

APPENDIX H

TECHNICAL MEMORANDUM #4

**City-wide Sanitary Servicing
Master Plan Update: Technical
Memorandum 4**

Task 3: Hydraulic Model
Benefit/Cost Analysis



Prepared for:
City of Waterloo


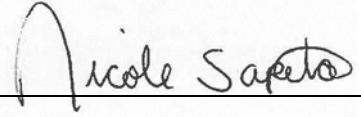
Prepared by:
Stantec Consulting Ltd.

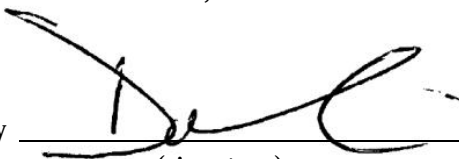
November 19, 2013

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Sign-off Sheet

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Background
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1.0 Background

The City of Waterloo (City) has retained Stantec Consulting Ltd. (Stantec) to complete the Waterloo Sanitary Servicing Master Plan (Master Plan). The purpose of the Master Plan update is to account for increases in population and employment growth projections up to a planning horizon of 2031, with consideration for the 2041 mature state boundary. Priority and strategic projects will be evaluated to allow the system to continue to operate efficiently and effectively operate, implement best management practices, and optimize staging of the sanitary capital program.

The following tasks form the basis of the Master Plan:

- Task 1: GIS Sanitary Quality Control and Field Verification - Complete
- Task 2: Hydraulic Needs Assessment - Complete
- Task 3: Hydraulic Model Benefit/Cost Analysis
- Task 4: Hydraulic Model Development, Train, and Implement
- Task 5: Flow Monitoring and Inflow/Infiltration
- Task 6: Public Consultation
- Task 7: Master Plan

Task 3 is intended to evaluate the net benefit of the City purchasing and implementing the preferred hydraulic model, PCSWMM. Both financial and non-financial factors shall be considered, including short and long term financial costs, access to technical expertise, staffing requirements, service levels, as well as utilization of assets, future opportunities, and faster implementation of projects.

2.0 Model Implementation Scenarios

The City has various options moving forward, including the option to own and implement the model outright, or to incorporate a Third Party in the modeling process. The third party involvement may range from providing engineering oversight of City processes, to full model development, maintenance and analyses. The City also has the option of allowing a Third Party Consultant to purchase and maintain the software, rather than the City incurring these costs and responsibilities. Each of these options has a distinct set of associated costs, benefits and risks to the City.

To allow for a direct basis of comparison from which to evaluate the relative costs and benefits of these short-term implementation options, four implementation scenarios have been created. The short-term level of effort and associated costs can be estimated with a high degree of accuracy, while future model applications and effort are highly variable, thus harder to define. Therefore, the economic evaluation will be based on the following four scenarios:

- Scenario 1: City owns, maintains, completes analyses and performs engineering oversight.
- Scenario 2: City owns, maintains, and completes analyses and third party performs engineering oversight.
- Scenario 3: City owns and maintains the model, and third party completes analyses, performs engineering oversight.
- Scenario 4: Third party provides all services (owns, maintains, completes analyses, and performs engineering oversight).

2.1 SCENARIO 1

In Scenario 1, the City purchases the modeling software and maintains the model in-house. The City will be responsible for all software costs (capital and annual maintenance fees), administrative time, and IT support. A City staff member would be designated to maintain the model and complete in-house analyses. In addition, a City Engineer would be required to oversee modeling activities and interpret modeling results.

2.2 SCENARIO 2

Scenario 2 is the same as Scenario 1, however a Third Party Consultant would be responsible for the engineering oversight for model activities and to interpret modeling results.

2.3 SCENARIO 3

In Scenario 3, the City purchases the modeling software and maintains the model in-house. The City will be responsible for all software costs (capital and annual maintenance fees), administrative time, and IT support. A City staff member would be designated to maintain the model, such as updating infrastructure

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Model Implementation Scenarios
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and loading rates. Analyses and engineering oversight would be completed entirely by a Third Party Consultant based on the model provided by the City.

2.4 SCENARIO 4

In Scenario 4, all model operation and maintenance is completed by a Third Party, and the City does not purchase nor implement the model in house. The Third Party will independently purchase the software (capital and annual maintenance fees), with no transfer of associated costs to the City. Therefore, Third Parties will complete all required analyses and provide engineering oversight. The City would still retain copies of the model on a regular basis to ensure an updated version of the model is always available in the event of an issue with a third party. City staff hours would be required to administer Third Party assignments and data exchange, and for on-going internal documentation.

3.0 Evaluation of Scenarios

In order to provide a direct means of comparison, modeling tasks and responsibilities must be quantified to equate a level of effort into financial metrics. A standard five step process (Figure 1) has been assumed based on the primary intended short-term use of the model for development application capacity assessments. It can be noted that model maintenance has not been included in this process as the level of effort will be significantly dependent on the rate of infrastructure upgrades, desired frequency for updating the loading data, and the preferred methodology and frequency for calibration. All implementation scenarios will involve maintaining the model to some extent. In Scenarios 1 through 3, the level of effort for the City will be the same. In Scenario 4, the level of effort for City Staff will be less as the City is not required to make the updates in the modeling software; however, the City will still need to obtain and transfer the supporting information to the Third Party Consultant to complete the updates and maintain records/copies of model versions. Therefore, for simplicity, this effort is assumed to be part of the five step process for the quantitative evaluation.

Roles have been assigned to personnel from either the City or a Third Party Consultant for each of the implementation scenarios based on the standard five step process for completing development application capacity assessments. The functional role assignments for each scenario are illustrated in Figure 2. The standard process and functional roles for each scenario were quantified and evaluated in the following section considering two situations:

- a) An existing full time equivalent (FTE) engineering technician allocated to development review and general model upkeep equivalent to 1 day per week (approximately 0.2 to 0.3 FTE, which is in keeping with the current usage in both Kitchener and Cambridge for the same purposes, and
- b) Hiring a new FTE dedicated to modeling activities. Financial considerations were considered over a five year period and non-financial were considered qualitatively over both the short and long term.

3.1 FINANCIAL ASSESSMENT

The financial portion of the cost/benefit analysis includes one-time costs and on-going annual costs. The one-time costs are associated with the purchase and setup of the model, including software setup, and staff training. Ongoing costs include software vendor annual fees, IT and administrative support, and labour associated with modeling activities. The key functional roles have been identified for each stage of the modeling process, as displayed in Figure 2. Estimated rates for the City functional roles have been provided by the City of Waterloo, and typical rates for third party consultant functional roles have been provided by Stantec. These rates are summarized in Appendix A.

Retail values have been determined for each of the scenarios, including the one-time costs and the annual costs. Table 1 summarizes the net present value for each scenario based on a five year life cycle. Details regarding the retail value calculations are provided in Appendix B.

Software costs have been provided by Computational Hydraulics Int. (see Appendix B), and for the purposes of analysis the more expensive Enterprise subscription rate (Quote Q12911) has been assumed.

Evaluation of Scenarios
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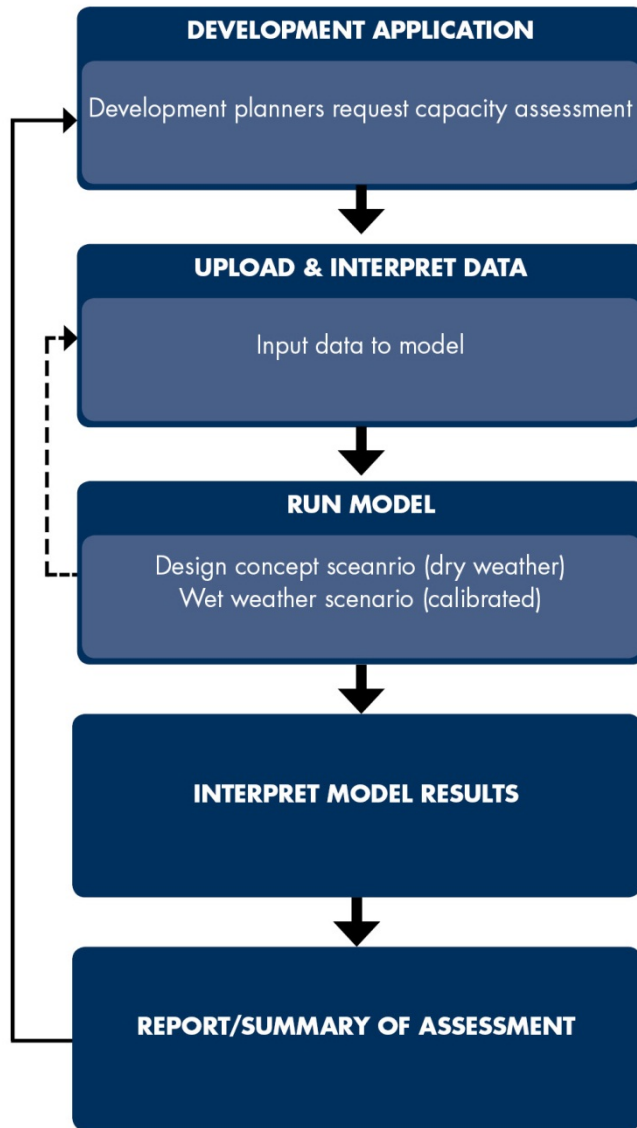
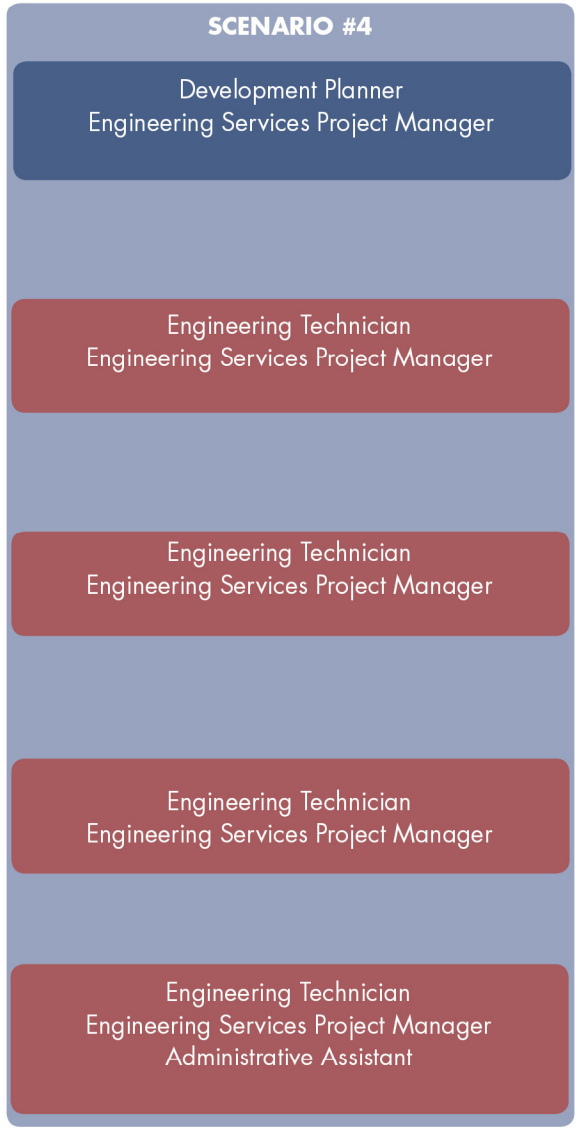
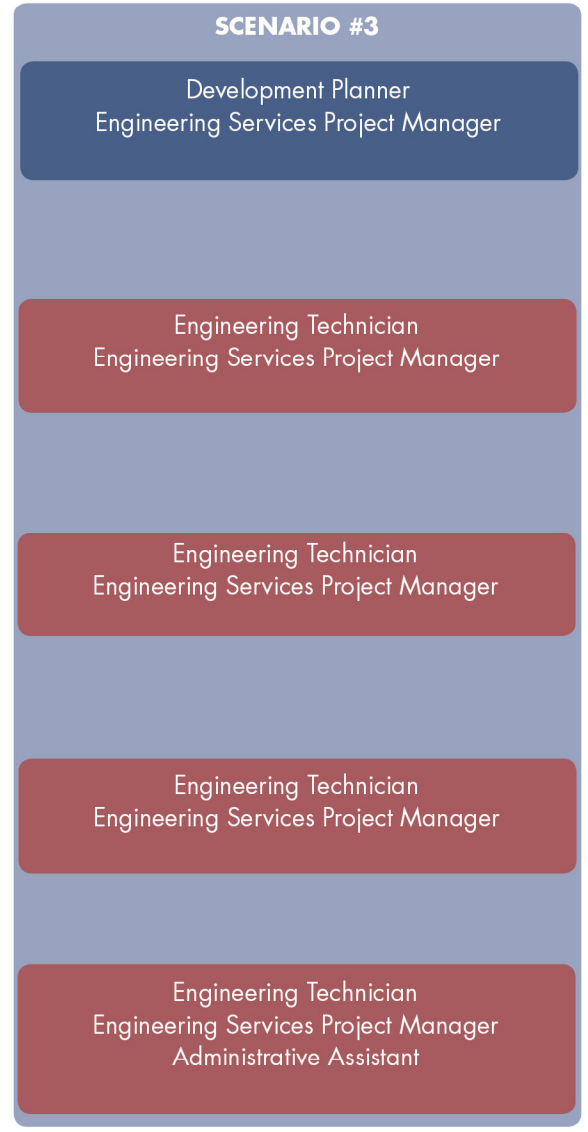
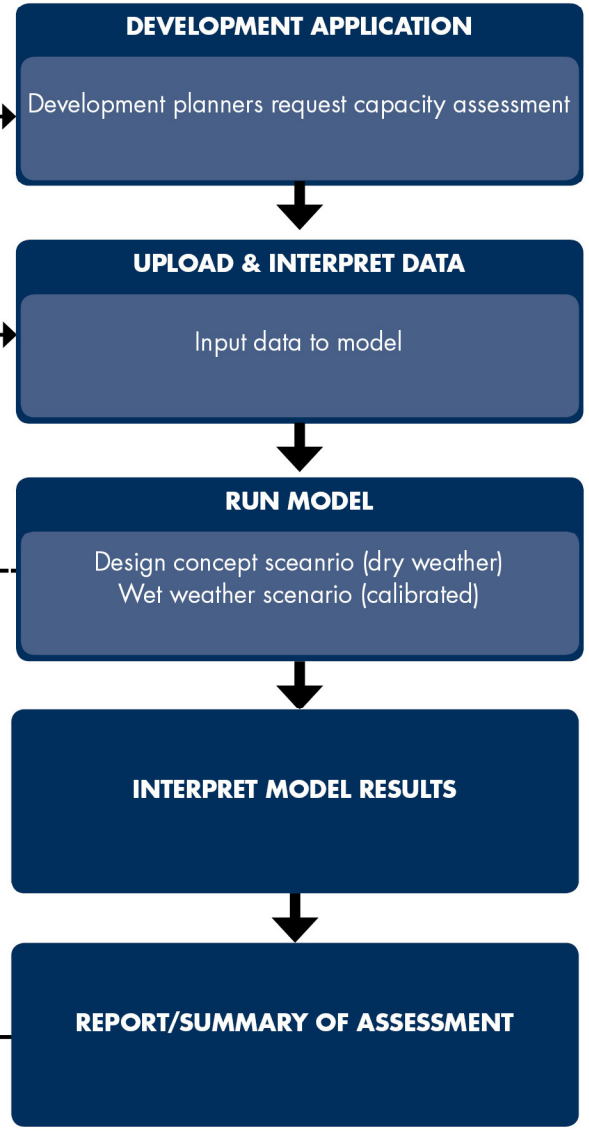


Figure 1: Key Stages in Modeling Activities



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Table 1 presents the results of the 0.2 FTE scenarios, which indicates Scenario 1 has the lowest cost to the City over the five year lifecycle and Scenario 3 has the highest economic impact, due to the heavier reliance on external for-profit resources. It should be noted that the software vendor cost in all scenarios (initial software plus annual maintenance) is less than 5% of the overall five year present value cost; therefore, the majority of economic influence lies within the allocation of labour.

Table 1: Retail Values for 0.2 FTE Implementation Scenarios

Economic	Scenario 1	Scenario 2	Scenario 3	Scenario 4
One Time Cost	\$9,742	\$9,742	\$9,742	\$0
Annual Cost	\$66,322	\$78,573	\$92,072	\$90,826
5yr Present Value ¹	\$335,656	\$395,857	\$462,195	\$446,330

1: Net present value calculated based on a five year lifecycle and an interest rate of 8%, inflation at 1.5%

For context, assuming 10 hrs per standard development review, this would translate to approximately 26 reviews per year, or 1 every two weeks for the entire year. With the inherent variability of number of reviews both annually and throughout the year, the impact at any given time could exceed or underestimate the 0.2 to 0.3 FTE. It is recognized that such a role may not be practical therefore the secondary review assuming a 1.0 FTE was undertaken to see the impact of hiring a new employee as summarized in Table 2.

Table 2: Retail Values for 1.0 FTE Implementation Scenarios

Economic	Scenario 1a	Scenario 2a	Scenario 3a	Scenario 4
One Time Cost	\$9,742	\$9,742	\$9,742	\$0
Annual Cost	\$185,314	\$197,564	\$240,812	\$90,826
5yr Present Value ¹	\$920,393	\$980,594	\$1,193,116	\$446,330

1: Net present value calculated based on a five year lifecycle and an interest rate of 8%, inflation at 1.5%

With the hiring a full-time dedicated employee, the financial impact remains greatest for Scenario 3a. However in terms of relative increase between the 0.2 and 1.0 scenarios, 1a represents the biggest differential since the cost is completely contained at the City with no moderating impact of constant external costs. Since Scenario 4 has no City modeling technician, it represents the cost of not hiring an individual which in the 5-year term, is approximately half of the cheapest Scenario 1a. Therefore, since owning and maintaining the model in-house requires dedication or hiring of an employee, the true economic impact will depend on what degree this staff member will be assigned to model-related activities. Based on the above, it would take an equivalent FTE of 0.33 to equate to Scenario 3 consultant costs.

To test this impact further, an addition set of scenarios were evaluated assuming only 2 development review per year would be conducted, as opposed to the continuous support assumed in Tables 1 and 2.

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Table 3: Retail Values 2 Reviews per Year Implementation Scenarios

Economic	Scenario 1b	Scenario 2b	Scenario 3b	Scenario 4
One Time Cost	\$9,742	\$9,742	\$9,742	\$0
Annual Cost	\$3,825	\$4,296	\$4,781	\$3,535
5yr Present Value ¹	\$28,538	\$30,854	\$33,237	\$17,372

1: Net present value calculated based on a five year lifecycle and an interest rate of 8%, inflation at 1.5%

Therefore, independent of FTE and other model-related efforts and assuming the City does not wish to own the software outright, it is more economical to have a third party conduct the modeling work.

All in all, the true economic impact will depend on the availability of existing staff for model-related activities, and the wish to own the software. Therefore, the City must assess their internal workload needs to evaluate the short and long-term financial viability of dedicated staffing. This is further discussed in the following sections.

3.2 NON-FINANCIAL ASSESSMENT

The non-financial portion of the benefit/cost analysis is intended to address the qualitative factors required for prudent decision-making. Considerations were made for staffing, software, asset management, and functionality. Key issues were identified by the City at the outset of the benefit/cost analysis and have been incorporated into the non-financial assessment. Non-financial evaluation criteria have been assigned a score of one through five, one being the least desirable and five being the most desirable.

3.2.1 Staff Considerations

Key items relating to staff considerations include the organizational readiness and capacity, staff training requirements, level of expertise required, and ability for City staff to access and review model inputs and results. The implementation scenarios have been scored based on these categories, as indicated the following table.

Staff Considerations	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Organizational Readiness and Capacity	2	3	4	5
Training Requirements	2	3	4	5
Level of Expertise	3	4	5	5
Staff Considerations Total	7	10	13	15

Organizational readiness and capacity can be defined as the City's immediate ability to commence work, taking into account any required startup time prior to the commencement of work. The City's need for 'ramp-up' time may be affected by the need for staffing adjustments, training, protocol development, and

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model setup. A greater involvement of the third party consultants will reduce the start-up time and preparatory activities required by the City, since we can assume any out-sourced professional firm will already have adequately trained modeling staff. In addition, should the modeling activities require a significant amount of effort, a third party consultant may have multiple qualified staff that could complete tasks in a more timely manner in comparison to the finite number of trained staff that would be available from the City to complete assignments. Based on these considerations, Scenario 4 has received the highest score and Scenario 1 has received the lowest score for organizational readiness.

The recommended training for City staff is dependent on their level of responsibility as it pertains to modeling activities. The level of responsibility for the City decreases as you progress from Scenario 1 to Scenario 4, corresponding to the decreasing level of analysis that is completed in house. In Scenarios 1 and 2, the City will be completing the majority of the analysis internally; therefore, a higher level of competency is required and the City is responsible for providing more extensive training to staff member(s). Scenarios 3 and 4 would require less training for City staff as the third party consultant will be responsible for the majority of the analysis. Based on these considerations, the highest score was assigned to Scenario 4, and the assigned score progressively decreased from Scenario 4 through Scenario 1.

In addition to training, an appropriate educational background and experience level is recommended for the personnel involved in modeling activities and oversight. The involvement of a third party may relieve the City of the need to internally maintain such a high level of expertise for what is likely to be a part-time role. Third Party Consultants collectively have a greater ability to retain designated modeling personnel and maintain best practice knowledge as part of on-going business with other clients, allowing them to provide a continued high level of expertise over time. For this reason, Scenarios 3 and 4 have scored higher than Scenarios 1 and 2, as there is greater involvement from Third Party Consultants.

3.2.2 Model Integrity

Model integrity relates to the model input data (i.e. infrastructure updates, dry weather and wet weather flow loading, calibration, etc.) and model versions (i.e. using correct versions, incorporating updates from multiple users). Ensuring the correct information is input into the model, and the correct version is used for the analysis, provides more accurate results. In addition, if the City staff are more familiar with the model and have a better system understanding, they will be able to better interpret and use the model results over the long term to ensure recommended upgrades or system modifications are beneficial. The implementation scenarios have been scored based on these considerations, as indicated below.

Model Integrity	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Risk to Model Data/Version Integrity	5	5	1	1
System Understanding	5	5	1	1
Model Integrity Total	10	10	2	2

Transferring the model versions, input information, and associated files between the City and third party consultants presents a risk for losing data or difficulty maintaining accurate versions between users. A file tracking system will be required, in addition to regular model maintenance, to maintain the integrity of

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the model versions and ensure information is up to date. Scenarios 3 and 4 will involve a greater number of files and more information to be transferred between the City and the third party consultant; therefore, they received the lowest score for risk to model data/version integrity. Conversely, Scenario 1 and Scenario 2 will require less files and information to be transferred between the City and the third party consultant; therefore, they received the highest score.

City staff will be more familiar with the model and develop a better understanding of the system the more involved they are in modeling activities. This will assist in interpreting modeling results and understanding the need for upgrades. In addition, having the system understanding in-house presents opportunities to coordinate with other departments to optimize upgrades based on information that may not easily be provided to the third party consultant. These factors will allow City staff to make more educated decisions and optimize the use of allocated funding. Based on these considerations, Scenarios 1 and 2 were assigned higher scores as they have greater City staff involvement for modeling activities, and Scenarios 3 and 4 were assigned lower scores.

3.2.3 Model Functionality

The software program recommended is PCSWMM. The functionality of the software program will be equivalent regardless of whether the model is maintained internally or by a third party. However, the ability of the City to access the model directly will impact the model functionality with respect to the flexibility to conduct internal analysis depending on how the needs of the City evolve. This functionality was scored based on these considerations, as indicated below.

Functionality	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Model Access and Flexibility	5	5	3	2
Functionality Total	5	5	3	2

In Scenarios 1, 2, and 3, the City owns the software program and software license, allowing staff to access the model directly. Staff benefit from the ability to review the model inputs and results more easily, and allows them the flexibility to conduct analysis internally if desired. Scenarios 1 and 2 have the greatest involvement from City staff and scored the highest for this category. Scenario 4 has the lowest involvement and therefore scores lowest. Scenario 3 has been assigned a midrange score because, although the software is available for the City staff to complete analyses, they may not have the appropriate knowledge and training to effectively use the model and obtain meaningful results.

3.2.4 Liability and Risk

Including a third party consultant in modeling activities allows the engineering decisions to be shared between the City and the third party. As a result, the liability associated with the modeling activities is dispersed between the two parties. However, there may be an increased risk associated with the ability of the City to access and use the software when relying on a third party consultant. In the unlikely event of the sudden termination of the working relationship between the City and a Third Party Consultant, the modeling analyses would be interrupted until the City retains another consultant. The liability and risk has been scored based on these considerations, as indicated below.

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Liability and Risk	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Liability for City	1	2	4	4
Risk of Dependence on Third Party	5	4	3	1
Liability and Risk Total	6	6	7	5

In Scenario 1, the City has the greatest involvement in the modeling activities; therefore, they would have the greatest liability. As a result, the lowest score was assigned to Scenario 1. Scenarios 3 and 4 were considered to have the lowest liability as the majority of the analysis is being completed by a Third Party Consultant, and were given the highest scores.

Although a greater amount liability is taken on by the City for Scenario 1, it is also associated with the lowest dependence on a Third Party. Therefore, it was considered to have the lowest risk for maintaining continued access to the model and received the highest score for the risk of dependence on a Third Party. The dependence on the Third Party Consultant, and therefore associated risk, increases progressively from Scenario 1 through Scenario 4. As a result, the score assigned for each scenario decreases as you progress from Scenario 1 to Scenario 4, Scenario 4 receiving the lowest score.

3.2.5 Non-Financial Evaluation Summary

The results of the non-financial assessment are summarized below.

Categories	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Staff Considerations	7	10	13	15
Model Integrity	10	10	2	2
Functionality	5	5	3	2
Liability and Risk	6	6	7	5
Overall Score	28	31	25	24

When reviewed without an economic perspective, the non-financial scoring (assuming equal weighting for each category) results in Scenarios 1 and 2 as the most desirable options. The merits of internal ownership and staff familiarity of the hydraulic model and the underlying asset/system performance, outweigh the risks associated with staffing allocation and in-house liability.

3.3 LONG TERM ACTIVITIES

The preliminary use, as identified by the City is capacity assessments for development applications. Based on this, the evaluation of scenarios, including the workflow processes, has been completed based on this initial short-term primary use.

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Additional long-term activities that the City identified as potential uses for the model include: design assessments, operational performance assessment, evaluating alternate servicing strategies/master planning, asset management, and rehabilitation planning using inflow/infiltration (I/I) data. These alternate activities may follow a separate process, and have not been included in the short-term evaluation process; however, it is acknowledged that there would be distinct benefits in the long-term with a functioning, continually updated hydraulic modeling tool.

3.4 OVERALL EVALUATION

Combining the financial and non-financial assessments, it is evident that there is ample net benefit in support of the City owning, operating and maintaining a hydraulic model of their collection system in the short term. This is further bolstered by the increasing benefits of expanded future functionality and natural progression to integration with storm drainage system management.

By way of summary, the following provides a further qualitative overview of the benefits and challenges associated with hydraulic model ownership and internal operation:

Benefits:

- Enhanced understanding of collection system operation, performance and system characteristics.
- Greater ability to control data management and integration with internal divisional pursuits.
- Low model investment and annual maintenance cost.
- Flexibility to perform work in-house or via third party.
- Experience and processes defined can easily translate to expansion to storm drainage collection system management.

Challenges:

- Allocating appropriate staff and/or roles in the short-term.
- Defining long-term need for related dedicated position(s).
- Overcome implications of staff mobility and reorganization.
- Defining an internal structure to maintain long-term model implementation and upkeep.
- Training.
- Maintaining 'momentum' over the long-term.

Based on the size of the City, it is unlikely that a modeling role would occupy a full time equivalent (FTE) position unless it was partnered with additional collections system management pursuits such as



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infiltration and inflow monitoring/planning, infrastructure rehabilitation, operations and maintenance tracking, and capital planning, which would naturally encompass storm drainage infrastructure pursuits as well. This would require an organizational structure review that is beyond the scope of this report.

4.0 Conclusions & Recommendations

Task 2 of the Master Plan demonstrated the City's desire from both a management and operational staff standpoint, to own, operate and maintain a hydraulic model of the sanitary collection system. From the benefit/cost assessment presented herein, there is both an economic and non-financial net benefit in support of this endeavour. Not without its challenges, implementation of a hydraulic model will require dedication from management and internal staff to the development and continued application of a structure and associated processes to maintain the long-term successful use of this tool.

It is recommended that based on the economic values presented herein, the City undertake a review of their internal workload needs along with available internal funding sources to further evaluate the long-term organizational and financial viability of dedicated staffing for model-related activities. In the interim, model development activities for the Master Plan will continue independent of resolving the staffing question, and the decision to purchase the software shall be determined at that time.

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Appendix A: Rates for Key Functional Roles
January 3, 2014

Appendix A : Rates for Key Functional Roles

To: Leigh McDermott
 Kitchener ON Office

From: Jenn Hale
 Kitchener ON Office

File: 1611 11191/10

Date: December 10, 2013

Reference: Cost Benefit Analysis Data

CITY STAFF RATES

For costing purposes, financial rates for key functional roles were provided by the City of Waterloo. These functional roles represent the key City staff members expected to be involved in modeling activities.

Functional Role	Annual Salary	Daily Rate
Administrative Assistant		
IT Support		
IT Supervisor		
Engineering Technician		
Engineering Services Project Manager		
Development Planning Support (GIS Analyst, Network Admin, Zoning Clerk)		
Development Planner		

These rates are confidential, and rounded values have been provided. The rates were updated based on the revised rates provided to Leigh McDermott by Jakub Cyberling via email on December 5, 2013.

All salaries above are based on a 35 hour work week (7hrs/day). The listed salaries approximate the maximum for the pay band. For the purposes of the financial analysis, all staff members are assumed to be regular full time employees; therefore 41% has been added to each salary to account for overhead costs such as benefits/EHT/WSB etc. Rates are expected to increase at a rate of 1.5% until 2015.

Reference: Cost Benefit Analysis Data

THIRD PARTY CONSULTANT RATES

For costing purposes, Stantec has provided rate estimates for key functional roles. These functional roles represent the key personnel expected to be involved in modeling activities. All salaries below are based on a 35 hour work week (7hrs/day).

Functional Role	Hourly Rate	Daily Rate
Engineering Services Project Manager		
Engineering Technician		
Administrative Assistant		

STANTEC CONSULTING LTD.

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Engineering Intern
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Appendix B: Financial Lifecycle Analysis
January 3, 2014

Appendix B : Financial Lifecycle Analysis

Scenario #1 - City Owns, Maintains, Operates Model In-House Only (0.2 FTE)

Stage	Item	Lump Sum	Staff	Rate/day	Days/yr	Cost
One Time Costs	Purchase of Software ²	\$4,960				
	Training	\$3,500				
	IT Supervisor		City			
Total One Time Costs						
Operational & Maintenance Costs	Vendor Maintenance Fee (2 users)	\$960				
	IT Support		City			
	Administrative Assistant		City			
Development Application	Engineering Services Project Management		City			
	Development Planning Support		City			
	Development Planner		City			
	Engineering, Infrastructure, Development Management		City			
Upload Data	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
Run Model	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
Interpret Data	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
Report/Summary of Assessment	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
	Administrative Assistant		City			
Total Annual Costs						\$66,322
5-Year Lifecycle Present Value³						\$335,656

1. Time allocations are based on the City Engineering Technician dedicating 1 day per week (0.2 FTE) on modelling activities.

2. Software price assumes PCSWMM Enterprise subscription base cost and two per-user subscriptions as per Quote Q12911, exclusive of HST.

3. Present value based on a 5 year lifecycle, 8% interest, and 1.5% inflation.

Scenario #1a - City Owns, Maintains, Operates Model In-House Only (1 FTE)

Stage	Item	Lump Sum	Staff	Rate/day	Days/yr	Cost
One Time Costs	Purchase of Software ²	\$4,960				
	Training	\$3,500				
	IT Supervisor		City			
Total One Time Costs						
Operational & Maintenance Costs	Vendor Maintenance Fee (2 users)	\$960				
	IT Support		City			
	Administrative Assistant		City			
Development Application	Engineering Services Project Management		City			
	Development Planning Support		City			
	Development Planner		City			
	Engineering, Infrastructure, Development Management		City			
Upload Data	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
Run Model	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
Interpret Data	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
Report/Summary of Assessment	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
	Administrative Assistant		City			
Total Annual Costs						\$185,314
5-Year Lifecycle Present Value³						\$920,393

1. Time allocations are based on the City Engineering Technician dedicating 1 day per week (0.2 FTE) on modelling activities.

2. Software price assumes PCSWMM Enterprise subscription base cost and two per-user subscriptions as per Quote Q12911, exclusive of HST.

3. Present value based on a 5 year lifecycle, 8% interest, and 1.5% inflation.

Scenario #1b - City Owns, Maintains, Operates Model In-House Only (2 Reviews/yr)

Stage	Item	Lump Sum	Staff	Rate/day	Days/yr	Cost
One Time Costs	Purchase of Software ²	\$4,960				
	Training	\$3,500				
	IT Supervisor		City			
Total One Time Costs						
Operational & Maintenance Costs	Vendor Maintenance Fee (2 users)	\$960				
	IT Support		City			
	Administrative Assistant		City			
Development Application	Engineering Services Project Management		City			
	Development Planning Support		City			
	Development Planner		City			
	Engineering, Infrastructure, Development Management		City			
Upload Data	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
Run Model	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
Interpret Data	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
Report/Summary of Assessment	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
	Administrative Assistant		City			
Total Annual Costs						\$3,825
5-Year Lifecycle Present Value³						\$28,538

1. Time allocations are based on the City Engineering Technician dedicating 1 day per week (0.2 FTE) on modelling activities.

2. Software price assumes PCSWMM Enterprise subscription base cost and two per-user subscriptions as per Quote Q12911, exclusive of HST.

3. Present value based on a 5 year lifecycle, 8% interest, and 1.5% inflation.

Scenario #2 - City Owns, Maintains, Operates with 3rd Party Oversight (0.2 FTE)

Stage	Item	Lump Sum	Staff	Rate/day	Days/yr	Cost
One Time Costs	Purchase of Software ²	\$4,960				
	Training	\$3,500				
	IT Supervisor		City			
Total One Time Costs						
Operational & Maintenance Costs	Vendor Maintenance Fee	\$960				
	IT Support		City			
	Administrative Assistant		City			
Development Application	Engineering Services Project Management		City			
	Development Planning Support		City			
	Development Planner		City			
	Engineering, Infrastructure, Development Management		City			
Upload Data	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
	Engineering Oversight		3rd Party			
Run Model	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
	Engineering Oversight		3rd Party			
Interpret Data	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
	Engineering Oversight		3rd Party			
Report/Summary of Assessment	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
	Administrative Assistant		City			
	Engineering Oversight		3rd Party			
Total Annual Costs						\$78,573
5-Year Lifecycle Present Value³						\$395,857

1. Time allocations are based on the City Engineering Technician dedicating 1 day per week (0.2 FTE) on modelling activities.

2. Software price assumes PCSWMM Enterprise subscription base cost and two per-user subscriptions as per Quote Q12911, exclusive of HST.

3. Present value based on a 5 year lifecycle, 8% interest, and 1.5% inflation.

Scenario #2a - City Owns, Maintains, Operates with 3rd Party Oversight (1 FTE)

Stage	Item	Lump Sum	Staff	Rate/day	Days/yr	Cost
One Time Costs	Purchase of Software ²	\$4,960				
	Training	\$3,500				
	IT Supervisor		City			
Total One Time Costs						
Operational & Maintenance Costs	Vendor Maintenance Fee	\$960				
	IT Support		City			
	Administrative Assistant		City			
Development Application	Engineering Services Project Management		City			
	Development Planning Support		City			
	Development Planner		City			
	Engineering, Infrastructure, Development Management		City			
Upload Data	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
	Engineering Oversight		3rd Party			
Run Model	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
	Engineering Oversight		3rd Party			
Interpret Data	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
	Engineering Oversight		3rd Party			
Report/Summary of Assessment	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
	Administrative Assistant		City			
	Engineering Oversight		3rd Party			
Total Annual Costs						\$197,564
5-Year Lifecycle Present Value³						\$980,594

1. Time allocations are based on the City Engineering Technician dedicating 1 day per week (0.2 FTE) on modelling activities.

2. Software price assumes PCSWMM Enterprise subscription base cost and two per-user subscriptions as per Quote Q12911, exclusive of HST.

3. Present value based on a 5 year lifecycle, 8% interest, and 1.5% inflation.

Scenario #2b - City Owns, Maintains, Operates with 3rd Party Oversight (2 Reviews/yr)

Stage	Item	Lump Sum	Staff	Rate/day	Days/yr	Cost
One Time Costs	Purchase of Software ²	\$4,960				
	Training	\$3,500				
	IT Supervisor		City			
Total One Time Costs						
Operational & Maintenance Costs	Vendor Maintenance Fee	\$960				
	IT Support		City			
	Administrative Assistant		City			
Development Application	Engineering Services Project Management		City			
	Development Planning Support		City			
	Development Planner		City			
	Engineering, Infrastructure, Development Management		City			
Upload Data	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
	Engineering Oversight		3rd Party			
Run Model	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
	Engineering Oversight		3rd Party			
Interpret Data	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
	Engineering Oversight		3rd Party			
Report/Summary of Assessment	Engineering Technician ¹		City			
	Engineering Services Project Management		City			
	Administrative Assistant		City			
	Engineering Oversight		3rd Party			
Total Annual Costs						\$4,296
5-Year Lifecycle Present Value³						\$30,854

1. Time allocations are based on the City Engineering Technician dedicating 1 day per week (0.2 FTE) on modelling activities.

2. Software price assumes PCSWMM Enterprise subscription base cost and two per-user subscriptions as per Quote Q12911, exclusive of HST.

3. Present value based on a 5 year lifecycle, 8% interest, and 1.5% inflation.

Scenario #3 - City Owns & Maintains, with 3rd Party Operation (0.2 FTE)

Stage	Item	Lump Sum	Staff	Rate/day	Days/yr	Cost
One Time Costs	Purchase of Software ²	\$4,960				
	Training	\$3,500				
	IT Supervisor		City			
Total One Time Costs						
Operational & Maintenance Costs	Vendor Maintenance Fee	\$960				
	IT Support		City			
	Administrative Assistant		City			
Development Application	Engineering Services Project Management		City			
	Development Planning Support		City			
	Development Planner		City			
	Engineering, Infrastructure, Development Management		City			
Upload Data	Engineering Technician ¹		3rd Party			
	Engineering Services Project Management		3rd Party			
Run Model	Engineering Technician ¹		3rd Party			
	Engineering Services Project Management		3rd Party			
Interpret Data	Engineering Technician ¹		3rd Party			
	Engineering Services Project Management		3rd Party			
Report/Summary of Assessment	Engineering Technician ¹		3rd Party			
	Engineering Services Project Management		3rd Party			
	Administrative Assistant		3rd Party			
Total Annual Costs						\$92,072
5-Year Lifecycle Present Value³						\$462,195

1. No FTE City Staff required for modelling.
2. Software price assumes PCSWMM Enterprise subscription base cost and two per-user subscriptions as per Quote Q12911, exclusive of HST.
3. Present value based on a 5 year lifecycle, 8% interest, and 1.5% inflation.

Scenario #3a - City Owns & Maintains, with 3rd Party Operation (1 FTE, Continuous)

Stage	Item	Lump Sum	Staff	Rate/day	Days/yr	Cost
One Time Costs	Purchase of Software ²	\$4,960				
	Training	\$3,500				
	IT Supervisor		City			
Total One Time Costs						
Operational & Maintenance Costs	Vendor Maintenance Fee	\$960				
	IT Support		City			
	Administrative Assistant		City			
Development Application	Engineering Services Project Management		City			
	Development Planning Support		City			
	Development Planner		City			
	Engineering, Infrastructure, Development Management		City			
Upload Data	Engineering Technician ¹		3rd Party			
	Engineering Services Project Management		3rd Party			
Run Model	Engineering Technician ¹		3rd Party			
	Engineering Services Project Management		3rd Party			
Interpret Data	Engineering Technician ¹		3rd Party			
	Engineering Services Project Management		3rd Party			
Report/Summary of Assessment	Engineering Technician ¹		City			
	Engineering Technician ¹		3rd Party			
	Engineering Services Project Management		3rd Party			
	Administrative Assistant		3rd Party			
Total Annual Costs						\$240,812
5-Year Lifecycle Present Value³						\$1,193,116

1. No FTE City Staff required for modelling.

2. Software price assumes PCSWMM Enterprise subscription base cost and two per-user subscriptions as per Quote Q12911, exclusive of HST.

3. Present value based on a 5 year lifecycle, 8% interest, and 1.5% inflation.

Scenario #3b - City Owns & Maintains, with 3rd Party Operation (2 Reviews/yr)

Stage	Item	Lump Sum	Staff	Rate/day	Days/yr	Cost
One Time Costs	Purchase of Software ²	\$4,960				
	Training	\$3,500				
	IT Supervisor		City			
Total One Time Costs						
Operational & Maintenance Costs	Vendor Maintenance Fee	\$960				
	IT Support		City			
	Administrative Assistant		City			
Development Application	Engineering Services Project Management		City			
	Development Planning Support		City			
	Development Planner		City			
	Engineering, Infrastructure, Development Management		City			
Upload Data	Engineering Technician ¹		3rd Party			
	Engineering Services Project Management		3rd Party			
Run Model	Engineering Technician ¹		3rd Party			
	Engineering Services Project Management		3rd Party			
Interpret Data	Engineering Technician ¹		3rd Party			
	Engineering Services Project Management		3rd Party			
Report/Summary of Assessment	Engineering Technician ¹		3rd Party			
	Engineering Services Project Management		3rd Party			
	Administrative Assistant		3rd Party			
Total Annual Costs						\$4,781
5-Year Lifecycle Present Value³						\$33,237

1. No FTE City Staff required for modelling.

2. Software price assumes PCSWMM Enterprise subscription base cost and two per-user subscriptions as per Quote Q12911, exclusive of HST.

3. Present value based on a 5 year lifecycle, 8% interest, and 1.5% inflation.

Scenario #4 - 3rd Party Completely Maintains, Operates Model (0.2 FTE, Continuous)

Stage	Item	Lump Sum	Staff	Rate/day	Days/yr	Cost
One Time Costs	Purchase of Software ²	\$0	--			
	Training	\$0	--			
Total One Time Costs						
Operational & Maintenance Costs	Vendor Maintenance Fee	\$0				
	IT Support		City			
	Administrative Assistant		City			
Development Application	Engineering Services Project Management		City			
	Development Planning Support		City			
	Development Planner		City			
	Engineering, Infrastructure, Development Management		City			
Upload Data	Engineering Technician ¹		3rd Party			
	Engineering Services Project Management		3rd Party			
Run Model	Engineering Technician ¹		3rd Party			
	Engineering Services Project Management		3rd Party			
Interpret Data	Engineering Technician ¹		3rd Party			
	Engineering Services Project Management		3rd Party			
Report/Summary of Assessment	Engineering Technician ¹		3rd Party			
	Engineering Services Project Management		3rd Party			
	Administrative Assistant		3rd Party			
Total Annual Costs						\$90,826
5-Year Lifecycle Present Value³						\$446,330

1. No FTE City Staff required for modelling.
2. Software purchase not required by City.
3. Present value based on a 5 year lifecycle, 8% interest, and 1.5% inflation.

Computational Hydraulics Int.

147 Wyndham Street, Suite 202
Guelph, Ontario, Canada, N1H 4E9
Tel: (519) 767-0197 Fax: (519) 489-0695
Email: info@chiwater.com
Web: www.chiwater.com

Quote Q12909

Thursday, August 22, 2013

Client Information

Nicole Sapeta
Stantec Consulting
207 Queens Quay W
Suite 100
Toronto ON M5J 1A7
Canada

Email: nicole.sapeta@stantec.com
Tel: 519-575-4110
Fax:

Shipping Address

Same as client address above...

Billing Address

Same as client address above...

Item	Description	Unit Price	Quantity	Amount
S220	PCSWMM Professional single user subscription (12 months)	\$1,440.00	1	\$1,440.00
SubTotal:				\$1,440.00
Shipping & handling:				\$0.00
HST:				\$187.20
Total in CAD dollars:				\$1,627.20

To confirm this order and enter your payment information, please go to:
<http://www.chiwater.com/pay.asp?Item=Q12909&Name=Sapeta>

This quote is valid till October 22, 2013.

If you have any questions concerning this quote, call: (519) 767-0197

THANK YOU FOR YOUR BUSINESS!

Computational Hydraulics Int.

147 Wyndham Street, Suite 202
Guelph, Ontario, Canada, N1H 4E9
Tel: (519) 767-0197 Fax: (519) 489-0695
Email: info@chiwater.com
Web: www.chiwater.com

Quote Q12910

Thursday, August 22, 2013

Client Information

Nicole Sapeta
Stantec Consulting
207 Queens Quay W
Suite 100
Toronto ON M5J 1A7
Canada

Email: nicole.sapeta@stantec.com
Tel: 519-575-4110
Fax:

Shipping Address

Same as client address above...

Billing Address

Same as client address above...

Item	Description	Unit Price	Quantity	Amount
S222	PCSWMM Professional 2D single user subscription (12 months)	\$2,160.00	1	\$2,160.00
SubTotal:				\$2,160.00
Shipping & handling:				\$0.00
HST:				\$280.80
Total in CAD dollars:				\$2,440.80

To confirm this order and enter your payment information, please go to:
<http://www.chiwater.com/pay.asp?Item=Q12910&Name=Sapeta>

This quote is valid till October 22, 2013.

If you have any questions concerning this quote, call: (519) 767-0197

THANK YOU FOR YOUR BUSINESS!

Computational Hydraulics Int.

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Quote Q12911

Thursday, August 22, 2013

Client Information

Nicole Sapeta
Stantec Consulting
207 Queens Quay W
Suite 100
Toronto ON M5J 1A7
Canada

Email: nicole.sapeta@stantec.com
Tel: 519-575-4110
Fax:

Shipping Address

Same as client address above...

Billing Address

Same as client address above...

Item	Description	Unit Price	Quantity	Amount
S236	PCSWMM Enterprise subscription base cost (12 months)	\$4,000.00	1	\$4,000.00
S237	PCSWMM Enterprise subscription per-user cost (12 months)	\$480.00	3	\$1,440.00
SubTotal:				\$5,440.00
Shipping & handling:				\$0.00
HST:				\$707.20
Total in CAD dollars:				\$6,147.20

To confirm this order and enter your payment information, please go to:
<http://www.chiwater.com/pay.asp?Item=Q12911&Name=Sapeta>

This quote is valid till October 22, 2013.

If you have any questions concerning this quote, call: (519) 767-0197

THANK YOU FOR YOUR BUSINESS!

CITY-WIDE SANITARY SERVICING MASTER PLAN UPDATE: TECHNICAL MEMORANDUM 4

Appendix C: Benefit/Cost Spreadsheet
January 3, 2014

Appendix C : Benefit/Cost Spreadsheet

Hydraulic Model Benefit/Cost Analysis

Topical Area	Item	Scenario #1	Scenario #2	Scenario #3	Scenario #4
Functional Uses	Master Planning	√	√	√	√
	Capacity Assessments	√	√	√	√
	Development Application Review	√	√	√	
	Storm/Sanitary Flooding	√	√	√	√
	I/I Source Control	√	√	√	√
	Design (Preliminary)	√	√	√	√
	Capital Programming (e.g. Deferrals)	√	√	√	
	Project Scoping (e.g. St. Jacobs WWTF, septic)	√	√	√	
	Operational Enhancements	√	√	√	√
Staffing	Existing Technical Expertise	+	0	0	0
	New Technical Expertise	+	++	++	++
	Internal Maintenance of Expertise	-	-	-	+
	Model User FTE				
	Organizational Capacity	+	+	-	-
	Organizational Readiness	-	-	+	+
	Service Levels to Developers	+	+	+	+
	Service Levels to Region (e.g. leachate, WI4)	+	+	++	++
	Staff Competency & Training	+	+	+	+
	Consultant Analysis/Internal Agility				
	Model Data Management	+	+	-	-
	Internal Workflow (Business Process)	-	+	++	++
	External Model Review	-	+	+	+
	Internal/External Updates (GIS, Amanda)	-	-	+	+
	Model Protocols	-	-	+	+
Software Vendor & Hardware	Software Licence	City Owned	City Owned	City Owned	3rd Party Owned
	Software Support (Annual)	+	+	+	+
	Product Sustainability	+	+	+	+
	Level of Service-Technical Support	+	+	+	+
	Hardware Requirements	no hardware upgrades required			
	Implementation Phase	City	City	City	3rd Party
Asset & Risk Management	Development Charges-Excess Capacity	+	+	+	+
	Waterloo Resident Level of Service	+	+	+	+
	Demand & Capacity	+	+	+	+
	Asset Optimization	+	+	+	+
	Overall Asset Functional Understanding	+	+	+	0
	Risk Retention or Transfer	+	+	-	-
	Technical Competence	+	++	+++	+++
	Asset Performance Monitoring	0	0	0	0
	Asset Maintenance (e.g. Predictive, Preventive)	0	0	0	0
	Qualitative vs. Quantitative Risk Assessment	+	+	+	0
	Staff Participation, Consultation & Awareness	+	+	-	-
	LOS & KPI Monitoring/Targets	+	+	-	-
	Policy Determination & Implementation	+	+	+	0
	Documentation inclusive of metadata	N/A			
Iterative and Defendable Capital Plan Updates	+	++	++	++	
Comparators/Other	GIS Data Integrity				
	GIS Update Methodology				
	Area Municipal Software Implementation				
	Ontario Municipal Benchmarking Initiative				
	National Benchmarking				
	In-house Expertise vs. Outsourcing Practice	To be discussed during Meeting #6b			
	Model Scalability to Storm Analysis				
	Flow Monitoring vs. Model Relative Error				
	Steady vs. Unsteady Flow				
	Reports (e.g. Regulatory, Council)				
	Model Rules (e.g. Barrie @ 278 sub-sewershed)				