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Section I – Items for Board of Directors Action

TO: Chair and Members of the Board of Directors
Meeting #6/19, Friday, June 21, 2019

FROM: Sameer Dhalla, Director, Development and Engineering Services

RE: TORONTO ISLANDS FLOOD CHARACTERIZATION AND RISK ASSESSMENT PROJECT
Approval to adopt the Toronto Islands Flood Characterization and Risk Assessment Study as prepared by W.F. Baird & Associates Coastal Engineers Ltd.

KEY ISSUE

Report back to the Board of Directors upon conclusion of the Toronto Islands Flood Characterization and Risk Assessment Project (*Amendment #B74/18*).

RECOMMENDATION

IT IS RECOMMENDED THAT the Toronto Islands Flood Characterization and Risk Assessment Project report (May 2019) prepared by W.F. Baird & Associates Coastal Engineers Ltd. be received;

AND FURTHER THAT staff be directed to work with the City of Toronto to secure funding, regulatory approvals, and assist the City with the implementation of the flood mitigation alternatives identified in the Toronto Islands Flood Characterization and Risk Assessment Project including advancing a Class EA to facilitate implementation of flood protection works.

BACKGROUND

At Executive Meeting #6/18, held on August 10, 2018, Resolution #B73/18 was approved as follows:

THAT Contract #10008379 for flood risk characterization and risk assessment engineering services for the Toronto Islands be awarded to W.F. Baird & Associates Coastal Engineers Ltd. at a total cost not to exceed \$174,092.00, plus HST, as they are the highest ranked bidder that best meets Toronto and Region Conservation Authority (TRCA) specifications;

THAT TRCA staff be authorized to approve additional expenditures to a maximum of 10% of the total cost of the contract as a contingency allowance, if deemed necessary;

THAT should staff be unable to execute an acceptable contract with the awarded contractor, staff be authorized to enter into and conclude contract negotiations with the other contractors that submitted tenders, beginning with the next lowest bidder meeting TRCA specifications;

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AND FURTHER THAT authorized TRCA officials be directed to take all necessary actions to implement the contract, including the signing and execution of any documents.

Also, at Executive Meeting #6/18, held on August 10, 2018, Amendment #B74/18 was approved as follows:

AND FURTHER THAT that TRCA staff report back to the Board at the conclusion of the project.

In the spring of 2017, water levels in Lake Ontario reached levels higher than had been measured since record keeping began in 1918. As of the time of writing this report those levels have now been matched. The effect of this flooding was significant on the Toronto Islands where over 800 residents, almost 30 businesses, and two schools were forced to adapt to rising waters and service disruptions. Notably, the closure of the Islands during peak season presented a major disruption in tourist and recreational activity which is an important source of revenue to the City and local businesses. The island parks also experienced significant shoreline erosion, damage and debris accumulation over the spring and summer of 2017. The flooding resulted in the activation of the City of Toronto Emergency Operations Centre and approximately \$8 million in direct and indirect damages related to the closing of Toronto Island Park.

In response to the 2017 flood conditions the Toronto and Region Conservation Authority (TRCA) and the City of Toronto deployed over 45,000 sandbags, 1000 meter bags, and over a dozen industrial pumps to mitigate the effects of the rising water. These assets were positioned throughout the islands, leveraging GIS maps with LiDAR imagery that identified areas and infrastructure that were threatened by the flood conditions. Mapping also identified the most strategic and effective locations to deploy the industrial pumps.

In 2018, TRCA worked with the City of Toronto to repair damaged areas and install naturalized berms and sumps to protect strategic areas from potential future flooding. The large meter bags were removed but the sand was left in place, forming berms that were planted with native grasses. Most of the sand from the smaller sandbags was deposited in a central area for future use. The installation of ten sumps was completed to collect surface flooding and drain low lying and saturated areas with a series of weeper tiles. The City also made significant alterations to the ferry docks, allowing for safe passenger embarkation/debarkation for a wider range of lake levels.

In 2018, TRCA in collaboration with the City of Toronto, successfully secured \$150,000 in grant funding from the federal National Disaster Mitigation Program (NDMP), with the City of Toronto matching \$150,000 for a total of \$300,000 for the Toronto Islands Flood Characterization and Risk Assessment Project. At TRCA Executive Committee Meeting #6/18 held on August 10, 2018 Resolution B73/18 approved the award of Contract #10008379 to W.F. Baird & Associates Coastal Engineers Ltd. for consulting services to undertake the Toronto Islands Flood Characterization and Risk Assessment Project.

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The study consists of four main components:

1. Flood Characterization Report
2. Flood Risk Assessment Report
3. Development of Flood Maps
4. Flood Mitigation Alternatives Report

Flood Characterization Report

This report describes the conditions that led to the 2017 Lake Ontario high water levels; proposes updated return period water levels in Toronto; evaluates the impacts of Plan 2014 the regulation for the St. Lawrence Seaway and Lake Ontario to regulate water levels on Lake Ontario; and reviews recent climate change research related to future Lake Ontario water levels. The report concludes that the 2017 high water levels were the result of extreme wet weather in the Lake Ontario basin, record inflows from Lake Erie, and reduced outflow capacity due to downstream flooding on the St. Lawrence and Ottawa rivers. Return period water level analysis indicates that the 100-year return period stillwater level for Lake Ontario should be increased from 75.75m to 76.05m International Great Lakes Datum of 1985 (IGLD85). The impact of Plan 2014 is estimated to account for 0.07m of this increase, with the remainder of the increase attributed to the inclusion of post-regulation data to 2018. With the new peak record water levels recorded in 2019, however, the statistical analysis will need to be reviewed once more to adjust the 100-year return period water level to account for this year's significant levels. The latest climate change research was also reviewed to estimate potential future changes to static water levels, storm surge, and waves at Toronto Islands. Current research suggests that average static water levels in the Great Lakes will remain similar or decline slightly due to increased evapotranspiration. The anticipated impacts of climate change on static water levels are less than the natural variability of long-term lake levels and will likely be manageable within the current regulation plan, therefore the consultant did not recommend to further increase or decrease the 100-year static water level due to climate change. Climate change considerations for specific storm events and correlated surge and wave effects, however, can be considered through ensuring sufficient freeboard (the height above the recorded high water mark of a structure associated with the water) in the design of mitigation measures.

Flood Risk Assessment Report

The study was commissioned to inform TRCA and the City of Toronto in identifying and understanding risk to property and infrastructure on the Toronto Islands. This report quantifies the financial costs and other impacts to Toronto Island residents, businesses, and the City of Toronto for the different return period flood events under existing conditions. Using a parallel process as that for riverine flooding, tangible (financial) damages for Toronto Island residents and businesses were estimated using the Alberta Provincial Flood Damages Assessment Study (PFDAS) method, which was endorsed by Natural Resources Canada's Guide to Flood Vulnerability Functions. Residential indirect damages such as flood mitigation, cleanup, etc. were included as a 15% markup on the structural and contents damages. Non-residential

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indirect damages were estimated using a method of business disruption and productivity rates outlined in the Canadian Floodplain Mapping Guidelines Series by Natural Resources Canada. All damages were adjusted to Ontario 2017 dollars using indexing methods. Estimated total tangible damages to residents and businesses range from \$0.5M to \$6.5M for the 2-year and 500-year flood event, respectively. The average annual tangible damages are estimated to be \$387,000 per year. City of Toronto damages were not included in the damage estimates due to the nature of the buildings (no appropriate Provincial Flood Damage Assessment Study category), and the fact that indirect damages such as flood mitigation, cleanup, lost ferry revenues, lost rents, etc. would not be captured in the damage estimates. Intangible damages are non-financial damages such as impacts to health, society, and the environment. The more severe intangible impacts include respiratory conditions that could develop due to mould, change in the social fabric of the island community, and loss of mature trees.

Flood Mapping

A series of Toronto Islands Flood Depth Maps indicating areas of inundation with varying water levels (from 75.3m to 76.2m) were developed. These maps are based on recent LiDAR topographic maps and were utilized to prioritize the ongoing response during the 2019 high levels, building upon the maps developed by TRCA's GIS department in 2017.

Flood Mitigation Alternatives Report

This new report identifies flood mitigation alternatives for the areas most affected by the 2017 flood. Flood mitigation concepts were not developed for private businesses such as the yacht clubs, but instead focused on community-scale flood protection measures. The alternatives build upon recommendations made by Toronto Island residents and include protecting low-lying residential areas with a berm or dyke structure, elevating low-lying roads, increasing the crest elevation of shore protection structures, and directing surface drainage to the sumps that were installed in 2018. This report presents the conceptual designs, estimated quantities, and budgetary cost estimates for the flood mitigation alternatives for six key areas. The estimated total cost of the project varies between \$13.9M and \$15.9M depending on the flood protection option at Ward's Island.

In summary, the Toronto Islands Flood Characterization and Risk Assessment Project provides TRCA and the City of Toronto with an improved understanding of flood scenarios and community and infrastructure vulnerabilities and risks. It also provides direction on future flood mitigation investments, where TRCA's experience in implementing shoreline and flood protection measures throughout the Toronto waterfront areas could be leveraged in the delivery of these flood protection measures.

RATIONALE

The Toronto Islands Flood Characterization and Risk Assessment Project was conducted to assist the City and TRCA to respond to and plan for future flood conditions. As of June 2019, Lake Ontario water levels have exceeded the previous records of 2017 and the utility of this study has already been demonstrated during the current flood condition. The Flood

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Characterization Report provided background information that informed the short-term mitigation measures for the current scenario. TRCA and the City were able to initiate flood mitigation efforts proactively in advance of the 2019 flood. The flood mapping allowed for the effective deployment of resources in response to the rising water levels.

The City of Toronto has also initiated a Toronto Islands Park Master Plan and the Toronto Islands Flood Characterization and Risk Assessment Project will be a key resource for this project. Staff expect that there will be many opportunities integrate the flood protection capital works into overall park improvements that benefit the public realm, in keeping with the City of Toronto's Climate Resilience Framework principle of integrating risk reduction with community enhancement.

Relationship to Building the Living City, the TRCA 2013-2022 Strategic Plan

This report supports the following strategies set forth in the TRCA 2013-2022 Strategic Plan:

Strategy 2 – Manage our regional water resources for current and future generations

Strategy 4 – Create complete communities that integrate nature and the built environment

Strategy 8 – Gather and share the best sustainability knowledge

FINANCIAL DETAILS

In 2018, TRCA in collaboration with the City of Toronto, successfully secured \$150,000 in grant funding from the federal NDMP, with the City of Toronto matching funding for a total of \$300,000 for the Toronto Islands Flood Characterization and Risk Assessment Project. Staff entered into a Service Level Agreement with the City of Toronto for the development of the Toronto Islands Flood Characterization and Risk Assessment Project. Funds for this project are identified in account code 251-87.

The Toronto Islands Flood Characterization and Risk Assessment Project presents the conceptual designs, estimated quantities and budgetary cost estimates for implementation of works that vary between \$13.9M and \$15.9M depending on the flood protection options. Additional costs will include regulatory approvals, public consultation and detailed design. No funding sources have confirmed for this work, however once design costs are factored in and final construction costs are determined, it may be possible to group the island flood protection measures with other waterfront flood protection measures and pursue matching funding through the federal Disaster Mitigation and Adaptation Fund.

DETAILS OF WORK TO BE DONE

The Toronto Islands Flood Characterization and Risk Assessment Project will be circulated to relevant TRCA and City of Toronto departments.

The Flood Mitigation Alternatives Report outlines flood mitigation alternatives. A Conservation Authority or MEA Class Environmental Assessment for Remedial Flood and Erosion Control is required to proceed with the development and eventual implementation of flood mitigation alternatives. TRCA will continue to work with the City of Toronto to identify and secure funding to undertake the Class EA and implementation of the flood mitigation alternatives.

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