SUBJECT: Woodward Avenue Wastewater Treatment Plant Primary Clarifier Upgrade - Expanded Works (C11-56-06) (PW08042) - (City Wide)

RECOMMENDATION:

(a) That the General Manager, Public Works be authorized and directed to negotiate an Expanded Works with Earth Tech Canada as it relates to additional coordinated works associated with the existing contract C11-56-06 - Woodward Avenue Wastewater Treatment Plant Primary Clarifier Upgrade;

(b) That the negotiated Expanded Works of approximately $2.0M be funded from Account No. 5160366302 – Primary Treatment Capacity Expansion.

Scott Stewart, C.E.T.
General Manager
Public Works

EXECUTIVE SUMMARY:

The Public Works’ Water and Wastewater Division are currently undertaking upgrades to the Primary Clarifiers located at the Woodward Avenue Wastewater Treatment Plant (WAWWTP). The Project primarily involves improvements for increasing hydraulic throughput to the existing treatment process as required to provide for improved control and treatment of wet weather flows in order to meet Hamilton Harbour Remedial Action Plan (HHRAP) and Provincial targets. Earth Tech Canada (ETC) was retained through a competitive Request for Proposal (RFP) process and was awarded the contract (C-11-56-06) for the design and contract administration services with a value of $1,098,061
(including contingency). The estimated construction cost for this project is $22M which is being partially funded through the Canada Ontario Infrastructure Program (COIP) program which imposes a project completion date of the first quarter of 2009.

Since the award of the contract, the Water and Wastewater Master Plan (WWWMP) was completed and identified a preferred strategy based on a Triple Bottom Line (TBL) analysis to expand the existing infrastructure at the WAWWTP to treat additional wet weather flow rather than invest further in Combined Sewer Overflow (CSO) facilities in the collection system. As a result, new infrastructure was identified in the same area of the Primary Clarifier for which ETC is designing upgrades for the original works. Considering the various pressures associated with COIP funding, achieving HHRAP targets and future construction at the WAWWTP site, staff undertook an analysis to determine the best options for moving forward to complete this additional work as identified in the WWWMP. This report outlines the analysis which supports the recommendation to negotiate an Expanded Works with Earth Tech Canada as it relates to additional coordinated works associated with the existing contract C11-56-06 - Woodward Avenue Wastewater Treatment Plant Primary Clarifier Upgrade. Benefits to this recommendation include, a total estimated avoided cost savings of $4.5M, an accelerated schedule compared to the next best alternative of 10 months, and a reduction in other associated project risks.

**BACKGROUND:**

In July 2006, the Water and Wastewater Division issued a Request for Proposal (RFP) for design and construction services related to upgrades to the Woodward Avenue Wastewater Treatment Facility, Primary Clarifiers. Earth Tech Canada was the successful proponent and was issued the contract with a value of $1,098,061 (including contingency). The required upgrades were to provide for improved control and treatment of wet weather flows in order to meet Hamilton Harbour Remedial Action Plan (HHRAP) and Provincial targets. At the time of project conceptualization, the City took advantage of funding opportunities and secured $20 million through the Canada Ontario Infrastructure Program (COIP) program which imposes a project completion date of the first quarter of 2009. Through the conceptual engineering stage and in coordination with the Woodward Master Plan, a number of significant changes have been identified/proposed. The changes relate mainly to works identified as a result of the recently completed Phases 3 and 4 of the Class Environmental Assessment for Combined Sewer Overflow Control and Woodward Avenue Wastewater Treatment Plant Expansion which identified that additional wet weather treatment undertaken at Woodward would reduce the need for further investment of wet weather control in the collection system. This additional wet weather control for Woodward Avenue is intrinsically linked to the existing primary clarifier upgrades currently being undertaken by Earth Tech. In general, the changes required impact the existing works and include the following:

- Construction of two new primary clarifiers and associated channels,
- Relocation of the existing Headworks’ screenings and bin storage building,
- Construction of a 20m deep drop shaft,
Construction of a new chlorine contact chamber, and
- Associated site works.

It must be noted that the scope changes did not take place as discrete points in time but evolved over time as the Master Plan was developed making it challenging for the existing project to effectively manage change. Now that the Master Plan has been completed, a final approach for addressing the change in scope was undertaken, options were analyzed, and a preferred approach recommended.

The current Earth Tech assignment involves development and analysis of hydraulic computer modeling of the existing primary clarifiers system based on specified design flow, followed by detailed design and construction administration services. The objectives were to implement improvements to:
- Ensure even flow distribution to each of the 12 primary clarifiers under all flow conditions,
- Ensure controlled primary clarifier effluent flow distribution to the two secondary treatment trains within a flow split range based on capacity of the individual secondary treatment trains,
- Provide for Chemically Enhanced Primary Treatment (CEPT) to improve primary clarifier performance in accordance with the objectives of the Hamilton RAP and MOE Policy F-5-5 as identified in the RFP,
- Provide process infrastructure improvements to accommodate the above changes and to upgrade any existing deficient facilities to provide a robust system for long-term operation and maintenance,
- Improvements to the by-pass channel or the outfall were identified as provisional items in the RFP.

Earth Tech completed the hydraulic and Computational Fluid Dynamics (CFD) computer modelling of the primary clarifiers, by-pass, and outfall during the period of October 2006 and February/March 2007. Technical Memoranda, including conceptual layouts of the proposed works to improve the hydraulics, were submitted. Earth Tech also completed the infrastructure review, conducted a project workshop, and initiated the CEPT pilot testing program.

Figure 1 (attached) presents the anticipated works arising from the Conceptual Design stage of the project based on the work program outlined in the RFP and Proposal. The estimated construction cost for this project is $22M which is being partially funded through the Canada Ontario Infrastructure Program (COIP) program which currently imposes a project completion date of the first quarter of 2009. Work associated with this assignment is outlined in Figure 1 and consists generally of:

Existing Works:
- Construction of a new second feed channel from the vortex grit system to the new common primary clarifier influent feed channel,
- Construction of a new common primary clarifier influent feed channel complete with channel aeration/mixing,
Construction of 12 new individual primary clarifier feed channels complete with cut-throat flume for flow balancing,

- Modifications to the effluent launders discharge in primary clarifiers 1-8,
- Installation of a flow control device in the discharge channel from the primary clarifiers to the North Secondary Treatment Train for flow balancing,
- Implementation of CEPT, and
- Miscellaneous site and process improvements.

Technical Memoranda were updated and new conceptual layouts of the facilities were prepared. Earth Tech also conducted the CEPT pilot studies (bench and column testing) during this period.

Through further coordination meetings with the Master Plan Team through 2007, a number of physical changes with direct connection to the primary clarifier project were identified and required to meet the wet weather treatment requirements under HHRAP and MOE F-5-5 on a system-wide basis and included the following:

**Proposed Works:**
- Extension of the common primary clarifier influent channel and construction of two new primary clarifiers,
- Modifications to the primary clarifier by-pass channel,
- Relocation of the headworks screenings and bin storage building,
- Construction of a 20m deep drop shaft to provide access to the existing raw sewage trunk sewer so that flow can be intercepted and re-directed to the new raw sewage pumping station,
- Construction of a new chlorine contact chamber for disinfection (and dechlorination) of all flows on a temporary basis and primary effluent by-pass flow on a permanent basis, including chemical dosing facilities,
- Construction of a by-pass channel from the headworks and a by-pass channel from the new raw sewage pumping station to the new chlorine contact chamber,
- Construction of channels from the existing secondary effluent channel to the influent of the new chlorine contact chamber and from the chlorine contact chamber effluent to the existing secondary effluent channel,
- Construction of a new effluent channel to by-pass the existing (to be decommissioned) chlorine contact chamber, and
- Associated site works.

Earth Tech updated the hydraulic profile and the CFD modelling to confirm that the proposed influent works could accommodate the increased flow and additional primary clarifiers. New conceptual site layouts were developed and submitted for review. The revised scope of work is presented in Figure 2.

Considering the close proximity and interdependencies of the newly proposed works as they relate to the current scope of work being undertaken by Earth Tech, several
elements of risk present themselves which must be considered when developing the preferred strategy in moving forward with design and construction of the additional scope of work. Areas of risk include a potential increase in cost and schedule to issue an RFP for the additional works, potential increased costs associated with coordination of two separate engineering firms designing in the same location, and the cost and logistical issues with becoming ‘constructor’ under the Occupational Health and Safety Act (OHSA) for having two contractors working in close proximity and costs associated with inflation resulting from schedule delays.

As such, understanding the risks associated with the various alternatives, analyses were undertaken to determine how best the City can most effectively proceed in implementing the ultimate upgrades required by comparing, tendering the newly proposed works separately, expanding the existing assignment with Earth Tech Canada to include the newly proposed work verses cancelling the existing contract and re-issuing a new RFP for the Entire Works.

**ANALYSIS/RATIONALE:**

Implementation of the works identified by the Master Plan represents a significant change in scope from the original primary clarifier hydraulic improvements scope of work being undertaken by Earth Tech. A number of approaches to implementing these works were evaluated. In order to best manage the overall project costs and risks to the City, three alternatives were considered feasible:

1. Have Earth Tech complete the design and implement the primary clarifier hydraulic upgrades (Existing Works), and retain a new consultant through Request for Proposal (RFP) to design and implement the additional works identified by the Master Plan (Proposed Works),

2. Increase Earth Tech’s scope of work to include all of the items identified by the Master Plan (Proposed Works), and

3. Cancel the existing assignment with Earth Tech and re-tender the Entire Works (Existing and Proposed).

Key elements in analyzing these alternatives are Cost, Schedule, Opportunities, and Risk. Table 1 summarizes the estimated cost and schedule implications for each alternative for the Total Project including the expanded works.

### Table 1: Cost and Schedule Estimates

<table>
<thead>
<tr>
<th>Item</th>
<th>Alternative 1 (two projects)</th>
<th>Alternative 2 (one project)</th>
<th>Alternative 3 (Re-tender Entire Works)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Cost ($-millions)</td>
<td>$4.00</td>
<td>$3.00</td>
<td>$3.1 (plus $0.3 resulting from cancellation of original contract)</td>
</tr>
<tr>
<td>Capital Cost ($-millions)</td>
<td>$48.5</td>
<td>$45.0</td>
<td>49.5</td>
</tr>
<tr>
<td>Total Project Cost ($-millions)</td>
<td>$52.50</td>
<td>$48.00</td>
<td>$52.9</td>
</tr>
<tr>
<td>Project Implementation (months)</td>
<td>47</td>
<td>37</td>
<td>48</td>
</tr>
</tbody>
</table>

The above estimates were developed by utilizing industry standards for determining engineering fees based on the estimated construction cost and accounting for additional
costs associated with each alternative. The lower engineering cost for Alternative 2 reflects the elimination of a request for proposal process, the cost for the new consultant to get up to speed as well as completing the conceptual design activities, and the fact that there will be no need for coordination between the two consultants throughout the project. The lower contracting costs are derived by eliminating mobilization/demobilization associated with the second contract, as well as extra coordination and increased contract inflation due to extended schedule. In addition, Alternative 2 offers environmental benefits whereby timely completion of the hydraulic improvements plus two additional primary clarifiers by almost one year will allow the City to treat more wet weather flows at the Woodward WWTP thereby reducing untreated combined sewer overflows to Hamilton Harbour.

Table 2 summarizes the opportunities and risks for the City of Hamilton associated with Alternative 2 - One Project.

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to achieve improved water quality discharge targets one year earlier (RAP, dechlorination, etc.).</td>
<td>Sole source award of significant “added” work to Earth Tech.</td>
</tr>
<tr>
<td>Less impact on operations, impacts shorter duration and better able to coordinate/plan.</td>
<td></td>
</tr>
<tr>
<td>Project completed and contractor off-site reduces coordination and potential impacts on other site projects (secondary treatment, power, etc.)</td>
<td></td>
</tr>
<tr>
<td>Less potential for claims due to delay and coordination issues.</td>
<td></td>
</tr>
<tr>
<td>Best able to demonstrate how the City is doing everything possible to maintain schedule should an extension to COIP funding be required.</td>
<td></td>
</tr>
<tr>
<td>Flexibility to accelerate schedule given Earth Tech’s previous involvement with the design and construction of the primary clarifiers.</td>
<td></td>
</tr>
<tr>
<td>Reduced impact of construction cost escalation by completing work sooner.</td>
<td></td>
</tr>
<tr>
<td>$4.5M savings from reduced Engineering and Construction cost as well as 10 months saving in schedule.</td>
<td></td>
</tr>
</tbody>
</table>

Therefore it is expected that by moving forward with Alternative 2, the City can save $4.5M on the total Project Cost, deliver the project 10 months sooner than that of the next best alternative being Alternative 1, while realizing Opportunities as outlined in Table 2.

**ALTERNATIVES FOR CONSIDERATION:**

An alternative (Alternative 1) considered was to tender the additional Proposed Works separately. The process for tendering the Proposed Works separately includes,
retaining a consultant through the Roster program to first develop a Terms of Reference for a proposal call through RFP to select a consultant to design and implement the additional Master Plan scope of work. The consultant, once selected, would validate/undertake additional CFD computer modelling, complete conceptual design, detailed design, tender and contract administration services for the works. The Consultant and Earth Tech would then be required to coordinate design activities to ensure that the Consultant understands the scope of work, interaction between the various project components, and incorporates any changes implemented during the construction of the hydraulic upgrades.

In order to minimize the risks/impacts to the City during design and especially during construction, and to avoid the City becoming ‘Constructor’, the tender and construction of the Master Plan works would need to be scheduled to take place after commissioning of the original primary clarifier hydraulics upgrades.

Table 3 summarizes the opportunities and risks for the City of Hamilton associated with Alternative 1 - Two Projects

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitive pricing procedure for consulting services.</td>
<td>Added effort required due to need for consultants to coordinate design and construction activities.</td>
</tr>
<tr>
<td>Two smaller construction projects would allow more contractors to be able to bid than one single $45M.</td>
<td>Additional effort required for City staff to administer two consultants and two construction project. Staff resources are already stretched given the magnitude of the overall program.</td>
</tr>
<tr>
<td>Cost of project spread over more time.</td>
<td>Impact to operations due to the longer construction period.</td>
</tr>
<tr>
<td>Infrastructure completed under the first project will not be available for use until the second construction phase catches up.</td>
<td>City could be exposed to claims for delays in the second construction contract if the first contract does not get completed on schedule.</td>
</tr>
<tr>
<td>More opportunity for claims due to the number of connection points and the fact that two contractors and two consultants are involved.</td>
<td>This will be aggravated by the fact that the first Contractor will have left the site when the second contract is commissioned.</td>
</tr>
</tbody>
</table>

A second alternative (Alternative 3) considered was to cancel the existing contract and re-tender the Entire Works (Existing and Proposed) through a new Request For Proposal (RFP) process. The process of re-tendering the Entire Works would include, cancelling the existing contract with Earth Tech, paying for services completed to date and collect all completed works. The City would then need to retain a consultant through the Roster program to develop a new Terms of Reference for a proposal call through RFP to select a consultant to design and implement the Entire Works. The consultant, once selected, would be required to first validate any engineering
calculations and CFD computer modelling results provided as deliverables from the original Earth Tech contract, undertake additional engineering and CFD computer modelling to complete the Existing Works as well as all engineering work for the Proposed Works, complete conceptual design, detailed design, tender and contract administration services.

Table 4 summarizes the opportunities and risks for the City of Hamilton associated with Alternative 3 - Re-Tendering Entire Works

### Table 3: Opportunities and Risk Associated with Alternative 3

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitive pricing procedure for consulting services.</td>
<td>Longer schedule results in higher contract pricing due to inflation</td>
</tr>
<tr>
<td>One consolidated contract would be easier to manage</td>
<td>Longer schedule results in missed opportunity to improve effluent discharge for over a one year period</td>
</tr>
<tr>
<td>Less potential for claims due to delay and coordination issues.</td>
<td>Longer schedule impacts ability to meet Federal Funding obligations</td>
</tr>
<tr>
<td></td>
<td>Cancelling existing contract will result in lost investment estimated at $300,000 as any new engineering firm will need to re-validate all work done by existing engineering firm in order to accept the inherent liabilities</td>
</tr>
</tbody>
</table>

### FINANCIAL/STAFFING/LEGAL IMPLICATIONS:

**Financial Implications:** Moving forward with the recommended approach is estimated to create an estimated avoided cost of $4.5M on the total project cost. The $3.0m in engineering costs for alternative 2 less the previously approved spending for hydraulic upgrades would result in an additional $2.0M required for the negotiated expanded works. There is sufficient available funding in Account No. 5160366302 - Primary Clarifier Capacity Expansion for these engineering costs associated with alternative 2.

**Staffing Implications:** Moving forward with the recommended approach offers the least impacts on staffing requirements.

**Legal Implications:** Moving forward with the recommended approach offers the least impacts on potential Legal Implications.

### POLICIES AFFECTING PROPOSAL:

**The Public Works Strategy Plan, Innovate Now**

The recommendations from this report will assist in meeting the Public Works key goal to be recognized as the centre of environmental and innovative excellence in Canada. In addition, implementing the recommendations will also assist Public Works in building on our Strategic Vision Drivers as follows:

- **Communities (Services our communities connect with and trust)** – Implementing the recommended approach will allow for improvements to our local environment by realizing the benefits of wet weather treatment 10 months sooner than
any alternative. A cleaner environment will result from this work through reduced water pollution, contributing to a healthier community, and a greater ability to make use of the waterfront and the Harbour as an area for recreation.

- **People (Skilled teams ready for any situation)** –
  This program demonstrates the ability of our City staff to respond to an important and complex opportunity that affects our community. Implementing proposed wastewater improvements requires the knowledge and skill of many staff that work with the system on a daily basis. Through an extensive consultation process stakeholders including many employees were invited to provide their input and contribute throughout the decision-making process. The proposed solution represents forward and innovative thinking that will highlight the City of Hamilton as a leader in protecting the environment.

- **Process (Smart processes to match our needs)** –
  Throughout the development process, plans have been formulated to ensure that all aspects of the Triple Bottom Line approach to problem solving are considered. Social, Environmental, and Economic impacts were all assessed to provide a balanced approach to the preferred alternative. A detailed analysis was employed in order to effectively arrive at the optimal solution which meets Hamilton-specific goals and objectives. The result is a sustainable long-term approach that addresses pressures from City growth, legislated requirements, and environmental protection.

- **Finances (Sound finance management for the long haul)** –
  By analyzing cost on a full project cycle rather than strictly the engineering element, the analysis was able to demonstrate that the recommended approach is estimated to yield the City $4.5M in savings.

### RELEVANT CONSULTATION:

All analysis was undertaken by Public Works staff including input from M.G. Thorne and Associates acting as an independent advisor, Corporate Services including Finance who validated sufficient funds exist in the identified account and Purchasing who recommended this report be brought forward.

### CITY STRATEGIC COMMITMENT:

By evaluating the “Triple Bottom Line”, (community, environment, economic implications) we can make choices that create value across all three bottom lines, moving us closer to our vision for a sustainable community, and Provincial interests.

- **Community Well-Being is enhanced.** ☑ Yes ☐ No
  Maximum utilization of existing infrastructure.

- **Environmental Well-Being is enhanced.** ☑ Yes ☐ No
  Supports improvement to Hamilton Harbour Water Quality.

- **Economic Well-Being is enhanced.** ☑ Yes ☐ No
  Direct savings to the City will be realized.

**Does the option you are recommending create value across all three bottom lines?**

☑ Yes ☐ No

As per above.

**Do the options you are recommending make Hamilton a City of choice for high performance public servants?**

☑ Yes ☐ No