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Town of Saint Andrews
212 Water Street,
Saint Andrews,
NB E5B 1B4

Attention: Paul Nopper
Clerk - Senior Administrator

Email: pnopper@townofstandrews.ca

Re: Delivery of the Coastal Study – Market Wharf, Saint Andrews

INTRODUCTION

GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) is pleased to provide further explanation of the proposed coastal study at the Market Wharf, St. Andrew, NB. As per the original proposal, the coastal study will address the following:

- 1) To simulate sediment transport in project area (berth area)
- 2) To assess potential shoreline change
- 3) To evaluate water quality in wharf area (and to avoid potential stagnant water)

The proposal summarizes GEMTEC's tasks, including:

- 1) Collect and review available data.
- 2) Provide a wave model of the area.
- 3) Carry out a hydrodynamic model.
- 4) Carry out a sediment transport model.
- 5) conduct shoreline evolution assessment.

DETAILED SCOPE OF WORK

Based on our understanding of the project requirements, the following tasks would be carried out:

- 1) Collect and Review Data** - This task will include the collection and evaluation of tidal events and wind information available from various resources. Tide information is typically sourced from Canadian Hydrographic Service and includes typical tidal and storm surge events. Storm surges have been studied by many authors such as Benier (2005), Zhai

(2014), and Daigle (2017) to have a better understanding how they impact coastal infrastructure. Extreme recent storm surges caused by Hurricane Lee (2023) as well as other recent destructive surges will be included. The sea level rise (SLR) caused by future climate change will be calculated at a 100-year projection. Offshore extreme wind and wave will be collected from MSC50, a wave database covering Atlantic Canada waters and managed by the Government of Canada (DFO, 2018).

- 2) **Wave Climate in the Project Area** – A wave model study will be conducted to calculate wave transformation from offshore to nearshore in the project area. GEMTEC uses DHIGROUP MIKE21 SW (Spectral Wave Model) advanced software suites to simulate wave transformation from offshore to the wharf area. The available data is entered to create the model that can simulate wind-wave generation, wave refraction, diffraction, shoaling, bottom friction, and wave breaking. A wave model mesh, as Per Figure 1, is created for the work area. A larger area (outside the work area) can be defined if required, understanding the model would increase in its scope and complexity.

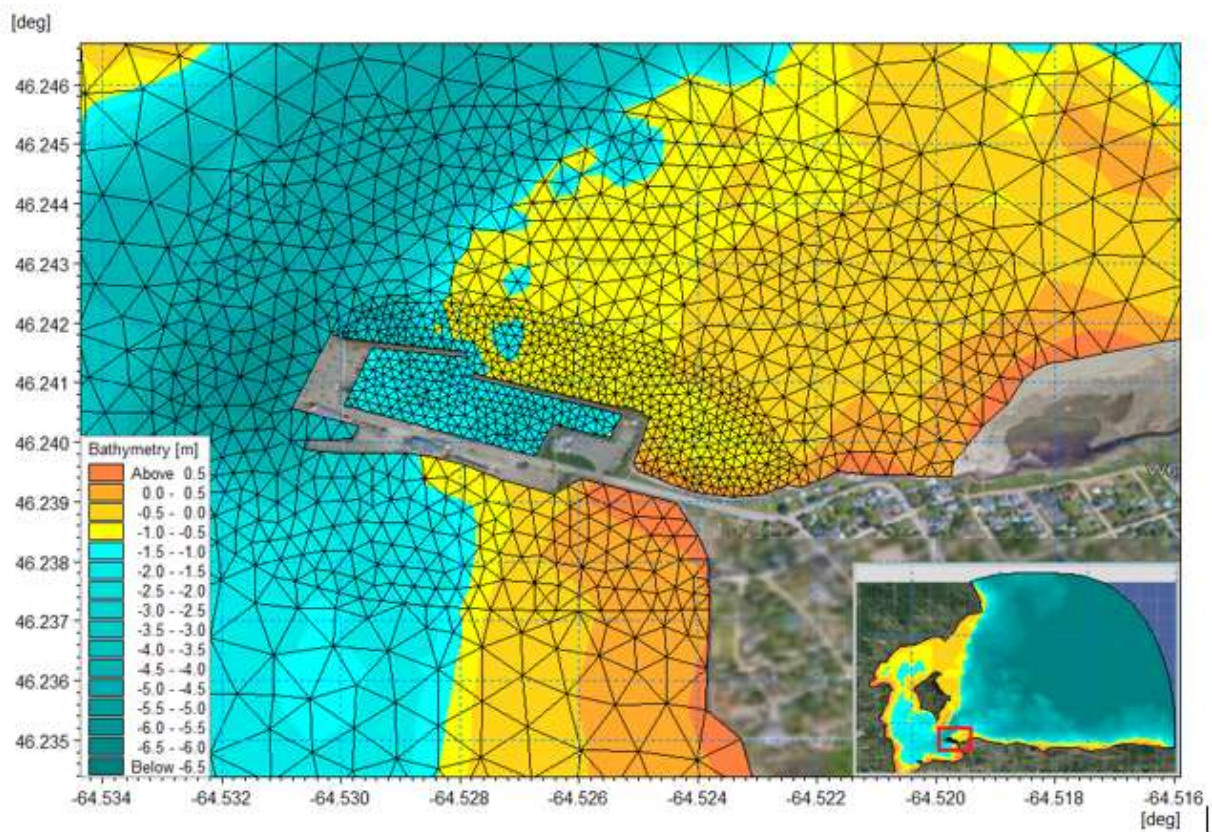


Figure 1 - Example of Wave Model Domain and Model Mesh System

The output from the model can generate simulated waves based upon wind direction and strength. An example of a typical output of the model using a combination wind speed, direction and sea level is shown in Figure 2. The information from the wave model is used to design wharf/ breakwater heights and the magnitude of rock protection to be considered.

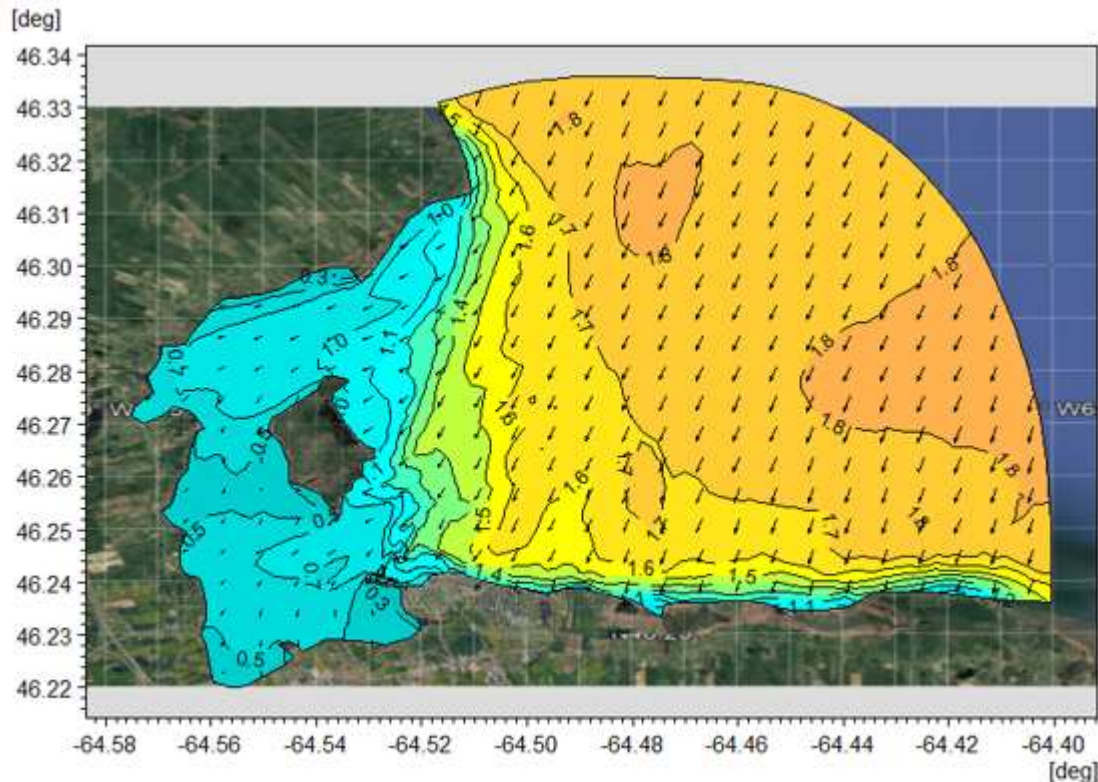


Figure 2 - Output of Wave Height H_s (m)

- 3) **Hydrodynamic Model** - A hydrodynamic or “tidal flow” model will be created using MIKE21 HD (Hydrodynamic Model) to study the movement of water in the work area. The model will be calibrated using flow data from available sources and/or can be measured over various tidal cycles. The current coastline and infrastructure configuration is introduced into the model, and calibrated, i.e. ensuring the model output resembles the coastal process that is occurring with the current shoreline arrangement. Once calibrated, various shoreline reconfigurations can be introduced and modelled. Model result will be used to run flow flushing and assess water quality change in wharf area. The purpose is to identify any stagnant water in the study area.
- 4) **Sediment Transport Study** - Sediment characteristics and availability will be introduced into the MIKE21 ST (Sediment Transport Model) coastal model to evaluate the potential for wave and tidal currents to create sedimentation in study area. The model will include

both normal and storm events. An output of a typical sedimentation transport study is depicted in Figure 3.

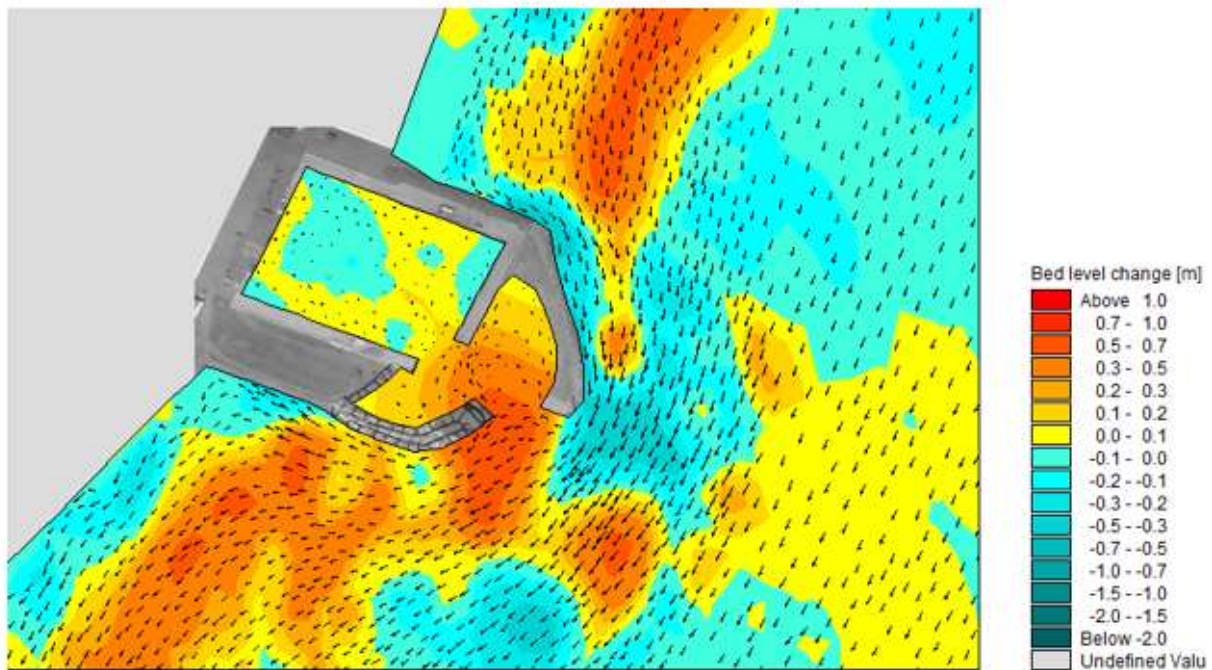


Figure 4 - Example of Output of Sediment Transport Model

- 5) Shoreline Evolution Assessment** – The evolution of the shoreline can be assessed for a single event or extended over many years. The changes to the shoreline or tidal currents because of introduced configurations changes can be compared to the status quo and quantified based on the model outputs. These results will be captured and summarized in a coastal report.

CLOSING

We hope this provides some clarity to the proposed coastal study. Please do not hesitate to contact the undersigned if you have any questions or concerns regarding the proposed work.

Respectfully submitted,

Garth Holder
Senior Civil Technologist