Mendocino City Community Services District

Memo

To: Board of Directors

From: District Superintendent

cc: Jim Jackson

Date: December 20, 2017

Re: Onsite vs Offsite Sludge Dewatering

Introduction

This memo was prepared to evaluate onsite vs offsite dewatering of sludge. The District's existing primary dewatering system is a combination belt filter press and thermal sludge dryer. The backup sludge dewatering system is by sand drying beds.

The drying beds have not been upgraded since they were installed in 1975. They were replaced as the primary sludge processing method in 1990 when a belt filter press was installed. Sludge from the belt press with a 10% solids content was mixed with Georgia Pacific fly ash and land applied at a ranch in the Fort Bragg area. One ten-yard dump truck of sludge was transported to the ranch weekly. When the mill closed, MCCSD installed a biosolids dryer. Biosolids are currently transported to the Redwood Landfill in Marin County. Three 10-yard transport trailers are now shipped to Marin on an annual basis.

The dryer is now twelve years old, and it is anticipated that in the future periods of prolonged maintenance or emergency repairs to the dryer or belt press may require the temporary use of at least one drying bed. On a one to three year basis, small amounts of waste and sludge are placed in the west bed to dry. The drying beds have a sand layer at the surface that is in contact with the sludge as it dewaters. Water from the sludge infiltrates down through the sand and through an underlying gravel layer. Below the gravel layer, water is collected in the underdrain and piped back to the influent wet well. The current beds are not lined and the bottoms of the beds are compacted soil. Dried sludge in the sand beds must be removed by hand by the operators.

The upgrade of the drying beds was added to the USDA funded plant upgrades project for the following reasons:

1. Provide a location that is always ready and safe to temporarily store digester sludge and waste removed from the collection system and wet wells
2. Protect groundwater by installing a concrete floor in the beds to prevent infiltration of sludge water into the aquifer
3. Allow for rapid cleaning of the beds by tractor
4. Eliminate the growth of weeds and berry vines in the sand beds that impair the use of the beds

The drying beds upgrade is one component of the USDA funded loan/grant project to upgrade several plant and recycled water systems. All costs, benefits, and disadvantages were assessed to justify an approval for either abandonment or continuation of the proposed drying bed upgrade. Several issues were analyzed:

1. Onsite treatment and offsite disposal of digester sludge
2. Onsite sludge dewatering during emergency conditions
3. Onsite vs. outsourcing digester sludge processing
4. Advantages and disadvantages of onsite vs offsite sludge and waste dewatering

Both time value of money and present worth analyses were used for the cost-benefit analysis. The initial spreadsheet evaluation was prepared by former MCCSD board member Jeffry Stubbs, and was modified by Superintendent Kelley with current costs. SHN Engineering provided the present worth spreadsheet analysis. Both spreadsheets were combined for comparison. The goal of the analyses was to determine if the benefits of onsite sludge dewatering that may include the use of one or more drying beds during emergencies and equipment repairs outweigh the advantages of implementing other possible actions.

1. Onsite Treatment and Offsite Disposal of Digester Sludge

The District's primary onsite sludge treatment process consists of an aerobic digester, a belt filter press, and a thermal sludge dryer. Excess activated sludge is wasted to the aerobic digester periodically. The digester sludge has a 1½ % solids content, which means the sludge on average has a 98.5% water content. The next two MCCSD sludge handling processes, the belt filter press and the sludge dryer, are used to progressively dewater the sludge and kill pathogenic organisms found in the sludge before being transported to a sanitary landfill. The belt filter press dewaters the sludge to about 10% solids (90% water content). The thermal dryer heats the sludge to >200°F for approximately four hours. The dryer dewaters the sludge to 90% solids and kills the pathogens in the sludge. The sludge is converted to non-hazardous, reusable Class-A biosolids following treatment by the dryer.

The District's treatment plant was originally designed with drying beds to dewater sludge. The rainy weather on the coast made this process inefficient in the winter, and the sand drying beds were labor intensive, since they required operators to hand remove dried sludge from the beds. Below the drying beds' underdrain system is compacted soil that potentially permits some infiltration of sludge water.

Initially, the dried sludge was disposed of locally to anyone who would allow it to be dumped on their property. Once the belt press was installed in 1990, approximately fifty 10-yard trailer loads of sludge per year had to be disposed of locally. Several sites were used, and in between disposal sites, the 10% solids sludge was stockpiled on the ground at the plant covered by tarps to keep it from being rained on in the winter. At one point, operators stored over 4 feet of sludge in the emergency overflow pond until a new disposal site could be found. The last disposal site was at the McGuire Ranch in Fort Bragg. In 1996, belt press sludge was mixed with Georgia Pacific fly ash and spread as a soil amendment. The District paid $42/yard to dispose of the sludge at the ranch. When the GP mill closed in 2002, the District started trucking sludge to the West Contra Costa Sanitary Landfill in the Bay Area at a cost of $1,000 per 10-yard trailer load or $100/yard to dispose of sludge with a 90% water content. In 2003, the District was informed that the landfill might not continue to accept sludge with a 10% solids content. The Board was concerned that there was potentially no other Bay Area site where the District could dispose of its 50 truckloads of 10% solids sludge if the West Contra County Landfill no longer accepted its sludge. The Mendocino Sewerage Plant sludge water content was too high for disposal at the other Bay Area sanitary waste disposal site, the Redwood Landfill. They only accepted sludge with a ≥ 20% solids content.

The District Superintendent attended a 2003 Funding Fair on June 4, 2003. The California Financing Coordinating Committee (CFCC) sponsored the Fair, which consists of state and federal agencies and departments that worked together to offer coordinated and streamlined access to infrastructure financing for California local communities. The Funding Fair provided information about loans, grants, and bond financing options for infrastructure projects. A Common Funding Inquiry Form was submitted to all state and federal agencies and departments participating in the CFCC program to determine if funding was available for installation of a District biosolids dryer. Each agency reviewed the proposed project and responded to the inquiry with information about available funding.

The California Infrastructure and Economic Development Bank (I-Bank) notified MCCSD that the proposed dryer installation qualified for funding with a low interest loan. A preliminary application for an I-Bank loan was submitted in June 2003. In April 2005, MCCSD was approved for a low interest State Revolving Fund loan from the I-Bank to purchase sludge dehydration equipment and to construct a building to house the equipment. Project groundbreaking started on June 1, 2005. The building construction and installation of the equipment was completed at the end of November 2005. On December 2, 2005, the first load of sludge was dried by the new process. In September 2007, MCCSD began disposing of 90% solids Class-A biosolids at the Redwood Landfill in Marin County. Only 2 to 3 10-yard trailer loads of biosolids are transported to the landfill annually.

Since the Mendocino Sewerage System was built in 1975, sludge dewatering and disposal has been an ongoing problem for the District. Following installation of the dryer in 2005 and use of the Redwood Landfill for disposal of the biosolids in 2007, the District finally had a stable sludge processing and disposal solution.

2. Onsite Digester Sludge Dewatering During Emergency Conditions

The combination belt filter press and sludge dryer used to produce Class-A biosolids, and disposal of the biosolids at the Redwood Landfill has provided the District with a reliable sludge handling system. Although this sludge handling system has worked well since 2005, the possibility of equipment breakdowns increase as the equipment ages. The belt press is 27 years old and the dryer is now 12 years old. When the dryer was purchased, the dryer was estimated to have a 30-year useful life (see attached P&H Consultants letter).

Since a portion of the digester sludge must be processed on a weekly basis, any prolonged shutdown of the primary press/dryer system may in the future require use of the redundant drying bed sludge handling system that the plant was originally designed with. Plant operators have avoided using the beds as much as possible, since dewatered sludge and other waste placed in the drying beds must be hand removed after it is dried. Since 1990, the emergency overflow pond was used for temporary sludge dewatering and storage, since a tractor could be used to remove the dried sludge. Following the installation of a pond liner in the overflow pond in 2013, that option was no longer possible. In 2015, the Board approved developing plans to upgrade the drying beds with concrete floors, so a tractor could be used to clean the beds if used for temporary sludge dewatering. The concrete floor upgrade to the beds would protect sludge water infiltration into the shallow unconfined aquifer. SHN Engineering completed the plans in early 2016.

The drying bed upgrade is also needed for dewatering small amounts of digester sludge debris and wet well and collection system waste that is generated on a routine basis. That material has always been dewatered in the drying beds, but a full digester volume has not been pumped into the beds since 1990, since the overflow pond was more convenient for dewatering digester sludge.

A significant benefit from upgrading the beds is being able to immediately pump digester sludge to the drying beds following an emergency shutdown of the primary press/dryer sludge dewatering system. Combination jetter/vacuum trucks can only dispose of waste removed from plant and lift station wet wells in the drying beds. It is implausible for a Vactor combo rig contractor to standby while the District arranges for a second waste hauler from the Bay Area to pick up the waste material removed from plant and lift stations wet wells or the collection system. In addition, there is no way to transfer the material from one truck to the other. Placing the waste in a drying bed is the most practical and cost-effective method for dewatering this waste. It can be dried onsite and disposed of in the onsite biosolids transport trailer after it is dewatered. Onsite dewatering of waste generated during wastewater treatment operations is particularly important when this material must be managed during an unexpected emergency situation. As the primary sludge dewatering system equipment ages, the possibility of a long equipment maintenance period or an emergency breakdown will likely require the use of at least one drying bed to temporarily dewater digester sludge.

3. Onsite vs. Outsourcing the Dewatering of Digester Sludge

The cost/lb. for dewatering digester sludge with the current press/dryer equipment is $0.86/lb.

Several neighbors adjacent to the plant raised concerns about the temporary use of the drying beds when it was announced that the beds would be upgraded with a concrete floor. They have expressed concerned about odors and the public view shed if the drying beds are used to dewater sludge. The neighbors have asked that all sludge dewatering in the drying beds be abandoned. They have suggested outsourcing the dewatering of both digester sludge produced during prolonged equipment maintenance periods or emergency breakdown of the primary sludge drying system and for processing small quantities of waste produced by other plant sewerage system processes. They claim it is less costly to dewater digester sludge and other waste material by hauling them to a Bay Area facility for treatment, and have requested that the District not dewater sludge and waste onsite with the drying beds even during emergency conditions.

In response to this request, the District analyzed several possible sludge dewatering options if the press/dryer is shutdown to determine the most cost-effective method of handling digester sludge and small amounts of waste generated during normal plant operations. The following sludge processing actions were analyzed:

1. Dry, transport, and disposal costs as at present and beds w/o upgrades used during emergency repairs to dewater 1, 2 or 4 digester volumes in 16 years
2. Dry, transport and disposal costs as at present, w/ one drying bed upgrade and beds used during emergency repairs to dewater 1, 2, or 4 digester volumes in 16 years
3. Drying, transport and disposal costs as at present w/ three drying beds upgraded and beds used during emergency repairs to dewater 1, 2, or 4 digester volumes in 16 years
4. Transport and disposal costs w/o drying bed upgrade and EBMUD process & disposal 1, 2, or 4 digester volumes in 16 years
5. Transport and disposal costs w/ drying bed upgrade and EBMUD process & disposal 1, 2, or 4 digester volumes in 16 years

Present Worth Dewatering Cost Analysis

SHN Engineering provided a spreadsheet that was used to evaluate 5 scenarios with a Present Worth analysis (see attached spreadsheet) for a 16 year period. The most cost-effective scenario was to dewater sludge with the press/dryer and 4 digester volumes dewatered in upgraded drying bed(s):

Drying, trans. and disposal costs as at present & periodic use of upgraded drying bed- $0.75/lb.

The average annual cost with this scenario is $45,029/yr. [($0.75/lb.)(60039 lbs./yr.) = $45,029/yr.].

The scenarios used to evaluate the cost-effectiveness of dewatering with the press/dryer and 1, 2, and 4 digester volumes indicated that dewatering costs decrease with increased use of the beds. The opposite is true for increased offsite disposal of digester sludge—dewatering costs increase.

Time Value Dewatering Cost Analysis

Disposal costs were also evaluated with time value of money analysis. The time value spreadsheet was provided by former Director Stubbs and costs were entered by the superintendent for each treatment scenario for a 16 year period (see attached spreadsheet). The most cost-effective of the 5 scenarios was by dewatering with the press/dryer and 4 digester volumes in upgraded drying bed(s) during repairs and emergency conditions:

Drying, trans. and disposal costs as at present & periodic use of upgraded drying bed- $0.84/lb.

With the Time Value evaluation, it was determined that the lowest annual sludge dewatering costs over a 16 year period were achieved by using the belt press/dryer system and 4 digester volumes dried in upgraded bed during emergency conditions—$50,433/yr. [($0.84/lb.)(60039 lbs./yr.) = $50,433/yr.].

Centrifuge Analysis

SHN also provided information on the annual cost of using one and two centrifuges and decommissioning the existing belt press and thermal dryer (see attached spreadsheet). A centrifuge will produce a sludge that is >20% solids. Both Present Worth and Time Value analyses were used to evaluate the cost per pound and the total annual cost to dewater with a centrifuge and dispose of the partially dewatered sludge in the Redwood Landfill.

Cost for transport and disposal as present and one centrifuge installed at 8 years w/ existing dryer taken out of operation and no drying bed upgrade - Present worth = $1.59/lb., $95,462/yr.
Time Value = $1.75/lb., $105,068/yr.

Cost for transport and disposal as present and two centrifuges installed at 8 & 16 years w/ existing dryer out of service at 8 years and no drying bed upgrade- Present Worth =$2.25/lb., $135,088/yr.
Time Value =_$2.31/lb., $138,690/yr.

Without a drying bed upgrade and one centrifuge the annual sludge treatment and disposal would costs would be $95,462 to $105,068 per year. With a redundant second centrifuge the annual costs would be $135,088 to $138,690.

Centrifuges will double or triple the costs for processing and disposing of sludge. Due to the high cost of operating one or more centrifuges to dewater and dispose of sludge with only 20% solids, switching to a centrifuge to replace the dryer is not cost-effective.

In the future when the belt filter press reaches the end of its useful life, replacing it with a centrifuge is a good option.

4. Advantages and Disadvantages of Onsite vs Offsite Sludge & Waste Dewatering

The District currently dewaters and thermally treats digester sludge onsite to produce non-hazardous Class-A biosolids. Biosolids are next transported to the Redwood Landfill for disposal. For emergency treatment of digester sludge due to an equipment breakdown of either the belt filter press or dryer, the District's redundant sludge dewatering process is accomplished by three sand drying beds.

The District analyzed several possible scenarios for dewatering digester sludge and waste removed from several sources at the plant and collection system during both emergency operations and extended repairs to the primary sludge handling system. The most cost-effective scenario until the press /dryer system is replaced was to dry, transport, and dispose of sludge as at present and occasional process digester sludge in 3 upgraded drying beds ($0.75/lb.). Increasing the number of drying bed upgrades from 1 to 3 will reduce annual sludge processing costs, since bed maintenance for weed abatement would be eliminated. There will be no cost to ratepayers for upgrading the beds, since the drying bed upgrades will be paid for with USDA grant funds.

1½% solids sludge must be pumped from the digester on a weekly basis to make room for additional waste activated sludge removed from the clarifier. On several occasions, the dryer malfunctioned with a full dryer hopper and a full digester. By the time the dryer was repaired, operators were within one day of diverting digester sludge to a drying bed. In this situation, the major advantage of having an onsite redundant sludge dewatering system is the digester sludge can be pumped to a drying bed within minutes of a determination that liquid sludge must be removed from the digester. In the event that the press/dryer system needs a major repair that could take one or more months to complete, the drying beds may be used to dewater digester sludge onsite with no disruption to the normal operation of the plant.

One of the main disadvantages of offsite treatment of digester sludge is the delay before the line of nine 5,000 gallon tanker trucks could arrive onsite to pump the liquid sludge from the digester. The Ramboll proposal submitted to the District by Mr. Potash for offsite dewatering and disposal of digester liquid sludge stated that a five-day notice was required before trucks could even be scheduled to assist MCCSD. Nine tanker trucks entering and leaving the plant will also significantly increase heavy commercial truck traffic in the Town of Mendocino.

There is no reasonable argument for offsite dewatering to limit odors or to protect the public view shed (see page 3 of Ramboll proposal). During the last twenty years, the District has not received any odor complaints due to the use of the drying beds or the overflow pond when digester sludge was being dewatered. The drying beds are located behind a six foot berm, and are not visible from public right-of-ways. No valid concerns have been raised that would necessitate offsite dewatering of digester sludge.

Compacted soil underlies the existing drying beds. Compacting soil increases the density of the soil and reduces water infiltration, but the existing drying bed bottoms are not impervious to water infiltration. The proposed upgrade to the drying beds includes a liner below the underdrain, which will prevent sludge water from infiltrating down to the aquifer. Nearby wells will be protected from any possible contamination by sludge water with upgraded beds. The District's plan is to upgrade all three drying beds with a concrete bottom if there are enough grant funds available for this component of the proposed treatment plant improvement and recycled water expansion project.

The original existing sand beds had to be cleaned by hand, which was labor intensive. The concrete floor in the upgraded beds will allow rapid cleaning of the beds with the District's bobcat tractor. Sludge removed from a drying bed will be stored in the onsite biosolids transfer trailer. This trailer is onsite at all times.

Small amounts of waste are periodically removed from plant and lift station wet wells. When the digester is cleaned periodically, small amounts of sludge are pumped from the digester to a drying bed to be dewatered. Collection system waste is also dewatered in a drying bed when required. At the October 2017 meeting, it was suggested that the small amounts of digester sludge and other waste produced by the sewerage system should be transported and disposed of at EBMUD's Oakland wastewater treatment plant. That would require a transport truck to be standing by to receive the digester sludge or grease from a lift station or waste material from a plant wet well. If the beds were not used, the District would have no way to temporarily remove small quantities of digester sludge or waste without arranging a week or longer in advance for a truck to be onsite. Not using the existing drying beds would eliminate the ability of District operators to dewater or temporarily store small quantities of digester sludge and waste from other processes during either normal operations or emergency conditions. There is also no guarantee that EBMUD will continue their current program to process and dispose of another agency's sludge and waste in the future.

Conclusion

Based on a time value of money and present worth spreadsheet evaluation of several sludge dewatering options, the most cost-effective way to dewater and dispose of Mendocino digester sludge, waste, and biosolids is with MCCSD's existing sludge dewatering systems. USDA grant funded drying bed upgrades will not increase annual sludge drying costs. Upgrading drying beds with a concrete floor will protect groundwater if the beds are used during emergency or planned maintenance to the primary sludge dewatering system.

Transporting digester sludge and small quantities of waste by a private Bay Area company and processing the material in a Bay Area wastewater plant are not cost-effective actions compared to temporarily dewatering this material onsite in upgraded drying beds if the District's primary press/dryer system is shut down for repairs. Staff recommend using MCCSD's existing facilities to dewater sludge and waste material. Offsite dewatering of digester sludge and other waste is not a workable solution in an emergency situation.

The District has analyzed the cost of both onsite and offsite sludge dewatering for 16 to 40 year periods. Using a mathematical approach can be helpful in evaluating the cost of onsite vs offsite sludge dewatering, but spreadsheet projections used to analyze long-term costs of various actions should be viewed with a degree of skepticism. The longer the projection period, the less confidence should be given to the results. Long-term cost projections can't predict the future. They are educated guesses that depend on data from the past, and the past by itself may not be a reliable predictor of the future. Ongoing sludge processing equipment performance evaluated by District staff and MCCSD's consultants, changes in regulatory requirements, and advancements in wastewater technologies should be the drivers for determining when and with what to modify or replace existing sludge processing systems at the Mendocino wastewater treatment plant.