



**C.C. Tatham & Associates Ltd.**  
Consulting Engineers

# **WASAGA SHORES SUBDIVISION**

## **Town of Wasaga Beach**

### **Shoreline Hazard Study**

prepared by:

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prepared for:

1428420 Ontario Inc.  
November 15, 2018  
CCTA File 116028

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Appendix B: Wave Uprush Calculations

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# 1 Introduction

C.C. Tatham & Associates Ltd. (CCTA) has prepared a Shoreline Hazard Study in support of a plan of subdivision application at 2320 Shore Lane in the Town of Wasaga Beach (Town). The subject property is regulated by the Nottawasaga Valley Conservations Authority (NVCA) as it is located along the shoreline of Georgian Bay, and is therefore subject to the associated flood and erosion hazards. Approval must be obtained from NVCA to allow for approval of the proposed draft plan of subdivision.

The proposed development will consist of a road connecting Betty Boulevard and Constance Boulevard, and 22 lots with two of the lots fronting Georgian Bay. A key plan is provided as **Figure 1**.

## 1.1 Objectives

The primary objective of this report is to demonstrate that the siting of the proposed development has made appropriate consideration for shoreline hazards. This will be accomplished by determining the extent of shoreline hazards acting on the subject shoreline and establishing development setbacks and minimum building elevations as required.

## 1.2 Guidelines & Background Information

This report was prepared recognizing provincial guidelines on natural hazards, including the following publications:

- The Ministry of the Natural Resources (now MNR) Technical Guide for Great Lakes – St. Lawrence River Shorelines (2001);
- NVCA Natural Hazards Technical Guide (2013); and
- Environment Canada and MNR Coastal Zone Atlas – Great Lakes Shore Damage Survey (1973).

Information relating to existing topography, ground cover and shoreline conditions was obtained through a review of relevant background studies, available plans and base mapping.

## 2 Existing Shoreline Conditions

### 2.1 Existing Conditions

The property is located on Georgian Bay. The site is exposed to waves generated from the northwest-north-northeast directions. The subject shoreline is a sand beach that transitions to mature vegetation further from shore, at a slope of approximately 2.0%. A series of cobble/boulder shoreline revetments exist on neighbouring properties.

The subject shoreline is located in a transitional area between sections of depositional sand beach and rip-rap beach per Environment Canada's *Environmental Sensitivity Atlas for Lake Huron's Canadian Shoreline* (1994). Shore-zone sediment transport occurs in a south-east direction.

The existing site is undeveloped and consists of forested land cover. Site photographs of the existing site conditions are seen in **Appendix A**.

### 2.2 Flood Hazard

The flood hazard limit is defined in the Provincial Policy Statement as the 100-year flood level plus a wave uprush allowance. The 100-year flood elevation applicable to this portion of the Georgian Bay shoreline is 178.0 m and includes the static lake level and wind setup, per the MNRF Technical Guide for Great Lakes – St. Lawrence River Shorelines.

We note that there is a small depression at the rear of the two waterfront lots that is just below 178.0 m, however, it is separated from the lake by a continuous ridge of higher ground. Thus, the small depression is isolated and not part of the flood hazard.

### 2.3 Wave Uprush Calculations

To determine the design wave uprush elevation, CCTA carried out an extreme value analysis of offshore wave conditions. Using historical wave data from buoy C45143 located in Georgian Bay, it was determined that the significant wave height with a 1:100-year return period is 6.6 m. This wave height was transformed to the nearshore using the SWAN spectral wave model with 300 m resolution that CCTA has developed to simulate wave conditions across Southern Georgian Bay. For a location offshore of the subject site, the SWAN model returned a wave height of 1.57 m with a corresponding wave period of 4.1 seconds.

The calculated wave height was then transformed to the shoreline to produce a wave run-up value using design charts from the United States Army Corps of Engineering Research Centre. The wave run-up was calculated to be 0.20 m, with the waves breaking on the beach. The resulting flood hazard elevation is 178.20 m. Supporting calculations are found in **Appendix B**.

## 2.4 Erosion

The subject sand beach is not believed to be a dynamic beach. Historic photos from 1978, 1989, 1997, 2008 and 2016 show an unchanging established treeline at the site location, therefore there is no dynamic beach and no dynamic beach hazard. Historic photos are attached in **Appendix C**.

Additionally, the Coastal Zone Atlas was used to confirm the likely extent of erosion at the site location. The site is located between erosion monitoring stations H-32 and H-33. The shoreline is described as a beach or dune complex, with permanent residential land use. No shoreline damage due to erosion is described at the site location.

The nearest erosion station to the subject site is H-32, which shows a recession rate of 0.0 m/year from 1954 to 1973. The station is located approximately 1.0 km east of the subject site. The closest station to the west is H-33, located approximately 2.0 km from the site. The station shows an accretion rate of 0.0 m/year from 1954 to 1972.

It is our opinion, based on review of historic aerial photos and available erosion station records, that the average annual recession rate is negligible and there is no erosion hazard at the subject site. The relevant pages from the Coastal Zone Atlas are found attached in **Appendix C**.

## 2.5 Ice Piling

Wind can cause melting ice to pile along shorelines and be pushed landward, causing erosion and damage to structures that are encountered.

A 15 m setback, in which the existing shoreline vegetation is preserved, is recommended to provide appropriate protection from hazards associated with ice piling. In addition, a minimum opening elevation of 178.6 m should be applied to all structures.

The hazard limits and proposed setbacks are shown on **Drawing HAZ-1**.

### 3 Conclusions & Recommendations


The proposed 22 lot subdivision can be protected from shoreline hazards through the application of a 15 m setback from the 100-year flood elevation of 178.0 m. This 15 m setback extends further landward than the calculated wave uprush elevation of 178.20 m and allows for potential erosion and ice piling effects. In addition, all proposed habitable structures should be constructed with a minimum opening elevation of 178.6 m.

All proposed building envelopes are to be located outside the shoreline hazard limit, as shown in **Drawing HAZ-1**. The shoreline hazard setback is to be enforceable as a provision of the by-law.

We trust the above presentation of a Shoreline Hazard Study is sufficient to satisfy the Draft Plan of Subdivision requirements.

All of which is respectfully submitted,  
**C.C. Tatham & Associates Ltd.**

  
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Intern Engineer

  
\_\_\_\_\_  
Reviewed by: Amanda Kellett, B.Sc.Eng., P.Eng.  
Senior Engineer, Group Leader

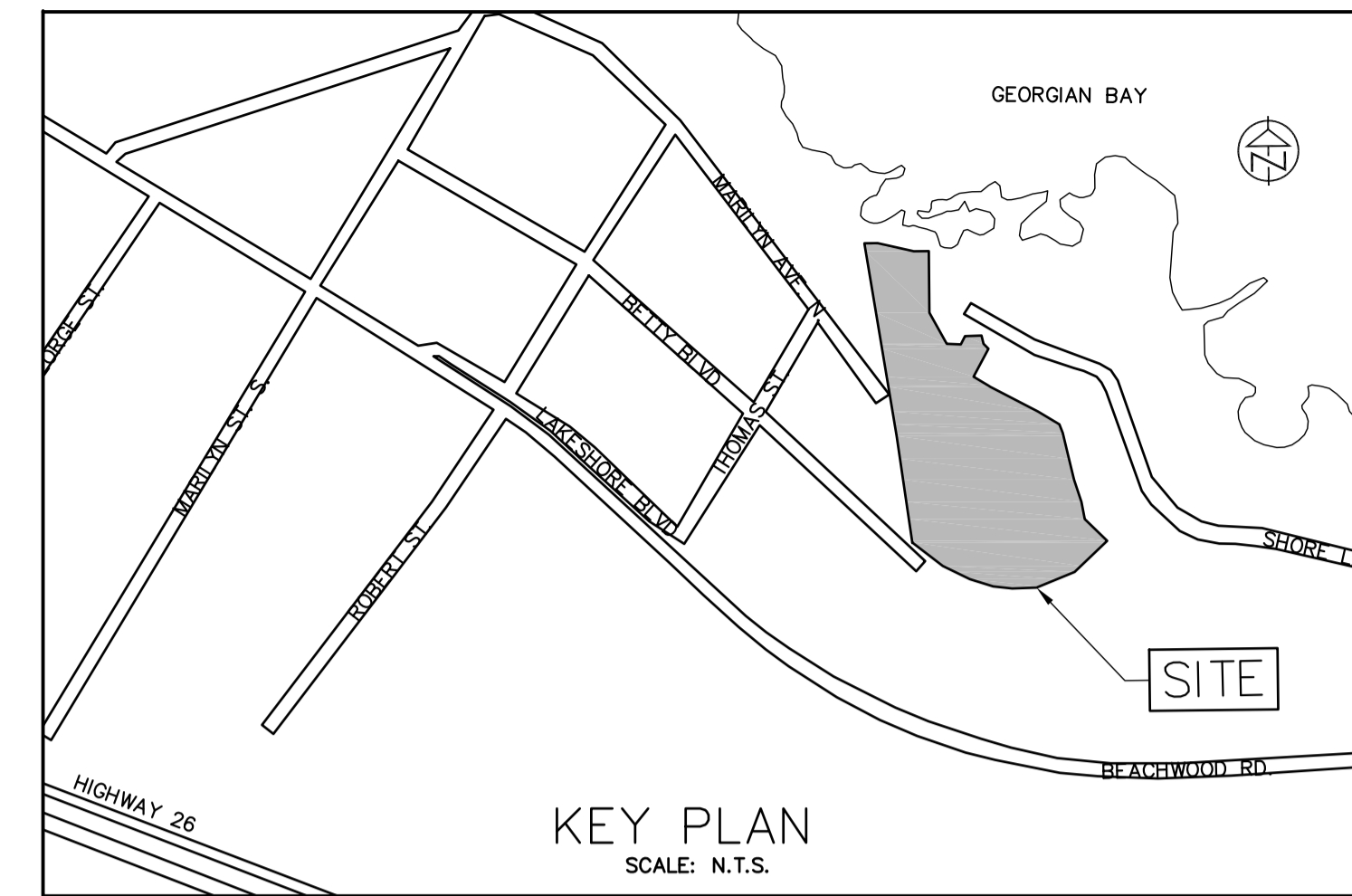
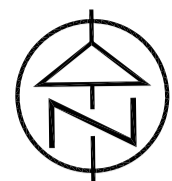
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**GEORGIAN BAY**



**KEY PLAN**  
SCALE: N.T.S.

**LEGEND**

PROPERTY/LOT LINE	---
EXISTING CENTERLINE	---
EXISTING EDGE OF ASPHALT	---
EXISTING STORM SEWER	---
EXISTING STORM MAINTENANCE HOLE	□ CBMH
PROPOSED REAR-YARD BIOSWALE	▬
PROPOSED SWALE	▬
PROPOSED GRADE & DIRECTION	← 2.0%
PROPOSED/EXISTING GRADES	423.00 423.00
EXISTING FLOW DIRECTION	→

**CONTRACT DRAWINGS**  
CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.  
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**CONTRACT DRAWINGS**  
LEGAL SURVEY INFORMATION AND LOT DIMENSIONS SHOWN ON THIS PLAN WERE TAKEN FROM A PLAN OF SURVEY PREPARED BY PATTEN & THOMSEN LTD. DATED NOV 1, 2005, WHICH MAY NOT BE FINAL AND ARE NOT GUARANTEED. THE FINAL REGISTERED PLAN SHALL BE REFERRED TO FOR CONFIRMATION OF THE DATA.

NO.	REVISIONS	DATE	INITIAL
1.	ISSUED FOR NVCA APPROVAL	NOV 15/18	ALK

APPROVED

**WASAGA SHORES SUBDIVISION**  
**PART OF LOTS 34 AND 35 CONCESSION 3**  
**PART 11, 12 & 13, PLAN 51R-34095**  
**TOWN OF WASAGA BEACH**  
**COUNTY OF SIMCOE**

**SHORELINE HAZARD PLAN**

**C.C. Tatham & Associates Ltd.**  
Consulting Engineers  
Collingwood Bracebridge Orillia Barrie

SCALE: 1:750	JOB NO. 116028
DESIGN: LG	CHECKED: ALK
DRAWN: DDOH	DATE: NOV 2018

DWG. **HAZ-1**



— — — Property Location



C.C. Tatham & Associates Ltd.  
Consulting Engineers

### 2320 Shore Lane, Town of Wasaga Beach Key Plan

Figure

1



**APPENDIX A:  
SITE PHOTOGRAPHS**



**Photograph 1: Existing Shoreline Facing North West**



**Photograph 2: Existing Shoreline and Vegetation Limit Facing East**



**Photograph 3: Neighbouring Shoreline Protection (Facing North West)**



**Photograph 4: Neighbouring Shoreline Protection (Facing East)**

**APPENDIX B:  
WAVE UPRUSH CALCULATIONS**



**C.C. Tatham & Associates Ltd.**  
Consulting Engineers

Collingwood      Bracebridge      Orillia      Barrie

<b>Project:</b>	Vandermeer Subdivision, Wasaga Beach
<b>Date:</b>	Nov-2018
<b>File No.:</b>	116028
<b>Designed By:</b>	ALK
<b>Checked By:</b>	RPM
<b>Subject:</b>	Wave Uprush Calculations

### Wave Uprush Calculations

100-yr Deep Water Significant Wave Height, transformed to nearshore ( $H'_o$ )	1.57	m	--> from SWAN model
Wave Period ( $T_p$ )	4.1	s	--> from SWAN model
Deep Water Wavelength ( $L_o$ )	26.25	m	
Beach Slope (m)	0.02	m/m	
$H'_o/gT^2$	0.0095		
$H_b/H'_o$	1.00		--> from Fig 2.11 Basic Coastal Engineering <sup>1</sup>
Breaking Wave Height ( $H_b$ )	1.57	m	(adapted from USACE Research Center, 1984)
$\cot \alpha$ (1/m)	50.00		
$R/H'_o$	0.14		--> from Fig 2.15 Basic Coastal Engineering <sup>1</sup>
Uncorrected Smooth Slope Runup (R.)	0.22	m	(adapted from USACE Research Center, 1984)
100-yr water level	178.00		
Wave Hazard El	178.22		

1. Basic Coastal Engineering Third Edition, Robert M Sorenson (2006)

**APPENDIX C:  
EROSION**

Site Photo - 1978



NORTHWAY SURVEY CORPORATION LIMITED

NORTHWAY SURVEY CORPORATION LIMITED

78-4433  
95

245

Site Photo - 1989





Site Photo - 1997

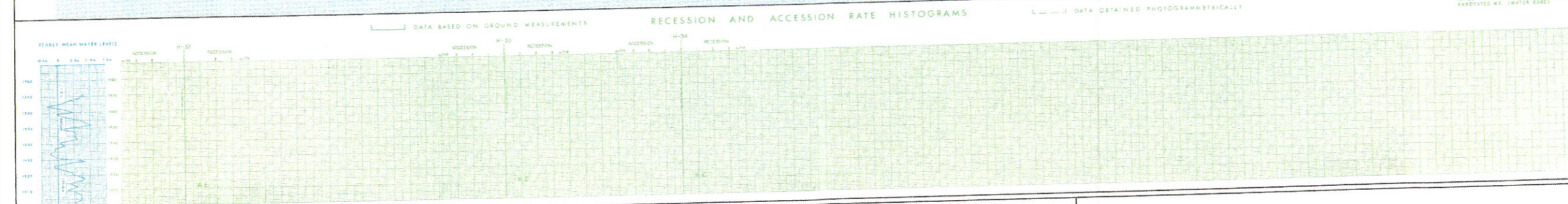
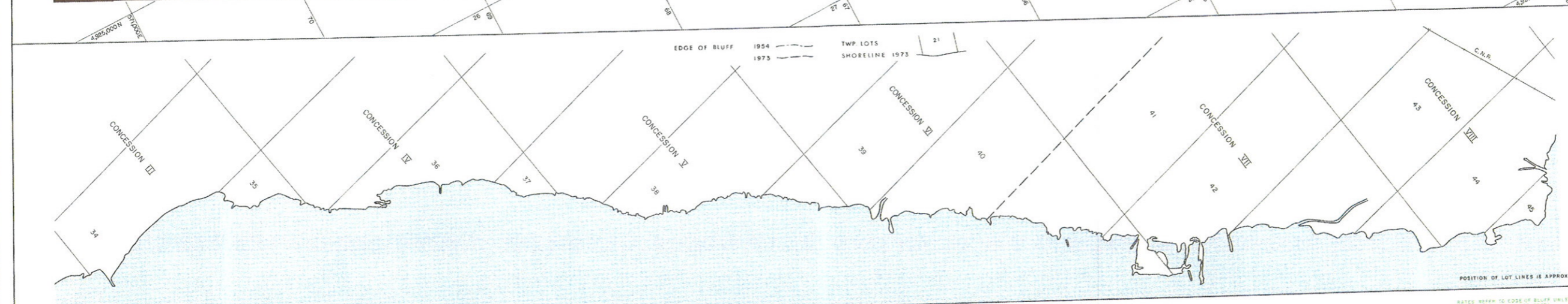
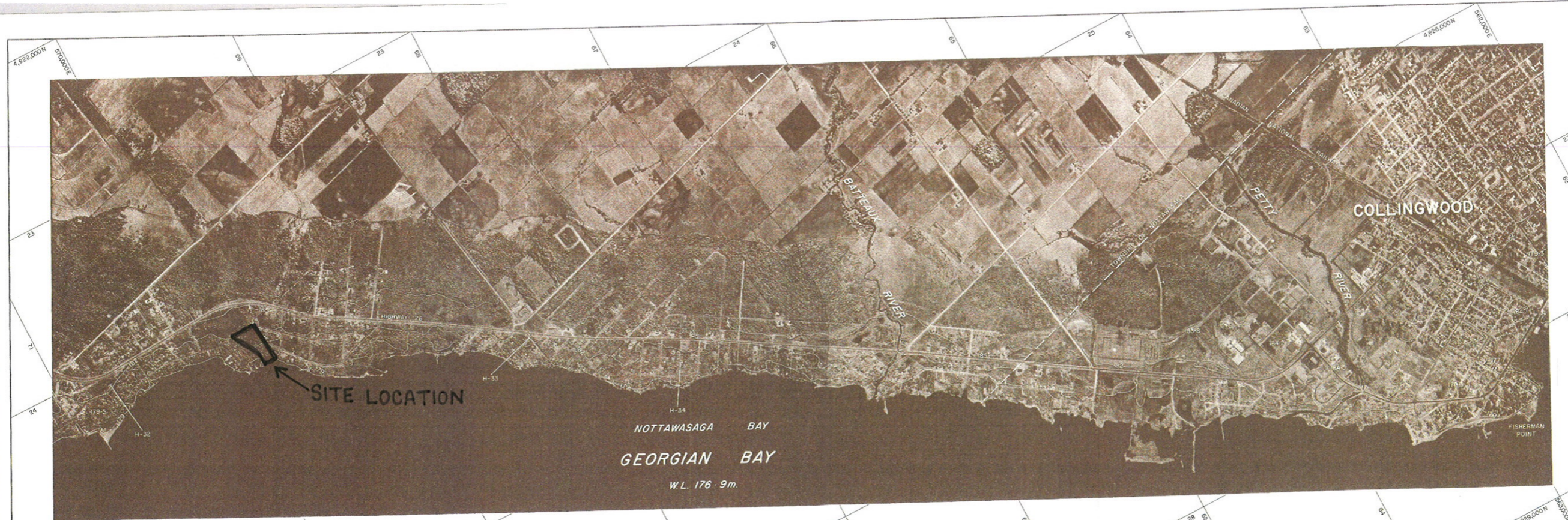


Site Photo - 2008



Site Photo - 2016

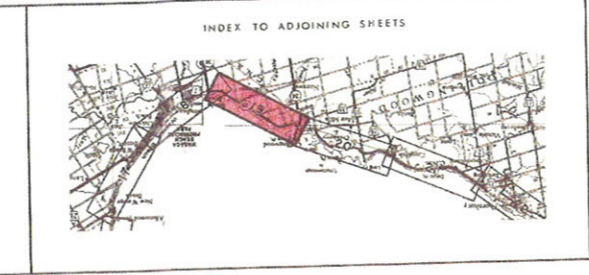
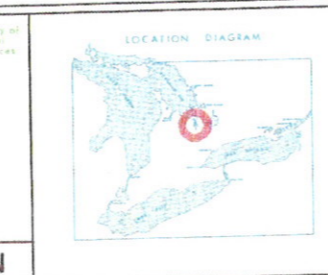




**CANADA - ONTARIO**  
**GREAT LAKES SHORE DAMAGE SURVEY - 1973**  
 COUNTY OF SIMCOE

SCALE 1:20,000  
 METRES 0 500 1000 1500  
 FEET 0 1000 2000 3000 4000

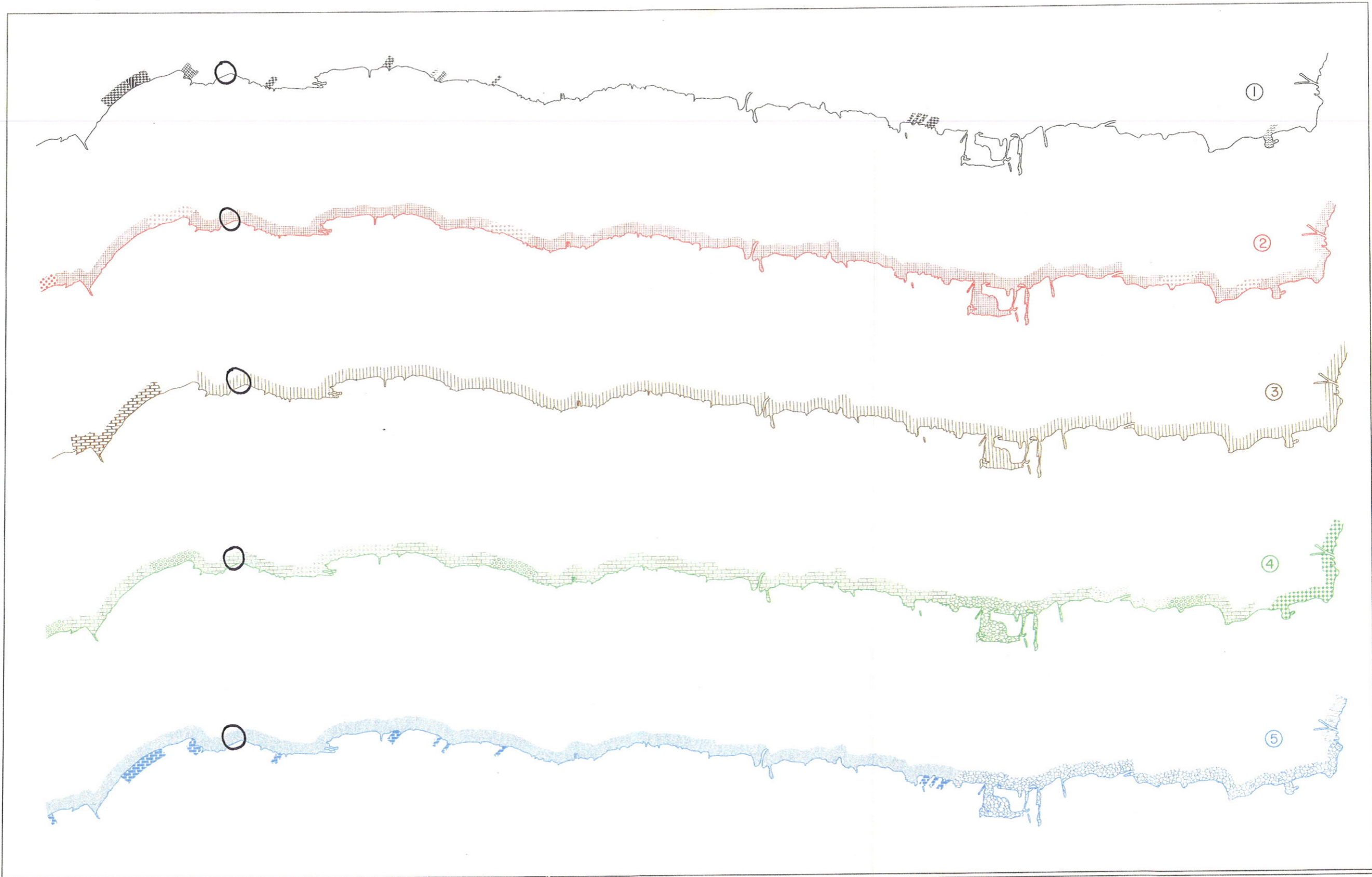
**SHEET 1-19** **LAKE HURON**



**LEGEND**

- PROFILE LOCATION: PHOTODRMMETRIC ERSION STATION (E-2) (E-6-15)
- CONTOUR INTERVAL 3 METRES
- COUNTY, REGIONAL MUNICIPALITY BOUNDARIES: ESSEX COUNTY
- MUNICIPAL BOUNDARIES AS OF JAN. 1 1970: DELHI
- PREVIOUS MUNICIPAL BOUNDARIES: DUNN TWP

3 METRE CONTOUR ELEVATIONS AND WATER LEVELS REFERRED TO INTERNATIONAL GREAT LAKES DATUM (1985) LAKE ERIE 174.2m.  
 WATER LEVEL SHOWN ON PHOTO-MOSAIC IS DAILY MEAN VALUE AT DATE OF AERIAL PHOTOGRAPHY JUNE 23 1973.  
 1000 METRE GRID SHOWN ON A 6° UNIVERSAL TRANSVERSE MERCATOR PROJECTION-ZONE 17



LEGEND		SHORELINE OWNERSHIP		SHORELINE LAND USE		SHORELINE PHYSICAL CHARACTERISTICS	
<b>1 SHORELINE DAMAGE</b> STRUCTURAL DAMAGE DUE TO EROSION Serious \$300/m and up Moderate \$31/m - \$199/m Minor \$20/m and less INUNDATION DAMAGE Serious \$700/m and up Moderate \$31/m - \$199/m Minor \$20/m and less		<b>2 SHORELINE OWNERSHIP</b> Federal Government Provincial Government Municipal Government Private		<b>4 SHORELINE LAND USE</b> Permanent Residential Seasonal Residential Recreational Wildlife Habitat Agricultural Commercial Forest Undeveloped Other		<b>3 A SHORELINE PHYSICAL CHARACTERISTICS</b> BEACH Bars and Spits Beach or Dune complex BLUFFE > 2 m High glacial drift > 10 m High bedrock > 10 m low glacial drift low bedrock low artificial fill	
		<b>3 B SHORELINE VALUE</b> Less than \$200/m \$200 - \$500/m \$501 - \$1,000/m \$1,001 - \$2,000/m \$2,001/m and up				<b>LOW FLASH</b> Glacial drift Bedrock Artificial fill <b>B EXISTING PROTECTIVE WORKS IN DAMAGED AREAS</b> Seawall, bulkhead, gabion, retaining wall Groynes, jetty Breakwater (full-shore) Revetment, bank stabilization Beach replenishment Dyke	

Environment Canada / Environnement Canada

CANADA - ONTARIO  
**GREAT LAKES SHORE DAMAGE SURVEY - 1973**  
 COUNTY OF SIMCOE

Ministry of Natural Resources / Ontario

SCALE 1:20,000  
 METRES 500 1000 1500  
 FEET 1000 2000 3000 4000

**LAKE HURON** **SHEET 2-19**