City of Belton
Belton Wastewater Treatment Facility Improvements Project

Clean Water State Revolving Fund
Green Project Reserve
Business Case

State Fiscal Year 2015 Intended Use Plan
Project Number C295712-01

Loan Closing Date: June 3, 2015
Loan Amount: $13,977,000
Green Amount: $747,160
I. SCADA CONTROL TECHNOLOGY

Summary

- Supervisory Control and Data Acquisition (SCADA) system will be installed for on-site control and monitoring of the treatment facility components and the new and existing influent pump stations in order to minimize power usage and to optimize operation and maintenance effectiveness.
- Anticipated Total Loan amount = $13,977,000
- Estimated energy efficient (green) portion of loan = 5.3% ($747,160)
- Estimated annual energy savings = $52,000 per year.

Background

Most functions of the existing Belton Wastewater Treatment Facility (WWTF) are not automated. Currently, emergency alarms are relayed to staff by an auto-dialer system. The Belton WWTF has a design average flow of 2.26 million gallons per day with a city population of 23,116 according to the 2010 census.

Energy Efficiency Justification

SCADA will be used to monitor equipment and treatment processes remotely and through a computer-based system. The system will log process and equipment conditions, provide supervised manual control, manage alarms, and dial out each critical alarm. This will allow staff the ability to troubleshoot before going out in the field.

- Plant Operations: The SCADA system provides for a single, centralized location for monitoring of all treatment processes across the WWTF and at the remote Influent Pump Station (IPS) sites that are tied into the system. The SCADA system allows the operator to fine-tune the various elements of the treatment process from a central location. It is estimated that the SCADA system will save on labor:
  - 3 hours/week, 52 weeks/year, 0.5 miles/trip to IPS, 2 trips/day, 260 work days/year = $6,955/year in labor costs.

- Operations & Maintenance: The SCADA system is set up to alert personnel of maintenance needs before the maintenance operation is required so that it can be scheduled ahead of time instead of being addressed as an emergency. Prior knowledge of maintenance items will also help to reduce equipment downtime. The SCADA system is designed to allow for the incorporation of maintenance management software that can be used to automatically generate work orders, as needed, for various equipment items,
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eliminating the time and effort required for WWTF personnel to review and generate work order request needs. The SCADA system is also designed to completely automate the treatment processes in the future, if so desired. This will further decrease the labor and time required to efficiently operate and monitor the treatment facilities.

- **Final Clarifiers:** Level sensors will be installed at each Final Clarifier to measure sludge blanket levels. These readings will be monitored by the SCADA system which will eliminate the overtime hours required to travel to the WWTF on weekends.
  
  Estimated labor savings: 4 hours/week, 52 weeks/year = $9,360/year in labor costs.

- **Influent Pump Stations:** New switchgear for operation of both the new and existing influent pumps will be installed at the New IPS. Signals from the pumps’ programmable logic controller (PLC) will be transmitted back and forth from the central SCADA system. The SCADA system provides a backup for the PLC at the IPS controls facility. This will result in virtually zero downtime with the automated control of the pumps. The SCADA system will also be set up to run pumps on an as-needed basis, which will result in energy savings costs. With remote monitoring, overnight labor hours associated with overnight monitoring at the IPS can be eliminated or greatly reduced.
  
  Estimated labor savings: 16 hours/occurrence, 6 occurrences/year = $4,320/year in labor costs.

- **Headworks:** The new Headworks is classified as a hazardous area with monitors and alarms to indicate unsafe conditions. The alarms installed in the new Headworks building are transmitted to the SCADA system - alerting personnel of unsafe conditions before entering the building.

- **Aeration Basins:** In the future, dissolved oxygen probes at the Aeration Basin can be monitored by the SCADA system to efficiently control the speed of the aerators to optimize energy usage based on actual demand. When diffused aeration equipment, along with energy efficient blowers, are installed in the future, the aeration system, controlled by the SCADA system, will prove to be even more energy efficient. The estimated energy savings associated with automated SCADA control of the system is illustrated in the table below. (Energy costs of $0.074/kilowatt-hour (kWh) were used based on historical billing records at the WWTF.)

<table>
<thead>
<tr>
<th></th>
<th>Manual Control</th>
<th>SCADA Control</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Estimated Energy Usage:</strong></td>
<td>1,502,340 kWh/year</td>
<td>1,077,661 kWh/year</td>
<td>424,679 kWh/year</td>
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<tr>
<td><strong>Energy Costs:</strong></td>
<td>$111,173/year</td>
<td>$79,747/year</td>
<td>$31,426/year</td>
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Ultraviolet (UV) Disinfection: SCADA can also be used to control the disinfection system through flow monitoring from the UV system PLC. Based on the current flow, UV lamps can be turned off, on, up or down, as required, to meet disinfection needs.

Conclusion

- The use of SCADA is the cost effective alternative.
- Total SCADA savings is approximately $52,000 per year in energy, labor, and travel costs with a payback period of 14.4 years.
- Per Section 3.5-8, “SCADA systems can be justified based upon substantial energy savings.”

References

- Carollo Engineers, Inc. facility plan, “Belton Wastewater Treatment Facility Expansion Project” for the City of Belton, Missouri sealed April 29, 2010.
- Carollo Engineers, Inc. facility plan addendum, “WWTF Facility Plan Update Technical Memorandum No. 1” for the City of Belton, Missouri sealed September 25, 2012.
- Carollo Engineers, Inc. facility plan addendum, “WWTF Facility Plan Update Technical Memorandum No. 2 WWTF Flow Projections and Project Phasing” for the City of Belton, Missouri dated June 2014.
- Gilmore & Bell, P.C. Loan Documents
- Preliminary Schedule of Values