2024 Clean Water State Revolving Fund (SRF) Project Plan Amendment

For Clinton River Water Resource Recovery Facility

Revision: Submitted to State

Date: February 2, 2024

Oakland County Water Resources Commissioner

2024 Clean Water State Revolving Fund (SRF) Project Plan Amendment

Client name:	Oakland County Water Resources Commissioner		
Project name:	For Clinton River Water Resource Recovery Facility		
Document no:	2	**Project manager:**	Allen Gelderloos, P.E.
Revision no:	Submitted to State	**Prepared by:**	Allen Gelderloos, P.E.
Date:	February 2, 2024	**File name:**	2024_SRF_Project_Plan_Amendment_to_EGLE

Jacobs Consultants, Inc.

30800 Telegraph Road
Suite 4900
Bingham Farms, MI 48025-4710
United States

T +1.248.633.1440
www.jacobs.com

Contents

Tables

Figures

No table of figures entries found.

1. Introduction

This section provides an overview of previous studies and design that have been recently completed to meet the Oakland County Water Resources Commissioner's (WRC's) goal of increasing the capacity and reliability of secondary treatment at the Clinton River Water Resource Recovery Facility (CRWRRF). The CRWRRF consists of two separate facilities, approximately a mile apart (Auburn Plant and East Boulevard Plant), that both provide primary and secondary treatment. The specific goal of these efforts, which was included in the 2022 Clean Water State Revolved Plan (SRF) Project Plan, is to increase the overall treatment capacity of the CRWRRF from about 30 million gallons per day (MGD) to 40 MGD, by increasing the secondary capacity at the Auburn Plant.

In 2020, the CRWRRF Operation Optimization Plan was completed by Hazen. The main objectives of this study were to 1) improve Auburn secondary treatment reliability; and 2) address hydraulic bottlenecks to meet a wet weather flow of 40 MGD through the CRWRRF (combination of Auburn and East Boulevard). A number of alternatives were evaluated, including:

1. Return activated sludge (RAS) Equalization (EQ)
2. Step Feed / Contact Stabilization
3. Chemically Enhanced Primary Treatment
4. Replacement of Final Clarifiers 1 and 2
5. High-Rate Treatment / BioActiflo

The highest ranked alternative was No. 4 – Replacement of Final Clarifiers 1 and 2. As such, this was the recommended alternative in the 2022 Project Plan.

In late 2022, design started for the two new final clarifiers and a new RAS pump station. (Electrical improvements were also included in this project). The design was fast-tracked to meet SRF design completion deadline of June 2023. A Construction Manager At-Risk (CMAR) generated a construction cost estimate for the project based on 60% design that was very high. Based on the high cost, WRC decided to move forward with only the electrical improvements portion of the project, and postpone work on the secondary treatment improvements until after bidding the electrical improvements.

Jacobs, the project consultant also evaluated locating the new final clarifiers 100 feet to the east of the originally proposed area to avoid costly earth retention systems. The retention systems were needed to protect the existing clarifiers and piping during construction. It was preliminarily determined that moving the clarifiers and RAS PS could minimize or eliminate the need for the earth retention systems. As such, moving the new clarifiers about 100 feet to the east was a potential alternative.

In late summer 2023, WRC asked Jacobs to determine whether other feasible secondary treatment alternatives should be considered or re-considered. Jacobs presented information on the Mobile Organic Biofilm (MOB) process. This alternative was not included in the *Operation Optimization Plan* in 2020 since it is a relatively new process. The MOB alternative involves the addition of an organic media (called kenaf) to the activated sludge system to provide biological intensification and create a much more rapidly settling solids in the final clarifiers. As a result, the existing Final Clarifiers 1 and 2 can continue to be used, with necessary improvements, to the clarifiers and mechanisms. This alternative eliminates the cost for two new clarifiers and the risks of constructing them.

Based on further evaluation of the MOB alternative, including capital cost savings for the MOB alternative, and MOB process satisfaction from superintendents of two of the largest operating facilities in cold weather climates (in Moorefield, West Virginia and Rigby, Idaho), WRC elected to move forward with the MOB alternative.

2. Project Background

No change is this section from the original Plan.

3. Analysis of Alternatives

This section presents the updated alternative analysis for the secondary treatment alternatives.

3.1 Secondary Treatment Alternatives for Evaluation

Alternatives included in this Project Plan Amendment include:

1) Two New Final Clarifiers
2) Mobile Organic Biofilm System

The No Action alternatives was included in the original Project Plan

3.2 Analysis of Principal Alternatives

3.2.1 Two New Final Clarifiers

This alternative was evaluated during the Phase 1 design of the Clinton River WRRF Optimization Project. Design of the final clarifiers was not completed under Phase 1 because of the overall high cost of the new final clarifiers and the plant -wide electrical improvements. When the design was put "on hold" during Phase 1, the final clarifier project consisted of the following major elements:

1) Two new final clarifiers, located about 100 feet to the east from the original location
2) Modifications to Final Clarifiers 3 and 4 to address hydraulic bottlenecks
3) A new Return Activated Sludge (RAS) Pump Station
4) Modifications to piping in the Blower Building basement
5) Aeration improvements for Aeration Tanks 1 and 2 to provide increased aeration capacity.

3.2.2 Mobile Organic Biofilm System

The MOB system is a relatively new process. It is similar to the integrated fixed-film activated sludge (IFAS) process, which has been used successfully in Michigan and throughout the United States for many decades. IFAS uses free-moving, plastic biofilm carriers that are retained in a specific bioreactor zone, whereas the MOB system has an organic biofilm carrier (media) that can travel throughout the secondary treatment process.

The MOB system can be retrofitted in most existing treatment processes to increase capacity and/or improve treatment performance. Retrofits consist of the addition of a mobile biofilm carrier to the secondary treatment system and carrier retention drum screens. The MOB-media-supported biofilm increases biological treatment capacity by allowing the solids retention time (SRT) to be lowered while achieving the same performance. Most importantly for CRWRRF, the MOB media impregnates the floc structure providing a ballast that significantly increases settleability allowing for the MLSS to settle in 5 minutes which would normally have settled in 30 minutes (e.g. 5-minute Sludge Volume Index [SVI] values that are like 30-minute SVI values). The increased settleability allows for the reuse of the existing shallower Final Clarifiers 1 and 2, with additional modifications to existing process systems at the plant and allows for meeting the goal of increasing secondary treatment capacity from 30 MGD to 40 MGD.

The MOB process is commercially available from Nuvoda (Raleigh, North Carolina). The Nuvoda MOB process uses kenaf, a lignocellulosic material (an organic material, not plastic material like IFAS), as the mobile carrier. Unlike IFAS where a perforated screen is needed to maintain the media in one location (i.e., the aeration tank), the mobile biofilms move freely throughout the activated sludge process (i.e., aeration tanks, clarification, and RAS and WAS pumping). This allows for a more homogenous biofilm to form. The mobile carrier media is retained within the system using a drum screen, typically located on the WAS line

and reintroduced ahead of the aeration tanks, similar to RAS. The screened WAS, devoid of media, continues to residuals handling for further treatment. Nuvoda provides the kenaf media and drum screens as the MOB system.

The process modifications for the MOB system include the following:

1) Individual RAS pump stations for each final clarifier and a new RAS line to the Blower Building
2) WAS drum screens to screen the MOB media and allow it to return to the activated sludge process
3) A waste activated sludge (WAS) PS to convey WAS to the existing gravity thickeners
4) Final clarifier modifications to Final Clarifiers (FCs) 3 and 4 to remove a hydraulic bottleneck
5) Aeration improvements for Aeration Tanks 1 and 2 to provide increased aeration capacity. This will be provided through new and larger efficient blowers and new diffusers in both tanks. Note that the need for additional blower capacity and the corresponding diffuser modifications was discovered at the beginning of Phase 2 and is applicable to both the MOB system and the alternative with two new clarifiers.

3.2.3 Cost Effectiveness Analysis

Table 3-1 and Table 3-2 present the construction costs for the Two New Final Clarifiers and MOB System alternatives, respectively.

Table 3-1. Construction Costs for Two New Final Clarifiers

Description of Work	Quantity	Type	Unit Cost	Total Amount	Comments
Secondary Treatment Improvement Costs (Split Project)					
60% Design Estimate - Clarifier Work	1	LS	N/A	$49,601,904	CMAR Estimate
60% Design Estimate - Centrate EQ	1	LS	N/A	$1,174,132	CMAR Estimate
Total Cost of Work				**$50,776,036**	Clarifier Work plus Centrate EQ Work
Cost Reductions in Moving Clarifiers					
TERS (Temporary Earth Retention System)	1	LS	N/A	$3,305,034	TERS cost with 25% CMAR and 6.75% Fee
Geotechnical Monitoring	1	LS	N/A	$700,927	50% of Geotech Monitoring with 25% CMAR and 6.75% Fee
Subtotal Cost Reduction in Moving Clarifiers				**$4,005,961**	Sum of Cost Reductions
Cost Additions in Moving Clarifiers					
Sitework	1	LS	N/A	$300,000	Estimate of soil removal and development of proposed location
16"- RAS Pipe	329	LF	$767	$252,000	Glass lined Ductile Iron Pipe
30" - RAS Pipe	110	LF	$3,480	$383,000	Glass lined Ductile Iron Pipe
6" - Scum Pipe	340	LF	$117	$40,000	Cement lined Ductile Iron Pipe
30" - Sec. Eff. Pipe	328	LF	$120	$39,000	C900 PVC Pipe
36" - Mixed Liquor Pipe	352	LF	$1,404	$494,000	Cement lined Ductile Iron Pipe
48" - Storm Drain	337	LF	$654	$220,000	Concrete Pipe
72" - Manhole	2	EA	$20,000	$40,000	Pre-cast Concrete
Subtotal Cost Additions in Moving Clarifiers				**$1,768,000**	Sum of Cost Additions
Estimated Cost of Moving Clarifiers (Based on CMAR Estimate)				**$48,538,000**	
Adjusted Cost of Moving Clarifiers Based on Phase 1 (Electrical Improvements) Costs					
Low Bid (Clark Construction)				$33,610,000	3-year project duration with conting.
60% Design Electrical Improvements Cost Estimate by CMAR				$47,290,000	For Single Project
Cost Adjustment Factor Based on Electrical Improvements Project				0.71	Low Bid / 60% CMAR Estimate
Adjusted Cost for Moving Clarifiers				$34,500,000	Estimated Cost of Moving Clarifiers (Based on CMAR Estimate) x Cost Adjustment Factor
Phased Dewatering and Impact on Extended Project				$6,000,000	Estimate for phased dewatering and extended duration of project
Aeration System Improvements				$12,000,000	From Extended Total Cost from MOB System Cost Estimate
Total Adjusted Construction Cost of Moving Clarifiers				**$52,500,000**	
Additional Project-Related Costs					
Engineering			25%	$ 13,100,000	
Legal and Admininstration			25%	$ 13,100,000	
Total Project Cost				**$ 78,700,000**	

Table 3-2. Construction Cost for MOB System

Item	Description of Work			Amount
1	MOB System		$	3,640,000
2	WAS Screen Building		$	609,000
3	Sitework		$	285,000
4	RAS Pump Stations		$	1,872,000
5	WAS Pump Station		$	475,000
6	Yard Piping		$	1,338,000
7	Final Clarifier Work		$	3,036,000
8	Blower Building Basement		$	229,000
9	Electrical		$	868,000
10	Instrumentation		$	410,000
$	Aeration System Improvements		$	6,000,000
12	**Total Estimated Construction Cost Before Markup**		**$**	**18,760,000**
13	**Contractor Cost Estimate Markups**	**Percent**		
14	Overhead	8%	$	1,421,000
15	Profit	5%	$	888,000
16	General Conditions	10%	$	1,777,000
17	Mob/Demob	5%	$	888,000
18	Insurance	2%	$	355,000
19	Performance Bond - General	1%	$	231,000
20	Performance Bond - Electrical	1%	$	231,000
21	Design Contingency	30%	$	7,070,000
22	Market Adjustment Factor	40%	$	9,420,000
23	Escalation to Mid-point of Construction	10%	$	2,360,000
24	**Total Estimated Construction Cost**		**$**	**43,400,000**
Additional Project-Related Costs				
25	Engineering	25%	$	10,900,000
26	Legal and Admininstration	25%	$	10,900,000
27	**Total Project Cost**		**$**	**65,200,000**

4. Selected Alternative

4.1 Selected Alternative

The selected alternative is the MOB System. This selection is based on the following advantages:

1) Lower construction cost

2) Less risk during construction

4.2 User Costs

The estimated costs to the users for the recommended projects are based on SRF financing (1.875%) and SRF financing assuming the total project costs for each alternative, as shown in Section 3. All costs are financed over a 20-year period. Incremental cost increases by segment are provided in Table 4-1.

Table 4-1. Annualized System Payments

Entity	Current Annual Payments	Incremental Increase	
		Segment 1	Segment 2
Communities Contributing to Clinton River WRRF	$22,991,240	$26,900,000	Not included in Amendment
Average Percent Increase		17.1%	

User costs to the typical residential users for each segment is shown in Table 4-2.

Table 4-2. Typical User Costs by Segment

Communities Contributing to Clinton River WRRF		User Cost by Segment	
Estimated Number of Households[1]	63,650	Segment 1	Segment 2
Estimated Average Annual Bill	$361	$423	Not included in Amendment
Increase in average annual bill from current	--	$62	
Estimated average monthly bill	$30.10	$35.24	
Estimated cumulative increase for average monthly bill	--	$5.14	

[1] Number of households is equal to the estimated number of REUs in the system

5. Evaluation of Environmental Impacts

No change from 2022 Project Plan.

6. Mitigation

No change from 2022 Project Plan.

7. Public Participation

The Project Plan Amendment will be posted on the Clinton River WRRF Drain Board web site. A posting note will be added to the web site indicating that the plan will be presented at the Clinton River WRRF Drainage Board public meeting on February 27, 2024 for approval. Any public comment will be accepted at the meeting.

The Project Plan Amendment public participation documentation and Drain Board resolution adopting the Project Plan will be submitted to EGLE separately after the Board meeting.