SEASIDE GROUNDWATER BASIN WATERMASTER

NOTICE

BUDGET AND FINANCE COMMITTEE MEETING TUESDAY, SEPTEMBER 19, 2017 1:00 P.M. - SEASIDE CITY HALL CONFERENCE ROOM

AGENDA

Committee Members

City of Seaside
Daphne Hodgson - Chair

California American Water
Eric Sabolsice

City of Sand City
Todd Bodem

Coastal Subarea Landowners
Paul Bruno

The next Watermaster Budget / Finance Committee meeting will be held on Wednesday, September 19, 2017 at 1:00PM at the Seaside City Hall Conference Room.

The public may comment on any item within the committee's jurisdiction. Please limit comments to three minutes in length.

Action Items:

1. Discuss/Consider Recommending a Cost Share Method to the Watermaster Board for Recalibration and Updating of Seaside Groundwater Basin Model in Preparation of the Monitoring and Management Fund – Operations 2018 Budget

2. Discuss/Consider Modeling of Potential Changes in Groundwater Quality Resulting from Introducing New Sources of Water into the Aquifers in Preparation of the Monitoring and Management Fund – Operations 2018 Budget

3. Discuss/Consider Recommendation to the Watermaster Board for Proposed Fiscal Year 2018 Annual Budgets.
   A. Administrative Fund
   B. Monitoring and Management Fund—Operations
   C. Monitoring and Management Fund—Capital
   D. Replenishment Fund (No Action Required)

4. Discuss/Consider Recommendation to the Watermaster Board to Approve the Proposed Replenishment Assessment Unit Costs for Operating Yield and Natural Safe Yield Overproduction for Water Year October 1, 2017 through September 30, 2018.

If requested, the agenda and documents in the agenda packet shall be made available in appropriate alternative formats to persons with a disability, as required by Section 202 of the Americans with Disabilities Act of 1990 (42 U.S.C. Sec. 12132), and the federal rules and regulations adopted in implementation thereof.

SEASIDE BASIN WATER MASTER
BUDGET AND FINANCE COMMITTEE
** * * AGENDA TRANSMITTAL FORM * * **

MEETING DATE:	September 19, 2017
AGENDA ITEM:	1
AGENDA TITLE:	Discuss/Consider Recommending a Cost Share Method to the Watermaster Board for Recalibration and Updating of Seaside Groundwater Basin Model in Preparation of the 2018 Monitoring & Management: Operations Fund Budget
RECOMMENDED ACTION:	Develop a cost-sharing recommendation to present to the Board regarding the costs to update and recalibrate the Model
PREPARED BY:	Robert Jaques, Technical Program Manager

SUMMARY:

Background

At its July 5, 2017 meeting the Board discussed with Staff two items that the TAC was considering recommending for inclusion in the 2018 Monitoring and Management Program (M&MP) Work Plan and Budget. One of these was whether or not the Basin Management Action Plan (BMAP) and the Seaside Basin Groundwater Model (Model) should be updated. The Board's direction on this was develop a cost and scope to perform this work and include it in the proposed 2018 Monitoring and Management Plan Work Plan and Monitoring and Management: Operations Fund Budget which will go to the Board for its consideration at its October 2017 meeting. Comments from Board members included:

- Look closely at the costs to perform this work and reduce them wherever possible.
- See if staff can do some portions of the updating of the BMAP in order to save consultant costs
- Only do updating when it is shown to be necessary
- Contact MPWMD/MRWPCA to seek their sharing of costs to update the Model, since the Pure Water Monterey Project is using our Model for their analyses
- It will be very important to have up-to-date data and documents when holding discussions with the Salinas Valley Basin Groundwater Sustainability Agency
- It will be good to update our documents periodically to keep them current and accurate
- Ask for input from Gus Yates of Todd Groundwater on what recalibrating and updating he feels should be done to the Model

Discussion

Pursuant to the Board's direction I did the following:

1. I re-reviewed HydroMetrics' proposed scope of work with the TAC to see if any of the work and/or costs could be reduced. The TAC did not identify any aspects of the work that could be reduced.

2. I asked Gus Yates to review HydroMetrics' proposed scope-of-work and to provide his comments and recommendations on that. Attached is Mr. Yate's Memo discussing his recommendations, and HydroMetrics' response to his Memo.

I contacted MPWMD/MRWPCA regarding sharing in the costs to update the Model (see attached letter sent to these entities). Attached is the joint response letter from MPWMD and MRWPCA indicating their willingness to share in these costs. I believe that the matter of how costs should be shared for this work is a Board policy decision, not a TAC decision, so I am deferring to the Budget and Finance Committee and the Board on how to pursue cost-sharing with these entities.

SEASIDE BASIN WATER MASTER
BUDGET AND FINANCE COMMITTEE

** * * AGENDA TRANSMITTAL FORM * * **

AGENDA ITEM:	1 (Continued)

3. I requested HydroMetrics to try to reduce its cost for Section 3 (Supplemental Water Supplies) of the BMAP, if Watermaster staff can provide much of the information in that section. I also requested that they revise their Scope of Work and Costs to reflect their response to Mr. Yates's Memo. Their attached revised Scope and Cost Proposal shows a $2,220 cost reduction in Task 3 to reflect having the Watermaster provide this assistance, and changes in costs for several other Tasks in accordance with their attached response letter to Mr. Yates's Memo.

The net result of these revisions is an increase in cost of $8,210 to update and recalibrate the Model, and an increase in cost of $1,380 to update the BMAP, over the amounts contained in their original Proposal. This results in a total increase in cost of $9,590 over the amount contained in their original Proposal ($99,630-$90,040).

If cost-sharing with MPWMD and MRWPCA were to occur using the approach outlined in their July 31, 2017 letter, those entities would pay for 50% of the costs to update and recalibrate the Model. This would result in them contributing $27,185 (50% of $54,370) toward the Watermaster's cost to perform that work.

ATTACHMENTS:	1. Memo from Gus Yates Regarding Updating the Model 2. HydroMetrics Letter Responding to Mr. Yates's Memo 3. Revised Proposal from HydroMetrics for Updating the BMAP and the Groundwater Model 4. Letter Sent to MRWPCA and MPWMD Asking Them to Share in the Costs of Updating the Model 5. Joint MPWMD-MRWPCA Response Letter

TODD GROUNDWATER

August 2, 2017

MEMORANDUM

To: Bob Jaques, Seaside Basin Watermaster Technical Program Manager

From: Gus Yates, Senior Hydrologist

Re: Recommendations Regarding Seaside Basin Groundwater Model Update and Recalibration

I have reviewed the proposed groundwater modeling tasks included in the "Scope and Cost to Update the Seaside Basin Management Action Plan" prepared by HydroMetrics Water Resources, Inc. (March 24, 2017). The proposed update and recalibration of the model are an opportunity to continue improving model performance, particularly with respect to some of the issues pointed out in my peer review of the current model (Todd Groundwater, 2015). Modeling is covered under Tasks 1 and 2 of the scope of work, and the subtasks listed for those two tasks are all reasonable to include in the work effort.

For the subtasks shown below, I offer a few suggestions and concerns related to how the analysis is carried out. I suspect HydroMetrics has already considered these issues, but perhaps some of the ideas are new.

Subtask 1.3 Model Recalibration

- Consider jointly calibrating recharge and aquifer parameters. Rainfall recharge, pipe leaks and irrigation efficiency are all poorly known yet generate most of the basin yield. If the simulated response to pumping ramp-downs in recent years has not been tracking measured water levels, the recharge estimate could be part of the problem.

- Emphasize long-term hydrograph trends in the calibration process. I find that residuals statistics are of little value. Also, trends are a key indicator of yield and sustainability; nonetheless they proved to be fairly unresponsive to model sensitivity tests we completed during my 2015 model peer review. It would be useful to identify which variables do control the trends in various parts of the basin.

- Consider not using PEST. Hydraulic conductivity (K) is undoubtedly highly variable, but the complex K patterns that typically result when PEST is used for calibration complicate the interpretation of results. For example, simpler K patterns might make it easier to identify which variables govern the development of the pumping trough in the Northern Coastal subarea.

- Seek consistency with the new Salinas Valley Integrated Hydraulic Model. Does the current Seaside Basin model boundary coincide with the SVIHM model boundary? Do both models treat that as a no-flow boundary because of a flow divide? Does either model predict water-level trends near the boundary that might alter the flow-divide location?

Subtask 2.1 Update Basin Conceptual Model

- Highlight data and understanding that have changed since 2009. The dynamic, flow-divide character of the northern and eastern basin boundaries has been recognized since at least 2005, but new areas of understanding might include:
    - Have data from the seawater intrusion sentry wells provided any new insight into how the Paso Robles and Santa Margarita aquifers are connected to the ocean?
    - The concept of the Laguna Seca Anticline as only a partial barrier to groundwater flow is relatively recent. It would be useful to present data and implications related to that reconceptualization.
    - The modeling work that HydroMetrics completed related to the locations of flow divides in the eastern part of the Laguna Seca subarea is a significant refinement of prior understanding of that boundary.
    - Has any information related to the injection wells or studies for the GWR project changed the conceptual understanding of the basin?
    - Do water levels during the past 8 years define the northeastern flow-divide basin boundary more precisely or indicate that its location is shifting?

Subtask 2.3 Update Estimates of Groundwater Storage

- Will the recently developed protective groundwater levels be used to define the bottom surface of a range of operable groundwater storage? How will protective groundwater levels be interpolated between wells and extrapolated inland for that purpose?

- How will areas where water levels are presently below protective elevations be balanced against areas where they are higher in the calculation of Useable Storage Space?

- How will temporary storage depletions (seasonal or multi-year drought) be handled in the calculation of Useable Storage Space?

- What assumptions regarding pumping location will be included in the calculation of Total Useable Storage Space? For example, there is a lot of storage space in the Northern Inland subarea, but is it useable if no wells are there to draw from it?

Subtask 2.4 Update Groundwater Budget

- A “current” groundwater budget might be tricky to define in light of pumping ramp-downs in recent years, plus the effects of a concurrent drought. As long as the pumping assumptions are stated clearly, pumping could be held at existing amounts[1] and simulated over a longer hydrologic period to obtain an average “current” water budget.

Subtask 2.5 Review Natural Safe Yield Estimates

- Appendix B of my 2015 peer review memo documented the shortcomings of the “natural safe yield” concept, and my low opinion of it remains unchanged. Even if “natural safe yield” calculations are required pursuant to the adjudication decision, the “operating yield” that HydroMetrics has calculated in previous reports should be emphasized.
- Applying the Zero Net Draft method for estimating yield could be difficult because 1) water levels in the Laguna Seca subarea have been continuously declining, and 2) water levels in the Northern Coastal subarea have been steady in some wells and declining in others. The Zero Net Draft method requires hydrographs that go up and down.

I look forward to learning what new insights about the basin emerge from the model update and recalibration process.

[1] Possibly including annual adjustments to irrigation pumping related to wet/dry year conditions.

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

Mr. Bob Jaques
Seaside Watermaster Technical Program Manager
83 Via Encanto
Monterey, CA 93940

August 4, 2017

Subject: Response to Todd Groundwater's *Recommendations Regarding Seaside Basin Groundwater Model Update and Recalibration*

Mr. Jaques,

Thank you for forwarding the above referenced memorandum from Gus Yates of Todd Groundwater. As always, Mr. Yates's comments are well thought out and appreciated. We have reviewed each comment, and included our responses in this letter. Based on Mr. Yates's recommendations, we have revised our cost estimate for updating the groundwater model.

COMMENT REVIEW

SUBTASK 1.3 MODEL RECALIBRATION

- We agree that jointly calibrating recharge and aquifer parameters is a good idea. The recent dry years provide a good opportunity to test the sensitivity of the model to both aquifer parameters and recharge estimates. This will be a somewhat more complicated calibration, and therefore take additional effort.

- Mr. Yates's point of emphasizing long-term hydrograph trends is well taken. While we disagree that residuals statistics are of little value, we do agree that long term trends should be a primary focus, and appreciate Mr. Yates focusing our attention on this gauge of model applicability. Recalibrating the recharge parameters may improve simulated long-term hydrograph trends.

- We will continue to use Parameter Estimate (PEST) software during calibration. While we strive to use this software judiciously in calibration, it is an important tool in our modeling toolbox. We view this as more of a modeling style comment by Mr. Yates rather than a substantial comment.

- Consistency with the Salinas Valley Integrated Hydraulic Model (SVIHM), currently being developed by the USGS, is desirable but may be impractical for the BMAP/model update because of timing. The SVIHM has not been completed and its completion date is uncertain. Waiting for its completion will delay our model update for many months. We propose that when the SVIHM has been finalized that we assess how well it simulates historical conditions in the Seaside Basin. Based on that assessment, if we conclude that improvement is needed in the Seaside Basin model we can revise it using parts of the SVIHM that we feel improve model calibration. It is important to note is that although the SVIHM includes the Seaside Bain, the USGS will exclude any reporting of the simulation results for the Seaside Basin. We should, however, be able to get the model code from the USGS for our assessment of how well the SVIHM matches historic conditions in the Seaside Basin.

SUBTASK 2.1. UPDATE BASIN CONCEPTUAL MODEL

We agree with the items Mr. Yates's recommends to include in this update to the narrative description of the basin's conceptual model in the BMAP. Some of the items will require a little more time than previously budgeted.

Important to note is that this update of the conceptual model will not be used to update the groundwater model layers and boundary conditions. This type of update is very intensive and not warranted at this point. Perhaps when the Salinas Valley Integrated Hydraulic Model has been completed, a Seaside Basin model update can include integrating Salinas Valley model data as well as updating the model layers to reflect an improved conceptual understanding of the Seaside Basin.

SUBTASK 2.3 UPDATE ESTIMATE OF GROUNDWATER STORAGE

We do not plan on making significant changes to our previous methodology for calculating groundwater storage, but will update the storage figures in this subsection using data and other information obtained since the BMAP was originally prepared. Our decision to adhere to the previous methodology is based on the observation that the estimated amount of groundwater in storage has not been a factor in basin management. The

Adjudication Decision requires that the Total Usable Storage Space be periodically adjusted (based on new information).

SUBTASK 2.4 UPDATE GROUNDWATER BUDGET

We agree that defining current groundwater budgets for any basin is difficult because basin management conditions vary with time. However, we disagree that the most effective way to deal with this is to hold pumping steady while simulating long-term hydrologic cycles. Pumping variability in response to wet and dry years is part of the hydrologic fluctuation of the basin, and cannot be discounted. We believe the best approach is to address the long-term water budget and acknowledge that recent years have been relatively dry. This approach will lead to a slight increase in budget, but less increase in budget than would be required to adopt the proposed approach of simulating constant pumping and fluctuating hydrology.

SUBTASK 2.5 REVIEW NATURAL SAFE YIELD

- We completely agree that the natural safe yield concept is badly flawed. It is, unfortunately, a construct that has burrowed its nose into too many groundwater basin adjudications. We will attempt to emphasize the operating yield concept more strongly.

- Mr. Yates' observation about our inability to apply a Zero Net Draft method for estimating yield is well taken. We will remove this approach from the BMAP update.

BUDGET IMPLICATIONS

There are four items that change our estimated budget for the BMAP update.

1. Jointly calibrating recharge and aquifer parameters will be a somewhat more complicated calibration, and therefore take additional effort. Add $8,210 to Subtask 1.2.
2. Update the BMAP's conceptual understanding of the basin will require an additional effort. Add $2,040 to Subtask 2.1.
3. Include analysis of long-term water budget that acknowledges recent drought. Add $1,300 to Subtask 2.4.
4. Zero Net Draft method for estimating basin yield will be removed from the budget. Subtract $1,130 from Subtask 2.5.

1814 Franklin St., Suite 501
Oakland, CA 94612

Mr. Robert S. Jaques
Seaside Groundwater Basin Watermaster
83 Via Encanto
Monterey, CA 93940

August 4, 2017

Subject: Revised Scope and Cost to Update the Seaside Basin Management Action Plan

Mr. Jaques:

Thank you for the opportunity to provide you with this scope and cost to update the Seaside Groundwater Basin's Basin Management Action Plan (BMAP). The scope we have put together addresses the BMAP items that were presented at the February 2017 Technical Advisory Committee meeting, and includes some of the recommendations made by Gus Yates of Todd Groundwater.

The Watermaster's first BMAP was completed in February 2009 (HydroMetrics LLC, 2009a). The BMAP constitutes the basic plan for managing the Seaside Groundwater Basin. The BMAP identifies both short-term actions and long-term strategies intended to protect the groundwater resource while maximizing the beneficial use of groundwater in the basin. It provides the Watermaster a logical set of actions that can be undertaken to manage the basin to its Safe Yield. Over the eight years since the BMAP was completed, the Watermaster has collected much groundwater level and quality data, and conducted various studies to improve the understanding of the basin. This improved understanding should be incorporated into an updated BMAP to facilitate ongoing responsible management of the groundwater resource.

At the time the 2009 BMAP was prepared, a groundwater model had not yet been developed for the basin, and the analysis contained in the BMAP was completed using analytical methods. Following the BMAP recommendation that a groundwater model be constructed to assist with groundwater management decisions, a calibrated model was completed in November 2009 (HydroMetrics LLC, 2009b). The model simulated groundwater conditions in the basin between January 1987 and December 2008. In 2014, the model was updated with data through September 2013 (HydroMetrics WRI, 2014) but not recalibrated because its accuracy was still acceptable. The 2014 update found that the uncalibrated portion of the model (January 2009 – September 2013) tended to simulate higher groundwater levels than measured levels. Periodic recalibration of the model is necessary to ensure the model simulates groundwater levels within an acceptable industry standard accuracy. If simulated groundwater levels are not accurate this reduces the accuracy of all output from the model such as groundwater storage and water budget.

The scope of work provided below assumes the model will be used to develop estimates of groundwater storage, water budget, and safe yield; and to test impacts of potential management actions. The groundwater model was developed to assist in making basin management decisions, and for providing the simulated results that are required for analysis in the BMAP. As the model currently only includes input data through September 2013, groundwater storage, water budget, and safe yield estimates can only reliably be obtained from the model up through Water Year 2013. The model needs to be updated through Water Year 2016 to be used for current estimates. It is likely recalibration of the model will be required so that it more accurately simulates the historic low groundwater levels currently occurring in the basin.

The scope outlined below starts with an update and recalibration of the groundwater model, and then generally updates each of the main sections of the BMAP.

Task 1: Update Seaside Basin Groundwater Flow Model.

Subtask 1.1. Update Model Input Data.

Groundwater production, groundwater levels, injected water, and precipitation data will be sourced and compiled for input into the groundwater model. In addition to precipitation, estimates of storm water percolation, septic tank leakage, and system losses are also needed as they all contribute to the recharge of the basin. Most data are already available from MPWMD or Watermaster, but some other pumpers such as Cal Water Service and Marina Coast Water District, which do not fall under the Watermaster will be contacted for their data.

The updated model input data will be incorporated into the groundwater model. Once the model has been updated and is successfully running, hydrographs comparing measured and simulated groundwater levels will be prepared. The hydrographs produced will be the same ones used in the 2009 model report.

Subtask 1.3. Model Recalibration.
Model calibration is a process that involves varying relatively uncertain and sensitive parameters such as horizontal and vertical hydraulic conductivities, over a reasonable range of values. Per Mr. Yates's recommendation, we will jointly calibrate recharge and aquifer parameters. This is a change from our previous calibration approach of only calibrating aquifer parameters. Calibration will be completed when simulated results match the measured data within an acceptable measure of accuracy, and when successive calibration attempts do not notably improve the calibration statistics. Parameter Estimation (PEST) software will be used as a tool to improve calibration.

Estimating the effort involved in model calibration is difficult because there is no defined set of steps that can be followed. The costs provided with this scope reflect our best estimate, but additional costs may be necessary to complete calibration successfully.

Subtask 1.4. Model Update Technical Memorandum.
A Draft Technical Memorandum will be prepared documenting the model update and calibration results. After presenting the Tech Memo to the TAC and receiving comments, a Final Tech Memo will be prepared for submission to the Board. For purposes of the cost estimate, we have assumed HydroMetrics WRI will present the findings to the TAC and to the Board. One presentation will be in-person and one will be by telephone.

Task 2: Update BMAP Section 2 - State of the Seaside Groundwater Basin.

Subtask 2.1. Update Basin Conceptual Model. Since the 2009 BMAP was completed, a significant amount of modeling has been undertaken that has assisted in improving our hydrogeologic understanding of the basin. Additionally, a few new wells have been drilled that may improve our understanding of basin geometry. Below is a list of recent developments that will be used to update our conceptual understanding of the basin:

- Modeling work we completed related to the locations of flow divides in the eastern part of the Laguna Seca subarea and how pumping outside of the basin affects groundwater within the basin.
- The concept of the Laguna Seca Anticline as only a partial barrier to groundwater flow is relatively recent. We will present data and implications related to that reconceptualization.
- New wells, such as the Pure Water Monterey ASR wells and the MPWMD ASR wells, may provide new data related to aquifer depths and bottom of the basin that could improve the conceptual understanding of the basin.
- Groundwater levels collected over the past eight years may provide an undated definition of the basin's northeastern flow-divide boundary.

Subtask 2.2. Analyze Groundwater Levels Trends. Since 2009, eight years of groundwater level data have been collected, some of it using data loggers that record groundwater levels multiple times a day. This has allowed us to vastly improve our understanding of both seasonal and long-term trends. The basin has also experienced a recent drought and Court-mandated pumping reductions. How groundwater levels have responded to these changes has also improved our understanding of the basin. Furthermore, protective groundwater elevations developed after the 2009 BMAP should be included and discussed in an updated BMAP.

Subtask 2.3. Update Estimates of Groundwater Storage. The updated BMAP will include updates of estimated total stored groundwater, usable storage space, and total useable storage space. The Watermaster is required under the Decision to recalculate Total Usable Storage Space and adjust the allocation as needed.

The groundwater model and protective groundwater elevations should be used to quantify these storage estimates for the Seaside Basin. The 2009 BMAP did not have the benefit of site specific protective elevations and thus used Ghyben-Herzberg generated elevations. This updated BMAP will instead use protective elevations developed using groundwater models that estimate onshore groundwater elevations that keeps the productive onshore aquifers fresh (HydroMetrics LLC, 2009b).

Subtask 2.4. Update Groundwater Budget. A long-term and current groundwater budget will be developed to enhance our understanding of the groundwater system, and how the basin has responded during the recent drought. Similar to Subtask 2.3, the groundwater budget can be readily generated from groundwater model output. However, the groundwater model needs to be updated through September 2016 and recalibrated for it be used reliably to evaluate the current and historical water budget.

Subtask 2.5. Review Natural Safe Yield Estimates. The State of California has experienced a recent drought which has impacted natural aquifer recharge more than was anticipated in the 2009 BMAP. Also, even though pumping in recent years has been below the amounts required under the Decision, groundwater levels have continued to fall. This suggests that the Natural Safe Yield of 3,000 AFY in the Decision may be too high.

The reevaluated Safe Yield will be compared against other Safe Yield estimates that were included in the 2009 BMAP. If appropriate, a revised Safe Yield to replace the Decision-established Natural Safe Yield of 3,000 AFY will be provided for basin management purposes.

Task 3: Update Section 3 – Supplemental Water Supplies.
This section will be primarily completed by Watermaster staff, and will be edited and integrated into the BMAP update by HydroMetrics WRI. Watermaster staff will update the old BMAP Section 3 with current information on projects being considered to meet the long-term water needs in the Seaside Basin. Included will be MRWPCA's Pure Water Monterey groundwater replenishment project and Cal Am's Monterey Peninsula Water Supply Project (MPWSP). Recent Environmental Impact Reports will be used to update the information. If any other projects are in early planning stage, they will also be included in the update.

In the revised cost estimate (Table 1), the number of hours has been reduced from our previous cost estimate in March to reflect that Watermaster staff will be responsible for the majority of this task.

Task 4: Update Section 4 – Groundwater Management Actions.
This section will be updated to reflect actions and interim water supplies that have already been implemented, eliminate actions that are no longer viable, and add potential future actions and interim water supplies that could be implemented to address basin imbalances in the short-term before the long-term supply projects in Section 3 of the BMAP can be permitted, built and operated.

An example of a local management action would be to identify optimal extraction well locations such that those wells can make more efficient use of useable stored groundwater. The groundwater model is the most appropriate tool for this as it is able to simulate cumulative impacts by taking into account long-term projects and any other short-term projects while optimizing well locations.

It is beyond the scope of the BMAP update to prepare preliminary costs for potential future actions and interim water supplies. However, as cost is an important factor in deciding which actions to pursue, the Watermaster may need to engage a financial expert to provide preliminary cost estimates for those actions that do not already have cost estimates associated with them.

Task 5: Update Section 5 – Recommended Management Strategies.
After developing the groundwater management actions, we will present the results to the TAC with the purpose of soliciting input that will allow each action to be ranked in order of preference. The top actions will become recommended management strategies that the Watermaster should consider going forward.

Task 6: Prepare Draft, Final Draft and Final Updated BMAP.
A Draft Updated BMAP will be prepared that follows the format of the 2009 BMAP. After the TAC has reviewed the Draft Updated BMAP, comments received will be incorporated into a Final Draft Updated BMAP that will be presented to the Board. If comments are received from the Board, these will be included in a Final Updated BMAP. Up to 15 bound hardcopies will be provided to the Watermaster. We assume that HydroMetrics WRI will attend one TAC and one Board meeting in person to present the Updated BMAP.

Estimated Budget
The total cost to update and recalibrate the groundwater model through September 2016, and to update the BMAP is provided in Table 1.

Schedule
We expect it will take two months to update and recalibrate the groundwater model. An updated BMAP draft can be completed in approximately six weeks after the model update.

References
HydroMetrics LLC. 2009a. Basin Management Action Plan. Seaside Groundwater Basin, Monterey County, California, prepared for Seaside Groundwater Basin Watermaster. February.

HydroMetrics LLC. 2009b. Seaside Groundwater Basin Modeling and Protective Groundwater Elevations, prepared for Seaside Groundwater Basin Watermaster. November.

HydroMetrics WRI. 2014. Technical Memorandum – 2014 Seaside Groundwater Model Update, prepared for Seaside Groundwater Basin Watermaster. July 31.

Please call if you have any questions.

Sincerely,

Georgina King
Principal Hydrogeologist
HydroMetrics Water Resources Inc.

Table 1: Cost Estimate for Basin Management Action Plan Update

Tasks	HydroMetrics WRI Labor			Labor Total		Other Direct Costs	TOTALS
	Derrik Williams	Georgina King	Hanieh Haeri				
	President	Principal Hydrogeologist	Hydrologist				
Rates	$220	$195	$130	Hours	($)	($)	($)
Task 1: Update Groundwater Model & Recalibrate							
Subtask 1.1. Update Model Input Data	8	24	40	72	$ 11,640	$ -	$ 11,640
Subtask 1.2. Model Recalibration	46	10	140	196	$ 30,270	$ -	$ 30,270
Subtask 1.3. Model Update and Recalibration Technical Memorandum	12	28	32	72	$ 12,260	$ 200	$ 12,460
Subtotal Task 1	***66***	***62***	***212***	***340***	***$ 54,170***	***$ 200***	***$ 54,370***
Task 2: Update BMAP Section 2 - State of the Seaside Groundwater Basin							
Subtask 2.1. Update Basin Conceptual Model	2	16	4	22	$ 4,080	$ -	$ 4,080
Subtask 2.2. Analyze Groundwater Levels Trends	1	16	4	21	$ 3,860	$ -	$ 3,860
Subtask 2.3. Update Estimates of Groundwater Storage	5	10	16	31	$ 5,130	$ -	$ 5,130
Subtask 2.4. Update Groundwater Budget	4	8	20	32	$ 5,040	$ -	$ 5,040
Subtask 2.5. Review of Natural Safe Yield Estimates	3	8	12	23	$ 3,780	$ -	$ 3,780
Subtotal Task 2	***15***	***58***	***56***	***129***	***$ 21,890***	***$ -***	***$ 21,890***
Task 3: Update BMAP Section 3 – Supplemental Water Supplies	*1*	*4*	*0*	*5*	*$ 1,000*	*$ -*	*$ 1,000*
Task 4: Update BMAP Section 4 – Groundwater Management Actions	*8*	*20*	*12*	*40*	*$ 7,220*	*$ -*	*$ 7,220*
Task 5: Update BMAP Section 5 – Recommended Management Strategies	*4*	*10*	*0*	*14*	*$ 2,830*	*$ -*	*$ 2,830*
Task 6: Prepare Draft, Final Draft and Final BMAP	*6*	*40*	*20*	*66*	*$ 11,720*	*$ 600*	*$ 12,320*
TOTAL for GROUNDWATER MODEL UPDATE	66	62	212	340	$ 54,170	$ 200	$ 54,370
TOTAL for BMAP UPDATE	34	132	88	254	$ 44,660	$ 600	$ 45,260
TOTAL	*100*	*194*	*300*	*594*	*$ 98,830*	*$ 800*	*$ 99,630*

Notes

Other direct costs include travel expenses, office supplies, photocopies, postage, and equipment rental

Seaside Basin Watermaster
P.O. Box 51502
Pacific Grove, CA 93950
(831) 641-0113

July 12, 2017

Monterey Regional Water Pollution Control Agency
Attention: Mr. Paul Sciuto, General Manager
5 Harris Court, Building D
Monterey, CA 93940

Monterey Peninsula Water Management District
Attention: Mr. David Stoldt, General Manager
5 Harris Court, Building G
Monterey, CA 93940

Subject: **Recalibration and Updating of Seaside Groundwater Basin Model**

Dear Mr. Sciuto and Mr. Stoldt:

The Seaside Basin Watermaster is considering recalibrating and updating its Seaside Groundwater Basin Model in 2018. The Model was developed for the Watermaster by our consultant, HydroMetrics WRI, and was provided to you free-of-charge for your use in performing modeling studies for your Pure Water Monterey groundwater replenishment project.

Attached is a preliminary proposal from HydroMetrics to perform this work. The proposal provides an explanation of why this work needs to be performed, and includes a preliminary estimate of approximately $46,000 to do this work (Task 1 of their proposal).

Because the Pure Water Monterey project will need to use the Model for further studies and reporting purposes, the Watermaster's Board of Directors believes it would be appropriate for your entities to share in the cost of recalibrating and updating the Model.

This letter is a request that you provide the Watermaster with an indication of your willingness to share in these costs. Over the next two months we will be developing a firm scope-of-work and cost to have HydroMetrics perform this work, and will be presenting it our Board for approval at their October 2017 meeting.

If you have any questions regarding this request, please contact me at (831) 375-0517 or by email at bobj83@comcast.net.

Sincerely,

Robert S. Jaques
Technical Program Manager
[Note: Attachment not included in the agenda packet version of this letter]

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

July 31, 2017

Robert S. Jaques
Technical Program Manager
Seaside Basin Watermaster
PO Box 51502
Pacific Grove, CA 93950

Subject: Cost Sharing for Recalibration and Updating of Seaside Groundwater Basin Model

Dear Bob:

Thank you for your July 12th letter discussing the recalibration and updating of the Seaside Groundwater Basin Model. In that letter, you inquired about the willingness of our District and Monterey One Water to share in the cost of HydroMetrics to perform the work.

Both of our agencies stand ready to share in the cost of recalibration and updating of the Seaside Groundwater Basin Model.

One possible paradigm for cost sharing might be based on average annual production rights from the basin. For example:

Cal-Am	2021 Safe Yield	1,474 AF	
	Middle School average ASR	650 AF	
	Fitch Park average ASR	590 AF	
	Total Cal-Am	2,714 AF	32%
Non-Cal-Am Pumpers	2021 Safe Yield	1,526 AF	18%
MPWMD	Santa Margarita average ASR	650 AF	8%
Monterey One Water	Pure Water Monterey	3,500 AF	42%

That would result in our two public agencies supporting 50% of the cost. Please let me know your thoughts on this.

Sincerely yours,

David J. Stoldt
General Manager

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831-658-5600 • Fax 831-644-9560 • http://www.mpwmd.net

SEASIDE BASIN WATER MASTER
BUDGET AND FINANCE COMMITTEE
** * * AGENDA TRANSMITTAL FORM * * **

MEETING DATE:	September 19, 2017
AGENDA ITEM:	2
AGENDA TITLE:	Discuss/Consider Modeling of Potential Changes in Groundwater Quality Resulting from Introducing New Sources of Water into the Aquifers in Preparation of the 2018 Monitoring and Management: Operations Fund Budget
RECOMMENDED ACTION:	1. Discuss this topic and decide whether to make a recommendation to the Board to include it in the proposed M&MP Work Plan and Budget for 2018. 2. If the Committee recommends that the work be performed, also decide what recommendation it should make, if any, regarding recovering the costs of the work.
PREPARED BY:	Robert Jaques, Technical Program Manager

SUMMARY:

<u>Background</u>

At its July 5, 2017 meeting the TAC received a presentation made by Jon Lear, Senior Hydrologist with MPWMD, regarding potential changes in groundwater quality that can result from introducing new sources of water into an aquifer. He explained that introducing new sources of water into an aquifer, with each source having its own unique water quality, can result in chemical reactions that have the potential to release minerals which have previously been attached to soil particles, such as arsenic or mercury, into solution and thus into the water itself. He reported that this has been experienced in some other locations where changes occurred in the quality of the water entering an aquifer, for example in the Orange County Water District's (OCWD) groundwater injection program in southern California. Attached are copies of the PowerPoint slides Mr. Lear used in his presentation to the TAC and some recent articles describing OCWD's experience with this.

As a result of discussion during Mr. Lear's presentation and further discussion at its August 9, and September 13, 2017 meetings, the TAC came to the unanimous conclusion that this is an issue that should be addressed by the Watermaster in order to protect the quality of groundwater in the Seaside Basin. The TAC also concluded that this would best be accomplished by performing what is called "geochemical modeling" of the portions of the Basin into which these new water sources, such as desalinated water (via Cal Am's Monterey Peninsula Water Supply Project), additional Carmel River water (via the expanded Aquifer Storage and Recovery [ASR] Project), and advance-treated wastewater (via the Pure Water Monterey Project), will be introduced.

<u>Discussion</u>

MPWMD reported that its consultants are already using this type of model to predict the geochemical effects of the injection of Carmel River water into the Seaside Groundwater Basin via the current ASR Project. It was also noted that such a model could be of help to those agencies that need to get permits for projects that would introduce new water sources into the Basin. Mr. Lear reported that while some assessment of the geochemical impacts of injecting these new water sources into the Basin had been made during the environmental review (CEQA) process, the assessment was limited in scope and only pertained to the individual waters themselves, not to the mixture of waters that would result from introducing multiple water sources having different water chemistries. That mixture will vary throughout the year due to the differing seasonal injection schedules for each source.

SEASIDE BASIN WATER MASTER
BUDGET AND FINANCE COMMITTEE
** * * AGENDA TRANSMITTAL FORM * * **

AGENDA ITEM:	2 (Continued)

I held a conference call with Georgina King of HydroMetrics and Jon Lear of MPWMD in August, and another conference call in early September involving Jon Lear, Derrik Williams (of HydroMetrics), and two representatives of Pueblo Water Resources (MPWMD's consultant), to discuss development of a geochemical model for use in the areas of the Basin where injection of these new water sources will occur. Attached is a "white paper" summarizing the issues discussed in the September conference call.

As a result of these discussions it appears that the most cost-efficient approach would be the following:

Step 1: MPWMD's consultant would use the water quality and water delivery schedule data provided by each of the project proponents to develop and run the geochemical model. If the geochemical modeling indicated there would be no water chemistry problems then there would be no need to have HydroMetrics run the Watermaster's groundwater model.

Step 2 (if needed): If the geochemical modeling in Step 1 indicates the potential for problems to occur, then HydroMetrics would use the Watermaster's existing groundwater model, and information about injection locations and quantities, injection scheduling, etc. provided by MPWMD for each of these projects, to develop model scenarios to see if the problem(s) can be averted by changing delivery schedules and delivery quantities.

The TAC has voiced its support for taking this approach. Performing this geochemical modeling has therefore been included in the proposed 2018 Management and Monitoring (M&MP) Work Plan and Budget for 2018.

At the August 9 TAC meeting there was also a brief discussion about the feasibility and appropriateness of the Watermaster recovering the costs to perform this work from those entities proposing to store water in the Basin. One thought was that the Watermaster might ask these three entities to fund the cost of the work upfront and share in those costs among themselves. Another thought was that the Watermaster might perform the work and then recover its costs by allocating the costs to each of the entities in conjunction with issuing them their Storage Agreements, which are a prerequisite for being able to introduce water into the Basin for storage and subsequent recovery.

I believe that the matter of whether the costs to perform this work should be recovered by the Watermaster is a Board policy decision, not a TAC decision, so I am deferring to the Budget and Finance Committee and the Board on that matter.

ATTACHMENTS:	1. Articles on OCWD's experience 2. Copies of Mr. Lear's PowerPoint slides 3. "White paper" of background information on geochemical modeling

ATTACHMENT 1:

Study Spurs Solution to Arsenic Release

A recent Stanford University study of the Orange County Groundwater Basin has determined that the highly-purified water of the Groundwater Replenishment System (GWRS), which is percolated into shallow aquifers, can release natural arsenic from sediments.

"This poses a challenge to maintaining our groundwater quality and requires special treatment," says Jason Dadakis, OCWD director of health and regulatory affairs. He is also a study co-author.

Arsenic, which is naturally found in the earth and is commonly detected in groundwater throughout California, is a known contaminant that can cause health problems with prolonged exposure above established regulatory thresholds. Low level increases found in the groundwater basin are temporary and occur in close proximity to recharge basins receiving water from the GWRS project. "The affected water never entered the public drinking water system," says Dadakis.

The Orange County Water District recharges the water into basin aquifers then stores it for at least six months, but typically many years, before it is extracted for potable use. As a part of its GWRS groundwater monitoring program, OCWD carefully tests for more than 500 contaminants, about five times more than those required by law. Its expert Water Quality Assurance Laboratory, which monitors the District water, discovered the initial increases via a voluntary enhanced monitoring program established at the onset of GWRS operations in 2008.

The issue stems from the purity of the water. The Stanford study found that the lime dose added to GWRS water to prevent erosion of the distribution pipelines needed to be increased to boost the recharge water calcium concentration, which should help prevent arsenic from being released from the aquifer sediments.

"This mobilization of arsenic is a poorly understood aspect of groundwater recharge using highly-purified water, so this OCWD-funded study was necessary. Its implications stretch worldwide as similar water reuse systems are being considered" says Dadakis. OCWD and Stanford are continuing to study this issue to better understand and manage potential contaminant mobilization associated with the recharge of purified recycled water. The Stanford Earth Study is found online in the journal *Environmental Science & Technology*.

Purified wastewater triggers release of arsenic within aquifer, study finds

The Orange County Water District has operated a potable reuse and groundwater replenishment system since 2008. Treated wastewater is purified using a mix of microfiltration, reverse osmosis, ultraviolet light and hydrogen peroxide. It is then added to a vast underground aquifer.

(Carlos Chavez / Los Angeles Times)
Monte Morin Contact Reporter

When it comes to the science of transforming sewage into tap water - or potable reuse - engineers say there's no question the product is clean enough to drink. The trouble is, researchers are now learning that this drinking water may be too clean to store underground without special treatment.

A study published this week in the journal Environmental Science & Technology found that when highly purified wastewater was stored in an Orange County aquifer, the water caused arsenic to escape from clay sediments in a way that naturally infiltrating water did not.

In some instances, researchers said that arsenic concentrations exceeded the drinking water limit of 10 micrograms per liter, although the increases were only temporary and levels eventually returned to normal. None of the affected water entered the public tap system, officials said.

The root of the problem, according to researchers at Stanford University and the Orange County Water District's Groundwater Replenishment System, was that the purified, recycled water lacked the minerals that native water acquires as it soaks into the earth or flows along rivers.

"Basically the water was too pure," said senior author Scott Fendorf, a Stanford geochemist. "It was devoid of everything other than water molecules."

The solution, according to the researchers, was to add quicklime or another calcium-rich substance to the purified water before adding it to the aquifer – essentially dirtying it up a bit.

Jason Dadakis, the OCWD's director of health and regulatory affairs and a study co-author, said the added calcium appears to be working.

"The initial results look positive," Dadakis said. "We still have more long-term monitoring we want to do."

Although scientists have identified several other methods by which arsenic can contaminate groundwater – lack of oxygen can be one of them – Fendorf said this may be the first time highly purified water was identified as a trigger. The finding may prove to be a significant factor in future efforts to recycle and store wastewater.

As severe drought continues to strain water resources throughout California and the West, planners and officials are increasingly considering potable reuse facilities and aquifer recharge systems as an answer to the crisis.

At the same time, however, researchers are becoming increasingly aware of problems that arise when waters of varying chemistries are pumped or filtered underground. Mismatched waters can trigger the release of small solid contaminants that may lead to widespread contamination of an aquifer, they say.

"What you're seeing in Orange County is something we have to be very careful of across the globe," Fendorf said.

Arsenic is a natural and ubiquitous component of the Earth's crust, according to the World Health Organization, and prolonged exposure can cause skin cancer and other serious health problems. While arsenic has contaminated drinking water everywhere from the United States to East Asia, it wasn't entirely clear why levels were rising and falling in Orange County's recharge system.

To find the answer, Fendorf and his colleagues took columns of sediment from beneath the Miraloma Basin, a surface recharge basin in Anaheim, and exposed them to a variety of different water samples: purified recycled water, water that was saturated with minerals or salts, and waters with different pH values. What they discovered was that a layer of clay beneath the basin contained naturally occurring arsenic. However, this arsenic was usually held in place by a coating of positively charged calcium and magnesium particles. When natural, mineral-rich water percolated through this clay sediment, the calcium, magnesium and arsenic usually stayed put. Yet when the purified H_2O soaked through, calcium and magnesium were more likely to leave the clay and hitch a ride with the water, because the water wasn't already crowded with other minerals. When this happened, the arsenic was set free and essentially "piggybacked" its way into the water, Fendorf said.

As the purified water flowed deeper and deeper into the aquifer, it acquired more and more minerals from other sediments. At the same time, its arsenic level declined, Fendorf said.

The researchers note that this phenomenon may also play a role in future efforts to establish so-called direct potable reuse facilities. Unlike Orange County's indirect potable reuse facility, which mixes purified recycled water with water from other sources and stores it in an aquifer before using it as drinking water, direct potable reuse systems pump purified recycled water directly in the public water system.

Historically, the public has been less open to direct potable reuse projects, which are often called "toilet to tap." Although advocates insist direct potable reuse is safe and efficient, the public has been more accepting of potable reuse if it involves aquifer storage.

"This is the benefit of direct potable reuse," Dadakis said. "You eliminate the potential of environmental degradation. You don't compromise the quality of the water you've worked so hard to put together."

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SEPTEMBER 2, 2015

Stanford soil sleuths solve mystery of arsenic-contaminated water

Stanford Earth scientist Scott Fendorf helped discover how trace amounts of arsenic were moving from sediments into groundwater aquifers in Southern California. BY KER THAN

Stanford Earth scientist Scott Fendorf discusses his work with the Orange County Water District to investigate how arsenic was getting into the water supply.

Can water ever be too clean? If the intent is to store it underground, the answer, surprisingly, is yes. In a new study, Stanford scientists have shown that recycled water percolating into underground storage aquifers in Southern California picked up trace amounts of arsenic because the water was too pure.

The research, published online in the journal ***Environmental Science & Technology***, sheds light on a poorly understood aspect of groundwater recharge with purified recycled water, namely the potential mobilization of arsenic. Arsenic is a naturally occurring element that can cause organ failure and cancer in humans with prolonged exposure above established health thresholds.

The finding has implications beyond California, as more communities are increasingly tapping into and actively managing their groundwater resources to combat drought and dwindling water supplies. “Globally, as we’re pushing our water resources, the use of groundwater, the replenishment of groundwater and subsurface water storage are all on the rise,” said study co-author **Scott Fendorf**, the Huffington Family Professor in Earth Sciences and a senior fellow by courtesy at the Stanford Woods Institute for the Environment.

The problem first came to light when the Orange County Water District (OCWD) in Fountain Valley, Calif., noticed that recycled wastewater that had undergone a rigorous purification process showed temporary, low-level increases in arsenic after it percolated into soils and sediments from recharge basins (essentially large, man-made surface ponds) into underground storage aquifers.

Advanced water purification

Orange County differs from most communities in that it purifies treated wastewater instead of discharging it directly into rivers and oceans. The water purification process at OCWD, known as the Groundwater Replenishment System, is one of the most advanced in the world and involves three major steps: microfiltration, reverse osmosis and a final cleansing with ultraviolet light and hydrogen peroxide.

“Reverse osmosis is really the heart of our process, and it involves forcing water through a semipermeable membrane that is essentially designed as a molecular sieve, allowing water molecules to pass through but rejecting other dissolved molecules and ions,” said study co-author Jason Dadakis, OCWD’s director of health and regulatory affairs.

The purified water is then piped 13 miles from the treatment plant to recharge stations, where it seeps into underground aquifers and is stored for at least six months before it is released for use by the county’s 2.4 million residents. The OWCD carefully tracks the water through each step of the purification and storage process.

Beginning in 2009, results from groundwater monitoring wells near the recharge basins first detected increased arsenic levels, and in some cases the levels were just above the acceptable U.S. drinking water standard of 10 micrograms per liter. The arsenic spikes were transient, and returned to acceptable background levels by the time the water was extracted for use farther away.

"At no point was the groundwater delivered for public consumption in the area unsafe, but the OCWD was considering expanding its recharge of purified recycled water, so we thought it was prudent to get a better understanding of what was going on," Dadakis said.

An OCWD investigation revealed that when the recycled water first arrived at the recharge basins, it was free of arsenic, so the contamination must have happened as the water seeped underground. However, none of the normal trigger mechanisms for arsenic contamination seemed to apply. For example, in Southeast Asia, arsenic contamination is largely due to bacteria removing oxygen from the soil and creating anaerobic conditions that cause arsenic atoms to migrate from sediments into the water. But the OCWD aerated their water, so low oxygen levels were not to blame.

Triggering an arsenic spike

OCWD investigators also noticed another curious thing: Only the purified recycled water triggered the arsenic spike. Local runoff and imported water from the Colorado River did not pick up arsenic as it percolated into the recharge stations. Puzzled, Dadakis enlisted the help of Fendorf, a soil scientist at Stanford's School of Earth, Energy & Environmental Sciences.

Fendorf's team analyzed sediment samples from the recharge stations and discovered that arsenic was present in very low concentrations in a thin band of clay above the aquifers. That explained where the arsenic was coming from, but not how the arsenic was getting into the water.

Further experiments eventually revealed the culprit: The water was too pure. In particular, the distilled water from the treatment plant was lacking in calcium and magnesium; this deficiency caused calcium and magnesium atoms in the sediments to migrate into the water and off of charged clay particles that harbored the arsenic. With the calcium and magnesium ions leaving the clay surface, the arsenic ions were repelled from the clay surface and entered the water. The other water sources used to replenish the groundwater basin didn't draw in arsenic because they already contained abundant calcium and magnesium ions.

"This is a new trigger for arsenic contamination that wasn't appreciated before," Fendorf said.

Now that the cause of the arsenic spike is known, OCWD is experimenting with ways to fix the problem. One possible solution is to add more calcium to the water during the treatment process.

"We've altered some of our post-treatment operations here," Dadakis said. "We keep a closer eye on the calcium level and have actually boosted it recently, in part due to the recommendations coming out of Scott's work."

Fendorf noted that as more communities consider manipulating groundwater resources and increasing subsurface water storage, the risk of large-scale contamination increases. "It only takes a little bit of arsenic or other elements to contaminate a big aquifer," Fendorf said. "In Orange County, the contaminant was arsenic, but in other areas, it might be uranium, chromium, selenium or boron, as examples."

Media Contacts

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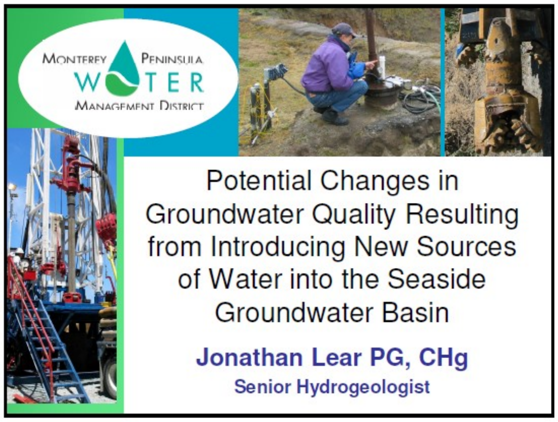
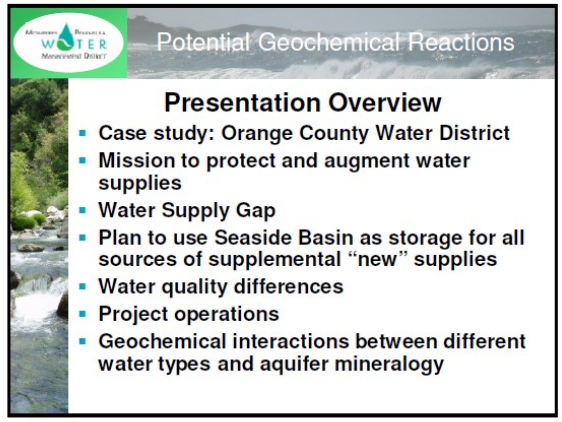
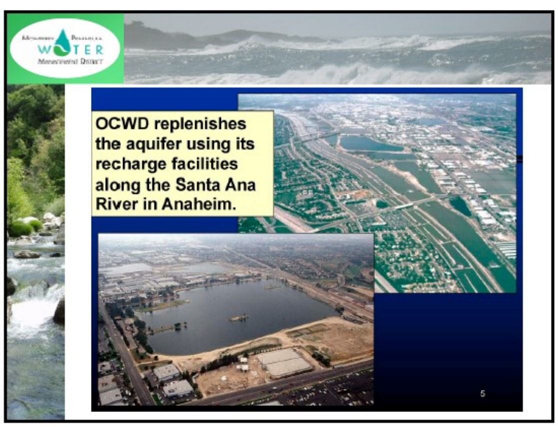
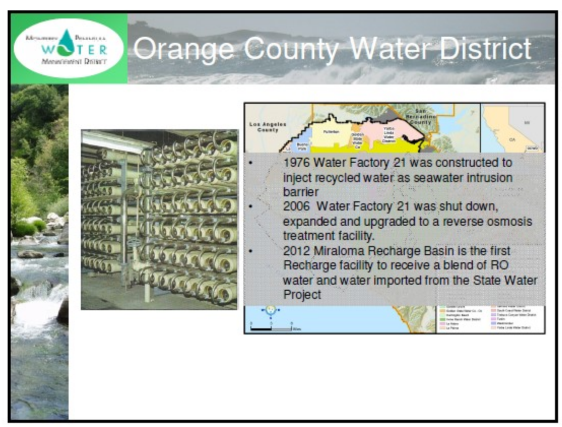
Ker Than, School of Earth, Energy & Environmental Sciences: (650) 723-9820, kerthan@stanford.edu
Dan Stober, Stanford News Service: (650) 721-6965, dstober@stanford.edu

ATTACHMENT 2:









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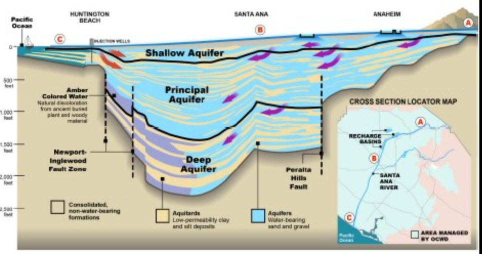
Cross Section of OCWD



Arsenic Occurrences in Groundwater

- Following mixing of water delivered from the State Water Project with Reverse Osmosis water produced at the upgraded Factory 21 plant, the Water District began to detect spikes of Arsenic in the groundwater.
- Arsenic spikes were transient and were later linked to the recharge of higher blend ratios of Reverse Osmosis water at the recharge facilities.
- Recharged water from Factory 21 had a resonance time in the ground from 6 months to 2 years, but the Arsenic spikes were not related to residence time.
- Stanford Professor, Scott Fendorf, discovered that is was not the residence time creating the Arsenic spikes, but rather the initial geochemical interactions between the clays in the aquifer and the low TDS RO water.
- Naturally occurring Arsenic was locked in the clays by Calcium and Magnesium ions. Naturally recharging water was not able to unlock the Arsenic, but RO water low in Calcium dissolved the ions from the clays and released the Arsenic.

Take Home Message

"It only takes a little Arsenic or other elements to contaminate a big aquifer. In Orange County the contaminant was Arsenic, but in other areas it may be Uranium, Chromium, Selenium, or Boron, as other examples" – Scott Fendorf

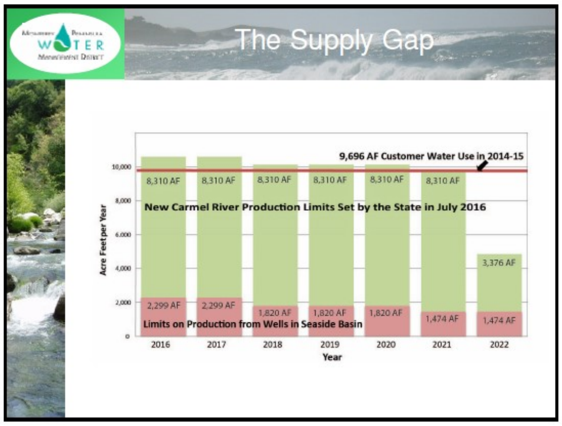
Take Home Message:

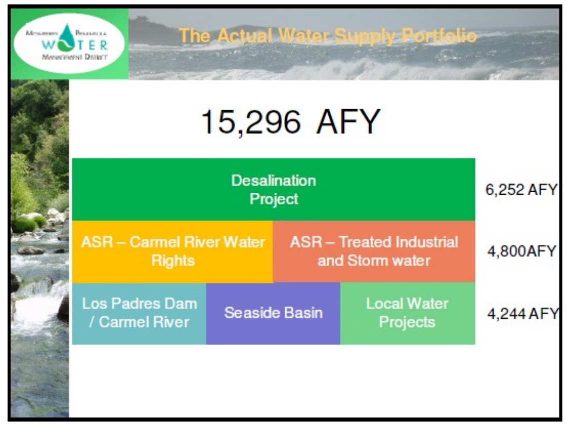
Mixing different water types can cause unexpected changes in geochemistry when reacting with aquifer matrix minerals.

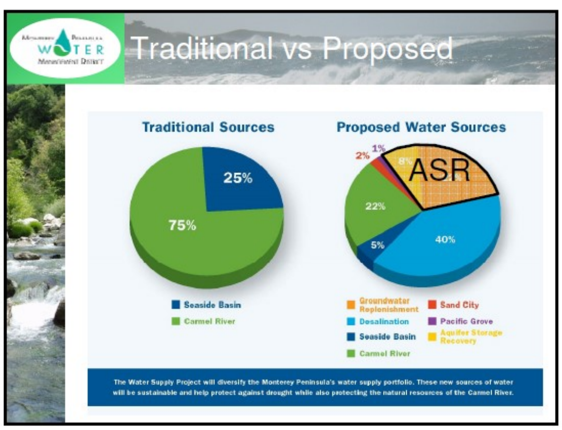
District Mission Statement

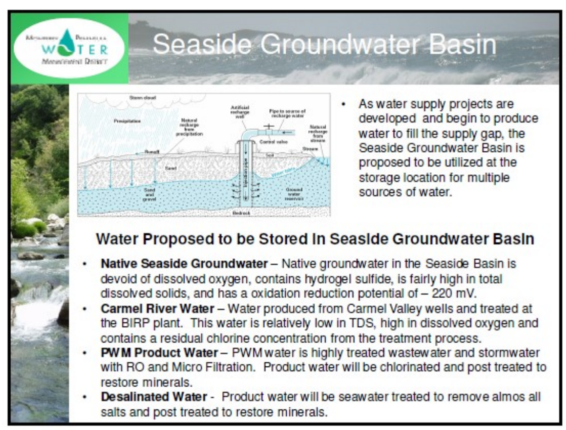
- The Monterey Peninsula Water Management District's mission is to promote or provide for a long-term sustainable water supply, and to manage and protect water resources for the benefit of the community and the environment.
- Seaside Adjudication – Water quality implications and Material Damage

2


The Supply Gap
9,696 AF Customer Water Use in 2014-15
New Carmel River Production Limits Set by the State in July 2016
Limits on Production from Wells in Seaside Basin
Acre Feet per Year
Year
2016
2017
2018
2019
2020
2021
2022
8,310 AF
3,376 AF
2,299 AF
1,820 AF
1,474 AF


The Actual Water Supply Portfolio
15,296 AFY
Desalination Project
6,252 AFY
ASR – Carmel River Water Rights
ASR – Treated Industrial and Storm water
4,800AFY
Los Padres Dam / Carmel River
Seaside Basin
Local Water Projects
4,244 AFY

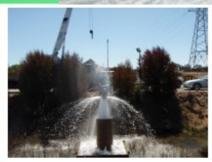

Traditional vs Proposed
Traditional Sources
Proposed Water Sources
25%
75%
ASR
2%
1%
8%
22%
5%
40%
Seaside Basin
Carmel River
Groundwater Replenishment
Sand City
Desalination
Pacific Grove
Seaside Basin
Aquifer Storage Recovery
Carmel River
The Water Supply Project will diversify the Monterey Peninsula's water supply portfolio. These new sources of water will be sustainable and help protect against drought while also protecting the natural resources of the Carmel River.


Seaside Groundwater Basin
As water supply projects are developed and begin to produce water to fill the supply gap, the Seaside Groundwater Basin is proposed to be utilized at the storage location for multiple sources of water.
Water Proposed to be Stored In Seaside Groundwater Basin
Native Seaside Groundwater – Native groundwater in the Seaside Basin is devoid of dissolved oxygen, contains hydrogel sulfide, is fairly high in total dissolved solids, and has a oxidation reduction potential of – 220 mV.
Carmel River Water – Water produced from Carmel Valley wells and treated at the BIRP plant. This water is relatively low in TDS, high in dissolved oxygen and contains a residual chlorine concentration from the treatment process.
PWM Product Water – PWM water is highly treated wastewater and stormwater with RO and Micro Filtration. Product water will be chlorinated and post treated to restore minerals.
Desalinated Water - Product water will be seawater treated to remove almos all salts and post treated to restore minerals.

3

Locations of Storage

Project Operations

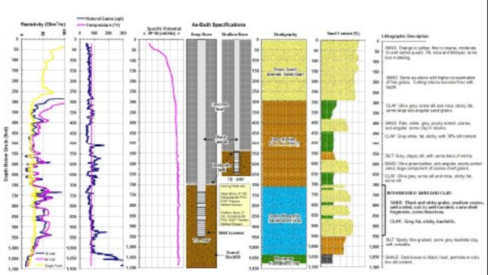


Climate drives the Carmel River ASR Injection Program and lower winter demand is proposed to drive the injection of desalinated water, but the PWM injection operations are proposed for 365 days a year. Due to the seasonality and climatic variability of the project operations, water mixing ratios in the Seaside basin will be transient.

Changes in Composition of Water

- **Wet Cycles** –System demand is low and Carmel River Water is available for injection which will result is a blend of PWM, Carmel River, and to a lesser extent, Desalinated water.
- **Drought** - Carmel River Water is unavailable so the blend of stored water will be more PWM and desalinated water banked in the winter.
- **Drought Reserve and Storage Payback** – PWM is proposing to establish a 1,000 AF drought reserve and CalAm has proposed to replenish the Seaside Groundwater Basin 700 AFY over 25 years.

Stratigraphy of Seaside Basin



Santa Margarita Sandstone

Santa Margarita Sandstone

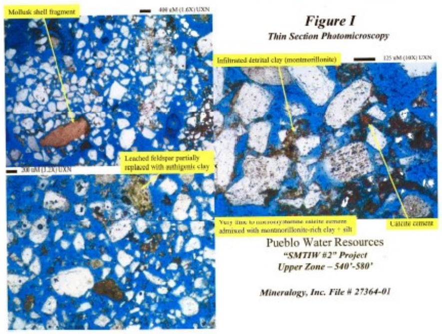


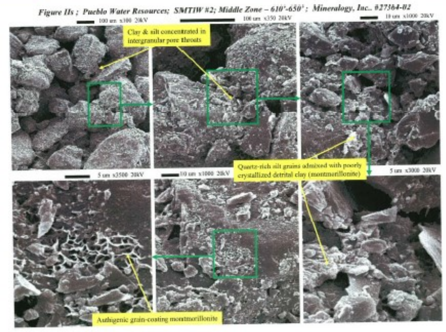
Figure I
Thin Section Photomicroscopy

Pueblo Water Resources
"SMTIW #2" Project
Upper Zone – 540'-580'

Mineralogy, Inc. File # 27364-01

Santa Margarita Sandstone

Figure IIs ; Pueblo Water Resources; SMTIW #2; Middle Zone – 610'-650' ; Mineralogy, Inc.. #27364-02



Geochemical Modeling

Defining Some Terms that Drive Geochemical Reactions

- **Aqueous speciation** – the distribution of individual ions and ion pairs in water
- **Saturation** – the state of an aqueous solution in chemical equilibrium with a particular solid phase
- **Undersaturation** – phase is thermodynamically favored to dissolve

Geochemical Modeling

- **Supersaturation** – phase is thermodynamically favored to form
- **Kinetics** – the rates of geochemical reactions
- **Mass Transfer** – moving mass between phases (solid, aqueous, gas)
- **Reactive Transport** – coupling flow and chemical reactions

Geochemical Modeling

- Input Data – Good quality required!
- Water Chemistry - Use proper methods of filtration, preservation, and dilution
  - Measure field parameters (pH, Eh, D.O., temperature, alkalinity, specific conductance) at time of sample collection
  - Charge balance must be within acceptable limits
- Aquifer Material and Minerology
  - Thin section analysis
  - Electron scanning microscopy
  - Bench leaching tests

Modeling Process

- Reaction paths - solution composition as a function of reaction progress, quantities of secondary minerals formed, and composition of solid-solutions formed
- Time of reaction - kinetic rate laws and relative reaction rates based on temperatures and pressures

Output from Model

- Transport Processes – Advection, Hydrodynamic Dispersion and Diffusion
- Reactions on Mineral Surfaces, Adsorption, Ion exchange
- Mineral Dissolution and Precipitation, Thermodynamic model, Kinetic rate expressions
- Biochemical Processes

Tasks

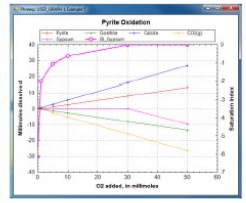
- Identify the different water qualities, quantities, flow paths, and residence times
- Characterize minerology of Santa Margarita Sandstone
- Collect water quality data to populate geochemical model
- Construct geochemical model and evaluate the effects of mixing differing water types in the Seaside Groundwater Basin.

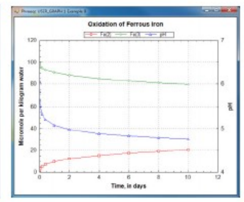
Goals

- Create a model to evaluate geochemical reactions between differing water types and aquifer mineralogy to forecast best post-treatment conditioning for RO water
- Create a tool to evaluate and model water quality issues and forecast solutions if they arise after project operations begin
- Create a tool to test options and assist with permitting water projects

ASR Water Quality Modeling

Questions?





ATTACHMENT 3:

GEOCHEMICAL MODELING TO ESTIMATE THE IMPACTS ON WATER QUALITY IN THE SEASIDE GROUNDWATER BASIN AS A RESULT OF INTRODUCING NEW SOURCES OF WATER INTO THE AQUIFERS

The New Water Sources

Three new water sources will deliver water to the aquifers in the Seaside Basin. These are (1) Cal Am desalinated water, (2) Pure Water Monterey (PWM) advance-treated wastewater, and (3) Carmel River water via the Aquifer Storage and Recovery (ASR) expansion project. Most of this water will be delivered to the Santa Margarita aquifer, but some of the PWM water will be delivered to the Paso Robles aquifer via vadose zone wells.

Geochemical Modeling Issues

A conference call was held on September 8, 2017 involving Bob Jaques (Watermaster), Jon Lear (MPWMD), Derrik Williams (HydroMetrics) and Steve Tanner and Robert Marks (Pueblo Water Resources) to discuss geochemical modeling. The objective of the call was to try to arrive at consensus on the most cost-effective approach to do the modeling.

The following bullet-points list some of the highlights of the conversation:

- The modeling will be a multi-step, iterative process. Each step will provide information that will determine what, if any, subsequent steps should be taken.
- There is some water quality information available in the EIRs for the separate water supply projects that can be used to start populating the model with data. However, it may be that not all of the chemical constituent data that will be needed for modeling are available from those documents. All of the water quality data for each project would have to be obtained and entered into the geochemical model in order to run it.
- There is no data readily available that identifies the expected monthly water supply amounts to be provided by each of the projects. In order to perform modeling scenarios that will represent the water quality of the water mixtures in the aquifers resulting from these separate sources, monthly water delivery amounts from each project will be needed.
- There is currently some consideration apparently being given to changing the capacity of the Cal Am desalination plant and/or the Pure Water Monterey project. Until firm capacities of these projects have been established it will not be possible to determine the probably monthly water delivery amount from each project.
- Initially there may just be Carmel River water being supplied through the ASR project. Subsequently, PWM water may be supplied, and lastly desalinated water may be supplied. Thus, the mixture of water that will result from these projects coming on-line will change over time until all of the projects are in full operation. Even then, due to scheduled and unscheduled maintenance or breakdowns, the mixtures may change even after all the projects have come on-line. For these reasons, a large number of water mixture scenarios will occur.
- If the geochemical modeling indicates that no water chemistry related problems are likely to occur, then it would not be necessary to use the Watermaster's groundwater model. The purpose of using the Watermaster's model would be to try to identify water mixtures that would <u>not</u> cause such problems. Those mixtures

could then be used to manage the monthly delivery amounts from each water supply project to avoid having water chemistry related problems.

- The Watermaster's existing groundwater model would need to be modified to also serve as a "transport" model that could "track" the movement of the various water sources as they travel through the aquifer from their various points of injection and mix with the native groundwater. HydroMetrics needs to look into whether or not the existing groundwater model can do this type of particle tracking. Also, HydroMetrics indicated that estimating constituent concentrations at specific places in the aquifer would require a different approach.
- Using the model with multiple water sources each having different water quality characteristics will be a complex and likely expensive undertaking.
- Some geochemical modeling has already been done on the existing ASR project to determine if there will be any water chemistry related problems from the mixture of Carmel River water with the native Santa Margarita groundwater. The geochemical model that Pueblo Water Resources developed for MPWMD to use on their ASR project could also be used to model the impacts of the new water supply projects.
- Even while final decisions on capacities and water delivery schedules are being made, if each project proponent could put forward their "best estimate" of their water delivery schedules and their water quality parameters, some "what if" scenarios could be modeled to see if any problems can be identified early-on.
- Jon Lear will work with Pueblo Water Resources to prepare a more specific proposal. He will provide that to Bob Jaques to share with the Watermaster TAC and Board members.

<u>The Model to be Used</u>
Pueblo Water Resources plans to use PHREEQCI Version 2, which is a computer program developed for the U.S.G.S. for simulating chemical reactions and transport processes in natural or contaminated water.

Some of the listed applications for this program include evaluating the impacts of contaminant migration, aquifer storage and recovery, and water treatment processes.

The program is useful in modeling situations where the possibility of mineral dissolution or precipitation needs to be known, as in water treatment, aquifer storage and recovery, artificial recharge, and well injection. The program uses a chemical analysis of a water to calculate the distribution of aqueous species, and then develops calculations of saturation indices for minerals which indicate whether a mineral should dissolve or precipitate.

SEASIDE GROUNDWATER BASIN WATERMASTER

TO: Budget/Finance Committee

FROM: Laura Dadiw, Administrative Officer

DATE: September 19, 2017

SUBJECT: Proposed Fiscal Year (Calendar Year) 2018 Annual Administrative Fund Budget

PURPOSE:
To advise the Board of the estimated amount necessary to properly fund the Administrative oversight portion of the Seaside Groundwater Basin Watermaster for Fiscal Year 2018.

RECOMMENDATION:
Recommended Board approval of the attached proposed Administrative Fund Budget for FY 2018.

DISCUSSION:
The court decision states that the next fiscal year's budgets must be approved by the Board of Directors no later than the end of October each year in order for the tentative budgets to be circulated to each Party to the adjudication "no earlier than November 1 and no later than November 15" of each fiscal year.

The budgeted administrative officer (AO) expenses are proposed to be reduced from the historic $60,000 per year to $50,000 due to administrative streamlining. Budgeted legal expenses take into consideration that (i) the technical program manager will develop the first drafts of the annual report and case management statement, (ii) the case management conference (CMC) in March 2018 will remain by phone rather than in person, and (iii) a marginal contingency is allowed in the event unanticipated issues develop before the CMC that requires addition time. The breakdown for legal fees is as follows:

Annual report:	$2,500
Case Management Statement and Case Management Conference:	4,500
Total:	$7,000

An estimated $42,000 in unspent 2017 funds is expected to be carried over to 2018.

FISCAL IMPACT:
An Administrative Fund Assessment of $40,000 is proposed:
$50,000(AO)+$7,000(Legal)+$25,000(Reserve) = $82,000-$42,000(Carryover) = $40,000

The assessments for the parties required to contribute to the Administrative Fund are:

California American Water 83.0%	$33,200
City of Seaside 14.4%	5,760
City of Sand City 2.6%	1,040

ATTACHMENTS
1) Proposed Administrative Fund Budget for FY (Calendar Year) 2018

Item 3. A.
9/19/2017

Seaside Groundwater Basin Watermaster
Administrative Fund
Proposed Budget
Administrative Year 2018

	2017 Adopted Revised Budget	2017 Estimated Total	2018 Proposed Budget
Assessment Income			
Reserve/Rollover*	$ 47,000	$ 37,000	$ 42,000
Administrative Assessment	52,000	52,000	40,000
Totals	99,000	89,000	82,000
Expenditures			
Contractual Services - Administrativ	60,000	50,000	50,000
Legal Services**	24,000	24,000	7,000
Total Expenses	84,000	74,000	57,000
Total Available	15,000	15,000	25,000
Less Reserve	15,000	15,000	25,000
Net Available	$ -	$ -	$ -

** Note: The reserve/rolloer balance of $42,000 was determined upon completion by Watermaster staff of a detailed reconciliation from 2006 through July 2017 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.*

*** July 5, 2017 board action to amend 2017 Administrative Fund Budget to include $10,000 additional for legal services for 3/17/17 Case Management Conference unanticipated expenses.*

SEASIDE BASIN WATER MASTER
BUDGET AND FINANCE COMMITTEE

** * * AGENDA TRANSMITTAL FORM * * **

MEETING DATE:	September 19, 2017
AGENDA ITEMS:	3.B & 3.C
AGENDA TITLE:	Discuss/Consider Recommendation to the Watermaster Board for Proposed Fiscal Year 2018 Annual Budgets: Monitoring and Management — Operations Fund and Monitoring and Management – Capital Fund
RECOMMENDED ACTION:	Approve or make changes, then recommend for approval by the Board
PREPARED BY:	Robert Jaques

Attached are the proposed M&MP 2018 Work Plan, and the proposed M&MP Operations and Capital Budgets for 2018 and 2019. The Board has asked that two-year budgets be developed to alert the Board to potential changes in scope and/or cost in near future years.

The M&MP 2018 Work Plan which is attached reflects revisions resulting from the TAC's discussion and input, as well as subsequent input from HydroMetrics, Martin Feeney, Todd Groundwater, and MPWMD.

The TAC approved the attached Work Plan and Budgets at its meeting of September 13, 2017.

The following are the principle differences between the 2017 Work Plan and the proposed 2018 Work Plan, and their respective budgets:

Tasks M.1.c, d, and e (Preparation for and Attendance at Meetings and Peer Review of Documents and Reports): I have allocated portions of the RFSs for general hydrogeologic consulting services from HydroMetrics, Todd Groundwater (Gus Yates) and Martin Feeney between these three tasks in the proportions that I anticipate we may be calling on them for assistance. I anticipate issuing, with TAC and Board approval, RFSs to each of these firms for general on-call/as-needed hydrogeologic consulting services in 2018 as follows:

HydroMetrics: $11,000
Todd Groundwater: $4,000
Martin Feeney: $4,000
Total: $19,000
These amounts are based on prior experience with these firms and what I believe is likely to be a growing need for these types of services, especially as we begin to interface with the Groundwater Sustainability Agency for the Salinas Valley Basin.

In 2017 the amount budgeted for these three tasks was $14,376. For 2018 the proposed amount is $19,000. We would only call on Mr. Yates and/or Mr. Feeney when an issue arises that the TAC or Board feels would benefit from their review or input.

AGENDA ITEM:	3.B & 3.C (Continued)

Task I.2.a.1 (Conduct Ongoing Data Entry/ Database Maintenance/Enhancement): In 2017 the amount budgeted for this Task was $13,452. The proposed scope of work for this task is unchanged from 2017, but the hourly rate for the MPWMD staff involved in performing their portion of this task has risen from $112/hour to $149/hour, so the amount proposed for 2018 is increased by $3,552 to $17,004. There was no increase in cost for the outside consultant that manages the Watermaster's website (where data from this task is posted), and that cost remained at $200/month.

Task I.2.b.2 (Collect Monthly Water Levels): In 2017 the amount budgeted for this Task was $7,192. The proposed scope of work for this task is unchanged from 2017, but the hourly rate for the MPWMD staff involved in performing this task has dropped from $89/hour to $62/hour, so the amount proposed for 2018 is reduced by $3,466 to $3,726.

Task I.2.b.3 (Collect Quarterly Water Quality Samples): In 2017 the total amount budgeted for this Task was $55,520, comprised of $29,834 for MPWMD and $25,686 for Martin Feeney. The proposed scope of work for this task is unchanged from 2017, but the hourly rate for the MPWMD staff involved in performing their portion of this task has dropped from $89/hour to $62/hour, so the amount proposed for their portion of this work for 2018 is reduced by $5,292 to $24,542. The amount proposed form Martin Feeney's portion of this work in 2018 is increased by the $900 additional lab cost of adding field blanks and duplicates to the Sentinel Well water quality sampling program, so the amount proposed for his portion of this work for 2018 is increased by $900 to $26,586. Therefore, the amount proposed for 2018 is reduced by $4,392 to $51,128.

Task I.2.b.6 (Reports): In 2017 the amount budgeted for this Task was $2,688. The proposed scope of work for this task is unchanged from 2017, but the hourly rate for the MPWMD staff involved in performing their portion of this task has risen from $112/hour to $149/hour, so the amount proposed for 2018 is increased by $888 to $3,576.

Task I.2.b.7 (CASGEM Data Submittal for Watermaster's Voluntary Wells): In 2017 the amount budgeted for this Task was $1,792. The proposed scope of work for this task is unchanged from 2017, but the hourly rate for the MPWMD staff involved in performing their portion of this task has risen from $112/hour to $149/hour, so the amount proposed for 2018 is increased by $592 to $2,384.

Task I.3.a.1 (Update the Existing Model): HydroMetrics proposed cost to update the existing Seaside Basin groundwater model is $54,370, and this is the amount proposed for this task in 2018. This amount reflects an increase in cost to address the items recommended in Gus Yate's peer review of HydroMetrics proposal. Copies of documents with detailed background information on this Task are included in Attachment 5. No amount for this task was budgeted in 2017.

Task I.3.a.3 (Evaluate Replenishment Scenarios and Develop Answers to Basin Management Questions): In 2017 the amount budgeted for this Task was $40,000. That was a placeholder amount in case the Board decided it wished to perform work of this type. Since the Model and BMAP will be updated under Tasks I.3.a.1 and I.3.c respectively, this Task would only be used if there were other issues the Board wished to evaluate and which were not covered in the updated BMAP. For this reason in 2018 it is proposed that this amount be reduced by $20,000 to $20,000.

Task I.3.c (Refine and/or Update the Basin Management Action Plan): In 2017 the amount budgeted for this Task was $25,000. That was a placeholder amount in case the Board decided it wished to perform this work. HydroMetrics' proposed cost to update the existing Basin Management

AGENDA ITEM:	3.B & 3.C (Continued)

Action Plan is $45,260, and this is the amount proposed for this task in 2018. This amount reflects a reduction in cost for having the Watermaster staff performing some of the work, and an increase in cost to address the items recommended in Gus Yate's peer review of HydroMetrics proposal. This is an increase of $20,260 over the 2017 amount. Copies of documents with detailed background information on this Task are included in Attachment 5.

Task I.3.e (Seaside Basin Geochemical Model): This is a proposed new Task for 2018. There was no such task in the 2017 Work Plan. The Task would be performed by HydroMetrics and MPWMD's Consultant, Pueblo Water Resource, Inc. working together. A preliminary estimate of HydroMetrics' cost for their portion of the work is $20,000 to $40,000 depending on how many scenarios need to be run and a preliminary estimate of Pueblo Water Resource's cost for their portion of the work is $50,000. The proposed budget amount to perform this Task is $70,000, based on using the low end of the range of estimated costs for HydroMetrics' portion of the work. Once proposals have been received from both of these firms, this budget amount will be revised, if necessary.

Task I.4.c (Annual Report- Seawater Intrusion Analysis): In 2017 the total amount budgeted for this Task was $21,786, comprised of $896 for MPWMD and $20,890 for HydroMetrics. The proposed scope of MPWMD's portion of this task is unchanged from 2017, but the hourly rate for the MPWMD staff involved in performing their portion of this task has risen from $112/hour to $149/hour, so the amount proposed for 2018 is increased by $296 to $1,192. HydroMetrics' proposed cost to perform their portion of this Task is $20,890, rather than $26,110 which would add a task to perform statistical trend analyses. The TAC felt that a decision on whether or not to perform trend analyses should be made only if monitoring anomalies are encountered in 2018. If a decision was made to perform that work, it could be funded from the Contingency line-item. Therefore, the proposed budget shows no change in the cost for performing their portion of this Task. Overall there would be an increase of only $296 for this Task in 2018.

The proposed line-item titled "Contingency (not including Technical Program Manager)" is increased from the percentage that was included in each year's budget up until the 2016 budget, because there is more uncertainty regarding the scope and cost for some of the items in the proposed 2018 M&MP Work Plan, such as Tasks I.2.b.3 (if additional unplanned sampling is required at the Sentinel or any other wells), I.3.a.1, I.3.c and I.3.e. The proposed budget is considerably larger than it was last year, so the TAC felt that a 15% contingency would be reasonable.

As indicated by the right-hand column titled "Comparative Costs from 2017 Budget" in the proposed 2018 M&MP Operations Budget in Attachment 2, the proposed Budget is $167,200 higher ($422,997-$255,797) than the 2017 Budget. It should be noted that the Watermaster's actual expenditures, if this Budget is approved, will be considerably less if there is cost-sharing with other entities for the work of Tasks I.3.a.1 and I.3.e.

ATTACHMENTS:	1. 2018 M&MP Work Plan 2. 2018 M&MP Operations Budget 3. 2019 M&MP Operations Budget 4. 2018 and 2019 M&MP Capital Budgets 5. Excerpt from August 9, 2017 TAC Meeting Agenda Packet Pertaining to Updating the Groundwater Model and the BMAP

ATTACHMENT 1

Seaside Groundwater Basin Monitoring and Management Program FY 2018 Work Plan

The tasks outlined below are those that are anticipated to be performed during 2018. Some Tasks listed below are specific to 2018, while other 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
($0)

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
($0)

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
($11,500)

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 incl[1] 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.
- 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
($7,500)

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
($0)

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** **($1,900)**	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** **($17,004)**	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 2018.
I. 2. a. 2 **Verify Accuracy of Production Well Meters** **($0)**	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 2018.

I. 2. b. Data Collection Program

I. 2. b. 1 **Site Representation and Selection** **($0)**	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 2018.
I. 2 b. 2 **Collect Monthly Manual Water Levels** **($3,726)**	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. The wells where the use of dataloggers is feasible or appropriate have been equipped with dataloggers. This Task includes the purchase of one datalogger and parts for the datalogger to keep in inventory as a spare if needed. All of the other wells will be manually measured.

I. 2. b. 3 **Collect Water Quality Samples.** **($51,128)**	Water quality data will be collected quarterly from certain of the monitoring wells, and annually or semi-annually from the Sentinel 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 2018. 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, or if a sampling pump needs to be installed on a Sentinel Well, an allowance to purchase a replacement sampling pump has been included in this Task. Improvements to the QA/QC program for the water quality sampling work were adopted in mid-2017 and will be included in this work in 2018.
I. 2. b. 4 **Update Program Schedule and Standard Operating Procedures.** **($0)**	All recommendations from prior reviews of the data collection program have been implemented. No additional work of this type is anticipated in 2018.
I. 2. b. 5 **Monitor Well Construction** **($0)**	An additional monitoring well was installed in 2009. No further work of this type is anticipated in 2018.
I. 2. b. 6 **Reports** **($3,576)**	The groundwater level and water quality monitoring will be conducted on a monthly, quarterly, semi-annual or 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** **($2,384)**	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** **($54,370 – from Hydro-Metrics August 4, 2017 Revised Proposal)**	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. In 2018 Step 1 (updating the Model) will be performed again, along with Steps 2 (recalibrating) and 3 (reporting on this work).

I. 3. a. 2 **Develop Protective Water Levels** **($0)**	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. Protective water levels will be updated, if appropriate, as part of the work of Task I.3.c.
I. 3. a. 3 **Evaluate Replenishment Scenarios and Develop Answers to Basin Management Questions** **($20,000)**	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 2018 to further examine this situation.
I. 3. b. **Complete Preparation of Basin Management Action Plan** **($0)**	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 2018 is discussed under Task I. 3. c.
I. 3. c. **Refine and/or Update the Basin Management Action Plan** **($45,260– from HydroMetrics' August 4, 2017 Revised Proposal)**	During 2018 the BMAP will be updated based on new data and knowledge that has been gained since it was prepared in 2009.
I. 3. d. **Evaluate Coastal Wells for Cross-Aquifer Contamination Potential** **($0)**	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 by the Watermaster on this matter is anticipated. In late 2017 a request was made to MPWMD to destroy one of its no-longer-used monitoring wells that is perforated in multiple aquifers (Well PCA-East Multiple). It is anticipated that MPWMD will perform that work in 2018.

I. 3. e. **Seaside Basin Geochemical Model** **(Preliminary Budget Estimate is $70,000 – this amount may need to be revised once firm proposals from the consultants have been received)**	When new sources of water are introduced into an aquifer, with each source having its own unique water quality, there can be chemical reactions that may have the potential to release minerals which have previously been attached to soil particles, such as arsenic or mercury, into solution and thus into the water itself. This has been experienced in some other locations where changes occurred in the quality of the water being injected into an aquifer. MPWMD's consultants have been using geochemical modeling to predict the effects of injecting Carmel River water into the Seaside Groundwater Basin under the ASR program. In order to predict whether there will be groundwater quality changes that will result from the introduction of desalinated water and additional ASR water (under the Monterey Peninsula Water Supply Project) and advance-treated wastewater (under the Pure Water Monterey Project) a geochemical model should be developed for use in the areas of the Basin where injection of these new water sources will occur. This can be most cost-efficiently accomplished in the following manner: Step 1: MPWMD's consultant would use the water quality and water delivery schedule data provided by each of the project proponents to develop and run the geochemical model. If the geochemical modeling indicated there would be no water chemistry problems then there would be no need to have HydroMetrics run the Watermaster's groundwater model. Step 2 (if needed): If the geochemical modeling in Step 1 indicates the potential for problems to occur, then HydroMetrics would use the Watermaster's existing groundwater model, and information about injection locations and quantities, injection scheduling, etc. provided by MPWMD for each of these projects, to develop model scenarios to see if the problem(s) can be averted by changing delivery schedules and delivery quantities. If the modeling predicts that there may be adverse impacts from introducing these new sources of water, measures to mitigate those impacts will be developed under a separate task that will be created for that purpose when and if necessary.

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** **($0)**	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** **($0)**	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 ($27,302) This includes preparing statistical trend analyses – if that work is not included the cost would be lowered to $22,082**	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. This year a statistical trend analysis of data from the monitoring wells that do not have seasonal fluctuations will be included in the report. 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** **($0)**	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 2018.
I. 4. e. **Refine and/or Update the Seawater Intrusion Response Plan** **($0)**	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 2018.
I. 4. f. **If Seawater Intrusion is Determined to be Occurring, Implement Contingency Response Plan** **($0)**	The SIRP will be implemented if seawater intrusion, as defined in the Plan, is determined by the Watermaster to be occurring.

ATTACHMENT 2

Monitoring and Management Plan Operations Budget For Tasks to be Undertaken in 2018								Comparative Costs from 2017 Budget
Task	Subtask	Sub-Subtask	Cost Description	CONSULTANTS & CONTRACTORS[3]			Total	
				MPWMD	Private Consultants	Contractors		
			Labor					
			Technical Project Manager	$0	$60,000	$0	$60,000	$60,000
M.1 Program Administration								
	M.1.a		Project Budget and Controls	$0	$0	$0	$0	$0
	M.1.b		Assist with Board and TAC Agendas	$0	$0	$0	$0	$0
	M.1.c & M.1.d		Preparation for and Attendance at Meetings[8]	$0	$11,500	$0	$11,500	$7,000
	M.1.e		Peer Review of Documents and Reports[8]	$0	$7,500	$0	$7,500	$7,376
	M.1.f		QA/QC	$0	$0	$0	$0	$0
	M.1.g		SGMA Documentation Preparation	$0	$1,900	$0	$1,900	$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	$14,604	$2,400	$0	$17,004	$13,452
		I. 2. a. 2.	Verify Accuracy of Production Well Meters	$0	$0	$0	$0	$0
	I. 2. b.		Data Collection Program					
		I. 2. b. 1.	Site Representation and Selection[7]	$0	$0	$0	$0	$0
		I. 2. b. 2.	Collect Monthly Water Levels[6]	$3,726	$0	$0	$3,726	$7,192
		I. 2. b. 3.	Collect Quarterly Water Quality Samples[1][5][6]	$24,542	$0	$26,586	$51,128	$55,520
		I. 2. b. 4.	Update Program Schedule and Standard Operating Procedures.	$0	$0	$0	$0	$0
		I. 2. b. 5.	Monitor Well Construction[7]	$0	$0	$0	$0	$0
		I. 2. b. 6.	Reports	$3,576	$0	$0	$3,576	$2,688
		I. 2. b. 7.	CASGEM Data Submittal for Watermaster's Voluntary Wells	$2,384	$0	$0	$2,384	$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	$54,370	$0	$54,370	$0
		I. 3. a. 2	Develop Protective Water Levels[12]	$0	$0	$0	$0	$0
		I. 3. a. 3	Evaluate Replenishment Scenarios and Develop Answers to Basin Management Questions[10]	$0	$20,000	$0	$20,000	$40,000
	I. 3. b.		Complete Preparation of Basin Management Action Plan	$0	$0	$0	$0	$0
	I. 3. c.		Refine and/or Update the Basin Management Action Plan	$0	$45,260	$0	$45,260	$25,000
	I. 3. d		Evaluate Coastal Wells for Cross-Aquifer Contamination Potential	$0	$0	$0	$0	$0
	I. 3. e		Seaside Basin Geochemical Model[13]	$0	$70,000	$0	$70,000	$0
I.4 Seawater Intrusion Contingency Plan								
	I. 4. a.		Oversight of Seawater Intrusion Detection and Tracking	$0	$0	$0	$0	$0
	I. 4. b.		Provide focused area hydrogeologic investigation for Sand City Public Works	$0	$0	$0	$0	$0
	I. 4. c.		Annual Report- Seawater Intrusion Analysis	$1,192	$26,110	$0	$27,302	$21,786
	I. 4. d.		Complete Preparation of Seawater Intrusion Response Plan[2]	$0	$0	$0	$0	$0
	I. 4. e.		Refine and/or Update the Seawater Intrusion Response Plan[2][9]	$0	$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 2018. If it Does Become Necessary, Use of Contingency Funds or a Budget Modification Will Likely be Necessary)				$0
		TOTALS CONSULTANTS & CONTRACTORS		$50,024	$299,040	$26,586		
SUBTOTAL not including Technical Program Manager =							$315,650	$183,706
Contingency (not including Technical Program Manager) @ 15%[4]=							$47,347	$12,091
Technical Program Manager =							$60,000	$60,000
TOTAL=							$422,997	$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 larger Tasks listed above at the time of preparation of this Budget, e.g. Tasks I.3.a.1, I.3.c, and I.3.e, it is recommended that a Contingency of approximately 15% 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 2018.

(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. This work may include participation in conference calls and reviewing documents prepared by others.

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

(10) Since the Model and BMAP will be updated under Tasks I.3.a.1 and I.3.c respectively, this Task would only be used if there were other issues the Board wished to evaluate and which were not covered in the updated BMAP.

(11) Not used.

(12) If new protective water levels are warranted, that work will be included in Task I.3.a.1.

ATTACHMENT 3

Monitoring and Management Plan Operations Budget
For Tasks to be Undertaken in 2019[12]

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 of at Meetings[8]	$0	$11,845	$0	$11,845
	M.1.e		Peer Review of Documents and Reports[8]	$0	$7,725	$0	$7,725
	M.1.f		QA/QC	$0	$0	$0	$0
	M.1.g		SGMA Documentation Preparation	$0	$1,957	$0	$1,957
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	$15,042	$2,472	$0	$17,514
		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]	$3,838	$0	$0	$3,838
		I. 2. b. 3.	Collect Quarterly Water Quality Samples[1][5][6]	$25,278	$0	$27,383	$52,661
		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	$3,683	$0	$0	$3,683
		I. 2. b. 7.	CASGEM Data Submittal for Watermaster's Voluntary Wells	$2,456	$0	$0	$2,456
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	$0	$20,000	$0	$20,000
	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	$0	$0	$0
	I. 3. d		Evaluate Coastal Wells for Cross-Aquifer Contamination Potential[13]	$0	$0	$0	$0
	I. 3. e		Seaside Basin Geochemical Model	$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.		Analyze and Map Water Quality from Coastal Monitoring Wells	(Costs Included Under I.4.a)			
	I. 4. c.		Annual Report- Seawater Intrusion Analysis	$1,228	$26,893	$0	$28,121
	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 2019. If it Does Become Necessary, Use of Contingency Funds or a Budget Modification Will Likely be Necessary)			
		TOTALS CONSULTANTS & CONTRACTORS		**$51,525**	**$130,892**	**$27,383**	
SUBTOTAL not including Technical Program Manager =							$149,800
Contingency (not including Technical Program Manager) @ 10%[4]=							$14,980
Technical Program Manager							$60,000
TOTAL=							**$224,780**

Footnotes:
(1) An outside contractor would be used to perform the induction logging, and potentially to also collect some water quality samples in conjunction
(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
(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 10% Contingency be included in the Budget.
(5) A portion of this cost is for maintaining sampling equipment that was installed in prior years.
(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.
(7) No additional monitoring well is expected to be constructed in 2019.
(8) For HydroMetrics, Todd Groundwater (Gus Yates), and Martin Feeney 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) Not used.
(11) If necessary to reflect knowledge gained from modeling work or other data sources. Since the BMAP will be updated in 2018, no work on this Task is anticipated in 2019.
(12) Includes a 3% inflation factor on most annually recurring costs in the 2018 Budget, except the Technical Program Manager cost which has no inflation factor applied to it.
(13) No further work on this Task is anticipated in 2019.

ATTACHMENT 4

Management and Monitoring Plan Capital Budget
For Tasks to be Undertaken in 2018

No Capital projects are anticipated to be undertaken in 2018, so this budget is $0.

Management and Monitoring Plan Capital Budget
For Tasks to be Undertaken in 2019

No Capital projects are anticipated to be undertaken in 2019, so this budget is $0.

ATTACHMENT 5

SEASIDE BASIN WATER MASTER ***TECHNICAL ADVISORY COMMITTEE*** **** * * AGENDA TRANSMITTAL FORM * * ****	
MEETING DATE:	August 9, 2017
AGENDA ITEM:	4
AGENDA TITLE:	Continued Discussion Regarding Updating the Basin Management Action Plan (BMAP) and the Seaside Basin Groundwater Model
PREPARED BY:	Robert Jaques, Technical Program Manager

SUMMARY:

At the TAC's July 12, 2017 meeting the TAC (for the second time) reviewed the scope-of-work and costs in the attached Proposal from HydroMetrics for updating the BMAP and the Model. Input was solicited regarding any of the proposed work TAC members felt did not need to be performed, as well as work that TAC members felt should be added to the proposed scope-of-work. The only item raised was a question about whether Task 4 (updating the Section on Groundwater Management Actions) was really necessary. Ms. King explained that it is important for this work to be done in order to see if the various supplemental water supply projects will improve water levels sufficiently to protect the basin.

I asked Gus Yates to review HydroMetrics' proposed scope-of-work and to provide his comments and recommendations on that. Attached are Mr. Yate's Memo discussing his recommendations and HydroMetrics response to his Memo. In response to the Board's request I also contacted MPWMD/MRWPCA regarding sharing in the costs to update the Model (see attached letter sent to these entities). Attached is the joint response letter from MPWMD and MRWPCA indicating their willingness to share in these costs. I believe that the matter of how costs should be shared for this work is a Board policy decision, not a TAC decision, and I will be providing this letter to the Board for its consideration at its next meeting.

I requested HydroMetrics to try to reduce its cost for Section 3 (Supplemental Water Supplies) of the BMAP, if Watermaster staff can provide much of the information in that section. I also requested that they revise their Scope of Work and Costs to reflect their response to Mr. Yate's Memo. Their attached revised Scope and Cost Proposal shows a $2,220 cost reduction in Task 3 to reflect having the Watermaster provide this assistance, and changes in costs for several other Tasks in accordance with their attached response letter to Mr. Yate's Memo. The net result of these revisions is an increase in cost of $9,590 over the amount contained in their original Proposal ($99,630-$90,040).

I am including updating the BMAP and the Model in the proposed 2018 Monitoring and Management Program (M&MP) which is the subject of item 5 on today's Agenda.

ATTACHMENTS:	1. Memo from Gus Yates Regarding Updating the Model (see page 3 of this agenda packet) 2. HydroMetrics Letter Responding to Mr. Yate's Memo (see page 6 of this agenda packet) 3. Revised Proposal from HydroMetrics for Updating the BMAP and the Groundwater Model (see page 10 of this agenda packet) 4. Letter Sent to MRWPCA and MPWMD Asking Them to Share in the Costs of Updating the Model (see page 17 of this agenda packet) 5. Joint MPWMD-MRWPCA Response Letter (see page 18 of this agenda packet)

Seaside Groundwater Basin Watermaster Replenishment Fund Water Year 2017 (October 1 - September 30) / Fiscal Year (January 1 - December 31, 2016) Balance through June 30, 2017 (And Proposed 2018 RA Budget)															ITEM 3.D. 9/19/2017
Replenishment Fund	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017 Estimated**	**Totals WY 2006 Through 2016**	**Proposed Budget WY 2018**	**Projected Totals Through WY 2017**
Assessments:	WY 05/06	WY 06/07	WY 07/08	WY 08/09	WY 09/10	WY 10/11	WY 11/12	WY 12/13	WY 13/14	WY 14/15	WY 15/16	WY 16/17		WY 17/18	
Unit Cost:	$1,132 / $283	$1,132 / $283	$2,485 / 621.25	$3,040 / $760	$2,780 / $695	$2,780 / $695	$2,780 / $695	$2,780 / $695	$2,702 / $675.50	$2,702 / $675.50	$2,702 / $675.50	$2,872 / $718		$2,872 / $718	
Cal-Am Water Balance Forward	**$ -**	**$ 1,641,004**	**$ 4,226,710**	**$ (2,871,690)**	**$ (2,839,939)**	**$ (3,822,219)**	**$ (6,060,164)**	**$ (8,735,671)**	**$ (6,173,771)**	**$ (3,102,221)**	**$ (676,704)**	**$ (676,704)**		**$ (556,704)**	
Cal-Am Water Production	**3710.0 AF**	**4059.9 AF**	**3862.9 AF**	**2966.0 AF**	**3713.5 AF**	**3416.0 AF**	**3070.9 AF**	**3076.6 AF**	**3232.1 AF**						
Exceeding Natural Safe Yield Considering Alternative Producers	2,106,652	2,565,471	5,199,014	3,773,464	4,112,933	3,187,854	2,280,943	2,380,842	2,790,539	2,113,414	-	100,000	$ 30,511,126	100,000	$ 30,611,126
Operating Yield Overproduction Replenishment	-	20,235	8,511	-	-	-	154,963	181,057	281,012	312,103	-	20,000	957,881	20,000	977,881
Total California American	**$ 2,106,652**	**$ 2,585,706**	**$ 5,207,525**	**$ 3,773,464**	**$ 4,112,933**	**$ 3,187,854**	**$ 2,435,907**	**$ 2,561,899**	**$ 3,071,550**	**$ 2,425,516**		**$ 120,000**	**$ 31,469,007**	**$ 120,000**	**$ 31,589,007**
CAW Credit Against Assessment	(465,648)		(12,305,924)	$ (3,741,714)	(5,095,213)	(5,425,799)	(5,111,413)	-	-	-	-	-	(32,145,711)	-	(32,145,711)
CAW Unpaid Balance	***$ 1,641,004***	***$ 4,226,710***	***(2,871,690)***	***$ (2,839,939)***	***$ (3,822,219)***	***$ (6,060,164)***	***$ (8,735,671)***	***$ (6,173,771)***	***$ (3,102,221)***	***$ (676,704)***	***$ (676,704)***	***$ (556,704)***	***$ (676,704)***	***$ (436,704)***	***$ (556,704)***
City of Seaside Balance Forward	**$ -**	**$ 243,294**	**$ 426,165**	**$ 1,024,272**	**$ 1,619,973**	**$ 891,509**	**$ (110,014)**	**$ (773,813)**	**$ (1,575,876)**	**$ (2,889,325)**	**$ (3,346,548)**	**$ (3,232,420)**		**$ (3,122,420)**	
City of Seaside Municipal Production	**332.0 AF**	**387.7 AF**	**294.3 AF**	**293.4 AF**	**282.9 AF**	**240.7 AF**	**233.7 AF**	**257.7 AF**	**223.6 AF**	**223.6 AF**	**185.01 AF**				
Exceeding Natural Safe Yield Considering Alternative Producers	219,689	174,082	402,540	465,300	314,721	141,335	163,509	236,782	142,410	69,630	102,330	100,000	$ 2,532,327	100,000	$ 2,632,327
Operating Yield Overproduction Replenishment	12,622	85	4,225	16,522	20,690	-	1,689	27,007	3,222	38	11,959	10,000	108,058	10,000	118,058
Total Municipal	232,310	174,167	406,764	481,823	335,412	141,335	165,198	263,788	145,631	69,667	114,290	110,000	2,640,385	110,000	2,750,385
City of Seaside - Golf Courses															
Exceeding Natural Safe Yield - Alternative Producer	-	-	131,705	69,701	-	-	-	-	-	-	-	-	201,406	-	201,406
Operating Yield Overproduction Replenishment	-	-	32,926	17,427	-	-	-	-	-	-	-	-	50,353	-	50,353
Total Golf Courses	-	-	164,631	87,128	-	-	-	-	-	-	-	-	251,759	-	251,759
Total City of Seaside*	**$ 232,310**	**$ 174,167**	**$ 571,395**	**$ 568,951**	**$ 335,412**	**$ 141,335**	**$ 165,198**	**$ 263,788**	**$ 145,631**	**$ 69,667**	**$ 114,290**	**$ 110,000**	**$ 2,892,144**	**$ 110,000**	**$ 3,002,144**
City of Seaside Late Payment 5%	10,984	8,704	26,712	26,750	15,737								88,887		88,887
In-lieu Credit Against Assessment	-		-	$ -	(1,079,613)	(1,142,858)	(828,996)	(1,065,852)	(1,459,080)	(526,890)	(162)	-	(6,103,451)	-	(6,103,451)
City of Seaside Unpaid Balance	***$ 243,294***	***$ 426,165***	***$ 1,024,272***	***$ 1,619,973***	***$ 891,509***	***$ (110,014)***	***$ (773,813)***	***$ (1,575,876)***	***$ (2,889,325)***	***$ (3,346,548)***	***$ (3,232,420)***	***$ (3,122,420)***	***$ (3,122,420)***	***$ (3,012,420)***	***$ (3,012,420)***
Total Replenishment Fund Balance	**$ 1,884,298**	**$ 4,652,874**	**$ (1,847,417)**	**$ (1,219,966)**	**$ (2,930,710)**	**$ (6,170,178)**	**$ (9,509,483)**	**$ (7,749,648)**	**$ (5,991,546)**	**$ (4,023,252)**	**$ (3,909,125)**	**$ (3,679,125)**	**$ (3,799,125)**	**$ (3,449,125)**	**$ (3,569,125)**
Replenishment Fund Balance Forward	-	**$ 1,884,298**	**$ 4,652,874**	**$ (1,847,417)**	**$ (1,219,966)**	**$ (2,930,710)**	**$ (6,170,178)**	**$ (9,509,483)**	**$ (7,749,648)**	**$ (5,991,546)**	**$ (4,023,252)**	**$ (3,909,125)**		**$ (3,679,125)**	
Total Replenishment Assessments	2,349,946	2,768,576	5,805,632	4,369,165	4,464,082	3,329,189	2,601,104	2,825,688	3,217,182	2,495,183	114,290	230,000	34,570,038	230,000	**34,800,038**
Total Paid and/or Credited	(465,648)	-	(12,305,924)	(3,741,714)	(6,174,826)	(6,568,657)	(5,940,409)	(1,065,852)	(1,459,080)	(526,890)	(162)	-	(38,249,162)	-	**(38,249,162)**
Grand Total Fund Balance	**$ 1,884,298**	**$ 4,652,874**	**$ (1,847,417)**	**$ (1,219,966)**	**$ (2,930,710)**	**$ (6,170,178)**	**$ (9,509,483)**	**$ (7,749,648)**	**$ (5,991,546)**	**$ (4,023,252)**	**$ (3,909,125)**	**$ (3,679,125)**	**(3,679,125)**	**$ (3,449,125)**	**$ (3,449,125)**

SEASIDE GROUNDWATER BASIN WATERMASTER

TO: Budget and Finance Committee

FROM: Laura Dadiw, Administrative Officer

DATE: September 19, 2017

SUBJECT: Unit Cost for Water Year 2017/18 Over Production Replenishment Assessment Amounts

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RECOMMENDATION:
It is recommended that the committee determine a Proposed Replenishment Assessment Unit Cost for both Operating Yield and Natural Safe Yield allocations for Water Year 2018 (October 1, 2017 - September 30, 2018) and recommend its determination to the Board for approval.

SUMMARY:
The Replenishment Assessment Unit Cost is used to calculate the Replenishment Assessments that are charged to any Standard Producer that exceeds its allocations (both Operating Yield and Natural Safe Yield allocations) during the Water Year.

Per page 33 of the Decision*, "The per acre-foot 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 in or before October of 2017 will be used to calculate Replenishment Assessments for pumping that occurs during the Water Year which begins on October 1, 2017 and ends on September 30, 2018.

BACKGROUND:
For each of the past three Water Years 2014, 2015, and 2016, the Board adopted a 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) listed in Table 1 for each project [$3,507+$1,800+$2,000+$3,500)/4], as the Replenishment Assessment Unit Cost. The Water Year 2014 unit cost was carried over to the two subsequent Water Years because no updated cost data was available for the projects listed in Table 1, and no other viable projects could be identified. For last Water Year (2016/17) the Budget and Finance Committee updated the basis from which the annual calculation of the Unit Cost of replenishment water is established, a blended cost of a reduced size desalination plant for the Monterey Peninsula Water Supply Project and groundwater replenishment provided by the Pure Water Monterey Project [($4,591+$2,025+$2,000)/3] = $2,872 (see Table 2).

DISCUSSION:
Due to the lack of more supportable data the recommendation is to continue using $2,872, the average of the Base Unit Cost ($/AF) listed in Table 2 for each project [($4,591+$2,025+$2,000)/3] as the Replenishment Assessment Unit Cost for the Water Year 2017/2018.

ATTACHMENTS:
Table 1: Water Year 2017 Unit Cost Calculation Data
Table 2: Updated Unit Cost Data

WATER YEAR 2014 (October 1, 2013-September 30, 2014)

ANTICIPATED UNIT COSTS OF REPLENISHMENT WATER FOR 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]	LEVEL OF PROJECT DEVELOP-MENT	CONTINGENCY INCLUDED IN BASE UNIT COST [2] (%)	BASE UNIT COST ($/AF)	BASE UNIT COST YEAR	ADDITIONAL CONTINGENCY ADDED TO REFLECT LEVEL OF PROJECT DEVELOPMENT [3] (%)	UNIT COST INCLUDING ADDITIONAL CONTINGENCY ($/AF)	UNIT COST INFLATED @ 3% FROM COST BASIS YEAR TO YEAR REPLENISH-MENT WATER COULD BECOME AVAILABLE ($/AF)	VOLUME-WEIGHTED AVG %
Monterey Peninsula Water Supply Project (Regional Desalination) [4]	2018	9,752	Project Report	30%	$3,507	2012	0%	$3,507	$4,188	56.53%
Seaside Basin ASR Expansion [5]	2015	1,000	Conceptual	11%	$1,800	2012	39%	$2,502	$2,734	5.80%
Regional Urban Water Augmentation Project [6]	2017	3,000	Design	5%	$2,000	2013	10%	$2,200	$2,476	17.39%
Groundwater Replenishment Project (GWRP) [7]	2017	3,500	Conceptual	50%	$3,500	2017	0%	$3,500	$3,500	20.29%

Total Quantity of Replenishment Water (AFY) the Listed Projects Could Cumulatively Potentially be Able to Produce Within the Next 10 Years [8] = 17,252

FOOTNOTES:

(1) For the Monterey Peninsula Water Supply Project this is the total amount of water from this source which could potentially come to the CAW distribution system. 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 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 5). For the RUWAP this is the total amount of water that this project is expected to produce. Only a portion of this amount might be used as in-lieu replenishment of the Seaside Basin. For the GWRP this is the quantity of water that is being considered at this time by CAW for inclusion in its Monterey Peninsula Water Supply Project.

(2)(3) The following Contingency percentages were considered reasonable for the indicated levels of project development: Conceptual Level - 50%, Project Report Level - 30%, and Design Level - 15%. The sum of the values in the columns titled "Contingency Included in Base Unit Cost" and "Additional Contingency Added to Reflect Level of Project Development" equals the Contingency appropriate for the project's level of development.

(4) Project data based on documents provided by Cal Am and MPWMD.

(5) Project 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.

(6) Project data provided by MCWD.

(7) Project data provided by MRWPCA. MRWPCA reported that the GWRP quantity being used in the current CEQA documentation is 3,500 AFY, but that the project could potentially supply 6,500 AFY or more. The unit cost would be lower if a quantity larger than 3,500 AFY were produced.

(8) This value is the cumulative production capacity of all of the Potential Sources of Replenishment Water that listed in this table, and is used only to determine the "Volume-Weighted Average." It is not the amount of water that is expected to be available to the Seaside Basin.

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	
Seaside Basin ASR Expansion (3)	2020	1,000	$2,025	2016
Regional Urban Water Augmentation Project (4)	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 3). 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) 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.

(4) Project data provided by MCWD.