Clean Water State Revolving Fund Green Project Reserve
- Preliminary-

City of Post Falls WWTP Upgrade Project

SRF Loan #WW1801 (pop. 33,434)

$24,100,060

Preliminary Green Project Reserve Justification[1]

Categorical GPR Documentation

1. INSTALLS ADVANCED ENERGY-EFFICIENT LIGHTING (Energy Efficiency). Categorical GPR per 3.2-2: "*Projects that achieve a 20% reduction in energy consumption...*" ($xxxxxx).

Business Case GPR Documentation

2. INSTALLS EQUALIZATION TANKS (Innovative/Energy Efficiency). Business Case GPR per Section: 4.4-1b "*Technology or approach that is not widely used in the state, but does perform as well or better than conventional technology/approaches at lower cost*". ($xxxxx).
3. PREMIUM EFFICIENCY MOTORS/VFDS (Energy Efficiency). Business Case GPR eligible (Energy Efficiency) per Section 3.2-2: *Use of premium efficiency motors and VFD pumps in a new project where they are cost effective* ($XXXXX).
4. INSTALLS VFDs/SCADA CONTROL TECHNOLOGY (Energy Efficiency). Business Case GPR-per Section 3.4-1*: "Project must be cost effective. An evaluation must identify energy savings and payback on capital and operation and maintenance costs that does not exceed the useful life of the asset" and 3.5-8: "SCADA systems can be justified based upon substantial energy savings" and 3.5-9: "Variable Frequency Drives can be justified based upon substantial energy savings."* ($xxxxx).

State of Idaho SRF Loan Program
February 2018

[1] All data in red font will be updated in the GPR Technical Memorandum, submitted by the loan recipient at design completion

1. INSTALLS ENERGY EFFICIENT LIGHTING

Summary

- Energy efficiency from the installation of LED lighting.
- Estimated loan amount = $24,100,060
- Estimated energy-efficient (green) portion of loan = x% ($xxxxx).

Energy Efficiency Improvements

- LED lighting is approximately 25.3% more energy efficient than a plant wide combination of typical high pressure sodium, metal halide, and fluorescent lighting for relatively the same light output.

LUMINAIRE ENERGY CONSERVATION SCHEDULE

		BASE			PROPOSED			TOTAL LUMINAIRES	TOTAL BASE ENERGY (W)	TOTAL PROPOSED ENERGY (W)	TOTAL NET ENERGY SAVINGS (W)
TYPE	DESCRIPTION	LAMP TYPE	WATTS / FIXTURE	UNIT MATL COST	LAMP TYPE	WATTS / FIXTURE	COST				
D	OUTDOOR ROTATING, LED STROBE WARNING LIGHT, POLYCARBONATE DOME, 120VAC, WITH WALL MOUNT BRACKET UL LISTED FOR WET LOCATIONS, BLUE LENS	INC	60	120	LED	5	145	6	360	30	330
G	4FT., 3500K, LED ENCLOSED AND GASKETED, FIBERGLASS, STAINLESS STEEL HARDWARE	(2) 3500K 32W T8	58	143	LED	60	250	26	1508	1560	-52
G3	HIGH/LOW BAY INDUCTION LIGHT WITH 280 W LAMP. FIXTURE WITH DIE CAST ALUMINUM BALLAST CASING WITH POWDER COATED FINISH FOR CORROSION RESISTANCE	MH 400W	420	300	IND	288	700	9	3780	2574	1206
M	LED WALL PACK WITH DIE-CAST ALUMINUM, BRONZE POWDER COAT FINISH.	MH 70W	78	250	LED 2272 LU	27	350	16	1248	432	816
M2	LED WALL PACK WITH DIE-CAST ALUMINUM, BRONZE POWDER COAT FINISH.	MH 150W	158	280	LED 5843 LU	75	400	2	316	150	166
N1	1 - FINNED DIE-CAST ALUMINUM RECTILINEAR LED AREA LUMINAIRE, DARK BRONZE, TYPE 4 DISTRIB., L90 RATED 60K HOURS ON 30 FT ROUND STEEL POLE.	(1) 4000K 400W MH	461	1840	LED 24199 LU	363	2876	12	5532	4356	1176
N2	2 - FINNED DIE-CAST ALUMINUM RECTILINEAR LED AREA LUMINAIRE, DARK BRONZE, TYPE 4 DISTRIB., L90 RATED 60K HOURS, RETROFIT USING EXISTING 30' ROUND STEEL POLE. PROVIDE NEW TENON MOUNT AS REQUIRED.	(2) 4000K 400W MH	922	2206	LED 48398 LU	726	4262	2	1844	1452	392
P	4 FT. 3 LAMP LED WITH CAST, LOW COPPER ALUMINUM END CAPS AND BALLAST BOX, BOROSILICATE GLASS LAMP TUBE, ALUMINUM REFLECTOR WITH WHITE BAKED ENAMEL.ED FINISH, CLASS 1, DIVISION 1/2 WITH EMERGENCY BATTERY WHERE INDICATED.	(3) 3500K 32W T8	84	1700	LED 8220 LU	73	2000	25	2100	1825	275
P2	4 FT. 4 LAMP LED WITH CAST, LOW COPPER ALUMINUM END CAPS AND BALLAST BOX, BOROSILICATE GLASS LAMP TUBE, ALUMINUM REFLECTOR WITH WHITE BAKED ENAMEL.ED FINISH, CLASS 1, DIVISION 1/2 WITH EMERGENCY BATTERY WHERE INDICATED.	(4) 3500K 32W T8	112	2200	LED 14112 LU	97	2500	10	1120	970	150
Q	STANTION MOUNTED CAST ALUMINUM LED, ENCLOSED AND GASKETED, ALUMINUM GUARD, ANGLE REFLECTOR, SUITABLE FOR WET LOCATION.	(2) 3500K 32W TT	68	350	LED 2540 LU	45	1291	2	136	90	46
X1	PHOTOLUMINESCENT EXIT SIGN		5	123	–	0	200	10	50	0	50
								COLUMN TOTAL	17994	13439	4555
										ENERGY REDUCTION	25.3%

Conclusion

- The proposed improvements are GPR-eligible as they greater than 20% more efficient than a standard installation.
- **GPR Costs**: Building LED Lighting = $xxxxx (Preliminary)
  Site LED Lighting = $xxxxx
  Total = $xxxxxx
- **GPR Justification**: Advanced fluorescent lighting and LED lighting is Categorically GPR-eligible per 3.2-2: "*Projects that achieve a 20% reduction in energy consumption...*"[2]

[2] Attachment 2 to the "April 2012 EPA Guidance for Determining GPR Eligibility"

2. INSTALLS EQUALIZATION TANKS

Summary

- Large-scale wastewater plant improvement project includes construction of influent flow equalization tank.
- Total Loan amount = $24,100,060
- Estimated Categorical energy efficient (green) portion of loan = 8.6% ($931,800)
- Estimated Average Annual Energy Savings = $44,100/year

Background

- The City of Post Falls owns and operates a Water Reclamation Facility (WRF) to reclaim municipal wastewater generated within its boundaries and from the nearby City of Rathdrum, Idaho. To meet new strict discharge limits tertiary filtration will be necessary.
- Tertiary filtration with flow equalization is the proposed project since this system will perform as well or better at a lower cost than the traditional tertiary filtration without flow equalization.
- This will result in significant energy savings.

GPR Justification

The GPR-eligibility of the proposed project was established by comparison to a Baseline Standard Practice (BSP).

- The BSP is a 12.0 mgd tertiary filtration system without flow equalization; the proposed project is an 8.76 mgd tertiary filtration system with flow equalization; final construction cost = $3,119,346.
- Flow equalization will reduce the peak flow from 12.0 mgd to 8.76 mgd (approximately 27%) and thereby reduce the size of the tertiary filtration facility and the building that would enclose it. A building that is 27% smaller will require 27% less energy for lighting, heating and ventilation.
- Flow equalization will also attenuate variations in the BOD and ammonia load making it easier to control the dissolved oxygen concentration in the aeration basins. The current dissolved oxygen set point is 3.25 mg/l. With equalization tanks attenuating variations in the load, it is estimated the dissolved oxygen set point can be reduced to 2.0 mg/l.
- The estimated energy savings are compared in the following table. The energy cost is estimated using $0.06/kW-hr, a 30 year life for the tertiary filtration building and 20 year life for the aeration system.

	BSP Energy Usage (kW-hrs/yr)	**GPR Energy Usage** (kW-hrs/yr)	**Energy Savings** (kW-hrs/yr)	**Annual Savings**	**Total Savings Over lifetime**
Tertiary Filtration Building[i]	308,000	225,000	83,000	$49,80	$149,400/ 30 yr lifetime
Aeration	3,188,000	2,536,000	652,000	$ 39,120	$ 782,400/20 yr lifetime
Total	---	---	735,000	$ 44,100	$ 931,800

[i] Lighting, heating, ventilation

Conclusion

- **GPR Justification:** Business Case GPR-eligible (Innovative) per Section 4.4-1b[3]: "*Technology or approach that is not widely used in the state, but does perform as well or better than conventional technology/approaches at lower cost".*
- **GPR Costs:** The GPR eligible cost is the cost of the energy saved = $ xxxxxx

[3] Attachment 2 to the "April 2012 EPA Guidance for Determining Project Eligibility".

3. Premium Efficiency Motors & VFDs

Summary

- The City of Post Falls upgraded their wastewater system, funded with a FY18 SRF Loan. The upgraded system includes premium pumps, premium motors, and Variable Frequency Drives (VFDs).
- Loan amount = $24,100,060[4]
- GPR-eligible = Motors/VFDs = $940,000 [Final Installed Costs]
- Green portion of loan = 9.4 %

Description

- Energy efficient practices incorporated in the design of the upgraded Post Falls WWTP include the installation of a number of premium efficiency motors/VFDs listed below:
- X vertical turbine aerators with 150 hp premium efficiency motors and VFDs,
- Two sludge pumps with 25 hp premium efficient motors,
- Two high efficiency sludge blowers with 75 hp premium efficiency motors and VFDs, and
- Nine submersible (3 at clarifier effluent lift station, 4 RAS, 2 WAS) explosion proof pumps and motors with VFDs (the motor sizes range from 5 to 18 hp).

GPR Justification

VFDs:

- The Baseline Standard Practice for comparison is a standard Epact motor that is not controlled by a VFD[5].
- The estimated combined annual energy savings for utilizing VFDs compared to the Baseline Standard Practice for each of the different pieces of equipment is summarized in the table below. The corresponding cost savings are estimated using an energy cost of $0.06/kWh. An estimated incremental cost increase of $5,000 for the pumps and $30,000 for the blowers and surface aerators was used to calculate the simple payback period per VFD[6]

Equipment	Energy Savings (kWh/yr per motor/VFD system)	Cost Savings ($)	Payback period (years) per VFD
Vertical Turbine Aerators			
Clarifier Effluent Lift Station Submersible Pumps			
RAS Submersible Pumps			
WAS Submersible Pumps			

Motors:

- Premium motor energy savings over the EPAct motor are summarized in the table below[7].
- An estimated incremental cost increase of $300 was used to calculate the simple payback per system.

Equipment	Energy Cost Savings	Payback Period (years) per system
Vertical Turbine Aerators		
Anaerobic Mechanical Floating Mixers		
Anoxic Mechanical Floating Mixers		
Sludge Pumps (Rotary Lobe Pumps)		

[4] FY18 SRF Loan Agreement
[5] NYS Energy Research and Development Authority, Energy Evaluation Memorandum, Village of Greenport WWTP Upgrade 8-2009
[6] See Appendix A for further analysis of VFD comparisons.
[7] Productive Energy Solutions Motor Slide Calculator, energy cost @ $0.06/kWh. See Appendix A for additional motor comparison information.

3. CON'T - PREMIUM EFFICIENCY MOTORS & VFDS

Conclusion

- The use of premium energy-efficient pumps and VFDs are categorically GPR eligible as they are cost effective as shown in the two tables above.
- **GRP Costs Identified**:
  - Vertical Turbine Aeration/VFD's $xxxx
  - Sludge Pump Premium Efficiency Motors: $xxxxx
  - High Efficiency Sludge Blowers with Premium Efficiency Motors/VFDs: $xxxxx
  - High Efficiency RAS Submersible Pumps and Motors/VFDs $xxxxx
  - High Efficiency Clarifier Lift Station Submersible Pumps, Motors, VFDs $xxxxx
  - High Efficiency WAS Submersible Pumps and Motors/VFDs: $xxxxxxx

  Total = $xxxxxx

- **GPR Justification**: The Pump/VFD system is Categorically GPR eligible (Energy Efficiency) per Section 3.2-2 page 9[8]: *Use of premium efficiency motors and VFD pumps in a new project where they are cost effective*.

[8] 2012 Clean Water State Revolving Fund Green Project Reserve: Guidance for Determining Project Eligibility

4. Combined VFD/SCADA Control Technology

Summary

- Energy efficient practices incorporated in the design of the WWTP upgrade include the installation of variable frequency drives (VFDs) for the equalization tank mixers and pumps. SCADA control technology will be installed to control the VFDs.
- Total Loan amount = $24,100,060
- Estimated energy efficient (green) portion of loan = 1.0% ($116,000)
- Estimated Average Annual Energy savings = $16,326

Background

- An equalization tank is used in the wastewater treatment process to reduce the variability of flow and loads entering the treatment plant. Mixers inside the tank keep solids suspended and the influent blended. The water level in the tank is variable. Less mixing energy is needed when the tank is low compared to when it is full. VFDs are be used to match the energy input to the volume of water in the tank. SCADA control technology is used to determine and control the correct mixing rate.
- Pumps are used to pump the water from the equalization tank into the treatment plant at a constant rate. VFDs are used to match the pumping rate to the flow rate needed. SCADA control technology is used to determine and control the correct pumping rate.

GPR Justification

- The GPR-eligibility of VFDs and SCADA control technology was established by comparison to a Baseline Standard Practice (BSP). The BSP is to operate the mixers and pumps continuously at full speed.
- The proposed project is to operate the mixers and pumps with VFDs and use SCADA technology to match the mixing and pumping rate to the water depth in the tank and the flow rate needed.
- The estimated annual energy costs are summarized in the table. The corresponding cost savings are estimated using an energy cost of 0.06$/kWh. The simple payback period was based on an installed cost of $5,000 per VFD (0 to 20 hp) and $10,000 per VFD (20 to 50 hp). The useful life of a VFD is greater than 10 years.

Energy Savings			
	BSP	**VFDs/SCADA**	**Savings**
Equalization Tank Mixers	459,876 kW-hr/yr	229,938 kW-hr/yr	229,938 kW-hr/yr
Equalization Tank Pumps	59,495 kW-hr/yr	17,326 kW-hr/yr	42,169 kW-hr/yr
Total Energy Savings			272,107 kW-hr/yr
			$ 16,326/yr

The payback period is 6.7 years.

Conclusion

- The use of VFDs and SCADA control technology is GPR-eligible because it is cost effective as shown above.
- **GPR Costs**: (All numbers are final construction costs)

VFDs for Equalization Tank Mixers & Pumps	$ 60,000
SCADA System	$ 55,000
Total	$ 116,000

- **GPR Justification**: Business Case GPR-eligible (Energy Efficiency) per Section 3.4-1*: "Project must be cost effective. An evaluation must identify energy savings and payback … that does not exceed the useful life of the asset"*; Section 3.5-8 *"SCADA systems can be justified based upon substantial energy savings";* and Section 3.5-9 *"Variable Frequency Drives can be justified based upon substantial energy savings."*