WORTON WWTP AND ELAS – CEAM LARGE PROJECT OF THE YEAR NOMINEE

ADDITIONAL PHOTOGRAPHS

Kent County is nominating the Worton Wastewater Treatment Plant (WWTP) Upgrade and Effluent Land Application (ELAS) for the County Engineers Association of Maryland (CEAM) large project of the year. The project is being nominated because it meets the needs of local and State citizens, it utilized innovative solutions during design, of its overall cost effectiveness, and because of its complexity.

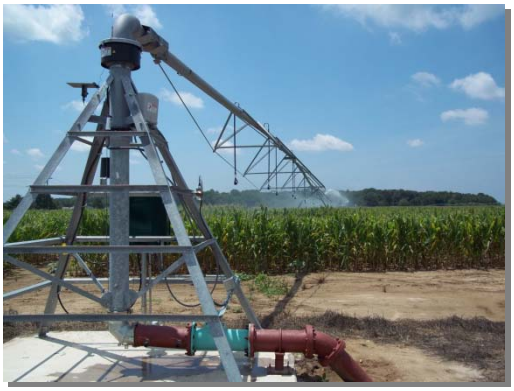
This letter provides a description of the overall project from a technical perspective. Then, commentary is made on how the project met the needs of local and State citizens, utilized innovative solutions, was cost effective, and the project's overall complexity.

Technical Description

The Worton WWTP Upgrade and Effluent Land Application System (ELAS) upgraded the existing lagoon treatment system to a 0.25 MGD membrane bio-reactor (MBR) treatment system capable of generating high quality effluent with concentrations of total nitrogen at, or less than, 4.8 mg/L and total phosphorous concentrations of 0.3 mg/L or less. The low nitrogen and phosphorous limits help Worton meet the nutrient removal goals issued by the Maryland Department of the Environment (MDE). Initial effluent discharge from the facility shows nitrogen and phosphorous concentrations well below those required by the discharge permit. The improvements associated with the project also allow the discharge of treated wastewater to existing farmland via the infrastructure installed under the ELAS. The discharge of treated wastewater onto crops allows further uptake of nutrients, resulting in a decreased nutrient load on the Chesapeake Bay.

UV Disinfection Effluent at WWTP

The treatment process begins with a 2 mm fine screening process that removes inorganic debris from the raw residential wastewater, septage, and onsite drains. The screened wastewater is then pumped to the influent of the biological process, a modified 4-stage Bardenpho® process. The biologically treated wastewater then passes through the ultra-filtration membranes, which separate solids from treated water. The treated water then passes through UV disinfection where Fecal Coliforms are reduced to less than 3 MPN per 100 mL.



Center Pivot Operation at ELAS

When discharging to the surface water discharge point, the effluent passes through a reaeration basin and effluent flow is measured. The reaerated water then enters a transfer pump station where it can be pumped to either the surface water discharge point, or to the ELAS. When discharging to the ELAS, the reaeration step is skipped, and effluent flow is diverted to the onsite storage lagoons. Stored water in the lagoons is then drawn out by the transfer pump station and pumped to the ELAS site.

Additional infrastructure at the WWTP site includes a 66' (L) x 63' (W) x 31.5' (H) pre-engineered metal building used to house the membrane tank, permeate skid, chemical area, blower room, restroom, dewatering equipment, electrical/control room, laboratory, and UV disinfection equipment. The building is equipped with a 7.5 ton bridge crane capable of picking up the membranes, and other equipment, for maintenance. The operations building has two levels in order to reduce its footprint.

The WWTP is also equipped with an aerobic digester that also serves as a pre-treatment step for the 7,000 gallons per day (gpd) of septage that is received at the treatment plant site. The septage is screened through an existing 1/4-inch bar screen, then flows by gravity to the dual basin aerobic digester. Septage and waste activated sludge are kept aerated in the digester, and supernatant is pumped from the digester to the head of the plant where it can be fine screened. Digester solids are pumped to the Somat dewatering units for dewatering and disposal in an onsite trash container. Solids are disposed of in the landfill.

The infrastructure associated with the ELAS consists of 10,000 feet of 10-inch PVC force main between the WWTP site and the ELAS site; a 2-million gallon earthen buffer lagoon lined with a geosynthetic clay liner; a 2,350 gallon per minute pump station used to pressurize the 6,000 feet of onsite PVC piping between the irrigation rigs; and five center-pivot irrigation units that apply treated wastewater over 75.5 acres of farmland.

Project Commentary

The Worton WWTP Upgrade and ELAS helped meet the needs of Kent County and State citizens. First, the project increases the capacity of the WWTP without increasing the nutrient load to the surface water discharge point or the Chesapeake Bay. Previous engineering studies identified the need to provide additional WWTP capacity due to the expected residential growth in the Worton sewer service area. The Worton sewer service area was under a moratorium for connection of additional sewer services until this project was completed. The upgraded WWTP and ELAS provide additional WWTP capacity while keeping nutrient loads to the surface water discharge point and the Chesapeake Bay, at or below existing levels. Helping the State of Maryland in its efforts to clean up the Chesapeake Bay, and meet total maximum daily loads (TMDL) goals, is a benefit to all Maryland citizens who enjoy the Chesapeake Bay and all it has to offer.

Second, the project met the needs of local citizens by staying within budget. The project was long, complex, filled with unexpected twists and turns, and still managed to stay within the funding budget that had been established during the study phase of the project.

The project should also be recognized for the several innovative approaches that were used to address design issues and keep project costs as low as possible. First and foremost, the use of existing farmland to apply treated effluent allowed increased WWTP capacity while keeping nutrient loads to the Chesapeake Bay at, or below, existing levels. A vigorous effort was put forth during the study and design phase to identify and permit land for the purpose of land application. The land was identified and then a rigorous permitting process ensued. The selected site was already part of the Maryland Agricultural Land Preservation Fund (MALPF) and therefore required additional coordination with that entity in order to not violate any existing agreements the land owner had with MALPF. Additionally, the dual discharge nature of the discharge permit (surface water and land application) required coordination with two different entities within Maryland Department of the Environment (MDE) since there are different departments for surface water discharge and ground water discharge. Land application is considered a ground water discharge method.

The second innovative aspect of the project is its incorporation of the positive aspects of existing land application systems in Maryland and Delaware, while including new provisions to address areas of improvement identified at existing projects. The design engineer, McCrone Inc, visited existing land application sites in Delaware and interviewed the system operators. McCrone took that data and incorporated such items as wide tires on the irrigation units to lessen rutting in the fields, use of the FieldNet program offered by the irrigation unit manufacturer that allows control of the system via a web browser, and inclusion of a self cleaning strainer to prevent irrigation nozzles from becoming clogged. McCrone also included variable frequency drives (VFDs) on the irrigation pumps and Cla-vals at each irrigation pivot. These improvements allow the irrigation units to fill slowly so as to prevent pressure surges that could potentially damage the irrigation units.

A third innovative aspect is seen at the buffer lagoon located at the ELAS site. The buffer lagoon is used to receive water continuously from the transfer pump station at the WWTP. This allows the transfer pump station at the WWTP to be smaller than it would be if it was sized to discharge directly to the center pivot irrigation equipment (690 gpm vs 2350 gpm). The buffer lagoon was sited on the existing farmland adjacent to an existing pond. Siting the buffer lagoon adjacent to the existing pond allowed the use of the existing pond berm as one side of the buffer lagoon. Siting the buffer lagoon in this manner decreased construction costs and lessened the footprint of the ELAS facility on the privately owned farmland.

A fourth innovative aspect of this system is the pretreatment of septage received at the WWTP. The site receives approximately 7,000 gpd of septage. The septage represents 3% of the design flow, but nearly one-half of the nitrogen load and one third of the phosphorous load to the plant. The septage's percentage of influent flow is even higher at initial WWTP flows, approximately 70,000 gpd. Adding septage directly to the residential influent stream would have caused over sizing of the biological treatment basins and associated air diffusers, blowers, and chemical feed systems. Therefore, the septage was diverted to the digester for pre-treatment of solids, nutrients, and BOD. The digester has a dissolved oxygen (DO) sensor that allows it to operate at a low enough DO to expect nutrient levels to be decreased when the waste activated sludge (WAS) is mixed with influent septage. The digester did become larger due to the increased solids load, but the upsize of the digester was less costly than upsizing of the biological treatment system. Please refer to the technical description of the project for additional information of how the septage is handled.

The fifth innovative approach at the Worton WWTP is the reuse of the existing lagoons at the WWTP site. The existing lagoons are being converted from treatment lagoons to storage lagoons. The storage lagoons allow the treated wastewater to be stored and then eventually applied at the ELAS. The storage is necessary because the WWTP cannot discharge to the surface water point between May 1 and November 1 of each year. That is the time of year the ELAS is to be utilized. If there are days that wastewater cannot be applied to the ELAS because of weather or other reasons, the water can be stored. The reuse of the existing lagoons in lieu of new storage resulted in considerable cost savings. Piping modifications were incorporated into the design to allow operator flexibility in selecting which existing lagoon receives effluent and which lagoon is drawn when sending effluent to the ELAS site.

The project is considered cost effective because it stayed within the level of funding provided to Kent County by USDA-RD and MDE. The project was able to be kept on budget because of the innovative solutions previously discussed, as well as other items such as keeping the 10-inch PVC inter-site force main on the shoulder of the County road to reduce restoration costs.

Finally, the project should be recognized because of its overall complexity. The project is complex from the perspective that the WWTP is "state of the art" in its use of MBR technology. The MBR treatment equipment, specifically the membranes and permeate skid, are more complex equipment than any other treatment plant Kent County staff operate. The County staff should be recognized for being able to transition to this new technology while simultaneously maintaining high quality effluent from the WWTP.

The project was complex from the permitting perspective as well. A dual discharge permit from MDE, approval by MALPF, sediment and erosion control and grading permits on an existing farm, and buy in from local citizens were all difficult obstacles that were overcome to make this project a reality. The overall project complexity was overcome by a culture of teamwork between all the project stakeholders. The stakeholders included Kent County Public Works, Kent County operators, McCrone Inc., MDE, USDA Rural Development, Soil Conservation Services, MALPF, the private farmland owner, the citizens of Kent County, and GE-Zenon who worked closely with the design engineer.

All of the aspects presented in this write-up would make the Worton WWTP and ELAS a worthy recipient for the CEAM project of the year award.

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ADDITIONAL PHOTOGRAPHS

ELAS- Completed Irrigation Pump Station and Buffer Lagoon at a USDA Earth Day Celebration

Completed WWTP - Screen Building, Aeration Basins and Operations Building Pictured