11	<0.03	<0.01	<0.2	0.12	0.66		620	1000

<0.1 = Not detected above detection limit of 0.1 mg/L all values in mg/L unless otherwise noted

Ryan Ranch #8

WM No. 216

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
CALAM	7/27/16	63	180	33	4.8	140	100	0.59	310	2.3	7	0.042	0.44	0.14	1.1		860	1400

Sand City Corp Yard

WM No. 165

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB52825	8/30/16	31	187	7	5	132	113	1.6	221	40	<0.01	0.017	<0.1	0.64	0.6	7.2	726	1220
AB48922	6/17/16	39	120	10	5.2	129	113	1.7	211	43	<0.01	<0.01	<0.4	0.22	<0.4	7.2	694	1174
AB41937	2/3/16	55	155	13	6.1	139	104	0.7	214	42	<0.01	<0.01	<0.1	0.3	0.6	7.1	689	1237
AB36416	10/6/15	21	372	2	4.2	212	193	6.6	363	<1	<0.010	0.05	<0.1	1.75	0.9	7.9	1086	1946

Seaside Golf - Coe

WM No. 189

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB48709	6/14/16	34	56	9	2.4	111	28	0.1	79	14	24	<0.002	<0.01	<0.01	0.1	7.5	311	523

Seaside Golf - Reservoir

WM No. 187

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB48708	6/14/16	15	43	5	2	57	8	<0.01	70	4	<0.004	<0.002	<0.01	<0.01	<0.01	7.9	177	358

Seaside Middle School (D)

WM No. 260

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB48897	6/16/16	43	41	11	2.8	163	70	0.3	29	<1	<0.01	<0.01	0.2	<0.05	<0.1	7.6	328	501
AB35800	9/23/15	84	98	19	4.7	317	73	0.3	124	<1	0.032	0.014	<0.1	0.1	0.3	7.3	611	1032

<0.1 = Not detected above detection limit of 0.1 mg/L all values in mg/L unless otherwise noted

Seaside Muni #4 — WM No. 173

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB48707	6/14/16	14	44	7	2	66	13	0.1	59	12	<0.004	<0.002	0.1	<0.01	0.1	7.2	194	371

Sentinel MW#1 (1,140 feet) — WM No. 245.1

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB50306	7/13/16	12	77	1	3	93	23	<0.4	72	<4	1.377	0.016	<0.4	0.09	<0.4	8.6	249	436
AB42308	2/11/16	13	87	1	3.4	94	24	0.2	87	<0.07	0.655	0.011	<0.02	0.09	0.3	8.1	286	508

Sentinel MW#1 (1,390 feet) — WM No. 245.2

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB50307	7/13/16	15	71	2	3.1	98	23	<0.4	67	<4	4.765	0.058	<0.4	0.08	<0.4	8.6	243	428
AB42309	2/11/16	36	100	6	5	150	28	0.2	103	<0.07	9.166	0.134	<0.02	0.12	0.3	8	391	622

Sentinel MW#2 (1,000 feet) — WM No. 246.1

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB50308	7/13/16	16	71	2	3	104	19	<0.4	68	<4	1.004	<0.01	<0.4	0.07	<0.4	8.5	251	429

Sentinel MW#2 (1,470 feet) — WM No. 246.2

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB50309	7/13/16	34	146	7	5.7	201	17	<0.4	178	<4	9.892	0.153	<0.4	0.34	0.4	7.9	534	906

<0.1 = Not detected above detection limit of 0.1 mg/L all values in mg/L unless otherwise noted

Sentinel MW#3 (1,275 feet) — WM No. 247.2

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB50311	7/13/16	17	58	3	3.7	102	16	<0.4	63	<4	2.151	0.032	<0.4	0.06	<0.4	8	234	414

Sentinel MW#3 (870 feet) — WM No. 247.1

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB50310	7/13/16	17	57	3	3.8	101	16	<0.4	63	<4	2.989	0.036	<0.4	0.06	<0.4	8	257	409

Sentinel MW#4 (715 feet) — WM No. 248.1

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB50312	7/13/16	69	99	12	7.9	232	37	<0.4	138	<4	6.669	0.092	<0.4	0.08	<0.4	7.5	506	868
AB42310	2/11/16	64	96	11	5.1	235	38	0.2	123	<0.07	2.374	0.054	<0.02	0.1	0.4	7.6	526	860

Sentinel MW#4 (900 feet) — WM No. 248.2

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB50313	7/13/16	39	132	2	26	56	28	<0.4	284	<4	15.366	0.119	<0.4	0.07	0.4	8.8	583	1068
AB42311	2/11/16	82	188	19	8.2	332	41	0.2	258	<0.07	2.472	0.107		0.28	0.8	7.5	806	1417

York School 2001 — WM No. 212

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB50016	7/11/16	34	176	28	4.2	78	33	<0.4	336	5	<0.01	<0.01	0.6	0.07	0.8	7	775	1237

Seaside Basin Monitoring and Management Plan
Water Level Data for WY 2016

Bay Ridge (Watermaster No. 226) — **Southern Inland**

Owner: California American Water

Well Type: Producer

Aquifer Unit: QTc/Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/04/2015	383	545.92	162.92	
09/24/2015	383	545.92	162.92	off
10/29/2015	437	545.92	108.92	on
12/03/2015	377	545.92	168.92	off
12/31/2015	425	545.92	120.92	on
01/28/2016	375	545.92	170.92	off
02/25/2016	375	545.92	170.92	off
03/31/2016	382	545.92	163.92	off
04/29/2016	374	545.92	171.92	off
05/26/2016	435	545.92	110.92	on
06/30/2016	378	545.92	167.92	off
07/28/2016	378	545.92	167.92	off
08/25/2016	413	545.92	132.92	on
09/26/2016	386	545.92	159.92	off

Bishop #3 (Watermaster No. 262) — **Southern Inland**

Owner: CAW

Well Type: Producer

Aquifer Unit:

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/24/2015	370	420.58	50.58	on
09/24/2015	370	420.58	50.58	Production Well On
10/29/2015	271	420.58	149.58	off

12/03/2015	268	420.58	152.58	off
12/31/2015	268	420.58	152.58	off
01/28/2016	267	420.58	153.58	off
02/25/2016	265	420.58	155.58	off
03/31/2016	263	420.58	157.58	off
04/29/2016	263	420.58	157.58	off
05/26/2016	263	420.58	157.58	off
06/30/2016	373	420.58	47.58	on
07/28/2016	371	420.58	49.58	on
08/25/2016	278	420.58	142.58	off
09/26/2016	368	420.58	52.58	on

Blue Larkspur-East End (Watermaster No. 143)

Southern Inland

Owner: Laguna Seca Resorts

Aquifer Unit:

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/02/2015	114.7	253.29	138.59	
04/05/2016	114.78	253.29	138.51	
09/21/2016	115.55	253.29	137.74	

CalAm Granite Construction (Watermaster No. 242)

Southern Inland

Owner: California American Water

Aquifer Unit: Tsm

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
04/05/2016	135.21	226.43	91.22	
10/05/2016	135.15	226.43	91.28	

CDM MW#4 (Watermaster No. 238)

Southern Coastal

Owner: MPWMD

Aquifer Unit: Qod

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/29/2015	14.9	18.69	3.79	
12/07/2015	13.9	18.69	4.79	
01/04/2016	13.97	18.69	4.72	
02/02/2016	14.00	18.69	4.69	
04/07/2016	14.09	18.69	4.60	
05/04/2016	14.93	18.69	3.76	
05/26/2016	15.14	18.69	3.55	
06/27/2016	15.43	18.69	3.26	
07/26/2016	15.15	18.69	3.54	
09/06/2016	15.13	18.69	3.56	
10/04/2016	15.30	18.69	3.39	

CDM MW-1 (Watermaster No. 251)

Northern Coastal

Owner: MPWMD

Aquifer Unit: Qod/Qar

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/29/2015	90.43	93.53	3.10	
12/07/2015	88.81	93.53	4.72	
01/05/2016	88.56	93.53	4.97	
03/01/2016	88.68	93.53	4.85	
04/04/2016				Locks Changed
05/04/2016	89.41	93.53	4.12	
05/27/2016	89.87	93.53	3.66	
07/08/2016	90.04	93.53	3.49	

07/28/2016	90.33	93.53	3.20
09/06/2016	90.36	93.53	3.17
10/04/2016	90.65	93.53	2.88

CDM MW-2 (Watermaster No. 252) **Northern Coastal**

Owner: MPWMD

Well Type: Monitor

Aquifer Unit: Qod/Qar

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/28/2015	60.72	68.83	8.11	
12/07/2015	58.25	65.83	7.58	
01/05/2016	58.61	65.83	7.22	
03/01/2016	58.22	65.83	7.61	
04/04/2016				Locks Changed
05/04/2016	59.33	65.83	6.50	
05/27/2016	60.03	65.83	5.80	
07/08/2016	60.61	65.83	5.22	
07/28/2016	61.89	65.83	3.94	
10/04/2016	61.39	68.83	7.44	

CDM MW-3 (Watermaster No. 239) **Southern Coastal**

Owner: MPWMD

Well Type: Monitor

Aquifer Unit: Qod/Qar

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/29/2015	31.88	33.81	1.93	
12/07/2015	28.23	33.81	5.58	
01/04/2016	29.90	33.81	3.91	
02/02/2016	31.52	33.81	2.29	
03/01/2016	30.78	33.81	3.03	
04/04/2016	32.42	33.81	1.39	

05/04/2016	31.68	33.81	2.13
05/26/2016	32.33	33.81	1.48
06/27/2016	32.31	33.81	1.50
07/26/2016	32.35	33.81	1.46
09/06/2016	32.35	33.81	1.46
10/04/2016	32.49	33.81	1.32

Cypress Pacific Production (Watermaster No. 150)

Southern Coastal

Owner: King Venture

Well Type: Producer

Aquifer Unit: QTc

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/24/2015		50.23		No Access
12/07/2015		50.23		No Access
01/04/2016		50.23		No Access
02/02/2016		50.23		No Access
03/01/2016		50.23		No Access
04/04/2016		50.23		No Access
05/04/2016		50.23		No Access
05/26/2016		50.23		No Access
06/27/2016		50.23		No Access
07/18/2016	46.8	50.23	3.43	
09/06/2016	47.14	50.23	3.09	
10/04/2016	47.19	50.23	3.04	

Del Monte Test (Watermaster No. 231)

Northern Coastal

Owner: California American Water

Well Type: Monitor

Aquifer Unit: QTc

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/24/2015	30.3	32.62	2.32	

09/24/2015	30.3	32.62	2.32	off
10/29/2015	30.2	32.62	2.42	off
12/03/2015	30.5	32.62	2.12	off
12/31/2015	27.4	32.62	5.22	off
01/28/2016	28.7	32.62	3.92	off
02/25/2016	28.9	32.62	3.72	off
03/31/2016	30.3	32.62	2.32	off
04/29/2016	28	32.62	4.62	off
05/26/2016	28.5	32.62	4.12	off
06/30/2016	29.3	32.62	3.32	off
07/28/2016	30.1	32.62	2.52	off
08/25/2016	30.1	32.62	2.52	off
09/26/2016	30.8	32.62	1.82	off

Design Ctr. (Watermaster No. 167) **Southern Coastal**

Owner: City of Sand City

Well Type: Producer

.quifer Unit: Qod/Qar/QTc

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/29/2015	14.67	21.31	6.64	
12/07/2015	14.49	21.31	6.82	
01/04/2016	14.13	21.34	7.21	
02/03/2016	14.02	21.34	7.32	
03/01/2016	13.65	21.34	7.69	
04/05/2016	13.49	21.34	7.85	
05/04/2016	13.48	21.34	7.86	
05/26/2016	13.65	21.34	7.69	
06/27/2016	13.71	21.34	7.63	
07/26/2016	13.75	21.34	7.59	
08/30/2016	13.73	21.34	7.61	

11/03/2016	13.69	21.34	7.65

FO-01-Deep (Watermaster No. 116)

Northern Inland

Owner: MPWMD

Well Type: Monitor

Aquifer Unit: Tm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/06/2015	341.53	362.57	21.04	
04/06/2016	341.30	362.57	21.27	
09/21/2016	341.80	362.57	20.77	

FO-01-Shallow (Watermaster No. 115)

Northern Inland

Owner: MPWMD

Well Type: Monitor

Aquifer Unit: QTc

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/06/2015	202.98	362.61	159.63	
04/04/2016	203.12	362.61	159.49	
09/21/2016	203.30	362.61	159.31	

FO-03-Deep (Watermaster No. 127)

Southern Inland

Owner: MPWMD

Well Type: Monitor

Aquifer Unit: Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/02/2015	637.43	774.74	137.31	
04/05/2016	637.45	774.74	137.29	
10/06/2016	637.44	774.74	137.30	

FO-04-Deep (W) (Watermaster No. 130)

Southern Inland

Owner: MPWMD

Aquifer Unit: Tsm

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/02/2015	113.95	167.44	53.49	
12/04/2015	113.50	167.44	53.94	
01/04/2016	113.12	167.44	54.32	
03/01/2016	112.99	167.44	54.45	
04/04/2016	112.7	167.44	54.74	
05/04/2016	112.35	167.44	55.09	
05/26/2016	112.36	167.44	55.08	
06/29/2016	112.41	167.44	55.03	
07/28/2016	112.97	167.44	54.47	
10/05/2016	113.16	167.44	54.28	

FO-04-Shallow (E) (Watermaster No. 129)

Southern Inland

Owner: MPWMD

Aquifer Unit: QTc

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/02/2015	113.60	168.23	54.63	
12/04/2015	112.52	168.23	55.71	
01/04/2016	112.37	168.23	55.86	
03/01/2016	111.78	168.23	56.45	
04/04/2016	111.60	168.23	56.63	
05/04/2016	111.07	168.23	57.16	
05/26/2016	111.23	168.23	57.00	
06/29/2016	111.90	168.23	56.33	
07/28/2016	112.7	168.23	55.53	

10/05/2016	113.44	168.23	54.79

FO-05-Deep (Watermaster No. 132) — **Southern Inland**

Owner: MPWMD

Well Type: Monitor

Aquifer Unit: Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/02/2015	320.35	479.29	158.94	
04/05/2016	316.65	479.29	162.64	
09/21/2016	320.03	479.29	159.26	

FO-05-Shallow (Watermaster No. 131) — **Southern Inland**

Owner: MPWMD

Well Type: Monitor

Aquifer Unit: QTc

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/02/2015	249.27	478.97	229.70	
04/05/2016	246.52	478.97	232.45	
09/21/2016	250.92	478.97	228.05	

FO-06-Deep (Watermaster No. 134) — **Southern Inland**

Owner: MPWMD

Well Type: Monitor

Aquifer Unit: Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/02/2015	236.6	470.62	234.02	
04/03/2016	232.07	470.62	238.55	
09/21/2016	236.33	470.62	234.29	

FO-06-Shallow (Watermaster No. 133)

Southern Inland

Owner: MPWMD

Aquifer Unit: QTc

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
12/02/2015	236.68	470.13	233.45	
04/05/2016	235.50	470.13	234.63	
09/21/2016	237.67	470.13	232.46	

FO-07-Deep (Watermaster No. 119)

Northern Inland

Owner: MPWMD

Aquifer Unit: Tsm

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/28/2015	495.63	470.15	-25.48	
12/04/2015	493.42	470.15	-23.27	
01/04/2016	492.02	470.15	-21.87	
02/03/2016	484.92	470.15	-14.77	
02/29/2016	489.4	470.15	-19.25	
04/04/2016	480.91	470.15	-10.76	
05/03/2016	487.1	470.15	-16.95	
05/26/2016	490.17	470.15	-20.02	
06/27/2016	492.43	470.15	-22.28	
07/27/2016	494.01	470.15	-23.86	
09/06/2016	496.63	470.15	-26.48	
10/03/2016	499.18	470.15	-29.03	

FO-07-Shallow (Watermaster No. 118)

Northern Inland

Owner: MPWMD

Well Type: Monitor

Aquifer Unit: QTc

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/28/2015	457.28	470.19	12.91	
12/04/2015	456.40	470.19	13.79	
01/04/2016	455.69	470.19	14.50	
02/03/2016	455.42	470.19	14.77	
02/29/2016	455.28	470.19	14.91	
04/04/2016	455.63	470.19	14.56	
05/03/2016	456.08	470.19	14.11	
05/26/2016	456.77	470.19	13.42	
06/27/2016	457.03	470.19	13.16	
07/27/2016	457.4	470.19	12.79	
09/06/2016	457.27	470.19	12.92	
10/03/2016	457.58	470.19	12.61	

FO-08-Deep (Watermaster No. 121)

Northern Inland

Owner: MPWMD

Well Type: Monitor

Aquifer Unit: Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/28/2015	402.86	378.1	-24.76	
12/07/2015	400.79	378.1	-22.69	
01/05/2016	399.42	378.1	-21.32	
02/03/2016	393.31	378.1	-15.21	
03/01/2016	396.82	378.1	-18.72	
04/04/2016	389.42	378.1	-11.32	
05/03/2016	obstructed	378.1		

05/27/2016	397.39	378.1	-19.29
06/28/2016	399.69	378.1	-21.59
07/28/2016	401.12	378.1	-23.02
09/06/2016	403.53	378.1	-25.43
10/04/2016	405.9	378.1	-27.80

FO-08-Shallow (Watermaster No. 120) **Northern Inland**

Owner: MPWMD

Well Type: Monitor

Aquifer Unit: QTc

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
12/07/2015	376.97	378.04	1.07	
01/05/2016	376.38	378.04	1.66	
02/03/2016	375.66	378.04	2.38	
03/01/2016	375.72	378.04	2.32	
04/04/2016	375.32	378.04	2.72	
05/03/2016	obstructed	378.04		
05/27/2016	376.18	378.04	1.86	
06/28/2016	376.92	378.04	1.12	
07/28/2016	377.5	378.04	0.54	
09/06/2016	377.79	378.04	0.25	
10/04/2016	378.40	378.04	-0.36	

FO-09-Shallow (Watermaster No. 111) **Northern Coastal**

Owner: MPWMD

Well Type: Monitor

Aquifer Unit: QTc/Tp

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/01/2015	114	118.89	4.89	

FO-10-Deep (Watermaster No. 114)

Northern Coastal

Owner: MPWMD

Aquifer Unit: Tp

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/28/2015	212.27	201.03	-11.24	
12/07/2015	211.65	201.03	-10.62	
01/05/2016	211.45	201.03	-10.42	
03/01/2016	213.61	201.03	-12.58	
04/05/2016	207.52	201.03	-6.49	
05/03/2016	208.83	201.03	-7.80	
05/27/2016	209.58	201.03	-8.55	
06/28/2016	210.03	201.03	-9.00	
07/28/2016	210.89	201.03	-9.86	
09/06/2016	211.7	201.03	-10.67	

FO-10-Shallow (Watermaster No. 113)

Northern Coastal

Owner: MPWMD

Aquifer Unit: QTc

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/28/2015	213.01	200.85	-12.16	
12/07/2015	211.16	200.84	-10.32	
01/05/2016	211.52	200.84	-10.68	
03/01/2016	211.22	200.84	-10.38	
04/05/2016	208.61	200.84	-7.77	
05/03/2016	209.86	200.84	-9.02	
05/27/2016	210.28	200.84	-9.44	
06/28/2016	210.48	200.84	-9.64	
07/28/2016	211.25	200.84	-10.41	

09/06/2016	211.45	200.84	-10.61

FO-11-Deep (Watermaster No. 123)

Northern Inland

Owner: MPWMD

Aquifer Unit: Tp

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/28/2015	339.73	332.96	-6.77	
12/07/2015	337.80	332.96	-4.84	
01/05/2016	336.61	332.96	-3.65	
03/01/2016	337.11	332.96	-4.15	
04/05/2016	333.23	332.96	-0.27	
05/03/2016	334.44	332.96	-1.48	
05/27/2016	334.05	332.96	-1.09	
06/28/2016	334.54	332.96	-1.58	
07/28/2016	334.83	332.96	-1.87	
09/06/2016	335.7	332.96	-2.74	
10/04/2016	336.46	332.96	-3.50	

FO-11-Shallow (Watermaster No. 122)

Northern Inland

Owner: MPWMD

Aquifer Unit: QTc

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/28/2015	359.89	332.93	-26.96	
12/07/2015	358.81	332.93	-25.88	
01/05/2016	358.34	332.93	-25.41	
03/01/2016	358.20	332.93	-25.27	
04/05/2016	356.37	332.93	-23.44	
05/03/2016	357.4	332.93	-24.47	
05/27/2016	357.69	332.93	-24.76	

06/28/2016	357.90	332.93	-24.97
07/28/2016	357.46	332.93	-24.53
09/06/2016	357.6	332.93	-24.67
10/04/2016	358.8	332.93	-25.87

Hilby MGT (Watermaster No. 244)

Southern Coastal

Owner: California American Water

Well Type: Monitor

Aquifer Unit: QTc

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/24/2015	241.4	248.04	6.64	
09/24/2015	241.4	248.04	6.64	off
10/29/2015	241.2	248.04	6.84	off
12/03/2015	241.3	248.04	6.74	off
12/31/2015	241.1	248.04	6.94	off
01/28/2016	241.2	248.04	6.84	off
02/25/2016	241.1	248.04	6.94	off
03/31/2016	241	248.04	7.04	off
04/29/2016	241.5	248.04	6.54	off
05/26/2016		248.04		blocked
06/30/2016		248.04		blocked
07/28/2016		248.04		blocked
08/25/2016		248.04		blocked
09/26/2016		248.04		blocked

Justin Court (Watermaster No. 135)

Southern Inland

Owner: California American Water

Well Type: Monitor

Aquifer Unit: QTc

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/06/2015	143.32	240.28	96.96	

04/05/2016	143.21	240.28	97.07
09/21/2016	143.29	240.28	96.99

K-Mart (Watermaster No. 125)

Southern Coastal

Owner: MPWMD

Aquifer Unit: Qod/Qar

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/29/2015	24.17	30.65	6.48	
12/07/2015	23.94	30.65	6.71	
01/04/2016	23.59	30.65	7.06	
02/02/2016	23.06	30.65	7.59	
03/01/2016	22.91	30.65	7.74	
04/05/2016	22.68	30.65	7.97	
05/04/2016	21.98	30.65	8.67	
05/26/2016	23.02	30.65	7.63	
06/27/2016	23.24	30.65	7.41	
07/26/2016	23.42	30.65	7.23	
09/06/2016	23.5	30.65	7.15	
10/03/2016	23.57	30.65	7.08	

LS Driving Range (Watermaster No. 141)

Southern Inland

Owner: County of Monterey

Aquifer Unit: QTc

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/18/2015	350.69	488.34	137.65	
04/05/2016	350.69	488.34	137.65	
09/21/2016	349.83	488.34	138.51	

LS No. 1 Subdivision (Watermaster No. 142)

Southern Inland

Owner: Laguna Seca Resorts

Well Type: Monitor

Aquifer Unit: Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/02/2015	137.87	277.13	139.26	
04/05/2016	137.80	277.13	139.33	
09/21/2016	138.72	277.13	138.41	

LS Pistol Range (Watermaster No. 136)

Southern Inland

Owner: County of Monterey

Well Type: Monitor

Aquifer Unit: Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/02/2015	289.52	514.39	224.87	
04/05/2016	288.62	514.39	225.77	
09/27/2016		514.39		Access Blocked

Luxton (Watermaster No. 243)

Northern Coastal

Owner: California American Water

Well Type: Monitor

Aquifer Unit: QTc

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/24/2015	101.5	89.12	-12.38	
09/24/2015	101.5	89.12	-12.38	off
10/29/2015	102.1	89.12	-12.98	off
12/03/2015	101.2	89.12	-12.08	off
12/31/2015	101.2	89.12	-12.08	off
01/28/2016	101.5	89.12	-12.38	off
02/25/2016	100.9	89.12	-11.78	off
03/31/2016	101	89.12	-11.88	off

04/29/2016	100.6	89.12	-11.48	off
05/26/2016	99.2	89.12	-10.08	off
06/30/2016	96.3	89.12	-7.18	off
07/28/2016	96	89.12	-6.88	off
08/25/2016	96.5	89.12	-7.38	off
09/26/2016	98.8	89.12	-9.68	off

Luzern #2 (Watermaster No. 159) **Northern Coastal**

Owner: California American Water

Well Type: Producer

Aquifer Unit: QTc/Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/24/2015	188.3	156.99	-31.31	off
09/24/2015	188.3	156.99	-31.31	
10/29/2015	178	156.99	-21.01	off
12/03/2015	177	156.99	-20.01	off
12/31/2015	169.8	156.99	-12.81	off
01/28/2016	171.8	156.99	-14.81	off
02/25/2016	181.1	156.99	-24.11	off
03/31/2016	181.3	156.99	-24.31	off
04/29/2016	181	156.99	-24.01	off
05/26/2016	179.3	156.99	-22.31	off
06/30/2016	178.3	156.99	-21.31	off
07/28/2016	178.2	156.99	-21.21	off
08/25/2016	177.3	156.99	-20.31	off
09/26/2016	198.7	156.99	-41.71	off

Military (Watermaster No. 151)

Northern Coastal

Owner: California American Water

Aquifer Unit: QTc

Well Type: Producer

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/24/2015	163.5	135.8	-27.70	off
09/24/2015	165.5	135.8	-29.70	
10/29/2015	163.7	135.8	-27.90	off
12/03/2015	163.2	135.8	-27.40	off
12/31/2015	161.6	135.8	-25.80	off
01/28/2016	159.8	135.8	-24.00	off
02/25/2016	157.1	135.8	-21.30	off
03/31/2016	156.9	135.8	-21.10	off
04/29/2016	156.3	135.8	-20.50	off
05/26/2016	157.5	135.8	-21.70	off
06/30/2016	157.2	135.8	-21.40	off
07/28/2016	157.2	135.8	-21.40	off
08/25/2016	158.1	135.8	-22.30	off
09/26/2016	160.8	135.8	-25.00	off

MMP monitor (Watermaster No. 154)

Northern Coastal

Owner: Mission Memorial Park

Aquifer Unit: QTc

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/28/2015	356.3	315.42	-40.88	on
12/07/2015	353.29	315.42	-37.87	
01/04/2016	351.27	315.42	-35.85	
02/02/2016	354.11	315.42	-38.69	
03/01/2016	353.71	315.42	-38.29	

04/04/2016	354.5	315.42	-39.08	
05/03/2016	342.41	315.42	-26.99	
05/26/2016	335.68	315.42	-20.26	on
06/27/2016	337.54	315.42	-22.12	
07/25/2016	346.22	315.42	-30.80	on
09/06/2016	349.42	315.42	-34.00	on
10/03/2016	353.99	315.42	-38.57	on

MSC-Deep (Watermaster No. 102) — **Northern Coastal**

Owner: MPWMD

Well Type: Monitor

Aquifer Unit: Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/29/2015	102.08	80.29	-21.79	
12/07/2015	101.35	80.29	-21.06	
01/04/2016	99.55	80.29	-19.26	
02/03/2016	96.17	80.29	-15.88	
03/01/2016	96.87	80.29	-16.58	
04/04/2016	91.49	80.29	-11.20	
05/04/2016	94.53	80.29	-14.24	
05/26/2016	96.37	80.29	-16.08	
06/27/2016	98.68	80.29	-18.39	
07/26/2016	98.61	80.29	-18.32	
09/06/2016	101.78	80.29	-21.49	
10/04/2016	103.21	80.29	-22.92	

MSC-Shallow (Watermaster No. 101) — **Northern Coastal**

Owner: MPWMD

Well Type: Monitor

Aquifer Unit: QTc

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments

09/29/2015	76.98	80.1	3.12
12/07/2015	77.27	80.1	2.83
01/04/2016	76.48	80.1	3.62
02/03/2016	77.07	80.1	3.03
03/01/2016	76.30	80.1	3.80
04/04/2016	76.58	80.1	3.52
05/04/2016	76.28	80.1	3.82
05/26/2016	76.72	80.1	3.38
06/27/2016	76.86	80.1	3.24
07/26/2016	75.98	80.1	4.12
09/06/2016	77.57	80.1	2.53
10/04/2016	77.29	80.1	2.81

MW-BW-08-A (Watermaster No. 240) **Southern Coastal**

Owner: U.S.A. Fort Ord

Well Type: Monitor

Aquifer Unit: Qod/Qar

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/29/2015	60.43	205.18	144.75	
12/04/2015	60.48	205.18	144.70	
03/01/2016	60.08	205.18	145.10	
06/27/2016	60.09	205.18	145.09	
09/21/2016	61.06	205.18	144.12	

MW-BW-09-180 (Watermaster No. 241) **Southern Coastal**

Owner: U.S.A. Fort Ord

Well Type: Monitor

Aquifer Unit: QTc

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/29/2015	210.65	206.22	-4.43	
12/04/2015	210.96	206.22	-4.74	

03/01/2016	211.47	206.22	-5.25
06/27/2016	211.25	206.22	-5.03
09/21/2016	211.44	206.22	-5.22

Ord Grove #2 (Watermaster No. 153) **Northern Coastal**

Owner: California American Water

Well Type: Producer

Aquifer Unit: QTc/Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/24/2015	384.2	292.39	-91.81	on
09/24/2015	384.2	292.39	-91.81	Production Well On
10/29/2015	384.6	292.39	-92.21	on
12/03/2015	371.3	292.39	-78.91	on
12/31/2015	340	292.39	-47.61	off
01/28/2016	337.5	292.39	-45.11	off
02/25/2016	322.2	292.39	-29.81	off
03/31/2016	366.2	292.39	-73.81	on
04/29/2016	317.6	292.39	-25.21	off
05/26/2016	307.1	292.39	-14.71	off
06/30/2016	309.3	292.39	-16.91	off
07/28/2016	307	292.39	-14.61	off
08/25/2016	308	292.39	-15.61	off
09/26/2016	309.2	292.39	-16.81	off

Ord Grove Test (Watermaster No. 107) **Northern Coastal**

Owner: California American Water

Well Type: Monitor

Aquifer Unit: QTc/Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/28/2015	349.32	294.00	-55.32	on
12/07/2015	346.4	294.00	-52.40	on

01/04/2016	328.67	294.00	-34.67	
02/02/2016	339.04	294.00	-45.04	on
03/01/2016	323.58	294.00	-29.58	
04/04/2016	340.67	294.00	-46.67	on
05/03/2016	319.96	294.00	-25.96	
05/26/2016	319.5	294.00	-25.50	
06/27/2016	323.38	294.00	-29.38	
07/25/2016	321.38	294.00	-27.38	
09/06/2016	322.02	294.00	-28.02	
10/03/2016	323.57	294.00	-29.57	

Ord Terrace-Shallow (Watermaster No. 109) **Northern Coastal**

Owner: MPWMD

Well Type: Monitor

Aquifer Unit: Tsm (upper)

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/28/2015	268.42	228.68	-39.74	
12/07/2015	266.60	228.68	-37.92	
01/04/2016	262.17	228.68	-33.49	
02/02/2016	259.80	228.68	-31.12	
03/01/2016	256.91	228.68	-28.23	
04/04/2016	257.37	228.68	-28.69	
05/03/2016	253.41	228.68	-24.73	
05/26/2016	253.13	228.68	-24.45	
06/27/2016	256.47	228.68	-27.79	
07/25/2016	255.26	228.68	-26.58	
09/06/2016	256.18	228.68	-27.50	
10/03/2016	258.11	228.68	-29.43	

Paralta (Watermaster No. 169)

Northern Coastal

Owner: California American Water

Aquifer Unit: QTc/Tsm

Well Type: Producer

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/24/2015	368.9	324.49	-44.41	
09/24/2015	368.9	324.49	-44.41	on
10/29/2015	368.7	324.49	-44.21	on
12/03/2015	349.7	324.49	-25.21	off
12/31/2015	348.1	324.49	-23.61	off
01/28/2016	333.6	324.49	-9.11	off
02/25/2016	342.6	324.49	-18.11	off
03/31/2016	328	324.49	-3.51	off
04/29/2016	339.5	324.49	-15.01	off
05/26/2016	362.2	324.49	-37.71	on
06/30/2016	365.1	324.49	-40.61	on
07/28/2016	369.5	324.49	-45.01	on
08/25/2016	370.3	324.49	-45.81	on
09/26/2016	377.9	324.49	-53.41	on

Paralta Test (Watermaster No. 108)

Northern Coastal

Owner: MPWMD

Aquifer Unit: QTc/Tsm

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/28/2015	346.8	330.72	-16.08	on
12/04/2015	337.58	330.72	-6.86	
01/05/2016	335.82	330.72	-5.10	
02/03/2016	327.81	330.72	2.91	
04/04/2016	325.10	330.72	5.62	

05/04/2016	334.03	330.72	-3.31	
05/26/2016	343.73	330.72	-13.01	on
06/27/2016	346.35	330.72	-15.63	on
07/25/2016	357.72	330.72	-27.00	on
09/06/2016	350.64	330.72	-19.92	on
10/03/2016	352.18	330.72	-21.46	on

Pasadera Golf - Main Gate (Watermaster No. 208)

Southern Inland

Owner: Pasadera Country Club, LLC

Well Type: Producer

Aquifer Unit: Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/26/2015	220.7	345.42	124.72	

Pasadera Golf - Paddock (Watermaster No. 204)

Southern Inland

Owner: Pasadera Country Club, LLC

Well Type: Producer

Aquifer Unit: QTc/Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/26/2015	220	359.69	139.69	

Playa #3 (Watermaster No. 162)

Northern Coastal

Owner: California American Water

Well Type: Producer

Aquifer Unit: QTc

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/24/2015	54	53.02	-0.98	off
09/24/2015	54	53.02	-0.98	
10/29/2015	52.1	53.02	0.92	off
12/03/2015	52.2	53.02	0.82	off
12/31/2015	51.4	53.02	1.62	off
01/28/2016	51.3	53.02	1.72	off

02/25/2016	50.6	53.02	2.42	off
03/31/2016	49.9	53.02	3.12	off
04/29/2016	49.9	53.02	3.12	off
05/26/2016	49.9	53.02	3.12	off
06/30/2016	80.2	53.02	-27.18	on
07/28/2016	152.3	53.02	-99.28	on
08/25/2016	150.9	53.02	-97.88	on
09/26/2016	145.2	53.02	-92.18	on

Plumas #4 (Watermaster No. 177) **Southern Coastal**

Owner: California American Water

Well Type: Producer

Aquifer Unit: Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/24/2015	221.8	161.48	-60.32	
09/24/2015	221.8	161.48	-60.32	on
10/29/2015	113	161.48	48.48	off
12/03/2015	112.2	161.48	49.28	off
12/31/2015	199.4	161.48	-37.92	on
01/28/2016	112.4	161.48	49.08	off
02/25/2016	111.1	161.48	50.38	off
03/31/2016	110.5	161.48	50.98	off
04/29/2016	110	161.48	51.48	off
05/26/2016	109.2	161.48	52.28	off
06/30/2016	216	161.48	-54.52	on
07/28/2016	219.9	161.48	-58.42	on
08/25/2016	217.1	161.48	-55.62	on
09/26/2016	219.4	161.48	-57.92	on

Plumas Test 1990 (Watermaster No. 124)

Southern Coastal

Owner: MPWMD

Well Type: Monitor

Aquifer Unit: Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/29/2015	108.65	157.83	49.18	on
12/04/2015	107.82	157.83	50.01	on
01/04/2016	107.38	157.83	50.45	on
03/01/2016	107.22	157.83	50.61	
04/04/2016	107.1	157.83	50.73	
05/04/2016	106.37	157.83	51.46	
05/26/2016	106.58	157.83	51.25	
06/27/2016	106.59	157.83	51.24	on
07/25/2016	107.13	157.83	50.70	on
09/06/2016	107.37	157.83	50.46	on
10/03/2016	107.70	157.83	50.13	on

Robley Deep (South) (Watermaster No. 140)

Southern Inland

Owner: County of Monterey

Well Type: Monitor

Aquifer Unit: Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/06/2015	396.61	566.44	169.83	
04/06/2016	392.01	566.44	174.43	
09/21/2016	397.19	566.44	169.25	

Robley Shallow (North) (Watermaster No. 139)

Southern Inland

Owner: County of Monterey

Well Type: Monitor

Aquifer Unit: QTc

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments

10/06/2015	321.38	566.54	245.16
04/04/2016	321.82	566.54	244.72
09/21/2016	321.14	566.54	245.40

Ryan Ranch #11 (Watermaster No. 215)

Southern Inland

Owner: California American Water

Well Type: Producer

Aquifer Unit: Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/24/2015	196	307.59	111.59	off
09/24/2015	196	307.59	111.59	
10/29/2015	195	307.59	112.59	off
12/03/2015	190	307.59	117.59	off
12/31/2015	185	307.59	122.59	off
01/28/2016	185	307.59	122.59	off
02/25/2016	188	307.59	119.59	off
03/31/2016	188	307.59	119.59	off
04/29/2016	191	307.59	116.59	off
05/26/2016	191	307.59	116.59	off
06/30/2016	192	307.59	115.59	off
07/28/2016	192	307.59	115.59	off
08/25/2016	193	307.59	114.59	off
09/26/2016	195	307.59	112.59	off

Ryan Ranch #7 (Watermaster No. 213)

Southern Inland

Owner: California American Water

Well Type: Producer

Aquifer Unit: Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/24/2015	386	294	-92.00	Production Well On
09/24/2015	386	294	-92.00	on

10/29/2015	386	294	-92.00	on
12/03/2015	387	294	-93.00	on
12/31/2015	223	294	71.00	off
01/28/2016	377	294	-83.00	on
02/25/2016	317	294	-23.00	off
03/31/2016	390	294	-96.00	on
04/29/2016	389	294	-95.00	on
05/26/2016	397	294	-103.00	on
06/30/2016	389	294	-95.00	on
07/28/2016	384	294	-90.00	on
08/25/2016	393	294	-99.00	on
09/26/2016	399	294	-105.00	on

Ryan Ranch #8 (Watermaster No. 216) **Southern Inland**

Owner: California American Water

Well Type: Producer

Aquifer Unit: Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/24/2015	199	306.86	107.86	
09/24/2015	199	306.86	107.86	off
10/29/2015	197	306.86	109.86	off
12/03/2015	192	306.86	114.86	off
12/31/2015	189	306.86	117.86	off
01/28/2016	189	306.86	117.86	off
02/25/2016	193	306.86	113.86	off
03/31/2016	199	306.86	107.86	off
04/29/2016	196	306.86	110.86	off
05/26/2016	198	306.86	108.86	off
06/30/2016	196	306.86	110.86	off
07/28/2016	197	306.86	109.86	off

08/25/2016	198	306.86	108.86	off
09/26/2016	200	306.86	106.86	off

Sand City Corp Yard (Watermaster No. 165) — **Southern Coastal**

Owner: City of Sand City

Well Type: Producer

Aquifer Unit: Qod/Qar/QTc

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/29/2015	42.42	47.25	4.83	
12/07/2015	41.76	47.25	5.49	1990
01/04/2016	41.52	47.25	5.73	1530
02/03/2016	41.51	47.25	5.74	1220
03/01/2016	41.52	47.25	5.73	930
04/04/2016	41.56	47.25	5.69	
05/04/2016	42.12	47.25	5.13	1540
05/26/2016	42.10	47.25	5.15	1040
06/27/2016	42.31	47.25	4.94	1610
07/26/2016	42.33	47.25	4.92	1310
08/30/2016	42.11	47.25	5.14	1230
10/03/2016	42.26	47.25	4.99	1900

Seaside Golf - Coe (Watermaster No. 189) — **Northern Coastal**

Owner: City of Seaside

Well Type: Producer

Aquifer Unit: QTc

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
11/01/2015	103.85	110.15	6.30	off
12/01/2015	103.55	110.15	6.60	off
01/01/2016	120.85	110.15	-10.70	Shut well off for 15 min
02/01/2016	102.97	110.15	7.18	off
03/01/2016	102.65	110.15	7.50	off

04/01/2016	104.37	110.15	5.78	off
05/01/2016	157.54	110.15	-47.39	Shut well off for 15 min
06/01/2016	109.91	110.15	0.24	off
07/01/2016	111.33	110.15	-1.18	Shut well off for 15 min
08/01/2016	105.02	110.15	5.13	off
09/01/2016	113.75	110.15	-3.60	Shut well off for 15 min
10/01/2016	113.02	110.15	-2.87	Shut well off for 15 min

Seaside Golf - Reservoir (Watermaster No. 187) **Northern Coastal**

Owner: City of Seaside

Well Type: Producer

Aquifer Unit: Qc, Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
11/01/2015	407.75	417.44	9.69	
12/01/2015	420	417.44	-2.56	Well shut off for 15 min
01/01/2016	400.4	417.44	17.04	
02/01/2016	399.01	417.44	18.43	
03/01/2016	408.05	417.44	9.39	Well shut off for 15 min
04/01/2016	407.8	417.44	9.64	Well shut off for 30 min
05/02/2016	413.85	417.44	3.59	Well shut off for 15 min
06/01/2016	416.85	417.44	0.59	Well shut off for 35 min
07/01/2016	417.11	417.44	0.33	Well shut off for 35 min
08/01/2016	418.87	417.44	-1.43	Well shut off for 35 min
09/01/2016	409.32	417.44	8.12	
10/01/2016	445.02	417.44	-27.58	Well shut off for 35 min

Seaside Muni #3 (Watermaster No. 174) **Northern Coastal**

Owner: City of Seaside

Well Type: Producer

Aquifer Unit: QTc, Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments

11/01/2015	270.95	307.19	36.24	off
12/01/2015	271.24	307.19	35.95	off
01/01/2016	270.66	307.19	36.53	off
02/01/2016	270.64	307.19	36.55	off
03/01/2016	270.55	307.19	36.64	off
04/01/2016	270.93	307.19	36.26	off
05/02/2016	270.07	307.19	37.12	off
06/01/2016	269.84	307.19	37.35	off
07/01/2016	279.61	307.19	27.58	off
08/01/2016	269.93	307.19	37.26	off
09/01/2016	269.97	307.19	37.22	off
10/01/2016	270.19	307.19	37.00	off

Seaside Muni #4 (Watermaster No. 173) **Northern Coastal**

Owner: City of Seaside

Well Type: Producer

Aquifer Unit: QTc, Tsm

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
11/01/2015	336.3	312.12	-24.18	off
12/01/2015	335.89	312.12	-23.77	off
01/01/2016	334.25	312.12	-22.13	off
02/01/2016	332.7	312.12	-20.58	off
03/01/2016	331.4	312.12	-19.28	off
04/01/2016	331.96	312.12	-19.84	off
05/01/2016	330.7	312.12	-18.58	off
06/01/2016	330.1	312.12	-17.98	off
07/01/2016	331.74	312.12	-19.62	off
08/01/2016	335.12	312.12	-23.00	off
09/01/2016	336.33	312.12	-24.21	off
10/01/2016	337.08	312.12	-24.96	off

Seca Place (Watermaster No. 138)

Southern Inland

Owner: County of Monterey

Aquifer Unit: Tsm

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/02/2015	270.2	427.58	157.38	
04/05/2016	263.42	427.58	164.16	
09/21/2016	270.03	427.58	157.55	

Target Well (Watermaster No. 152)

Northern Coastal

Owner: DBO Development

Aquifer Unit: QTc/Tsm

Well Type: Producer

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/29/2015	64.2	44.42	-19.78	
12/07/2015	63.44	44.42	-19.02	
01/04/2016	63.52	44.42	-19.10	
02/02/2016	63.42	44.42	-19.00	
03/01/2016	63.07	44.42	-18.65	
04/05/2016	62.85	44.42	-18.43	
05/04/2016	60.54	44.42	-16.12	
05/26/2016	58.2	44.42	-13.78	
06/27/2016	58.11	44.42	-13.69	
07/26/2016	58.17	44.42	-13.75	
08/30/2016	58.44	44.42	-14.02	
10/04/2016	58.55	44.42	-14.13	

Toro #3 (Watermaster No. 303)

Southern Inland

Owner: Cal-Am

Aquifer Unit: QTc

Well Type: Producer

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
09/24/2015	206	499	293.00	off
10/29/2015	206	499	293.00	off
12/03/2015	205	499	294.00	off
12/31/2015	205	499	294.00	off
01/28/2016	205	499	294.00	off
02/25/2016	205	499	294.00	off
03/31/2016	205	499	294.00	off
04/29/2016	205	499	294.00	off
05/26/2016	205	499	294.00	off
06/30/2016	205	499	294.00	off
07/28/2016	205	499	294.00	off
08/25/2016	205	499	294.00	off
09/26/2016	205	499	294.00	off

York Rd-West (Watermaster No. 137)

Southern Inland

Owner: County of Monterey

Aquifer Unit: Tsm

Well Type: Monitor

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/02/2015	322.42	490.28	167.86	
04/05/2016	321.01	490.28	169.27	
09/21/2016	332.41	490.28	157.87	

York School 2001 (Watermaster No. 212)

Southern Inland

Owner: York School

Aquifer Unit: QTc/Tsm

Well Type: Producer

All Values in Feet

Date Measured	Depth To Water	Ref Point	Water Elevation	Comments
10/01/2015	225.09	384.3	159.21	
01/04/2016	224.69	384.3	159.61	
04/05/2016	224.33	384.3	159.97	
05/05/2016	222.55	384.3	161.75	
05/27/2016	223.07	384.3	161.23	
06/27/2016	223.81	384.3	160.49	
08/01/2016	232.20	384.3	152.10	
08/30/2016	226.78	384.3	157.52	
10/05/2016	227.10	384.3	157.20	

ATTACHMENT 8

EXECUTIVE SUMMARY
FROM THE
WY 2016 SEAWATER INTRUSION ANALYSIS REPORT

EXECUTIVE SUMMARY

This annual report addresses the potential for, and extent of, seawater intrusion in the Seaside Groundwater Basin. Continued pumping in excess of recharge and fresh water inflows, coastal groundwater levels well below sea level, and ongoing seawater intrusion in the nearby Salinas Valley all suggest that seawater intrusion could occur in the Seaside Groundwater Basin.

Up until this water year, all of the monitoring data from the existing monitoring and production wells in the Seaside Basin have indicated that seawater intrusion has not occurred. This year for the first time there is conflicting data from two of the Watermaster's sentinel wells. Some of the data are suggestive of the initial onset of seawater intrusion, while other data indicate seawater intrusion is not occurring.

The data which are suggestive of the initial onset of seawater intrusion is described in the bulleted items below. It is important to note that all of these data are based on the same two discrete groundwater quality samples taken from wells SBWM-2 (1,470 ft depth) and SBWM-4 (900 ft depth).

- Water samples for sentinel wells SBWM-2 (1,470 ft) and SBWM-4 (900 ft) experienced a shift in water chemistry that plots closer to seawater on Piper diagrams than historical samples.
- Stiff diagrams for sentinel wells SBWM-2 (1,470 ft) and SBWM-4 (900 ft) show a chloride spike somewhat similar to Stiff diagrams of seawater intruded wells in the Salinas Valley.
- July 2016 chloride concentrations in sentinel wells SBWM-2 (1,470 ft) and SBWM-4 (900 ft) are at 178 and 284 mg/L respectively. This is an increase of 112 mg/L for sentinel well SBWM-2 (1,470 ft) over the past water year and 26 mg/L for sentinel well SBWM-4 (900 ft) from February 2016 to July 2016.
- The sodium/chloride molar ratios of both SBWM-2 (1,470 ft) and SBWM-4 (900 ft) have dropped, but are not below 0.86.
- Groundwater elevations in sentinel wells SBWM-2 (1,470 ft) and SBWM-4 (900 ft) are at historical lows.
- Maps of chloride concentrations for the deep aquifer show chlorides increasing towards the coast.

Data which are indicative of seawater intrusion not occurring is described in the bulleted items below:

- Maps of chloride concentrations for the shallow aquifer do not show chlorides increasing towards the coast.
- Induction logging data at the coastal sentinel wells does not show changes indicative of seawater intrusion.
- Other than the sentinel wells SBWM-2 (1,470 ft) and SBWM-4 (900 ft) samples, no other monitoring or production wells in the basin have water quality that is indicative of seawater intrusion.

Because of the conflicting data no conclusions with regard to the initial onset of seawater intrusion can be drawn at this time. Verification resampling, as contained in the Recommendations section of this report, will be necessary in order to reach a conclusion.

The following groundwater level and production data suggest that conditions in the basin continue to provide a potential for seawater intrusion:

- Northern Coastal subarea groundwater levels in the deep aquifer remain below sea level (Figure 29 and Figure 31). The 4th quarter deep aquifer groundwater levels along the coast are in some cases greater than 30 feet below sea level and are at historical lows.
- Groundwater levels remain below protective elevations in all deep target monitoring wells (MSC deep, PCA-W, and sentinel well SBWM-3). Two of the three shallow wells' groundwater levels are above protective elevations: PCA-W shallow and CDM-MW4. The MSC shallow well remains below protective elevations.
- Groundwater production in the Seaside Groundwater Basin for Water Year 2016 was 2,913.5 acre-feet, which is 848.5 acre-feet less than Water Year 2015. This amount is less than the Court-mandated operating yield of 3,920 acre-feet per year that is required between October 1, 2014 and September 30, 2017, and the current safe yield of 3,000 acre-feet. Although pumping in Water Year 2016 was below the current safe yield, many groundwater elevations in deep monitoring wells continue to decline. It seems likely that the long-term effects of pumping over the safe yield and the dry climatic conditions of the past five years have a greater impact on groundwater levels than one year of reduced pumping,

Due to its long distance from the coast, seawater intrusion is not an issue of concern in the Laguna Seca subarea. However, groundwater levels in the Laguna Seca subarea are continuing to decline at the same rate since 2001 despite triennial reductions in allowable pumping. The shallow groundwater levels are declining at a rate of approximately 0.6 feet per year, while the deep groundwater levels in the eastern portion of the subarea are declining at a much faster rate of between two and three feet per year. The cause of this decline is due in part to the safe yield of the subarea being incorrect and in part due to the influence of wells to the east of the groundwater basin. The rate of decline in groundwater levels in the western portion of the subarea is between one and two feet per year.

Based on the findings of this report, the following recommendations should be implemented to continue to monitor and track potential seawater intrusion, and to verify recent results in sentinel wells SBWM-2 and SBWM-4.

1. **Verification Water Quality Sampling and Analysis for Sentinel Well SBWM-2, Sentinel Well SBWM-4, and the Ord Terrace Shallow Monitoring Well**

   Analysis of two samples, one from sentinel well SBWM-2 (1,470 ft) and one from SBWM-4 (900 ft), provided data that are in conflict with other types of data from these wells and from other wells in the vicinity in terms of drawing any conclusions regarding seawater intrusion. Additionally, increasing chlorides have been observed at the Ord Terrace Shallow well; although other geochemical evidence suggests this may not be incipient seawater intrusion. In accordance with the Watermaster's Seawater Intrusion Response Plan (SIRP), these wells should be resampled immediately to determine if the data from these two samples are valid, or whether the July 2016 samples experienced analytical errors or were not representative samples. Re-sampling should include the full suite of major cations and anions, which will allow all of the indicators used in this SIAR to be verified. Laboratory analyses should be conducted with an expedited turnaround time.

2. **Potentially Analyze Additional Water Quality Constituents for Seawater Intrusion**

   Depending on the results of the verification sampling, the Watermaster may wish to begin to regularly analyze additional water quality constituents: iodide, bromide, boron, and barium in wells that indicate incipient seawater intrusion.

3. **Increase Water Quality Sampling and Analysis for Sentinel Well SBWM-2**

   Currently sentinel wells SBWM-1 and SBWM-4 are sampled twice a year, in the 2nd and 4th quarters. If verification sampling shows the sentinel well SBWM-2 has elevated chloride concentrations, at the very least this well should be sampled twice a year, in the 2nd and 4th quarters.

4. **Potentially Increase Water Quality Sampling and Analysis for Sentinel Well SBWM-2 and SBWM-4**

   Depending on the results of verification sampling, the Watermaster may wish to increase the sampling frequency of SBWM-2 and SBWM-4 to more frequently than twice a year. If indeed the chloride concentrations at these wells are increasing rapidly, monthly sampling may be needed.

5. **Potentially Implement Follow up Actions Outlined in the Seawater Intrusion Response Plan**

   If verification sampling indicates that incipient seawater intrusion is occurring along the coast, additional actions that are outlined in the SIRP will need to be implemented. These actions need not be implemented if verification sampling does not indicate incipient seawater intrusion.

6. **Install a Data Logger in the monitoring well, PCA West Shallow**

   The PCA West Shallow well is a coastal monitoring well that is an important part of the monitoring system for the basin and is one of the wells used to monitor protective groundwater elevations. Because of limited access to this well site, groundwater levels were not measured this water year. A dedicated logger, like that installed in PCA West Deep, at this well will continuously record groundwater levels much more reliably.

7. **Continue to Document Declining Groundwater Levels in the Laguna Seca Subarea**

   Although this recommendation is not one that is related to seawater intrusion because of the inland location of the wells, it is important for the sustainability of the groundwater basin. The state of groundwater levels in monitoring wells in the Laguna Seca subarea needs to be reported at least annually to the Watermaster. The current rate of decline, particularly in the eastern portion of the subarea, is not acceptable. For the sustainability of the subarea, the Watermaster should consider options in the next water year to address the situation.

ATTACHMENT 9

SEASIDE GROUNDWATER BASIN MANAGEMENT AND MONITORING PROGRAM ANTICIPATED 2017 WORK PLAN

Seaside Groundwater Basin Management and Monitoring Program
FY 2017 Work Plan

The tasks outlined below are those that are anticipated to be performed during 2017. Some Tasks listed below are specific to 2017, while others Tasks recur throughout the program, such as data collection and database entry, and Program Administration Tasks.

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

M.1 Program Administration

M. 1. a **Project Budget and Controls**	Consultants will provide monthly or bimonthly invoices to the Watermaster for work performed under their contracts with the Watermaster. Consultants will perform maintenance of their internal budgets and schedules, and management of their subconsultants. The Watermaster will perform management of its Consultants.
M. 1. b **Assist with Board and TAC Agendas**	Watermaster staff will prepare Board and TAC meeting agenda materials. No assistance from Consultants is expected to be necessary to accomplish this Task.
M. 1. c. & M. 1. d **Preparation for and Attendance at Meetings**	The Consultants' work will require internal meetings and possibly meetings with outside governmental agencies and the public. For meetings with outside agencies, other Consultants, or any other parties which are necessary for the conduct of the work of their contracts, the Consultants 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 Tasks M.1.c and M.1.d will be: Those associated with attendance at TAC meetings (either in person or by teleconference connection), including providing periodic progress reports to the Watermaster for inclusion in the agenda packets for the TAC meetings, when requested by the Watermaster to do so. These progress reports will typically include project progress that has been made, problem identification and resolution, and planned upcoming work. and From time-to-time when Watermaster staff asks Consultants to make special presentations to the Watermaster Board and/or the TAC, and which are not included in the Consultant's contracts for other tasks. Appropriate Consultant representatives will attend TAC meetings when requested to do so by Watermaster Staff (either in person or by teleconference connection), but will not be asked to prepare agendas or meeting minutes. As necessary, Consultants may provide oral updates to their progress reports (prepared under Task M.1.d) at the TAC meetings.
M. 1. e **Peer Review of Documents and Reports**	When requested by the Watermaster staff, Consultants may be asked to assist the TAC and the Watermaster staff with peer reviews of documents and reports prepared by various other Watermaster Consultants and/or entities.
M. 1. f **QA/QC**	A Consultant (MPWMD) will provide general QA/QC support over the Seaside Basin Monitoring and Management Program. These costs are included in the other tasks.

M.1.g Prepare Documents for SGMA Reporting	Section 10720.8 of the Sustainable Groundwater Management Act (SGMA) requires adjudicated basins to submit annual reports. Most of the documentation that needs to be reported is already generated by the Watermaster in conjunction with preparing its own Annual Reports. However, some information such as changes in basin storage is not currently generated and will require consultant assistance to do so. This task will be used to obtain this consultant assistance, as needed.

I. 2 Comprehensive Basin Production, Water Level and Water Quality Monitoring Program

I. 2. a. Database Management

I. 2. a. 1 Conduct Ongoing Data Entry and Database Maintenance/ Enhancement	The database will be maintained by a Consultant (MPWMD) performing this work for the Watermaster. MPWMD will enter new data into the consolidated database, including water production volumes, water quality and water level data, and such other data as may be appropriate. Another Consultant will periodically post database information to the Watermaster's website, so it will be accessible to the public and other interested parties. No enhancements to the database are anticipated during 2017.
I. 2. a. 2 Verify Accuracy of Production Well Meters	To ensure that water production data is accurate, the well meters of the major producers were verified for accuracy during 2009 and again during 2015. No additional work of this type is anticipated during 2017.

I. 2. b. Data Collection Program

I. 2. b. 1 Site Representation and Selection	The monitoring well network review that was started in 2008 has been completed, and sites have been identified where future monitoring well(s) could be installed, if it is deemed necessary to do so in order to fill in data gaps. No further work of this type is anticipated in 2017.
I. 2. b. 2 Collect Monthly Manual Water Levels	Each of the monitoring wells will be visited on a regular basis. Water levels will be determined by either taking manual water levels using an electric sounder, or by dataloggers. Most wells where the use of dataloggers is feasible or appropriate have been equipped with dataloggers, but in accordance with the recommendation in the 2016 SIAR this Task budget amount includes the purchase and installation of one additional new datalogger at Monitoring Well PCA West-Shallow at a price of $680, plus $50 for installation parts. This Task also includes 2 replacement dataloggers @ $680, and the purchase of one datalogger @ $680 to keep in inventory as a spare if needed, plus $50 in parts for each datalogger. All of the other wells 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. In 2012 water quality analyses were expanded to include barium and iodide ions, to determine the potential benefit of performing these additional analyses. These two parameters have been useful in analyzing seawater intrusion potential in other vulnerable coastal groundwater basins, and are briefly mentioned in the Watermaster's annual Seawater Intrusion Analysis Reports. These parameters were added to the annual water quality sampling list for the four Watermaster Sentinel wells (SBWM-1, SBWM-2, SBWM-3, and SBWM-4), and also for the 3 most coastal MPWMD monitoring wells (MSC, PCA, and FO-09). Barium and iodide analyses will continue being performed in 2017. Water quality 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. The Consultant or Contractor selected to perform this work will make this judgment based on consideration of costs and other factors. Under this Task in 2013 retrofitting to use the low-flow purge approach for getting water quality samples was completed on all of the wells that are sampled. This sampling equipment sits in the water column and may periodically need to be replaced or repaired. Accordingly, an allowance to perform maintenance on previously installed equipment has been included in this Task. Also, in the event a sampling pump is found to be no longer adequate due to declining groundwater levels, an allowance of $2,000 to purchase a replacement sampling pump has been included in this Task. The additional water quality sampling at certain of the Sentinel Wells and the Ord Terrace Shallow Well, as recommended in the 2016 SIAR, is included in this Task.
I. 2. b. 4 **Update Program Schedule and Standard Operating Procedures.**	All recommendations from prior reviews of the data collection program have been implemented. No additional work of this type is anticipated in 2017.
I. 2. b. 5. **Monitor Well Construction**	An additional monitoring well was installed in 2009. No further work of this type is anticipated in 2017.
I. 2. b.6 **Reports**	The groundwater level and quality monitoring will be conducted on a monthly, quarterly, and annual basis, as described in the Consultant's Scope of Work. Reports summarizing data collected and analyzed will be submitted to the Watermaster on a schedule to be established during the year, and will consist of: 1. A review of the water quality and water level data at the end of each quarter of the Water Year, including tabularized data summaries of the WQ/WL data twice per year, once for the Q1 and Q2 period and once for the Q3 and Q4 period, so this data can be posted to WATERMASTER's website. No reporting on a quarterly basis is required but the Consultant will promptly notify the Watermaster of any missing data or data collection irregularities that were encountered during the quarterly reporting period. 2. An annual report summarizing the water quality and water level data for the Water Year, and containing tables of this data for the complete Water Year. The report will include a brief cover letter describing any missing data or data collection irregularities that were encountered during the reporting period, and any recommendations for changes to be made to the data collection program.

I.2.b.7 **CASGEM Data Submittal**	Compile and submit data on the Watermaster's "Voluntary Wells" into the State's CASGEM groundwater management database. The term "Voluntary Well" refers to a well that is not currently having its data reported into the CASGEM system, but for which the Watermaster obtains data. This will be done in the format and on the schedule required by the Department of Water Resources under the Sustainable Groundwater Management Act.
	I. 3 Basin Management
I. 3. a. **Enhanced Seaside Basin Groundwater Model (Costs listed in subtasks below)**	The Watermaster and its consultants use a Groundwater Model for basin management purposes.
I.3.a.1 **Update the Existing Model**	The existing Model, described in the report titled "Groundwater Flow and Transport Model" dated October 1, 2007, was updated in 2009 in order to develop protective water levels, and to evaluate replenishment scenarios and develop answers to Basin management questions (Tasks I.3.a.2 and I.3.a.3). The scope and budget in 2014 for again updating the Model included the following: Step1: Update the model and check its accuracy - $10,000 Step 2: Recalibrate the model - $15,000 Step 3: Prepare report describing the work that was done - $5,000 Step 1 was completed in 2014 by incorporating recent pumping data, groundwater level data, and rainfall data, and then checking to see if the recently simulated groundwater levels match the recently measured groundwater levels. These are the principle findings and conclusions of this Step 1 work: • The model still provides reliable results in the Laguna Seca Subarea. • Although the performance of the model during the updated period is worsening, the calibration of the model remains within acceptable standards. • The northern boundary condition needs to be updated to reflect real groundwater elevation variations for the model period of 2005-2013. The behavior of the northern boundary will impact flows and the ability to calibrate the model for the area of the model that is adjacent to the northern boundary. An alternative method for defining this boundary condition will have to be developed that does not rely upon simulations from the Salinas Valley Integrated Groundwater Surface Water Model (SVIGSM). • The groundwater model should be updated in a maximum of five years and its calibration reevaluated at that time. However, if groundwater related projects are implemented in the Basin before that time, the update and calibration reevaluation may need to be performed sooner. Modeling of the Laguna Seca Subarea was performed in 2014 and a peer review of that work was performed in 2015. The peer review concluded that the model is a reasonable representation of the Seaside Basin groundwater flow system. No major errors in assumptions, data or results were identified during this peer review, and the simulated water levels generally matched observed water levels for the historical calibration simulation. The peer review recommended some aspects of the model should be explored to try to determine some differences between field-measured conditions and model-predicted conditions in some parts of the Basin, but stated that the model should be used for estimating the operational safe yield of the basin and subareas, and for simulating the effects of possible management measures. It also recommended that some additional simulations should be completed for management measures likely to be implemented. Therefore, Steps 2 and 3 will not be needed and no further work of this type is anticipated in 2017.

I. 3. a. 2 **Develop Protective Water Levels**	A series of cross-sectional models was created in 2009 in order to develop protective water levels for selected production wells, as well as for the Basin as a whole. This work is discussed in Hydrometrics' "Seaside Groundwater Basin Protective Water Elevations Technical Memorandum." In 2013 further work was started to refine these protective water levels, but it was found that the previously developed protective water levels were reasonable. Therefore, no further work of this type is anticipated.
I. 3. a. 3 **Evaluate Replenishment Scenarios and Develop Answers to Basin Management Questions**	In 2009 the updated Model was used to evaluate different scenarios to determine such things as the most effective methods of using supplemental water sources to replenish the Basin and/or to assess the impacts of pumping redistribution. This work is described in HydroMetrics' "Seaside Groundwater Basin Groundwater Model Report." In 2010, and again in 2013, HydroMetrics used the updated Model to develop answers to some questions associated with Basin management. Modeling performed in 2014, 2015, and 2016 led to the conclusion that groundwater levels in parts of the Laguna Seca Subarea will continue to fall even if all pumping within that subarea is discontinued, because of the influence of pumping from areas near to, but outside of, the Basin boundary. Additional modeling work may be performed in 2017 to further examine this situation.
I. 3. b. **Complete Preparation of Basin Management Action Plan**	The Watermaster's Consultant completed preparation of the Basin Management Action Plan (BMAP) in February 2009. The BMAP serves as the Watermaster's long-term seawater intrusion prevention plan. The Sections that are included in the BMAP are: Executive Summary Section 1 – Background and Purpose Section 2 – State of the Seaside Groundwater Basin Section 3 – Supplemental Water Supplies Section 4 –Groundwater Management Actions Section 5 – Recommended Management Strategies Section 6 – References The only work which may be performed on the BMAP in 2017 is discussed under Task I. 3. c.
I. 3. c. **Refine and/or Update the Basin Management Action Plan**	During 2017 it may be beneficial to update the BMAP based on new data, and/or knowledge that is gained from the work described under Task I. 3. a. 3. Such work might involve issues pertaining to Operational and Natural Safe Yields or pumping redistribution strategies. Updating the BMAP has been scheduled and budgeted in several of the preceding years, but was not deemed to be necessary. This task is included primarily for budgeting purposes in the event such work is deemed necessary during 2017.
I. 3. d. **Evaluate Coastal Wells for Cross-Aquifer Contamination Potential**	If seawater intrusion were to reach any of the coastal wells in any aquifer, and if a well was constructed without proper seals to prevent cross-aquifer communication, or if deterioration of the well had compromised these seals, it would be possible for the intrusion to flow from one aquifer to another. An evaluation of this was completed in 2012 and is described in MPWMD's Memorandum titled "Summary of Seaside Groundwater Basin Cross-Aquifer Contamination Wells Investigation Process and Conclusions" dated August 8, 2012. This Memorandum did not recommend performing any further work on this matter at this time, other than to incorporate into the Watermaster's Database data from wells that were newly identified by the work performed in 2012. That data has now been incorporated into the Database, and no further work on this matter is anticipated.
I. 4 Seawater Intrusion Response Plan (formerly referred to as the Seawater Intrusion Contingency Plan)	
I. 4. a. **Oversight of Seawater Intrusion Detection and Tracking**	Consultants will provide general oversight over the Seawater Intrusion detection program under the other Tasks in this Work Plan.

I. 4. b. **Focused Hydrogeologic Evaluation**	MPWMD attempted to compile historical and current water quality data in the coastal area to provide more in-depth evaluation of conditions in the shallow Dune Sand/Aromas Sand aquifer in the vicinity of the Sand City Public Works well, where unique water quality conditions and variability have recently been observed as discussed at TAC meetings. However, it was found that no historical water quality data from Cal Am's now-abandoned wells existed, and consequently it was not possible to answer the question of why water quality in the Sand City Public Works well differs from water quality in other wells in the Basin. The Sand City desalination plant could be affecting water quality in this area, but without the prior water quality data from now-abandoned wells, this could not be determined. The results of this work were summarized in 2013 in a brief Technical Memorandum prepared by MPWMD with conclusions and recommendations, and no further work on this matter is planned.
I. 4. c. **Annual Report- Seawater Intrusion Analysis**	At the end of each water year, a Consultant 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 **Complete Preparation of Seawater Intrusion Response Plan**	The Watermaster's Consultant (HydroMetrics) completed preparation of the long-tem Seawater Intrusion Response Plans (SIRP) in February 2009. The Sections that are included in the SIRP are: Section 1 – Background and Purpose Section 2 – Consistency with Other Documents Section 3 – Seawater Intrusion Indicators and Triggers Section 4 –Seawater Intrusion Contingency Actions Section 5 - References No further work on the SIRP is anticipated in 2017.
I. 4. e. **Refine and/or Update the Seawater Intrusion Response Plan**	At the beginning of 2009 it was thought that it might be beneficial or necessary to perform work to refine the SIRP and/or to update it based on new data or knowledge that was gained subsequent to the preparation of the SIRP. However, this did not prove to be necessary, and no further work of this type is anticipated in 2017.
I. 4. f. **If Seawater Intrusion is Determined to be Occurring, Implement Contingency Response Plan**	The SIRP will be implemented if seawater intrusion, as defined in the Plan, is determined by the Watermaster to be occurring.

ATTACHMENT 10

DISCUSSION PAPER
ON
CITY OF SAND CITY
PUBLIC WORKS WELL

DISCUSSION PAPER ON CITY OF SAND CITY PUBLIC WORKS WELL

The 2012 Annual Report introduced the issue of anomalies in water quality data for the Sand City Public Works Well and contains this section discussing it:
Management and Monitoring Program Work Plan The Management and Monitoring Program Compiling historical and current water quality data in the coastal area to provide more in-depth evaluation of conditions in the shallow Dune Sand/Aromas Sand aquifer in the vicinity of the Sand City Public Works well, where unique water quality conditions and variability have recently been observed as discussed at TAC meetings. This work is under Task I.4.b.

The 2013 Annual Report continued discussion of this issue and contains this section discussing it:
Investigation into Water Quality Anomalies at the City of Sand City Public Works Well Under Task I.4.b in the 2013 M&MP, MPWMD was to undertake a "Focused Hydrogeologic Evaluation" of the Sand City Public Works well. This work was envisioned as consisting of compiling historical and current water quality data in the coastal area to provide more in-depth evaluation of conditions in the shallow Dune Sand/Aromas Sand aquifer in the vicinity of the Sand City Public Works well, where unique water quality conditions and variability have recently been observed. The results of this evaluation were to be summarized in a brief Technical Memorandum with conclusions and recommendations.

MPWMD started this work in 2013 but after an exhaustive search, including inquiries to California American Water who at one time had wells in this area (these have all since been abandoned), was only able to locate a very small amount of historical water quality data that could be used to perform the evaluation. Therefore, it was not possible to definitively determine the cause of the water quality anomalies. However, the numerous reports that are cited in the Technical Memorandum indicate that other wells perforated in this shallow dune formation had experienced unusual variations in water quality for many years dating back into the 1960s, presumably due to seawater intrusion into this shallow formation.

The Watermaster will continue performing sampling of this well at the increased (quarterly) frequency that was initiated in 2012 in order to identify any water quality trends at this well. The Technical Memorandum summarizing the work that MPWMD performed is contained in Attachment 14. (Note: Attachment 14 is attached to this Agenda Transmittal).

The 2014 Annual Report continued discussion on this topic and contains this section discussing it:
Investigation into Water Quality Anomalies at the City of Sand City Public Works Well. Under Task I.4.b in the 2013 M&MP, MPWMD was to undertake a "Focused Hydrogeologic Evaluation" of the Sand City Public Works well. This work was envisioned as consisting of compiling historical and current water quality data in the coastal area to provide more in-depth evaluation of conditions in the shallow Dune Sand/Aromas Sand aquifer in the vicinity of the Sand City Public Works well, where unique water quality conditions and variability have recently been observed. However, after an exhaustive search, including inquiries to California American Water who at one time had wells in this area (these have all since been abandoned), MPWMD was only able to locate a very small amount of historical water quality data that could be used to perform the evaluation. Therefore, it was not possible to definitively determine the cause of the water quality anomalies. The Technical Memorandum summarizing the work that MPWMD performed was contained in Attachment 14 of the 2013 Annual Report. The Watermaster will continue performing sampling of this well at the increased (quarterly) frequency that was initiated in 2012 in order to identify any water quality trends at this well.

The 2015 Annual Report continued discussion on this topic and contains this section discussing it:
No modifications to the quarterly data collection frequency from the enhanced network of monitoring wells were made during WY 2015 and none are being proposed for WY 2016.

The 2015 SIAR contains these statements on this topic:

The Sand City's Public Works Corp Yard production well Piper diagram shows that its cations, namely calcium, sodium, and potassium, vary while the anions remain more stable (Appendix A: Figure A-23). Initially, it was thought this well's chemistry was evolving over time, but now after multiple years of monitoring, it appears that the relative percentage of cations varies between fixed points and is not evolving in one direction only. The source of this variance is not seawater because it does not follow the pattern depicted on Figure 4 and Figure 5. Note: Figure A-23 is shown below.

The York School production well, in the Laguna Seca subarea, and Sand City's Public Works Corp Yard production well, in the Southern Coastal subarea both have Stiff diagrams different from most other wells' water quality (Figure 18). Although the shapes are different, they do not display the large chloride spike associated with seawater intrusion as shown on Figure 7. None of the production wells analyzed using Stiff and Piper diagrams show an indication of seawater intrusion.

The complete set of chemographs is included in Appendix B. This year, the Sand City Public Works Corp. Yard well has been included in Appendix B (Figure B-23) because even though it is not a dedicated monitoring well, it is a well with the highest chloride concentrations in the basin and should be monitored closely, and compared with other nearby wells. Note: Figure B-23 is shown below.

The Sand City Public Works Corp. Yard well has had increasing chloride concentrations since last year. The most recent concentration of 345 mg/L is not as high as recorded historically, so the increase is within the range of fluctuations historically observed.

Sand City's Public Works Corp Yard well continues to be the only coastal well in the Southern Coastal subarea with measured chloride data, and has the highest concentration of all shallow wells (345 mg/L). Although this is an 83 mg/L increase over last year's concentration, it is still within the range of concentrations measured in the well since Water Year 2011 (Appendix B: Figure B-23). The Piper and Stiff diagrams, and sodium/chloride molar ratio for the well continue to suggest that the source of high chloride is not seawater.

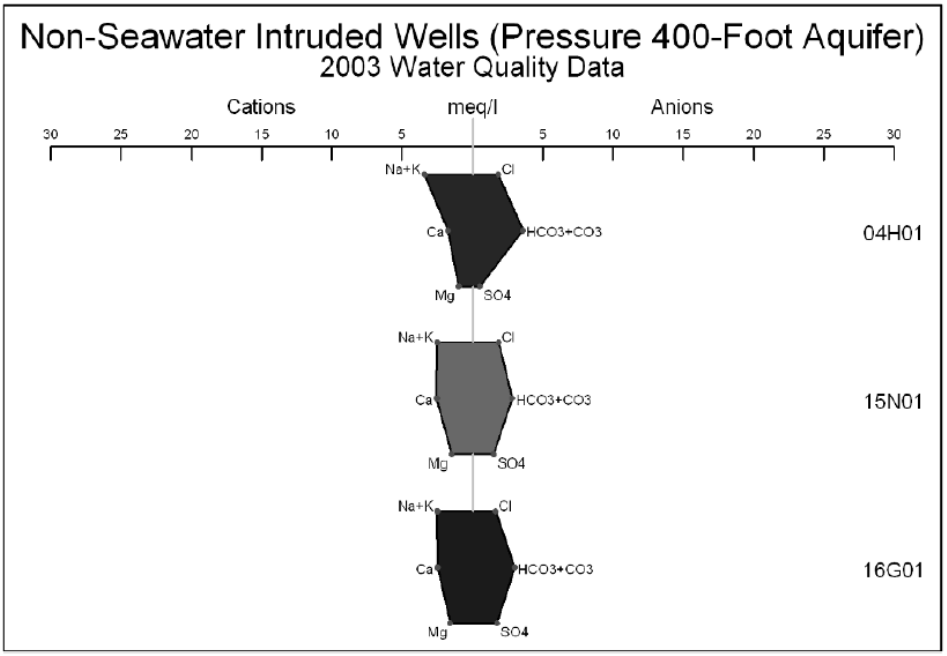

Figure 6: Stiff Diagrams from Salinas Valley Wells without Seawater Intrusion (Source: MWCRA)

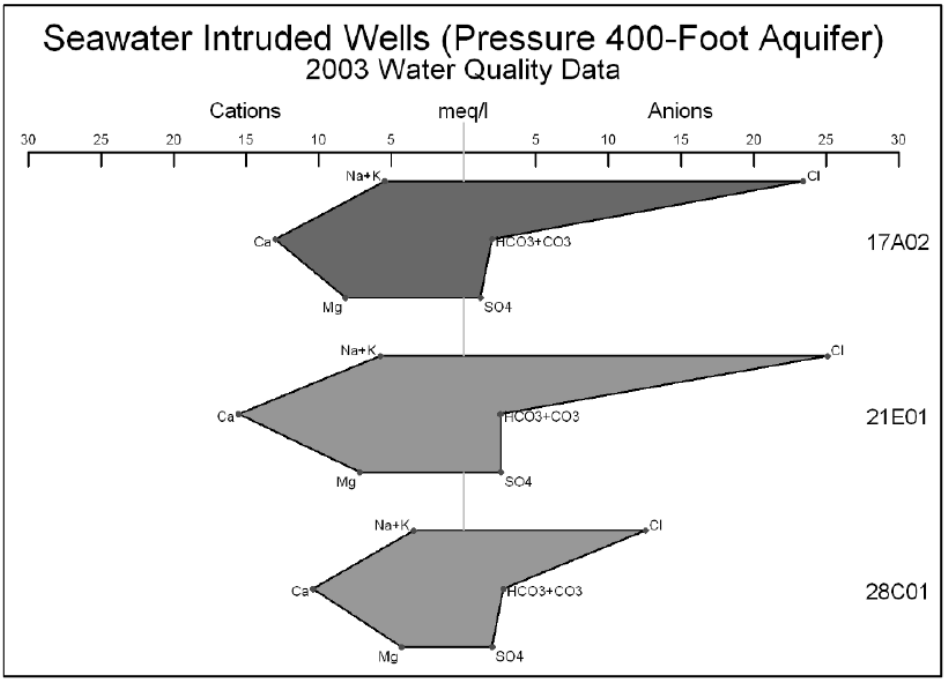

Figure 7: Stiff Diagrams from Salinas Valley Wells with Seawater Intrusion (Source: MWCRA)

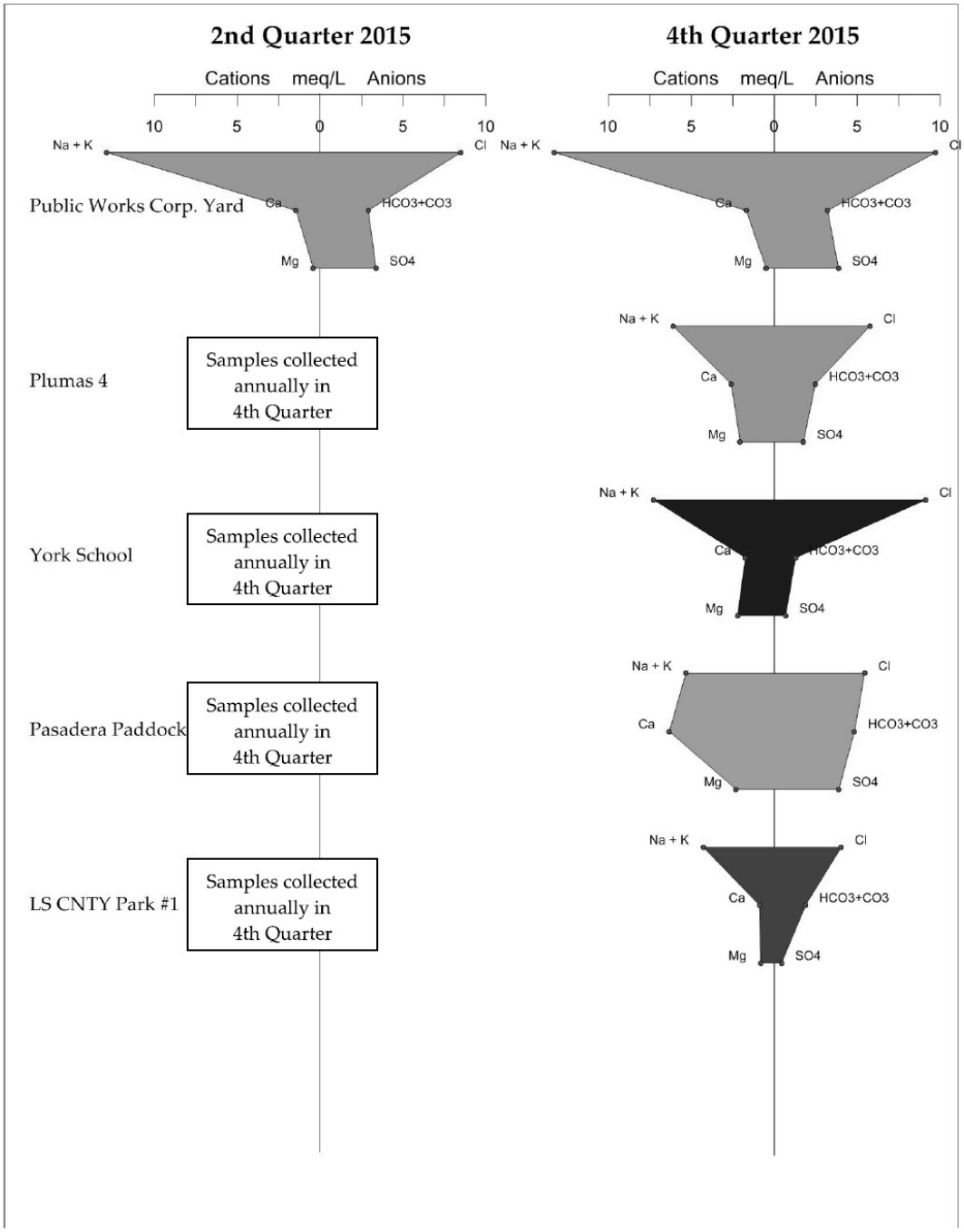

Figure 18: Stiff Diagrams for Southern Coastal and Inland Subarea Production Wells (Data source: Watermaster)

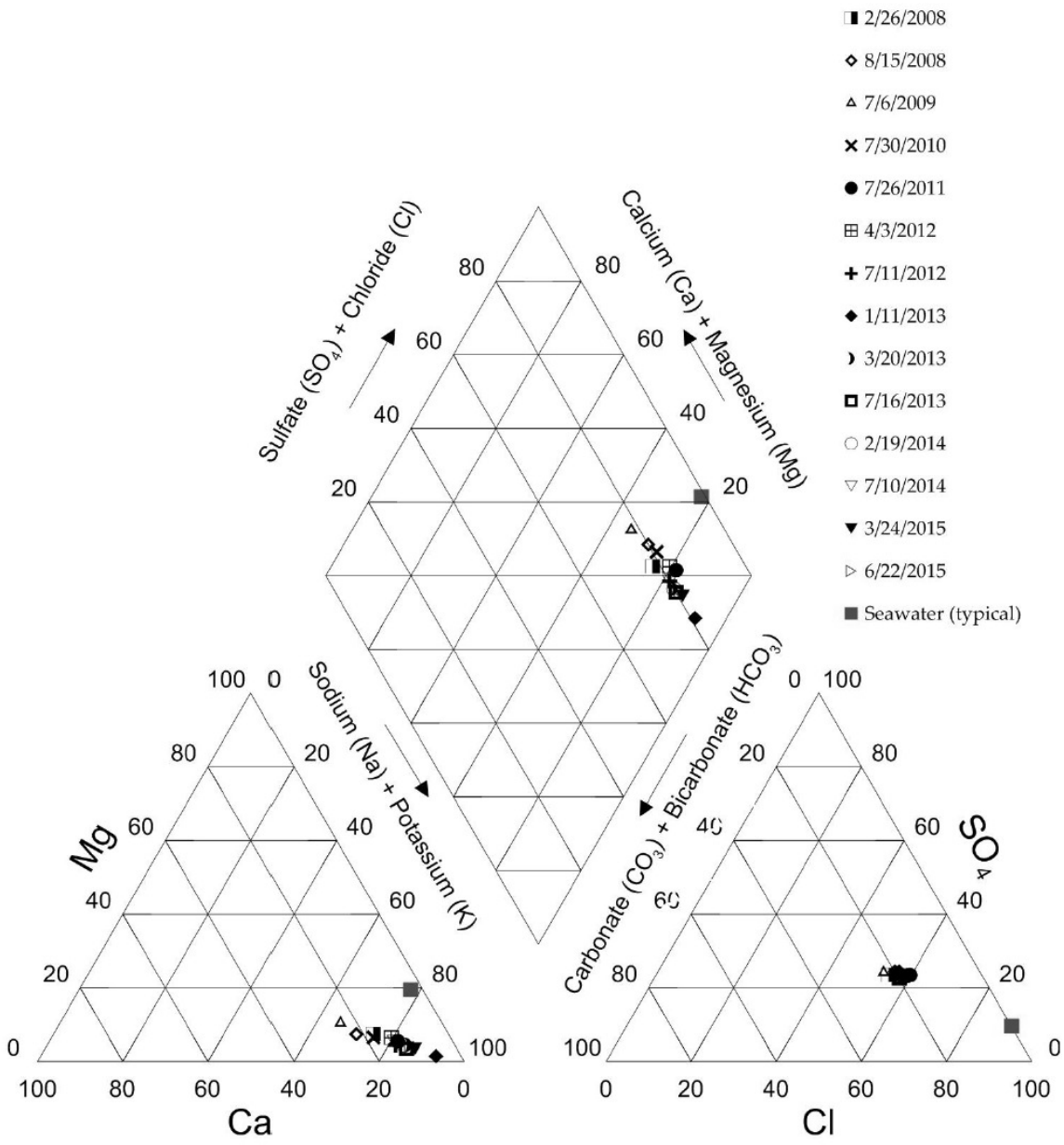

Figure A-23: Piper Diagram of Public Works Corp. Yard Production Well

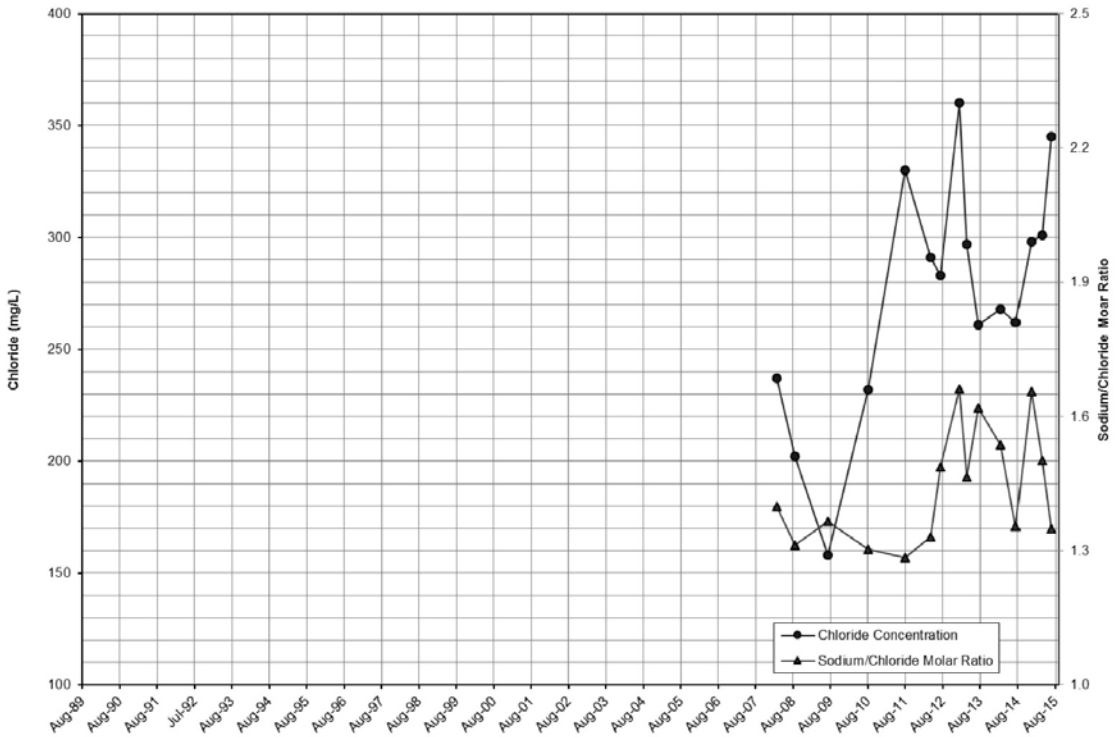

Figure B-23: Sand City Public Works Corp Yard Production Well

Below is Water Quality data from the Sand City Public Works Well, taken from the indicated Annual Reports:

2013 Annual Report

Well No. 165 Sand City Corp Yard

	Major Cations				Major Anions					Minor Ions					Physical		
	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
07/16/2013	34	274	6	5.1	157	133	3.5	261	31	<0.01	0.025	<0.1	1.17	0.7	7.4	860	1475
03/20/2013	33	282	8	4.9		157	3.6	297	17	<10	0.026	<0.1	1.33	0.7	7.5	957	1630
01/11/2013	23	388	2	4.6		200	5.3	360	4	<10	0.039	<0.1	1.91	0.8	7.9	1117	1930

2014 Annual Report

Sand City Corp Yard **WM No. 165**

		Major Cations				Major Anions					Minor Ions					Physical		
SPL Id.	Date	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
AB17763	7/10/14	34	230	7	5	160	142	3.4	262	27	<0.010	0.028	<0.1	0.99	0.6	7.4	857	1519
AB11890	2/19/14	34	267	7	5.3	156	138	3.4	268	30	<0.01	0.019	<0.1	1.07	0.4	7.5	868	1515

2015 Annual Report

Well No. 165 Sand City Corp Yard

	Major Cations				Major Anions					Minor Ions					Physical		
	Ca^+	Na^+	Mg^+	K^+	HCO_3^-	SO_4^-	F^-	Cl^-	NO_3^-	Fe^{2+}	Mn^{2+}	HPO_4^-	B	Br^-	pH	TDS	EC (us/cm)
10/06/2015	21	372	2	4.2	212	193	6.6	363	<1	<0.010	0.05	<0.1	1.75	0.9	7.9	1086	1946
06/22/2015	34	302	6	5.1	196	186	5.5	345	10	<0.010	0.031	<0.1	1.31	0.9	7.9	1040	1834
03/24/2015	29	293	5	4.5	177	162	4.4	301	20	0.011	0.025	<0.1	1.2	0.8	7.4	960	1652
12/10/2014	30	320	5	4.8	179	150	4.5	298	18	<0.010	0.034	<0.1	1.38	1.0	7.8	948	1664

ATTACHMENT 14
(From the 2013 Annual Report)

TECHNICAL MEMORANDUM REGARDING INVESTIGATION OF WATER QUALITY ANOMALIES AT THE CITY OF SAND CITY PUBLIC WORKS WELL

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

SEASIDE BASIN WATERMASTER MEMORANDUM 2013-03

Date: **November 25, 2013**
To: **Seaside Basin Watermaster**
From: **Joe Oliver, PG, CHg, Water Resources Division Manager**
Jonathan Lear, PG, CHg, Senior Hydrogeologist

Subject: **Focused Hydrogeologic Evaluation with Emphasis on Water Quality at the Sand City Corporation Yard Well in relation to Historical Water Quality of the Shallow Aquifer System in an area of the Southern Coastal Subarea of the Seaside Basin**

SUMMARY

The Seaside Basin Watermaster, through its Technical Advisory Committee (TAC) has requested that the Monterey Peninsula Water Management District (MPWMD) conduct a focused evaluation on water quality of the Sand City Public Works Corporation Yard well (Public Works well) in relation to historical water-quality conditions in the shallow aquifer system of the Seaside Groundwater Basin in the vicinity of the Public Works well, as part of the MPWMD's work on the Seaside Basin Monitoring & Management Program (MMP) in 2013. This memorandum summarizes that effort.

BACKGROUND

Results from the routine annual water-quality sampling of the Public Works well were discussed in the Watermaster's 2011 Seawater Intrusion Analysis Report (SIAR).[1] The 2011 SIAR recommended re-sampling of the Public Works well to confirm the Chloride concentration measured at 330 milligrams per liter (mg/L) in the annual sample collected in July 2011. As part of the Monterey County Superior Court's review and approval of the Watermaster's 2011 Annual Report, which incorporated the SIAR, presiding Judge Randall directed the Watermaster to provide the Court with the results of the re-sampling of the Public Works well.[2] At the May 9, 2012 TAC meeting, MPWMD provided an update report to discuss the water-quality fluctuations that had been observed at the Public Works well. The Watermaster subsequently provided a response to the judge's Minute Order[3], which included the historical water-quality data collected to-date from the well by the Watermaster. In that response, it was indicated that the Watermaster would in the future continue to track the water quality from this well for seasonal variations and long-term trends.

[1] HydroMetrics, November 2011. Water Year 2011 Seawater Intrusion Analysis Report, see pages 2, 24 and 59.
[2] Monterey County Superior Court Minute Order, filed March 7, 2012.
[3] Notice of Filing of Watermaster Response to March 7, 2012 Minute Order, filed August 7, 2012.

HYDROGEOLOGIC SETTING

The Public Works well is located in the southern coastal subarea of the Seaside Groundwater Basin, as depicted in the general Seaside Basin location map (**Figure 1**). Other former and existing wells within the southern coastal subarea are shown in **Figure 2.** The southern coastal subarea is bounded to the south along the trace of the Chupines Fault system, where the relatively impermeable shales of the Monterey Formation are uplifted to near sea level. A hydrogeologic boundary created by the Laguna Seca Anticline generally separates the northern and southern parts of the basin, and in the southern coastal subarea this plunging anticline feature merges with the Seaside Fault. The two primary aquifers in this part of the basin are the Paso Robles and Santa Margarita aquifers. The Public Works well is completed in the Recent Dune Sand / Aromas Sand Formation, which is collectively described herein as the "shallow aquifer system". This shallow aquifer system is situated stratigraphically above the Paso Robles and Santa Margarita aquifers. Due to faulting and erosion, the occurrence and significance of both the Paso Robles and Santa Margarita aquifers is considerably less than in the northern coastal subarea, where most of Cal-Am's Seaside production wells are located. Near the coast, a continuous clay layer has been mapped between the shallow aquifer system and the deeper Paso Robles and Santa Margarita aquifers, as depicted in the cross section from a previous hydrogeologic investigation report, which is shown as **Figure 3** for illustration purposes. The inferred thicknesses of the Paso Robles and Santa Margarita aquifer sediments at this location is approximately 100 feet and 50 feet, respectively, compared to at least 300 feet and 200 feet of thickness for these units throughout much of the northern coastal and northern inland subareas of the basin. Saturation within the shallow aquifer system is restricted to a relatively narrow strip of land along the coastline.

HISTORICAL GROUNDWATER QUALITY IN VICINITY OF PUBLIC WORKS WELL

As part of this investigation, a detailed search of available well records and reports was made in an attempt to locate historical water-quality data from this area of the basin. Based on this search, it was concluded that historical groundwater-quality availability from wells completed in the shallow aquifer system in the coastal area of the basin is sparse. Nonetheless, where references were made to coastal groundwater quality or where such data were included in the historical documents that were found, that information is summarized briefly below in chronological order of the dates of the documents that were reviewed.

California Department of Water Resources, 1974. ***Zone 11 Investigation, Carmel Valley and Seaside Ground Water Basins, Monterey County*****, July 1974.**

On page 16, the Seaside area stratigraphy is described as consisting of two aquifers: the recent sand dune deposits near the coast are characterized as a "minor aquifer", and the "main aquifer" that underlies the sand dune deposits and is equivalent to the Paso Robles Formation to the east and the Aromas Formation to the north. Also on page 16, there is a discussion of water quality that states:

> "The Orange well had a good yield from this upper aquifer, but the aquifer is open to sea water intrusion, and when heavily pumped, the salinity in the Orange and Monte wells tends to increase noticeably. Since the Elm and Playa wells are also open to this aquifer, they could have the same problem."

In addition, there is a brief discussion of sea-water intrusion in the Seaside area on page 17 of this report. This discussion includes:

> "The minor aquifer is subject to sea water intrusion as shown particularly by the Orange and Monte wells. The Elm and Playa wells, located farther from the bay, have not given such evidence of sea water intrusion."

Unfortunately, there are no water-chemistry data that were included with this report.

California Department of Water Resources, 1975. Sea-Water Intrusion in California, Inventory of Coastal Ground Water Basins. DWR Bulletin 63-5, October 1975.

This DWR report includes descriptions regarding the status of sea-water intrusion in various coastal basins throughout the state. In the Monterey Peninsula area, this included the basin listed as "Basin 150" (page 190), that is shown on Figure 21 of the report as spanning the coastline roughly from Monterey up through former Fort Ord. On Figure 21 of the report, this basin is described as "Chlorides Exceed 100 ppm" based on data collected from 1970-71. The figure is shown as **Figure 4** of this memorandum. In the description on page 190 of the report, seawater intrusion is discussed as follows:

> "Several local areas of high mineral concentrations found in the Monterey area near the coast during the summer of 1953 probably represent the natural quality of available ground water. Near Seaside, chloride concentrations ranging from 69 to 204 ppm are found in an area of about 4 square miles, extending 3 miles inland. The condition represents available native ground water."

One water-quality analysis from a well in the Sand City area is included in Table 85 (page 192) of this report. This well, listed as "15S/01E-22C1", is shown in Table 1 of the Staal, Gardner & Dunne, Inc. (SGD, 1997) coastal Seaside hydrogeologic assessment report as the "AMFAC" well in Sand City, however, no depth or aquifer completion data are available for this well. This well is located approximately 3,000 feet northwest of the Public Works well on the north side of the Seaside Fault. Notes regarding this well in MPWMD files indicate the well was drilled in 1944 or 1945, has no well construction log, had several water-quality samples analyzed by California Water and Telephone Company in 1955-56, and was being used to supply water to several nearby businesses in Sand City in 1981. Even though the aquifer completion of this well is not known, this well appears to have the most historical water-quality data available in the Sand City area. Accordingly, the water-quality analyses that could be located for this well and for other wells in the Sand City vicinity both from this report and other DWR annual reports are provided in **Table 1** of this memorandum for historical reference. As shown in **Table 1**, the chloride concentration at the AMFAC well ranged from 114 to 128 mg/L from 1962 to 1968.

Muir, K.S., 1977. ***Initial Assessment of the Ground-Water Resources in the Monterey Bay Region, California.*** **US Geological Survey Water-Resources Investigations 77-46.**

On page 26 of this report, the "Carmel Subbasin" is described as being comprised of two groundwater systems; one is in the Carmel Valley, and the other is in the Canyon Del Rey area. The boundary of the Canyon Del Rey groundwater system is shown here as **Figure 5**; this boundary is generally similar to the current depiction of the Seaside Basin boundary shown in **Figure 1**. On page 28 of this report under "Ground-Water Quality", it is stated

> "Seawater intrusion occurs in the Canyon Del Rey area. At the present time (1977) the intrusion seems to be limited, and it affects only those wells that pump from the sand dune deposits near Monterey Bay."

Presumably this reference to seawater intrusion reflects earlier discussion in the 1974 DWR Zone 11 investigation described above. Unfortunately there are no water-chemistry results included as part of this report.

Logan, J., 1982. ***Hydrogeology of the Seaside Area*****, June 1982. Unpublished report prepared for MPWMD.**

This report provides a detailed water-chemistry section that indicates 318 chemical analyses were reviewed as part of the analysis. The raw data for these chemical analyses are not included with the report. As discussed on page 35 of the report, some of these analyses were plotted for comparison on a geochemical diagram in Figure 44 of the report. In that figure, it is noted that 13 chemical analyses were available for the Cal-Am "Orange" well, and the author on page 35 interpreted from Figure 44 that the Orange well "contained water having a chloride content of nearly 60 percent and with the highest concentration (T = 13) of any of the waters studied".

Muir, K.S., 1982. ***Ground Water in the Seaside Area, Monterey County, California.*** **US Geological Survey Water-Resources Investigations 82-10.**

A discussion regarding the "paucity of water quality data" of wells situated adjacent to Monterey Bay in the Seaside Basin is provided on page 30 of this report. This discussion includes:

> "The limited water-quality data collected in September 1980 (table 6) and those shown in figure 10 indicate that there has been no general seawater intrusion in the Seaside area. The depth of wells sampled in September ranged from about 60 ft to more than 600 ft, and their pumping water levels were all below sea level. Well 15S/1E-21 H1 is the only well sampled that had water with a relatively high chloride concentration – 700 mg/L. This 70-foot-deep well is located in the sand dunes within a few hundred yards of Monterey Bay and has always had water with a high chloride concentration. In 1969, the chloride concentration was 1,600 mg/L, and in 1975 the chloride concentration was 1,090 mg/L."

MPWMD records show that Well 21H1 was completed for the Seaside Sanitary District in 1969. It is our understanding that the well was used for chlorine control of effluent as part of the

wastewater treatment operations at that plant that was later taken over by the Monterey Regional Water Pollution Control Agency until the plant shut down when the regional treatment plant took over treatment of wastewater from the service area of the former Seaside plant. The depth of this well shown on DWR Drillers Report No. 13348 is confirmed at 70 feet, which is within the shallow aquifer system. The location of Well 21H1 is approximately 950 feet from the Public Works well. It is unknown if this well still exists.

Table 6 of the 1982 Muir report provides several water-quality results from wells in the Seaside area; however, there are no complete general mineral water-quality data from wells in the vicinity of the Public Works well in this table or elsewhere in the report. Figure 10 of the 1982 Muir report shows plots of chloride concentration from selected Seaside area wells. Included in this graph, which is shown here as **Figure 6**, are plots for two nearby former Cal-Am wells, the "Elm" well (Well 15S/1E-21R1) and the "Orange" well (Well 15S/1E-21J1). The Elm and Orange wells are now abandoned and destroyed, but were located approximately 2,200 and 1,400 feet from the Public Works well, respectively. The Elm well plot showed chloride concentration in the 160 to 200 milligrams per liter (mg/L) range with no clear trend for the period from 1966 to 1978. The Orange well plot, however, showed considerably more fluctuation in chloride concentration from less than 150 mg/L to greater than 550 mg/L during the record period from 1960 to 1977.

Staal, Gardner & Dunne, Inc., 1992. ***Feasibility Study, Saline Ground Water Intake Disposal System, Sand City, California.*** **Unpublished report prepared for MPWMD.**

The focus of this investigation was on the feasibility of developing the shallow aquifer system in the coastal part of Sand City for desalination plant source water and brine disposal. The report provided analysis of the shallow aquifer system's hydraulic characteristics, and also included water-quality data from one of the observation wells installed as part of the investigation. This well, OB-4, was located 160 feet from the shoreline at the end of Bay Avenue (approximately 1,130 feet from Public Works well). At this location adjacent to the coastline, the water quality in this 57-foot deep well (bottom elevation about -40 feet AMSL) was approximately 60% of typical Monterey Bay seawater (SGD, 1992, page 13). The chemical analysis of water from this well is shown in **Table 1**.

DISCUSSION OF HISTORICAL WATER PRODUCTION IN SAND CITY AREA

Only incomplete water production records are available for wells that are known to have historically produced water from the shallow aquifer system near the coast in the southern coastal subarea of the basin. Of those wells, the ones with the better production history are listed in **Table 2**. The earliest date that production data are available for these wells is 1966, which is the year that California American Water acquired one or more small water systems that had been operating in this area of the basin (one such system was known as the East Monterey Water Company). During the 11-year period from 1966 until 1977, when the last well production was recorded, a total of 2,830 acre-feet had reportedly been produced from these wells. The amount of pre-1966 production is unknown as these production records could not be located. Most of the available historical production (77%) occurred from the three closest wells to the Public Works well, i.e., the Orange, Monte and Elm wells. The locations of these three former

municipal water supply wells in relation to the Public Works well is shown here in **Figure 7**, which is from the 1982 Logan report prepared for MPWMD.

Based on the anecdotal evidence and minimal water-quality records as summarized from the reports described above, it is surmised that production from these wells was largely discontinued due to the poor quality of the water that resided in the shallow aquifer system, and was likely aggravated by overpumping that induced poorer water quality (i.e., seawater intrusion) locally into this system.[4] As part of this investigation, efforts were made to locate historical water quality for these wells from archived records on file at the MPWMD office and through requests made to Cal-Am staff. Despite these efforts, no historical water quality records could be located for any of the former shallow municipal production wells that existed in this area of the basin. These records were likely sent to archive storage at some point and subsequently destroyed. Without these historical water-quality data to review, it was not possible to definitively unravel what changes in water quality occurred as a result of past production practices, and how these antecedent conditions might be affecting current water quality in this area of the basin.

More recently, water is being produced from shallow wells located adjacent (i.e., approximately 220 to 280 feet) to the coastline as feedwater intake for the Sand City desalination plant. The plant began official production into the Cal-Am delivery system in WY 2010 (April 2010). Through WY 2013, approximately 750 AF of desalinated product water have been produced for Cal-Am system customers from the plant.

DISCUSSION OF PUBLIC WORKS WELL WATER QUALITY

Currently, the Public Works well is the only well sampled for water quality under the Watermaster's Monitoring and Management Program (MMP) that has casing perforations in the shallow aquifer system. All the other wells sampled as part of the MMP have completions in the Paso Robles, Santa Margarita, or Purisima formations, or in some cases more than one of these formations. The Public Works well (Well # 15S/01E/22Ed) was drilled by Dougherty Pump & Drilling in 1993 and is completed to a depth of 140 feet. Per the DWR log for this well, the screened interval from 50 to 140 feet straddles sand deposits attributable to the shallow aquifer system down to 96 feet, with sediments likely transitioning to the Paso Robles Formation below this depth down to 136 feet. The log indicates Monterey Shale at the bottom of the well. With the well's location 1,200 feet from the shoreline and its primary completion in the shallow aquifer system, hydrogeologic conditions do not prevent potential seawater intrusion under the right hydraulic conditions. Based on recent work conducted as part of the annual seawater analyses for the Watermaster, however, it does not appear that the recent water-quality fluctuations observed from the Public Works well are directly attributable to emerging seawater intrusion at this location. **Figure 8** shown here is from the WY 2012 Seawater Intrusion Analysis Report (HydroMetrics, 2012, Figure A-21) and while the data on this Piper diagram do indicate a change in water quality, this evolution currently does not appear to trend towards the seawater-quality endpoint. The Public Works well water chemistry results from samples collected since 2008 and shown in **Table 3** also suggest other factors besides typical emerging seawater intrusion may be influencing water quality at this location. In particular, the levels of

[4] This understanding is also based on the author's personal communications with a former Cal-Am operations engineer (G. Haas) who indicated that based on his review of well data in the 1990's, the water quality in this area of the basin was poor and of a very peculiar quality, but the specific nature of the water quality was not articulated at that time.

certain constituents, including nitrate, ammonia and fluoride are significantly out of range from other wells that are sampled for water quality under the MMP in the coastal area, and do not reflect values that would point to emerging seawater intrusion as the primary cause.

It is possible that groundwater flow dynamics associated with current operations at the Sand City desalination plant have set up a condition that is causing impaired water quality at the Public Works well due to: (1) influx of poor quality native water that has had a relatively long residence time attributable to slow movement due to low hydraulic gradients in the shallow aquifer system, (2) renewed circulation of non-native water from historical incursion of seawater into this area of the basin, or (3) some combination of both.

CONCLUSIONS

- Sparse historical groundwater-quality data are available from the southern coastal subarea of the Seaside Basin in the vicinity of the Public Works well.
- Groundwater was produced from several wells for municipal supply in this area of the basin for a known period from 1966 to 1977, and for an unknown period prior to 1966.
- Based on the historical reports that were reviewed and other anecdotal information, it appears that past groundwater production practices from this area of the basin contributed to local seawater intrusion prior to the time that use of those wells was discontinued.
- Due to the paucity of groundwater-quality data that could be discovered as part of this effort, it is not possible to estimate the extent or degree of historical seawater intrusion that has occurred in the southern coastal subarea of the basin, or the extent that these antecedent conditions may have contributed to current observed water-quality conditions at the Public Works well.

RECOMMENDATIONS

- Quarterly water-quality sample collection from the Public Works well should continue to develop a longer record of observed water-quality fluctuations at this well.

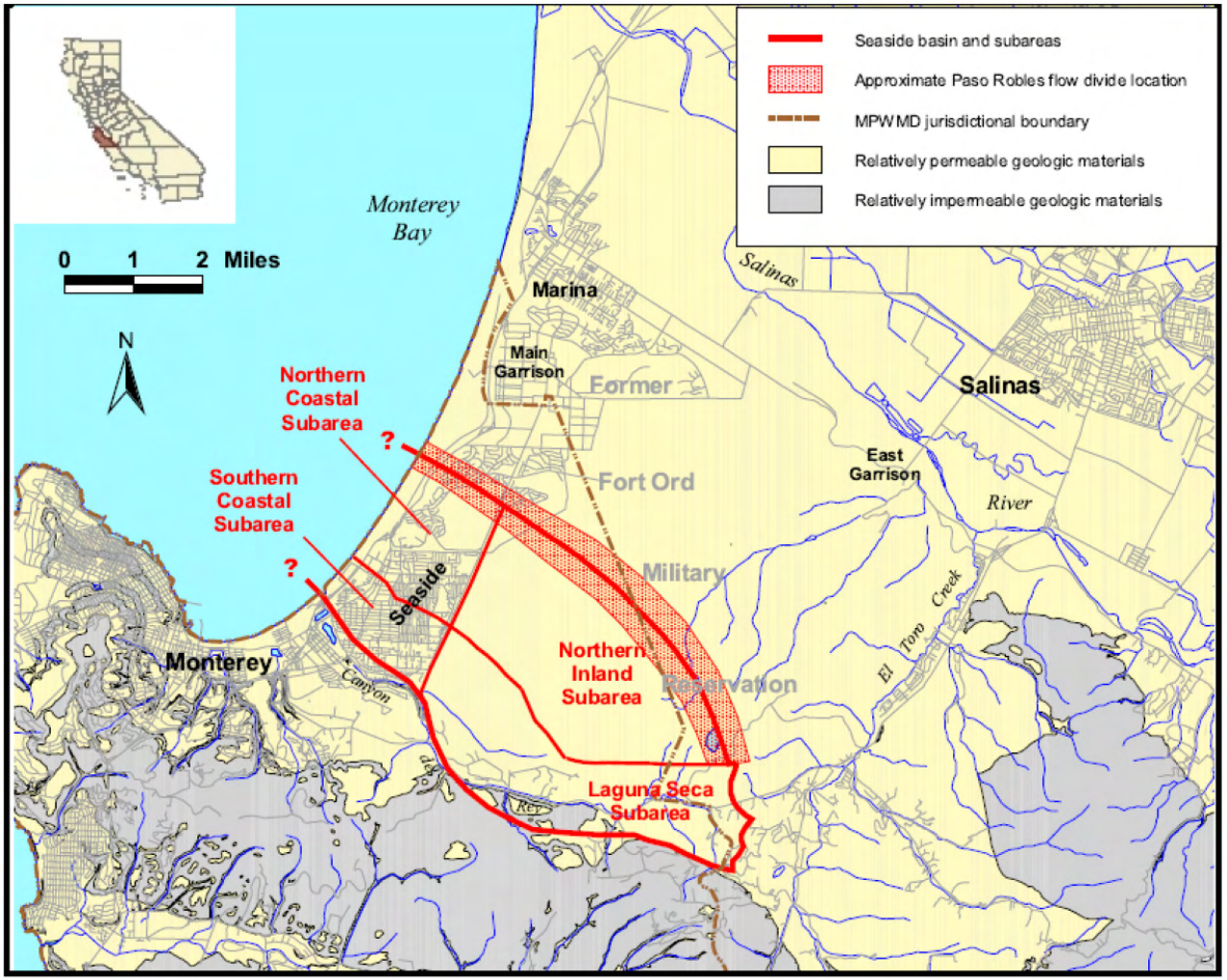

Figure 1. General location of Seaside Groundwater Basin and Basin Subareas (from Yates and others, 2005, Figure 1).

Figure 2. Map showing well locations in the Southern Coastal Subarea of the Seaside Basin.

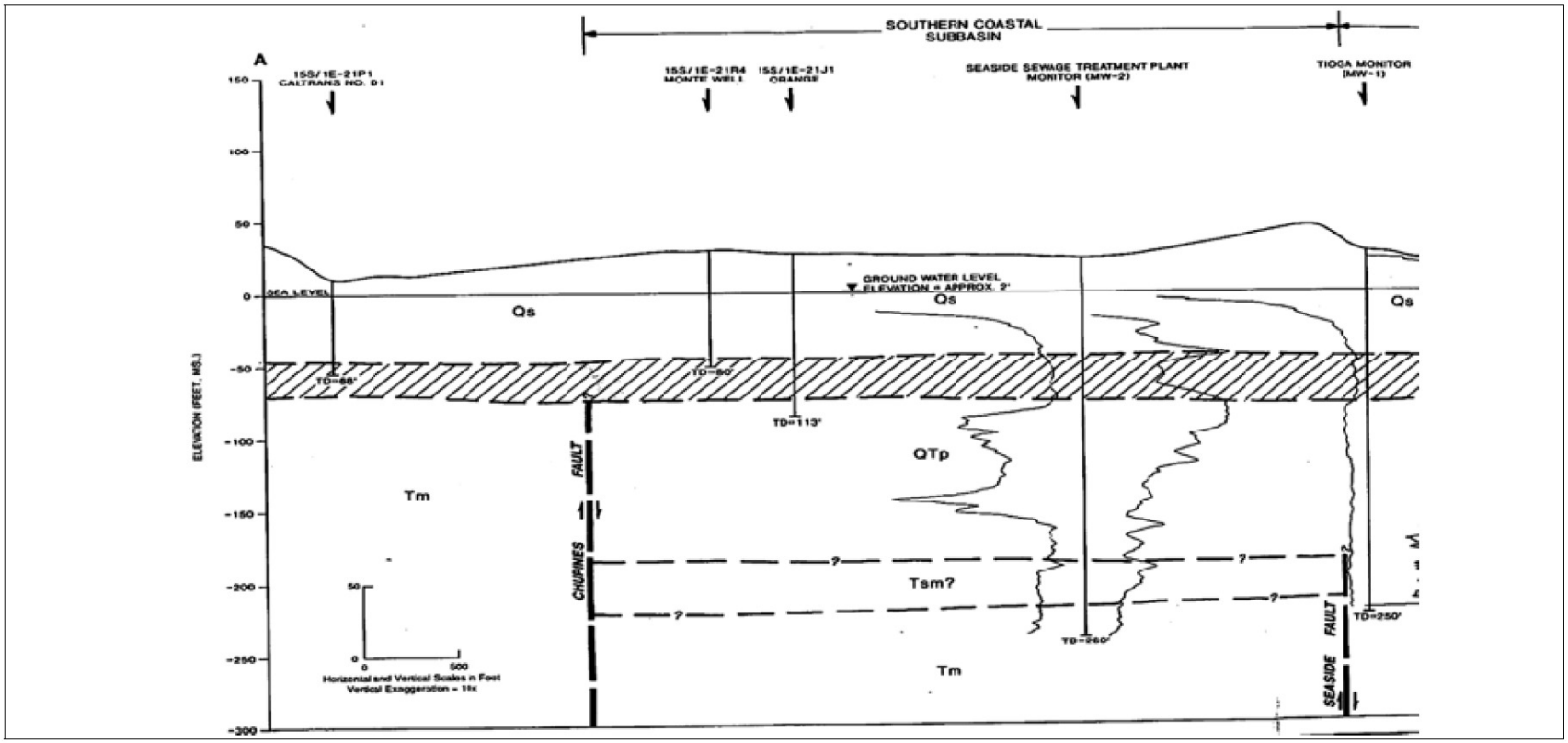

Figure 3. Part of hydrogeologic cross section parallel to shoreline in Southern Coastal Subarea of Seaside Basin (adapted from Staal, Gardner & Dunne, Inc., 1992, Plate 2). Shaded area denotes continuous clay layer.

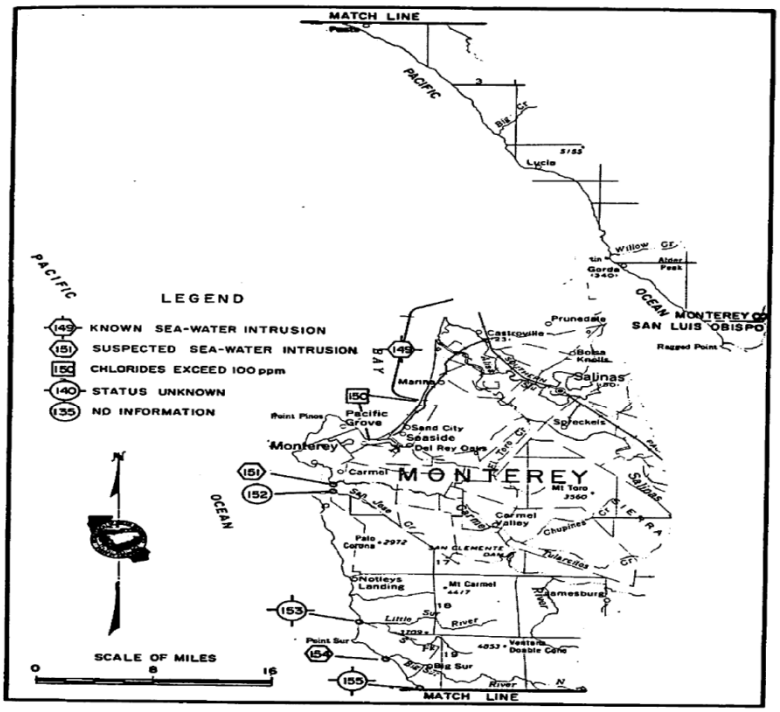

Figure 4. Status of Sea-Water Intrusion, Monterey County, 1970-71 (from DWR Bulletin 63-5, Figure 21).

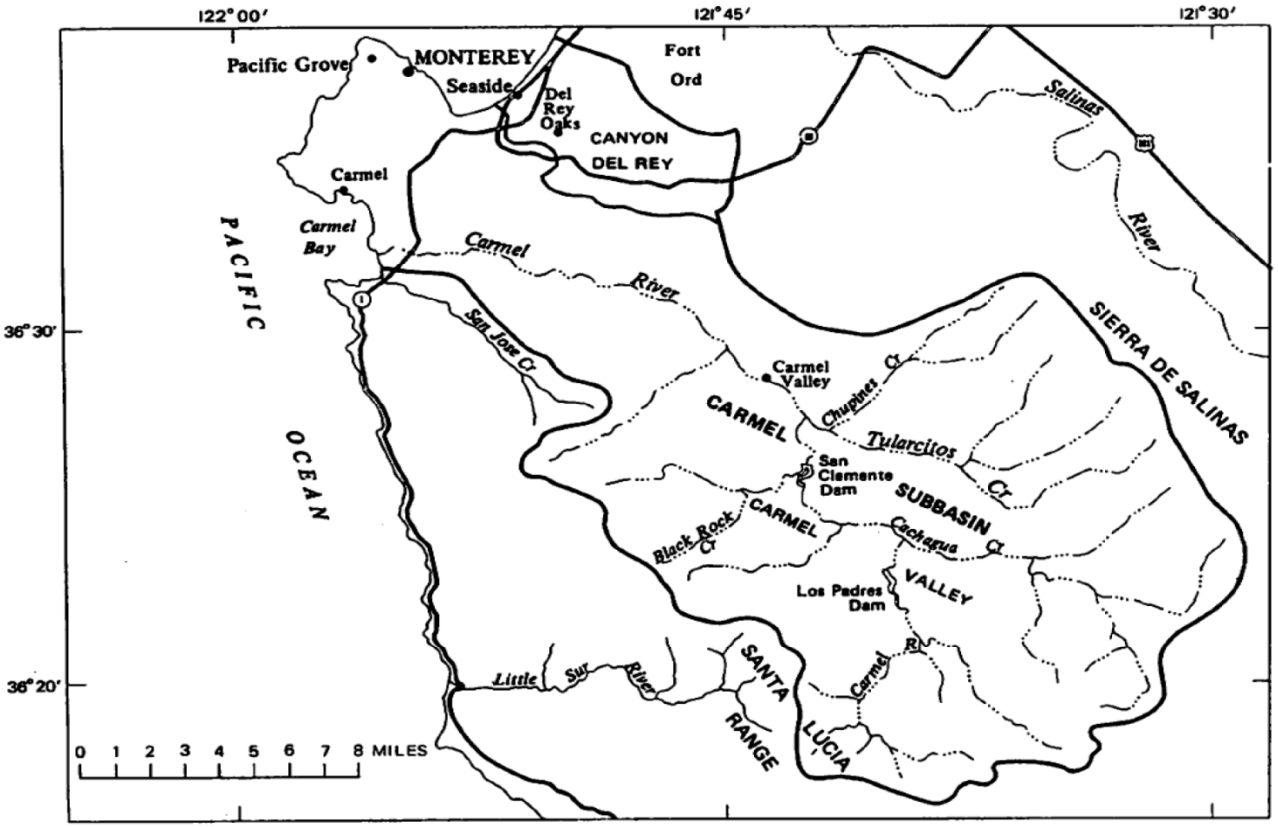

Figure 5. Carmel Subbasin (from Muir, 1977, Figure 5).

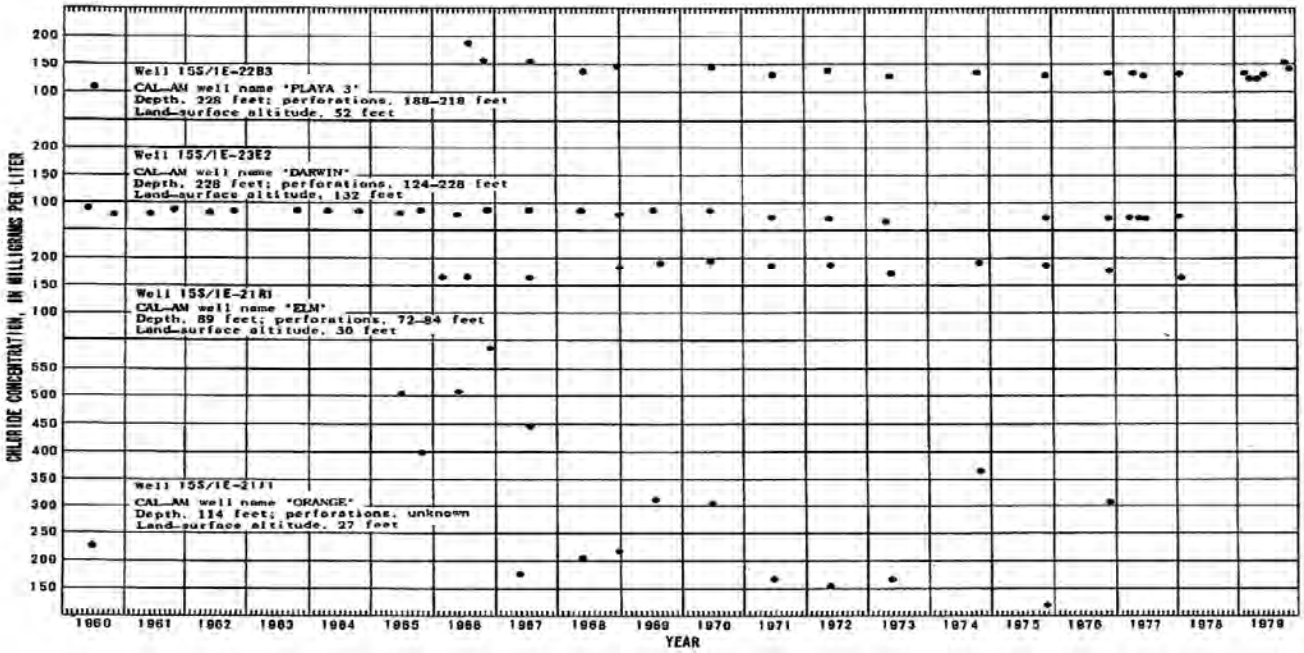

Figure 6. Chemograph showing chloride concentrations for selected wells the coastal subareas of the Seaside Basin (from Muir, 1982, Figure 10).

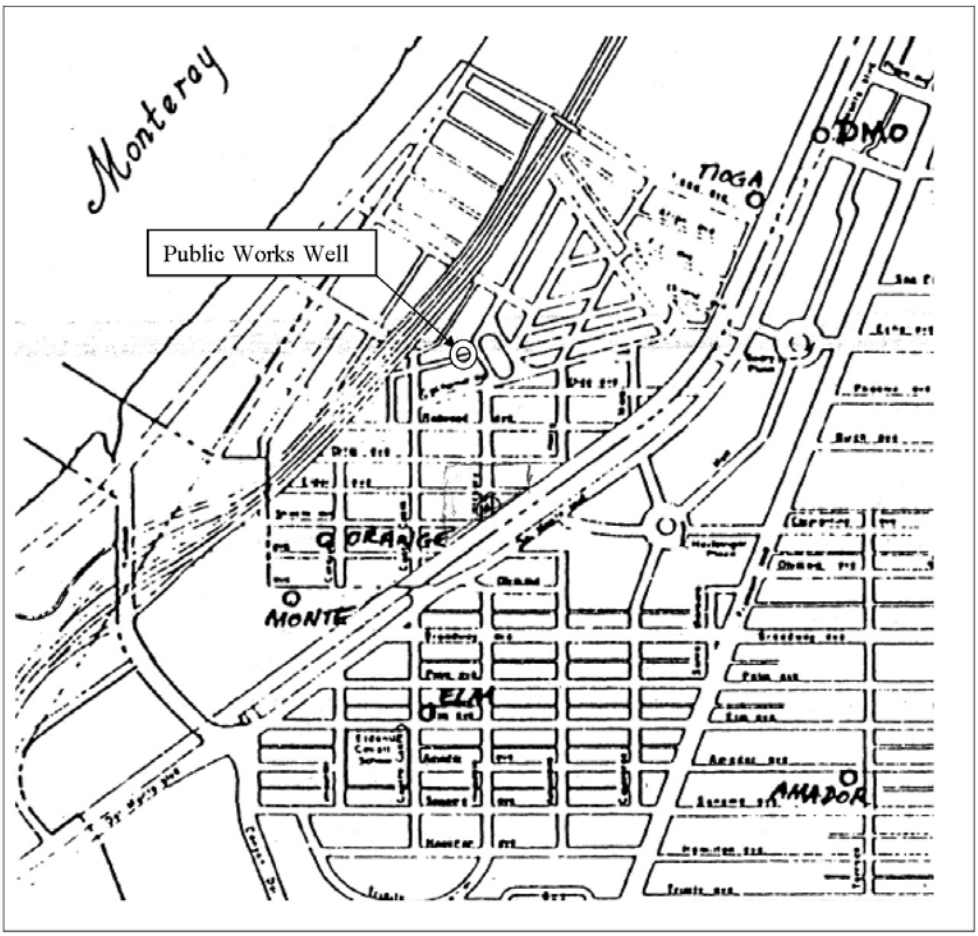

Figure 7. Portion of Seaside Basin coastal area showing older supply wells near Sand City Public Works Well (adapted from Logan, 1982, Figure 48).

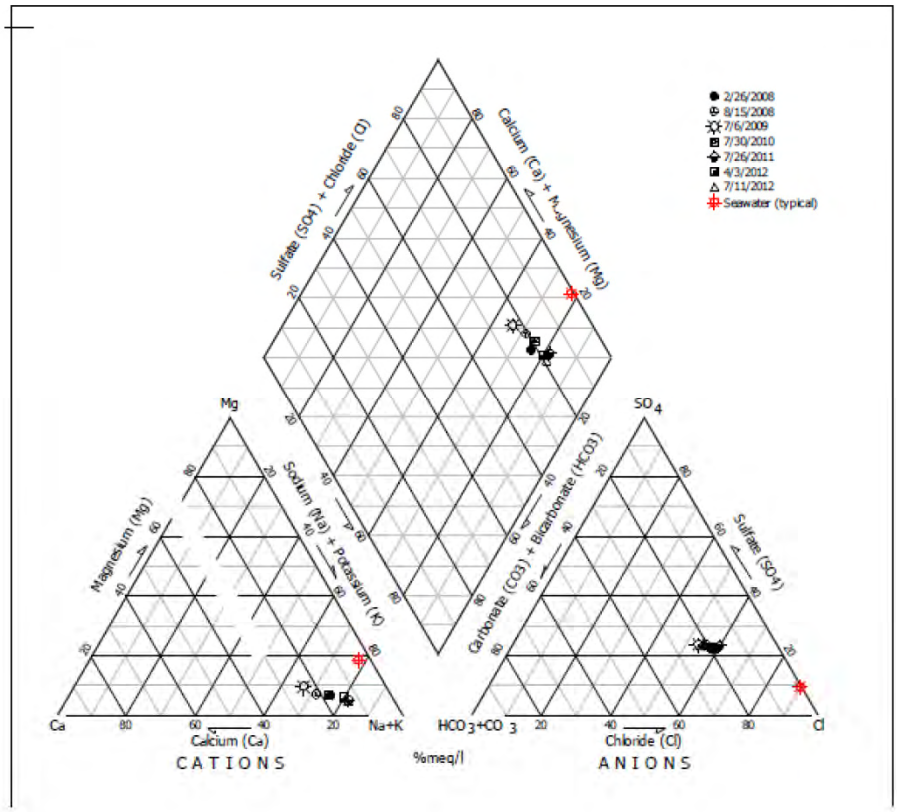

Figure 8. Piper Diagram of Public Works Well (from HydroMetrics, 2012, Appendix A, Figure A-21.

Table 1

GROUNDWATER-QUALITY ANALYTICAL RESULTS

Water Quality from Selected Locations in vicinity of Sand City
Well Results from Shallow Dune Sand Aquifer System

Units are milligrams per liter unless otherwise noted.

Water Quality Constituent	Data Source	Sample Date	Well Depth (feet)	Approx. dist. From Public Works well (feet)	Total Organic Carbon	Calcium	Sodium	Magnesium	Potassium	Bicarbonate	Sulfate	Chloride	Nitrate Nitrogen (as NO3)	Ammonia Nitrogen (as N)	Silica	Fluoride	Iron	Manga-nese	Orthophos-phate	Barium	Strontium	Boron	Bromide	Hardness (as CaC03)	Total Alkalinity (as CACO3)	pH	Specific Conductance (micromhos / cm)	Total Dissolved Solids
Drinking Water Standard(1)					NA	NA	NA	NA	NA		250 500 600 (3)	250 500 600 (3)	45	NA	NA	NA	0.3	0.05		NA	NA	NA	NA	NA	NA	NA	900 1600 2200 (2)	NA
Well Name and Number																												
AMFAC 15S/01E-22C1	1	7/11/1962		2800		49	75	19	2.8	165	54	114	8.5		35	0.2						0.1				8.2	705	438
AMFAC 15S/01E-22C1	2	8/17/1966		2800		53	79	23	3.4	196	67	120	7.3									0.1				8.2	849	504
AMFAC 15S/01E-22C1	1	8/29/1967		2800		67	85	24		190		128										0.2					877	
AMFAC 15S/01E-22C1	4	8/14/1968		2800			87			203		128	12											236		7.3	910	
Seaside Sanitary 15S/1E-21H1	5	10/31/1969	70	960		196		107		107		1600					<0.05							928	88	7.0	4000	
Seaside Sanitary 15S/1E-21H1	5	11/12/1975	70	960		132		89		151	220	1090					<0.01							700	124	6.7	3500	
MPWMD OB-4	6	7/13/1992	57	1130		384	7507	151	290	140	1429	11750	0.71		50	0.95	0.450	3.340		0.03	9.00		45			6.8	37500	20132
Calabrese - Tioga (WM#263)	7	9/25/1980	58	1860								130														7.9	981	
Miscellaneous Seawater Analyses																												
Typical Seawater	8					400	10500	1350	380	143	2712	19000					0.010					0.24					50000	34475
Typical Seawater	9					410	10500	1350	390	142	2700	19000			6	1.30	0.003	0.002		0.02	8.00	4.50	67					
Monterey Bay Seawater	10					400	10600	1270		140	2690	19000														7.5		34400

Chemical Analyses Data Sources:

1 California Department of Water Resources, 1965. *Hydrologic Data: 1963, Volume III: Central Coastal Area.* Bulletin 130-63. Table E-1.
2 California Department of Water Resources, 1968. *Hydrologic Data: 1966, Volume III: Central Coastal Area.* Bulletin 130-66. Table E-1.
3 California Department of Water Resources, 1969. *Hydrologic Data: 1967, Volume III: Central Coastal Area.* Bulletin 130-67. Table E-1.
4 California Department of Water Resources, 1975. *Sea-Water Intrusion in California, Inventory of Coastal Ground Water Basins.* Bulletin 63-5. Table 85, Page 192.
5 MPWMD record notes on DWR Log No. 13348, Seaside Sanitary District well.
6 SGD, 1992. *Feasibility Study, Saline Ground Water Intake/Disposal System, Sand City, California.* Appendix C.
7 MPWMD Well Record sheet for Well# 15S/01E/22Da. The well that this sample was collected from is the older of two wells at this location, known as the Calabrese "Dune well". Sample collected by K. Muir, USGS.
8 Atkinson, S.F. and others, 1986. *Salt Water Intrusion, Status and Potential in the Contiguous United States.* Lewis Publishers, Inc. Page 27.
9 Hem, 1985. Study and Interpretation of the chemical characteristics of natural water. USGS WSP 2254. Table 2, Page 7.
10 James M. Montgomery, 1992. MPWMD Desalination Preliminary Design, Final Report. March 1992. Table 2-2.

Table 2

Production Wells in Coastal Portion of Seaside Basin, Southern Coastal Subarea that Formerly Operated as Municipal Supply Wells

Well Name	Twp/Rng/Sec	Distance From Public Works Well (feet)	Drill Date	Well Depth (feet)	Test Pumping Rate (gpm)	Test Pumping Date	Production Data Available		
							From	To	Production (AF)
Orange	15S/01E/21Jb	1,400	1956	116	643	NA	1966	1976	1,233
Monte No. 4	15S/01E/21Ja	2,000	1963	80	20	7/1/1966	1966	1973	278
Elm No. 1	15S/01E/21Ra	2,200	1966	86	100	NA	1966	1967	36
Elm No. 4	15S/01E/21Rb	2,200	1968	87	160	1/1968	1968	1976	622
Amador	15S/01E/22P2	3,000	1967	NA	NA	NA	NA	NA	NA
Harcourt	15S/01E/27D1	3,300	1963	NA	NA	NA	1966	1976	425
Palm	15S/01E/22Q1	4,200	NA	NA	NA	NA	1966	1977	230

NOTES:
1. Well completion data from MPWMD well data files.
2. Well location data from Logan, 1982, *Hydrogeology of the Seaside Area*, Figure 48. More distant wells are shown on this figure, but no data are available for them (i.e., Lowell, Flores).
3. Well number ending in a numeral represents official State-assigned number; well number ending in a letter represents unofficial MPWMD-assigned number.
4. Production data from Fugro West, Inc., 1997, *Hydrogeologic Assessment, Seaside Coastal Groundwater Subareas*, Table 3. This table was based on production data available in MPWMD files. Production data prior to 1966 could not be located.

Table 3

Sand City Corporation Yard Well Water Quality Sample Results

All values in mg/L, except pH (units), EC (umhos/cm)

Sample Date	Calcium	Sodium	Magnesium	Potassium	Bicarbonate	Sulfate	Chloride	Nitrate Nitrogen (as NO3)	Ammonia Nitrogen (as N)	Fluoride	Iron (Total)	Manganese (Total)	Ortho-phosphate	Barium	Iodide	Boron	Bromide	Hardness (as CaCO3)	Alkalinity (as CaCO3)	pH	Total Organic Carbon	EC	TDS
2/26/2008	44	215	10	6.0	159	134	237	39	0.22	2.2	<0.1	<0.020	<0.2			0.88	0.70	151	130	7.7	1.10	1360	823
8/15/2008	46	172	9	5.6	127	116	202	60	0.24	1.6	<0.1	0.025	0.4			0.76	0.70	152	104	7.6	1.90	1187	710
7/6/2009	45	140	11	6.0	115	95	158	56	0.37	0.5	<0.05	0.022	<0.05			0.46	0.60	158	94	7.5	0.84	1017	632
7/30/2010	42	196	9	5.5	132	125	232	29	0.58	2.2	0.016	<0.020	<0.05			0.67	0.39	142	108	7.2	0.92	1207	735
7/26/2011	39	275	9	5.1	159	174	330	19	1.22	4.2	<0.01	0.022	<0.05			1.05	0.94	134	130	7.9	1.00	1640	992
12/1/2011	33	314	6	4.8	166	165	326	28	1.33	3.7	<0.01	0.029	<0.05			1.39	0.67	107	136	7.6	0.57	1604	906
4/3/2012	38	251	10	5.3	160	152	291	30	1.25	3.5	<0.01	0.019	<0.05			1.08	0.68	136	131	7.3	0.70	1532	897
7/11/2012	40	273	8	5.2	159	147	283	31	0.77	3.5	<0.01	0.023	<0.1			1.11	1.04	133	130	7.5	0.53	1492	855
1/11/2013	23	388	2	4.6	205	200	360	4	1.55	5.3	<0.01	0.039	<0.1	0.029		1.91	0.80	66	168	7.9	0.73	1930	1117
3/20/2013	33	282	8	4.9	176	157	297	17	1.31	3.6	<0.01	0.026	<0.1	0.065	0.028	1.33	0.70	115	144	7.5	0.78	1630	957
7/16/2013	34	274	6	5.1	157	133	261	31	1.90	3.5	<0.01	0.025	<0.1	0.065	0.028	1.17	0.70	110	129	7.4	0.53	1475	860
Minimum	**23**	**251**	**2**	**4.6**	**115**	**133**	**158**	**4**	**0.22**	**0.5**	**0**	**0.019**	**0**	**0.029**	**0.028**	**1.08**	**0.39**	**66**	**94**	**7.3**	**0.53**	**1475**	**632**
Maximum	40	388	10	6.0	205	200	360	31	1.90	5.3	0	0.039	0.4	0.065	0.028	1.91	1.04	158	168	7.9	1.90	1930	1117
Mean	34	297	7	5.1	156	159	271	24	0.98	3.1	- -	0.027	- -	0.053	- -	1	1	128	128	7.5	0.87	1611	862

NOTES:
1. Sand City Corporation Yard well is ID# 165 in Watermaster database.
2. DWR Log# 490449 filed 1/29/93; Mo. Co. Health Permit #W6966; well depth = 140 ft; well screen = 50 - 140 ft.
3. Sample analyses are as reported by Monterey Bay Analytical Services; where Bicarbonate was not reported, value is calculated as 1.22 x Alkalinity.

ATTACHMENT 11

CITY OF SEASIDE NOTICE OF REQUESTED TRANSFER/ASSIGNMENT OF WATER ALLOCATION

RESOURCE MANAGEMENT SERVICE
440 Harcourt Avenue
Seaside, CA 93955

Telephone (831) 899-6825
FAX (831) 899-6311

March 29, 2016

Mr. Dewey Evans
Seaside Groundwater Basin Watermaster
2600 Garden Road, Suite 228
Monterey, CA 93940
Via email watermasterseaside@sbcglobal.net

Subject: **Seaside Municipal Water System**
Re: **Transfer of Water Allocation**

The City of Seaside (the City) is requesting to transfer seven and one half acre-feet (7.50 AF) of its water allocation within the Seaside Groundwater Basin to California American Water Company (Cal Am) for the Water Year Ending (WY) 2015. The purpose of this transfer of water allocation is to offset the transfer of 7.50 AF of water from Cal Am to the City due to the city's well failure that occurred within the Seaside Groundwater Basin between June 25, 2015 and July 20, 2015.

Per Monterey County Superior Court Order Case Number M66343 dated February 9, 2007, (the Adjudication), the City of Seaside has a Standard Production Allocation in the amount of 184.96 acre-feet (AF) for WY 2015. Per the Adjudication Section C.4, "Transferability of Seaside Basin Rights," the City is requesting that 7.50 AF of production allocation be assigned to Cal Am from the City's Standard Production Allocation. Therefore, the City's allocation would be reduced for the above described incident in WY 2015 by 7.50 AF to 177.46 AF and Cal Am's allocation would be increased by 7.50 AF for WY 2015.

Please contact Mr. Tim O'Hallaron, City Engineer / Public Works Service Manager at (831) 899-6839 to discuss any questions or comments.

Sincerely,
City of Seaside

For

Diana Ingersoll, PE
Deputy City Manager – Resources Management Services

Copy:
Roger Hulbert, Operations Manager – California American Water Company (via email Roger.Hulbert@amwater.com)
Laura Dadiw, Watermaster (via email watermasterlaura@sbcglobal.net)

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ATTACHMENT 12

FLOW DIVIDE TECHNICAL MEMORANDUM

HydroMetrics WRI
1814 Franklin St, Suite 501
Oakland, CA 94612

TECHNICAL MEMORANDUM

To: Bob Jaques, Technical Program Manager
Seaside Basin Watermaster

From: Stephen Hundt and Georgina King

Date: January 22, 2016

Subject: Groundwater Flow Divides within and East of the Laguna Seca Subarea

INTRODUCTION

The Seaside Groundwater Basin Watermaster (Watermaster) has raised a number of questions and initiated various studies in response to declining groundwater elevations in the Laguna Seca subarea (LSSA). Recent studies by HydroMetrics WRI indicated that declining groundwater elevations at least partially result from pumping outside the LSSA (HydroMetrics WRI, 2013). The eastern side of the subarea will suffer the greatest and most persistent declines. Additionally, modeling results show that pumping groundwater elevations are predicted to fall below the top of the well screen prior to 2041 in wells Bishop #3, Ryan Ranch #7, and Laguna Seca Golf Resort – Racetrack. Because the Watermaster has no control or influence over pumping outside the Seaside Basin boundaries, it is effectively unable to prevent declining groundwater elevations in a portion of the LSSA.

To obtain a better understanding of its future groundwater management options, the Watermaster asked HydroMetrics WRI to prepare a map of existing and potential future groundwater divides based on groundwater model results. Although these groundwater divides are not a strong barrier to flow, they do indicate regions where pumping may influence groundwater elevations. Based on the locations of these divides, the Watermaster may opt to move the boundary of the LSSA, or define different groundwater management options for different portions of the LSSA.

This technical memorandum presents the results of a study to identify model-estimated groundwater flow divides within and to the east of the LSSA. This study was requested by the Seaside Groundwater Basin Watermaster.

METHODS

The locations of flow divides in the LSSA were estimated from results of the existing groundwater flow model. Groundwater divide locations may move over time in response to changes in recharge and pumping. Therefore, the groundwater divide locations were mapped for a number of times from the historic scenario and two alternative future scenarios.

Scenarios and Time Periods

Three model scenarios, representing different pumping conditions and model periods, were identified for which to delineate groundwater flow divides in the Santa Margarita Aquifer in the vicinity of the eastern LSSA:

- Historic Scenario
- Baseline Scenario (predictive)
- No Standard or Alternative Producer Pumping Scenario (predictive)

The time periods of the three model scenarios are shown on Figure 1. The Historic Scenario simulates observed pumping and groundwater elevation conditions for the period of 1987 through 2013. The two predictive scenarios are the same model scenarios used in a previous safe yield analysis of the LSSA (Hydrometrics WRI, 2013). The Baseline Scenario represents anticipated pumping in which Alternative Producers continue to pump at 2011 levels and Standard Producer California-American Water Company (Cal-Am) pumping is reduced to zero by 2018, with required triennial reductions taking place. The No Standard or Alternative Producer Pumping Scenario is a hypothetical case in which pumping is eliminated for all Standard and Alternative Producers for the entire predictive simulation. Both predictive scenarios simulate groundwater conditions over a 33 year period, from 2009 to 2041.

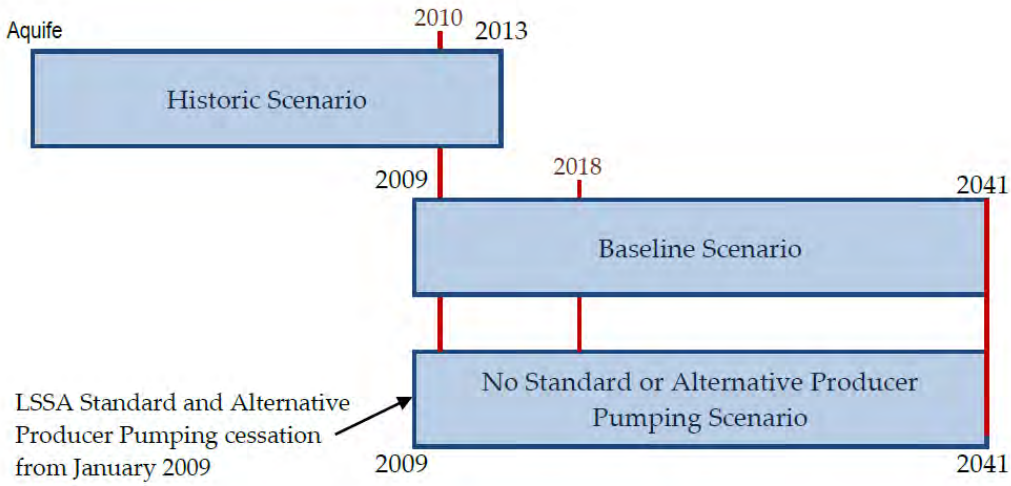

Figure 1: Model Scenario Time Periods

A summary of average annual pumping rates under these two predictive scenarios is shown in Table 1. The safe yield analysis found that even under the hypothetical extreme No Standard or Alternative Producer Pumping Scenario groundwater levels continue to fall in the eastern portion of the LSSA, likely due to the presence of pumping from wells outside of the eastern boundary of the LSSA (Hydrometrics WRI, 2013). For this reason, the groundwater conditions under this scenario, and how they compare to those of the Baseline Scenario, are of particular interest.

Table 1: LSSA Pumping Rates for Predictive Scenarios

	Average Annual Pumping (AF/year)	
	Baseline Scenario	**No Standard or Alternative Pumping Scenario**
Standard Producers	36	0
Alternative Producers	480	0
Private Producers**	8	8
Standard + Alternative	516	0
All Producers	524	8

** Private producers are: Shoreline Community Church - Merrill Trust, SPCA, Stolich, and Wayland (formerly Fowler).

Three years were selected from which to extract results from the groundwater model: 2010, 2018, and 2041. The year 2010 was selected because it was near the end of the model calibration period, and had more strongly defined flow divides than water years 2011 or 2012. Results from the Historic and No Standard or Alternative Producer Pumping Scenarios were extracted for water year 2010.

The year 2018 was selected because this is the year when under the Baseline Scenario, Cal-Am's LSSA pumping is eliminated in accordance with the Adjudication Decision (HydroMetrics LLC, 2009, Table 15). The year 2041 was selected because it is the last year in the model simulations and provides for the longest outlook of how flow divides evolve under different pumping conditions. Results from the Baseline and No Standard or Alternative Producer Pumping Scenarios were extracted for model years 2018 and 2041.

For each of the three years selected, results from the months of February and August were examined in order to capture seasonal variations in groundwater conditions. These months tend to display the greatest difference in groundwater conditions for any six-month period. This resulted in a total of twelve different months for which groundwater flow divides were identified (Table 2).

Table 2: Model Scenarios and Months

Model Scenario	Year	Month	Figure
Historic	2010	February	Figure 2
		August	Figure 3
Baseline	2018	February	Figure 4
		August	Figure 5
	2041	February	Figure 6
		August	Figure 7
No Standard or Alternative Producer Pumping	2010	February	Figure 8
		August	Figure 9
	2018	February	Figure 10
		August	Figure 11
	2041	February	Figure 12
		August	Figure 13

Together, these 12 months provide snapshots of how groundwater flow divides vary from their present location under different pumping conditions over both a seasonal, decadal, and multi-decadal time period.

Flow Divide Delineation

Model-simulated groundwater elevations and groundwater flow directions in the Santa Margarita Aquifer were extracted for each of the 12 months discussed above. The Santa Margarita Aquifer is represented by the bottom or fifth layer in the Seaside Groundwater Basin groundwater flow model and was selected as the unit for this analysis because it has the greatest thickness in the east LSSA area and is likely to maintain the greatest saturated extent. It must be noted, however, that not every pumping and monitoring well discussed in the safe yield analysis report (HydroMetrics WRI. 2013) is screened in this aquifer. Wells not screened in model layer 5 include:

- Toro 1
- Toro 2
- Toro 3
- Bishop #3
- LSRA #2
- Shoreline Community Church
- York School
- Corral de Tierra CC

Groundwater flow divides were delineated by identifying groundwater highs or ridges based on one foot groundwater elevation contour maps generated by the model, and locations where flow directions diverge. The flow divides were termed either "well-defined" or "less-defined" based upon a qualitative inspection of the degree of divergence in the groundwater flow vectors. Several well-defined flow divides were apparent where flow vectors were oriented at wide angles. Other less-defined divides were identified where flow vectors were almost parallel, with only slightly divergent orientations. Note that although the flow divides were located based upon a one foot contour interval to improve accuracy in defining the flow divide locations, the maps in this memorandum show a five foot contour interval in order to keep the maps uncluttered.

RESULTS

Figure 2 through Figure 13 show groundwater contours, flow direction vectors, and flow divides that were generated from simulated groundwater elevations from the Seaside Basin groundwater flow model. Groundwater elevations are displayed at five foot intervals with blue contour lines and groundwater flow directions are shown in the background as small grey arrows. The relative rate of pumping from each production well that extracts from the Santa Margarita Aquifer is shown with light blue circles, with the size of the circle indicating the volume of groundwater pumped over the water year. Wells that have no pumping during the water year but that have historically pumped from the Santa Margarita are shown as black squares. Model cells that have no groundwater flow due to the presence of the Laguna Seca Anticline are shown as light grey rectangles. The Laguna Seca Anticline separates the northern and southern subbasins of the Seaside Groundwater Basin. This feature, including the segment of the Old Terrace Fault that offsets the anticline, forms a subsurface hydraulic partial barrier to flow (HydroMetrics WRI, 2009).

Groundwater flow divides are shown as purple dashed and solid lines. The groundwater flow divides were classified as more-defined and less-defined, as indicated by the solid or dashed line, respectively.

A map including the location and names of all production wells in the study area is provided on Figure 14.

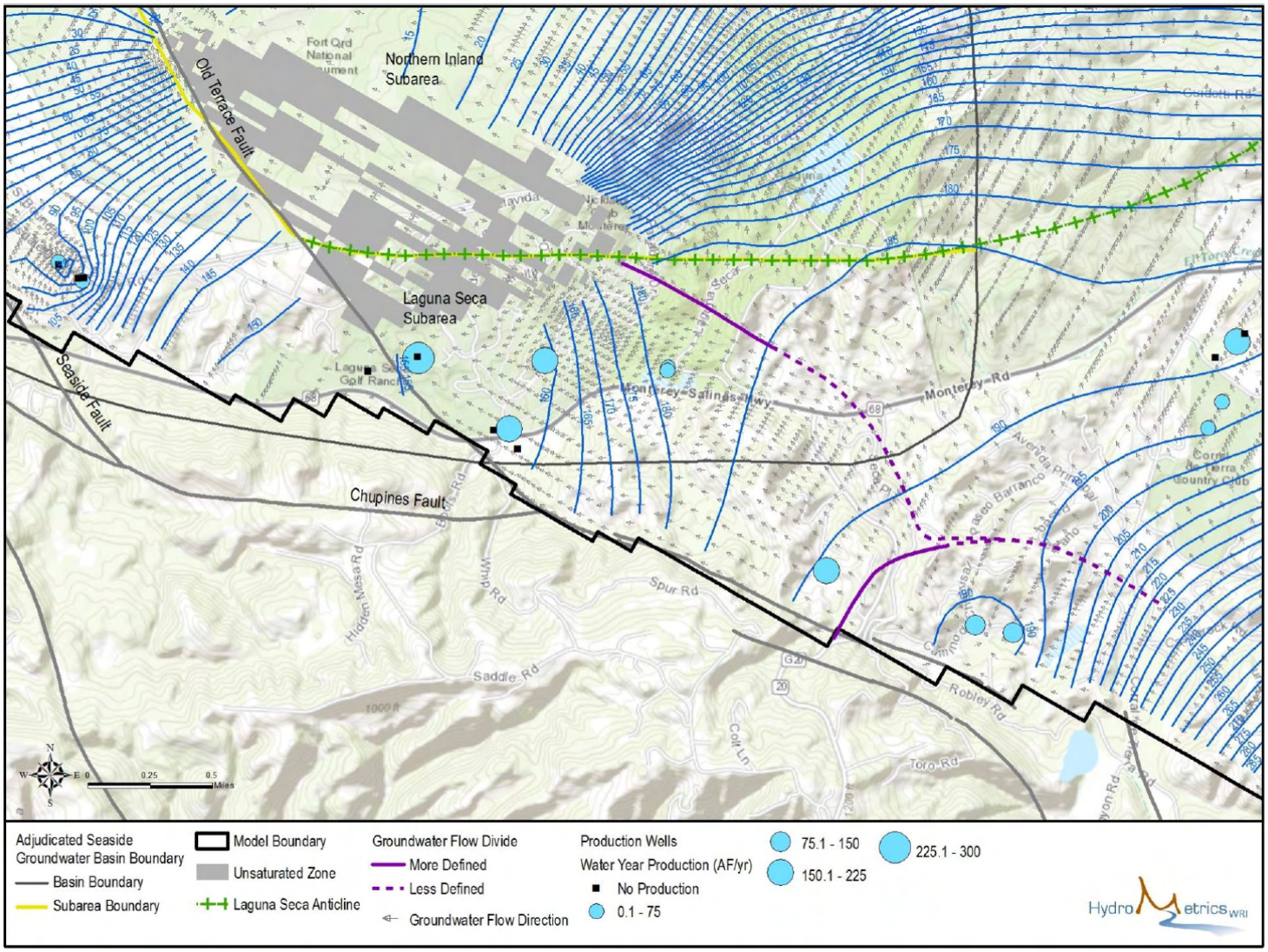

Figure 2: Groundwater Elevations and Flow Divides in the Santa Margarita Aquifer (Layer 5) – Historic Scenario, February 2010

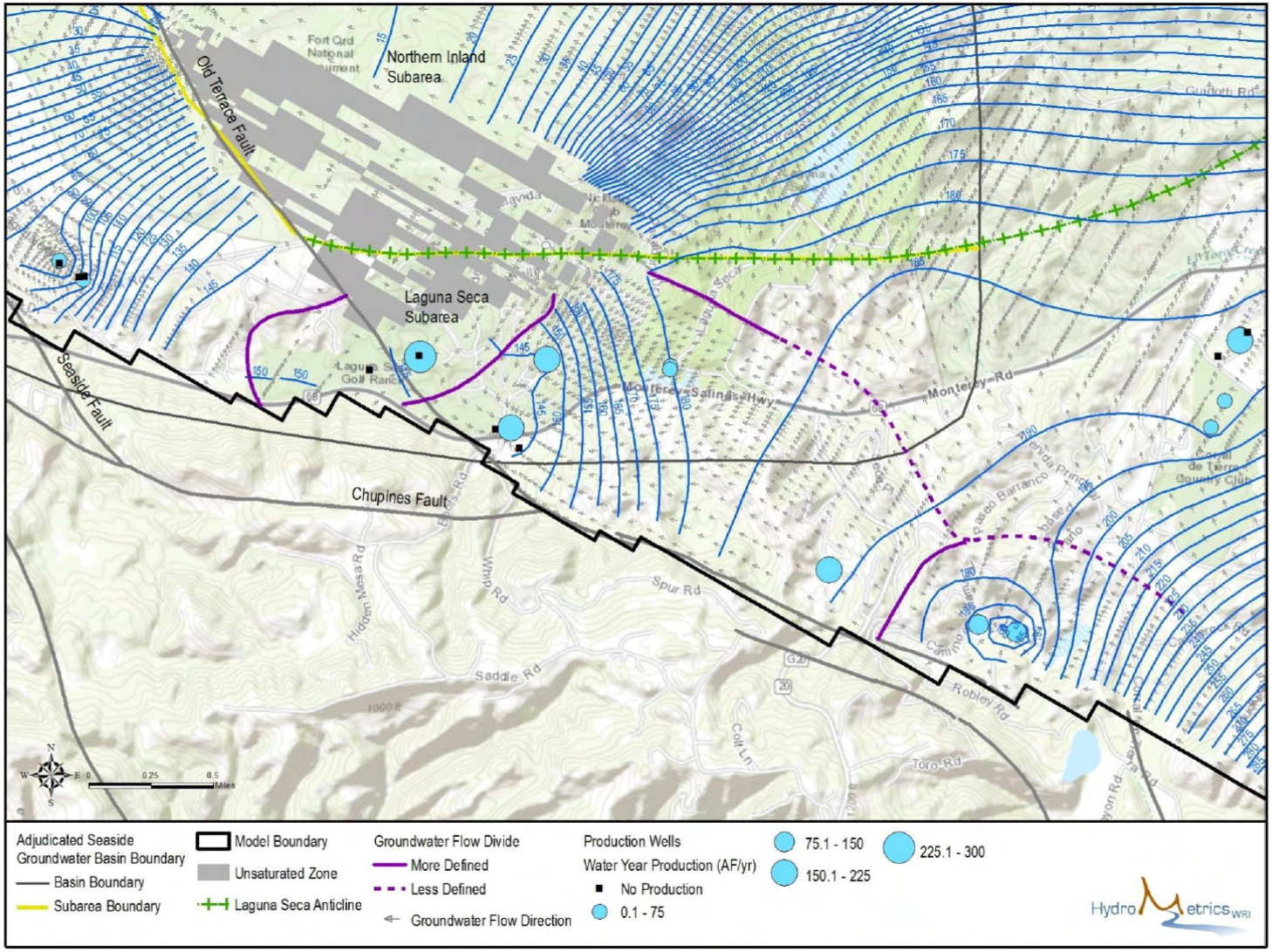

Figure 3: Groundwater Elevations and Flow Divides in the Santa Margarita Aquifer (Layer 5) – Historic Scenario, August 2010

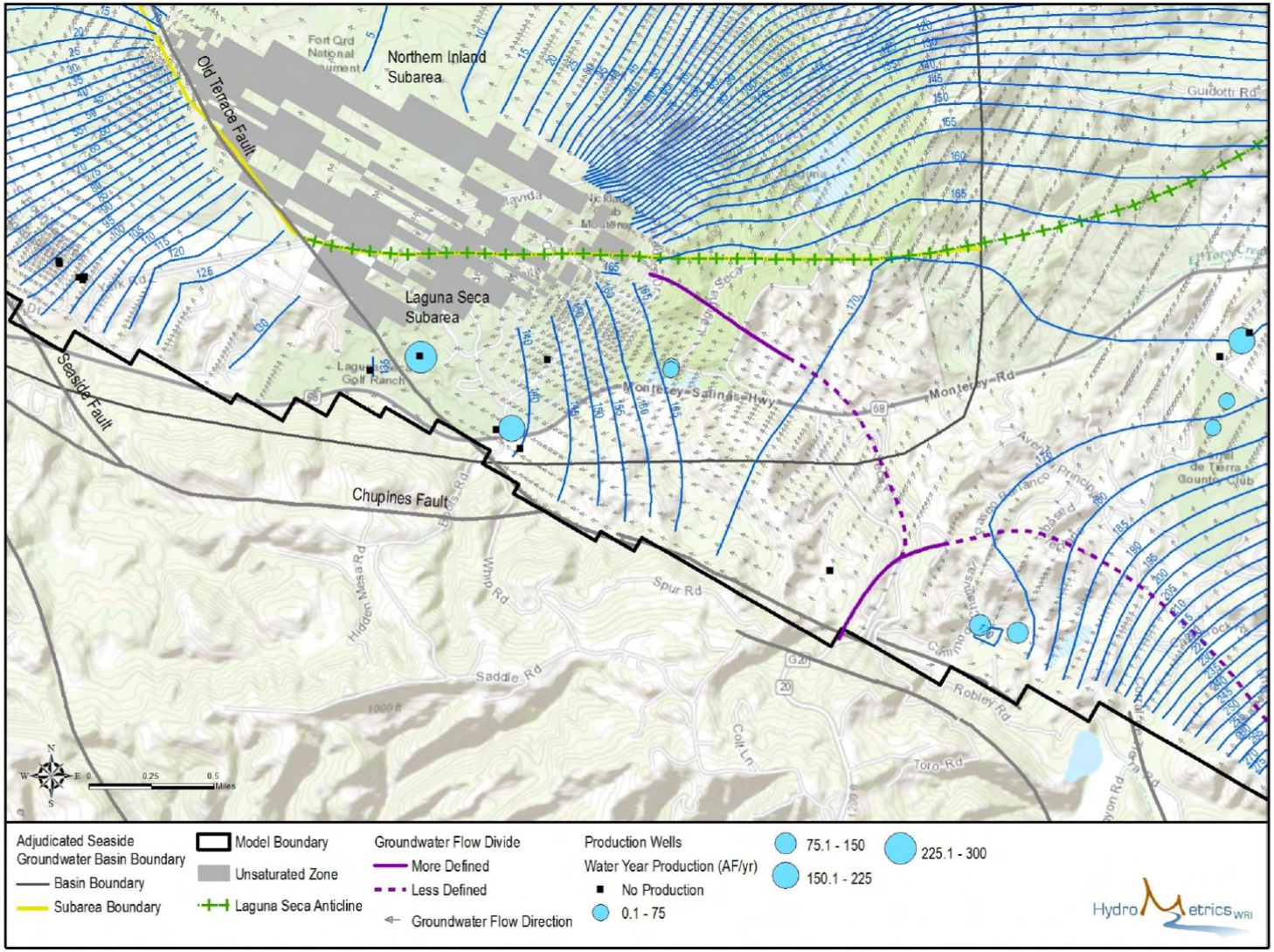

Figure 4: Groundwater Elevations and Flow Divides in the Santa Margarita Aquifer (Layer 5) – Baseline Scenario, February 2018

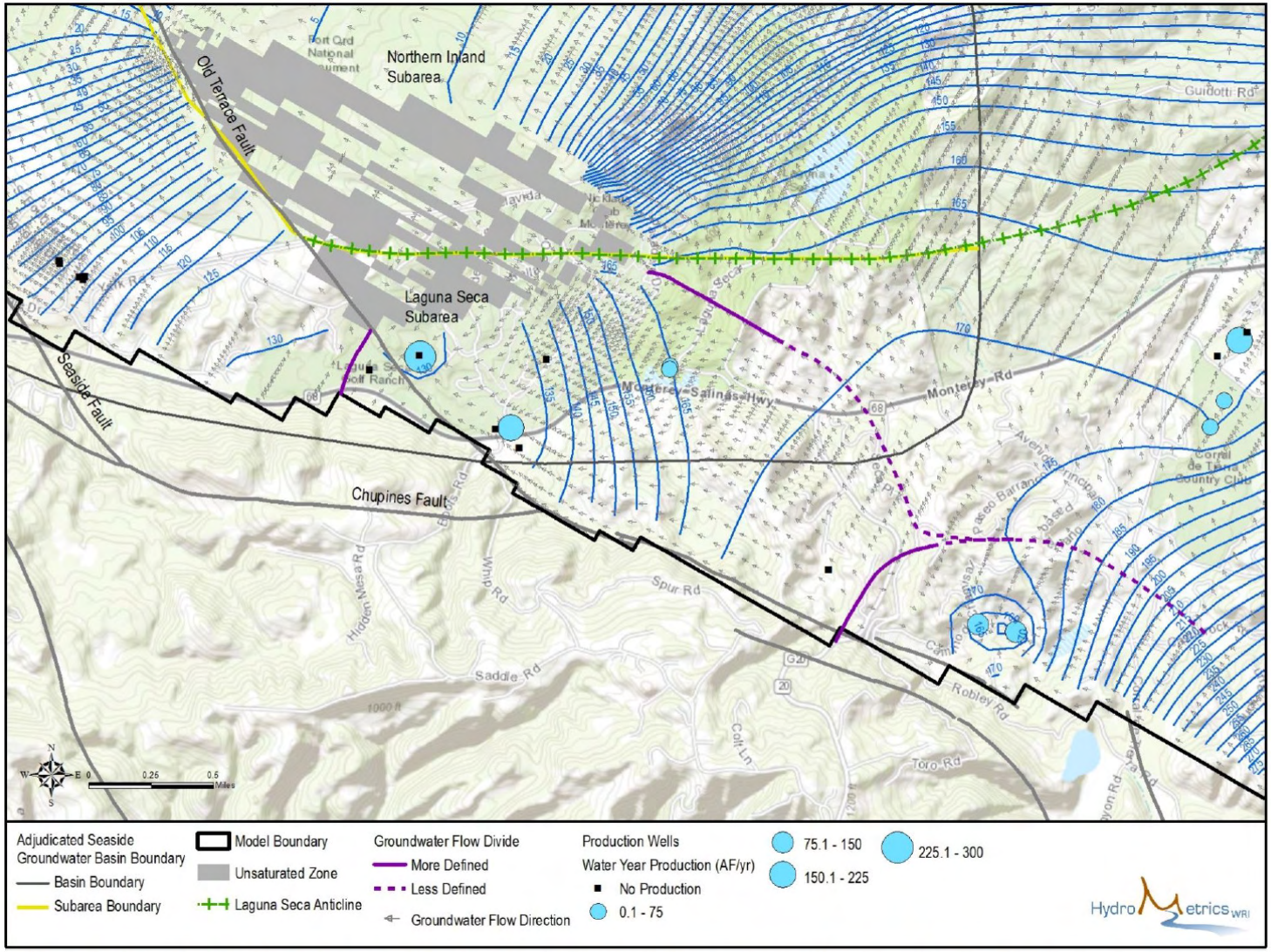

Figure 5: Groundwater Elevations and Flow Divides in the Santa Margarita Aquifer (Layer 5) - Baseline Scenario, August 2018

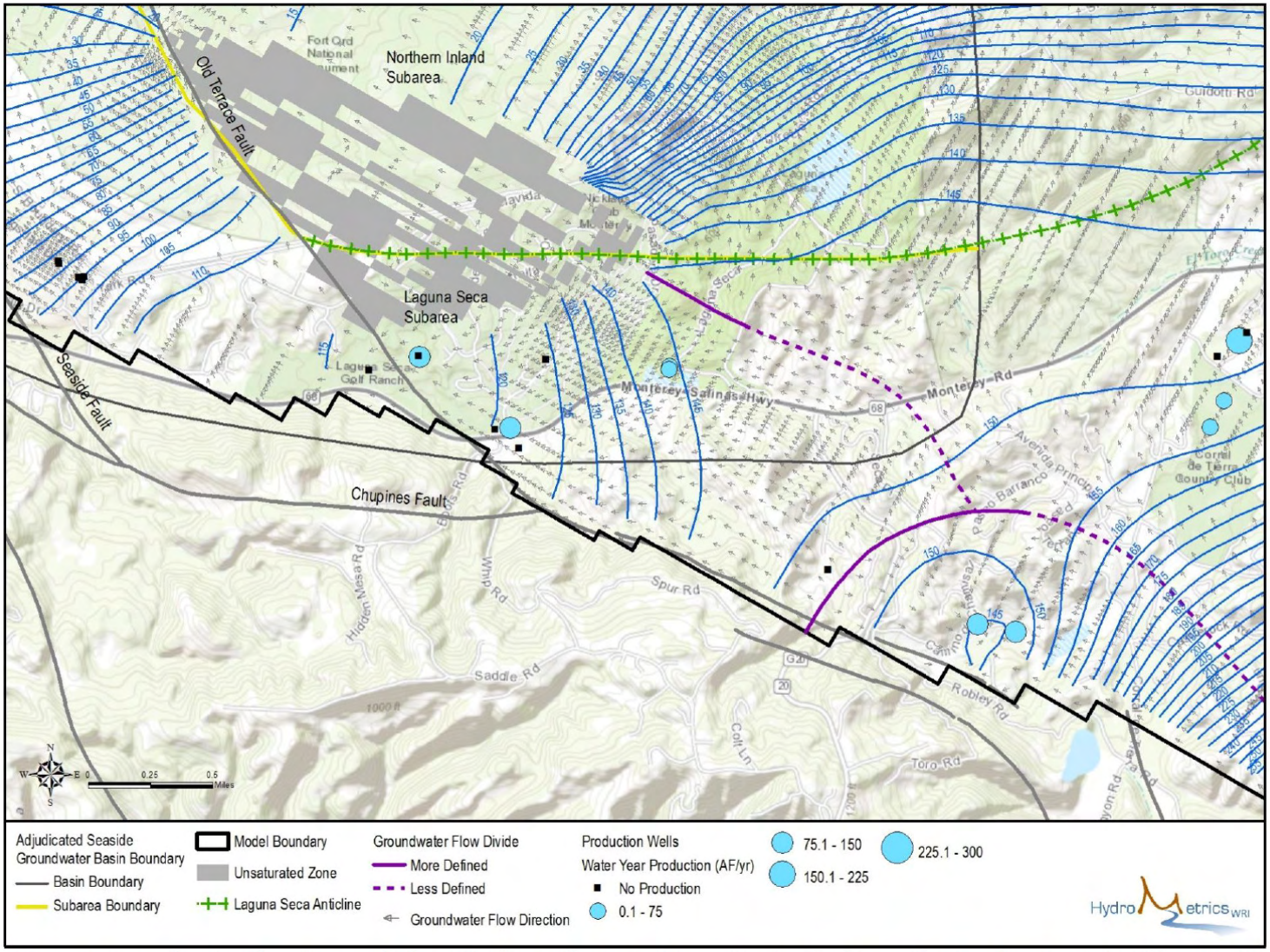

Figure 6: Groundwater Elevations and Flow Divides in the Santa Margarita Aquifer (Layer 5) - Baseline Scenario, February 2041

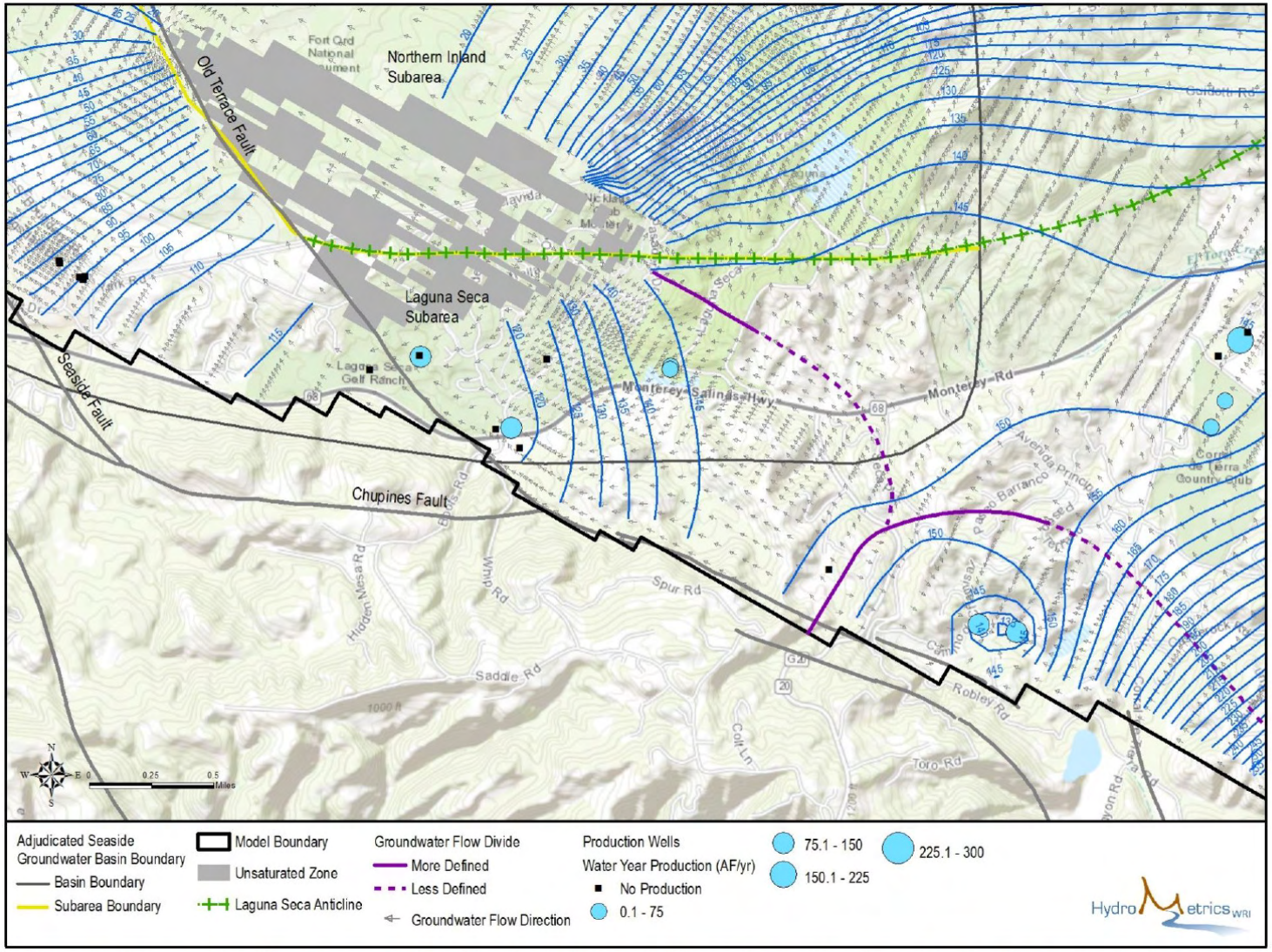

Figure 7: Groundwater Elevations and Flow Divides in the Santa Margarita Aquifer (Layer 5) - Baseline Scenario, August 2041

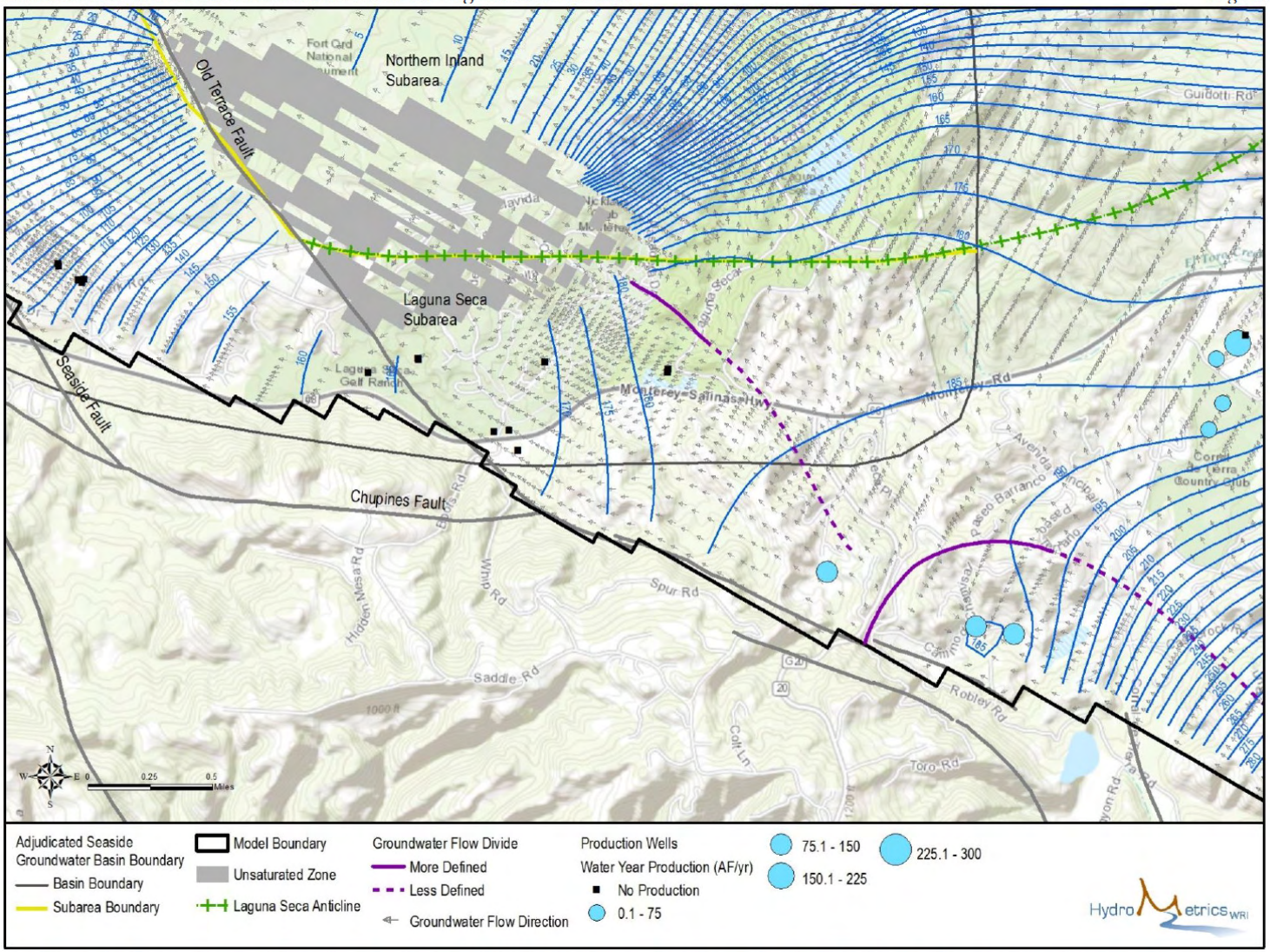

Figure 8: Groundwater Elevations and Flow Divides in the Santa Margarita Aquifer (Layer 5) – No Standard or Alternative Producer Pumping Scenario, February 2010

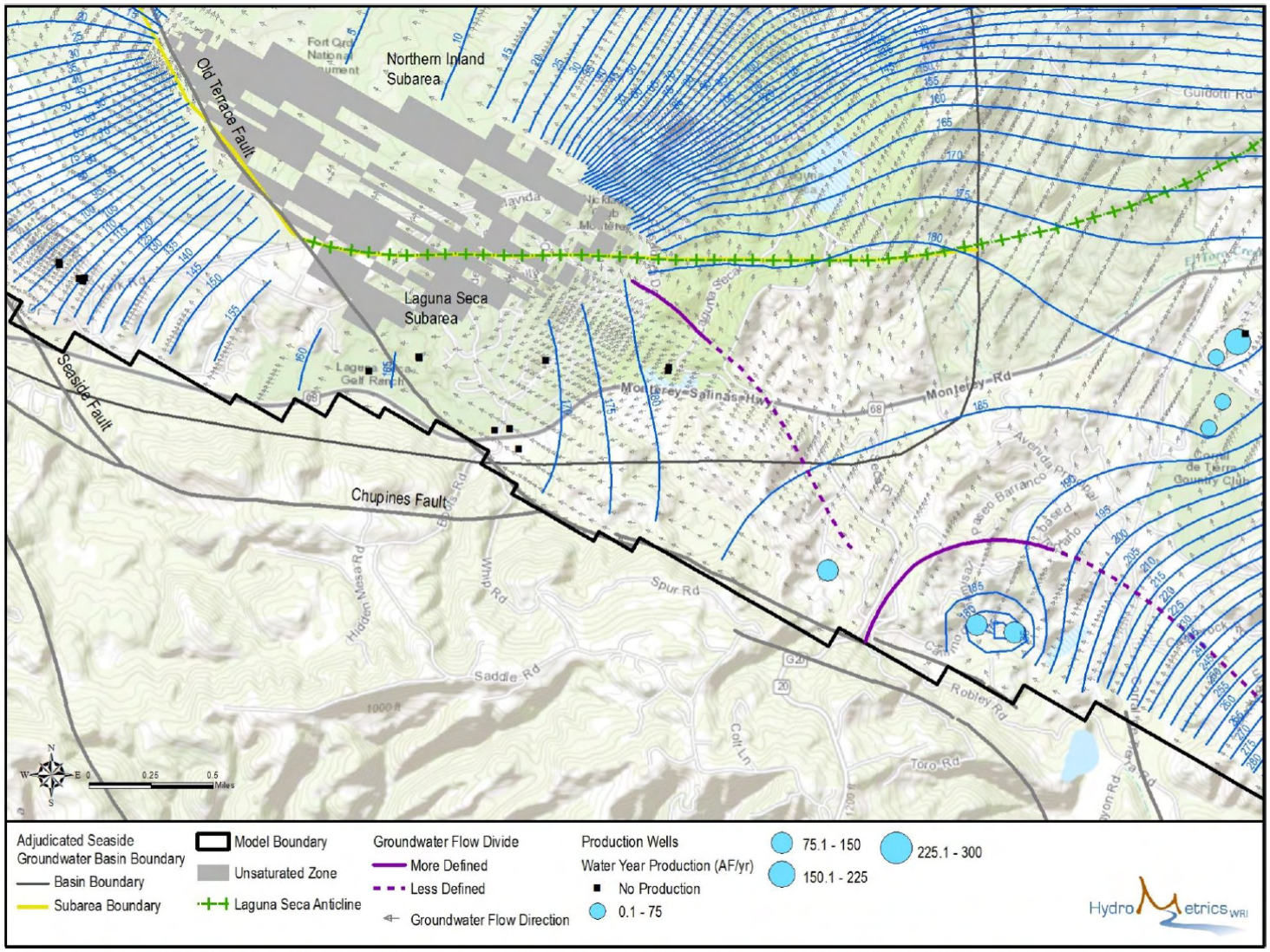

Figure 9: Groundwater Elevations and Flow Divides in the Santa Margarita Aquifer (Layer 5) - No Standard or Alternative Producer Pumping Scenario, August 2010

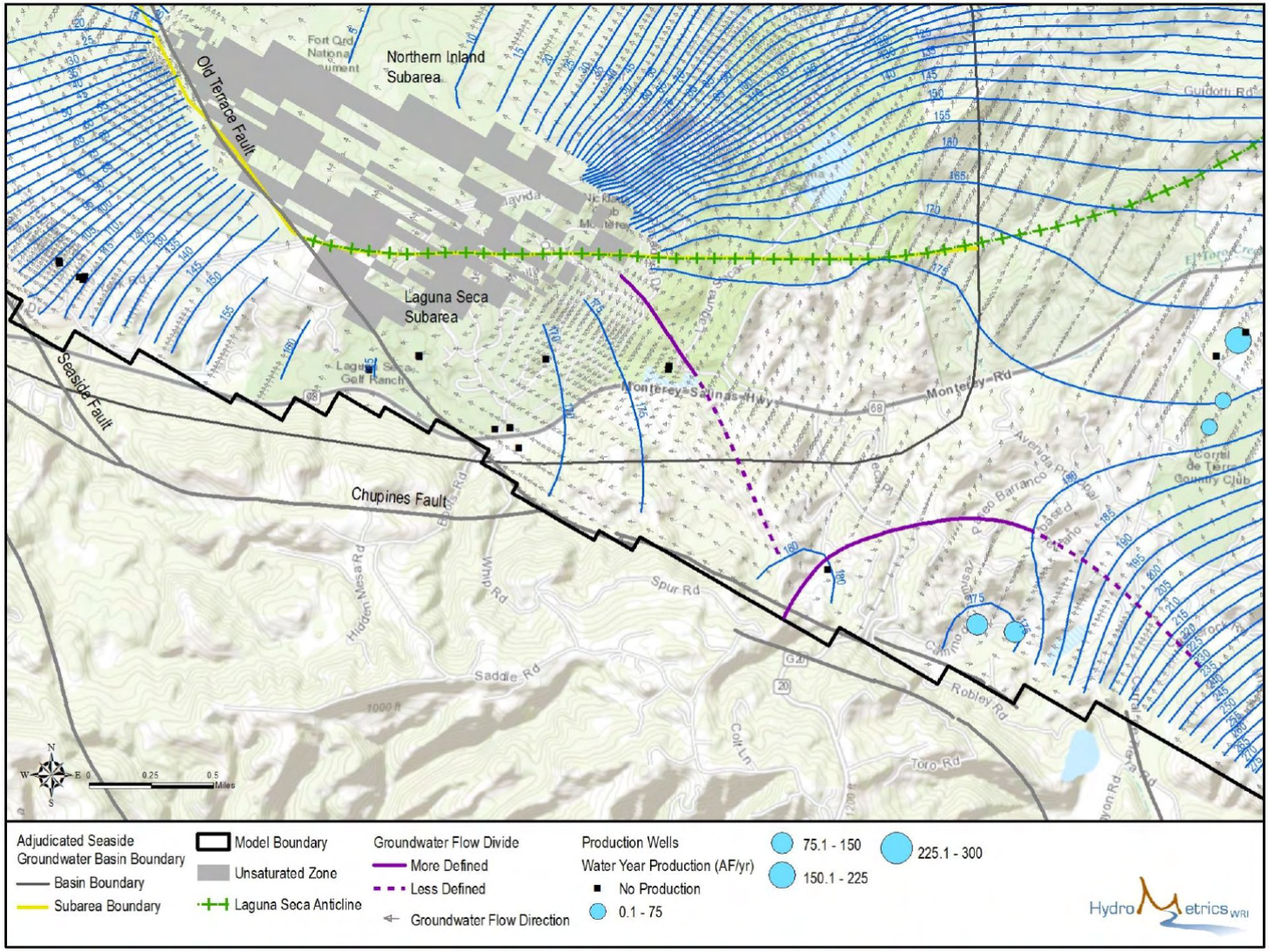

Figure 10: Groundwater Elevations and Flow Divides in the Santa Margarita Aquifer (Layer 5) - No Standard or Alternative Producer Pumping Scenario, February 2018

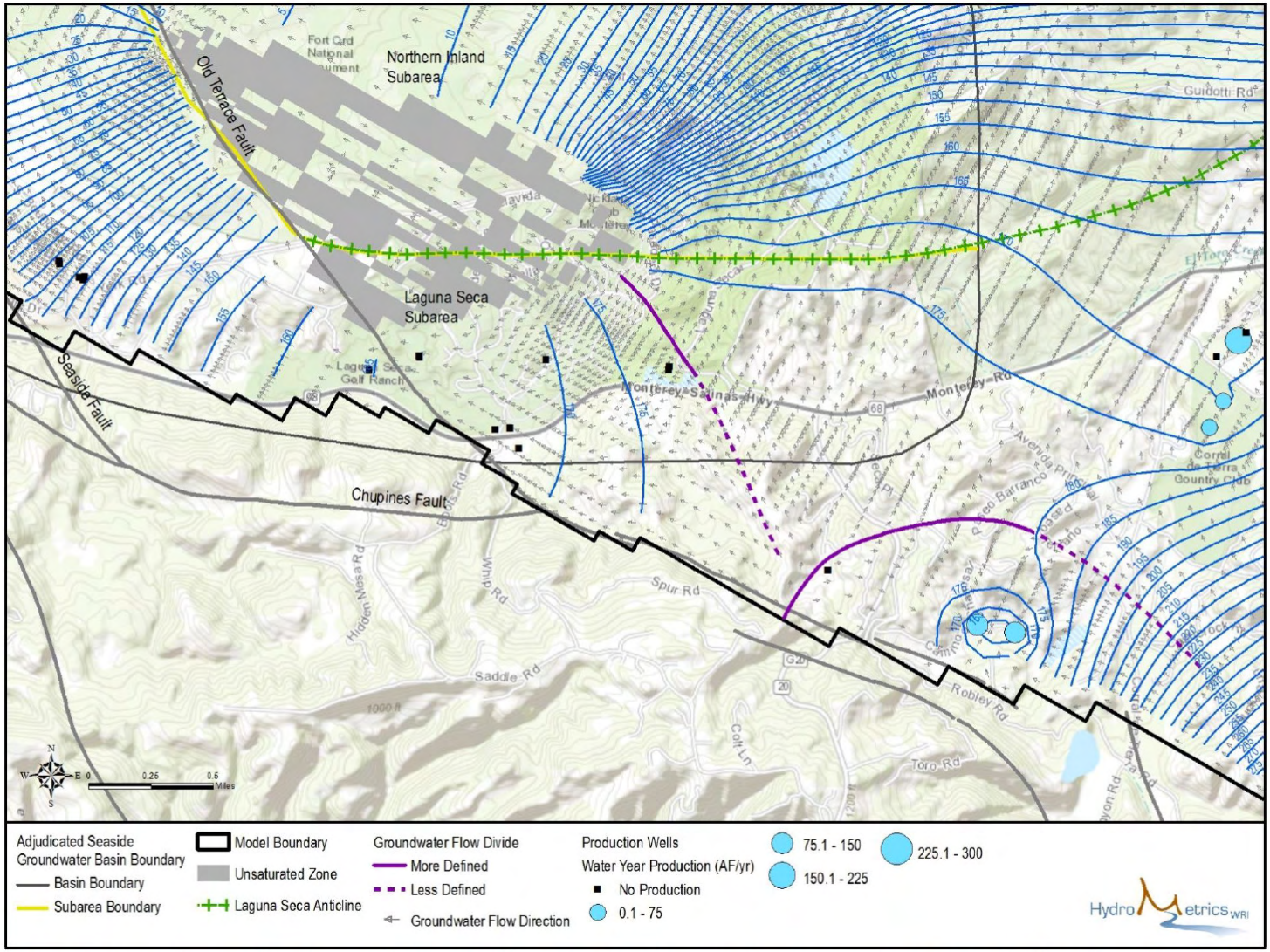

Figure 11: Groundwater Elevations and Flow Divides in the Santa Margarita Aquifer (Layer 5) - No Standard or Alternative Producer Pumping Scenario, August 2018

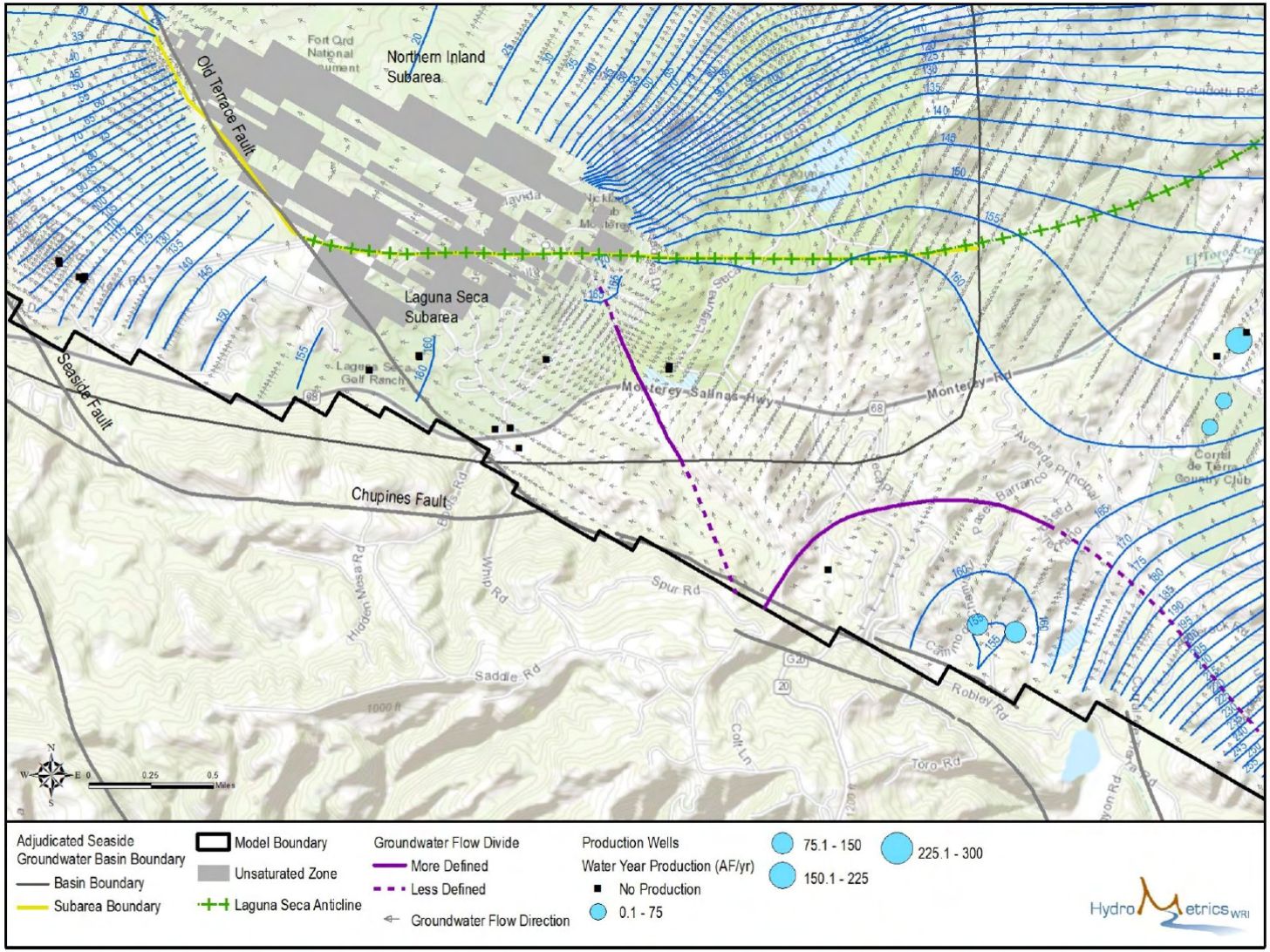

Figure 12: Groundwater Elevations and Flow Divides in the Santa Margarita Aquifer (Layer 5) - No Standard or Alternative Producer Pumping Scenario, February 2041

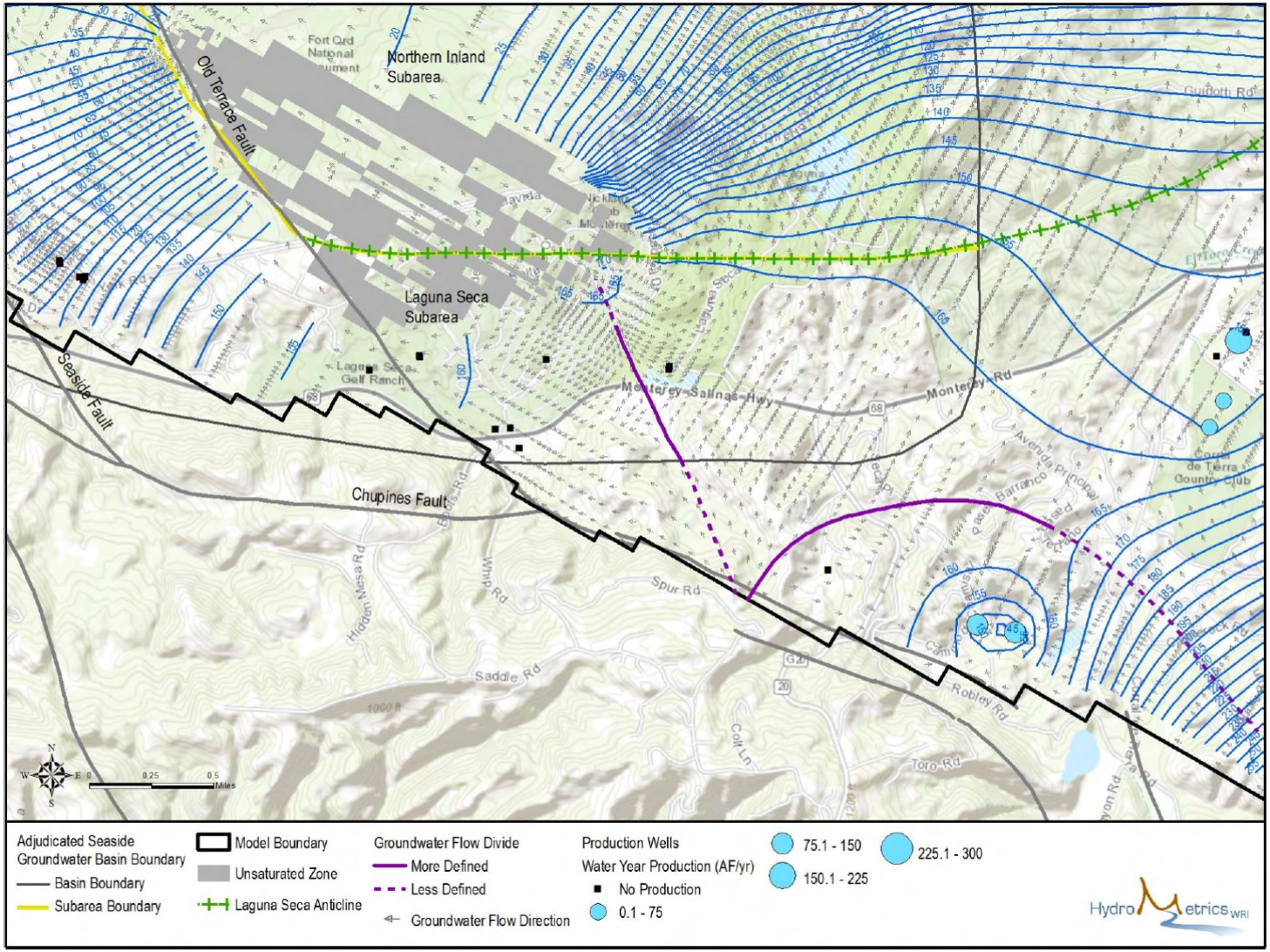

Figure 13: Groundwater Elevations and Flow Divides in the Santa Margarita Aquifer (Layer 5) - No Standard or Alternative Producer Pumping Scenario, August 2041

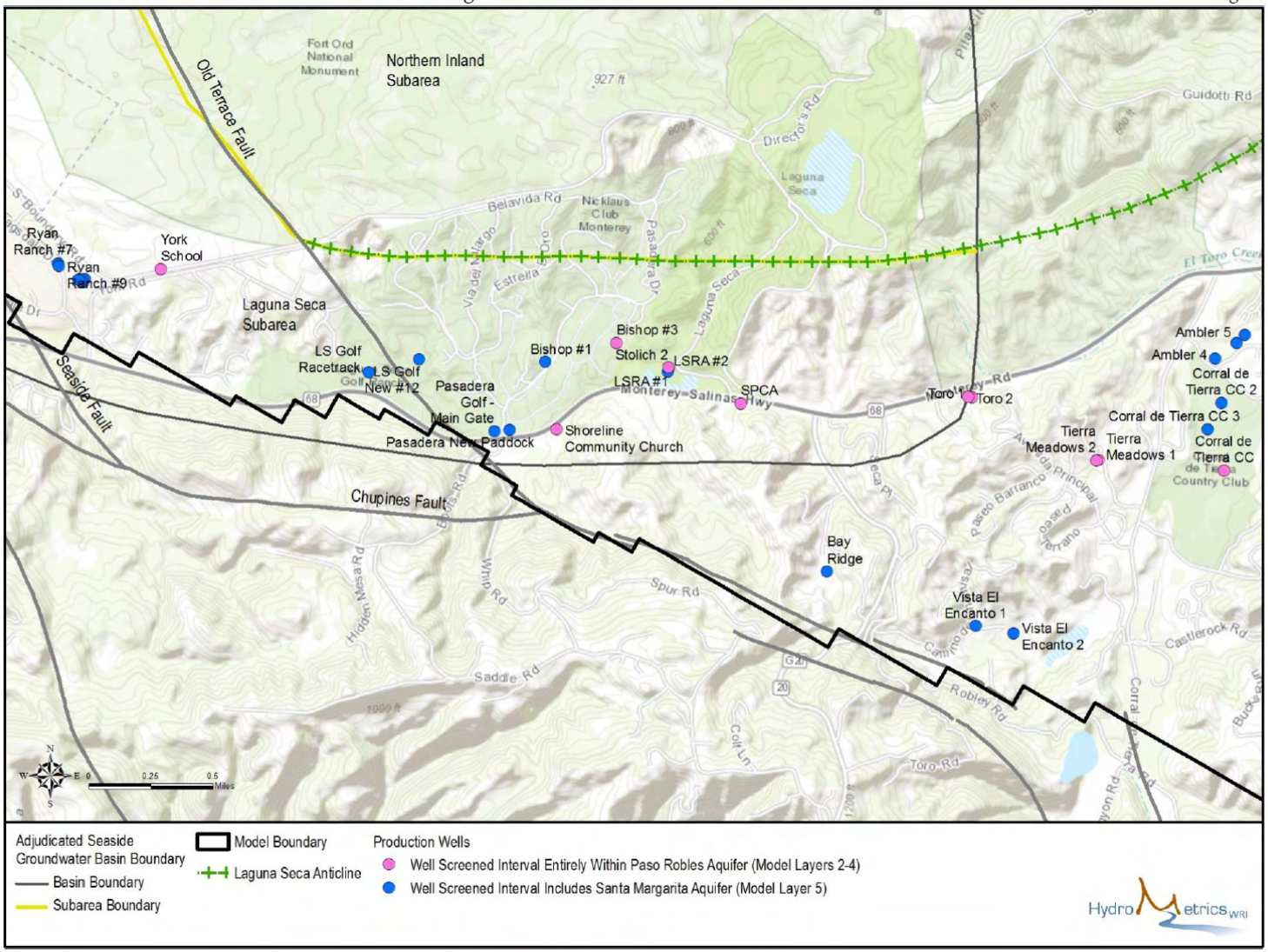

Figure 14: Production Wells

General Results

The regional groundwater flow direction is the same for every month examined. Groundwater flows from the southeast of the model where the topographic high and aerial recharge are located, westwards toward the coast. As groundwater flows along this general path it approaches the Laguna Seca Anticline whose structure results in a thinner and shallower aquifer system between the LSSA and the Northern Inland Subarea that remains unsaturated and acts as a barrier to flow. Groundwater takes two paths around this feature, one flowing west through the LSSA to the south of the barrier and one flowing northwest into the Northern Inland Subarea located north of the barrier. The impact of individual pumping wells are visible only locally and sometimes temporarily, and can be seen in groundwater contours and groundwater flow direction vectors that deviate from their regional patterns towards depressions caused around the wells.

There are two prominent groundwater flow divides present in each of the 12 months analyzed. One of these flow divides begins southeast of the Laguna Seca Anticline, which at this location forms the boundary of the LSSA and Northern Inland subareas. It runs east-southeast to just outside of the Seaside Basin where it connects with a second flow divide. The northern portion of this divide appears to be relatively well defined, but the southern portion of this divide is weakly defined. It is likely that the southern portion of this divide has less of an influence on flow directions. Groundwater on the southern side of the divide flows west into the LSSA and groundwater on the northern side of the divide flows northeast into the Northern Inland subarea. This flow divide exhibits notable variations in different periods that are explored further in the section below and will be referred to henceforth as the East LSSA Flow Divide. The second flow divide (referred to henceforth as the Southeast Flow Divide) is located outside and southeast of the LSSA where a well-defined pumping depression has developed near the southern boundary of the groundwater model. The general shape of this flow divide remains relatively constant throughout each of the 12 months analyzed, although the location of the western edge of the flow divide varies up to roughly three quarters of a mile depending on the scenario.

Additional groundwater flow divides emerge within the LSSA during 2010 of the Historic Scenario and 2018 of the Baseline Scenario. These temporary and localized flow divides occur during the summer months around seasonal pumping depressions. Two such flow divides are present during the August 2010 of the Historic Scenario while only one remains in August 2018 of the Baseline Scenario. These flow divides develop in a portion of the LSSA where groundwater flow takes place between, and generally parallel to, two structural features: the outcrop of the Monterey Formation which defines the

southern edge of the groundwater model and basin, and the Laguna Seca Anticline located at the boundary of the LSSA and Northern Inland subareas. The proximity of these boundaries exacerbates the pumping depressions that drive the development of the flow divides. The origination of these divides by short term pumping depressions during peak pumping periods is evident by their absence during model periods with lower rates of pumping in the LSSA. These seasonal flow divides fade by the winter season and do not appear at all during 2041 of the Baseline Scenario or at any time during the No Standard or Alternative Producer Pumping Scenario.

Comparison of Findings of Safe Yield Investigation with Flow Divide Results

The East LSSA Flow Divide behaves differently in the two predictive scenarios. Comparing Figure 3, Figure 5, and Figure 7, it can be seen that while groundwater elevations in general are decreasing over time, the position of the East LSSA Flow Divide shows little movement from the Historic Scenario through the end of the Baseline Scenario. Figure 9, Figure 11, and Figure 13, by contrast, show that the East LSSA Flow Divide migrates progressively westward into the LSSA in the No Standard or Alternative Producer Pumping Scenario.

This behavior can be explained by reviewing the conditions that will cause a groundwater flow divide to shift or maintain its position in general. A groundwater flow divide occurs where locally high groundwater elevations form a ridge-type feature. The position and elevation of the groundwater flow divide can change if groundwater elevations on one side of the divide change relative to the opposite side of the flow divide. Rising or falling groundwater elevations can both cause the position of a groundwater flow divide to shift, but the direction of the shift will depend upon which change takes place. Rising groundwater elevations on one side of a flow divide will shift it toward the side with rising groundwater elevations, while falling groundwater elevations will shift the divide away from the side with falling groundwater elevations. A relatively uniform fall or rise in groundwater elevations on either side of the flow divide will maintain a stable flow divide.

What appears to be taking place as the groundwater levels in the region around the eastern LSSA decline from 2010 of the Historic Scenario through 2018 and 2041 of the Baseline Scenario is that declines on both sides of the East LSSA Flow Divide balance in a way that leaves it's position relatively stable throughout the 31 year period. In the No Standard or Alternative Producer Pumping Scenario, however, groundwater elevations decline in a way that does not maintain a balance on either side of the divide. Instead, while groundwater elevations do decline on both sides of the East LSSA Flow Divide, the cessation of pumping within the LSSA slows the decline of groundwater elevations on

the LSSA side of the flow divide relative to the other side. As a result, the flow divide migrates further into the LSSA.

The East LSSA Flow Divide is located within a portion of the eastern LSSA that was the primary subject of analysis in the safe yield study (HydroMetrics WRI, 2013), and as a result further discussion on the flow divide results in light of the safe yield study region are warranted.

In the safe yield study it was found that even the extreme pumping restrictions included in the No Standard or Alternative Producer Pumping Scenario failed to stabilize groundwater levels in the eastern portion of the LSSA. A comparison was made between the Baseline Scenario and No Standard or Alternative Producer Pumping Scenario in an attempt to reveal the dynamics that may be preventing successful management in that portion of the LSSA. One such comparison from that study is included in Figure 15 which shows the rate of groundwater flow across the eastern boundary and southeastern boundary of the LSSA for both future scenarios. This chart is referenced in the following paragraphs.

In comparing the results from the LSSA safe yield study, it is important to note that although the East LSSA Flow Divide maintains a relatively stable position throughout the Baseline Scenario, as seen in Figure 4 through Figure 7, other aspects of groundwater flow in this region do change throughout this scenario. Groundwater elevations decline throughout the area as do hydraulic gradients and the rate of water flowing across the eastern boundary of the LSSA. This is consistent with the generally declining rates of flow that were observed into the eastern LSSA in the Baseline Scenario, as shown in Figure 15.

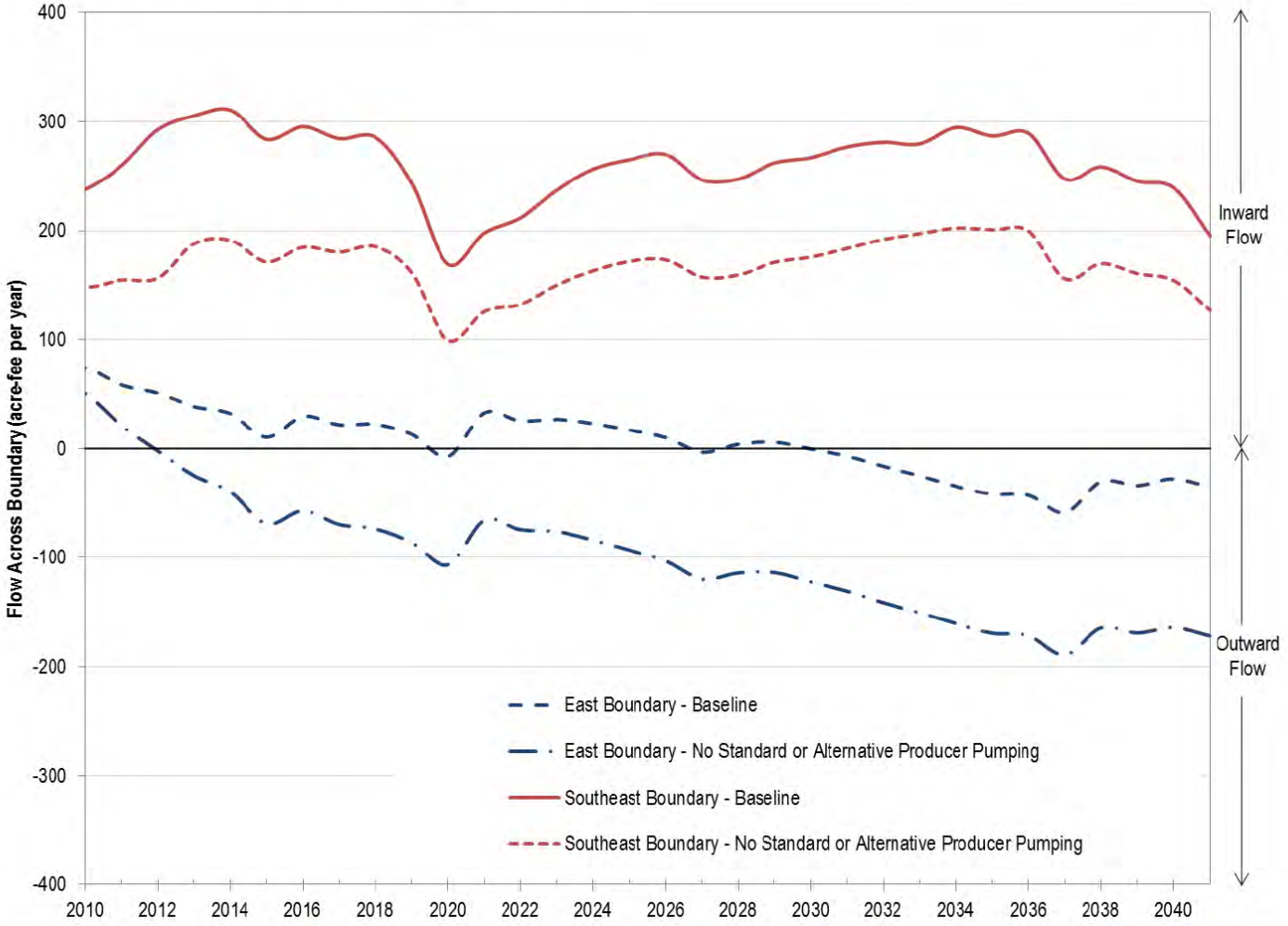

Figure 15: Groundwater Flows Across the Laguna Seca East and Southeast Boundaries under the Baseline and No Standard or Alternative Producer Pumping Scenarios (Aggregated for all Model Layers)

Also important to note is that the results presented in Figure 2 through Figure 13 are only for the bottom layer of the groundwater flow model (Layer 5), which represents the Santa Margarita Aquifer, while several of the results discussed in the safe yield study were aggregated across all layers. For example, the net flow rate across the eastern boundary of the LSSA, aggregated for all model layers, for both predictive scenarios was shown to begin as a net inflow into the LSSA which declined over time until flow became a net outflow from the subarea (Figure 15). Figure 2 through Figure 13 illustrate that the flow into the LSSA at its eastern boundary in the Santa Margarita Aquifer decreases over time, but only appears to switch to a net outward flow in the 2018 and 2041 periods of the No Standard or Alternative Producer Pumping Scenario.

This is supported in Figure 16 which shows the flow across the eastern LSSA boundary in model layer 5 (Santa Margarita Aquifer) for both predictive scenarios as the solid and dashed black lines. The boundary flow in the Baseline Scenario never switches to an outward flow, while the boundary flow in the No Standard or Alternative Producer Pumping Scenario switches to an outward flow in 2013. In contrast, the flow across the eastern LSSA boundary for model layers 2-4 (Pas Robles Aquifer), shown as the solid and dashed red lines in Figure 16, switches to an outward flow as early as 2014 in the Baseline Scenario and 2012 in the No Standard or Alternative Producer Pumping Scenario. The net flow across the eastern LSSA boundary, aggregated for all model layers, as shown in Figure 15, switches to an outward flow in 2030 of the Baseline Scenario and in 2012 of the No Standard or Alternative Producer Pumping Scenario.

The Toro-1 and Toro-2 production wells directly across the boundary from the LSSA were cited in the safe yield study as good examples of outside wells that may be strongly influencing groundwater elevations within the LSSA (HydroMetrics WRI, 2013). These wells are screened in the Paso Robles Aquifer and therefore their effect cannot be distinguished in the results presented in Figure 2 through Figure 13 which focus on the Santa Margarita Aquifer (model layer 5). To illustrate the impact the Toro-1 and Toro-2 production wells have on the LSSA, groundwater levels and flow directions from model layer 2, which represents the top of the Paso Robles Aquifer, were extracted for August 2041 of the Baseline Scenario (Figure 17). This map demonstrates how conditions in the Paso Robles Aquifer differ from the Santa Margarita Aquifer and, more specifically, how the Toro-1 and Toro-2 wells influence local groundwater flow around the eastern LSSA boundary.

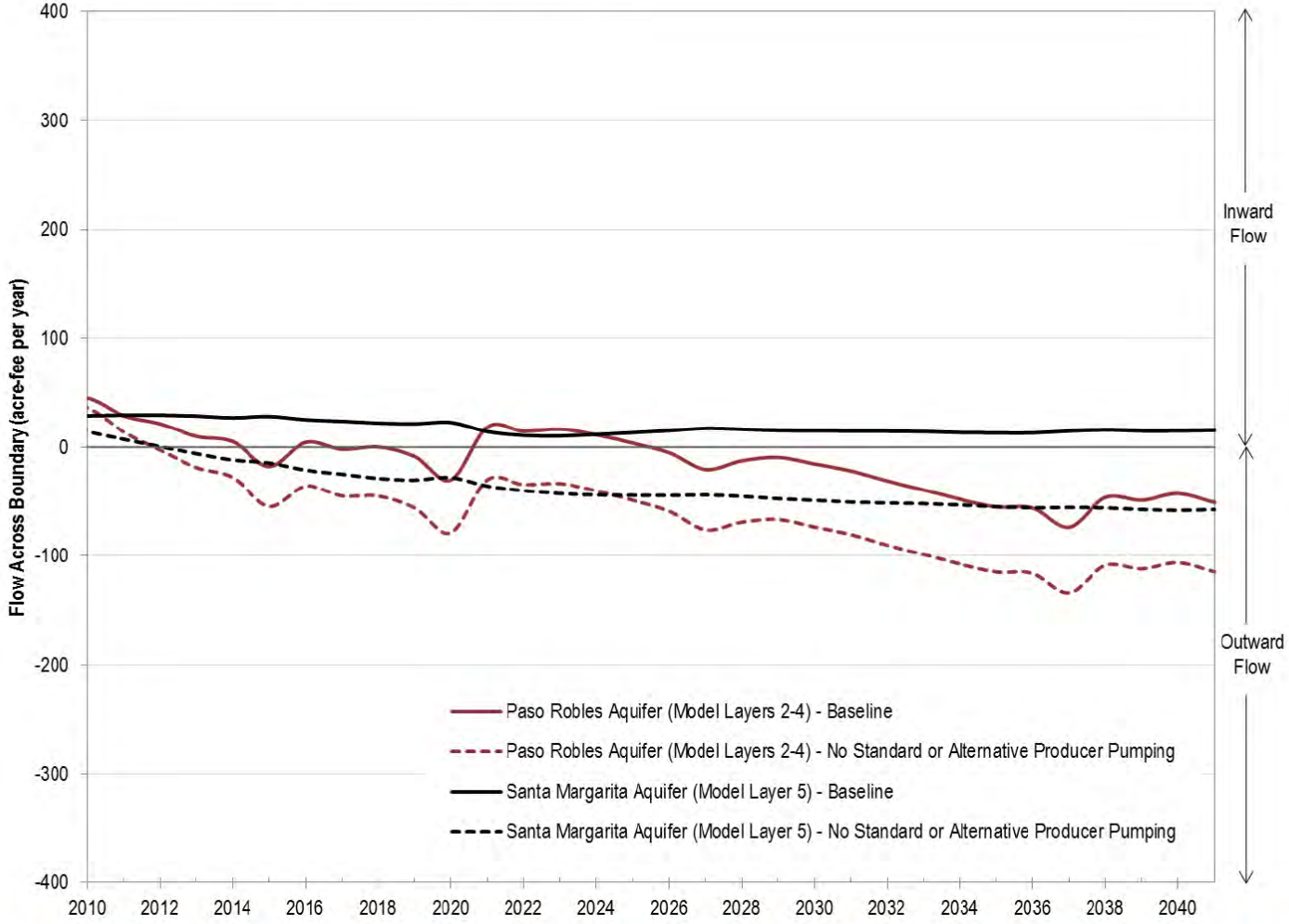

Figure 16: Groundwater Flows Across the Laguna Seca East Boundary in the Paso Robles and Santa Margarita Aquifers under the Baseline and No Standard or Alternative Producer Pumping Scenarios

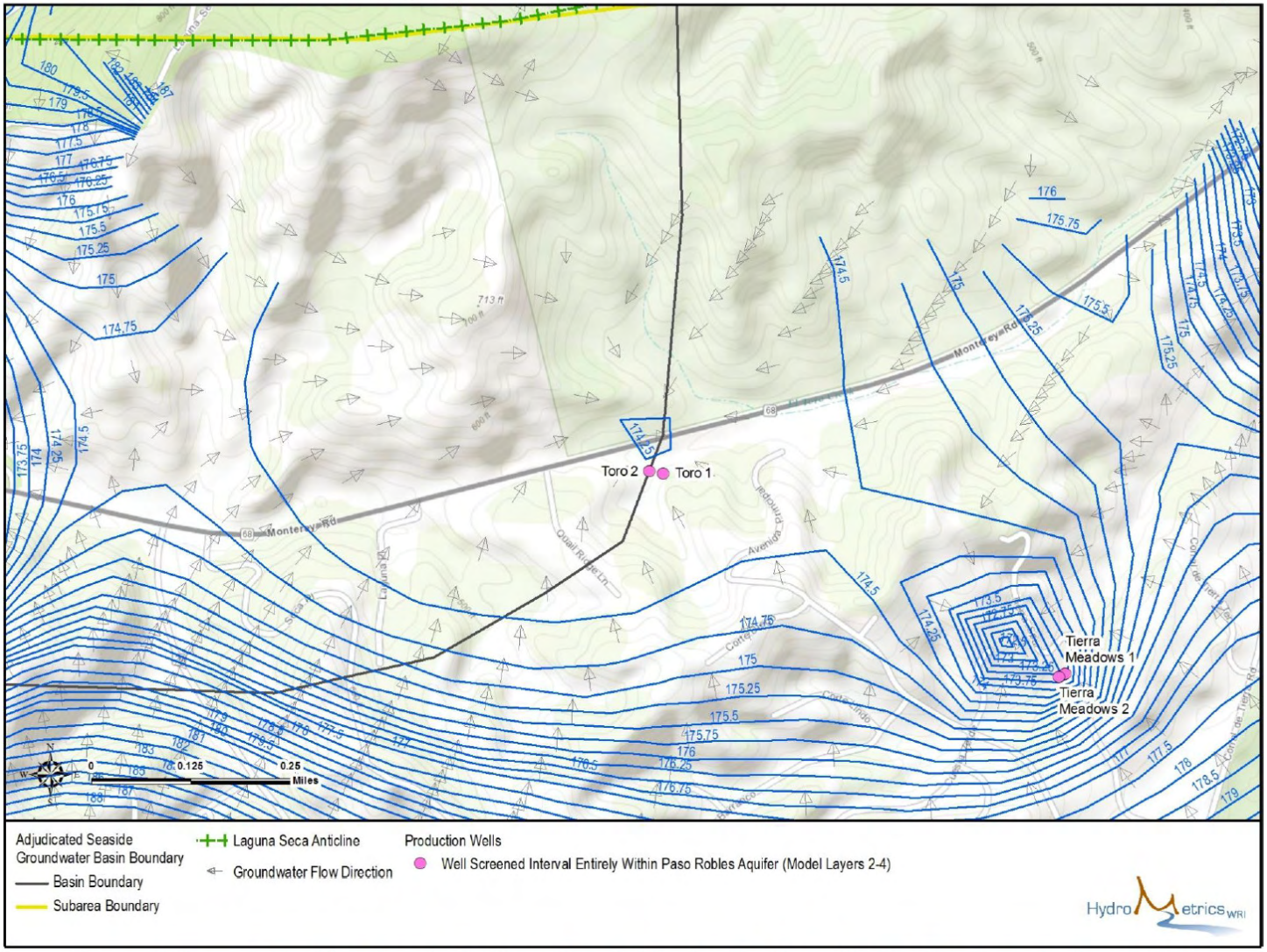

Figure 17: Groundwater Elevations in the Upper Paso Robles Aquifer (Layer 2) – Baseline Scenario, August 2041

A pumping depression can be seen around the Toro wells, into which groundwater is flowing from both sides of the LSSA boundary. A deeper pumping depression can also be seen around the Tierra Meadow wells. The offset between the location of the Toro and Tierra Meadows wells and their pumping depressions is an artifact of the numerical model, which spreads a well's pumping throughout an entire model cell rather than focusing it at the exact location of the well. A close look at the flow directions at the boundary reveal that groundwater is only flowing out of the LSSA in the vicinity of the Toro wells. While the remainder of the eastern boundary experiences inward flow, the gradient and flow rates near the Toro wells are greater and result in a net outward flow of water across the eastern LSSA boundary for model layer 2. At this location, the Toro wells draw water directly out of the LSSA, having a very direct influence on the groundwater resources of the LSSA. The other wells located further to the east, despite not drawing water directly out of the LSSA, may nonetheless have a similar or greater impact on the LSSA by intercepting groundwater that may otherwise flow towards, and thus recharge, the LSSA.

Finally, neither the groundwater flow divide nor the flow directions presented in this memorandum provide specific answers of how to manage groundwater elevations in the LSSA when outside pumping wells may be impacting these groundwater levels. The flow divides are neither static features nor hard physical barriers to flow. Instead, they are local high points or ridges that appear in groundwater elevations in response to the specific stresses that are placed on the groundwater system. A change in these stresses can cause flow divides to move, appear, or disappear. The dynamic nature of these divides is highlighted by the seasonal flow divides within the LSSA that develop and dissipate with changes in pumping and by the migration of the flow divide that is observed to take place during the No Standard or Alternative Producer Pumping Scenario.

Saturated Aquifer Thickness in Model Layer 5

To examine the concern of potential aquifer dewatering in the LSSA because of declining groundwater levels, the saturated aquifer thickness of model layer 5 for August 2041 based on the Baseline Scenario (anticipated conditions) was extracted from the model (Figure 18).

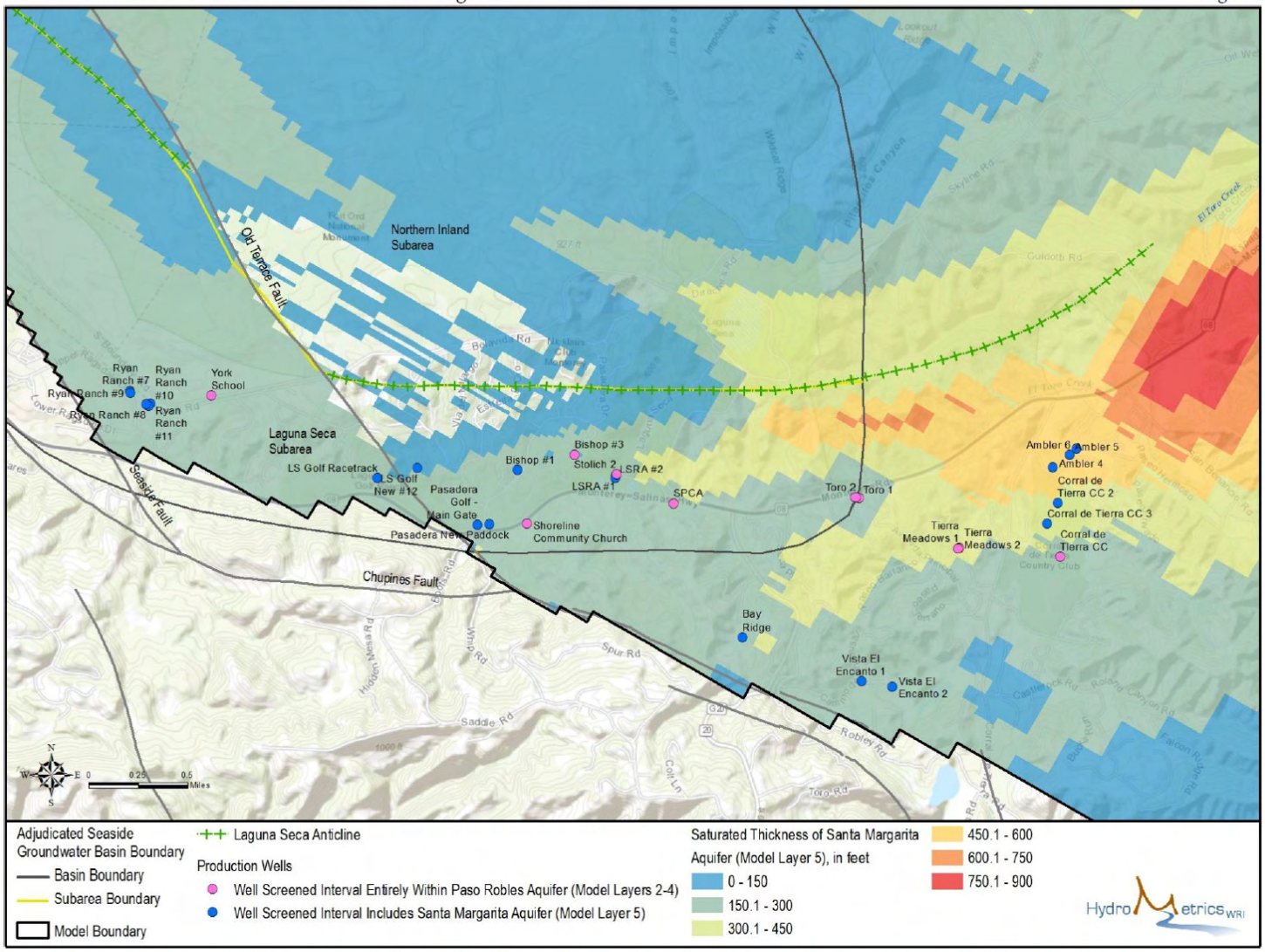

Figure 18: Saturated Thickness of the Santa Margarita Aquifer (Model Layer 5) in August 2041 of the Baseline Scenario

Areas with the least saturated thickness are located in the Northern Inland Subarea, the southeastern portion of the model, and following the Laguna Seca Anticline along the northern border of the LSSA. A notable area of large saturated thickness is observed in the Corral De Tierra subbasin[1] to the east of the adjudicated basin. As discussed in the section below, this may partially be a result of an uncertain geologic interpretation regarding the thickness of aquifer units in that area. It was found that, in general, the saturated thickness of this layer follows the aquifer layer thickness of the groundwater model.

Geologic Uncertainty

The East LSSA Flow Divide discussed above lies between the majority of the LSSA to the west, the Seaside Basin's Northern Inland Subarea to the north, and the Corral de Tierra subbasin to the east. Pumping from the Toro wells was identified in the safe yield study as a factor impacting groundwater levels in the eastern portion of the LSSA. One conclusion was that this pumping may prevent the Watermaster from taking measures to stabilize groundwater elevations in the eastern LSSA. As a result, conditions in the El Toro area will be an important factor in LSSA groundwater management decisions. Unfortunately, there is hydrogeologic uncertainty regarding the thickness of aquifer units in the Corral de Tierra subbasin that may impact the results of the groundwater model that is being used to assist in making these decisions.

A cross-section of the groundwater model layers was developed along a line roughly parallel to highway 68 that passes through, and to the northeast of, the LSSA. The cross-section location is shown on Figure 19 and the cross-section is shown on Figure 20. A vertical exaggeration of five was applied for clarity, and the point at which the cross section intersects the eastern boundary of the LSSA is highlighted with a red vertical line.

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[1] The Corral de Tierra subbasin is a groundwater subbasin of the Salinas Valley Groundwater Basin. The subbasin extends into the adjudicated basin as its western boundary is the DWR Bulletin 118 defined Seaside Area subbasin, which is not aligned with the adjudicated Seaside Basin. For purposes of this report, the Corral de Tierra subbasin is the area to the east of the adjudicated basin boundary, and includes the communities or areas of El Toro and Corral de Tierra that are referred to in other parts of this memorandum.

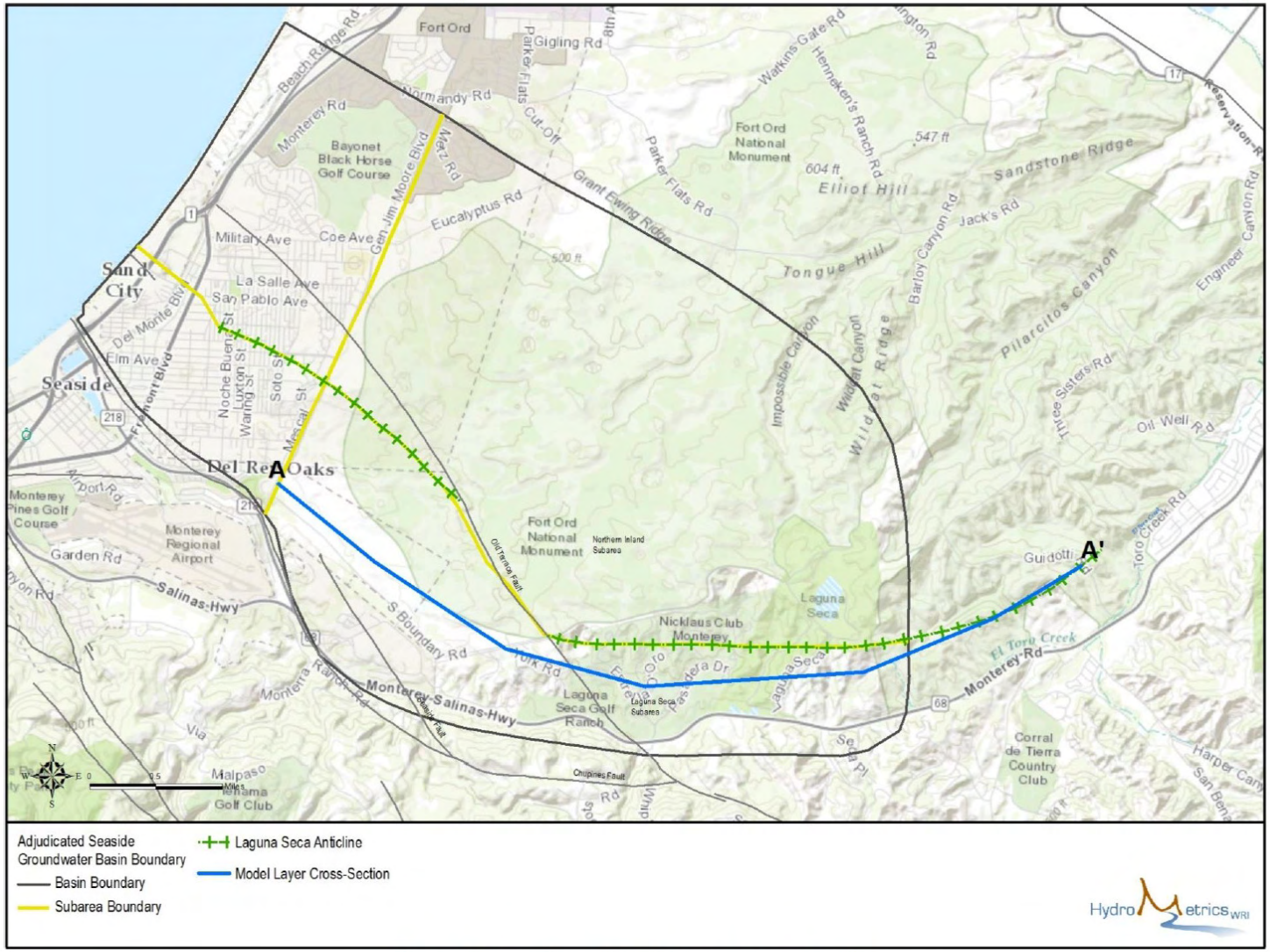

Figure 19: Location of Model Layer Cross-Section

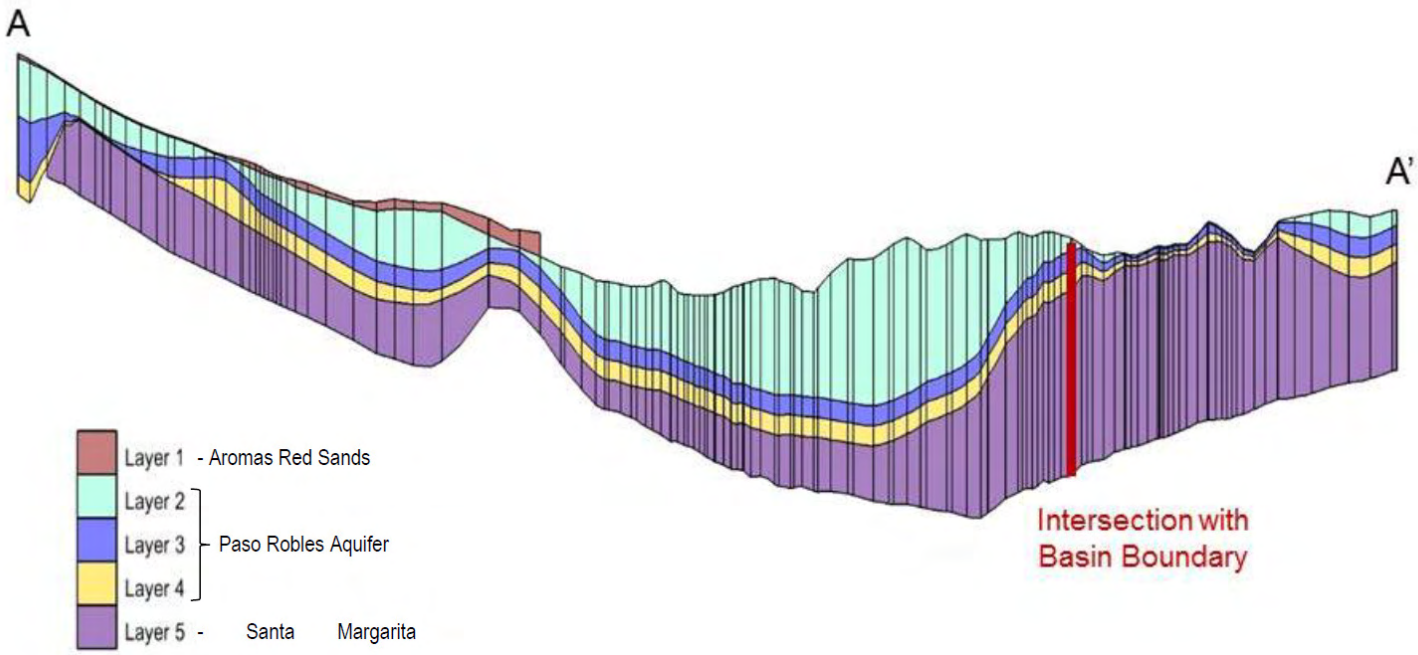

Figure 20: Model Layer Cross-Section with 5x Vertical Exaggeration

The cross-section shows that the model layer representing the Santa Margarita Aquifer is very thick in the El Toro area. This thickness will have a large impact on the model's aquifer transmissivity and how pumping may impact groundwater elevations in the area. The hydrostratigraphy[2] of this area was based upon a compilation of different sources. A map of the of the top of the Monterey formation (Rosenberg, 2001) was used to set the bottom of the Santa Margarita (layer 5). The bottom of the Paso Robles Formation was obtained from other sources. During model development, the contact between the Santa Margarita Aquifer and the Paso Robles Formation required adjustment to form reasonable geologic interpretations. Because the geologic data came from numerous sources, there is no assurance that the various geologic interpretations are consistent. During model development, geologic inconsistencies were encountered where the interpreted bottom of the Paso Robles formation dipped below the mapped bottom of the Santa Margarita aquifer.

These inconsistencies demonstrate the amount of geologic uncertainty in the basin, particularly in the Corral de Tierra subbasin which has not been extensively studied and was not a primary focus when the groundwater model was developed. Reducing the geologic uncertainty in the Corral de Tierra subbasin may impact the understanding of the interaction between the Toro wells' pumping and LSSA groundwater elevations. For example, if new data suggests that the Santa Margarita Aquifer in this area is thinner and of lower transmissivity than is currently assumed, pumping would be expected to induce deeper and more extensive cones of depression.

Two additional sources of information raise questions about the simulated hydrogeology in this area. First, the County of Monterey has declared the Corral de Tierra subbasin as having severe water constraints and being in overdraft. This is contrary to the thickness and transmissivity that the groundwater model simulates in the area. Second, observations of groundwater elevations in the area show that despite the relatively high pumping in the area only limited drawdown has been experienced. This is more consistent with the representation included in the model, but is contrary to the County's assessment of the area.

The limited and conflicting data for the region, combined with the importance of this region in understanding how successful management of the LSSA may be achieved, leads

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[2] Hydrostratigraphy refers to the grouping of geologic units based on hydraulic properties that control the movement of groundwater.

to the recommendation that additional geologic and hydrogeologic investigations be undertaken in the area.

The type of study needed to improve geological and hydrostratigraphic understanding in this area would be to 1) review the technical documents that led to the County's assessment that the Corral de Tierra subbasin has severe water constraints and is in overdraft, 2) review all technical documents submitted to the County for proposed developments, 3) review and use well logs for all available wells in the area to develop more accurate geological cross-sections, 4) in areas where data are lacking, drill new exploratory wells to complete geological cross-sections, and 5) perform aquifer testing on selected wells to determine aquifer properties. The full scope of the studies provided above constitute a typical hydrogeological study in an area where more geological information is needed. It would be possible to work through the scope in a phased approach. If enough data is collected using available data, it may not be necessary to collect new data by drilling.

CONCLUSIONS

1. Based on the LSSA safe yield study (HydroMetrics WRI, 2013), the Seaside Basin groundwater flow model predicts that under anticipated future pumping conditions, groundwater elevations in the LSSA will continue to decline. The eastern portion of the LSSA suffers the greatest and most persistent declines. Pumping groundwater elevations are predicted to fall below the top of the well screen prior to 2041 in wells Bishop #3, Ryan Ranch #7, and Laguna Seca Golf Resort – Racetrack.

2. The groundwater flow divides illustrated in this technical memorandum do not appear to move appreciably between 2010 of the Historic Scenario and 2041 of the Baseline Scenario. This indicates that groundwater flow divides will remain relatively stable under currently anticipated pumping conditions in the future.

3. Regional groundwater flow through the eastern portion of the LSSA is both westwards towards the Southern Coastal Subarea and northward into the Northern Inland Subarea. The Laguna Seca Anticline is a structural feature that causes groundwater flow to split into these directions.

4. The groundwater flow divide (East LSSA Flow Divide) located in the eastern portion of the LSSA is shown to migrate westward during the No Standard or Alternative Producer Pumping Scenario. This movement is caused by relative increases in groundwater elevations in the LSSA because pumping is reduced compared to east of the LSSA where pumping is not reduced. This migration highlights the fact that groundwater flow divides are not static physical features. A shift in groundwater flow directions along the eastern boundary of the LSSA accompanies this migration in the East LSSA Flow Divide. The groundwater flow direction in the easterly portion of the LSSA shifts towards the northeast and east by 2041 of the scenario, resulting in groundwater flowing out of the LSSA and into the Corral de Tierra subbasin.

5. For every month investigated in all scenarios, groundwater in the Santa Margarita Aquifer in the most northeastern portion of the LSSA flows north and northeast out of the LSSA and into the Northern Inland Subarea and Corral de Tierra subbasin. This northeastern portion of the LSSA was also shown by the safe yield study to be more influenced by pumping outside of the LSSA than by pumping within the subarea. The presence of a flow divide between this region and the rest of the LSSA further to the west indicates that this region is in greater

hydrogeological connection with the Corral de Tierra subbasin, as well as the Northern Inland Subarea.

6. The groundwater flow model shows the Toro-1 and Toro-2 production wells to draw water directly from the LSSA in the Paso Robles Aquifer, thereby having a direct influence on groundwater conditions within the LSSA. However, it must be noted that the impact of the Toro wells was not compared to the cumulative impact of the other production wells located further east which indirectly affect the LSSA by diverting groundwater which may otherwise flow into, and thus recharge, the LSSA. This diversion results in lowering groundwater levels in the LSSA.

7. Because of the influence of wells outside of the eastern LSSA, it will not be possible for the Watermaster to implement effective groundwater management strategies preventing groundwater levels in that portion of the LSSA from continuing to decline due to ongoing pumping in the Corral de Tierra subbasin. The Watermaster is likely to have greater success implementing strategies aimed at stabilizing groundwater levels within the portion of the LSSA that is westerly of the East LSSA Flow Divide. Such strategies, however, would need to be revised over time to account for new wells, or increased pumping from existing wells, near the eastern edge of the LSSA, since these could influence groundwater levels west of the current flow divide.

8. Previous modeling results (Hydrometrics WRI, 2013) suggest that the net flow of groundwater across the eastern LSSA boundary for the aggregation of all model layers is currently from the Corral de Tierra subbasin into the LSSA, but that this flow may switch directions in the future. The Baseline Scenario predicts a net flow of groundwater from the LSSA into the Corral de Tierra subbasin by 2030, while the No Standard or Alternative Producer Pumping Scenario predicts the switch to occur much earlier (by around 2012).

9. During 2010 of the Historic Scenario and 2018 of the Baseline Scenario, flow divides within the LSSA are present in August but are not present in February. These temporary flow divides emerge due to seasonal pumping depressions that form during the summer months and disappear when pumping rates are reduced.

10. It must be recognized that the groundwater model results are based upon an uncertain understanding of the hydrogeologic conditions in the Corral de Tierra

subbasin. Proper management of the LSSA will require learning more about the area of the Corral de Tierra subbasin within the groundwater model area to improve the geologic and hydrogeologic understanding of this area. A typical hydrogeological study to improve hydrogeologic understanding would involve first examining existing well data and studies, followed by, if necessary, field work to drill new wells and determine aquifer properties to provide data where hydrogeological data does not exist.

REFERENCES

HydroMetrics LLC. 2009. *Seaside groundwater basin modeling and protective groundwater elevations*. Prepared for Seaside Basin Watermaster, 151 pp.

HydroMetrics WRI. 2013. *Technical memorandum: results of Laguna Seca safe yield analysis*. Prepared for Seaside Basin Watermaster, December 24, 2013.

Rosenberg, L.I. 2001. *Geologic resources and constraints, Monterey County, California - a technical report for the Monterey County 21st century general plan update program.* Prepared for Monterey County.