



RPT 21-175

TITLE: Waste Water Treatment Plant Detail Design Award

DATE: April 14, 2021

TO: City Council

PUBLIC: X

INCAMERA:

RECOMMENDATION:

- That the Professional Agreement for the Waste Water Treatment Plant Detail Design be awarded to AECOM of Saskatoon in the estimated amount of \$1,826,000 plus GST and PST.
- That the Mayor and City Clerk be authorized to execute the amendment to Professional Services Agreement, and any other applicable documents on behalf of the city once prepared.

TOPIC & PURPOSE:

For the City to approve the amendment to the Professional Engineering Agreement for the Detail Design of the upgrades to the Waste Water Treatment Plant.

BACKGROUND:

The existing Prince Albert Waste Water Treatment Plant is a Class IV 44 ML/day facility located at 2000 – 1st Street East. The facility was originally constructed in 1972 as a means of providing primary treatment of waste water for the City. Upgrades to the plant in 1999 included a secondary treatment expansion and in 2009, UV disinfection was added.

A more detailed description of the City's Waste Water Treatment Plant and process is described below.

Raw sewage enters the WWTP at the headworks, where it is screened using a 6-mm perforated screen and pumped to two primary clarifiers. A Septage Receiving Station (SRS) discharges upstream of the 6-mm perforated screen. The received septage is metered, and passes through a rock trap prior to discharge upstream of the screen in the headworks facility. Historical septage volume is estimated at approximately 2,000 m³/month.

Primary effluent flows into two parallel bioreactor trains configured in a Ludzack-Ettinger (LE) process to remove carbonaceous biochemical oxygen demand (cBOD) and total ammonia nitrogen (TAN). A portion of the bioreactor mixed liquor effluent is directed to two Waste Activated Sludge (WAS) pumps, the other portion flows through two Parshall flumes (for flow measurement) and into two secondary clarifiers for solids separation. Clarified final effluent is UV disinfected before being discharged to the North Saskatchewan River (NSR).

Primary Sludge (PS) is pumped to a cyclone where heavier grit is separated from the lighter organic matter. The grit is deposited along with the screenings in a bin that is periodically hauled by truck to a landfill. De-gritted PS flows into a gravity settler for further thickening. Thickened PS (TPS) is pumped into a tank where it is blended with Thickened Waste Activated Sludge (TWAS). The supernatant from the gravity settler flows back to the primary settling basins.

WAS is pumped to a single Dissolved Air Flootation (DAF) thickener that produces a TWAS with a concentration between 3-4% solids. TWAS flows into a blending tank and is mixed with TPS before being pumped to a single Belt Filter Press (BFP) for dewatering and transport offsite. DAF supernatant is returned to the primary basins. The BFP can produce twenty (20%) solids cake suitable for composting. Typically, three (3) truckloads per day, or 21 m³/d, of unstabilized dewatered sludge are hauled to the composting area located at the landfill. The City wishes to abandon the composting process and provide inactivation and dewatering of sludge at the WWTP site, prior to transport.

Solids collected at the bottom of the secondary clarifiers are pumped to the bioreactors as Return Activated Sludge (RAS). The amount of WAS removed from the secondary treatment process establishes the solids retention time (SRT) of the system. The amount of RAS recycled to the secondary treatment process affects the mixed liquor suspended solids (MLSS) concentration, i.e., biomass, in the bioreactors and the performance of the biological treatment process. The SRT is a critical factor in the selection and growth of desired microorganisms to assimilate a specific substrate, in this case cBOD and TAN.

- The main plant is now 49 years old and badly in need of major renovations and upgrades. The 2017 Twenty Five Year WWTP Master Plan noted that following deficiencies at the plant.
- Headworks are in poor hydraulic conditions that are damaging to the pumps. The screens are overloaded at high flows, exacerbating the pumping problems.
- Grit Handling and Primary Clarifiers collect grit within the primary clarifiers which is damaging the equipment. A third Clarifier is needed to reduce overloading and allow for repair shutdowns.
- Bioreactors are a Ludzack-Ettinger process with future conversion to a Modified Ludzack-Ettinger process. This would reduce oxygen requirements and total nitrogen.

- Blowers are highly inefficient, prone to failure and must be replaced.
- Secondary Clarifiers require a third Clarifier to reduce overloading and allow for repair shutdowns.
- Effluent UV Disinfection is periodically overwhelmed and both banks must run to achieve the required dosage leaving no redundancy for repair shutdowns.
- Solids Handling processing system are without redundancy and the composting practice is no longer operating. A completely new approach to the solids handling are required.
- HVAC system are inefficient and controlled with outdated equipment. New systems would reduce operating costs and remove gasses and humidity from the buildings which damage equipment and is a danger to employees.
- Electrical and Standby Power is too small to maintain operations of the plant process. Existing electrical system are prone to surcharges due to low power factor.

In 2019 the Waste Water Treatment Plant had 37 major emergency repairs incidents costing \$788,546 and resulting in 11 spills, process upsets outside permit limits or bypass discharges to the river. Operations costs were \$1,346,870. Both Operations and Maintenance are expected to increase as equipment continues to wear out or break down.

PROPOSED APPROACH AND RATIONALE:

Last April 2020, after an RFP with four engineering companies submitting, Council approved the award of the Waste Water Treatment Plant Modeling and Pre-Design to AECOM for total cost of \$365,955 plus GST and PST. As scheduled the modeling and pre-design as taken one full year to complete. The following topics were analysis in detail:

- Design Basis
- Process Modeling
- Regulatory Review
- Firm Treatment Capacity
- Biosolids Management
- Condition Assessment
- Process Capacity
- Process Efficacy
- Electrical and Instrumentation
- Standby Power

The results of the technical investigations supports many of the 2017 Master Plan recommendations for upgrades which include; Grit and primary, Bioreactors, Blowers, Secondary clarifiers, Solids handling, Electrical and standby power system. The series of AECOM technical memos identified the following additional upgrades at the plant required to achieve the proposed effluent quality, improve treatment capacity for the 1:25 year storm event, and improve plant performance and efficacy.

- Wet weather storage to capture the 1:25 year storm event
- Dedicated headworks building to service the wet weather storage and improve inlet pumping hydraulics
- Replacement of the Air Handling Units in all buildings
- Declassification of the Administration Building
- Increase bioreactor volume to provide enhanced biological phosphorus removal
- Tertiary filtration to meet new low effluent phosphorus concentrations
- Effluent pumping to accommodate tertiary filtration into the plant hydraulic profile
- Sludge stabilization

A Downstream User Impact Study was also completed as it was a requirement of the Water Security Agency. WSA had proposed a phosphorus limit of 0.75 mg/kl. The study work undertaken by AECOM and submitted to WSA was able to establish that a phosphorus limit of 1.0 mg/kl would achieve effectively the same effluent results in the downstream environment. The WSA agreed and provided acceptance in writing. This one small change in limits has easily saved \$5 million in additional tertiary filtration.

In summary the pre-design findings presented by AECOM have been developed over the past 12 months of engineering design and assessment at the facility. The engineering efforts by AECOM have included an expansive sampling and testing regime at key locations throughout the facility. This information was necessary to properly calibrate a biological model of the facility utilizing the BioWin software platform. The modelling of the facility has allowed for confident determination of the performance of the plant in comparison to existing and future effluent regulations. A condition assessment has also been undertaken to quantify and identify remaining life of facilities and equipment at the site and assist in determining the requirements for the facility to continue to operate into the future. Through the pre-design phase of the project the needs of the facility have developed into the following recommendations related to upgrade and/or expansion of major components:

- New Headworks Building
- New Surge Pond (wet weather flow buffering)
- New UV / Blower Building
- Repurposing of the existing blower room for upgraded/expanded Electrical systems
- Addition and Repurposing to existing Biosolids Building
- Implementation of Fournier Press
- Implementation of Rotary Drum Thickeners
- Implementation of Aerobic Digestion
- Additional Primary Clarifier
- Additional Bioreactor
- Additional Secondary Clarifier

- Rehabilitation to existing primary clarifier, secondary clarifier and Bioreactors
- Upgrades and replacement to major electrical Systems throughout
- Upgrades and replacement to major mechanical systems throughout

CONSULTATIONS:

There were monthly Project Team Meetings with the AECOM Design Team and Director of Public Works, Manager of Engineering Services, Manager of Capital Projects, and Waste Water Treatment Plant Manager. There was also consultation with Water Security Agency which has resulted in approved effluent limits to the North Saskatchewan River.

Based on the work completed in the Modeling and Pre-design, the value engineering that carefully looked at every possible option, and the work done on the Downstream User Impact Study that has saved the City of Prince Albert over \$5 million in additional construction costs, it is the recommendation of Administration we continue with AECOM through Detailed Design.

COMMUNICATION AND/OR ANNOUNCEMENT PLAN:

Administration will contact AECOM and notify them of the Council's decision so that they may begin Detailed Design.

FINANCIAL IMPLICATIONS:

The Utility Budgets allocated as follows:

2020	Pre-design	\$ 370,000
2021	Detail Design	\$1,100,000
2022	Detail Design	<u>\$ 900,000</u>
Total	Design	\$2,370,000

The estimated expenditures are as follows:

Pre-design	\$ 365,955	Completed
Detail Design	<u>\$1,826,000</u>	Proposed
Total Design	\$2,191,955	

Based on the above numbers there is sufficient budget to complete the detailed design over the next two years.

OTHER CONSIDERATIONS/IMPLICATIONS:

There are no other considerations, implications, policy implications, privacy implications.

STRATEGIC PLAN:

A goal of the 2015 City of Prince Albert Five Year Strategic Plan is for the replacement of the aging infrastructure in the City. An additional goal is to complete the detailed design on the Waste Water Treatment Plant so that the City is in a "Shovel Ready" position when the next Investing in Canada Infrastructure Program is announced as this project will required higher level government funding to proceed to construction.

OFFICIAL COMMUNITY PLAN:

Section 10.3 Protection of Forests, Rivers, Watershed and Environmentally Sensitive Water Bodies. Upgrade water and waste water treatment facilities to reduce contaminant sources and impacts.

OPTIONS TO RECOMMENDATION:

The only option to the recommendation would be to not award the contract and cancel the project. This would not be recommended as existing plant is averaging over \$15,000 per week in repairs. Failure to meet Environmental discharge regulations to the North Saskatchewan River could result in fines starting at \$1 Million per day for the corporation. Failure to have the design completed (Shovel Ready) could mean missing an opportunity to apply for future Federal Infrastructure Funding Grants.

PUBLIC NOTICE:

Public Notice pursuant to the Public Notice Bylaw No. 24 of 2015 is not required.

PRESENTATION: none

ATTACHMENTS:

WWTP Pre-Design Site Plan.

Written by: Director of Public Works

Approved by: City Manager