

Clean Water State Revolving Fund Green Project Reserve
- Final -



White Bird Wastewater Treatment Upgrade Phase 1

SRF Loan #WW1601 (FY16) (pop. 91)

\$1,500,000

Final Green Project Reserve Justification

Business Case GPR Documentation

1. INSTALLS NEW ENERGY-EFFICIENT PREMIUM PUMPS (Energy Efficiency). Categorical per GPR 3.2-2: *projects that achieve a 20% reduction in energy consumption.* (\$17,285).
2. REPLACEMENT OF SURFACE AERATORS WITH A DIFFUSED AIR AERATION SYSTEM (Energy Efficiency). Business Case per GPR 3.2-2 & 3.4.1: *if a project achieves less than a 20% reduction in energy efficiency, then it may be justified using a business case; project must be cost effective... energy savings and payback ... [must] not exceed the useful life of the asset.* (\$277,992).

Categorical GPR Documentation

3. INSTALLS SAND FILTRATION (Environmentally Innovative). Categorical GPR per 4.5-5a, 4.5-5b: *Projects that significantly reduce or eliminate the use of chemicals; Treatment technologies or approaches that ...lower the amount of chemicals in residuals.* (\$45,300).
4. INSTALLS UV DISINFECTION ELIMINATING EXISTING CHLORINE DISINFECTION (Environmentally Innovative). Categorical GPR per 4.5-5a, B4.5-5b: *Projects that significantly reduce or eliminate the use of chemicals; Treatment technologies or approaches that ...lower the amount of chemicals in residuals.* (\$135,000).

1. NEW PREMIUM PUMPS IN INFLUENT LIFT STATION

Summary

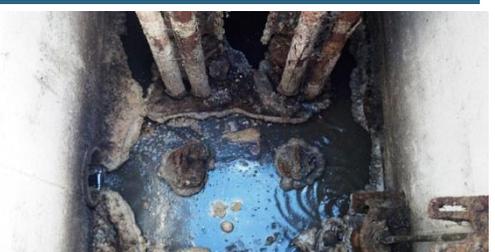
GPR-eligible improvements to the City of White Bird wastewater treatment system include: influent pump station rehabilitation, replacement of floating aerators/mixers with a diffused air aeration system, sand filter media replacement, and replacement of chlorine disinfection with UV disinfection.

- The influent lift station includes two (2) new pumps with premium efficiency motors.
- Estimated Loan Amount = \$1,500,000; Cost Pumps = \$17,285 (Final Installed)
- Estimated green portion of loan = 1.2%



Background

- Raw wastewater gravity flows to an influent lift station at the plant which used to contain two 1.3 HP submersible pumps (Flygt model CP-3085) operated by float switches located in the wet well.
- The influent lift station pumps were corroded and at the end of their useful life.



Results

- The influent lift station improvements included two (2) new Flygt 3085 submersible pumps with premium efficiency motors to conserve energy and enhance operability.

Calculated Energy Efficiency Improvements

Motors

- Since the performance of the old outdated pumps was very inefficient and indeterminate, the BSP was compared with a Flygt 3085 pump with standard efficiency motor.
- The new pumps have premium efficiency 3HP motors (90.1% efficiency). The pump is anticipated to run for 8,700 hours per year. If a standard 3HP (2.24 kW) motor is 77.9% efficient the following savings can be realized:

$$\text{Energy Savings} = 2.24 \text{ kW} \times 8,700 \text{ hrs/yr} \times (1 - (0.779 / 0.901)) = 2,634 \text{ kWh/yr}$$

$$\text{Cost Savings} = 2634 \text{ kWh/yr} \times \$0.10/\text{kWh} = \$264/\text{yr}$$

If the premium efficiency motor costs \$515 more than a standard efficiency motor¹, the payback period is 1.9 years, which is less than the useful life of the motor.



Flygt Submersible Pump

Conclusion

- The premium efficiency pumps for the influent lift station are GPR-eligible since the motor payback period (1.9 years) is less than the useful life of the pump/motor (20 years).
- **GRP Costs Identified:** New premium energy efficient pumps = 2 @ \$8500 = \$17,285 (SRF GPR portion of costs)
- **GPR Justification:** Categorical and Business Case per GPR 3.2-2 & 3.4.1: *projects that achieve a 20% reduction in energy consumption; if a project achieves less than a 20% reduction in energy efficiency, then it may be justified using a business case; project must be cost effective...energy savings and payback [must] not exceed the useful life of the asset.*

¹ Scott Lackey, Xylem Pump Supply, 4-2-18
State of Idaho SRF Loan Program

2. TREATMENT PROCESS – DIFFUSED AIR AERATION SYSTEM

Summary

- GPR-eligible improvements to the City of White Bird wastewater treatment system include: replacement of floating aerators/mixers with a diffused air aeration system, sand filter media replacement, and replacement of chlorine disinfection with UV disinfection.
- Lagoon improvements included a new diffused air aeration system to replace surface aerators.
- Estimated Loan Amount = \$1,500,000;
- Estimated Aeration system SRF GPR portion of loan = 18.6% (\$277,992) (Installed)



Background²

- Aeration Cell 1 was originally equipped with three 3-HP single speed floating aerators (Aqua-Jet model 4200317, 1745 rpm). However, two of the three aerators failed and were replaced, along with the third aerator which was still operable.
- Aeration Cell 2 was equipped with a dual speed floating aerator which drew 3 HP at 1745 rpm and 1.2 HP at 1170 rpm (Aqua-Jet model 4200311). This aerator failed.
- All aerators were powered by deteriorated standard efficiency motors, resulting in very poor oxygen transfer efficiency (when operational).
- The aerators had to run 24 hours per day to supply the required oxygen to the system.



Results

- The old aeration system was replaced with a higher efficiency submerged diffused aeration system consisting of one premium 20HP blower, which will need to run only 12 hours per day.
- The annual cost of energy consumed per motor =
 - Existing 3HP 79.5% Standard Efficiency Motor (estimated 7% < Epack Motors) =*
 $(\text{HP} * .746\text{kWatt/HP} * \% \text{ML} * \text{Hours} * \text{¢/kWh}) / \text{Efficiency}$
 $(3\text{HP} * .746\text{kW/HP} * .75 * 8,760\text{h/yr} * \$0.10/\text{kWh}) / .795 = \$1,850/\text{yr} * 4 = \$7,400/\text{yr}$
 - Proposed 20HP 93% Efficient Premium Motor =*
 $(20\text{HP} * .746\text{kW/HP} * .75 * 4,380\text{h/yr} * \$0.10/\text{kWh}) / .93 = \$4,900/\text{yr}$
- The estimated annual energy cost for the old system averaged \$7,400.
- The estimated annual energy cost by the new system will be \$4,900.

² January 2016 Wastewater Facilities Plan, Mountain Waterworks
 State of Idaho SRF Loan Program

Energy Efficiency Improvements

- The resulting reduction in energy requirements with the new system = $1 - (4900 \div 7400) = 34\%$
- Since the old aerators were most likely performing less than standard efficient motors, the difference was most likely much higher than 34%.

Conclusion

- By replacing the current system with a diffused air aeration system, complete mixing and aeration of the lagoons is provided while reducing energy requirements by at least 34%.
- **GPR Costs:** \$277,992 (SRF GPR portion of costs)
- **GPR Justification:** Categorically GPR-eligible (Energy Efficiency) per Section 3.2-2³: *projects that achieve a 20% reduction in energy consumption.*

³ Attachment 2. April 2010 EPA Guidance for Determining Project Eligibility.
State of Idaho SRF Loan Program

3. SAND FILTRATION

Summary

- GPR-eligible improvements to the City of White Bird wastewater treatment system included: replacement of floating aerators/mixers with a diffused air aeration system, sand filter media replacement, and replacement of chlorine disinfection with UV disinfection.
- System improvements included refurbishment of sand filters, including media replacement.
- Estimated Loan Amount = \$1,500,000; SRF GPR Costs: Sand Filters = \$45,300 (installed)
- Estimated green portion of loan = 3%

Background

- Treated effluent flows from Cell 3 by gravity to two polishing sand filters.
- The filters were refurbished with 220 cubic yards of specialized media to enable removal of any carry-over solids in the treated effluent.
- The replacement of filter media allows the design UV transmissivity (or the ease at which UV light can pass through the water) to increase from 55% to 65%.
- The energy savings is not completely linear, but UV disinfection suppliers indicate the increase in transmissivity would reduce energy consumption, O&M costs, and upfront equipment capital costs.
- Without adequately functioning polishing filters to reliably remove solids, the effluent would have to be chlorinated for disinfection, then chemically dechlorinated to meet permit standards.



Results

- With the tertiary filter the standard UV design transmissivity ratings = 65%; design number of lamps required = 2 banks of 3 lamps.
- Tertiary sand filtration reduces the need for chemical disinfection of the effluent (chlorination/dechlorination), and eliminates chemical residuals in the effluent.

Conclusion

- The tertiary sand filter allows for the use of UV disinfection of the effluent, eliminating the need for chemical disinfection of the effluent, and eliminating chemical residuals in the effluent. Filtration preceding UV disinfection also reduces the UV power requirements and capital costs.
- **GPR Costs:** Tertiary filter⁴ = \$45,300 (SRF GPR portion of costs)
- **GPR Justification:** Categorically GPR-eligible per Section 4.5-5a⁵: *Projects that significantly reduce or eliminate the use of chemicals in wastewater treatment*; and 4.5-5b: *Treatment technologies...that significantly ...lower the amount of chemicals in the residuals.*

⁴ 3-20-18 D Allison, Mountain Waterworks

⁵ Attachment 2. April 21, 2010 EPA Guidance for Determining Project Eligibility. Page 9.

4. UV DISINFECTION SYSTEM⁶

Summary

- A UV system was specified for the project, replacing the existing chlorine system.
- Estimated Loan Amount = \$1,500,000; SRF UV system costs = \$135,000 (installed)
- Estimated green portion of loan = 9%

Background

- The City replaced the existing chlorine disinfection system with an ultraviolet light (UV) disinfection system.

Results

- The UV system installed is an effective germicidal agent, without the use of dangerous chemicals.
- Replacing the current chlorine system with a UV disinfection system eliminated a chemical residual.



Conclusion

- By selecting a UV disinfection system and retiring the current chlorine disinfection system, a chemical (chlorine), and a potentially dangerous chemical residual, were eliminated.
- **GPR Costs:** UV disinfection system: \$135,000 (SRF GPR portion of costs)
- **GPR Justification:** Business Case GPR-eligible (Innovative) per Section 4.5-5a: *projects that significantly reduce or eliminate the use of chemicals in wastewater treatment; and 4.5-5b: technologies..that minimize the generation of residuals*”.

⁶ 3-20-18 D Allison, Mountain Waterworks
State of Idaho SRF Loan Program