Council FY19 Wastewater System Project (pop. 839)
SRF Loan #WW1901
$6,445,000

Final Green Project Reserve Justification

Categorical GPR Documentation

1. INSTALL FINE BUBBLE DIFFUSED AIR AERATION SYSTEM (Energy Efficiency). Categorical GPR per Section 3.2-2: *Projects that achieve a 20% reduction in energy consumption; retrofits to compare existing system to that proposed; new POTW projects or capacity expansion projects should be designed to maximize energy efficiency and should select high-efficiency premium motors and equipment where cost effective* ($724,434).

Business Case GPR Documentation

2. RENOVATION OF GRAVITY WASTEWATER COLLECTION SYSTEM EXPERIENCING EXCESSIVE I/I (Energy Efficiency). Business Case GPR per 3.5-4: *I/I correction projects that save energy from pumping and are cost effective* ($211,480).

3. INSTALLS UV DISINFECTION ELIMINATING EXISTING CHLORINE DISINFECTION (Environmentally Innovative). Categorically 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* ($500,000).

1. Treatment Process – Fine Bubble Diffused Aeration

Summary

- The City of Council obtained a SRF loan to fund significant improvements to the city's wastewater collection and treatment system.
- Green Project Reserve (GPR)-eligible improvements to Council's wastewater system included installing a fine bubble diffused air aeration system, with energy-efficient positive displacement blowers, air main piping and control valves in the renovated wastewater treatment ponds.
- Estimated loan amount = $6,445,000
- Estimated aeration system green portion of loan = $724,434 (11.24%) (Final Costs)

Background[1]

- Council's wastewater treatment facility consisted of a three-cell lagoon system discharging to a ditch that flows into the Weiser River.
- The system could not meet existing permit limits and was under an Administrative Order to make necessary improvements to comply with the IPDES permit.

Existing Discharge

Results

To compare the alternatives, the energy consumed on an annual basis =

(HP * .746 kW/HP * Hours/yr)/Efficiency = kWh/yr

Baseline Standard Practice (BSP)

- The BSP design for mixing and oxygen transfer for a lagoon system is to utilize floating surface aerators to achieve necessary oxygen levels. It would require 17-7.5 HP aerators in Lagoon 1, and 2-7.5 HP aerators in Lagoon 2, = 142.5 HP total. If the aerators run year-round, 24 hours per day, and surface aerator motors are 90.8% efficient, the energy consumed on an annual basis for the BSP design =

  (142.5 HP *.746 kW/HP * 8,760 hr/yr)/.908 = 1,025,586 kWh/yr

GPR Alternative

- The GPR alternative replaces the surface aerators of the BSP with a submerged, fine bubble diffused air aeration system, powered by a premium energy-efficient 25 HP blower. The blower will need to run 24 hours per day, the premium motor is 94% efficient, so the energy consumed on an annual basis for the diffused air system =

  (25 HP * .746k W/HP * 8,760 h/yr)/.94 = 173,802/ kWh/yr

Fine bubble diffuser

GPR Savings versus BSP

[1] January 2019 A Kimmel, Great West – K McNeill, IDEQ

- The annual power savings = total power use for the BSP design versus the GPR alternative. The calculated power savings = 1,025,586 – 173,802 = is 851,784 kWh/year. The resulting percent reduction in energy requirements with the diffused air system = 83%.
- The annual cost savings is = annual power savings * cost of power = 851,784 kWh/yr * $0.04854/kWh = $41,346/yr.
- The payback period for the GPR alternative is the cost difference between the BSP and the GPR alternative ÷ $/year savings = 6.4 years.

Conclusion

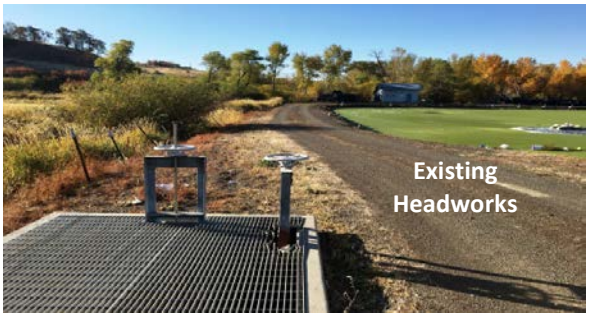
- The new fine bubble diffused air aeration system with premium energy-efficient blower, results in complete mixing and aeration of the lagoons while reducing energy requirements by at least 83%.
- **GPR Costs:** $724,434 (Final costs)
- **GPR Justification:** Categorically GPR-eligible (Energy Efficiency) per Section 3.2-2[2]: *Projects that achieve a 20% reduction in energy consumption.*

[2] Attachment 2. April 2010 EPA Guidance for Determining Project Eligibility.

2. Renovation of Gravity WW Collection System[3]

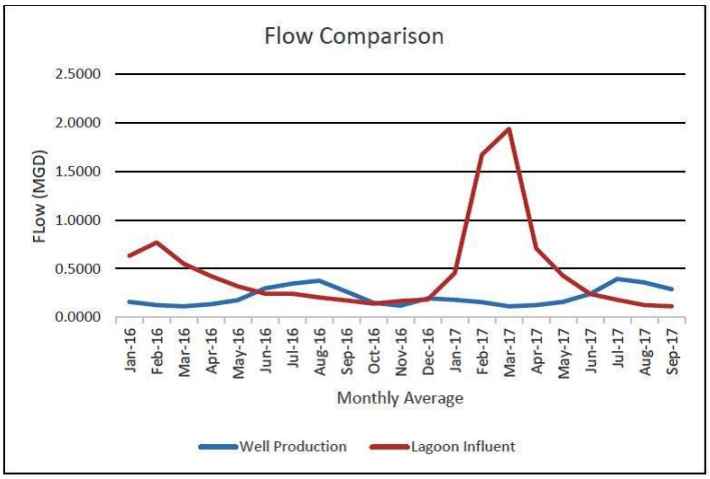
Summary

- To manage excessive inflow and infiltration (I/I) in Council's wastewater collection system, the city chose to replace the most deteriorated portions of the system. This choice was in lieu of providing storage for the I/I with additional pumping and treatment capacity at the wastewater treatment lagoons.
- Estimated loan amount = $6,445,000
- Estimated energy efficient (green) portion of loan = $211,480 (3.3%) (Final Costs)



Background[4]

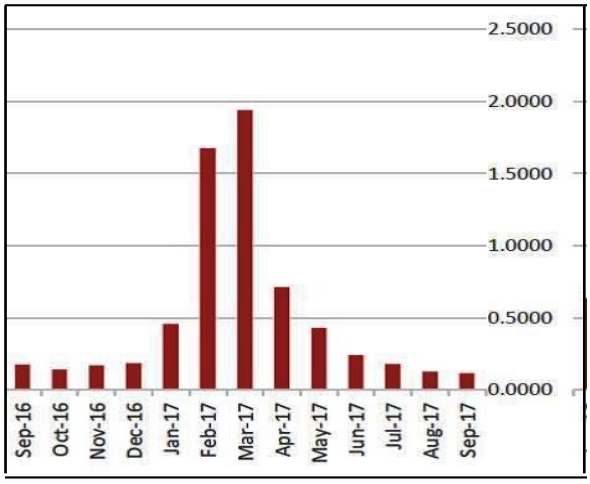
- The average dry month flow of wastewater is 0.14 MGD.
- During wet months the city experiences flows up to 2.0 MGD (hydraulic limit based on pipe size).
- Maximum I/I in the system is 1.86 MGD.
- The Facility Planning Study recommended alternative was to eliminate I/I, which would require replacing dilapidated gravity mains. Presently available funding allows for replacing approximately 40% of the most dilapidated sections of the gravity wastewater collection system.



Average Monthly Flow Comparison

Results[5]

- Total annual dry weather volume = .14 MGD x 365 days = 51 MG.
- Total 5 month (Jan – May) wet weather volume = 158 MG.
- Total 5 month (Jan – May) dry weather volume = .14 MGD x 150 days = 21 MG.
- I/I volume = 158 MG – 21 MG = 137 MG
- Total annual volume = dry weather volume + I/I volume = 51 + 137 = 188 MG
- I/I = 137 ÷188 = 73% of existing overall annual



Average Monthly Influent (MGD)

[3] Facility Plan, Great West Engineering
[4] A. Kimmel, Great West Engineering, 12-19-18
[5] Based on the I/I project GPR analysis for the City of Cascade FY12 Wastewater project.

wastewater volume.

- The project replaced approximately 40% of the collection system, resulting in an estimated 30% reduction in I/I[6]. (Volume saved = 30% of I/I volume = 0.30 x 137 MG = 41 MG).

Cost Effectiveness[7]

Capital Costs

- To determine the overall cost effectiveness and energy savings of the work, it was compared to a BSP. For I/I projects, the BSP consists of equalizing influent flow, followed by additional downstream treatment of the increased wastewater I/I volume. The stored, equalized I/I volume would subsequently be transferred by gravity flow through the lagoons for treatment.
- The pipe replacement was cost effective because the BSP was more expensive and energy intensive. Capital costs: (i) BSP = (41/31) x $2,452,750 = $3,243,960; (ii) Collection system piping replacement and manhole repair = $1,878,914.

Energy Savings

- The project eliminated the need for a lift station: Without I/I reduction, it would have been necessary to raise the lagoon embankments. By reducing system I/I by 30% the existing lagoon size is utilized, thus eliminating the need for a lift station. It is estimated that a lift station would have required a 50 hp pump and would have operated 6 hours per day at a cost of = $5,287/ year for forty years = **$211,480**

Conclusion

- The significant reduction in the quantity of wastewater resulting from eliminating I/I in the collection system makes the project GPR-eligible because the need for a lift station is eliminated, along with significantly reduced treatment costs.
- The I/I correction project is cost effective, incurring less capital cost than the BPA.
- ∴ Eligible GPR costs = **$211,480** (GPR portion of the total cost for replacement of 72 manholes + 19,258 feet of sewer = $1,878,914) (Final costs)
- **GPR Justification**: The prioritized replacement of gravity sewer lines by the city is GPR eligible by a Business Case per Section 3.5-4 (Energy Efficient): *Infiltration/Inflow (I/I) correction projects that save energy from pumping and reduced treatment costs and are cost effective*.

[6] A. Kimmel, Great West Engineering, 12-19-18

[7] Based on I/I analysis for the City of Cascade FY12 Wastewater project.

3. UV Disinfection System[8]

Summary

- An ultraviolet light (UV) system replaced the existing chlorine system.
- Estimated loan amount = $6,445,000; Costs: UV system = $500,000 (Final Costs)
- Estimated green portion of loan = $500,000 (7.76%)

Background

- The city replaced the existing chlorine disinfection/decholorination system with a UV disinfection system.

Results

- The UV system 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/dechlorination system, the use of chemicals, and any potential chlorine residual, are eliminated.
- **GPR Costs:** UV disinfection system: $500,000
- **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*.

[8] A Kimmel, Great West Engineering, email 6-24-20