

# **GREAT LAKES WATER AUTHORITY**

## **PS-1 Ferric Chloride System Rehabilitation and Struvite Removal at the Water Resource Recovery Facility (WRRF)**

**Project Plan  
June 13, 2018**



Pump Station 1 Ferric Chloride Facility



## Proposed Improvements

Rehabilitation of the Ferric Chloride System is an integral part of GLWA's Master Plan as it will be critical for the WRRF to meet phosphorus removal limits outlined in the NPDES permit. A new Capital Improvement Project was been scoped and submitted for inclusion in the current Capital Improvement Project. The PS-1 Ferric Chloride System Rehabilitation and Struvite Removal project was evaluated on a life-cycle cost basis and selected based on the combined ability to meet the regulatory requirements and GLWA's operational goals to operate a reliable world class facility that ensures healthy sewage treatment.

The recommended plan for Alternative 2-Rehabilitate Existing Facilities with Optional Secondary Feed Point addresses all of the necessary rehabilitation and repair needs, provides better dosing and treatment control for the WRRF while also addressing concerns with biomass settleability within the Secondary Clarifiers.

The recommended plan for Alternative B-Chemical or Physical Struvite Removal is the selected alternative for addressing the struvite in the Waste Activated Sludge (WAS) transfer pipeline between Gravity Thickener Complexes B and A because it provides redundancy for the plant for future maintenance and repair activities of the WAS transfer pipeline.

## Summary of Project Need

GLWA is proceeding with implementation of a project for the rehabilitation of the Pump Station No. 1 (PS-1) Ferric Chloride Feed System and for addressing issues associated with struvite buildup in the WAS transport line. GLWA is required to remove phosphorus from wastewater flows to reach limits as specified by the NPDES permit. Phosphorus has been shown to be a contributor to algae buildup in the Great Lakes. The primary method for removing phosphorus at the GLWA WRRF is by adding iron salts (ferric or ferrous chloride) to the wastewater stream at each of the pump stations (PS-1 and PS-2) and then precipitating it out in the primary clarifiers. The ferric chloride feed system at PS-2 has been recently rehabilitated and the system at PS-1 needs rehabilitation. Rehabilitating the ferric chloride feed system at PS-1 will be critical for the WRRF to continue to remove phosphorus to the limits required in the NPDES permit.

Currently, WAS is thickened at the WRRF Complex B Gravity Thickeners. There is a single line that transports WAS to Complex A where the thickened WAS is blended with thickened Primary Sludge. The blended sludge is then pumped to dewatering facilities and then ultimate disposal. Recent investigations have indicated significant buildup of struvite in the pipe that transports thickened WAS to Complex A. Struvite and vivianite are crystalline structures that can occur in biologically treated wastewater sludge and buildup on the inside walls of pipes, valves and equipment. The struvite reduces the cross-sectioned area of the pipe and can eventually lead to full blockage. If this occurs, the WRRF will not be able to pump WAS to the blending and dewatering areas. Addressing the issues associated with the struvite buildup in the WAS transport line will allow the WRRF to continue to thicken, dewater and ultimately dispose of biosolids that are removed during the treatment process.

Ferric Chloride System in PS1



## Potential Alternatives

A total of four (4) alternatives were considered for the Pump Station 1 Ferric Chloride facility, with one alternative discarded because it would have been too risky for the overall plant treatment process. Ultimately the selected alternative addresses all of the necessary rehabilitation and repair needs with a cost-effective project plan. The selected project provides better dosing and treatment control for the WRRF while also addressing concerns with biomass settleability within the Secondary Clarifiers.

- Alternative 1: Rehabilitate Existing Facilities
- Alternative 2: Rehabilitate Existing Facilities with Optional Secondary Feed Point
- Alternative 3: Aluminum Sulfate Phosphorus Removal
- Alternative 4: Incorporate Biological Phosphorus Removal (BPR) to the Secondary Treatment System

Two (2) alternatives were considered for addressing the struvite in the WAS transfer pipeline between Gravity Thickener Complexes B and A and alternative B was selected because it provides redundancy for the plant for future maintenance and repair activities of the WAS transfer pipeline.

- Alternative A: Replace WAS Piping
- Alternative B: Chemical or Physical Struvite Removal

## Monetary Evaluation – Cost Effectiveness

COST EFFECTIVENESS ANALYSIS FOR FERRIC CHLORIDE ALTERNATIVES 1, 2, 3 AND STRUVITE ALTERNATIVES A & B.

Item	Ferric Chloride Alternative			Struvite Alternative	
	Alt. 1	Alt. 2	Alt. 3	Alt. A	Alt. B
Capital Cost*	\$5,017,000	\$5,930,500	\$9,106,000	\$2,822,104	\$1,290,500
Interest During Construction	\$299,820	\$354,411	\$544,182	\$168,651	\$77,121
Salvage Value	\$626,313	\$700,200	\$1,769,889	\$1,532,509	\$291,340
Total Present Worth	\$4,690,507	\$5,584,712	\$7,880,293	\$1,458,246	\$1,076,282
Equivalent Annual Cost	\$239,482	\$285,137	\$402,341	\$74,453	\$54,951

\* Includes construction, engineering (design and construction), plus administrative costs (numbers rounded).

## Estimated Project Cost

Item	Estimated Cost
<i>Opinion of Probable Construction Cost</i>	
Alternative 1 - Rehabilitate Existing Facilities with Optional Secondary Feed Point	\$5,930,500
Alternative A – Replace WAS Piping	\$2,822,104
<i>GLWA Portion of 15% of Engineering &amp; Administrative Costs</i>	
Alternative 1 - Rehabilitate Existing Facilities with Optional Secondary Feed Point	\$1,046,559
Alternative A – Replace WAS Piping	\$498,018
<b>Total</b>	<b>\$10,297,181</b>

## Environmental Evaluation

- The proposed improvements will significantly improve GLWA's capability to operate a reliable WRRF and provide a more reliable solids handling system
- Construction is not expected to have adverse effects on the neighborhoods in the project area.
- The project will not detrimentally affect the water and the air quality in the project area.
- Implementation of the improvements will also generate construction-related jobs, and local contractors will have an opportunity to bid contract work.

## User Cost Impact

Item	Improvements
Total Cost of Project	\$10,297,181
Annualized Cost of Project (Assuming SRF interest rate of 2% over 20 years)	\$629,800
Service Area Households (City of Detroit and surrounding communities)	1,136,500
Estimated Household User Cost	+/- \$0.55 / household / year

## Implementation Schedule

Project Activity	Project Milestone
Post Draft SRF Project Plan and Public Hearing Notice	May 13, 2018
Public Hearings (33 days after Public Hearing Notice)	June 13, 2018
Deliver "Final" Project Plans to MDEQ	June 28, 2018
Complete Engineering Study and Design	April 2019
Issue Notice to Proceed / Start of Construction	October 2019
Complete Construction	March 2022



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