




CITY OF HAMILTON
PUBLIC WORKS DEPARTMENT
Hamilton Water Division

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	June 17, 2024
SUBJECT/REPORT NO:	Woodward Water Treatment Plant Phase 2 Upgrades (PW22078(a)) (City Wide)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Stuart Leitch (905) 546-2424 Ext. 7808
SUBMITTED BY:	Nick Winters Director, Hamilton Water Public Works Department
SIGNATURE	

RECOMMENDATION

- (a) That the Hamilton Water Divisional staff complement be increased by four new permanent Full-Time Equivalents as detailed in Appendix “A” to Report PW22078(a) to deliver the Woodward Water Treatment Plant Phase 2 Upgrades Capital Program;
- (b) That the four Full-Time Equivalents identified in recommendation (a) to Report PW22078(a) be funded from the Water, Wastewater and Stormwater Rate Capital Program (Project ID No. 5142166110 and 5143066110) at an approximate annual cost of \$622K;
- (c) That three permanent Full-Time Equivalents be included in the recommended 2025 Water, Wastewater and Stormwater Rate Budget to provide operational support for the Woodward Water Treatment Plant Phase 2 Upgrades and other large capital upgrades occurring at the City’s two wastewater treatment facilities.

EXECUTIVE SUMMARY

Report PW22078 received by Public Works Committee on September 19, 2022, updated Council about the Woodward Water Treatment Plant (Water Treatment Plant) Phase 2 upgrades. The report identified that staff would submit a recommendation

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OUR Mission: To provide high quality cost conscious public services that contribute to a healthy, safe and prosperous community, in a sustainable manner.

OUR Culture: Collective Ownership, Steadfast Integrity, Courageous Change, Sensational Service, Engaged Empowered Employees.

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report to the Public Works Committee once a Third-Party Review Assignment (Review Assignment) had been completed.

The Review Assignment, attached as Appendices “B”, “C”, “D” and “E” to Report PW22078(a) includes key areas that are deemed critical to the success of the Water Treatment Plant Phase 2 upgrades with a focus on reviewing the Phase 2 Conceptual Design components developed in 2022. The Review Assignment considered whether certain portions of the work could be deferred as a future phase to reduce project scope or to defer capital expenditures. The Review Assignment concluded that the Water Treatment Plant Phase 2 Capital Program should be split into Phases 2A and 2B which will provide project staff the ability to prioritize key process upgrades that protect public health ahead of a capacity expansion to support Hamilton’s growth and development.

The City’s Waterworks Asset Management Plan (2022) identified that the condition of the Water Treatment Plant is rated as Poor, largely due to the deficiencies that will be addressed by the Water Treatment Plant Phase 2 Capital Program. The key goals of this capital program are to address the poor asset condition, resolve process capacity restrictions, provide a resilient water treatment system and robust production process, while utilizing best available technologies. The estimated capital cost for the Water Treatment Plant Phase 2A and 2B Projects is \$335M and \$208M respectively, including engineering, construction, contingency and inflation.

The Review Assignment investigated the project team structures for the design and construction of major water treatment plants and plant rehabilitation programs across other major Canadian municipalities. The recommendations in Report PW22078(a) will ensure that Hamilton Water has the required staff resources to successfully design, construct, and commission an extremely complex capital rehabilitation and upgrade program at the City’s most critical water facility.

Alternatives for Consideration – See Page 10

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: The recommendations in Report PW22078(a) do not require any additional budget approvals.

The staffing additions in recommendation (a) will be funded through the existing approved water, wastewater, and stormwater capital program, specifically the Water Treatment Plant Phase 2A and 2B Capital Project ID No. 5142166110 and 5143066110. The approximate annual cost of these positions is \$622K. Individual position costs are identified in Appendix “A” to Report PW22078(a).

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The financial implications of recommendation (c) will be detailed during the 2025 Water, Wastewater and Stormwater Rate Budget process.

Staffing: The recommendations in this report will increase the Hamilton Water Divisional staffing complement by four permanent full-time equivalents.

Legal: N/A

HISTORICAL BACKGROUND

The Woodward Water Treatment Plant (Water Treatment Plant) is a conventional drinking water treatment plant with a rated capacity of 909 million litres per day, providing potable drinking water and fire protection to the Hamilton community. It is the only Water Treatment Plant servicing the City's greater urban area and as a result it provides potable drinking water for close to 570,000 residents, industrial, commercial, and institutional properties, and there are also service connections to limited areas of Halton Region and Haldimand County.

The plant was originally constructed in 1931 and expanded in the late 1950s with various improvements occurring over the decades. The treatment process includes intake chlorination (for zebra mussel control and pathogen inactivation), screening, pre-chlorination (for pathogen inactivation), coagulation, flocculation, conventional gravity sedimentation, granular activated carbon filtration, post-filter followed by fluoridation (for the reduction of dental caries), and ortho-phosphate addition (for corrosion control).

Over the last several years, the Hamilton Water Division completed a Best Available Technologies and Feasibility Study (CH2M Hill 2016) and a Conceptual Design (AECOM 2022) for the Water Treatment Plant Phase 2 Process upgrades. Concurrently, Hamilton Water completed the Water Treatment Plant Phase 1 Process upgrades through a \$25M construction project that involved large capital upgrades. The key goals of the Water Treatment Plant Phase 2 Process upgrades are to address the poor asset condition, resolve process capacity restrictions, provide a resilient water treatment system and robust production process, while utilizing best available technologies.

The estimated capital cost for the Water Treatment Plant Phase 2A and 2B Projects is \$335M and \$208M respectively, including engineering, construction, contingency and inflation. Phase 2 has been split up into Phase 2A (water quality improvements) which requires priority completion and a future Phase 2B (growth-related upgrades) which targets completion by 2035.

In 2023, Hamilton Water completed a Third-Party Review Assignment (Review Assignment) that provided recommendations for key areas that are deemed critical to

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the success of the Water Treatment Plant Phase 2 upgrades. The Review Assignment was completed utilizing a due diligence approach, focusing on a review of the 2022 Phase 2 Conceptual Design components. The following is a summary of the Review Assignment findings:

1. Staff Resourcing Requirements - Dedicated City staff resources are required for the delivery of the Water Treatment Plant Phase 2 upgrades including the support of successful project management, design, and construction administration. These resources include positions to create and staff a capital project team, and operations and maintenance positions that will provide critical support throughout all phases of the capital program.
2. Process Risk During Construction - Risks associated with the proposed upgrades were highlighted and preferred alternatives/technologies identified for suitability to achieve the desired objectives for the Water Treatment Plant Phase 2 upgrades. In addition, the proposed construction staging, overall schedule, and potential impact to Water Treatment Plant operations during the course of construction were reviewed with respect to maintaining water production and treatment objectives. An evaluation was used to compare proposed technologies and their rated treatment capacity to the overall rated capacity for the Water Treatment Plant to confirm that existing hydraulic restrictions at the Water Treatment Plant will be addressed with the capital upgrades.
3. Constructability and Construction Phasing - The constructability and construction sequencing was considered, and risks were identified and accounted for in the project planning. The Review Assignment concluded that the construction activity is suitable for the Water Treatment Plant. In addition, the Review Assignment considered whether certain portions of the work could be deferred as a future phase to reduce project scope or to defer capital expenditures. The Review Assignment concluded that the Water Treatment Plant Phase 2 Capital Program should be split into Phases 2A and 2B which will provide project staff the ability to prioritize key process upgrades that protect public health ahead of a capacity expansion to support Hamilton's growth and development.
4. Capital Construction Cost - Following the recommendation that the construction program be split into two distinct contracts for Phase 2A and 2B, the review of the conceptual cost estimate resulted in the following capital cost and timeline breakdown:

Woodward Water Treatment Plant Upgrades Phase	Capital Cost Estimate	Schedule Estimate
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Phase 2A (assuming construction start 2028, including inflation, engineering, construction and contingency)	\$335M	Design - 2025 to 2027 Construction - 2028 to 2032
Phase 2B (assuming construction start 2032, including inflation, engineering, construction and contingency)	\$208M	Design: 2029 to 2031 Construction: 2032 to 2035

The Water Treatment Plant Phase 2A and 2B upgrades include the following major scope items:

Phase 2A Upgrades	Description
Filter Building Components:	
Filter to Waste	Currently the plant does not include a filter to waste process. A new system will allow for filter 'ripening' after backwash prior to finished water production. This process will mitigate water quality challenges after a backwash cycle and will address Ministry of the Environment, Conservation and Parks design concerns.
Filter Underdrains	Replace the filter underdrains in 22 out of 24 filters (two filter underdrains were previously replaced due to failure). The works will ensure reliable filtration redundancy and capacity is maintained.
Replace Filter Media	This is necessary to ensure maintenance of filtered water quality. This is a recurring activity approximately every four years in order to meet water quality objectives.
Ultra-violet Disinfection / Filter Backwash System Building Components:	
Ultra-violet (UV) Disinfection	Adding post-filter UV will address Ministry of the Environment, Conservation and Parks concerns regarding disinfection credits, reduce the quantity of chlorine needed for disinfection, and address concerns over degradation of process equipment and filter media due to the current practice of pre-treatment with chlorine. In addition, UV will provide an extra barrier against pathogens.

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Phase 2A Upgrades	Description
Filter Backwash System	The filter backwash pumping equipment will be housed in the new ultra-violet building. The new backwash system will use non-chlorinated water which will prolong the service life of the filter media and reduce replacement frequency.
Chlorine Disinfection Building:	
Chlorine Disinfection	A new Chlorine Disinfection Building is required to replace the existing aged facility and ensure security of supply with growing demands from both the Water and Wastewater treatment processes. The new building will incorporate the ability to use two alternate chlorine supply strategies.
Ancillary Requirements:	
Miscellaneous	Other ancillary works required such as landscaping, yard piping, drain piping, clearwell tank concrete restoration, excess soils management, etc.
Phase 2B Upgrades	Description
Low Lift Pumping Station	Upgrades are anticipated as a result of changes to the hydraulics through the new Water Treatment Plant pre-treatment process.
Pre-Treatment Process & Superstructure	New process technology housed in a new superstructure is required to reduce the hydraulic bottleneck in the existing sedimentation tanks and increase production capacity. This will also improve pre-treatment water quality and filter performance.
Ancillary Requirements	Other ancillary works required such as landscaping, yard piping, drain piping, excess soils management, etc.

A 10-year forecasted budget (cash flowed) for the Water Treatment Plant Phase 2 Process upgrades of \$353M (excluding contingencies and inflation) was included in the

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2023 Water, Wastewater and Storm Rate Budget. In the 2024 Water, Wastewater and Stormwater Rate Budget the 10-year forecast budget was updated and increased to \$543M (including contingencies and inflation), and to reflect the Water Treatment Plant Phase 2A (\$335M) and 2B (\$208M) projects. Phase 2A is the non-growth component of the upgrades and is 100% funded from the City's water revenues. Phase 2B is the growth component of the upgrades and is 100% funded by Development Charges.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

The Water Treatment Plant Phase 2 Upgrades are required to ensure the City's ability to produce potable drinking water that meets or exceeds the regulatory requirements stipulated by the *Ontario Safe Drinking Water Act* *Safe Drinking Water Act, 2002*, S.O. 2002, c. 32, and regulations.

The Water Treatment Plant Phase 2 Upgrade are also required to ensure that the City has potable drinking water production capacity to support the City's growth to the year 2051 as identified in Ontario by the Greater Golden Horseshoe: Growth Forecasts to 2051 Technical Report, August 26, 2020.

RELEVANT CONSULTATION

The following groups have been consulted and are supportive of the recommendations in this report:

- Financial Planning Administration and Policy Division, Corporate Services Department
- Hamilton Water Division, Public Works Department

ANALYSIS AND RATIONALE FOR RECOMMENDATION

The Third-Party Review Assignment (Review Assignment), attached as Appendices "B", "C", "D" and "E" to Report PW22078(a) includes the investigation of project team structures for the design and construction of major water treatment plants and plant rehabilitation programs across other major Canadian municipalities. The staffing recommendations in Report PWS22078(a) are supported by the results of that investigation and will ensure that Hamilton Water has the required staff resources to successfully design, construct, and commission an extremely complex capital rehabilitation and upgrade program at the City's most critical water facility.

The recommended resource structure for the Water Treatment Plant Phase 2 Upgrade includes dedicated Capital staff with project support from Operations, Supervisory Control and Data Acquisition (SCADA) and Maintenance. This resource structure will significantly minimize risks including schedule and budget variances for the program

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which has project timelines that are estimated to carry through to 2035 for the design and construction of both Phases 2A and 2B. In addition, there will be a requirement in the future for additional staff to operate and maintain the new process once the equipment is commissioned roughly around 2032 (Phase 2A) to 2035 (Phase 2B). The future staffing requests will be better understood once the design commences for Phases 2A and 2B and the level of operational and maintenance effort is assessed considering the type of new process infrastructure.

The following provides details regarding each position that is encompassed by the recommendation (a) in Report PW22078(a):

Manager, Capital Delivery, Water Treatment Plant Program:

There is currently no dedicated Manager resource for the management of the Water Treatment Plant large capital program. The responsibilities of the Manager will be to oversee the overall project management of the Phase 2A and 2B Water Treatment Plant upgrades along with the overall Capital Program and staffing management. The Manager will also be responsible for the sponsorship oversight for the Senior Project Manager led capital projects within the Water Treatment Plant Capital Program.

Senior Project Manager, Capital Delivery, Water Treatment Plant Program:

There is currently no dedicated Senior Project Manager resource for the Water Treatment Plant Capital Projects. The responsibilities of the Senior Project Manager will be to provide oversight for the investigative, design, construction, commissioning, and warranty services for the Filter Building components within the Water Treatment Plant Phase 2A and 2B upgrades. This position will require the qualifications and experience to project manage complex, large capital projects. The Senior Project Manager will also be responsible for the sponsorship oversight for the Project Manager led capital projects within the Water Treatment Plant Capital Program.

Project Manager, Capital Delivery, Water Treatment Plant Program:

There is currently no dedicated Project Manager resource for the Water Treatment Plant Capital Projects. The responsibilities of the Project Manager will be to provide oversight for the investigative, design, construction, commissioning, and warranty services for the Chlorine Building components within the Water Treatment Plant Phase 2A and 2B upgrades.

Engineering Technologist, Capital Delivery, Water Treatment Plant Program:

There is currently no dedicated Engineering Technologist resource for assisting with the Water Treatment Plant Capital Projects. The responsibilities of the Engineering

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Technologist will be to address the number of day-to-day requests received. This position is also required to provide project and program support, maintain a document management system, and provide project controls for the various capital projects within the Water Treatment Plant Phase 2A and 2B upgrades and Program related tasks.

The following provides details regarding each position that is encompassed by the recommendation (c) in Report PW22078(a) which will be referred to the 2025 Water, Wastewater and Stormwater Budget:

Treatment Plant Senior Process Engineer:

Currently operational input into the design of large capital projects at the Water and Wastewater Treatment Plants is provided by the Manager of Plant Operations and the Overall Responsible Operator (ORO) for the Water Treatment system and the ORO for the Wastewater Treatment systems. Given that the Water Treatment Plant Phase 2 project is planned to occur simultaneously with the Woodward Wastewater Treatment Plant Phase 2 Expansion project and the Dundas Wastewater Treatment Plant replacement project, the current structure for operational input will create significant project risks. The Senior Process Engineer will provide regulatory and process operational requirements to the engineering design teams and provide coordination throughout the construction period for these projects.

SCADA Project Manager:

There is currently no dedicated SCADA Project Manager for assisting Water Treatment Plant Capital Projects. The SCADA Project Manager will play a crucial role in overseeing and supporting automation and SCADA-related tasks throughout the lifecycle of the project, including design, construction, training, and commissioning phases. This position will also support the Woodward Wastewater Treatment Plant Phase 2 Expansion project and the Dundas Wastewater Treatment Plant replacement project.

Maintenance Supervisor:

There is currently no dedicated maintenance support for assisting Water Treatment Plant Capital Projects. The Maintenance Supervisor will offer technical and field support in mechanical, electrical, instrumentation aspects throughout the project lifecycle. This role will serve as the primary representative of Plant Maintenance throughout the design, construction, training, commissioning, and warranty phases. This position will also support the Woodward Wastewater Treatment Plant Phase 2 Expansion project and the Dundas Wastewater Treatment Plant replacement project.

ALTERNATIVES FOR CONSIDERATION

Alternative 1:

Staff could be directed to resource the Water Treatment Plant Phase 2 Capital Program by re-allocating existing Hamilton Water capital program staff. This alternative is not recommended because it would impact the existing water, wastewater and stormwater capital program resulting in increased risk of infrastructure failures, loss of water, wastewater or stormwater services, adverse public health impacts, adverse environmental impacts, and requiring expensive and unplanned emergency interventions.

Council has received several reports since 2021 that identify the poor overall condition of the City's water, wastewater, and stormwater assets, and the need to increase spending across the water, wastewater, and stormwater capital program to reduce risk, support community growth and development, and improve environmental outcomes. Council has also supported this critical infrastructure deficit through increasing investments through the 2022, 2023, and 2024 Water, Wastewater and Stormwater Rate Budgets.

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: The annual estimated staffing costs for the four full-time equivalents estimate at \$622K would be avoided.

In addition, Hamilton Water would have to analyse the 10-year water, wastewater and stormwater capital program and identify projects for deferral in order to free-up the necessary staff resources to support the Water Treatment Plant Phase 2 Capital Program.

Staffing: The Hamilton Water Divisional Complement would not increase.

Legal: Increased risk of infrastructure failure is accompanied by increased risk of regulatory non-compliance, fines, and exposes the City to significant liability. Mayor and Council, and senior members of City staff may also be exposed to personal liability under the Standard of Care Provisions within the Ontario Safe Drinking Water Act.

Alternative 2:

The four full-time equivalents identified in recommendation (a) could be approved on a temporary basis expiring at the end of the Water Treatment Plant Phase 2 Capital

Program. This alternative is not recommended because it adds significant risk to the capital program resulting from increased staff turn-over. The Water Treatment Plant Phase 2 Capital Program represents a \$543M investment in the City's most critical water asset, with an accompanying 10-year program schedule. There is ample evidence across municipalities that capital projects and programs with higher levels of staff turn-over result in projects that experience delays, increased overall project costs, and increased operational risk.

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: There is increased risk that project costs will exceed estimates because of delays and change orders required to respond to operational issues that develop through the course of the capital program.

Staffing: The Hamilton Water Divisional staffing complement by four full-time equivalents for the duration of the Water Treatment Phase 2 Capital Program, currently estimated for completion in 2035.

Legal: N/A

APPENDICES AND SCHEDULES ATTACHED

Appendix "A" to Report PW22078(a) – Breakdown of Full-Time Equivalents

Appendix "B" to Report PW22078(a) – Woodward Water Treatment Plant Phase 2 Upgrades Third-Party Review (Stantec 2023) – Constructability and Construction Phasing Review

Appendix "C" to Report PW22078(a) – Woodward Water Treatment Plant Phase 2 Upgrades Third-Party Review (Stantec 2023) Process Risk Review

Appendix "D" to Report PW22078(a) – Woodward Water Treatment Plant Phase 2 Upgrades Third-Party Review (Stantec 2023) Resourcing Review

Appendix "E" to Report PW22078(a) – Woodward Water Treatment Plant Phase 2 Upgrades Third-Party Review (Stantec 2023) – Capital Construction Cost Review