

## WASTEWATER COLLECTION SYSTEM IMPROVEMENTS PROJECT

### Summary

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- The GPR portion of the proposed project for the Liberty Regional Waste District (LRWD) includes all of the improvements except for the backup generators which were bid as an additive alternate. The improvements include sewer and manhole rehabilitation and lift station rehabilitation. These improvements will result in energy savings.
- Estimated Loan Amount: \$1,830,000
- Total GPR Energy Efficiency amount based on Contract/Agreements: \$1,304,208: \$1,155,708.50 for construction costs and \$13,500 for planning and \$135,000 for design. The GPR costs equates to 90% of the total project cost.

### Background

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- The existing gravity sewer was installed in 1978 and consists of mostly PVC pipe. In 2002, LRWD contracted with GRW Engineers, Inc. (GRW) to perform a Sanitary Sewer Evaluation Study (SSES) located within areas of their system that had the most Inflow/Infiltration (I/I). This was done in preparation for a monthly repair program as well as this proposed project.
- Liberty RWD owns the sanitary sewers and lift stations for their district. The Muncie Sanitary District provides treatment for the wastewater. This project addresses collection system needs to reduce the clear water flow component and, in turn, to reduce the treatment cost. The improvements include lining of sanitary sewers and manholes, lining of six lift station wet wells, replacement of pumps and valving, the addition of VFD's, new electronics, and new SCADA system.

### Energy Efficiency Discussion – Cured-In-Place Pipe and Manhole Lining

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- Currently the District has nineteen (19) lift stations and on an average dry day all the pumps within the District run approximately 24 to 25-hours combined. During wet weather days due to snow melt or rain, as experienced in March 2010, the District recorded one (1) day with approximately 184-hours worth of pumping time. According to rainfall data, approximately 2 inches of rain fell that day. That creates a peaking factor for the whole system of 7.67. The proposed project includes CIPP rehabilitation for approximately three (3) miles of sewers or roughly 17% of the 22 miles of pipe in the collection system. GRW and the District are expecting to see about a 25% reduction in total system run time with the CIPP project, which equates to roughly a 46-hour savings for a day of wet weather.

- Factoring in the electric cost for the resulting 46-hour savings, it would equate to approximately a \$13.72 savings based on an electric rate of \$0.08/KW for a five (5) horsepower pump running continually for 46-hours. This is the cost savings for just one major rainfall event.
- In addition to the reduction in lift station pumping costs, the cost incurred by LRWD to have Muncie Sanitary District (MSD) treat their wastewater will also be reduced because there will be less I/I coming into the collection system. Approximately 17% of LRWD's collection system will be rehabilitated using the CIPP method. Although I/I will still enter the system as this is the nature of a gravity sewer system, it is predicted that the I/I reduction seen from the lining will equate to approximately 10% across the entire system. The base flow for LRWD with 1,645 customers at 215 gpd should be 350,000 gpd (average dry day flows) or approximately 10.5 million gallons monthly. LRWD records approximately 10.5 million gallons monthly on an average dry month. However, a wet month can increase the monthly flow by 100%. Based on the last three years of billings, it is apparent that about four months per year result in an increase of approximately 5 million gallons per month. This is about 20 million gallons annually. The estimated total flow sent to MSD for treatment is 146 MG.
- Because CIPP will be used to effectively eliminate I/I at most of LRWD's most infiltrated line segments, it is expected that 15 of the 20 million excess gallons of I/I will be eliminated. Eliminating 15 million gallons annually equates to the expected 10% elimination of I/I due to the lining overall. Based on \$2.32/100cf, this will equate to approximately \$46,500 per year in treatment costs that will be saved. This will also result in an energy savings for the MSD through a reduction in clear water needing treatment prior to discharge into the White River. After contacting MSD to determine their energy usage, it was determined that approximately 16% of the treatment cost could be attributed to energy consumption.
- See the attached Cost Comparison Table for the Cured-In-Place Pipe and Manhole Lining for the present worth analysis, overall energy reduction calculation and estimated pay back period for this component of the project.

### **Energy Efficiency Discussion – Lift Station Improvements**

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- The lift station improvements component of the project will reduce energy usage in several ways. The sealing of the lift stations will reduce flow that requires pumping and requires treatment. The submersible pump replacements will provide for more efficient motors and reduced energy use. Valve replacements at the station may prevent recirculation of flow back through the lift station which equates to wasted energy. The proposed control cabinets design will be more efficient. The Remote Telemetry Units (RTU's) and radios are much smaller and utilize more solid-state circuitry, thus requiring less electricity to perform the same task. The use of Variable Frequency Drives (VFD's) in lieu of the present rotary phase converters will be much more efficient. And, the SCADA system will reduce gasoline consumption. Some of these improvements are discussed in more detail below. See the attached Cost Comparison Table

which is attached for the Lift Station Improvements which shows that this portion of the project is expected to reduce annual operating cost to the District by approximately 22%.

- All six (6) Lift Stations will have both the wet well and valve vault sealed with an epoxy lining system to stop I/I and prevent future hydrogen sulfide attack. During the design phase of this project, it became apparent that several structures were experiencing visibly flowing I/I. For instance the Smithfield LS valve vault had I/I coming in around the lower joint of the structure at an approximate rate of 10 to 15-gpm. Assuming that either the valve vault or the wet well at each lift station had a 10-gpm leak, the 60-gpm would result in a 86,400-gallon leak that would cost the district approximately \$268/day (for all six (6) lift stations combined) using the treatment cost rate of \$2.32/hundred cf. not including the pumping cost such as electric usage. The district has paid an average treatment cost to MSD of \$430,000 annually over that last three years. The cost savings annually by rehabilitating the joints of the structures equates to approximately \$98,000. The cost to rehabilitate the six lift stations including telemetry according to the bids is about \$780,000. Just by reduction of I/I at the lift stations, these modifications at the lift stations will have paid for themselves in approximately 8 years.
- The use of Variable Frequency Drives (VFD's) in lieu of the rotary phase converters is much more efficient. The older technology of using an electric motor running off of single-phase current to make a 3-phase current requires the use of additional electricity just to run the single-phase motor. Typically these rotary converters are sized twice the rated horsepower of the pump motor they will be required to run. With the VFD technology, the VFD is being utilized not to control the speed of the pump but to convert single-phase current into three-phase current by utilizing the VFD as an inverter. Since this is being done with capacitors and solid-state electronics there is much less energy used, either in heat generated or turning of the rotary phase converter.
- The use of a SCADA system in lieu of the existing alarm dialer panel will save money in two ways. First, the new main control panel with all of the components utilizing solid-state electronics and eliminating the need for separate auto dialers and chart recorders, electric usage will be less. Secondly, by having a more robust system that will be able to report many more alarms and faults, the District staff will be able to trouble shoot several problems before leaving the office. By having an idea what the problem might be, the staff will be able to bring the most likely part(s) with them, thus reducing or eliminating the need for multiple trips back to the office for additional parts and the resulting extra fuel consumption of their trucks. It reasonable to say that LRWD could reduce the amount of driving to each L.S. daily to check on pump status by two (2) days x 15 miles/day equaling 30 miles/week. This could translate into an annual savings of \$278 (30 miles/week x 52 weeks/year x \$2.85/gallon of fuel/16 miles/gallon). This calculation does not account for O&M of the pick-up truck or wages of the LRWD employees since the employees are on salary and would be freed up to perform other tasks.

## Conclusion

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- The Lift Station rehabilitation option is the cost effective alternative. The energy saving is approximately 21% and the payback period is reasonable at approximately 7.9 years.
- The CIPP/Manhole Lining option is the cost effective alternative. The energy saving is approximately 10.3% and the payback period is very reasonable at 8 years.

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### Attached Documents –

- Cost Comparison Table for CIPP and Manhole Lining and for Lift Station Rehabilitation

### Referenced Material –

- GRW Engineers, Inc. report, “Clean Water State Revolving Fund, 20% Green Project Reserve” for Liberty Regional Waste District, Selma, Indiana dated 9/13/2010

**LIBERTY REGIONAL WASTE DISTRICT - BUSINESS CASE  
COST COMPARISON TABLE**

**Present Worth Analysis - Cured-in-Place Pipe and Manhole Lining**

	<u>Existing System</u>	<u>Rehabilitated System</u>	<u>Cost Difference</u>	
<b>Capital Cost</b>	\$ -	\$ 374,333	\$ (374,333)	Total Cost for Contract A
<b>Annual O &amp; M Cost</b>				
Pumping Electrical	\$ 3,155	\$ 2,831	\$ 324	Assumes 15 MG reduction in pumped flow
Treatment Cost	\$ 452,834	\$ 406,310	\$ 46,524	Assumes 15 MG reduction in treated flow
	<u>\$ 455,989</u>	<u>\$ 409,141</u>	<u>\$ 46,848</u>	
			\$ -	
Present Worth of O & M	\$ 6,994,876	\$ 6,276,225	\$ 718,652	Assumes PW factor of 15.34 (2.67% interest, 20 years)
			\$ -	
<b>Present Worth Value</b>	<u><b>\$ 6,994,876</b></u>	<u><b>\$ 6,650,558</b></u>	<u><b>\$ 344,319</b></u>	
<b><u>Overall Energy \$ Savings</u></b>				
Pumping Cost	\$ 3,155	\$ 2,831	\$ 324	
WWTP Cost	\$ 72,453	\$ 65,010	\$ 7,444	Based on 16% of WWTP cost related to energy expenses
Total Energy Costs	<u>\$ 75,609</u>	<u>\$ 67,841</u>	<u>\$ 7,768</u>	
% Reduction	10.3%			
Payback Period (years)	8.0			

**CONCLUSION**

The CIPP/Manhole Lining option is the cost effective alternative. The energy saving is approximately 10.3% and the payback period is very reasonable at 8 years.

**LIBERTY REGIONAL WASTE DISTRICT - BUSINESS CASE  
COST COMPARISON TABLE**

**Present Worth Analysis - Lift Station Rehabilitation (Lining, new pump and valves, VFDs, controls, telemetry and SCADA)**

	<u>Existing System</u>	<u>Proposed System</u>	<u>Cost Difference</u>	
<b>Capital Cost</b>	\$ -	\$ 781,375	\$ (781,375)	Total Cost for Contract B except 3 Generators
<b>Annual O &amp; M Cost</b>				
Maintenance Cost	\$ 4,952	\$ 3,714	\$ 1,238	Assumed 16 hr/mo at \$20/hr and a 25% reduction w/ new plus gas costs
Pumping Electrical *	\$ 3,155	\$ 2,997	\$ 158	Assume 5% more efficient motors
Treatment Cost	\$ 452,834	\$ 355,022	\$ 97,812	Assumes 86,400 gpd reduction in flow
	<u>\$ 460,941</u>	<u>\$ 361,733</u>	<u>\$ 99,208</u>	
			\$ -	
Present Worth of O & M	\$ 7,070,840	\$ 5,548,990	\$ 1,521,850	Assumes PW factor of 15.34 (2.67% interest, 20 years)
			\$ -	
<b>Present Worth Value</b>	<b><u>\$ 7,070,840</u></b>	<b><u>\$ 6,330,365</u></b>	<b><u>\$ 740,475</u></b>	
<b><u>Overall Energy \$ Savings -</u></b>				
Gasoline Cost	\$ 1,112	\$ 834	\$ 278	
Pumping Cost	\$ 3,155	\$ 2,997	\$ 158	
WWTP Cost	\$ 72,453	\$ 56,804	\$ 15,650	Based on 16% of WWTP cost related to energy expenses
Total Energy Costs	<u>\$ 76,721</u>	<u>\$ 60,635</u>	<u>\$ 16,086</u>	
% Reduction	21.0%			
Payback Period (years)	7.9			

**CONCLUSION**

The Lift Station rehabilitation option is the cost effective alternative. The energy saving is approximately 21% and the payback period is reasonable at approximately 7.9 years.