M E E T I N G N O T I C E A N D A G E N D A

TECHNICAL ADVISORY COMMITTEE
OF THE
SEASIDE BASIN WATER MASTER

DATE: Wednesday, July 12, 2017
MEETING TIME: 1:30 p.m.
Monterey Regional Water Pollution Control Agency Offices
5 Harris Court, Building D (Ryan Ranch)
Monterey, CA 93940

If you wish to participate in the meeting from a remote location, please call in on the Watermaster's new Conference Line by dialing (650) 472-5814. In the event the new Conference Line number has not been activated by the time this meeting occurs, then revert back to using the earlier number of (712) 432-1212. Regardless of which number you call in on, use the Meeting ID 355890617. Please note that if no telephone attendees have joined the meeting by 10 minutes after its start, the conference call will be ended.

OFFICERS
Chairperson: Nina Miller, California American Water Company
Vice-Chairperson: Jon Lear, MPWMD

MEMBERS
California American Water Company | **City of Del Rey Oaks** | **City of Monterey**
City of Sand City | **City of Seaside** | **Coastal Subarea Landowners**
Laguna Seca Property Owners | **Monterey County Water Resources Agency**
Monterey Peninsula Water Management District

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The next regular meeting will be held on Wednesday August 9, 2017 at 1:30 p.m. at the MRWPCA Board Room.

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SEASIDE BASIN WATER MASTER
TECHNICAL ADVISORY COMMITTEE

**** * * AGENDA TRANSMITTAL FORM * * ****

MEETING DATE:	July 5, 2017
AGENDA ITEM:	2.A
AGENDA TITLE:	Approve Minutes from the June 14, 2017 Meeting
PREPARED BY:	Robert Jaques, Technical Program Manager

SUMMARY:

Draft Minutes from this meeting was emailed to all TAC members. Any changes requested by TAC members have been included in the attached version.

ATTACHMENTS:	Minutes from this meeting
RECOMMENDED ACTION:	Approve the minutes

D-R-A-F-T
MINUTES

Seaside Groundwater Basin Watermaster
Technical Advisory Committee Meeting
June 14, 2017

Attendees: TAC Members

City of Seaside – Rick Riedl (via telephone)
California American Water – Nina Miller
City of Monterey – Laurie Williamson (via telephone)
Laguna Seca Property Owners –Bob Costa
MPWMD – Jon Lear
MCWRA – Tamara Voss
City of Del Rey Oaks – No Representative
City of Sand City – No Representative
Coastal Subarea Landowners – No Representative

Watermaster
Technical Program Manager - Robert Jaques

Consultants
HydroMetrics – Georgina King (via telephone)
Martin Feeney – Martin Feeney (via telephone)

Others
MRWPCA – Bob Holden
MPWMD – Maureen Hamilton

The meeting was convened at 1:33 p.m. after a quorum had been established.

1. Public Comments
There were no public comments.

2. Administrative Matters:

A. Approve Minutes from the April 12, 2017 Meeting
On a motion by Mr. Lear, seconded by Ms. Voss, the minutes from this meeting were unanimously approved as presented.

B. Change in Conference Line Telephone Number
Mr. Jaques summarized the agenda packet materials for this item. He will include the new conference line telephone number on the Meeting Notice for the next meeting.

3. Presentation on Pure Water Monterey Project
Ms. Hamilton made an overview presentation on the Pure Water Monterey Project with the aid of the PowerPoint slides that were included in the agenda packet. She explained that she is an employee of Monterey Peninsula Water Management District, and is working with Monterey Regional Water Pollution Control Agency on the Pure Water Monterey Project.

Some of the items highlighted in her presentation included:

- The Blanco drain diversion is currently under construction. It collects tile drain water from approximately 6,400 acres of farmland in the lower Salinas Valley.

- Some of the issues being addressed in the Project include sensitive species in some portions of the construction area, unexploded ordinance in some portions of the construction area, and complying with numerous requirements of the Proposition 1 State Revolving Fund loan program.
- Environmental clearance under CEQA for the injection wells covers a large enough area to allow some movement of these facilities if necessary once construction begins.
- The monitoring wells are constructed in pairs-one is perforated in the Paso Robles aquifer and one in the Santa Margarita aquifer.
- The 1st on-site bore will be the deep monitoring well. This is a portion of the Phase I work which is now under construction. Mr. Lear commented that core samples are being collected during the borings, and a model will be developed in the future that can use the core sample data.
- A Draft Storage Agreement with the Watermaster is being developed by California American Water and by the Monterey Peninsula Water Management District. There will likely be a single joint agreement requested from these entities. A Draft of the agreement will probably be submitted to the Watermaster in the fall of 2017.
- Approximately 90% of the injected water will go into the deep injection wells and approximately 10% will go into the vadose zone wells and the backwash percolation basin.
- Some water quality information was included in the final slide as shown on page 17 of the agenda packet. It was pointed out that some rise in groundwater levels is expected to result from the injection project.
- Funding for a portion of the project is being provided by the State Revolving Fund loan program. The loans are at an interest rate of 1% per year for a 30-year term. The loan amount is on the order of $100,000,000.
- Funding for the other portions of the Project is being provided by two State Water Resources Control Board grants, with one grant being for approximately $10,000,000 and the other grant being for approximately $15,000,000.

Ms. King inquired how the water level rises had been predicted. Mr. Lear responded that HydroMetrics had served as a subconsultant to Todd Groundwater, and HydroMetrics' groundwater model (the Watermaster's groundwater model of the Seaside Basin) had been used to predict the water level rises.

4. Modifications to the Sentinel Wells Induction Logging and Water Quality Sampling Work
Mr. Jaques summarized the agenda packet materials for this item.

Mr. Riedl asked how the field blanks would be collected. Mr. Jaques described the field blank collection process. Mr. Feeney elaborated that the field duplicates will be split samples.

Mr. Riedl asked what diameter the sampling devices were and Mr. Feeney responded that they were 2 ½ inches in diameter and the casing itself is 3 inches in diameter.

Mr. Feeney explained that the original plan for the Sentinel Wells was for them to have blank casings and not to have screens and to serve only as induction log guide tubes. Then the idea arose of also collecting water level data representative of the lower aquifer as a whole, and the wells were perforated in all of the various water-bearing zones that comprise this lower aquifer system. Finally, the idea of collecting discrete water quality grab samples from selected zones was added to the program. He noted that the water quality data obtained when the wells were constructed (as documented in the well construction report) was found to be different from well-to-well and from different depths within each well, and that the composite samples from the wells differed from the discrete samples. All of the wells are perforated in multiple water-bearing zones within a single aquifer.

Mr. Riedl asked if the screens in a given well were all within the same aquifer, or were some of them across more than one aquifer. Mr. Feeney explained that in a given well all of the screens were in the

same aquifer, and there was no cross-aquifer connection possibility due to having screens in more than one aquifer.

Mr. Riedl inquired about the use of osmotic samplers. Mr. Feeney explained that the normal type of osmotic sampler fills up over time, so it would get a blended sample over a period of time, and would not provide information on discrete-time water quality. Mr. Lear noted that the more sophisticated types of osmotic sampler can reportedly collect discrete-time samples, but these are apparently considerably more expensive.

Mr. Riedl asked what the purpose of the alert levels in Table 3 was. Mr. Jaques explained that in response to TAC direction in the fall of 2016, these levels had been developed by HydroMetrics and had been provided to Monterey Bay Analytical Services, so that if the laboratory technician performing analyses on the Sentinel Well water quality samples found that any of the values reach these alert levels, the Watermaster would be immediately notified by telephone.

Mr. Feeney asked how many duplicate samples were supposed to be taken per event. Mr. Jaques noted that the 5% sampling level is what MCWRA uses. If 5% is less than 1 sample, then a minimum of 1 duplicate is to be taken during each sampling event.

Mr. Riedl had further questions about why three casing volumes of water could not be pumped out, and Ms. King and Mr. Feeney provided further explanations on this.

Ms. Voss commented that although the wells were not designed for water quality sampling, but were designed for induction logging, the issues listed on page 30 of the agenda packet in the paragraph "Section 4.2.3 in the USGS document titled…" are still valid and we need to keep them in mind when interpreting the chemistry data. However, USGS's recommendation to pump out three casing volumes before taking samples, as described on page 30 of the agenda packet, was still applicable.

Mr. Feeney reported that when the wells were constructed they were air-lift developed. The air-lift flow out of the wells at that time was on the order of 75 gallons per minute

Mr. Jaques asked Ms. Voss if she felt there was any value to the water quality sampling data that we are currently getting. Ms. Voss said that she felt there is some value, but that she is not certain exactly what the samples represent.

There was discussion by several parties about this topic. The value of the water quality sampling data was questioned.

There was consensus on doing the field blank and field duplicate samples as recommended by the Technical Program Manager.

There was consensus on it being inappropriate to do a three-casing volume purging of the wells, because it would result in a blend, not a discrete, water quality sample.

Ms. Voss commented that if the Seawater Intrusion Response Plan sets specific water quality triggers, such as a chloride concentration, then we should move toward trying to get such data using a different sampling technique.

Mr. Lear commented that a more robust water quality sampling device, such as a low-flow sampling device, could be used if the results from the bomb sampler (as a proxy) indicated water quality might be reaching trigger levels.

Ms. Voss recommended continuing with the current sampling methods unless alert levels are reached, at which point we should consider changing from the bomb sampler collection device to a better water quality sample collection method.

Mr. Jaques noted that it might be desirable to modify the language in the Seawater Intrusion Response Plan to address this.

A motion was made by Mr. Lear, seconded by Mr. Costa, to approve the modifications recommended in the agenda packet by the Technical Program Manager. The motion passed unanimously.

5. Approve Amendment No. 2 to RFS No. 2017-01 to Martin Feeney to Perform Conductivity and Temperature Profiling of the Sentinel Wells, and to Include Field Blank and Field Duplicate Samples in the Water Quality Sampling of these Wells

Mr. Jaques summarized the agenda packet materials for this item. On a motion by Ms. Voss, seconded by Mr. Costa, the amendment was unanimously approved.

6. Initial Discussion of Potential Changes in Groundwater Quality Resulting from Introducing New Sources of Water into the Aquifers

Mr. Jaques summarized the agenda packet materials for this item. There was no further discussion.

7. Schedule

Mr. Jaques reported that there were no significant changes in the schedule, and there was no further discussion on this item.

8. Other Business

Mr. Riedl asked for clarification as to whether all well samples are to be taken in September. It was confirmed that all wells are to be sampled in March and September, starting this September.

Ms. Miller reported that Cal Am is working on a draft storage agreement and will be submitting it shortly.

Ms. Williamson reported that she will not be present to attend the July 12 TAC meeting.

9. Set Next Meeting Date

The next regular meeting will be held on Wednesday July 12, 2017 at 1:30 p.m. at the MRWPCA Board Room.

The meeting adjourned at 3:06 p.m.

SEASIDE BASIN WATER MASTER
TECHNICAL ADVISORY COMMITTEE

**** * * AGENDA TRANSMITTAL FORM * * ****

MEETING DATE:	July 5, 2017
AGENDA ITEM:	2.B
AGENDA TITLE:	Sustainable Groundwater Management Act (SGMA) Update
PREPARED BY:	Robert Jaques, Technical Program Manager

At the State level:
Since my last update, I have not received any new materials from the State that would impact the Watermaster.

At the Monterey County level:
At its June 8, 2017 meeting the Board of Directors of the Salinas Valley Basin Groundwater Sustainability Agency had on its agenda two items of interest to the TAC:

1. "Update on Status of GSA NOI filings with the Department of Water Resources - Consideration of request to State Water Resources Control Board to advise with respect to overlaps with Marina Coast Water District and the Arroyo Seco Groundwater Sustainability Agency.'
2. "Advisory Committee Update".

The first of these items pertains to the SVBGSA seeking advice from the SWRCB on how best to address the issues of overlapping jurisdictions seeking to be the GSA for portions of the Salinas Valley Basin. This includes the request by Marina Coast Water District to be the GSA for the portion of the Basin bordering the Adjudicated Seaside Basin's northern and northeastern boundaries.

The second item pertains to the makeup of the Advisory Committee which will provide advice and recommendations to the SVBGSA on technical issues. This is the Committee that I have applied for membership on, on behalf of the Watermaster. Gary Peterson, who is the interim General Manager of the SVBGSA, reported that the Advisory Committee expressed a desire for me to attend their next meeting to speak to the role I would see myself playing on the Committee. He will let me know when they schedule their next meeting.

ATTACHMENTS:	None
RECOMMENDED ACTION:	None required – information only

SEASIDE BASIN WATER MASTER
TECHNICAL ADVISORY COMMITTEE

** * * AGENDA TRANSMITTAL FORM * * **

MEETING DATE:	July 5, 2017
AGENDA ITEM:	3
AGENDA TITLE:	Discussion of Potential Changes in Groundwater Quality Resulting from Introducing New Sources of Water into the Aquifers
PREPARED BY:	Robert Jaques, Technical Program Manager

SUMMARY:

As briefly discussed at recent TAC meetings, 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. 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 some recent articles describing OCWD's experience with this.

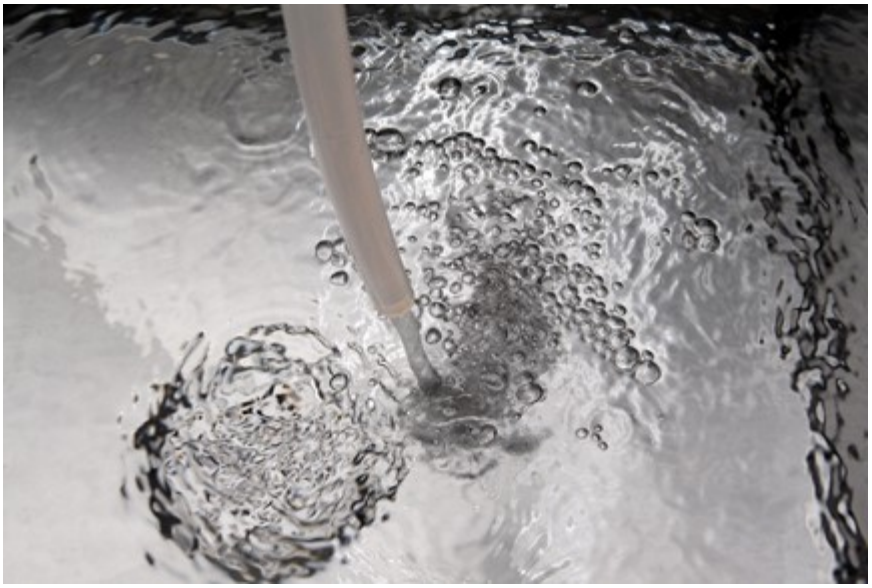
At the TAC's last meeting it was reported that Jon Lear had offered to make a presentation on this topic at today's TAC meeting to begin this discussion with the TAC. The PowerPoint slides he will be using in his presentation will be emailed out separately a day or so before this TAC meeting.

If the TAC feels this is an issue that should be addressed by the Watermaster in order to protect the quality of groundwater in the Seaside Basin as new water sources, such as desalinated water and advance treated wastewater, are introduced into the Basin, then an approach to address this will need to be developed. Presumably the Board will look to the TAC for technical recommendations on this issue. If the TAC feels that any consultant assistance, or other activities that would involve cost, should be pursued in 2018, then those recommendations should be included in the 2018 Management and Monitoring (M&MP) Work Plan and Budget for 2018. Those documents are scheduled for TAC approval at the September TAC meeting, so work on this will need to proceed rapidly in order to meet that schedule.

ATTACHMENTS:	1. Articles on OCWD's experience
RECOMMENDED ACTION:	Provide input/direction to the Technical Program Manager regarding further discussion on this topic

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 H2O 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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Dan Stober, Stanford News Service: (650) 721-6965, dstober@stanford.edu

SEASIDE BASIN WATER MASTER TECHNICAL ADVISORY COMMITTEE

** * * AGENDA TRANSMITTAL FORM * * **

MEETING DATE:	July 5, 2017
AGENDA ITEM:	4
AGENDA TITLE:	Follow-up from Board Discussion and Direction Regarding Updating the Basin Management Action Plan (BMAP) and the Seaside Basin Groundwater Model
PREPARED BY:	Robert Jaques, Technical Program Manager

SUMMARY:

At its February and April, 2017 meetings the TAC discussed the topic of updating the Basin Management Action Plan (BMAP) and the Seaside Basin Groundwater Model. The TAC's recommendation was that it would be desirable to update these documents, but that action on this should be deferred until the 2018 Management and Monitoring Program (M&MP) was being developed.

At its July 5, 2017 meeting I alerted the Board that the TAC might be recommending that these documents be updated, and solicited their direction on this matter. My purpose in doing this was to ascertain whether there would be Board support for undertaking that work. If the Board was not supportive of it, then there would be no need to have the TAC devote its time and efforts into defining the scope and cost of that work.

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 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

At today's TAC Meeting input is requested regarding the detailed proposed scope-of-work in the attached Proposal from HydroMetrics for updating the BMAP and the Model, regarding any of the proposed work TAC members feel does not need to be performed, as well as work that TAC members feel should be added to the proposed scope-of-work. I will contact Gus Yates to solicit his input and will also contact MPWMD/MRWPCA regarding sharing in the costs to update the Model.

ATTACHMENTS:	Proposal from HydroMetrics for Updating the BMAP and the Groundwater Model (previously included in the April 12, 2017 TAC Agenda Packet)
RECOMMENDED ACTION:	Provide Input/Direction to the Technical Program Manager Regarding the Scope and Cost for Updating the BMAP and the Groundwater Model

HydroMetrics WRI

1814 Franklin St., Suite 501
Oakland, CA 94612

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

March 24, 2017

Subject: 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.

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. 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. 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. In particular, it has been found that the northern and eastern boundaries of the basin are dynamic and therefore change depending on pumping and recharge conditions. How this affects the movement of groundwater across the boundaries is important for managing the basin's groundwater resource.

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 current groundwater budget should be developed to enhance our understanding of the groundwater system. 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 water budget for each subarea together with the Zero Net Draft method of estimating Safe Yield will be used to reevaluate the Natural Safe Yield. The Zero Net Draft method relies on selecting a historical period of time that has the same starting and end mean depth to groundwater and comparing it to groundwater production for the same period. The groundwater production during that period can be considered a measure of the safe yield.

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 updated 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.

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 six weeks to develop the automated model update system and to update and recalibrate the groundwater model.

The 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,

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