Item 8.1

Section III – Items for the Information of the Board

TO: Chair and Members of the Board of Directors
Friday, October 28, 2022 Meeting

FROM: Sameer Dhalla, Director, Development and Engineering Services

RE: **UPDATE ON TRCA'S SHORELINE HAZARD MAPPING PROJECT**

KEY ISSUE

Toronto and Region Conservation Authority's (TRCA) Lake Ontario Shoreline Hazard maps are a key technical output necessary to fulfill TRCA's mandate and specific TRCA Strategic Plan objectives to identify and reduce flood and erosion risks and protect communities. Shoreline hazard maps are one of the foundational pieces of several programs within TRCA, including flood forecasting and warning, and land use planning and regulation. Leveraging National Disaster Mitigation Program (NDMP) funding, TRCA Engineering Services has completed a comprehensive Lake Ontario Shoreline Hazard mapping study.

RECOMMENDATION:

THAT the update on the Lake Ontario Shoreline Hazard Mapping Project be received;

THAT TRCA staff communicate to member municipalities and stakeholders with shorelines in TRCA's jurisdiction the results of TRCA's Lake Ontario Shoreline Hazard Mapping project;

AND FURTHER THAT staff report to the Board of Directors when future comprehensive Lake Ontario Shoreline Hazard Mapping projects are completed.

BACKGROUND

The 60-kilometre stretch of Lake Ontario shoreline in TRCA's jurisdiction extends from the Etobicoke Creek watershed in the west to the Carruthers Creek watershed in the east. The lands along the shoreline are subject to naturally occurring processes that give rise to shoreline hazards in the form of lake-based flooding, erosion, and dynamic beach movement. These shoreline hazards are quantified and delineated to help improve the accuracy of TRCA's regulation mapping, assist with land use planning, infrastructure design, erosion management, and emergency management planning along the Lake Ontario shoreline.

The previous shoreline flood hazard standards were developed using information from the Ministry of Natural Resources and Forestry (MNRF) in 1989, making them over 30 years old. Since 1989, multiple significant events have occurred, which necessitates an update to the flood hazard limit. In 2017 and 2019, record water levels in Lake Ontario were greater than the 100-year limit established in 1989. Also, the International Joint Commission (IJC) implemented a new regulation plan for the St. Lawrence Seaway and Lake Ontario in 2017. The plan, known as Plan 2014, is expected to result in a broader range of water levels, depending on the return period considered. Taken together, these factors produce higher return period lake levels and larger flood hazard limits than those previously calculated.

The Shoreline Hazard mapping study was an opportunity to recharacterize shoreline erosion and dynamic beach hazards using new lake level information, new base mapping information based on LiDAR, and information from site-specific studies. All calculations and procedures

used were consistent with provincial policy, provincial technical guides, and TRCA's Living City Policies and its section 28 regulation under the Conservation Authorities Act (Ontario 166/06).

At Board of Directors Meeting #8/21, held on Friday, October 22, 2021, RES.#A208/21 - was approved as follows:

IT IS RECOMMENDED THAT the Update on the Delegated Authority to Award Contract No. 10035896 For TRCA Shoreline Hazard Mapping Update be received.

RATIONALE

Completion of this project has resulted in the creation of new shoreline hazard information incorporating the latest data, and technologies to better support land use, infrastructure and emergency management planning, and engineering standards development. The new shoreline hazard information will be used to update TRCA regulation mapping along the entire Lake Ontario shoreline across TRCA's jurisdiction. Currently, TRCA's regulation mapping contains an estimated shoreline hazard limit as one of the criteria that make up the regulated area as prescribed in Ontario Regulation 166/06. Ultimately, the updated mapping serves to better protect people and property from shoreline flooding, erosion, and dynamic beach hazards.

The shoreline hazard mapping project was a multi-phased process that required several studies to be completed prior to map generation:

1. The first phase consisted of the development of the 100-year Lake Ontario flood level required to delineate the Lake Ontario Shoreline Flood Hazard.

2. The second phase consisted of the development of the Lake Ontario Shoreline Erosion Hazard and the Lake Ontario Dynamic Beach Hazard.

3. The final phase was the development of the final mapping product, which identifies the three aforementioned hazard limits, topographical information (contour lines) overlaid on recent aerial imagery depicting geospatial data such as roads, houses, bridges, and other similar infrastructure. The project also defined the overall Lake Ontario Shoreline Hazard Limit, which is the hazard limit that is the furthest landward extent of the flooding, erosion, and dynamic beach hazard limits.

All mapping was completed on a reach-by-reach basis. The TRCA shoreline was divided into a total of 49 reaches based on shoreline characteristics such as the changes to shoreline exposure, shoreline orientation, shoreline type, and locations of artificial lakefill areas.

The technical studies and the mapping were completed by qualified professional coastal engineers (W. F. Baird & Associates) and geotechnical engineers (Grounded Engineering) retained by TRCA. Throughout the project, TRCA Policy Planning, Development Planning and Permits, and Engineering Services staff provided direction to the consultants. This project was also supported by TRCA's Restoration & Infrastructure staff who provided valuable background data. All methods used are consistent with TRCA's Living City Policies, Ontario Regulation 166/06, as well as MNRF's Technical Guides.

Lake Ontario Shoreline Flood Hazard

The Lake Ontario Flood Hazard Limit is defined as the 100-year flood level plus an allowance for wave uprush. The 100-year flood level was obtained by performing statistical analyses on

historical water level data between 1962 to 2020 and incorporates the changes made to the regulation of Lake Ontario levels under Plan 2014. The methods used in this study are consistent with those presented in the Toronto Islands Flood Risk Characterization Study presented to the TRCA Board at Meeting #6/19 on Friday, June 21, 2019. The 100-year Lake Ontario flood level for TRCA's jurisdiction was determined to be 76.2m (vertical datum of IGLD85) for the entire jurisdiction. This level is higher when compared to the previous 100-year flood levels of 75.8m west of Yonge Street and 75.7m east of Yonge Street.

A technical study was also undertaken to determine the hazards associated with wave uprush that occur when shorelines are exposed to wave action, driving the water to levels above the 100-year flood level. The technical study involved the use of a two-dimensional spectral wave model called MIKE21 SW and other shoreline profile modelling using coastal engineering models such as CSHORE and EurOtop. The modelling results produced the wave uprush allowance for each of the 49 reaches. This assessment is an improvement over the previous flood hazard estimation exercise, which used the standard 15m wave uprush allowance across the jurisdiction.

Lake Ontario Shoreline Dynamic Beach Hazard
The Lake Ontario Shoreline Dynamic Beach Hazard is the landward limit of the flooding hazard plus a 30m dynamic beach allowance, or a distance determined by an accepted coastal study. Dynamic beach hazards only apply to beaches of sufficient size and depth, and which contain deposits overlying suitable material. For this update to the Shoreline Dynamic Beach Hazard limits, site visits and desktop assessment were undertaken to confirm the locations of dynamic beaches in TRCA's shorelines. A total of 13 dynamic beaches were identified. At these locations, a 30-m hazard line was plotted offset from the Lake Ontario Shoreline Flood Hazard. However, at locations where the beach is obstructed by a significant physical barrier, such as a road or cohesive bluff, the dynamic beach hazard limit was not extended beyond the barrier.

Previous TRCA mapping only identified 9 dynamic beach hazard locations. The updated technical study has resulted in the identification of a total of 13 dynamic beach locations and refinements to the dynamic beach hazard limits of the previously identified locations.

Lake Ontario Shoreline Erosion Hazard
The Lake Ontario Shoreline Erosion Hazard is defined as the sum of the 100-year toe erosion allowance and the stable slope allowance. The 100-year toe erosion allowance estimates how much a shoreline would recede over a 100-year time period and is calculated using historical aerial images and topographic data. Additional procedures were applied to consider major public revetments and large lakefill projects where appropriate.

The stable slope allowance predicts the long-term stable slope from the toe erosion allowance. A geotechnical study was undertaken to determine appropriate stable slope allowances across the entire shoreline by examining soil characteristics, groundwater conditions, and by undertaking modelling using slope stability software. Based on TRCA's guidelines that require a minimum factor of safety of 1.5, stable slope was determined for each of the 49 reaches. In locations with insufficient data, a stable slope allowance of 3H:1V was used as per MNRF Technical Guide.

The updated erosion hazard limits are an improvement over the previous hazard mapping exercise, which used the standard 30 m erosion allowance and a 3H:1V stable slope allowance.

Lake Ontario Shoreline Hazard Mapping
To create shoreline hazard maps, the technical studies' results were transposed onto base maps. Prior to finalization, various TRCA experts within TRCA's Engineering Services, Planning and GIS business units completed a detailed review of the resulting hazard lines to ensure that the mapping products were consistent with mapping standards from provincial Technical Guides, TRCA's Living City Policies and Ontario Regulation 166/06. A total of 97 map sheets were generated and stamped by a Professional Engineer.

A public-facing Shoreline Hazard Map viewer, together with a set of Frequently Asked Questions, will be made available on a TRCA website.

Project deliverables include digital hazard lines overlaid on digital base mapping of the entire TRCA shoreline. This new process allows for the development of custom mapping products, where needed, with less staff time involved in developing and orienting set-size map sheets. Mapping is frequently requested by municipal partners, the development industry and associated professional consulting firms, as well as the public. Custom maps can be prepared easily based on the needs of the user; consulting engineers well-versed in hazard mapping can request the full suite of mapping information, whereas the public can be provided simplified maps with the hazard limit overlaid on an aerial photo base. In all instances, the full mapping product can be made available via the existing TRCA data request channels for any interested party.

An example of the updated shoreline hazard mapping product is shown in **Attachment 1**.

Outcomes and Next Steps
The updated shoreline hazards maps do not change the inherent risks of a given location; it is a technical process that provides an updated *understanding* of the risks based on the best available information. Even though the shoreline hazard maps were comprehensively updated across TRCA's jurisdiction, emerging issues and other program updates will need to be addressed and completed. These consist of the following:

- TRCA's approaches to managing natural hazards with respect to planning and development are in accordance with provincial standards as outlined in The Living City Policies. The development and infrastructure planning process advances through a complex hierarchy. Therefore, it is possible for the update to shoreline hazard mapping to occur at various stages of the planning hierarchy.
    - As a result, there may be instances where TRCA staff have already reviewed and are in support of a proposed development on the basis of information that changes mid-process.
    - The *Conservation Authorities Act* is the jurisdictional authority in the permitting process and does not provide for the grandfathering of historical planning decisions. For transitional files (as recognized by TRCA staff), where it is technically feasible and appropriate, innovative design approaches may be considered to address site constraints and accommodate the development while meeting current regulatory requirements. TRCA is committed to utilizing the best available information to achieve the policy objectives noted in Section 8.3 of The Living City Policies, including minimizing the risk to people and property due to natural hazards.
    - The best available information may include site specific studies and quality control checks. It is important to recognize that a solution may not always be technically feasible, and that the above only applies to transitional files that have recent previous support from TRCA staff for the same application.

- TRCA's Regulation Limit will need to be updated using the new shoreline hazard limits. This will be undertaken by Engineering Services, Planning Policy and Regulation, and Business Intelligence and Data Analytics (GIS) staff. The updated mapping will be communicated to the Board of Directors via the Annual Regulation Mapping Update by the Planning Policy and Regulation team, as per the current practice.

- Development and Engineering Services will work with Restoration and Infrastructure, and Policy Planning to actively maintain TRCA's shoreline hazard map set on an ongoing basis, which could include actions such as incorporating new shoreline protection infrastructure and technical studies as they become available.

- Development and Engineering Services, together with Policy Planning, will communicate to municipal partners on the results of TRCA's revised shoreline hazard mapping updates through the TRCA website. Staff will provide a summary of the project and an opportunity for stakeholders and interested members of the public to view, in greater detail, the updated mapping.

    - As a first step in communicating the information, TRCA planning staff recently met with City of Toronto planning staff to explain the mapping update and discussed options for informing landowners. TRCA Policy Planning staff will report back to the Board of Directors on next steps in this process through a report on the Annual Regulation Mapping Update in early 2023.

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 7 – Build partnerships and new business models

FINANCIAL DETAILS
NDMP will fund 50% of the project costs and remaining costs were funded through TRCA's Flood Protection and Remedial Studies program account 107-02, supported by funding from the City of Toronto, as well as funding from the Region of Durham. Funds were tracked in account 107-18

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Attachments: 1

Attachment 1: Example of a Lake Ontario Shoreline Hazard Map Sheet