Daphne Utilities (DU) submitted a pre-application for the Clean Water State Revolving Fund Program. The following are the Business Cases for each of these projects that include information to demonstrate that energy efficiency is one primary goal of these projects. The four recommended items to demonstrate energy efficiencies have been included for each project along with the blower replacement project to be included in the CWSRF application.

Project A: Biosolids Processing Facility Upgrades

This project will replace Daphne Utilities' existing belt press and natural gas-fired dryer with a more energy efficient and cleaner technology for producing Class A biosolids from sewage sludge. Daphne Utilities first started producing Class A biosolids in the early 1990s. However, the existing equipment, which is a prototype direct dryer, for the treatment of biosolids is a heavily mechanical process and has reached the end of its useful life. This is demonstrated by the inability to use the equipment daily as it requires bi-monthly shutdowns to perform needed maintenance to keep the equipment running. This also increases operational costs as the biosolids are not able to be processed to meet Class A requirements and are disposed of at a permitted landfill. The landfill is approximately 40 miles round trip from the treatment facility and currently multiple 18 wheeler trucks are required per week to dispose of the dewatered sludge increasing the negative impact on the environment. In addition the existing dryer produces noxious emissions due to the high operating temperatures and poor condition. While there are no air emissions violations occurring during this time, the offensive odor is noticeable for miles around the facility and decreases the quality of life for residents and the public enjoying amenities such as open air shopping and dinning and parks. The sludge is dewatered with a belt press prior to entering the dryer. The belt press has also reached the end of its useful life. The operation of this system has experienced inefficiencies with the polymer system, energy use to operate and maintain treatment parameters, and water usage.

Energy Efficient Equipment

The microwave dryer will incorporate both microwave technology and clean-burning natural gas burners to optimize the drying process. Microwave technology will be utilized at the beginning of the process with natural gas burners being utilized at the end of the process to evaporate the moisture from the microwave process. This arrangement will allow for the most energy efficient removal of water from the biosolids. Utilizing the microwave units at the beginning of the process will evaporate one pound of water with approximately 27% less BTUs. The gas burner size will be substantially less than currently utilized and will not require the high temperatures used by the existing system. The air emissions will also be reduced and an odor control scrubber will be installed to clean the air prior to discharge.

A new screw press will replace the existing belt press to dewater the sludge prior to entering the microwave dryer unit. This new screw press will significantly outperform the existing belt press by dewatering the sludge to a higher solids percentage; thereby increasing the overall performance of the biosolids system. We currently anticipate increasing solids percentage by approximately five percent which will decrease the amount of wet tons of biosolids to be processed by approximately 1,000 tons/year. Also, VFDs will be incorporated on the sludge pumps to optimize their energy efficiency.

Equipment that meets design conditions with the highest efficiencies standards available will be utilized.

Energy Efficient Design Practices and Considerations

Generation of Class A biosolids allows for the beneficial use of biosolids and is considered a green technology. Daphne Utilities is planning to replace infrastructure that has reached its useful life and can no longer consistently produce Class A biosolids and requires landfill applications. Daphne Utilities has performed an extensive evaluation of current technologies that would allow for the consistent production of Class A biosolids and significantly reduce operation and maintenance costs. This evaluation included site visits to various installed technologies to visually inspect the operation of the equipment and the end product.

After completing this evaluation, Daphne Utilities determined that a new emerging technology of microwave drying is the best suited application to meet their needs. The technology of using microwaves for drying has been a proven reliable method in the food industry and meets all the requirements to produce Class A biosolids. This technology is relatively new to the wastewater industry with most installations in the Great Lakes area. **This would be the first installation in Alabama utilizing microwave energy to meet Class A with low emission.** Daphne Utilities will utilize a microwave/natural gas combination system to increase the efficiency of the operation. The microwave technology allows for the most efficient removal of the water from the biosolids during the initial passing of the biosolids through the microwave unit. Microwave energy heats products volumetrically allowing all exposed product to be heated at the same time. It creates heat from within the product being dried. The existing drying system relies on the convection of heat to heat and dry product which requires that an oven cavity be heated with air and the heat from the air must pass through the product being treated. The requirement to heat the oven cavity in order to heat the product causes a significant amount of energy (heat) to be lost to the environment. The final stage will be completed with natural gas since it provides a more effective removal method for the water at this stage in the process since a majority of the water will be removed at this point.

Additionally, the existing belt press will be replaced with a more energy efficient dewatering process. Again, multiple processes were reviewed including replacing the existing belt press, installing a new centrifuge, or installing a new screw press. While the belt press is a low horsepower process it is difficult to obtain a high dewatered cake solid percentage with this process; thereby increasing energy requirements downstream to process the biosolids through larger units or longer run times. Also, this process uses a considerable amount of water to operate. Therefore, a study of a centrifuge dewatering process versus a screw press dewatering process was performed. It was determined after evaluating a side by side trail of the two processes that were being performed in the Orlando area that a screw press would provide an equivalent cake solid percentage with far less horsepower compared to a centrifuge.

VFD drives will also be incorporated into the sludge pumps to increase the efficiency of the pump operation.

An odor control scrubber is being incorporated into the design to have cleaner emissions from the microwave unit. While the emissions will be significantly less than the current dryer system, the scrubber will further enhance the quality of the emission prior to discharge into atmosphere.

SCADA upgrades will be incorporated into the design to allow the operator to monitor and control the system to react quickly to changes in conditions. Also, the system will monitor change in sludge characteristics and adjust operation as necessary to maintain the most optimum performance level. This will occur by adjusting polymer feed rates, pump speed, and press speed. Also, DU currently operates a biodiesel program from used cooking oil collected from residents in their service area. This program has been successful in reducing SSOs in the system by approximately 40% by removing grease. DU went a step further by using the waste cooking oil collected to produce biodiesel for their vehicles and equipment. This project will incorporate a permanent place for this operation inside the building eliminating the impact of the outside elements on this process.

Energy Savings

Currently, DU has an annual landfill cost of approximately $200,000 due to the inability to operate the existing dryer system consistently, which will be eliminated by these upgrades.

Energy Savings Justification

Daphne Utilities' commitment to continue producing consistent Class A biosolids is the most environmentally responsible method for disposal of sewage sludge. This project will incorporate energy efficient improvements to the extent possible while allowing for a safe work environment.

The following alternatives were reviewed when evaluating the microwave process: Option 1: Replace Existing Equipment with Chemical Stabilization / Pasteurization: Option 2: Replace existing equipment with natural gas-fired dryer: Option 3: Do not replace existing equipment. Option 1 method increased the amount of biosolids by approximately 250% since the product is not dried; thereby increase operation and hauling requirements. Option 2 utilizes more energy as described above and Options 3 does not allow for the consistent production of Class A biosolids. Daphne Utilities is committed to providing the most environmentally responsible method for treating biosolids.

Project B: Septic Receiving Station

This project will add additional screening and pretreatment of septic waste at Daphne Utilities' Water Reclamation Facility. The upgrades will improve the energy efficiency of the treatment facility by helping to reduce the loading concentrations and providing for a more constant flow in lieu of surges of highly concentrated sewage. DU is the only utility in the immediate area accepting septic waste. It is currently estimated that 20% of City of Daphne residents have septic system. Daphne Utilities acceptance of this waste minimizes travel on the highways by large septic haulers as well as reduces the incidences of illicit dumping.

Energy Efficient Equipment

All pumps and motors that are utilized will be designed to operate in their most efficient zone. The system will be automated to allow for the uniformed slow release of the material after laboratory results have been received. The laboratory results are performed on site by Daphne Utilities to ensure there are no known toxins in the sewage received prior to discharge into the treatment system.

Equipment that meets design conditions with the highest efficiencies standards available will be utilized.

Energy Efficient Design Practices and Considerations

Daphne Utilities is one of the only wastewater treatment facilities in the area which accepts sewage from septic haulers, offering a cost effective disposal method to help mitigate illegal dumping. Although the WRF average daily flow is approximately 2.72 MGD, which is just 65% of the current design and permitted capacity, the WRF currently experiences a biological loading of approximately 85%, 90%, and 35% of its biological treatment capacity for BOD, TSS, and ammonia, respectively. Septic waste contributes to this higher biological loading and causes treatment challenges at the facility. It also requires additional aeration for treatment at an increased energy usage.

The septic receiving station will allow for a uniform slow release of the material from the storage basin into the headworks system or the digester system to improve the overall treatment capabilities of these systems and the WRF.

Energy Savings

By incorporating energy efficient pumps and appurtenances to allow for the slow release of the septage, downstream processes will be able to operate more efficiently reducing energy consumption. When discharged at a slower rate to the headworks, which is currently undergoing improvements, additional biological loading will be able to be removed by not sending surges that will overwhelm the system. **The primary savings will be in this biological loading reduction which will decrease necessary aeration for treatment requiring less operation of the blowers.** Also, all components of the septic receiving station will be low horsepower reducing energy requirements.

Energy Savings Justification

Daphne Utilities' receipt and treatment of septage received in the community provides a convenient disposal method at a fair rate. These proposed improvements will enhance the overall operation of the system; thereby, reducing necessary power consumption at the treatment facility.

Daphne Utilities discussed alternatives to modifying their septage receiving station and confirmed that this service was too vital to the community to be discontinued. Through the use of previous SRF funds, DU is completing renovations to the screening at their headworks to reduce biological loading concentrations. During that design it became evident that further enhancements were needed at the septage receiving station to ensure the new improvements can operate at their optimum level.

Project C: Lift Station & Infrastructure Upgrades

This project proposes to replace aging infrastructure of the Windscape Lift Station for greater energy efficiency and to protect the environment by accommodating surges experienced during peak flows including wet weather events. This will be accomplished by the construction of a larger force main and installation of high performance pumps.

Energy Efficient Equipment

All pumps and motors will be designed to operate in their most efficient zone. Also, VFD will be incorporated to increase the energy efficiency of the pump by optimizing the pumping rate. In addition, the force main diameter will be increased to lower friction losses in the piping system also reducing the pumping requirements while accommodating flows experienced during wet weather events.

Equipment that meets design conditions with the highest efficiencies standards available will be utilized.

Energy Efficient Design Practices and Considerations

In previous years, the Windscape Lift Station and Force Main were determined to be nearing capacity due to growth of the service areas. Through modeling, it was determined that the lift station and force main require upgrading to meet the current demands during peak periods. Also, this station has experienced multiple outages due to aging infrastructure requiring bypass pumping and emergency repairs in order to avoid sanitary sewer overflows (SSOs). At times, this portion of the system has experienced excessive flows due to inflow and infiltration (I/I) causing SSOs to occur in nearby areas. Currently, an evaluation is being performed to determine the most economical approach of either upgrading the Windscape Force Main or diverting a portion of the flow to another part of the system and performing necessary lift station upgrades.

Pump performance will be optimized by pump selection and installation of VFDs. Also, the force main will be sized to operate within the system conditions and provide lower friction losses; thereby reducing pumping requirements.

SCADA controls through the Mission system and pump controllers will be utilized to enhance the overall operation of the system.

Energy Savings

By incorporating energy efficient pumps, VFDs and appurtenances, the overall system will operate more efficiently reducing power consumption.

Energy Savings Justification

This project will incorporate energy efficient pumps, drives, and appurtenances including piping and electrical components to improve the efficiency of the operation.

The conditions of Daphne Utilities collection system and this particular lift station require that modifications be performed at this station. Daphne Utilities strives to utilize green components such as VFDs and selecting pumps that will operate in their most energy efficient condition as is planned for this facility. These aspects are in lieu of not incorporating these design concepts or constructing large flow equalization tanks which also require additional pumping.

Blower Replacement

This project involves the retrofit of blowers at the Daphne Water Reclamation Facility. The blowers utilized in the treatment of the wastewater represent a significant portion of the energy consumption at the facility. Developments in

blower manufacturing have led to significant improvements in efficiency of these units.

Energy Efficient Equipment
Existing blowers will be replaced with energy efficient blowers that provide the necessary air flow for treatment with less horsepower.

Equipment that meets design conditions with the highest efficiencies standards available will be utilized.

Energy Efficient Design Practices and Considerations
Recent improvements in blower designs by manufacturers have led to significant improvements in efficiency. These blowers can provide the required air as measured in cubic feet per minute for the treatment process with significantly less horsepower. Currently, it is anticipated that the existing six (6) 60 horsepower blowers at the treatment plant will be replaced with three (3) 74 horsepower blowers. This is an approximate 38% reduction in required horsepower. The reduction in energy will in turn reduce greenhouse gas emissions and the draw of electricity for the grid. The blowers currently being reviewed are cooled by blower suction air, so no additional fan for motor cooling is necessary (no additional power consumption) and are oil-free, thus eliminating the need to change oils. Also, the blowers have a much lower noise and vibration level which provides for a safer and more comfortable working environment.

Energy Savings
It is estimated that the new energy efficient blowers would reduce the energy consumption by approximately 30% or 450,000 kWh. This would result in a savings of approximately $30,000 per year in energy costs. Recently, DU received an EECBG for this project. However, the current estimated project cost will exceed the grant and matching funds.

Energy Savings Justification
This project will incorporate new technology for improved blower efficiency to meet the aeration needs of the wastewater treatment facility. Aeration devices consume up to 40-65% of the electricity required for the wastewater treatment facility.

Daphne Utilities recognizes the value of emerging technologies and is always seeking new technologies that maintain or enhance treatment while utilizing less energy. That is the case for this project in lieu of replacing aging blowers in kind.