

BONNYBROOK WASTEWATER TREATMENT PLANT CAPACITY EXPANSION PROGRAM

EXECUTIVE SUMMARY

Administration is recommending capital budget pre-approval of \$126.1 million at the March 17 Special Strategic Planning Meeting of Council for two major projects in advance of Action Plan 2015-2018 approval in 2014 November. With growth rates in Calgary significantly exceeding previous population forecasts the need to be proactive in capital project planning is crucial to ensuring wastewater treatment capacity. The capital projects will deliver increased treatment capacity at the Bonnybrook Wastewater Treatment Plant (BBWWTP) within the next seven years. The intention of this report is to provide information on why advanced approval for these projects is required. The increased treatment capacity is necessary to keep pace with growth, maintain service levels to citizens, and meet regulatory compliance.

The two BBWWTP capacity projects require approval totalling \$126.1 million between the years of 2015-2018. The funds will deliver capacity increases in the short term (BBWWTP Capacity Upgrades) and advance the detailed engineering design of the major WWTP expansion (BBWWTP Plant D Expansion). These two projects are included in the Water Infrastructure Investment Plan (WIIP) which will be presented to Council on 2014 March 17.

The key driver for the advanced approval request is to secure consultant and contractor services for these projects in 2014 in order to meet the project schedules and milestones that extend into the 2015-2018 budget cycle.

ADMINISTRATION RECOMMENDATION(S)

That the SPC on Utilities and Corporate Services:

1. Receive this report for information;
2. Refer this report to the 2014 March 17 Special Strategic Planning Meeting of Council and;
3. Recommend that Council pre-approve capital budget for the Bonnybrook Capacity Upgrades and Plant Expansion as per Attachment 4.

RECOMMENDATION OF THE SPC ON UTILITIES AND CORPORATE SERVICES, DATED 2014 FEBRUARY 26:

That Council pre-approve capital budget for the Bonnybrook Capacity Upgrades and Plant Expansion as per Attachment 4.

PREVIOUS COUNCIL DIRECTION

None

BACKGROUND

The City of Calgary is serviced by three (3) wastewater treatment plants (WWTPs): Bonnybrook (BBWWTP), Fish Creek (FCWWTP) and Pine Creek (PCWWTP).

PCWWTP, the newest plant, was commissioned over 5 years ago in 2008, and treats wastewater generated in the City's southwest and southeast as well as gravity transfers from

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the Fish Creek sanitary catchment. For planning purposes, the capacity of the PCWWTP can be combined with the capacity of the FCWWTP to serve a single 'south catchment' due to the geographical location of the two plants, and the gravity pipe that allows wastewater transfers from the FCWWTP to the PCWWTP. The BBWWTP is considered to be in a separate 'north catchment' due to its geographical location and because the flows from this plant cannot be transferred to the south. The north catchment represents about 70 percent of the city's generated wastewater. Flows from the south catchment can be diverted north to the BBWWTP if the south catchment becomes overloaded. The total capacity of the three WWTPs can be divided according to these north and south catchment definitions.

Over the last two years, growth rates in Calgary have significantly exceeded previous population forecasts. Previous five year population forecasts for The City of Calgary used in 2011 showed an annual population growth of approximately 16,600. New updated five year forecasts from 2013 are about 50 percent higher showing updated annual population growth of 24,800. Actual growth in 2011 and 2012, based on census data, was approximately 29,000 persons per year. This higher than expected growth advances the need for more capacity to accommodate this increased serviced population while continuing to meet regulatory compliance requirements.

Additional treatment capacity is needed to ensure that population and economic growth does not outpace the City's capacity to treat wastewater. Furthermore, treatment capacities must be matched to the population and economic activity in each of the north and south catchments. Based on the previous population projections, Water Resources had identified that additional capacity would be required at the BBWWTP. A schedule for the next major WWTP expansion was developed leading up to the 2012-2014 Business Plan and Budget Coordination (BPBC3) process. Preliminary engineering design was incorporated in the 2012-2014 capital budget, with the intent to request budget approvals for the detailed design and construction of the expansion as part of Action Plan 2015-2018. Through the conceptual design, it was identified that a two pronged approach that includes capacity upgrades and a plant expansion would provide the necessary capacity at the BBWWTP.

Based on the new population projections, BBWWTP has only three years of remaining treatment capacity, so the plans for capacity upgrades need to be advanced. The new population projections also show that additional capacity will be required in the south catchment in 2019. Since current infrastructure also allows for the transfer of wastewater from the Fish Creek and Pine Creek WWTPs to the north catchment an upgrade to the BBWWTP would address this capacity need.

The BBWWTP is the largest of The City's three plants and is separated into three distinct secondary treatment areas: Plant A, Plant B and Plant C. These plants were constructed in 1971, 1985 and 1994 respectively. The BBWWTP Plant D Expansion project will add a fourth secondary treatment module at the facility by 2020. A figure of the BBWWTP is provided Attachment 1.

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INVESTIGATION: ALTERNATIVES AND ANALYSIS

Bonnybrook Wastewater Treatment Plant Capacity Upgrades

To address the higher than predicted population growth in Calgary, Water Resources is advancing their two pronged approach which will include accelerated investment in capacity upgrades and the accelerated completion of the major plant expansion design. This will allow Water Resources to increase the capacity sooner to address short-term growth while working towards the WWTP expansion project which will span 6 to 7 years. Based on updated population projections all of the capacity upgrade projects are required by 2019 and the major plant expansion is required to be operational by 2020. Attachment 2 graphically demonstrates how the BBWWTP Capacity Upgrades and Plant D Expansion projects will increase the treatment capacity of the plant to meet the demands of the wastewater loads from the population in the north catchment until about 2030.

The BBWWTP Capacity Upgrades project will yield progressive capacity increases in advance of the major plant expansion, thereby maintaining regulatory compliance and treatment capacity to accommodate growth in the short term. This project will allow The City to more efficiently utilize existing BBWWTP infrastructure and will provide incremental capacity increases at a lower per capita cost than the major WWTP expansion. However, there is a limit to the capacity gains that can be achieved through these upgrade projects. The BBWWTP Capacity Upgrades will provide an additional 10 percent treatment capacity which will accommodate population growth of approximately 95,000. Additional secondary clarifiers will be constructed and internal pumping capacity will be increased. The capacity of the blower system that provides air for secondary biological treatment systems at the BBWWTP will also need to be increased to achieve the capacity upgrades.

The total cost of the BBWWTP Capacity Upgrades is estimated at \$117.2 million. This is a Class 4 (Conceptual Design) estimate. The advanced approval of \$101.1 million for the BBWWTP Capacity Upgrades by 2014 June is required to enable contractor mobilization by 2014 Q4 and to secure equipment purchases for 2015. Construction will continue through 2018. The balance of the funds required for the project is \$16.1 million, which has been approved in the 2012-2014 budget. The procurement strategy of tendering the complete package of upgrades in 2014 will achieve cost efficiencies through economies of scale and reduce the delivery risks associated with multiple contractors working on different pieces of the same project. This will facilitate the completion of construction by 2018 and provision of the required wastewater treatment capacity in advance of the next major plant expansion.

Bonnybrook Wastewater Treatment Plant – Plant D Expansion

The BBWWTP Plant D Expansion has been selected as the best and most resilient option for the next major plant expansion. Other alternatives have been considered, including expansion at the Pine Creek WWTP. The BBWWTP Plant D Expansion will deliver 26 percent additional treatment capacity on the BBWWTP site which will accommodate population growth of approximately 250,000. This project involves the addition of new primary, secondary and tertiary treatment infrastructure, including: clarifier tanks and mechanisms, bioreactor tanks and aeration systems, solids handling, thickening, and digestion facilities, an effluent filtration facility,

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and conveyance systems to transfer the wastewater between process areas. This project will also include upgrades and/or life-cycle replacements of some existing process and ancillary facilities (e.g. Ultra Violet Disinfection and control, laboratory and administration buildings) to accommodate the additional capacity that will be brought online under the expansion project.

In order to provide electrical power to the planned infrastructure at BBWWTP, an upgrade to the plant's electrical system is required. The objective of this program is to increase the capacity and reliability of the electrical network at BBWWTP. Funding for this electrical upgrade program has been included in the BBWWTP Plant D Expansion budget seen in Attachment 4.

A flood resiliency component has also been incorporated into this project, which involves relocating the treated effluent outfall further downstream on the Bow River to prevent river backup into the plant during high water events. In addition to this project, there are several other new flood resiliency projects planned for the BBWWTP site between 2014 and 2017, including the construction of a flood wall and groundwater pumping system.

The current schedule for the BBWWTP Plant D Expansion is for the design to be complete by 2016, with tendering in late 2016 and contractor mobilization to begin construction in early 2017. This program will be delivered as a series of phased projects.

The advanced approval of \$25 million is required to complete the design for the BBWWTP Plant D Expansion. Due to the complexity of designing a major expansion and obtaining the necessary regulatory approvals, fund approval is required in 2014 to ensure the engineering design can be streamlined and the approvals process can be initiated. Funds are currently approved within the 2012-2014 budget to initiate conceptual design activities. However, this expansion project spans a period of 6-7 years, and therefore, approval of funds for the 2015-2018 budget cycle prior to June 2014 is required to continue the design process so that implementation can be complete by 2020.

The requested budget of \$25 million will enable the procurement of consultant services through the preparation of tendering documents. The balance of the program budget, from the issuing of tender documents through construction and commissioning of the BBWWTP Plant D Expansion, will be included as a part of Action Plan 2015 -2018 in 2014 November. The Class 5 estimate (order of magnitude) for implementation is \$690 million, including inflation. This estimate will be refined through conceptual and preliminary design in 2014.

Other Bonnybrook Wastewater Treatment Plant Projects

In addition to the upcoming capacity related projects at BBWWTP, there are several other major capital projects ongoing at this facility. These projects include:

- Biosolids Dewatering Building – This facility will dewater digested sludge to increase the solids concentration prior to sending to the new composting facility.
- Headworks Upgrade – This facility will provide more effective screening and grit removal for the wastewater entering BBWWTP.
- Blower Upgrade – Mechanical blowers provide air to the secondary treatment processes at the BBWWTP. This project will provide additional blower capacity required to meet the

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treatment demands associated with the increasing population in the north catchment, and is required for the BBWWTP Capacity Upgrades and BBWWTP Plant D Expansion projects.

- Treated Effluent Water Pump Station - This facility will provide Enmax with treated effluent water to use in the cooling towers at the Shepard Energy Centre.
- Biogradex™ Demonstration– This project involves a full scale demonstration of the Biogradex™ mixed liquor degasification technology in Plant C, which could aid in solids settling and help increase the capacity of the BBWWTP.

Budget approval is in place for all of these projects. A schematic of the BBWWTP site showing the location of these projects can be seen in Attachment 1. An overview of the project implementation schedules can be seen in Attachment 3.

Future WWTP Expansions

Based on current growth forecasts and the projected capacity after the BBWWTP upgrades and expansion, a subsequent WWTP expansion will be required to be operational in the south catchment by the year 2025. Several studies are planned for the 2015-2018 budget cycle to determine the most effective way to meet the wastewater treatment demands of the growing population in the south catchment.

Stakeholder Engagement, Research and Communication

The projects will adhere with the Corporate Project Management Framework. This framework requires formal project chartering, including the preparation and implementation of a stakeholder engagement and communication plan. Reports to Council, through the SPC on Utilities and Corporate Services, will be scheduled at key milestones of the projects.

Consultation has been initiated with Alberta Environment and Sustainable Resource Development, and will continue over the life of these projects.

Strategic Alignment

The investment in capacity upgrades and expansions is necessary to provide sanitary servicing for a growing population. The UEP Business Plan includes performance measure PM4.4 that requires at least 5 years of wastewater treatment capacity in place to support growth.

Social, Environmental, Economic (External)

The two pronged approach to increase wastewater treatment capacity will ensure that the projected high rates of population growth in the next 5 years can be serviced without elevating the risk of regulatory non-compliance.

Financial Capacity

Current and Future Operating Budget:

The advanced approval of funding for the design of the two treatment plant projects will not impact current or future operation budgets. Operating budget requirements for new plant infrastructure will be incorporated into future business plans and budgets as required.

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Current and Future Capital Budget:

There are sufficient funds in the approved 2012-2014 Capital Budget to undertake the engineering work scheduled to the end of 2014. The advanced approval of funding for the BBWWTP Capacity Upgrades and the preparation of the design and tender documents for the major WWTP expansion allows Water Resources to meet the advanced schedule. The 2015-2018 budget will reflect the advanced approval of these requested funds. Capital budget approvals are required as follows:

BBWWTP Capacity Upgrades – Total Request \$101.1 million
BBWWTP Plant D Expansion – Total Request \$25.0 million

Attachment 4 shows the cash flow projections for each project between 2013 and 2020. The balance of the budget required for the BBWWTP Plant D Expansion will be incorporated into the 2015-2018 capital budget.

Risk Assessment

The BBWWTP is currently servicing a population that is nearing its installed capacity at a much greater rate than previously anticipated. The actual growth in 2011 and 2012 was significantly higher than expected, and has led to new 5-year population forecasts that are approximately 50 percent higher than previously forecast. Water Resources must respond to this significant population trend to ensure that treatment capacity keeps pace with growth. Advancing the two pronged approach provides a cost effective means of boosting the treatment capacity in the short term while positioning The City to deliver the major WWTP expansion under an accelerated program. The alternative is to not have sufficient capacity to meet the wastewater treatment needs of Calgary and to increase the likelihood of regulatory non-compliance.

The proposed two pronged approach also addresses the operational need to take process equipment out of service for maintenance tasks. As the treatment needs approach the installed treatment capacity of the City's treatment plant, these routine maintenance tasks elevate the risk of regulatory non-compliance.

REASON(S) FOR RECOMMENDATION(S):

This report is intended to provide information on why advanced approval for the BBWWTP WWTP Capacity Upgrade and Expansion projects is required.

The recommendations will ensure that funds are in place to purchase required equipment in 2015 and to mobilize contractors by Q3 of 2014 for the BBWWTP Capacity Upgrades and complete the design for the BBWWTP Plant D Expansion.

ATTACHMENT(S)

1. Schematic of BBWWTP showing Plant Areas and Major Projects
2. Bonnybrook Wastewater Treatment Plant Capacity and Population Growth
3. Overview Schedule of Major Wastewater Treatment Capital Projects
4. Cash Flow Projections