Comparison Report
for the
RRWCID
WWTP ODOR CONTROL OPTIONS

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EXECUTIVE SUMMARY

The Reunion Ranch Water Control and Improvement District (RRWCID) includes a Wastewater Treatment Plant (WWTP). Over the past several years, odor complaints associated with the WWTP have been increasing. At this time the WWTP is undergoing an expansion that both increases the WWTP capacity and improves the treatment process and includes engineered odor control measures. The RRWCID Board has requested that Murfee Engineering Company (MEC) investigate options to add odor control systems to the WWTP not included in the current construction contract. The options discussed in this report are: Option 1 – close-fitting covers over the treatment basins, Option 2 – construction of a building that encloses the treatment processes, and Option 3 – do not install any additional odor control measures at this time. Options 1 and 2 could be implemented as a change order to the existing construction contract or as a separate project at a later time when the new treatment processes are online, implementing either Option 1 or 2 as a separate project is considered to be a fourth option. These four options are discussed in greater detail below and are compared in order to illustrate the advantages and disadvantages of each option.

The conclusion of this report is that the Board should wait until after the WWTP expansion to make a decision on adding odor control. The expansion already includes odor control at the key treatment process where the strong odors are expected to be produced. Additionally, the improved treatment processes should reduce the production of odors from the treatment basins. If the odor problems persist after the expansion is operational, this issue should be re-evaluated.

INTRODUCTION

The purpose of this report is to present four options under consideration for implementation at the Reunion Ranch WCID (The District) Wastewater Treatment Plant (WWTP) in order to control odors. These four options are 1) to cover the two sequencing batch reactor (SBR) basins with close-fitting covers as a change order to the current project, 2) to enclose the entire process in a building envelope as a change order to the current project, 3) to do nothing beyond what has already been included as part of the expansion project, and 4) to wait to implement a solution after the current contract.

Odor complaints are an ongoing issue at the WWTP. In an attempt to reduce odor, the District has implemented several temporary odor control solutions and permanent odor controls at the influent lift station are part of the expansion project at the WWTP. Given the plant expansion is underway, further permanent odor control solutions may be able to be implemented under the existing construction contract as a change order. It is important to note when discussing the further odor control options that the current WWTP expansion contract already includes odor control for the new influent lift station and headworks screen as well as making use of fully enclosed solids processing equipment. Typically, the processes that produce odors at a wastewater treatment facility are raw sewage handling processes (e.g. influent handling, influent screening, equalization basins, etc.) and solids handling processes (e.g. sludge holding, solids dewatering, etc.), though the odor produced by different solids handling processes varies. At the Reunion Ranch WWTP the most likely sources of odor after the expansion is complete include the influent lift station, sludge holding basin, and solids dewatering unit.

The WWTP expansion includes two primary odor control measures as part of the design which are intended to address odors at the probably odor sources. All influent is handled through the influent lift station which includes screening as well as pumping. This portion of the process is physically separate from the other treatment processes and, when complete, will be fully contained so that air within the lift station will be continuously treated using activated carbon filtration prior to release into the atmosphere. This system covers the most significant source of odors encountered at the majority of wastewater treatment facilities.

The existing influent equalization basin is temporarily being treated using a rented activated carbon filter unit. Upon completion of the expansion, the equalization basin will be converted into sludge storage. The temporary cover will remain in place in event that the sludge storage basin produces odors, however well treated activated sludge is typically mild in odor. Once the WWTP is completed and operational, the sludge basin will be evaluated for odor production and the cover may be able to be removed. In addition, the dewatering unit will be completely enclosed to contain any potential odors.

Each of the four option will be discussed and advantages/disadvantages will be developed under the following categories:

- Cost
- Treatment/Operations
- Maintenance
- Odor
- Construction Contract
- Other Considerations

Each category may be further broken down into subcategories that better describe the particular advantage/disadvantage.

1. Implement Improvements per the Current Plan

This option means that no additional odor control measure will be implemented beyond those already included in the current WWTP expansion contract. The odor control measures that will be in place have been carefully considered to balance both capital and operational cost with the potential for odor complaints. During the design process, additional odor control measures were not found to be required as the marginal benefit of treating odors at other plant processes did not appear to outweigh the costs.

The WWTP expansion includes two primary odor control measures as part of the design which are intended to address odors at the probably odor sources. All influent is handled through the influent lift station which includes screening as well as pumping. This portion of the process is physically separate from the other treatment processes and, when complete, will be fully

contained so that air within the lift station will be continuously treated using activated carbon filtration prior to release into the atmosphere. This system covers the most significant source of odors encountered at the majority of wastewater treatment facilities.

The existing influent equalization basin is temporarily being treated using a rented activated carbon filter unit. Upon completion of the expansion, the equalization basin will be converted into sludge storage. This basin will be aerated and the sludge be dewatered on site, typically aerated activated sludge such as this has a very mild odor. The temporary cover will remain in place in event that the sludge storage basin produces odors, however well treated activated sludge is typically mild in odor. Once the WWTP expansion is complete and the plant is operating normally, odors will be evaluated at the sludge storage basin. The cover will be removed and odors will be observed for several days. If at that time the odor associated with the sludge storage basin is considered to be excessive, the cover will be put back into place and the option of installing an odor control unit similar to what is being installed for the lift station can be installed to serve the sludge storage basin. In addition, the dewatering unit will be completely enclosed to contain any potential odors and the dumpster that the unit discharges dried sludge into will be protected from precipitation. Dried sludge has very little odor.

1.1. Cost

There is no additional cost associated with this option.

1.2. Treatment/Operations

There are no additional concerns associated with treatment or operations. The current design maximizes the operators' ability to access and view the system in order to monitor the process and make adjustments as needed.

1.3. Maintenance

Maintenance of the system is straightforward under the current design. The minimum impediments to access are associated with the layout.

1.4. Odor

The primary potential odor sources are addressed in the current expansion project. The raw sewage in the influent lift station is the primary concern. At the influent lift station, air in the headspace is treated by forced air activated carbon air filtration. The screen installed in the influent lift station is fully enclosed and screenings will be discharge into a continuous bagging system so that solids do not off-gas any odors. The sludge dewatering system is also fully enclosed.

1.5. Construction Contract

There will be no impact to the construction contract associated with this option.

1.6. Other

The main disadvantage associated with this option is the possibility of odors continuing after completion of the expansion project and complaints continuing. If this is the case, there is still opportunity to implement additional solutions depending on which portions of the treatment process are causing the odor issues.

1.7. Summary

This option avoids any additional costs associated with either the construction of odor control systems beyond those included in the design or the maintenance of those systems. However, there is the potential that some amount of odor will persist, this could lead to a future project to address these odors. The design of the WWTP expansion includes odor control for the treatment processes most likely to produce the majority of odor at the plant.

2. Close-Fitting Covers

Close-fitting covers are solid covers that would be installed at the top of the concrete basin walls. They would be designed both to be completely removable as well as include hatches to provide access to equipment that requires regular maintenance. The primary benefit of covering the basins is to contain and control potentially odorous gasses produced in the SBR basins during the treatment process. Additionally, this is a “relatively inexpensive” method of containing and treating the headspace of the SBR basins for odor control and it may be able to

be added to the current contract via change order. There are several potential issues that arise from covering the basins which will be addressed individually, under the corresponding general category.

2.1. Cost

Most of the disadvantages mentioned in the following paragraphs will add to either the capital or operations and maintenance costs of the system. The covers will require upkeep and will require replacement or rehabilitation on a regular basis due to sun exposure, perhaps every 10 to 15 years. Any active or passive odor control system will require regular operator time to inspect the system and replace wear parts. An active odor control system will require more operator time than a passive one, along with electricity for operation. The manufacturer provided a budgetary estimate of $93,000 for the equipment and ducting along with a drawing of the proposed system, but this estimate does not include the cost of the contractor's labor and materials to install the equipment, their administrative efforts, or the design efforts for the structural and electrical engineers for housekeeping pads and integrating the equipment into the controls and power system.

If ventilation is not selected to maintain 12 air changes per hour, the cost of maintaining and replacing equipment within the basins increases significantly as a qualified shop must be used for any class 1 div 1 electrical equipment maintenance and none of said maintenance can occur on site. Installation of and class 1 division 1 rated equipment is a significant disadvantage. Maintaining 12 air changes per hour has the disadvantage of requiring larger air handling units but the advantages of not requiring any class 1 division 1 rated equipment and protecting the operators against any buildup of explosive gasses.

In addition to the increased costs associated with the added equipment required to cover the basins, the maintenance of the treatment process will require additional operator time. The removable sections of the covers will need to be removed any time the operators need to inspect the basin, a daily requirements. These costs are difficult to estimate and have not been integrated into any kind of life-cycle cost analysis at this point due to the need to develop a recommendation as quickly as possible.

Installing close-fitting covers as part of the current construction project will require a change order. Table 1 shows rough budgetary numbers for the cost items involved in installing close-fitting covers. These numbers are estimated and may not reflect actual contractor costs, the actual cost of this option may be 100% higher than those shown in Table 1.

Table 1: Estimated Costs for Close-Fitting Covers

Item	Cost	Notes
Covers	$ 150,000.00	Based on most recent coordination with contractor/manufacturer
Equipment Upgrade to Explosion Proof	$ 100,000.00	Estimate
Odor Control Equipment	$ 100,000.00	Based on manufacturer's estimate for maintaining negative pressure during aeration
Total	**$ 350,000.00**	

Annual operating costs will increase if close-fitting covers are installed around the basins. These costs are difficult to estimate at this stage, but Table 2 shows some budgetary estimates for the additional annual costs. These costs only reflect the approximate additional cost associated with the close-fitting covers and odor control system for the basins. These costs are estimates only and may be as much as 50% higher.

Table 2: Annual Operating Costs for Close-Fitting Covers

Category	Estimated Cost	Notes
Operator Labor	$7,000	Based on discussion with Inframark
Electricity	$1,400	Based on a rate of $0.067/ kWh
Cover Maintenance	$100	Based on average roof maintenance costs of $0.15/sqft/yr
Equipment Maintenance	$5,500	Carbon replacement, motor repair, etc.
Total	**$14,000**	

2.2. Treatment/Operations

Treatment of the community's wastewater is the primary purpose of the wastewater treatment plant. Any interruption to the treatment process or to operational access to the treatment process is considered a disadvantage. The treatment process includes diffuser aeration and mixing. It is important to be able to visually verify the aeration pattern in the basin to confirm the functionality of the diffusers. It is also important to monitor the treatment for telltale signs of imbalance such as foaming or poor settling, both of which can only be determined visually. There are a variety of other reasons that operators require visual access to the treatment basins, however these are the two main concerns for maintaining treatment efficacy. By covering the basins, the operators will be unable to observe the process without removing the covers. While there may be solutions to this issue (viewing ports, whether removable or translucent, or closed circuit cameras), the covers significantly impede the operators' ability to monitor the process and the solutions do not provide the visual access to the process that the operators require. This could lead to effluent quality problems and is a significant concern of both the operators and engineers when considering close-fitting covers for odor control purposes.

There may be a minor increase in process stability caused by covering the basins be limiting the treatment exposure to solar radiation. However, since the covers would be designed to drain into the basins there would be no protection provided from precipitation impacts, i.e. added volume and temperature fluctuations from rain and snow events. It is difficult to quantify this advantage.

2.3. Maintenance

Close-fitting covers will increase the overall maintenance time and costs associated with the treatment system. No advantage to the maintenance of the system is gained by installing close-fitting covers.

2.3.1. Difficulty maintaining the equipment within the basins

The covers will be designed with removable sections to allow for access to the equipment within the basin, however the covers impose a barrier to maintaining the equipment and even

the hatches will likely require lifting devices (crane truck) to remove. It will be more difficult for the operators to determine if the equipment is malfunctioning as they will need to remove the cover just to check the equipment. These extra steps will require additional operator hours and may lead to delays in discovering issues. There may be a need for additional lifting equipment to be rented in order to handle maintenance efforts as the existing crane trucks may not be capable of lifting the larger hatches. Any maintenance effort that requires the covers to be completely removed may also require rental of larger crane units.

If sufficient airflow is not maintained through the basin by an installed blower or fan system, humidity in the headspace will be higher than typical for basins. This will lead to pre-mature corrosion of any metal components including piping, conduit, instruments, and other equipment. If twelve air changes per hour are maintained, as discussed in a following section, this will be less of a concern as sufficient air changes will likely provide the airflow needed to maintain the humidity in the basin headspace equal to the humidity of the atmosphere.

2.3.2. Need to remove air as it is introduced through the aeration process

While the purpose of the covers is to contain odors, the process requires that outside air be added to the basins during the treatment process. This creates a positive pressure within the covered basin and necessitates either passive or active removal of air from the headspace in order to ensure operation of the aeration system. In order to address this issue, an odor control unit similar to what is temporarily treating the headworks and influent equalization basins would be set to meet the airflow of the aeration system. Alternatively, a passive ventilation system could be installed with carbon filters to reduce the odor of the outflowing air. Either option represents a maintenance item that would require additional operator time and cost.

2.3.3. Potential electrical hazard

The most significant concern related to covering the basins is the potential build-up of hazardous or explosive gases in the event that there is a process failure or as a product of treatment. This is a significant concern for operations and maintenance personnel as it increases the danger to the operators during normal operations and to any maintenance crew attempting to access equipment within the basins.

While uncovered aeration basins are not considered to be classified spaces, enclosing the basins makes them into Class 1 Division 1 spaces. This will require all electrical equipment within the basin be upgraded to Class 1 Division 1 compatible, unless the confined space is ventilated at a rate of twelve air changes per hour or more, making the classification Class 1 Division 2. Upgrading the electrical equipment within the basin to meet the requirements imposed by Class 1 Division 1 classification would be costly and impose further operational and maintenance issues, as well as significantly extend the current construction contract to allow for purchase of replacement equipment for the equipment that has already been purchased by the contractor. Ventilating the space at the required air exchange rate would allow for treatment of the confined air and potentially further reduce odors, and none of the in-basin equipment would need to be upgraded. This ventilation would also effectively protect the operations and maintenance personnel from hazardous or explosive gases.

Ventilation through an odor control unit similar to the one temporarily treating the air pulled from the influent screen and equalization basin would not only be able to meet the air exchange rate requirements but would further reduce the chance of odorous compounds escaping the treatment footprint. This unit would be significantly larger than what would be required to keep up with the air being added to the basin by the aeration system. The rate of air exchange would require the cover to include vents to allow for outside air to balance the pressure and ensure sufficient and effective ventilation.

If ventilation is selected to avoid a Class 1 Division 1 space classification, the blowers or fans used to maintain airflow will need to be able to accept power from a generator, in the event of a power outage, and will need to be installed as fully redundant, in the event that one blower or fan fails. This will ensure that ventilation is maintained through the most likely operational issues.

2.4. Odor

Most of the potential odor compounds will be contained within the headspace and can be withdrawn for treatment through an odor control system, whether active or passive. This solution provides as much control over odor compounds as is feasible at a WWTP.

2.5. Construction Contract

Adding scope to the existing construction contract is possible, but will likely lead to a contract time extension because of the added time needed for manufacture and delivery of the covers and selected odor control system, along with potential modifications to the current design required to accommodate the covers. The installation of basin covers is complicated by the numerous pipes that enter the basin from above the concrete walls, the instruments that are required for the process to function, the access walkway needed for the equipment within the basin, the various pieces of equipment that require removable panels for access, and the need to slope the cover to allow rainwater to drain into the basins. All of these requirements make the design and installation of the cover difficult and potentially decrease the cover's effectiveness at containing odors as every penetration creates the potential for a leak. In addition to complicating the design of the cover, the cover design may require that some of the pipe penetrations or walkway supports be moved to accommodate portions of the cover that cannot be designed around them. This may require significant re-design of the basin internals, if that is the case the substantial completion of the project may be significantly delayed meaning that the plant would not be operational until later than currently planned. All of these concerns will likely lead to a longer construction period than currently planned and significant engineering and change order costs.

2.6. Summary

While covering the SBR basins with close fitting covers will contain any gasses produced by the treatment process, the operational impacts that the covers cause are a very significant concern. The inability to view the process and the added barriers to equipment maintenance represents a significant risk to meeting the primary purpose of the WWTP, which is to effectively treat the sewage produced by the community to meet the requirements of the TCEQ. In addition, it is likely that covering the SBR basins would provide a marginal additional odor control benefits when compared to both the capital and operation and maintenance costs.

3. Building Enclosure

Construction of a building around the entire wastewater treatment process basin footprint is a potential option for containing odors that may be produced by the treatment process. Although wastewater treatment processes are not typically contained within buildings in Texas, it is common in colder climates.

3.1. Cost

Constructing an enclosure around the treatment basins will have a higher capital cost than the other options. The process will need to be maintained during the course of construction and the building will need to be designed carefully in order to accommodate existing yard piping and electrical systems. A structural engineer indicated that the best option for the application would be to construct a metal building on piers, which typically cost about $80 per square foot (SF). The proposed building footprint is approximately 4,200 SF. In addition to the cost of the building shell, there is also cost associated with electrical equipment, interior and exterior lights, ventilation systems, crane lifting systems, and building rainwater control systems. The costs shown in Table 3 are extremely preliminary and could be 100% higher.

Table 3: Estimated Costs for Building

Item	Cost	Notes
Building	$ 336,000.00	$80/SF
Odor Control Equipment	$ 200,000.00	Estimate 2x price compared to cover system
Building Electrical	$ 84,000.00	25% building Cost
HVAC	$ 105,000.00	$25/SF
Crane System	$ 20,000.00	Estimate
Building Run-off system	$ 50,000.00	Estimate
Permitting Efforts	$ 100,000.00	Estimate
Total	**$ 895,000.00**	

These costs do not address the costs associated with design of the building and associated systems, permitting efforts required for adding a building to the existing site permit, or the contractor's costs associated with handling the additional scope (e.g. new subcontractors, administration of the change order, extended insurance period, etc.).

Annual operating costs will increase if a building is constructed around the treatment basins. Estimated costs for labor, electricity, building maintenance, and equipment maintenance are shown in Table 4. It should be noted that a portion of the building will be in the 100-yr flood plain which may make insurance significantly more expensive. These costs only reflect the approximate additional cost associated with the building and odor control system for the basins. These costs are estimates only and may be as much as 50% higher.

Table 4: Estimated Annual Cost for a Building

Category	Estimated Cost	Notes
Operator Labor	$3,500	Based on discussions with Inframark
Electricity	$6,000	Based on a rate of $0.067/ kWh
Building Maintenance	$6,300	Based on average building maintenance costs of $1.50/sqft
Equipment Maintenance	$7,000	Carbon replacement, motor repair, rainwater system, etc.
Building Insurance	$1,500	Estimate based on building value
Total	**$24,300**	

3.2. Treatment/Operations

Buildings serve to control and contain the environment that they enclose. Wastewater treatment process can benefit from being protected from the elements (sun, rain, snow, etc.). Keeping ambient temperature consistent and eliminating solar radiation may improve the treatment process. Extreme heat can warm the wastewater and impact the efficiency of the aeration system. Solar radiation encourages the growth of algae, which can make the effluent quality worsen. Rain causes the wastewater quality to fluctuate. Constructing a building would eliminate all of these variables, in addition to containing the potentially odorous compounds that wastewater treatment can produce.

3.3. Maintenance

Construction of a building around the majority of the treatment system would provide both an advantage to maintenance of equipment and a disadvantage in terms of hazardous spaces and effort to maintain the building.

3.3.1. Protection for Equipment

In addition to the weather being hard on the treatment process, it is hard on the equipment. Rain, snow, and sun all contribute to weathering equipment installed outdoors. Equipment installed indoors typically has a longer lifespan, barring unusual indoor air quality issues. This is an advantage to installing a building to contain the entire process, however it is difficult to quantify this type of benefit.

3.3.2. Potential Electrical Hazard

As with the covers, enclosing processes often changes the classification of the space. Typically, aeration process enclosed in buildings are not classified in the same manner as those that are covered, however, since the sludge storage basin will also be enclosed in the same space, the entire space will be classified based on the sludge storage basin. The entire space would be either Class 1 Division 1 or Class 1 Division 2 depending on the level of ventilation provided for the space. In order to avoid providing Class 1 Division 1 equipment for the entire building, selecting twelve air changes per hour allows for a classification of Class 1 Division 2 and no specific equipment requirement. The building envelop represents a significantly larger volume of air that needs to be processed than the close-fitting covers create. Odor control for the building may be addressed differently than for the close fitting cover, but will likely represent a larger capital and operation and maintenance cost due to the large volume of air that requires treatment. It may be possible to reduce this cost by separating the sludge storage basin from the rest of the building with a wall and properly sealing all penetrations, however this will likely be difficult as the basin walls were not designed to support a building structure so any walls separating the sludge basin would not be able to be load bearing.

3.3.3. Building Maintenance

A building represents a significant maintenance burden. The building will require continual maintenance of the shell and systems. Maintenance items include interior/exterior painting, door replacement, roof repairs or replacement, light replacement, etc.; all of which will occur at regular intervals and cost will depend on the design of each system, although and average cost of $1.50 per square foot per year would indicate approximately $6,300 annually. This does not include the cost of insuring the building.

3.4. Odor

As mentioned previously, a building would contain the potentially odorous compounds produced during the treatment of the wastewater. The contained air could then be treated using a variety of odor control methods prior to being released to the atmosphere. A building is a very effective solution for environmental control, although building openings (doors, windows, etc.) will allow some building air to escape without treatment.

3.5. Construction Contract

There are various impacts of adding the scope associated with the construction of a building to the existing construction contract.

3.5.1. Construction of a building around an existing process

The existing site is space constricted as a significant portion of the property is dedicated to subsurface drip fields for effluent disposal. The building would need to be designed to fit between the fence and contact basin wall, the filters and the ground storage tank, the SBR basin wall and the access drive, and the headworks screen basin wall and the influent lift station, all while maintaining sufficient distance between the drilled piers and the existing infrastructure to avoid damaging the structural components. Additionally, there are a variety of underground pipes and conduits that will need to be considered during design and protected during construction. In order to access the east and south side of the basins in order to construct the building, the heavy construction equipment would need to drive over the drip fields and may cause damage to the shallowly buried irrigation system.

In order to effectively maintain the equipment within the building several man doors, at least one roll-up door, and at least one crane would be required. All of these items further complicate the design and construction of the building. Of significance is that the limited site space restricts where doors can be located. Also, installation of cranes requires the building to be appropriately reinforced to handle the static and dynamic loadings associated with pulling equipment using the cranes.

3.5.2. Schedule

The building design will require a significant of time as will obtaining the required permits and require an extension to the construction contract. The length of this extension is unknown, however the permitting effort will likely require a minimum of 60 days and design may take 90 days, a portion of which may overlap with the permitting effort. In addition to these time requirements, the contractor will require time to hire subcontractors for the scope not covered by current subcontractors and obtain construction materials which will likely take a minimum of 60 days. Overall, a minimum contract extension is likely to be approximately 90 days.

3.6. Other

3.6.1. Runoff and Permitting

While the basins have been excluded from run-off calculations for water quality purposes because all water is captured be the basins, buildings are not given the same consideration. While the close-fitting covers can be sloped to still collect all water falling within the basin footprint and drain into the basins, a building will require a rainwater collection system. There does not seem to be a path in place to use rainwater collected for supporting impervious cover variance requests. Regardless of the potential need for a variance request, a new site permit will be required in order to update the impervious cover and water quality calculations. This will likely cost between $50,000 and $100,000 and require a minimum of 60 days, although a significantly longer duration should be expected.

3.6.2. Noise Containment

A significant portion of the noise associated with the treatment process will come from the blower units and pumping systems. While the current design includes sound attenuation, a

building will be very effective at containing any noises produced by the equipment within the footprint. Additionally, any active odor control units should be housed within the building, effectively reducing the noise impact they may have. However, the pump skid for the drip field system will not be within the footprint of the proposed building, neither will the proposed irrigation skid.

3.6.3. Security

There is a much higher level of security associated with a building when compared to the existing fence and gate. Access to the treatment basins by unauthorized persons will be effectively curtailed.

3.7. Summary

While enclosing the entire process in a building provides distinct benefits to the operators' ability to maintain the process when compared to close-fitting covers, it also represents a significant engineering challenge and long-term operations and maintenance cost increase. Given the various aforementioned construction concerns, the need to complete a new site permitting process, and the requirement for structural design, it is likely that the building design would take up a significant portion of the remaining contract period and the construction of the building would require a significant contract extension. It is possible that the current construction contractor would not be interested in such a large and complicated change order. Even if the contractor were willing to undertake this additional scope, the change order amount may be too great to legally add without undergoing the bidding process.

4. Wait

This option is similar to the first option presented in terms of the impact on the current construction contract; however, it allows for preparation of a selected solution during the construction of the expansion and implementation soon after construction is complete. Minor change orders could be made to address items such as piping configuration at the basins in order to make construction of either the close-fitting covers or a building easier, but the design of either the covers or the building would be carefully considered and the contract end date would not impact the length of time available for design. The main benefit of this option is that

there is not a rush to select a solution and enough time can be set aside to deal with design and permitting of the option selected.

Most of the advantages and disadvantages discussed for options two and three would still apply. Some of the disadvantages may be mitigated by waiting and allowing sufficient time for design to minimize the disadvantages and targeting the process that produce the most odors as determined after the WWTP expansion is complete and online.

4.1. Cost

The cost of this option will depend on what option is implemented as part of the separate contract. The costs for construction and maintenance will likely be similar to what was discussed for options two and three.

The downside of this option is that the cost of mobilization and demobilization will be imposed for any further project to add covers or a building to the site, which might have been saved if the covers or building could have been added to the existing contract by change order; it will be difficult to show this savings without receiving competitive bids. This is balanced by the potential to not spend any additional capital funds if odors are sufficiently controlled by the engineering controls implemented as part of the current expansion contract. Also, it may not be possible to add either option one or two to the existing contract via change order if the cost is higher than legally allowable without completing the bidding process. It should be noted that the cost of this option will depend on the solution selected and could range from nothing to an estimated $1,790,000.

4.2. Treatment/Operations

The advantages and disadvantages of options two and three would still apply depending on which option is selected. Some of the disadvantages may be mitigated by allowing additional time for design.

4.3. Maintenance

The maintenance advantages and disadvantages will be the same as those discussed for options two and three, depending on which option is selected.

4.4. Odor

This option also allows for the WWTP to be placed back into service and the odors to be re-evaluated, if the Board elects to wait until after the WWTP expansion is placed online to make a decision. Significant process changes are being implemented as part of the expansion and are likely to impact the production of odorous gasses. As previously stated, the engineering controls included in the design of the expansion are expected to contain and control the majority of odors produced by the process and any additional engineering controls will likely provide only marginal additional benefit. This benefit would be eliminated if a selection is made prior to completing the expansion and design is completed shortly after plant start-up.

4.5. Construction Contract

There will be little impact to the construction contract associated with this option, it is possible that a few change orders may be added to the current contract in order to make installation, operation, or maintenance of the covers or building better or easier.

4.6. Other

The main disadvantage of this option is the need for a second construction contract and an extended period of construction on the site. Also a disadvantage it the potential to continue to have odor issues until the selected option (close-fitting cover or building) is installed.

4.7. Summary

The option to wait provides more flexibility in the design and permitting process and allows for modification of the design based on actual odors that are produced by the treatment process after it is upgraded. This might provide some cost savings both for construction and annually if the design of either the close-fitting covers or the building can be fine-tuned during the design process, this may also mitigate some of the disadvantages associated with the selected option.

Conclusion

While there are advantages and disadvantages associated with each of the four options, the option to only implement the improvements included in the current contract or to wait and implement improvements as part of a separate contract have the primary advantage of saving

money at this time and the primary disadvantage of delaying action on this issue. Table 5 shows a summary of the advantages and disadvantages for the close-fitting covers and the building options.

While either close-fitting covers or a building would provide odor control for the treatment basins, both options come with risks and high costs. Attempting to integrate either option into the current construction contract via change order will lead to a contract extension, especially given the need to obtain a new site permit if the building option is selected. MEC believes that the operational issues associated with the close fitting covers make that solution the worst option, although the high cost of enclosing the process in a building makes the building solution a close second. At this time, MEC recommends that no additional odor control systems be added to the current construction contract. The odors at the plant should be evaluated after the WWTP expansion is complete and on-line and a decision should be based on the observations made at that time.

Table 5: Summary of Advantages and Disadvantages for Close-Fitting Covers and Building

	Current Plan		Close-Fitting Cover		Building		Wait	
Estimated Capital Cost	$0		$350,000 - $700,000		$895,000 - $1,790,000		$0 - $1,790,000	
Estimated Added Annual Cost	$0		$14,000 - $21,000		$24,300 - $36,500		$0 - $36,500	
	Advantages	**Disadvantages**	**Advantages**	**Disadvantages**	**Advantages**	**Disadvantages**	**Advantages**	**Disadvantages**
Treatment/ Operations	• No impact to treatment/operations		• Reduced solar impact on treatment	• Inability to observe treatment	• Protects process from weather	• No apparent disadvantages to treatment/operations	• Can select an option based on actual odor production	• Will need a new construction contract
Maintenance	• No impact on maintenance		• No advantages to maintenance	• Equipment maintenance becomes difficult • Covers or hatches will need to be removed on a regular basis to view the equipment to determine if maintenance is required • Need either explosion proof equipment or 12 air changes per hour	• Checking equipment and doing minor maintenance will not be impacted by weather considerations	• Either built-in cranes or roof hatches and mobile cranes will be required for removing equipment from the basins • Some type of roof run-off capture will be needed to reduce building impact on stormwater run-off • Need for either explosion proof equipment or 12 air changes per hour • Building and systems will require ongoing maintenance	• No immediate impact on maintenance – the selected solution will have the same advantages/disadvantages as if it were installed under this construction contract	
Odor	• Existing design includes odor control for the primary odor sources	• No added odor control	• Odors that may be produced will be contained • Air volume for treatment is minimized	• Need to treat basin headspace with additional odor control equipment	• Odors that may be produced will be contained	• Need to treat building envelop air with odor control equipment • Large volume of air to treat	• The best option can be selected after the WWTP expansion is operational	• Delay in any additional odor control system installation
Construction Contract	• No impact on the construction of the WWTP expansion		• May be able to add to the existing contract via change order, depending on amount	• May cause an increase in the construction contract duration	• May be able to add to the existing contract via change order, depending on amount	• Will cause and increase in construction contract duration	• No impact on the construction of the WWTP expansion	
Other	• No other impacts discussed		• No other impacts discussed		• Improved security for basins • Improved noise containment	• A new site permit will be required to address the added impervious cover	• No other impacts discussed	