123-TCP Treatment Pilot Project for Domestic Well Households in Northern Monterey County

Appendices

June 2023

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1,2,3-Trichloropropane (1,2,3-TCP)

- Legal Limit (Maximum Contaminant Level: MCL): 0.005 μg/L.
- Public Health Goal (PHG): 0.0007 μg/L.

Common sources of the contaminant in the Central Valley and Central Coast

Most 1,2,3-TCP contamination stems from the extensive application of soil fumigants manufactured by Shell Oil and Dow Chemical Company containing the unnecessary impurity 1,2,3-TCP prior to the 1980s. 1,2,3-TCP has also been used as an industrial solvent, and as a cleaning and degreasing agent. Even though 1,2,3-TCP is no longer being applied to fields as a pesticide ingredient, it is extremely persistent and remains in groundwater a very long time.

Significant health risks of long-term exposure in drinking water

- Cancer

At-risk populations

Communities in agricultural regions (even many urban areas that were former agricultural regions) frequently have 1,2,3-TCP in their groundwater from its historic application as a pesticide byproduct. Communities at locations that manufactured the chemical or near hazardous waste sites where 1,2,3-TCP was improperly stored or disposed, are also at risk.

Pathways of exposure

Exposure can occur through inhalation (usually from steam produced from 1,2,3-TCP contaminated water), ingestion of contaminated water (by drinking, cooking, showering, etc.), or dermal (skin) exposure.

Tips for reducing exposure at home

- Buy bottled water for drinking, cooking, making ice cubes, and brushing teeth.
- Avoid bathing, showering, or washing dishes and produce with hot water that produces excess steam.
- Take cooler temperature showers and limit the length of your showers to minimize exposure.
1,2,3-TCP References


e. California Water Boards (website) “1,2,3, -Trichloropropene (1,2,3 - TCP),” available at www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/123TCP.html (last visited June 2023).


Appendix B
TAC Members and Meeting Minutes

TAC Members and Contributors
Michael Adelman, Stantec Consulting Services, Inc.
Mark Bartson, *(retired)* State Water Board (Division of Drinking Water - DDW, Technical Operations)
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Paul Boyer, *(retired)* Self-Help Enterprises (SHE)
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Kyle Graff, State Water Board (DDW, Monterey District)
Tarrah Henrie, California Water Service
Alex Huang, State Water Board (Division of Financial Assistance)
Brian Kidwell, State Water Board (DDW, Northern Engagement Unit)
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Eugene Leung, State Water Board (DDW, Technical Operations)
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Tami McVay, SHE
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Laura Satterlee, SHE
Chad Seidel, Corona Environmental Consulting
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Additional Participants in and Contributors to TAC Meetings
Tamara Anderson, Central Coast Regional Water Quality Control Board (CCRWQCB)
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123-TCP Treatment Pilot Project for DAC Households in the Northern Monterey County Area
Technical Advisory Committee
October 27, 2020 Meeting Minutes
12:00-2:00 PM

Meeting Format: This meeting took place in the form of an online webinar where participants joined via video and audio. During part of the meeting, participants followed a live powerpoint presentation.

Meeting Minutes Format: The information covered during the presentation as well as the group discussion is captured in these notes. At times, minutes are paraphrased and abbreviated to try to capture the intent of what was said. A recording of the TAC meeting is also available upon request. Some sections of the discussion were rearranged to group similar items together.

Attendance:
Mark Bartson, State Water Board (Division of Drinking Water - DDW, Technical Operations)
Kevin Berryhill, Provost & Pritchard Consulting Group
Brandon Bollinger, Community Water Center (CWC)
Paul Boyer, Self-Help Enterprises (SHE)
Tim Bushman, Culligan QWE Commercial Systems
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Kyle Graff, State Water Board (DDW, Monterey District)
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Allie Sherris, Stanford University
Cecilia Vela, SHE
Dave Wallis, RCAC
I. Introduction
Heather from Community Water Center (CWC) welcomed all attendees to the first TAC meeting for the 123-TCP Point of Entry (POE) Treatment Pilot Project and reiterated that each TAC member was invited because they are a regulatory and/or technical expert and that all input is important and will support this project being a success. Each attendee introduced themselves and shared what inspires them about this project. Many attendees acknowledged a personal connection to this work, shared their experiences related to 123-TCP treatment and device registration, recognized the scale of the problem statewide, and shared interest in working together on collaborative, cost-effective solutions. Attendees also discussed an awareness of the technical challenges related to 123-TCP treatment for private wells and the importance of this project in identifying actual costs of 123-TCP POE treatment for domestic wells.

**Today’s Meeting:** Heather reviewed the agenda, TAC member list, key CWC staff working on this project, and emphasized the goal of the meeting which is to share project updates and to engage the TAC in the design and implementation of the first pilot treatment system. Our goal is for this project to inform state-wide efforts to provide safe drinking water for all Californians specific to 123-TCP.

II. CWC Background & Motivation for this Project
CWC is a Californai based non-profit organization with offices in Visalia, Watsonville, and Sacramento. CWC was co-founded by Susana De Anda who is CWC’s executive director. CWC has been building the movement for water justice in California alongside impacted community members and many other organizations and agency partners (including many meeting attendees) for more just and sustainable water policies and projects for over 13 years. CWC’s vision is that all Californians have access to safe and affordable drinking water. CWC’s mission is to act as a catalyst for community driven solutions through organizing, education, and advocacy.

CWC’s Executive Director, Susana, facilitates the AGUA coalition which currently includes members from 26 impacted communities and 12 non-profit organizations working for safe and affordable drinking water for the San Joaquin Valley. AGUA is an acronym in Spanish which stands for the Association of People United for Water. AGUA is in the process of expanding to include members from the Central Coast.

Heather shared a map showing the location of public water systems serving over 1 Million people impacted by unsafe drinking water in California. This map does not include systems serving less than 15 households or those dependent on private wells like those in this project. CWC works in environmental justice communities where drinking water contamination impacts low-income populations in the San Joaquin Valley and Central Coast.

CWC also engages in advocacy with community partners and other organizations, and supported the Human Right to Water Law (2012) and the Safe and Affordable Drinking Water Fund (2019). CWC experience with point-of-use treatment pilot projects in Kern County (schools, arsenic, project led by RCAC) and Tulare County (residential, nitrate, project with SHE).
Mayra from CWC then shared CWC’s approach to community organizing which led to the development of this project. CWC started organizing in the area north of Moss Landing in north Monterey County because of known nitrate contamination. By connecting residents to the Central Coast Water Board’s well testing program, CWC learned that 11 of the 17 wells tested had high levels of both 123-TCP and nitrate. CWC supported community members in forming a community-based organization - *El Comité Para Tener Agua Sana Limpia Y Económica (El Comité)* or the Committee for Safe, Clean, and Affordable Drinking Water - to advocate for both interim and long-term drinking water solutions. They were successful in securing a grant for bottled water delivery for their community in May 2019. Community members’ concerns around exposure to 123-TCP while showering led to this project being a priority for El Comité and CWC’s involvement.

In 2021, CWC will also be conducting an alternatives analysis to explore long-term solution options for households in the area north of Moss Landing (e.g. consolidation, treatment, or new groundwater source). This 123-TCP Treatment Pilot Project will inform the cost estimates for the treatment alternative in the alternatives analysis, and will provide an interim solution through July 2023 as long-term solutions are being developed.

Next, Heather shared CWC’s approach and recommendations regarding point-of-use (POU) and POE treatment. CWC does not endorse particular technologies or companies and relies on State Water Board guidance and certification for residential treatment systems.¹ POU/POE Treatment Regulations in California for public water systems have many requirements including a performance indicator device, monthly monitoring (on a rotating basis), and a maintenance plan.² CWC reinforces state regulations and guidance in communities - for example, we support community education and understanding that residential treatment systems are certified to remove specific contaminants. CWC recommends POE treatment for contaminants - like 123-TCP - where there are health risks due to inhalation of steam or dermal exposure.

For private domestic wells, where there is limited source water data and/or no management structure, CWC recommends the following:

- **Test source water for multiple contaminants** - CWC learned about the 123-TCP in this area because of the well testing program for multiple contaminants and also just recently learned of a well that also has perchlorate contamination during the site assessments.
- **State funding for a master contract for operation, maintenance, and monitoring** - it can be difficult to ensure POU/POE devices continue to function properly on unregulated drinking water sources.
- **Follow draft Monterey County POU/POE treatment ordinance**, which was based on State regulations and applies to wells serving 2-14 connections

2. https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/regulations/
CWC has not been able to recommend state-certified devices (“off-the-shelf” devices) under certain circumstances, including:

- Bacteria present
- More than one contaminant present
- High levels of nitrate (greater than State’s certification/registration limit)\(^3\)
- No certified devices for 123-TCP
- No performance indicator device

CWC recognizes the work by State Water Board staff, including some on this call, to address these challenges to POU/POE treatment of domestic wells.

CWC uses evaluation criteria related to the Human Right to Water Law to evaluate interim solutions like POE/POU including water safety, affordability, accessibility, and adequacy. CWC prioritizes public health and seeks solutions that ensure safe water with good operation, maintenance, and monitoring that does not put the burden of determining whether water is safe on local residents. This project was motivated by the community need and designed to address some of the challenges to POU/POE treatment of domestic wells.

### III. Project Overview

Heather then presented an overview of information shared in advance of this meeting in the “Project Overview for Technical Advisory Committee: 123-TCP Treatment Pilot Project for DAC Households in the Northern Monterey County Area (October 21, 2020).” This overview is provided as an attachment to these meeting minutes.

**Project Goals**

- To effectively treat 123-TCP to levels below the Maximum Contaminant Level and reduce exposure to 123-TCP for all project participants.
- To provide transparent documentation of costs, outcomes and lessons learned to inform state-wide efforts to provide safe drinking water for all Californians specific to 123-TCP.

Heather explained that this pilot project is only addressing 123-TCP contamination at the point-of-entry (POE). It is not addressing additional contaminants like nitrate that may be present. The project findings will be relevant for the following scenarios:

1) Public water systems that only have 123-TCP (over 500,000 people statewide are in this category),
2) Private domestic wells that only have 123-TCP,
3) Private domestic wells with 123-TCP plus POU treatment for an additional contaminant with a state certified device (e.g. If the co-contaminant is nitrate at levels lower than 20

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\(^3\) The California State Water Board registers devices for nitrate treatment at levels less than 108 mg/L of nitrate (measured as NO\(_3\)) or 24 mg/L nitrate (measured as N). There are currently no devices registered to remove nitrate at higher levels.

https://www.waterboards.ca.gov/drinking_water/certlic/device/watertreatmentdevices.html
mg/L nitrate as N, then the 123-TCP POE system could be complemented by a POU treatment system for nitrate),

4) Private domestic wells with both 123-TCP and another contaminant with no state certified POU device or when nitrate levels are greater than 20 mg/L, the interim solution would be POE for 123-TCP and bottled water for all consumptive uses. This is the case for many of the wells that are candidates for this project.

Heather then reviewed slides with the location and water quality data for private domestic wells that are candidates for this study. See table and maps in Project Overview (Pgs 5 and 6). Wells that are candidates for this study have a range of 123-TCP levels ranging from 0.007 ug/L to 0.165 ug/L (with the Maximum Contaminant Level of 0.005 ug/L).

Project tasks and timeline were briefly discussed including an emphasis on the role of the TAC in advising on the design and implementation of the study and also sharing findings of the study with a wider audience. TAC meetings will be held throughout the project to receive feedback at key project stages. Weber Hayes and Associates has been contracted to complete the first phase of this project which includes site assessments and the installation of one treatment system this Fall.

Questions and Answers on Project Overview

Alex Huang: Many of the wells shown on the map are currently covered under a bottled water agreement with the State Water Board currently managed by Pajaro Sunny Mesa Community Services District. Do you know if 123-TCP is the only contaminant?

Heather Lukacs: No, for all wells located in the Moss Landing area covered by that grant, they also have nitrate contamination as well as Total Dissolved Solids. See Table: Private Domestic Wells with High 123-TCP in the Pilot Project Area (Project Overview, Page 6). All households that could potentially be part of this project are already receiving bottled water through state grants. This project will focus on the 123-TCP contamination and dermal and inhalation exposure.

Tori Klug: Helpful to see paired interim solutions for bottled water and point-of-entry 123-TCP treatment. How will this study inform the alternatives analysis of long-term solution options?

Heather: POE/POU treatment will be one of the alternatives which will be considered in the alternatives analysis. This pilot project will inform the costs used for this alternative in the alternatives analysis. Current Monterey County regulations for state and local small water systems do not allow POE/POU treatment as a strategy to come into compliance. The State Water Board has advised us to include POE/POU as an alternative. CWC views the 123-TCP treatment pilot project as an interim solution. However, for some households that are part of this project, there may be no other long-term solution options so POE/POU could become the default long-term solution.

IV. Project Updates
Heather (CWC) provided project updates and community considerations from conducting site assessments with Weber, Hayes, and Associates and also from conversations with property owners and residents in the project area.

Heather shared a photo of a cracked well seal at a potential pilot project location where the well also tested positive for total coliform bacteria. This well was one of the three wells where site assessments have been completed. In addition, at least one potential project participant does not have access to the well on their property (they own the land and lease it to a grower that restricts access to the well). Property owners have also raised questions and concerns regarding possible property modifications, the size and appearance of the treatment systems, and have requested to have the option to uninstall the system at the end of the project if they are unable to afford operation and maintenance costs. Another project finding so far is that some households will require additional plumbing in order to separate water used indoors from water used outdoors (some houses are plumbed such that irrigation/outdoor water first enters the household). This may result in an additional project cost.

Questions and Answers on Project Updates

**Could POU systems for additional contaminants be tested as part of an add-on to this project?**

**Summary:** Eugene Leung inquired into the possibility of exploring POU treatment of additional contaminants as an add-on to this pilot project for 123-TCP. The TAC discussed different strategies and examples of other pilot projects that address nitrate contamination at high levels and also pros and cons of anion exchange for nitrate treatment. Given technology and budget limitations, this pilot project is focused on point-of-entry treatment for TCP only. CWC is open to exploring funding opportunities for add-ons to this pilot project.

Eugene Leung: Would it be possible, as part of the pilot, to install a Point-of-Entry (POU) treatment system with a booster pump to see how well it works for other contaminants in the source water? It would be helpful to get data on POU treatment system performance with real well water like what was presented earlier and to not only focus on 123-TCP. Units could be run for a month or so at one site and then moved from site to site. The goal would be to test the POU system for data gathering purposes not as a solution (the POU treated water would not be used for drinking). It’s a golden opportunity to broaden the scope of solutions available [for those reliant on private wells]. The pilot project offers a rare opportunity to use real groundwater that has TCP to see how well POU systems are able to reduce other contaminants on household level. It may motivate manufacturers to do something new.

Heather: We did receive quotes during the proposal phase of this project to include nitrate treatment but it was determined to be beyond the scope of this project due to the cost and extremely high levels of nitrate (more than 6 times the Maximum Contaminant Level). We are open for a follow-up discussion on this topic and to exploring potential funding opportunities.

**Under-the-sink RO pilot project for high nitrate well source water in Monterey County**
Tim Bushman: Culligan piloted an under-the-sink RO system (registered by the State of California) in south Monterey County on source water with 45 ppm nitrate as nitrogen. This system had a booster pump and permeate pump (that is an energy recovery system that decreases back pressure) and was very successful. We used the booster pump because every house has different pressures and pressure determines rejection factor. Monterey County monitored and approved this pilot system with a booster pump and permeate pump. The system includes a pre and post TDS meter, faucet monitor, rejection monitor, and a totalizing meter. These are all add-ons to the Culligan system.

Need for more research on scalable, standard systems certified through NSF
Eugene Leung: For broader, more scalable applications, the goal is to use a standard package system that is certified through NSF standards for high nitrate so that we do not have to custom engineering solutions for each site. Regarding a POU nitrate system that may be done in tandem with a POE for 123 TCP, there are two questions that we need to answer:
- What is the best you can get with a standard booster pump setup?
- How much water is wasted during RO treatment? Use a totalizer to determine. If there is too much water wasted, a well could run out of water.

Anion exchange for nitrate treatment of private wells (in addition to GAC for 123-TCP)
Tori Klug: Did you consider using anion exchange for nitrate removal at the same point of entry as the GAC?

Tim Bushman: For anion exchange, TDS has a big effect on capacity and the bleed of nitrates. The amount of sulfates, a competing ion, and the percentage of sulfates compared to nitrate, also influences treatment capacity. In the previous slide, it indicates high levels of sulphate as compared to nitrate. Typically, we give the sulfate and nitrate data to chemical engineers at the media manufacturers who can give us projections for nitrate leakage through the system, capacity, salt dosage, and wastewater. There are times when nitrate-selective anion exchange is not feasible because capacity is too low or dosage of salt is too high (in order to get low leakages). It does generate less waste than an RO system would and at a lower capital cost for whole house systems, but there are limitations to it.

Eugene Leung: Another problem with anion exchange, is that shallow domestic wells have nitrate levels that fluctuate during the year. It is really difficult to determine treatment capacity because having an online nitrate analyzer is cost prohibitive ($16K minimum). Ion Exchange is cost prohibitive because of unpredictability and the potential of providing a false sense of security. Using POU RO is more robust for nitrate if you have a pressure booster. It is a difficult problem.

Heather Lukacs: We did not consider anion exchange or other nitrate treatments for the reasons noted. Because nitrate poses acute public health risk, the complexity of source water in the

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4 The Maximum Contaminant Level (MCL) for Nitrate as Nitrogen (or Nitrate as N) is 10 mg/L. Thus, 45 mg/L nitrogen as N is 4.5 times higher than the MCL for nitrate. Heather confirmed this value with Tim Bushman after the meeting. The source water is 45 ppm nitrate as nitrogen or 200 nitrate as nitrate.
pilot project area, and the lack of state-certified devices for nitrate at this high of level, households in this pilot project area are already receiving bottled water for consumptive uses. The focus of this pilot project is on 123-TCP treatment at the point-of-entry and to address dermal and inhalation exposure risks to public health.

V. Review Draft 123-TCP POE Treatment System Design & Monitoring Plan

Heather reviewed design requirements provided to Weber, Hayes, and Associates for the first pilot system:

- Point of Entry Treatment for 123-TCP only (This system will be used in combination with bottled water delivery, for reasons previously discussed.)
- Must use Best Available Technology for 123-TCP treatment of Granular Activated Carbon, according to CA Drinking Water Regulations (Table 64474.4-A)
- Must use a lead / lag design and have a flow meter and temperature sensor.

Craig Drizin from Weber, Hayes, and Associates shared the diagram of a system designed with Tim Bushman from Culligan Salinas. Craig shared that this design is the probably the best point-of-entry system from the logistical standpoint of installing it and running it. The driving design force was to make it simple. The biggest design question was whether to backwash the filters, and the design team decided not to. Weber, Hayes, and Associates plans to install the system, run the system, and monitor for 123-TCP removal in order to see how long the media lasts and to what extent it matches the protections from the carbon manufacturers. They will also identify any problems with the installation, other questions or issues the property owner or tenant might have, and document observations while operating the system. They think the system can be sized properly to effectively remove 123-TCP, which is the focus of this pilot.

Questions & Answers Related to Draft Treatment System Design

How common is bacterial contamination of private wells in this study area and statewide?
How will this study approach the issue of bacterial contamination?

Mark Bartson: You had a statistic in the presentation that 1 out of 3 wells had a positive bacteria test. How many wells have you been able to test? Globally, it would be good to better understand [the prevalence of bacterial contamination of private wells]. We may want to talk about how we are going to approach this issue more broadly. This would be a good topic to discuss this at the next meeting.

Allie Sherris: Followed up on Mark's question, did you find total coliform bacteria or E. coli?

Heather: Good suggestion - we will put this topic on the next agenda. We have sampled three wells so far in this project, with one of them testing positive for total coliform bacteria and all were negative for E.Coli. We should have the complete results before the next TAC meeting in December. We have chosen to install the first treatment system in a location without bacteria contamination. As we do more testing we expect to find more bacterial problems, and we do
expect this pilot project to need to address bacteria in some homes. In the Central Valley, Community Water Center has found that ~50% of wells have bacterial problems.\(^5\) When we consider the applicability of this pilot project to statewide issues, it will be important to consider bacteria.

**Follow-up:**
- Heather to add discussion of bacteria to next TAC agenda
- TAC members to share any information they have related to the incidence of total coliform bacteria in private domestic wells
- Mark Bartson will follow-up to see how the State Water Board is taking bacteria into account in their Needs Assessment

### Total Coliform Bacteria Pre-Treatment, Potential Impacts to GAC, and Other Considerations

Eugene Leung: Because influent water quality might be total coliform positive, are there solutions available to make sure the water is bacteriologically safe?

Craig Drizin: The solution would require chlorine or some type of disinfectant. Chlorine would impact absorption in the carbon so we have chosen to start with the first installation at a well that does not have bacterial problems. Total coliform bacteria was found at one well out of three that we have tested so far, and the bacteria was associated with visible damage to the well seal. Although we are not conducting a complete well examination, there is a high likelihood that some wells are not designed to modern well standards which include a 50 foot sanitary seal. At the other two sites where there is no bacteria, the wellhead looks intact and we do not think bacteria will be an issue there. For pilot study, we should look at sites without bacteria issues especially because it is possible the bacteria is a hardware issue and not chronic. If the bacteria is chronic, then that well really needs to be replaced or at least evaluated.

Eugene Leung: Does Culligan have any disinfection systems that could be used downstream of the POE systems?

Tim Bushman: This system was designed assuming no bacteria in the water. Options for bacteria treatment include chlorine, UV sterilization, ozone, and hydrogen peroxide. One problem in using UV sterilization before the GAC system is that you can have issues with scaling that can trigger the system to automatically shut off which would then require a service visit. You could install UV sterilization after the POE system if the source water has low hardness, but the carbon

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\(^5\) Update/correction from CWC after TAC Meeting: In reviewing well testing results from two different CWC studies in the San Joaquin Valley, we found that 48% (15 of 31 wells) tested positive for total coliform bacteria in a 2015/2016 study and 59% (13 of 22 wells) tested positive in another 2019 study. During the TAC meeting, Heather had said she thought the percentage of wells with bacteria problems was closer to 30-40%.

This GAMA study of six CA counties found 26% of private domestic wells were positive for Total Coliform Bacteria:
https://www.waterboards.ca.gov/water_issues/programs/gama/docs/dwprjct_tstng_smmry.pdf
itself can become a breeding ground for the bacteria. Ozone is another option, but it can be expensive. Hydrogen peroxide could be considered as it is not as hard on the carbon filter media as chlorine, and residuals are easier to address. In order to protect the carbon in the GAC, a roughing carbon filter could be added to remove the oxidizer (either chlorine or peroxide) before the 123 TCP treatment system. The oxidizer requires adequate contact time to work. At 10 gpm, a polishing filter with backwash could be used for pre-treatment to extend the carbon life even further. These are ideas that can be discussed to develop a standardized workable solution.

Paul Boyer: Have you ever tested bacteria coming out of GAC filters?

Tim Bushman: For the system previously mentioned in south Monterey County, quarterly or monthly monitoring has shown that there are not any bacteria issues. If bacteria is not coming into the system and the system has been sanitized when it was installed, it should not be an issue. But if bacteria comes in, the granular activated carbon can be a bacteria breeding ground and result in bacteria proliferating. It is important to take into account.

Paul Boyer: Is this one reason why you try not to locate it in sunny areas?

Tim Bushman: We have seen photosynthesis happening in the tank. We use opaque black tanks and try to keep them out of the sun in order to reduce or stop photosynthesis. All components have UV inhibitors in the manufacturing of the plastics, but they are not UV proof. So keeping them out of the weather is also helpful, but the main concern is photosynthesis happening inside the tank.

What are the water system pressures and will there be a pressure drop in the system causing low flow into the house?

Kevin Berryhill: What kinds of pressures do these water systems have? Will there be a pressure drop with the system causing low flow into the house due to pre and post filters and the lead/lag treatment system? Will this affect the functioning of household plumbing?

Harrison Hucks: I conducted the site assessments for the first three sites and reported pressure ranges of approximately 40-60 psi, 50-60 psi, and 35-55 psi for each well.

Tim Bushman: The system was designed with parts in series and in parallel to minimize head loss and reduce maintenance requirements of having to frequently replace pre filters. We expect a 5-7 psi drop in pressure through the system. The pre-filter is 1.5 inches which could accommodate up to 100 gallons\(^6\) per minute of flow. The post-filter was added as a safeguard to capture carbon fines, and is not expected to reduce pressure. The system was designed to get 10 minute empty bed contact time, and the vessels are oversized for 10 gpm (Typically these size vessels could be used for 50-60 gpm if you had large enough inlet and outlet piping).

\(^6\) There was some discussion whether it was 100 gallons or 200 gallons per minute of flow.
Follow-up: Tim will double-check expected pressure drop data and provide an update to the TAC.

Why did you not include the option of backwash in this study? Could the system be designed to have the option of backwash, if needed, in the future? What experience do TAC members have with backwash of systems at the household level?

Kevin Berryhill: Have you used these systems where there is very high hardness like in this area - 1000 mg/L? Why did you not include an option to backwash in the case of scaling and potential pressure loss?

Tim Bushman: We predict that the hardness measured in this pilot project will not be high enough to cause scaling and impact the functioning of the GAC systems. We are mostly concerned about organic compounds plugging the carbon. The surface area and the internal pore structure of the carbon determine the capacity of GAC, and organic compounds can reduce the surface area. Backwashing re-exposes the sites by friction. The problem with backwash is that you have liquid waste, and it is difficult to get a treatment system approved in Monterey County if there is liquid waste. Hauling waste is very expensive. This is why we chose good pre-filtration to protect the carbon from organics or any big particles. Backwashing can also potentially stratify the carbon media which could have an effect on the adsorption although a recent study showed that this was not an issue.

Heather Lukacs: We would like to get more perspectives on pros and cons of backwash. This topic has been raised previously by TAC members and others involved in this project. One advantage to backwash is that there is a lot of uncertainty around how these systems will respond to the complex water quality in the wells in this area, and backwash could provide an option to refresh the carbon, which could potentially be helpful. One challenge to the backwash, is that it can be difficult to permit discharges for backwash, if needed, at a private residence with a septic system. We also understand that backwash systems can be designed in a way that does not have a discharge. Backwash systems also require additional space and other requirements, which add to the overall system cost and complexity. Does anyone have experience with installing a backwash system for 123-TCP treatment at an individual household level?

Kevin Berryhill: Do we know what bed life we are anticipating? How long will these treatment systems be online before being backwashed? I agree you do not want to backwash regularly (or voluntarily), but the option to backwash could be added as a contingency measure, something you do only if you have to if you have head loss buildup. Even if the beds will last a long time with all the scaling compounds in the water (hardness, iron, etc), you may want to design to allow backwash as a future option in case you need it.

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7 The Table of Private Domestic Wells with High 123-TCP (Page 5 of the Pilot Project Area in the TAC Pilot Project Overview) shows TDS levels greater than 1000 mg/L for the majority of wells that are candidates for this study.
Tim Bushman: If we backwash, we would need much larger vessels with 40 percent more volume for the media to expand. This would require a much larger footprint for the system. If there is iron in water, we would definitely need to backwash. These systems are designed assuming no iron in water or that the iron has been removed. Iron, manganese, and any heavy organics can all require backwash. That was another consideration in the design of the system. The 10 minute contact time for 10 gpm means you really need a lot of carbon. We chose two parallel lead-lag tanks because otherwise you are dealing with tanks that are difficult to move. Small tanks are much easier to service.

Eugene Leung: Agrees that it is a good idea for the first pilot system to design plumbing with the option to backwash in the future. Concern here is that these are private wells that could have fines that are passing through the pre-filter and cause a head loss in the system. Having the flexibility of backwash can be useful as a diagnostic tool. If there is no backwash capability, you would have to disconnect the system and bring it back to your facility to see what is causing the problem. It would be good to have the flexibility of backwash to discharge into a tank that you could haul away.

Tim Bushman: You can effectively backwash by just reversing the flow direction, could be manually backwashed if needed, but need to increase the vessel size to have more volume for expansion. If the tank is too full of carbon, you will not get as much benefit of backwash unless we can lift it up and expand it, but that can be done. In fact, the first system we did (in the photo in the presentation) was designed to be manually backwashed, if needed.

Eugene Leung: Backwash could be helpful if the heterotrophic plate count or coliform gets really bad and we have to figure out a way to disinfect the media (which could be done using chlorine). I know it can be challenging for larger water systems using continuous GAC treatment - almost all use chlorination downstream of it and they have to mitigate this problem sometimes. So as we scale down for this project, it can be helpful to consider how larger water systems deal with this.

Follow-up with Tarrah Henrie about feedback related to Cal Water’s experience with GAC treatment (Eugene asked but Tarrah had already dropped from call.)

Craig Drizin: Weber Hayes’ initial plan was to have the backwash option in place and will probably size the tanks accordingly. But the design we looked at that included backwash was much more complicated. We considered: Where are we going to backwash to? What volume or flow rate do we want to backwash with? The anticipated volume and flow rate might be difficult to meet with the existing onsite pumps. We also considered a separate backwash pump and separate tank to recycle the backwash water into. Considering the whole constellation of factors, we believe the no backwash option will be a lot simpler and easier to maintain, if it works. It will also be a lot less expensive to maintain and more cost effective if not more effective overall.
Eugene Leung: I agree that the intent is not a continuous backwash system like a surface water treatment plant that backwashes once a week and then the water is recycled. My suggestion is to have the piping available to occasionally backwash (once every couple of months) if you encounter operational issues and the system clogs. You could bring in a temporary backwash system to push water backwards in the system. The valving should be flexible enough to backwash and have some room for expansion in case you run into trouble.

Tim Bushman: Culligan has a regeneration plant in Salinas where we backwash carbon along with ion exchange media. One option would be to remove the tank for a couple of hours, take to their facility to backwash, and then return it. Another option might be to put carbon in another vessel on site and to wash and replace (put it back in the tanks). It would be a good idea to have that capability.

Kevin Berryhill: If you do have to backwash frequently, it may be a dealbreaker for your average homeowner.

Heather Lukacs: We agree with what has been raised about backwash. When considering the design, we are interested to compare the cost of backwash and no backwash systems including waste disposal costs of backwash. We are also interested to learn more about the estimated time until breakthrough - five years is pretty different from a few months. If frequent maintenance is needed, we agree this may be cost prohibitive to some homeowners.

How do we preserve and lengthen the life of that carbon? If GAC vessel size is larger to allow backwashing, will this result in channeling (e.g. decreased performance for the same volume of carbon)?

Tim Bushman: In a pilot system at a commercial property, we just replaced carbon in the lead tank because of a pressure drop. We had estimated 3 years until media replacement and got only 2 years because of the organics, not the TCP. We designed the pre-filters on this [POE residential treatment] pilot project to be larger than those on the commercial system. Three years would be a good starting point to budget for the media, but that would vary from site to site.

Harrison Hucks: How do we preserve and lengthen the life of that carbon? One way is through backwashing but it comes with additional costs both short term and long-term versus not backwashing - we save a lot but we will be switching out the carbon more often. How long will the carbon last? 2-3 years is a good estimate, but this pilot project will provide a better idea based upon the TCP concentration and the concentration of other constituents in the source water.

Kevin Berryhill: Do we know the TOC (Total Organic Carbon) of the water being tested? If not, it should be tested before the start of the study.
Follow-up: CWC and Weber Hayes and Associates added TOC to the parameters to be tested during the initial site assessments.

Eugene Leung: You should consider purposefully over sizing some systems and and under sizing other systems for the pilot to determine the right size. I have dealt with treatment systems at schools (these were resin systems not GAC) in which oversizing the system caused in channeling which resulted in a shorter life of the carbon (despite there being more carbon in the system). It is possible that GAC systems could be plagued with the same issue. If the majority of the time you have low flow and then just occasional surges of high flow, it could become very challenging to get a predictable result.

Craig Drizin: Resetting the bed and preventing channelling is a good reason to consider backwashing. One reason we did not consider oversizing was due to potential channelling. We believe the filters have been correctly sized for 10 gpm. We will get data out of this pilot study that is reliable and that will answer these questions.

Harrison Hucks: As an operator, I consider long-term costs. For this pilot, it is important to have the capabilities to backwash, but from a long-term perspective having additional pumps and having additional backwash results in additional costs upfront and additional O&M costs down the road. For the pilot project, it is an important opportunity to have that capability but from a long-term perspective, if this is going to be a viable option for homeowners, we will need to make sure this is a system that is cost effective.

Sampling Protocol Recommendation: Sample at the typical maximum flow rate not at the rate when only the sample tap is being used.

Kevin Berryhill: You can have a highly variable flow through these canisters so if you open up the sample tap, you will get a very small flow rate which will not be representative of when someone is taking a shower and running the dishwasher at the same time. When you collect samples you need to determine what flow rate you would like to see for treated water, and I would suggest that it is something higher than what is coming out of the sample taps.

Craig Drizin: Our plan is to sample at the maximum flow rate. The plan would be to open up a flushing valve or a full size hose bib on the outlet. We will have a flow meter, and we understand a trickle out of a quarter inch sample tap under static head is not a representative sample and we want to sample at the maximum flow rate. We will definitely have that written down so everyone can understand that.

Self-Help Enterprises Pilot Treatment System for 123-TCP POE and Nitrate POU - Success Story

Tami McVay shared a success story from a Self Help Enterprises project in Tulare County. The source water for this system has 123-TCP and also nitrate (39.6 mg/L). After 7 months of working on this well, they found a successful resolution of a major issue they were having. They
worked very closely with Culligan R&D. It will be a success for that family and it will not be a burden or cost.

Heather thanked Tami for sharing this example, and also emphasized that SHE’s pilot project using POE treatment for 123-TCP and nitrate for POU in the Central Valley informed CWC’s seeking funding for this pilot project for 123-TCP POE treatment for households on private wells. CWC would like to continue to learn from SHE and others who are conducting pilot projects.

VI. Meeting Closing & Exit Survey
Heather thanked everyone for attending and for the great discussion and questions, and encouraged everyone to add additional comments and questions in the exit survey. Harrison also thanked everyone for participating and encouraged suggestions in the exit survey related to additional information to include in the site assessments that will be conducting this and next week.

Link to brief Exit Survey: https://forms.gle/vdpRQuZtYfkjWEUJ8.

Responses from TAC members who responded are attached separately and are available here.

VII. Next Steps
● **Next Meeting: 12/8, 12-2pm**
  ○ Heather to include an agenda item on bacteria prevalence in private domestic wells and pre-treatment options.
● TAC members to share any information they have related to the incidence of total coliform bacteria in private domestic wells. Mark Bartson will talk with the SAFER team about this issue.
● Heather will follow-up with Eugene about potential add ons to this project related to POU treatment of nitrate at high levels.
● CWC and Weber Hayes and Associates added TOC to the parameters to be tested during the initial site assessments.
● Tim will double-check expected pressure drop data and provide an update to the TAC. (During the meeting, Tim estimated a 5-7 psi drop in pressure through the system.)
“Every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes.”

- California Assembly Bill (AB) 685 signed into law in 2012
Technical Advisory Committee Meeting October 27, 2020:
1,2,3-TCP Point-of-Entry Treatment Pilot Project in North Monterey County Area
Heather Lukacs, Director of Community Solutions
Technical Advisory Committee Meeting Agenda

1. Introductions (Noon-12:20pm)
2. CWC Background & Motivation for this Project (12:20-12:35)
3. Project Overview (12:35-12:50)
4. Project Updates (12:50-1:10)
   - Water Quality Data
   - Community Considerations
5. Review Draft 1,2,3-TCP POE Treatment System Design & Monitoring Plan (1:10-1:40)
6. Schedule Next Meeting
   - 12/8, 12-1:30pm or 12/9, 3-4:30pm
7. Exit Survey (1:45-1:55)

Attendees at a groundwater workshop at San Jerardo Cooperative in October 2019 hosted by Community Water Center. (We wish we could all gather with you in person, but for now, this TAC will be all virtual.)
# Technical Advisory Committee Members

## 1,2,3-TCP Residential Treatment Pilot Project in Northern Monterey County Area

<table>
<thead>
<tr>
<th>Name</th>
<th>Company / Agency / Organization</th>
<th>Title / Position</th>
</tr>
</thead>
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<tr>
<td>Mark Bartson, P.E.</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Program Management Branch Technical Operations</td>
</tr>
<tr>
<td>Kevin Berryhill, P.E.</td>
<td>Provost &amp; Pritchard Consulting Group</td>
<td>Principal Engineer</td>
</tr>
<tr>
<td>Paul Boyer</td>
<td>Self-Help Enterprises</td>
<td>Program Director - Community Development</td>
</tr>
<tr>
<td>Guadalupe Gonzalez</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Safe and Affordable Funding for Equity and Resilience</td>
</tr>
<tr>
<td>Kyle Graff</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Northern California Drinking Water Field Operations</td>
</tr>
<tr>
<td>Tarrah Henrie</td>
<td>Corona Environmental Consulting</td>
<td>Senior Scientist</td>
</tr>
<tr>
<td>Alex Huang, P.G.</td>
<td>State Water Resources Control Board (DFA)</td>
<td>Office of Sustainable Water Solutions Branch</td>
</tr>
<tr>
<td>Brian Kidwell, P.E.</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Safe and Affordable Funding for Equity and Resilience</td>
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<tr>
<td>Tori Klug, P.E.</td>
<td>Stantec Consulting Services, Inc.</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Eugene Leung</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Program Management Branch Technical Operations</td>
</tr>
<tr>
<td>Edwin B. (Ned) Lofink, P.E.</td>
<td>Axiom Engineers</td>
<td>Senior Project Engineer</td>
</tr>
<tr>
<td>Zane Mortenson</td>
<td>Rural Community Assistance Corporation</td>
<td>Rural Development Specialist</td>
</tr>
<tr>
<td>Allie Sherris</td>
<td>Stanford University</td>
<td>PhD Candidate, Emmett Interdisc. Prog. in Env &amp; Res.</td>
</tr>
<tr>
<td>Dave Wallis</td>
<td>Rural Community Assistance Corporation</td>
<td>Rural Development Specialist III - Environmental</td>
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</tbody>
</table>
Heather Lukacs, Director of Community Solutions
David Okita, Senior Fellow
Mayra Hernandez, Community Organizer
Brandon Bollinger, Organizing Manager
Daisy Gonzalez, Community Solutions Coordinator
Ryan Jensen, Community Solutions Senior Manager
Reyna Gabriel-Peralta, Community Organizer
Susana De Anda, E.D. & Co-Founder
Community Water Center Mission
Act as a catalyst for community water solutions through organizing, education and advocacy in California.

Our Vision
Ensure that ALL Californians have access to safe, clean and affordable water.
AGUA Coalition
Over 1M people in CA are impacted by unsafe drinking water each year

Public water systems out of compliance with drinking water standards (as of Feb 2019) are denoted by a star.

Source: Human Right to Water Portal, CA State Water Resources Control Board
Many residents spend up to 10% of their household income on drinking water.

Arsenic and nitrate drinking water contamination disproportionately impacts low-income and Latino communities.

Pacific Institute 2011

Balazs et al. 2011
Community Water Center

- Act as a catalyst for community-driven drinking water solutions through education, organizing, and advocacy in California
- Safe and Affordable Drinking Water Fund (SB 200, now the SAFER program) - $1.4 billion over 10 years (2019)
- Experience with point-of-use treatment pilot projects in Kern County (schools, arsenic) and Tulare County (residential, nitrate) (2015/2016)
- Point-of-entry residential pilot project for 1,2,3-TCP (2020/2021)

CWC supported the installation and community education for over 70 POU arsenic treatment systems in Arvin, CA in schools, health clinic, parks, and other community locations in 2015 as part of a State Water Resources Control Board funded pilot project. RCAC (Dave Wallis) was lead for this project.
Community-Driven Drinking Water Solutions

1. Started community organizing in area with known contamination

2. Learned about water issues from community members

3. Connected residents to free Central Coast regional water board well testing program.
   - Found very high nitrate, 123-TCP, and TDS.
   - In one area, 75% (13 of 17) wells over MCL
     - Nitrate and 1,2,3-TCP (11)
     - Arsenic and nitrate (1)

CWC has facilitated the testing of ~70 private wells Monterey County and nearby areas through a free well testing program. Photo: Regional Water Board staff, Community Member, CWC staff, and Tetra Tech staff testing well in January 2019.
Community-Driven Drinking Water Solutions

4. Monthly community meetings to discuss results and solutions led to formation of a community-based organization or *El Comité* (Feb. 2019)

5. *El Comité* was successful in advocating for a grant for bottled water delivery for their community (May 2019)

6. Due to continued concern about 1,2,3-TCP exposure, CWC secured funding for this point-of-entry treatment pilot project (July 2020)
Community-Driven Drinking Water Solutions

7. CWC will be exploring all long-term solution options through an alternatives analysis for households in the area north of Moss Landing (2021).

Proposed pipeline construction from Local Entity Formation Grant report from several years ago in area north of Moss Landing.
Point-of-use and Point-of-Entry Treatment

CWC recommendations for communities where we work:

- State certified devices for a particular contaminant
- If public water system, must comply with state regulations
  - Performance Indicator Device
  - Monthly Monitoring
  - Maintenance
  - Interim solution
- Use POE if health impacts through inhalation of steam and/or dermal
POU/POE Recommendations for Private Wells

- Test source water for multiple contaminants
- Funding for master contract for O&M and monitoring
- Follow draft Monterey County ordinance (based on State’s for wells serving 2-14 households)
- Not able to recommend state-certified device when:
  - Bacteria is present
  - More than one contaminant present
  - High levels of nitrate (greater than certified devices can treat)
  - No certified devices for 1,2,3-TCP
  - No performance indicator device

Community meeting in north Monterey County private well area during which residents learned about state resources for emergency bottled water deliveries (June 2019)
Interim Solutions Evaluation

- **Water Safety**
  - Need guaranteed safe water
  - Need to know water quality first (before treatment)
  - Community conversations about how to limit exposure
  - Monitoring frequency needs to correspond to health risk posed
  - Need automatic shut-off if water not safe

- **Affordability**
  - Opportunity cost of impacted residents time
  - Cost estimates should include professional service, not place burden on residents

First day of water delivery in Monterey Co. to each household (July 2019)
Interim Solutions Evaluation

- Accessibility
  - In CA, access should be in one’s home.
  - (International development debates about whether access is inside home, yard, community, or within 1 km)

- Adequacy (or sufficiency)
  - Should consider route of exposure for each contaminant
  - Might require two different interim solutions (e.g. bottled water for nitrate, POE for 123-TCP)

Press conference in East Porterville when first household received piped water from Porterville water system.
CWC Approach to Community-Driven Solutions

1. Work directly with impacted residents
2. Evaluate potential solutions based on water safety, accessibility, affordability, and adequacy
3. Prioritize public health

“Every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes.”

AGUA (Association of People United for Water) is comprised of members from 26 impacted communities and 12 non-profit organizations working to secure safe and affordable drinking water in the San Joaquin Valley.
CWC Approach to Community-Driven Solutions

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Any Questions or Comments?

AGUA (Association of People United for Water) is comprised of members from 26 impacted communities and 12 non-profit organizations working to secure safe and affordable drinking water in the San Joaquin Valley.
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Project Goals: 1,2,3-TCP POE Treatment Pilot

1. To effectively treat 1,2,3-TCP to levels below the Maximum Contaminant Level and reduce exposure to 1,2,3-TCP for all project participants.

Community members provide public comment at the Pajaro Sunny Mesa CSD meeting in May 2019 requesting bottled water service.
Project Goals: 1,2,3-TCP POE Treatment Pilot

1. To effectively treat 1,2,3-TCP to levels below the Maximum Contaminant Level and reduce exposure to 1,2,3-TCP for all project participants.

2. To provide transparent documentation of costs, outcomes and lessons learned to inform state-wide efforts to provide safe drinking water for all Californians specific to 1,2,3-TCP.

According to the Open Oakland Tool (water.openoakland.org/), 565,258 people are served by community water systems, schools, and daycares with current exceedance/compliance issues related to 1,2,3-TCP. Information based on the State Water Board’s Human Right to Water Portal.
Project Goals: 1,2,3-TCP POE Treatment Pilot

Relevance for:
1. Public water systems with only 1,2,3-TCP
2. Private domestic wells with only 1,2,3-TCP
3. Private domestic wells that have 1,2,3-TCP plus additional contamination:
   - If nitrate < 20 mg/L, add nitrate POU
   - If nitrate > 20 mg/L, add bottled water

Whole-House or Point-of-Entry Granular Activated Carbon Treatment System. Canisters are about 4 ft tall and 15 inches in diameter. Source: Minnesota Department of Health. [https://www.health.state.mn.us/communities/environment/hazardous/topics/gac.html#GACuse](https://www.health.state.mn.us/communities/environment/hazardous/topics/gac.html#GACuse)
Project Goals: 1,2,3-TCP POE Treatment Pilot

Relevance for:

1. Public water systems with only 1,23-TCP
2. Private domestic wells with only 1,2,3-TCP
3. Private domestic wells that have 1,2,3-TCP plus additional contamination:
   - If nitrate < 20 mg/L, add nitrate POU
   - If nitrate > 20 mg/L, add bottled water*

*POU and POE Nitrate Treatment is beyond this scope of this pilot project due to very high levels of nitrate, acute health risk posed by nitrate (need for frequent monitoring), potential need for off site waste disposal, and overall cost of nitrate treatment
Project Location: 1,2,3-TCP POE Treatment Pilot
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<td>0.128</td>
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<tr>
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<td>ND</td>
<td>5.1</td>
<td>50</td>
<td>4.4</td>
<td>290</td>
<td>180</td>
<td>1100</td>
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Project Overview: 1,2,3-TCP POE Treatment Pilot

1. Project Outreach, Education and Enrollment - CWC
2. Site Assessments & First POE Treatment System Installed - Weber, Hayes and Associates
3. Up to 20 Treatment Systems Installed, Monitored, and Maintained until July 2023
4. Lessons Learned and Recommendations - CWC/TAC
5. Sharing Results - CWC/TAC

Community members of the Community Based Organization, *El Comité para tener agua sana, limpia y económica*. (Feb. 2019)
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### Technical Advisory Committee Meeting Schedule

**1,2,3-TCP Residential Treatment Pilot Project in Northern Monterey County Area**

<table>
<thead>
<tr>
<th>Date</th>
<th>Meeting Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 2020</td>
<td>Project goals, motivation, background, and overview. Review draft design of 1,2,3-TCP POE treatment system. Review proposed monitoring plan.</td>
</tr>
<tr>
<td>December 2020</td>
<td>Phase 2 scope of work</td>
</tr>
<tr>
<td>February 2021</td>
<td>Cost documentation methodology</td>
</tr>
<tr>
<td>July 2021</td>
<td>Review monitoring results, Draft recommendations for POE/POU treatment for private wells</td>
</tr>
<tr>
<td>July 2022</td>
<td>Review monitoring results</td>
</tr>
<tr>
<td>February 2023</td>
<td>Draft final report</td>
</tr>
<tr>
<td>June 2023</td>
<td>Plan to share final report and results to inform state-wide efforts</td>
</tr>
</tbody>
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*Exact meeting dates to be determined*
Technical Advisory Committee Meeting Agenda

1. Introductions (Noon-12:20pm)
2. CWC Background & Motivation for this Project (12:20-12:35)
3. Project Overview (12:35-12:50)
4. Project Updates (12:50-1:10)
   ○ Community Considerations
5. Review Draft 1,2,3-TCP POE Treatment System Design & Monitoring Plan (1:10-1:40)
6. Exit Survey (1:40-1:50)
7. Schedule Next Meeting
   ○ 12/8, 12-1:30pm or 12/9, 3-4:30pm

Attendees at a groundwater workshop at San Jerardo Cooperative in October 2019 hosted by Community Water Center. (We wish we could all gather with you in person, but for now, this TAC will be all virtual.)
Project Updates: 1,2,3-TCP POE Treatment Pilot

Community Considerations

● Bacteria found in 1 of 3 wells so far
● Resident does not have access to well
● Questions/concerns from property owners
  ○ Property modifications
  ○ Size and appearance
  ○ Request for option to uninstall system at end of project, if unable to afford continued O&M
● Additional cost of plumbing to separate out indoor water use from irrigation

Cracked well seal at potential pilot project location. Photo by Weber Hayes and Associates.
Project Updates: 1,2,3-TCP POE Treatment Pilot

Design Requirements for First Pilot System

- Point-of-Entry Treatment for 1,2,3-TCP Only
- Must use Best Available Technology for 1,2,3-TCP treatment of Granular Activated Carbon, according to CA Regulations Related to Drinking Water (Table 64447.4-A)
- Lead/Lag Design
- Flow meter
- Temperature sensor

System designed by Culligan
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- Flow meter
- Temperature sensor

Design Considerations

- Backwash or no backwash
  - Waste disposal
- Contact Time
- Shed, covering, or locate out of direct sunlight (e.g. Temperature changes could cause rolloff of nitrate)
- Estimated time until breakthrough
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Exit Survey

1. Short exit survey (see chat box in zoom)
2. Please spend 5 minutes now jotting down your thoughts.
3. We will share results along with meeting minutes with the TAC
The meeting took place in the form of an online webinar where participants joined via video and audio. During part of the meeting, participants followed a live powerpoint presentation.

The information covered during the presentation as well as the group discussion is captured in these notes. At times, minutes are paraphrased and abbreviated to try to capture the intent of what was said. A recording of the TAC meeting is also available upon request. Some sections of the discussion were rearranged to group similar items together.

**Attendance**

- Michael Adelman, Stantec Consulting Services, Inc.
- Mark Bartson, State Water Board (Division of Drinking Water - DDW, Technical Operations)
- Kevin Berryhill, Provost & Pritchard Consulting Group
- Brandon Bollinger, Community Water Center (CWC)
- Paul Boyer, Self-Help Enterprises (SHE)
- Tim Bushman, Culligan QWE Commercial Systems
- Craig B. Drizin, Weber, Hayes, and Associates
- John Erickson, CWC
- Kyle Graff, State Water Board (DDW, Monterey District)
- Guadalupe Gonzalez, State Water Board (DDW, Northern Engagement Unit)
- Tarrah Henrie, Corona Environmental Consulting
- Mayra Hernandez, CWC
- Harrison Hucks, Weber, Hayes, and Associates
- Alex Huang, State Water Board (Division of Financial Assistance)
- Brian Kidwell, State Water Board (DDW, Northern Engagement Unit)
- Tori Klug, Stantec Consulting Services, Inc.
- Eugene Leung, State Water Board (DDW, Technical Operations)
- Heather Lukacs, CWC
- Tami McVay, SHE
- Eddie Ocampo, SHE
- David Okita, CWC
- Laura Satterlee, SHE
- Allie Sherris, Stanford University
- Dave Wallis, RCAC
I. Introduction

Heather Lukacs from Community Water Center (CWC) welcomed all attendees to the second TAC meeting for the 123-TCP Point of Entry (POE) Treatment Pilot Project and encouraged participants to provide feedback throughout the meeting by speaking up and using the chat and to provide input after the meeting via the exit survey. Each attendee introduced themselves and shared where they were calling from or where they would normally be working from.

Today's Meeting:

Heather reviewed the motivations for the project and Brandon Bollinger presented several quotes from a survey of community members about their motivations for participating in the project. Heather also reviewed the agenda for the meeting. She described the first and second phases of the project and emphasized that the main goal of this meeting is getting feedback to incorporate into Phase 2. Lastly, Heather reviewed the schedule for the remaining TAC meetings.

Brandon Bollinger described water use surveys and presented highlights of community members' responses regarding why they're interested in the project. Community members mentioned motivations such as the fear and difficulty of living with unsafe water, their children and grandchildren's health, and helping to contribute to the development of more affordable treatment solutions for everyone.

II. Discussion of TAC Feedback

Prior to the TAC meeting, Weber, Hayes & Associates and CWC shared the following responses to the exit survey from the previous TAC meeting hosted on Oct 27, 2020:

- Weber Hayes Responses to TAC Exit Survey Feedback from Oct 27 2020 Meeting
- CWC Responses to TAC Exit Survey Feedback from Oct 27 2020 Meeting

During the meeting, Harrison Hucks emphasized the value of feedback received during the last TAC meeting and in the exit survey and encouraged participants to fill out the exit survey for this meeting as well. He provided a high-level recap of the last meeting, brief responses to comments received, and updates based on those comments:

- Backwashing: We are moving forward with the non-backwashing system for cost-effectiveness and simplicity and based on Culligan's past experience. There will still be an opportunity for a manual backwash by bringing the tanks Culligan's plant for backwash.
- System design:
  - Will be sampling for Total Organic Carbon (TOC)
  - Pressure drop is anticipated to be only 2 psi at peak flows and lower than that at lower flows.
  - Specifying FILTRASORB® 400 activated carbon to ensure uniformity and consistency over the life of the project. Among other requirements, the carbon must be 100% virgin and acid washed.
- Monitoring:
  - Will sample for 123-TCP at the effluents of the lead and lag tanks monthly.

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See the linked "CWC Responses to TAC Exit Survey Oct 27 2020 Meeting."
Four of 11 wells (36%) tested positive for total coliform bacteria in the site assessments and one of them tested positive for E. coli. Bacteria are a concern because they could have impacts on the granular activated carbon (GAC) treatment. A site where the well tested negative for coliform bacteria was selected for the first installation. CWC is recommending that households with positive coliform results disinfect and re-test their wells. So far, one well has been disinfected and re-tested and that test came back negative. CWC is also working on getting support for well repair.

CWC has seen even higher incidence of total coliform bacteria when testing wells in the Central Valley. This will likely be a recurring issue when looking at wells in low-income communities:

- 15 of 31 wells (48%) tested positive in a 2015/2016 study by CWC
- 13 of 22 wells (59%) tested positive in a 2019 study by CWC
- GAMA data from multiple counties from 2002-2011 showed 300 of 1126 wells (26%) positive for total coliform bacteria, with 33% of wells tested in Tulare County positive.

Tarrah Henrie: These sample taps were likely threaded hose bibs, which can be difficult to clean and a source of bacteria. It would be good to try to narrow down the cause of contamination, since it could be coming from the well, after the well, or due to a contaminated sample tap.

Harrison Hucks: The sampling protocols used dictate using a torch and isopropyl alcohol to clean the sample tap if it is a threaded hose bib, so he would not expect coliform contamination to come from the sample port itself.

Heather: In the future, if there's time, we might consider doing a verification test on wells that initially test positive for total coliform bacteria to confirm the positive result before moving forward with disinfection.

David Wallis: What time of year were the samples collected?

All of the 11 samples for the site assessments were collected between August and November, 2020.

Variability in 123-TCP results

John Erickson summarized the 123-TCP sampling results:

- Site assessments, including water quality sampling, were conducted for 12 sites where previous well testing through a Regional Water Board program (mostly in 2019) had identified 123-TCP at levels higher than the MCL (0.005 ppb).

Therefore, we have results for 123-TCP for samples collected at two different times:

- Regional Water Board sampling, mainly in 2019 and
- Sampling during the site assessments for this project, in Fall 2020.

One site assessment sample in the Moss Landing area had 0.87 μg/L 123-TCP which, for

Although site assessments were conducted for 12 sites, water quality results are only presented for 11 sites, since water quality results for one site were not yet available at the time of the TAC meeting.
unknown reasons, was much higher than all of the other samples and higher than the previous Regional Water Board result of 0.159 μg/L at that site. For the 10 other sites, the site assessment samples tended to have lower 123-TCP concentrations than the earlier Regional Water Board samples. The lower concentrations during the site assessments resulted in four sites being below the 123-TCP maximum contaminant level (MCL) of 0.005 μg/L. GAMA 123-TCP data compiled by Allie Sherris for shallow wells in nearby counties showed somewhat similar variability, with some wells going back and forth between above the MCL and non-detect. Explanations considered for variability:

- Differences in sampling methods: Sampling protocols appeared to be similar between the two sets of samples.
- Variation in the groundwater depth: Based on contour maps provided by the Pajaro Valley Water Management Agency, depth to groundwater in the area (about 140 feet in recent years) varies seasonally by 3-5 feet.
- Recharge of shallow aquifer during the wet season with water that contacts shallow 123-TCP.

To address this variability in the pilot, CWC proposes to:

- Only install treatment systems where there have been at least two samples greater than the MCL.
- Sample the source water for each treatment system quarterly during the pilot.

Discussion question: How does this 123-TCP variability compare to previous experience?

Kevin Berryhill: When they have looked at a number of municipal wells (not private wells), they have seen TCP variability across the board and have not been able to find a correlation with potential explanations such as differing water levels or pumping patterns. Variability is the rule and not the exception.

Heather: With the two sites that first tested two to three times the MCL, we were surprised that they dropped so much to be non-detect. Is it common to see TCP decrease that much?

Michael Adelman: Stantec has also seen this sort of TCP variability in municipal wells in other groundwater basins.

Discussion question: Any other suggestions for addressing 123-TCP variability in this project?

Michael: The way CWC proposes to handle the variability is reasonable. Starting with places where you know the TCP has consistently been greater than the MCL and continuing to sample the source water for 123-TCP makes a lot of sense. The good news about TCP's absorbability is that, even at the level of variability seen, Stantec's adsorption model from the Chino Basin predicts that you'd see bed life in the neighborhood of 2,000 to 9,000 days.
John presented a table showing water quality data for other constituents based on the results from 11 of the 12 site assessments. Key results were:

- **Non-Volatile Organic Carbon**: <0.30 to 1.4 mg/L
- **Turbidity**: One sample of 1.4 NTU; all others <1 NTU
- **Total coliform bacteria**: Positive at 4 sites (as mentioned before)
- **Very hard water**: 309 to 7,400 mg/L as CaCO₃ with a median of 670 mg/L (the 7,400 mg/L site was an outlier)
- **Iron and Manganese**: Generally below the secondary MCLs (0.3 mg/L for iron and 0.05 mg/L for manganese), with one sample having iron above the SMCL (0.44 mg/L)
- **High total dissolved solids (TDS)**

Discussion questions:

- Any concerns for interference with GAC treatment or any other issues? Is pre-treatment needed (other than for bacteria)?
- Tim Bushman: Iron above 0.3 mg/L will be a problem for the carbon. If it’s in solution it will pass right through the prefilter.
- He’s not sure what the effect of the very high TDS would be, but imagines it would have some effect since it’s so high.
- Carbon can be a breeding ground for bacteria, so it’s important to treat the coliform bacteria ahead of time.
- Kevin: The organic carbon levels shown are not particularly low for a groundwater source. The TCP, at the levels shown, will not determine the carbon change-out frequency. The change-out frequency will instead be determined by the other organic carbon constituents.
- Michael Adelman: Agrees with Kevin’s point. The theoretical bed life based on TCP concentrations is so long that some other factor, such as headloss from hardness precipitation, bacteria issues, or breakthrough of other organic constituents will end up determining the bed life. Were there other trace organics detected in the water that have MCLs and might break through before the TCP does? For example, at one well head in the Chino Basin study, chloroform was expected to break through before TCP would.
- John: The analysis did include other volatile organics and pesticides and they were below the MCLs, so hopefully that captured anything else of concern that might break through.
- John: Will the 10-minute empty-bed contact time still be sufficient with the levels of organic carbon in the source water?
- Michael: The sizing seems reasonable. For the TCP itself, the bed life for 123-TCP is on the order of thousands of days and other constituents will govern when it needs to be replaced. Even if the background organic carbon reduces the bed life by 20 percent for TCP, it will still be very long. Not sure if making the carbon beds deeper will increase bed life for the TCP. If TCP didn’t adsorb as well, for instance if it was PFAS, the calculus might be a little bit different.
- Kevin: Wouldn’t recommend changing the empty bed contact time. To treat TCP down to low levels you will need a fair amount of contact time. The point about...
the background organics is that the carbon will pick up orders of magnitude more of these background organics than there is TCP.

Discussion question: Should any other water quality parameters be considered?

- Tarrah: It looks like the main water quality parameters have been captured. But she is wondering whether the iron and manganese measured was dissolved or if it could have included particulate. The dissolved would go through the pre-filters, but the particulate would be captured. If these wells are sanding, then the iron and manganese could be particulate, which would change the amount of concern.

- John: The manganese and iron samples were total.

- Tarrah: If moving forward with these wells with higher iron or manganese, it would be best to re-test for both dissolved and particulate iron and manganese.

IV. Backwash Procedures

Heather Lukacs presented a summary of the backwash options and considerations discussed at the October TAC meeting:

- The TAC had agreed that it was not feasible to automatically and routinely backwash GAC onsite at the POE scale.
- Options discussed for occasional backwash in the future if headloss becomes too high:
  - Option A (selected for the first installation): Tanks could be removed and backwashed at a facility in Salinas (design would require larger tanks)
  - Option B: Put carbon in another vessel onsite, wash, and replace it (design would not require larger tanks)
  - Option C: Manual backwash with temporary backwash system (design would require larger tanks)

Considerations:

- Channelization: If tanks are sized larger to allow for backwash, that might cause channelization, which could result in lower performance.
- Cost
- Proper disposal of waste generated
- Need to sanitize carbon and/or vessels
- Homeowner preference
- Space

Given that a backwash plan is already in place for the first installation, Heather requested the TAC's feedback on how backwash should be approached in the Phase 2 installations.

- Should we compare different options and have vessels of different sizes? Or is there enough variability in the source water that we should make all of the systems the same?
- Are there opportunities to lower cost and improve efficiency in the second phase?

Tim Bushman: You would normally want 40% freeboard to be able to lift the media when it backwashes. With the amount of carbon we have, this would require a 24-inch diameter tank.
because the 16-inch tank is pretty much full of carbon. You would need 25 gallons per minute to lift the media during backwash in the 24-inch tank.

Kevin Berryhill: It would be best to avoid fluidizing the media during backwash, since that could disturb the mass transfer zone, move spent carbon down in the bed, move some carbon that's still effective up on the bed, and risk breakthrough of the TCP. We will more likely need a lower flowrate just to break up clumping due to the high hardness and remove any sediment that's built up on top.

Michael Adelman: Agrees that fluidizing the bed is not a good idea, both because of the freeboard volume required and the risk of disturbing the mass transfer zone and having premature breakthrough. If there is an onsite cleaning cycle, the upflow rate should be limited to around or slightly below the incipient fluidization rate. You just want a gentle backflush to remove sediment or hardness.

Tim: That rate of backwash could be done by just reversing flow through the media.

Kevin: This reverse flow backwash may not work because at a residence you won't have a source of water on the downstream side. You may need some sort of mobile truck arrangement with a freshwater tank, a little pump, and an end water tank on it.

Heather: How does the gentler backwash option Kevin and Michael are recommending relate to the options listed above?

Michael: This lower backwash could be a modified version of Option C where the flowrate through the media is limited to prevent the bed from fluidizing. The FILTRASORB® 400 carbon has an incipient fluidization loading rate of about 4 gallons per minute per square foot, so you would want to stay just below that for the backwash.

Kevin: Option B can be eliminated, because that would be the worst case scenario for mixing up the media.

Tori Klug: Mixing up the media might be a concern for Option A as well, unless there's a way to backflush at this lower rate at the Culligan facility.

Tim: There would be an option to backflush at the lower rate at the facility, but that could be done onsite just as easily.

Michael clarified that this slower backwash, which they sometimes refer to as “backflush”, would not require the additional 40% of vessel volume for expansion.

Heather: Could this backflush be done by a truck and the backflush water be taken offsite? This would prevent the need to dispose of the backflush water onsite, which would be a permitting issue.
Michael: The backflush would only require about 4 to 5 bed volumes of water, which could be captured by a truck and transferred offsite.

Tarrah Henrie: In a presentation that Tarrah sent to CWC by Stefanos Word with MKN about a pilot study they did to treat TCP for 40 homes in the Valley, they took a really different approach. How did we end up with such a different approach from theirs? They only had one GAC POE unit, not so many like we do, and were expecting breakthrough to occur sooner, which would just require an annual replacement of the carbon.

Heather: The difference could be related to different source water quality, given the high hardness and other constituents we're seeing in these private wells.

Tim: The design being used for the first installation is all about getting the 10-minute contact time. If we went with just one lead and one lag vessel, we'd need double the amount of carbon per vessel to get the 10-minute contact time.

Tarrah: Based on the sizing of the MKN systems, it didn't look like they could have been getting a 10-minute contact time.

Tim: There are people in the Central Valley getting 3 and 4 minute contact times and they say it's removing the TCP. The design being used here was based on a Calgon Carbon study back in the 1990s with the City of Tulare where they came up with a 10-minute contact time.

Kevin: For municipal systems, 10-15 minute contact time is pretty typical for TCP treatment, but there isn't a lot of experience with these POE systems. One of the outcomes out of this study could be that, if we find we get enough life out of the lead bank, maybe the contact time could be reduced.

Tarrah: Her concern is that, when leaving carbon out at these sites for this long, something else is going to happen that will require changing the carbon out sooner. So it might be better to just accept a more frequent annual change-out. Even if you plan for 5-year carbon life, that might not match reality.

Tim: The proposed design really isn't based on the longevity of the carbon, but rather the contact time. He'd like to see smaller vessels, especially for residential, since this is a lot of carbon. Based on previous experience, he thinks we'll see organics fouling the carbon before it's saturated with TCP.

Heather: What recommendations does the TAC have for sizing of the vessels in Phase 2 of the pilot, given that the number of systems we can install and maintain is limited by our budget?

Eugene: The approach we have here makes sense, because the high volume of carbon will mean a greater chance of success, and being able to test at the midpoint (between the lead and lag tanks) and see how long the carbon lasts in all of the installations will allow us to go to the...
The next phase of how to implement the systems. Using the known Calgon carbon in all of the systems is a more serviceable and transparent approach as opposed to the Aquasana carbon used in the Central Valley project where you run into the "black box" issue where different installations may have had different carbon suppliers. If 5 minutes proves to be successful, then we can cut it down to one vessel for future installations. Based on Tarrah’s suggestion, in the future we could even design the systems to allow one year of carbon life for the given influent water quality, which would allow for a one-year service model.

Heather: We’d appreciate any additional feedback on system size via the exit survey.

V. Carbon Sourcing Recommendations

Heather Lukacs summarized TAC feedback on carbon from the last meeting and exit survey:

- Need to use the same carbon over time.
- Virgin media certified for drinking water use.
- Need to detail how to manage carbon replacement and deal with spent carbon.

This feedback was incorporated by Weber Hayes in the Phase 1 design with FILTRASORB® 400 media and the following carbon disposal procedure:

- Design to replace media.
- Spent carbon should undergo the California WET test prior to landfill disposal.
- While carbon will most likely pass the WET test, the procedure for reactivating carbon or alternate disposal if it fails should be described and take into account that the volume of spent carbon will be small.

Heather: Are there any additional carbon cleaning or disposal recommendations that we should include in the Phase 2 RFP?

- Tim Bushman clarified that Culligan doesn’t have facilities to reactivate carbon. It would have to go to Calgon or the facility of another carbon company. He’s heard of another facility in Los Angeles.
- Michael Adelman: The Los Angeles facility Tim is thinking of might be Carbon Activated Corp.
- Kevin Berryhill: Recommends talking to the relevant authority to see whether this carbon could be disposed of as household waste, because the profiling cost is pretty significant if you have to do it for every single home. But a typical refrigerator Brita filter can be disposed of in household waste.
- Tarrah Henrie: Recommends asking for prewashed carbon that will have fewer fines in it. Even with the prewashed carbon, you still get some fines. Cal Water used to have the supplier bring a truck out so that the initial backwash water could be captured to avoid discharging the fines. In this case, we won’t easily be able to backwash, so it will be important to minimize the amount of fines that could foul the postfilter.
Michael: Agrees with Tarrah. It would be good for Culligan to make sure these fines are removed in their facility before the systems go out in the field.

Tim: Typically Culligan soaks the carbon for 24 hours or flushes the carbon at their facility to deal with fines. He's not sure if the carbon comes rinsed, but either way fines can be generated during transport, so this flushing or soaking would be a good idea prior to installation.

Heather: Please include any suggested language about fines in the exit survey.

Tarrah: Doesn't recommend regenerating carbon for this application in any case. But if you do, manganese in the source water would prevent regeneration from being cost effective.

Eugene: If the state has a bigger POE treatment program in the future, it would be good to know if Culligan or Calgon would be able to collect all of the spent carbon and take it back. It could be regenerated not necessarily for drinking water use, but perhaps for groundwater cleanup or some other use. It would be good to know if the quantity generated by POE systems would be enough to allow for the carbon to be taken back and regenerated and whether there would be any hesitancy to do that.

1. Tim agrees on that. Culligan has liability anytime they take back spent media. They're careful about disposing of media without proper validation that it's able to go to a landfill. Calgon might have some way to work with us on this, especially since it could be a big business for them if there's a way to dispose of this.

2. Heather: This discussion of whether spent media can be disposed of as household waste makes her think of nitrate treatment. In Monterey County you can dispose of a point-of-use nitrate treatment system as household waste, but she doesn't think POE nitrate systems can be disposed of in this way.

VI. Bacteria Pre-Treatment Options

John Erickson summarized CWC and Weber Hayes' current proposed approach to address total coliform positives in the wells that might be included in the study:

- First, disinfect the well and retest
- If the retest is positive, assess whether it is feasible to repair or upgrade the well to prevent contamination. (This may be harder to justify economically, if there is a chance that the well will not be the long-term water source for the household.)
- If the well can't be improved, it would be good to have a bacteria pre-treatment option.

John also summarized bacteria pre-treatment options considered:

- UV disinfection (NSF Class A for drinking water)
- Chemical disinfection (chlorine, ozone, hydrogen peroxide)

Potential configurations and concerns

- Upstream of GAC: Effect on TCP removal in GAC?
- Upstream of GAC with roughing filter to quench oxidant before GAC
Downstream of GAC: Bacteria colonizing GAC? Taste and odor?

Discussion questions:
- What are the microbial treatment standards for domestic wells?
- Is UV treatment feasible with high hardness?
- Thoughts on relative cost, complexity, and reliability of different chemical disinfection options?

Tim Bushman: Based on past experience, he wouldn’t put a UV treatment system on a water source with over 10 grains of hardness. With that much hardness, if you have a sensor on the UV system, it may be alarming constantly and will become a real issue. As far as disinfecting with chlorine or any oxidizer, you will also have organics left over from chlorinating that will accumulate within the GAC and potentially clog up the pores and deplete its capacity. You would want some type of filtration before the GAC.

Kevin Berryhill: The complexity of looking at this bacteria problem has spiraled way out of control in proportion to the GAC project, both from a regulatory standpoint of what the Division of Drinking Water is going to require for operating a system and with respect to the downstream effects. Agrees that UV treatment for this size of system is impractical. Even just adding chlorine would add a lot of complexity. And if you add a roughing filter you’d need to be able to backwash that because the carbon disintegrates slowly over time as it reacts with an oxidant.

Michael Adelman: Also if you dose chlorine upstream of the GAC bed, there will be an accumulation of oxidized iron and manganese particles, since we know some of these sites have iron and manganese.

Tim: There is a new electro-positive charged filter process that isn’t approved by NSF yet that rejects the bacteria and is getting a 4-log removal. He’s hoping that this gets validated by NSF soon, and hopefully that would solve this issue.

Kevin: It’s important to keep in mind that if the well is compromised and we detect bacteria there could also be viruses in the well.

Heather Lukacs: 4 out of the 12 wells tested positive for coliform bacteria. One was chlorinated and retested and came back negative. Assuming we could do that with the remaining wells, could they stay in the study or are you worried that the bacteria would return?

Kevin: It’s important to understand what the sanitary defect is. It could be that the bacteria has been there a long time since the well pump was installed. But if there is a cracked seal on the pump head or something like that, then there is a reasonable chance that it will come back. Carbon definitely grows bacteria. They saw that in a point-of-use study where they saw thousands of HPC bacteria per milliliter (really high levels).
Tarrah Henrie: Agrees with Kevin on all those points. Also important to consider how much time passed and how much the well was flushed between when you disinfected and resampled. Sometimes bacteria come back after just a short period. Sometimes they clear up for a longer period. Also should check if contamination comes back after it rains. Unfortunately so far we don't have a lot of data to go from.

Kevin: Bacteriological issues seem common with this kind of system. Maybe we need to meet these systems where they are at. E. Coli is a non-starter in his mind for any study. For other bacteria, we may want to use this study to measure bacteriological quality downstream of the POE device and evaluate that issue. This will be relevant, since a lot of systems will have this same problem.

Tim: HPC could be an issue with GAC systems, especially if they will be installed for 3 to 4 years.

Eugene Leung: Completely agrees with Tarrah and Kevin's comments. If they have compromised wells, we need to resolve that problem first before we consider putting in treatment. Otherwise we would be investing a lot of resources in something that may be very questionable. Best to take bacteriological samples over time and after a rain event to diagnose whether you've resolved the problem. E.Coli in particular you need to resolve, since it's an indication of fecal contamination from the surface or a failing septic system nearby and probably indicates a physical defect.

Heather: If we can afford it, if we incorporate post-GAC bacteria testing, maybe for a site or two that had bacteria contamination but then cleared up, is there a recommendation around pretreatment given what we know about hardness and the complexity of all of the options?

Eugene: If it’s coliform negative, then no pretreatment should be required. If it does have coliform bacteria, then an NSF Class A UV system is designed for unknown water quality (including possible coliform positives or presence of viruses) and would be an appropriate technology, but those systems are not cheap.

Tarrah: Are all of these wells tiny submersible pumps, or are there any other types of pumps?

Harrison Hucks: The vast majority are submersible pumps, but a handful — maybe 2 or 3 — of the wells have turbine pumps.

Tarrah: Are they oil-lubed or water-lubed pumps? They have been associated with bacteria positives and HPC growth in the well, especially when food grade oil was used historically rather than the mineral based oil used now. A lot of municipalities have switched out oil lube pumps to water lube pumps. Could be a potential source, but changing to water lube pumps is a capital improvement. We may want to leave a system like this out if we encounter it. A less expensive option than changing the pump could be to switch the lubrication oil in the pump. But there will still usually be an oil layer floating on the water surface in the well until you bail it out and clean it, which is a
whole separate project (and she's not sure how it would be done on a small domestic well).

- Harrison: He would have to go back and check in the notes about whether the turbine pumps are water or oil lubricated. But both of the turbine pumps had bacteria positives.

VII. Exit Survey and Next Steps

In the interest of time, Heather Lukacs asked that TAC members include any recommendations for implementation in their responses to the exit survey, including:

- Are there specific considerations for scalability?
- Anything else to incorporate into Phase 2 to answer key questions?
- Alternatives to test
- Monitoring

Heather noted that this project is complicated and thanked the TAC for accompanying throughout.

Eugene Leung asked what the funding source of the project is. Heather said that it is being funded through a supplemental environmental project that is the result of a settlement agreement with the Central Coast Regional Water Quality Control Board. This project is funded directly by the other party to the settlement. CWC was approached by that party and asked if CWC had any needs in this geographic area, and CWC identified this project as a high priority.

Next Steps:

- CWC will follow to answer any questions that they were unable to respond to today.
- The next meeting is planned for February 2021 after proposals for the second phase have been received. This next meeting will focus on cost documentation methodology.
- Based on the TAC's availability, it was decided that this meeting would be noon-2pm on February 23, 2021.

14
“Every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes.”

- California Assembly Bill (AB) 685 signed into law in 2012
Technical Advisory Committee Meeting December 8, 2020:
1,2,3-TCP Point-of-Entry Treatment Pilot Project in North Monterey County Area
Heather Lukacs, Director of Community Solutions
1. TAC Roll Call (Noon-12:10pm)
2. Discussion of TAC Feedback (12:10-12:20)
3. Project Updates and Discussion (12:20-12:45)
4. Backwash Procedures (12:45-1:00)
5. Carbon Sourcing and Disposal (1:00-1:15)
6. Bacteria Pre-Treatment (1:15-1:30)
7. Implementation Recommendations (1:30-1:50)
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<tr>
<th>Name</th>
<th>Company / Agency / Organization</th>
<th>Title / Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark Bartson, P.E.</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Program Management Branch Technical Operations</td>
</tr>
<tr>
<td>Kevin Berryhill, P.E.</td>
<td>Provost &amp; Pritchard Consulting Group</td>
<td>Principal Engineer</td>
</tr>
<tr>
<td>Paul Boyer</td>
<td>Self-Help Enterprises</td>
<td>Program Director - Community Development</td>
</tr>
<tr>
<td>Guadalupe Gonzalez</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Safe and Affordable Funding for Equity and Resilience</td>
</tr>
<tr>
<td>Kyle Graff</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Northern California Drinking Water Field Operations</td>
</tr>
<tr>
<td>Tarrah Henrie</td>
<td>Corona Environmental Consulting</td>
<td>Senior Scientist</td>
</tr>
<tr>
<td>Alex Huang, P.G.</td>
<td>State Water Resources Control Board (DFA)</td>
<td>Office of Sustainable Water Solutions Branch</td>
</tr>
<tr>
<td>Brian Kidwell, P.E.</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Safe and Affordable Funding for Equity and Resilience</td>
</tr>
<tr>
<td>Tori Klug, P.E.</td>
<td>Stantec Consulting Services, Inc.</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Eugene Leung</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Program Management Branch Technical Operations</td>
</tr>
<tr>
<td>Edwin B. (Ned) Lofink, P.E.</td>
<td>Axiom Engineers</td>
<td>Senior Project Engineer</td>
</tr>
<tr>
<td>Tami McVay</td>
<td>Self-Help Enterprises</td>
<td></td>
</tr>
<tr>
<td>Zane Mortenson</td>
<td>Rural Community Assistance Corporation</td>
<td>Rural Development Specialist</td>
</tr>
<tr>
<td>Laura Satterlee</td>
<td>Self-Help Enterprises</td>
<td></td>
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<tr>
<td>Allie Sherris</td>
<td>Stanford University</td>
<td>PhD Candidate, Emmett Interdisc. Prog. in Env &amp; Res.</td>
</tr>
<tr>
<td>Dave Wallis</td>
<td>Rural Community Assistance Corporation</td>
<td>Rural Development Specialist III - Environmental</td>
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</table>
**Technical Advisory Committee Meeting Schedule**  
1,2,3-TCP Residential Treatment Pilot Project in Northern Monterey County Area

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>October 2020</td>
<td>Project goals and overview. Phase 1 scope of work. Review draft design of 12,3,-TCP POE treatment system. Review proposed monitoring protocols.</td>
</tr>
<tr>
<td>Nov/Dec 2020</td>
<td><strong>Phase 2 scope of work</strong></td>
</tr>
<tr>
<td>February 2021</td>
<td>Cost documentation methodology</td>
</tr>
<tr>
<td>July 2021</td>
<td>Review monitoring results, Draft recommendations for POE/POU treatment for private wells</td>
</tr>
<tr>
<td>July 2022</td>
<td>Review monitoring results</td>
</tr>
<tr>
<td>February 2023</td>
<td>Draft final report</td>
</tr>
<tr>
<td>June 2023</td>
<td>Plan to share final report and results to inform state-wide efforts</td>
</tr>
</tbody>
</table>

*Exact meeting dates to be determined*
Community Member Motivations (Nov. 2020)

“ For my children’s health, they can’t shower comfortably. It would relieve my stress to get it treated.”

“To help this study and help elevate [the need] and make the machines less expensive so that people can afford it.”

“I am tired of it, I lived here for the last 40 years, I am 67 years old now, I cannot do anything else to make this right. It’s hard! It’s hard living here.”

“It scares me that its in such high concentrations in my water and the steam.”

“Because our health and the health of our kids and grandkids matters greatly to us.”

“To try to make things better for everyone and to improve the water system.”

*16 households that are candidates for this study completed water use surveys and were asked why they are interested in participating in this study
Technical Advisory Committee Meeting Agenda

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7. Implementation Recommendations (1:30-1:50)
8. Exit Survey & Next Steps (1:50-2:00)
Schematic of First 123-TCP Treatment System

Explanation:
- Sample Point
- Valve
- Pressure Gauge

Draft schematic produced by Culligan (QWE Commercial Services) based on a 8.97 GPM Flow Rate

Commumity Water

Pilot 1,2,3 TCP Reduction System Dimensions

Culligan QWE Commercial Services
625 West Market St., Salinas, CA 93901
831.755.0600

Rev: 85
123-TCP Treatment System

Tank Volume: 16" D x 65" D
(49 gallons, 6.55 cubic feet per tank)

Design Flow: 8.97 gpm

Empty Bed Contact Time (EBCT): 10 minute @ 8.97 GPM

Carbon: FILTRASORB® 400

- 100% acid-treated virgin (not regenerated)
- NSF/ANSI 61 - Drinking Water System Components - Health Effects Standard

3/4" x 1" Totalizing Water Meter
123-TCP Treatment System - Carbon Backwash Procedure

- Plan to remove lead tanks, bypass will allow lag tanks to be online during backwash
- Transport to Culligan facility in Salinas
- Media is lifted into backwash funnel, manually backwashed and then returned to tank
- Backwash water is chlorinated
- Estimated cost of process: $475
- Pros: Do not need larger tank, no onsite waste
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Project Updates: 1,2,3-TCP POE Treatment Pilot

Household Selected for First Installation

- 123-TCP Level = 0.017 ug/L
- Well ID: DWMC02
- Located north of Moss Landing
- Community partner
- Member of Committee for Safe, Clean, and Affordable Drinking Water
- Has been working to get a long-term solution for her community for many years, including hosting community meetings outside her home

Community meeting in area north of Moss Landing in pre-COVID times.
**TCP Pilot Project Bacteria Results**

- **36% (4 of 11)** for pilot project tested positive for total coliform bacteria, one for E. Coli
  - Re-tested DWSB02 after disinfection

<table>
<thead>
<tr>
<th>Well ID</th>
<th>Total Coliform Bacteria</th>
<th>E. Coli</th>
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</thead>
<tbody>
<tr>
<td>DWMC01</td>
<td>133.4</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td>DWMC05</td>
<td>150</td>
<td>2</td>
</tr>
<tr>
<td>DWMC09</td>
<td>3.1</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td>DWSB02</td>
<td>71.2 (re-test &lt;1.0)</td>
<td>&lt;1.0</td>
</tr>
</tbody>
</table>

Cracked well seal at potential pilot project location. Photo by Weber Hayes and Associates.
Project Updates: 1,2,3-TCP POE Treatment Pilot

TCP Pilot Project Bacteria Results

- **36%** (4 of 11) for pilot project tested positive for total coliform bacteria, one for E. Coli
  - Re-tested DWSB02 after disinfection

Other Studies - Positive Total Coliform

- **48%** (15 of 31 wells)
  - CWC 2015/2016
- **59%** (13 of 22 wells)
  - CWC 2019
- **26%** (300 of 1126), **33%** in Tulare County
  - GAMA 2002-2011*

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*https://www.waterboards.ca.gov/water_issues/programs/gama/docs/dwprjct_tstng_smmry.pdf
Project Updates: 1,2,3-TCP POE Treatment Pilot

TCP Pilot Project Bacteria Results

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- 59% (13 of 22 wells)
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- 26% (300 of 1126), 33% in Tulare County
  - GAMA 2002-2011*

Discussion Question: Do TAC members have any experiences or studies to share on percentages of private wells with total coliform bacteria and/or E. Coli?

*https://www.waterboards.ca.gov/water_issues/programs/gama/docs/dwprjct_tstng_smmry.pdf

Cracked well seal at potential pilot project location. Photo by Weber Hayes and Associates.
Project Updates: 1,2,3-TCP POE Treatment Pilot

Site Assessment Results
- 12 site assessments were conducted (Aug-Nov 2020) by Weber Hayes and Associates

- Water Quality Results
  - TCP variability in shallow wells including 4 samples showing non-detect
  - Summary of other constituents of interest, including high levels of hardness (as CaCO3)
TCP Variability in Shallow Wells

![Graph showing 1,2,3-TCP concentration over time in shallow wells.](image)

- **1st Install (Moss Landing - Springfield)**
- **Moss Landing - Bluff/Jensen**
- **Moss Landing - Giberson**
- **Salinas**
- **San Juan Bautista**

(n = 11)
TCP Variability in Shallow Wells

MCL = 0.005 μg/L

4 non-detect sites
(MDL = 0.0006 μg/L)

(n = 11, but one high-TCP sample not shown)
GAMA TCP Data for Four Similar Wells
(Courtesy of Allie Sherris, Stanford University)

- From nearby counties (Monterey, San Benito and San Luis Obispo)
- Screened at depth of <200 ft
- At least one TCP detect between 2018-2020

MCL = 0.005 ug/L

Wells Graphed:
- 2700771-001 Near Moss Landing
- 2701036-001 Monterey County
- 4000768-001 San Luis Obispo
- 4000604-001 San Luis Obispo
Approximate Groundwater Depth near Moss Landing
(Interpolated from maps provided by the Pajaro Valley Water Management Agency)

Level a few feet higher in springtime
TCP Variability

Potential Explanations for Variability

- Recharge of shallow aquifer during wet season with water that contacts shallow TCP
- Seasonal variation in depth to groundwater
- Sampling and analysis variability (but we think similar methods were used)

Proposed Strategies to Address Variability in the Pilot:

- Only install treatment systems where we have at least two TCP samples greater than the MCL.
- Quarterly sampling of source water for TCP.

Discussion Questions:

- How does this TCP variability compare to previous experience?
- Any other suggestions for addressing TCP variability as part of this project?
## Other Constituents of Interest

<table>
<thead>
<tr>
<th></th>
<th>Units</th>
<th>Sec. MCL</th>
<th># Sites</th>
<th>Min</th>
<th>Max</th>
<th>Median</th>
<th>DWMC 02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Volatile Org. Carbon</td>
<td>mg/L</td>
<td>n/a</td>
<td>10</td>
<td>&lt;0.30</td>
<td>1.40</td>
<td>0.93</td>
<td>&lt;0.30</td>
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<tr>
<td>Turbidity</td>
<td>NTU</td>
<td>5</td>
<td>11</td>
<td>&lt;0.10</td>
<td>1.4</td>
<td>0.24</td>
<td>&lt;0.10</td>
</tr>
<tr>
<td>Total Coliform Bacteria*</td>
<td>CFU/100 mL</td>
<td>&lt;1.0 (primary)</td>
<td>11</td>
<td>&lt;1.0</td>
<td>150</td>
<td>&lt;1.0</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td>Hardness (as CaCO3)</td>
<td>mg/L</td>
<td>n/a</td>
<td>11</td>
<td>309</td>
<td>7,400</td>
<td><strong>670</strong></td>
<td>1,000</td>
</tr>
<tr>
<td>Iron</td>
<td>mg/L</td>
<td>0.3</td>
<td>11</td>
<td>&lt;0.03</td>
<td>0.44</td>
<td>0.073</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/L</td>
<td>0.05</td>
<td>11</td>
<td>&lt;0.004</td>
<td>0.036</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
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<tr>
<td>Total Dissolved Solids</td>
<td>mg/L</td>
<td>1,000</td>
<td>11</td>
<td>540</td>
<td>18,000</td>
<td><strong>1,400</strong></td>
<td>1,800</td>
</tr>
</tbody>
</table>

* Of 11 sites, 4 were positive for Total Coliforms and one was positive for E. coli (2 CFU/100mL)

### Discussion Questions:

- **Concerns for interference with GAC treatment or any other issues?**
- **Pre-treatment needed (other than for bacteria)?**
- **Other parameters to consider?**
Technical Advisory Committee Meeting Agenda

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7. Implementation Recommendations (1:30-1:50)
8. Exit Survey & Next Steps  
   (1:50-2:00)
Recommendation: Backwash Procedure

TAC Meeting (October) Summary

1. Options for backwash in the future
   - Option A: Put carbon in another vessel, wash, and return
   - Option B: Tanks could be removed and backwashed at facility in Salinas*
   - Option C: Manual backwash with temporary backwash system*

*Design would require larger tanks.

2. Continuous backwash (TAC agreed this was not feasible at the household scale)
# Backwash or Carbon Cleaning Procedure

## TAC Meeting (October) Summary

1. **Options for backwash in the future**
   - **Option A:** Tanks could be removed and backwashed at facility in Salinas
   - Option B: Put carbon in another vessel, wash, and return
   - Option C: Manual backwash onsite with temporary backwash system

   *Some options might require larger tanks.

2. **Continuous backwash (TAC agreed this was not feasible at the household scale)**

## Considerations

- Channelization (due to larger tanks with same volume of media) could reduce performance.
- Cost
- Proper disposal of waste generated
- Need to sanitize carbon and/or vessels
- Homeowner preference
- Space
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- Cost
- Proper disposal of waste generated
- Need to sanitize carbon and/or vessels
- Homeowner preference
- Space

Discussion Question for TAC:
- For next phase of project (up to 19 systems installed), do you have recommendations related to backwash?
  - Comparing vessels of different sizes with the same amount of carbon and contact time?
  - Using same procedure consistently in all locations (e.g. source water quality provides enough variability)
  - Opportunities to lower costs and improve efficiency?
  - Other

Backwash or Carbon Cleaning Procedure
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Carbon Sourcing and Cleaning/Backwash

TAC Feedback

- Need to use same carbon over time
- Virgin media
- Certified for drinking water use
- Need to detail how to manage carbon replacement and deal with spent carbon
Carbon Sourcing and Cleaning/Backwash

TAC Feedback (Oct.)
- Need to use same carbon over time
- Virgin media
- Certified for drinking water use
- Need to detail how to manage carbon replacement and deal with spent carbon

CWC Recommendations

Carbon: FILTRASORB® 400 or approved equal
- 100% acid-treated virgin (not regenerated)
- NSF/ANSI 61 - Drinking Water System Components - Health Effects standard
- Must indicate the source of coal, carbon manufacturing location and a description of the reagglomeration/thermal process.

Backwash Procedure

Carbon Disposal Procedure
Carbon Sourcing and Cleaning/Backwash

TAC Feedback (Oct.)

- Need to use same carbon over time
- Virgin media
- Certified for drinking water use
- Need to detail how to manage carbon replacement and deal with spent carbon

CWC Recommendations

Carbon: FILTRASORB® 400 or approved equal

Backwash Procedure

Carbon Disposal Procedure

- The spent activated carbon media should be designed to be replaced.
- Spent carbon should undergo the California WET test prior to landfill disposal.
- While spent carbon will most likely pass the WET test, the procedure for reactivating carbon or alternate disposal alternatives if it fails the WET test should be described.
- Verify the ability to dispose of waste (that does not pass the WET test) at a (regeneration) facility that will accept a low volume of spent carbon.
**Carbon Sourcing and Cleaning/Backwash**

**CWC Recommendations**

*Carbon: FILTRASORB® 400 or approved equal*

**Backwash Procedure**

**Carbon Disposal Procedure**

- The spent activated carbon media should be designed to be replaced.
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---

**TAC Feedback Request**

- Do you agree with our carbon specification recommendations?
- Any additional recommendations related to carbon cleaning or disposal that we should include in the RFP for the second project phase?

*Do you agree with our carbon specification recommendations?* Any additional recommendations related to carbon cleaning or disposal that we should include in the RFP for the second project phase?
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Addressing Positive Coliform Tests

Positive Coliform Test

Disinfect Well and Re-Test

Retest Positive

Can well be repaired or upgraded to prevent contamination? (May not be economically feasible, especially if well is an interim solution.)

Bacteria Pre-Treatment Required

Discussion Question: What are the microbial treatment standards for domestic wells?
- UV: NSF Class A
- Chemical: Concentration x Time?
Bacteria Pre-Treatment

● UV Disinfection (NSF Class A for drinking water)
  ○ Discussion Question: Is UV feasible with high hardness? (309 - 7,400 mg/L vs. <120 mg/L rec. by Viqua™)
  ○ Automatic shut-off due to scaling

● Chemical Disinfection (Chlorine, Ozone, Hydrogen Peroxide)
  ○ Configuration:
    ■ Upstream of GAC: Effect on TCP removal in GAC?
    ■ Upstream of GAC with roughing filter to quench oxidant before GAC
    ■ Downstream of GAC: Bacteria colonizing GAC? Taste and odor?
  ○ Discussion Question: Thoughts on relative Cost, Complexity, Reliability of different chemicals?
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6. Bacteria Pre-Treatment (1:15-1:30)
7. Implementation Recommendations (1:30-1:50)
8. Exit Survey & Next Steps (1:50-2:00)
TAC Recommendations for Implementation

1. Are there specific considerations for scalability?

2. Anything else to incorporate into Phase 2 to answer key questions?
   - Alternatives to test
   - Monitoring
<table>
<thead>
<tr>
<th>Month</th>
<th>Description</th>
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<tbody>
<tr>
<td>October 2020</td>
<td>Project goals and overview. Phase 1 scope of work. Review draft design of 1,2,3-TCP POE treatment system. Review proposed monitoring protocols.</td>
</tr>
<tr>
<td>Nov/Dec 2020</td>
<td>Phase 2 scope of work</td>
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<tr>
<td>February 2021</td>
<td><strong>Cost documentation methodology</strong></td>
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<tr>
<td>July 2021</td>
<td>Review monitoring results, Draft recommendations for POE/POU treatment for private wells</td>
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<tr>
<td>July 2022</td>
<td>Review monitoring results</td>
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<tr>
<td>February 2023</td>
<td>Draft final report</td>
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<tr>
<td>June 2023</td>
<td>Plan to share final report and results to inform state-wide efforts</td>
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*Exact meeting dates to be determined*
Next Steps

1. **Short exit survey** (see chat box in zoom)
2. Next Meeting
   - Feb 23, Noon-2pm
   - Feb 25, 10-Noon, Noon-2pm, 2-4pm

Communitywatercenter.org

Heather.Lukacs@
communitywatercenter.org

John.Erickson@
communitywatercenter.org
Meeting Format:
This meeting took place in the form of an online webinar where participants joined via video and audio. During part of the meeting, participants followed a live powerpoint presentation.

Meeting Minutes Format:
The information covered during the presentation as well as the group discussion is captured in these notes. At times, minutes are paraphrased and abbreviated to try to capture the intent of what was said. A recording of the TAC meeting is also available upon request. Some sections of the discussion were rearranged to group similar items together.

Attendance:
Michael Adelman, Stantec Consulting Services, Inc.
Mark Bartson, State Water Board (Division of Drinking Water - DDW, Technical Operations)
Kevin Berryhill, Provost & Pritchard Consulting Group
Brandon Bollinger, Community Water Center (CWC)
Paul Boyer, Self-Help Enterprises (SHE)
Tim Bushman, Culligan QWE Commercial Systems
Marliez Diaz, SHE
Craig B. Drizin, Weber, Hayes and Associates (WHA)
John Erickson, CWC
Guadalupe Gonzalez, State Water Board (DDW, Northern Engagement Unit)
Kyle Graff, State Water Board (DDW, Monterey District)
Tarrah Henrie, Corona Environmental Consulting
Mayra Hernandez, CWC
Alex Huang, State Water Board (Division of Financial Assistance)
Harrison Hucks, WHA
Brian Kidwell, State Water Board (DDW, Northern Engagement Unit)
Tori Klug, Stantec Consulting Services, Inc.
Dan Larkin, SHE
Eugene Leung, State Water Board (DDW, Technical Operations)
Heather Lukacs, CWC
Tami McVay, SHE
Zane Mortensen, Rural Community Assistance Corporation
David Okita, CWC
Matthew Pavelshik, State Water Board (DFA)
Cheryl Sandoval, Monterey County Environmental Health Bureau
Laura Satterlee, SHE
Allie Sherris, Stanford University
Cecilia Vela, SHE
I. Introduction and Roll Call

Heather Lukacs from Community Water Center (CWC) welcomed all attendees to the third TAC meeting for the 123-TCP Point-of-Entry (POE) Treatment Pilot Project and reviewed the agenda for the meeting. Heather introduced the CWC team members on the call and confirmed which TAC members were on the call.

Cheryl Sandoval, Supervisor of the Monterey County Environmental Health Bureau's Drinking Water Program, was joining for the first time and introduced herself. She said that the County's Drinking Water Program regulates drinking water systems under 200 connections and that, apart from permitting well construction, the County does not regulate systems with only one connection. Matt Pavelchik (Senior Engineering Geologist for the Cleanup and Abatement Account and Emergency Drinking Water Unit at the State Water Board's [SWB] Division of Financial Assistance), Dan Larkin (Water Quality Specialist at Self Help Enterprises [SHE]), and Marliez Diaz (Water Sustainability Manager at SHE) were also joining for the first time and introduced themselves.

Heather reviewed the project timeline and past and future TAC meeting topics.

I. Discussion of TAC Feedback

Heather Lukacs reviewed items for which there was consensus at the December 9, 2020 TAC meeting and decisions CWC and WHA have made as a result:

- Will proceed with the 10-minute empty bed contact time (EBCT). While that capacity may be conservative, the intermediate sampling point between the lead and lag vessels will give an indication of how a 5-minute EBCT system would have performed.
- Will want an option to backwash, but should avoid fluidizing the media bed during backwash, which could rearrange the carbon. Will use a gentle "backflush" that does not fluidize the bed. Backflush water and other waste will be disposed of offsite for this project.
- Will use the GAC specification based on Carlgon's Filtrasorb 400 AR carbon.
- Variation in TCP concentration observed in wells sampled for this pilot is similar to what TAC members have seen elsewhere. We plan to re-sample wells where results were non-detect for 123-TCP when possible.

Heather provided an overview of the agenda for today's meeting, which includes a follow-up discussion of bacteria, whether UV treatment should be included, and whether UV treatment is feasible in water with high hardness. CWC followed up with some TAC members after the December TAC meeting and prior to this meeting on some of these items and appreciates their guidance.

II. Project Updates and Discussion

Heather Lukacs provided an update on progress since the last meeting:

...
The first 123-TCP POE treatment system was installed as planned at a household north of Moss Landing. The house is owned by a community partner who has been working to get a long-term solution for their community for many years. The system was designed by Weber, Hayes and Associates (WHA) and Culligan.

Initial TCP results after installation were non-detect at the intermediate sample point downstream of the lead vessels.

Later, total coliform bacteria were detected downstream of the existing storage tank upstream of the treatment system.

This site was selected because it had not tested positive for coliform bacteria during the site assessment. After the installation of the system, the coliform bacteria were detected.

Based on guidance from Calgon Carbon, WHA and Culligan disinfected the treatment vessels and GAC with 5% caustic solution.

WHA also disinfected the well and distribution system with 50 ppm chlorine solution.

CWC and WHA are working with the homeowner to look at options to rehabilitate or perhaps replace the storage tank.

Based on this experience from Phase 1, the plan for the Phase 2 sites moving forward is:

- Continue to prioritize the installation of treatment systems at sites without bacteria issues,
- Resample for bacteria at the POE prior to installation, and
- Monitor GAC influent and effluent for total coliform bacteria and E. coli.

CWC and WHA plan to install six additional treatment systems during Phase 2. Heather showed photos of potential installation sites from the site assessment reports completed by WHA.

After the Phase 2 systems are installed and monitored for 6-12 months, costs will be revisited, and additional Phase 3 systems could potentially be installed with remaining budget or additional supplemental funding.

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III. Bacteria and Disinfection

Background and Feedback from December 2020 TAC Meeting

Heather Lukacs presented background on bacteria issues related to the project:

- Total coliform bacteria contamination is a common issue in private wells, both in this study and in other areas where CWC has worked.

1 Project update: CWC and WHA are moving forward with a phased approach to Phase 2, which will include the installation of two additional treatment systems and the monitoring of the two new systems plus the one already installed for 4-6 months prior to installing additional systems.
CWC has not found clear regulatory guidance on microbial control for GAC POE treatment systems on private wells. We are not planning to include UV disinfection in this pilot because:

- Water being treated by these POE systems is not intended for drinking or cooking, because all participants are part of SWB-funded bottled water programs due to high levels of nitrate in their wells. The POE systems are intended to remove 123-TCP to reduce inhalation and dermal exposure during other water uses such as showering.

- We will make every effort to avoid sites with coliform contamination that cannot be remedied.

CWC wants to discuss microbial issues during this meeting in case coliform issues arise in this study despite efforts to avoid them (as in the case of our first treatment system), and to inform future POE treatment efforts in other parts of the state.

John Erickson summarized feedback regarding bacteria from the December TAC meeting, and how CWC and WHA are incorporating and responding to that feedback:

- TAC feedback: Some microbial growth in GAC and associated biofouling may be unavoidable in GAC.

  - CWC Response: We will include all piping and valving necessary for each system to be backflushed. Backflushing may also help to remove precipitates from hardness.

- TAC feedback: Coliform bacteria in source water is a concern, and measures should be taken to prevent contamination at the source when possible. Any sites with persistent E. coli contamination should not be included.

  - CWC Response: We will work to address coliform at the source when possible and plan to sample the POE for bacteria before installation. We will also conduct routine bacteria monitoring at the well and POE.

- TAC feedback: Hardness is a challenge for UV disinfection and other disinfection alternatives, such as chlorine, would likely be too operationally complex for the scope of this pilot.

  - CWC Response: We are not planning to include UV or other disinfection. However, we are interested in exploring when UV disinfection might be needed and which systems would be effective for disinfecting water with high hardness.

Available Guidance for Microbial Control in GAC POE Treatment

In these minutes we use “microbial control” to refer to any methods used to ensure the microbiological safety of the water leaving the POE device, including monitoring, disinfection, or measures to limit microbial growth in the GAC.

2 CWC and WHA have budgeted for one backflush per system for the duration of the project.

3 It was also discussed during the December TAC meeting that chlorinating upstream of the GAC could interfere with GAC treatment by reducing the life of the GAC or causing iron or manganese to precipitate.

4 In these minutes we use “microbial control” to refer to any methods used to ensure the microbiological safety of the water leaving the POE device, including monitoring, disinfection, or measures to limit microbial growth in the GAC.
John summarized CWC's research related to guidance for control of microbial growth in GAC POE treatment, with the caveat that available guidance does not specifically address the use of GAC POE treatment for private wells:

- Federal Code (40 CFR § 141.100) for public water systems using POE devices: “The design and application of the point-of-entry devices must consider the tendency for increase in heterotrophic bacteria concentrations in water treated with activated carbon. It may be necessary to use frequent backwashing, post-contactor disinfection, and Heterotrophic Plate Count monitoring to ensure that the microbiological safety of the water is not compromised.”

- This guidance is more related to general heterotrophic bacteria growth in GAC, as opposed to coliform bacteria.

- Minnesota Pollution Control Agency POE guidance does not show disinfection downstream of POE GAC treatment.

John said that based on the above information, there is no clear guidance related to microbial control in POE GAC systems for households served by private wells, and asked Cheryl Sandoval if Monterey County has any experience with or requirements for microbial control or monitoring for GAC treatment in State or Local Small Water Systems.

Cheryl said the County has only permitted one GAC treatment system for 123-TCP on a local small water system, and has not required any additional bacteria monitoring. But, they might consider it in the future as they learn more about GAC treatment.

Cheryl does not have any bacteria testing results for the small water system where the GAC treatment system was permitted, but has asked someone in her office to look up the data. The treatment system was designed by Culligan for treatment of 123-TCP. It was installed on a water system with brand new piping and tanks (she was not sure if the well was also new), so would be less likely to have the bacterial contamination issues seen in the aging systems in this pilot.

Cheryl said that most contamination in small systems happens downstream of the well. For that reason, bacteria testing at the tanks and in the homes is important, since pipes and tanks tend to be old.

Tim Bushman mentioned that Culligan also installed 123-TCP treatment on Encinal Water System (a small public water system).

Heather pointed out that this will be an important topic to consider in the future for state and local small water systems as well as public water systems, since they...
are regulated differently. In counties where CWC has worked in the Central Valley, there is little or no county-level regulation of state and local small water systems, so the situation there is different than Monterey County, which specifies additional requirements for these systems in addition to state regulations.

**Potential Microbial Concerns for GAC POE Treatment**

John presented an outline of potential microbial concerns for POE GAC treatment:

- **General microbial growth of heterotrophic bacteria**
  - Sources: These bacteria are found in the environment
  - Control:
    - Limit HPC and total organic carbon (TOC) in the well by preventing the ingress of surface water or shallow groundwater
    - Disinfection after the GAC.
  - Indicator: HPC bacteria
  - Potential concern: Opportunistic pathogens such as Legionella or Non-Tuberculosis Mycobacterium (health concern)
    - But water temperatures expected in this pilot are expected to be too low to promote growth of these bacteria.

- **Enteric bacteria and viruses**
  - Sources: Sanitary defects in the system that would allow ingress of contaminated water
  - Control: Prevent contamination or disinfect
  - Indicators: E. coli and (to a lesser extent) total coliform bacteria
  - Concerns: Waterborne illness

**Review of Proposed Phase 2 Strategy**

John reiterated the proposed strategy (previously presented by Heather) for addressing microbial concerns in Phase 2:

- Require homeowners whose systems test positive for coliform bacteria to do repairs and disinfect their water system to be considered for the TCP Pilot Project.
  - These repairs may include repair of wellseal repairs, installation of pressure relief valves and vents on the well, installation of check valves on the pipe to the tank, and sealing of any contamination routes on the tank.
  - In many cases, the cost of these repairs is significant and will likely be a barrier to entry for this project. CWC is seeking additional funding to support homeowners with these repairs if needed.
  - Sample for total coliform bacteria and E. coli at POE prior to installation.
After installation, monitor before and after the GAC for total coliform bacteria and E. coli. Given that the water is not used for drinking, consider UV disinfection downstream of the GAC only for one or two sites to test UV feasibility for hard water (if funding available), or sites where unanticipated persistent coliform contamination arises.

Discussion question: Any comments on this proposed strategy for Phase 2? What repairs should be required for a homeowner to participate?

Cheryl Sandoval: When people disinfect, the County tells them to look for any obvious routes of entry at the wellhead and tank, seal them, and then disinfect. Sometimes there is a missing bolt on the wellhead or a missing screen on a vent. Sometimes steel tanks are corroded and have holes. Sometimes it is necessary to disinfect twice.

There is also an AWWA process to circulate chlorine through the well to get a more thorough disinfection, which could be considered. Newer wells should have proper sanitary seals, but some wells are older than that.

The area has a lot of seawater intrusion, and that can cause steel well casings to corrode, resulting in holes in the casing. If there are holes in the casing there is really nothing you can do about that.

Kevin Berryhill: This is a pilot study, but looking ahead toward broader implementation, it seems unlikely funding will be available to fix the sanitary issues for all private domestic wells. Perhaps the pilot should focus on evaluating whether the addition of GAC treatment is exacerbating a bacteria problem that was already there to begin with? If GAC treatment is not making bacteria problems worse, that would open doors to implement these treatment systems more broadly, knowing that maybe 50 percent of the wells out there are going to be contaminated with bacteria.

John: Would the idea be to monitor for coliform bacteria upstream and downstream of GAC treatment systems installed at sites that have low levels of coliform bacteria?

Kevin: Yes, you would want to do quantitative bacteriological tests on a regular basis, see if counts are increasing during treatment, and perhaps monitor HPC in addition to total coliform and E. coli. Additionally, you could consider sampling for bacteria periodically at the intermediate sample port to see if bacteria counts are increasing after one vessel vs. two vessels. The biggest concern would be if water is stagnant for a period of time and gets warm.

Michael Adelman: It could also be helpful to monitor headloss across each vessel to evaluate to what extent increased headloss can be a field indicator that biofouling is taking place. Monitoring headloss could inform operational guidance regarding when to backflush.
Heather: If we do observe headloss, can we assume it’s due to biological activity or could it be due to something else?

Michael: It could also be due to solids from the well, which would be a function of well construction, but seems unlikely since there will be prefiltration upstream of the system. Or could be from entrainment of air in the GAC bed, but with no aeration upstream there is no reason to think there would be a lot of air. Given this situation, biofilm development is the most likely cause of increased headloss, but that’s not guaranteed. Headloss is easy to measure in the field compared to bacteriological sampling.

Tori Klug: If households have hot water heaters, it might be helpful to take a sample downstream of the hot water heater when warmer water is being run for a shower. If you start to see amplification of Legionella, for instance in an outdoor pipe that’s above grade, it’s going to go to the hot water heater and may grow abundantly there depending on the temperature of the hot water heater. Even though we don’t know if any of these wells have a pathway for Legionella contamination, this would be a good thing to look into.

Heather: Do you have a recommendation for what parameter we could monitor downstream of the hot water heater?

Tori: You could monitor for HPC.

Michael: Think you could also do an assay for Legionella specifically. This is a known occurrence of Legionella in water heaters and there is a plausible story that the GAC provides a great surface for bacteria growth which is introduced in the plumbing throughout the house, and the water heater provides a nice environment for the Legionella to grow. You could learn something by monitoring HPC for general bacteria and also monitoring for Legionella specifically since that would be the acute public health concern.

Tarrah Henrie: Corona has an expert on Legionella who could point CWC in the right direction about labs and methods.

Eugene Leung: The WHO put out a document in 2003 noting that while different agencies like USEPA and Health Canada looked into prohibiting the use of POU and POE GAC treatment devices because of concerns with HPC, they decided against banning the filters because there was no evidence of health effects or illnesses linked to these devices. For this project, we could leverage Culligan’s experience servicing POE GAC.
- Eugene supports Kevin’s suggestion of monitoring bacteria upstream and downstream of the GAC and seeing how the systems develop over the course of the project. It will be interesting to see how these new treatment systems behave when installed on systems with old plumbing, but will not be practical within the scope of this project to find a solution to all of these questions surrounding bacteria.

- Eugene continued: For public water systems, there are no regulations for on-premise plumbing, except for lead and copper. If you start looking into Legionella in private homes, you will be pushing ahead of what public water systems are required to do. Even for large buildings, like highrises for example, there is no drinking water system regulatory framework for on-premise plumbing. There were guidelines for addressing Legionella when opening up after COVID, but it is up to the building owner to follow the ASHRAE standards to flush and maintain the distribution system.

At the connection to the building, there is a demarcation of what the public water system is responsible for and what the building or homeowner is responsible for.

- Eugene continued: We should not try to fix this issue with HPC, when there is no health standard for it. In this project, with our limited resources, maybe the best we can do is say how much HPC we observed.

- Heather: Based on discussions with Eugene, we understand that regulation of disinfection for GAC treatment is limited in public water systems. And in Monterey County, which is at the cutting edge of regulating state and local small public water systems, we have just heard from Cheryl Sandoval that one GAC system has been permitted with no additional monitoring required. Then the next tier smaller is private wells, where we are working with this project. Initially, CWC was only aware of POE GAC systems without disinfection, but then we found guidance that included disinfection, so it is helpful to get feedback on the range or practices out there.

- Michael: As part of communication to homeowners and operational guidance, it would be good to encourage them to monitor the pressure drop and use that as an indicator for how clean their media is. If pressure loss increases, a backflush may be warranted.

- Kevin: Many homeowners may have Brita filters in their house. Most of these people have probably already been exposed to water treated with GAC already, regardless of

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whether there was POE treatment on the house. If there were really serious health effects from GAC then we would probably know it by now.

- Michael: The philosophy of managing biological growth in a Brita filter is to not let it get too old.
- Eugene: With Brita filters there are also disclaimers in the instructions that you should refrigerate your filter, but most people leave it on the counter. In the NSF household treatment unit standards, their guidance is to use the best source possible, and that’s what we’re doing here, using a source we know is coliform negative. We are also adding an additional layer of testing the distribution system to make sure it is not a problem (as Cheryl mentioned), making sure that the water entering the treatment system is good, routinely maintaining the GAC treatment system, and monitoring to make sure there is no acute health risk from E. coli monitoring. Those are the steps. Most people, as mentioned, are exposed to HPC anyway. For these systems, the main issue is that we do not want to have pathogens. By monitoring for E. coli we can make sure there are no fecal contamination routes. Timed sampling may be important for these systems, like collecting samples after a first rain event to make sure there is no wastewater being washed toward the well. If we find a problem, like E. coli contamination that indicates a failing well, then we need to alert the homeowner to the risk and tell them that the POE treatment system only treats 123-TCP and the well needs to be fixed.

- Heather: When Self Help Enterprises (SHE) installs a POU device through their Household Solutions Program (funded by the SWB) and finds defects in the well, are they able to repair the well as part of the program?
- Tami McVay: Yes, SHE is able to make corrections. When they do their assessment, they are looking at the well quality, in addition to the water quality and quantity. The wells they look at are often pretty old and may only have about 20 feet of water left in them, in which case SHE is able to recommend drilling a new well or connecting to a nearby local water system. If the well’s problems are related to drought, they are able use their funding to correct those as well.
- Heather: For issues that are not related to drought, but rather are related to whether a POU system would work for the well, are they able to fix those as well?
- Tami: They do have some discretionary funding. However, their existing funding is mainly related to drought. Moving forward, they are working toward being able to also address non-drought deficiencies when they find them.

- Heather: CWC is excited to learn more about SHE’s Household Solutions program and will follow up more with SHE. These questions get to the issue of what the state may be able to support with some of these wells. When possible, we want to connect people to a long term solution, but if that’s not possible, we would like to better understand what resources are available for well repair.
John: Two take-aways he is hearing from this discussion are that 1) E. coli is an indicator of pathogens and we need to definitively address it or avoid systems that have it, and 2) HPC should not cause serious concern but is something we could understand more from this project.

- We would like to have more discussion specifically related to total coliform bacteria. Total coliform bacteria are somewhere in the middle between E. coli and HPC. Kevin suggested that wells with low levels of coliform bacteria can be included in the project and the treatment systems could be monitored to see if coliform levels increase in the GAC. That proposal is pretty attractive, because it will be costly to make all of these systems coliform-free.

Discussion question: What are the best practices if a total coliform bacteria sample is detected at GAC influent?

- Are TAC members comfortable with the idea of leaving systems online if they have low levels of total coliform and continuing to monitor them?
- Or do we need to immediately disinfect if coliform bacteria are detected? If we disinfect, should we disinfect just the distribution system and the well with chlorine, or do we need to also disinfect the GAC with caustic?

Eugene (comment in chat): You should always start with a well that is total coliform negative. Kevin: In his experience with these smaller rural wells, it is not simple to get them cleaned up, even if you have identified the sanitary defects. If the goal is to clean up any wells that are coliform positive during the study it could become an endless cycle trying to re-disinfect and resample the wells.

Allie Sherris: There really is not a lot of literature, if any, that demonstrates a health risk associated with total coliform bacteria when E. coli is not also present, particularly if the water is not being used for drinking. She would be very wary of removing the health benefit of 123-TCP treatment (e.g. reducing exposure to 123-TCP in the shower) in order to reduce potential risk from total coliform bacteria. That tradeoff does not make a lot of sense from a public health perspective.

Tarrah Henrie: She really agrees with Eugene’s perspective, that this (bacteria) could be a whole different research project. Staying with the primary goal of this research project is important.

John: CWC had prepared some slides on potential UV Treatment, but given the TAC feedback received at this meeting, it seems adding UV treatment should not be a priority for this project. Any feedback the TAC has on the potential for UV treatment or when it may be advisable in other situations (such as if the water is being used for drinking) would be much appreciated in the exit survey.

Heather: We will flag remaining questions related to bacteria as a future item. As Eugene and others mentioned, the question of whether additional monitoring and/or disinfection should be required for GAC treatment at private wells is a question that is bigger than this particular project CWC is still interested in learning more, and will follow up with Eugene about the WHO study, and with Allie about the research she mentioned.
IV. Monitoring Protocol

Harrison Hucks from Weber, Hayes and Associates presented the monitoring protocols (included as an attachment to these minutes).

TAC feedback:

- Kevin Berryhill: Not sure that the pH data will be very useful. Temperature may be useful for bacteriological considerations. It would be useful to determine what the maximum representative flowrate through these systems is, for instance during morning and evening periods when cooking and showering are going on. Water use may not be that high when samples are collected in the middle of the day.

- John Erickson: For Phase 2, the flow meters installed will be able to provide pulse outputs, so that data loggers can be installed to continuously monitor flow if a funding source is identified.

- Heather Lukacs: CWC is also interested in logging pressure data, if resources are available to do so, and would appreciate any monitoring recommendations the TAC has.

- Eugene Leung: Does Culligan have any remote (WiFi or cellular) monitoring systems they use on their industrial systems to monitor production and use? This would allow for virtual monitoring.

- Tim Bushman: Culligan does have controllers they could use to monitor flowrate, but they’re all for building management systems and need cables. At one point they tried cellular, but it wasn’t very successful. Some of their controllers do measure pressure and flow ranges, but that might require quite a bit of reconfiguration.

- Tarrah Henrie: At a pilot unit, Corona once set up a camera with a timer to monitor a flow meter.

- David Okita (from chat): In Davis, attached to water meters is a device that reports hourly water use in every home.

V. Cost Tracking Methods

Heather Lukacs presented the proposed approach for tracking costs for the pilot:

- Purpose

The goal of the project is to reduce exposure to 123-TCP and also to provide transparent documentation of actual project costs.

Costs from this project are already being used and could be used to inform other work, such as:

1. ...
Methodology

- Track labor and materials by the following categories:
  - Outreach and education (CWC)
  - Well testing and site assessments
  - Installation
  - Monthly field monitoring (CWC is considering posting this online, with households identified by ID # and not location or name)
  - Operation and maintenance
  - Project management

- Will work to differentiate between costs specific to this pilot project and anticipated costs for future projects

- Will break down operation and maintenance costs into two categories:
  - Planned: Backflushing, Media replacement, Maintenance and service calls, Maintenance log
  - Other: Media disinfection, Treatment system removal, Other additional services

- Will track costs by system so it is clear how much cost is related to more challenging systems.

TAC feedback:

- Tarrah Henrie: This is really terrific. For the interim solutions cost calculator that Corona worked on for CWC’s Early Action Plan Report, it was hard to find information on administrative costs. Some of those soft costs (administration, reporting, finding the wells, and sampling the wells for the first time) won’t go away even once you go to scale. These costs can sometimes be higher than the installation. It would be great to capture

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12 Project website: https://www.communitywatercenter.org/mosslandingwaterproject. POE treatment is not currently an approved solution in Monterey County, but the SWB has asked CWC to include it in this analysis since it could become an option in the future.


14 CWC hopes the systems can remain in service after the pilot ends, but if homeowners are unable to cover the costs to maintain them and CWC is not successful in fundraising for those costs, removal may be required.
Heather: CWC's experience is consistent with this. Sometimes, CWC receives requests to conduct well testing from other organizations or agencies and they suggest testing fewer parameters to cut costs. Yet, in CWC's experience, staff time to recruit participants, conduct the well testing, and follow-up with results is often much higher than the analytical costs. This is the case if you want to have an impact so that people make changes to reduce their exposure to contaminants based on what they learn from the results. Are there specific administrative costs that we should track?

Tarrah:
- Ongoing monthly labor for an operator to go out and take samples and check on the system.
- Ongoing outreach to participants, especially with rental housing where there is turnover.

Eugene Leung (from the chat): Question for Tim, for POE systems, what are the long-term recurring costs?

Heather: We are not able to specifically pinpoint the long-term costs because of the complexity of the source water. We are not sure whether it will be necessary to backflush or replace the media within the term of the pilot.

Eugene: His question was mainly about more long-term costs beyond the maintenance costs already discussed, such as vessel replacement or piping problems.

Tim Bushman:
- The pre-filter and post-filter cartridges will need to be replaced. These are commercial sizes, so they don't have to be replaced frequently. He has a system that has been online for 18 months and the filters still haven't been replaced.
- There are no moving parts on the system itself. The actual vessels have four layers, which was why they switched to Culligan's non-backwashing stock filter equipped with the Filtrasorb 400 carbon. The system has covers on it, to prevent photosynthesis from happening, and is NSF certified as a system. The Quadra Hull® tank has a lifetime warranty. (It is not normally transferable, but if the system is transferred Tim's local office would still honor the warranty). The main concern for longevity of the tanks would be UV rays from the sun and algae from photosynthesis.
- There is the normal potential for PVC piping to be damaged, such as a hard freeze causing broken pipes, but this is all standard PVC pipe and easy to fix.
- Other than these items and the media, he doesn't expect any long-term...
VI. Other Feedback

Cheryl Sandoval: She saw the discussion in the minutes from the last meeting about household hazardous waste disposal. She verified that up to 27 gallons or 220 pounds can be disposed of as household hazardous waste, and it would have to be disposed of by the homeowner. If a contractor disposed of it, they would need to be certified as a hazardous waste hauler.

- Kevin Berryhill: Is that a State or County requirement?
- Cheryl: It is enforced by the County Environmental Health’s hazardous materials team, but she believes it is a state regulation that they’re enforcing. She’s also not sure whether the media would be classified as hazardous waste.

- Heather: The current plan, based on Tim Bushman’s recommendation, is to do the California WET test. In the past, Tim has seen that the media from similar systems can be disposed of in a regular landfill.

- Harrison Hucks: What does carbon weigh dry?
- Tim: 40 lbs/cf (the two lead tanks have 12 cf dry). If it doesn’t pass the WET test, it should be treated as a hazardous waste and the homeowner should not handle it.

- Heather: For Phase 2, we are getting quotes for both of the disposal options and may follow up with Cheryl or a contact she has shared previously if we have any questions.

VII. Exit Survey and Next Steps

- Heather Lukacs asked that any additional feedback or questions be added to the exit survey, and reviewed the schedule for future TAC meetings:
  - Sept. 2021: Review monitoring results, Draft recommendations for POE/POU treatment for private wells
  - July 2022: Review monitoring results
  - February 2023: Draft final report
  - June 2023: Plan to share final report and results to inform state-wide efforts

- Next steps
  - The next TAC meeting will be Tuesday Sept. 14 noon-2pm.
  - CWC will follow up with Tarrah Henrie for any information needed on Legionella detection methods.
  - Tarrah Henrie is available to provide CWC information on flow monitoring methods that Corona has used in past projects.
“Every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes.”
Technical Advisory Committee Meeting Agenda

1. TAC Roll Call (Noon-12:10pm)

2. Discussion of TAC Feedback
   (12:10-12:20)

3. Project Updates and Discussion
   (12:20-12:40)

4. Bacteria and Disinfection
   (12:40-1:10)

5. Monitoring Protocol (1:10-1:25)

6. Cost Tracking Methods (1:25-1:50)

7. Exit Survey & Next Steps
   (1:50-2:00)
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<th>Title / Position</th>
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<tr>
<td>Mark Bartson, P.E.</td>
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<td>Kevin Berryhill, P.E.</td>
<td>Provost &amp; Pritchard Consulting Group</td>
<td>Principal Engineer</td>
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<td>Paul Boyer</td>
<td>Self-Help Enterprises</td>
<td>Program Director - Community Development</td>
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<td>Guadalupe Gonzalez</td>
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<td>Safe and Affordable Funding for Equity and Resilience</td>
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<td>Kyle Graff</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Northern California Drinking Water Field Operations</td>
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<tr>
<td>Tarrah Henrie</td>
<td>Corona Environmental Consulting</td>
<td>Senior Scientist</td>
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<td>Alex Huang, P.G.</td>
<td>State Water Resources Control Board (DFA)</td>
<td>Office of Sustainable Water Solutions Branch</td>
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<td>Edwin B. (Ned) Lofink, P.E.</td>
<td>Axiom Engineers</td>
<td>Senior Project Engineer</td>
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<td>Tami McVay</td>
<td>Self-Help Enterprises</td>
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<td>Zane Mortenson</td>
<td>Rural Community Assistance Corporation</td>
<td>Rural Development Specialist</td>
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<td>Laura Satterlee</td>
<td>Self-Help Enterprises</td>
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<tr>
<td>Allie Sherris</td>
<td>Stanford University</td>
<td>PhD Candidate, Emmett Interdisc. Prog. in Env &amp; Res.</td>
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<tr>
<td>Dave Wallis</td>
<td>Rural Community Assistance Corporation</td>
<td>Rural Development Specialist III - Environmental</td>
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<tr>
<td>Cheryl Sandoval</td>
<td>Monterey County</td>
<td>Supervisor, Drinking Water Protection Program</td>
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7. Exit Survey & Next Steps (1:50-2:00)
Response to TAC Feedback

We received consensus or majority TAC recommendation on the following items:

1. Empty Bed Contact Time (EBCT) - 10-minutes with lead/lag design

2. Backwash plan will not fluidize the bed, all waste will be disposed of offsite

3. Carbon specifications and disposal
Schematic of First 123-TCP Treatment System

Draft schematic produced by Culligan (QWE Commercial Services) based on a 8.97 GPM Flow Rate.
Response to TAC Feedback

We received consensus or majority TAC recommendation on the following items:

1. Empty Bed Contact Time (EBCT) - 10-minutes with lead/lag design
2. Backwash plan will not fluidize the bed, all waste will be disposed of offsite
3. Carbon specifications and disposal
4. TCP Variability in pilot project is similar to other locations.
Response to TAC Feedback

We received consensus or majority TAC recommendation on the following items:

1. Empty Bed Contact Time (EBCT) - 10-minutes with lead/lag design
2. Backwash plan will not fluidize the bed, all waste will be disposed of offsite
3. Carbon specifications and disposal
4. TCP Variability in pilot project is similar to other locations.

Today, we will discuss UV treatment, bacteria, and hardness in more detail and request the TAC recommendation on this topic.
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Project Updates

First System Installed

- 123-TCP Level = 0.017 ug/L
- Well ID: DWMC02
- Located north of Moss Landing
- Community partner
- Member of Committee for Safe, Clean, and Affordable Drinking Water
- Has been working to get a long-term solution for her community for many years, including hosting community meetings outside her home
Project Updates

First System Installed

- Initial TCP results were non-detect between lead and lag vessels
- Bacteria issues within storage tank.
- Disinfected treatment vessels with 5% caustic solution per Calgon recommendation
- Disinfected distribution system - with 50 ppm chlorine.
- In process of storage tank rehabilitation/replacement.
Project Updates

Plan for Phase 2 Sites

- Prioritize the installation of additional systems at locations without bacteria issues (that we know about)
- Re-sample for bacteria at POE prior to placing the system in service.
- Monitor system influent and effluent for total coliform bacteria and E. coli

Potential Phase 2 Installation Locations (Photos by Weber Hayes & Associates)
Project Updates

Plan for Phase 2 Sites

- Prioritize the installation of additional systems at locations without bacteria issues (that we know about)
- Re-sample for bacteria at POE prior to placing the system in service.
- Monitor system influent and effluent for total coliform bacteria and E. coli
- Consult TAC regarding additional recommendations (next agenda item)
Project Updates

Possible Phase 3 of Project

- After systems have been operating for 6-12 months, consider installing additional systems and/or continuing monitoring and maintenance after the project end date.

Potential Phase 2 Installation Locations (Photos by Weber Hayes & Associates)
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Bacteria and Disinfection

Background

- Coliform contamination is a common issue in private wells
- CWC has not found any clear regulatory guidance on microbial control for GAC POE systems on private wells
- Not including UV disinfection in this POE pilot, because:
  - Water not intended for drinking*
  - Avoiding sites with coliform contamination that can’t be remedied
- Discussing microbial issues out of caution and to inform future POE systems

*POU and POE Nitrate Treatment is beyond this scope of this pilot project due to very high levels of nitrate, acute health risk posed by nitrate (need for frequent monitoring), potential need for off site waste disposal, and overall cost of nitrate treatment. (From Oct 2020 TAC Meeting)
<table>
<thead>
<tr>
<th>Dec. 2020 TAC Feedback</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microbial growth in GAC and biofouling may be unavoidable</td>
<td>Including the ability to backflush for this reason</td>
</tr>
<tr>
<td>Coliforms in source water are concerning and likely a common problem in private wells</td>
<td>Proposing well and system improvements ($200 - $6,000) at sites with coliform positives</td>
</tr>
<tr>
<td>Take measures to prevent contamination at the source by protecting wells</td>
<td>Re-testing for bacteria at POE at least one month after disinfection/repairs and after rain</td>
</tr>
<tr>
<td>Exclude sites from the project with <em>E. coli</em></td>
<td></td>
</tr>
<tr>
<td>Hardness is a challenge for UV disinfection.</td>
<td>Not planning to include disinfection at all sites</td>
</tr>
<tr>
<td>Disinfection other than UV would likely be too operationally complex</td>
<td>UV Pure Hallett 500PN may be an option for sites with high hardness chronic bacteria issues</td>
</tr>
</tbody>
</table>
Federal Code (40 CFR § 141.100) for public water systems using POE devices:
“The design and application of the point-of-entry devices must consider the tendency for increase in heterotrophic bacteria concentrations in water treated with activated carbon. It may be necessary to use frequent backwashing, post-contactor disinfection, and Heterotrophic Plate Count monitoring to ensure that the microbiological safety of the water is not compromised.”

Minnesota Pollution Control Agency POE GAC systems do not appear to include downstream disinfection.

Corrective Action Plan prepared by consultants in Vermont shows UV downstream of POE GAC to treat PFOA.
Potential Microbial Concerns

**General Microbial Growth**

- **Sources:** Environment
- **Control:**
  - Limit HPC and TOC in source water (Prevent contamination)
  - Disinfect downstream of GAC
- **Indicator:** HPC
- **Concerns Considered:**
  - Opportunistic pathogens: Optimal temperature for Legionella or Non-Tuberculosis Mycobacterium >80°F
  - Biofouling of GAC or premise plumbing

**Pathogens** (e.g. enteric bacteria and viruses)

- **Sources:** Septic tanks, Runoff, Distribution system contamination
- **Control:**
  - Prevent contamination
  - Disinfect
- **Indicators:**
  - *E. coli*
  - Total coliform (to a lesser extent)
- **Concerns:** Waterborne illness
Proposed Phase 2 Strategy

1. Require homeowners to repair and disinfect systems with coliform positives or obvious defects (prior to participating in this pilot project)*
   a. Wells: Repair surface seal, *Pressure relief valve & vent, Elevate well head*
   b. Tanks: Check valve and air gap on fill line, Seal penetrations
2. Sample at POE prior to installation
3. After installation, monitor before and after GAC for total coliform and E. coli
4. Given that water is not to be used for drinking, consider UV post-GAC only for:
   a. One or two sites to test UV feasibility for hard water (if funding available*)
   b. Sites where unanticipated persistent coliform contamination arises

*We are seeking additional project funding to support homeowners who are interested in participating in this study but who are unable to afford repairs in the $200 - $6,000 range, and also for project partners interested in better understanding UV feasibility for hard water.*
Proposed Phase 2 Strategy

1. Require homeowners to repair and disinfect systems with coliform positives or obvious defects (prior to participating in this pilot project)*
   a. Wells: Repair surface seal, Pressure relief valve & vent, Elevate well head
   b. Tanks: Check valve and air gap on fill line, Seal penetrations
2. Sample at POE prior to installation
3. After installation, monitor before and after GAC for total coliform and E. coli
4. Given that water is not to be used for drinking, consider UV post-GAC only for:
   a. One or two sites to test UV feasibility for hard water (if funding available)
   b. Sites where unanticipated persistent coliform contamination arises

Comments on this strategy? What repairs should be required for a homeowner to participate?
Discussion Questions - Indicator Bacteria

1. What are the best practices if a total coliform bacteria sample is detected at the GAC influent?
   a. Bypass the GAC, Disinfect the well and all water system plumbing (recommended by Minnesota Pollution Control Agency guidance on POE GAC, 2009)
   b. Is it necessary to disinfect the carbon with caustic?

2. What bacteriological monitoring should be done as part of point-of-entry GAC treatment?
   a. Coliform sampling upstream and downstream of GAC?
   b. HPC sampling upstream and downstream of GAC?
UV Treatment Options

UV Pure Hallett 500PN
NSF Class A Cert.
40 gal/min
For hardness up to 855 mg/L as CaCO$_3$
Indoor installation required
$2,550 (w/ 25\%\text{ discount})$

Softener

Viqua NSF Class A UV (~$2000)
1. Under what conditions should UV treatment be used with POE GAC treatment?
   a. Water not used for drinking
   b. Water used for drinking
2. Should UV be installed upstream or downstream of the GAC?
3. Would a finer post-filter be feasible and effective?
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## Monitoring Protocol: Operational Monitoring

### Operational

1. **Totalizing flow meter reading**

2. **Inlet/Outlet Pressure:**
   a. Pre-Filter
   b. All 4 vessels
   c. Post-Filter

3. **Note any issues**
# Water Quality Monitoring

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Well Head</th>
<th>Treatment Influent</th>
<th>After Lead Vessel</th>
<th>Treatment Effluent</th>
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<td>pH &amp; Temp.</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
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<tr>
<td>123-TCP</td>
<td>Q</td>
<td>-</td>
<td>M</td>
<td>M (HOLD)</td>
</tr>
<tr>
<td>Coliform, E. coli, HPC</td>
<td></td>
<td>Develop monitoring plan based on unique conditions at each site</td>
<td></td>
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- Flush effluent tap for 15 min prior to sampling
- M = Monthly, Q = Quarterly
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Cost Tracking Purpose

Project Goal:

- To provide transparent documentation of costs, outcomes and lessons learned to inform state-wide efforts to provide safe drinking water for all Californians specific to 1,2,3-TCP.

Current and Potential Applications:

- Reports: Developing Equitable and Effective Early Action Plan for CV Salts
- Alternatives Analysis for Long-term Drinking Water Solution Options for the Area North of Moss Landing
- State Water Board Needs Assessment

Report and calculator available here:
www.communitywatercenter.org/protecting-drinking-water-in-a-gricultural-regions
Cost Tracking Methodology

1. Track labor and materials by the following categories
   a. Outreach & Education (CWC)
   b. Well Testing and Site Assessments
   c. Installation - Installation report
   d. Monthly Field Monitoring - Monitoring reports
   e. Operation and Maintenance - Maintenance Log
   f. Project Management

2. Differentiate costs specific to this pilot project only and anticipated costs for future projects
Cost Tracking Methodology

1. Operation and Maintenance (Planned)
   a. Backflushing
   b. Media replacement
   c. Other maintenance and service calls
   d. Maintenance log

2. Operation and Maintenance (Other)
   a. Media disinfection
   b. Treatment system removal
   c. Other additional services

Any feedback on main cost considerations and categories for tracking project costs?
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<td><strong>Technical Advisory Committee Meeting Schedule</strong></td>
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<td>1,2,3-TCP Residential Treatment Pilot Project in Northern Monterey County Area</td>
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Next Steps

1. Short exit survey (see chat box in zoom)

2. Next Meeting
   - Sept 14, Noon-2pm
   - Sept 21, Noon-2pm

Communitywatercenter.org

Heather.Lukacs@
communitywatercenter.org

John.Erickson@
communitywatercenter.org
Meeting Format:
This meeting took place in the form of an online webinar where participants joined via video and audio. During part of the meeting, participants followed a live powerpoint presentation.

Meeting Minutes Format:
The information covered during the presentation as well as the group discussion is captured in these notes. The powerpoint slides from the presentation during the meeting are attached and are referenced in the minutes. At times, minutes are paraphrased and abbreviated to try to capture the intent of what was said. A recording of the TAC meeting is also available upon request. Some sections of the discussion were rearranged to group similar items together.

Attendance:
Michael Adelman, Stantec Consulting Services, Inc.
Tamara Anderson, Central Coast Regional Water Quality Control Board
Mark Bartson, State Water Board (Division of Drinking Water - DDW, Technical Operations, Retired)
Kevin Berryhill, Provost & Pritchard Consulting Group
Brandon Bollinger, Community Water Center (CWC)
Paul Boyer, Self-Help Enterprises (SHE) (Retired)
Tim Bushman, Culligan QWE Commercial Systems
Marliez Diaz, SHE
Craig B. Drizin, Weber, Hayes and Associates (WHA)
John Erickson, CWC
Michelle Frederick, State Water Board (DDW, SAFER Engagement Unit)
Kyle Graff, State Water Board (DDW, Monterey District)
Tarrah Henrie, California Water Service
Harrison Hucks, WHA
Tori Klug, Stantec Consulting Services, Inc.
Dan Larkin, SHE
Eugene Leung, State Water Board (DDW, Technical Operations)
Heather Lukacs, CWC
Karen Nishimoto, State Water Board (DFA)
Jose Robledo, State Water Board (DDW, Fresno District)
Cheryl Sandoval, Monterey County Environmental Health Bureau
Laura Satterlee, SHE
Chad Seidel, Corona Environmental Consulting
Vanessa Soto, State Water Board (OPP)
Allie Sherris, Stanford University
Cecilia Vela, SHE
I. Introduction and Roll Call

Heather Lukacs from Community Water Center (CWC) welcomed all attendees to the fourth TAC meeting for the 123-TCP Point-of-Entry (POE) Treatment Pilot Project. She introduced the CWC team members on the call, confirmed which TAC members were on the call, and reviewed the agenda for the meeting. Heather also reviewed the project timeline and past and future TAC meeting topics.

II. Discussion of TAC Feedback

Heather Lukacs reviewed the updated strategy CWC and WHA are implementing to address the presence of total coliform and E. coli bacteria in some of the private well water systems considered for 123-TCP treatment system installation. This strategy was developed based on TAC feedback from the February 23, 2021 TAC meeting and is summarized in the attached Slide 8. Attendees did not have any comments on the strategy.

III. Updates on Three Installed Systems

Heather Lukacs provided an overall update on the three 123-TCP POE treatment systems that have been installed (see Slide 10 for a summary). The pilot project has now been divided into three phases: Phase 1 (complete), Phase 2A (in progress) and Phase 2B (planned). The work completed in or planned for each phase is summarized in Slide 11.

John Erickson presented:

- More detailed updates on the three installed systems (see Slides 12-14), including challenges with total coliform bacteria in two of the systems (DWMC-02 and DWMC-04).
- 123-TCP monitoring results (see Slide 15): All samples between the lead and lag vessels resulted below the detection limit.
- Source water 123-TCP concentrations (sampled quarterly) have been somewhat variable at two of the three sites. Despite testing above the MCL twice before installation, the DWMC-04 well tested below the detection limit in June 2021. It later tested well above the MCL (0.04 μg/L) in August 2021.
- Flow monitoring data from the totalizing flow meters installed on each system (see Slide 16) and a flow datalogger installed at DWMC-04 (see Slide 17)
- Due to the intermittency of water use, average flow through the systems ranges between only 0.18 to 0.58 gal/min, far below the design peak flow of 9 gpm.
- Average flow during flushing of the systems during sampling (intended to maximize flow) has been 4.9-8.1 gal/min, also less than the peak design flow. However, the hose bibs through which the systems are being flushed may be limiting flow to below the peak flow that could be reached due to high household consumption.
- Data from the flow datalogger at DWMC-04 has not yet been analyzed in detail.
Pressure drop through the system during system flushing (Slide 18)

Pressure drop has been greater than expected. The project team is investigating what is leading to this higher pressure drop.

Total coliform and E. coli monitoring results and the project team’s approach to date for dealing with the presence of total coliform bacteria in two of the treatment systems (Slides 19-21)

No E. coli bacteria have been detected upstream or downstream of the treatment systems. In recent monitoring, total coliform bacteria have been detected in the effluents of systems DWMC-02 and -04, but not in the influents of those systems. CWC thinks this total coliform bacteria in the effluent could potentially be due to sporadic presence of total coliform bacteria in the influent making its way to the effluent or due to contamination of the GAC by other means.

HPC bacteria monitoring results (Slide 22)

For most samples, the effluent HPC has been higher than the influent HPC. The highest HPC result to date was 1,200 MPN/mL at the influent to the DWMC-02 system in June 2021, shortly after the system was brought back online after repairs to and disinfection of the upstream water system.

The project team will monitor the HPC counts to see how they develop.

Operations and maintenance (O&M) activities to date (Slide 23)

There have been no significant O&M activities, only minor post-installation issues that Culligan has covered under its warranty.

Discussion:

Michael Adelman:

- Water quality data meets expectations.
- It was expected that even the lead vessel would have a bed life on the time scale of years until 123-TCP breakthrough, so the non-detect results are not a surprise.
- Presence of coliform bacteria was somewhat anticipated since GAC is a surface that bacteria can grow on. It appears the project team is dealing with that as best they can. Improvements to the water system to eliminate potential sources of contamination could help with this problem.

Could the headloss be due to accumulation in the pre-filter?

John: The initial data has not shown a lot of pressure loss through the pre-filter.
Tim Bushman: The majority of the pressure loss is probably coming from the flow restrictors as flow through them reaches their limit. He could also get data on the pressure drop through the carbon beds.

Michael: Pressure loss through the carbon was anticipated to be only about 1 psi even at peak flow, but that does not account for pressure loss due to some of the internal features of the vessels or any biological growth or solids accumulation in the media.

Kevin Berryhill: For systems with coliform bacteria coming out but not going in, it might be worthwhile to collect bacteria samples at intermediate sampling points to figure out whether the bacteria are in the lead vessel, lag vessel, or possibly the pre-filter. Once bacteria get in the system it is hard to get it out.

Michelle Frederick: Where total coliform is coming in from the well, you may want to look for surface water near the wells, since this can be a source of total coliform bacteria if the well is not screened very deep. The worst bacteria contamination is usually found after the first rain. Sampling within a day or two of the first big rain is when you are most likely to capture the impact.

Eugene Leung: Stepping back, troubleshooting everyone's private well system as part of this project to avoid coliform bacteria will use a lot of resources. There is no way to fix everyone's well, when a lot of them are shallower wells. There are multiple ways that low levels of total coliform bacteria can be introduced to the system, levels can increase over time, and given the high surface area of the GAC it is very easy for it to become contaminated with total coliform bacteria. That is why public water systems often resort to disinfection to mitigate the problem. Having no E. coli bacteria in the influent to the systems and adding UV disinfection to the effluent may be a way to mitigate bacteria issues.

Kevin: Agrees with Eugene. For other states that have been using POE systems for longer, the best practice seems to be putting in UV systems as a standard practice. You may not have the budget to install UV as part of this project, but long-term that is something that probably needs to be looked at.

IV. Next Installations

A. Opportunities for optimization, including system size

Harrison Hucks described how the current (Phase 1 and 2A) design was developed. The current design with 10-minute empty-bed contact time (EBCT) in the lead vessels and 10-minute EBCT in the lag vessels was based off of a City of Tulare 123-TCP treatment pilot and a pilot system Culligan received a permit for and installed in Monterey County. The design peak flow of 9 gal/min was based on approximate flow data and fixture counts collected for each household.
A standard for groundwater contaminant treatment is to design with the desired EBCT specification in the lead bank, and the same EBCT as insurance in the lag bank. For that reason, each bank was designed with a 10-minute EBCT for a total EBCT of 20 minutes.

Harrison also described the design being considered for Phase 2B: 5-minute EBCT in lead vessel and 5-minute EBCT in lag vessel. (Slides 26)

Now that it appears biofouling will likely be more of an issue than the GAC's 123-TCP sorption capacity, the project team considered a smaller and more cost-effective system design for Phase 2B.

Slide 27 outlines reasons this lower EBCT is being considered, the potential benefits of the smaller design, as well as the potential for higher O&M costs (carbon change-out and backflushing) with the smaller design.

Discussion:

Tim Bushman:
The Phase 1 and 2B design was based on a conservative design used for a Monterey County pilot where they used the same EBCT that was used in the Tulare Pilot because they wanted to be sure the system would work. Since we have the means to install, run and monitor these systems in this pilot, it would be advantageous to see what EBCTs are actually effective. Other dealers in the United States are installing systems with only 2.5-minute EBCT, which, for this design flow, would be 3.5 cubic feet of carbon in the lead vessel and 3.5 cubic feet in the lag vessel. The current (Phase 1 and Phase 2A) design is 24 cubic feet of carbon, so a lot more, which increases potential for contamination, organic loading, and pressure drop, and makes the logistics of moving and backwashing the tanks more difficult. Smaller 14-inch diameter, 3.5-cubic foot tanks could be taken to a facility to be backwashed and sanitized. Most providers in this business can source and operate those. Culligan has hundreds of these smaller tanks and uses them in a portable exchange service. Most providers in his business are able to source and work on tanks of that size.

Michael Adelman:
Agrees you can do a lot for 123-TCP removal, with less than 10-minute EBCT. He shared Stantec's projections with John Erickson that indicated that even with half the EBCT you would still get a bed life of over one year before breakthrough, maybe even close to 3 years. You would probably still be in a situation where you would be changing out the carbon for other reasons before the 123-TCP breaks through.

We can and should take advantage of the adsorption parameters for 123-TCP being really good and the fact that you do not necessarily need a really big carbon bed to avoid seeing breakthrough for a long time. With a smaller bed there would be the advantages of lower pressure drop, lower O&M costs, and easier logistics.

E AOKNOVAR KŘÉ
smaller vessels, smaller footprint, easier logistics for moving vessels around, and a smaller surface area for bacteria to inhabit.

- Contact time is often thought of as the time needed for a reaction to complete itself. But absorption actually happens really fast, far faster than the 2.5- to 10-minute timescale that water spends in a vessel. As shown in the figure on Slide 26, you end up seeing a front of the exhausted GAC moving down through the bed. The absorption reaction is taking place quickly when the water contacts the media, and the front where that reaction is taking place moves down through the bed. He is not surprised to hear that people have seen removal of 123-TCP even with 2.5-minute EBCT. EBCT is normally a design guideline to make sure that you are not changing out carbon too frequently.

- It seems reasonable to design for a lower EBCT and still be able to expect a reasonable change-out interval.

Kevin Berryhill: Nationally, he is seeing others handle difficult-to-treat contaminants such as PFAS and MTBE with design assumptions that are less conservative than the assumptions we are currently working with. Typical design assumptions he is seeing are:

- 5 gal/min peak design flow
- Total EBCT of approximately 6 min, with two contactors in series that each have a 3-minute EBCT

Compared to a municipal system, with intermittent flow through a POE system you are seeing so little water go through these vessels that the mass transfer zone is moving very slowly down through the bed and you can get away with a less conservative design.

In addition to reducing EBCT, the project team may want to consider using a lower peak flow design assumption.

Heather Lukacs: In the other examples Kevin is seeing nationally, are the designs used for private domestic wells with the complex water quality we are seeing here, including total organic carbon (TOC)?

Kevin: They are being used for private domestic wells, but there is not enough information available right now to tell you how the TOC or other background water quality parameters compare. In some states he does know that it is more common to have iron and other constituents in the water that are competing for or fouling the carbon.

Heather: We want to learn from these other cases. So far we have not been able to find information on sizing or longevity or breakthrough for GAC treatment systems on private wells.

Update: Since the TAC meeting, CWC has become aware of system sizing and time-to-breakthrough data for POE GAC systems.
PFAS pilot highlights the significant uncertainty around the multiple factors that impact time-to-breakthrough. For example, for 14 samples indicating breakthrough, the average water consumption at breakthrough ranged from 14,034 to 223,716 gallons, and the influent concentration of PFAS was determined to not be the driver for when breakthrough occurs.

- Kevin: One challenge is that there is not a lot of data for treating 123-TCP specifically, because it is not regulated in other states.
- Michael: Having data on these other constituents is somewhat beneficial, because, compared to them, 123-TCP is quite easily adsorbed. If people are seeing good performance of these systems for a somewhat poorly adsorbed compound like PFAS, performance will be even better for a more easily adsorbed contaminant.
- Chad Seidel: The key issue for TCP, which is well documented in peer-reviewed literature, is that TCP is much better absorbed than those other contaminants. Short EBCT is actually more efficient from the perspective of GAC utilization: You use less GAC to remove TCP the shorter the EBCT is.
- The challenge is monitoring and capturing the breakthrough curve because you will need to replace the carbon more often and will have less time to react when the EBCT is shorter. For POE treatment, you need to have really good flow monitoring and corresponding sampling at the appropriate intervals to inform when the GAC needs to be changed out. There is a tradeoff between the benefits of shorter EBCT and costs of more frequent monitoring and changeout and probably some optimal EBCT that balances these two factors.
- It is helpful to learn from larger-scale treatment systems, but the variability of flowrate is going to be a bigger driver of performance of POE systems.
- He supports the approach proposed by the project team and thinks it will be important to have the right monitoring in place.
- He is hoping that in this pilot we will see that TCP breakthrough is more a function of water throughput than of other factors such as fluctuating water quality. That is mostly what they are seeing in full-scale treatment.

breakthrough and monitoring requirements, as shown on Slide 27. With more regular monthly monitoring, this pilot is a good opportunity to try a shorter EBCT.

- Michael: A month is still short compared to the expected timescale for breakthrough. Breakthrough through both vessels definitely will not happen in a month, so that should be a sufficiently frequent monitoring interval.

- John Erickson: When you talk about TCP readily absorbing, does that mean the mass transfer zone is pretty short and that even with smaller EBCTs you will have utilized almost all of your carbon when that short mass transfer zone breaks through the end of the vessel?

- Michael: Yes, for well absorbed contaminants like TCP, they expect to have a shorter mass transfer zone and thus a sharper breakthrough curve to be sharper.

- Eugene Leung: We are talking about two factors: For treatment at a utility scale, the well usually runs continuously for a substantial duration of time at the same flow rate. For these household treatment units the operation is in really short spurts, with there being flow maybe a maximum of two hours per day. If you cut the EBCT and your peak flow rate is really high, would that be an issue?

- Kevin: Early on in this study, the need to flush the system when collecting compliance samples was discussed, so that the system is seeing peak flow rates and the mass transfer zone is stretched out to its maximum length. That will hopefully mitigate the concern that Eugene is mentioning.

- Michael: Agrees that the most practical thing we can do to account for the issue of the mass transfer zone being stretched out is to take samples at a flow as close to the design flow as possible. Regarding how adsorption might look different compared to a municipal system that would run near its design flow all the time, you would think that these POE systems would last longer because the design flow is really only happening in very short spurts and the average flow is quite a bit lower than that. That means the aggregate mass loading to the bed is a lot lower. The flip side is, if the instantaneous flow rate is too low and you don’t have sufficient headloss to distribute flow through the bed, then you might have channeling through the GAC and have less efficient utilization of the bed. The best operating point for a GAC system like this might be when there is enough flow to distribute flow across the bed. Bigger (longer EBCT) is not always better in this case.

- Eugene: If the peak flow is 9 gal/min, maybe you almost want to design to a peak flow of 7 gal/min to avoid oversizing the system. Would you want to intentionally undersize the system so that you can stress out the media a little bit?
of the flow range. Want to make sure that on the low end we are getting a high enough loading rate to get good distribution across the media, and on the high end we are not getting too much head loss.

- Eugene: He is thinking it might make sense to undersize the treatment system and install a hydropneumatic tank downstream of it so that the flow would go through the system pretty regularly and a higher peak flow could also be supplied.

- Micheal: This brings up the point that we are talking about two sizes: Media Volume (about bed life and reasonable EBCT) and Vessel Diameter (determines loading rate). These two are related because the diameter of the vessels influences the volume of the media, but if you pick a 5-minute EBCT, for example, you could fit a bed of that size into vessels of different diameters. A little smaller diameter may have some advantages to ensure that the instantaneous loading rates are not really low. The flow data will tell us more about this. Water usage tends to be in bursts rather than a constant low flowrate throughout the day.

- Eugene: This is getting more challenging, because of low-flow fixtures.

- Heather: The project team is proposing to halve the contact time, and she is hearing a consensus from the TAC in favor of reducing contact time. In terms of monitoring, CWC sees value in the monthly monitoring we have (with quarterly 123-TCP monitoring at the source) given the variation in water quality we are seeing. Given that, do TAC members see any other opportunities to optimize the design or monitoring program?

- Kevin: He thinks the 9 gal/min peak flow assumption should be revisited based on flow data before determining what volume of carbon is needed in the next phase for the proposed EBCT. He expects the 9-gal/min assumption may be high.

- Heather: What flow data does Kevin recommend we collect?

- Kevin: Recommends working with community partners. Have them turn a bunch of fixtures on and read the flow meter. You don’t necessarily need a datalogger.

- Eugene: Others have mentioned the pre-loading of the GAC. The lag vessel, when moved to the lead, may already be loaded with organics and not last as long as the lead vessel did. Shortening the EBCT may prevent some of the issues caused by the preloading. In future phases, we may...

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$^2$ Candidate households do not currently have flow meters. Based on this feedback from the TAC, the project team is planning to provisionally install flow meters, and perhaps data loggers as well, on houses where installation is anticipated to measure peak flow prior to installation.
want to consider having a smaller lag vessel that is just a safety net vessel. In this case, both the lead and lag vessels would be replaced at once.

B. Potential sites

- Heather Lukacs presented information about three sites being considered for Phase 2B installations and next steps for those sites (see Slides 30-31).

- DWMC-01 has two households and the project team will consider installing either one system to serve both households there, or two systems with one serving each household. This site has a history of total coliform bacteria contamination and the owner is willing to and interested in making repairs.

- DWMC-10 first tested negative for total coliform bacteria but later tested positive for low levels of total coliform bacteria at the storage tank and point of entry. The property owner there is also interested in making repairs.

- DWMC-14 was tested as part of the Central Coast Regional Water Board well testing program, which recently started back up. This site has lower nitrate (10.2 mg/L as N) than other sites and tested negative for total coliform bacteria.

- CWC has received supplemental funding to fund high-priority repairs to address potential contamination routes prior to installation.

- The TAC had no feedback on the potential future installation sites.

C. UV Treatment Options

John Erickson presented a summary of potential options and considerations for UV treatment (Slide 33):

- The high levels of hardness are a challenge for UV treatment in the project area, but CWC did find the UV Pure Hallett 500PN treatment system, which is designed to treat water with hardness up to 855 mg/L as CaCO₃. This system has a design flow of 40 gal/min, so is oversized for this application.

- CWC also looked into the option of softening the water prior to UV treatment, and noted that a TAC member previously suggested that softening the water could be a concern for corrosion.

- Even though residents are not drinking the water coming out of the POE treatment systems in this pilot, CWC wants to avoid setting a precedent of not disinfecting after GAC treatment if it is a best practice to disinfect.

Discussion questions:

- If CWC could find supplementary funding to install UV treatment after one or more of the pilot POE GAC treatment systems, would that add value to this pilot?

- More broadly, under what conditions should UV treatment be used with POE GAC treatment?
Kevin Berryhill and Eugene Leung were talking about this the other day, and a big question is whether to go with Class A or Class B UV treatment systems. Elsewhere, Kevin has seen Class B systems due to the lower power requirements. The power requirements of the UV Pure Hallet 500PN system shown on the slide may be prohibitive, given that it is Class A and for 40 gal/min.

- Eugene: Class A vs Class B is a really tough choice. Class B is really for municipal water and assumes your water is already safe and you are just installing the system in case there is a problem at the treatment plant. Class A is meant for a higher UV dose for water that may not be bacteriologically safe or is E. coli positive. Class B is sufficient for groundwater that is coliform negative. It is a lot of time and effort to assess whether Class A or Class B is needed, since water quality can vary seasonally as the result of heavy rains for instance.

- Michael Adelman: There is a good argument for doing something. As discussed in the previous TAC meeting, most GAC treatment systems for wellhead applications have UV downstream disinfection because GAC is a great surface for microbes to grow. The data from the pilot is consistent with that, with total coliform numbers in some cases being higher downstream of the system than upstream of the system, suggesting that some growth is potentially taking place in the GAC.

- Kevin: Not sure if there is value added or much would be learned by bringing UV treatment into this pilot study, since you would be looking at devices that are already NSF certified. If concerned about setting a precedent a prominent caveat could be included in the report stating that for full-scale implementation UV treatment should be included.

- Michelle Frederick: To Kevin’s point, she agrees technically that it makes sense whenever possible to put in UV downstream of GAC treatment. But if you apply this statewide and use UV in areas that don’t have total coliform or E. coli, she worries about the cost effectiveness. You would be adding several thousand dollars to the overall cost. She is wondering if there may be a gradation based on your total coliform history. She has often seen E. coli bounce in and out in places where you have total coliform, so would be careful with that. A lot of disadvantaged people may look at this and may not get funding from the state. She would want them to do something safe, but also to do something cost effective.

- Heather Lukacs: To Kevin’s point, by including UV treatment in this pilot, we could learn how UV works on this type of water—private well water with high hardness. She thinks it would be valuable if additional funding comes along, but is not currently the priority. The priority is to see how effectively the GAC systems are removing 123-TCP. To Michelle’s point about scaling, those will be tough choices for the health agencies and State Water Board, especially if people are drinking this water. We have a site where total coliform bacteria was not originally detected in the well, and now we are seeing it in the effluent of the treatment system installed there. At another site, no total coliform bacteria has been in the influent for a few months, but it is rising in the effluent. If this is...
STATEWIDE, THERE WILL NEED TO EITHER BE SIGNIFICANT MONITORING ON A CASE-BY-CASE BASIS OR UV SHOULD BE USED AFTER EVERY GAC TREATMENT SYSTEM.

EUGENE LEUNG PROVIDED AN UPDATE ON NSF STANDARDS FOR POE TREATMENT:
- A STANDARD FOR CERTIFYING POU- AND POE-SCALE 123-TCP TREATMENT DEVICES HAS NOW BEEN ADDRESSED UNDER THE NSF 53 STANDARDS TO TREAT WATER SO IT COMPLIES WITH THE CALIFORNIA MCL. IT WILL NOW TAKE SOME TIME FOR MANUFACTURERS TO PUT IN REQUESTS FOR CERTIFICATION OF THEIR PRODUCTS AND FOR THEIR PRODUCTS TO GET CERTIFIED.
- THE THREE CERTIFIERS, IAPMO, NSF, AND WQA ARE WORKING TO HAVE SOME SCALING FACTORS THEY CAN USE TO CHALLENGE TEST SMALLER UNITS AND CERTIFY BIGGER UNITS.
- IN THE SERVICE MODEL IN THIS PROJECT, GAC IS BEING REPLACED BY CULLIGAN. EUGENE IS PUSHING FOR NSF TO DETERMINE WHETHER OR NOT THIS REPLACEMENT OF CARBON IS WITHIN THE SCOPE OF THE DRINKING WATER TREATMENT UNIT STANDARD.

HEATHER LUKACS PROVIDED A BRIEF OVERVIEW OF THE COST TRACKING METHODS BEING USED IN THE PROJECT, INCLUDING DETAILED TRACKING OF COSTS FOR 19 SUBTASKS FOR EACH TREATMENT SYSTEM ON WHA’S INVOICES (SLIDES 36-37).
- COSTS TO DATE WERE INCLUDED IN SLIDES 38-40, BUT WERE NOT DISCUSSED DURING THE MEETING DUE TO TIME CONSTRAINTS.
- UPDATED COSTS WILL BE REVIEWED IN MORE DETAIL DURING THE NEXT TAC MEETING.
- THE MAIN COST UNCERTAINTY AT THIS POINT IS WHAT THE OPERATION AND MAINTENANCE COSTS WILL BE THROUGHOUT THE LENGTH OF THE PROJECT.

HEATHER LUKACS ASKED THAT ANY ADDITIONAL FEEDBACK OR QUESTIONS BE ADDED TO THE EXIT SURVEY (SENT IN THE MEETING CHAT AND BY EMAIL) AND REVIEWED THE SCHEDULE FOR FUTURE TAC MEETINGS (SEE SLIDE 42).

- NEXT STEPS
  - THE NEXT TAC MEETING WILL BE EITHER TUESDAY JULY 12 OR THURSDAY JULY 28, 2022, NOON-2PM. HEATHER WILL SEND CALENDAR HOLDS FOR BOTH OF THESE TIMES AND CONFIRM ONE OF THEM AS THE DATE GETS CLOSER.
  - THE PROJECT TEAM WILL DEVELOP A FEW DIFFERENT OPTIONS AND GET FEEDBACK FROM THOSE ON THE TAC WHO GAVE A LOT OF FEEDBACK REGARDING EBCT TO REFINISH THE PROPOSAL FOR THE SYSTEM DESIGN FOR PHASE 2B.
Phase 2B Design Update as of October 29, 2021:

After the September TAC meeting, CWC held follow-up conversations with TAC members to reach consensus on a reduced-size system design. The proposed design was emailed to all TAC members on Oct. 26, 2021 and CWC staff followed-up by phone with key technical experts who serve on the TAC and have confirmed their support of this revised design. This confirmation of support is noted under Question 1 of Attachment F. Sept 2021 TAC Meeting Exit Survey Responses. See the description of the proposed design and rationale below.

CWC is confident that we have received support from the TAC for the reduced design provided that we continue monitoring monthly. The exception to this is that we were unable to confirm this smaller system size with one key staff person from the technical operations division in the State Water Board, who is on leave this Fall.

Proposed Phase 2 Design and Rationale for Reducing the System Size

Install systems of two different sizes, continuing to use 9-gpm flow restrictors for both sizes:

1. Half of systems: 2 x 2-cf vessels (lead and lag), 3.3-minute total EBCT at 9 gpm
2. Half of systems: 2 x 3.6-cf vessels (lead and lag), 6.0-minute total EBCT at 9 gpm

We are proposing this design for multiple reasons:

- The Phase 1 and 2A design (10-minute lead vessel and 10-minute lag vessel EBCT) was a conservative design based on a previous Monterey County pilot and typical designs for 123-TCP treatment in larger public water systems. GAC POE treatment systems used elsewhere for removal of 123-TCP in water from a public water system or for treatment of other organic contaminants such as PFAS from private wells have used much lower EBCTs. To CWC’s knowledge, no well-documented 123-TCP treatment studies have been conducted with source water similar to that in our pilot (private well water with substantial 123-TCP, high TDS and high hardness). Including a range of design EBCTs in this pilot will allow us to evaluate the advantages and disadvantages of different system sizes in terms of initial installation costs and long-term operation and maintenance requirements.

- These designs will result in more manageable tank sizes (10-inch diameter for 2-cf tanks and 13-inch diameter for 3.6-cf tanks)

- These designs with a smaller carbon volume could reduce the risk that the GAC will become ineffective due to biological growth, hardness precipitation, or other reasons before its capacity to sorb 123-TCP is exhausted.

- Installing the two smaller 3.3-minute EBCT systems is intended to increase the likelihood that the carbon will be exhausted in the lead vessels of at least those systems within the timeframe of this pilot, providing information on required replacement frequency.

- While actual peak consumption at most households will likely be less than 9 gpm, experience during Phases 1 and 2B indicates that the pressure available at some installation sites is insufficient to result in 9 gpm of flow through the flow restrictors. By conservatively sizing the flow restrictors, households will be less likely to experience insufficient flow or supply pressure.
“Every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes.”
Technical Advisory Committee Meeting Agenda

1. TAC Roll Call (Noon-12:10pm)
2. Discussion of TAC Feedback (12:10-12:20)
3. Updates on 3 installed systems (12:20-12:45)
4. Next installations
   - Opportunities for optimization, including system size (12:45-1:05)
   - Potential sites (1:05-1:15)
   - UV disinfection (1:15-1:25)
5. Review costs to date (1:25-1:45)
6. Exit Survey & Next Steps (1:45-2:00)
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<thead>
<tr>
<th>Name</th>
<th>Company / Agency / Organization</th>
<th>Title / Position</th>
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<tbody>
<tr>
<td>Michael Adelman, P.E.</td>
<td>Stantec Consulting Services, Inc.</td>
<td>Environmental Engineer</td>
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<tr>
<td>Mark Bartson, P.E.</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Program Management Branch Technical Operations</td>
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<tr>
<td>Kevin Berryhill, P.E.</td>
<td>Provost &amp; Pritchard Consulting Group</td>
<td>Principal Engineer</td>
</tr>
<tr>
<td>Paul Boyer (retired)</td>
<td>Self-Help Enterprises</td>
<td>Program Director - Community Development</td>
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<tr>
<td>Guadalupe Gonzalez</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Safe and Affordable Funding for Equity and Resilience</td>
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<tr>
<td>Kyle Graff</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Northern California Drinking Water Field Operations</td>
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<tr>
<td>Tarrah Henrie</td>
<td>Corona Environmental Consulting</td>
<td>Senior Scientist</td>
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<tr>
<td>Alex Huang, P.G.</td>
<td>State Water Resources Control Board (DFA)</td>
<td>Office of Sustainable Water Solutions Branch</td>
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<tr>
<td>Brian Kidwell, P.E.</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Safe and Affordable Funding for Equity and Resilience</td>
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<tr>
<td>Tori Klug, P.E.</td>
<td>Stantec Consulting Services, Inc.</td>
<td>Project Manager</td>
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<tr>
<td>Eugene Leung</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Program Management Branch Technical Operations</td>
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<tr>
<td>Edwin B. (Ned) Lofink, P.E.</td>
<td>Axiom Engineers</td>
<td>Senior Project Engineer</td>
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<tr>
<td>Zane Mortenson</td>
<td>Rural Community Assistance Corporation</td>
<td>Rural Development Specialist</td>
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<tr>
<td>Cheryl Sandoval</td>
<td>Monterey County</td>
<td>Supervisor, Drinking Water Protection Program</td>
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<tr>
<td>Laura Satterlee</td>
<td>Self-Help Enterprises</td>
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<tr>
<td>Allie Sherris</td>
<td>Stanford University</td>
<td>PhD Candidate, Emmett Interdisc. Prog. in Env &amp; Res.</td>
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* Craig Drizin and Harrison Hucks from Weber, Hayes & Associates and Tim Bushman from Culligan are consultants contracted for implementation of this project and participate in TAC meetings to provide information from the TAC and to consider input from the TAC.

We recognize and appreciate the participation of all TAC members as well as additional staff from Self Help Enterprises who have attended our TAC meetings including Cecilia Vela, Marliez Diaz, and Dan Larkin.

In addition to those listed, CWC provides all TAC information to additional State Water Board staff who supervise and/or support TAC members: Michelle Frederick, Matthew Pavelchik, Stefan Cajina, and Karen Nishimoto.

We may also be joined today by:
- Tamara Anderson, Central Coast Regional Water Quality Control Board, overseeing project funding
- Jose Robledo, SWB DDW overseeing a water system that is implementing a 123-TCP POE pilot project
- Vanessa Soto, SWB Office of Public Participation, stakeholder feedback for POU/POE Pilot White Paper
Heather Lukacs, Director of Community Solutions

John Erickson, Community Solutions Manager

Mayra Hernandez, Community Solutions Advocate

Brandon Bollinger, Community Advocacy Manager

Daisy Gonzalez, Community Solutions Coordinator

Ryan Jensen, Community Solutions Senior Manager

David Okita, Senior Fellow

Susana De Anda, E.D. & Co-Founder
<table>
<thead>
<tr>
<th><strong>Technical Advisory Committee Meeting Schedule</strong></th>
<th><strong>1,2,3-TCP Residential Treatment Pilot Project in Northern Monterey County Area</strong></th>
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<tbody>
<tr>
<td>October 2020</td>
<td>Project goals and overview. Phase 1 scope of work. Review draft design of 12,3,-TCP POE treatment system. Review proposed monitoring protocols.</td>
</tr>
<tr>
<td>Nov/Dec 2020</td>
<td>Phase 2 scope of work</td>
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<tr>
<td>February 2021</td>
<td>Cost documentation methodology and Bacteria/Disinfection Follow-up</td>
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<tr>
<td><strong>Sept 2021</strong></td>
<td><strong>Review monitoring results and costs from Phase 2A. Consider EBCT update for Phase 2B.</strong></td>
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<tr>
<td>July 2022</td>
<td>Review monitoring results, Draft recommendations for POE/POU treatment for private wells</td>
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<tr>
<td>February 2023</td>
<td>Draft final report</td>
</tr>
<tr>
<td>June 2023</td>
<td>Plan to share final report and results to inform state-wide efforts</td>
</tr>
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*Exact meeting dates to be determined*
Technical Advisory Committee Meeting Agenda

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   - UV disinfection (1:15-1:25)
5. Review costs to date (1:25-1:45)
6. Exit Survey & Next Steps (1:45-2:00)
1. Require homeowners to repair and disinfect systems with coliform positives or obvious defects (prior to participating in this pilot project)

2. After installation, monitor before and after GAC for total coliform bacteria, E. coli, and HPC. *(HPC added due to TAC recommendation.)*

3. If total coliform bacteria is identified following installation, we will provide this information to the residents and owner and continue to operate the treatment system with bacteria in the effluent.
   a. All participating households will sign an agreement acknowledging potential bacteria contamination.
   b. All households are currently receiving delivered bottled water and are not using this water for drinking or cooking.

*We have received additional project funding to support a few homeowners who are interested in participating in this study but who are unable to afford repairs. We are seeking project partners interested in better understanding UV feasibility for hard water and/or nitrate sloughing.*
Technical Advisory Committee Meeting Agenda

1. TAC Roll Call (Noon-12:10pm)
2. Discussion of TAC Feedback (12:10-12:20)
3. Updates on 3 installed systems (12:20-12:45)
4. Next installations
   - Opportunities for optimization, including system size (12:45-1:05)
   - Potential sites (1:05-1:15)
   - UV disinfection (1:15-1:25)
5. Review costs to date (1:25-1:45)
6. Exit Survey & Next Steps (1:45-2:00)
Project Updates

- Total of three systems currently installed and successfully removing 123-TCP to below the detection limit in June, July, and August
- Two additional treatment systems installed in June 2021 (Phase 2A)
- Coliform detected in effluent of GAC in two systems, when not present in the influent
- No significant O&M incidents to date

Family members of community partner who live in home that will receive treated water from the second system installed in June 2021 as part of the 123-TCP Pilot near Salinas.
Phased Implementation for Adaptive Approach

**Phase 1**
- Site assessments
- Treatment system design
- Install 1 system
- Monitor 4 months

*Complete*

**Phase 2A**
- 4 Preconstruction visits ✓
- Install 2 systems serving 3 households using Phase 1 design ✓
- 26 months monitoring and O&M for Phase 1 & 2A systems
- Track installation, monitoring & O&M costs

*In Progress*

**Phase 2B**
- Install 4-5 more systems
- Consider reduced system size
- Monitoring and O&M for Phase 2B systems through end of project

*Planned*
Phase 1 System: DWMC-02

Operating despite total coliform bacteria

- POE tested positive for total coliform bacteria (no E. coli) after installation
- WHA disinfected treatment system with caustic following protocols from Calgon Carbon
- Community partner paid for WHA to make many small repairs and to disinfect the storage tank (likely source of contamination)
- Coliform bacteria present in treatment system effluent after repairs
- **Owner/resident, CWC and WHA agreed to re-connect POE treatment**

New tank lid installed

DWMC02 - Replaced Junction Box at Tank for Float Switch and Ozonator
Phase 2A Installation: DWMC-04

- System installed in June 2021 near Moss Landing
- Well and water system in very good condition
- No total coliform detected at well or POE prior to installation
- 1 POE system serving 1 household
- Property owner installed concrete pad
- CWC installed data-logger to track flow meter pulse output
- Low levels of total coliform bacteria detected downstream of treatment system once in operation
Phase 2A Installation: DWMC-09

- Improvements by owner to eliminate total coliform contamination
  - Sealed tank lid
  - Installed check valve on well discharge
  - Installed overflow and vent on tank
- One treatment system between well and storage tank to serve two households installed in June 2021 south of Salinas
  - Installed VFD on well pump to reduce flow to 9 gpm

DWMC09 - Screened downturned installed by community partner to prevent bacteria contamination.
Monitoring: 123-TCP

All samples between lead and lag vessels resulted below the detection limit (<0.001 - <0.0006)

Below Detection Limit (tested 0.07 & 0.036 ug/L prior to installation)

MCL = 0.005 ug/L
## Monitoring: Flow (totalizing meter)

<table>
<thead>
<tr>
<th>System</th>
<th>No. of Households</th>
<th>No. of Residents</th>
<th>Average gal/day</th>
<th>Average gal/min</th>
<th>Average Flow during Flush (gal/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DWMC-02</td>
<td>1</td>
<td>4</td>
<td>262</td>
<td>0.18</td>
<td>4.9</td>
</tr>
<tr>
<td>DWMC-04</td>
<td>1</td>
<td>2</td>
<td>134</td>
<td>0.09</td>
<td>6.5</td>
</tr>
<tr>
<td>DWMC-09</td>
<td>2</td>
<td>10</td>
<td>839</td>
<td>0.58</td>
<td>8.1</td>
</tr>
</tbody>
</table>

- Average flow much less than flow during system flush and than the design flow of 9 gpm
- If hose bib limits flow during flushing, actual peak flow may be greater
Monitoring: Flow (datalogger)
Monitoring: Flow and Pressure during Flush

- Higher than expected pressure drop observed across system during flushing for sampling.

- Continuing to:
  - Collect more data
  - Investigate pressure drop across each element of the system (carbon, pre- and post-filters, flow restrictors)

- DWMC-04 resident has noticed reduced pressure. Says it is currently manageable, but plans to increase booster pump setting to mitigate.
Monitoring: Total Coliform and E. coli

Disinfected Distribution System with Chlorine and GAC with Caustic

Detection Limit = 1 MPN/100 mL

All samples (in and out) for E. coli have been non-detect

DWMC-02 Offline (Tank Repairs)
Monitoring: Total Coliform and E. coli

All samples (in and out) for E. coli have been non-detect

Detection Limit = 1 MPN/100 mL
Monitoring: Total Coliform and E. coli

- No E. coli detected in influent or effluent of systems
- Total coliform detected in effluent of 2 systems, at levels higher than in influent
- Potential sources of total coliform
  - Well or distribution system upstream of treatment system
  - GAC
- For residents and property owners with coliform bacteria, CWC is:
  - Providing information on total coliform bacteria
  - Confirming that they are drinking and cooking with bottled water
  - Asking them to sign consent form to continue operation of system
Monitoring: HPC Bacteria

Detection Limit = 5 MPN/mL
Operations and Maintenance

- Resolution of minor post-installation issues (covered by Culligan warranty)
  - Repair leak in treatment system piping at DWMC-02
  - GAC clogging manifold at DWMC-09
  - Malfunctioning pressure gauges
Monitoring and O&M Summary

- All systems successfully removing 123-TCP to below the detection limit
- Investigating pressure drop
- Bacteria: Coliform detected in GAC effluent in two systems, when not present in the influent. No E. coli detected
- No evidence so far of drastic increases in HPC during treatment. Continuing to monitor.
- No significant O&M incidents to date
- Monthly monitoring has provided valuable information and revealed significant variation in water quality

Any additional feedback related to indicator bacteria or optimization of monitoring?
1. TAC Roll Call (Noon-12:10pm)
2. Discussion of TAC Feedback (12:10-12:20)
3. Updates on 3 installed systems (12:20-12:45)
4. Next installations
   - Opportunities for optimization, including system size (12:45-1:05)
   - Potential sites (1:05-1:15)
   - UV disinfection (1:15-1:25)
5. Review costs to date (1:25-1:45)
6. Exit Survey & Next Steps (1:45-2:00)
Empty-Bed Contact Time

- **Current design**: 10 min EBCT for lead vessels only*
  - Based on Monterey County pilot and City of Tulare pilot (WHA and Culligan)
  - * EBCT sometimes refers to total EBCT and sometimes to EBCT just for lead vessels

- **Proposed Phase 2B design**: 5 min lead vessel EBCT + 5 min lag vessel EBCT
  - Modeling results from Calgon pending to estimate time to breakthrough

Empty-Bed Contact Time

Reasons Lower EBCT Likely Appropriate for POE Pilot

- Average Flow much less than Peak Design Flow
- Monthly monitoring would allow prompt detection of breakthrough and replacement of lead vessel if necessary
- Earlier breakthrough → More learning during 26 month pilot

Potential Benefits of Lower EBCT

- Reduced installation cost: Culligan’s materials and labor ~$3,925 (27%) lower per system (including WHA 10% markup)
- More frequent carbon change out may limit biological growth
- Potential to use smaller and more manageable tanks (not proposed for Phase 2B)
- Smaller footprint reduces disturbance
- Less risk of channeling of flow through carbon

Potential Disadvantages of Lower EBCT

- Potential for increased O&M costs if carbon change-out or backflush increases (higher labor costs for more trips)

Request for TAC recommendation for Phase 2B EBCT
TAC Feedback: Other Opportunities for Optimization

Any other opportunities to optimize the design and monitoring program?

Project Team Recommendation: Continue monthly monitoring of system and quarterly monitoring of source, as previously described, due to water quality variation and to allow study of smaller GAC.
1. TAC Roll Call (Noon-12:10pm)
2. Discussion of TAC Feedback (12:10-12:20)
3. Updates on 3 installed systems (12:20-12:45)
4. Next installations
   - Opportunities for optimization, including system size (12:45-1:05)
   - Potential sites (1:05-1:15)
   - UV disinfection (1:15-1:25)
5. Review costs to date (1:25-1:45)
6. Exit Survey & Next Steps (1:45-2:00)
Potential Sites for Future Installation

DWMC-01 (Moss Landing), 2 houses, 13 residents
- Total Coliform - variation in previous levels

DWMC-10 (Salinas), 1 house, 3 residents
- Total Coliform (cfu/100 mL) = 1 tank, 2 POE

DWMC-14 (Las Lomas), 1 house, 6 residents
- Total Coliform (cfu/100 mL) = <1 tank, <1 POE

Sites selected based on:
- Property owner interest in being a project partner & willingness to make site improvements
- High 123-TCP
- No previous E. coli detections

<table>
<thead>
<tr>
<th>Parameter</th>
<th>1,2,3-TCP</th>
<th>Non-Volatile Organic Carbon</th>
<th>Turbidity</th>
<th>Nitrate (as N)</th>
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<tbody>
<tr>
<td>Units</td>
<td>ug/L</td>
<td>mg/L</td>
<td>NTU</td>
<td>mg/L</td>
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<tr>
<td>DWMC-01</td>
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<td>1.4</td>
<td>0.29</td>
<td>64</td>
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<tr>
<td>DWMC-10</td>
<td>0.128</td>
<td>1.4</td>
<td>1.3</td>
<td>65.7</td>
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<tr>
<td>DWMC-14</td>
<td>0.114</td>
<td>0.3</td>
<td>0.11</td>
<td>10.2</td>
</tr>
</tbody>
</table>
Potential Sites for Future Installation

Next Steps:

- WHA/Culligan to complete pre-construction site visits at DWMC-01 and DWMC-14.
  - Determine whether 1 or 2 systems will be installed at DWMC-01
  - Identify high priority repairs to address potential contamination routes
- CWC to support high priority repairs using supplementary project funding prior to installation
- CWC to continue to test new wells and follow-up with potential candidates from past testing
  (We have identified ~3 additional new sites with 123-TCP between 0.008-0.014 ug/L.)

Any TAC feedback on potential sites for future installations?
Technical Advisory Committee Meeting Agenda

1. TAC Roll Call (Noon-12:10pm)
2. Discussion of TAC Feedback (12:10-12:20)
3. Updates on 3 installed systems (12:20-12:45)

4. Next installations
   - Opportunities for optimization, including system size (12:45-1:05)
   - Potential sites (1:05-1:15)
   - UV disinfection (1:15-1:25)

5. Review costs to date (1:25-1:45)
6. Exit Survey & Next Steps (1:45-2:00)
UV Treatment Options

UV Pure Hallett 500PN
NSF Class A Cert.
40 gal/min
For hardness up to 855 mg/L as CaCO₃
Indoor installation required
$2,550 (w/ 25% discount)

Softener

Viqua NSF Class A UV (~$2000)
UV Treatment Options

UV Pure Hallett 500PN
NSF Class A Cert.
40 gal/min
For hardness up to 855 mg/L as CaCO₃
Indoor installation required
$2,550 (w/ 25% discount)

Softener

Viqua NSF Class A UV (~$2000)

Under what conditions should UV treatment be used with POE GAC treatment?
1. **TAC Roll Call** (Noon-12:10pm)
2. **Discussion of TAC Feedback** (12:10-12:20)
3. **Updates on 3 installed systems** (12:20-12:45)
4. **Next installations**
   - Opportunities for optimization, including system size (12:45-1:05)
   - Potential sites (1:05-1:15)
   - UV disinfection (1:15-1:25)
5. **Review costs to date** (1:25-1:45)
6. **Exit Survey & Next Steps** (1:45-2:00)
1. Track labor and materials by the following categories
   a. Outreach & Education (CWC)
   b. Well Testing and Site Assessments
   c. Installation - Installation reports
   d. Monthly Field Monitoring - Monitoring reports
   e. Operation and Maintenance - Maintenance Log
   f. Project Management

2. Differentiate costs specific to this pilot project only and anticipated costs for future projects
## PHASE 2 CURRENT BILLING - BY SYSTEM

**Dates Covered by Invoice:** 07/01/2021 - 07/31/2021

<table>
<thead>
<tr>
<th>01:00</th>
<th>TASK 1: POE Treatment System Install (SFD)</th>
<th>2T-TAG Project Management</th>
<th>2T-TECH DMAC10</th>
<th>2T-TECH DMAC10c</th>
<th>2T-TECH DMAC6c</th>
<th>2T-TECH DMAC6c</th>
<th>2T-TECH DMAC1c</th>
<th>Current Billing</th>
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<td>01.30</td>
<td>Task 1C: Treatment System Construction Oversight/Subs</td>
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<tr>
<td>01.40</td>
<td>Task 1D: Installation Reporting</td>
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<td>02:00</td>
<td>TASK 2: Monthly Monitoring</td>
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<td>Task 2C: Monitoring Report, Coordination, FW Prep</td>
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<td>03:00</td>
<td>TASK 3: Operations &amp; Maintenance</td>
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<td>Task 3A: Backflushing</td>
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<td>03.20</td>
<td>Task 3B: Media Replacement</td>
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<tr>
<td>03.50</td>
<td>Task 3C: Other Maintenance &amp; Service Calls</td>
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<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
</tr>
<tr>
<td>03.40</td>
<td>Task 3D: Maintenance Reports &amp; Coord with CWC</td>
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<td>04:00</td>
<td>TASK 4: Project Management</td>
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<td>$ 291.25</td>
<td>$ 1,273.75</td>
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<td>04.10</td>
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<td>05:00</td>
<td>TASK 5: Additional Services</td>
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<td>05.10</td>
<td>Task 5A: Additional Backflushing</td>
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<td>05.20</td>
<td>Task 5B: Additional Media Replacement</td>
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<td>05.30</td>
<td>Task 5C: Media Disinfection</td>
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<tr>
<td>05.40</td>
<td>Task 5D: Treatment System Removal</td>
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<td>05.50</td>
<td>Task 5E: Other Additional Services</td>
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<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>$ 2,382.50</strong></td>
<td><strong>$ 845.00</strong></td>
<td><strong>$ 291.25</strong></td>
<td><strong>$ 1,273.75</strong></td>
<td><strong>$ -</strong></td>
<td><strong>$ -</strong></td>
<td><strong>$ -</strong></td>
</tr>
</tbody>
</table>
## Installation Costs - Budget vs. Actual (Phase 2A)

<table>
<thead>
<tr>
<th>Task 1: POE Treatment System Install</th>
<th>DWMC-04</th>
<th>DWMC-09</th>
<th>Cumulative to Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BUDGET</strong></td>
<td>$16,927</td>
<td>$16,927</td>
<td>$33,854</td>
</tr>
<tr>
<td>Subcontracts (Equipment, install and concrete pad)</td>
<td>$13,787</td>
<td>$13,787</td>
<td>$27,574</td>
</tr>
<tr>
<td>Task 1A: Pre-construction Site Visits</td>
<td>$800</td>
<td>$800</td>
<td>$1,600</td>
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<tr>
<td>Task 1B: Installation Coordination</td>
<td>$770</td>
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<td>$1,540</td>
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<tr>
<td>Task 1C: Treatment Sys Construct Oversight</td>
<td>$970</td>
<td>$970</td>
<td>$1,940</td>
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<td>Task 1D: Installation Reporting</td>
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<td>$600</td>
<td>$1,200</td>
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<td><strong>ACTUAL</strong></td>
<td>$14,277</td>
<td>$20,109</td>
<td>$34,386</td>
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<tr>
<td>Subcontracts (Equipment, install and concrete pad)</td>
<td>$12,436</td>
<td>$16,278</td>
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<td>Task 1A: Preliminary Site Visits/CEMS</td>
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<td>$709</td>
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<td>Task 1B: Installation Coordination</td>
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<td>$1,919</td>
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<tr>
<td>Task 1C: Treatment Sys Construct Oversight</td>
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<td>$1,466</td>
<td>$1,933</td>
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<td>Task 1D: Installation Reporting</td>
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<td>$768</td>
<td>$1,111</td>
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<tr>
<td><strong>Percent Over (+) or Under (-) Install Budget</strong></td>
<td>-16%</td>
<td>19%</td>
<td>2%</td>
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</table>
### Phase 2A Budgeted Costs per System

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Installation</strong></td>
<td></td>
</tr>
<tr>
<td>Treatment system equipment, installation and concrete pad <em>(Sub-contractors)</em></td>
<td>$16,927</td>
</tr>
<tr>
<td>Pre-construction site visit(s), installation coordination, construction oversight, and reporting <em>(WHA, 32 hours total)</em></td>
<td>$3,140</td>
</tr>
<tr>
<td><strong>2. Monthly monitoring (26 months)</strong></td>
<td></td>
</tr>
<tr>
<td>Travel, onsite time, monitoring reports/coordination, technical review <em>(WHA, 6.5 hrs/month)</em></td>
<td>$14,106</td>
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<tr>
<td>Total coliform, E. coli and HPC analysis <em>(CWC, includes discount)</em></td>
<td>$2,494</td>
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<tr>
<td>123-TCP analysis (monthly effluent and quarterly source) <em>(CWC, includes discount)</em></td>
<td>$2,660</td>
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<tr>
<td><strong>3. O&amp;M (26 months)</strong></td>
<td></td>
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<tr>
<td>1 Backflush, 1 media replacement, and on-call <em>(WHA, 1 hr per month, Year 1 covered through Culligan warranty)</em></td>
<td>$6,402</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$42,589</td>
</tr>
</tbody>
</table>

An additional $12,650 are budgeted for Weber Hayes’ project management costs for Phase 2.
Summary of Costs to Date

- Detailed invoicing and cost tracking methodology will provide valuable information for pilot project
  - Ability to compare actuals to budget for monitoring, O&M, and additional installations
- Installation actuals were similar to budget
  - Culligan held to contract amount
- Monitoring actuals will be compared to budget after 4-6 months of monitoring. Currently, similar to budget amount.
- Significant uncertainty around O&M costs for length of project

**TAC Feedback: Recommendations to improve our estimation of O&M costs or other project costs.**

(O&M Costs assume 1 backflush, 1 media changeout, and 1 hour per month of operator response for duration of 26 month contract. We plan to continue to monitor pressure drop and all the other parameters to better predict need / timing for O&M. DWMC-09 with a higher water use may help us predict future O&M for other sites.)
1. **TAC Roll Call** (Noon-12:10pm)
2. Discussion of TAC Feedback (12:10-12:20)
3. Updates on 3 installed systems (12:20-12:45)
4. Next installations
   - Opportunities for optimization, including system size (12:45-1:05)
   - Potential sites (1:05-1:15)
   - UV disinfection (1:15-1:25)
5. Review costs to date (1:25-1:45)
6. **Exit Survey & Next Steps** (1:45-2:00)
<table>
<thead>
<tr>
<th>Date Range</th>
<th>Details</th>
</tr>
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<tbody>
<tr>
<td>October 2020</td>
<td>Project goals and overview. Phase 1 scope of work. Review draft design of 12,3,-TCP POE treatment system. Review proposed monitoring protocols.</td>
</tr>
<tr>
<td>Nov/Dec 2020</td>
<td>Phase 2 scope of work</td>
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<tr>
<td>February 2021</td>
<td>Cost documentation methodology and Bacteria/Disinfection Follow-up</td>
</tr>
<tr>
<td>Sept 2021</td>
<td>Review monitoring results and costs from Phase 2A. Consider EBCT update for Phase 2B.</td>
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<tr>
<td>July 2022</td>
<td><strong>Review monitoring results, Draft recommendations for POE/POU treatment for private wells</strong></td>
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<tr>
<td>February 2023</td>
<td>Draft final report</td>
</tr>
<tr>
<td>June 2023</td>
<td>Plan to share final report and results to inform state-wide efforts</td>
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*Exact meeting dates to be determined*
Next Steps

1. Short exit survey (see chat box in zoom)

2. Next Meeting (Hold these two times)
   - July 12, Noon-2pm
   - July 28, Noon-2pm

Communitywatercenter.org

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Meeting Format: This meeting took place in the form of an online webinar where participants joined via video and audio. During part of the meeting, participants followed a live powerpoint presentation.

Meeting Minutes Format: The information covered during the presentation as well as the group discussion is captured in these notes. The powerpoint slides from the presentation during the meeting are attached and are referenced in the minutes. At times, minutes are paraphrased and abbreviated to try to capture the intent of what was said. A recording of the Technical Advisory Committee (TAC) meeting is also available upon request. Some sections of the discussion were rearranged to group similar items together.

Attendance:
Michael Adelman, Stantec Consulting Services, Inc.
Tamara Anderson, Central Coast Regional Water Quality Control Board
Kevin Berryhill, Provost & Pritchard Consulting Group
Brandon Bollinger, Community Water Center (CWC)
Tim Bushman, Culligan QWE Commercial Systems
Craig B. Drizin, Weber, Hayes and Associates (WHA)
John Erickson, CWC
Chad Fischer, State Water Board (DDW, SAFER Engagement Unit)
Michelle Frederick, State Water Board (DDW, SAFER Engagement Unit)
Kyle Graff, State Water Board (DDW, Monterey District)
Tarrah Henrie, California Water Service
Mayra Hernandez, CWC
Harrison Hucks, WHA
Mikel Irigoyen, CWC
Tori Klug, Stantec Consulting Services, Inc.
Dan Larkin, Self Help Enterprises (SHE)
Eugene Leung, State Water Board (DDW, Technical Operations)
Heather Lukacs, CWC
Cheryl Sandoval, Monterey County Environmental Health Bureau
Chad Seidel, Corona Environmental Consulting
Allie Sherris, University of Washington
I. Introduction and Roll Call
Heather Lukacs from Community Water Center (CWC) welcomed all attendees to the fifth TAC meeting for the 123-TCP Point-of-Entry (POE) Treatment Pilot Project. She introduced the CWC team members on the call, confirmed which TAC members were on the call, and reviewed the agenda for the meeting. Heather also reviewed the current, past and future TAC meeting topics.

II. Discussion of TAC Feedback
Heather Lukacs reviewed the TAC feedback from the past meeting and how it was addressed (see Slides 8-10), including:
- The installation of smaller GAC treatment systems for Phase 2B of the project, per TAC feedback during and after the last TAC meeting:
  - Three systems with one 3.6-cubic foot (cf) lead vessel and one 3.6-cf lag vessel for a total empty-bed contact time (EBCT) of 6 minutes (at 9 gal/min)
  - Three systems with one 2.0-cf lead vessel and one 2.0-cf lag vessel for a total EBCT of 3.4 minutes (at 9 gal/min)
- Peak flow monitoring at households prior to installation of the Phase 2B systems was recommended to inform system sizing. However, flow meters were not pre-installed due to high cost and difficulty securing a contractor to complete the work. Like the Phase 1 and 2A systems, the Phase 2B systems were designed based on a conservative 9 gal/min peak flow.
- To better understand the presence of total coliform bacteria, TAC members recommended sampling for bacteria at intermediate points in the treatment train and looking for surface water near well heads during rain events. However, this additional investigation was not done because bacteria levels have remained stable or reduced and do not appear to be increasing during treatment.
  - Discussion:
    - Eugene Leung asked whether coliform bacteria at the system effluent appeared to be mainly from coliform bacteria entering the system or from increases in the coliform counts during treatment.
    - Heather said that this question would be addressed later in the Project Updates portion of the meeting.
- CWC is looking for additional funding to pilot UV treatment as part of the pilot, based on the observation that the installation of UV treatment on POE systems appears to be a common practice in other states.
III. Project Updates

Installation

- Heather Lukacs described how CWC and WHA are continuing to use a phased approach for implementing the treatment systems (see Slide 12), partly due to the challenges of installing treatment systems in water systems with deficiencies that can lead to bacteria contamination and the time required to make repairs to these systems.
- Brandon Bollinger provided an update on installation of the Phase 2B systems (see Slides 13-17). Five Phase 2B systems have been installed and four of those systems are online. CWC and WHA are continuing to work with households to complete high priority repairs before the other two installed systems are put online. A sixth system will be installed when materials arrive.
- Harrison Hucks discussed the logistical aspects of the installations:
  - Acquiring the materials for the job was a challenge due to current supply chain issues.
  - Labor shortages were also an issue for system installation and water system repairs prior to installation. It was a challenge to find contractors to do the work in a timely manner.
  - Water system condition is always a challenge for these installations. Nevertheless, it is important to highlight that the Phase 1 and 2A systems are functioning well.
  - The smaller tanks for the Phase 2B systems are easier to install and less expensive. Monthly monitoring will provide insight into how these smaller systems perform, but he expects that they will perform just as well.
- Heather said that these challenges mentioned by Harrison have caused delays in the project overall and CWC has had to work closely with community partners to explain these project delays and encourage continued community partner participation.
- Eugene Leung asked if CWC and WHA have an inventory of the common problems with well systems like this and the costs of resolving them. This information will be valuable when budgeting and planning for future projects.
  - Harrison: There are two different costs 1) The repairs the water systems need prior to installation and 2) Operation and Maintenance (O&M) issues that have come up while the treatment systems are operating.
  - Heather:
    - For all of the Phase 2A and 2B systems, WHA is tracking their costs, including well repairs and O&M costs, in many specific categories, so

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1 At the TAC meeting, it was stated that three systems were online, but actually four of the systems were already online.
these costs will be itemized. We sent out the O&M log prior to this meeting which details what has been needed so far and associated costs.

- The repairs being done to water systems prior to installation are not holistic and complete. Two of the systems that were repaired still need additional work. The project team is prioritizing high priority repairs, but we cannot guarantee that bacteria issues will be resolved.

- Kevin Berryhill: Regarding temperature, in some areas, if you get a cold spell, freezing could cause pipes to break if the pipes are not protected from freezing. From the photos, it looks as though the pipes are not insulated. Are there plans to insulate these pipes?
  - Heather: The project team currently does not have plans to insulate the pipes but this is helpful information to consider.
  - Tim Bushman: Freezing is always a possibility, but typically you will not see it close to the coast. You may see it farther inland in the Salinas Valley. The majority of well pump systems are not using insulation. Culligan has tens of thousands of portable softeners installed, and they do not insulate them. But every five years or so you may get some freezes, if this occurs, Culligan responds and fixes a lot of leaks. Overall, freezing pipes are not a common occurrence.
  - Harrison: Agrees with Tim. The DWMC-21 owner/resident said that they will see freezing temperatures about a day or two per year, and so they have considered the possibility of exposed pipe freezing. It might make sense to consider enclosing the shade structure to keep the systems a couple degrees warmer during short periods of below freezing temperatures.

Source water quality

- Heather Lukacs presented data on the source water quality for the Phase 1, 2A and 2B sites, the number of people in each household, as well as the EBCT and total cumulative volume of water treated for the installed systems (see Slide 18).
  - Heather mentioned that while this pilot is providing some information on 123-TCP concentrations in the Monterey County area, the forthcoming Ag Order 4.0 sampling data for on-farm domestic wells will provide additional information.
  - Heather pointed out that we continue to see variability in 123-TCP concentrations in wells over time.
  - Eugene Leung asked to confirm that no one participating in the pilot is drinking the water due to persistently high nitrate levels.
    - Heather confirmed that no one is drinking the water and that all households are receiving bottled water. All households with installed systems have signed an implementation agreement including an acknowledgement of the presence of nitrate and that the water should
not be used for drinking or cooking. They also signed a form acknowledging the presence of or the potential for total coliform bacteria.

- Eugene: Sites DWMC14, DWMC15, and DWMC19 have nitrate levels below 27 mg/L, which is the level that point-of-use (POU) reverse osmosis (RO) treatment devices are certified to treat. In those cases he said the combination of RO and GAC treatment may be able to produce safe water. Culligan has treatment systems certified to treat nitrate at these levels, as well as booster pumps that can improve efficiency. With booster pumps, it may also be possible to treat the nitrate levels (29.3 mg/L) at DWMC-21. Installation of these combined RO/GAC systems as part of this pilot could be a good way to learn more about how these systems function in real life.

- Heather: In addition to nitrate, some of these systems also have total coliform bacteria contamination. CWC could consider including RO treatment in a funding proposal for follow-on work for this project. Given bacteria issues at some sites, UV treatment could also be considered. If community partners are willing, it would also be informative (as Eugene has suggested in previous TAC meetings) to install RO treatment for water that will not be used for drinking to see how it performs on the water quality in these wells.

- Eugene: In the Central Valley, some have complained that the RO systems were not producing enough water. Some were continuously treating water and then storing it in 5-gallon jugs so they would have more water for use. Piloting RO would also be a good way to look at the quantity of water produced.

- Heather asked if SHE or others have installed treatment systems with both GAC (for 123-TCP) and RO (for nitrate), or know of any examples of that being done.

  - Tim Bushman: Culligan does this all the time. Carbon treatment of all water entering the house would help the RO filters to last longer. Anytime Tim is installing treatment for nitrates, he includes a booster pump, which increases upstream pressure and ensures removal of as much nitrate as possible. They also include a permeate pump, which reduces the backpressure on the membrane. They have county-approved systems installed at sites with high levels
of nitrate (around 65 mg/L) and they are performing. They include pre and post TDS monitoring on these systems. RO treatment downstream of a whole-house water softener is also an example of a 2-stage process.

- Eugene: Softening can raise concerns about brine disposal and salt loading for the groundwater and the septic system.

- Tim: This is an example of other 2-stage systems, and could be used in a case where a softener is installed somewhere connected to municipal sewers.

- Heather: Has Corona Environmental Consulting looked at GAC and RO treatment combined? CWC was informed at the beginning of this pilot of the potential for GAC to slough nitrate downstream if there are temperature changes.

- Tarrah Henrie: A study by Corona Environmental Consulting found that temperature changes could cause nitrate to slough off of GAC, affecting the nitrate concentrations downstream. They were not looking at the use of RO downstream specifically, but this is a concern with GAC treatment in general if there are high levels of nitrate in the source water. This means that nitrate concentrations downstream of the GAC may be different from levels upstream and that there can be short-term spikes downstream. Chad Seidel may be able to provide more information based on more recent data from the Water Research Foundation.

- Eugene suggested providing shade over the systems to protect them from the sun and prevent water from being heated up in the black tanks, which could contribute to the nitrate sloughing problem.

- Harrison: The project team agrees and we are working with a contractor to install shade structures over the sunnier systems. The covers and tanks are UV rated, but nevertheless, the plumbing will last longer if it is in the shade.
IV. Summary of the performance of the three installed systems

John Erickson summarized monitoring data to date from the three installed systems:

- **123-TCP (Slide 20)**
  - All samples between the lead and lag vessels have had 123-TCP levels below the detection limit, so there is no evidence of breakthrough.
  - Source water concentrations continue to be variable, with some wells switching between being non-detect and above the MCL

- **Discussion**
  - Michael Adelman: He is pleased to see the 123-TCP results, which confirm what we expected: after a year of operation the 123-TCP should not break through even the first vessel. This data can give us more confidence in the lower-EBCT Phase 2B systems that are easier to implement.

- **Flow and pressure monitoring (Slides 21-27)**
  - Monthly flow through each system has been generally consistent over time, with higher flow through DWMC09 during the summer months, perhaps due to higher outdoor water use during those months. Because DWMC09 was installed to serve all households on the property, it treats water for both indoor and outdoor use prior to entering a storage tank.
  - Average flow per day correlates with the number of residents served by the treatment system.
  - Flow and pressure drop through each system during flushing prior to sampling (with a downstream hose bib wide open) have been generally consistent over time. This suggests that headloss through the systems has been relatively consistent, with no major blockage of the carbon or pre- and post-filters.
  - Pressure loss and flushing flow were higher for systems with higher upstream pressure.
  - Where pressure loss is occurring:
    - Most of the pressure loss is occurring through the flow restrictors.
    - Very little pressure drop is observed through the GAC vessels themselves.
    - WHA observed that the post filter was fouled with carbon fines that may have initially been flushed from the GAC when the systems were put into service, which likely also caused some additional pressure loss.
    - While there are some outliers in the pressure data, these trends are clear when all measurements are considered together.
  - Water passing through the Phase 2B systems will only have to pass through one flow restrictor. This is expected to result in lower pressure loss than in the Phase 1 and 2A systems, where flow has to pass through two flow restrictors in series.
- Higher-resolution (0.1 gallon) flow meters and data loggers will be installed on Phase 2B systems, which will allow for accurate measurement of peak flow while systems are in use.

- Discussion:
  - Eugene Leung commented on the very high pressure loss (55 psi) through DWMC09 during flushing.
    - Tim Bushman: This pressure drop was primarily due to the flow restrictors.
    - John: The particularly high pressure drop through DWMC09 was due to the high available upstream pressure and the fact that the system was discharging freely into a storage tank. This high available pressure produces more flow through the system and thus generates more pressure drop through the flow restrictors.
  - Harrison Hucks summarized residents’ comments regarding pressure loss.
    - DWMC09: Since the treatment system is upstream of the storage tank and booster pump, there has been no change in pressure.
    - DWMC02: Residents did not notice any pressure drop. They have had low pressure for a long time and are accustomed to it.
    - DWMC04: Residents noticed a small drop in pressure and that their shower is not as strong. Today, Harrison increased the well pump pressure range setting at that site from 40-60 psi to 43-63 psi and, based on an initial test of their taps, the residents thought that the pressure in the house had improved.
  - Tim Bushman: Pressure loss is related to the flows used in the house. Once the data loggers are installed, we will be able to see the actual flow rates. Culligan just installed a treatment system in a new 3-bedroom, 2-bathroom house with water saving features, and with all of the fixtures in the house open they were not able to get the total flow up to 7 gallons per minute.

- Total coliform and E. coli bacteria (Slides 28-29)
  - There have been no detections of E. coli upstream or downstream of the treatment systems.
  - Total coliform detections have been less frequent since Fall 2021 than they were earlier in 2021, perhaps due to longer operation or seasonality.
  - Phase 2B implementation agreements signed with residents and owners included a document to:
    - Recommend system repairs to reduce bacteria contamination risk
    - Provide information on total coliform bacteria
- Confirm that residents are drinking and cooking with bottled water
- Request consent to continue operation of systems if total coliform bacteria are detected

Discussion:
- Michele Frederick (via chat): We haven’t had much rain over the past few months. That may be the cause of the decrease in coliform.

- Heterotrophic plate count (HPC) bacteria (Slide 30)
  - HPC levels have been relatively stable and not that high.
- Summary: Overall, John said that the monthly monitoring of the systems continues to provide valuable information.

John Erickson and Harrison Hucks summarized operations and maintenance (O&M) activity to date for the three installed systems (Slide 31):
- John: There have been no major O&M issues to date, only minor issues such as leaks, GAC initially clogging a piping manifold at DWMC09 after installation, malfunctioning pressure gauges, and post filter replacement. CWC sent out the O&M log for this project prior to the meeting for reference. It has also been attached to these meeting minutes.

Discussion:
- Chad Fisher: Are the small O&M incidents being discovered during routine monitoring visits, are residents calling to report them, or is it a combination of both?
  - Harrison: About two thirds of the time Harrison will notice the issues during routine monthly visits. About one third of the time the homeowner will call Harrison or CWC to report an issue.
- Chad Fisher: Is Culligan visiting the sites monthly?
  - Harrison: WHA is visiting the sites monthly for monitoring and is able to do some small repairs, such as tightening a leaky flow meter or replacing a hose bib or fitting. For any other more significant repairs, Culligan will come out after WHA reports the issue.
  - Heather: It was important to CWC that residents and owners report O&M issues and have them resolved in a timely manner. The implementation agreement that CWC signs with the property owner and tenants includes an agreement to respond to any issues within a certain timeframe. Some of the community members knew WHA and/or Harrison before this project because WHA operates small water systems in the area. Others have gotten to know Harrison through the project and also communicate with CWC about other projects. Some O&M issues can be urgent, but most to date have not been that urgent.
- Eugene Leung: The data is really helpful. For instance, without the HPC and coliform trend data we would not know that HPC and coliform levels are staying relatively stable and that there is no explosive growth. Hopefully we will get more rain this fall and will see what happens to bacteria levels for the duration of the project.

- Eugene Leung: This project shows that the people factor is huge. It is very unique that Harrison and Tim work so well together and do such a good job. It is very hard to recreate that elsewhere in the state, especially a Culligan dealership being so responsive and working on these small systems. We need Tim to help train other water dealers throughout the state to work like he does. It also makes a difference that people know Harrison and he is local.

  - Heather Lukacs: At CWC, Brandon Bollinger primarily and also Mayra Hernandez and Shirley Robles coordinate closely with Harrison regarding monthly monitoring and community questions that come up. The community partners are key in this project, and communicating all of the information we have been discussing today with community partners is very important.

- Tarrah Henrie: Are CWC and WHA finding that the cost of time spent sampling and/or the analytical costs are similar to or more expensive than what was originally estimated? When thinking about implementing these systems, there are always questions about whether the state would cover these O&M and monitoring costs and how they would, since ongoing O&M for individuals is not normally feasible unless you do it through a centralized place like CWC.

  - Heather: WHA and CWC are tracking all of this information and it is forthcoming. We are interested to see, as we move to WHA sampling more systems per month, if that brings down the average time spent per system even though the systems are spread out. Will also need to account for CWC staff time (Brandon Bollinger and soon Mikel Irigoyen) for coordination and providing community partners with monthly updates on the water quality results. Reporting back these results is a key part of the process. One community partner who has fluctuating coliform levels always celebrates when the results come back negative.

Discussion of potential UV Treatment (Slides 33-34)

- Heather Lukacs summarized feedback regarding UV treatment from the previous TAC meeting:
  - Given precautions being taken in this pilot (bacteria monitoring and residents not drinking the water due to nitrate), the pilot can continue without UV treatment. However, UV treatment should be considered for future POE projects due to the difficulty of keeping bacteria out of wells and water systems.
- TAC members discussed pros and cons of using Class A and Class B UV treatment for this application, but no specific recommendation was made.
- There were also some concerns about the cost effectiveness of adding UV treatment.

Heather said that CWC is seeking additional funding to pilot UV treatment as part of this project and would like the TAC’s feedback on what type of treatment system to install. The UV treatment could be installed a) on water systems currently in line for POE treatment installation but held up waiting for well repairs intended to resolve bacteria issues and/or b) as part of future phases of the project.

- Tarrah Henrie: She has not worked with these smaller systems but has worked with larger ones and they are a challenge. It requires significant maintenance to keep the bulbs clean and change the bulbs out.
- Tim Bushman: Agrees that UV systems can be a challenge, especially if you have a Class A system that is frequently shutting down due to an automatic shutoff, leaving people without water until maintenance is performed.
- Eugene Leung: The University of Illinois offers private well classes for rural well owners (link shared in chat: https://www.isws.illinois.edu/groundwater-science/the-private-well-class ). This program can be found at www.privatewellclass.org and is funded by the EPA. If we can bring this to California, for folks to learn more about maintaining their wells rather than us throwing technology to solve problems, that may be a good option. This will help people to assess their well to make sure it is coliform negative. If it is coliform positive, Class B UV treatment could be considered. If a well is contaminated with E. coli, we have a bigger problem and should not throw technology at that problem, but rather should help them find an alternate source of water.

- Heather: CWC is aware of this program, has reviewed some of the online training materials, and has been in touch with them and requested training for community partners related to well disinfection and water quality sampling.
- Brandon: Some households in the project have installed water systems themselves and are knowledgeable of their systems. But major repairs like replacing a well head or tank can be cost-prohibitive. Some use intermittent chlorination and pour chlorine into the well each time total coliform is detected.

- Heather: Based on past experience, she has not seen many households on private wells chlorinating on their own on a continuous basis. An exception to this (which applies to at least
one household in this pilot) is very small water systems where Monterey County samples, detects bacteria, and recommends and provides guidance for chlorination.

- Brandon agrees this is the case. He has also seen some households reliant on private wells that are not regulated by Monterey County chlorinate because they have relatives who have received guidance from Monterey County.

- Heather: What types of UV systems have TAC members seen installed in other states? We are aware that this project area has hard water, which will affect UV treatment.

  - Eugene: In a lot of states using UV systems, like Minnesota, where UV systems are installed in summer cottages, wells are not very deep, are influenced by surface water, and the water is not as hard.

  - Kevin Berryhill: He does not have any specific experience, but has seen that typically other states are using Class B systems that look similar to the Viqua Class A system shown on Slide 34.

  - Tim Bushman: Small-scale UV systems are all pretty much identical, except for ones that have wipers to clean the bulbs, which are generally on larger commercial systems and are included on the Hallet system shown on Slide 34. With the wipers, you generally run into expense and complexity. Hallet systems have a brilliant design, but Culligan does not use them any more because they had too many service issues with them.

    - Culligan typically uses UV treatment for prophylactic protection. Not having a disinfectant residual is a drawback if you are actually trying to disinfect water.

  - Cheryl Sandoval: She does not see very much UV treatment in the County. A couple public systems might have some UV treatment for extra protection. They have one 60-connection surface water system with UV treatment, but she does not know which UV system they use.

  - Michelle Frederick: They may have had some small UV systems for surface water treatment in Mendocino County. She thinks they may have been Trojan UV. She could look at other small surface water systems to see if some have UV treatment.

    - Eugene: Viqua is a smaller household system that is made by Trojan.

  - Eugene Leung linked this New Hampshire Department of Environmental Services “Guidance on Addressing Bacteria Contamination in Small
Chad Fischer: UV treatment is very much on his radar, and he is happy to hear it may be included in potential future funding proposals. As his group has been workshopping the POU/POE white paper, UV treatment is coming up a lot. Imperial Irrigation District has some small-scale UV systems.

Heather requested that TAC members provide any additional feedback or information they have on UV after the meeting, including information on the systems Cheryl and Michelle mentioned in Monterey County and the state database. CWC will follow up further with the group and individual TAC members.

V. State Water Board POU/POE updates

- Heather summarized the update on NSF standards for POE treatment of 123-TCP that Eugene Leung provided at the last meeting (see Slide 36).
- Chad Fischer summarized DDW’s current efforts related to POU/POE treatment:
  - DDW has conducted four outreach workshops regarding POU/POE treatment, and he appreciates the participation of some TAC members in those efforts. The efforts have been really successful in highlighting issues, both issues that were already on DDW’s radar and issues that are new. Based on those workshops, DDW is preparing a white paper on the current state of POU/POE treatment and knowledge gaps. They are tentatively planning on holding a public workshop in late summer.
- Kevin Berryhill: Right now there is no regulatory framework for domestic water supplies. What is the master plan? Are we expecting that there will be regulatory guidance for private systems in the future; for instance, guidance that if you have coliform positive you need to put in UV, or guidance on minimum EBCT for GAC treatment?
  - Chad: The concept right now is to provide resources and guidance rather than regulation.
  - Michelle Frederick: This is a great question. If the TAC has feedback, it would be great to hear it. DDW is planning to conduct a survey of all the counties to see what their various policies are. They are trying to understand the breadth of these policies across the state for the white paper. The white paper may include recommendations around pilot studies, legislative updates that may be needed, and a categorization of issues around education, technology, or having enough
trained operators. The paper will also include significant POU/POE treatment case studies that DDW is aware of around the state. They are also trying to collect all the data for where POU/POE is being used across California, and put that on a map so people can understand what treatment is being used for and where.

- Kevin Berryhill: He appreciates the feedback. As often happens, there is a game of regulatory chicken, where everyone wants to do the right thing. The knee-jerk reaction tends to be to think conservatively, like putting UV treatment on if there is a total coliform positive, when that may or may not be a requirement or necessary. The sooner we get guidance, the better off everyone will be on this.

- Michelle: To be clear, it is outside DDW’s jurisdiction to regulate domestic wells. So they cannot do anything more than make recommendations.

- Heather: The SWB has significant funding to implement the HRTW across the state, and that includes projects for private wells. There could be guidance for implementing state-funded treatment programs for private wells in a way that ensures water quality. CWC sees this as a human rights issue and would like to see the state funds reach these hard-to-reach communities, and not just in a token way where a system is installed but not maintained, but where private well solutions are compared apples to apples with other alternatives like consolidation.

- Eugene: Going back to the NSF standards, there has been some fragmentation, with NSF having drinking water treatment unit standards and IAPMO coming out to work with the American Society of Sanitary Engineers to create some listing standards for some other treatment devices. NSF standards will apply to treatment systems built in a factory, but it appears they may not apply to custom systems built by a dealer. We may need to work with the California delegation for WQA to have certification of or guidelines for a custom-built solution. At the national level there really is not much interest in having a certification process for custom-built systems. If we can replicate the quality assurance that is being done by the TAC with this pilot, we may be able to keep going with the custom-built approach. But he is not sure whether the certification process will come to save the day.

- Heather: CWC would also like to see these treatment certification and registration issues included in the State Water Board white paper. How do we get from the SWB’s current residential treatment certification system program, which has gaps, to something that will allow for successful implementation of 123-TCP POE treatment? CWC started our first TAC meeting for this project discussing limitations of the SWB’s residential treatment system program and certification process that make it hard for CWC to recommend residential treatment in many cases. The current program does not meet the needs of some of the community members that CWC works with.
VI. CWC draft recommendations for POE/POU treatment for private wells

- Prior to the TAC meeting, Heather emailed TAC members a copy of the comments that CWC and other organizations submitted to the State Water Board in February 2022. CWC sees POU/POE treatment as an environmental justice and human right to water issue. We need to ensure safe, reliable, and affordable drinking water for all Californians.

VII. Next steps

- CWC will follow-up with the TAC about recommendations regarding specific UV treatment technologies that may be appropriate for this pilot.
- The next TAC meeting will be February 16, 2023 noon-2pm.

Short discussion after the meeting related to TAC members preference for when we host the next TAC meeting:

- Michael Adelman: If there are any indications of breakthrough through the first vessels, that would be a good time to check in with TAC members. It will be interesting to look at the shape of the breakthrough curve. If the 123-TCP gradually ramps up slowly, that might mean the mass transfer zone has a significant length.
  - Heather: Current funding ends July 2023 and a final report will be provided by then based on results to date. Hopefully, CWC will secure funding to continue the project, which would provide more information on time to breakthrough if breakthrough does not occur by July 2023.
- Eugene Leung asked if it would be good to have a quick one-hour check-in in the fall to discuss updated water quality data.
  - Heather said that by the time CWC receives data from the lab and it is uploaded into our monitoring log, the February meeting would be a good time to see the data from the Fall (through November). CWC can also send out an update in late November with the Summer data, if the TAC is interested in seeing that in advance.
“Every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes.”
Technical Advisory Committee Meeting Agenda

1. TAC Roll Call (12:30-12:40)
2. Discussion of TAC Feedback (12:40-12:50)
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4. Summary of performance (3 installed systems) (1:05-1:45)
5. State Water Board POU/POE updates (1:45-2:00)
6. CWC Draft recommendations for POE/POU treatment for private wells (2:00-2:15)
7. Next Steps (2:15-2:30)
<table>
<thead>
<tr>
<th>Name</th>
<th>Company / Agency / Organization</th>
<th>Title / Position</th>
</tr>
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<tbody>
<tr>
<td>Michael Adelman, P.E.</td>
<td>Stantec Consulting Services, Inc.</td>
<td>Environmental Engineer</td>
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<tr>
<td>Mark Bartson (retired)</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Program Management Branch Technical Operations</td>
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<tr>
<td>Kevin Berryhill, P.E.</td>
<td>Provost &amp; Pritchard Consulting Group</td>
<td>Principal Engineer</td>
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<tr>
<td>Paul Boyer (retired)</td>
<td>Self-Help Enterprises</td>
<td>Program Director, Community Development</td>
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<td>Guadalupe Gonzalez</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Safe and Affordable Funding for Equity and Resilience</td>
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<td>Kyle Graff</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Northern California Drinking Water Field Operations</td>
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<tr>
<td>Tarrah Henrie</td>
<td>California Water Service (CalWater)</td>
<td>Manager, Water Quality</td>
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<tr>
<td>Chad Seidel, PhD, PE</td>
<td>Corona Environmental Consulting</td>
<td>President</td>
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<td>Alex Huang, P.G.</td>
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<td>Office of Sustainable Water Solutions Branch</td>
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<td>Brian Kidwell, P.E.</td>
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<td>Tori Klug, P.E.</td>
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<td>Eugene Leung</td>
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<td>Program Management Branch Technical Operations</td>
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<td>Edwin B. (Ned) Lofink, P.E.</td>
<td>Axiom Engineers</td>
<td>Senior Project Engineer</td>
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<tr>
<td>Cheryl Sandoval</td>
<td>Monterey County</td>
<td>Supervisor, Drinking Water Protection Services</td>
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<td>Laura Satterlee</td>
<td>Self-Help Enterprises</td>
<td>Water Division Manager</td>
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<tr>
<td>Allie Sherris</td>
<td>Univ. of Washington (Stanford University)</td>
<td>Postdoctoral Researcher, Public Health</td>
</tr>
</tbody>
</table>
* Craig Drizin and Harrison Hucks from Weber, Hayes & Associates and Tim Bushman from Culligan are consultants contracted for implementation of this project and participate in TAC meetings to provide information from the TAC and to consider input from the TAC.

We recognize and appreciate the participation of all TAC members as well as additional staff from Self Help Enterprises who have attended our TAC meetings including Cecilia Vela, Marliez Diaz, and Dan Larkin.

In addition to those listed, CWC provides all TAC information to additional State Water Board staff who supervise and/or support TAC members: Michelle Frederick, Matthew Pavelchik, Stefan Cajina, and Karen Nishimoto.

We may also be joined today by:
- Tamara Anderson, Central Coast Regional Water Quality Control Board, overseeing project funding
- Jose Robledo, SWB DDW overseeing a water system that is implementing a 123-TCP POE pilot project
- Vanessa Soto, SWB Office of Public Participation
- Chad Fischer, SWB DDW SAFER Engagement Unit, leading POU/POE Pilot White Paper effort
<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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</thead>
<tbody>
<tr>
<td>October 2020</td>
<td>Project goals and overview. Phase 1 scope of work. Review draft design of 12,3,-TCP POE treatment system. Review proposed monitoring protocols.</td>
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<tr>
<td>Nov/Dec 2020</td>
<td>Phase 2 scope of work</td>
</tr>
<tr>
<td>February 2021</td>
<td>Cost documentation methodology and Bacteria/Disinfection Follow-up</td>
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<tr>
<td>Sept 2021</td>
<td>Review monitoring results and costs from Phase 2A. Consider EBCT update for Phase 2B.</td>
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<tr>
<td>May 2022</td>
<td>Review monitoring results, Draft recommendations for POE/POU treatment for private wells</td>
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<tr>
<td>February 2023</td>
<td>Draft final report</td>
</tr>
<tr>
<td>June 2023</td>
<td>Plan to share final report and results to inform state-wide efforts</td>
</tr>
</tbody>
</table>

*Exact meeting dates to be determined*
Technical Advisory Committee Meeting Agenda

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Empty-Bed Contact Time of Installed Systems (at 9 gal/min peak flow)

- Phase 1 and 2A Design: 10 min lead vessel EBCT + 10 min lag vessel (3 systems total)
  - DWMC02, DWMC04, DWMC09

- Phase 2B Designs
  - 3 min lead vessel EBCT + 3 min lag vessel EBCT (3 systems total @3.6 cf carbon per vessel)
  - 1.7 min lead vessel EBCT + 1.7 min lag vessel EBCT (3 systems total @2.0 cf carbon per vessel)

Other Feedback from Sept. 2021 TAC Meeting

- To inform system size for Phase 2B, monitor peak household flow rate prior to system installation by opening multiple plumbing fixtures and metering flow
  - Did not measure pre-installation peak flow due to the high cost to pre-install flow meter and difficulty to secure a contractor to complete the work
  - Sized Phase 2B systems based on a lower EBCT, still calculated at conservative 9 gal/min peak flow, and we will monitor the flow rate after installation
Other Feedback Related to Indicator Bacteria

● If bacteria levels continue to increase during treatment, consider:
  ○ Sampling for bacteria at intermediate locations to determine where increase is taking place
  ○ Looking for surface water near wells and sampling following rain events

■ Bacteria levels have reduced and do not appear to be increasing substantially during treatment

● Due to difficulty in keeping bacteria out of shallow wells and treatment systems, consider adding UV disinfection to mitigate bacteria issues.
  ○ “For other states that have been using POE systems for longer, the best practice seems to be putting in UV systems as a standard practice. You may not have the budget to install UV as part of this project, but long-term that is something that probably needs to be looked at.”

■ CWC agrees and is looking for additional funding for UV and high priority well repairs as part of future phases of this project
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Phased Implementation for Adaptive Approach

**Phase 1**
- Site assessments
- Treatment system design
- Install 1 system
- Monitor 4 months

*Complete*

**Phase 2A**
- 4 Preconstruction visits ✓
- Install 2 systems serving 3 households using Phase 1 design ✓
  - 20 min EBCT @ 9gpm
- 26 months monitoring and O&M for Phase 1 & 2A systems
- Track installation, monitoring & O&M costs

*In Progress*

**Phase 2B**
- Install 6 more systems
  - 3 Systems - 3.6 cf per vessel (6.0 min EBCT @ 9gpm)
  - 3 Systems - 2.0 cf per vessel (3.3 min EBCT @ 9gpm)
- Monitoring and O&M for Phase 2B systems through June 2023

*In Progress*
Project Updates

- **Phase 1 & 2A:** Three systems have been successfully removing 123-TCP to below the detection limit from June 2021 through last monthly monitoring

- **Phase 2B:**
  - Five additional treatment systems were installed in April and May 2022*
  - One more system will be installed in the coming weeks

- No significant O&M incidents to date

- More information to follow on bacteria

* 2 are installed but not yet in operation pending high priority well repair

CWC Team Member Shirley Robles pictured next to the Phase 2B treatment system installed at DWMC-19 located near Las Lomas in north Monterey County. This treatment system is the 3.6 cubic foot size.
Phase 1 and 2A Systems

DWMC-04
Moss Landing

DWMC-09
Salinas

DWMC-02
Moss Landing

Systems contain 6 cubic feet (cf) of carbon per vessel or 24 cf total for 20 min EBCT total @ 9gpm.
Phase 2B Systems

**DWMC-14**
Royal Oaks
2 x 3.6 cubic foot vessel

**DWMC-19**
Royal Oaks
2 x 3.6 cubic foot vessel

**DWMC-21**
Moss Landing
2 x 2.0 cubic foot vessels
Treatment System Locations in North Monterey County (Map shows 7 of 9 total systems)
Treatment System Locations Near Salinas
(Map shows 2 of 9 total systems)
## Water Quality Summary and Project Updates for Households Participating in this Study

<table>
<thead>
<tr>
<th>No.</th>
<th>Site ID (with Report Link)</th>
<th># of people in each household</th>
<th>Empty Contact Time of Treatment System @ 9gpm (minutes)</th>
<th>Total Cumulative Volume of Water Treated (Gallons) 3/16/22</th>
<th>Sample Date</th>
<th>1,2,3-TCP MCL</th>
<th>Nitrate (as N)</th>
<th>Turbidity</th>
<th>Non-Volatile Organic Carbon</th>
<th>Iron</th>
<th>Manganese</th>
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<td>7/1/21</td>
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<td>ND</td>
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</tr>
</tbody>
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7. Next Steps (2:15-2:30)
Monitoring: 123-TCP

All samples between lead and lag vessels resulted below the detection limit (<0.001 - <0.0006)

MCL = 0.005 ug/L
Avg. daily volume treated each monitoring period
(*totalizing flow meter*)

![Graph showing volume treated over time for DWMC-02, DWMC-04, and DWMC-09 wells.]

- DWMC-02 Avg: 187 gal/day
- DWMC-04 Avg: 120 gal/day
- DWMC-09 Avg: 577 gal/day
## Monitoring: Flow (totalizing meter)

<table>
<thead>
<tr>
<th>System</th>
<th>No. of Households</th>
<th>No. of Residents</th>
<th>Average gal/day</th>
<th>Average gal/day /person</th>
<th>Average gal/min</th>
<th>Total Gallons Treated as of 4/20/2022</th>
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<tbody>
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</table>
Monitoring: Flow and Pressure during Flush

(Preliminary Data)
Monitoring: Flow and Pressure during Flush

<table>
<thead>
<tr>
<th>System</th>
<th>Average Upstream Pressure (psi)</th>
<th>Average Downstream Pressure (psi)</th>
<th>Average Pressure Loss (psi)</th>
<th>Average Flushing Flow (gal/min)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>21</td>
<td>12</td>
<td>9</td>
<td>4.7</td>
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<tr>
<td>DWMC-04</td>
<td>42</td>
<td>22</td>
<td>21</td>
<td>6.9</td>
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<td>DWMC-09</td>
<td>55</td>
<td>0</td>
<td>55</td>
<td>7.8</td>
</tr>
</tbody>
</table>

- Pressure loss and flushing flow are higher for systems with higher upstream pressure.
- Flushing flow may be an indicator of peak flow through the system, unless flushing hose bib is limiting flushing flow.
- Installing higher-resolution (0.1 gal) flow meters and dataloggers on Phase 2B systems to better understand peak flow during use.
Monitoring: Pressure Losses during Flushing

(Preliminary Data)

- Data shown are based on pressure gauge readings during monitoring visits 6/2021-4/2022.
- Data from some pressure gauges known to have been faulty have been removed. However, additional cleaning and validation of the data is needed to determine the explanation for outliers.
Data shown are based on pressure gauge readings during monitoring visits 11/2021-4/2022. Early months of data were removed due to malfunctioning pressure gauges.

Data from some pressure gauges known to have been faulty have been removed. However, additional cleaning and validation of the data is needed to determine the explanation for outliers.
Monitoring: Pressure Losses during Flushing

(Data shown are based on pressure gauge readings during monitoring visits 10/2021-4/2022. Early months of data were removed due to malfunctioning pressure gauges. Data from some pressure gauges known to have been faulty have been removed. However, additional cleaning and validation of the data is needed to determine the explanation for outliers.)
Monitoring: Total Coliform and E. coli

Disinfected Distribution System with Chlorine and GAC with Caustic

Detection Limit = 1 MPN/100 mL

All samples (in and out) for E. coli have been non-detect

DWMC-02 Offline (Tank Repairs)
Monitoring: Total Coliform and E. coli

- No E. coli detected in influent or effluent of systems
- Total coliform in 2 system effluents early in study, at levels higher than influent
- Total coliform positives becoming less frequent, perhaps due to longer operation or seasonality
- Regardless of whether coliform bacteria have been detected, Phase 2B implementation agreements signed with residents and owners:
  - Recommend any water system repairs to reduce bacteria contamination risk
  - Providing information on total coliform bacteria
  - Confirm that residents are drinking and cooking with bottled water
  - Request consent to continue operation of system if total coliform bacteria are detected
Monitoring: HPC Bacteria

Highest level measured: 1,200 MPN/100 mL

Detection Limit = 5 MPN/mL
Operations and Maintenance

- Minor operations and maintenance activity to date:
  - Repair leak in treatment system piping at DWMC-02 (post-installation)
  - GAC clogging manifold at DWMC-09 (post-installation)
  - Replace malfunctioning pressure gauges
  - Replace leaky sampling hose bibs
  - Replace leaky ‘O’ Ring on DWMC-09 tank header
  - Replace post filters on all three systems (suspected fouling with carbon fines)
Monitoring and O&M Summary

- All systems successfully removing 123-TCP to below the detection limit
- Peak flow through system appears to be limited by supply pressure. High-resolution flow monitoring will provide more insight.
- Bacteria:
  - Total coliform positives less frequent. No E. coli detected
  - HPC concentrations decreasing or stable over time.
- No significant O&M incidents to date
- Monthly monitoring continues to provide valuable information

Any additional feedback related to indicator bacteria or optimization of monitoring?
Due to difficulty in keeping bacteria out of shallow wells and treatment systems, consider adding UV disinfection to mitigate bacteria issues.
- “For other states that have been using POE systems for longer, the best practice seems to be putting in UV systems as a standard practice. You may not have the budget to install UV as part of this project, but long-term that is something that probably needs to be looked at.”
  - CWC agrees and is looking for additional funding for UV and high priority well repairs as part of future phases of this project

Deciding between Class A and Class B UV treatment systems is a touch choice
- Class B systems used in other states due to lower power requirements, assumes water is already safe and installed as a precaution
- Class A intended for water that may not be bacteriologically safe or is E.coli positive

Concerns about cost effectiveness of adding UV treatment
Which UV Treatment system should we include in proposal for future funding?

UV Pure Hallett 500PN
NSF Class A Cert.
40 gal/min
For hardness up to 855 mg/L as CaCO$_3$
Indoor installation required
$2,550 (w/ 25% discount)

Softener

Viqua NSF Class A UV (~$2000)

Source water: Hardness 240-1,000 mg/L as CaCO$_3$; Iron up to 0.14 mg/L
1. TAC Roll Call (12:30-12:40)
2. Discussion of TAC Feedback (12:40-12:50)
3. Project Updates (12:50-1:05)
4. Summary of performance (3 installed systems) (1:05-1:45)
5. State Water Board POU/POE updates (1:45-2:00)
6. CWC Draft recommendations for POE/POU treatment for private wells (2:00-2:15)
7. Next Steps (2:15-2:30)
State Water Board POU/POE Updates

- At last TAC meeting in September 2021, Eugene Leung provided an update on NSF standards for POE treatment:
  - A standard for certifying POU- and POE-scale 123-TCP treatment devices has now been added under the NSF 53 standards to treat water so it complies with the California MCL.
  - It will now take some time for manufacturers to put in requests for certification of their products and for their products to get certified.
  - Three certifiers, IAPMO, NSF, and WQA are working to have some scaling factors.
  - Working to determine whether or not the replacement of carbon is within the scope of the NSF drinking water treatment unit standard.
Technical Advisory Committee Meeting Agenda

1. TAC Roll Call (12:30-12:40)
2. Discussion of TAC Feedback (12:40-12:50)
3. Project Updates (12:50-1:05)
4. Summary of performance (3 installed systems) (1:05-1:45)
5. State Water Board POU/POE updates (1:45-2:00)
6. CWC Draft recommendations for POE/POU treatment for private wells (2:00-2:15)
7. Next Steps (2:15-2:30)
POU/POE Treatment is an Environmental Justice and Human Rights issue. All solutions need to consider:

- Reliability
- Exposure to contaminants from other taps
- Possible exposure if system fails (without warning)
- Increased cost of POU/POE treatment paid for by customers/households
- Burden of determining whether water is safe placed on households
- Community trust and community choice

See CWC, LCJA, and CWA’s comments on the State Water Board POU/POE White Paper (Feb 2022) for more information. These were sent to the TAC separately.
CWC Draft Recommendations for POU/POE Treatment for Private Domestic Wells

- Need critical evaluation and framework to determine the conditions under which POU/POE treatment is appropriate and feasible
  - Total coliform and e.coli
  - Need state certified device
  - High risk of acute contaminants like nitrate and perchlorate
- SWB White Paper should provide guidance for POU/POE treatment on private wells. We recommend:
  - Source water monitoring to determine feasibility
  - POE treatment for 123-TCP or other contaminants to address not consumptive routes of exposure
  - Automatic shut off if systems stop working, and mechanical warning device
  - Monitoring frequency that matches risk posed by contaminants
  - O&M funding to ensure system function, and evaluate tradeoff between capital and O&M

See CWC, LCJA, and CWA’s comments on the State Water Board POU/POE White Paper (Feb 2022) for more information. These were sent to the TAC separately.
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## Technical Advisory Committee Meeting Schedule

**1,2,3-TCP Residential Treatment Pilot Project in Northern Monterey County Area**

<table>
<thead>
<tr>
<th>Month</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 2020</td>
<td>Project goals and overview. Phase 1 scope of work. Review draft design of 12,3,-TCP POE treatment system. Review proposed monitoring protocols.</td>
</tr>
<tr>
<td>Nov/Dec 2020</td>
<td>Phase 2 scope of work</td>
</tr>
<tr>
<td>February 2021</td>
<td>Cost documentation methodology and Bacteria/Disinfection Follow-up</td>
</tr>
<tr>
<td>Sept 2021</td>
<td>Review monitoring results and costs from Phase 2A. Consider EBCT update for Phase 2B.</td>
</tr>
<tr>
<td>May 2022</td>
<td>Review monitoring results, Draft recommendations for POE/POU treatment for private wells</td>
</tr>
<tr>
<td>February 2023</td>
<td><strong>Draft final report</strong></td>
</tr>
<tr>
<td>June 2023</td>
<td>Plan to share final report and results to inform state-wide efforts</td>
</tr>
</tbody>
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*Exact meeting dates to be determined*
Next Steps

● CWC to continue support high priority repairs using supplementary project funding prior to installation
● CWC to install final Phase 2B system and put two additional systems online
● CWC to apply for funding to continue O&M and monitoring after June 2023 and for other key improvements to this pilot project.
● CWC to continue to test new wells and follow-up with potential candidates from past testing
Next Steps

1. Short exit survey (see chat box in zoom)

2. Next Meeting (Hold these two times)
   - Th. Feb 16, Noon-2pm
   - Tu. Feb 21, Noon-2pm

Communitywatercenter.org
Brandon.Bollinger@communitywatercenter.org
Mikel.Irigoyen@communitywatercenter.org
John.Erickson@communitywatercenter.org
123-TCP Treatment Pilot Project for DAC Households in the Northern Monterey County Area
Technical Advisory Committee
February 16, 2023 Meeting Minutes
12:30-2:30 PM

Meeting Format: This meeting took place in the form of an online webinar where participants joined via video and audio. During part of the meeting, participants followed a live PowerPoint presentation.

Meeting Minutes Format: The information covered during the presentation as well as the group discussion is captured in these notes. The PowerPoint slides from the presentation during the meeting are attached and are referenced in the minutes. At times, minutes are paraphrased and abbreviated to capture the intent of what was said. A recording of the Technical Advisory Committee (TAC) meeting is also available upon request. Some sections of the discussion were rearranged to group similar items together.

Attendance:
Michael Adelman, Stantec Consulting Services, Inc.
Tamara Anderson, Central Coast Regional Water Quality Control Board
Brandon Bollinger, CWC
Tim Bushman, Culligan QWE Commercial Systems
Craig B. Drizin, Weber Hayes, and Associates (WHA)
John Erickson, CWC
Chad Fischer, SWB (DDW, SAFER Engagement Unit)
Kyle Graff, State Water Board (DDW, Monterey District)
Tarrah Henrie, California Water Service
Mayra Hernandez, CWC
Harrison Hucks, WHA
Mikel Irigoyen, CWC
Tori Klug, Stantec Consulting Services, Inc.
Eugene Leung, State Water Board (DDW, Technical Operations)
David Okita, CWC
Karmina Padgett, State Water Board (DFA)
Roxanne Reimer, CWC
Cheryl Sandoval, Monterey County Environmental Health Bureau
Chad Seidel, Corona Environmental Consulting
Allie Sherris, Stanford University
David Zensius, State Water Board (DDW)
I. Introduction and Roll Call

John Erickson from Community Water Center (CWC) welcomed all attendees to the sixth TAC meeting for the 123-TCP Point-of-Entry (POE) Treatment Pilot Project. He introduced the CWC team members on the call, confirmed which TAC members were on the call, and reviewed the agenda for the meeting. John also reviewed the current, past, and future TAC meeting topics.

II. Discussion of TAC Feedback

John Erickson reviewed the TAC feedback from the last meeting and how it was addressed (see Slides 8-9), including:

- The installation of shade structures for systems that receive large amounts of sunlight per feedback from the TAC last meeting about how temperature is an important factor to consider for nitrate sludging and microbial growth.
  - Shade structures were installed at DWMC01, DWMC09, and DWMC15.
  - Benefits include longer-lasting plumbing and better temperature regulation to reduce potential for microbial growth and nitrate sludging.

- Discussion:
  - Chad Seidel said it is great to see shade structures, which are especially important for equipment longevity. He will be interested to see how they impact temperature and nitrate.
  - Feedback from Eugene Leung in the last TAC meeting that having an inventory of common problems with wells/water systems and the observed costs of resolving them will have value when budgeting and planning for future projects
    - John said that CWC plans to include a list of repairs and associated cost in the technical appendix of the final report.
  - Observation from TAC members in the last meeting regarding lack of rain and how that may correlate with lower total coliform levels.
    - John said this would be discussed in the System Performance portion of the meeting, including looking at how the extensive rains in December/January affected coliform levels.

III. Project and System Performance Updates

Mikel Irigoyen presented Project Updates (Slides 11-18):

- CWC and WHA are continuing to use a phased approach for implementing systems (Slide 11). Phase 1 is complete; Phase 2A installations are complete with monitoring and O&M in progress; and Phase 2B is in progress with 6 systems installed, 4 of them online and
O&M in progress. CWC is looking to install multiple additional Phase 2B systems.

- DWMC14 & DWMC19 were taken offline in mid-June shortly after installation due to E.coli detections (1 - 3 MPN/100mL) downstream of treatment systems (Slide 13). WHA and Culligan replaced the carbon in both systems, disinfected the tanks and all plumbing components, and resampled the system effluents. Both system effluents were non-detect for E.coli. The E. coli could have been from minor contamination from upstream of the systems or during installation.
  - Next steps taken or being taken for each system are:
    - DWMC14: A water system inspection did not identify likely contamination routes. System was put back online 11/30/22 and has been non-detect for E. coli in subsequent sampling events.
    - DWMC19: Well repairs are needed to eliminate contamination routes and address total coliform contamination prior to putting the system back online.

- Discussion:
  - Eugene Leung: At DWMC14, did you collect a source sample to check that E. coli was present at the well? E. coli would not normally just show up within a treatment system.
  - Harrison Hucks: I collected a source sample downstream of the tank at DWMC14, which is the closest sample tap to the well, since there is no tap at the well. The post-tank sample was Non-Detect. The E. coli contamination could be from two different potential routes:
    - Coincidental contamination in the source water that was not detected in source water sampling.
    - Contamination during installation, despite Culligan installation team’s efforts to avoid contamination by laying down plastic sheets and disinfecting pipes. The presence of chickens at both sites may have contributed to contamination.
  - Eugene: Did you collect a confirmation sample to confirm E. coli contamination?
    - Harrison: Confirmation samples were collected. [CWC confirmed after the meeting that DWMC14 samples downstream of treatment were positive for E. coli on 6/16/2022 and 6/29/2022, and DWMC19 samples downstream of treatment were positive for E. coli on 6/15/2022 and 6/29/2022.]
  - Eugene: In the future it would be helpful to have a sample tap right at the well.
- E. coli (1 MPN/100 mL) was detected both upstream and downstream of the DWMC21 treatment system during a routine monitoring visit on 12/21/2022 and homeowners were notified immediately (Slide 14). Confirmation samples were taken upstream and downstream of the treatment system on 12/30/22 but were lost by the lab. Upstream and downstream confirmation samples were re-collected on 1/4/2023 and again on 1/12/2023. E. coli was not detected in any of the upstream or downstream confirmation samples. The initial E. coli detection may have been a false positive and the system remains online.

- Well repairs are planned to eliminate identified contamination routes at DWMC15 and DWMC19 (Slide 15). DWMC15 is installed but has yet to be put online due to the presence of total coliform bacteria and potential contamination routes. Limited well contract availability has delayed progress on these repairs.

- A successful well repair was completed at DWMC-01 (Slide 16), where total coliform levels were previously very high, and previous disinfection attempts were unsuccessful. As shown in the pictures on Slide 16, the actual well casing was smaller than and within the well head. Previous disinfection attempts were unsuccessful, likely because chlorine solution poured through a hole in the well head cap did not actually enter the well. Repairs included lifting the well head to disinfect, replacing the existing cement pad, and installing a new surface seal. Total coliform bacteria have not been detected after repairs and the system has been online since 11/17/2022.

  - Harrison: This is a really good example of what we have been seeing in the pilot: In terms of 123-TCP concentrations downstream of the lead tanks we have been really successful, but bacteria and distribution issues have been a major hurdle. DWMC01 is a great example of how spending the money, figuring out what the problem is, and hiring the right people to get the work done can be successful. You create a sealed, tight distribution system, and we haven’t detected coliform since this repair. With these older systems, you want to get treatment, but to do that you also have to address the distribution system. It is a dual battle.

- The project team is considering four additional sites for potential additional installations (Slides 17-18), three in Royal Oaks and one in Aromas. WHA has conducted site assessments at all four sites and is finalizing the reports from those assessments.
  - DWMC14B is served by the same well as DWMC14.
  - DWMC25 would be serving two households and the project team is considering whether it would be best to install one or two treatment systems there. Total coliform has been detected at DWMC25 and disinfection or water system repairs may be required prior to treatment system installation.

*John Erickson provided an update on System Performance (Slides 19-25)*
- **123-TCP (Slide 19)**
  - All samples collected between lead and lag GAC vessels have been non-detect for 123-TCP. It is good that the systems have performed well this long without GAC replacement, but this also means we need to continue the project for longer to know how long the different sized systems will last until breakthrough.
  - Source water 123-TCP concentrations have continued to vary, with some wells fluctuating between above the MCL and non-detect. (Slide 19)

- **Total Coliform**
  - Phase 1 and 2A systems (Slide 20)
    - No recent total coliform detections downstream of the treatment systems.
    - Some periodic detections of low levels of total coliform bacteria upstream of DWMC02 & 04.
    - There was a small uptick in total coliform levels for DWMC-02 around the most recent rain events in November, December and January, but nothing big. It would be interesting to look at past rain events and compare how coliform levels changed then.
  - No E. coli detections
  - Phase 2B systems (Slide 21).
    - Some higher levels of total coliform, especially in DWMC21 and DWMC10.
      - One DWMC21 sample with high levels of total coliform was the same sample where E. coli was detected. The high levels of total coliform may also have been due to sampling error. The follow-up samples collected had lower total coliform levels.
      - There did appear to be an increase in total coliform levels for these systems associated with recent rain events.

- **Heterotrophic plate count (HPC) bacteria (Slides 22-23)**
  - The influent and effluent HPC levels generally follow similar trends and we are not seeing any large amounts of growth.
  - DWMC21 has higher HPC levels coming from the well compared to other systems.

- **Discussion:**
  - Chad Seidel: In addition to 123-TCP have you been tracking other indicators of GAC utilization, such as TOC UV absorbance breakthrough?
    - John: We have not had that in our monitoring plan, but could consider adding it. Could monitoring for this quarterly provide an early indicator of potential 123-TCP breakthrough?
- Chad: Source water TOC is a bigger driver for 123-TCP breakthrough than source water 123-TCP concentration is, because TOC concentrations are much higher than 123-TCP concentrations. TOC breakthrough usually precedes TCP, but more analysis of data on this topic is needed. UV absorbance as a surrogate for TCP breakthrough is typically a pretty fast, low cost way to help schedule carbon replacement, particularly in cases where the time to go out and do the replacement is a large part of the cost.
- John: Can UV absorbance be measured in the field?
- Chad: It can be measured in the field to some extent with more sophisticated colorimetric methods, but it is more typically measured in a local lab with a spectrometer. The sample does not need to be preserved. Larger water utilities typically measure UV absorbance with something like the Hach DR6000 spectrophotometer.
- John: This sounds like something to consider, if not as part of the last 6 months of the SEP project, maybe as we look to expand this project for three more years.
- Tarrah Henrie: You may want to do an initial round of sampling for TOC. If you do not detect TOC in that initial round, you may not want to do this quarterly, since you will probably continue to see non-detect. A lot of groundwater wells in California have very minimal amounts of TOC, and many labs still test in the mg/L range which will not detect the very minimal amounts actually present.
- Chad: You need a lab that will report TOC at levels below 1 mg/L. Detection at 0.3 mg/L is usually achievable. Most wells in California have less than one mg/L TOC.
- John: Some of the wells in the pilot did have somewhat significant levels of TOC, but it sounds like it would be important to be able to detect the lower levels downstream of treatment.
- Tarrah: You need to look at both influent and effluent TOC.

Mikel provided an update on Operations and maintenance (Slide 24)
- Minor maintenance activities since the last TAC meeting have been similar to those reported at the last meeting.
- WHA has been replacing the pre-filter at DWMC21 monthly due to persistent sedimentation issues. DWMC21 is the same system that had high levels of HPC bacteria and coliform. This leads us to believe that the well/water system may be in need of repairs.
Harrison Hucks said the issue seems to be a well issue, either an incorrectly set well pump depth or a failed well screen. WHA recently recommended that the homeowner have a video log survey done to determine the cause. WHA’s priority is to protect the carbon until the well owner can remediate the issue. To do that they are replacing the pre-filter on a monthly basis. Source water quality issues like this have been typical with this project and are informative. They bring up the question of whether these issues will shorten the life of the carbon, or result in needing to backflush the carbon. That is still to be determined, but so far we have not seen a 123-TCP breakthrough.

Mikel summarized the Monitoring and O&M updates (Slide 25) previously discussed and said that monthly monitoring continues to provide valuable information like E.coli detection and the identification of problems that come up due to the uniqueness of each system/location.

- Michael Adelman: These results seem to confirm initial suspicions that biofilm development and other factors are going to govern carbon life to a much greater extent than TCP breakthrough.

IV. Overview of Draft Report
Mikel Irigoyen described the objectives of the draft community facing report that was shared with the TAC before the meeting and is to be completed in June (Slides 27-28). The main audience for the report is project participants and others that live in areas with 123-TCP present in the groundwater. CWC is aiming for the community facing report to be around 10 pages. Technical appendices will be attached and directed mainly toward stakeholders like policymakers, TAC members, and organizations considering implementing POE treatment. Mikel then shared a screen briefly walked through the report, and asked for feedback.

Discussion:
- Chad Seidel: How do the community members respond to this project? Are others in the community clambering to have a 123-TCP POE treatment system installed?
  - Brandon Bollinger: There is a range of community feedback related to the project. Many participants have appreciated them and their children being able to shower without having to worry about 123-TCP. On Slide 8 a community partner is holding up a sign expressing appreciation for the project and saying that it has provided their family peace of mind. Others who have chosen not to participate have had various reasons including looking towards longer-term solutions and uncertainty about how long the pilot will continue.
- Chad: Has residents’ water usage changed at all?
  - John Erickson: We considered installing flow meters at the POE prior to
treatment system installation to be able to compare water usage before and after installation, looking at both monthly consumption and peak flows to see if the system restricted peak flows. We have not been able to do that yet, because it would be a significant additional cost to separately install the meter prior to installing the system. But we still need to look more at the flow data we have and can continue to think about whether there is a way to do a before and after comparison.

- David Okita (in chat): One suggestion is to add information about other contaminants (nitrates) that are in the area.

- Tamara Anderson: It would be great if the report assessed the value of putting a system at one household or one that serves multiple households and seeing if there are benefits related to that. Separately, I wanted to make sure that it is clearly stated in this report that this pilot project is funded through the settlement with Monterey Mushrooms.

- John: CWC can send language to Regional Board Staff to make sure it is appropriate. Also, thanks for the comment on the number of households served, as it will be of interest to community partners.

- Eugene Leung: Earlier you mentioned these households are looking towards long-term solutions. Are they looking at consolidation? Or what are the other options being considered?

- John: It depends on the household and where they are located. The majority are in areas where CWC is working with the community to pursue long-term solutions. A few households are in more isolated areas that do not have a long-term solution on the horizon as of now.

- Eugene: It would be good to consider that long-term solutions like consolidation come with costs to these households that were not previously there, such as a water bill and it may not be cheap.

- John: In CWC’s experience, community partners are very interested in costs associated with long-term solutions. This is taken into consideration when looking into the feasibility of long-term solutions. Community members also face costs related to domestic well ownership and upkeep, such as the sanding issue at DWMC21.

- Eugene: The households participating in this pilot are all on bottled water. For the long-term solution, the public water system would be treating both 123-TCP and other contaminants, which would eliminate the need for bottled water service. Are community partners okay with getting off bottled water and not having these 123-TCP treatment systems? Would there be push-back to losing the bottled water service?

- Brandon: That is a really good point. In both the bottled water enrollment process and the 123-TCP pilot project we frequently bring up with residents that this is an interim solution until we obtain a long-term one. In our experience, community members have
been very receptive to and understanding of that message.

- Harrison Hucks: Homeowners in this 123-TCP project are very invested in how the system is performing, but also in the long-term solution. I get asked frequently about the status of the long-term solutions, especially in the North of Moss Landing area. The community partners are the most important part of this project, and providing them with information is incredibly important.

- Tori Klug: Regarding costs, there is a pretty substantial range on the site assessment, monitoring, and installation costs by site. It would be helpful to include things like well condition and necessary well and water system improvements to better understand the context of the high and low range. This information can be used to inform applications in other communities as well. It would also be helpful to include notes about why some of the wells with E. coli detections have higher monitoring costs.

- John: That makes a lot of sense, and we will plan to go into more detail about costs in the technical appendices.

- Eugene: Detailed source water quality should be included. Raw water quality is critical to this project. If someone has bacteriologically unsafe water coming from their well, there will be additional costs and delays to do well repairs before treatment can be implemented. Less is known about the health of these domestic wells than with public water system wells, and you may need more time upfront in investigating the well to make sure you have a bacteriologically safe system. Also, participants in this particular project cannot drink this water because of the high levels of nitrates. This project is taking steps to address inhalation exposure to 123-TCP through uses like bathing and washing dishes. Unfortunately, 123-TCP tends to occur in areas with high levels of nitrate, and in those situations this type of treatment system is not a complete solution.

- David: Regarding source water and variability of 123-TCP levels, Kevin Berryhill mentioned in a past TAC meeting that this variability is fairly common with 123-TCP. It would be good to point that out in the report.

- Eugene: It is important to note that the MCL is based on a running average of quarterly samples over a year.

- John: This is all very helpful feedback. We will have time to update this report as we move towards June, so any additional feedback or suggestions via email would be appreciated.

V. State Water Board POU/POE Updates

Chad Fischer summarized the Division of Drinking Water’s (DDW) current efforts to finalize their report on POU/POE treatment:

- DDW has a draft report on POU/POE treatment out and solicited public comments on it
late last year. They received several comments and DDW followed up and reached out to commenters, and incorporated comments into the report as they apply. DDW is doing some additional vetting on the recommendations with State Water Board executive management and board members. Chad anticipates the report will be finalized in March, 2023. DDW has initiated internal detailed talks about the POU/POE piloting that the draft report suggests and is trying to further detail what should be accomplished in those pilots and what kind of outcomes or datasets should come out of them we are looking for to come out of these pilots.

- John Erickson: CWC has been really interested in this report and appreciates the large quantity of work and thought that clearly went into the report.

John Highlighted some public comments that CWC, Leadership Counsel for Justice and Sustainability, and Clean Water Action submitted on DDW’s draft POU/POE report (Slide 31):
- DDW’s POU/POE treatment draft report identifies a lot of the challenges with POU/POE treatment that we have been experiencing in this pilot, such as source water quality. Given these challenges and the limitations of POU/POE treatment, it is important that POU/POE treatment not be disproportionately deployed in disadvantaged communities, and CWC wants to make sure that is reflected in the SWB’s Needs Assessment and strategy for implementing the Human Right to Water.
- When developing this pilot, CWC searched for guidance on details such as the number of tanks and how much carbon to use, and fortunately received guidance from the TAC. CWC plans to publish as much of this detail as possible about this pilot. Cost information and monitoring data will help inform State policy.
- It is important to consider both the technical and managerial aspects of deploying POU/POE treatment. If POU/POE treatment needs to be a long-term solution for some households, we need to find the institutional process to make that sustainable.
- CWC is also working with DDW to include a summary of this 123-TCP POE treatment pilot project in DDW’s POU/POE report.

John asked if Eugene Leung wanted to provide any updates regarding the registration process for POU/POE technologies.
- Eugene Leung: The registration process is handled by the regulatory development unit. I know they are working on improving their database/improving their process. He will see if there are any updates.
- Harrison Hucks: Will the system used in this pilot be state certified for 123-TCP treatment, or is that still being worked on?
- Eugene: In the case of this GAC treatment system, we know it works, but there is not a way to do a standardized certification. These vessels are filled by Culligan in Salinas, so
we have to work on it on a case-by-case basis. There is not a standardized system that Culligan has done, where there is an assurance of uniformity across all of Culligan's dealerships. Other treatment products that are certified are manufactured in a centralized location, but in this case Culligan's headquarters is not getting these GAC vessels certified so we need to work at a more local level to make sure each franchisee has the same quality.

- Tim Bushman: The larger filters that we originally used and the Calgon carbon were actually standard Culligan products that are certified to WQA NSF 61, but that is all they have been certified as.

- Eugene: I agree that each component is certified for use in drinking water systems, but that is not a certification of treatment performance. Certifications for POU devices give a contaminant concentration range and capacity for which they are safe for use. In this case, we know the materials being used are certified as safe for use with drinking water systems (they will not be leaching additional chemicals into the water), but we do not have a certification for the contaminant removal capacity or concentration for which they work.

- Eugene: We are willing to determine a setup that works. For instance, having lead/lag capacity, looking at the range of raw water quality including interfering agents like TOC, and seeing how much treatment capacity that we can get out of that. Then maybe we can reduce monitoring frequency to quarterly because of the lead/lag configuration. For public water systems the monitoring will always be monthly because they have more users. Since the breakthrough is so slow on these smaller systems quarterly monitoring may be acceptable.

VI. SWB Funding Proposal: Continue Pilot through June 2026

John Erickson provided an update on CWC’s goal to continue the pilot through June 2026 (Slide 33). The main impetus to extend this pilot is to continue providing treatment for community members since long-term solutions have not yet been implemented and to learn when breakthroughs will occur and more about the longer-term costs. Extending the pilot also offers the opportunity to install additional systems.

John asked for the TAC’s feedback on two components CWC plans to add to the pilot as part of the extension: disinfection and sampling for nitrate to gain a better understanding of the extent to which nitrate sloughing from the GAC is a concern:

- Discussion:
  - John: Should we just focus on piloting UV disinfection, or are there any other disinfection methods we should consider as part of this project?
- Chad Seidel: What is the objective? Is the objective to control coliform levels or is it something else?
- John: The objective is to provide microbiologically safe water to households where we have not been able to eliminate total coliform with well repairs and well disinfection. Coliform is an indicator, but we are wanting to inactivate any pathogens that could potentially come with it. Another objective would be figuring out what the costs, challenges, and implementation process for disinfection at the household level.
- Chad: UV is likely the preferable option, but may not achieve all the objectives. A beneficial result of piloting disinfection could be to compare different disinfection options, even if it is just a desktop comparison and only one option is piloted physically. The biggest challenge for the small systems in terms of chlorine is that it has more potential to be detrimental, but it has some advantages.
- John: In terms of detrimental, are you referring to overdosing and disinfection byproducts?
- Chad: Yes, chlorine disinfection is more onerous to operate and maintain. Appropriate dosing at low flows is a challenge, and there can be more of an impact on the plumbing downstream that can be detrimental depending on the plumbing material. Beyond that, folks may not be used to having chlorinated water in their taps and may not like it.
- Tim Bushman: I agree, keeping a chlorine feed system operating correctly is a challenge. We see challenges all the time with homeowners operating these systems.
- Eugene Leung (in chat): For UV Treatment, it should be installed upstream of the GAC treatment. Also, [prior to installation], you need to measure the hardness of the water and UVT (UV Transmissivity) to determine if UV will even be effective. The recommended place [to install] is usually ahead of the filter, to make it safe. Then the GAC would not contaminate the water. That is the typical setup, but open to other thoughts. Checking the hardness to [determine feasibility is important]. If it is too hard, you may need a softener.
- John: Does the TAC have any guidance on how nitrate sampling might help us to better understand nitrate sloughing? CWC has thought mainly about grab sampling. We thought about continuous monitoring, but understand from talking with Tim that those online analyzers are costly and difficult to maintain.
- Chad: Hopeful that we are within months of having a Water Research Foundation project publication on nitrate sloughing funded by Cal Water
and Calgon available. This report looked at 123-TCP contaminated water with lower levels of nitrate that can peak above the 10 mg/L MCL downstream of GAC, and defined temperature as the driving influence. Another influence is run time of the well, but temperature differential was the biggest issue. Nitrate adsorption decreases with increased temperature which increases the risk for nitrate sloughing. This report will be really useful to reference. Online nitrate analyzers are in the $30,000 range and are more onerous to operate than anything else at the pilot sites. A low-flow meter with a temperature sensor was used in the other study and could be a recommendation here.

John provided an update on the timeline for CWC’s proposal to incorporate funding to continue the 123-TCP treatment pilot into its State Water Board Regional Bottled Water agreement and highlighted that completing well and water system repairs done, getting all systems online, and installing additional systems will be a priority for use of SEP funding from now until June. CWC plans on extending implementation agreements with residents if State Water Board funding to extend the pilot is approved (Slides 35-36).

VII. Next Steps

The next meeting will be held in June and will be focused on discussion of the Final Report
- Mikel Irigoyen will send out meeting minutes, PowerPoint slides, and a Doodle to confirm the next TAC meeting date and time.
“Every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes.”
1. **TAC Roll Call** (12:00-12:10)
2. Discussion of TAC Feedback (12:10-12:15)
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4. Overview of Draft Report (12:40-1:10)

---------- *Short Break* (1:10-1:20) ----------

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6. Project Next Steps (Proposal for SWB Funding to Continue) (1:35-2:00)
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<tr>
<td>Michael Adelman, P.E.</td>
<td>Stantec Consulting Services, Inc.</td>
<td>Environmental Engineer</td>
</tr>
<tr>
<td>Mark Bartson (retired)</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Program Management Branch Technical Operations</td>
</tr>
<tr>
<td>Kevin Berryhill, P.E.</td>
<td>Provost &amp; Pritchard Consulting Group</td>
<td>Principal Engineer</td>
</tr>
<tr>
<td>Paul Boyer (retired)</td>
<td>Self-Help Enterprises</td>
<td>Program Director, Community Development</td>
</tr>
<tr>
<td>Guadalupe Gonzalez</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Safe and Affordable Funding for Equity and Resilience</td>
</tr>
<tr>
<td>Kyle Graff</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Northern California Drinking Water Field Operations</td>
</tr>
<tr>
<td>Tarrah Henrie</td>
<td>California Water Service (CalWater)</td>
<td>Manager, Water Quality</td>
</tr>
<tr>
<td>Chad Seidel, PhD, PE</td>
<td>Corona Environmental Consulting</td>
<td>President</td>
</tr>
<tr>
<td>Alex Huang, P.G.</td>
<td>State Water Resources Control Board (DFA)</td>
<td>Office of Sustainable Water Solutions Branch</td>
</tr>
<tr>
<td>Brian Kidwell, P.E.</td>
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<tr>
<td>Tori Klug, P.E.</td>
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<td>Project Manager</td>
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<tr>
<td>Eugene Leung</td>
<td>State Water Resources Control Board (DDW)</td>
<td>Program Management Branch Technical Operations</td>
</tr>
<tr>
<td>Edwin B. (Ned) Lofink, P.E.</td>
<td>Axiom Engineers</td>
<td>Senior Project Engineer</td>
</tr>
<tr>
<td>Cheryl Sandoval</td>
<td>Monterey County</td>
<td>Supervisor, Drinking Water Protection Services</td>
</tr>
<tr>
<td>Laura Satterlee</td>
<td>Self-Help Enterprises</td>
<td>Water Division Manager</td>
</tr>
<tr>
<td>Allie Sherris</td>
<td>Univ. of Washington (Stanford University)</td>
<td>Postdoctoral Researcher, Public Health</td>
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### Technical Advisory Committee Members (cont.)

**1,2,3-TCP Residential Treatment Pilot Project in Northern Monterey County Area**

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<tr>
<td>Tami McVay</td>
<td>Self-Help Enterprises</td>
<td>Assistant Program Director-Partner Services</td>
</tr>
<tr>
<td>Dave Wallis</td>
<td>Rural Community Assistance Corporation</td>
<td>Rural Development Specialist III - Environmental</td>
</tr>
</tbody>
</table>

* Craig Drizin and Harrison Hucks from Weber, Hayes & Associates and Tim Bushman from Culligan are consultants contracted for implementation of this project and participate in TAC meetings to provide information from the TAC and to consider input from the TAC.

We recognize and appreciate the participation of all TAC members as well as additional staff from Self Help Enterprises who have attended our TAC meetings including Cecilia Vela, Marliez Diaz, and Dan Larkin.

In addition to those listed, CWC provides all TAC information to additional State Water Board staff who supervise and/or support TAC members: Michelle Frederick, Matthew Pavelchik, Stefan Cajina, and Karen Nishimoto.

We may also be joined today by:
- Tamara Anderson or Thea Tyron, Central Coast Regional Water Quality Control Board, overseeing project funding
- Vanessa Soto, SWB Office of Public Participation
- Karmina Padgett, SWB Division of Financial Assistance
- Chad Fischer, SWB DDW SAFER Engagement Unit, leading POU/POE Pilot White Paper effort
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*Exact meeting dates to be determined*
Technical Advisory Committee Meeting Agenda

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2. Discussion of TAC Feedback (12:10-12:15)
3. Project and System Performance Updates (12:15-12:40)
4. Overview of Draft Report (12:40-1:10)

-------- Short Break (1:10-1:20) --------

5. State Water Board POU/POE Updates (1:20-1:35)
6. Project Next Steps (Proposal for SWB Funding to Continue) (1:35-2:00)
Shade Structures

- Shade structures were installed at DWMC01, DWMC09, and DWMC15
- Benefits include:
  - Plumbing will last longer
  - Reducing potential for microbial growth and nitrate sloughing

Community partner María Gonzalez next to DWMC01 with installed shade structure.
Other Feedback from May 2022 TAC Meeting

- Inventory of common problems with well systems like this and the costs of resolving them will be valuable when budgeting and planning for future projects.
  - Will include list of repairs and cost in technical appendix to final report

- Lack of rain may contribute to decreasing levels of total coliform.
  - December/January are an opportunity to look at this
  - Will revisit when we look at water quality data later in presentation
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6. Project Next Steps (Proposal for SWB Funding to Continue) (1:35-2:00)
Phased Implementation for Adaptive Approach

**Phase 1**
- Site assessments
- Treatment system design
- Install 1 system
- Monitor 4 months

*Complete*

**Phase 2A**
- 4 Preconstruction visits ✓
- Install 2 systems serving 3 households using Phase 1 design ✓
  - 20 min EBCT @ 9gpm
- 26 months monitoring and O&M for Phase 1 & 2A systems
- Track installation, monitoring & O&M costs

*Monitoring & O&M In Progress*

**Phase 2B**
- Install 6 more systems
  - 3 Systems - 3.6 cf per vessel (6.0 min EBCT @ 9gpm)
  - 3 Systems - 2.0 cf per vessel (3.3 min EBCT @ 9gpm)
- Monitoring and O&M for Phase 2B systems through June 2023

*6 Systems Installed, 4 of them Online Monitoring, O&M In Progress*
Project Updates

- 9 systems installed, 7 currently online and effectively treating 123-TCP
- E.coli detections at DWMC14, 19, & 21
- Well/water system repairs
- Four potential sites assessed for future system installs: DWMC25, 26, 27, &14B

Community Partner Roberto Ramirez pictured next to the Phase 2B treatment system installed at DWMC-14 located near Royal Oaks in north Monterey County. This treatment system is the 3.6 cubic foot size.
E. Coli Detected and Carbon Replaced (DWMC 14 & 19)

- Both taken offline in mid-June shortly after installation due to E. Coli downstream of treatment systems (1 MPN/100 mL).
- Carbon was replaced and systems thoroughly disinfected.
- Effluent was re-sampled, and both systems were confirmed to be non-detect for E.Coli.
- **DWMC14**: Water system inspected and no contamination routes identified. GAC system put online 11/30/22 and has been non-detect for E. coli since then.
- **DWMC19**: Well repairs needed to eliminate contamination routes and address total coliform prior to being put online.
- E. coli could have been from minor contamination from upstream system or during installation.
E. Coli Detected (DWMC21)

- E. coli (1 MPN/100 mL) detected both upstream and downstream of the system during a routine monitoring visit on 12/21/2022 and homeowners were notified immediately.

- Resampled 12/30/2022 but sample lost by lab.

- Confirmation samples collected on 1/4/2023 and 1/12/2023 and E. coli was not detected upstream or downstream of the system on either date.

- The system remains online.

Phase 2B treatment system installed at DWMC-21 located near Moss Landing in north Monterey County.
Planned Well Repairs to Eliminate Identified Contamination Routes

- **DWMC15:**
  - Lifting the well head and disinfecting
  - Installing new well seal plate
  - Replumbing well discharge piping
  - Replacing concrete pad
  - Repairing electrical supply conduit

- **DWMC19:**
  - Lifting the well head and disinfecting
  - Installing new control box support and relocating off of the well plate
  - Installing watertight conduit from control box to the well plate
  - Disinfecting the well casing

Estimator going out week of 2/13/23  
Repairs scheduled for 2/17/23
Completed Well Repairs (DWMC01)

- Consistently high total coliform levels not resolved with initial disinfection

- Repairs included:
  - Lifting well head to disinfect
  - Replacing existing cement pad
  - Installing new surface seal

- Total Coliform bacteria has not been detected after repairs

- System online since November 17th, 2022
Additional Site Assessments

- Four additional candidate sites
  - DWMC14B
  - DWMC25
  - DWMC26
  - DWMC27
- Pending finalized site assessment reports
### Additional Site Assessments

<table>
<thead>
<tr>
<th>Site</th>
<th>Number of Households</th>
<th>TCP Level (ug/L)</th>
<th>Total Coliform (MPN/100mL)</th>
<th>E. Coli (MPN/100 mL)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>DWMC14B</td>
<td>1</td>
<td>0.114</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>Same well as DWMC14A (already installed), but different property.</td>
</tr>
<tr>
<td>DWMC25</td>
<td>2</td>
<td>0.00516</td>
<td>9.7 (tank effluent)</td>
<td>&lt;1 at both locations</td>
<td>Cound install one or two systems.</td>
</tr>
<tr>
<td>DWMC26</td>
<td>1</td>
<td>0.0222</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>DWMC27</td>
<td>1</td>
<td>0.186</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td></td>
</tr>
</tbody>
</table>
Monitoring: 123-TCP

- All samples collected between lead and lag GAC vessels have been non-detect for 123-TCP.

- We have continued to see variation in source water 123-TCP concentrations, with some wells fluctuating between above the MCL and non-detect.
Monitoring: Total Coliform, Phase 1 and 2A systems

Disinfected Distribution System with Chlorine and GAC with Caustic

All Ph. 1 and 2A samples (in and out) for E. coli have been non-detect

Detection Limit = 1 MPN/100 mL

DWMC-02 Offline (Tank Repairs)

High Precipitation
Monitoring: Total Coliform, Phase 1 and 2B systems

12/21/22 DWMC21 In & Out: 1 MPN/100 mL E. coli
1/4/23 and 1/12/23 follow-ups: No E. coli

High Precipitation
Monitoring: HPC Bacteria, Phase 1 & 2A systems

Highest level measured: 1,200 MPN/100 mL

Typical Detection Limit = 5 MPN/mL
Monitoring: HPC Bacteria, Phase 2B systems

Highest level measured: 5,840 MPN/mL

Typical Detection Limit = 5 MPN/mL
Operations and Maintenance

- Minor operations and maintenance activity to date:
  - Replace pre-filter at DWMC-21 monthly
    - Persistent sediment issues
  - Replace hose bibs to address leaks
  - Replace faulty gauges
  - Replace cracked plastic fitting to address leak
Monitoring and O&M Summary

- Online systems successfully removing 123-TCP to below the detection limit
- E.coli detected at three systems (DWMC14,19, & 21). Addressed by:
  - Confirmation sampling (DMWC21)
  - Carbon replacement (DWMC14 and DWMC19)
  - Planned well repairs (DWMC19)
- Monthly monitoring continues to provide valuable information

Any additional feedback related to monitoring and O&M?
1. **TAC Roll Call** (12:00-12:10)

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3. Project and System Performance Updates (12:15-12:40)

4. **Overview of Draft Report** (12:40-1:10)

  -------- *Short Break* (1:10-1:20) --------

5. State Water Board POU/POE Updates (1:20-1:35)

6. Project Next Steps (Proposal for SWB Funding to Continue) (1:35-2:00)
Proposed format of report

10-page Report (provided in draft form)

**Audience:**
- Project participants and community members concerned with 123-TCP contamination
- Policymakers and other stakeholders seeking high-level overview of project

Detailed Technical Appendices (under development)

**Audience:**
- Technical stakeholders
- Organizations considering implementing 123-TCP or other POE treatment
Information to include in technical appendices

- System Design:
  - Diagram of system
  - Granular activated carbon specification
- Well and water system repairs: Cost and detail
- Water quality monitoring data
- O&M Log
- Detailed source water quality for each site
- Implementation agreement signed with property owners and residents
- TAC meeting minutes
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5. **State Water Board POU/POE Updates** (1:20-1:35)
6. Project Next Steps (Proposal for SWB Funding to Continue) (1:35-2:00)
State Water Board POU/POE Updates
The report identifies limitations on where POE/POU can be effectively implemented and the importance of not disproportionately deploying it in disadvantaged communities.  
  ○ State Water Board’s Needs Assessment and strategy for implementing the Human Right to Water should account for these considerations.

We have much to learn about how to reliably and sustainable implement POE/POU treatment. More pilots are required that:  
  ○ Transparently report cost information, details on the treatment technology, and monitoring data.  
  ○ Include the full POE/POE implementation process.
1. **TAC Roll Call** (12:00-12:10)
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4. Overview of Draft Report (12:40-1:10)
5. Short Break (1:10-1:20)
6. State Water Board POU/POE Updates (1:20-1:35)
7. Project Next Steps (Proposal for SWB Funding to Continue) (1:35-2:00)
**SWB Funding Proposal:**
Continue Pilot through June 2026

**Project Area: Monterey and San Benito Counties**

- Task 1: Outreach and Well Testing (~75 wells, Contaminants relevant to pilot + PFAS)
- Task 2: Recruitment and site assessment visits (~14 site assessments)
- Task 3: Well and water system repairs (~$7,800 per site, including CWC staff oversight)
- Task 4: Installation (~8 new systems)
- Task 5: Monitoring
- Task 6: O&M
- Task 7: Nitrate sampling (for sloughing) and piloting disinfection (likely UV at ~6 sites)
- Task 8: TAC facilitation and sharing lessons learned
- Task 9: Project management
Requests for feedback: Task 7: Nitrate sampling and piloting disinfection

- Piloting disinfection
  - Were any TAC members able to find more information on the application of UV or other disinfection to domestic wells?
  - Should any disinfection methods other than UV be considered for piloting?

- Nitrate sampling to better understand sloughing
  - Can useful information be gained from grab sampling? Can grab samples be collected at certain times when risk of sloughing is highest?
  - Would continuous nitrate monitoring be feasible and useful?
SWB Funding Proposal: Continue Pilot through June 2026

- Proposal Submitted October 2022
- CWC and SWB Division of Financial Assistance (DFA) staff decided to include it as an amendment to CWC’s existing “Central Coast Region Bottled Water Project” funding agreement
- Anticipating DFA approval next week
Well/Water System repairs so DWMC15 and DWMC19 can be put online

Install 3-5 additional systems (once SWB funding to continue monitoring and O&M is confirmed)

Update implementation agreements for existing systems to extend monitoring and O&M through 2026 if property owners and residents want to continue participation

Continue monitoring and O&M of all systems through June 2023

Finalize and share report
### Technical Advisory Committee Meeting Schedule

**1,2,3-TCP Residential Treatment Pilot Project in Northern Monterey County Area**

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*Exact meeting dates to be determined*
Next Steps

Next Meeting
(Hold these two times)
- Thur. June 8th Noon-2pm
- Tues. June 13th, Noon-2pm

Communitywatercenter.org
Mikel.Irigoyen@communitywatercenter.org
John.Erickson@communitywatercenter.org
Brandon.Bollinger@communitywatercenter.org
Source water quality sampling results for samples collected prior to treatment system installation are shown in Table C-1 at the end of this appendix. Those samples were collected through the Central Coast Regional Water Quality Control Board’s free well testing program and by WHA during site assessments for this project.

After treatment systems were installed, source water quality was sampled quarterly for 123-TCP and monthly for total coliform, E. coli, and heterotrophic plate count (HPC) bacteria. 123-TCP source water quality sampling results before and after installation are shown below in Figures C-1 and C-2. Source water bacteria sampling results are provided in a tabular form in Appendix G and are also graphed in the slides from the February 16, 2023 TAC meeting provided in Appendix B.

Figure C-1: Source water levels of 123-TCP in DWMC02, DWMC04, and DWMC09. Samples with non-detect results are shown as zero (detection limits varied from <0.0006 μg/L to <0.0007 μg/L).
Figure C-2: Source water levels of 123-TCP in DWMC01, DWMC10, DWMC14, DWMC19, and DWMC21. Samples with non-detect results are shown as zero (detection limits varied from <0.0006 μg/L to <0.0007 μg/L).
# Appendix C - Source Water Quality

## Table C-1: Water Quality Summary for households participating in this study

| No. | Site ID | # Houses Served By Well | # of people in each household | Area          | Sample Date | Arsenic (ug/L) | Hexavalent Chromium (mg/L) | Nitrate (as N) (mg/L) | Perchlorate (ug/L) | Turbidity (NTU) | Total Organic Carbon (mg/L) | Iron (mg/L) | Manganese (mg/L) | Calcium (mg/L) | Magnesium (mg/L) | Hardness (mg/L) | Chloride (mg/L) | Sulfate (mg/L) | TDS (mg/L) | Install Date |
|-----|---------|-------------------------|-------------------------------|---------------|-------------|---------------|--------------------------|---------------------|-------------------|----------------|------------------|---------------|----------------|---------------|----------------|----------------|-------------|--------------|
| 1   | DWMC02  | 1                       | 2                            | Moss Landing  | 1/20/2021   | 4.5           | 3.5                       | 0.81                | <0.1              | 0.14           | 1                | 1.7            | 0.03           | 0.8            | 0.14           | 0.07           | 150          | 160          | 1000         | Dec 2020     |
| 2   | DWMC04  | 1                       | 2                            | Moss Landing  | 10/29/2020  | 1.3           | 2.8                       | 1.2                 | 1                 | <0.04          | 0.004           | 0.14           | 0.04           | 0.14           | 0.04           | 0.04           | 150          | 120          | 850          | June 2021    |
| 3   | DWMC09  | 2                       | House A: 5                    | Salinas       | 11/4/2020   | 1.4           | 3.5                       | 1.7                 | 0.47              | 0.15           | <0.04           | 0.004         | 0.15           | 0.12           | 0.15           | 0.05           | 150          | 160          | 1000         | June 2021    |
| 4   | DWMC10  | 1                       | 2                            | Salinas       | 2/22/2022   | 2.6           | 1.9                       | 1.6                 | 1.6               | <0.04          | 0.14           | 0.0054         | 1.6           | 0.44           | 0.14           | 0.44           | 0.04           | 150          | 120          | 850          | April 2022   |
| 5   | DWMC14  | 2                       | 6                            | Royal Oaks    | 9/22/2022   | 2.4           | 0.908                     | 1.8                 | 1.8               | <0.04          | 0.14           | 0.0054         | 1.7           | 0.54           | 0.14           | 0.54           | 0.04           | 150          | 120          | 850          | April 2022   |
| 6   | DWMC21  | 1                       | 3                            | Moss Landing  | 6/2/2022    | 2.1           | 1.2                       | 0.4                 | 0.4               | 0.15           | 0.04           | 0.0054         | 1.2           | 0.5           | 0.14           | 0.5           | 0.04           | 150          | 120          | 850          | April 2022   |
| 7   | DWMC01  | 2                       | House A: 7                    | Moss Landing  | 2/28/2022   | 5.9           | 10                        | <0.8                | 0.44              | 0.15           | 0.04           | 0.0054         | 10           | 0.3           | 0.14           | 0.3           | 0.04           | 150          | 120          | 850          | Installed: May 2022, Put online: November 2022 |
| 8   | DWMC19  | 1                       | 7                            | Royal Oaks    | 1/20/2022   | 0.689         | 5.15                      | 0.14                | 0.14              | 0.04           | 0.14           | 0.14           | 0.14           | 0.14           | 0.14           | 0.14           | 150          | 160          | 1000         | Installed: May 2022, Put online: April 2023 |
| 9   | DWMC15  | 1                       | 2                            | Royal Oaks    | 7/27/2021   | 1.3           | 6.5 (Tot Cr)              | 1.7                 | 0.8               | 0.85           | ND              | ND             | 0.85           | ND             | ND             | ND             | 150          | 160          | 1000         | June 2023 Not yet online |

Notes:
- MCLs shown for turbidity, Iron, Manganese, Chloride, Sulfate and TDS are Secondary Maximum Contaminant Levels.
Appendix D
Treatment System Design

The Request for Proposals (RFP) for this project specifically requested that the consultant's design use granular activated carbon (GAC). The RFP also specified the carbon specifications, developed with input from the TAC and available upon request.

In most cases, one POE treatment system was installed at the point-of-entry to one household to treat only the water used indoors by that household. Treating water for outdoor uses unnecessarily expends the GAC’s capacity. However, in two cases, one treatment system was installed to treat water for two households on the same property served by the same well. At one site (DWMC-01), a tap was installed upstream of the treatment system and residents were encouraged to use untreated water from that tap for outdoor use. At the other site (DWMC-09) a tap was installed upstream of the treatment system; however, the distance from the residences to the upstream tap is too great for practical outdoor use. Outdoor use at DWMC-09 was estimated to be low.

The treatment system is also equipped with:
● Pre-filter to prevent sediment from entering into the GAC tanks
● Post-filter to filter out any GAC that might come out of the tanks
● Flow restrictors to prevent the flow through the system from exceeding its maximum design flow of 9 gallons per minute
● Flow meter to measure how much water is treated
● Pressure gauges to measure the pressure loss through the treatment system
● Taps to collect water samples upstream of the system, after the lead GAC tank, and after the lag GAC tank

Three different sizes of treatment systems were installed in the project to test the costs and benefits of larger and smaller systems. All systems had a maximum design flow of 9 gallons per minute:
● 24-cubic-foot, 20-minute empty bed contact time (EBCT): The first three systems installed in the project have four GAC tanks each, with two parallel trains of lead and lag tanks. The tanks have a total of 24 cubic feet of GAC.
● 7.2-cubic-foot, 6.0-minute EBCT: Three systems installed later in the project have two GAC tanks each, one train consisting of a lead tank and a lag tank. The tanks have a total of 7.2 cubic feet of GAC.
● 4.0-cubic-foot, 3.3-minute EBCT: Three other systems installed later in the project also have the same two-tank design as the 7.2-cubic-foot systems, except they only have a total of 4.0 cubic feet of GAC.
Treatment System Design Specifications:

- Peak design flow: 9 gallons per minute
- Treatment technology: Must use Best Available Technology for 123-TCP treatment of Granular Activated Carbon, according to CA Regulations Related to Drinking Water (Table 64447.4-A).
- Granular Activated Carbon (GAC): Calgon Filtersorb 400 AR or approved equal
- Empty bed contact time (EBCT) at peak design flow (including lead and lag vessels):
  - 24-cubic foot systems: 20 minutes
  - 7.2-cubic foot systems: 6.0 minutes
  - 4.0-cubic foot Systems: 3.3 minutes
- Configuration:
  - 24-cubic foot systems: Four equally sized GAC tanks, installed in one line but piped in two parallel trains, with each train consisting of a lead tank and a lag tank.
  - 7.2- and 4.0-cubic foot systems: Two equally sized GAC tanks installed in series (one lead tank and one lag tank).
- Prefilter:
  - 24-cubic foot systems: Two-stage (20 microns and 10 microns) pleated cartridge filter, equivalent to Enpress Cartridge Tank Filtration System with Orange Filtration Series filters.
  - 7.2- and 4.0-cubic foot systems: Pentair 20-inch DGD polypropylene filter cartridge in heavy-duty Big Blue housing or approved equivalent.
- Postfilter: Pentair 20-inch DGD polypropylene filter cartridge in heavy-duty Big Blue housing or approved equivalent.
- Flow control and distribution: Design to limit total flow to a maximum of 9 gpm. For the 24-cubic foot design, provide even flow distribution between the two parallel trains (either by hydraulic similarity or the use of flow control devices).
- Materials: All materials in contact with the water shall be NSF certified as lead-free and suitable for contact with potable water and shall not interact with constituents in the water in any way that will prevent the system from functioning as designed.
- Plumbing:
  - Quick-release connections or unions shall be included to allow easy removal and reconnection of individual tanks.
  - The system shall be valved and plumbed to allow for the bypass of the entire system and the bypass of any individual tank.
  - The plumbing should be designed to allow the system to be gently backwashed without fluidizing the GAC of the media bed. The plumbing design should allow this backwash to take place either onsite or offsite.
  - A sample tap between the lead and lag vessels and a sample tap downstream of the lag vessel shall be included. The sample tap downstream of the lag vessel shall be PVC ball valves of the same diameter as the connecting piping, to maximize the flushing flow rate.
- A pressure relief valve shall be installed at the system influent to prevent excessive pressures from developing in the treatment system.

- Required monitoring devices:
  - Flow monitoring:
    - All systems: A flow meter in series with the treatment system that provides both a totalizer visual readout and a pulse output that could be used for continuous flow monitoring as potential additional scope for the project.
    - 4.0-cubic foot and 7.2-cubic foot systems shall also include an EasyLog EL-USB-5+ pulse data logger for continuous flow monitoring.
    - Pressure sight gauges (with resolution of 1 psi or less) at the locations shown in the schematics at the end of this Appendix to monitor headloss through the system. An isolation ball valve shall be installed directly upstream of each gauge so that the gauges can be replaced without shutting off flow to the system.

- At most sites, the tanks shall be installed single-file on concrete pads (to be constructed as part of this project) along the wall of an existing building and attached to the wall with seismic restraints.
Note the following additions will be included for Phase II installations:
- Isolation valves and pressure gauges on inlet and outlet of each filter vessel
- Additional valving for disinfection
- NSF 65 and Lead Free for wetted components and Pulse output flow meter
ADDENDUM 1: Phase 2B Treatment System Design Schematic

1,2,3 TCP TREATMENT SYSTEM SCHEMATIC

CWC - NORTH MONTEREY COUNTY
SITE: CWC
ADDRESS: Moss Landing, CA

DATE: JANUARY 2022

Revisions/Notes:

F.C. 4.5 gpm flow control
PRV + VB Pressure Relief Valve (PRV) and Vacuum Breaker (VB) to be installed as-needed
Hose Bib and Sample Point (S.P.)
Ball Valve
Pressure Gauge

Explanation
- See attached specification sheets for additional detail on components characteristics
- Treatment system plumbed with 1 inch diameter Schedule 80 PVC pipe. Components will be NSF Certified. Threaded ball valves to be installed at all pressure gauge locations.
- Draft schematic produced by Culligan (QWE Commercial Services) based on a 8.97 GPM Flow Rate. Not to Scale.

To Residence

Add Check Valve if System is installed between well and Storage Tank

Three way ball valve for greater flushing capacity

To Residence

Prefilter

1" Clip Type Quick Connections/Integrated Bypass (Each Tank)

Lead Vessel

Lag Vessel

1,2,3 TCP REDUCTION SYSTEM SCHEMATIC
COMMUNITY WATER
QWE COMMERCIAL SERVICES
625 West Market Street, San Jose, CA 95110
831-755-9000

ADDENDUM 1: Phase 2B Treatment System Design Schematic
Appendix E

Well and Water System Condition and Repairs

The condition of domestic wells and water systems varied among the households considered for inclusion in the project. Many systems had deficiencies resulting in potential contamination routes, such as cracks or openings in well heads, cracked concrete well pads, unsealed perforations or apertures in storage tanks, and poorly fitting storage tank lids. Total coliform bacteria were detected in samples collected at the POE of many households considered for the project, and E. coli was detected in a few cases. Regardless of whether total coliform or E. coli bacteria were detected, CWC and WHA worked with households to eliminate potential contamination routes through the high-priority well and water system repairs described in Table E-1. Systems, where total coliform or E. coli had been detected, were also disinfected after the repairs. Depending on the case, repairs and disinfection were done directly by homeowners or residents, or paid for by CWC using either SEP funding or supplemental grant funding.

Based on TAC feedback, households, where E.coli was detected during site assessments, were not included in the project due to concerns that the E. coli contamination could reoccur even with repairs. However, E. coli was detected and confirmed at two sites after treatment systems were already installed. At one site (DWMC-14), this contamination was addressed by re-inspecting the system and not finding any potential contamination routes, replacing the GAC and disinfecting the treatment system, confirming that E. coli was no longer present, and placing the treatment system back online. At the other site (DWMC-19), the GAC was replaced, the treatment system was disinfected, and the system was put back online after the repairs described in Table E-1 were completed.
<table>
<thead>
<tr>
<th>System ID and Repair Status</th>
<th>Well or Water System Repairs Made or Planned</th>
<th>Who Made Repairs</th>
<th>Funding</th>
<th>Cost (includes WHA coordination but not CWC coordination)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DWMC-01 (completed)</td>
<td>Initial unsuccessful disinfection of well. Lift the well head to more thoroughly disinfect the well. Replace the concrete well pad and install a new well cap.</td>
<td>Well contractors</td>
<td>Supplemental Grant</td>
<td>$6,957</td>
</tr>
<tr>
<td>DWMC-02 (completed)</td>
<td>Tank repairs (seal crack; replace lid; remove old ozonator; replace cracked drain valve; install screened vent and overflow; replace electrical junction box). Replace the leaking irrigation pipe. Replace leaking fittings at the pressure pump discharge. Disinfect tank and distribution piping.</td>
<td>WHA</td>
<td>Homeowner</td>
<td>$700 (discounted rate)</td>
</tr>
<tr>
<td>DWMC-09 (completed)</td>
<td>Seal tank lid. Install screened vent and overflow on the tank. Install check valve on well discharge.</td>
<td>Homeowner</td>
<td>Homeowner</td>
<td>Unknown</td>
</tr>
<tr>
<td>DWMC-10 (completed)</td>
<td>Tank repairs and improvements (replace lid and float valve; seal and move electrical conduit; install screened overflow and vent)</td>
<td>Well contractor</td>
<td>Supplemental Grant</td>
<td>$2,375</td>
</tr>
<tr>
<td>DWMC-15 (planned)</td>
<td>Lift the well head and disinfect well. Well repairs and improvements (Install new well cap, pressure relief valve, sample tap, and pump-out valve; re-plumb discharge piping; replace concrete pad; repair electric supply conduit).</td>
<td>Well contractor</td>
<td>SEP ($5,500) and Supplemental Grant ($2,166)</td>
<td>$7,666 (estimated)</td>
</tr>
<tr>
<td>DWMC-19 (completed)</td>
<td>Tank repairs and improvements (seal/move electrical conduit; install overflow and vent). Install sample tap between well and tank.</td>
<td>Well contractor</td>
<td>Supplemental Grant</td>
<td>$1,462</td>
</tr>
<tr>
<td>DWMC-19 (completed)</td>
<td>Lift well head and disinfect well. Install new control box and electrical conduit near well.</td>
<td>Well contractor</td>
<td>Supplemental Grant</td>
<td>$2,782</td>
</tr>
</tbody>
</table>
Appendix F
Bacteria Consent Form and Implementation Agreement

Letter Attached to Ongoing Bacteria Consent

Option 1: Total coliform bacteria has been detected at this site. All text in brackets will be updated based on site specific recommendations and conditions.

—
Hello [Property Owner/Resident],

As we have discussed with you on Day, Month, Year the water at [the well and/or POE on xx/xx/xx at Address] tested positive for total coliform bacteria. However, water at [the well and/or POE] tested negative for E. coli bacteria. The laboratory results are attached to this letter.

It is very important that you DO NOT drink or cook with your water. Your water is not safe to drink or cook with because it has very high levels of nitrate. Not drinking or cooking with your water will also reduce any potential health risks from microbial contaminants such as bacteria or viruses. The 123-TCP point-of-entry treatment system that will be installed at your household will not remove nitrate or microbial contaminants. It is only designed to remove the harmful chemical 123-TCP.

Given the positive test for total coliform bacteria, we recommend and can support you in taking the following measures to attempt to address the total coliform bacteria contamination:

1. Re-sampling for total coliform bacteria and E. coli at the well and each POE
2. In the event that total coliform bacteria contamination is confirmed, we recommend disinfecting the well and distribution system/storage tank according to Monterey County guidelines.
3. In order to determine whether the disinfection procedure worked, we recommend testing for total coliform bacteria and E. coli at the [well, tank and POE’s] one week after the procedure and conducting a second round of testing approximately one month after the procedure and/or after it has rained.
4. [Insert any recommended water system improvements to prevent contamination here]

However, it is possible that the recommended upgrades to the well and water system may not completely resolve the total coliform bacteria contamination.

Based on guidance from the Technical Advisory Committee for this project, which is composed of technical, regulatory and public health experts, Community Water Center and Weber, Hayes & Associates recommend that the 123-TCP treatment system to be installed at [Address] be kept in use to reduce your exposure to 123-TCP, even if total coliform bacteria are detected.

If total coliform bacteria are detected and E. coli continues to not be detected in your water system, it is less likely that your water is contaminated with microbes from human or animal
waste that would cause disease. Your risk from microbial contamination is also decreased as long as you do not use your water for drinking or cooking.

For the duration of this project, we will monitor regularly for total coliform and E. coli bacteria and keep you informed of those results. If E. coli bacteria are later detected and confirmed, we will have to disconnect the system until the E. coli contamination can be addressed.

We request that you review the attached information on total coliform bacteria that is present in your water. If you agree with keeping the 123-TCP treatment system in use when total coliform bacteria is detected, please review and sign the attached consent form so we can continue to reduce exposure to 123-TCP even though total coliform bacteria is present. The removal of 123-TCP reduces your exposure to this harmful chemical from inhalation of water vapor during uses such as showering and washing dishes. If you have any questions, please do not hesitate to contact me at the phone number below.

Sincerely,
Mikel Irigoyen / Brandon Bollinger
Community Water Center
831-809-5937 / 831-500-2162
Letter Attached to Ongoing Bacteria Consent

Option 2: Total coliform bacteria has not been detected at this site. All text in brackets will be updated based on site specific recommendations and conditions.

—

Hello [Property Owner],

As we have discussed with you on Day, Month, Year the water at [the well and/or POE on xx/xx/xx at Address] tested negative for total coliform bacteria and E.coli.

It is very important that you DO NOT drink or cook with your water. Your water is not safe to drink or cook with because it has [very high levels of nitrate]. Not drinking or cooking with your water will also reduce any potential health risks from microbial contaminants such as bacteria or viruses. The 123-TCP point-of-entry treatment system that will be installed at your well will not remove nitrate or microbial contaminants. It is only designed to remove the harmful chemical 123-TCP.

[Even though total coliform bacteria were not detected in your system, we recommend and can support you in taking the following measures to reduce the risk of any future total coliform bacteria contamination:]

- [Insert any recommended water system improvements to prevent contamination here]

For the duration of this project, we will monitor regularly for total coliform and E. coli bacteria and keep you informed of those results. If E. coli bacteria are later detected and confirmed, we will have to disconnect the system until the E. coli contamination can be addressed.

We are seeking your consent to continue to operate the 123-TCP treatment system even if total coliform bacteria are detected at your well or at the POE of your water system at a later date.

Based on guidance from the Technical Advisory Committee for this project, which is composed of technical, regulatory and public health experts, Community Water Center and Weber, Hayes & Associates recommend that the 123-TCP treatment system at your property be kept in use to reduce your exposure to 123-TCP, even if total coliform bacteria are detected.

If total coliform bacteria is detected and E. coli continues to not be detected in your water system, it is less likely that your water is contaminated with microbes from human or animal waste that would cause disease. Your risk from microbial contamination is also decreased as long as you do not use your water for drinking or cooking.

We request that you review the attached information on total coliform bacteria that is present in your water. If you agree with keeping the 123-TCP treatment system in use when total coliform bacteria is detected, please review and sign the attached consent form so we can continue to reduce exposure to 123-TCP even though total coliform bacteria is present. The removal of 123-TCP reduces your exposure to this harmful chemical from inhalation of water vapor during
uses such as showering and washing dishes. If you have any questions, please do not hesitate to contact me at the phone number below.

Sincerely,
Mikel Irigoyen / Brandon Bollinger
Community Water Center
831-809-5937 / 831-500-2162
Ongoing Bacteria Consent - All residents and owners at sites where treatment systems will be installed will sign these forms to acknowledge potential future total coliform bacteria and provide ongoing consent to continue to operate 123-TCP treatment systems when total coliform bacteria are present.

Information on Total Coliform Bacteria

According to the Monterey County Health Department, “Coliform bacteria normally live in the soil, on plants and in the intestinal tract of humans and other warm blooded animals. Coliform bacteria is not naturally present in groundwater. If water sampling shows the presence of coliform bacteria, this indicates that there is contamination in your water supply. If coliform bacteria are present, other organisms that cause disease can also be present in your water supply.”
(Source: County of Monterey Health Department. "Instructions for the Care of Small Water Supplies when Coliform Bacteria is Found." Accessed Sept. 1, 2021. https://www.co.monterey.ca.us/home/showpublisheddocument/14834/637203007046930000)

According to the California State Water Resources Control Board: “Coliforms, a group of common bacteria, are generally harmless to humans. However, some coliforms may cause illness in humans, and the presence of coliforms at any concentration is an indication that other harmful microorganisms may be present. Fecal coliforms such as E. coli, and other types of harmful bacteria are found in animal and human wastes, and when detected they are indicators of water supply contamination. Ingestion of water containing coliform bacteria increases the risk of contracting a water-borne illness.”

Ongoing Consent to Operate 123-TCP Treatment System if Total Coliform Bacteria are Present

By signing below, I am indicating that:

● I have read the attached letter and information above about total coliform bacteria.

● I want Weber, Hayes and Associates and Community Water Center to continue to operate, monitor, and maintain the 123-TCP treatment system located at [ADDRESS] even if total coliform bacteria are present.

● The residents on my property will NOT use tap water for drinking or cooking. Eliminating these uses will prevent residents from being exposed to nitrates and any other contaminants in the tap water, and will also reduce any potential risks related to the presence of total coliform bacteria.

Property Owner Name: ________________________________________
Signature: ____________________________      Date: ________________________________

Resident Name: _______________________________

Signature: ____________________________      Date: ________________________________
COMMUNITY WATER CENTER
POINT-OF-ENTRY TREATMENT PROJECT AGREEMENT

THIS POINT-OF-ENTRY TREATMENT PROJECT AGREEMENT (the “Agreement” or “Project”) is entered into effective as of ______________________, 20_____ by and between Community Water Center (“CWC”), a California Non-Profit Corporation, and ______________________, “Homeowner”, and (if applicable) ______________________, “Tenant”. CWC will contract with an engineering firm “Consultant” for implementation of this project and the engineering firm will subcontract with a “Contractor” for the installation of the treatment system.

In consideration of the mutual covenants set forth herein and other good and valuable consideration, the parties agree as follows:

1. DESCRIPTION OF SERVICES. Subject to the terms and conditions of this Agreement, Community Water Center shall install a Point-Of-Entry (POE) device on the outside or near the residence located at the Homeowners ’s property, specifically (address, city, state, zip): _________________________________________________________________________ to be monitored and maintained at no cost to the Homeowner and Tenant (if applicable) from the time of installation through June 2023. The POE device is designed to provide water that meets drinking water standards for 1,2,3-trichloropropane (123-TCP). If other contaminants are present, the Homeowner and Tenant (if applicable) should continue to use bottled water for all consumptive uses including drinking and cooking. Installation will be conducted by a licensed contractor chosen by the Consultant. Water quality testing by a third-party certified laboratory will be conducted on a monthly basis for 123-TCP. Any POE failure properly reported as stated in Article 3 of this Agreement will be addressed and a confirmation sample for 123-TCP will be conducted to ensure the device is functioning properly. This service will be provided by the Consultant at no cost to the Homeowner or Tenant (if applicable), as described in Article 3. Test results will be available to the Homeowner or Tenant (if applicable) upon request. The test results report will include an identification number assigned to the Homeowners and Tenant’s house and well along with the 123-TCP level (if any). In the event the 123-TCP level exceeds the maximum contaminant level (MCL) of 0.005 parts per billion, the Homeowner and Tenant (if applicable) will be notified of such results and instructed as to how to limit exposure to 123-TCP. Repairs or replacement will be made by the Consultant as needed and a confirmation sample for 123-TCP will be conducted to ensure the device is working properly.

2. INSTALLATION. Installation of the POE device will be performed by a licensed contractor. The Contractor will use every reasonable effort to install the necessary equipment, which may include drilling holes in exterior walls, installing straps on exterior walls, installing a small concrete pad, modifying existing plumbing infrastructure, opening walls to gain access to necessary plumbing, and/or modifying plumbing fixtures to accommodate the treatment system. The Contractor will make every reasonable effort to confer with the Homeowner and Tenant (if applicable) in order to minimize disturbance, but the Contractor will have the final decision in order to best install the POE device in the safest, most cost efficient manner. The Contractor will use every reasonable effort to install the necessary equipment without damaging water system
plumbing. The Contractor and Consultant are only responsible for repair of equipment or piping they install. The Contractor and Consultant are not responsible for other parts of the water system or plumbing. Installation of equipment does not include any repairs to the Homeowner’s plumbing system. The Consultant and CWC warrant that any plumbing work furnished in connection with this agreement shall be free from defects for the term of the agreement.

3. **HOMEOWNER RESPONSIBILITIES AND AGREEMENTS.** From the time of installation through June 30, 2023, the Homeowner understands that CWC will own and operate the POE device and will ensure proper operation, maintenance, and compliance with the drinking water standard for 123-TCP. The Homeowner and Tenant (if applicable) agrees to installation and use of a POE treatment device and grants access to the property, including both the exterior of the home and the well for installation, as well as regular maintenance and sampling. Access inside the home is not necessary. The Homeowner and Tenant (if applicable) further agrees to allow CWC, the Consultant, and the Contractor access to all relevant and necessary property for other purposes of this Agreement. The Homeowner and Tenant (if applicable) understands the POE treatment device is designed for 123-TCP contamination only and to reduce dermal and inhalation exposure from this contaminant. If other contaminants are present, the Homeowner and Tenant (if applicable) should continue to use bottled water for all consumptive uses including drinking and cooking. The Homeowner and Tenant (if applicable) acknowledge that water pressure in their household may drop up to 10 psi as a result of a normally functioning POE system, and that this pressure loss does not constitute a system failure. The Homeowner and Tenant (if applicable) will be responsible for maintaining, to the standards provided by CWC and/or the Consultant, the exterior of the installed POE device to ensure the device is clean, hygienic, and working properly. In the event of any damage or deficiency of any equipment furnished or installed under this agreement, any claim by the Homeowner or Tenant (if applicable) shall be initiated via written notice to CWC within 24 hours of the occurrence of the event giving rise to the claim. At no time will the Homeowner and Tenant (if applicable) or any other unauthorized person attempt to disable, tamper with, alter, bypass, repair, or otherwise interfere with the proper use and maintenance of the POE device. Such action will void this Agreement and the Homeowner will be responsible for any and all damages, including repair, replacement, and/or additional sampling costs.

4. **CONSULTANT AND CWC RESPONSIBILITIES AND AGREEMENTS.** CWC and the Consultant agree that they are responsible for the purchase, installation, testing, repairs, replacement, and ongoing maintenance of the POE device, to include monthly water sampling for 123-TCP and replacing filters as needed. Any deficiencies of the POE device and its operation, including leaks, that are beyond the Homeowner and Tenant (if applicable) control, will be the responsibility of the Consultant and CWC for the term of the agreement. Other plumbing or piping deficiencies upon the property not related to the POE device will solely be the responsibility of the Homeowner and Tenant (if applicable).

5. **AUTHORITY TO ACCESS PROPERTY.** The Homeowner and Tenant (if applicable) agrees to allow the Consultant, Contractor, and CWC staff access to the property, including POE location and well location, during normal business hours at mutually agreed upon dates and mutually agreed upon times. Access will be provided in order to make repairs,
exchanges, deliveries, or other maintenance of the equipment, and also for water sampling and monitoring purposes. Sampling and monitoring will occur on a continuous basis until June 2023 when this contract ends. If needed, CWC or the Consultant will provide 24 hours notice to reschedule routine monitoring at a mutually agreed upon time. During the COVID-19 emergency, the Homeowner, Tenant (if applicable), CWC, and the Consultant agree to make every effort to avoid in person contact, maintain at least 6 feet of distance, and wear a face covering during installation and monitoring. The Consultant will also require the Contractor to take the same precautionary measures.

6. **FUNDING.** Funding for this project through the end of June 2023 is provided by a Supplemental Environmental Project as part of a Settlement Agreement with the Central Coast Regional Water Quality Control Board.

7. **CONTRACTOR AND SUBCONTRACTOR CLAIMS.** The Homeowner and Tenant (if applicable) further agree, to the fullest extent permitted by law, to limit the liability of CWC, the Consultant, and all contractors and subcontractors on the Project for any and all claims, losses, costs, damages of any nature whatsoever or claims expenses from any cause or causes, including attorneys’ fees, so that the total aggregate liability of CWC, the Consultant, and the Contractor to all those named shall not exceed total cost of services rendered by CWC for this Project. It is intended that this limitation apply to any and all liability or cause of action however alleged or arising unless otherwise prohibited by law.

8. **MEDIATION AND ARBITRATION.** The parties agree to meet and negotiate in good faith in order to resolve any claims or disputes arising out of or related to this Agreement or work performed by CWC, the Contractor, or the Consultant prior to using mediation, arbitration or court intervention. If the claims or disputes cannot be resolved informally, the parties agree to mediate any claims or disputes using a professional mediator. Any party refusing to mediate shall not prevent the other party or parties from pursuing their claims in arbitration. The parties will share the cost of mediation equally. If the parties cannot resolve their claims or disputes at mediation, the parties agree that their claims or disputes shall be decided by arbitration in accordance with the Commercial Arbitration rules of the American Arbitration Association then in effect. No such arbitration shall include, by consolidating or joinder or other manner, any party other than the Contractor, Consultant, CWC, the Homeowner, and the Tenant (if applicable). Nothing herein will be construed to prevent any party’s use of injunction, and/or any other prejudgment or provisional action or remedy. Any such action or remedy will not waive the moving party’s right to compel arbitration of any dispute.

9. **INDEMNITY.** The Homeowner and Tenant (if applicable), agrees to indemnify, hold harmless, and defend in any action or proceeding, CWC, the Consultant, and the Contractor, from and against all claims, damages, liability, costs, losses or expenses, including but not limited to attorneys’ fees and costs, expert fees, and any other expense, for or relating to any injury to person, property, or reputation, suffered or claimed to have been suffered by anyone, arising out of or resulting from the Homeowner and Tenant (if applicable) access to or use of the POE device, regardless of whether the act or omission complained of was caused by negligence in any form by CWC, or any of its subconsultants or subcontractors.
10. **WAIVER.** Homeowner and Tenant (if applicable) hereby waives and releases CWC and its officers, agents and employees from any and all claims for loss or damage caused by any act or omission on the part of CWC or any of its officers, agents and employees, exempting any willful misconduct by same.

11. **APPLICABLE LAW; CONSTRUCTION.** This Agreement will be governed by and construed in accordance with the laws of the State of California, without regard to any conflict of laws rule or principle that might refer to the governance or construction of this Agreement to the laws of another jurisdiction. This Agreement will at all times and in all events be construed as a whole, according to its fair meaning, and not strictly for or against any party.

12. **ENTIRE AGREEMENT.** This Agreement constitutes the entire understanding between the parties and supersedes all proposals, commitments, writings, negotiations, and understandings, oral and written, and all other communications between the parties relating to the subject matter hereof. This Agreement may not be amended or otherwise modified except in writing duly executed by all of the parties.

13. **PARTIES BOUND.** This Agreement will be binding upon, and inure to the benefit of, each of the parties hereto to the extent applicable to them and their respective successors and assigns. If the Homeowner intends on transferring the real property subject to the Agreement (for example, the homeowner decides to sell the household where the POE treatment is installed), the Homeowner will notify CWC in writing 30 days prior to the sale or agreement for sale, whichever is earlier.

14. **TERM OF AGREEMENT.** This Agreement will be held in force and effect until 30th day of June, 2023 and may be extended by written agreement by both parties. Upon this date, CWC will relinquish ownership of the POE device and all associated rights and responsibilities to the Homeowner. The Homeowner accepts and agrees to assume ownership, and all rights and responsibilities related to the installed POE device, including maintenance, monitoring, repairs, media replacement, and filter purchase and replacement. By February 1, 2023, CWC will provide information on operation and maintenance costs to the Homeowner. The Homeowner will notify CWC in writing no later than March 1, 2023 if they would like to have the treatment system disconnected or removed when the project ends in June 2023. If the Homeowner asks for the treatment system to be removed, CWC will retain all of its ownership, rights and responsibilities pertaining to the POE device. The Homeowner and Tenant (if applicable) understand that this is a pilot treatment project and performance can not be guaranteed. If E.coli is detected in the water supply or if CWC or the Consultant are unable to address a system failure due to raw water quality challenges or other unforeseen circumstances, CWC will notify the Homeowner and Tenant (if applicable) and remove the POE system at a time agreed upon with the Homeowner and Tenant. This Agreement will be terminated upon system removal.

15. **MUTUAL UNDERSTANDING.** Each party has read this entire Agreement, fully understands the contents hereof and has had the opportunity to obtain independent advice as to
its legal effect. This Agreement reflects the mutual understanding of the parties with respect to all subject matter addressed herein and will be construed accordingly.

16. **NOTICE.** Except as expressly provided to the contrary herein, any notice required or permitted under this Agreement will be deemed sufficiently given if in writing and personally delivered, transmitted by facsimile, sent by email, or sent by certified mail (postage prepaid) to the party at the address set forth beneath its signature below or at such other address as the party may subsequently designate.

IN WITNESS WHEREOF, the parties have executed this Agreement effective as of the date first above written.

Community Water Center ___________  Homeowner

___________________________  ______________________________
Signature  Signature

Signed By: ____________________________  Signed By: ____________________________
Address: ____________________________  Address: ____________________________
City, State, Zip: _____________________  City, State, Zip: _____________________

**Tenant (if applicable)**

___________________________
Signature

Signed By: ____________________________
Address: ____________________________
City, State, Zip: _____________________

**Tenant (if applicable)**

___________________________
Signature

Signed By: ____________________________
Address: ____________________________
City, State, Zip: _____________________
Appendix G
Monthly Monitoring

WHA visits the treatment systems monthly to collect water samples to confirm the treatment systems are removing 123-TCP to below the MCL, and monitor for total coliform, E. coli, and heterotrophic plate count bacteria upstream and downstream of the treatment systems. The results are shown on the following page. Sample results are reported to community partners on a monthly basis. The Field Sampling Methodology that WHA uses during each visit is provided after the sampling results. Graphs of bacteria results through January 2023 can be found in February 16, 2023 TAC meeting slides in Appendix B, and graphs of 123-TCP in source water are provided in Appendix C
## Appendix G - Monthly Monitoring Report

**CWC 123-TCP Point-of-Entry Treatment Pilot Monitoring Data Through April 2023**

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<tr>
<td>System ID</td>
<td>Monitoring Date</td>
<td>Time System Has Been In Service (Days)</td>
<td>Total Cumulative Volume of Water Treated (Gallons)</td>
<td>123-TCP Well (ug/L)</td>
<td>123-TCP Between Lead/Lag Vessels (ug/L)</td>
<td>123-TCP After Lag Vessels (ug/L)</td>
<td>Total Coliform Bacteria Upstream of Treatment (MPN/100 mL)</td>
<td>Total Coliform Bacteria Downstream of Treatment (MPN/100 mL)</td>
<td>E. coli Upstream of Treatment (MPN/100 mL)</td>
<td>E. coli Downstream of Treatment (MPN/100 mL)</td>
<td>HPC Upstream of Treatment (MPN/mL)</td>
<td>HPC Downstream of Treatment (MPN/mL)</td>
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<td>----------------------------------------</td>
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1,2,3 TCP Treatment System Sampling Field Methodology

This 1,2,3-Trichloropropane (1,2,3 TCP) Treatment System specific sampling methodology has been prepared in addition to our standard Domestic Well Sampling Field Methodology. 1,2,3 TCP sampling protocols described below have been prepared for systems managed by the Community Water Center.

Sample Port Locations and Frequency of Sampling:

• Well Head (source water) – Quarterly sampling for 1,2,3 TCP
• Mid-point (hose-bib between ‘lead & lag’ filter vessels) – Monthly sampling for 1,2,3 TCP
• Effluent (hose-bib at end of treatment system, prior to POE) – Monthly sampling for 1,2,3 TCP placed on HOLD

Sampling Protocols:

The first step in sampling preparation is to identify the sampling ports where water samples will be collected in the given sampling event. Efforts will be taken to label each of the respective sample ports, however it is the responsibility of the sampler to correctly identify the required sample ports.

Field staff will

1. Identify the sampling ports where water samples will be collected in the current sampling event
2. Record the volume of water shown on the totalizing flow meter prior to flushing
3. Connect a hose to the effluent hose-bib located at the end of the treatment train
4. Open effluent hose-bib to the maximum position and flush for at least 15 minutes - the water will be flushed to waste and/or irrigation
5. Following the 15-minute flushing time period, record the volume shown on the totalizing flow meter
6. Collect the sample(s):
a. 1,2,3 TCP samples will be collected in unpreserved amber glass 40 milliliter (ml) Volatile Organic Analyses (VOA) bottles (laboratory provided)

b. Open the mid-point hose-bib (between the parallel lead & lag vessels) fully for 1 minute, then close it to reduce flow and collect a VOA sample as described below. Collect the mid-point sample while the effluent hose-bib is still fully open. Close the mid-point hose bib after collecting the sample. Label and handle the sample as described below.

c. Follow the same sampling procedure at the effluent location (OK to sample at reduced flow rate). Identify the effluent hose-bib sample to be placed on HOLD on the Chain-of-Custody form.

d. Make sure all sample ports are closed

7. Label all samples in the field with the sample ID, sampler initials, and collection date/time

8. Transport the samples in insulated containers cooled with ice to the appropriate state-certified laboratories under proper chain of custody procedures

Record Field Data:

Data regarding the treatment system will be collected on an operation log (totalizing flow meter, pressure gauge readings, descriptive notes, etc.).

VOA Sampling:

VOAs are to be filled slowly by allowing water to “pour” into the side of the vial until a positive meniscus is present at the top of the vial. The vial should then be tightly capped to compress the meniscus and inverted to confirm there are no air bubbles within the vial. If air bubbles are present the vial is discarded, and a new sample should be collected. A total of three 40 ml vials will be collected via this method for each sample, packed within foam packaging, and placed on ice for transport under proper chain-of-custody procedures to a State-Certified Laboratory for analysis.

Quarterly source water 1,2,3 TCP samples will be collected following our Domestic Well Sampling Field Methodology.
<table>
<thead>
<tr>
<th>Sampler / Technician</th>
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<th></th>
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<td>Date</td>
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<td>Time</td>
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</table>

**Pre-Treatment**

- Totalizing Flow Meter (pre-15 min Flush)
- Totalizing Flow Meter (post-15 min Flush)
- Approximate Flow Rate (GPM)
- Avg. Vol Water Treated per Day (gallons)
- Total System Pressure Range During Inspection

<table>
<thead>
<tr>
<th>Pre-Filter Inlet / Outlet (psi)</th>
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**Treatment System**

**Lead Vessels**

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<table>
<thead>
<tr>
<th>Vessel B:</th>
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<td>Inlet / Outlet (psi)</td>
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**Lag Vessels**

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</table>

<table>
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<th>Vessel D:</th>
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<td>Inlet / Outlet (psi)</td>
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**Post-Treatment**

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**NOTES**

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<tbody>
<tr>
<td>Samples Collected (Y or N)? From Where?</td>
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</table>

**Sampling Frequency for 123 TCP**

- **Monthly**: Mid-point between 'lead & lag vessels'
- **Monthly**: HOLD Effluent Sample Point
- **Quarterly**: Well Head

Weber, Hayes Associates
Domestic Well Sampling Field Methodology


The first step in sampling preparation is to identify the most appropriate sampling port (e.g. dedicated downturned sample port or hose bib) in the water system and remove any attachments. Samples are collected as close to the well head as possible, and the sampling location is noted on field data sheets.

All field and sampling equipment are decontaminated before, between, and after measurements or sampling by washing in a Liqui-Nox and tap water solution, rinsing with tap water, and rinsing with distilled water.

Field staff prepare a YSI Professional Plus Multi-Parameter flow-through meter and a demarcated 5-gallon bucket in the sample port vicinity. All field instruments are calibrated before each use. Water is purged prior to sampling to ensure a representative sample is collected. The purge water volume is measured and recorded. During well purging, the physical parameters of temperature, conductivity, pH, dissolved oxygen concentration, and oxidation-reduction potential of the purge water are monitored with the YSI meter to determine when these parameters have stabilized (are within 15 percent of each other for three consecutive measurements). Purging is determined to be complete (stabilized aquifer conditions) after at least 15 minutes of purging, the physical parameters have stabilized, and/or approximately three to five well casing volumes (if well construction diagrams and depth-to-water information are available) have been removed from the well. After physical
parameters have stabilized, a groundwater sample is collected from the well at a reduced flow rate in the appropriate laboratory-supplied sample container(s).

All field data (well purge volume, physical parameters, and sampling method) is recorded on field data sheets. All samples are labeled in the field with the sample ID, sampler initials, and collection date/time, and transported in insulated containers cooled with ice to state-certified laboratories under proper chain of custody procedures. Purge water is pumped to waste on the property.

After well purging and prior to collecting water samples for bacteriological analyses, the sampling port is decontaminated using heat and/or isopropyl alcohol to remove fixture bacteria bias. Water is flushed through the sampling port after decontamination and prior to collecting a sample in laboratory-supplied bacteriological sample container(s).

Samples to be analyzed for Volatile Organic Compounds (VOCs) are collected following the above purging procedures and a minimum of 15 minutes of purging. VOC samples are collected in 40 milliliter (ml) laboratory-supplied glass Volatile Organic Analyses (VOA) vials. VOAs are filled slowly by allowing water to “pour” into the side of the vial until a positive meniscus is present at the top of the vial. Care is taken to prevent preservative in the VOA from being washed out during filling. The vial is then tightly capped to compress the meniscus and inverted to confirm there are no air bubbles within the vial. If air bubbles are present the vial is discarded, and a new sample is collected. A total of three 40 ml vials are collected via this method for each sample, packed within foam packaging, and placed on ice for transport under proper chain-of-custody procedures to a State-Certified Laboratory for analysis.
# Appendix H
## Operation and Maintenance Log
### 123-TCP Treatment Systems

<table>
<thead>
<tr>
<th>Treatment System #</th>
<th>Incident Date Report</th>
<th>Incident Date Resolved</th>
<th>Resolution Action</th>
<th>Resolution Time</th>
<th>WHA, Subcontractor &amp; Materials Expenses (See Note 1)</th>
<th>Total O&amp;M Expense</th>
</tr>
</thead>
<tbody>
<tr>
<td>DWMC-01</td>
<td>4/24/23 - WHA inspected pre-filter and post-filter - none present.</td>
<td>4/24/23 - Install new pre- &amp; post-filters</td>
<td>4/24/23 - Install new pre- &amp; post-filters.</td>
<td>Same day</td>
<td>Filter = $40.19 x 2 No labor cost because completed during monitoring visit</td>
<td>$80.38</td>
</tr>
<tr>
<td>DWMC-01</td>
<td>4/24/23 - WHA observed flow data logger battery dead</td>
<td>4/24/23 - Replaced battery</td>
<td>Replace battery on Flow Data Logger</td>
<td>Same day</td>
<td>Battery = $10.25 No labor cost because completed during monitoring visit</td>
<td>$10.25</td>
</tr>
<tr>
<td>DWMC-02</td>
<td>1/14/21 - WHA reported faulty pressure gauge on lag bank C.</td>
<td>10/15/21 - Culligan replaced faulty gauge.</td>
<td>Gauge replacement</td>
<td>Reported immediately upon observation - ~9 months for replacement under warranty</td>
<td>Covered under warranty</td>
<td></td>
</tr>
<tr>
<td>DWMC-02</td>
<td>6/1/21 - Worked with property owner after storage tank disinfection and water system repairs to plan to put treatment system back online</td>
<td>N/A</td>
<td>Put treatment system back online on 6/10/21.</td>
<td>N/A</td>
<td>3 hrs @ $85/hr = $255</td>
<td>$255.00</td>
</tr>
<tr>
<td>DWMC-02</td>
<td>6/29/21 - Voicemail from Property Owner. Reported leak on system.</td>
<td>WHA inspected on 6/30/21, reported the leak to Culligan, and took two of the four vessels offline to stop the leak until it was repaired. Culligan repaired the leak and put the full system back online on 7/2/21.</td>
<td>Leak at hose bib (post-treatment) and leak at flow controller effluent on vessel A. WHA completes inspection of problem and coordinates with Culligan plumber for repair. Culligan plumber completes repair.</td>
<td>3 days</td>
<td>WHA coordination: 1 hr @$85/hr = $85 Culligan costs covered under warranty</td>
<td>$85.00</td>
</tr>
<tr>
<td>DWMC-02</td>
<td>10/19/21 - WHA to replace post-filter during November monitoring visit</td>
<td>11/11/21 - WHA replaced post filter</td>
<td>Post-filter replacement</td>
<td>Scheduled and completed - 23 days</td>
<td>Post-Filter Cost ($35) + Replacement Labor (1.25 hrs @ $75/hr = $93.75) + Vehicle Use ($16) = $143.75</td>
<td>$143.75</td>
</tr>
<tr>
<td>DWMC-02</td>
<td>1/20/22 - WHA observed very small leak at post treatment hosebib. Will need to replace hose bib.</td>
<td>1/28/22 - WHA replaced hosebib</td>
<td>Hosebib replacement</td>
<td>8 days</td>
<td>1 hour of WHA Labor - Senior Scientist ($85)</td>
<td>$85.00</td>
</tr>
<tr>
<td>Treatment System #</td>
<td>Incident Date Report</td>
<td>Incident Date Resolved</td>
<td>Resolution Action</td>
<td>Resolution Time</td>
<td>WHA, Subcontractor &amp; Materials Expenses (See Note 1)</td>
<td>Total O&amp;M Expense</td>
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<tr>
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<tr>
<td>DWMC-02</td>
<td>6/03/22 - CWC staff put system into bypass. Property owner completed disinfection prior to collecting bacteria sample. 06/10/22 - CWC requested chloride sample and system to be placed online.</td>
<td>6/12/22 - WHA sampled water system for chlorine and put system online</td>
<td>System online</td>
<td>2 days</td>
<td>Completed as part of Monthly Monitoring</td>
<td></td>
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<tr>
<td>DWMC-02</td>
<td>9/15/22 - WHA observed faulty gauge on pre- pre-filter and potentially Vessel A. Still need gauge replacement on Vessel A.</td>
<td>10/20/22 - WHA replaced gauge on pre- pre-filter</td>
<td>Gauge replacement</td>
<td>Approx. 1 month</td>
<td>Labor Costs Covered under warranty</td>
<td>$62.13</td>
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<tr>
<td>DWMC-02</td>
<td>No incident - pre-filter purchased to have on standby for replacement.</td>
<td>12/13/22 - Pre-filter purchased</td>
<td>Pre-filter purchase</td>
<td></td>
<td>Filter cost: $205.70</td>
<td>$205.70</td>
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<tr>
<td>DWMC-02</td>
<td>Pressure gauge malfunction over time</td>
<td>2/22/23 - Replace pressure gauges</td>
<td>Pressure gauge replacement (2 total)</td>
<td>N/A</td>
<td>Pressure Gauge Cost ($90.97 - 2 total)</td>
<td>$90.97</td>
</tr>
<tr>
<td>DWMC-04</td>
<td>6/23/21 - WHA reported faulty pressure gauges on lag banks C &amp; D. Culligan to replace under warranty. Gauge is used for monitoring, but does not affect treatment.</td>
<td>10/15/21 - Culligan replaced faulty gauge.</td>
<td>Gauge replacement</td>
<td>Reported immediately upon observation - ~3.5 months for replacement under warranty</td>
<td>Covered under warranty</td>
<td></td>
</tr>
<tr>
<td>DWMC-04</td>
<td>10/19/21 - WHA observed slight leak at Lead Bank A during monitoring. Reported to Culligan immediately.</td>
<td>11/11/21 - Re-inspected with no leak observed</td>
<td></td>
<td>1.5 weeks</td>
<td>Covered under warranty</td>
<td></td>
</tr>
<tr>
<td>DWMC-04</td>
<td>10/19/21 - WHA to replace post-filter during November monitoring visit</td>
<td>11/11/21 - WHA replaced post filter and O-ring</td>
<td>Post-filter and O-ring replacement</td>
<td>Scheduled and completed - 23 days</td>
<td>Post-Filter Cost ($35) + O-ring cost ($5.43) + Replacement Labor (1.25 hrs @ $75/hr = $93.75) + Vehicle Use ($16) = $149.18</td>
<td>$149.18</td>
</tr>
<tr>
<td>DWMC-04</td>
<td>01/10/22 - Home owner reported a small leak on treatment system and requested repair tech visit.</td>
<td>1/14/22 - Culligan inspected system and completed repair of leak</td>
<td>Remove and Clean hosebib + threads. There is a potential leak will return - Culligan is ordering replacement fitting if needed in future.</td>
<td>4 days</td>
<td>Covered under warranty</td>
<td></td>
</tr>
<tr>
<td>Treatment System #</td>
<td>Incident Date Report</td>
<td>Incident Date Resolved</td>
<td>Resolution Action</td>
<td>Resolution Time</td>
<td>WHA, Subcontractor &amp; Materials Expenses (See Note 1)</td>
<td>Total O&amp;M Expense</td>
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<tr>
<td>DWMC-04</td>
<td>5/24/22 - WHA confirmed Vessel A inlet gauge needs replacement. Contacted Culligan for gauge replacement.</td>
<td>10/20/22 - WHA purchased replacement gauge</td>
<td>Gauge replacement</td>
<td>Approx. 1 month</td>
<td>Labor Costs Covered under warranty</td>
<td>$62.14</td>
</tr>
<tr>
<td>DWMC-04</td>
<td>8/23/22 - WHA observed slight leak on two Vessel C hosebibs. Will replace on next monthly monitoring visit.</td>
<td>9/15/22 - WHA replaced leaking hosebibs.</td>
<td>Hosebib replacement</td>
<td>Approx. 1 month</td>
<td>Hosebib Cost (2 total + markup): $26.08</td>
<td>$26.08</td>
</tr>
<tr>
<td>DWMC-04</td>
<td>No incident - pre-filter purchased to have on standby for replacement.</td>
<td>12/13/22 - Pre-filter purchased</td>
<td>Pre-filter purchase</td>
<td></td>
<td>Filter cost: $205.70</td>
<td>$205.70</td>
</tr>
<tr>
<td>DWMC-04</td>
<td>1/31/23 - Flow Data Logger ran out of battery</td>
<td>1/31/23 - Replace battery</td>
<td>Replace battery on Flow Data Logger</td>
<td>1 day</td>
<td>Battery Cost: $10.23</td>
<td>$10.23</td>
</tr>
<tr>
<td>DWMC-04</td>
<td>2/28/23 - Pressure gauge malfunction over time</td>
<td>2/28/23 - Replace pressure gauges</td>
<td>Pressure gauge replacement (1 total)</td>
<td>1 day</td>
<td>Pressure Gauge Cost ($45.49 - 1 total)</td>
<td>$45.49</td>
</tr>
<tr>
<td>Treatment System #</td>
<td>Incident Date Report</td>
<td>Incident Date Resolved</td>
<td>Resolution Action</td>
<td>Resolution Time</td>
<td>WHA, Subcontractor &amp; Materials Expenses (See Note 1)</td>
<td>Total O&amp;M Expense</td>
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</tr>
<tr>
<td>DWMC-09</td>
<td>10/19/21 - WHA reported potentially faulty pressure gauges on lag bank C. However, during the subsequent 4 months the gauges appeared to function normally. WHA will continue to monitor this gauge and ask Culligan to replace under warranty if it appears to have problems in the future.</td>
<td>11/11/21 - WHA replaced post filter</td>
<td>WHA continuing to monitor monthly.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DWMC-09</td>
<td>10/19/21 - WHA to replace post-filter during November monitoring visit</td>
<td>11/11/21 - WHA replaced post filter</td>
<td>Post-filter replacement</td>
<td>Scheduled and completed - 23 days</td>
<td>Post-Filter Cost ($35) + Replacement Labor (1.5 hrs @ $75/hr = $112.50) + Vehicle Use ($15) = $162.50</td>
<td>$162.50</td>
</tr>
<tr>
<td>DWMC-09</td>
<td>12/21/21 - WHA observed small leak on Vessel B tank header while well pump is operating. Notify Culligan of leak and request technician visit. 3/3/22 - Culligan observed leak and scheduled repair for week of 3/7/22</td>
<td>3/28/22 - Culligan replaced 'O' ring on vessel B header</td>
<td>Culligan replaced 'O' ring on vessel B header</td>
<td>Reported upon observation. Confirmation of repair on 3/28/22 - Approx. 3 months.</td>
<td>Covered under warranty</td>
<td></td>
</tr>
<tr>
<td>DWMC-09</td>
<td>4/20/22 - WHA observed leak on mid-point hosebib.</td>
<td>6/15/22 - WHA replaced hosebib</td>
<td>Hosebib replacement</td>
<td>Monitored until repaired on 6/15/22 - Approx. 2 months</td>
<td>No Additional Charge</td>
<td></td>
</tr>
<tr>
<td>DWMC-09</td>
<td>No incident - pre-filter purchased to have on standby for replacement.</td>
<td>12/13/22 - Pre-filter purchased</td>
<td>Pre-filter Purchase</td>
<td></td>
<td>Filter cost: $205.70</td>
<td>$205.70</td>
</tr>
<tr>
<td>DWMC-09</td>
<td>Pre-filter replacement</td>
<td>2/9/23 - Pre-filter replaced</td>
<td>Pre-filter Replacement</td>
<td>Ongoing O&amp;M</td>
<td>WHA labor ($85 * 2)</td>
<td>$170.00</td>
</tr>
<tr>
<td>Treatment System #</td>
<td>Incident Date Report</td>
<td>Incident Date Resolved</td>
<td>Resolution Action</td>
<td>Resolution Time</td>
<td>WHA, Subcontractor &amp; Materials Expenses (See Note 1)</td>
<td>Total O&amp;M Expense</td>
</tr>
<tr>
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</tr>
<tr>
<td>DWMC-10</td>
<td>1/30/23 - Flow Data Logger ran out of battery</td>
<td>1/30/23 - Replace battery</td>
<td>Replace battery</td>
<td>1 day</td>
<td>Battery Cost: $10.23</td>
<td>$10.23</td>
</tr>
<tr>
<td>DWMC-14</td>
<td>5/24/22 - Resident reported to CWC a leak in a valve - CWC reported to WHA who went in person on 5/25/22 to review, and reported to Culligan's to fix on 5/26/22</td>
<td>5/26/22 - Culligan resolved leak in valve</td>
<td>Replace cracked plastic fitting</td>
<td>Scheduled and completed - 2 days</td>
<td>Covered under warranty</td>
<td></td>
</tr>
<tr>
<td>DWMC-14</td>
<td>5/26/22 - Resident reported to CWC additional hosebib leak, CWC reported to WHA who inspected on 6/2/22</td>
<td>6/2/22 - WHA resolved leak</td>
<td>Replaced hose bib</td>
<td>Scheduled and completed - 7 days</td>
<td>No Additional Charge</td>
<td></td>
</tr>
<tr>
<td>DWMC-14</td>
<td>6/17/22 - Lab results indicate presence of E.coli post-treatment. WHA notified CWC immediately. WHA put treatment system into bypass on 6/19/22. WHA re-sampled post-treatment on 6/29/22. E.coli still present post-treatment. Notified CWC. Treatment system remains in bypass. Developing plan to resolve the issue.</td>
<td>7/11/22 - WHA completes ongoing coordination of carbon replacement</td>
<td>7/11/22 - WHA Labor for Solution Coordination ($85 * 0.5)</td>
<td>$42.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DWMC-14</td>
<td>6/23/22 - Resident reported additional leak to CWC, CWC reported to WHA who inspected on 6/29/22. Repaired by Culligan on 6/30/22</td>
<td>6/30/22 - Culligan resolved leak</td>
<td>Replace cracked plastic fitting</td>
<td>Scheduled and completed - 7 days</td>
<td>Covered under warranty</td>
<td></td>
</tr>
<tr>
<td>Treatment System #</td>
<td>Incident Date Report</td>
<td>Incident Date Resolved</td>
<td>Resolution Action</td>
<td>Resolution Time</td>
<td>WHA, Subcontractor &amp; Materials Expenses (See Note 1)</td>
<td>Total O&amp;M Expense</td>
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</tr>
<tr>
<td>DWMC-14</td>
<td>Week of 10/17/22 - Culligan replaced GAC and sanitized the system. Flushed system and collected bacteria samples prior to placing system in service.</td>
<td>10/17/22 - Prep 10/20/22 - Bacteria Sampling</td>
<td>Collect confirmation bacteria samples</td>
<td>3 days</td>
<td>10/17/22 - WHA labor ($85<em>0.25) 10/20/22 - WHA labor ($85</em>1) GAC replacement cost (with 10% WHA markup) $2103.81</td>
<td>$2,210.06</td>
</tr>
<tr>
<td>DWMC-14</td>
<td>10/28/22 - Resident reported seeing carbon fines in water. Pre and Post filters were removed during carbon treatment sanitizing.</td>
<td>10/31/22 - WHA replaced pre-and post-filters</td>
<td>Replace pre-filter and post-filter</td>
<td>3 days</td>
<td>10/31/22 - WHA labor + truck for filter replacement and oversight ($85<em>2) ($130</em>.25) ($15) Pre/Post Filters (2) = $67.87</td>
<td>$285.37</td>
</tr>
<tr>
<td>DWMC-19</td>
<td>6/16/22 - Lab results indicate presence of E.coli post-treatment. WHA notified CWC immediately. WHA put treatment system into bypass on 6/17/22 and re-sampled. E.coli absent post-treatment. Re-sampled on 6/29/22 to confirm absence of E.coli post-treatment. E.coli was present. Notified CWC. Treatment system remains in bypass. Developing plan to resolve the issue.</td>
<td>7/11/22 - WHA completes ongoing coordination of carbon replacement 9/6/22, 9/30/22 - WHA coordinates with Culligan to complete carbon replacement</td>
<td></td>
<td></td>
<td>7/11/22 - WHA Labor for Solution Coordination ($85 * 0.5) 9/22 - WHA Labor for Solution Coordination ($85 * 0.5) + ($130 * 0.5)</td>
<td>$107.50</td>
</tr>
<tr>
<td>Treatment System #</td>
<td>Incident Date Report</td>
<td>Incident Date Resolved</td>
<td>Resolution Action</td>
<td>Resolution Time</td>
<td>WHA, Subcontractor &amp; Materials Expenses (See Note 1)</td>
<td>Total O&amp;M Expense</td>
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</tr>
<tr>
<td>DWMC-19</td>
<td>Week of 10/3/22 - Culligan replaced GAC and sanitized the system. Flushed system and collected bacteria samples prior to placing system in service. system in service.</td>
<td>10/6/22 - Prep and Bacteria Sampling</td>
<td>Collect confirmation bacteria samples</td>
<td>3 days</td>
<td>10/20/22 - WHA labor ($85*1.75) GAC replacement cost (with 10% WHA markup) $2083.65</td>
<td>$2,232.40</td>
</tr>
<tr>
<td>DWMC-19</td>
<td>4/19/23 - WHA inspected pre-filter and post-filter - none present.</td>
<td>4/19/23 - Install new pre- &amp; post-filters.</td>
<td>4/19/23 - Install new pre- &amp; post-filters.</td>
<td>Same day</td>
<td>Filter = $40.19 x 2 WHA Labor ($85*1.5)</td>
<td>$207.88</td>
</tr>
<tr>
<td>DWMC-21</td>
<td>6/1/22 - Resident reported having brown water and no water pressure. Resident called Culligan, who told them to turn the three-way valve to bypass (i.e. treatment system off-line). WHA inspected on 6/2/22 when out at the household for monthly monitoring.</td>
<td>6/2/22 - WHA inspected system</td>
<td>It appears the well is producing sand/turbid water. This is likely due to the well pump intake sucking in sand. There could be sedimentation in the bottom of the well. There could be a failure in the well screen which is causing sand/filter pack material to enter well. Treatment system was put in bypass until this well-related issue could be addressed by pump contractor.</td>
<td>Inspected - 1 day</td>
<td>No Additional Charge</td>
<td></td>
</tr>
<tr>
<td>DWMC-21</td>
<td>6/16/22 - CWC reported no sand/mud/turbidity observed in water system by resident in last two weeks. CWC requested treatment system to be placed online.</td>
<td>6/16/22 - WHA inspected system and purged well until well pump operated. No observable sand/sediment observed in water.</td>
<td>Treatment system placed back online</td>
<td>Inspected - 1 day</td>
<td>Completed during Monthly Monitoring</td>
<td></td>
</tr>
<tr>
<td>DWMC-21</td>
<td>6/30/22 - Potential for sediment/sand clogging of pre-filter (noticeable pressure drop). WHA will inspect pre/post filters on next visit.</td>
<td>7/27/22 - WHA inspected pre-filter. Appeared heavily impacted with turbid water/sand. Post-treatment filter appeared impacted with carbon fines. Place system in bypass until filters changes and discussion with property owner.</td>
<td>Change pre and post filters. Property owner to complete additional well investigation regarding long-term well solution</td>
<td>Inspected - 27 days</td>
<td>1.5 hrs @ $85/hr = $127.50 Pre/Post Filters (2) = ($30.85 * 2) = $61.70</td>
<td>$127.50</td>
</tr>
<tr>
<td>DWMC-21</td>
<td>8/23/22 - WHA inspected pre-filter. Appeared heavily impacted with turbid water/sand.</td>
<td>8/23/22 - Pre-filter Replacement</td>
<td>Replace and sanitize pre-filter</td>
<td>Inspected and replaced - 1 day</td>
<td>Pre Filter = $30.85 No labor cost because completed during monitoring visit</td>
<td>$30.85</td>
</tr>
<tr>
<td>Treatment System #</td>
<td>Incident Date Report</td>
<td>Incident Date Resolved</td>
<td>Resolution Action</td>
<td>Resolution Time</td>
<td>WHA, Subcontractor &amp; Materials Expenses (See Note 1)</td>
<td>Total O&amp;M Expense</td>
</tr>
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</tr>
<tr>
<td>DWMC-21</td>
<td>9/15/22 - WHA inspected pre-filter. Appeared heavily impacted with turbid water/sand.</td>
<td>9/15/22 - Pre-filter Replacement</td>
<td>Replace and sanitize pre-filter</td>
<td>Inspected and replaced - 1 day</td>
<td>Pre Filter = $30.85 No labor cost because completed during monitoring visit</td>
<td>$33.94</td>
</tr>
<tr>
<td>DWMC-21</td>
<td>10/20/22 - WHA inspected pre-filter. Appeared heavily impacted with turbid water/sand.</td>
<td>10/20/22 - Pre-filter Replacement</td>
<td>Replace and sanitize pre-filter</td>
<td>Inspected and replaced - 1 day</td>
<td>Pre Filter = $30.85 No labor cost because completed during monitoring visit</td>
<td>$33.94</td>
</tr>
<tr>
<td>DWMC-21</td>
<td>11/17/22 - WHA inspected pre-filter. Appeared heavily impacted with turbid water/sand.</td>
<td>11/17/22 - Pre-filter Replacement</td>
<td>Replace and sanitize pre-filter</td>
<td>Inspected and replaced - 1 day</td>
<td>Pre Filter = $30.85 No labor cost because completed during monitoring visit</td>
<td>$33.94</td>
</tr>
<tr>
<td>DWMC-21</td>
<td>12/21/22 - WHA inspected pre-filter. Appeared heavily impacted with turbid water/sand.</td>
<td>12/21/22 - Pre-filter Replacement</td>
<td>Replace and sanitize pre-filter</td>
<td>Inspected and replaced - 1 day</td>
<td>Pre Filter = $46.52 No labor cost because completed during monitoring visit</td>
<td>$33.94</td>
</tr>
<tr>
<td>DWMC-21</td>
<td>12/21/22 - Bacteria sample positive for E.coli</td>
<td>12/21/22 - Notify/discuss with CWC immediately 12/30/22 - Confirmation bacteria sampling</td>
<td>Confirmation samples collected upstream and downstream of the treatment system on 1/4/23 and 1/12/23 were non-detect for E. coli and the system was left online.</td>
<td>Notified immediately and re-sampled</td>
<td>WHA Labor: ($75 * 2)</td>
<td>$150.00</td>
</tr>
<tr>
<td>DWMC-21</td>
<td>1/31/23 - WHA inspected pre-filter. Appeared heavily impacted with turbid water/sand.</td>
<td>1/31/23 - Pre-filter Replacement</td>
<td>Replace and sanitize pre-filter</td>
<td>Inspected and replaced - 1 day</td>
<td>Pre Filter = $30.85 No labor cost because completed during monitoring visit</td>
<td>$30.85</td>
</tr>
<tr>
<td>DWMC-21</td>
<td>3/30/23 - WHA inspected pre-filter. Appeared heavily impacted with turbid water/sand.</td>
<td>3/31/23 - Pre-filter Replacement</td>
<td>Replace and sanitize pre-filter</td>
<td>Inspected and replaced - 2 day</td>
<td>Pre Filter = $40.19 No labor cost because completed during monitoring visit (Billed in April 2023)</td>
<td>$40.19</td>
</tr>
<tr>
<td>DWMC-21</td>
<td>4/24/23 - WHA inspected pre-filter. Appeared heavily impacted with turbid water/sand.</td>
<td>4/24/23 - Pre-filter Replacement</td>
<td>Replace and sanitize pre-filter</td>
<td>Same day</td>
<td>Pre Filter = $40.19 No labor cost because completed during monitoring visit</td>
<td>$40.19</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total O&amp;M Expense</td>
<td>$8,293.26</td>
</tr>
</tbody>
</table>
NOTES:

(1) For CWC’s contract with Weber Hayes and Associates (WHA), Culligan is providing a one-year warranty on equipment and appurtenances they supply for installation and a five-year warranty on the filter tanks after installation. This warranty does not include WHA staff time to coordinate repairs and the granular activated carbon (GAC) filter media or pre- or post-filter cartridges. Operation and maintenance activities not covered under Culligan’s warranty are performed by WHA and Culligan according to costs shown in CWC’s contract with WHA or on a time and materials basis.
Appendix I
Costs

In addition to system implementation costs, there were additional costs for community outreach and education as well as project management and technical oversight (see Table I-1) that are not shown in the Project Costs section of the main report. Project outreach, education and enrollment included the time spent connecting with households served by drinking water wells with 123-TCP contamination; drafting and signing of participation and implementation agreements; coordination of site assessments, monitoring, and other site visits; overall determination of the feasibility of system installation on a case-by-case basis; and troubleshooting numerous issues with community partners as they arose based on the unique aspects of each site. Technical oversight included coordination with WHA and convening of the TAC. Project management included management of CWC’s SEP funding agreement as well as CWC’s subcontract with WHA.

WHA’s project management costs are also shown in Table I-1 and were not included in the costs presented in the main report.

The costs in Table I-1 do not include CWC staff time spent on outreach and recruitment for initial well testing of 211 wells facilitated by CWC (which identified 27 wells with 123-TCP), or CWC staff time to develop this report or present the results of the pilot.

Table I-1: Outreach, Management, Technical Oversight Costs

<table>
<thead>
<tr>
<th></th>
<th>CWC Outreach, Technical Oversight, and Project Management (through May 2023)</th>
<th>WHA Project Management (through April 2023)</th>
<th>Total Outreach, Management, and Technical Oversight Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cost</td>
<td>$181,804</td>
<td>$19,305</td>
<td>$201,109</td>
</tr>
<tr>
<td>Average Cost per System Installed</td>
<td>$20,200</td>
<td>$2,145</td>
<td>$22,345</td>
</tr>
</tbody>
</table>

Table I-2 illustrates the implementation costs through April 2023 of all nine installed systems. Installation costs are higher, as expected, for the larger systems. In addition, some individual systems had higher costs due to the following:
- The DWMC-09 installation cost was higher due to the need to install a variable frequency drive and controller on the well pump so that the treatment system could be located directly downstream of the well and serve both households on the property.
- Shade structures were installed at DWMC-01, DWMC-09, and DWMC-15 to protect the treatment systems from direct sunlight, prolong the life of plastic plumbing components, and prevent high temperatures which could promote microbial growth in the GAC.
- The higher monthly monitoring costs for DWMC-14 and DWMC-19 represent only seven and two months of monitoring, respectively, and thus may not be representative of long-term monitoring costs.
- The high average monthly minor maintenance cost for DWMC-14 and DWMC-19 includes WHA’s time to inspect the water system after E. coli was detected following installation and is also averaged over a short time span so is likely not representative of long-term costs.

Table I-2: Implementation Costs (through April 2023)

<table>
<thead>
<tr>
<th>System ID</th>
<th>Volume of Carbon (cubic feet)</th>
<th>Site Assessment and Installation (WHA and Culligan)</th>
<th>Months in Service</th>
<th>Average Monthly Monitoring Cost to Date (WHA)</th>
<th>Average Monthly Minor Maintenance Costs (WHA and Culligan)</th>
<th>GAC Replacement Costs to Date$^1$ (WHA and Culligan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DWMC-01</td>
<td>7.2</td>
<td>$11,502</td>
<td>5</td>
<td>$388</td>
<td>$18</td>
<td>N/A $1,317</td>
</tr>
<tr>
<td>DWMC-02</td>
<td>24</td>
<td>$12,233</td>
<td>23</td>
<td>$366</td>
<td>$40</td>
<td>N/A $2,915</td>
</tr>
<tr>
<td>DWMC-04</td>
<td>24</td>
<td>$14,277</td>
<td>22</td>
<td>$364</td>
<td>$23</td>
<td>N/A $2,915</td>
</tr>
<tr>
<td>DWMC-09</td>
<td>24</td>
<td>$20,673</td>
<td>22</td>
<td>$425</td>
<td>$24</td>
<td>N/A $2,915</td>
</tr>
<tr>
<td>DWMC-10</td>
<td>4.0</td>
<td>$9,796</td>
<td>12</td>
<td>$392</td>
<td>$1</td>
<td>N/A $771</td>
</tr>
<tr>
<td>DWMC-14</td>
<td>7.2</td>
<td>$10,295</td>
<td>7</td>
<td>$403</td>
<td>$113</td>
<td>$2,228 $1,317</td>
</tr>
<tr>
<td>DWMC-15</td>
<td>4.0</td>
<td>$10,101</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A $771</td>
</tr>
<tr>
<td>DWMC-19</td>
<td>7.2</td>
<td>$9,882</td>
<td>2</td>
<td>$524</td>
<td>$149</td>
<td>$2,293 $1,317</td>
</tr>
<tr>
<td>DWMC-21</td>
<td>4.0</td>
<td>$9,359</td>
<td>12</td>
<td>$339</td>
<td>$46</td>
<td>N/A $771</td>
</tr>
</tbody>
</table>

$^1$Because 123-TCP breakthrough has not occurred in any systems yet, GAC replacement frequency (and thus annual cost) is not yet known. The budgeted cost for replacing the lead tank(s) in each system is shown for reference. GAC in DWMC-14 and DWMC-19 lead and lag tanks was replaced shortly after installation to resolve E. coli contamination issues.