

# Request for Research Proposals on the Adaptation of Municipal Water Infrastructure Design to Climate Change

January 24, 2017

## Background

With the urgent challenge that climate change poses, there is a collective need to better understand and rigorously consider our communities' resilience to climate change. The Region of Peel has undertaken the initial steps in addressing climate change through the development of the Peel Climate Change Strategy (PCCS; 2011). To implement the PCCS, the Peel Climate Change Partnership was formed, of which, Toronto Region Conservation Authority (TRCA) is a member. Through this partnership, TRCA led the Peel Region Climate Change Natural Systems Vulnerability Assessment (final draft report 2016) and provided technical review/guidance for the Water and Water Infrastructure Climate Change Vulnerability Assessment lead by Credit Valley Conservation (final report in progress). These reports identify changes in rainfall patterns and volumes that are very likely results of a changing climate affecting Peel Region. These changes are linked to increasing vulnerabilities amongst water resources and in particular exasperating vulnerabilities of municipal stormwater drainage infrastructure. These vulnerabilities include potential increased risk of design failure or increased reduction in capacity during more intense or frequent large storm and flood events. As the managers of stormwater infrastructure, roads and other pieces of infrastructure that may be vulnerable to the effects of increased frequency and intensity of flooding and other effects of climate change, Peel Region and local municipalities are searching for solutions to help them adapt the design and maintenance of their stormwater infrastructure systems.

The current, standard approach to water infrastructure design is based on using Intensity, Duration, Frequency (IDF) curves that are developed using historical rainfall patterns. There is a desire from municipal engineers to simply update the IDF curve to include data from future climate projections. This would allow for a continuation of current design processes with new curves replacing previous ones. Recently, TRCA participated in a study that examined several different techniques using information from climate model future projections to develop new IDF curves. (available at: <http://climateconnections.ca/our-work/a-comparison-of-alternative-techniques-for-deriving-extreme-rainfall-statistics-in-the-context-of-climate-change/>) This study indicated that available science and techniques used to develop new IDF curves are not converging on a solution. This gives TRCA little confidence that a robust solution, (i.e., updating current IDF curves), is likely to be developed soon. In the meantime, guidance that enables

stormwater infrastructure design decisions that are feasible to implement, while accounting for climate change risks and uncertainty, is needed.

The issue of adapting stormwater infrastructure to a changing climate also has spatial and temporal elements that need consideration. While a given piece or section of infrastructure has a life cycle of 50-75 years, the broader network of infrastructure is generally not replaced at the same time. Climate change related upgrades (e.g. upsizing) at an upstream location can cause problems (e.g. increase risk of infrastructure failure) if an older, downstream component of a water drainage system is not large enough to convey the increased flow. Additionally, infrastructure is anticipated to be exposed to different climactic conditions and extreme weather throughout its lifespan, as per projections for climate scenarios 2050s and 2080s. Through this lens, it may not make financial sense to design a piece of infrastructure to extremes that may occur only in 75 years (at the end of its lifecycle), meaning the infrastructure could be overdesigned for the majority of its lifecycle. Taking this into consideration, there may be an optimal, systematic approach to designing, maintaining or replacing water infrastructure at a regional or watershed scale.

### **Project Goals and Objectives**

As a member of the Peel Climate Change Partnership, TRCA is leading a phased project with the primary goal of providing guidance to the Region of Peel and local municipalities on how to accommodate the uncertainty of future climate projections and non-stationary climate in the design of stormwater infrastructure.

The first phase of the project is the focus of this RFP and has two main research objectives:

- to consolidate and critically examine available knowledge on best practice and case examples of adapting stormwater infrastructure design to a changing climate; and
- to review and analyze decision-making approaches or frameworks that may be applicable to designing stormwater infrastructure at a system-wide scale.

Phase one will conclude with communicating research findings to support a series of municipal stakeholder engagement sessions.

Phase two will continue the stakeholder engagement process to develop the needed guidance regarding design of municipal stormwater infrastructure in a changing climate, including an explicit consideration of risk tolerance and management. Although Phase 2 is not part of this RFP, understanding how the research will be used is valuable context.

## **Key Research Areas and Questions for Phase 1**

### **Area 1: Current Best practices in adapting stormwater infrastructure design to a changing climate:**

- a) What information on best practice or case studies are available to demonstrate decision making processes and actions taken in other jurisdictions that are adapting their infrastructure design to a changing climate?
- b) What lessons does this information or case studies offer for development of climate change adaptation techniques for the Toronto Region? Why were these approaches taken? Are there any concerns of this approach? How has the uncertainty of climate change projections been taken into account?
- c) Which other jurisdictions have updated their IDF curves using future climate model outputs to consider climate change. What techniques did they use?
- d) What guidance has been provided in the use of IDF (current or updated) that may facilitate their use while considering climate change? What is the confidence in the proposed IDF curve solution?
- e) How might the different alternatives be evaluated in a cost- benefit analysis? Outline potential methods of evaluating alternative design methodologies that incorporate climate change within a cost-benefit framework.

### **Area 2: Systems Approach to Advancing Adaptation and Addressing Risk:**

- a. Has a system wide management approach of stormwater infrastructure in a changing climate been implemented anywhere? If not, has a system wide management approach been applied by other disciplines that could be adapted to stormwater infrastructure?
- b. How might the temporal aspect of climate change over the life of the stormwater system be taken into account when replacing infrastructure?
- c. Is it possible to develop an approach that minimizes the cost of replacing infrastructure while maximizing benefit? How might that be designed?
- d. Is there any research/recommendations on a risk-based decision support system that would assist in designing a stormwater drainage system or network considering the uncertainty of future climate projections.

## Deliverables

### 1. Draft Report Table of Contents – Draft 1

Prepare a draft Table of Contents and workplan that outlines the proposed research. Outline any initial thoughts on additional or modified questions that may be included in the review of research areas 1 and 2. Any change in questions to be approved by TRCA. Include in the Table of Contents a breakdown by percentage of emphasis to be placed on each section.

### 2. Interim Research Report – Draft 2

Complete an Interim Research Report that summarizes and analyzes the information uncovered by the research to date, following the outline set by Draft 1. The report can also provide a summary of potential new questions that may be emerging from initial research and identify options to adjust the research direction for the remainder of the project, if appropriate. The Project Advisory Group will review and any change in direction/research will need to be approved by TRCA.

### 3. Draft Report – Draft 3

Complete a Draft Report, based on the Interim Research Report, to be reviewed by the Project Advisory Group.

### 4. Final Report

Complete a Final Report based on the Draft Report comments provided by the Project Advisory Group. .

### 5. Project Meetings

There are a minimum of four project meetings as noted in the Anticipated Project Timeline below. Three additional meetings, that would include presentations at various stakeholder meetings, are also required after the completion of the final report to communicate results. The researcher will be expected to participate in weekly project update calls with the Project Manager to review weekly progress and direction of research.

#### Anticipated Project Timeline

Task	Anticipated Due Dates (2017)
1. Development and meeting with the Project Manager to review draft Table of Contents – Draft 1	Week of February 13
2. Meeting with the Project Advisory Group to review initial progress on research questions	Week of March 13
3. Update meeting with Project Advisory Group to review and revise the Interim Research Report – Draft 2	Week of April 17

<b>Task</b>	<b>Anticipated Due Dates (2017)</b>
4. Circulate Draft Report – Draft 3 for review by Project Advisory Group.	Week of May 1
5. Researcher receives written feedback from Project Advisory Group. Project meeting with Project Manager to discuss feedback.	Week of May 22
6. Final Report Due	Week of June 5
7. Attend and present at three meetings with external stakeholders for Phase 2 of the project.	June –December 2017

### **Evaluation Criteria**

The following criteria have been identified as the basis for evaluation of the RFP process:

- **Completeness:** Proposal contains all the information requested in the RFP document;
- **Project Scope:** Cover letter clearly articulates proponents understanding of the project purpose and scope.
- **Expertise:** Proponent possesses the knowledge and experience required to undertake this research (academic/workplace experience clearly articulated);
- **Experience:** The proponent is able to demonstrate experience undertaking similar research in the past and specific understanding of the major issues relevant to the project (i.e. climate change, decision making in uncertainty);
- **Project Completion:** Clearly articulated explanation detailing how the proponent would ensure the timely completion of the project;
- **Project Cost:** Proposals should not exceed \$25,000 plus taxes (if applicable).

Submissions should include:

The main proposal should include:

i) A description and discussion of the Consultants' understanding of the work for this project, including objectives, tasks and a discussion of potential issues that may require particular attention.

ii) A description of the Consultant's experience related to this project, as well as a brief description of each individual who may be part of the Consultant's team and is anticipated in the project.

- General information about the company and detailed qualifications and capabilities.

- Résumés of any individuals who will be involved in this project as part of the Consultant's team should be appended and do not "count against" the 10 page length maximum.

iii) A detailed work plan indicating the following information:

- The specific tasks to be carried out, rationale, qualifications of individual(s) assigned to each task, the total hours required to complete each task.

iv) A detailed schedule indicating the start date and the anticipated duration of each task, together with the timing of key milestones and meetings.

v) A project budget, including the following:

- A fee breakdown including hourly rate per individual, hours that each individual will be involved on each task; and number of total hours per task
- All anticipated project expenses the specific tasks to be carried out, together with the individual(s) assigned to each,

vi) Three relevant brief project descriptions and references.

viii) A sample of work that is relevant to the scope outlined for this project, this item can be satisfied providing one of the following:

- A copy (in PDF format) or online link to two relevant previously finished pieces of writing;
- Or 1 page of writing, including design, on any section of the provided VA reports.

ix) The proposal must also include Attachment 1 and Attachment 2, signed by an authorized representative of the organization, including name, title, address, and telephone number of one individual who is the responder's designated representative.

### **Submission of Proposals**

Respondent shall submit one (1) original copy:

By email with the subject line: **Proposal Submission\_ [Surname] \_WIDFA** in PDF or WORD format.

All proposals must be received by TRCA no later than **4:30 PM on Wednesday, February 8th 2017**. The contract will be awarded by Friday, February 10<sup>th</sup>. TRCA assumes no obligation, no responsibility and no liability for costs incurred by the responding parties prior to issuance of a contract.

Please send all proposals or inquiries care of:

Fabio Tonto, Project Manager (ftonto@trca.on.ca)