Item 8.2.

Section I – Items for Board of Directors Action

TO: Chair and Members of the Board of Directors
Meeting #3/19, Friday, March 29, 2019

FROM: Sameer Dhalla, Interim Director, Development and Engineering Services

RE: **BOLTON BERM REMEDIATION STUDY**

KEY ISSUE

In the historic village of Bolton there is a system of flood control infrastructure to protect it from riverine flooding. TRCA recently completed a comprehensive study to assess the hydraulic performance and structural integrity of this system. The study also explored opportunities to enhance the level of flood protection. This report summarizes the results of the assessment taking into account observations from the recent March 15th-16th, 2019 event including proposed next steps and implementation considerations.

RECOMMENDATION

THAT staff be directed to disseminate the study report and all information developed from the Bolton Berm Remediation Study to Engineering staff at the Town of Caledon and Region of Peel;

THAT TRCA immediately undertake general repairs and maintenance to the Bolton flood control infrastructure as recommended in the study report as option 1 at a cost of approximately $75,000;

THAT TRCA immediately initiate the detailed design process for the preferred restoration plan, option 3, at an estimated cost of $150,000;

THAT TRCA, in consultation with the Town of Caledon and Region of Peel initiate planning for the preferred restoration plan including public consultation and budgeting so that implementation can occur in 2020;

AND THAT TRCA make a funding request to the Ministry of Natural Resources and Forestry's Water and Erosion Control Infrastructure program to help fund the preferred restoration plan;

BACKGROUND

The historic village of Bolton, (intersection of King Street and Queen Street), in the Town of Caledon is located within the valley corridor and floodplain of the Humber River. This area has a long history of flooding with 233 structures susceptible to flooding during a Regional Storm event. Due to the flood vulnerability of the community, the historic village of Bolton was designated as a Special Policy Area (SPA) to allow for the continued viability of existing uses and address the significant social and economic hardships to the community that would result from strict adherence to provincial policies concerning development in a floodplain. Flood protection measures were constructed in the 1980's to provide flood protection up to and including the 500-year flood.

These flood protection measures include:

- a diversion channel, parallel to King Street through Humber Lea Road to convey higher flows;
- a box culvert at Humber Lea Road;
- a concrete crib wall installed upstream of King Street on the east bank; and
- earth berms constructed along the south side of the Humber River from the bridge by Old King Road to Queen Street.

These measures helped to minimize impacts to properties from flooding as evidenced by their performance during recent events. While the March 15th event exceed the capacity of the river to convey flows the above infrastructure remained intact during the recent flooding. Additional study to confirm performance is currently underway.

In 2013 the Town of Caledon initiated the "Bolton Special Policy Area Review" with the purpose of:

- reviewing the SPA boundary in light of new floodplain mapping information developed by TRCA;
- undertaking a comprehensive assessment of flood risk within the SPA;
- the preparation of a Planning Justification Report; and,
- the preparation of an Official Plan Amendment, implementing Zoning By-law, and Site Plan Control Provisions.

During the SPA update process, TRCA identified that a comprehensive assessment of the flood infrastructure was needed given the age of the infrastructure and changes in the watershed. At TRCA Authority meeting #2/18, Friday March 23, 2018 (Item 7.3), TRCA received authorization to undertake an assessment of the flood control infrastructure. This assessment, titled "The Bolton Berm Remediation Study", fulfills TRCA's commitment to assess the state of the flood control infrastructure within the Bolton SPA for the Town of Caledon.

The intent of the Bolton Berm Remediation Study was to characterize flood conditions within the SPA, asses the level of service and structural competency of the existing flood infrastructure, and to develop a preliminary restoration strategy for the Bolton flood control berms. Key project deliverables included:

- A 2D hydraulic flood model for the area using the MIKE Flood hydraulic modelling platform;
- the completion of a number of technical assessments including Geotechnical, Structural, and Fluvial Geomorphology;
- An existing Conditions summary report; and
- A Restoration/Remediation study report.

RATIONALE

In April 2016, TRCA retained Valdor Engineering to undertake the Bolton Berm Remediation Study. TRCA's Request for Proposal as well as Valdor's project proposal provided study goals and objectives, a detailed work plan, and schedules. Key components of the study work plan included:

1. the development of a coupled 1 Dimensional and 2 Dimensional (1D-2D) hydraulic model for the study area;
2. geotechnical field investigations and assessment of the stability of the Bolton berms under various conditions and failure modes;
3. structural investigations of a TRCA owned crib wall to quantify its current condition and structural stability;
4. fluvial geomorphic investigation of the flood control channel to quantify the interaction between the flood control channel and the berms; and,
5. a detailed characterization of the flooding within the study area including the identification of flood zones and the mechanisms of flooding to aid in the development of restoration options.

The components of the overall study and assessment results were completed and presented in two summary reports titled:

- Bolton Berm Remediation Study – Existing Conditions Report (Valdor, 2017);
- Bolton Berm Remediation Study, Restoration/Remediation Alternatives Report (Valdor, 2018).

Existing Conditions Report

The existing flood control berms were designed in the 1980's to provide flood protection up to the 500-year flood. The results of the revised hydraulic model determined that the flood control berms fall short of this target. The western-most berm provides flood protection up to the 350-year flood and the eastern berm provides flood protection up to the 100-year flood. Factors contributing to the reduced level of flood protection include lower berm elevations compared to the design elevations due to settling at a number of locations and less sophisticated hydraulic modeling methods used as part of the original design process. Hydraulic modelling also revealed that water circumvents both berms due to flows exceeding channel capacity at the upstream end, causing flows to spill into areas previously thought to be protected by the berms. The Bolton Berm Existing Conditions report recommends that options to rehabilitate and restore the berms to provide 500-year level of flood protection should be investigated for future consideration and implementation.

The Existing Conditions Report also identified a number of minor berm deficiencies based on field and geotechnical investigations. The deficiencies include excessive vegetation, minor deterioration of berm toe protection, a number of blocked/missing flap gates, minor sediment and debris in culverts. Further, the geotechnical stability analysis indicated the berms do not meet current Factor of Safety (FOS) engineering design standards for a number of loading conditions. As such, some structural repairs are required as part of the restoration plan.

The Existing Conditions Report noted that the western berm is lower than design elevations by up to 10 cm and that the eastern berm is lower than design elevations by up to 30 cm. This is primarily a result of a lack of freeboard being incorporated into the original design. Current standards now require applications of freeboard into design.

Restoration/Remediation Alternatives Report

The Bolton Berm Remediation Study, Restoration/Remediation Alternatives Report examined five options to rehabilitate the berms to address all the deficiencies described above and to enhance the level of flood protection provided.

The options including an estimated cost to implement are as follows:

Option 1 – General Maintenance Requirements with Current Level of Flood Protection (100-year Storm) - $75,000;

Option 2 – Rehabilitation Providing Flood Protection up to the 350-year Storm - $401,000;

Option 3(a) – Rehabilitation Providing Flood Protection up to the 500-year Storm - $690,000;

Option 3(b) – Rehabilitation Providing Flood Protection up to the 500-year Storm and meet all FOS requirements - $940,000; and,

Option 4 – Remediation Providing Flood Protection for Greater than the 500-year Storm - $1,150,000.

It is important to note that Option 1 is required at minimum to meet current engineering standards for flood control berms. Options 2-4 will increase the level of flood protection and can only be considered once Option 1 has been implemented. Based on thorough evaluation of the remediation options and feedback from Town of Caledon staff, the preferred approach to restoring flood protection is to implement Option 1 immediately and begin the planning and engineering for Option 3(b) so that implementation can begin in 2020. The cost to undertake the planning and engineering for Option 3(b) is an additional $150,000, bringing the total to $1,090,000, plus an additional $75,000 to implement Option 1.

Proposed phasing for the overall restoration plan project is as follows:

Phase 1 – through 2019 and into 2020 TRCA staff will initiate repairs and replacement of flap gates, repair culvert end treatments and clean culverts where required;

Phase 2 – in 2019 TRCA will initiate and complete the design process to (1) restore and raise the flood berm west of Humber Lea Road and east of Queen Street and (2) restoration activities for the diversion channel. Staff anticipates that the implementation of Phase 2 works will commence in 2020, subject to funding and construction scheduling; and

Phase 3 – the design of Phase 3 will be combined with the design process for the Phase 2 and will include (1) restoring and raising the flood berm and (2) raising the crib wall east of Humber Lea Road. Implementation of Phase 3 is anticipated to commence in 2021 subject to funding and construction scheduling.

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 1 – Green the Toronto region's economy
Strategy 2 – Manage our regional water resources for current and future generations
Strategy 4 – Create complete communities that integrate nature and the built environment

FINANCIAL DETAILS

The total estimated cost to design and implement Option 1 and 3(b) is $1,165,000. Operating accounts 108-01 (Flood Infrastructure Operation, Maintenance and Supervision) and Capital Account 107-03 (Flood Control Infrastructure Maintenance) will be used to undertake the immediate repairs and maintenance as recommended in the report at a cost of approximately $75,000. Peel Capital Account 129-19 (Flood Remedial Works) includes a budget provision to undertake the detailed design and permitting process for Option 3(b) at a cost of $150,000.

The total estimated cost to implement option 3(b) is $940,000. This work is eligible for funding under the Ministry of Natural Resources and Forestry (MNRF) Water and Erosion Control funding program (WECI). Funding for 50% of the restoration program ($470,000) will be pursued through the WECI program and the remaining funds ($470,000) will be allocated in the 2020 and 2021budget under Peel Capital Account 129-19 (Flood Remedial Works).

RESOLUTIONS

TRCA staff will implement the general maintenance works as recommended as part of the Bolton Berm Remediation Study immediately. TRCA staff will continue to work through the detailed design process including meeting with representatives from the Town of Caledon and Region of Peel to disseminate study results, and gather input for the design process. Further, TRCA staff will finalize implementation costs based on the results from the detailed design process and will ensure budget has been allocated in 2020 and 2021 to implement Phases 2 and 3 of the restoration plan.

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