

**2014 CWSRF Wastewater Improvements
Eastlake Wastewater Treatment Plant
Guntersville, Alabama**

**Supplemental Information
TVA Energy Efficiency SRF Loan/Grant Application
October 7, 2014**

Description of Improvements and Energy Efficiency

The existing treatment process at the Eastlake Wastewater Treatment Plant (WWTP) is highly inefficient due to the age, condition, and physical configuration of the existing clarifiers, RAS pumps, and WAS pumps, which are approximately 40 years old. The primary purpose of the improvements at the Eastlake WWTP is to upgrade the existing process equipment to provide reliable treatment while simultaneously achieving a significant reduction in power usage. This will be accomplished by incorporating an anoxic zone (for de-nitrification/nitrogen removal) into the treatment process. The aeration process is typically where most of the energy is used at a WWTP, and the anoxic zone will provide nitrogen removal while also reducing the oxygen required for treatment and higher oxygen transfer efficiency.

The improvements required to incorporate the anoxic zone into the treatment process will generally consist of converting the existing primary clarifiers to anoxic basins, replacing the two existing (rectangular) secondary clarifiers with two new circular secondary clarifiers, replacing the RAS and WAS pumps with newer, more efficient pumps. A septage receiving station will also be provided to divert high strength waste, grit, grease, and debris from septage haulers, which will improve treatment capacity and efficiency.

The main sanitary sewer lift station, Lift Station No. 1, is also aging and inefficient. The existing pumps were designed to operate at optimum efficiency during (relatively infrequent) peak/storm events. As a result, the pumps typically operate at a lower efficiency. The Lift Station No. 1 improvements will replace the existing pumps with larger, more efficient pumps that will run fewer hours during the day. The improvements will also include pipe and valve replacement, modifications to the existing pumping station structure, and replacement of the existing electrical motors/starters and controls with new motors/starters and controls.

A summary of energy savings for each component and a summary of estimated project costs are provided on the following pages.

Supplemental Information
TVA Energy Efficiency SRF Loan/Grant Application
October 7, 2014

POWER SAVINGS DUE TO REDUCED OXYGEN DEMAND/BLOWER USAGE			
Item Description	Current	Proposed	% Change
Flow, MGD	4.9	4.9	-
Influent CBOD ₅ , (mg/l)	250	250	-
CBOD ₅ Loading, Lbs/Day	10,223	10,223	-
Influent Ammonia (NH ₃) Concentration, (mg/L)	25	25	-
Ammonia (NH ₃) Loading, Lbs/Day	1,022	1,022	-
Nitrate (NO ₃) Produced from Denitrification, Lbs/Day	3,731	3,731	-
Calculate Oxygen Demands			
O ₂ Demand (1.2Lb O ₂ /Lb CBOD ₅ Removed, safety factor=2) for CBOD ₅ Removal, Lbs/Day	24,534	24,534	-
O ₂ Demand for Nitrification (4.6Lb O ₂ /Lb NH ₃ Removed, safety factor=2), Lbs/Day	9,405	9,405	-
O ₂ Credit for Denitrification (2.9 Lb O ₂ /Lb NO ₃ Removed), Lbs/Day	0	(10,821)	-
Total Oxygen Demand, Lbs/Day	33,939	23,118	-32%
Theoretical Air Demand, scfm	1,355	923	-32%
Actual Air Demand (20% O ₂ transfer efficiency), scfm	6,773	4,613	-32%
Blower Capacity, scfm/HP	12	12	
Required HP for Biological Treatment	564	384	-32%
Daily Blower Power Usage (KW/Day)	10,105	6,883	-32%
Annual Blower Power Usage (KW/Year)	3,688,251	2,512,343	-32%
Add Annual Power Required for New Anoxic Zone Mixers, 30 HP (KW/Year)	0	196,049	
Add Annual Power Required for Recycle Pumping, 10 HP (KW/Year)	0	65,350	
Total Annual Power Usage for Biological Treatment	3,688,251	2,773,742	-25%
Power Cost (\$/kw-hr)	\$0.09	\$0.09	
Annual Power Cost (\$)	\$331,943	\$249,637	-25%
Annual Power Savings (KW)		\$914,509	
Annual Power Savings (2014\$)		\$82,306	
20 Years of Annual Power Savings (2014\$)		\$1,646,117	
Present Value of Savings (20 years, 5%)		\$620,404	
Discounted Interest (Over 20 Year Period)		\$1,025,712	

Supplemental Information
TVA Energy Efficiency SRF Loan/Grant Application
October 7, 2014

POWER SAVINGS DUE TO NEW CLARIFIERS			
Item	Current	Proposed	% Change
	(2 Primary & 2 Secondary)	(2 Secondary Clarifiers)	
Flow (gpm)	-	-	-
Head (feet)	-	-	-
Efficiency	-	-	-
HP	8	3	-63%
KW	6	2	-63%
Hours/Day	24	24	-
Days/Year	365	365	-
Annual Power Usage (KW/Year)	52,280	19,605	-63%
Power Cost (\$/kw-hr)	\$0.09	\$0.09	-
Annual Power Cost (\$)	\$4,705	\$1,764	-63%
Annual Power Savings (KW)	\$32,675		
Annual Power Savings (2014\$)	\$2,941		
20 Years of Annual Power Savings (2014\$)	\$58,815		
Present Value of Savings (20 years, 5%)	\$22,167		
Discounted Interest (Over 20 Year Period)	\$36,648		

Supplemental Information
TVA Energy Efficiency SRF Loan/Grant Application
October 7, 2014

POWER SAVINGS DUE TO NEW RAS PUMPS			
Item	Current (Avg. Flow)	Proposed (Avg. Flow)	% Change
	(Requires 3 - 10 HP Pumps)	(1 - 30 HP Pump)	
Flow (gpm)	2,100	2,100	-
Head (feet)	30	30	-
Efficiency	0.6	0.749	-25%
HP	26.5	21.2	-20%
KW	20	16	-20%
Hours/Day	24	24	-
Days/Year	365	365	-
Annual Power Usage (KW/Year)	173,275	138,805	-20%
Power Cost (\$/kw-hr)	\$0.09	\$0.09	-
Annual Power Cost (\$)	\$15,595	\$12,492	-20%
Annual Power Savings (KW)	\$34,470		
Annual Power Savings (2014\$)	\$3,102		
20 Years of Annual Power Savings (2014\$)	\$62,046		
Present Value of Savings (20 years, 5%)	\$23,385		
Discounted Interest (Over 20 Year Period)	\$38,662		

Supplemental Information
TVA Energy Efficiency SRF Loan/Grant Application
October 7, 2014

POWER SAVINGS DUE TO NEW WAS PUMPS			
Item	Current (Avg. Flow)	Proposed (Avg. Flow)	% Change
	(Requires 3 - 10 HP Pumps)	(1 - 30 HP Pump)	
Flow (gpm)	500	500	-
Head (feet)	30	30	-
Efficiency	0.6	0.749	-25%
HP	6.3	5.1	-20%
KW	5	4	-20%
Hours/Day	4	4	-
Days/Year	365	365	-
Annual Power Usage (KW/Year)	6,876	5,508	-20%
Power Cost (\$/kw-hr)	\$0.09	\$0.09	-
Annual Power Cost (\$)	\$619	\$496	-20%
Annual Power Savings (KW)	\$1,368		
Annual Power Savings (2014\$)	\$123		
20 Years of Annual Power Savings (2014\$)	\$2,462		
Present Value of Savings (20 years, 5%)	\$928		
Discounted Interest (Over 20 Year Period)	\$1,534		

Supplemental Information
TVA Energy Efficiency SRF Loan/Grant Application
October 7, 2014

POWER SAVINGS DUE TO NEW PUMPS AT LIFT STATION NO. 1			
Item	Current (Avg. Flow)	Proposed (Avg. Flow)	% Change
	(Requires 5 - 30 HP Pumps)	(3 - 50 HP Pump)	
Flow (gpm)	568	2,100	-
Head (feet)	100	70	-
Efficiency	0.6	0.81	-35%
HP	23.9	45.8	
KW	18	34	
Hours/Day	24	8	-
Days/Year	365	365	-
Annual Power Usage (KW/Year)	156,223	99,829	-36%
Power Cost (\$/kw-hr)	\$0.09	\$0.09	-
Annual Power Cost (\$)	\$14,060	\$8,985	-36%
Annual Power Savings (KW)	\$56,393		
Annual Power Savings (2014\$)	\$5,075		
20 Years of Annual Power Savings (2014\$)	\$101,508		
Present Value of Savings (20 years, 5%)	\$23,385		
Discounted Interest (Over 20 Year Period)	\$38,662		

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October 7, 2014

GUNTERSVILLE WASTEWATER IMPROVEMENTS PRELIMINARY OPINION OF PROJECT COST	
Eastlake Wastewater Treatment Plant Improvements	
Description	Construction Cost
Sitework and Piping for Treatment Plant Improvements	\$1,805,500
New Anoxic Zone/Biological Treatment Modifications	\$805,000
New Final Clarifiers - Clarifiers, Splitter Box, and Scum P.S.	\$1,794,000
RAS/WAS Pumping Station, Plant Water Pumps, and Pump Suction Wells	\$1,104,000
Electrical and Instrumentation	\$724,500
Operations and Lab Building	\$655,500
Septage Receiving Station	\$253,000
Subtotal - Construction Costs at WWTP	\$7,141,500
Geotechnical Investigation for WWTP	\$10,610
Preliminary Engineering for WWTP	\$87,000
Surveying and Detailed Design for WWTP	\$290,000
Construction Materials Testing for WWTP	\$40,000
Bidding and Construction Administration for WWTP	\$447,000
Subtotal Estimated Costs for WWTP Improvements	\$8,016,110
Lift Station No. 1 Improvements	
Description	Construction Cost
Pump/Piping Replacement and Pumping Station Modifications	\$810,000
Electrical and Control Improvements	\$340,000
Subtotal - Construction Cost at Lift Station No. 1	\$1,150,000
Geotechnical Investigation at Lift Station No. 1	\$0
Design for Lift Station No. 1	\$120,000
Construction Materials Testing	\$10,000
Bidding and Construction Administration	\$250,000
Subtotal Estimated Costs for Lift Station No. 1 Improvements	\$1,530,000
Preliminary Engineering and Collection System Improvements	
Description	Construction Cost
RFP/PM Coordination of Trunk Sewer Flow Monitoring	\$40,000
Flow Monitoring of Trunk Sewer	\$75,000
TV Inspection of Trunk Sewer	\$35,000
Preliminary Engineering for Trunks Sewer/Highway 227 Force Main	\$150,000
Collection System Improvements	\$500,000
Subtotal Estimated Costs for Lift Station No. 1 Improvements	\$800,000
Total Estimated Costs	\$10,346,110