Miscellaneous Treatment Plant Projects

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Project Purpose:
The purpose of the project(s) under this title is to address several in-plant improvements. The small improvements (less than $75,000) are combined into one larger project to provide the ability to make incremental improvements to the plant's existing infrastructure on an as need basis. The project funding will provide flexibility to complete the highest priority improvements and bid work as combined improvement projects.

Project History and Status:
Over time Nine Springs staff has noted a number of minor improvements that are desired to improve the facility and make overall operation easier. Historically these types of projects (sometimes referred to as "'tweeners" due to them being small enough in scope and cost to be planned and administered in-house without outside consultant assistance) have been handled within the Operations work group from funding approved in the annual O&M budget request by obtaining quotes from local contractors.

For planning it was suggested that perhaps several of these smaller projects could be rolled into a single package for purposes of funding as well as obtaining quotes for work. Several of these projects are addressed within, and are summarized as follows:

- Acid digester piping changes
- New level sensors for digesters 1-3
- Add mixers to whey wells
- Lagoon Return Piping Repair / Replacement
- DAF thickener exhaust fan
- GBT building HVAC upgrades
- Grit basin improvements
- Strainpress on thickened sludge lines
- Struvite Dryer Improvements

Preliminary Path:
It is believed by staff that these projects can be broken into smaller, appropriately sized projects for bid and completion. In some cases consideration can be given to combining with work that is similar or would be handled by the same type of contractor in order to create efficiencies in cost and

administration. When combination opportunities are believed to be potentially favorable, identification of these opportunities will be pointed out for further investigation and consideration.

Alternatives

Alternatives generally are to defer work or to not make improvements. Projects in this section are items that in many cases have been deferred or staff have (and are) operating "as-is". The downside to continued deferment or denial of projects depends on the project but generally could be classified as continued degradation of material condition, or continued operation in a less than optimal means (with respect to important operating considerations such as energy use, labor, or safety). An attempt will be made to touch on the specific risks or downside as each project is summarized below.

Project:Acid Digester Piping Changes

This project is to provide and install piping and valving inside the acid digester building transfer pump room to permit rapid change of the on-line digester as well as allow simpler and safer draining of the off-line digester. The acid phase digesters were newly constructed as part of the Eleventh Addition project and represented a new system to the district. Acid digesters are fairly uncommon and it was not known precisely what to expect with respect to operation, so they were designed with some flexibility. However, after several years' time in operation it became clear that foreign materials were gradually accumulating in this digester necessitating a change in the lead ("on-line") digester. In making this change and dealing with the foreign material inside the digester the pump that was planned to be used for transfer began plugging. Plant staff feared expensive damage to this pump system if continued attempts to transfer debris laden sludge were made, so an alternate means of accomplishing this switch was devised. This alternate means did work but was very cumbersome and lengthy. Moreover, while safe in this instance due to the digester having water left over from initial testing and start-up, in the future this method would not necessarily be safe due to the presence of anaerobic sludge.

The acid digester piping change project would make some piping additions and modifications to permit alternate pumping configurations and allow simpler and safer shifts in operation without expenditure of extensive time and labor or undue risk of damage to equipment or risk to human health and safety.

Anticipated cost of this project is $25,000.

Project:New level sensors for digesters 1, 2 and 3

Digesters 1, 2, and 3 are collectively referred to by staff as "The west digestion complex" and are the digesters that accomplish the time-temperature batching required to achieve pathogen reduction to meet Class A biosolids criteria. These digesters are each 0.67 million gallons in capacity and are the oldest three digesters at Nine Springs. They were modified in the Eleventh Addition to meet the time-temperature batching requirements. Accurate level readings for these digesters is a critical element of the complex control system that sequences the feed-batch-withdraw cycle needed to

meet class A criteria and preserves process integrity from a regulatory standpoint.

As part of the Eleventh Addition a radar level indicator was installed and initially used, but this system proved to be unreliable in this operating environment. It was replaced by staff with a simpler system that is a major improvement in reliability over the initial system, but despite better reliability it remains prone to some hiccups and disruptions in providing correct level readings. When these events occur, class A biosolids can overflow into the process treatment basins or in rare cases even exit via the gas relief system onto the cover of the digester. Both of these are undesirable occurrences, creating biological process disruptions, additional work for staff, a slight risk of permit violation if an event would become severe enough before being noticed, and in the case of exiting via the gas relief system can represent a safety issue due to explosion risk.

This project proposes modifications to install a pressure transducer type level sensor into these digesters and wire that back into the control system. Also needed would be valving to allow isolation / removal of the transducer for maintenance, water piping for flush water, and compliance with environment rating code requirements. The modifications would involve purchase of sensors, minor piping modifications to provide a location for installation, and the interconnecting wiring for the sensors.

Estimated cost for this project is $50,000-$75,000 to complete the work on all three digesters.

Project:Add mixers to whey wells

The district has a pair of receiving wells next to the gravity belt thickening (GBT) building that were originally built to accept high strength whey from Bancroft Dairy (this was part of a contract arrangement with Bancroft and was a driver for installation of the current engine generators). Each of these wells is approximately 24,000 gallons in capacity and at present is the primary receiving point for high strength wastes received by the district that are desirable to add directly to the digesters. Due to the nature of the whey and the frequency of delivery there was no provision made for mixing in the original whey wells.

At present, the district receives a variety of high strength wastes and the frequency of delivery can vary considerably. This can lead to settlement issues in the wells that can create generation of odorous gasses which also have potential to create conditions that jeopardize structure material condition and human safety. An area identified as a potential improvement would be to add mixing to the wells to allow waste containing solids to be mixed and keep the solids in suspension, which may widen the range of acceptable wastes to be received. It is expected that this project would focus on the addition of a pump mixing system due to the varying level conditions these wells operate in.

Anticipated cost to install this type of mixing system would be $90,000.

Project:Lagoon Return Piping Repair / Replacement

The lagoon (to the east of the Nine Springs site) has piping and valves that permit return of flow to the plant using a

portable pump. This system is in addition to the normally used lagoon pump system, and is normally used in situations where a large amount of flow is accumulated in the lagoon and needs to be returned faster than the pump station has capacity to accomplish (i.e.: following or during a wet weather period), or when repairs are being made to the lagoon pump system (which in and of itself has no redundant pump).

In 2017 it was discovered that a portion of this pipeline was leaking when pressurized making it unreliable and unusable. This project would repair and upgrade this pipe to restore redundancy and supplemental transfer capacity to the lagoon pumping system.

Estimated cost for this project is $50,000.

Project: DAF Thickener Exhaust Fan

Dissolved air floatation (DAF) thickener 1 has an exhaust fan located on the peak of its fiberglass dome. This exhaust fan serves as the HVAC system for the thickener tank and provides the necessary air changes to protect equipment. Air is pulled in at the base of the dome by the fan and exhausted out of the top of the dome.

In 2014, the fan began having operational issues and the fan finally failed in 2017. The fan is no longer operational and safety concerns with its location on top of the dome doesn't allow for a direct replacement. Since its failure, equipment within the DAF tank and dome has deteriorated at an accelerated rate due to the lack of air changes. This project would install a new fan located at ground level with ductwork extending to the peak of the fiberglass dome. Upgrades in the DAF electrical system will be necessary to facilitate this installation.

Estimated cost for this project is $30,000.

Project: GBT Building HVAC upgrades

The GBT building was constructed in the late 1980's and the HVAC system remains original. Currently there are two air handling units (AHU) that serve the building; one AHU serves the polymer room and basement and the other AHU serves the belt room. There are also 4 exhaust fans that complete the HVAC system in the building. Although functional, these units are past their useful life and need replacement.

There are also concerns that the belt room isn't receiving the proper number of air changes per hours. This concern is derived from the deterioration of equipment and from intense ammonia smell in the room.

This project would involve hiring a consultant to evaluate and redesign the current system up to today's standards. Based on the consultant's recommendations and design, the district would install an upgraded HVAC system in the building.

****This project along with the DAF project and several other know HVAC issues begs the question should we just hire a single consultant to evaluate and redesign all of HVAC deficient areas in the plant. The condition assessment done as part of the asset management plan would recommend replacement of many HVAC units based on condition

Estimated cost for this project is $75,000.

Project: Grit Basin Improvements

The headworks grit system was installed as part of the Tenth Addition to Nine Springs project which went on line around 2005. The system installed was the typical best practice available at that time, but research has demonstrated that the methods for sizing grit vortex systems in that era tended to overestimate the amount of fine grit they could remove. Current practice is to size grit vortex basins more conservatively and with a refined design to capture more grit and remove it from the treatment system. Passage of too much grit into the treatment works has many negative impacts, including reduced treatment efficiency and excessive wear on pumps. The Nine Springs facility experiences markedly higher grit loads in conjunction with high flow events and actively adjusts in plant operations to respond to these higher grit loads, the fact of being significant enough to demand a response from operations to these events to address increased grit speaks to how much can get through the system.

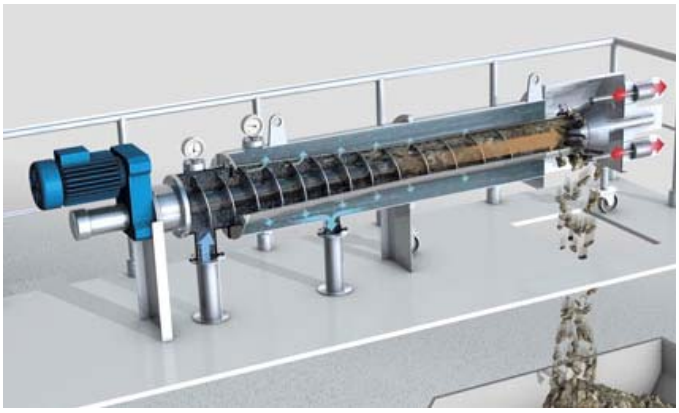
The manufacturer of the grit vortex system in place (Smith and Loveless) has responded to the updated state of knowledge with retrofit kitting for their grit chambers. While the installation complexity is not difficult, the cost for the components is high. Purchase and installation of retrofits to the grit chambers would—if successful—increase the removal of finer grit sizes from the waste stream, which should result in equal or slightly improved treatment and digestion efficiencies as well as decreased pump wear in the sludge pumps in the treatment facility (especially the primary sludge pumping and handling systems). The removal of extra grit could result in increased wear on the grit pumps and classifiers in the headworks, and higher hauling fees to dispose of the grit removed.

An approach would be to consider retrofit of one grit basin per year, and once the first retrofit is in attempt to determine the success of the unit by quantity of the grit collected. Short of an expensive study the methods for this may be inexact, but a general sense of if the improvements are working should be realistically attained by some side-by-side comparison. If after the initial retrofit the benefits are deemed minimal or not worth the cost the retrofit project could be abandoned.

The retrofit project would largely be costs for design, fabrication, and delivery of components by the manufacturer. It is assumed that a local contractor would be used to install the components in the grit chamber.

Estimated cost for this project is $66,000 per grit chamber.

Project: Strainpress for Acid Digester Feed Lines



The acid digestion process was installed as part of the Eleventh Addition to Nine Springs project and was placed on line in late 2013. The system accepts two sludge inputs, thickened waste activated sludge (TWAS) and thickened primary sludge (TPS). The TWAS stream is combined with recirculated acid-phase digestate and heated with direct steam injection through a steam injector. Since placing on line, the steam injection system has experienced regular issues with plugging due to debris carried to it in the TWAS and TPS sludge streams. Beyond the disruption of the process and time needed to clean the injector of debris, the debris (which is largely non-biodegradable) in the biosolids eventually is land applied as part of the biosolids. To remove the debris, a strainpress is proposed. A strainpress is equipment that strains sludges under pressure and remove larger debris for eventual disposal (in this case, landfilling) while passing on the strained sludges for further treatment (in this case, digestion).

The project proposed in this business base would pilot a strainpress and—if successful—install the strainpress permanently in the sludge lines, which should benefit the overall solids handling process by removing inert and minimally-biodegradable debris that cause maintenance issues and degrade the value of the final biosolids product distributed by MMSD.

The first phase would be to pilot the strainpress on one of the sludge lines (probably the primary sludge line) and determine if the system is effective and worth purchasing. If the pilot is deemed successful, the plan would be to install strainpress equipment on both of the sludge lines as a project. The schedule and budget assume a pilot be performed in 2020, and installation of two units in 2021. A reduced alternate approach would install only one strainpress in 2021, most likely on the TPS line.

The project would largely be costs for pilot, design, fabrication, and delivery of pilot and equipment components by the manufacturer. It is assumed that a local contractor would be used to install the strainpress and make the necessary piping and electrical modifications to connect it into the plant systems. It is assumed programming would be completed by plant staff. If the pilot was deemed unsuccessful or not worth it, the project would be abandoned with only the initial pilot testing monies expended.

Estimated total cost for this project is $415,000 ($15,000 for pilot in 2020 and $400,000 for purchase and installation of two strainpresses in 2021).

Project: Struvite Dryer Modifications

Struvite (magnesium-ammonium-phosphate) recovery—sometimes referred to as the "Ostara" process after the vendor we partner with—was added to the facility as part of the Eleventh Addition to Nine Springs and was placed on line at the end of 2013. The process removes phosphorus from the solids handling return streams and precipitates it as a chemical fertilizer that has market value due to both its nutrient content as well as it's "green properties" (slow release, recovered resource, etc). In preparing the chemical precipitate for handling and shipping the product needs to be dried in a pair of industrial dryer units. These units accept saturated product slurry and through heated forced air and vibration discharge a dried product ready for size sorting, bagging, and shipping to market.

As production has grown the existing units have experienced increasing issues with handling the throughput, in part because the smaller product size produced is harder to dry thoroughly (especially with the lower grade heat provided by recovered hot water) and produces a lot of dusty particulate fines. An assessment was done in late 2018 by the dryer manufacturer and Ostara to assess potential for improving the dryer performance, both as measured by throughput capacity as well as reduction of nuisance dust. The results of the assessment as well as advances in dryer technology and greater experience with handling struvite resulted in a number of improvements that could be made to the existing dryers on site to aid in performance.

Some of the proposed improvements were already screened out as not being cost effective on a retrofit application. However, a number of improvements could be implemented to increase drying efficiency and reduce fugitive dust. These distill down to splitting of the dryer inlet and exhaust plenum to create a "two zone" dryer to focus a higher amount of warm air on the early (wetter) areas of the dryer and reduce the airflow once the product has begun to dry.

Estimated total cost for this project is $47,500 (minimum) to $100,000 (full Carrier recommendations) per dryer. Assume $95,000 for minimum recommended modifications to both dryers.

Recommendation:
The projects listed in this business case have been identified by Operations staff as projects which should be completed within the next five years. The intent of this line item in the Capital Improvements Plan is to provide an annual allowance to complete projects of this type. Each year Operations staff will review the projects listed in this category and prioritize them, with the total project amount for each budget year not to exceed the annual allocation in the CIP. For the 2020 CIP the annual allocation has been set at $110,000.

Project summary:

Project	Total Est. Cost
Acid Digester Piping Changes	$25,000 (10)
New Level Sensors for Digesters 1-3	$50,000-$75,000 (9)
Add Mixers to Whey Wells	$90,000 (12)
Lagoon Return Piping Repair / Replacement	$50,000 (8)
DAF thickener exhaust fan	$30,000
GBT building HVAC upgrades	$75,000
Grit Basin Improvements	$66,000 (1 basin 2020) $135,000 (basins 2&3 2021)
Strainpress	$15,000 (pilot 2020) $400,000 (2021)
Struvite Dryer Modifications	$95,000
Total*	**$290,000**

***Total 2020 budget not to exceed $110,000 for Miscellaneous Treatment Plant Projects.**