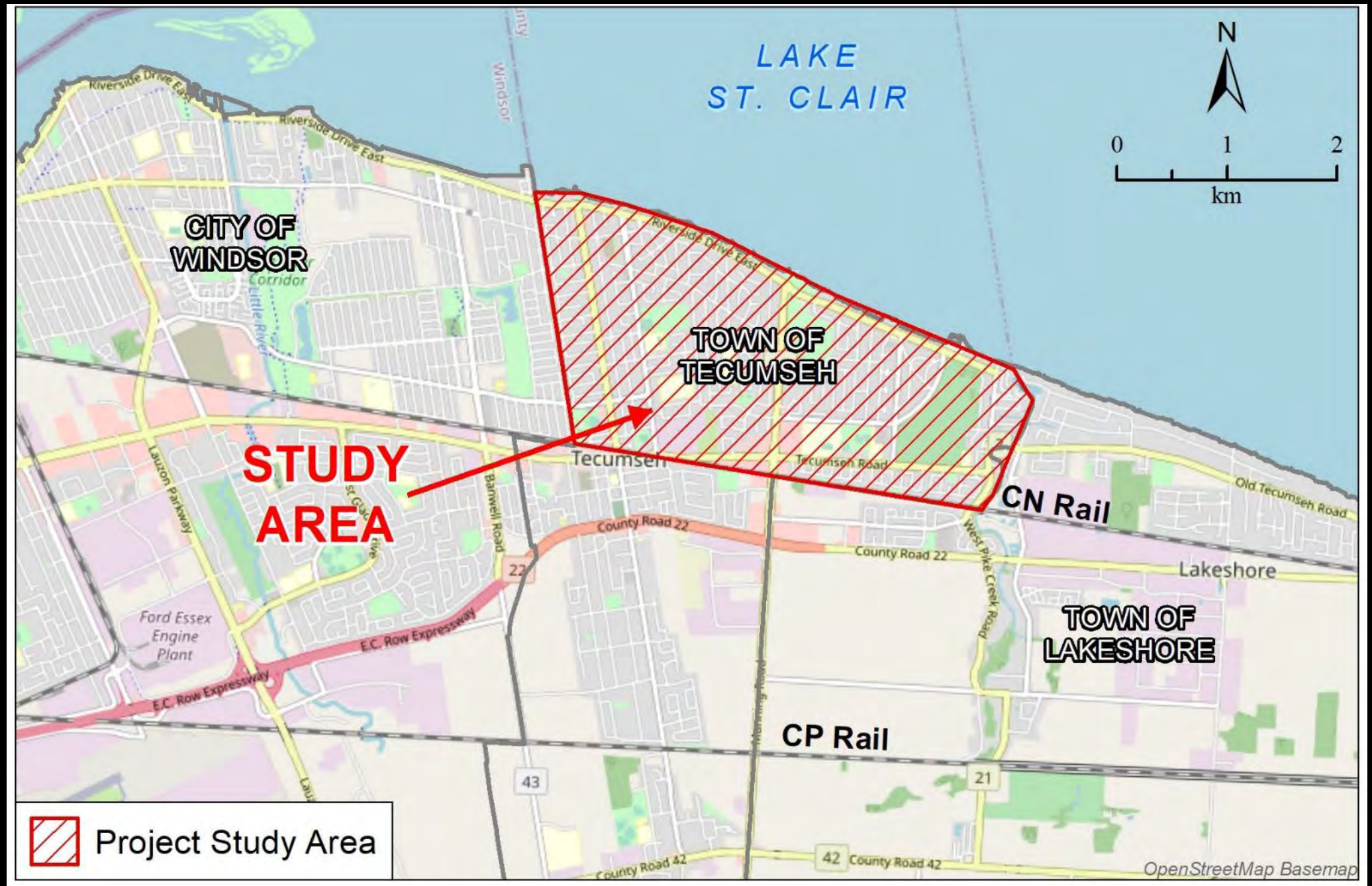
Town of Tecumseh
Shoreline Management Plan Update
Coastal Flood Risk Assessment

Public Information Centre #1

October 29, 2020

Study Area


LAKE
ST. CLAIR
N
0
1
2
km
CITY OF
WINDSOR
TOWN OF
TECUMSEH
STUDY
AREA
CN Rail
CP Rail
TOWN OF
LAKESHORE
Lakeshore
Tecumseh
Riverside Drive East
Tecumseh Road
County Road 22
E.C. Row Expressway
Ford Essex
Engine
Plant
Lauzon Parkway
Barnwell Road
West Pike Creek Road
Old Tecumseh Road
Little River
Corridor
County Road 42
22
43
21
42
Project Study Area
OpenStreetMap Basemap

Public Information Centre Guidelines

- All participants are muted and off video
- The panelists will present the webinar and have their video on
- During the feedback portion you can use the '**Question and Answer**' button found at the bottom of your screen
  - Open the Question and Answer Window
  - Type your question or comment in the window. Click send
  - Your question will be read to all participants by the facilitator and one of the panelists will respond to the comment or question
- Note: Check **Send Anonymously** if you don't want your name attached

Public Information Centre (PIC) #1 GOALS

- Provide an overview of the project and workplan
- Share the preliminary findings from the field work and technical analysis
- Discuss emergency response and present flood hazard mitigation and climate change adaptation approaches
- Gather feedback from the attendees about local conditions and evaluation criteria

AGENDA FOR PIC#1

- Welcome and introductions
- Overview of the project and timelines
- Review of technical work completed to date
- Projected climate change impacts on hazards and flood risk
- Emergency access and flood hazard mitigation
- Question and answer on the presentation
- Interactive discussion with the participants
- Next Steps

LOOKING AHEAD FOR PIC#2 AND PIC#3

- PIC#2: January 2021 (tbd)

- Afternoon and evening sessions

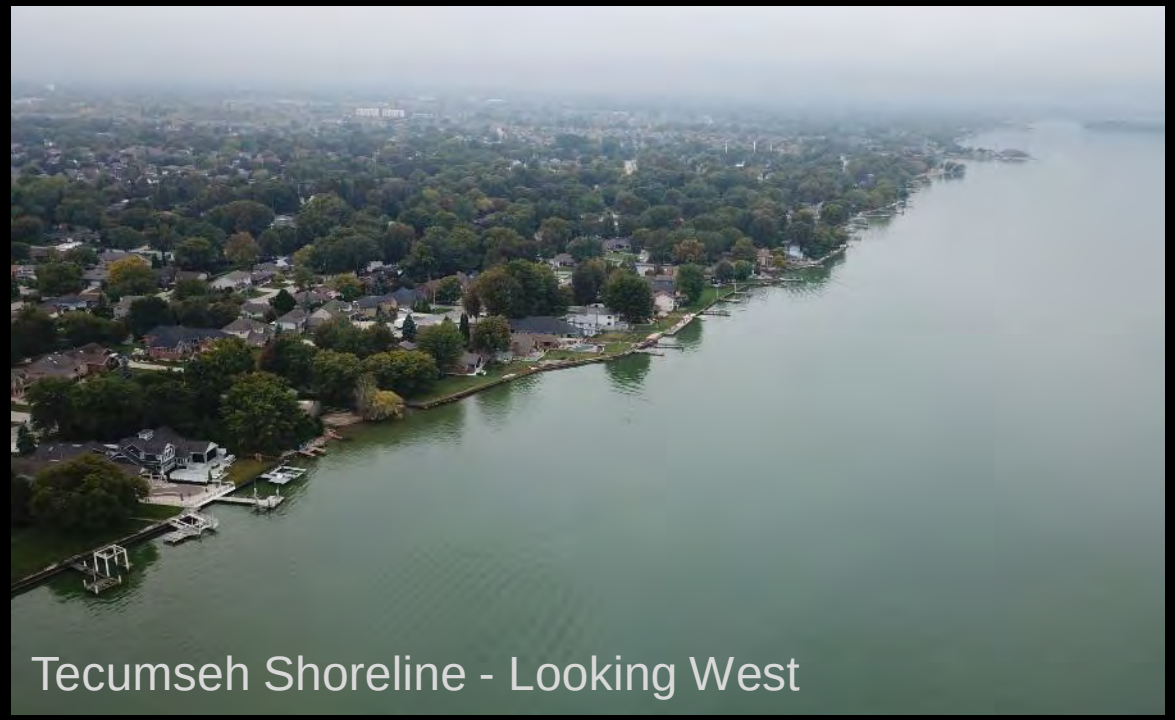
- Scope of meeting (partially based on feedback today):
  - Update on technical work
  - Review of draft floodplain mapping that considers climate change
  - Potential economic damage calculations for different flood scenarios
  - Review questions with the attendees

- PIC#3: 2021 (tbd)

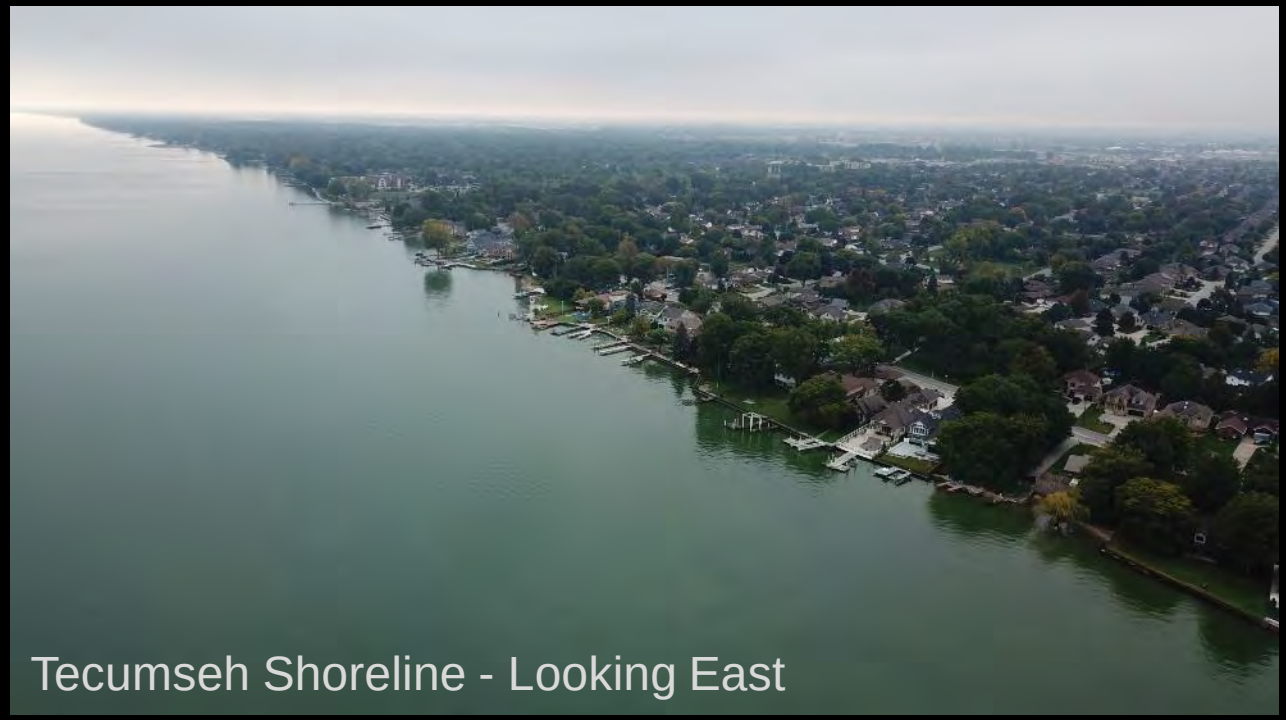
FIELD INVESTIGATIONS AND TECHNICAL ANALYSIS

Oblique Aerial Photographs

- Photos collected documenting the state of the Tecumseh shoreline as of September, 2020.



Tecumseh Shoreline - Looking West



Tecumseh Shoreline - Looking East

Sample of Oblique Photos
(West Tecumseh)


West Project Boundary


Chippewa Park

Sample of Oblique Photos

(Central Tecumseh)

Lakewood Park

Sample of Oblique Photos

(East Tecumseh)

Beach Grove Golf Club

Pike Creek Jetties

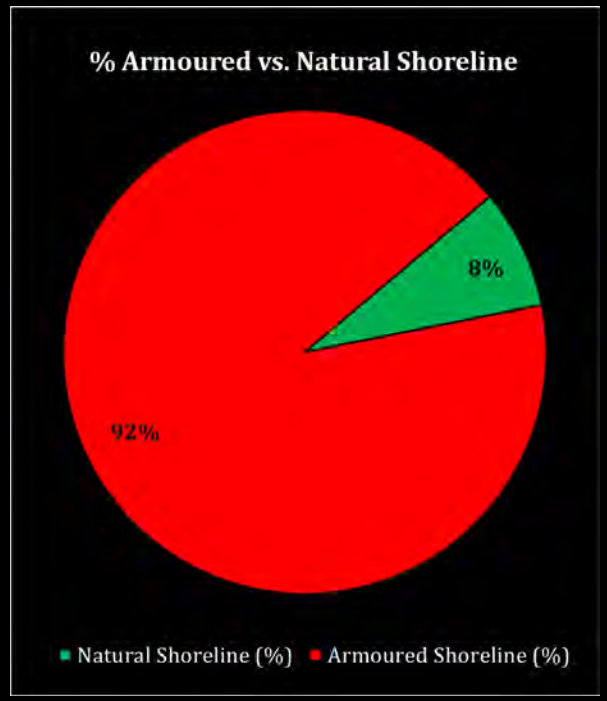
Pike Creek

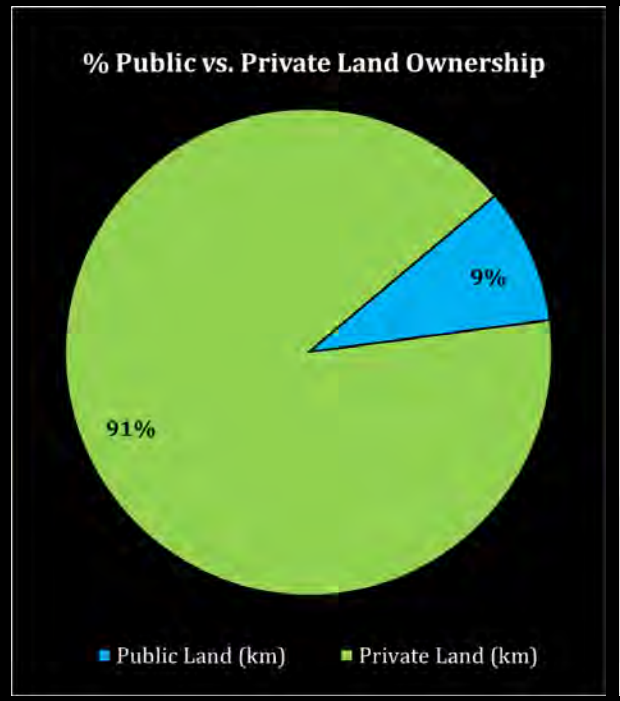
CN Rail Crossing

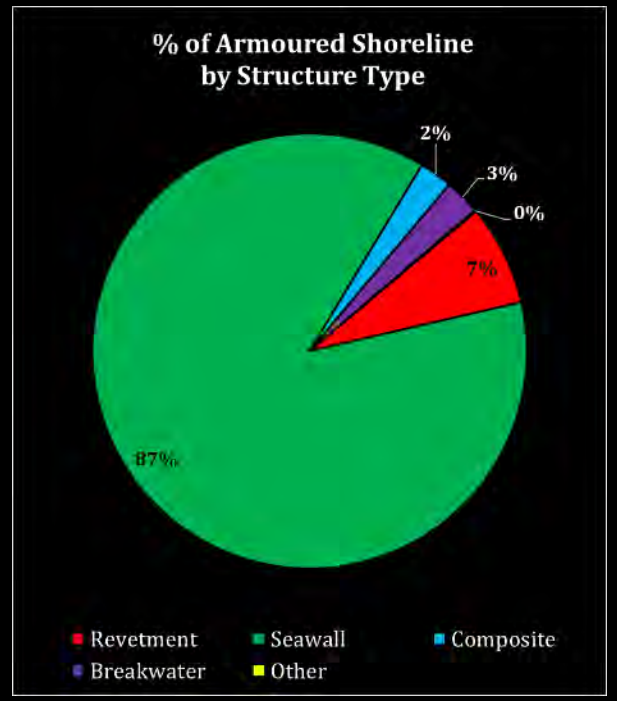
Shore Protection Database

- Shoreline protection database was assembled for the entire study shoreline
- Summary statistics:
  - Armoured vs. natural shoreline
  - Structure type
  - Structure condition
  - Level of design
  - Importance

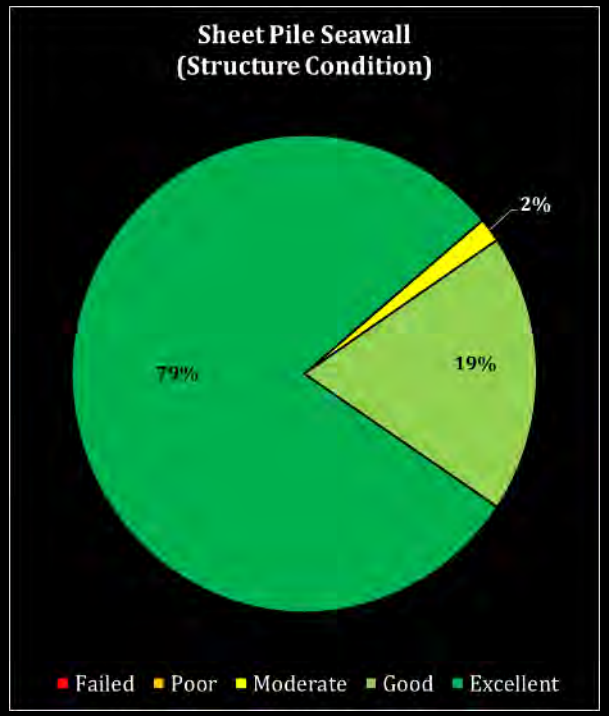
Sample Statistics:

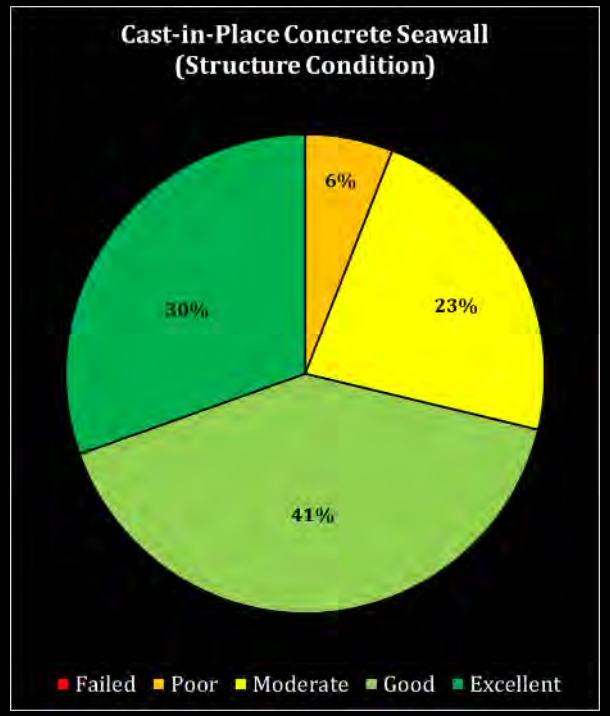


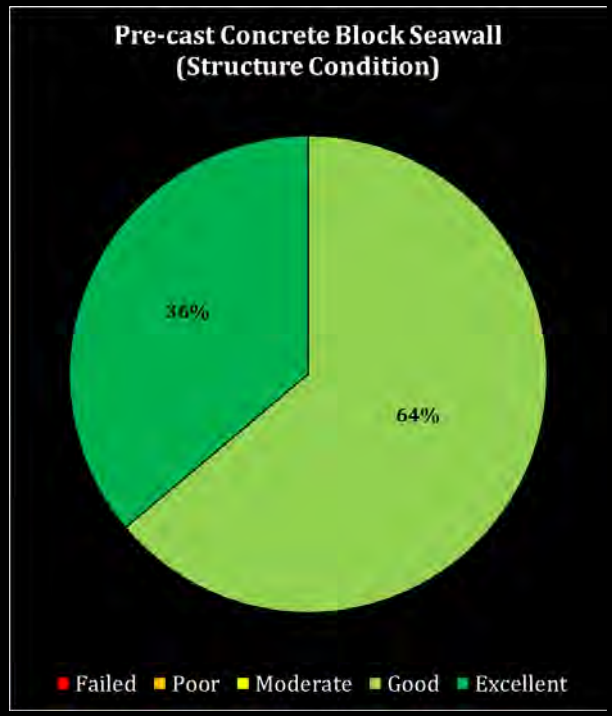


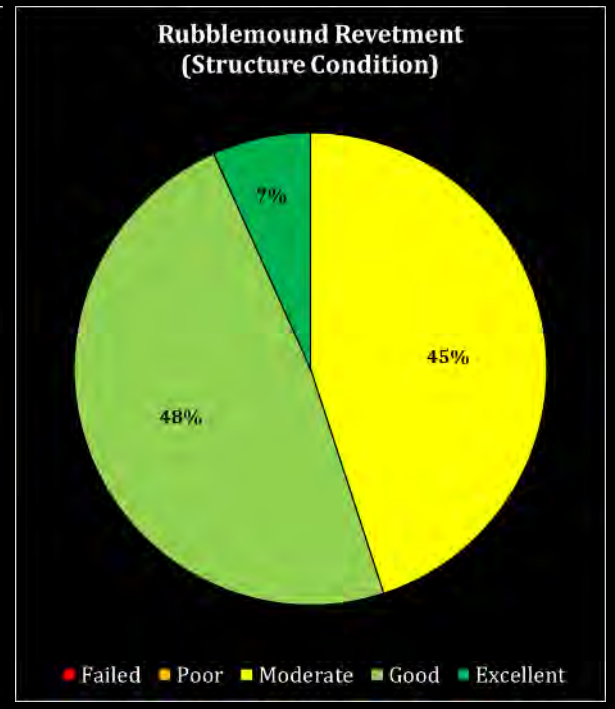


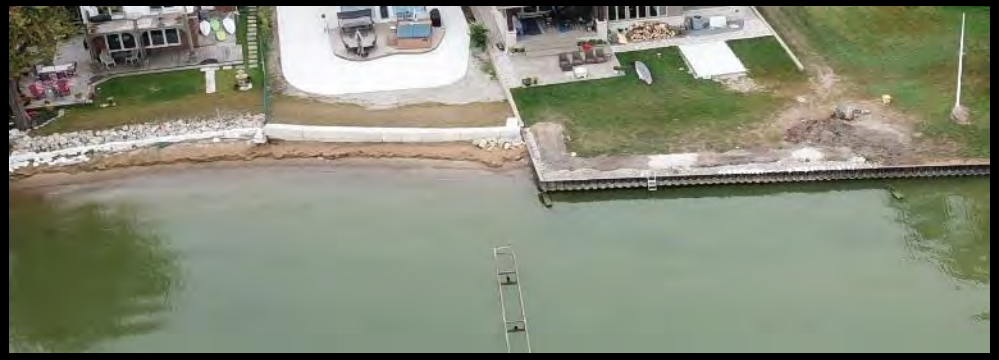
Shore Protection Database





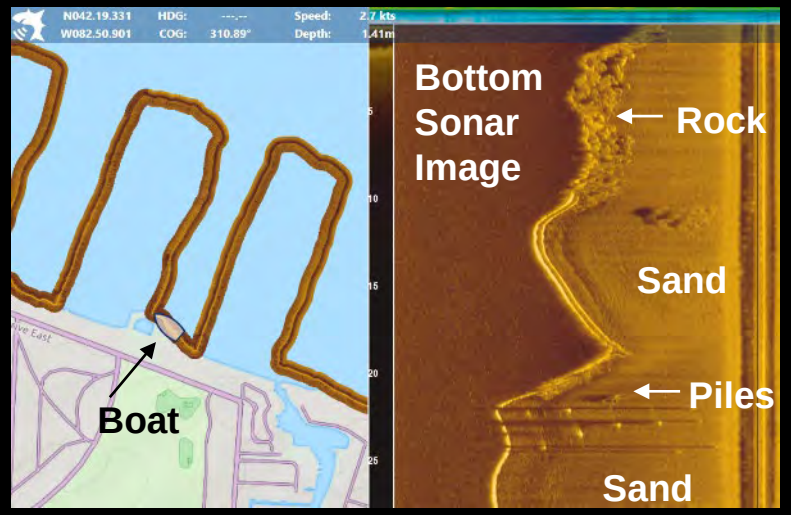


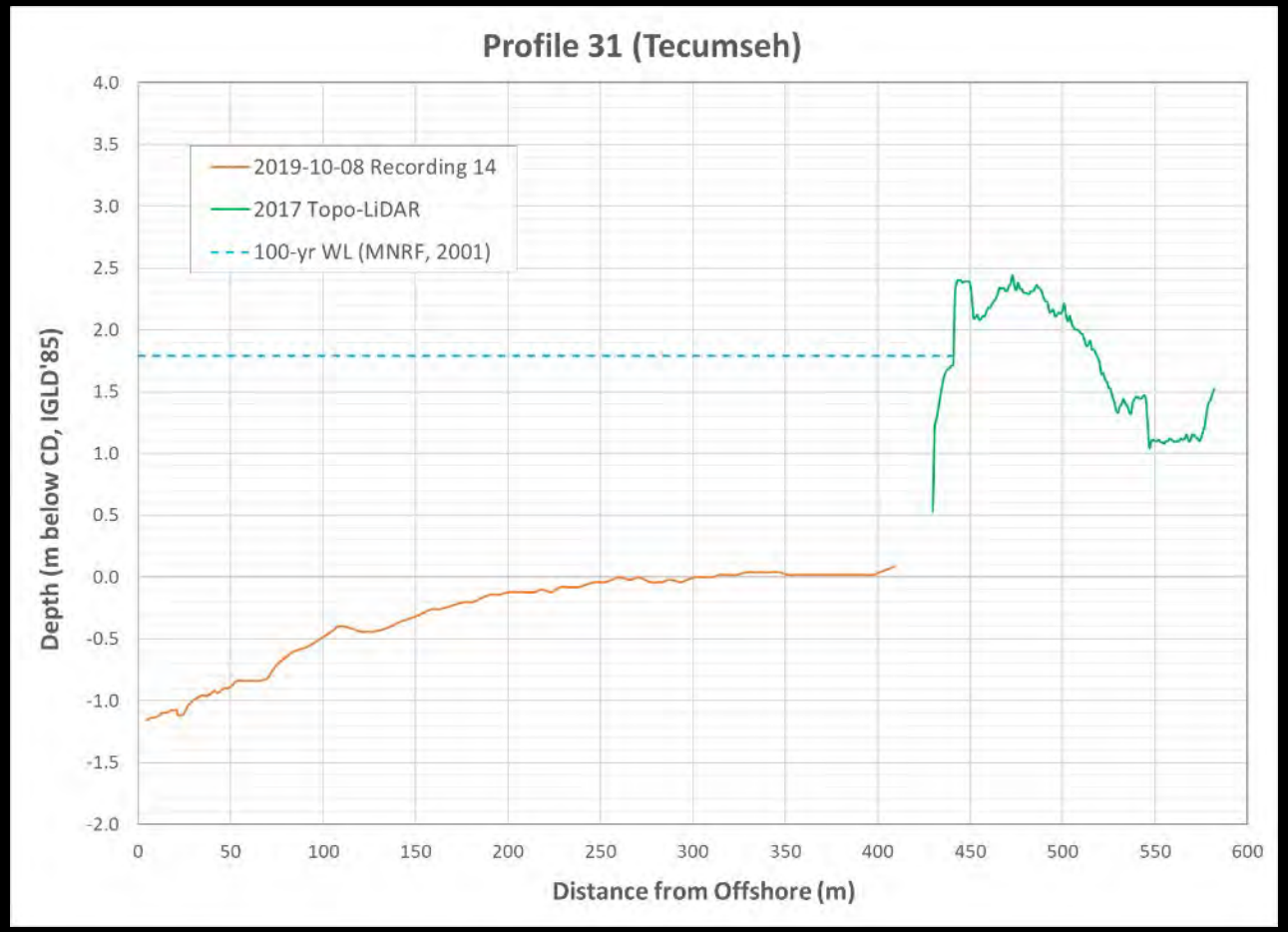




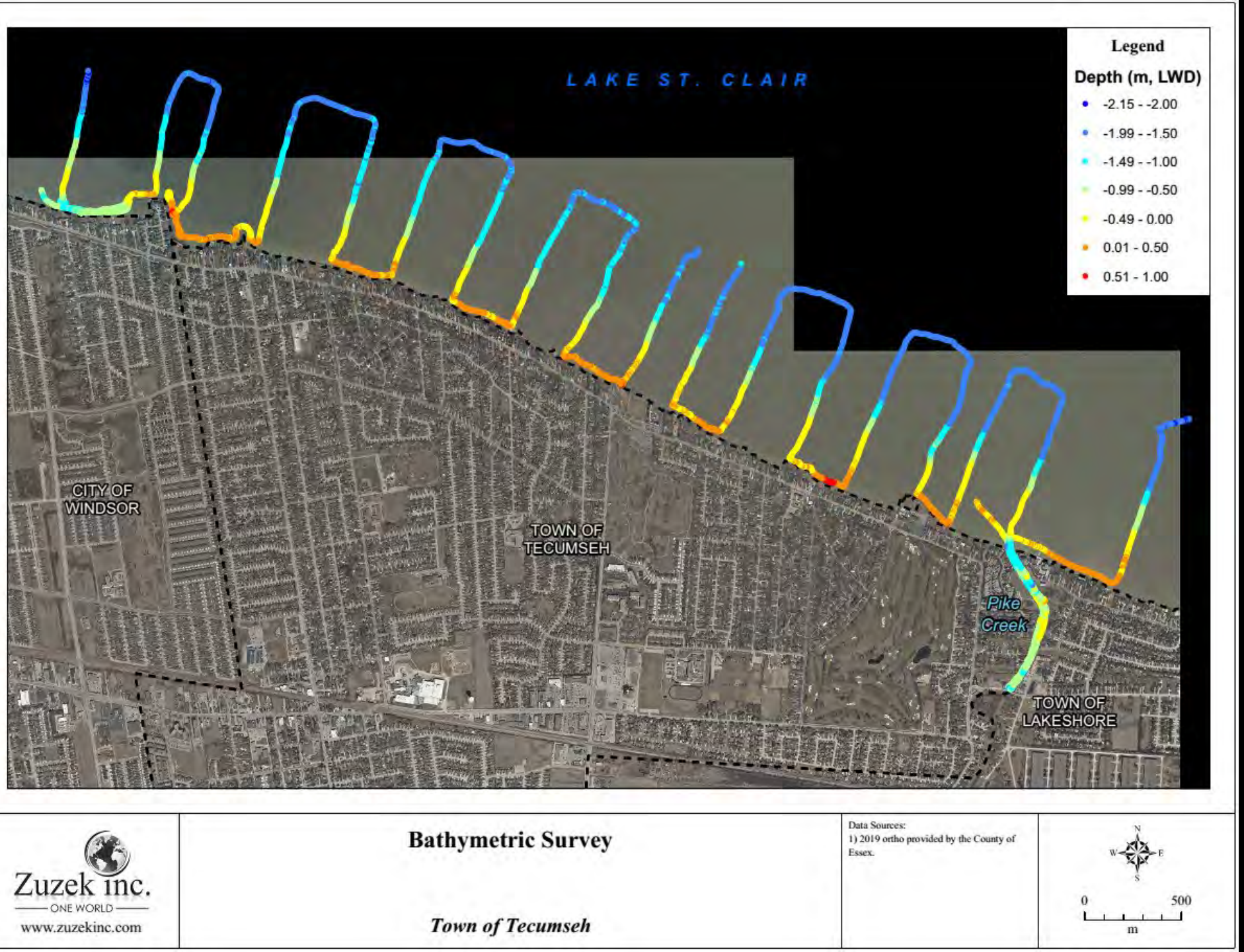
Bathymetric Survey

- Lakebed elevations and substrate logged using SOLIX™ 2D Sonar instrument





Bathymetric Survey
August 2020



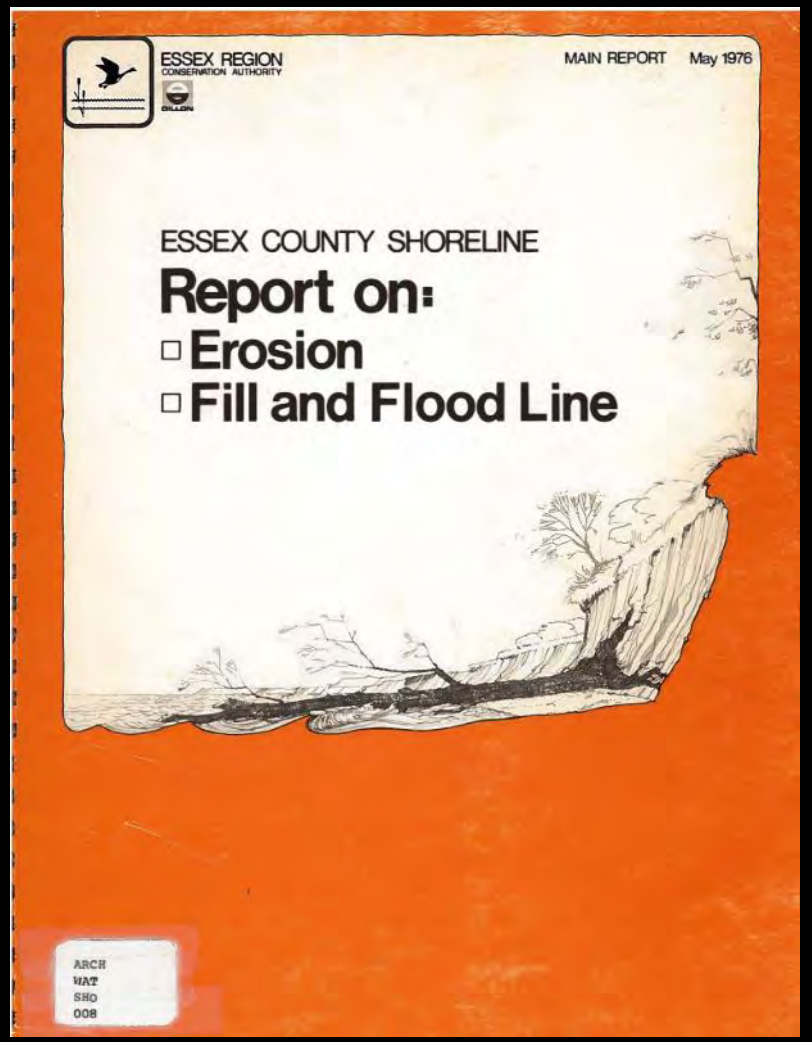
Detailed Topographic Shoreline Survey

by JD Barnes

Extreme Water Level Analysis

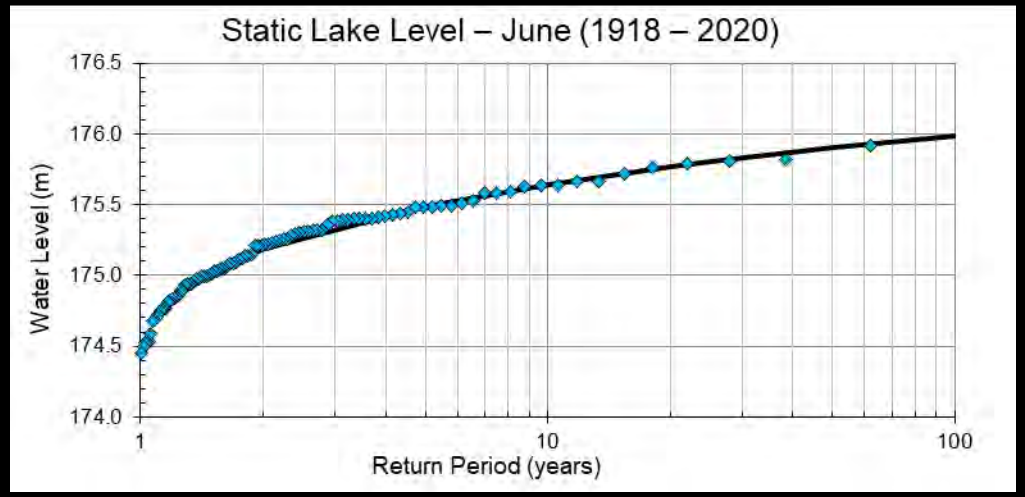
- 100-year flood level:
  - 1% probability of occurrence in any given year
  - Combination of static lake level and storm surge
- Existing regulatory 100-year flood level is 176.4 m IGLD’85 (from Dillon, 1976)
- MNR (1989) also published water level extremes

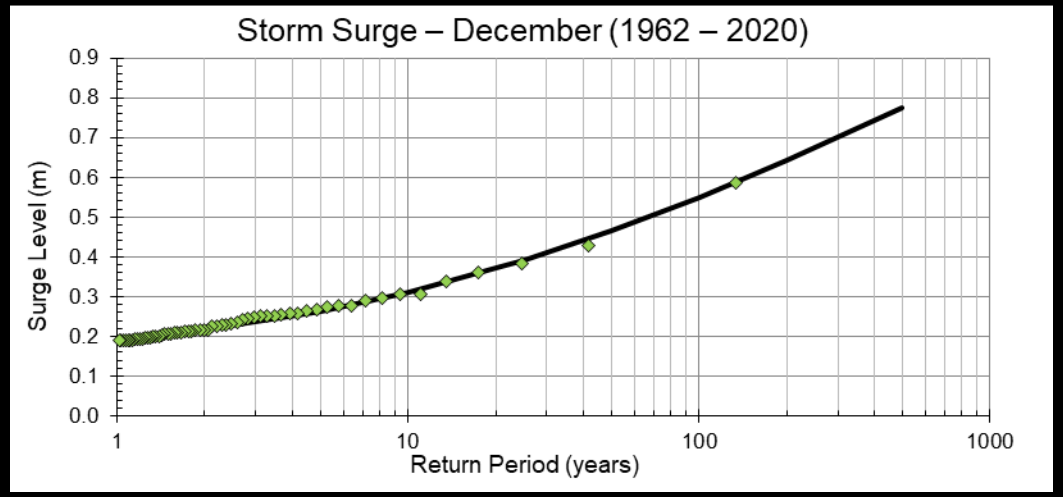
- This study will update the analysis to 2020 with measured water levels
- Integrate the projected impacts of climate change (not complete yet)



Water Level Analysis

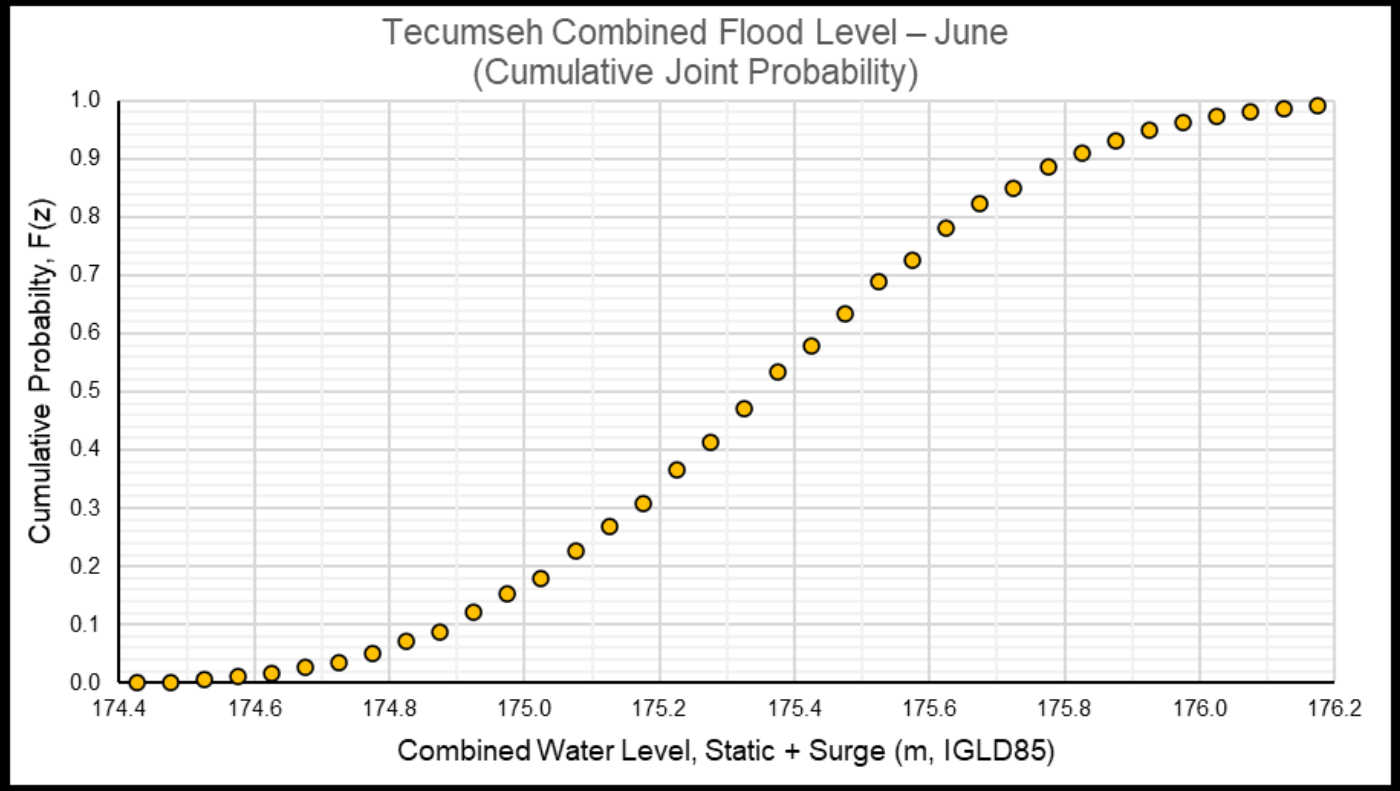
- 100-year static lake level re-analyzed based on data from 1918 – 2020:
  - 100-year static lake level = +176.03 m IGLD'85 (June/July)
    - Up ~12 cm from MNR (1989)
- 100-year storm surge re-analyzed using data from 1962 – 2020:
  - 100-year storm surge = 0.55 m (occurs in Winter)
    - Up ~10 cm from MNR (1989) estimate for Tecumseh shoreline





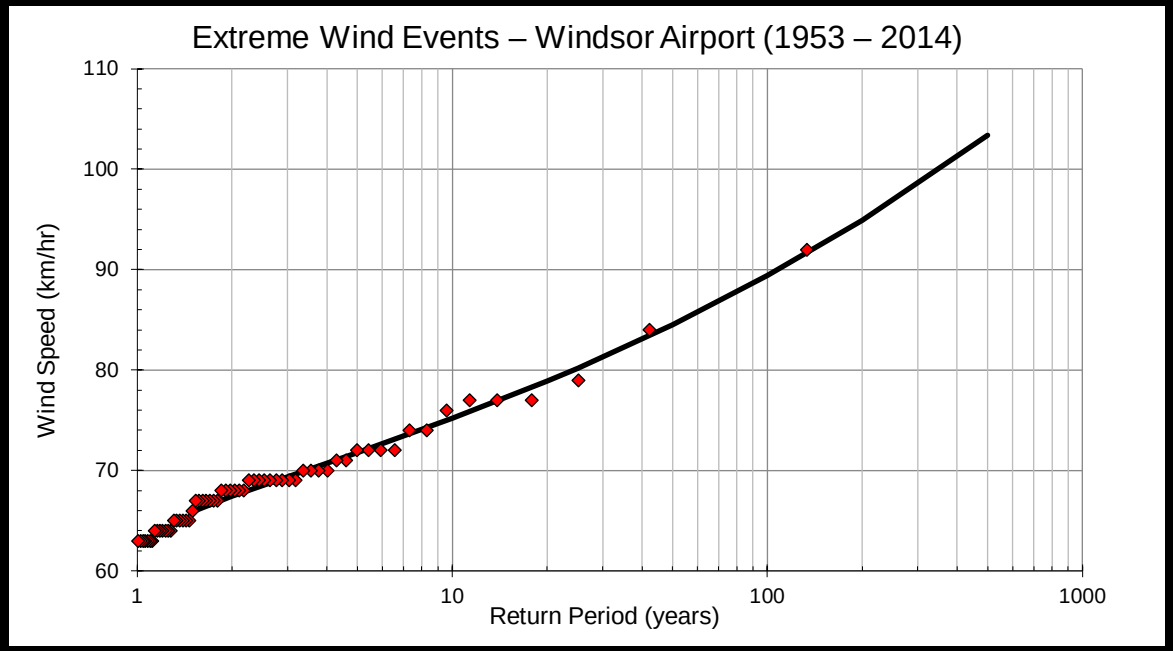
Water Level Analysis

- 100-year combined flood level re-analyzed using a seasonal (monthly) joint probability analysis (no climate change considerations included yet)
  - 100-year flood level for Tecumseh = +176.23 m IGLD'85 (based on historical data)



Analysis of Storm Waves

- No long-term (30+ years) wave data available for Lake St. Clair
- Historical wind events assessed from Windsor Airport (1953 – 2014) and Belle River Marina (1994 – 2005)
  - Extreme value analysis performed on winds arriving from NW and NE quadrants:



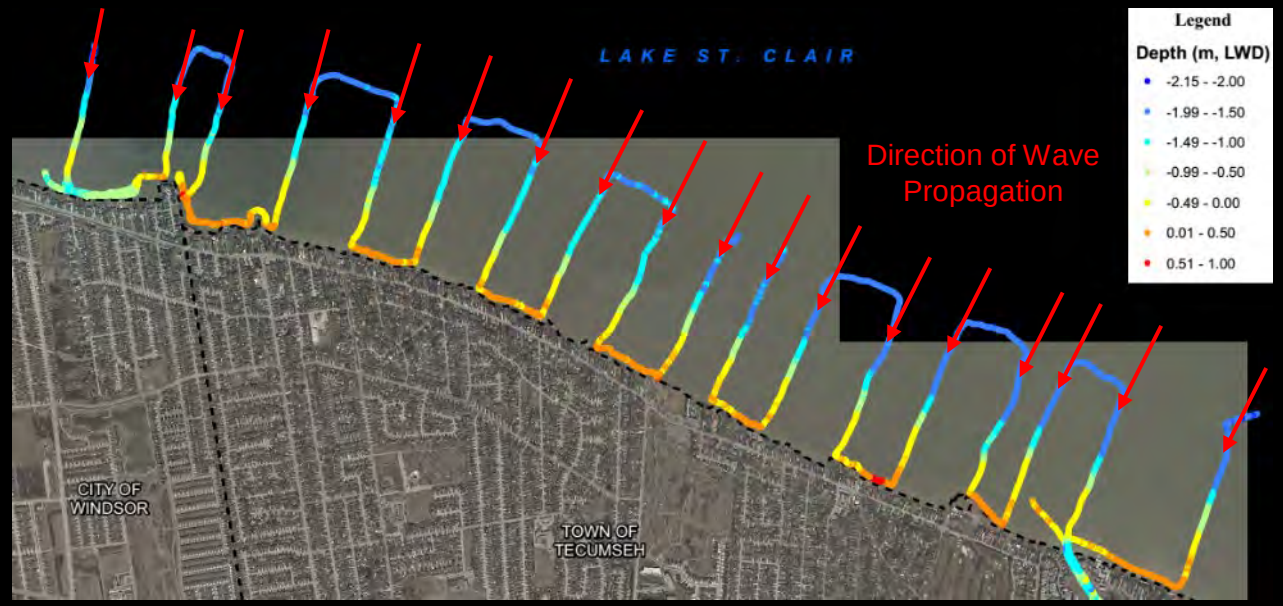
Analysis of Storm Waves

- Wave hindcast performed to predict wave generation over Lake St. Clair during extreme wind events (i.e. 100-year, etc.)
  - Validated against available wave buoy data (2000 – 2019, intermittent)

RP (years)	Wind Speed (km/hr)	1977 SPM – Shallow Water	
		Wave Height (m)	Wave Period (s)
1.5	66.07	1.30	4.7
2	67.53	1.32	4.7
5	71.82	1.37	4.8
10	75.33	1.42	4.9
20	79.31	1.46	5.0
25	80.72	1.48	5.0
50	85.54	1.53	5.2
100	91.18	1.59	5.3
200	97.78	1.65	5.4
500	108.30	1.75	5.7

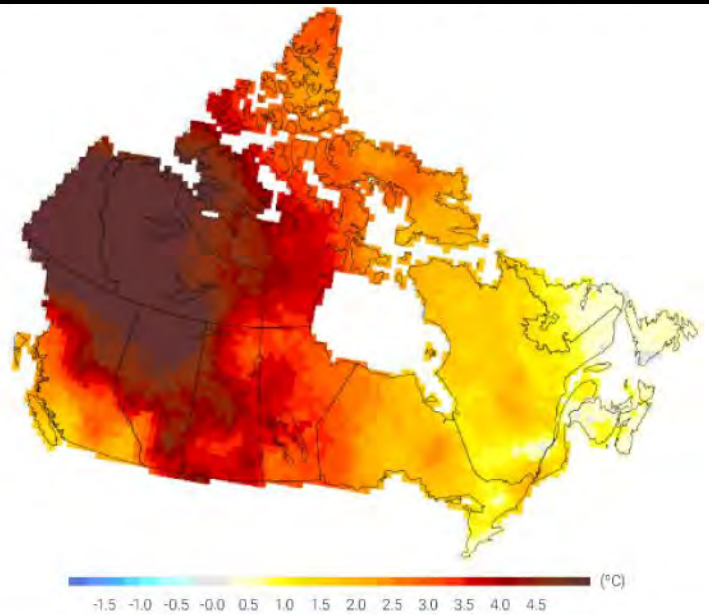
Analysis of Storm Waves

- Offshore waves transformed to Tecumseh shoreline at each bathymetric profile
  - Includes effects of shoaling, refraction and wave breaking
- 100-year wave conditions output at toe of shoreline protection & beaches
  - To be used in wave runup and overtopping calculations to inform flood mapping
  - To be used in development of risk mitigation concepts, including recommendations for shoreline protection structures



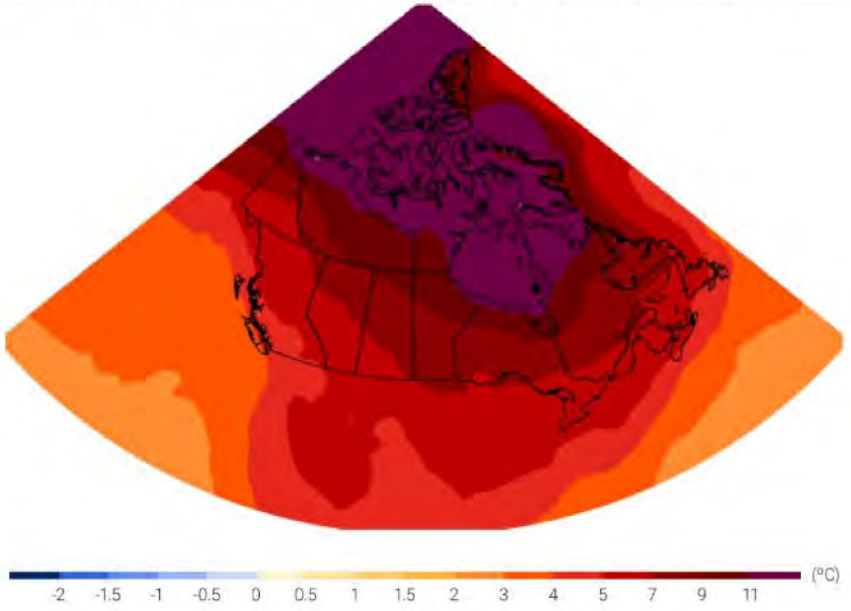
PROJECTED CLIMATE CHANGE IMPACTS

1948 to 2016 Winter Air Temperature Increase



Source: Vincent et al. 2015. In 'Zhang, X., Flato, G., Kirchmeier-Young, M., Vincent, L., Wan, H., Wang, X., Rong, R., Fyfe, J., Li, G., Kharin, V.V. (2019): Changes in Temperature and Precipitation Across Canada; Chapter 4 in Bush, E. and Lemmen, D.S. (Eds.) Canada's Changing Climate Report. Government of Canada, Ottawa, Ontario, pp 112-193'.

2081-2100 Winter Warming Projection for RCP8.5



Source: Climate Research Division, Environment and Climate Change Canada. In 'Zhang, X., Flato, G., Kirchmeier-Young, M., Vincent, L., Wan, H., Wang, X., Rong, R., Fyfe, J., Li, G., Kharin, V.V. (2019): Changes in Temperature and Precipitation Across Canada; Chapter 4 in Bush, E. and Lemmen, D.S. (Eds.) Canada's Changing Climate Report. Government of Canada, Ottawa, Ontario, pp 112-193'.

Warming has already decreased the extent and duration of Lake Erie ice cover. In the future, the lake could be ice-free in the winter.

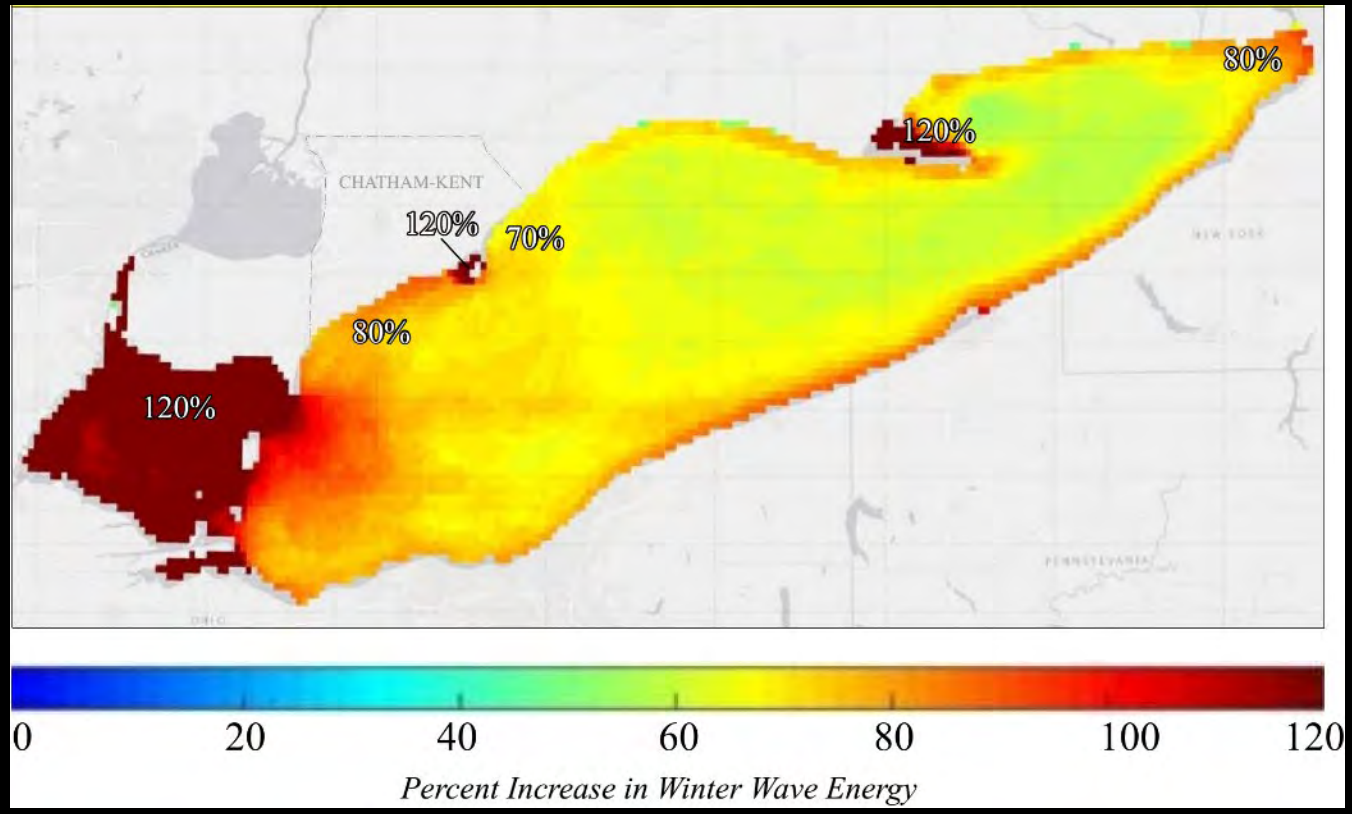
Lake Ice Cover Near 100%

Partial Ice Cover on the Lake

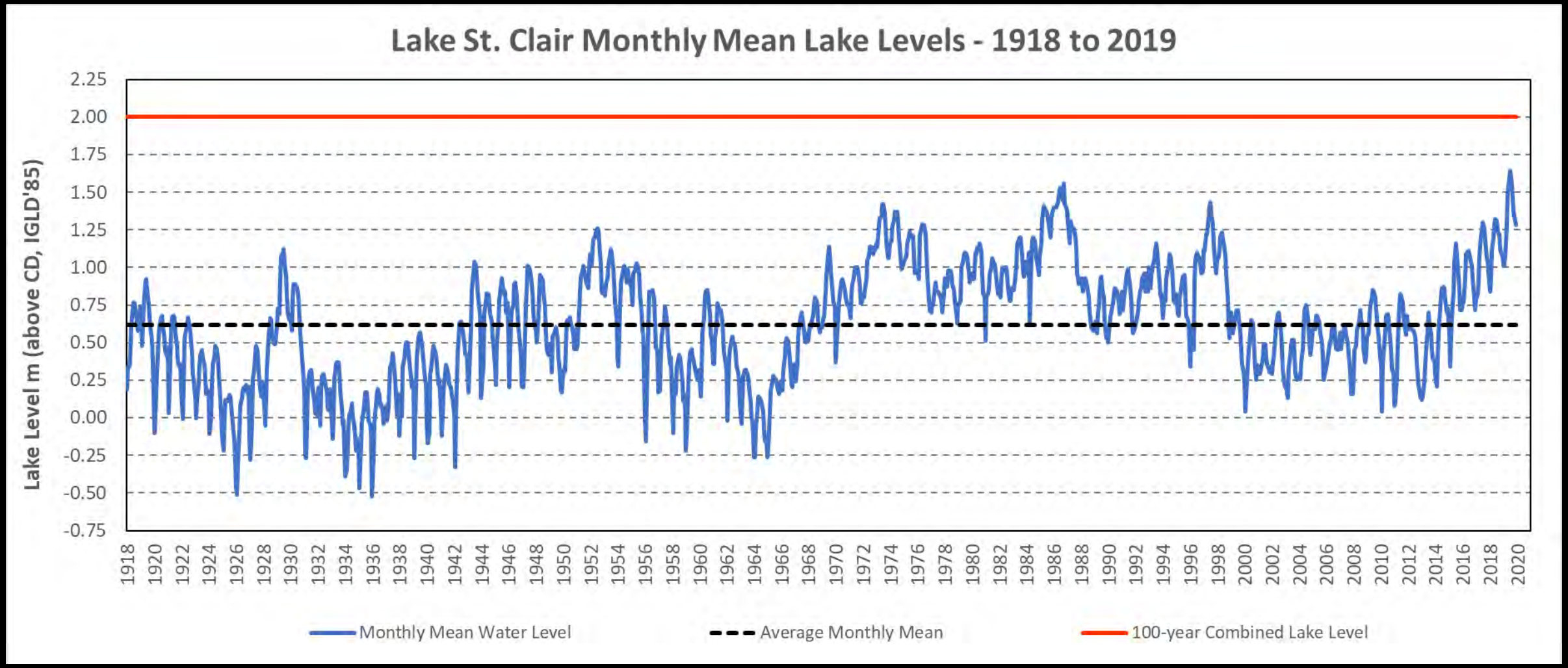
Ice Cover Limited to the Eastern Basin

Projected Increase in Wave Energy due to Reduced Ice Cover (Lake Erie Research)

- Due to projections for future decreases in ice cover, winter wave energy may increase 80% to 120% for the study area shoreline (by late century/2080)
- Shoreline erosion rates may also increase 80% to 120%



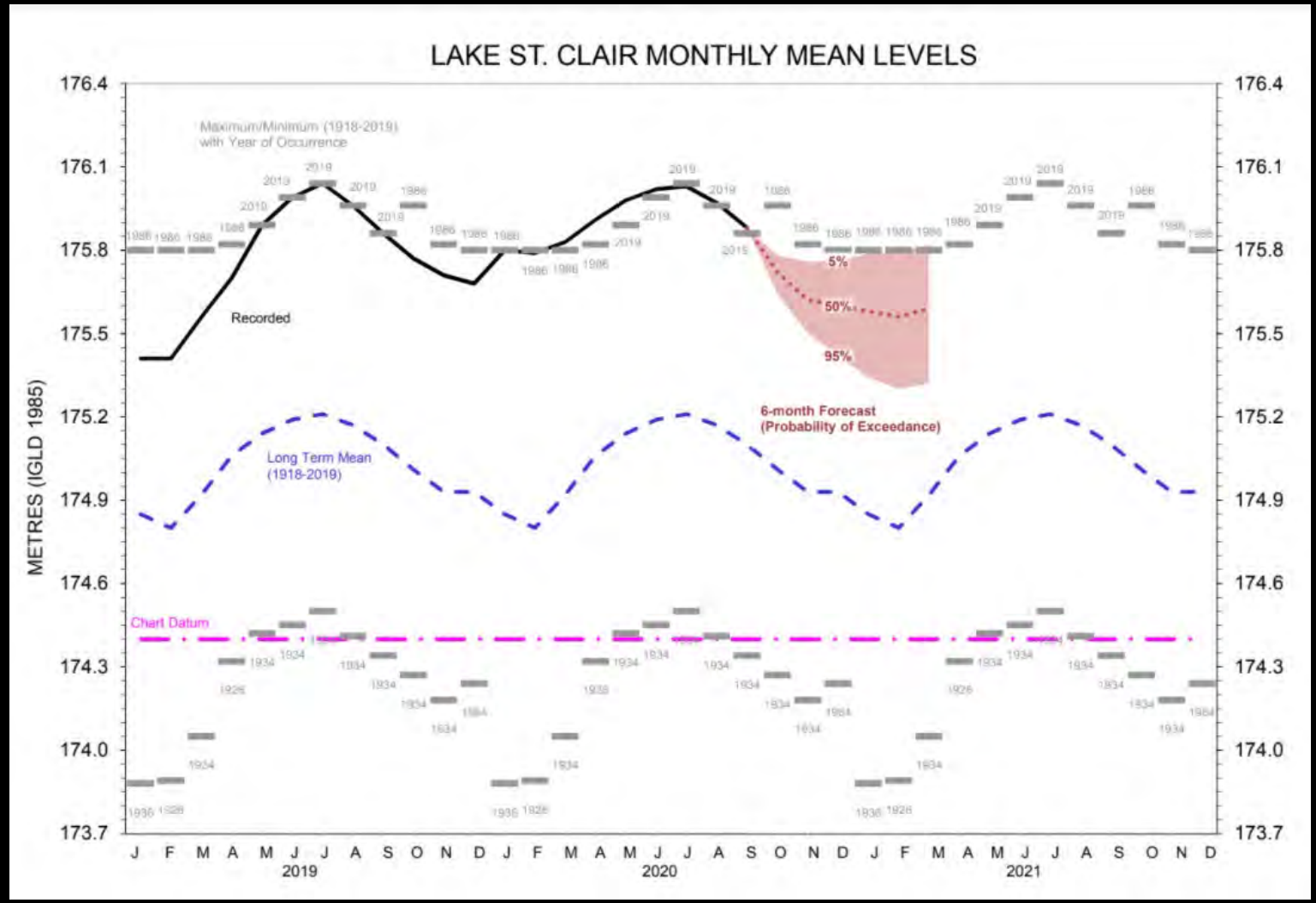
Historical Water Levels and Existing Regulatory 100-year Flood Level (176.4 m IGLD'85)



Short-term Lake Level Forecast and Climate Change Projections

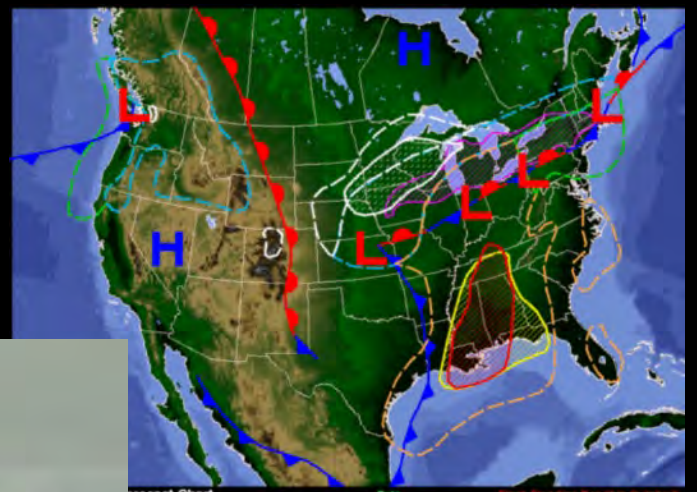
- **Short-term**: water levels should continue to fall into the winter. Next summer the peak will depend on local precipitation and inputs from Lake Huron

- **Future**: Latest Environment and Climate Change Canada projection is higher lake levels in the future (more details in PIC#2)



Linkages Between Rainfall Flooding and Coastal Storm Flooding Under Investigation

- Dillon (2019) completed interior flood risk assessment (rainfall)
- This study will focus on coastal flooding & combined coastal and interior flooding
- The impacts of both happening at the same time (never studied)
- Impacts of climate change on the magnitude of the potential flood



RISK ASSESSMENT AND FLOOD HAZARD MITIGATION

Sample Hazard Map

PROPERTY PARCEL DATABASE

Zuzek inc.
ONE WORLD
www.zuzekinc.com

Parcel Database
Collection of Estimated First Floor Elevations
(in progress)
Town of Tecumseh

Data Sources:
1) 2019 ortho provided by the County of Essex.

N
W
E
S
0 200 400
m

Attributing the Property Parcel Database

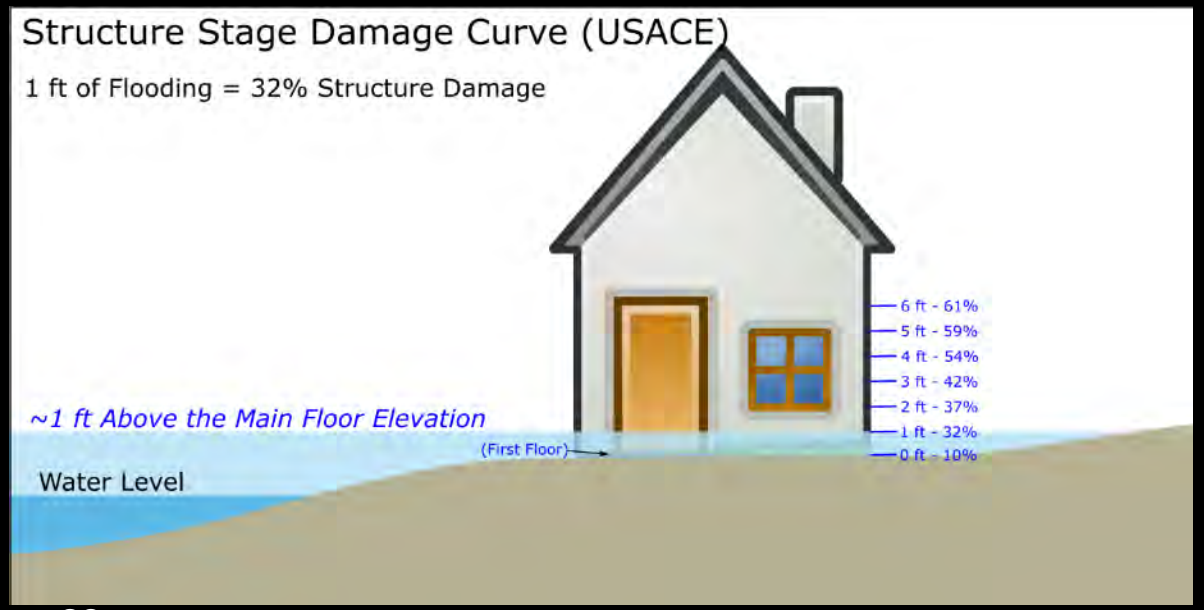
- Three dimensional buildings and terrain in GIS software
- Type of building (single, double storey, etc.) from Google Streetview
- Presence or absence of basement
- Number of stairs above front yard
- Land elevation in front of stairs (yellow dot on slide 30)

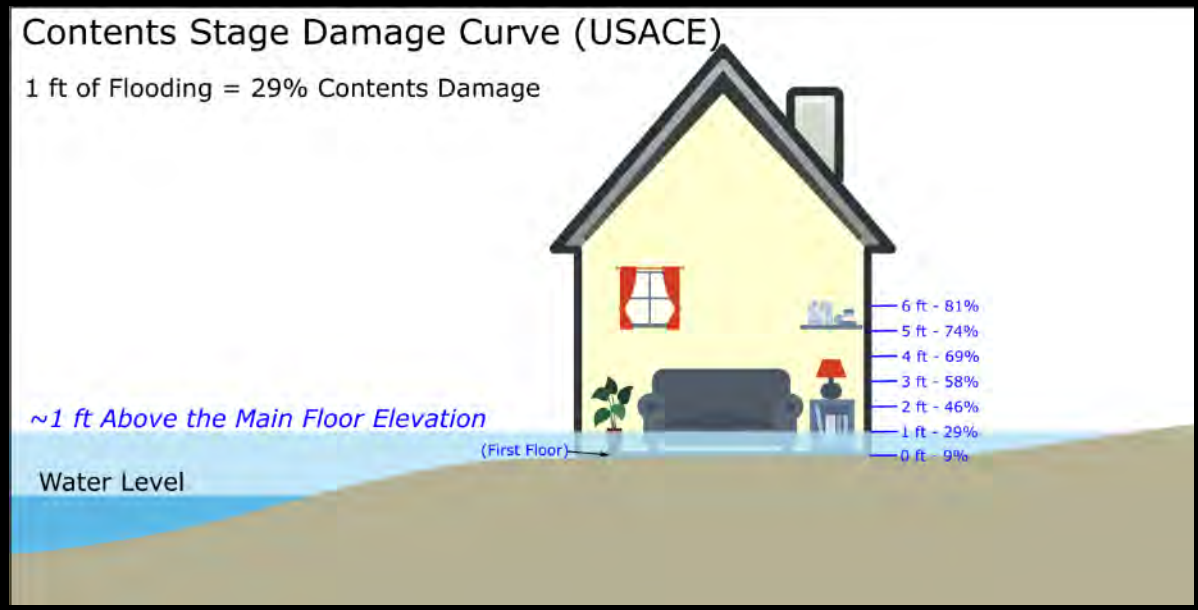
Generate information on:

- First floor elevation for economic damage calculations

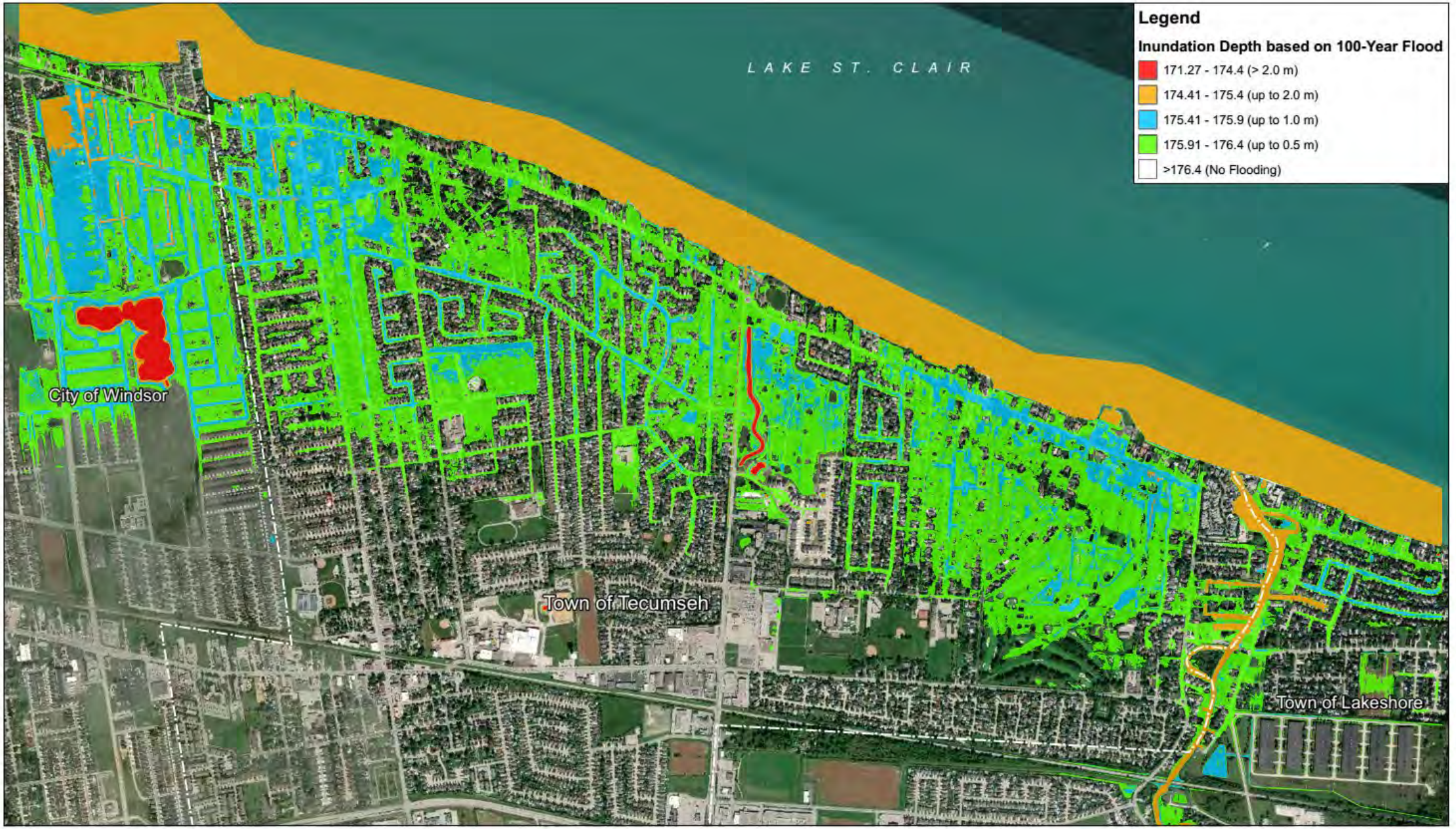
Flood Damage Methodology

- Property value based on current MPAC assessments (not market values)
- Building and content damages based on the depth of flooding above the first floor (USACE methodology shown below)
- Damages associated with wave forces will be calculated on front-row parcels





PRELIMINARY



TOWN OF TECUMSEH SHORELINE MANAGEMENT PLAN

Inundation Depth based on 100-year Flood
(assumes flow pathways exist for interior flooding)

DRAFT

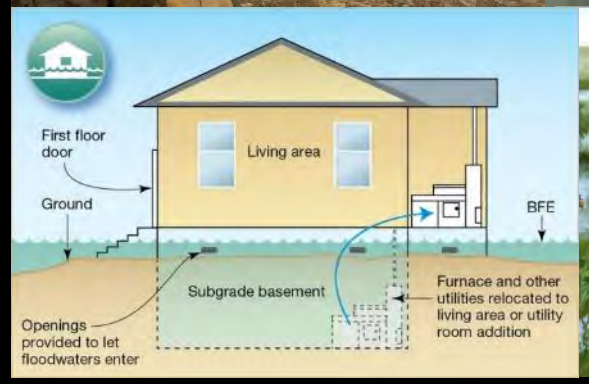
Data Sources:
1) Elevations derived from 2017 LiDAR DTM (MNRF)
2) Esri World Imagery Basemap

0 300
m

N

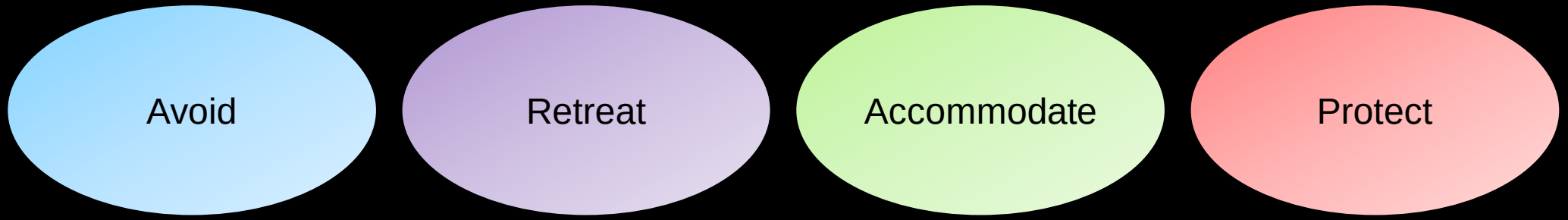
Zuzek inc.
ONE WORLD

ADAPTATION CONCEPTS

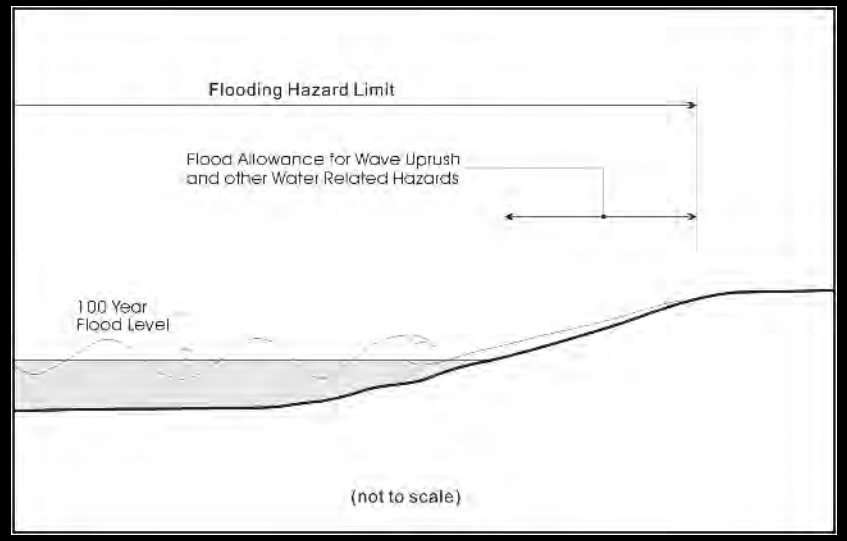


Types of Climate Change Adaptation Strategies

- **Avoid**: reduce exposure by ensuring new development doesn't occur on hazardous land
- **Retreat / Re-Align**: a strategic decision to relocate public and private assets exposed to significant coastal hazards or change existing land uses
- **Accommodate**: an adaptive strategy that allows for continued occupation while changes to human activities or infrastructure are made to reduce risk
- **Protect**: a reactive strategy to protect people, property, and infrastructure. Traditional approach and often the first considered



AVOID: Hazard Setbacks, Naturalized Shorelines, and Public Open Space



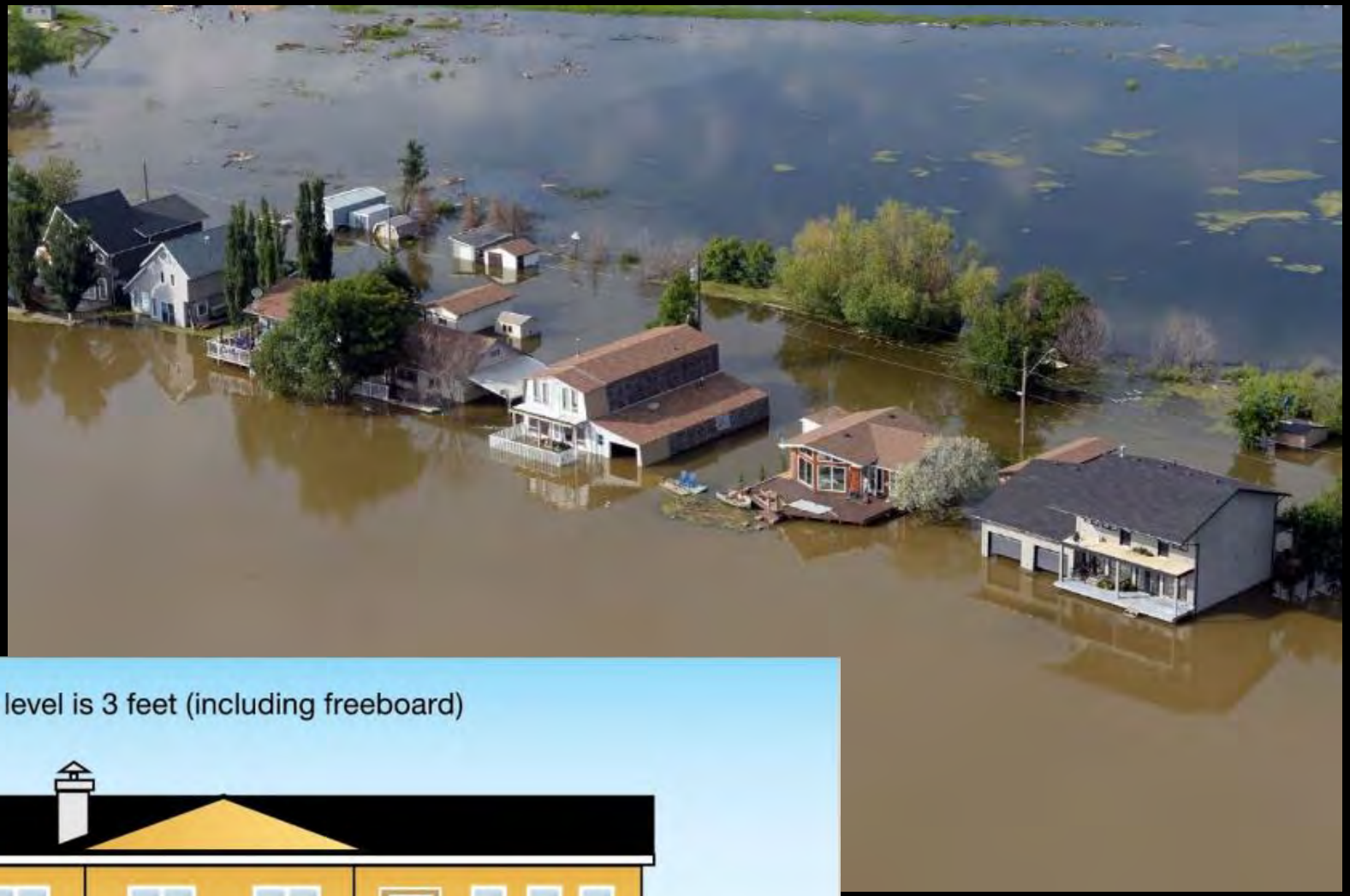
RETREAT

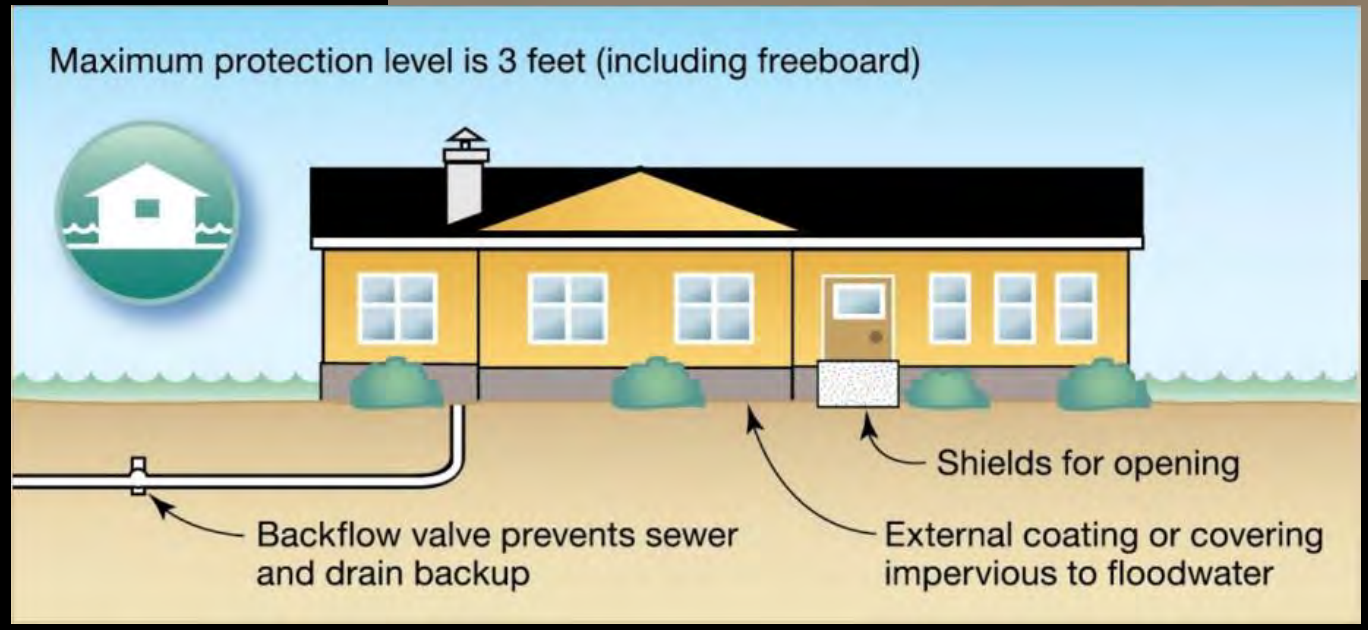
Building Relocation

- Individual buildings re-located away from the flooding and erosion hazards

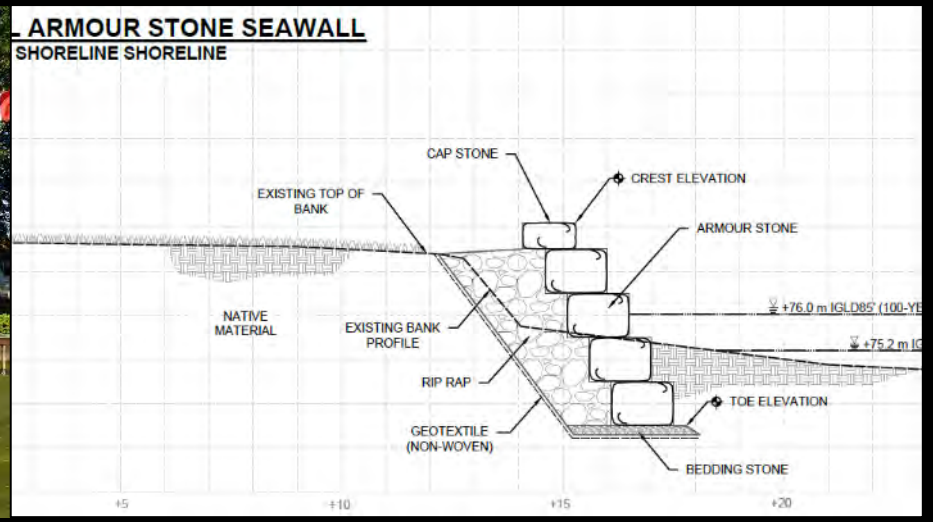
ACCOMMO-DATE

Retrofitting Homes





PROTECT: Traditional Private Property Approach



- Should be “well-engineered”
- Structures should dissipate wave energy and have gradual failure mechanisms
- Monitoring and maintenance required

QUESTION AND ANSWER PERIOD ON THE PRESENTATION

INTERACTIVE DISCUSSION WITH THE PARTICIPANTS

QUESTION #1

1. What are the most important aspects of the flood risk assessment?

QUESTION #2

2. With respect to flooding and erosion hazards, where are the most vulnerable areas in Tecumseh?

QUESTION #3

3. What are your priorities when evaluating long-term solutions to flood risks in Tecumseh?

COMMENT SHEET AND NEXT STEPS

www.tecumseh.ca\shorelinemanagementplan