WATER MANAGEMENT &
LONG RANGE PLANNING
COMMITTEE
AGENDA LETTER

Secretary of the Board of Directors
4699 Hollister Avenue
Goleta, CA 93110
(805) 879-4621

Department:	Engineering
For Agenda Of:	November 15, 2017
Estimated Time:	15 minutes
Continued Item:	No
If Yes, date from:	

TO: Committee Members

FROM: Department: Engineering

Contact Info: Daniel Brooks, P.E., Chief Engineer

SUBJECT: **THM Reduction Program**

Legal Concurrence:
As to Form: Yes

Recommended Actions:
Receive a report on the District's THM Reduction Program and provide direction to staff as appropriate.

Summary Text:
Each year the District collects thousands of water samples to monitor water quality and ensure compliance with drinking water standards. As reported in the most recent Consumer Confidence Report, the water the District serves is currently in compliance with all State and Federal standards. However, the prolonged drought and recent fires in the Lake Cachuma watershed have led to changing water quality conditions and raised concerns about future impacts to water quality. The District is already adjusting treatment protocols and operations to address these conditions in the short term, but it is anticipated that additional treatment will be required to address water quality challenges in the mid to long term.

Changing Water Quality Conditions
Six years of drought and two major wildfires (the 240,207-acre Zaca Fire in 2007 and 32,606-acre Rey Fire in 2016) in the Cachuma watershed in the last ten years have introduced large amounts of organic matter into the lake via stormwater runoff. Data show that organic matter levels in Cachuma reached a historic high during the past year and are expected to increase further. The 18,430-acre Whittier Fire above Lake Cachuma in July 2017 is expected to deliver a significant amount of organic matter to the lake when its steep watershed slopes experience runoff and erosion during winter storms in 2017, 2018, and beyond. Additionally, as lake levels dropped during the drought, vegetation grew on previously submerged areas of the lake bed. As lake levels rose in 2017, the vegetation was submerged and is now decaying, further increasing organic material in the lake.

Currently, one of the District's top water quality priorities is to reduce trihalomethanes (THMs). THMs are a byproduct formed in water when chlorine, used for disinfection, reacts with natural organic matter

such as decaying vegetation. THM concentrations and the rate of THM formation is driven by the organic matter concentration, the chlorine dosage, time, and temperature. A permanent solution to the District's THM problem is likely to consist of both reducing THM precursors and reducing THMs formed in treated water.

The drinking water standard for THMs is 80 micrograms per liter (µg/L) based on a four-quarter locational running annual average (LRAA). While the District's potable water currently meets drinking water standards for THMs, increasing levels of organic matter in Lake Cachuma are expected to drive THMs beyond the current treatment capabilities of the Corona Del Mar Water Treatment Plant (CDMWTP) and above the regulatory standard, which would trigger notification to customers as required by law.

To address these challenges, the District has increased water quality sampling, implemented operational changes, and begun work on determining short-, medium-, and long-term treatment solutions. The Board-approved 2017 amendment to the Infrastructure Improvement Plan (IIP) for 2015-2020 identified water quality as the top priority for capital spending.

This report provides an overview of the District's activities to date and details the current efforts to reduce THM levels and, if possible, avoid exceeding the regulatory standard. To ensure that the District's planning and testing is sound and complete, the District has hired an industry-leading water quality expert from West-Yost Associates to provide peer review of all THM-related activities. While the District's ongoing work is based on current information and test results, the approach is designed to be flexible and adaptive to incorporate ongoing water quality results and analysis.

Immediate Operational Changes to Control THMs

The District has increased its water sampling efforts to better understand and monitor THM formation throughout the treatment and distribution systems. The District has also initiated the following measures to reduce THMs in the near term:

- To decrease water age, the District has reduced storage in distribution reservoirs to 50% during normal operations. Reducing storage means reducing the time it takes for newly treated water to reach customers, which means less time for THMs to form.
- The District's Operations staff flushed the entire distribution system of sediment and mineral deposits for the first time since the drought started in 2011. Sediment and mineral deposits within the distribution system can act as a sink for chlorine, so a clean system naturally lowers chlorine demand.
- To reduce the chlorine dose used at the start of the treatment process at CDMWTP, the District reduced pre-chlorination levels to the minimum possible while still preventing algae growth in the basins at CDMWTP.

The District will be operating its groundwater wells at maximum capacity through May, recognizing that the wells can meet system demand during periods of low seasonal demand until full-scale treatment can be implemented in the long term. Since customer demand between May to November is higher than can be met with groundwater alone, the District will return to surface water production during that time. Groundwater contains very little organic matter and therefore does not pose a THM problem. Relying on groundwater supplies for part of the year will enable the District to minimize the four-quarter LRAA.

With this approach, the District will conserve its remaining groundwater supply while balancing the challenges associated with THMs to the extent currently feasible.

Risks and Challenges
As the District's strategy for reducing THMs is highly dependent on groundwater production, maintaining the reliability of the well facilities is essential. Given the age of the facilties and the amount of mechanical equipment involved, coordinating the operation of all nine wells to operate simultaneously over sustained periods requires significant effort. To meet this challenge, the District is in the process of hiring an engineering consultant to prepare an operations, maintenance, and monitoring plan for the District well field to maximize long-term, sustained production as well as develop protocols to keep the wells in standby mode such that they can be quickly activated in the event of emergency.

While the goal is to reduce risk of well facilities not being available, the temporary or permanent loss of a large producing well at any time during the next several years increases the risk that the District may exceed the THM standard. Therefore, staff is currently re-evaluating a range of potential well upgrades to increase groundwater production reliability.

The District has also hired a consultant to perform hydraulic modeling to determine the hydraulic controls and operating scenarios needed to mix well water and treated surface water to maximize the proportion of well water being distributed throughout the District's system, thereby reducing the relative prevalence of THMs in the blended water.

Short-Term Treatment Approaches
To facilitate permanent THM reduction, the District is currently designing a spray aeration system to be installed at Fairview Reservoir in 2018. Spray aeration can generally achieve THM reductions of 30-50% via evaporation in reservoirs. The installation at Fairview Reservoir will be used to reduce THMs locally and to test the efficacy of spray aeration in District systems before considering its deployment at other reservoirs. This aeration system is a short-term project that can quickly be implemented by staff with existing resources.

Beyond spray aeration, the District has identified several cost-effective measures to reduce water age, thereby limiting the opportunity for THMs to form. While subject to further investigation, cost-benefit analysis, and risk assessment to implement in the field, these measures include:

- More frequent flushing of fire hydrants to decrease water age in areas of the system with low demand;
- Modifications to the inlet to the Barger Canyon reservoir to improve mixing and capabilities; and
- Temporary removal of the 6.4 million-gallon Van Horne Reservoir from normal operations during periods of surface water treatment.

Any decision to reduce storage beyond current levels will be subject to hydraulic modeling to ensure sufficient fire flows are maintained throughout the system.

Medium-Term Treatment Approaches
To decrease THMs mid-term, the District is pursuing the construction of an air stripping facility at the Ellwood Reservoir. Air stripping removes THMs from treated water through evaporation, accelerated by blowing large volumes of air over water as it trickles through trays designed to maximize the air-water

surface area. This air stripping facility is expected to be completed in 2019 and to treat 4 million gallons per day (MGD). The facility will be designed to remove THMs from water produced at CDMWTP before delivering it to the Dos Pueblos, Winchester Canyon, Ellwood, and Isla Vista areas. This effort follows pilot testing of currently available technologies that demonstrated 80-90% THM removal from the District's treated water. The cost of the project is estimated to be $3 million. To help fund the project, the District submitted a grant application on November 1, 2017 to the Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant Program for potential funding of $2 million toward the air stripping facility construction.

The District is also investigating the installation of covers on the sedimentation, flocculation, and filter basins to reduce chemical loss, lower temperatures, and reduce algae growth.

Long-Term Treatment Approaches
While the short-term and mid-term approaches cannot completely eliminate the possibility of exceeding the four-quarter LRAA THM standard of 80 µg/L, current efforts offer the highest probability of avoiding that scenario. A permanent, long-term solution is expected to take approximately five years to field-test, design and construct. At this stage, the District is jar testing and pilot testing several potential treatment approaches, including proprietary chemical mixes, superoxide ionization, ion exchange, ozonation, and chlorine dioxide. Each of these treatment technologies reduces organic matter levels by either breaking apart organic molecules or physically removing them from the water using charged particles.

Following jar testing and pilot testing, the more promising of approaches will be further screened and evaluated for impacts to corrosivity in the distribution system, generated waste byproducts, minimizing costs, establishing conservative timelines, comprehensive risk analysis, and other emerging disinfection byproducts for which regulations have not yet been established. As the District learns more from ongoing jar and pilot testing being conducted over the next 12 months, updates will be provided to the Committee and Board as appropriate.

Background:
Chlorine is the most widely used disinfectant in water treatment systems to treat pathogenic microbes and viruses. THMs form in water as a disinfection byproduct (DBP) when chlorine reacts with organic matter. Organic matter enters water systems from natural and anthropogenic sources. Natural organic matter (NOM) can come from animal sources, algae blooms, decay of submerged vegetation, surface runoff from burn areas, and other sources. At Lake Cachuma, contributors of NOM are believed to include surface runoff from burn areas, decay of submerged vegetation, and algal blooms. Untreated water rarely contains THMs in significant concentrations.

THM challenges are not unique to the Goleta Water District. In Santa Barbara County alone, according to the Drinking Water Enforcement Actions website of the State Water Resources Control Board, agencies required to notify customers of THM violations between 2013 and 2017 include Carpinteria Valley Water District, Central Coast Water Authority, Cuyama Community Services District, City of Santa Maria, Montecito Water District, and Vandenberg Air Force Base,. In response to increasing THM levels, the City of Santa Barbara completed the construction of a $20.7 million ozonation facility in 2013 at their Cater Water Treatment Plant. Agencies across California, including several in San Luis Obispo County, Ventura County, Los Angeles County, San Diego County, and other counties have been

required to notify customers of THM violations during the same period. East Bay Municipal Utility District, a large water agency that serves customers in Alameda and Contra Costa Counties, has been proactively notifying their customers of their efforts to reduce THMs and the potential for violation.

Fiscal Analysis:
Short-term costs related to THM reduction are funded in the FY 2017-18 budget. The Board-approved 2017 amendment to the 2015-2020 Infrastructure Improvement Plan (IIP) included $360,000 for water quality maintenance at CDMWTP and wells and $682,000 for aeration technology. The Board-approved 2017-2018 budget included $200,000 for the THM Reduction Program and $100,000 for hydraulic modeling of scenarios including those to help minimize THMs.

The 2018 amendment to the IIP is expected to reallocate funding from previously anticipated projects to address anticipated costs for FY 2017-18, 2018-19, and 2019-20, including an additional $2.3M for the air stripping facility at Ellwood Reservoir. Long-term costs are not yet known of funded but may exceed $20M. Once determined, they will need to be included in future rates and the 2020-2025 IIP.

Authored by:
Daniel Brooks, P.E., Chief Engineer