Analysis of Wastewater Systems Operations

December 2007

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Technical Memorandum

DATE: December 19, 2007

TO: Bennie Sellers, Director of Public Services

FROM: Adrienne Fancher, Project Manager

SUBJECT: HATTIESBURG WASTEWATER CONSULTING PROJECT
Capital Replacement Plan

Project Team

Adrienne Fancher – Project Manager
Adam Yaden – CMMS Development and Implementation
Bill Thompson – Capital Replacement Plan
Steve Wold – Lagoon Operations

Scope of Services

United Water was asked to establish a rolling five-year capital replacement plan for critical equipment and facilities in the wastewater utility. The project team identified the lagoon aerators and the lift station pumps and generators as the highest priorities for replacement or rebuilding. In addition to developing a budget schedule for the aerators and pumps, the team offered recommendations for other capital improvements that will assist operations and maintenance.

Observations

United Water conducted random inspections throughout the collection and treatment system to assess the current condition of critical equipment. The observations were made with respect to the areas of operations and compliance, safety, and general maintenance. There was no single equipment issue that could account for the compliance problems experienced within the last year, but the project team noted a number of conditions that should be addressed within the five-year planning horizon of this project.

There is one basic decision to be made to determine the direction of the capital program: adapt the maintenance program to extend the useful life of the existing equipment or begin a systematic replacement of critical equipment with more suitable technology. In this memorandum, United Water will present recommendations for new equipment or facilities that will enhance the operations and maintenance program and recommendations for an alternative maintenance program for the existing equipment.

Recommendations for Operations and Compliance

At the North Lagoon, the flow through the facility is short-circuited by design. The plant influent flow enters Cell No. 2 from the northwest side and exits on the southeast side into Cell No. 1. However, the flow enters and exits from the northeast corner of Cell No. 1 into Cell No. 3, the polishing pond. This configuration effectively eliminates the treatment capacity of Cell No. 1. The planned 2008 North Lagoon Expansion Project will add another treatment cell to the lagoon and change the flow pattern to alleviate this short-circuiting.

Following a period of observation of the new flow configuration, the staff will be able to determine if effluent quality is impacted by any persistent causes such as an industrial discharge. Anecdotal observations from the staff and from the City's contract laboratory indicate that the quantity of some pollutants increases following a rain event. United Water recommends that the staff proceed with consistent sampling in each cell to analyze for BOD, TSS, Total Nitrogen, Total Phosphorus, pH, and DO, to observe any changes due to construction or any industrial user.

Although it represents a small portion of the total influent flow, the South Lagoon is under the influence of the discharge from the USA Yeast manufacturing facility. Cell No. 5 has been configured to treat the high-strength waste from that discharge. The issues associated with the USA Yeast discharge will be addressed separately, but the following recommendations address the general collection and treatment system operation.

Aerators

The existing aerators are more than ten years old, but many were rebuilt within the last few years. There are different types of aeration systems that are designed specifically for wastewater treatment applications. Several members of the City staff expressed a preference to retrofit the lagoons with a diffused aeration system. The expense of a diffused air system is unwarranted at this time.

United Water recommends replacing the aerators as the existing units fail. There are surface aeration and mixing systems, such as those manufactured by Aqua-Aerobics, which would be suitable replacements for the existing units and would require minimal modifications for power supply and controls. Preliminary investigations of solar-powered technologies, including the SolarBee™ circulator, were inconclusive and require further investigation for this application.

To estimate the cost of maintaining the existing aerators, the project team assumed that an aerator or pump with remaining useful life could be rebuilt and maintained at an annual rate of $100 per horsepower during the planning period. Equipment that has already exceeded its service life will likely be replaced during the planning period. Therefore, the team budgeted $250 per horsepower for annual maintenance and replacement costs. The five-year plan is included as Attachment A to this memorandum.

Flow Monitoring

It is apparent that there is insufficient flow monitoring data to provide the operators with the information necessary to make operational decisions. In addition to installing meters on all influent streams, United Water recommends conducting a flow tracer study on each lagoon cell to determine if all of the available treatment volume is in use. The project team considered adding more baffles, or curtains, to the lagoon as necessary to channel the flow through every aerator. The dark color of the effluent may be an indicator of short-circuiting. The results of a tracer study will guide the choice of options for improving flow through the lagoon cells.

Sampling Access

For both lagoons, access to the influent and effluent sampling locations is challenged by the conditions in the vicinity. At the lagoon sites, more effective mowing would make the approach to the influent manholes and effluent channels more accessible. At the North Lagoon, screening over the effluent box with a sampling port would facilitate collecting samples and prevent staff, objects, or wildlife from falling into the discharge channel.

Samples from the City of Petal influent are collected from a manhole in the middle of Dawson Cut-off, a busy two-lane road. The influent from Petal discharges into Cell No. 1 at the South Lagoon. United Water suggests further investigation of installing a tap on that pipeline to permit sampling within the security of the lagoon site enclosure.

Lagoon Dredging

The scope of this project included developing a profile of the sludge blanket in the lagoons. The results of this study indicated an immediate need for sludge removal throughout the North Lagoon. City staff theorized that some of the sludge blanket encountered was actually fill material eroded from the levees. A high quantity of sludge was also detected in one cell at the South Lagoon. Removing sludge from a lagoon may not fit the definition of equipment replacement, but when projecting major capital costs for the next five years, it is imperative to include the cost of dredging the lagoon, disposing of the sludge, and making any necessary repairs to the wiring, piping, baffles, liners, or levees that may be damaged by the dredging operation.

Pump Stations

The United Water project team inspected a representative sample of the pump stations in the collection system. A list of recommended improvements for selected pump stations is included in Attachment B. Among several common observations made at multiple locations was the need for VFD-controlled, submersible grinder pumps. The maintenance

crew spends a disproportionate amount of time addressing seal failures and clearing rags and debris from the pumps. Grinder pumps would minimize that maintenance problem and minimize the large debris that would reach the lagoon.

United Water's recommendation is to replace the existing pumps with grinder pumps as they reach the end of their useful life. As an alternative to replacing the pumps, the City must plan to completely rebuild each pump on a five-year cycle.

Recommendations for Safety

United Water places a high value on the health and safety of the staff that performs the important work of any water or wastewater facility. Therefore, the observations and recommendations include safety-related issues and remedies. The recommendations range from replacing light bulbs and installing ground fault circuit interrupter outlets in the pump stations to verifying that the hydrogen sulfide monitors are functional. These issues are summarized with the other recommendations in Attachment B.

Recommendations for General Maintenance

The maintenance program will undergo a shift from reactive mode to proactive mode with the implementation of the computerized maintenance management system (CMMS). The third category of capital replacement recommendations is for maintenance-related improvements.

Lagoon Cell Access

One of the major challenges to operating and maintaining the lagoons is access. The existing "ramps" into the lagoons are inadequate to move a boat into or out of a lagoon cell. The staff uses a hoist to lower boats and equipment into the lagoon. United Water's recommendation is to save labor and equipment costs by investing in the construction of a concrete and steel pier ramp in each cell that is oriented parallel to the roadway. In this manner, a pair of technicians could load or unload a boat trailer safely. The small volume of treatment space occupied by these ramps would be negligible compared to the greater efficiency of well-maintained aerators.

Pump Station Roof Access

The project team noted that the enclosed pump stations have poor access to the roof of the buildings. Poor maintenance on the ventilation system is attributed to the lack of access. United Water recommends providing a readily accessible means of accessing the roof for inspection and maintenance of the ventilation system.

Wet Well Modification

The larger Hattiesburg pump stations are configured to draw all flow from a single wet well. As a result, it is not possible to clean the wet well without shutting down or bypassing the entire station. United Water recommends constructing a wall to divide the wet well into two sections. This division will allow each side of the wet well to be

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isolated and cleaned of scum and grit on a scheduled basis. Regular cleanings will minimize opportunities for this debris to damage the pumps or reach the lagoon.

Routine Maintenance

The list of improvements provided in Attachment B includes recommendations for routine maintenance. For example, United Water recommends providing additional trash cans in the pump stations and weekly disposal to make cleaning the station easier. United Water recommends supplying the maintenance crews with light bulbs as standard materials to carry on the trucks so that light bulbs may be replaced immediately upon discovery. These recommendations are simple steps that will facilitate routine maintenance and improve the overall operation of the system.

Recommendations for Future Study

The investigation of the critical equipment in the Hattiesburg system led to many questions that were beyond the scope of this project. A summary table of recommendations for capital improvements and additional studies is included for your reference as Attachment C.

Cc: Mayor Johnny DuPree, City of Hattiesburg
Mark Jordan, City of Hattiesburg
John Stanford, City of Hattiesburg
Jerry Jones, United Water
Jim Columbo, United Water

CAPITAL IMPROVEMENT RECOMMENDATIONS

SAFETY	OPERATION AND MAINTENANCE	ROUTINE MAINTENANCE
East Laurel Pump Station		
Install an "I" beam across the dry well, wall to wall, directly in line with the pumps. Access to this beam will eliminate the need to tie-off from the end walls to align a motor or pump when maintenance or repair activities are required. An electric hoist can be used to lift the motor or pump. In addition to making work on the pump units safer, this configuration will reduce the time and effort required to perform the work. Installing this I-beam may require rotating the position of the circular stairway into the dry well.	Install a wall to divide the wet well into two sections. This division will allow each wet well section to be isolated and cleaned of scum and grit on a scheduled, semi-annual basis. Adding this capability will minimize opportunities for these materials to get into the Lagoon. The "island" in the Lagoon is the product of similar debris reaching the Lagoon.	Provide trash cans on the upper and lower levels of the pump station. Put all debris in the trash cans and empty them weekly.
Install ground fault interrupter (GFI) outlets throughout the pump station.	Replace one of the pumps with a variable frequency drive (VFD) dry well type submersible grinder/chopper pump in the near future. Add additional grinder/chopper pumps when existing pumps fail until all pumps have been replaced. Seal failures occur when grit and debris get into the collection system and reach the pump station pumps. Because the pumps must pump the contents of the wet well, all of these materials pass through the pumps and shorten pump life. Rag accumulations often plug the pump, requiring the excessive maintenance it takes to disassemble, clean, and repair the pump.	Keep electrical cabinet doors closed.
Provide access to the roof to facilitate maintenance on the intake fans. Currently there is little to no air flow into the dry well, a location where a hazardous atmosphere can develop and noxious gasses do accumulate.	Increased control of the influent flow to the Lagoon will help the operators control the treatment process. Convert the motors of the pumps to VFD units which will help equalize the flow of wastewater into the Lagoon.	Keep dehumidifier operational.
It appears that an unmarked gas line terminates in the dry well. The purpose of this line is unclear. For an unmanned station, it would be prudent to remove the line and make provisions for temporary gas supplies as needed. If this line is under pressure and rusts through in the future, or if the line is struck by a motor or pump in the course of maintenance, the staff would immediately face a serious situation. The circular stairs are very close to the termination point of the gas line and could be rendered inaccessible in an emergency.	Provide electrical or air-driven tools for opening and closing the inlet and discharge valves on the pump. It currently takes two people one-half hour to close the valves which must be closed when a pump is shut down for maintenance. Otherwise, the pump suction line becomes plugged with debris and grit, often making it difficult to start the pump after maintenance is completed. In addition to increased efficiency, these tools will decrease the likelihood of an ergonomic injury caused by opening and closing the valves manually or an impact injury due to incomplete closure of the valve.	Change bulbs when lights go out to keep all work spaces well lit. Maintenance crews should carry light bulbs on the trucks to make an immediate exchange when necessary.
The hydrogen sulfide monitor that is installed in the dry well was flooded at some point. This issue, combined with the ventilation issue referenced previously, presents a potentially hazardous situation for the staff upon entry. The monitor should be replaced with a unit that activates a flashing light near the entry door to the pump station. The alarm should be properly marked "Do Not Enter – Hazardous Atmosphere in Pump Station".	Add a second sump pump and a corresponding second discharge line. This pump should be installed at an elevation approximately 1 foot above the existing sump pump suction intake. Debris removed from pumps during maintenance often accumulates on the floor and ends up in the sump, resulting in plugging the pump.	Maintain a First Aid kit and an adequate supply of rubber gloves in the station.

CAPITAL IMPROVEMENT RECOMMENDATIONS

SAFETY	OPERATION AND MAINTENANCE	ROUTINE MAINTENANCE
Evaluate the best locations for emergency lights that are aimed to light all critical areas in the station and install them properly.	Repair or replace the fan cover currently missing for the dry well fan.	Verify that the air supply fan for the dry well is working properly on a routine basis.
Install safety chains across the entry to the circular stairs.		
Install locks on all hatches and doors. In particular, lock any doors that provide access to the wet well or to any below grade area.		
Repair or replace the entry doors so they open and close freely and can be securely locked.		
Provide a First Aid kit and an adequate supply of rubber gloves in the station.		
Install an electric hot water heater and sink plumbed to drain into the wet well to provide hot water for employees to wash up after working in the pump station.		
Burkett Pump Station		
Install safety chains across locations with access to stairs.	Provide electric or air operated drive motors for use in expediting the opening and closing the inlet and discharge valves for the pumps.	Provide trash cans on the upper and lower levels of the pump station. Put all debris in the trash cans and empty them weekly.
As at the Laurel Pump Station, remove or modify the gas line in the dry well.	Replace one pump with a VFD Dry Well Submersible grinder/chopper pump. Replace all pumps over a five year period or as existing pumps fail.	Keep electrical cabinet doors closed.
Replace the manhole cover, on the manhole across from the pump station. If this manhole must be accessed build a path with stairs from the road down to it. Replace the heavy cover with a lockable aluminum cover and provide a level work area around the manhole.	Install access to the roof so the fan providing air to the dry well can be inspected and maintained. Currently little or no air is getting to the dry well.	Keep dehumidifier operational.
Install emergency lights that light all areas of the station.	Consider the installation of a wall across the wet well so each section can be cleaned of scum and grit accumulations semi annually.	Change bulbs when lights go out to keep all work spaces well lit. Maintenance crews should carry light bulbs on the trucks to make an immediate exchange when necessary.
Keep all control panel doors closed.	Modify current VFD control configuration so more than two pumps can run in the variable speed mode. Currently two can run in the variable speed mode, but if a third pump is required, it comes on at full speed, not as a variable speed unit.	Maintain a First Aid kit and an adequate supply of rubber gloves in the station.
Repair or replace the access door into the pump station to permit it to be closed and locked.	Add an additional backup sump pump.	Verify that the air supply fan for the dry well is working properly on a routine basis.
Install or modify the hydrogen sulfide or noxious gas monitor to activate a flashing light on the outside of the station near the access door properly marked with a warning sign.		
Provide a fully stocked First Aid Kit and a supply of rubber gloves in the station.		

Attachment C

Recommendations for Capital Improvements

EQUIPMENT	FUTURE STUDY / DESIGN
Rebuild or replace aerators every 3 to 5 years -- Assess all aerators annually with the expectation that 10% will need complete rebuild or replacement. Continue on this schedule until sufficient data has been collected to determine mean time between failures, and adjust the schedule accordingly. Assume annual maintenance cost of 10% of installed cost: approximately $1,500 per aerator.	Investigate suitable replacement technology for the aerators and replace the existing aerators, as they fail, with a model that is more traditionally applied to wastewater such as those manufactured by Aqua-Aerobics.
Rebuild or replace lift station pumps every 5 years -- Assess all pumps annually with the expectation that 10% will need complete rebuild or replacement. Continue on this schedule until sufficient data has been collected to determine mean time between failures, and adjust the schedule accordingly. Assume annual maintenance cost of $100/hp for rebuild or $250/hp for replacement.	Conduct an intensive study of flow patterns (Dye Test) to determine if maximum available treatment volume is used. Investigate feasibility of adding more curtains to South Lagoon to channelize the flow through all of the aerators if short-circuiting is confirmed.
Replace the existing lift station pumps, as they fail, with submersible grinder pumps. Submersible grinder pumps will be easier to maintain (including fewer shutdowns due to rags and large debris) and will prevent large debris from reaching the lagoon.	Assess the viability of either solar panels to supplement existing power supply or installation of SolarBee™ circulators to minimize energy costs.
Rebuild or replace the pumps at the Yeast Lift Station annually -- Currently installed pumps - particularly the impellers - require frequent maintenance to stay in service. Pumps should be rebuilt annually to minimize unscheduled downtime. Alternatively, replace the pumps with a model designed for aggressive environments and corrosive flow.	Perform an annual sampling of sludge to measure the sludge blanket profile and determine when dredging is needed.

EQUIPMENT	FUTURE STUDY / DESIGN
Replace the corroded Chlorine Gas System components -- Replacement of the chlorinator and some piping is in progress, but recommend replacing all parts for safety.	Analyze the cost and logistics of replacing the existing use of Chlorine with Sodium Hypochlorite. Given that much of the existing system requires repair or replacement, this is the opportunity to switch to the safer chemical.
Construct a wall in each wet well to divide the wet wells in the major pump stations to facilitate maintenance. The current single well configuration requires complete station shutdown and/or bypass to clean the wet well. A divided wet well would allow the station to stay in service while one side is cleaned.	
Construct boat ramps in each lagoon cell for easier access to water surface. The ramps should be oriented with respect to the roadways on the levees. Current methods of moving the maintenance boats from one cell to another are inefficient and potentially hazardous. The loss of the volume occupied by the ramp foundations and piers should be offset by gains from other operational efficiencies.	
Install a sampling valve on the Petal influent pipeline for safer, more convenient access. The current sampling point is a manhole in the middle of a well-traveled road. The sample tap should be located within the lagoon site.	
Add flow monitoring to unmetered influent lines to obtain data needed to evaluate lagoon performance. This data will also benefit future capital planning.	

EQUIPMENT	FUTURE STUDY / DESIGN
Add Chlorine Residual Analyzers immediately downstream of the chlorine injection point and the sulfur dioxide (dechlorination) injection point for feedback on the effectiveness of the chlorination and dechlorination. Use the information for manual control until automated controls can be installed and tied into this feedback loop to maximize the efficiency of chlorine addition.	

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Scope of Services

This task included developing a systematic solids deposition profile for each lagoon to facilitate the City's long-term planning process for lagoon maintenance and/or expansion and developing a more detailed sampling and testing program for better operational control.

The City's South Lagoon has received high strength waste from the USA Yeast manufacturing facility for approximately five years with noticeable effects. Although the lagoon was modified to accommodate the loading from this waste stream, United Water examined operations and maintenance records to assess the existing treatment system's ability to reliably meet the terms of the permit. Alternative treatment systems were evaluated to meet the demand, but the initial results were inconclusive.

Observations

The City's South Wastewater Treatment Plant was cited for permit non-compliance on several occasions within the last year. United Water sampled the influent and effluent

flow streams and the sludge blanket. The project team interviewed the staff and observed operations in the field to look for potential opportunities for procedural improvements.

The overall impression of the wastewater program is that the basic structure of the staff and the equipment is adequate and the problems identified are not insurmountable. Three key elements appear to be contributing factors to the problems in the wastewater system:
- lack of control over the lagoon operation
- inefficient maintenance
- high strength waste discharged from an industrial user

The maintenance issues are addressed in other memoranda concerning the new computerized maintenance management system (CMMS) and capital improvements. This document will address the operational control issues and the influence of the high strength discharge.

The observation period for this project was primarily during the month of September 2007. At that time, the lagoons were substantially covered with blue-green algae. Although the algae infestation is seasonal for Hattiesburg, the impact of the algae's photosynthetic respiratory cycle cannot be ignored. In fact, because algae add oxygen to the water, it may be possible to work with the algae cycle by turning down or turning off certain aerators during the daylight hours.

Chlorine is added at the maximum rate for disinfection, but the chlorine is often completely consumed prior to discharge. Under those circumstances, the staff is able to turn off the sulfur dioxide feed because there is no need for dechlorination. The concern is that when chlorinating at maximum capacity and producing zero total chlorine residual, the staff cannot be certain of a complete pathogenic kill.

The sludge sampling revealed that with a few exceptions, the sludge blanket is essentially one foot thick throughout many of the lagoon cells. The exceptions, however, are cells where the buildup of sludge is sufficient to make those cells a priority for cleaning. The sludge profiles for each cell are provided in Attachment A to this memorandum.

The City of Hattiesburg accepts wastewater discharged directly from the USA Yeast manufacturing facility. The color and texture of this waste stream is distinctive: reddish brown with the consistency of molasses. Although this industrial flow represents a small portion of the total influent flow at the South Lagoon, the effluent is stained to the color of tea.

Recommendations

The wastewater department staff is primarily a maintenance organization. The staff performs daily operational duties, but the focus is maintenance. The staff is knowledgeable about the lagoon and recognizes when conditions are not right. However, it appears that there is little effort made to control the lagoons beyond controlling the

water level to avoid flooding the aerators. Compliance sampling is contracted to a local laboratory, Bonner Analytical Testing Company (BATCO). The staff is dependent on the results provided by BATCO for process control.

As part of the effort to understand the current sampling program, United Water engaged BATCO and another local laboratory, EDL Labs, Inc. (EDL) to split samples taken over a two-day period for analysis. BATCO followed its usual sampling procedure to collect influent and effluent samples at the lagoons. They also set up a 24-hour composite sampler at the Yeast lift station to characterize the discharge from USA Yeast. The results of that sampling exercise presented only a "snapshot" of a typical day's operation – a series of data points would illustrate any trends in the data – but the exercise provided insight into the City's sampling program and a basis for recommendations regarding sampling procedures and maintenance plans. The results of this analysis are included in Attachment B.

With the current program, the staff does not have enough information to make informed operational decisions. Now that nearly all of the aerators are back in service, the staff must collect and analyze more samples for process control. United Water recommends identifying suitable locations for sampling and providing additional equipment and training, as needed, for the staff to analyze the samples for process control. For the short term, United Water also recommends increasing the frequency of sampling performed by BATCO to a minimum of weekly sampling events to serve as a check for the staff's results and to demonstrate an aggressive approach to compliance.

Liquid Sampling
Sampling and analysis for total suspended solids (TSS), pH, dissolved oxygen (DO), and total chlorine residual should be performed on a daily basis (at least weekdays) at the influent to each cell of each lagoon. Biochemical oxygen demand (BOD) and the nitrogen spectrum should be measured weekly, at a minimum, until the operations have stabilized. Sampling may return to permit frequency after several consecutive months of compliance. However, the staff must be prepared to respond as soon as decreasing performance is observed.

Until the facilities can be fully equipped with analytical tools, the staff could use field test strips to check pH, ammonia, and phosphorus. DO meters should be permanently installed in each cell, but until suitable installations are made, the staff may use handheld meters. United Water recommends purchasing the necessary equipment to measure TSS as quickly as possible.

The purpose of this increased data collection is to provide the staff with early warning signals when compliance is threatened. United Water recommends that the staff develop graphs on which TSS, pH, and DO results are plotted each day. These graphs will have warning limits and take-action-now limits drawn in bold lines so that whenever an operator plots the day's results, he/she knows immediately if the data collected is acceptable or requires contacting the supervisor and taking some pre-determined action.

These response actions are written standard operating procedures (SOPs) that the staff reviews and practices on a regular basis. For example, if the DO from a cell is too high, there may be directions in the SOP to shut down certain aerators. If it is detected that the dechlorination process is not terminating all of the chlorine, the operator must check the sulfur dioxide feed to determine if it is clogged or if the chlorine system has failed in the open position.

Another, more detailed, study will be necessary to determine the current relationship between the average BOD loading and the placement of aerators in service with respect to treatment capacity. That is, the operators must have detailed information about the capability of each aerator in order to make decisions regarding which aerators to have in service in response to a given set of conditions. With the oxygen transfer rate and mixing capabilities known for each aerator and the amount of influent BOD, the operator can calculate how many mixers need to be on (and which ones could be shut off temporarily). Although greater frequency would be preferred, the operations supervisor should be provided with at least weekly influent BODs to make these decisions and issue process control orders.

As noted previously, the operators control the water level in the lagoons to avoid submerging the aerators. Although the aerators float, they are tethered and anchored such that it is possible for the motor to be submerged under high water. The staff is aware of the prescribed high and low water levels, but there is no means of determining the actual water level without measuring. United Water recommends installing some type of measuring pole in every cell so that an operator may read the water level from the safety of the lagoon bank. This information should be recorded daily. The operators may then use influent and effluent flow data and water levels to correlate decisions about chemical addition and maintaining adequate freeboard to accommodate major storm events.

Solids Sampling

The island in the middle of the South Lagoon formed over a formerly active influent pipe. Debris and sludge accumulated in a pile that eventually rose higher than the water level. United Water collected samples from the sludge blanket and found similar mounds that are below the water surface. These mounds are shown on the sludge profiles illustrated in Attachment A.

The mounds of sludge indicate that sludge management has been a low priority. The staff must maintain an awareness of the sludge blanket thickness in order to properly calculate the liquid volume available for treatment. Sludge removal from a lagoon is not an overnight process. It takes months of planning and coordination to successfully dredge and dispose of sludge from a lagoon. The staff must monitor the sludge blanket in order to start the removal process before the volume of sludge reaches a crisis level.

United Water recommends that the City purchase at least one "sludge judge" tool for each lagoon for the operators to monitor the sludge blanket levels and collect samples for analysis. The sludge judge is a hollow tube that collects a core sample from the sludge

do not gain control of the process, then the lagoon will continue to fail to meet permit limits.

The scope of this project did not include an organizational analysis to determine the appropriate level of staffing or a financial analysis to prove the economic feasibility of the proposed program. The City would benefit by the addition of certified wastewater operators. The project team understands that certification training is scheduled for the staff in 2008. Clear lines of communication and direction must be established for the department to function successfully. A designated Operator in Responsible Charge (ORC) must have the authority to direct operational policy. The ORC must coordinate operations activities with maintenance activities. Other recommendations for improving the operation and maintenance of the wastewater system are provided in Attachment D.

Cc: Mayor Johnny DuPree, City of Hattiesburg
Mark Jordan, City of Hattiesburg
John Stanford, City of Hattiesburg
Jerry Jones, United Water
Jim Columbo, United Water

Attachment D

Recommendations for the Lagoon Operating Plan

Sampling and Analysis

The operators need more information about the influent coming to the lagoons and the reactions within the lagoon cells to maintain control of the treatment process. It does not appear that the staff collects enough data to make operating decisions. This lack of information and dependency on a contract laboratory for analytical results leaves the operations group in a reactive mode. The proposed minimal sampling program for process control can be accomplished with field test kits and additional analytical work by the contract laboratory until the City's analytical facilities can be refurbished.

Daily Grab Samples from the Lagoon Cells:
Influent and Effluent Flow, TSS, pH, DO, Chlorine Feed, Post-Chlorine Injection Chlorine Residual, Post-Dechlorination Injection Chlorine Residual

Three Times Per Week Grab Samples from the Lagoon Cells:
BOD, Total Nitrogen, Nitrate, Ammonia, Fecal Coliform

Daily Grab Samples from the Yeast Lift Station:
BOD, TSS, pH, DO

24-hour Composite Samples from the Yeast Lift Station:
Up to 5 Random Sampling Events per month

Routine Operations

The operators must store the data in an organized manner and analyze the results to understand how the process is working. Analyzing the data for trends will give the operators a basis for making process control decisions in the form of process control orders (PCOs) and standard operating procedures (SOPs). Upon receiving an indicator of non-compliance, the operators will have a predetermined response procedure to follow to minimize the risk of an effluent violation. Along with more intense process control, the operators need to exercise more responsibility for the facilities. More training to collect good samples and to understand the analytical results will yield more assertive control of the process. More safety-related training and simple housekeeping will improve the condition of the facilities and facilitate lagoon operations.

Establish an organized, verifiable system for Monitoring Records and Operator Logs

Plot Daily and Weekly Trends for Process Data, Weather, and Odor Complaints

Develop and implement a Response Plan for Non-compliant Results

Train continuously in Technical and Safety Procedures

Improve Cleaning/Landscaping at Lagoons and Pump Stations

Monitor the sludge blanket annually and remove sludge as needed to maintain adequate treatment volume

Yeast Lift Station Recommendations

Because of the influence of the yeast plant discharge on the lagoon operation, the operators must take an active approach to operating the lift station that serves the yeast plant. The recommendations listed below are beyond the scope of routine lagoon operations, but the results of these suggested studies will impact standard lagoon operations.

Develop methods of flow equalization and/or dilution with domestic wastewater to reduce shock loads

Conduct extended treatability study to determine pretreatment options

Determine if additional flow controls in the treatment cells will improve effluent quality