

# **Lake Ontario Shoreline Hazard Summary, Risk Assessment and Management Plan**

## **Terms of Reference**

**Prepared by the Central Lake Ontario Conservation Authority**

**June 2021**

## **1.0 Background and Purpose**

Since its formation over 10,000 years ago, Lake Ontario has moved water and soil in a never-ending process. During low water and quiet weather, there are spectacular vistas over beaches and bluffs. In high water and stormy weather, the Lake's immense power and energy has an incredible ability to alter its shoreline.

Shorelines are continually shaped by the erosion and accretion of sediments. Lake waves continually erode beaches and bluffs, transport sediments along the Lake, and accrete sediments on beaches. Like many natural systems, water and sediment movement is a dynamic equilibrium that can be sensitive to interference or alteration. Anthropologic interference to the natural shoreline can have detrimental effects to the natural processes, and to our shoreline communities.

Great Lakes shoreline communities face natural hazards from beach and bluff erosion, unstable slopes, dynamic beaches, high water levels, storm surge, and waves. Riverine flooding and erosion can also affect shoreline communities, especially adjacent to coastal wetlands and barrier beaches.

The recently completed Lake Ontario Shoreline Hazard Management Plan (Zuzek,2020) [LOSHMP] contains a reach-by-reach analysis of Central Lake Ontario Conservation Authority's (CLOCA's) 30 km long shoreline. The study provides updated flood and erosion hazard mapping for the entire shoreline, includes information on the amount of shoreline hardening that has taken place in each reach, and identifies potential climate change impacts to coastal properties. Based on this recent hazard mapping, seven (7) separate Shoreline Flood Damage Centres (SDCs) have been identified where one or more residential buildings fall within lands susceptible to natural hazards. To better understand and quantify the risks associated with these hazards and to identify potential mitigation solutions to eliminate or reduce the risks, CLOCA is seeking a proponent to complete a Lake Ontario Shoreline Hazard Summary, Risk Assessment and Management Plan for these SDCs.

The major project components will be to identify the shoreline hazards, assess the risks, and prepare a risk management plan. It is anticipated the work plan will include the following tasks:

### **1) Identify the Shoreline Hazards**

- a. Review reference documents and resources noted below in section 4.
- b. Complete site investigations and document existing site conditions.
- c. Summarize the natural hazards (Lake Ontario flood hazard, erosion hazard, and riverine flood hazard) applicable to each SDC using available information.

### **2) Assess the Risks**

- a. Complete a risk assessment following the Hazard Identification and Risk Assessment process.

- b. Provide risk mapping for each SDC. Risk mapping should differentiate high risk sites from lower risk sites within the same centre.
- c. Provide mapping of detailed information related to the existing municipal zoning by-law zone classification and zoning regulations for each SDC.

**3) Prepare a Risk Management Plan**

- a. Review hazard mitigation strategies using the Avoid-Retreat-Accommodate-Protect approaches.
- b. Recommend preferred and alternative mitigative actions and provide concepts, approximate costs, and implementation considerations including corresponding recommended zoning by-law amendments (approvals, time requirements, etc.).

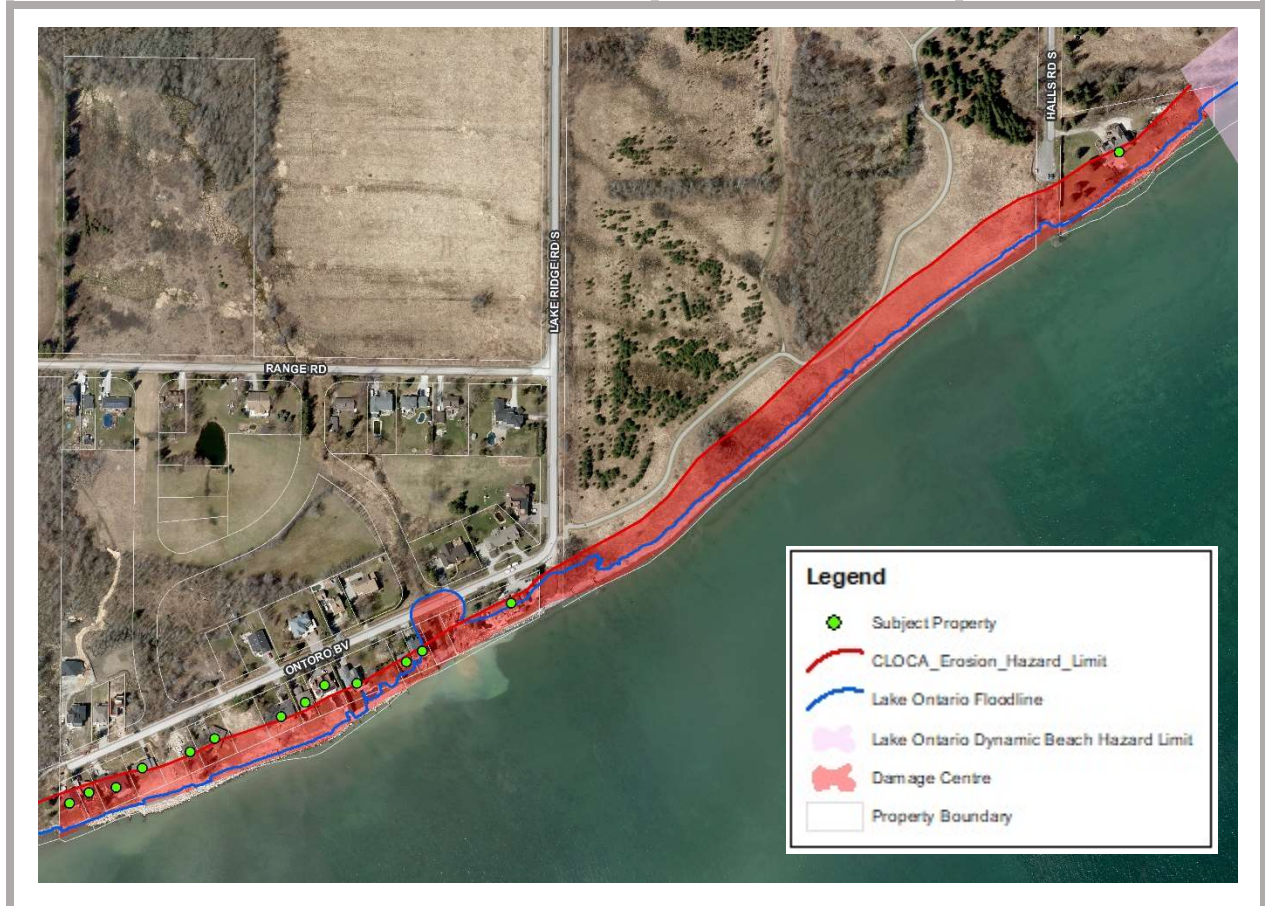
Further information on each damage centre and the project scope are provided in Sections 2 and 3, respectively. Funding for this study has been secured through the Region of Durham with matching funding from the National Disaster Mitigation Program (NDMP) totalling \$60,000. Due to stipulations of the NDMP program funding, the project must be completed by March 31, 2021. Proposals exceeding the total budget or project deadline will not be considered. Proponents may expand their proposals to detail alternative project plan/phasing ideas or value-added solutions to meet the project objectives, budget and timeline.

## 2.0 Study Areas

The study will cover the seven (7) Shoreline Damage Centres (SDCs) listed below.

### Shoreline Damage Centre #1: Ontoro Boulevard

Location & Description	Applicable Hazards	Further Reference
<p>Thirteen (13) homes located along Ontoro Boulevard in Ajax and one home at the end of Halls Road in Whitby are impacted by the shoreline in this SDC. Many shoreline protection structures along the properties are under-engineered, vertical seawall-type structures comprised of undersized pre-cast concrete blocks. Many have failed or are susceptible to failure.</p>	<p>All these homes are located within the shoreline erosion hazard limit. A couple are also in the shoreline flood hazard area.</p>	<p>Falls within Reach 1 of the LOSHMP. Refer to specific reach recommendations and Map 1.</p>



## Shoreline Damage Centre #2: Crystal Beach

Location & Description	Applicable Hazards	Further Reference
<p>Crystal Beach Boulevard is a private road at the south end of Thickson Road in Whitby. The street is located between the shoreline and about 30 residences. Shoreline protection fronting Crystal Beach Blvd is predominantly ad-hoc, under-designed or aging. Homes may soon be threatened. The Region of Durham is currently completing a hazard summary and risk assessment for this SDC. It is anticipated the Region's study will be completed first and the resulting analysis will greatly inform this project.</p>	<p>Eighteen (18) homes are impacted by the shoreline erosion hazard limit. At the east limit of the SDC some homes are also impacted by shoreline flooding, dynamic beach hazards, and the regulatory floodplain of Corbett Creek.</p>	<p>Falls within Reach 2 of the LOSHMP. Refer to specific reach recommendations and Maps 9 &amp; 10.</p>



### Shoreline Damage Centre #3: Stone Street

Location & Description	Applicable Hazards	Further Reference
<p>There are approximately 53 properties along Stone Street in Oshawa which back on to the shoreline where active bluff erosion is occurring. Shoreline protection is predominantly ad-hoc or under-designed. Flanking of shoreline protection occurring where neighbouring properties are unprotected. Homes may soon be threatened.</p>	<p>Twenty-six (26) homes are located in the shoreline erosion hazard area and an additional 6 homes are in close proximity to the limit and may be impacted by the erosion.</p>	<p>Falls within Reach 2 of the LOSHMP. Refer to specific reach recommendations and Maps 13 &amp; 14.</p>



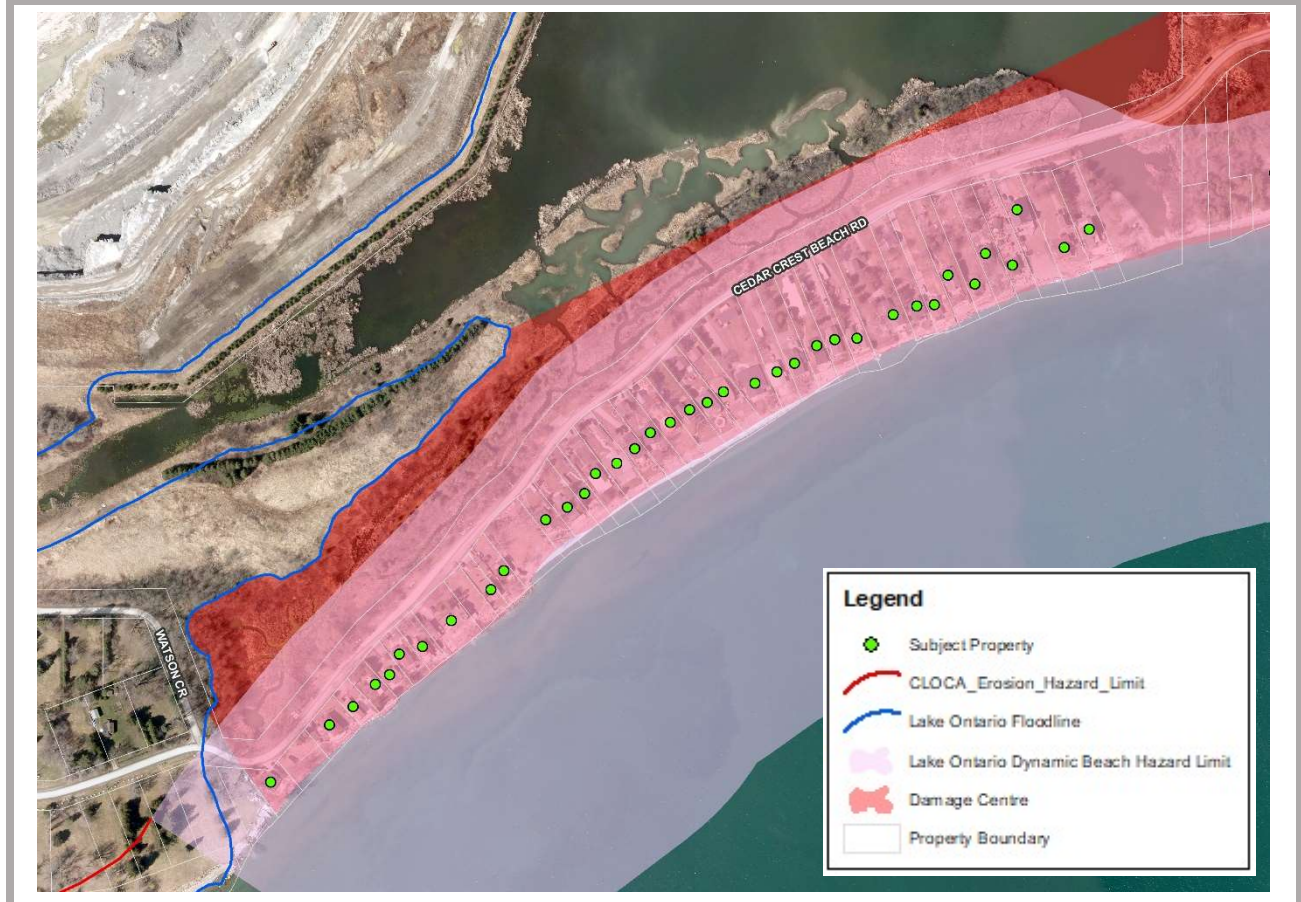
## Shoreline Damage Centre #4: Muskoka Avenue

Location & Description	Applicable Hazards	Further Reference
<p>Six (6) homes on Muskoka Avenue in Oshawa are located in close proximity to the shoreline on a headland which rises to a steep bluff. One house is located at the top of the bluff (on Kluane Avenue). Existing shoreline conditions along Muskoka Ave include a well-engineered cast-in-place concrete seawall, ad-hoc shoreline protection and unprotected properties.</p>	<p>All homes affected by shoreline erosion. At the west limit of Muskoka Ave a few homes are also within the shoreline flood hazard area.</p>	<p>Falls within Reach 2 of the LOSHMP. Refer to specific reach recommendations and Maps 14 &amp; 15.</p>



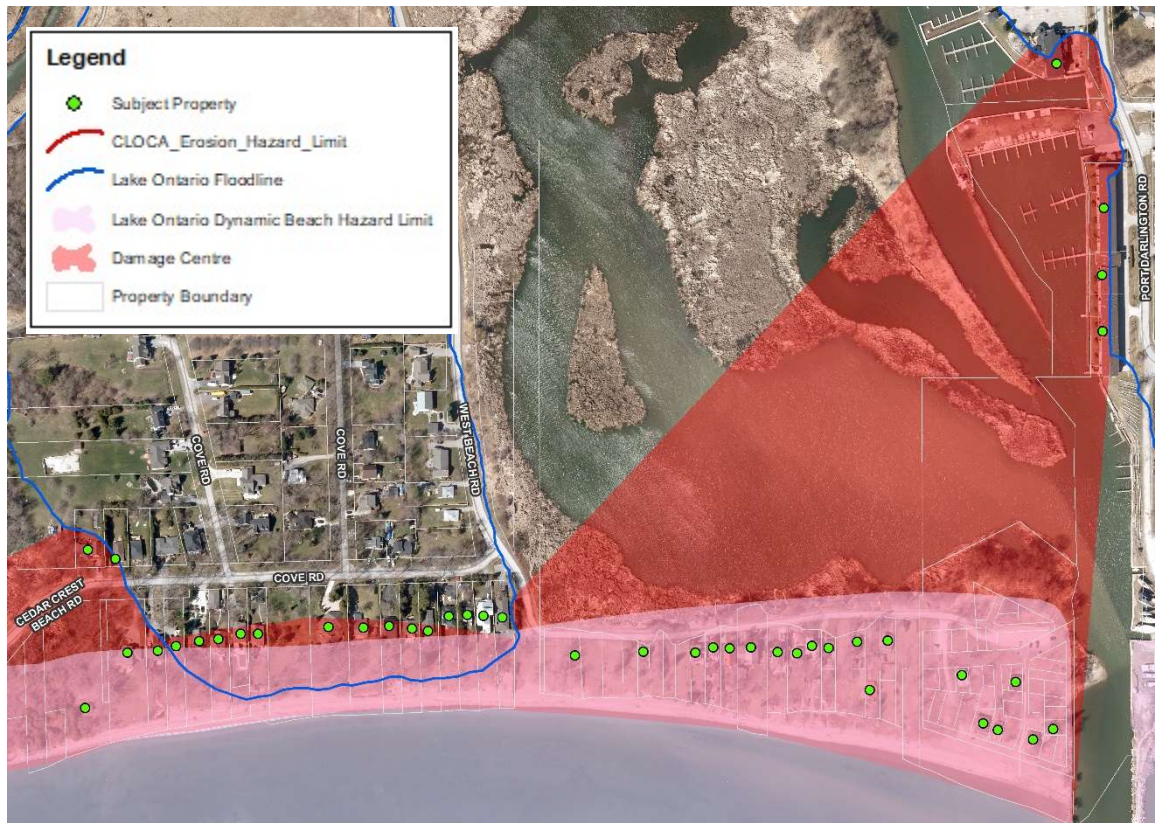
## Shoreline Damage Centre #5: Port Darlington

Location & Description	Applicable Hazards	Further Reference
<p>The Port Darlington SDC includes homes on Cedar Crest Beach Road, West Beach Road and Cove Road in Clarington. Along Cedar Crest Beach Road, approximately 37 lakefront properties are located on a sand spit separating Lake Ontario from Westside Marsh. Similarly, 19 properties on West Beach Road are situated between Bowmanville Marsh and the shoreline. This SDC includes homes on Cove Road which are located on a dynamic beach, as well as a restaurant and condo building on Port Darlington Boulevard situated inland fronting onto Bowmanville Marsh. Most buildings are close to the lake and vulnerable to coastal and riverine flooding. The shoreline is almost entirely armoured and features a wide variety of structure types, levels of design and condition. All structures have a very low crest due to the low land elevation and suffer from settlement during periods of high lake levels due to ongoing vertical erosion of the lakebed. The community has experienced flooding in recent times, the worst of which occurred during record high lake levels in 2017.</p>	<p>Homes are located on a dynamic beach and are impacted by both riverine flooding from Westside Creek as well as Bowmanville/Soper Creek, and shoreline flooding from Lake Ontario. The condo building and restaurant on Port Darlington are susceptible to both riverine and shoreline flooding.</p>	<p>Falls within Reach 4 of the LOSHMP. Refer to specific reach recommendations and Maps 30, 31 &amp; 33.</p>



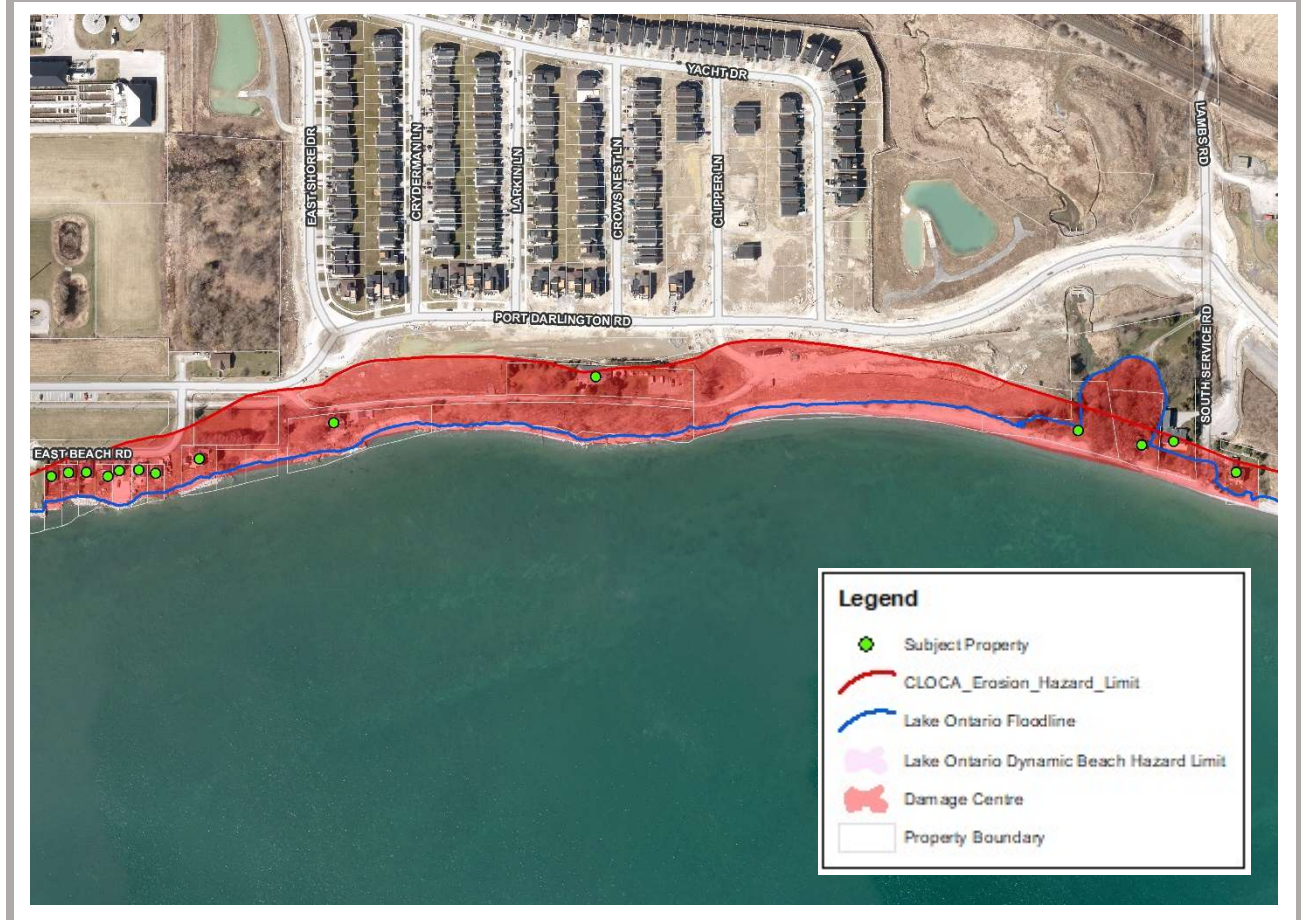


### Shoreline Damage Centre #5: Port Darlington cont'd



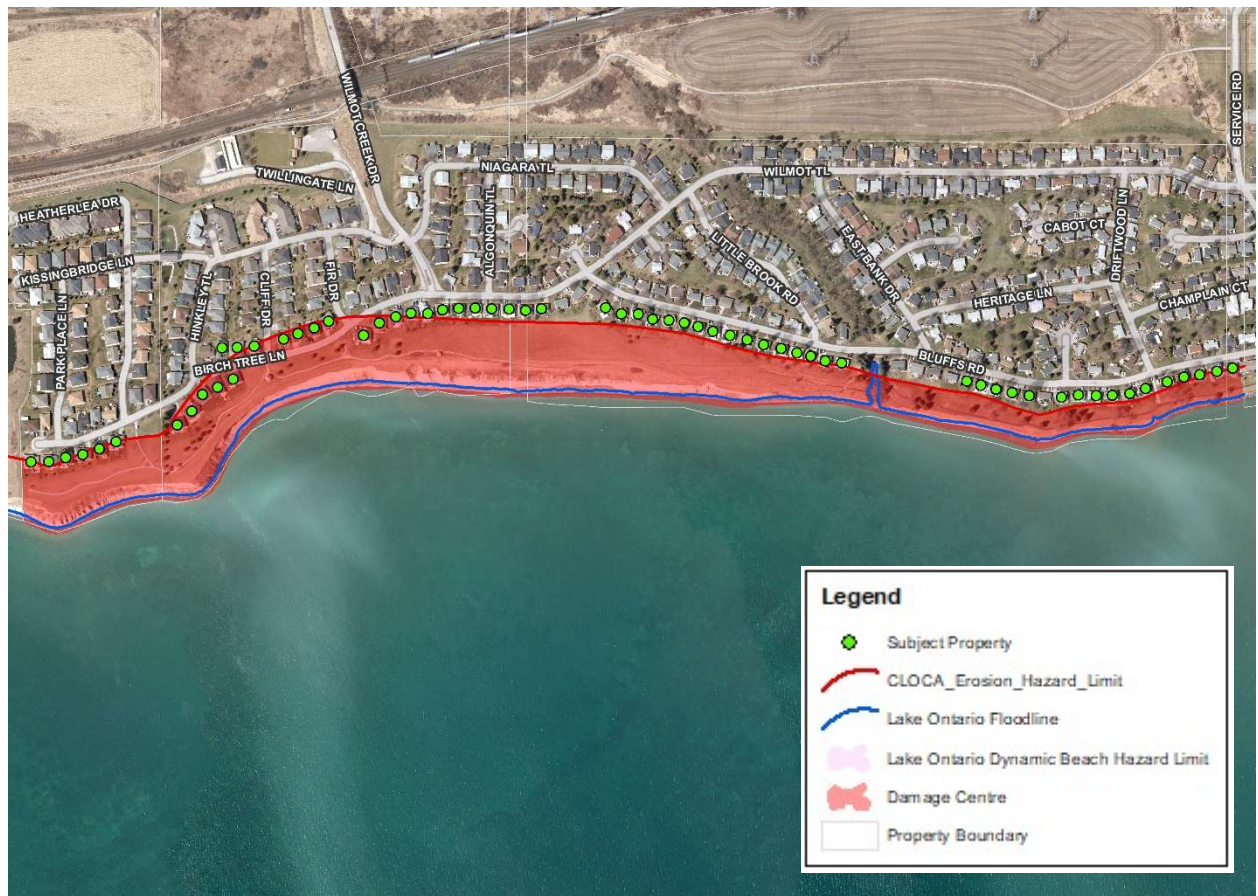
## Shoreline Damage Centre #6: East Beach Road

Location & Description	Applicable Hazards	Further Reference
<p>Ten (10) homes located along Port Darlington East Beach Road and 4 homes at the end of South Service Road in Clarington are impacted by the shoreline in this SDC. The properties along Port Darlington East Beach Road are sitting atop a high, rapidly eroding bluff. Some properties feature shore protection of varying quality and condition, while others are unprotected and continue to erode. These properties are at risk due to their proximity to the bluff crust.</p>	<p>All homes affected by shoreline erosion. Two homes on South Service Road are also within the shoreline flood hazard area and the regulatory floodplain of Bennett Creek.</p>	<p>Falls within Reach 5 of the LOSHMP. Refer to specific reach recommendations and Map 33 and 34.</p>



## Shoreline Damage Centre #7: Wilmot Creek

Location & Description	Applicable Hazards	Further Reference
<p>The Wilmot Creek Retirement Community includes approximately 66 homes stretching along almost 3 km of eroding bluffs in Clarington. A shoreline structure has been engineered and implemented in the last decade, however it is only an interim, porous structure comprised of an armour stone berm resting directly on the beach at the toe of the bluff. Some vertical beach erosion and horizontal recession of the bluff is expected to continue behind the structure during periods of extreme lake levels.</p>	<p>Thirty (30) homes along the shoreline are within the shoreline erosion hazard limit an additional 32 homes are in close proximity to the limit and may be impacted by erosion.</p>	<p>Falls within Reach 5 of the LOSHMP. Refer to specific reach recommendations and Map 35, 36 &amp; 37.</p>



### **3.0 Study Approach**

A Shoreline Hazard Summary, Risk Assessment, and Management Plan is required for the seven (7) shoreline flood damage centres identified in Section 2.0.

#### **3.1 Natural Hazard Identification**

The Lake Ontario Shoreline Hazard Management Plan has recently been completed by CLOCA and it provides updated information and hazard mapping. This latest report replaces the 1990 Sandwell report and Environment Canada shoreline hazard mapping. As noted in this report, from the 2017 through 2020 period, the Great Lakes broke water level records with record Great Lakes watershed precipitation. In the same period, unpredictable spring weather and unstable ice conditions caused havoc with spring water level regulation in Lake Ontario. Adding to the uncertainty, climate change is predicted to reduce ice cover on Lake Ontario, leaving our shoreline exposed to winter winds and storms.

The Lake Ontario Shoreline Hazard Management Plan Mapped Lake Ontario 1:100 year flood hazard, comprised of the 1:100 year water level, storm surge, and wave run-up. This analysis included the recent record water levels and resulted in a higher flood elevation than in previous reports. The report also provides a 100-year erosion allowance limit based upon annual recession interpreted from historical aerial photography. Both shoreline bluff features and beaches are mapped with erosion limits, as the study determined Lake Ontario beaches are also receding. The report also contains a reach by reach analysis of the shoreline, and provides information on the amount of shoreline hardening that has taken place in the reach. Using the data from this report in conjunction with the reference documents listed in Section 4, SDC specific hazards will need to be identified, analyzed, and summarized.

Some of the identified shoreline damage centres are also impacted by flood hazards from riverine sources. Where these exist, the additional risk associated with the riverine flooding should also be included in the assessment. Floodplain mapping, hydraulic and hydrologic reports exist for these sites and are to be provided by CLOCA.

#### **3.2 Risk Assessment**

The scope of work will include a detailed risk assessment of the seven Shoreline Damage Centres (SDCs) listed in Section 2. Damage Centres are identified at the convergence of natural hazards and the built environment. While shoreline damage centres are identified by homes and businesses located in hazard areas, they are also likely to contain public infrastructure including roads, utilities, and shoreline protection works. To direct the management for protecting damage centres, the level of risk imposed by the hazards needs to be assessed. To assess risk, consideration must be given to:

1. The **vulnerability** of the structures and community based on the range of hazards and potential extent for damage. Vulnerability factors include public safety and extent of damage to property. Consideration should be given to emergency access, and also vulnerability of private septic and water supply systems where they exist.
2. The **likelihood** of an event or hazard occurrence. Flooding predictions are based upon statistical events with a likelihood of occurrence in any given year (i.e.: a 1:100 year flood has a 1% chance of occurring in any year). Similarly, with known shoreline recession rates, and distance between structures and an eroding shoreline, a timeline for erosion impacts can be assigned.
3. The **economic impact** that would be experienced from a natural hazard event is related to the value of property within the damage centre, and the economic cost of business disruption. Consideration must be given to the type of damage expected (i.e.: structural damage versus content damage). Consideration should also be given to the cost for preparation and implementation of emergency operations, as needed, and the cost related to clean-up after an event.
4. The **social impact**. Natural disasters cause hardship to the victims. Financial hardship, displacement or disruption to home and work life, loss of valued possessions, and uncertainty all add to physical and mental stress. While natural disasters can be short duration events, the effects linger for long periods as repair and recovery efforts require extensive time. Proposals should recommend a method to quantify and evaluate social impact.
5. **Environmental impacts** can include debris swept away during floods, contamination from materials damaged during events, or submergence of septic systems and contamination of surface water and groundwater.

It is anticipated the risk assessment will include an evaluation process and scoring system based on the above considerations. The risk assessment must be thoroughly documented and include SDC specific risk mapping showing areas of higher and lower risk (i.e. heat map).

Associated with the risk assessment will be a presentation of detailed in-force municipal zoning by-law information for each parcel of land within the SDCs. The zoning information will include mapping showing the applicable zone classification and the detailed regulations (permitted uses, setback requirements, lot coverage limits, etc.) associated with each zone along with any applicable approved minor variances for any given parcel.

### 3.3 Risk Mitigation Plan

Once the risk assessment is complete, remedial measures shall be considered and summarized in the report. The risk assessment will help to identify the appropriate approaches for remedial action. The approaches include:

1. **Avoid** (all risk categories): New development or re-investment needs to be located outside of natural hazards to avoid the associated risk.
2. **Retreat** (high risk categories): Where the risk is high, the best means to mitigate the risk is to relocate to a location outside of the hazards or to a location of low risk. This option is the most disruptive but provides safety and eliminates long term costs from repeated efforts to remain in place.
3. **Accommodate**: In some instances, risk can be mitigated through structural improvements such as flood proofing or raising of structures to prevent flood inundation.
4. **Protect**: Shoreline works such as rock revetments and breakwaters can be used to provide protection to damage centres. These works need to be monitored and maintained to ensure continued effectiveness.

The risk mitigation plan should build on the risk assessment to formulate the preferred mitigation alternatives for each SDC. It is anticipated the preferred mitigation plan for each SDC will consider, at a minimum, the environment, existing infrastructure, health & safety, public and agency acceptance, ease of implementation/construction, technical feasibility, operations and maintenance, capital and lifecycle costs and benefits, proposed amendments to the existing zoning to implement the mitigation plan and conform to the Planning Act and the Provincial Policy Statement, 2020 natural hazard tests and policies and climate change impacts.

### 4.0 Existing Information

The following is a list of available background documents. Some links are provided below. All remaining information can be viewed at the following link: <https://cloca-my.sharepoint.com/:f:/p/lbenham/ErfdmZVXvT1GmHQsa79TnK4BN2SyBIBA4YoGR6rYWVpnig?e=3qjtuG>

- Lake Ontario Shoreline Hazard Management Plan (Zuzek 2020) including hazard mapping, Ground photos and oblique aerial photography of nearly all damage centres (oblique images captured in November 2018 using an unmanned aerial vehicle), and a shoreline inventory database.
- Whitby Coastal Flood Risk Assessment and Municipal Class Environmental Assessment (Ahydtech 2020)
- CLOCA Flood Risk Assessment (CLOCA 2017)

- National Disaster and Mitigation Program Guidelines including Risk Assessment Information Template: <https://www.publicsafety.gc.ca/cnt/mrgnc-mngmnt/dsstr-prvntn-mtgtn/ndmp/prgrm-gdlns-en.aspx>
- Corbett Creek Master Drainage Plan (TMIG 2021) including digital hydrologic and hydraulic models and floodplain mapping.
- Westside Creek Hydrologic and Hydraulic Modeling (CLOCA 2013) including all digital models and floodplain mapping
- Hydrologic modeling for Bowmanville & Soper Creeks (CLOCA 2007, Revised 2011) including digital model
- Bowmanville Creek and Soper Creek Floodplain Mapping Study (Aquafor Beech Limited 2009) including digital model and floodplain mapping.
- Bennett Creek Hydrologic and Hydraulic Modeling (CLOCA 2012) including digital models
- Bennett Creek Floodplain Mapping Update (CLOCA 2013) including digital floodplain maps.
- Lidar data for CLOCA's entire jurisdiction (CLOCA Lidar 2018, Omafra Lidar 2016): <https://geohub.lio.gov.on.ca/datasets/mnrf::ontario-digital-terrain-model-lidar-derived>
- 2018 First Base Solutions Digital Ortho Mapping used in LOSHMP
- 2020 First Base Solutions Digital Ortho Mapping
- The Durham Region Coastal Wetland Management Plan: <https://www.cloca.com/wetland-monitoring-project>
- Report on Hydrotechnical Analysis of Modifications to Westside Creek and Marsh Associated with Future Operations of Blue Circle Cement (Marshall Macklin Monaghan, 1998)
- Port Darlington Community Shoreline Management Plan: Report on Flooding (CLOCA 2018)
- Port Darlington Shore Protection Concepts (Baird 2018)
- Port Darlington Shoreline Management Report (Aqua Solutions 5, 2018)
- Functional Understanding of Westside Marsh (Dillon 2018 memo)
- Provincial Policy Statement, 2020: [www.ontario.ca/pps](http://www.ontario.ca/pps)
- Municipal Zoning By-laws for the Town of Ajax, Town of Whitby, City of Oshawa and Municipality of Clarington

## 5.0 Public Consultation

A community and agency consultation plan shall be provided with the project proposals, and shall include a minimum of one public consultation session at a facility to be provided by CLOCA.

## 6.0 Deliverables

Report submissions will be required through the study process as follows:

- Draft Study Report
- Final Study Report including paper mapping products

Additional draft reports may be required at CLOCA's discretion to resolve contentious issues, etc. The draft and final reports must be made available to CLOCA in hard copy (2) and digital form, including digital copies of models and mapping products. The consultant should also budget for a minimum of four virtual meetings with CLOCA (assume two (2) hours each in duration). Meeting minutes are to be prepared and issued within five (5) business days.

## 7.0 Proposal Contents, Submission

All proposals shall be evaluated based on the suggested methodology and work program, company experience, staffing experience, knowledge of the shoreline and watersheds, and cost. CLOCA reserves the right to reject any or all proposals should it be deemed in their best interest to do so. A complete proposal shall include the following information:

**6.1 A Work Plan** including a brief description of each component of the methodology should be provided following the format of Section 3 of these Terms of Reference. Any optional/additional work suggested in the interest of creating a better product should be identified and priced as a separate item.

**6.2 A Project Schedule** including deliverables and major milestones showing sequence of work, any interdependencies, and the project critical path. Include reasonable timelines for addressing agency approval requirements. Assume a project start date of late July 2021.

**6.3 A Time-Task Matrix** identifying the number of hours and hourly rate by staff member.

**6.4 Per Diem and Project Component Costs** shall be provided as well as total costs (including HST) for all work required to complete the project

**6.5 Company Experience** with shoreline projects shall be identified. Please list recent similar projects and provide references. Similar information should be provided for any sub-consultants that are part of the study team.



**6.6 Knowledge of the Lake Ontario Shoreline** including a list of projects undertaken in the area.

**6.7 Key Staff Members** that will lead the various components of the study shall be identified, and a summary of recent experience for each individual provided. Where sub-consultants are proposed, list projects where the various study members worked together. The structure of the study team is to be clearly identified with one individual ultimately responsible for reporting to CLOCA.

**6.8 Any Potential Conflicts** shall be listed including on-going work for development or personal interests along the Lake Ontario Shoreline.

**Questions regarding the Terms of Reference can be submitted in writing by Monday, June 28, 2021. A digital copy of the proposal must be received by the Central Lake Ontario Conservation Authority by 4:00pm, July 9, 2021. Late submissions will not be accepted.**

## 8.0 Evaluation

Proposals submitted shall be evaluated using the criteria listed below.

<b>Evaluation Criteria</b>	<b>Available Points</b>
<b>Qualifications and Experience</b> <ul style="list-style-type: none"><li>• Demonstrated experience of firm</li><li>• Demonstrated experience of key personnel</li><li>• Experience with similar projects, in both scope and value</li></ul>	25 points
<b>Quality of Proposal</b> <ul style="list-style-type: none"><li>• Responsiveness/completeness of submission</li><li>• Demonstrated willingness to comply with the terms of the RFP</li></ul>	10 points
<b>Project Deliverables</b> <ul style="list-style-type: none"><li>• Demonstrated understanding of the requirements</li><li>• Quality and completeness of approach/work plan/methodology</li><li>• Project management structure</li><li>• Ability to provide necessary resources to meet milestone dates and deadline</li><li>• Value added services</li></ul>	45 points
<b>Pricing</b> <ul style="list-style-type: none"><li>• Cost effectiveness of the proposal</li><li>• Proposals exceeding the NDMP budget will be disqualified</li></ul>	20 points
<b>Total Points</b>	100 points