Regional Coastal Flood Mapping for Four (4) Nunavut Communities

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Appendix D Communities Coastal Flood Hazard Maps

Abbreviations

1D ..... One-Dimensional
2D ..... Two-Dimensional
AEP ..... Annual Exceedance Probability
BC ..... British Columbia
BC MFLNRO ..... British Columbia Ministry of Forests, Lands and Natural Resource Operations
CD ..... Chart Datum
CGVD2013 ..... Canadian Geodetic Vertical Datum of 2013
CHS ..... Canadian Hydrographic Service
CSRS ..... Canadian Spatial Reference System
CST ..... Central Standard Time
DFO ..... Fisheries and Oceans Canada
DTM ..... Digital Terrain Model
ECCC ..... Environment and Climate Change Canada
ECMWF ..... European Centre for Medium-Range Weather Forecasts
ERA5 ..... European Centre for Medium-Range Weather Forecasts Reanalysis 5th Generation
EVA ..... Extreme Value Analysis
FES2014 ..... Finite Element Solution 2014
FHIMP ..... Flood Hazard Identification and Mapping Program
FHL ..... Flood Hazard Level
GEV ..... Generalized Extreme Value
GIA ..... Glacial Isostatic Adjustment
GIS ..... Geographic Information System
GN ..... Government of Nunavut
GPS ..... Global Positioning System
HAT ..... Highest Astronomical Tide
HHWLT ..... Higher High Water Large Tide
HHWMT ..... Higher High Water Mean Tide
Hs ..... Significant Wave Height
HWMT ..... High Water Mean Tide

IPCC	Intergovernmental Panel on Climate Change
IQ	Inuit Qaujimajatuqangit
LAT	Lowest Astronomical Tide
LiDAR	Light Detection and Ranging
LLWLT	Lower Low Water Large Tide
LLWMT	Lower Low Water Mean Tide
LWMT	Low Water Mean Tide
MAE	Mean Absolute Error
MWL	Mean Water Level
NAD83	North American Datum of 1983
NONNA	Non-Navigational Bathymetric Data
NRCan	Natural Resources Canada
OCAP®	Ownership, Control, Access, and Possession
OMNR	Ontario Ministry of Natural Resources
$R_{2\%}$	Runup Elevation Exceeded by 2% of Incident Waves
RCP	Representative Concentration Pathway
RFQ	Request for Quote
RMSE	Root Mean Square Error
Tp	Peak Wave Period
UAV	Unmanned Aerial Vehicle
UTC	Coordinated Universal Time
UTM	Universal Transverse Mercator

1 Introduction

Coastal communities in Nunavut are vulnerable to coastal flooding due to their location along exposed shorelines and the combined effects of extreme water levels, storm surge, wave action, and changing climatic conditions. Coastal flooding can affect residential areas, critical infrastructure, transportation corridors, and community services, and may result in both direct inundation and secondary impacts such as erosion and damage to shoreline assets. Despite these risks, comprehensive and consistent coastal flood hazard mapping is not currently available for many Nunavut communities. Nevertheless, the available regional datasets, historical information, local knowledge, and site-specific observations provide a sufficient basis for assessment at an appropriate level of detail. When integrated with advanced numerical modelling and established scientific methods, these sources can be used to support coastal flood hazard assessment despite limited spatial and temporal coverage and continuity of observations, and to provide a consistent basis for coastal flood hazard information across the communities.

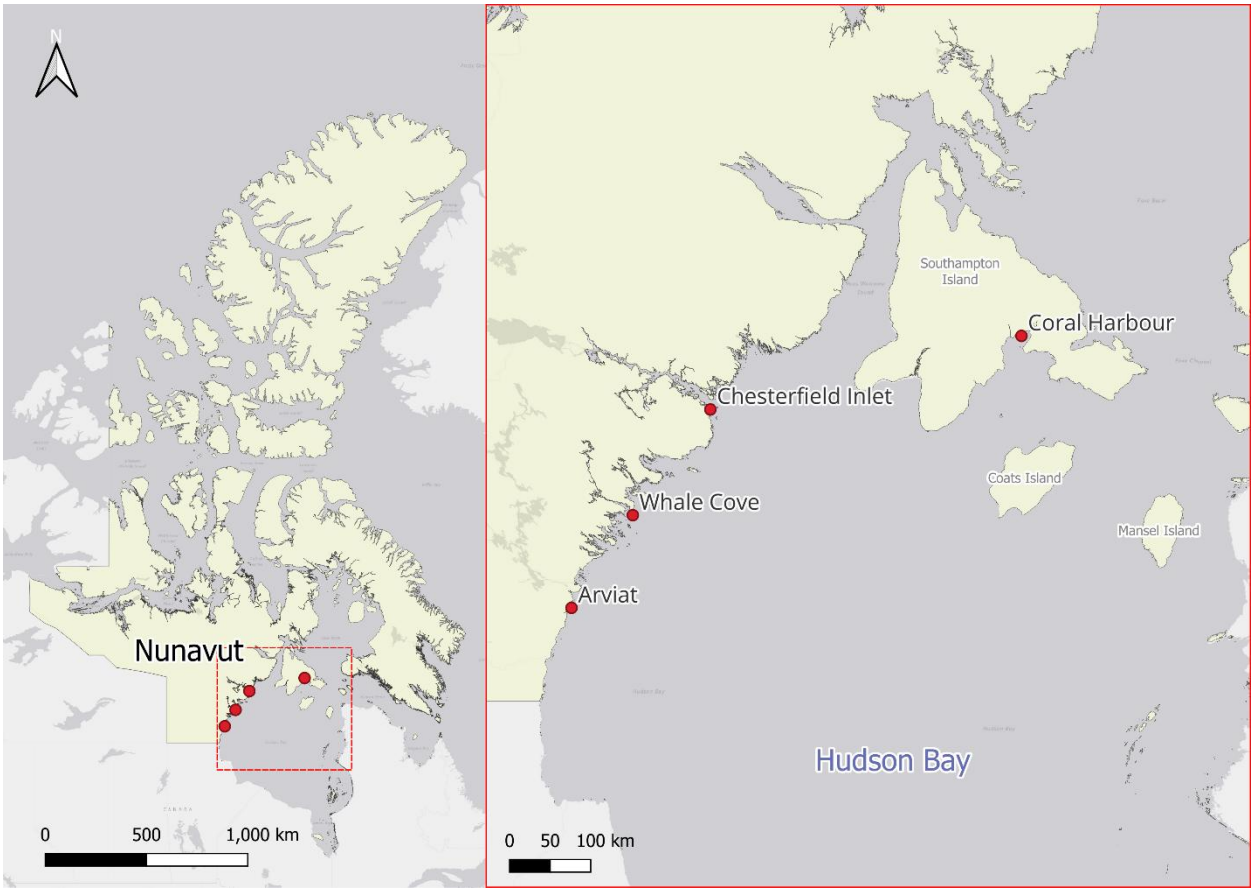
The Government of Nunavut (GN) is advancing a regional coastal flood mapping initiative to support the improved understanding of coastal flood hazards and to provide a consistent technical basis for flood risk awareness, land use planning, emergency management, and future adaptation measures. The project focuses on four Hudson Bay coastal communities across the Kivalliq region of Nunavut: Arviat (ᐊᕐᕕᐊᑦ), Whale Cove/ Tikirarjuaq (ᑎᑭᕐᕕᐊᖅ), Chesterfield Inlet/ Igluligaarjuk (ᐃᓚᓕᑦᓴᕐᕕᖅ), and Coral Harbour/ Salliq (ᓴᓪᓕᖅ) (Figure 1-1). These communities experience varying degrees of coastal exposure, shoreline configuration, and development patterns, which influence their susceptibility to coastal flooding.

Coastal flooding in Nunavut is influenced by a combination of astronomical tide, storm surge, wind-driven waves, and regional factors such as relative sea level change. Limited long-term observational data on water levels and wave climate, and the absence of territory-specific coastal flood mapping standards, necessitate the use of regionally appropriate modelling approaches and clearly documented assumptions. As a result, this project adopts a regional-scale perspective to characterize coastal flood hazards using a consistent methodology across four communities.

This work builds on previous scoping-level assessments (Nunami Stantec, 2025) that identified available datasets, data limitations, and key technical considerations for coastal flood mapping in Nunavut. In accordance with the request for quote (RFQ) requirements, this study will be completed using a Tier 2 regional flood hazard modelling approach and will achieve a modelling accuracy grade of B, as defined in the National Feasibility Study for Regional Flood Hazard Mapping - Technical Recommendations and Guidelines (KGS Group, 2025), to support the intended flood hazard mapping use cases. Tier 2 regional flood hazard modelling provides an intermediate level of analysis between broad, screening-level products and detailed site-specific studies, supporting regional-scale flood hazard characterization, with accuracy grade B reflecting a medium level of confidence based on the use of regionally appropriate data resolution, representation of major controlling features, and calibration and validation to the extent supported by available information. The current project advances that foundation by developing regional coastal flood hazard mapping products to support documentation suitable for decision-making at the community planning and risk management level, while clearly communicating the uncertainty and limitations inherent in the available data and methods. The resulting flood hazard mapping products are

not intended for site-specific design, regulatory floodplain delineation, or development permitting purposes.

Figure 1-1 The communities identified for the Nunavut Regional Coastal Flood Mapping project



1.1 Project Objectives

The objective of this project is to advance a consistent, scientific understanding of coastal flood hazards for selected Nunavut communities by developing Tier 2 regional-scale flood hazard mapping products with an accuracy of Grade B. The project focuses on the technical characterization of coastal flooding using available data and regionally appropriate modelling approaches, with an emphasis on clarity, consistency, and transparency in assumptions.

Specifically, the objectives of the project are to:

- Develop regional-scale coastal flood hazard maps for selected Nunavut communities (Chesterfield Inlet, Coral Harbour, Whale Cove, and Arviat) using a consistent and replicable technical methodology.

- Incorporate community outreach and regional Knowledge, including Indigenous Knowledge and input from local Knowledge Holders, to support the interpretation of historical flooding, coastal processes, and local shoreline conditions.
- Define a structured methodological framework and sequence of steps that may inform the future development of comprehensive shoreline and coastal hazard guidance in Nunavut.
- Develop the framework and delineate coastal flood inundation extents for defined probability events under current and future climate conditions.
- Apply coastal flood modelling approaches suitable for regional-scale assessment and available data conditions.
- Document assumptions, limitations, and uncertainty associated with the coastal flood hazard mapping.
- Provide technical outputs that may be used in future to develop community-based shoreline management plans, emergency management, or adaptation initiatives.

1.2 Background

Nunami Stantec conducted a Scoping Study to Advance Future Floodplain Mapping in Nunavut (Nunami Stantec, 2025) to identify flood risk for each community in Nunavut. The following summarizes the findings for the four communities.

1.2.1 Community Flood Risk Assessment

Table 1-1 presents the results of the community coastal flood risk assessment, high-level risk to the community in the Scoping Study to Advance Future Floodplain Mapping in Nunavut, for each of the four communities in the Terms of Reference. Coastal flooding risk is identified as high for selected communities. Coastal erosion risk is identified as high for Arviat and low for Chesterfield Inlet, Coral Harbour, and Whale Cove. A high-level description of the assessment for each community is provided in the text below.

Table 1-1 Nunavut Flooding Risk/History by Community

Community	Risk for Each Type of Flooding	
	Coastal Flooding	Coastal Erosion
Hamlet of Arviat	High	High
Hamlet of Chesterfield Inlet	High	Low
Hamlet of Coral Harbour	High	Low
Hamlet of Whale Cove	High	Low

1.2.1.1 Arviat

Arviat has infrastructure close to the coastline with homes, the health centre and Northern Store located along the coast, situated on 3rd and 1st Avenues. The community faces north in a bay that is fully exposed to Hudson Bay to the east. The fetch for wind-induced waves for the coastal part of the community is approximately 900-1100 km from the east across Hudson Bay. There is a coastal structure in the middle of the coastline with a road built over it that protects the western half of the shoreline from waves coming from the east. Satellite imagery indicates that the shoreline is composed of erodible material, lacking vegetation and showing no signs of resistant formations like rock outcrops or bluffs.

1.2.1.2 Whale Cove

Whale Cove has a few homes and a fuel farm located along the coast. The community faces southeast in a small bay that is fully exposed to Hudson Bay to the east. The fetch for wind-induced waves for the coastal part of the community is approximately 800-1300 km from the east across Hudson Bay. No significant constructed coastal protection was observed; however, the area is largely composed of rocky materials, with prominent outcrops offering natural resistance to erosion.

1.2.1.3 Chesterfield Inlet

Chesterfield Inlet has infrastructure close to the coastline with homes, the Co-op Store and Northern Store located along the coast along Nunavut Avenue, Chesterfield Inlet Road, and 9th Street. The community faces southeast in a small bay that is fully exposed to Hudson Bay to the east. The fetch for wind-induced waves for the coastal part of the community is approximately 700-1400 km from the east across Hudson Bay. No significant constructed shoreline protection structures were found; however, satellite images indicate that much of the shoreline consists of rock outcrops and non-erodible materials.

1.2.1.4 Coral Harbour

Coral Harbour has homes located on the coast around the harbour at the south end of the community and along low-lying land along the shoreline on the east side of the community. The community is somewhat protected by a headland, and the fetch for wind-induced waves for the coastal part of the community is approximately 140-180 km south to Coats Island. Around Coats Island, it is open to Hudson Bay to the southwest with fetch up to approximately 860 km. The satellite imagery shows a constructed road situated over a rocky outcrop, and much of the shoreline appears to consist of similar rocky formations, which are generally considered non-erodible.

1.3 Regulatory and Intended-Use Notice

The flood hazard maps and results presented in this report are intended for community-scale flood hazard screening, land-use planning, emergency preparedness, and preliminary development review. They are not intended for site-specific engineering design, regulatory floodplain delineation, development permitting, or the design of flood-protection works. Where proposed development or infrastructure is

located within or adjacent to a mapped flood hazard area, a site-specific assessment should be completed using appropriate survey, geotechnical, hydraulic, and coastal engineering information.

2 Methodology Overview

The study methodology was developed to provide a framework for regional coastal flood hazard assessment for Arviat, Whale Cove, Chesterfield Inlet, and Coral Harbour. The methodology was based primarily on applicable federal coastal flood hazard guidance and the regional flood hazard modelling requirements specified by the Government of Nunavut. Similar provincial guidance from British Columbia (BC), Newfoundland and Labrador, and Ontario was reviewed to supplement the federal guidance and inform specific technical components of the assessment.

The following subsections describe the technical guidance review, data assessment, model development, calibration and validation, extreme value analysis (EVA), flood hazard estimation, and mapping procedures. The modelling framework progresses from regional-scale wave and hydrodynamic hindcasts to higher-resolution community-scale wave models, followed by representative shoreline transect analysis and wave runup calculations. Outputs from the regional-scale models provide consistent offshore wave and stillwater level conditions for the community-scale assessments, where local bathymetry, shoreline configuration, and nearshore wave transformation are resolved in greater detail. This modular framework provides a repeatable methodology across the four communities while allowing individual model components to be refined as improved datasets, observations, or modelling approaches become available.

2.1 Coastal Flood Hazard Components

Coastal flooding can result from the combined effects of astronomical tide, storm surge, wave setup, wave runup, wave overtopping, and relative sea-level change. These components affect coastal water levels over different spatial and temporal scales and must be distinguished to avoid omitting or double-counting individual processes.

Astronomical tide is the predictable variation in water level caused primarily by the gravitational influence of the Moon and Sun. Storm surge is the meteorologically driven departure of the water level from the predicted astronomical tide and is generated mainly by wind stress and atmospheric-pressure variations.

Wave setup is the increase in the mean nearshore water level caused by the transfer of wave momentum as waves shoal and break. Wave runup, also referred to as wave uprush in some provincial guidance, is the vertical extent reached by individual waves above the stillwater level along a beach, bluff, shoreline, or coastal structure. Wave overtopping occurs where the wave runup exceeds the crest elevation of the shoreline or a coastal structure, allowing water to pass into the backshore area.

Stillwater level represents the water surface before the short-period vertical fluctuations associated with individual waves are considered. Depending on the modelling framework, wave setup may be incorporated into the modelled stillwater level or calculated separately. The treatment of wave setup must therefore be stated explicitly.

For this study, higher high water large tide (HHWLT) was used as the astronomical tidal reference. The storm surge residual was calculated as the difference between a fully forced hydrodynamic simulation and a corresponding tide-only simulation. The fully forced simulation included spatially and temporally varying wind and atmospheric pressure and wave radiation stresses. Consequently, the calculated residual includes water-level effects associated with wind stress, atmospheric pressure, and wave setup represented by the radiation stresses.

The stillwater level was calculated by adding the applicable return-period storm surge residual to HHWLT and applying the adopted relative sea-level allowance. Wave setup represented in the regional hydrodynamic simulation was not added a second time. Wave runup above the stillwater level was subsequently evaluated at representative shoreline transects.

2.2 Applicable Technical Guidance

The technical guidance reviewed for the study included two federal documents and selected provincial documents. The federal documents provide the principal technical basis for the study. The provincial documents were reviewed as supplementary references because Nunavut does not currently have a territory-specific coastal flood hazard mapping guideline.

Provincial design events, freeboard values, setbacks, planning horizons, mapping scales, and regulatory requirements were not adopted automatically. These requirements were developed for different physical and jurisdictional conditions. The applicable technical principles were considered in relation to the Hudson Bay setting, available data, project scope, and intended use of the Tier 2 mapping.

2.2.1 Coastal Flood-Hazard Assessment for Risk-Based Analysis on Canada's Marine Coasts, Natural Resources Canada (NRCan), 2025

The federal guideline titled Coastal Flood-Hazard Assessment for Risk-Based Analysis on Canada's Marine Coasts provides technical guidance for assessing current and future coastal flood hazards along Canada's marine coasts (NRCan, 2025). The guideline forms part of the Federal Flood Mapping Guidelines Series and was published by NRCan in collaboration with Public Safety Canada.

NRCan (2025) addresses project scoping, engagement, data requirements, hazard identification, statistical analysis, numerical modelling, climate change, uncertainty, mapping, and communication of results. Astronomical tide, storm surge, wave setup, wave runup, wave overtopping, relative sea-level change, sea ice, and other locally relevant processes are identified as potential contributors to coastal flooding.

The guideline recommends that the applicable coastal processes be identified at the beginning of the assessment and represented at a level of detail consistent with the study objectives, available information, and intended use of the mapping. The guideline is non-prescriptive and does not establish a statutory design event, freeboard, setback, or mapping scale for Nunavut.

Where local water-level and wave observations are limited, NRCan (2025) supports the use of regional numerical models and long-term hindcasts. A regional model may be required to establish the water-level

and wave parameters needed for a higher-resolution local model. Variable-resolution meshes, nested models, or downscaled community-scale models may be used to represent regional processes while providing additional resolution near the shoreline.

Meteorological forcing should represent the wind and atmospheric-pressure fields responsible for storm-surge generation. Gridded reanalysis products may be used where long-term measurements are unavailable or do not provide sufficient spatial coverage. Regional wave models may be used to simulate wave generation and propagation, while higher-resolution models may be used to represent nearshore wave transformation.

NRCan (2025) describes several approaches for estimating extreme coastal water levels, including analysis of observed or simulated stillwater levels, joint probability analysis, event-based hindcasting, and simplified combined methods. Under a combined method, a return-period storm surge is added to a high tidal reference such as HHWLT. The method is generally conservative because the return-period storm surge is assumed to occur at the same time as the selected high tidal level.

The guideline also distinguishes wave setup from wave runup and overtopping. Wave setup contributes to the mean nearshore water level, while runup and overtopping represent the response of individual waves at the shoreline. The selected modelling framework should state where each component is represented.

2.2.2 National Feasibility Study for Flood Hazard Modelling and Mapping at a Regional Scale - Technical Recommendations and Guidelines, KGS, 2025

The National Feasibility Study for Flood Hazard Modelling and Mapping at a Regional Scale - Technical Recommendations and Guidelines was prepared by KGS Group and DHI for NRCan (KGS, 2025). Draft Revision D was issued on June 6, 2025. The Government of Nunavut identified this document as the basis for the required Tier 2 regional flood hazard modelling approach and the minimum Grade B mapping accuracy objective.

KGS (2025) distinguishes among three broad levels of flood hazard modelling:

- Tier 1 consists of national- or global-scale screening using lower-resolution information and limited calibration and validation.
- Tier 2 consists of regional flood hazard modelling using medium- to high-resolution data, variable model resolution, available information on controlling features, and some degree of calibration and validation.
- Tier 3 consists of detailed engineering flood hazard modelling using higher-resolution data and more detailed representation of local terrain, bathymetry, structures, and hydraulic processes.

Tier 2 products are intended to support applications such as hazard screening and prioritization, public awareness, emergency response planning, preliminary land-use planning, and high-level risk

assessment. They are not equivalent to detailed site-specific engineering studies or regulatory floodplain assessments.

KGS (2025) also defines modelling accuracy grades according to the quality and resolution of the input data, representation of controlling features, model calibration and validation, uncertainty, and intended use of the resulting maps. Grade B generally includes the integration of available high-resolution terrain information, variable model resolution, representation of major controlling features, and moderate calibration and validation based on the available observational, historical, hydrometric, or remotely sensed information.

For coastal applications, KGS (2025) recommends consideration of astronomical tide, storm surge, waves, wave setup, wave runup, relative sea-level change, and other applicable coastal processes. The guidance recognizes that long-duration water-level and wave records are limited in many regional and northern settings. Regional numerical models and hindcast datasets may therefore be required to generate water-level and wave records of sufficient duration for extreme value analysis.

The guidance also identifies the importance of atmospheric and oceanographic data, including spatially varying wind, atmospheric pressure, water levels, waves, and sea-ice conditions. Variable-resolution meshes and local downscaling may be used to represent basin-scale processes while resolving conditions near individual communities.

The present study was completed as a Tier 2 regional coastal flood hazard assessment with a Grade B mapping accuracy objective, consistent with the project requirements and KGS (2025).

2.2.3 Flood Hazard Area Land Use Management Guidelines, Province of British Columbia, 2018

The Flood Hazard Area Land Use Management Guidelines provide provincial guidance for development and land-use management within flood hazard areas in British Columbia (Province of British Columbia, 2018). The document was originally issued in May 2004. Sections applicable to coastal areas were amended effective January 1, 2018. The amended document is therefore cited as Province of British Columbia (2018).

For coastal areas, the guideline allows the coastal Flood Construction Level to be determined using either a probabilistic method or a combined method. Under the probabilistic method, the stillwater level is calculated through statistical analysis of tide and storm surge and is combined with relative sea-level change, vertical land movement, wave effects, and freeboard.

Under the combined method, a high tidal reference is added to the design storm surge, relative sea-level change, vertical land movement, wave effects, and freeboard. The combined method is considered conservative because it assumes that the design storm surge occurs concurrently with the selected high tidal reference.

The guideline generally applies a 0.5% annual exceedance probability (AEP), corresponding to a nominal 200-year return period, for coastal design. A 0.2% AEP, corresponding to a nominal 500-year return period, may be used for areas with higher population or development. These British Columbia design

criteria, freeboard values, setbacks, and planning horizons were not adopted as Nunavut requirements. The component-based treatment of tide, storm surge, relative sea-level change, wave effects, and freeboard was considered relevant to the present study.

2.2.4 Coastal Floodplain Mapping - Guidelines and Specifications, British Columbia Ministry of Forests, Lands and Natural Resource Operations (BC MFLNRO), 2011

The Coastal Floodplain Mapping - Guidelines and Specifications was issued by BC MFLNRO and prepared by Kerr Wood Leidal Associates Ltd. (BC MFLNRO, 2011).

The document describes the development of coastal floodplain mapping, calculation of coastal Flood Construction Levels, acquisition and processing of topographic information, use of consistent horizontal and vertical datums, coastal engineering analysis, map preparation, and documentation of assumptions and results.

BC MFLNRO (2011) identifies HHWLT, relative sea-level change, storm surge, wave effects, and freeboard as principal components of coastal flood elevation. The document also provides information on the combined method for calculating coastal design levels and emphasizes that the vertical datum applied to the water-level, bathymetric, and topographic datasets must be documented and applied consistently.

The document's mapping scales, terrain specifications, Flood Construction Level requirements, and freeboard criteria are specific to British Columbia. Its treatment of coastal flood components, datum control, terrain quality, wave effects, and documentation was considered as supplementary technical guidance for this study.

2.2.5 Sea Level Rise Adaptation Primer: A Toolkit to Build Adaptive Capacity on Canada's South Coasts, BC Ministry of Environment, 2013

The Sea Level Rise Adaptation Primer: A Toolkit to Build Adaptive Capacity on Canada's South Coasts was prepared for the British Columbia Ministry of Environment (BC Ministry of Environment, 2013). The document provides a framework for identifying, evaluating, implementing, and monitoring adaptation measures related to relative sea-level rise and coastal flooding.

The primer is primarily an adaptation-planning document rather than a coastal flood modelling specification. It identifies coastal hazard mapping, land-use planning, regulation, emergency preparedness, structural measures, and ecosystem-based measures as potential components of an adaptation program. It also supports periodic review as new observations, terrain information, climate projections, and community knowledge become available.

The sea-level-rise scenarios and policy measures presented in the primer were not adopted directly for the present study. Relative sea-level change in Nunavut is strongly influenced by vertical land movement and differs from the conditions considered for Canada's southern coasts. The adaptive-management framework was considered relevant to the future use and updating of the Nunavut coastal flood hazard mapping.

2.2.6 Technical Guidelines for Flood Hazard Mapping Studies, Government of Newfoundland and Labrador, 2025

The Technical Guidelines for Flood Hazard Mapping Studies were issued for 2025-2026 by the Water Resources Management Division of the Newfoundland and Labrador Department of Environment and Climate Change (Government of Newfoundland and Labrador, 2025).

For coastal studies, the guideline requires consideration of tides, storm surge, waves, nearshore wave transformation, wave setup, wave runup, shoreline conditions, bathymetry, topography, atmospheric forcing, coastal structures, and future relative sea-level conditions. Coastal flood hazard mapping is required for the 5% and 1% AEP events, corresponding to nominal 20- and 100-year return periods, for specified present and future conditions.

The guideline supports the development of regional coastal information followed by localized hydrodynamic and wave modelling. Nearshore waves are transformed to the foreshore, and onshore wave runup is evaluated using one-dimensional (1D) representative transects or other dynamic modelling approaches appropriate to the shoreline setting.

Transect locations are selected based on shoreline orientation, slope, exposure, shoreline material, coastal structures, development, and changes in nearshore bathymetry. The guideline also requires that tide-and-surge flood zones and wave-effect zones be represented separately. Static application of a peak nearshore water level to a digital elevation model is not considered sufficient where dynamic coastal processes and flood pathways control the hazard.

These principles support the use of regional modelling, community-scale wave transformation, representative shoreline transects, and separate stillwater and wave-effect mapping in the present study. The Newfoundland and Labrador AEP requirements, mapping scales, climate scenarios, and deliverable specifications were not adopted as Nunavut requirements.

2.2.7 Technical Guide for Great Lakes - St. Lawrence River Shorelines, Part 3: Flooding Hazard, Ontario Ministry of Natural Resources (OMNR), 2001

The Technical Guide for Great Lakes - St. Lawrence River Shorelines, Part 3: Flooding Hazard was issued by OMNR (2001).

The document defines the Great Lakes flooding-hazard limit as the combined effect of the 1% AEP stillwater flood level, wave uprush, wave overtopping, and other water-related hazards. The stillwater flood level includes the combined probability of the static lake level and wind setup, while wave uprush and overtopping are considered separately.

Where a site-specific engineering study is unavailable, the document provides standard horizontal wave-uprush allowances of 15 m landward of the 1% AEP flood-level contour along the Great Lakes and 5 m along connecting channels. Site-specific assessment is required where shoreline irregularities, coastal structures, overtopping, ponding, or local evidence make these standard allowances unsuitable.

The Great Lakes water-level statistics and standard horizontal allowances are specific to Ontario and are not applicable design criteria for Hudson Bay. However, the separation of stillwater level, wave runup, wave overtopping, ponding, and other water-related hazards provides supplementary context for interpreting the coastal flood hazard limit.

2.3 Application of the Technical Guidance to the Nunavut Study

The methodology was based primarily on the federal Coastal Flood-Hazard Assessment for Risk-Based Analysis on Canada's Marine Coasts (NRCan, 2025) and the National Feasibility Study for Flood Hazard Modelling and Mapping at a Regional Scale - Technical Recommendations and Guidelines (KGS, 2025). The provincial documents were used as supplementary references where their methods were transferable to the physical setting and intended use of the Nunavut mapping.

Consistent with the project requirements and KGS (2025), the work was completed as a Tier 2 regional coastal flood hazard assessment with a Grade B mapping accuracy objective. The regional methodology was selected because continuous, long-duration water-level and wave observations were not available at the four communities. Regional numerical hindcasts were used to generate the multi-decadal water-level and wave records required for extreme value analysis.

The study evaluated AEP values of 10%, 5%, 2%, 1%, 0.5%, and 0.2%, corresponding to nominal return periods of 10, 20, 50, 100, 200, and 500 years, respectively. These events were specified in the project requirements and were not selected by adopting the design standard of any individual province.

The combined method was used to calculate design stillwater levels. HHWLT was combined with the applicable return-period storm surge residual and relative sea-level allowance. This method assumes that the return-period residual occurs concurrently with HHWLT and is therefore conservative with respect to tidal coincidence.

Wave effects were evaluated using transformed nearshore wave conditions and the wave runup elevation exceeded by 2% of incident waves ($R_{2\%}$) was estimated following the methods described in EurOtop (Van der Meer et al., 2018), at representative shoreline transects. Stillwater inundation and the additional wave-effect zone were evaluated separately so that the contributions of tide, storm surge, wave setup, and wave runup could be identified.

2.4 Modelling and Mapping Framework

Consistent with the applicable federal coastal flood hazard guidance, the modelling and mapping framework was developed to represent the regional and local processes contributing to coastal flooding. The framework consists of regional-scale two-dimensional (2D) hydrodynamic and wave hindcasts, followed by higher-resolution community-scale wave transformation and representative shoreline transect analysis.

The regional hydrodynamic model was developed to simulate astronomical tide, storm surge, wave setup, and the spatial variation in water level across the study area. Spatially and temporally varying wind and atmospheric pressure were applied to represent the atmospheric conditions responsible for storm surge

generation. A regional wave model was developed to simulate wind-wave generation and propagation across the regional domain and to provide the offshore wave conditions required for the community-scale assessments.

The regional hydrodynamic model provided the water-level information used to establish design stillwater levels at the four communities. The regional wave hindcast provided the offshore wave conditions used as boundary inputs to the community-scale wave models. At the community scale, wave transformation across the local bathymetry was simulated, and nearshore wave conditions were extracted for representative shoreline transects. Wave runup and landward hydraulic connectivity were then considered in the delineation of the coastal flood hazard limits.

This section provides a general overview of the modelling and mapping framework. The selected numerical models, forcing datasets, computational meshes, boundary conditions, numerical settings, calibration, validation, extreme value analysis, and model results are described in subsequent sections.

2.4.1 Regional Wave and Hydrodynamic Hindcasts

Regional wave and hydrodynamic hindcasts were completed for Hudson Bay for the period from 1940 to 2025. The regional models were developed using an unstructured computational mesh with increased resolution near Arviat, Whale Cove, Chesterfield Inlet, and Coral Harbour. The model resolution was selected to represent regional-scale wave and water-level processes while providing sufficient resolution for the extraction of conditions at the four communities.

The regional wave hindcast was forced using spatially and temporally varying wind fields. The simulation represented the development and propagation of waves across the regional model domain, including the spatial and temporal variation in significant wave height, wave period, wave direction, and wave radiation stresses.

The regional hydrodynamic hindcast was forced using time-varying astronomical tidal boundary conditions, spatially and temporally varying wind and atmospheric pressure, and wave radiation stresses calculated by the regional wave model. The regional hydrodynamic model was used to represent the combined water-level response associated with astronomical tide, wind stress, atmospheric pressure, and wave setup.

A corresponding tide-only simulation was completed using the same astronomical tidal boundary conditions without atmospheric or wave forcing. The storm surge residual was calculated by subtracting the tide-only water level from the fully forced water level at each community. Under the definition adopted for this study, the storm surge residual includes the water-level effects associated with wind stress, atmospheric pressure, and wave setup represented through the transfer of wave radiation stresses.

The regional wave and hydrodynamic models were calibrated and validated using the available wave and water-level observations. The available regional records were supplemented by shorter local records where applicable. The calibration and validation methods, observational datasets, model performance, and limitations associated with the duration, location, and completeness of the available observations are described in subsequent sections.

2.4.2 Extreme Value Analysis and Stillwater Levels

Continuous wave, wind, and storm surge residual time series were extracted from the regional hindcasts at locations representative of the community water levels and the offshore boundaries of the community-scale wave models. Annual maxima were identified from the 1940 to 2025 records and were used in the extreme value analyses.

Candidate probability distributions were fitted to the annual maximum series. The distribution selected using the adopted goodness-of-fit criterion was used to estimate conditions corresponding to the 10%, 5%, 2%, 1%, 0.5%, and 0.2% AEP events. These events correspond to nominal return periods of 10, 20, 50, 100, 200, and 500 years, respectively. Bootstrap resampling was used to estimate the 95% confidence intervals associated with the fitted return levels.

For each community and AEP event, the stillwater level was calculated as:

$$Stillwater\ Level = HHWLT + Storm\ Surge\ Residual + Relative\ Sea\ Level\ Allowance$$

All tidal elevations, modelled water levels, terrain elevations, and calculated coastal flood elevations were converted to the Canadian Geodetic Vertical Datum of 2013 (CGVD2013) before the coastal flood hazard limits were delineated.

Because the fully forced regional hydrodynamic simulation included wave radiation stresses, wave setup represented at the regional-model resolution is incorporated into the calculated storm surge residual and design stillwater level. A separate regional wave-setup term was therefore not added to the design stillwater level. The extreme value analysis methods, fitted probability distributions, goodness-of-fit assessment, uncertainty analysis, and calculated return levels are presented in subsequent sections.

2.4.3 Community-Scale Wave Transformation and Wave Runup

Extreme wave conditions were extracted from the regional wave hindcast at locations representative of the offshore boundaries of the community-scale models. The extracted significant wave height, peak wave period, and wave direction were used to define the offshore wave boundary conditions for the applicable AEP events.

Separate higher-resolution 2D wave models were developed for Arviat, Whale Cove, Chesterfield Inlet, and Coral Harbour. These models were used to transform the regional offshore wave conditions across the local bathymetry and into the nearshore zone. The community-scale model resolution was increased near the shoreline to represent the spatial variation in wave exposure and the effects of shoaling, refraction, breaking, and dissipation.

Each community shoreline was divided into representative shoreline segments. Representative transects were established based on changes in shoreline orientation, foreshore slope, wave exposure, shoreline material, coastal structures, development, and nearshore bathymetry. This approach allowed spatial variations in nearshore wave conditions and wave runup to be represented without applying a single wave condition uniformly along the shoreline.

Nearshore wave conditions were extracted at the toe of each representative transect. $R_{2\%}$ was calculated using the selected empirical wave-runup method and the local transect geometry. The calculated $R_{2\%}$ represents the vertical wave-runup height above the design stillwater level.

The transect results were assigned to their corresponding shoreline segments to characterize the alongshore variation in wave effects. The resulting wave-effect elevations were considered together with the community terrain data, shoreline configuration, local topographic barriers, depressions, and landward hydraulic connectivity when delineating the wave-effect hazard limits.

The community-scale model setup, offshore boundary conditions, transect selection, wave transformation results, wave-runup calculations, and flood hazard mapping procedures are described in subsequent sections.

2.4.4 Relative Sea-Level Change and Sea Ice

Relative sea-level change was assessed using the available federal projections applicable to the four communities. The projections include the combined influence of global sea-level change and vertical land movement.

Where the projected relative sea-level change indicated a reduction in future water level because vertical land uplift exceeded projected global sea-level rise, a relative sea-level allowance of 0.0 m was retained rather than applying a negative value. This prevented the future assessment condition from producing a lower design water level than the present condition.

Sea ice can influence wave generation, propagation, and coastal flooding through attenuation of wave energy and alteration of fetch conditions. Due to spatial and temporal variability in ice cover and limitations in long-term ice datasets and their integration into the model, sea-ice effects were evaluated qualitatively rather than incorporated directly into the numerical model. Therefore, sea-ice attenuation and other ice-related coastal flood processes were not modelled quantitatively. No reduction was applied to the design wave conditions to account for potential sea-ice attenuation. The wave assessment therefore represents open-water conditions. This avoids applying an unsupported reduction to wave exposure but does not represent potential ice-related coastal hazards. The implications of this assumption are identified in the study limitations.

2.4.5 Coastal Flood Hazard Mapping

Two related coastal flood hazard components were delineated for each community and AEP event:

1. The stillwater flood hazard extent associated with HHWLT, the return-period storm surge residual, wave setup represented in the hydrodynamic simulation, and the adopted relative sea-level allowance.
2. The additional wave-effect hazard extent associated with $R_{2\%}$ calculated at representative shoreline transects.

The flood hazard extents were delineated using elevation data referenced to CGVD2013. Terrain elevation, shoreline configuration, local crests, barriers, depressions, and landward hydraulic connectivity were considered when interpreting the mapped limits. Transect-based wave-effect elevations were applied to the corresponding shoreline segments rather than uniformly across the full community shoreline.

The resulting maps are intended to support regional hazard screening and prioritization, public awareness, emergency response planning, preliminary land-use planning, and high-level risk assessment. The maps are not intended to replace detailed site-specific engineering assessments required for infrastructure design, development permitting, regulatory approval, or design of coastal protection works.

3 Community Outreach and Inuit Qaujimajatuqangit Integration

Community outreach was undertaken through participation in GN-facilitated engagement sessions to support and inform the coastal flood mapping study. These sessions consisted of virtual meetings with community representatives from the four communities of focus and local organizations and were facilitated by GN. Stantec supported these sessions by preparing presentation materials, contributing to discussions, and documenting meeting summaries, including key inputs, action items, and outcomes. All presentation materials were provided in both English and Inuktitut and a translator was present for each virtual session to ensure inclusive and meaningful participation. Four virtual engagement sessions were planned throughout the project delivery which included:

- Two community outreach sessions during the methodology development phase to gather Inuit Qaujimajatuqangit (IQ) and local knowledge of historical flooding, coastal processes, and local shoreline conditions; and
- Two community outreach sessions during the draft mapping and results review phase to review draft coastal flood hazard maps with the communities of focus.

All IQ and local knowledge was incorporated where appropriate and as recommended by participating Inuit organizations, in a manner consistent with the principles of Ownership, Control, Access, and Possession (OCAP®).

3.1 Community Outreach to Gather Inuit Qaujimajatuqangit and Local Knowledge

The integration of IQ and local knowledge is fundamental to the development of accurate, meaningful, and community-relevant coastal flood hazard maps in Nunavut. Inuit possess generations of detailed knowledge of coastal environments, including historical flooding events, storm surge impacts, sea ice dynamics, shoreline change, erosion patterns, and areas vulnerable to wave action and inundation. This knowledge provides critical context that complements scientific datasets and numerical modelling by identifying past flood extents, validating model results, and highlighting local-scale processes that may not be captured through remote sensing or topographic data alone. Engaging Elders, harvesters, and community members throughout the hazard mapping process also ensures that culturally significant locations, travel routes, infrastructure, and areas important for subsistence activities are appropriately considered in risk assessments. By integrating IQ with scientific and engineering analyses, coastal flood hazard mapping becomes more robust, locally relevant, and better suited to support community planning, infrastructure resilience, emergency preparedness, and climate change adaptation while respecting Inuit knowledge systems and fostering collaborative decision-making.

Specifically, insights from the engagement sessions were used to inform interpretation of model outputs, identify areas of concern and local coastal conditions, and support verification of the mapped flood hazards.

This information also assisted in ground-truthing model outputs, improving confidence in flood extents, and ensuring that mapped hazards reflect community experience and priorities.

Two sessions during the methodology development phase occurred in May and June 2026:

- Regional Coastal Flood Mapping for four (4) Nunavut Communities Project - Community Outreach Session 1 at 2 p.m. CST, May 26, 2026
- Regional Coastal Flood Mapping for four (4) Nunavut Communities Project - Community Outreach Session 2 at 2 p.m. CST, June 18, 2026

The two community outreach sessions to gather IQ and local knowledge focused on gathering the following information on the following topics from community representatives for each of the four communities in question:

- Historical coastal flooding events
- Observed shoreline changes
- Significant infrastructure
- Vulnerable areas of concern
- Sea ice conditions
- Wave exposure
- Wind patterns

Both community outreach sessions included a presentation that described the project objectives, including the development of regional-scale coastal flood hazard maps for Arviat (ᐊᕐᕕᐊᑦ), Whale Cove/ Tikirarjuaq (ᑎᑭᖅᕋᐊᖅ), Chesterfield Inlet/ Igluligaarjuk (ᐃᓚᓕᒻᒪᕆᐊᓕᒃ), and Coral Harbour/ Salliq (ᓴᓕᓂᖅ); the integration of IQ and local knowledge; and the assessment of both current and future climate conditions.

The first Community Outreach Session on May 26, 2026, was attended by representatives from Arviat and Whale Cove. Representatives from Arviat shared that seasonal high tides and slush conditions affect the winter travel routes between Arviat and Whale Cove and identified other important community travel corridors that may be affected by coastal processes. Representatives from Arviat shared observations that no significant coastal flooding has occurred within living memory, and discussion of recurring overland flooding caused by snowmelt and runoff that can affect roads, drainage areas, and low-lying portions of the community. Representatives from Arviat also identified areas of potential flood concern near travel routes, creeks, and community infrastructure and provided feedback on the proposed mapping extents. Representatives from Whale Cove shared that the community has had limited experience with coastal flooding due to bedrock shorelines and higher elevations. Representatives from Whale Cove identified the marina area as the location with the greatest potential vulnerability to coastal flooding and discussed prevailing wind directions that can generate larger waves. Additionally, Whale Cove noted that the airport road and surrounding areas are at risk of overland flooding, but during the session it was

confirmed that these areas are not considered at risk from coastal flooding. Representatives from Whale Cove confirmed that the proposed mapping areas captured the primary locations of interest.

The second Community Outreach Session on June 18, 2026, was attended by representatives from Chesterfield Inlet and Coral Harbour. Representatives from Chesterfield Inlet shared that coastal water levels have remained relatively consistent over time, with higher tides typically observed during full moon periods. Representatives from Chesterfield Inlet also noted that seawater has not historically reached community roads, buildings, or other key infrastructure and indicated no significant concerns regarding coastal flooding within the proposed mapping area. Feedback provided during the session confirmed that the proposed mapping extents were appropriate for the community. Representatives from Coral Harbour shared information regarding historical flooding and erosion concerns within the community. Participants from Coral Harbour identified past road washouts affecting the airport road and other travel routes, noting that these events were generally associated with rainfall, snowmelt, and drainage conditions rather than coastal flooding. Representatives also described localized flooding near residential areas during periods of high water and identified additional locations where seasonal runoff and washout concerns have affected community infrastructure and land users.

A summary of the IQ and local knowledge gathered in the Community Outreach Sessions is presented in Table 3-1 below. The locations associated with each discussion point are identified by corresponding IDs on the maps provided in Appendix A.

Overall, the community engagement program found limited reports of historical coastal flooding within the four study communities. Observations provided by community representatives generally identified localized areas of potential vulnerability, transportation routes of concern, and locations affected by non-coastal flooding mechanisms (e.g., snowmelt and rainfall runoff). The information collected through engagement was used to support interpretation of model results and improve confidence in the mapped flood hazards.

Table 3-1 Summary of IQ identified during Methodology Development Phase

ID	Community	Theme	Description	Longitude	Latitude
1	Arviat	Historical coastal flooding events	August/September flooding on this important travel route for hunting.	-94.12037939	61.06907427
2	Arviat	Vulnerable areas of concern	Water comes through this creek and then through the lakes. Coastal Flooding	-94.00295442	61.08757506
3	Arviat	Vulnerable areas of concern	One of the first places to see inundation and impacts on the community. Coastal Flooding	-94.05276584	61.09181224
4	Arviat	Vulnerable areas of concern	This area amongst the first area to feel the impacts of inundation. Coastal Flooding	-94.05735399	61.10931416
5	Arviat	Vulnerable areas of concern	This area amongst the first area to feel the impacts of inundation. Coastal Flooding	-94.04386005	61.10760437
6	Arviat	Vulnerable areas of concern	This area amongst the first area to feel the impacts of inundation. Coastal Flooding	-94.03000874	61.10566913
7	Arviat	Any other information you would like the team to have	Seasonal flooding from around this location due to snow melt. Overland Flooding	-94.19589223	61.12217236
8	Arviat	Any other information you would like the team to have	snow melting flooding the road and extending to the east. Softens the substrate of the community.	-94.07457563	61.10936606
9	Whale Cove	Any other information you would like the team to have	Unload the sea dock	-92.56988504	62.17073253
10	Whale Cove	Any other information you would like the team to have	Second dock but rarely used	-92.56202218	62.17176838
11	Whale Cove	Wind patterns	East and south wind produce the biggest waves into the bay.	-92.57840223	62.17119315
12	Whale Cove	Any other information you would like the team to have	remove from the map sheets.	-92.57583746	62.19350682
13	Chesterfield Inlet	Any other information you would like the team to have	During the full moon, the sea level increases in elevation by 1-3ft	-90.70420985	63.34010517
14	Chesterfield Inlet	Any other information you would like the team to have	Water in this area gets high, but has not in memory breached the crest of the road.	-90.70767361	63.33944634
15	Chesterfield Inlet	Any other information you would like the team to have	no issues during spring when the snow is melting. Northern and COOP shorelines are pretty high like 8 or so feet	-90.69511805	63.34031985
16	Chesterfield Inlet	Any other information you would like the team to have	Future possible development site. High upon the bedrock.	-90.70606636	63.33369861
17	Coral Harbour	Significant infrastructure	Road washout during high rainfall, overland event.	-83.18383215	64.13189163
18	Coral Harbour	Vulnerable areas of concern	Fall time early 2020's, there was high water surrounding the property. No known damage. Properties to the west were unaffected.	-83.15824017	64.13457858
19	Coral Harbour	Any other information you would like the team to have	Properties here have not been known to have been impacted by coastal flooding events.	-83.16431859	64.13240262
20	Coral Harbour	Any other information you would like the team to have	No issues with coastal flood inundation at seasonal properties along the shoreline.	-83.2186766	64.11866318
21	Coral Harbour	Any other information you would like the team to have	No issues with flooding at road where it nears the shoreline.	-83.27176911	64.14489069
22	Coral Harbour	Significant infrastructure	Damage to road from snow melting and inshore processes	-83.19767527	64.12335335
23	Coral Harbour	Any other information you would like the team to have	Property experiences some flooding. Could be due to seasonal snow melt in the spring.	-83.16081321	64.13996672

4 Metocean Data

The metocean assessment defines the coordinate and vertical references, terrain and bathymetric inputs, astronomical tide, observed water levels, wind forcing, relative sea-level treatment, and wave observations used in the study. Section 4 describes the data and their limitations. Section 5 describes terrain integration and transects. Section 6 describes model configuration, calibration, hindcasting, and extreme-value analysis.

4.1 Elevation Datums

4.1.1 Horizontal Coordinate System Selection

The study area spans several Universal Transverse Mercator (UTM) zones. The Canada Lambert Conformal Conic projection was used for regional terrain, bathymetry, model meshes, and geographic information system (GIS) processing, with a central meridian of 96 degrees West (W) and standard parallels of 50 degrees North (N) and 70 degrees N. One metric projection avoids zone boundaries and limits inconsistent scale changes across Hudson Bay. This is important because fetch length, point spacing, wave propagation, and wind-driven water-level response depend on distance. The projection does not remove all distortion, but it provides a more consistent regional basis than combining several UTM zones.

4.1.2 Vertical Elevation Datums

CGVD2013 was used as the common reporting datum for terrain, modelled water levels, and flood elevations. Terrestrial Light Detection and Ranging (LiDAR) and photogrammetric products were supplied in CGVD2013. Canadian Hydrographic Service (CHS) bathymetry and tidal statistics are referenced to local Chart Datum (CD) and were converted using the available CHS separation information.

The vertical datum offset grid was obtained from CHS through the CHS Intellectual Property Application process. The dataset is developed and maintained by CHS, is not publicly available for download; however, it can be purchased via the CHS application process. For information, follow this web link.

Chart Datum remains useful in this region because a tidal station is available at each community and publishes astronomical tidal levels locally. It is also a practical local reference where vertical land uplift varies rapidly. The conversion to a national geodetic datum remains a data challenge because benchmarks and separation information are sparse; the local transformation applied at each community is therefore documented with the reported levels.

4.2 Topography and Bathymetry

4.2.1 Topographic Dataset

LiDAR-derived Digital Terrain Model (DTM) data were used at Arviat, Whale Cove, and Chesterfield Inlet. The Coral Harbour terrain surface was derived from Unmanned Aerial Vehicle (UAV) photogrammetry. These datasets resolve low-lying land, coastal slopes, and controls used for transect definition and flood-limit delineation. Coverage is not uniform outside the developed areas, and the available source extents are shown in Section 5.

4.2.2 Bathymetric Dataset

Bathymetric data were compiled from the CHS Non-Navigational Bathymetric Data (NONNA) products at 100 m and 10 m resolutions (Canadian Hydrographic Service, 2025), referred to as NONNA100 and NONNA10, respectively. Both datasets were originally referenced to Chart Datum. For the bay-wide regional model, the bathymetric elevations were converted to CGVD2013 using the spatially varying vertical-datum offset grid provided by CHS.

For the community-scale models, the published community-specific Chart Datum-to-CGVD2013 conversion values provided by Fisheries and Oceans Canada (DFO) were applied (Table 4-1). The converted bathymetric data were subsequently integrated with the terrestrial elevation data.

Table 4-1 Chart Datum to CGVD2013 Conversion Values

Community	DFO Station	Chart Datum to CGVD2013 Conversion (m)
Arviat	05040	-2.36
Whale Cove	05055	-2.43
Chesterfield Inlet	05140	-2.92
Coral Harbour	05180	-2.30

The conversion is applied as:

$$\text{Elevation (CGVD2013)} = \text{Elevation (Chart Datum)} + \text{Conversion}$$

4.3 Tide and Water Level

Observed water-level measurements and published tidal information were obtained from DFO for Arviat, Whale Cove, Chesterfield Inlet, Coral Harbour, and Churchill. The available observed records at the four study communities are short and discontinuous, whereas Churchill station 05010 provides a substantially longer regional water-level record. Table 4-2 summarizes the available observation periods and sampling intervals identified in the DFO archive. For hydrodynamic model validation, approximately one month of sufficiently continuous observations was selected at each study community, comprising August 1997 for Arviat, Whale Cove, and Chesterfield Inlet, and August 1998 for Coral Harbour. The longer Churchill

record was used for regional hydrodynamic model calibration and for observation-based stillwater-level frequency analysis. The specific calibration and validation periods are described in Section 6.

Table 4-2 DFO Observed Water-Level Data Availability

Community	DFO Station	From	To	Sampling Interval (min)
Arviat	05040	1965-07-16	1965-07-31	60
		1997-07-21	1997-09-10	15
		1997-08-14	1997-08-14	3
Whale Cove	05055	1997-07-22	1997-08-27	15
Chesterfield Inlet	05140	1952-08-13	1952-09-18	60
		1973-09-16	1973-09-24	60
		1997-07-22	1997-08-26	15
Coral Harbour	05180	1971-01-01	1971-01-01	60
		1979-03-01	1979-07-01	60
		1998-07-25	1998-09-11	15
		1998-08-29	1998-08-29	3
Churchill	05010	1940-01-03	2025-01-01	Variable

4.3.1 Tidal Levels at Arviat, Whale Cove, Chesterfield Inlet, and Coral Harbour

Astronomical tide is a principal component of coastal water levels in Hudson Bay. Observed water-level records and published tidal levels were retrieved from DFO stations at Arviat (05040), Whale Cove (05055), Chesterfield Inlet (05140), Coral Harbour (05180), and Churchill (05010). The station locations are presented in Figure 4-1.

The published tidal levels are referenced to local Chart Datum. For consistency with the terrestrial elevations, model results, and coastal flood hazard mapping, the tidal levels were converted to CGVD2013 using the community-specific conversion values provided by DFO. The adopted shifts are (-2.36) m at Arviat, (-2.43) m at Whale Cove, (-2.92) m at Chesterfield Inlet, and (-2.30) m at Coral Harbour.

Table 4-3 presents the published tidal elevations in both Chart Datum and CGVD2013. HHWLT was adopted as the astronomical tidal component of the design stillwater level. The other tidal statistics are provided to characterize the local tidal regime and document the vertical-datum conversion applied at each community.

Table 4-3 DFO tidal levels at the four communities, referenced to CGVD2013

Tidal Levels	Arviat CD (m)	Arviat CGVD2013 (m)	Whale Cove CD (m)	Whale Cove CGVD2013 (m)	Chesterfield Inlet CD (m)	Chesterfield Inlet CGVD2013 (m)	Coral Harbour CD (m)	Coral Harbour CGVD2013 (m)
Highest Astronomical Tide (HAT)	4.09	1.73	4.18	1.75	4.99	2.07	3.69	1.39
Higher High Water Large Tide (HHWLT)	4.03	1.67	4.12	1.69	4.89	1.97	3.63	1.33
Higher High Water Mean Tide (HHWMT)	3.47	1.11	3.54	1.11	4.07	1.15	2.99	0.69
High Water Mean Tide (HWMT)	3.43	1.07	3.49	1.06	4.02	1.1	2.93	0.63
Mean Water Level (MWL)	2.13	-0.23	2.18	-0.25	2.49	-0.43	1.86	-0.44
Low Water Mean Tide (LWMT)	0.78	-1.58	0.83	-1.6	0.96	-1.96	0.74	-1.56
Lower Low Water Mean Tide (LLWMT)	0.7	-1.66	0.75	-1.68	0.88	-2.04	0.67	-1.63
Lower Low Water Large Tide (LLWLT)	0.04	-2.32	0.1	-2.33	0	-2.92	0	-2.3
Lowest Astronomical Tide (LAT)	-0.01	-2.37	0.05	-2.38	-0.09	-3.01	-0.08	-2.38

Notes:

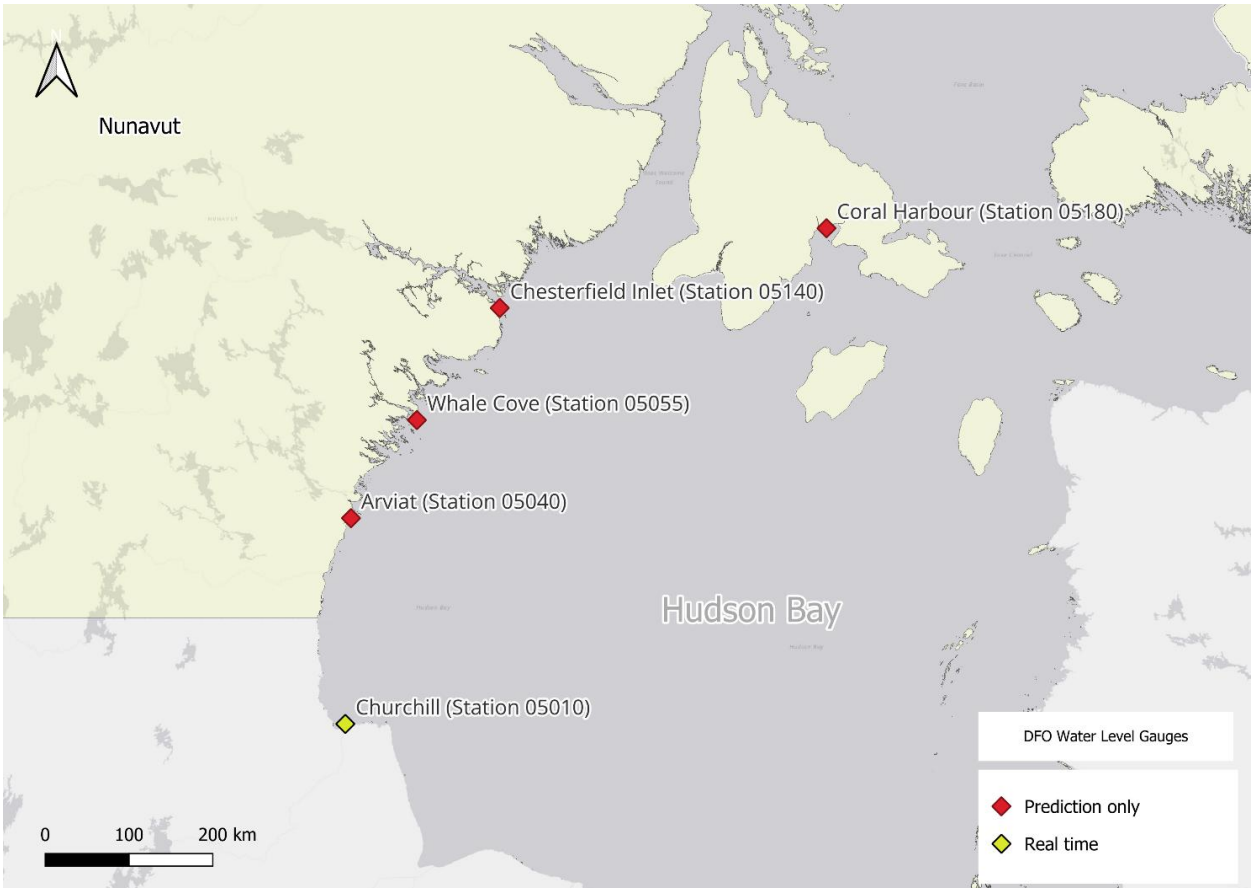
1. Tidal elevations were obtained from the DFO station pages for Arviat station 05040, Whale Cove station 05055, Chesterfield Inlet station 05140, and Coral Harbour station 05180.
2. Chart Datum-to-CGVD2013 shifts of -2.36, -2.43, -2.92, and -2.30 m were applied at Arviat, Whale Cove, Chesterfield Inlet, and Coral Harbour, respectively.

The characteristics of the community tidal regimes are summarized below:

- **Arviat:** HHWLT is 4.03 m CD, corresponding to 1.67 m CGVD2013. The large-tide range between HHWLT and LLWLT is approximately 3.99 m. The mean tidal range between HHWMT and LLWMT is approximately 2.77 m.
- **Whale Cove:** HHWLT is 4.12 m CD, corresponding to 1.69 m CGVD2013. The large-tide range is approximately 4.02 m, and the mean tidal range is approximately 2.79 m. The tidal range is similar to that at Arviat.
- **Chesterfield Inlet:** HHWLT is 4.89 m CD, corresponding to 1.97 m CGVD2013. The large-tide range is approximately 4.89 m, and the mean tidal range is approximately 3.19 m. Chesterfield Inlet has the largest tidal range and the highest HHWLT elevation among the four communities.
- **Coral Harbour:** HHWLT is 3.63 m CD, corresponding to 1.33 m CGVD2013. The large-tide range is approximately 3.63 m, and the mean tidal range is approximately 2.32 m. Coral Harbour has the lowest HHWLT elevation and the smallest tidal range among the four communities.

Long-duration observed water-level records are not available at the four community stations. Short-duration records from Arviat, Whale Cove, and Chesterfield Inlet in August 1997 and from Coral Harbour in August 1998 were used as independent datasets for validation of the regional hydrodynamic model. These records were not considered sufficiently long for direct estimation of return-period stillwater levels.

Figure 4-1 DFO tide and water-level stations used in the study. Local stations are Arviat 05040, Whale Cove 05055, Chesterfield Inlet 05140, and Coral Harbour 05180; Churchill 05010 provides the long-duration observed record.



4.3.2 Regional Tidal Boundary Conditions

The Finite Element Solution 2014 global ocean tide atlas (FES2014) was used to define the time-varying astronomical tidal boundary conditions for the regional hydrodynamic model. FES2014 is based on an unstructured hydrodynamic tide model with assimilation of satellite-altimetry and tide-gauge observations. The principal tidal constituents were extracted along the regional model boundaries and combined to generate the continuous tidal boundary time series.

The same tidal boundary conditions were applied to the fully forced and tide-only regional hydrodynamic simulations. The fully forced simulation additionally included spatially and temporally varying wind, atmospheric pressure, and wave radiation stresses. Applying identical tidal forcing in both simulations allowed the residual surge to be calculated by subtracting the tide-only water level from the fully forced water level at corresponding time steps. The development and validation of the tidal boundary conditions are described further in Section 6.

4.3.3 Churchill Water-Level Record

DFO Churchill station 05010 provides the longest available observed water-level record on the western side of Hudson Bay. The station is located near the mouth of the Churchill River in a locally sheltered setting. The Churchill record was used for calibration of the regional hydrodynamic model and for comparison of modelled and observation-based stillwater-level frequency estimates.

The published Churchill tidal elevations are presented in Table 4-4. The elevations were converted from Chart Datum to CGVD2013 using a shift of −2.60 m.

Table 4-4 Tidal elevations at DFO Churchill station 05010

Tidal Elevations	Chart Datum (m)	CGVD2013 (m)
Highest Astronomical Tide (HAT)	4.94	2.34
Higher High Water Large Tide (HHWLT)	4.84	2.24
Higher High Water Mean Tide (HHWMT)	4.09	1.49
High Water Mean Tide (HWMT)	4.05	1.45
Mean Water Level (MWL)	2.56	-0.04
Low Water Mean Tide (LWMT)	0.96	-1.64
Lower Low Water Mean Tide (LLWMT)	0.88	-1.72
Lower Low Water Large Tide (LLWLT)	-0.02	-2.62
Lowest Astronomical Tide (LAT)	-0.12	-2.72

Note: Tidal elevations were obtained from DFO Churchill station 05010. A Chart Datum-to-CGVD2013 shift of −2.60 m was applied.

Annual-maximum observed stillwater levels were extracted from the available Churchill record between approximately 1944 and 2025. Years without sufficient observations were excluded. Nine candidate probability distributions were evaluated: Generalized Extreme Value, Weibull, Gumbel, Gamma, Pearson Type III, Log-Pearson Type III, Normal, Log-Normal, and Exponential.

The distributions were ranked using the coefficient of determination calculated from the empirical and fitted quantiles. The Weibull distribution provided the highest quantile-based coefficient of determination and was therefore selected. The fitted upper tail was also reviewed graphically to confirm that the selected distribution provided a reasonable representation of the annual maxima over the available record. Bootstrap resampling was used to calculate the 95% confidence limits.

Figure 4-2 presents the empirical annual maxima, selected Weibull distribution, and 95% confidence limits. The estimated stillwater level increases from 3.14 m CGVD2013 for the 10-year return period to 3.66 m CGVD2013 for the 500-year return period. The increasing width of the confidence limits reflects the uncertainty associated with extrapolating beyond the available observation period.

Figure 4-2 Extreme-value analysis of annual-maximum observed stillwater levels at DFO Churchill station 05010, including the selected Weibull distribution and 95% confidence limits.

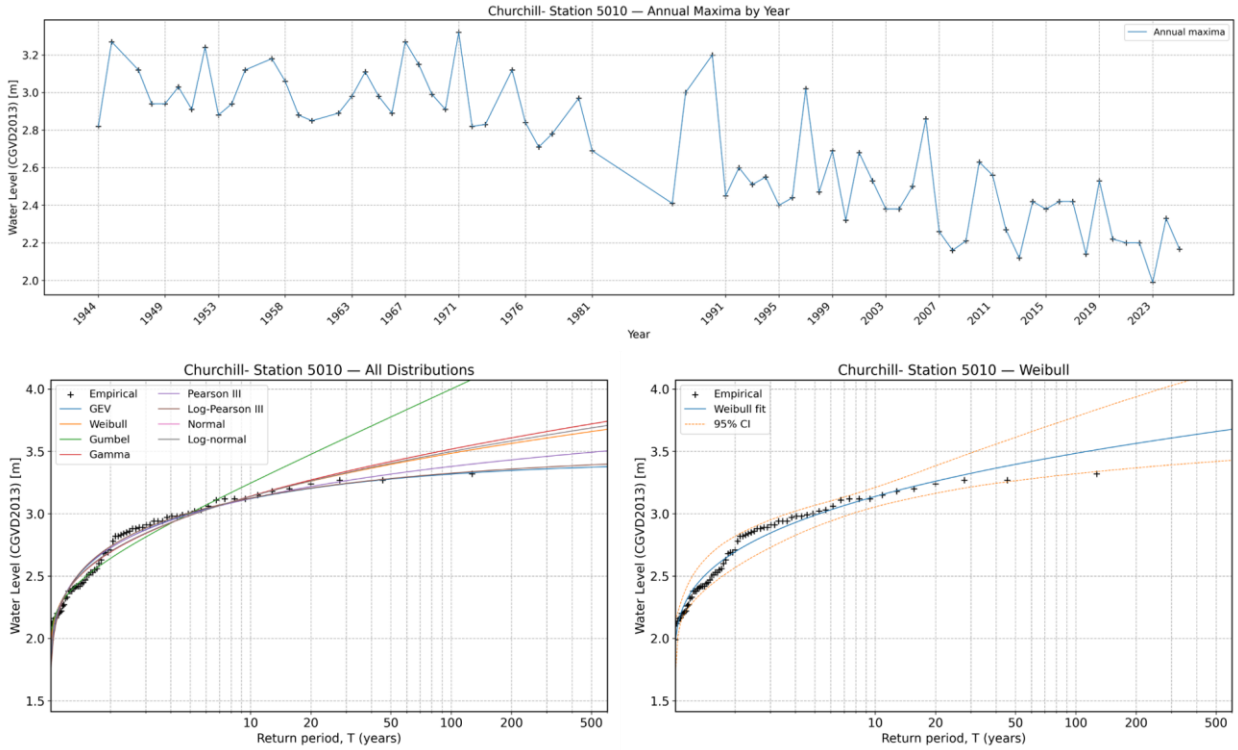


Table 4-5 Estimated stillwater levels at DFO Churchill station 05010

Return period (years)	AEP (%)	Estimated stillwater level (m CGVD2013)	95% lower confidence limit (m CGVD2013)	95% upper confidence limit (m CGVD2013)
10	10	3.14	3.06	3.21
20	5	3.26	3.16	3.37
50	2	3.4	3.26	3.6
100	1	3.48	3.32	3.77
200	0.5	3.56	3.36	3.92
500	0.2	3.66	3.41	4.11

4.4 Sea Level Rise

Sea level change is a critical consideration for coastal flooding risk assessment in Nunavut, influenced significantly by glacial isostatic adjustment (GIA), which refers to the ongoing rise of land previously depressed by ice sheets during the last ice age (James et al., 2014). Nunavut exhibits some of Canada's highest rates of land uplift due to GIA, resulting in relative sea-level fall in many regions, a trend projected to persist throughout the 21st century (James et al., 2014). The distribution of vertical land motion across Canada can be seen in Figure 4-3.

Figure 4-3 GPS-derived vertical crustal motion for Canada and surrounding regions (James et al., 2014; Craymer et al., 2011)

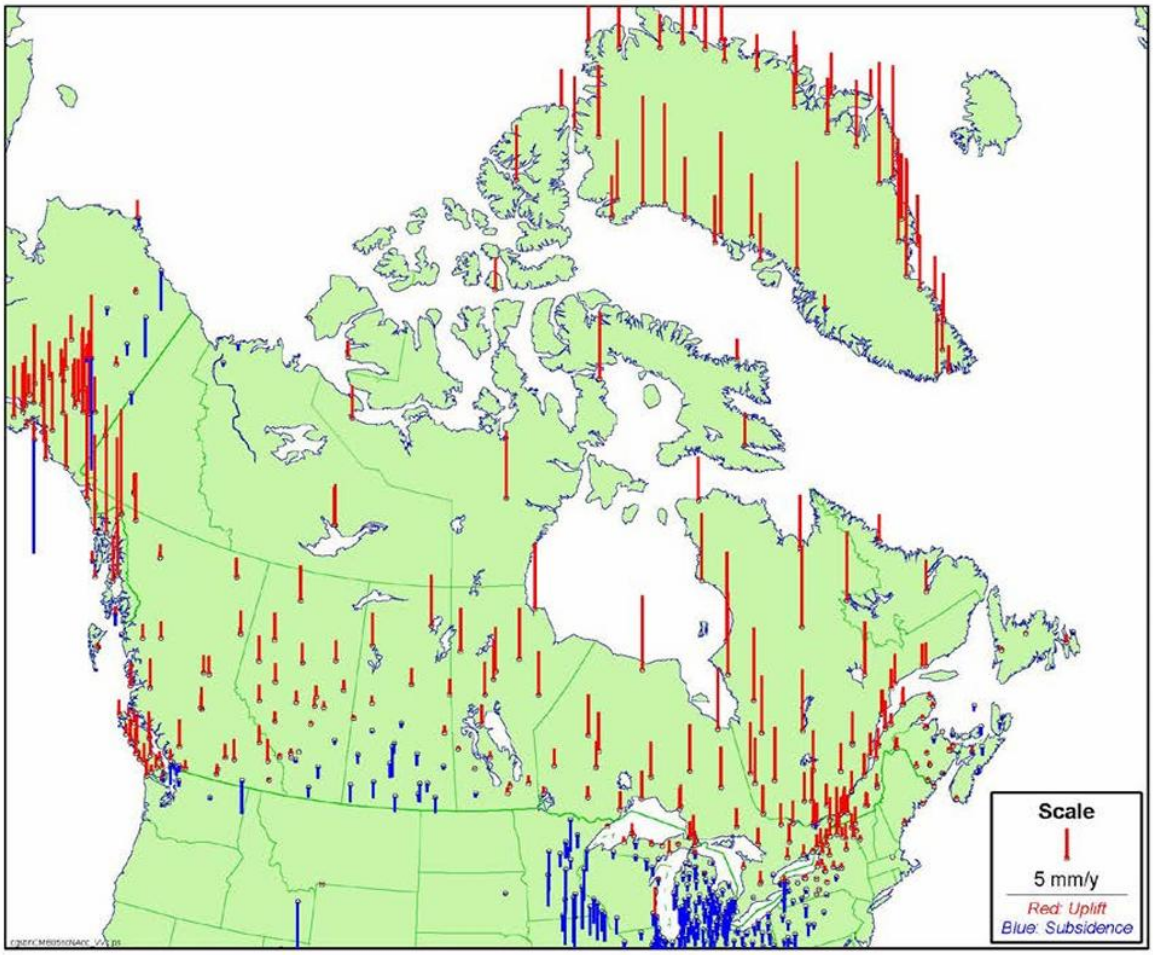
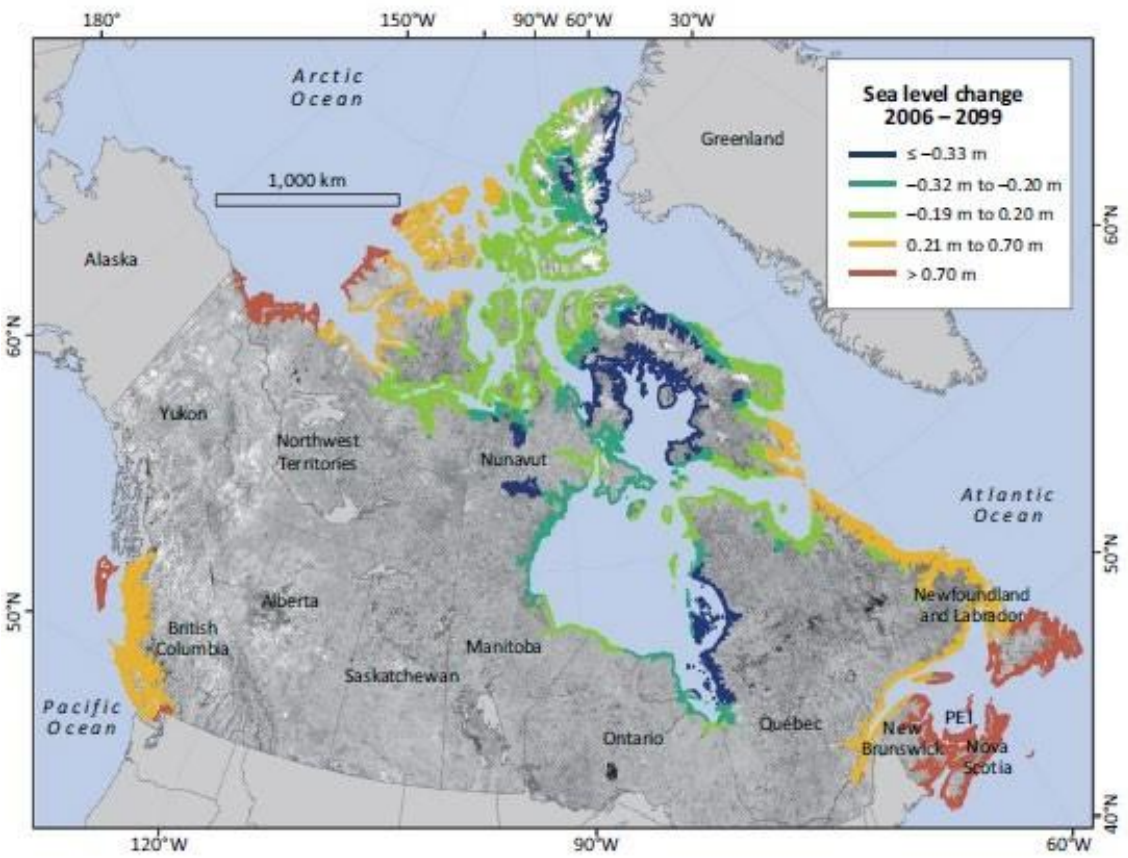


Figure 4-4 shows the sea level change in Canada for 2099 based on 2006 water levels (CSA, 2021).

Figure 4-4 Projected sea level change in Canada 2006-2099 (CSA, 2021)



In the Hudson Bay region, ongoing land uplift associated with GIA offsets a substantial portion of the projected global sea-level rise and can result in a net fall in relative sea level.

The Canadian Extreme Water Level Adaptation Tool and the available federal relative sea-level projections were reviewed. Community-specific values were extracted from the 0.1-degree gridded dataset published by James et al. (2021). This dataset updates the earlier projections presented by James et al. (2014) and combines the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report sea-level projections with the NAD83v70VG national crustal velocity model. Projections are provided relative to the 1986 to 2005 reference period for each decade through 2100.

NAD83v70VG is the national crustal velocity model associated with Version 7.0 of the North American Datum of 1983, Canadian Spatial Reference System, NAD83(CSRS). The model provides gridded estimates of horizontal and vertical crustal movement across Canada. It was developed using continuous and repeated campaign Global Navigation Satellite System observations collected at stations across Canada and surrounding regions. In areas where observations are limited, particularly in northern Canada, the vertical velocity grid was supplemented using predictions from GIA and elastic loading models. Gridded uncertainty estimates are also provided with the velocity model (Robin et al., 2020).

For the relative sea-level projections, the vertical component of NAD83v70VG was used to represent the rate of land uplift or subsidence. Positive vertical velocities indicate that the land surface is rising, while negative velocities indicate subsidence. Relative sea-level change was calculated by combining the projected change in ocean level with the projected vertical movement of the land surface. Consequently, land uplift reduces relative sea-level rise and can result in a projected fall in relative sea level where the rate of uplift exceeds the projected increase in ocean level.

The Hudson Bay region continues to experience relatively high rates of land uplift associated with GIA following the retreat of the Laurentide Ice Sheet. The NAD83v70VG vertical velocity estimates therefore have a substantial influence on the projections at the four study communities. For Arviat, Whale Cove, Chesterfield Inlet, and Coral Harbour, the estimated land uplift generally equals or exceeds the projected ocean-level increase through 2100. This produces negative median relative sea-level projections under the assessed Representative Concentration Pathway (RCP) RCP4.5 and RCP8.5 scenarios. The federal projections combine the crustal-velocity model with the IPCC Fifth Assessment Report sea-level projections and provide gridded results at a spatial resolution of 0.1 degrees (James et al., 2021).

The RCP4.5 and RCP8.5 projections were reviewed in accordance with the project requirements. Table 4-6 presents the projected changes for 2050 and 2100. Median projections are presented together with the 5th- to 95th-percentile range. Negative values represent a fall in relative sea level, while positive values represent a rise.

Table 4-6 Projected relative sea-level change at the study communities

Community	RCP4.5, 2050 median [5th to 95th] (m)	RCP4.5, 2100 median [5th to 95th] (m)	RCP8.5, 2050 median [5th to 95th] (m)	RCP8.5, 2100 median [5th to 95th] (m)
Arviat	-0.34 [-0.46 to -0.23]	-0.67 [-0.95 to -0.39]	-0.31 [-0.48 to -0.15]	-0.52 [-0.90 to -0.14]
Whale Cove	-0.36 [-0.44 to -0.29]	-0.70 [-0.94 to -0.48]	-0.33 [-0.48 to -0.19]	-0.56 [-0.92 to -0.20]
Chesterfield Inlet	-0.37 [-0.44 to -0.30]	-0.71 [-0.95 to -0.48]	-0.34 [-0.49 to -0.18]	-0.57 [-0.96 to -0.19]
Coral Harbour	-0.31 [-0.48 to -0.14]	-0.61 [-0.98 to -0.24]	-0.28 [-0.50 to -0.06]	-0.49 [-0.99 to +0.02]

Notes:

1. Values were extracted from the nearest 0.1-degree grid cell in the federal dataset published by James et al. (2021).
2. Projections are relative to the 1986 to 2005 reference period.
3. Values in brackets represent the 5th- to 95th-percentile range.

The median projections indicate a fall in relative sea level at all four communities under both RCP4.5 and RCP8.5. Under the upper 95th-percentile RCP8.5 projection, relative sea level also continues to fall at Arviat, Whale Cove, and Chesterfield Inlet through 2100. At Coral Harbour, the corresponding upper projection is approximately +0.02 m by 2100. This small positive value would not materially change the mapped flood limits at the resolution and accuracy of the present regional assessment.

The relative sea-level projections therefore indicate that sea-level rise is not a controlling contributor to the future stillwater levels at the four communities under the RCP4.5 and RCP8.5 scenarios. Vertical land uplift is projected to equal or exceed the ocean-level increase over the assessment period. Applying the negative median projections would reduce the future stillwater levels and mapped flood extents relative to the present condition.

No reduction in the stillwater level was credited for projected relative sea-level fall. A relative sea-level allowance of 0.0 m was adopted for each community. This treatment prevents the future assessment condition from producing a lower stillwater level than the present condition and maintains a conservative basis for coastal flood hazard mapping.

Relative sea-level change is only one potential climate-related influence on coastal flooding. The adopted 0.0 m allowance does not account for possible future changes in storm tracks, wind climate, storm intensity, open-water duration, or sea-ice conditions. Sea-ice attenuation was not applied to the wave conditions, and the wave assessment represents open-water conditions. The implications of these assumptions are discussed in the study limitations.

Although projected relative sea-level fall does not increase the mapped coastal flood levels, it may affect navigation, shoreline access, and the long-term functionality of marine infrastructure by reducing available water depth. These effects are outside the scope of the coastal flood hazard mapping but should be considered in future infrastructure and adaptation planning.

4.5 Winds and Atmospheric Pressure

Wind and atmospheric pressure are principal meteorological inputs to the regional wave and hydrodynamic models. Wind controls wave generation and contributes to wind-driven water-level setup, while spatial variation in atmospheric pressure contributes to the water-level response through the inverse barometer effect and associated pressure gradients.

The following wind and atmospheric pressure data sources were used and compared:

- ERA5: Hourly, spatially varying 10 m wind components and atmospheric pressure were obtained from the fifth-generation global atmospheric reanalysis produced by the European Centre for Medium-Range Weather Forecasts (ECMWF). ERA5 was used as the meteorological forcing for the regional wave and hydrodynamic hindcasts and as the basis for the wind extreme-value analysis.
- Environment and Climate Change Canada (ECCC) climate stations: Hourly observed wind speed, wind direction, and station pressure were obtained from the climate stations at Arviat, Whale Cove, Chesterfield Inlet, and Coral Harbour. These observations were used to evaluate ERA5 at the four communities. The station observations were not applied directly as model forcing because the stations are located on land and do not represent the spatial variation in offshore meteorological conditions across Hudson Bay.

- DFO Hudson Bay buoy C45158: Observed offshore wind speed and direction from buoy C45158 were compared with ERA5 at the buoy location. The buoy provides the only available offshore wind observations within Hudson Bay and therefore provides an additional assessment of ERA5 away from the coastal land stations. The buoy observations were not applied directly as regional model forcing.

ERA5 provides hourly data on a 0.25-degree latitude-longitude grid. The wind and atmospheric pressure fields covering the complete Hudson Bay regional model domain were retrieved for the period from 1 January 1940 to 31 December 2025. The gridded fields were spatially interpolated to the regional model mesh at each model time step. Accordingly, the wind and atmospheric pressure forcing varied both spatially across Hudson Bay and temporally throughout the 86-year hindcast.

The regional wave model was forced using the spatially and temporally varying ERA5 10 m wind field. The regional hydrodynamic model was forced using the same wind field together with the spatially and temporally varying ERA5 atmospheric pressure field. Atmospheric pressure was therefore explicitly included in the hydrodynamic model. The community extraction points shown in Figure 4-5 were used to summarize the ERA5 record and complete the extreme-value analysis.

Figure 4-5 ERA5 extraction points at ECCC climate stations, and Hudson Bay buoy C45158.

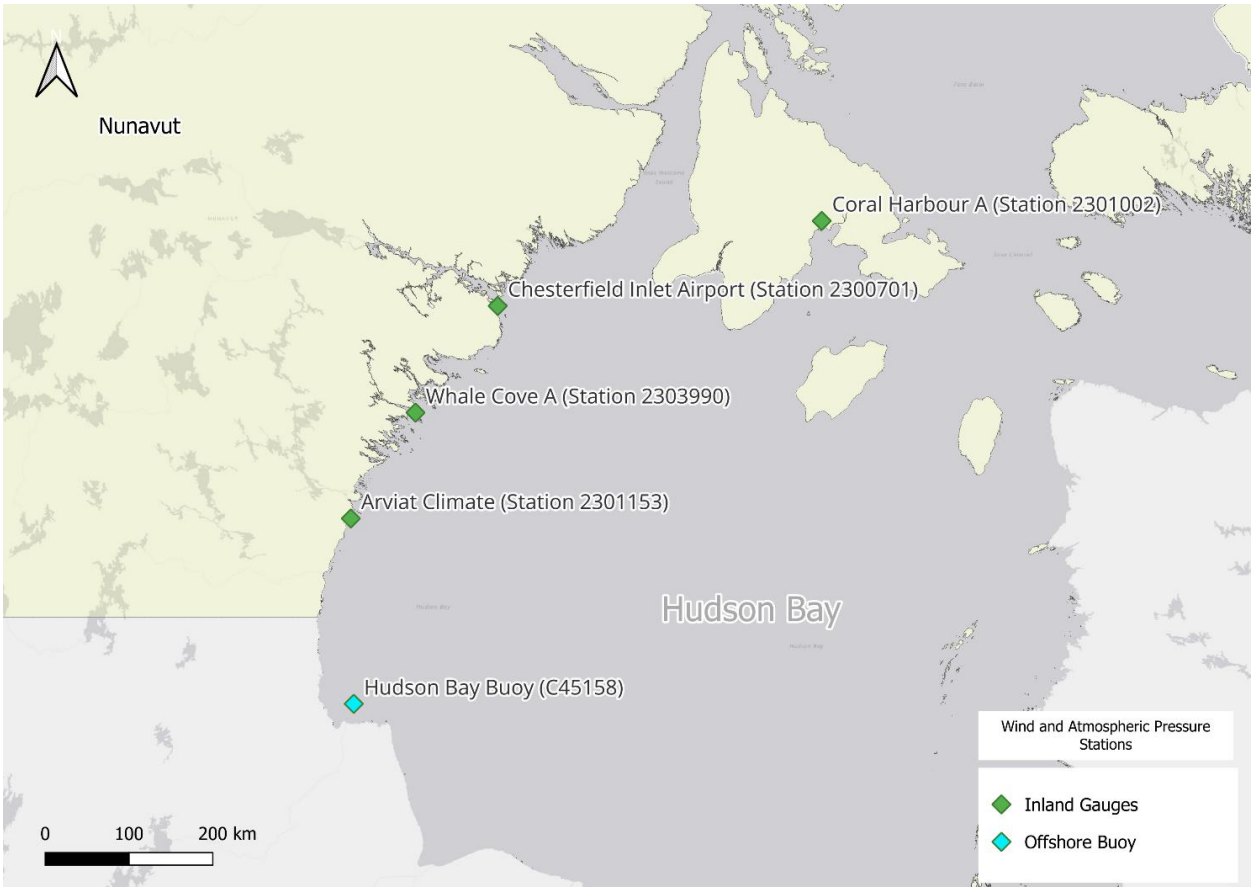


Table 4-7 summarizes ERA5 wind-speed distributions at the community extraction points. Wind directions are reported using the meteorological convention and identify the direction from which the wind originates.

Table 4-7 ERA5 hourly 10 m wind-speed statistics for 1940-2025

Community	Mean (m/s)	10th percentile (m/s)	Median (m/s)	90th percentile (m/s)	Maximum (m/s)	Dominant direction
Arviat	6.22	2.76	5.91	10.1	22.13	Northwest
Whale Cove	6.55	2.87	6.24	10.64	23.4	Northwest
Chesterfield Inlet	6.21	2.79	5.93	10.01	21.72	Northwest
Coral Harbour	5.57	2.35	5.08	9.42	22.88	North

The ERA5 wind conditions at each community are summarized as follows:

- Arviat: Hourly ERA5 wind speeds ranged from near-calm conditions to 22.13 m/s, with a mean of 6.22 m/s. Winds from the northwest were most frequent over the hindcast period.
- Whale Cove: Hourly ERA5 wind speeds ranged from near-calm conditions to 23.40 m/s, with a mean of 6.55 m/s. Whale Cove had the highest mean wind speed among the four community extraction points. Winds from the northwest were most frequent.
- Chesterfield Inlet: Hourly ERA5 wind speeds ranged from near-calm conditions to 21.72 m/s, with a mean of 6.21 m/s. Winds from the northwest were most frequent.
- Coral Harbour: Hourly ERA5 wind speeds ranged from near-calm conditions to 22.88 m/s, with a mean of 5.57 m/s. Winds from the north were most frequent, with winds from the northeast and northwest also occurring frequently.

4.5.1 Comparison of ERA5 and Observed Wind Conditions

ERA5 represents atmospheric conditions averaged over a gridded area. Local terrain, coastal exposure, land-water transitions, and short-duration gusts cannot be fully resolved at the ERA5 grid scale. Reanalysis datasets may therefore smooth or underestimate short-duration peak wind speeds measured at individual stations. Because the regional wave and hydrodynamic hindcasts depend on the magnitude, direction, and timing of the wind forcing, ERA5 was compared with the available land-based and offshore observations before it was applied over the complete hindcast period.

The comparison period at each location was selected using the highest observed hourly wind speed within the quality-controlled overlapping record. The complete calendar month containing the observed peak was then compared. Use of the complete month allowed the peak event, the preceding and following conditions, the wind-speed distribution, and the variation in wind direction to be assessed together. This approach was applied consistently to the four ECCC stations and Hudson Bay buoy C45158.

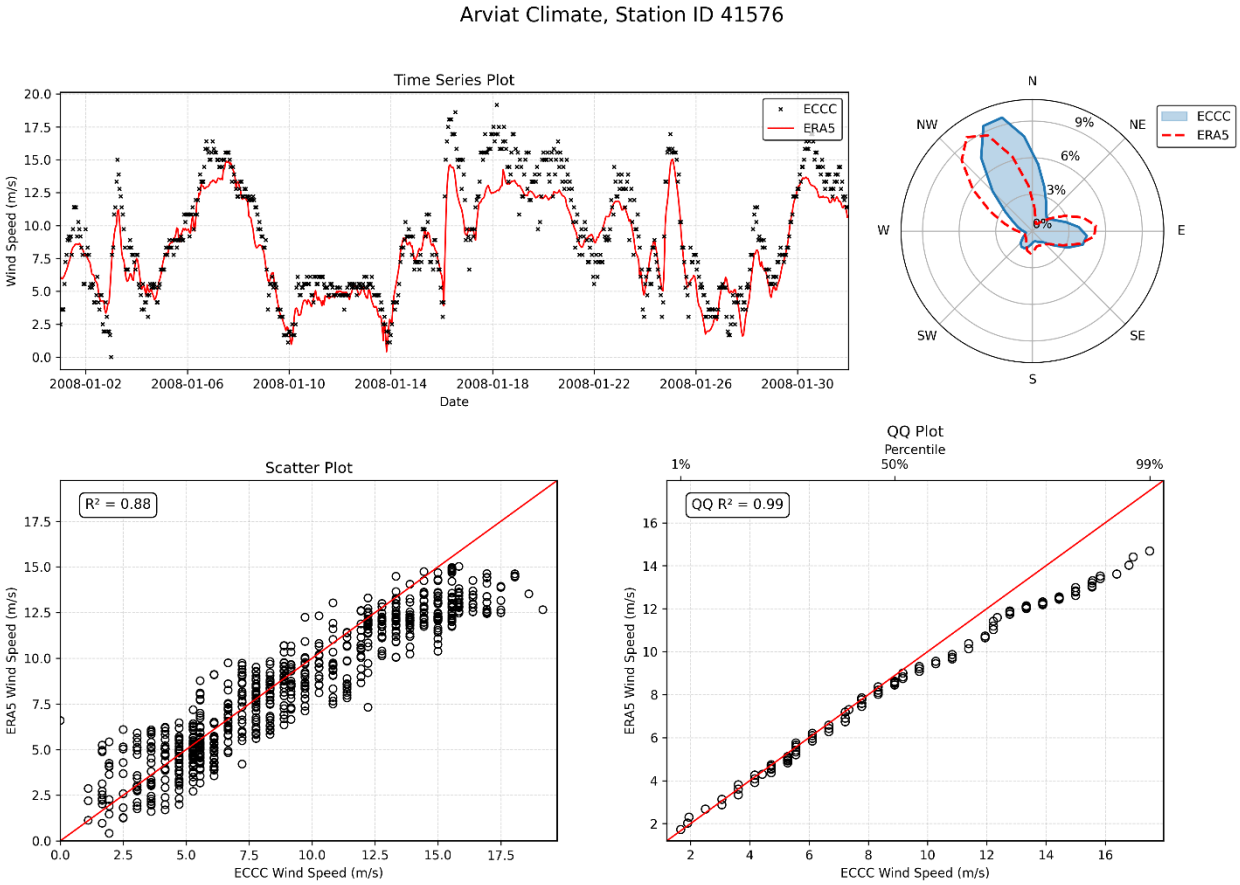
Two coefficients of determination were calculated. The hourly coefficient of determination, (R^2), measures agreement between ERA5 and the observations at corresponding timestamps and therefore reflects the agreement in event timing and hourly variability. The quantile-based coefficient of determination compares the ERA5 and observed wind-speed distributions without requiring individual wind-speed values to occur at the same hour. A high quantile-based (R^2) with a lower hourly (R^2) indicates that the overall distribution is represented more closely than the exact timing of each short-duration variation.

Arviat

Hourly observations at Arviat Climate station, Station ID 41576 and Climate ID 2301153, were available from December 2004 through December 2025. The highest retained observed wind speed used for the comparison occurred in January 2008. The complete month of January 2008 was therefore selected. Figure 4-6 presents the comparison between ERA5 and observed wind-speed at Arviat station.

During the selected month, the available observed wind speeds ranged from 0.0 to 19.17 m/s, with a mean of 9.17 m/s. The continuous ERA5 series ranged from 0.41 to 15.03 m/s, with a mean of 8.40 m/s. The dominant observed direction was north, while the ERA5 wind rose indicated predominantly northwesterly winds. The hourly and quantile-based coefficients of determination were 0.88 and 0.99, respectively. ERA5 reproduced the monthly wind-speed distribution and general event sequence, although the highest observed peaks were reduced.

Figure 4-6 ERA5 and ECCC 10 m wind-speed comparison at Arviat Climate, ECCC Station ID 41576 (Climate ID 2301153), January 2008.

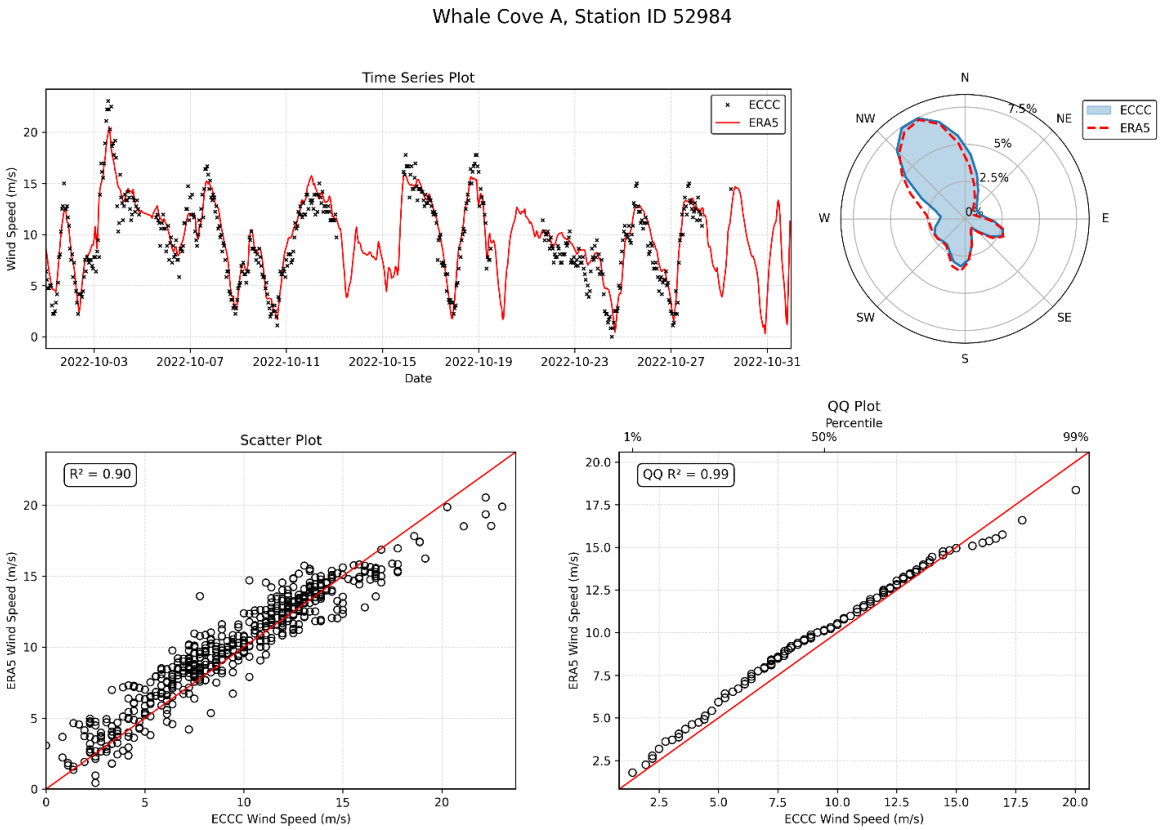


Whale Cove

Hourly observations at Whale Cove A, Station ID 52984 and Climate ID 2303990, were available from October 2014 through December 2025. The highest retained observed wind speed used for the comparison occurred in October 2022. The complete month of October 2022 was therefore selected. Figure 4-7 presents the comparison between ERA5 and observed wind-speed at Whale Cove A station.

During the selected month, the available observed wind speeds ranged from 0.0 to 23.06 m/s, with a mean of 9.48 m/s. The continuous ERA5 series ranged from 0.28 to 20.54 m/s, with a mean of 9.60 m/s. Northwesterly winds were dominant in both datasets. The hourly coefficient of determination was 0.90, and the quantile-based coefficient of determination was 0.99. The monthly mean and wind-speed distribution showed reasonable agreement, while ERA5 reduced the highest observed peak.

Figure 4-7 ERA5 and ECCC 10 m wind-speed comparison at Whale Cove A, ECCC Station ID 52984 (Climate ID 2303990), October 2022.

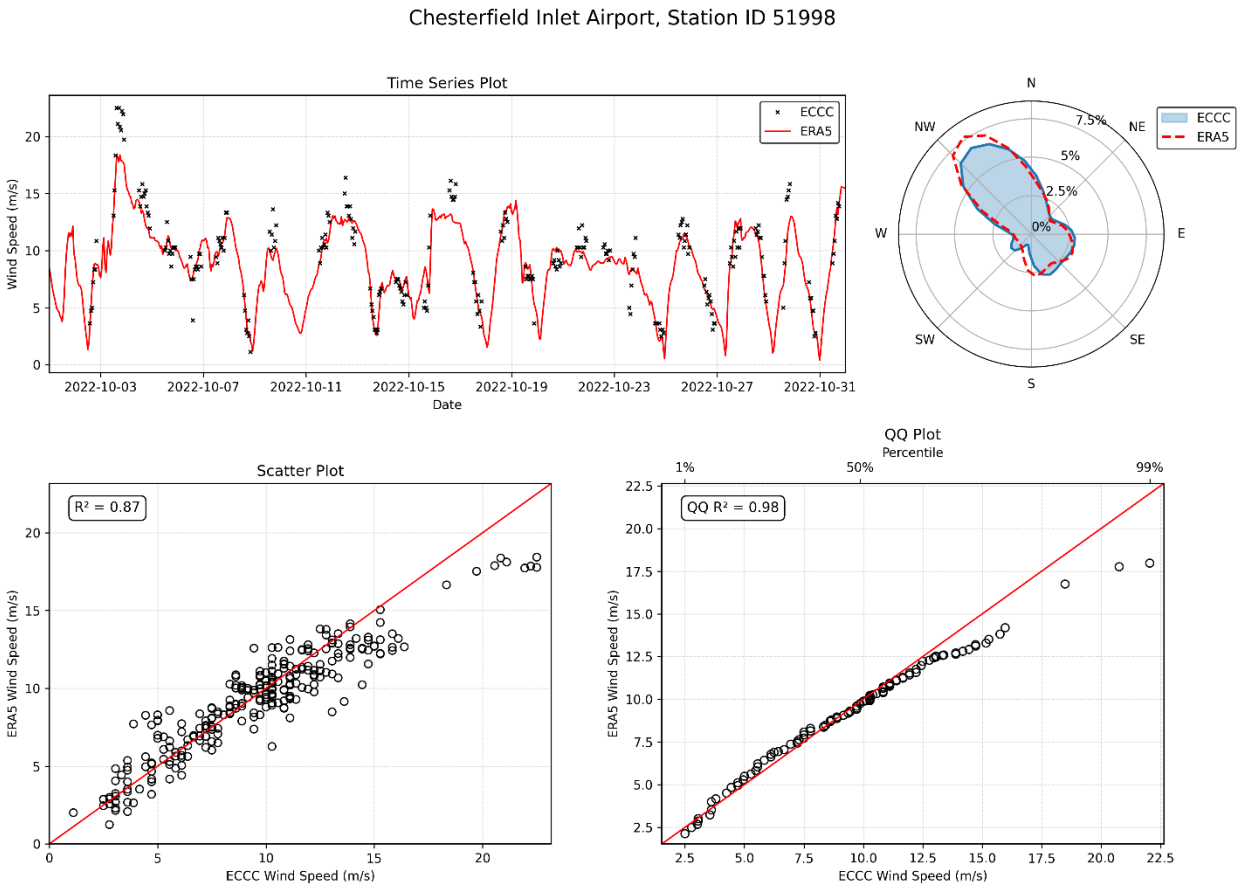


Chesterfield Inlet

Hourly observations at Chesterfield Inlet Airport, Station ID 51998 and Climate ID 2300701, were available from December 2013 through December 2025. The highest retained observed wind speed used for the comparison occurred in October 2022. The complete month of October 2022 was therefore selected. Figure 4-8 presents the comparison between ERA5 and observed wind-speed at Chesterfield Inlet Airport station.

During the selected month, the available observed wind speeds ranged from 1.11 to 22.50 m/s, with a mean of 9.59 m/s. The continuous ERA5 series ranged from 0.40 to 18.43 m/s, with a mean of 8.67 m/s. Northwesterly winds were dominant in both datasets. The hourly coefficient of determination was 0.87, and the quantile-based coefficient of determination was 0.98. ERA5 represented the principal wind events and dominant direction but reduced the highest observed wind speeds.

Figure 4-8 ERA5 and ECCC 10 m wind-speed comparison at Chesterfield Inlet Airport, ECCC Station ID 51998 (Climate ID 2300701), October 2022

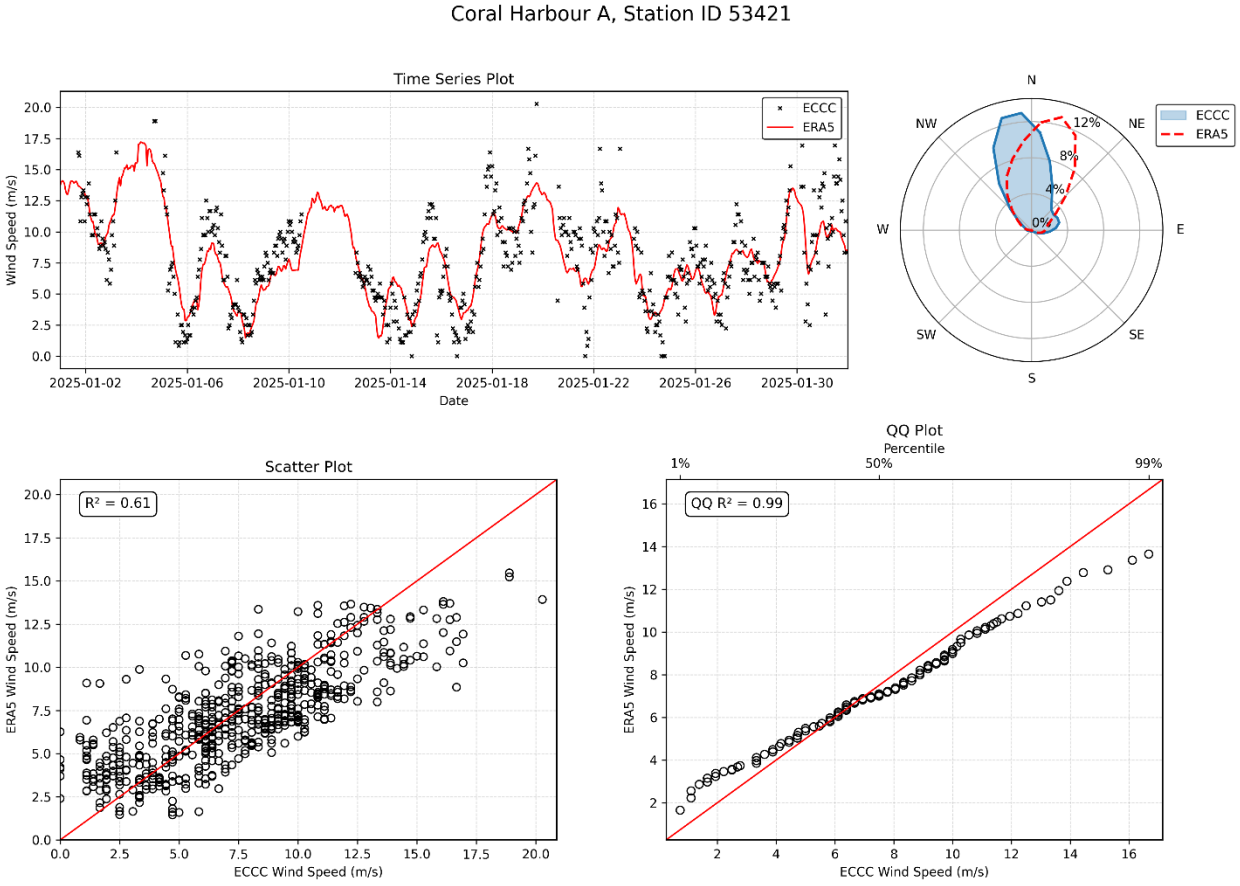


Coral Harbour

Hourly observations at Coral Harbour A, Station ID 53421 and Climate ID 2301002, were available from May 2015 through December 2025. The highest retained observed wind speed used for the comparison occurred in January 2025. The complete month of January 2025 was therefore selected. Figure 4-9 presents the comparison between ERA5 and observed wind-speed at Coral Harbour station.

During the selected month, the available observed wind speeds ranged from 0.0 to 20.28 m/s, with a mean of 7.52 m/s. The continuous ERA5 series ranged from 1.45 to 17.21 m/s, with a mean of 8.37 m/s. Northerly winds were dominant in both datasets, with a greater northeasterly component represented by ERA5. The hourly coefficient of determination was 0.61, while the quantile-based coefficient of determination was 0.99. The lower hourly coefficient indicates differences in the timing and short-duration variability of individual events. However, the high quantile-based coefficient indicates that the monthly wind-speed distribution was represented more closely.

Figure 4-9 ERA5 and ECCC 10 m wind-speed comparison at Coral Harbour A, ECCC Station ID 53421 (Climate ID 2301002), January 2025.

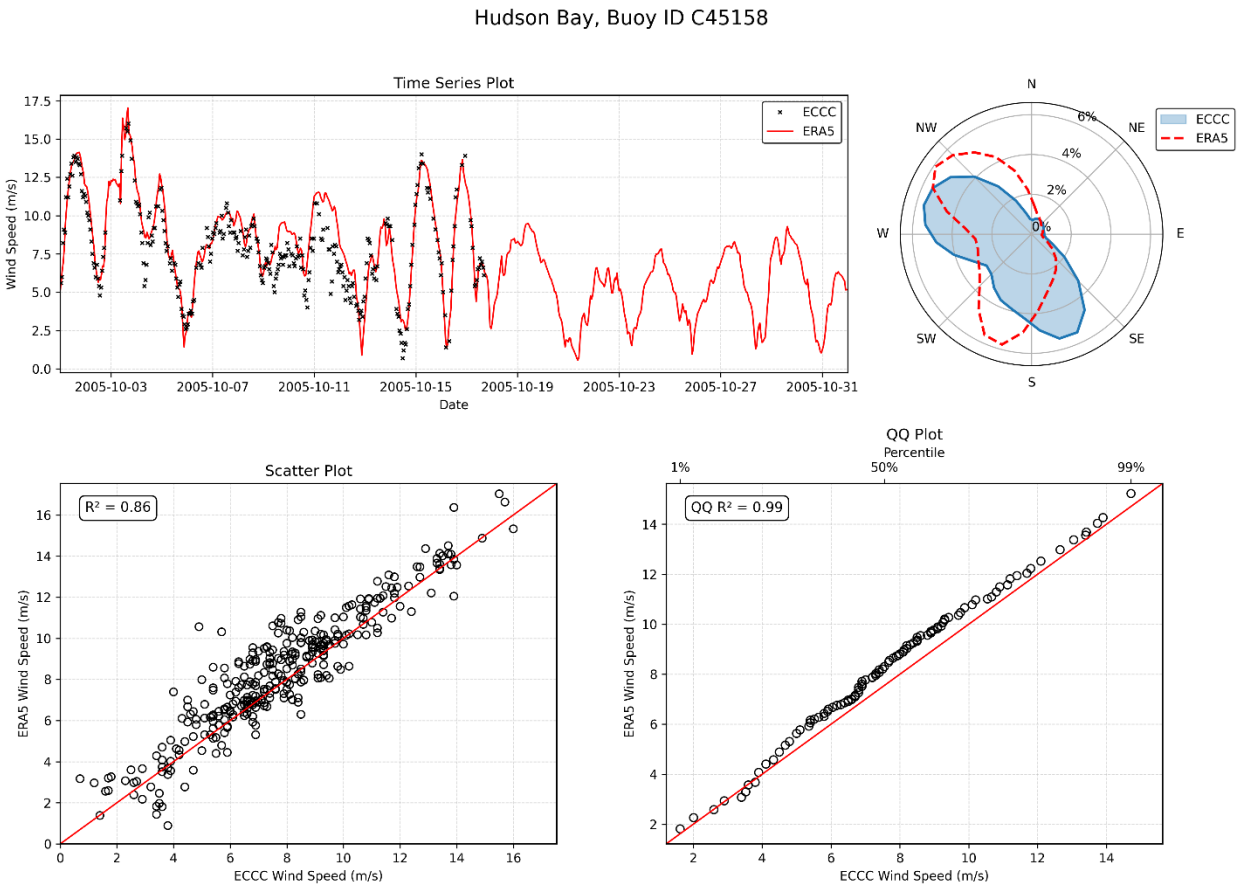


Hudson Bay Buoy C45158

Buoy C45158 is located offshore in Hudson Bay at approximately 59.0° N and 94.0° W in a water depth of approximately 40 m. The buoy record provides an offshore comparison that is not directly affected by the local land exposure of the community climate stations. The highest retained observed wind speed used for the offshore comparison occurred in October 2005. The complete month of October 2005 was therefore selected. Figure 4-10 presents the comparison between ERA5 and observed wind-speed at Buoy C45158.

During the selected month, the available observed wind speeds ranged from 0.70 to 16.00 m/s, with a mean of 7.78 m/s. The continuous ERA5 series ranged from 0.57 to 17.02 m/s, with a mean of 7.16 m/s. The observed wind directions included westerly, northwesterly, southerly, and southeasterly components, while ERA5 indicated primarily northwesterly and southerly to southwesterly winds. The hourly coefficient of determination was 0.86, and the quantile-based coefficient of determination was 0.99. Unlike the four land-station comparisons, ERA5 did not underestimate the maximum wind speed during the selected offshore comparison month.

Figure 4-10 ERA5 and observed 10 m wind-speed comparison at Hudson Bay buoy C45158, October 2005.



The four land-station comparisons indicate that ERA5 generally represented the monthly wind-speed distributions and dominant directional patterns, but the highest observed station peaks were reduced by approximately 2.5 to 4.1 m/s. This reduction is consistent with the spatial averaging inherent in a gridded reanalysis and does not indicate a uniform low bias across all wind speeds. At some locations, the ERA5 monthly mean was similar to or greater than the observed mean. The offshore buoy comparison also did not show a reduction in the maximum monthly wind speed.

ERA5 was retained for the regional hindcasts because it provides a continuous and spatially consistent 86-year record of wind and atmospheric pressure across the complete Hudson Bay model domain. A single land station or offshore buoy cannot represent the movement of storm systems, spatial pressure gradients, changing wind fetch, or the variation in wind forcing across the bay. The smoothing of localized peak winds remains a limitation of the regional forcing and is considered in the interpretation of the extreme-value and model results.

4.5.2 Wind Speed Extreme-Value Analysis

Continuous ERA5 wind-speed series were extracted at the centre of each community-scale model domain. Annual maximum wind speeds were identified from the 1940 to 2025 record and used in the extreme-value analysis. Candidate statistical distributions were fitted to each annual-maximum series, and the distribution with the highest quantile-based coefficient of determination was selected. Bootstrap resampling was used to estimate the associated 95% confidence limits.

Generalized Extreme Value (GEV) distributions were selected for Arviat and Chesterfield Inlet (Figure 4-11 and Figure 4-13), while Weibull distributions were selected for Whale Cove and Coral Harbour (Figure 4-12 and Figure 4-14). The quantile-based coefficients of determination were at least 0.99. Table 4-8 presents the estimated return-period wind speeds. These values represent omnidirectional wind magnitudes and were used as inputs to the applicable community-scale wave simulations.

Table 4-8 Return-period ERA5 wind speeds at the community-scale model locations

Return period (years)	AEP (%)	Arviat (m/s)	Whale Cove (m/s)	Chesterfield Inlet (m/s)	Coral Harbour (m/s)
10	10	19.71	21.06	19.36	20.70
20	5	20.47	21.82	19.98	21.46
50	2	21.37	22.68	20.72	22.34
100	1	21.99	23.27	21.23	22.93
200	0.5	22.56	23.81	21.71	23.47
500	0.2	23.25	24.46	22.28	24.13

Figure 4-11 ERA5 annual-maximum wind-speed EVA at Arviat; selected GEV fit, R^2= 1.00, with 95% confidence limits.

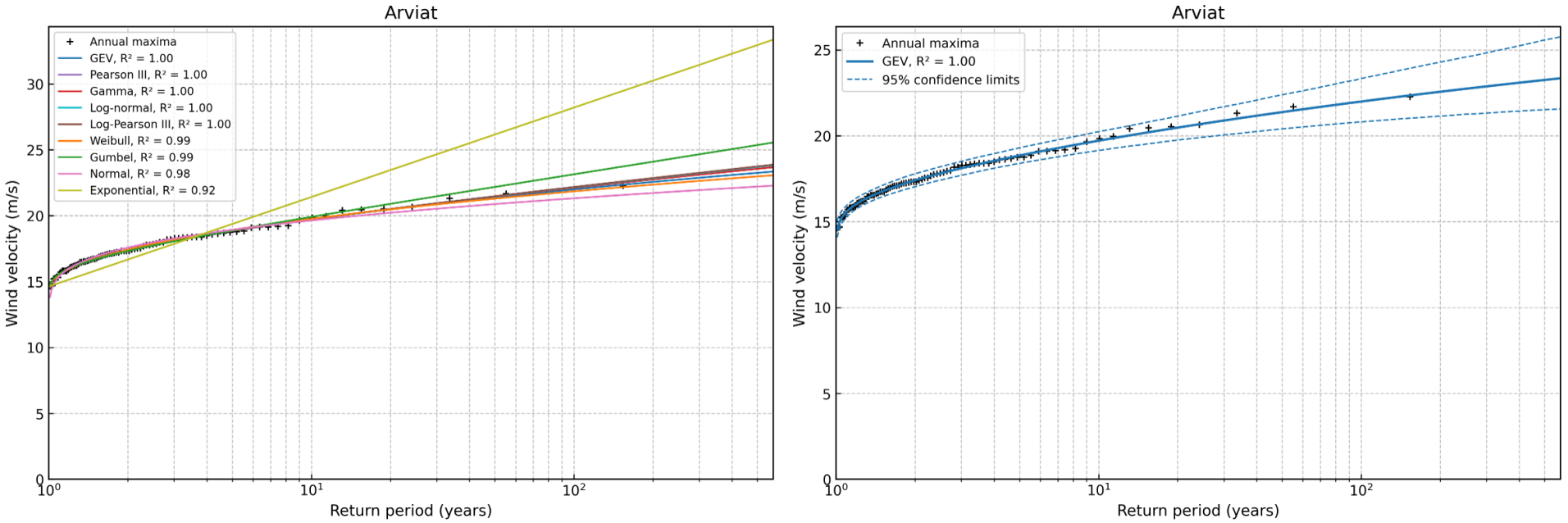


Figure 4-12 ERA5 annual-maximum wind-speed EVA at Whale Cove; selected Weibull fit, R^2= 0.99, with 95% confidence limits.

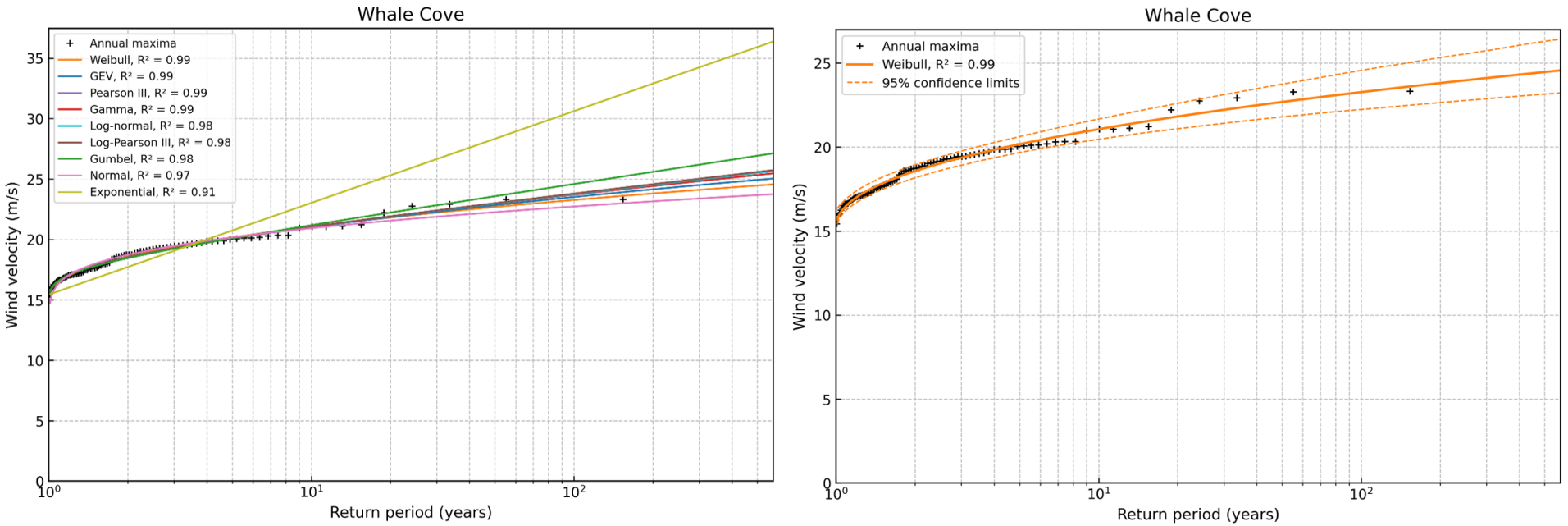


Figure 4-13 ERA5 annual-maximum wind-speed EVA at Chesterfield Inlet; selected GEV fit, R^2= 1.00, with 95% confidence limits.

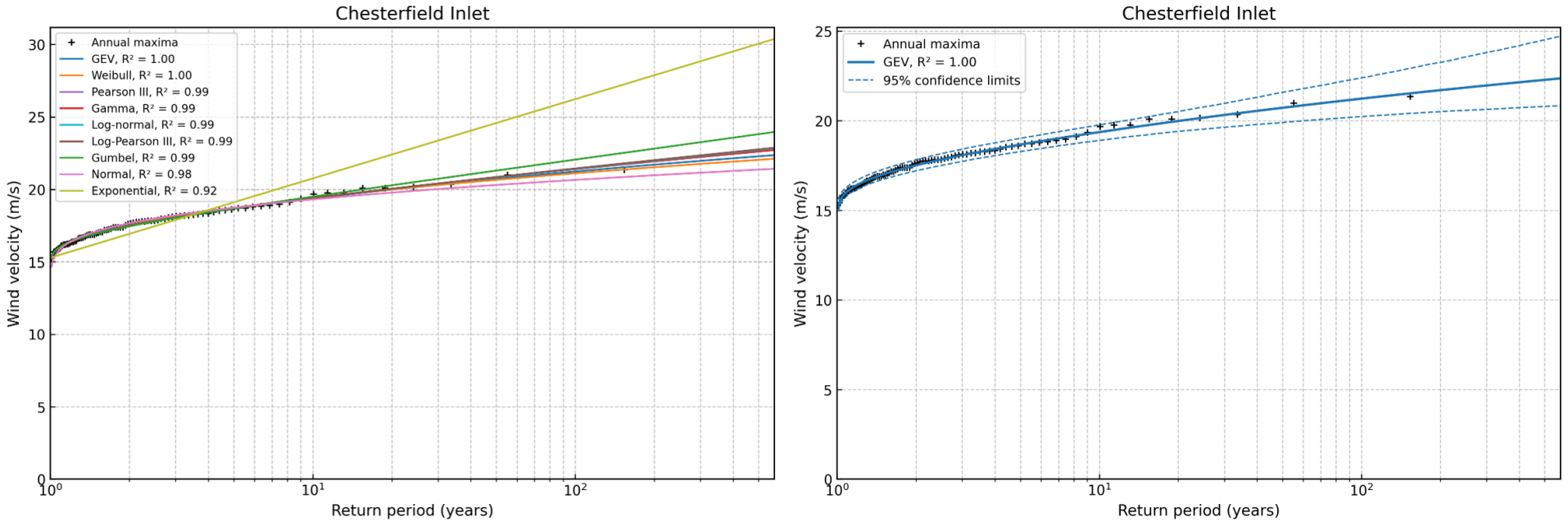
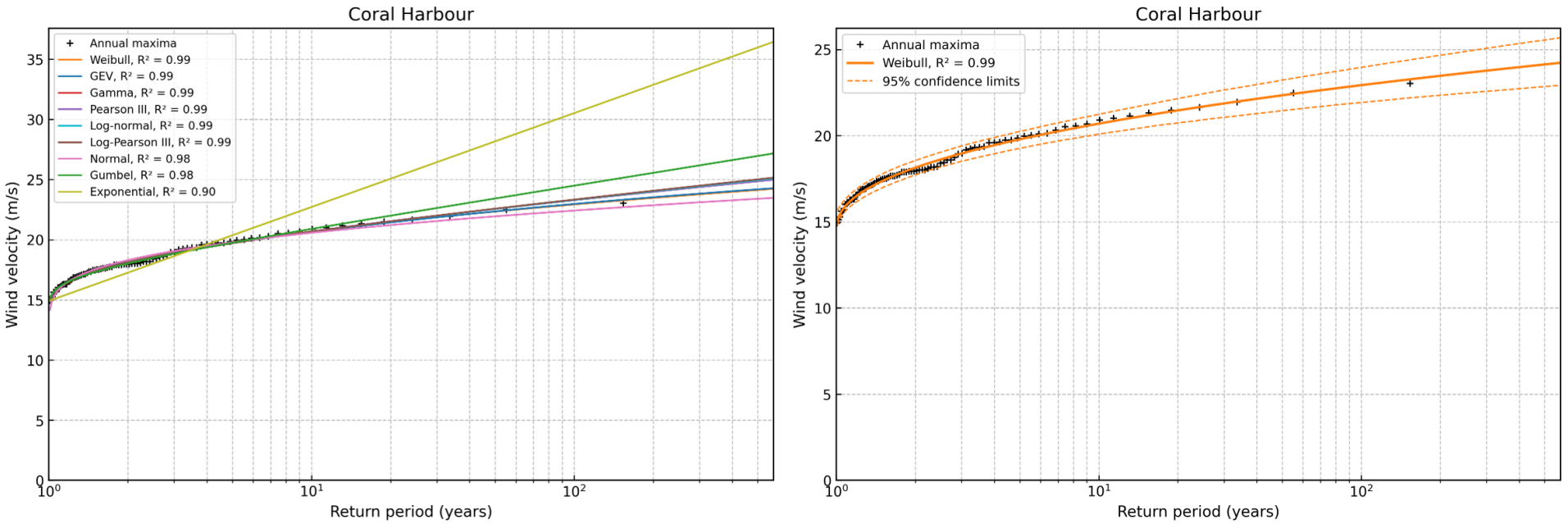


Figure 4-14 ERA5 annual-maximum wind-speed EVA at Coral Harbour; selected Weibull fit, R^2= 0.99, with 95% confidence limits



A separate extreme-value analysis was not completed for atmospheric pressure. The complete spatially and temporally varying ERA5 atmospheric pressure fields were applied directly throughout the regional hydrodynamic hindcast. The subsequent extreme-value analysis of the modelled storm surge residual therefore incorporates the combined hydrodynamic response to wind, atmospheric pressure, wave radiation stresses, and the basin-scale processes represented by the regional model.

4.6 Waves

DFO's Hudson Bay buoy C45158 is located approximately 27.5 km north-northeast of DFO Churchill station 05010, in approximately 40 m water depth. The buoy provides the only available offshore wave observations within Hudson Bay and was used for calibration and validation of the regional wave hindcast. Suspect observations were assessed based on temporal continuity with adjacent values and consistency with the development and decay of the surrounding wave event. Isolated values that were not supported by the preceding and following observations were removed, while elevated wave conditions that formed part of a relatively continuous event were retained.

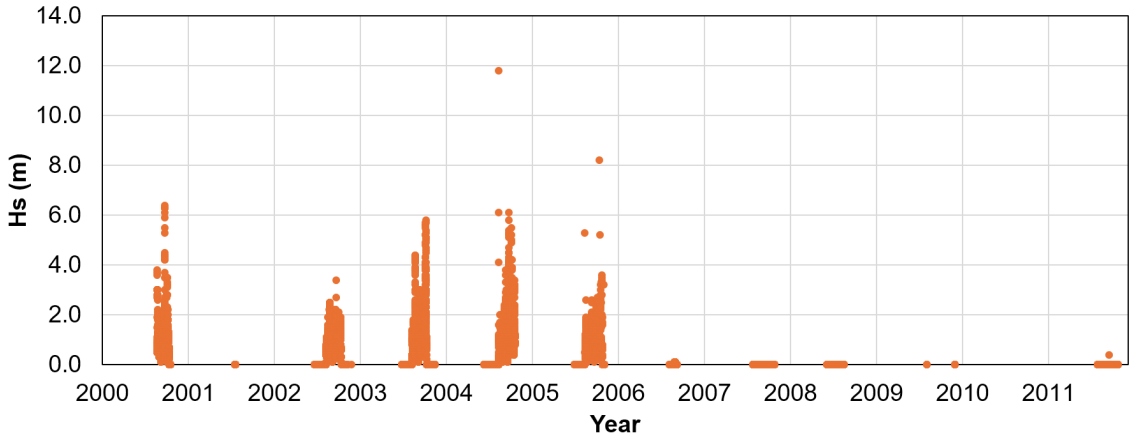
The supplied buoy dataset contains 15,700 nominally hourly records spanning 20 August 2001 to 19 October 2012. Following quality control, 6,162 significant wave height (Hs) and peak wave period (Tp) observations were retained, representing 39.2% of the supplied records. The retained observations extend from 20 August 2001 to 27 August 2007 and occur within 21 calendar months. The retained time series contains 31 data gaps longer than 24 hours and represents approximately 11.7% of a continuous hourly record over the period from August 2001 to August 2007. The available observations are therefore intermittent and include multi-month and multi-year gaps. Figure 4-15 presents the retained observations without interpolation across the data gaps. The buoy record was considered suitable for event-scale calibration and validation during periods that overlap the regional wave hindcast. However, its duration and completeness were insufficient for direct long-term extreme-value analysis.

For the retained observations, Hs ranges from 0.01 to 6.37 m, with a mean of 0.74 m, a median of 0.56 m, and a standard deviation of 0.80 m (Table 4-9). The 25th and 75th percentiles are 0.14 m and 1.02 m, respectively. The 90th, 95th, and 99th percentiles are 1.63 m, 2.23 m, and 4.04 m, respectively. A total of 417 observations, equivalent to 6.8% of the retained record, have Hs values of at least 2.0 m. Sixty-four observations, equivalent to approximately 1.0% of the retained record, have Hs values of at least 4.0 m. The maximum retained Hs was 6.37 m and occurred at 23:34 UTC on 10 October 2006. The corresponding Tp was 9.85 s. Across the retained record, Tp ranges from 2.22 to 13.47 s, with a mean of 6.95 s, a median of 6.40 s, and a standard deviation of 2.75 s. The 90th and 95th percentile Tp values are 11.13 s and 12.19 s, respectively. The supplied buoy dataset does not contain a wave-direction parameter.

Table 4-9 Summary of wave observations at DFO Hudson Bay buoy C45158 (outliers removed)

Parameter	Hs	Tp
Minimum	0.01 m	2.22 s
Mean	0.74 m	6.95 s
Median	0.56 m	6.40 s
Standard deviation	0.80 m	2.75 s
95th percentile	2.23 m	12.19 s
Maximum	6.37 m	13.47 s

Figure 4-15 Quality-controlled Hs at DFO Hudson Bay buoy C45158, 20 August 2001 to 27 August 2007.



5 Digital Elevation Model and Coastal Transects

Community-scale terrain models were developed by combining terrestrial elevations with CHS bathymetry in the project coordinate system and vertical datum. Source-supported elevations were retained, overlaps were resolved, and continuous topographic-bathymetric surfaces were prepared for mesh interpolation, transect extraction, and GIS mapping.

5.1 Elevation Sources

5.1.1 Topography

At Arviat, Whale Cove, and Chesterfield Inlet, the supplied DTM LiDAR was acquired by Eagle Mapping Ltd. for IGI Consulting Inc. on 3 and 4 August 2023 for the Kivalliq Inter-Community Road project. The source data are referenced to NAD83(CSRS), epoch 2010, UTM Zone 15N horizontally and CGVD2013 vertically. Figures in Appendix B show the available LiDAR extents for these communities.

The Coral Harbour elevation surface was derived by Stantec from UAV photogrammetry acquired with a senseFly Aeria X camera on 25 September 2023. The source data are referenced to NAD83(CSRS) v7, UTM Zone 17N horizontally and CGVD2013 vertically. Only the landward portion was used because submerged photogrammetric elevations could not be independently verified.

5.1.2 Bathymetry

CHS NONNA100 raster tiles supported broader bathymetric continuity and NONNA10 tiles represented the nearshore areas at each community. The source rasters use WGS 84 horizontally and local Chart Datum vertically. They were projected to Canada Lambert Conformal Conic and converted to CGVD2013 before integration. Figures in Appendix B show the available NONNA10 and NONNA100 extents for the communities.

5.2 Integrated Terrain Model

The valid extent of each terrestrial dataset was used as a mask so elevations outside measured or supportable coverage were not retained. Terrestrial surfaces were sampled to a 1 m point grid and transformed to the project horizontal reference. At Coral Harbour, the shoreline was interpreted from orthophotography and the terrain surface, and photogrammetric values seaward of the interpreted waterline were removed.

Available CHS vertical separation points were interpolated to represent the local offset between Chart Datum and CGVD2013. The offset was applied to NONNA elevations before terrain merging. Isolated NONNA10 elevations inconsistent with surrounding nearshore trends were removed during quality control. Where terrestrial and bathymetric sources overlapped, the terrestrial elevation was retained.

5.3 Coastal Transects

Representative transects were placed where shoreline orientation, nearshore slope, exposure, coastal form, or adjacent development changed sufficiently to affect wave transformation or uprush. Each transect was approximately perpendicular to the local shoreline, extended offshore below the coastal toe, crossed the foreshore, and continued inland above the potential 500-year flood limit.

Table 5-1 outlines the terrain sources and representative coastal transects for each community. Four transects were defined at Arviat (Figure 5-1), five at Whale Cove (Figure 5-2), seven at Chesterfield Inlet (Figure 5-3), and five at Coral Harbour (Figure 5-4). Elevations were sampled at 1 m intervals. A representative slope was selected for each profile and reviewed against the shoreline segment assigned to it. This approach follows the guideline principle that transect location should respond to changes in coastal form and exposure rather than uniform spacing alone.

Table 5-1 Community terrain sources and representative coastal transects

Community	Terrestrial elevation source	Acquisition date	Source horizontal reference	Number of Transects
Arviat	Bare-earth LiDAR, Eagle Mapping Ltd. for IGI Consulting Inc.	3-4 Aug 2023	NAD83(CSRS), epoch 2010, UTM 15N	4 (AR-1 to AR-4)
Whale Cove	Bare-earth LiDAR, Eagle Mapping Ltd. for IGI Consulting Inc.	3-4 Aug 2023	NAD83(CSRS), epoch 2010, UTM 15N	5 (WC-1 to WC-5)
Chesterfield Inlet	Bare-earth LiDAR, Eagle Mapping Ltd. for IGI Consulting Inc.	3-4 Aug 2023	NAD83(CSRS), epoch 2010, UTM 15N	7 (CI-1 to CI-7)
Coral Harbour	UAV photogrammetric elevation surface, Stantec	25 Sep 2023	NAD83(CSRS) v7, UTM 17N	5 (CH-1 to CH-5)

Figure 5-1 Representative transects at Arviat



Figure 5-2 Representative transects at Whale Cove



Figure 5-3 Representative transects at Chesterfield Inlet



Figure 5-4 Representative transects at Coral Harbour



6 Hydrodynamic and Wave Modelling

The modelling framework (Figure 6-1) comprised regional-scale hydrodynamic and spectral wave hindcasts, followed by higher-resolution community-scale wave transformation modelling. All numerical models were developed using components of the open-source TELEMAC-MASCARET modelling system.

To assess coastal flood hazards, several numerical models were used to simulate different coastal processes. Each model was developed to represent a different component of the coastal environment and provided information required for subsequent stages of the flood hazard assessment. The hydrodynamic model (TELEMAC-2D, which solves the depth-averaged, two-dimensional shallow-water equations on an unstructured triangular finite-element mesh) was used to simulate stillwater levels throughout Hudson Bay, including the effects of tides, wind, atmospheric pressure, storm surge, and wave setup. The 2D spectral wave model (TOMAWAC, which solves the spectral wave-action balance equation) was used to simulate the generation and propagation of waves across Hudson Bay and estimate offshore wave conditions near the study communities. Higher-resolution community-scale 2D TOMAWAC models were then used to simulate how offshore waves transform as they travel through shallow nearshore waters toward the shoreline. The outputs from these models were subsequently combined to estimate stillwater levels, wave runup elevations, and coastal flood hazard extents for the range of AEP events evaluated in this study. Table 6-1 summarizes the purpose, inputs, and outputs of each modelling component.

Table 6-1 Overview of numerical models used in the coastal flood hazard assessment

Modelling Component	Purpose	Key Inputs	Primary Outputs
TELEMAC-2D Regional 2D Hydrodynamic Model	Simulates water levels and storm surge throughout Hudson Bay	Astronomical tides, wind speed and direction, atmospheric pressure, bathymetry, wave radiation stresses	Water levels, residual storm surge
TOMAWAC Regional 2D Wave Model	Simulates wave generation and propagation across Hudson Bay	Wind speed and direction, bathymetry	Hs, Tp, wave direction, wave radiation stresses
Community-Scale 2D TOMAWAC Wave Models	Simulates nearshore wave transformation at each study community	Offshore wave conditions, local bathymetry, shoreline geometry, stillwater levels	Nearshore wave height, nearshore wave period, nearshore wave direction

The regional model resolution was considered sufficient to model stillwater level for each community, considering astronomical tides, storm surge, wave setup, and basin-scale water-level seiche at the four study communities. Because water levels vary relatively gradually across the nearshore areas of interest, additional community-scale hydrodynamic models were not needed to model stillwater levels. Community-scale modelling efforts were therefore focused on wave transformation processes, which are

more sensitive to local bathymetry and shoreline characteristics and have a greater influence on the spatial variation of coastal flood hazards.

Two regional 2D hydrodynamic hindcasts were completed using the same numerical geometry. The fully forced simulation incorporated spatially and temporally varying ERA5 wind and atmospheric pressure fields, FES2014 tidal water levels at the open boundaries, and wave radiation stresses obtained from the regional wave model. The tide-only simulation included the tidal boundary forcing but excluded wind, atmospheric pressure, and wave radiation stresses. At each community, the residual surge was calculated at every model time step by subtracting the tide-only water level from the fully forced water level. The calculated residual surge therefore represents the combined non-tidal water-level response simulated by the regional hydrodynamic model, including wind-driven surge, atmospheric-pressure effects, wave setup associated with wave radiation stresses, regional setup, basin-scale oscillations, and interactions among these processes.

Extreme residual surge values were determined from the regional hydrodynamic hindcast through extreme value analysis. For each return period, the stillwater level was calculated by adding the corresponding return-period residual surge to HHWLT:

$$\textit{Stillwater Level} = \textit{HHWLT} + \textit{Return-Period Residual Surge}$$

The regional and community-scale spectral wave models were implemented using TOMAWAC. TOMAWAC solves the phase-averaged wave-action balance equation and represents wind-wave generation, directional and frequency-space propagation, refraction, shoaling, wave breaking, and energy dissipation. The regional wave hindcast was used to characterize the offshore wave climate and determine extreme wave conditions for the four communities.

Extreme wave conditions obtained from the regional wave hindcast were subsequently applied to the higher-resolution community-scale wave models. For each return period, omnidirectional extreme wind and wave conditions were applied together with the stillwater level corresponding to the same return period. The community-scale models transformed the offshore wave conditions across the nearshore bathymetry toward the shoreline. The resulting wave height and wave period were extracted at the coastal transect locations for use in the subsequent wave runup and coastal flood hazard analyses.

The use of unstructured triangular meshes allowed the spatial resolution to be varied across the model domains. The regional hydrodynamic and wave models represented the broader water-level and wave processes across Hudson Bay, while finer elements were applied within the community-scale wave models to represent nearshore wave transformation near the communities and coastal transects. Because TELEMAC-MASCARET is open-source software, the model inputs, steering files, numerical settings, and source code can be retained and reviewed without reliance on a proprietary modelling licence. This supports technical review, reproducibility, and potential future updates or reuse by the Government of Nunavut.

Figure 6-1 Regional-to-community coastal flood modelling and mapping framework

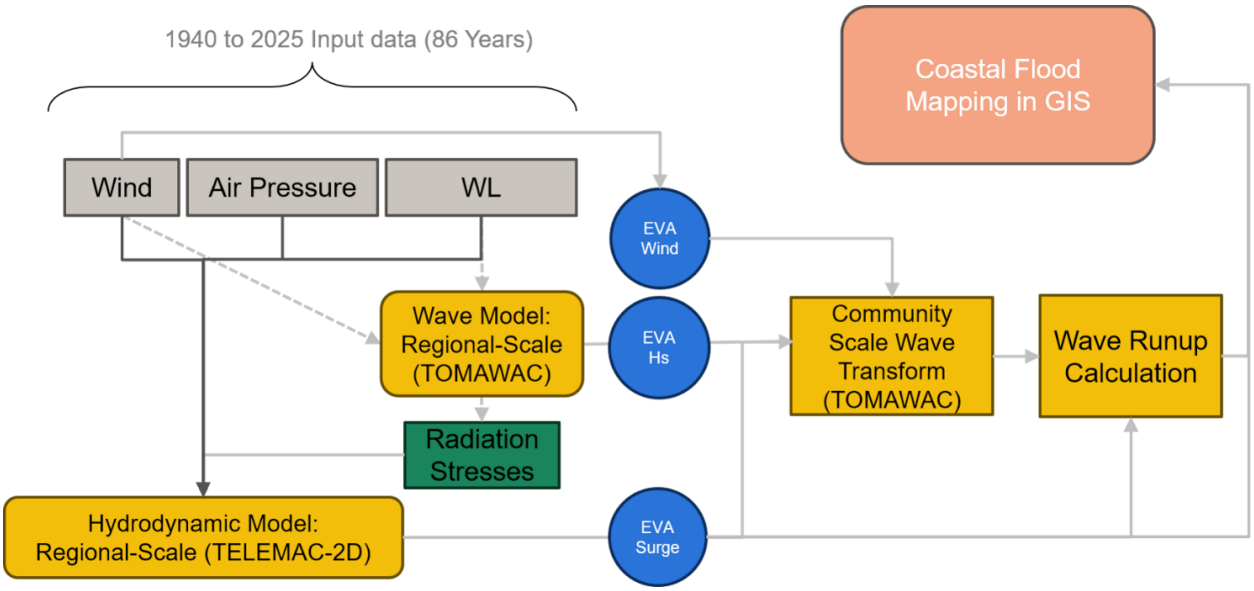
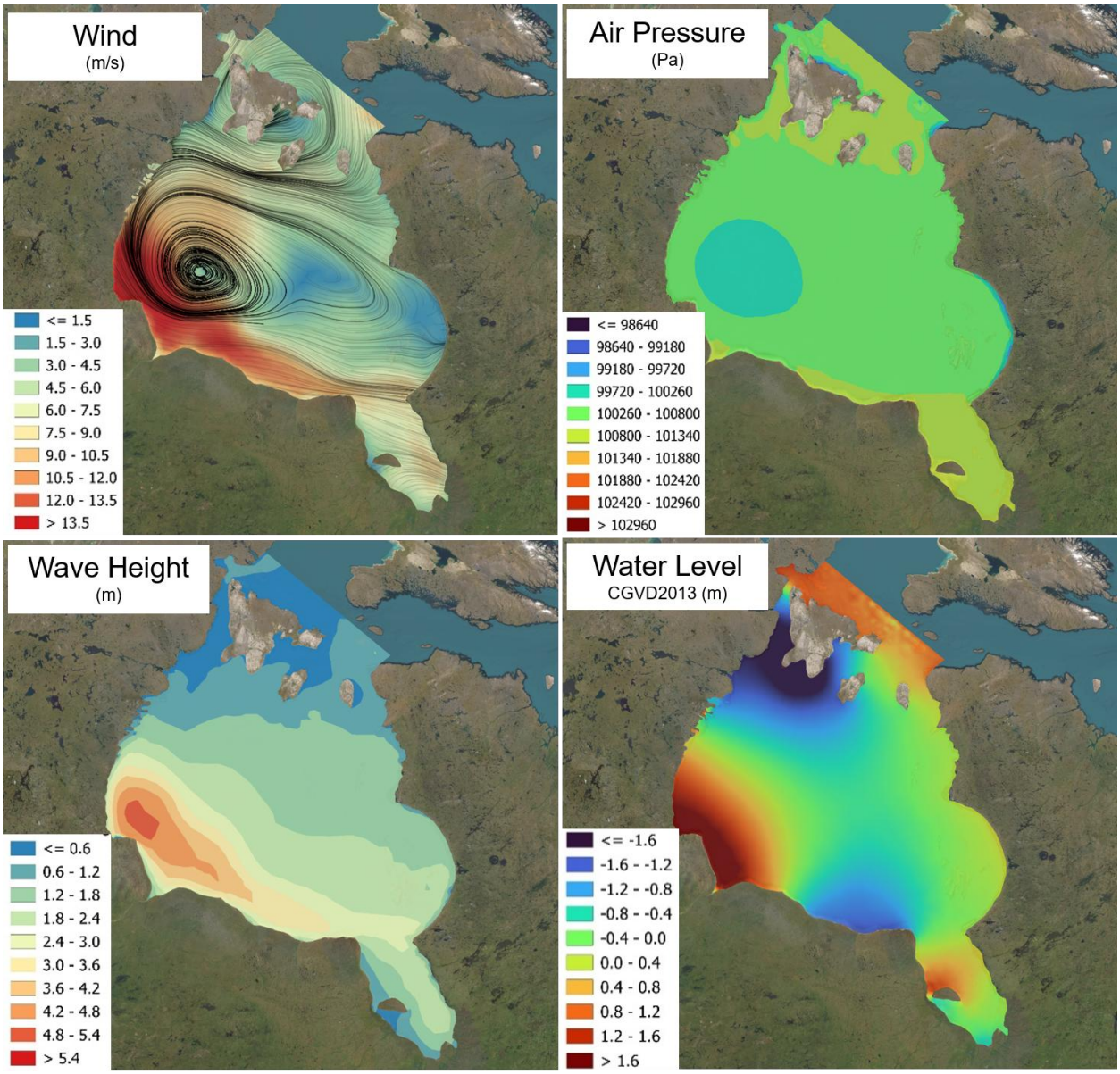


Figure 6-2 presents an example time snapshot from the regional-scale modelling system for 10 November 2025. Spatially and temporally varying ERA5 wind and atmospheric pressure were applied across the regional model domain. The ERA5 wind field was used to force the TOMAWAC wave hindcast, which simulated the spatial distribution of Hs. The resulting wave radiation stresses were transferred to the TELEMAC-2D hydrodynamic model, together with the spatially varying wind and atmospheric pressure fields and the tidal water-level forcing applied at the open boundary. These combined inputs were used to simulate the regional water-level response, including wind-driven surge, the inverse-barometer response to atmospheric pressure, wave setup, tidal variation, and basin-scale water-level oscillations.

Figure 6-2 Example regional-scale model inputs and outputs for 10 November 2025, including spatially varying ERA5 wind and atmospheric pressure forcing, hindcast Hs, and simulated water level



6.1 Numerical Model Setup

The regional 2D hydrodynamic model, implemented using TELEMAC-2D (Version 8.4), used the k-epsilon turbulence closure and Strickler bottom friction. Under the Strickler formulation, a higher coefficient represents lower hydraulic resistance. Wind stress was calculated using the TELEMAC-2D speed-dependent drag formulation. ERA5 wind and atmospheric pressure varied in space and time.

The northern open boundary was located northeast of Southampton Island to retain the principal Hudson Bay basin-scale processes while limiting unnecessary extension of the model domain. The boundary is far from the four communities and is forced with time-varying FES2014 tidal water levels, while spatially and temporally varying wind and atmospheric pressure are applied throughout the domain. Its influence on modelled water levels at the communities is considered limited based on the boundary separation, representation of the Hudson Bay basin, and the calibration and validation results at Churchill and the four communities. The same tidal boundary forcing is also applied to the fully forced and tide-only simulations, so common tidal boundary effects are substantially removed when the residual surge is calculated as their difference.

Table 6-2 outlines the configuration of the regional numerical model. The regional wave and hydrodynamic models used the same Hudson Bay-wide triangular mesh (Figure 6-3). The mesh contains 4,532 nodes and 7,723 elements. Reported nominal element size ranges from approximately 50 m near resolved shoreline and community areas to 50 km offshore. Sharing the geometric framework provides consistent extraction locations, spatially and temporally varying wave forcing to the hydrodynamic model.

Table 6-2 Regional numerical model configuration

Item	Regional wave model Hindcast	Regional hydrodynamic model, Water Level Hindcast
Simulation period	1940-2025 (86 years)	1940-2025 (86 years)
Software	TOMAWAC (Version 8.4)	TELEMAC-2D (Version 8.4)
Mesh	4,532 nodes; 7,723 elements	4,532 nodes; 7,723 elements
Nominal element size	Approximately 50 m to 50 km	Approximately 50 m to 50 km
Primary forcing	Spatially and temporally varying ERA5 10 m wind	FES2014 tide and spatially and temporally varying ERA5 10 m wind, atmospheric pressure, and wave radiation stresses forcing
Primary output	Hourly Hs and Tp at Community-Scale Boundary, and wave radiation stresses	Water levels

6.1.1 Regional Hudson Bay Wave Hindcast Model

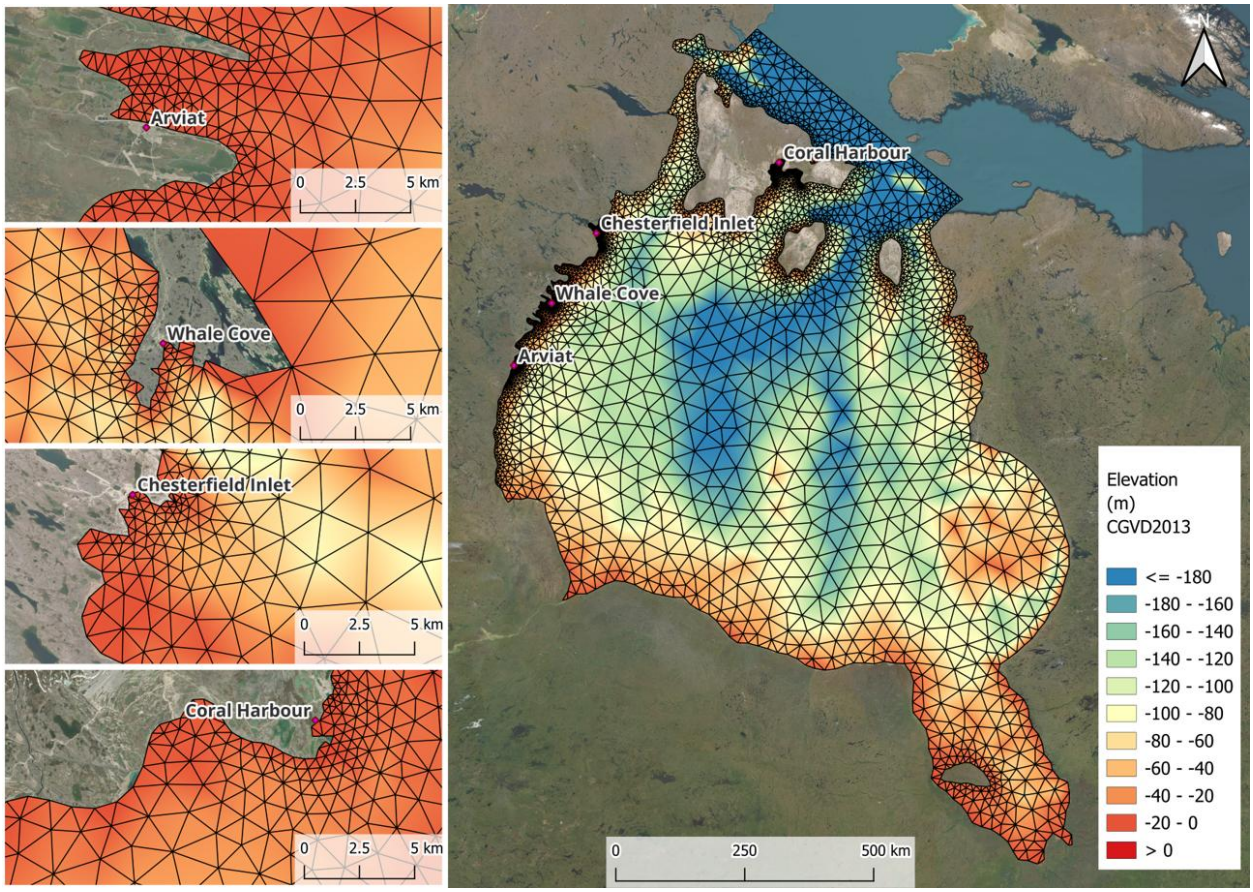
The 86-year regional wave hindcast was implemented in TOMAWAC with 36 directional bins and 36 frequency bins. The minimum frequency was 0.04 Hz and adjacent frequencies used a ratio of 1.10. The spectrum-tail factor was 5.0 (Table 6-3). No bottom friction dissipation is included, depth-induced breaking used dissipation option 1 with a saturation threshold of 0.00188. Hourly Hs and Tp were extracted at the community-scale model boundaries. Spatially and temporally varying wave radiation stresses were extracted to force the hydrodynamic model as well.

Table 6-3 Regional wave model spectral and dissipation settings (TOMAWAC)

Parameter	Value
Number of directional bins	36

Number of frequency bins	36
Minimum frequency	0.04 Hz
Frequency ratio	1.10
Spectrum-tail factor	5.0
Bottom friction Dissipation	0 (False)
Depth-induced breaking dissipation option	1 (True)
Saturation threshold for dissipation	0.00188

Figure 6-3 Hudson Bay regional unstructured mesh used by the separate wave and hydrodynamic models, with local refinement near the four community domains.



6.1.2 Regional Hudson Bay Hydrodynamic and Surge Hindcast Model

Two regional hydrodynamic simulations were completed, using the same grid cells as the wave model. The fully forced simulation incorporated FES2014 tidal boundary conditions, spatially and temporally varying ERA5 wind and atmospheric pressure, and wave radiation stresses. The tide-only simulation used the same mesh, bathymetry, tidal boundary conditions, bottom friction, and numerical settings but

excluded wind, atmospheric pressure, and wave radiation stresses. At each community extraction point, the residual surge was calculated at every time step by subtracting the tide-only water level from the fully forced water level. Under this project definition, the residual surge represents the combined non-tidal water-level response simulated by the hydrodynamic model, including wind-driven surge, the inverse-barometer response to atmospheric pressure, wave setup associated with wave radiation stresses, regional setup, basin-scale oscillations, and interactions among these processes.

6.1.3 Community-Scale Wave Transformation Models

A separate higher-resolution, unstructured community-scale wave mesh was developed for each community using the integrated topographic-bathymetric terrain and implemented in TOMAWAC. Extreme water-level and wave conditions obtained from the regional-scale models were selected to force the community-scale models. For each return period, omnidirectional wind and wave conditions were combined with the water level corresponding to the same return period. The return-period wind speeds used in the community-scale wave models were derived from an omnidirectional EVA and therefore represent wind magnitude only. Wind direction was selected separately based on shoreline orientation, local fetch, and the offshore wave approach direction relevant to each community. The selected direction was intended to represent a conservative onshore forcing condition for nearshore wave transformation and does not represent a directional extreme-value analysis.

The offshore waves were transformed across each community-scale model, and the resulting wave conditions were extracted at the locations of the coastal transects for further analysis. The interpolated topography and bathymetry and the numerical grid developed for each community are presented in Figure 6-4 to Figure 6-7.

Figure 6-4 Interpolated terrain and community-scale wave model mesh for Arviat, implemented in TOMAWAC.

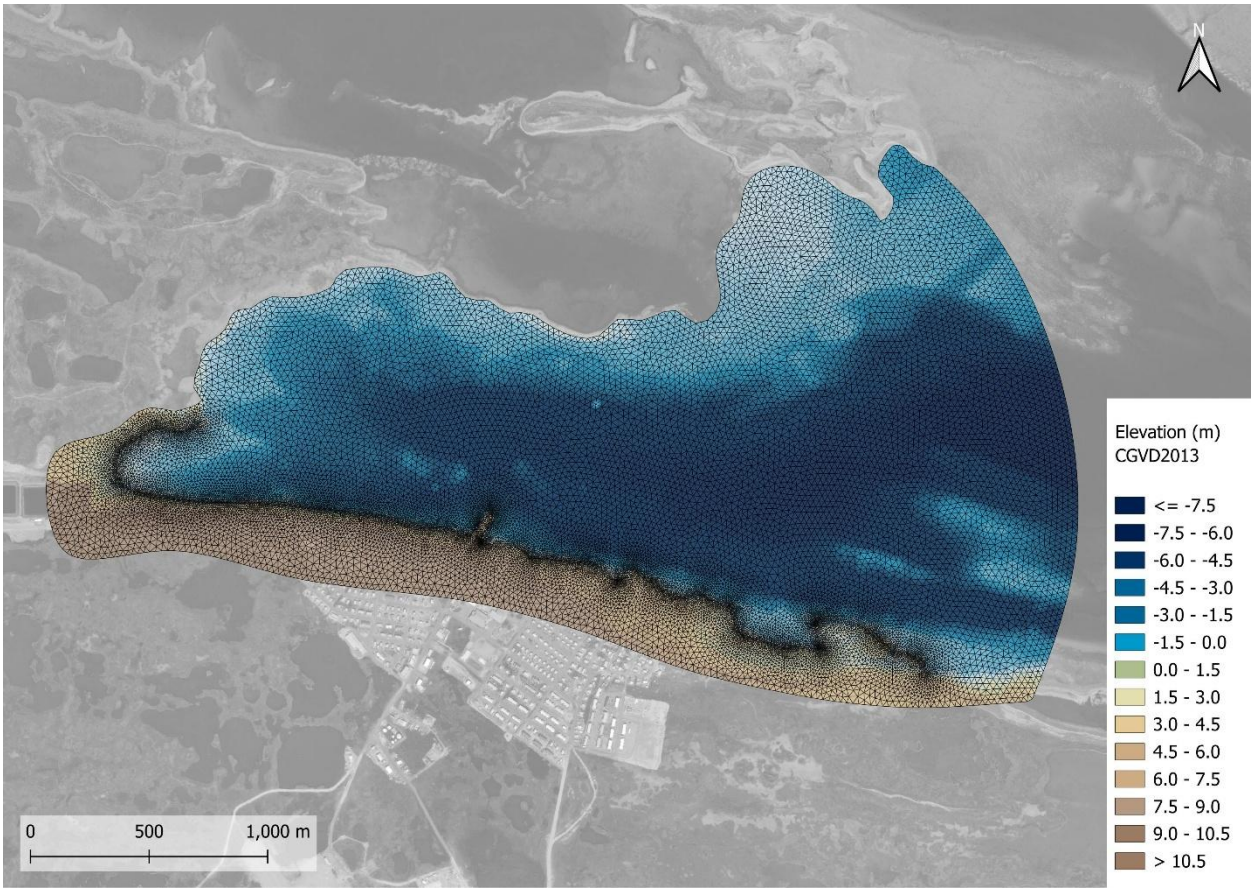


Figure 6-5 Interpolated terrain and community-scale wave model mesh for Whale Cove, implemented in TOMAWAC.

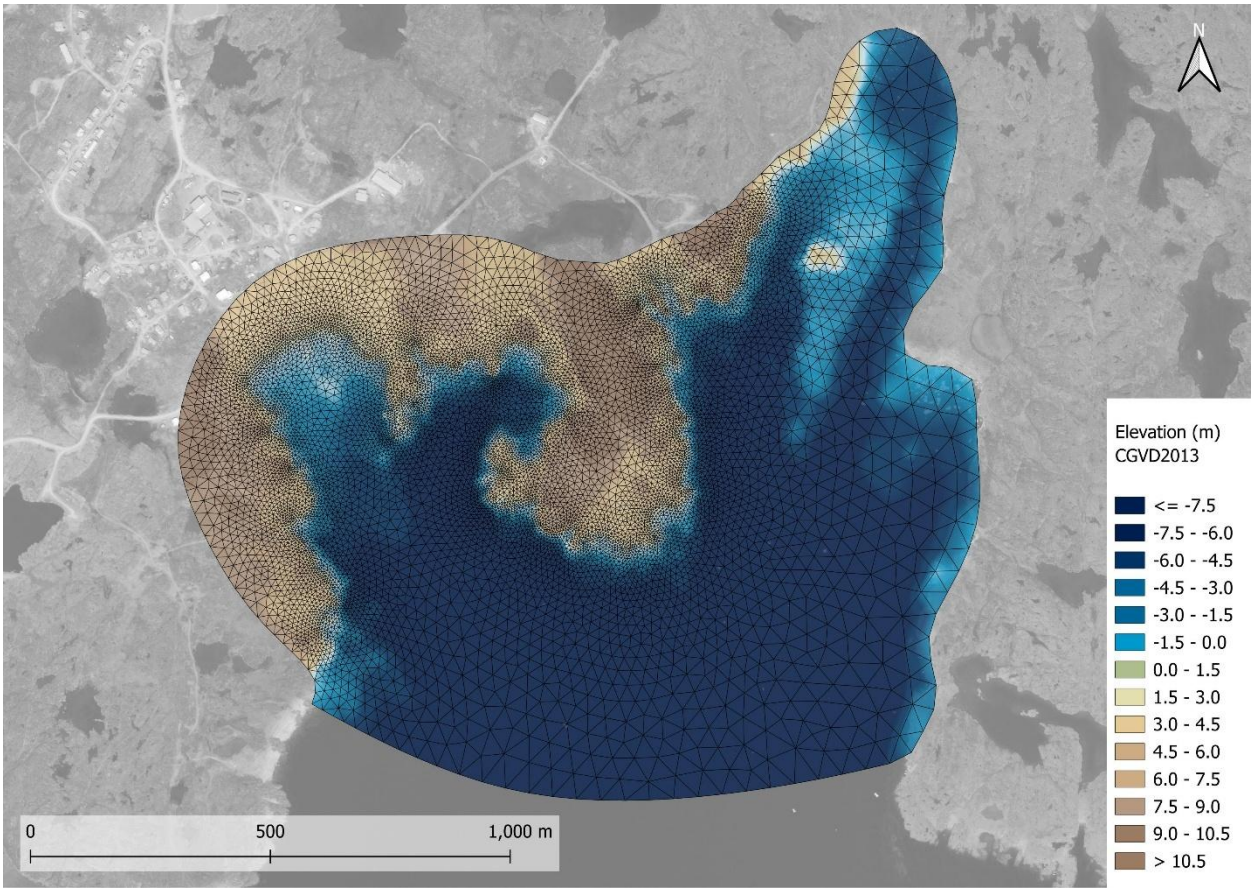


Figure 6-6 Interpolated terrain and community-scale wave model mesh for Chesterfield Inlet, implemented in TOMAWAC.

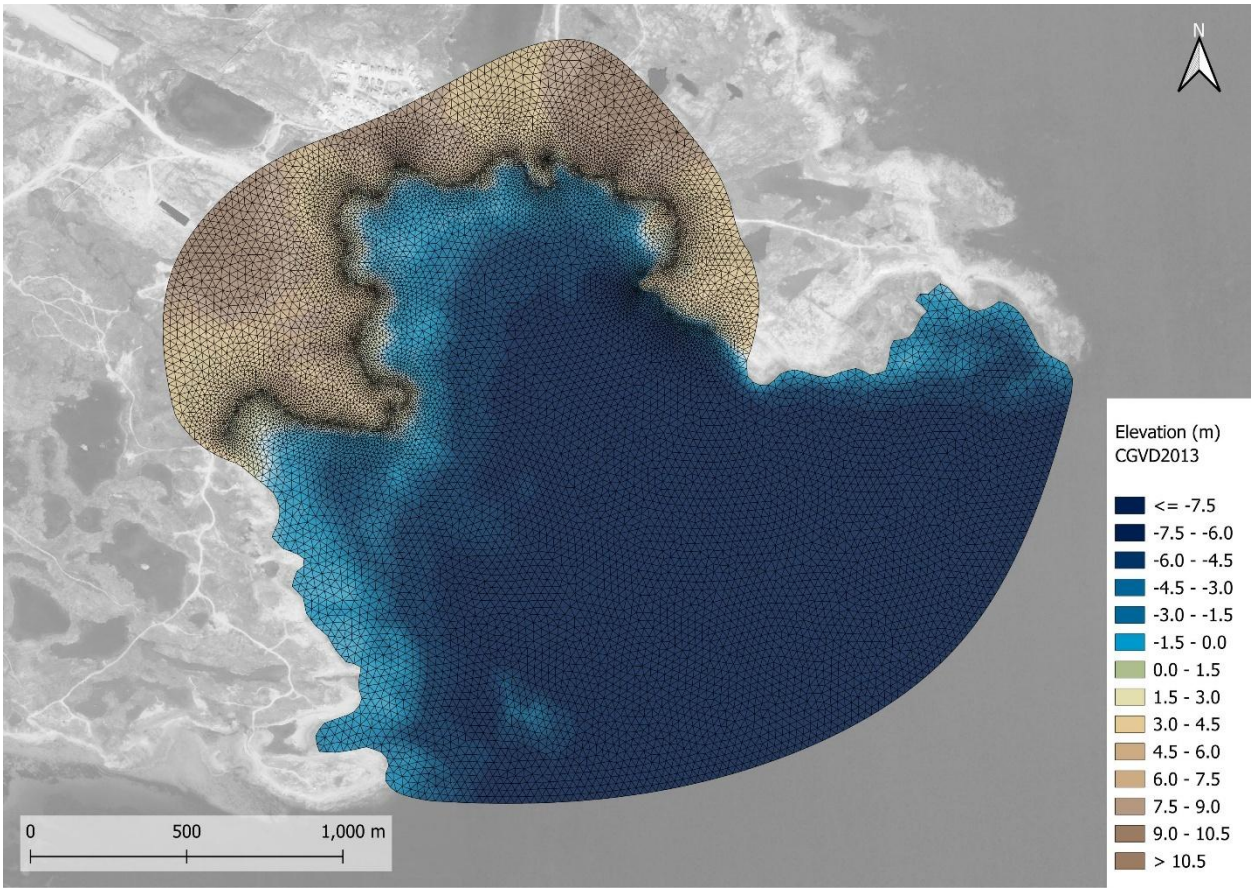
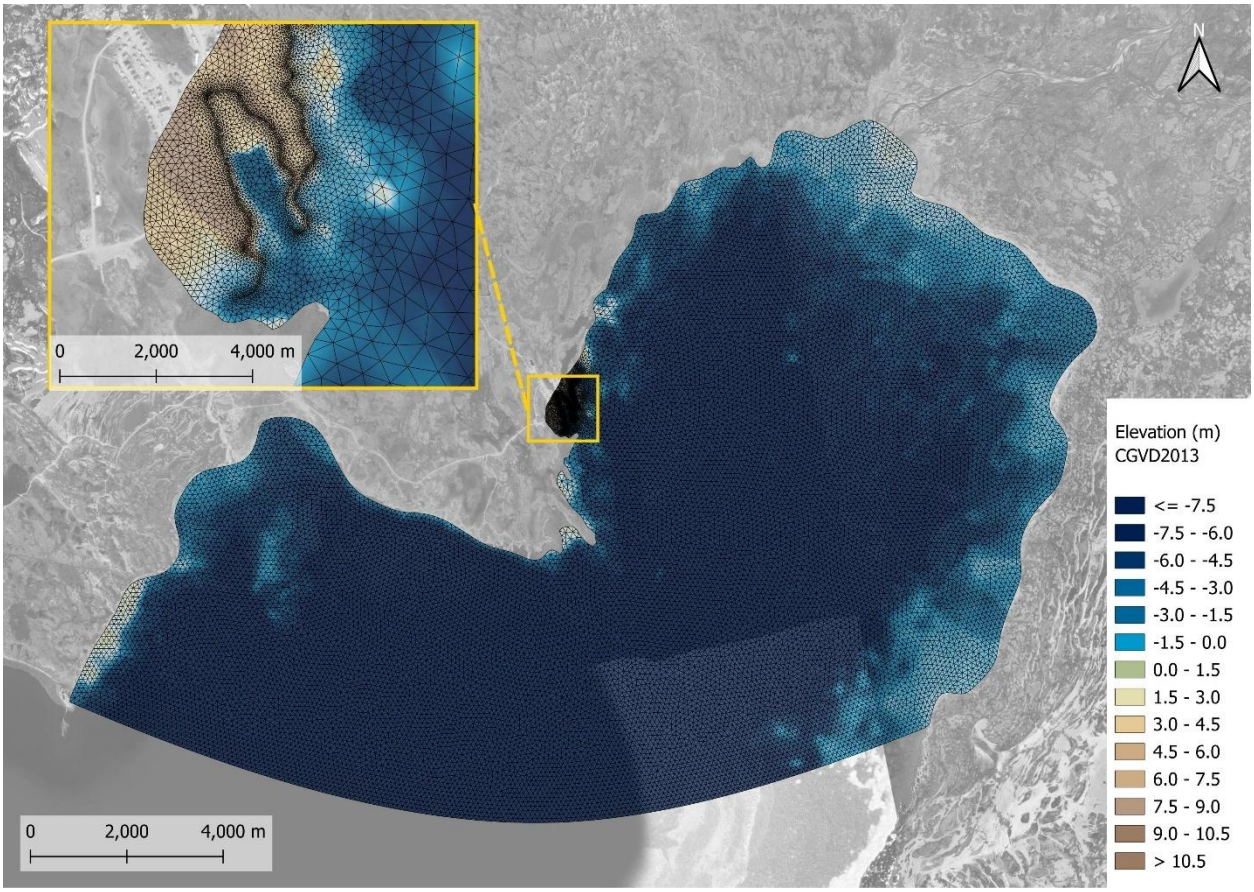


Figure 6-7 Interpolated terrain and community-scale wave model mesh for Coral Harbour, implemented in TOMAWAC.



Mesh size is approximately 2 to 50 m across resolved nearshore and transect areas; larger elements occur locally at outer boundaries, as shown by the edge-length ranges in Table 6-4.

Table 6-4 Community-scale wave model mesh statistics

Community	Nodes	Elements	Calculated edge-length range (m)
Arviat	22,342	44,193	2 - 50
Whale Cove	11,712	23,259	2 - 50
Chesterfield Inlet	17,077	33,777	2 - 50
Coral Harbour	23,751	46,765	2 - 150

6.2 Model Calibration and Validation

Regional wave-hindcast calibration used the largest quality-controlled observed wave event available at buoy C45158, and validation used a separate high-wave event. Regional hydrodynamic calibration used the largest suitable observed water-level event at Churchill station 05010. Independent local observations at the four communities were then used to evaluate the regional tidal and water-level response.

6.2.1 Regional Wave Hindcast Calibration and Validation

The regional wave model was calibrated and validated against Hs observations at DFO buoy C45158. The period from 19 to 25 September 2001 was used for calibration, and the independent period from 1 to 7 October 2004 was used for validation. These periods were selected based on the availability of sufficiently continuous observations and the occurrence of elevated wave conditions. Each simulation covered approximately two weeks. The first week was used as model warm-up to allow the wave field to develop from the initial conditions. The warm-up period was excluded from the figures and statistical analysis. The comparisons were therefore limited to the subsequent seven-day periods.

The final regional wave-model configuration is summarized in Table 6-5. The spectral discretization and source-term settings were retained for the complete 1940 to 2025 regional hindcast.

Table 6-5 Final regional TOMAWAC wave-model settings

Parameter	Adopted value
Number of directional bins	36
Number of frequency bins	36
Minimum frequency	0.04 Hz
Frequency ratio	1.10
Spectrum-tail factor	5.0
Depth-induced breaking dissipation option	1
Saturation threshold for dissipation	0.00188

Model performance was evaluated using bias, mean absolute error (MAE), root mean square error (RMSE), pointwise R^2, and quantile R^2. Pointwise R^2 evaluates agreement in the timing and temporal variation of Hs, while quantile R^2 evaluates agreement between the modelled and observed Hs distributions without requiring the corresponding values to occur at the same time. Bias was calculated as modelled minus observed Hs, with positive values indicating average overestimation. Table 6-6 presents the calculated statistics for calibration and validation.

Table 6-6 Regional wave hindcast calibration and validation statistics at DFO buoy C45158

Assessment	Comparison period	Paired observations	Bias (m)	MAE (m)	RMSE (m)	Pointwise R^2	Quantile R^2
Calibration	19 to 25 September 2001	108	+0.04	0.26	0.33	0.95	0.99
Validation	1 to 7 October 2004	114	+0.17	0.26	0.38	0.96	0.99

For the calibration event (Figure 6-8), the model had a bias of +0.043 m, an MAE of 0.262 m, and an RMSE of 0.332 m. The R^2 value of 0.953 indicates that the timing and temporal variation of the observed event were generally represented. The small positive bias indicates limited average overestimation during the calibration period.

For the independent validation event (Figure 6-9), the model had a bias of +0.172 m, an MAE of 0.259 m, and an RMSE of 0.378 m. The R^2 value of 0.960 indicates that the temporal variation was also represented during the validation event. The larger positive bias and RMSE indicate greater overestimation and variability in the individual errors than during calibration.

The quantile R^2 value was 0.99 for both periods, indicating close agreement between the modelled and observed wave-height distributions for the selected events. Collectively, the time-series comparisons and error statistics indicate that the model reproduced the principal event timing and wave-height variation with RMSE values of approximately 0.33 to 0.38 m. Some positive bias remained, particularly during the validation event. The results were considered suitable for applying the regional model to the long-term wave hindcast, subject to the limitations of the available buoy record and the spatial resolution of the regional atmospheric forcing.

Figure 6-8 Regional wave hindcast calibration at DFO buoy C45158, 19-25 September 2001

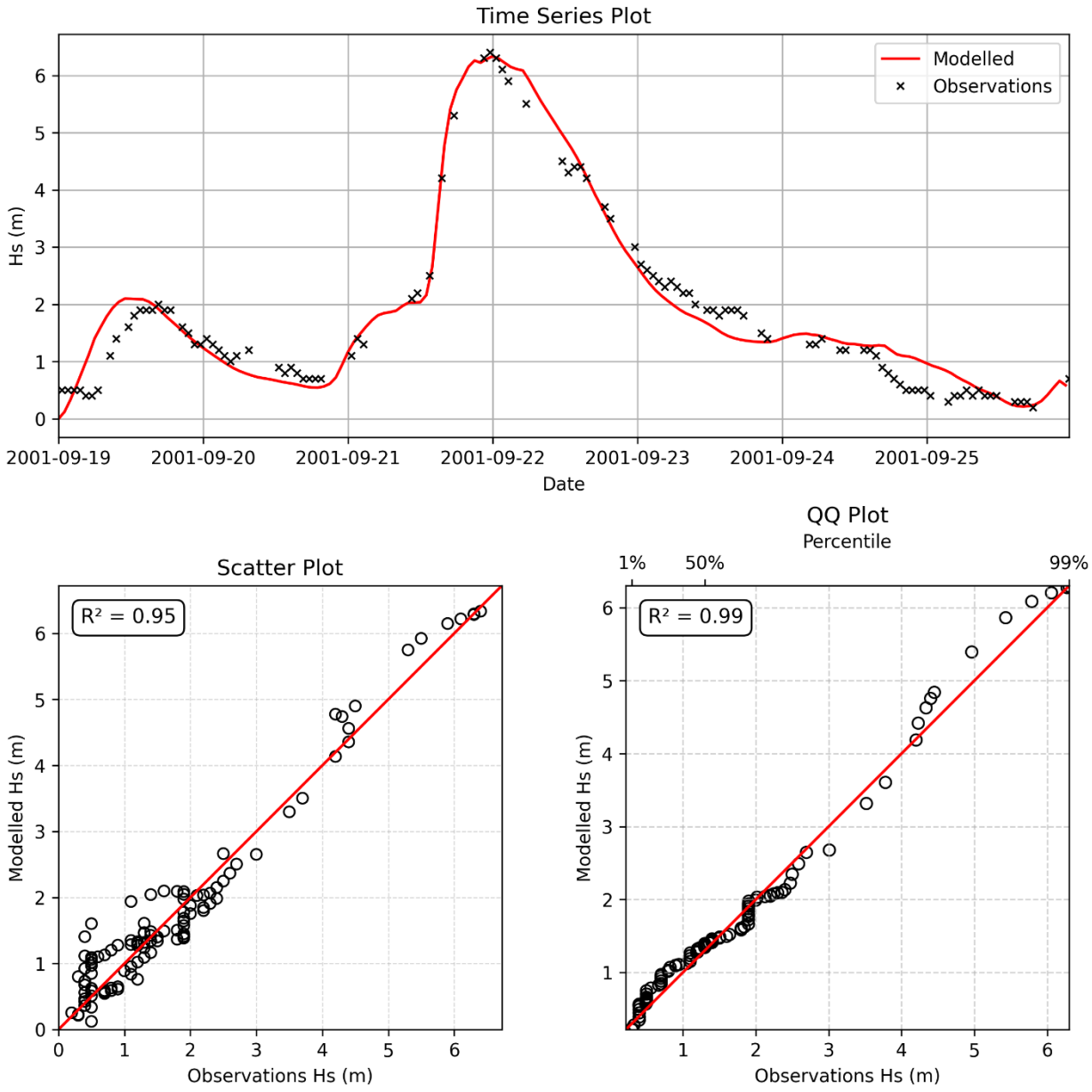
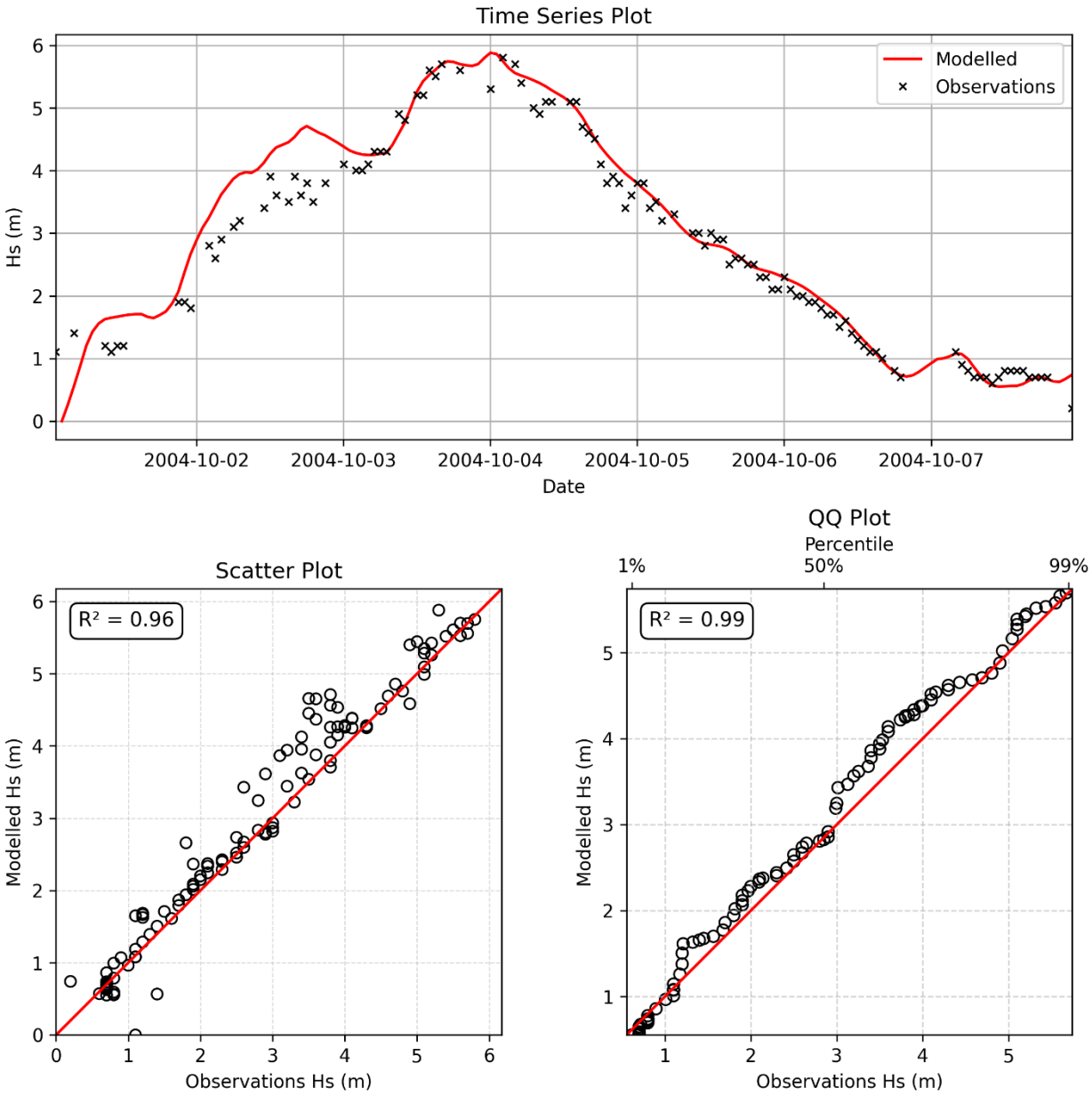


Figure 6-9 Regional wave hindcast validation at DFO buoy C45158, 1-7 October 2004



6.2.2 Regional Hydrodynamic Model Calibration and Validation

The regional hydrodynamic model was calibrated against observed water levels at DFO Churchill station 05010 and independently validated against the available observations at the four study communities. All observed and modelled water levels were referenced to CGVD2013 before comparison.

Churchill station 05010 is located near the western boundary of the regional model, at the mouth of the Churchill River. Although its sheltered setting is not directly representative of the four study communities, the station provides the longest available observed water-level record in the study area. It was therefore used to evaluate the regional representation of tide propagation and the water-level response to wind and atmospheric pressure.

The period from 25 January to 5 February 1971 was selected for calibration because it contained the largest suitable observed water-level event with sufficiently continuous observations and overlapping meteorological forcing. The period included the development, peak, and recession of an elevated water-level event and therefore allowed both the tidal and non-tidal model responses to be assessed.

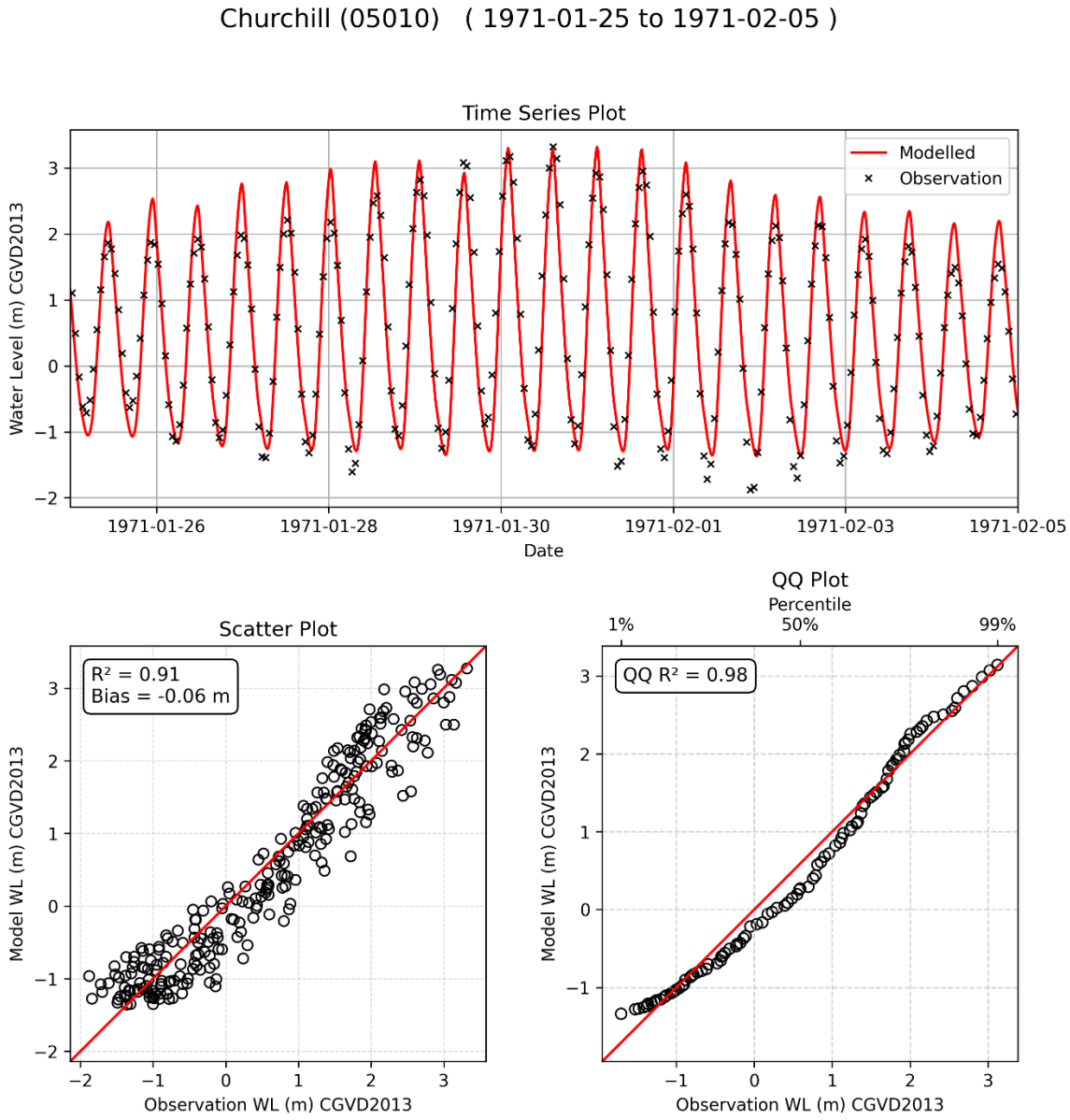
The calibrated model retained the regional mesh, bathymetry, FES2014 tidal boundary conditions, ERA5 wind and atmospheric pressure forcing, wave radiation stresses, bottom-friction formulation, and numerical settings described in Section 6.1.2. The calibrated configuration was subsequently applied without adjustment during the community validation periods and the 1940 to 2025 hindcast.

Model performance was evaluated using mean bias, pointwise R^2, and quantile R^2 and the statistics are summarized in Table 6-7. For the Churchill calibration period (Figure 6-10), the pointwise R^2 was 0.91, and the quantile R^2 was 0.98. The mean bias was -0.06 m, indicating a small average underestimation of the observed water levels. The results indicate that the model generally represented the timing, temporal variation, and distribution of water levels during the selected event.

Table 6-7 Regional hydrodynamic model calibration and validation statistics

Assessment	DFO station	Comparison period	Mean bias (m)	MAE (m)	RMSE (m)	Pointwise R^2	Quantile R^2
Calibration	Churchill 05010	25 January to 5 February 1971	−0.05	0.338	0.409	0.91	0.98
Validation	Arviat 05040	August 1997	+0.01	0.224	0.268	0.97	0.99
Validation	Whale Cove 05055	August 1997	−0.01	0.248	0.291	0.97	0.98
Validation	Chesterfield Inlet 05140	August 1997	+0.01	0.196	0.239	0.97	0.99
Validation	Coral Harbour 05180	August 1998	−0.01	0.224	0.273	0.90	0.99

Figure 6-10 Regional hydrodynamic model water-level calibration at DFO Churchill station 05010, 25 January-5 February 1971.



The adopted model configuration was independently validated against the available short-duration water-level observations at the four study communities (Figure 6-11 to Figure 6-14). August 1997 was selected for Arviat, Whale Cove, and Chesterfield Inlet because sufficiently continuous observations were concurrently available at the three stations. Use of a common period allowed the regional model response to be assessed at multiple locations under the same tidal and meteorological forcing. Comparable observations were not available at Coral Harbour during August 1997; therefore, the sufficiently continuous record available during August 1998 was used.

The absolute mean biases were less than 0.008 m at all four validation locations. The RMSE values ranged from 0.239 m at Chesterfield Inlet to 0.291 m at Whale Cove. Pointwise R^2 values were approximately 0.97 at Arviat, Whale Cove, and Chesterfield Inlet, indicating reasonable agreement in the timing and temporal variation of the observed and modelled water levels.

At Coral Harbour, the pointwise R^2 was 0.898, which was lower than the values obtained at the other communities. However, the mean bias was -0.008 m, the RMSE was 0.273 m, and the quantile R2 was 0.99. These results indicate that the overall water-level distribution was represented more closely than the timing of individual water-level variations. The remaining differences may be associated with the representation of local bathymetry, coastal geometry, tidal propagation, and the resolution of the regional atmospheric forcing.

Quantile R^2 values ranged from 0.98 to 0.99 across the four validation locations, indicating close agreement between the observed and modelled water-level distributions. Overall, the calibration and validation results indicate that the adopted mesh and bottom-friction configuration generally represented the observed water-level range, phase, temporal variation, and distribution at the available stations. Some differences remained at individual timestamps, particularly at Coral Harbour. Based on the available observations, the regional hydrodynamic model was considered suitable for the long-term water-level hindcast and subsequent residual-surge analysis, subject to the limited duration of the community observations and the spatial resolution of the regional input datasets.

Figure 6-11 Regional hydrodynamic model water-level validation at DFO Arviat station 05040, August 1997.

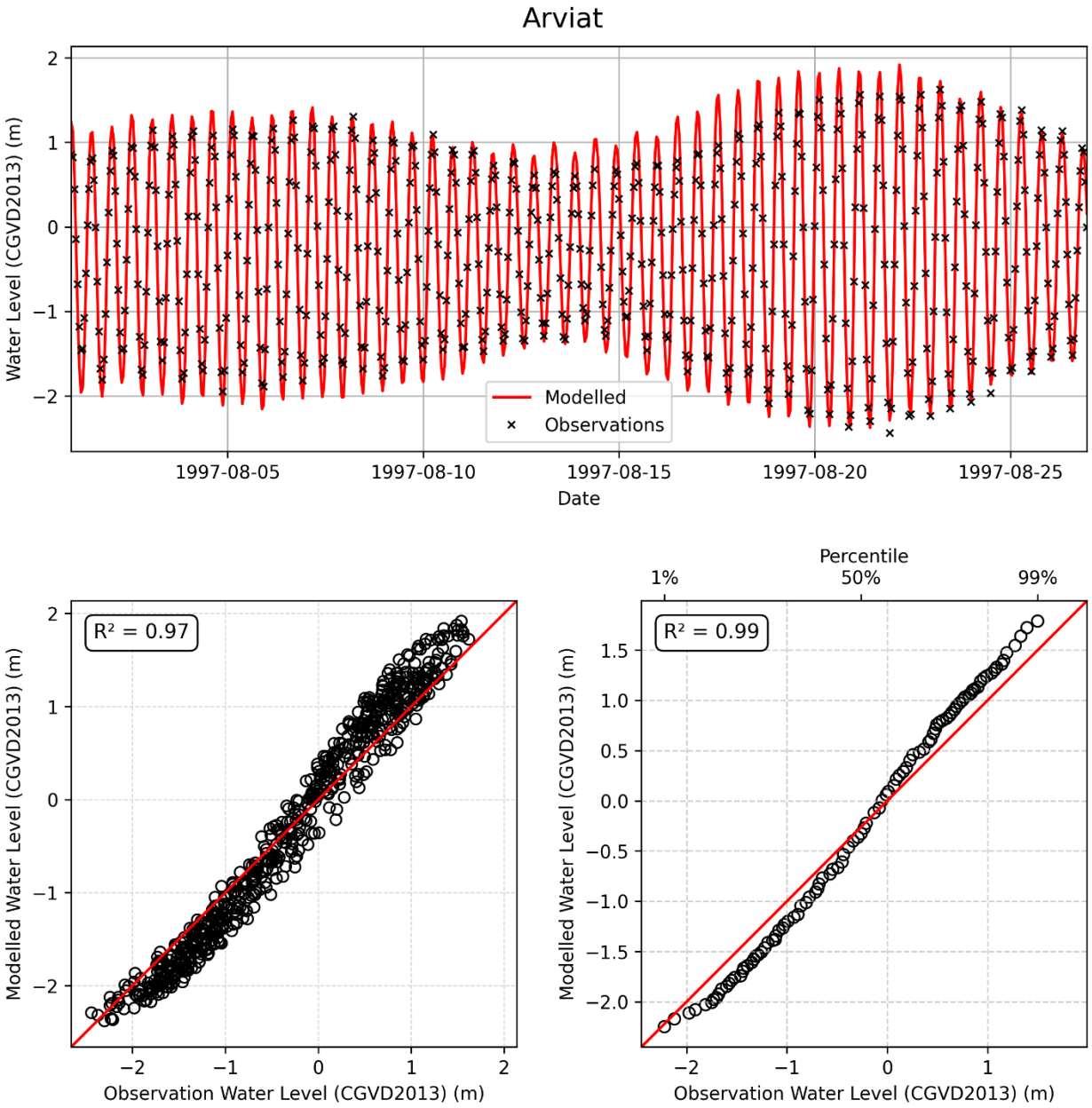


Figure 6-12 Regional hydrodynamic model water-level validation at DFO Whale Cove station 05055, August 1997.

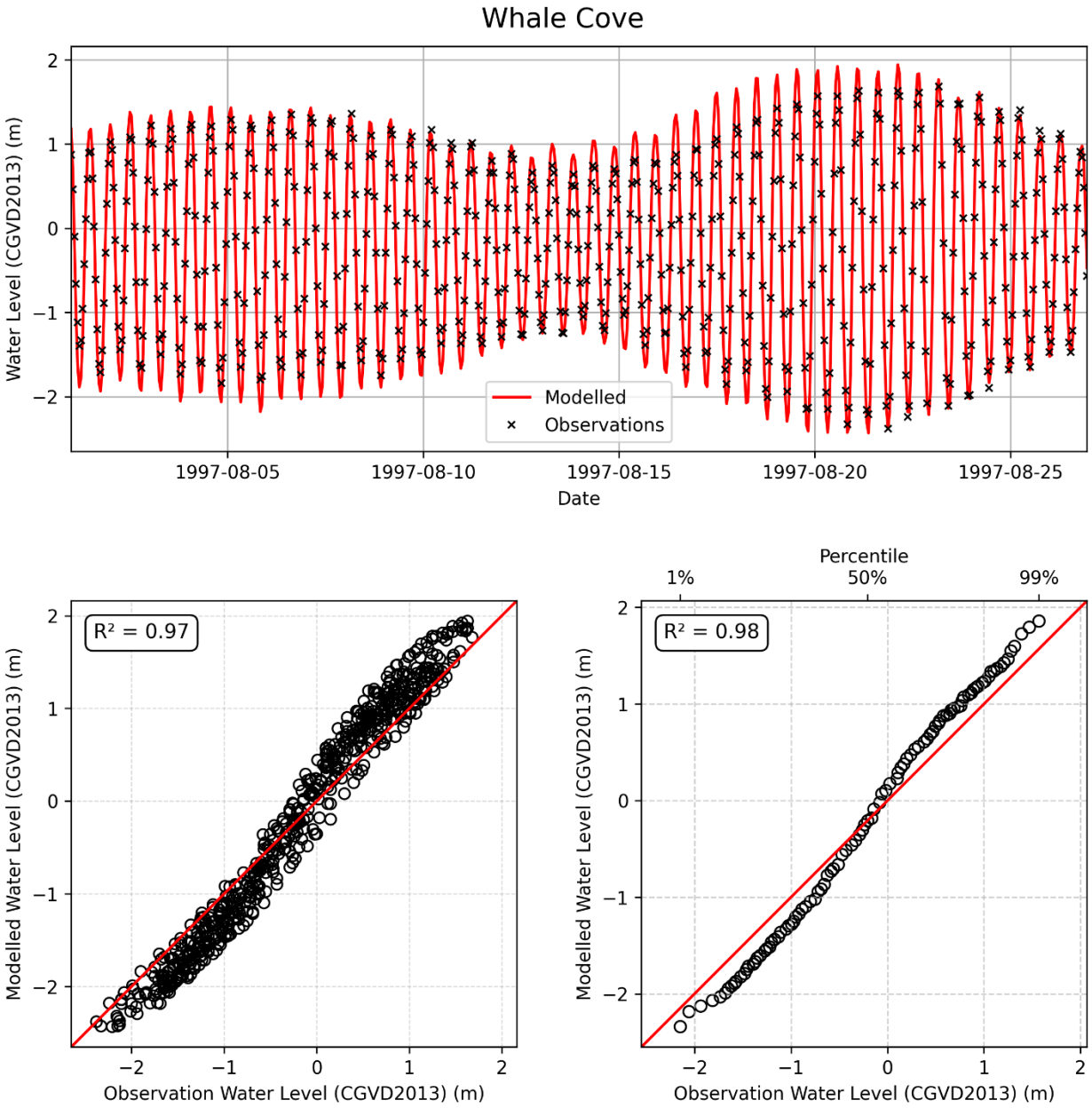


Figure 6-13 Regional hydrodynamic model water-level validation at DFO Chesterfield Inlet station 05140, August 1997

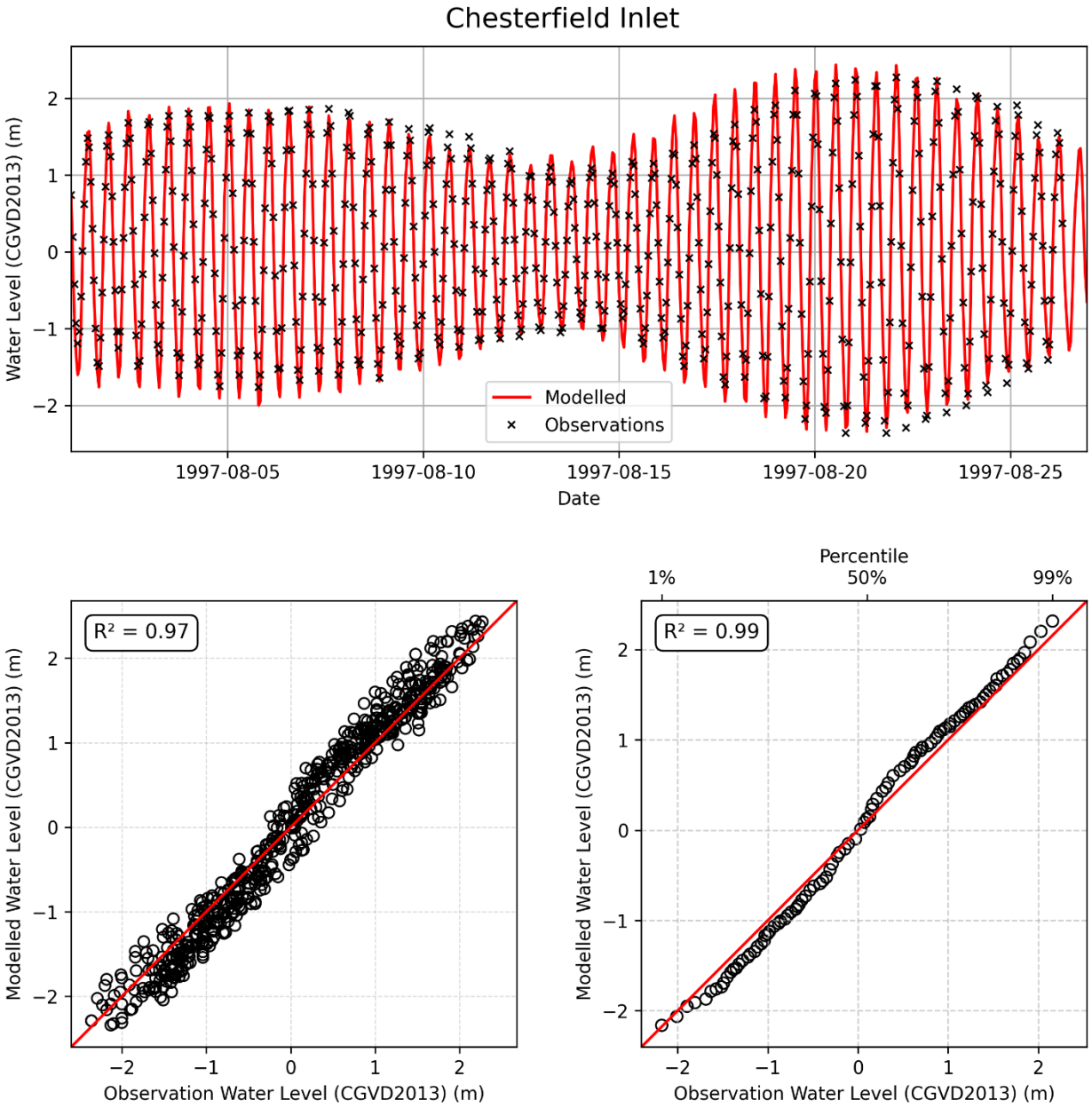
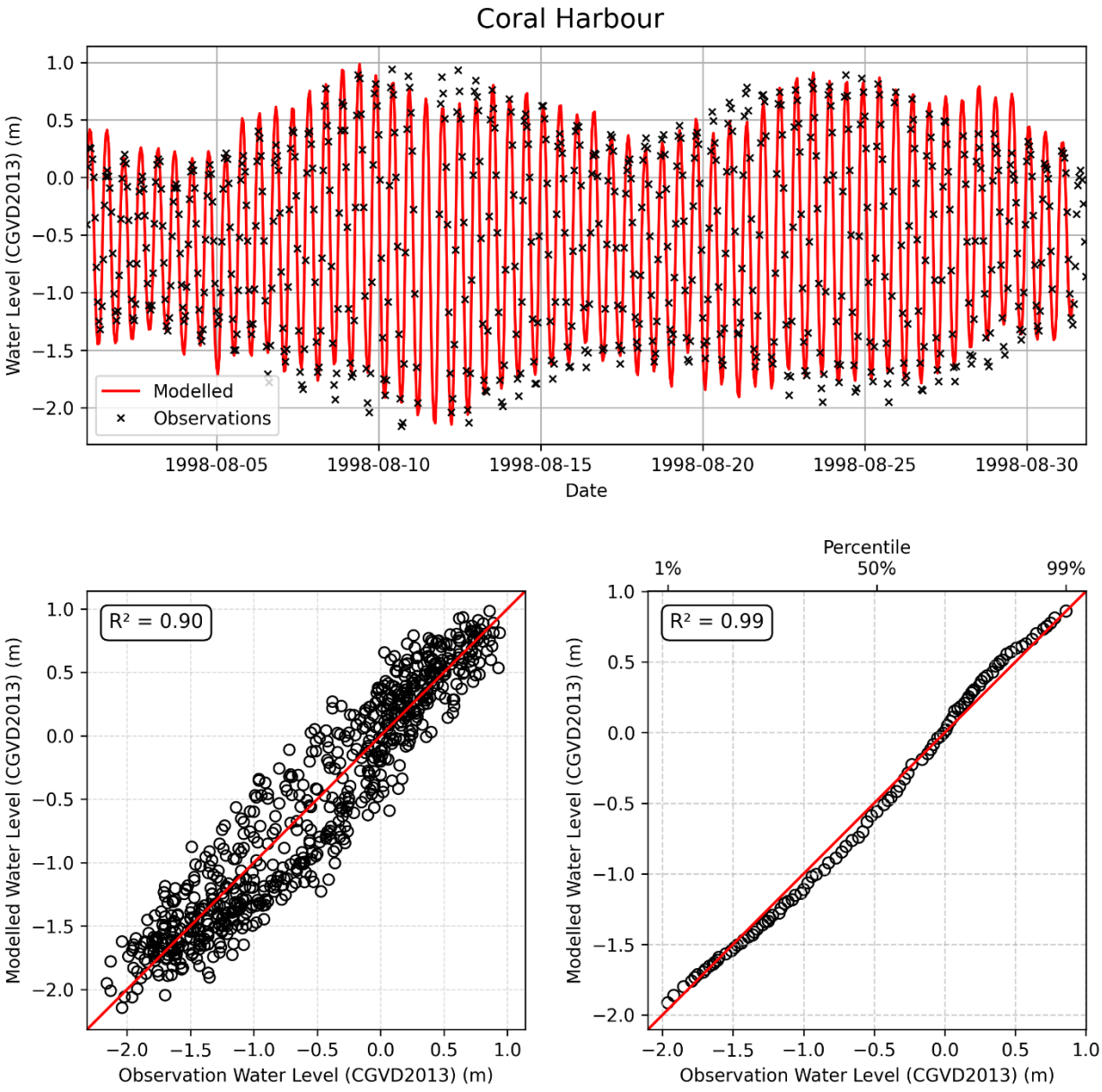


Figure 6-14 Regional hydrodynamic model water-level validation at DFO Coral Harbour station 05180, August 1998.



6.3 Regional-Scale Models Output Processing

Hourly outputs from the 1940 to 2025 regional wave and hydrodynamic hindcasts were processed at the offshore extraction locations associated with the four Community-Scale model domains. The regional wave outputs were used to derive return-period Hs values and associated Tp values. The regional hydrodynamic outputs were used to derive return-period surge residuals and stillwater levels.

Nine candidate statistical distributions were evaluated: GEV, Weibull, Gumbel, gamma, Pearson Type III, log-Pearson Type III, normal, log-normal, and exponential. The distributions were ranked primarily using R^2, which measures agreement between the fitted and empirical quantiles. The selected fit was also reviewed for stability and representation of the upper tail. A single distribution was not imposed across the four communities because the shape, skewness, and upper-tail behaviour of the annual-maximum samples differed by location.

Confidence limits were estimated by repeatedly resampling the annual maxima with replacement, refitting the selected distribution, and recalculating the return levels. The 2.5th and 97.5th percentiles of the resulting estimates define the 95% confidence limits. These limits represent the uncertainty associated with the finite annual-maximum sample. They do not include uncertainty associated with the ERA5 forcing, bathymetry, model structure, or future climate conditions. Uncertainty generally increases for the 200- and 500-year return levels because these values require extrapolation beyond the 86-year hindcast period.

6.3.1 Wave Height Extreme Value Analysis for Community-Scale Boundary Condition

Annual-maximum Hs values were extracted from the regional wave hindcast at the offshore boundary of each Community-Scale model. The GEV distribution was selected for Arviat and Whale Cove (Figure 6-15 and Figure 6-16), the log-normal distribution was selected for Chesterfield Inlet (Figure 6-17), and the Pearson Type III distribution was selected for Coral Harbour (Figure 6-18). The selected distributions had R^2 values ranging from 0.97 to 1.00.

The return-period Hs values were used to define the offshore wave boundary conditions for the Community-Scale models. The associated Tp values were derived from the hindcasted relationship between Hs and Tp at the corresponding offshore locations. A separate univariate extreme-value analysis was not applied to Tp, since an independently selected extreme Tp would not necessarily represent a physically consistent pairing with the return-period Hs. The adopted Hs and Tp combinations are presented in Table 6-8.

Table 6-8 Return-period offshore Hs and associated Tp inputs for the Community-Scale models

Community	Return period (years)	Hs (m)	Tp (s)
Arviat	10	2.65	10.5
Arviat	20	2.77	11.0
Arviat	50	2.89	11.0
Arviat	100	2.97	11.5
Arviat	200	3.03	11.5
Arviat	500	3.10	11.5
Whale Cove	10	2.08	12.0
Whale Cove	20	2.19	12.5
Whale Cove	50	2.33	12.5
Whale Cove	100	2.43	13.0
Whale Cove	200	2.54	13.0
Whale Cove	500	2.68	13.5
Chesterfield Inlet	10	3.82	9.5
Chesterfield Inlet	20	3.99	10.0
Chesterfield Inlet	50	4.19	10.0
Chesterfield Inlet	100	4.32	10.0
Chesterfield Inlet	200	4.45	10.5
Chesterfield Inlet	500	4.60	10.5
Coral Harbour	10	3.08	9.0
Coral Harbour	20	3.29	9.0
Coral Harbour	50	3.55	9.5
Coral Harbour	100	3.74	9.5
Coral Harbour	200	3.91	10.0
Coral Harbour	500	4.14	10.0

The community-specific results are summarized as follows:

- Arviat: The selected GEV fit produced Hs values ranging from 2.65 m for the 10-year return period to 3.10 m for the 500-year return period. The associated Tp values range from 10.5 to 11.5 s.
- Whale Cove: The selected GEV fit produced the lowest Hs values among the four communities, ranging from 2.08 to 2.68 m. However, Whale Cove has the longest associated Tp, ranging from 12.0 to 13.5 s.
- Chesterfield Inlet: The selected log-normal fit produced the largest Hs values for each return period, ranging from 3.82 to 4.60 m. The associated Tp values range from 9.5 to 10.5 s.

- Coral Harbour: The selected Pearson Type III fit produced Hs values ranging from 3.08 to 4.14 m. The increase of 1.06 m between the 10- and 500-year return levels is the largest among the four communities, reflecting the fitted upper-tail behaviour of the annual-maximum series. The associated Tp values range from 9.0 to 10.0 s.

Figure 6-15 Regional wave hindcast annual-maximum offshore Hs EVA for Arviat; selected GEV fit, R^2= 0.99, with 95% confidence limits.

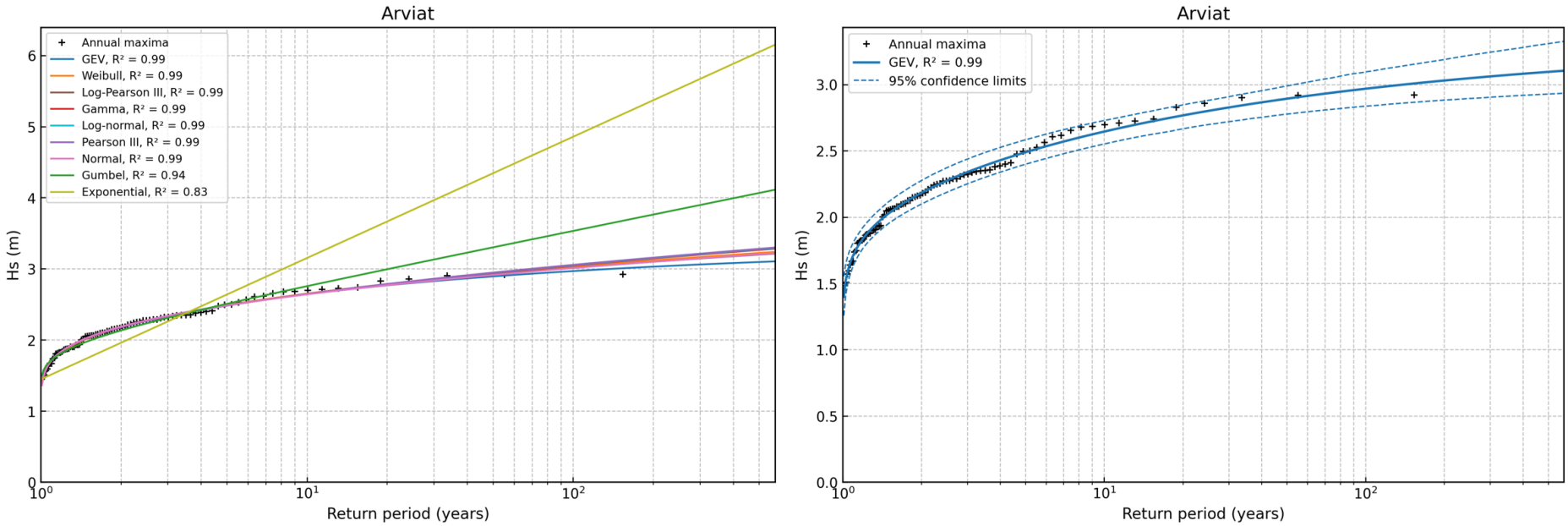


Figure 6-16 Regional wave hindcast annual-maximum offshore Hs EVA for Whale Cove; selected GEV fit, R^2= 0.97, with 95% confidence limits.

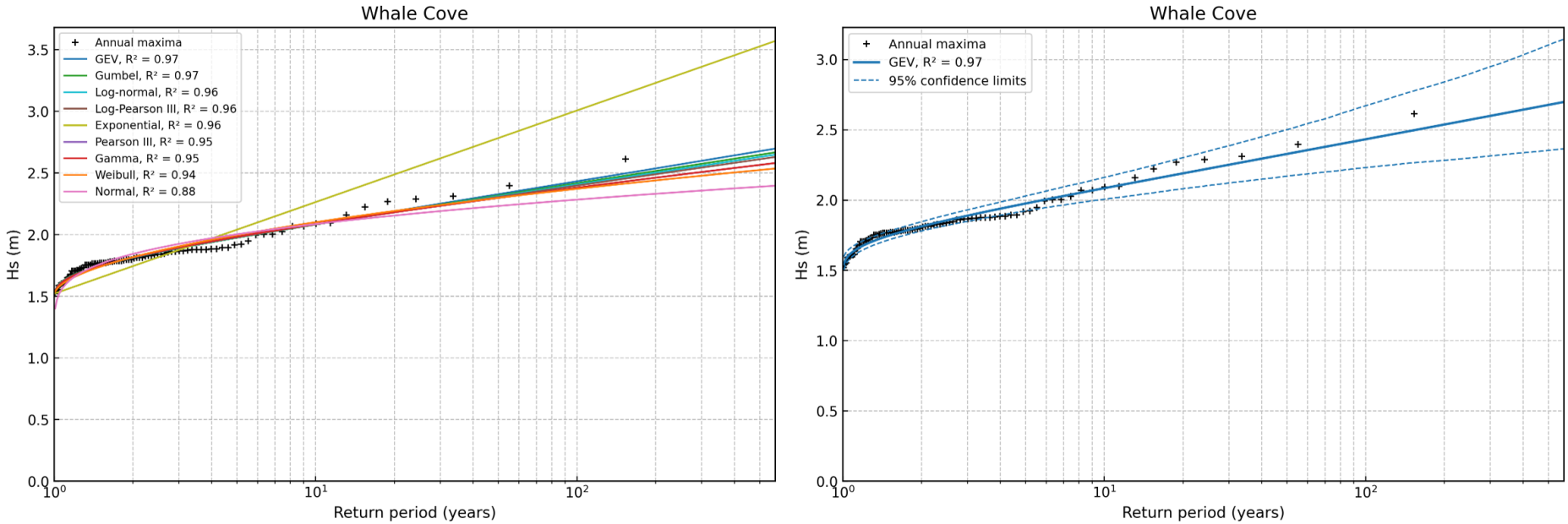


Figure 6-17 Regional wave hindcast annual-maximum offshore Hs EVA for Chesterfield Inlet; selected log-normal fit, R^2 = 0.99, with 95% confidence limits.

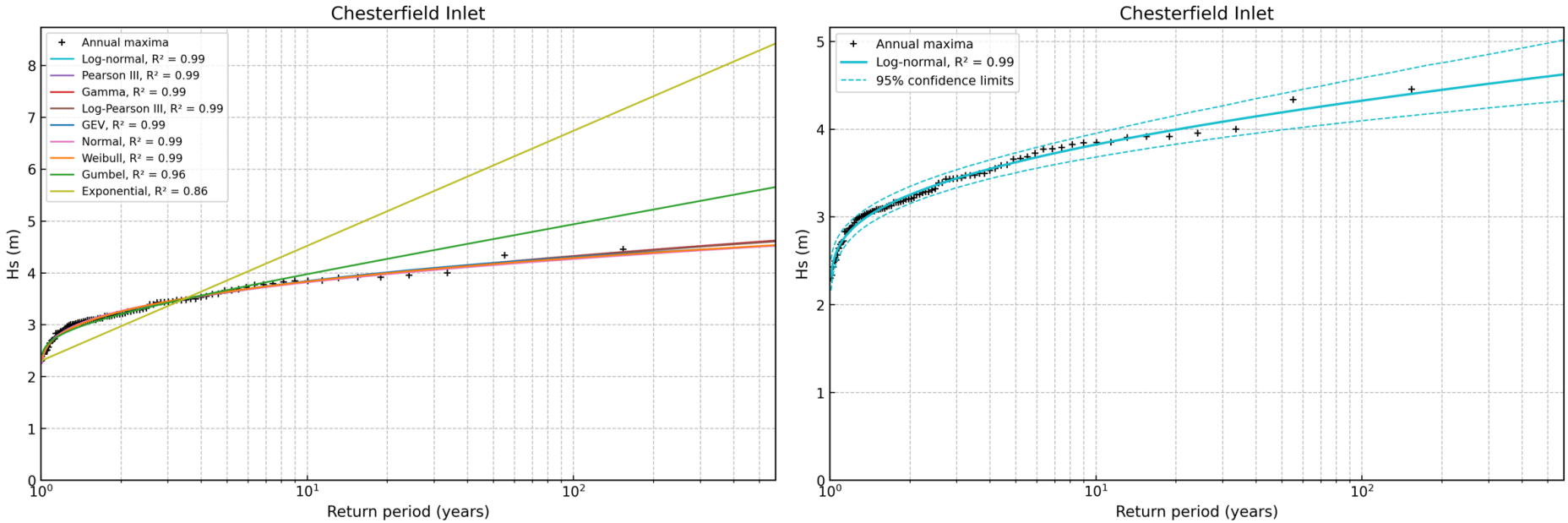
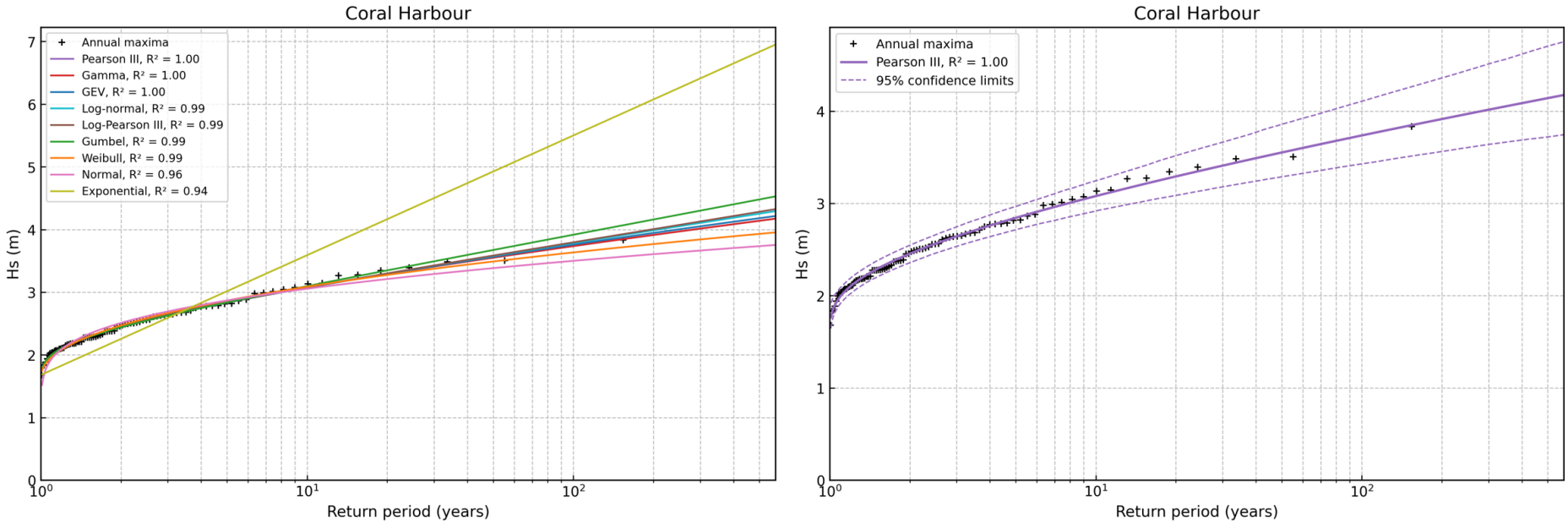


Figure 6-18 Regional wave hindcast annual-maximum offshore Hs EVA for Coral Harbour; selected Pearson Type III fit, R^2= 1.00, with 95% confidence limits.



6.3.2 Surge-Residual Extreme-Value Analysis for Community-Scale Model Input

The surge-residual series was calculated as the hourly difference between the fully forced regional hydrodynamic simulation and the corresponding tide-only simulation. In this report, the term surge residual refers to the modelled non-tidal water-level response and includes the effects represented by the wind, atmospheric pressure, and wave radiation-stress forcing.

Annual maxima were extracted separately at each community. The Weibull distribution was selected for Arviat, Whale Cove, and Chesterfield Inlet (Figure 6-19 to Figure 6-21), while the GEV distribution was selected for Coral Harbour (Figure 6-22). These selections resulted from the community-specific fit assessment. The Weibull distribution provided the preferred representation of the upper-tail curvature at Arviat, Whale Cove, and Chesterfield Inlet, while the Coral Harbour annual maxima exhibited a different upper-tail form that was represented by the selected GEV fit. The surge residual represents the modelled non-tidal contribution to the water level. The return-period stillwater level includes the surge residual and HHWLT. For return period T, the stillwater level was calculated as:

$$\text{Stillwater Level}(T)=\text{HHWLT}+S(T)$$

where S(T) is the return-period surge residual. This approach assumes that the return-period surge residual occurs concurrently with HHWLT. It does not represent a joint-probability analysis of the timing of tide and surge and may therefore provide a conservative basis for flood mapping. The DFO tidal statistics, datum conversions, and adopted HHWLT values are presented in Section 4 and are not repeated in this section.

The estimated surge residuals are presented in Table 6-9. The 10-year values range from 0.86 to 1.23 m, while the 500-year values range from 1.37 to 1.54 m. Coral Harbour has the largest surge residual at each reported return period.

Table 6-9 Return-period surge residuals at the four communities

Return period (years)	Arviat (m)	Whale Cove (m)	Chesterfield Inlet (m)	Coral Harbour (m)
10	0.89	0.87	0.86	1.23
20	0.99	0.98	0.97	1.31
50	1.11	1.12	1.10	1.39
100	1.19	1.21	1.19	1.44
200	1.27	1.30	1.28	1.49
500	1.37	1.42	1.39	1.54

The calculated stillwater levels are presented in Table 6-10. Across the four communities, the 10-year stillwater level ranges from 2.56 to 2.83 m CGVD2013, while the 500-year stillwater level ranges from 2.87 to 3.36 m CGVD2013.

Table 6-10 Return-period stillwater levels calculated as HHWLT plus surge residual

Return period (years)	Arviat (m CGVD2013)	Whale Cove (m CGVD2013)	Chesterfield Inlet (m CGVD2013)	Coral Harbour (m CGVD2013)
10	2.56	2.56	2.83	2.56
20	2.66	2.67	2.94	2.64
50	2.78	2.81	3.07	2.72
100	2.86	2.90	3.16	2.77
200	2.94	2.99	3.25	2.82
500	3.04	3.11	3.36	2.87

Figure 6-19 Annual-maximum surge-residual EVA for Arviat; selected Weibull fit with 95% confidence limits.

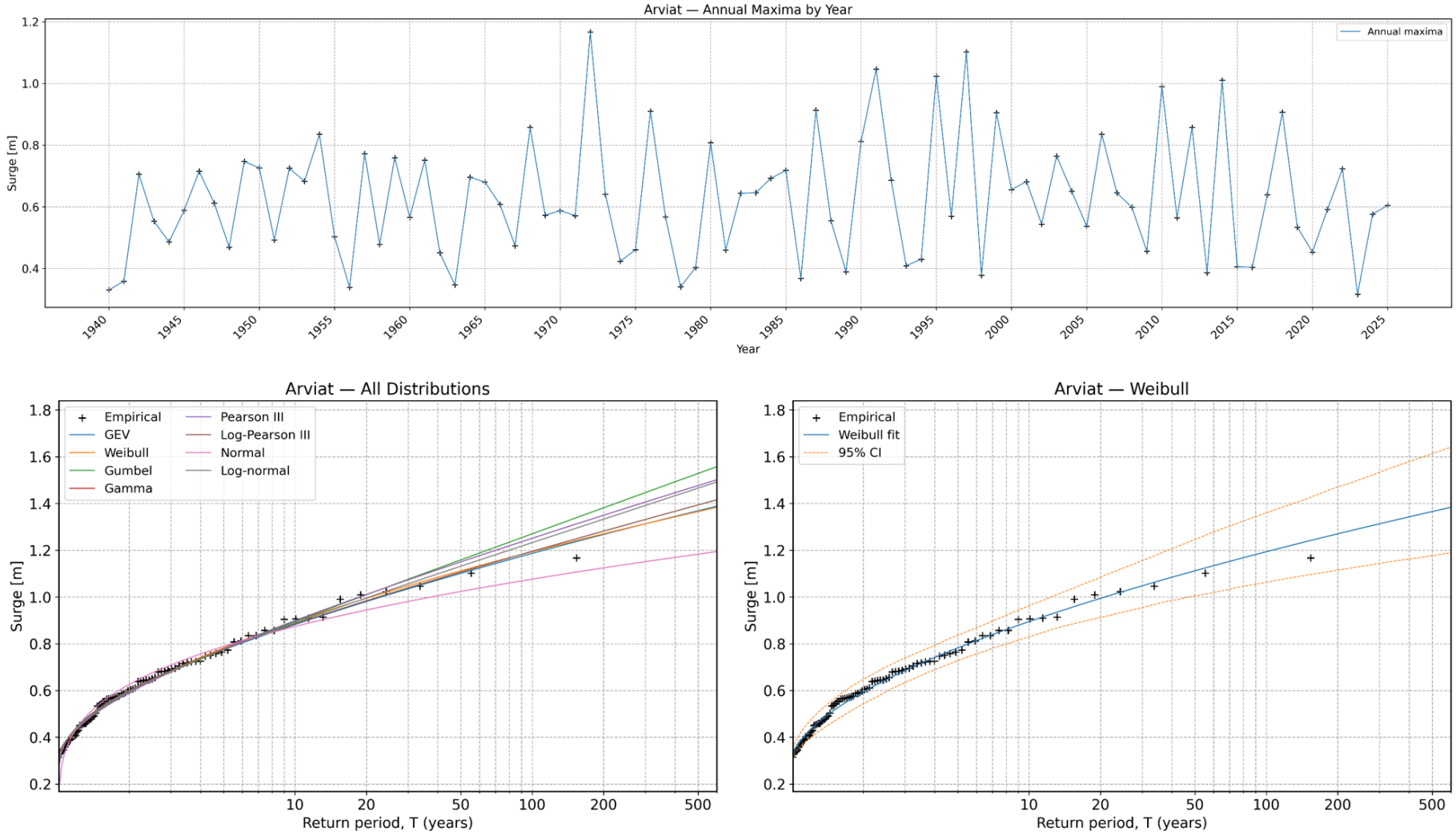


Figure 6-20 Annual-maximum surge-residual EVA for Whale Cove; selected Weibull fit with 95% confidence limits.

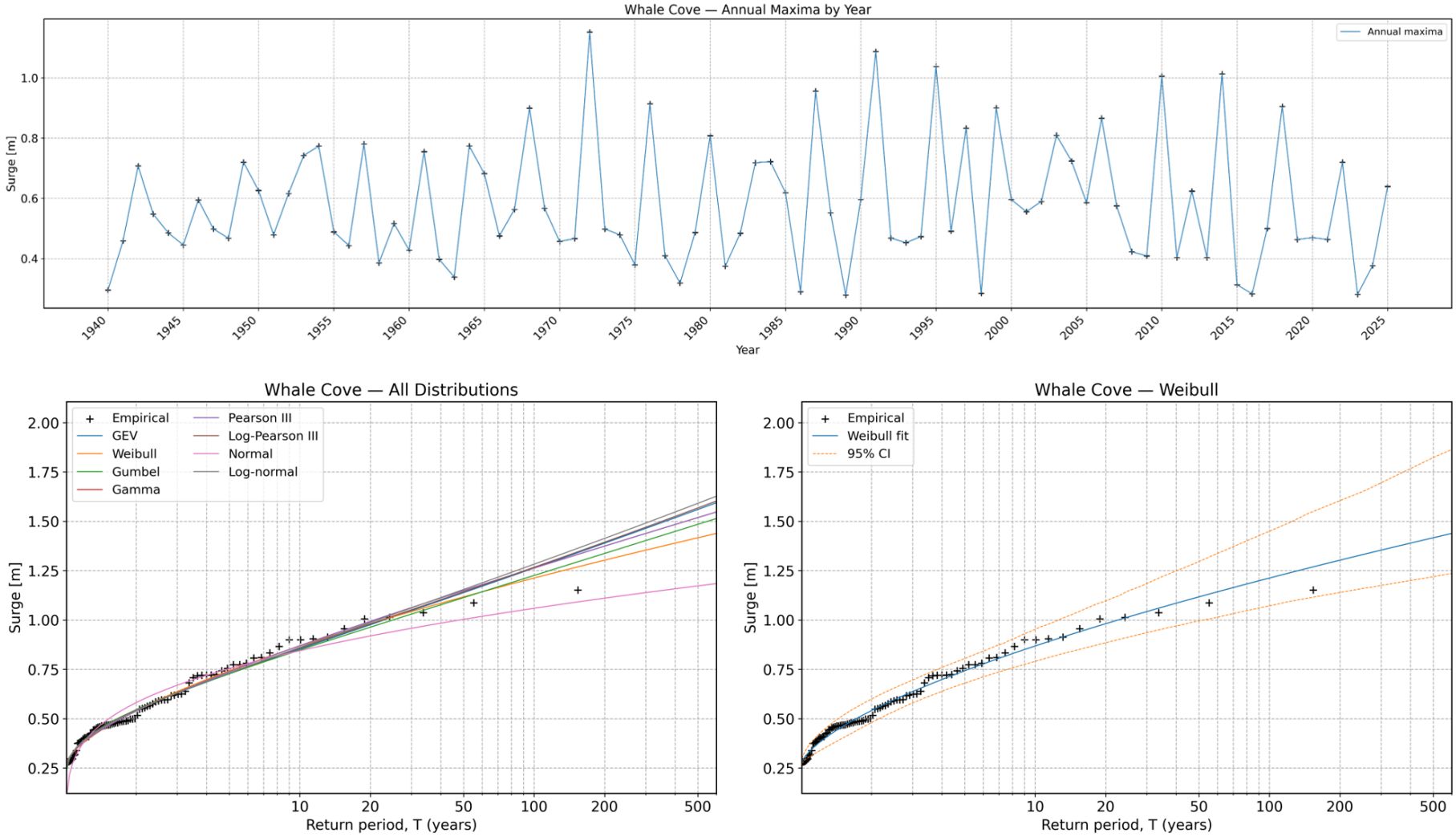


Figure 6-21 Annual-maximum surge-residual EVA for Chesterfield Inlet; selected Weibull fit with 95% confidence limits

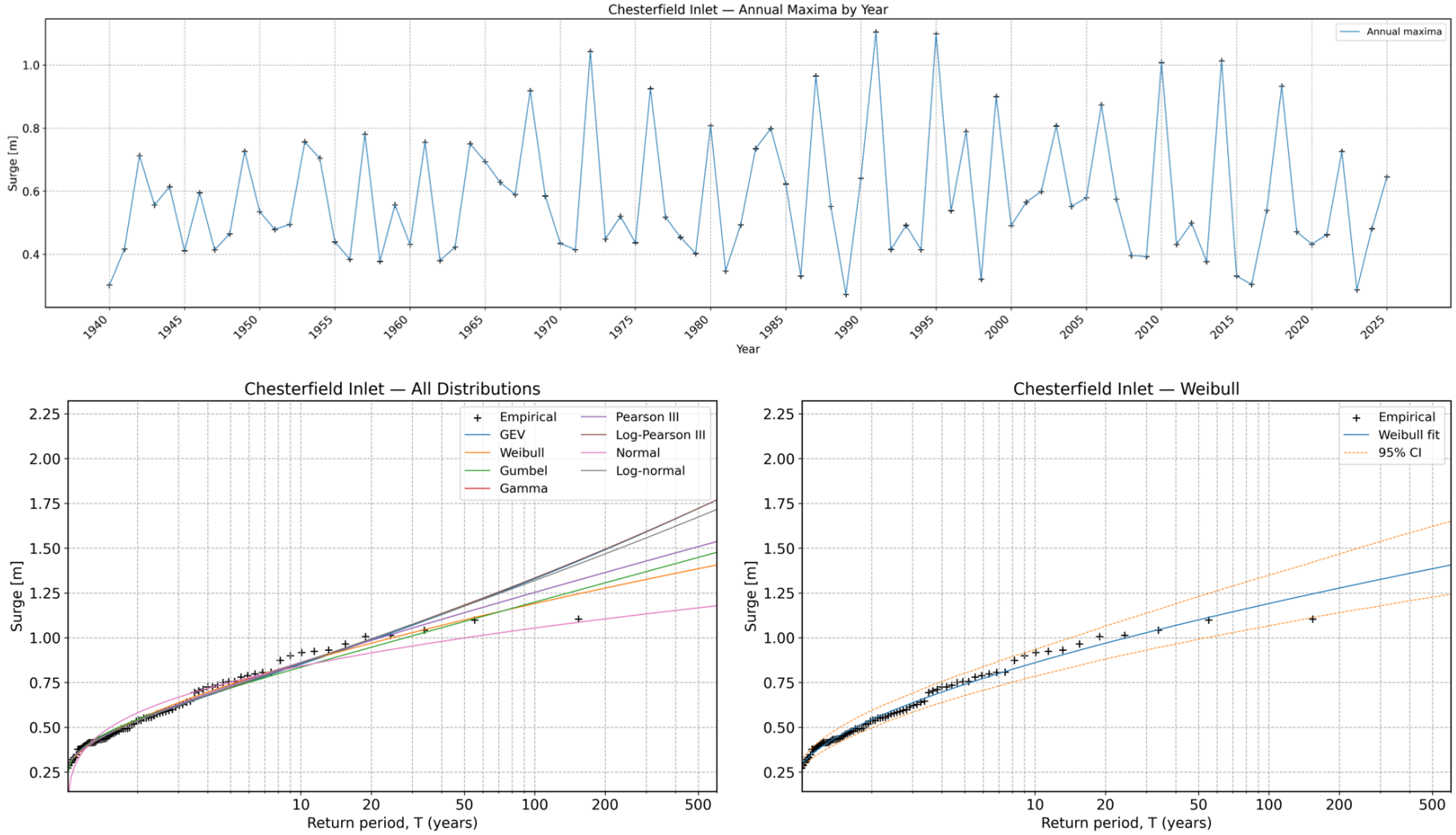
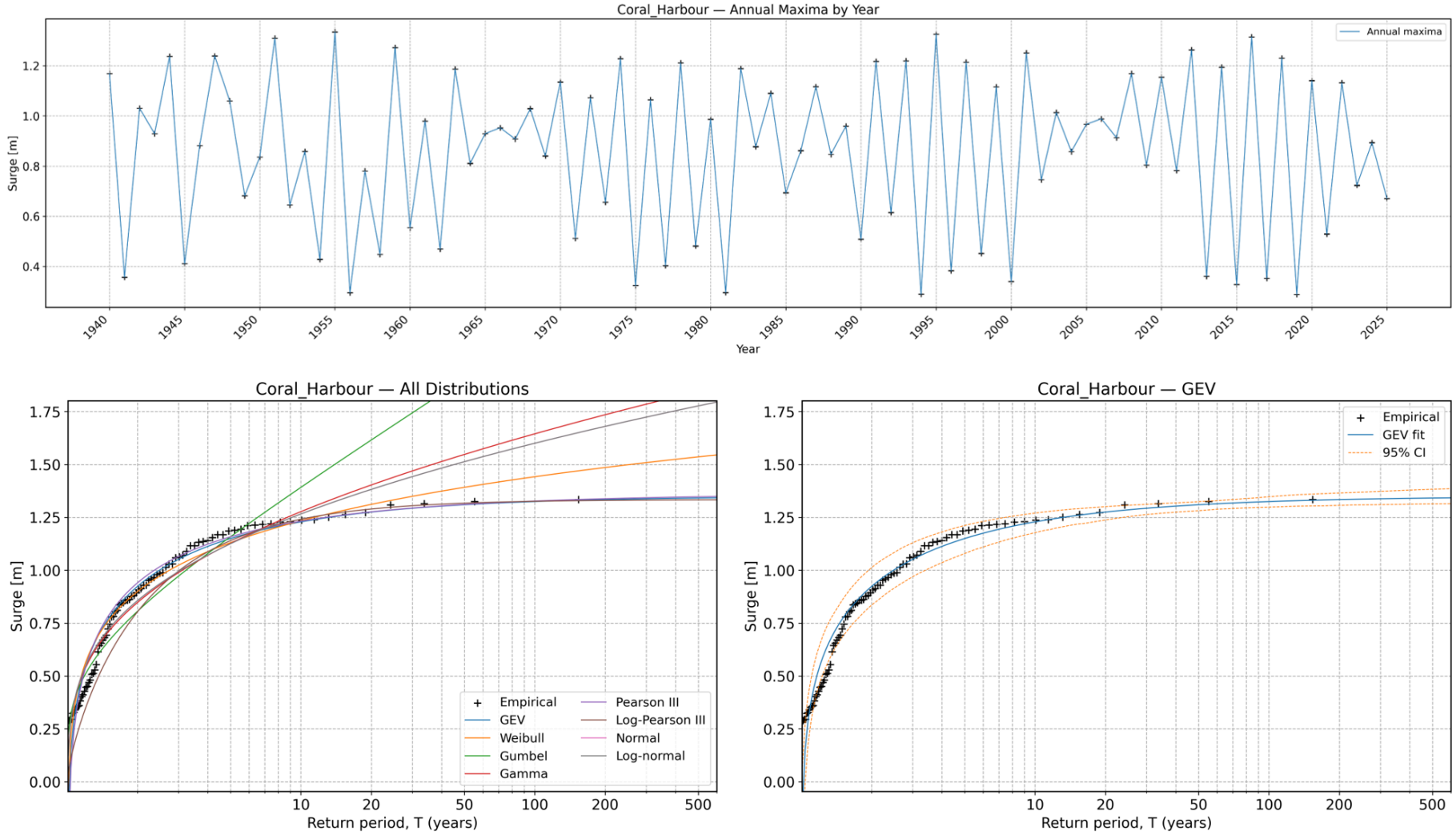


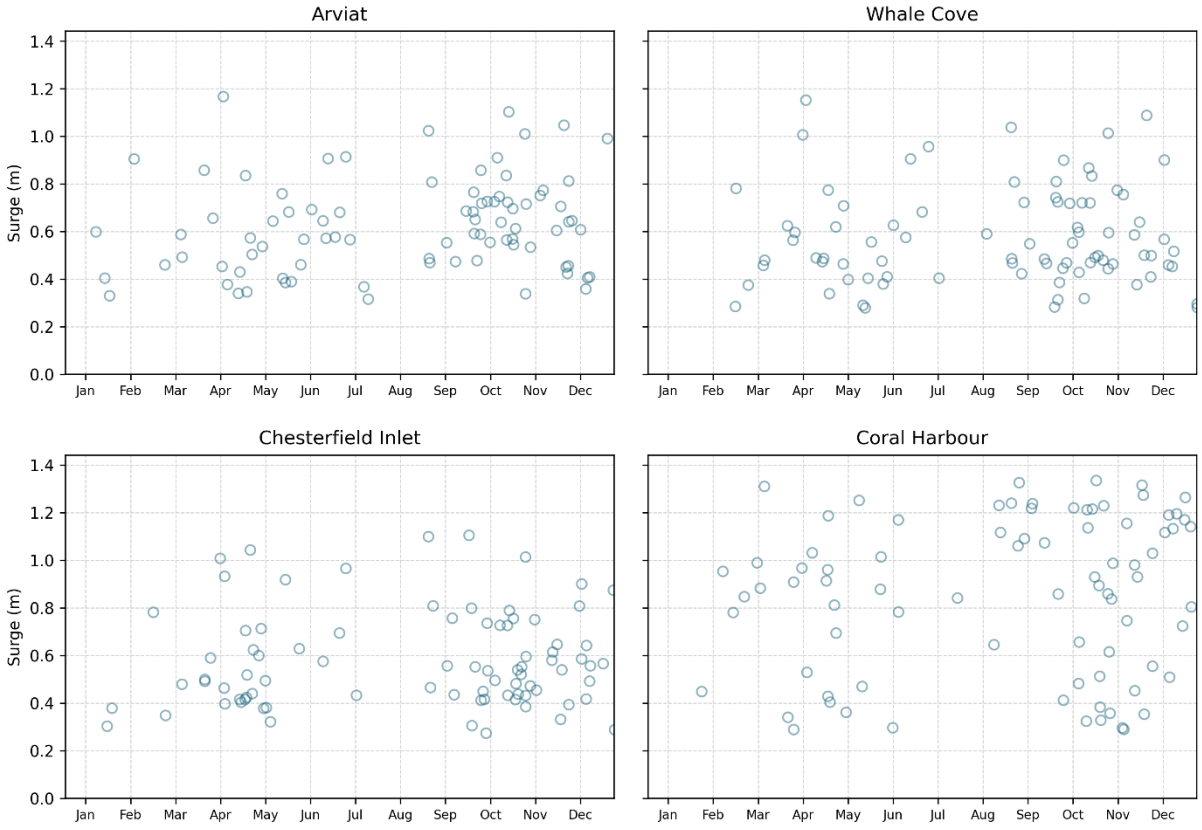
Figure 6-22 Annual-maximum surge-residual EVA for Coral Harbour; selected GEV fit with 95% confidence limits.



6.4 Seasonality of Annual Maximum Surge Events

The timing of the annual maximum surge residuals was reviewed for the 1940-2025 hindcast period to assess the seasonal occurrence of the events used in the extreme-value analysis. As shown in Figure 6-23, the annual maxima occur throughout the year but are concentrated primarily in the fall, particularly from September through November, at all four communities. October is the most frequent month of occurrence at each community, with September and November also contributing a substantial number of annual maxima. Fewer annual maxima occur during mid-winter and summer months. This seasonal distribution indicates that many of the larger surge-generating events occur during the open-water or transitional ice season, which supports the assumption of this study not including sea-ice attenuation.

Figure 6-23 Seasonal timing and magnitude of annual maximum modelled surge residuals at Arviat, Whale Cove, Chesterfield Inlet, and Coral Harbour for the 1940-2025 hindcast period.



6.5 Community-Scale Wave Transform

The reported community scenarios used the return-period stillwater level, wind speed, offshore Hs, and Tp listed in Table 6-11. Additional directional sensitivity cases were oriented toward transects where stronger local waves could occur; no significant change was identified.

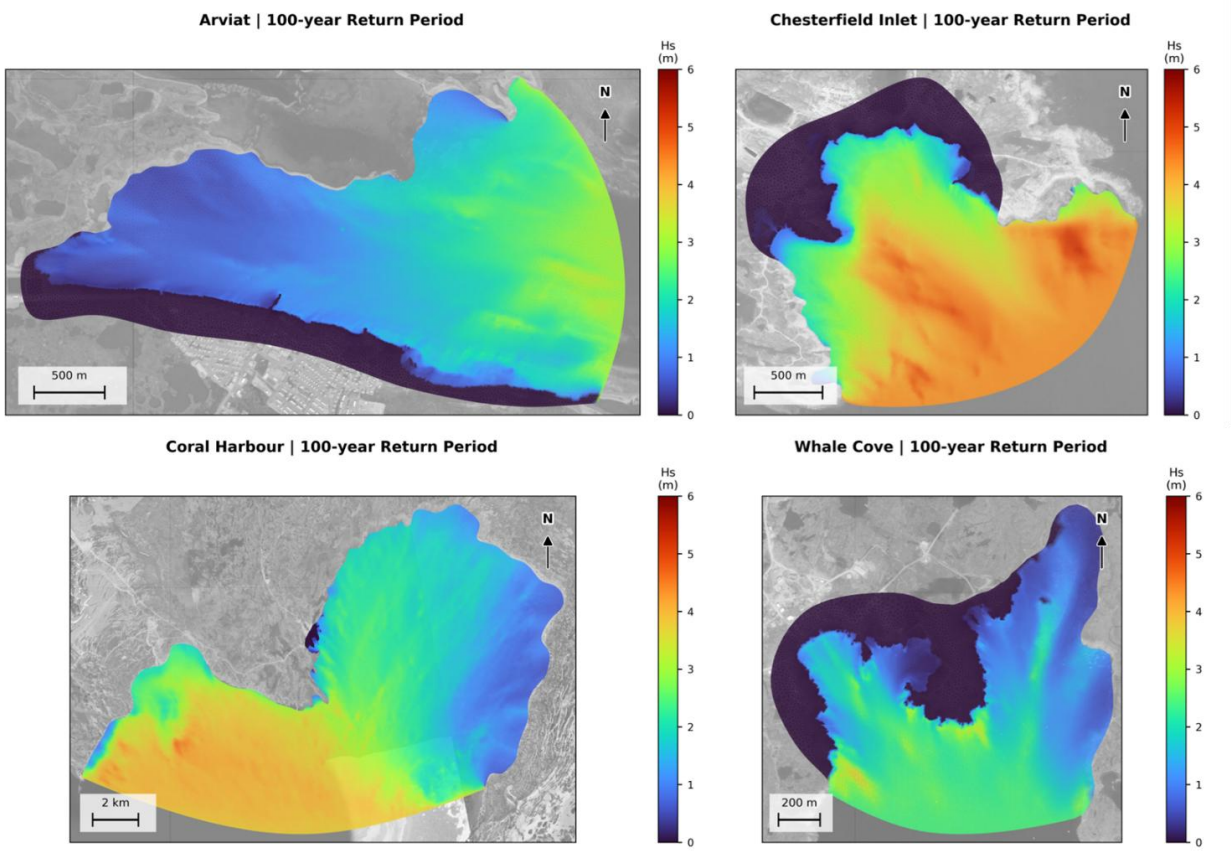
Long-term coincident measurements of water level, waves, and offshore wind are not available at the four communities to support a reliable joint-probability analysis. The design conditions therefore use a conservative combination of HHWLT, return-period surge residual, offshore wave conditions, and wind magnitude for the same nominal return period. Although these processes are partly related through common meteorological forcing, their exact joint probability was not quantified. For this regional flood hazard assessment, the conservative approach provides a practical basis for hazard mapping where the observational data required for a more detailed joint-probability assessment are unavailable.

Hs and Tp were extracted at each transect toe for the R2% calculation. The transformed waves for all communities and return periods can be found in Appendix C. For example, 100-year transformed waves at community-scale models are presented in Figure 6-24.

Table 6-11 Omnidirectional community-scale inputs

Community	Return period (years)	AEP (%)	Stillwater level (m CGVD2013)	Wind speed (m/s)	Offshore Hs (m)	Tp (s)
Arviat	10	10	2.56	19.71	2.65	10.5
Arviat	20	5	2.66	20.47	2.77	11.0
Arviat	50	2	2.78	21.37	2.89	11.0
Arviat	100	1	2.86	21.99	2.97	11.5
Arviat	200	0.5	2.94	22.56	3.03	11.5
Arviat	500	0.2	3.04	23.25	3.10	11.5
Whale Cove	10	10	2.56	21.06	2.08	12.0
Whale Cove	20	5	2.67	21.82	2.19	12.5
Whale Cove	50	2	2.81	22.68	2.33	12.5
Whale Cove	100	1	2.90	23.27	2.43	13.0
Whale Cove	200	0.5	2.99	23.81	2.54	13.0
Whale Cove	500	0.2	3.11	24.46	2.68	13.5
Chesterfield Inlet	10	10	2.83	19.36	3.82	9.5
Chesterfield Inlet	20	5	2.94	19.98	3.99	10.0
Chesterfield Inlet	50	2	3.07	20.72	4.19	10.0
Chesterfield Inlet	100	1	3.16	21.23	4.32	10.0
Chesterfield Inlet	200	0.5	3.25	21.71	4.45	10.5
Chesterfield Inlet	500	0.2	3.36	22.28	4.60	10.5
Coral Harbour	10	10	2.56	20.70	3.08	9.0
Coral Harbour	20	5	2.64	21.46	3.29	9.0
Coral Harbour	50	2	2.72	22.34	3.55	9.5
Coral Harbour	100	1	2.77	22.93	3.74	9.5
Coral Harbour	200	0.5	2.82	23.47	3.91	10.0
Coral Harbour	500	0.2	2.87	24.13	4.14	10.0

Figure 6-24 Community-Scale 100-Year Transformed Wave



7 Coastal Flood Mapping

From the results of the calibrated 2D hydrodynamic and wave models, coastal flood hazard maps were prepared for current climate conditions with AEPs of 1:10, 1:20, 1:50, 1:100, 1:200, and 1:500. Climate change scenarios were not included in the hazard mapping because the projected overall water level trend was decreasing. Given the associated uncertainties in climate change projections, excluding climate change from the hazard mapping was considered the more conservative approach. The sets of coastal flood maps were prepared and summarized in Appendix D as follows:

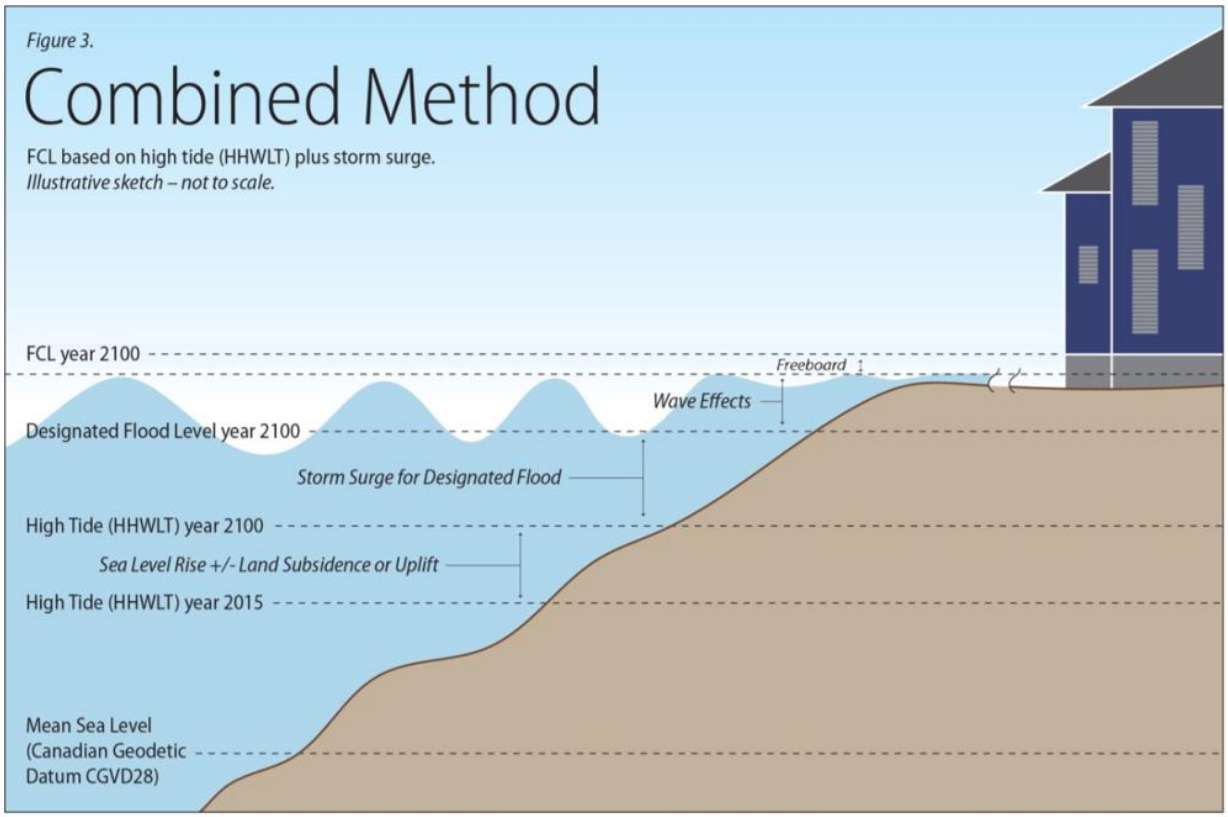
- Coastal floodplains associated with coastal flooding from storm surge and tides for 1:10, 1:20, 1:50, 1:100, 1:200, and 1:500 AEPs for current climate conditions
- Flood hazard maps indicating the inland extent of wave uprush (wave runup) beyond the coastal floodplain for 1:10, 1:20, 1:50, 1:100, 1:200, and 1:500 AEPs for current climate conditions

The coastal flooding from storm surge is hereby referred to as the “Storm Surge Flood Level” which is defined by the astronomical tide and storm surge as its stillwater level components. The flood hazard maps containing wave uprush extends further inland of the Storm Surge Flood Level whereby the inland extent is defined by the wave runup (R2%). All flood levels provided in this report are referenced vertically to CGVD2013.

Since long-term water level records were not available within the communities, a combined-method approach was adopted to estimate extreme coastal stillwater levels (Figure 7-1). This approach is well suited for regions influenced by tidal processes, as it separates the astronomical tide and storm surge components before combining them to derive stillwater levels for coastal flood hazard assessment. The astronomical tide component is represented by a high tidal reference level, such as HHWLT, consistent with the BC Flood Hazard Area Land Use Management Guidelines (Province of British Columbia, 2011). The storm surge component represents the meteorologically driven increase in water level above the predicted tide, including wind setup, atmospheric pressure effects, and wave setup represented through the wave radiation stresses. The stillwater level design corresponding to a given AEP event is then computed by combining the astronomical tide and storm surge components using a conservative pairing approach, where appropriate.

Climate change may affect coastal flooding through changes in relative sea level, sea-ice conditions, waves, winds, and storm surge. Future changes in extreme wind conditions over Hudson Bay remain uncertain and were not quantified in this assessment. Reduced sea-ice cover and a longer open-water season are expected in the future (James et al. 2014) and could increase wave exposure and wind-driven water-level response by allowing wind stress to act directly over a greater open-water area and by reducing wave attenuation associated with ice. Sea-ice effects were not included in the numerical modelling; therefore, the regional wave and hydrodynamic simulations represent open-water conditions, with no reduction in wave energy or wind-driven surge due to ice cover. This provides a conservative representation of sea-ice attenuation. Relative sea-level change was the climate-related effect explicitly quantified, while future changes in winds, waves, and storm surge remain uncertain.

Figure 7-1 Combined method description from BC Flood Hazard Area Land Use Management Guidelines (Province of British Columbia, 2011)



7.1 Storm Surge Flood Level

As per the combined method described in Section 7, Storm Surge Flood Level for each AEP was derived for each community as the sum of HHWLT and the storm surge residual water level simulated using the calibrated TELEMAC-2D hydrodynamic model. Due to the relatively short shoreline extent of each community, spatial variation in storm surge was negligible. Therefore, a single Storm Surge Flood Level was adopted and reported for each community. Table 7-1, Table 7-2, Table 7-3, and Table 7-4 summarize the Storm Surge Flood Level for Arviat, Whale Cove, Chesterfield Inlet, and Coral Harbour, respectively.

Table 7-1 Storm Surge Flood Levels at Arviat for Various AEPs

AEP	HHWLT (m CGVD2013)	Storm Surge (m)	Storm Surge Flood Level (m CGVD2013)
1:10	1.67	0.89	2.56
1:20	1.67	0.99	2.66
1:50	1.67	1.11	2.78
1:100	1.67	1.19	2.86
1:200	1.67	1.27	2.94
1:500	1.67	1.37	3.04

Table 7-2 Storm Surge Flood Levels at Whale Cove for Various AEPs

AEP	HHWLT (m CGVD2013)	Storm Surge (m)	Storm Surge Flood Level (m CGVD2013)
1:10	1.69	0.87	2.56
1:20	1.69	0.98	2.67
1:50	1.69	1.12	2.81
1:100	1.69	1.21	2.90
1:200	1.69	1.30	2.99
1:500	1.69	1.42	3.11

Table 7-3 Storm Surge Flood Levels at Chesterfield Inlet for Various AEPs

AEP	HHWLT (m CGVD2013)	Storm Surge (m)	Storm Surge Flood Level (m CGVD2013)
1:10	1.97	0.86	2.83
1:20	1.97	0.97	2.94
1:50	1.97	1.10	3.07
1:100	1.97	1.19	3.16
1:200	1.97	1.28	3.25
1:500	1.97	1.39	3.36

Table 7-4 Storm Surge Flood Levels at Coral Harbour for Various AEPs

AEP	HHWLT (m CGVD2013)	Storm Surge (m)	Storm Surge Flood Level (m CGVD2013)
1:10	1.33	1.23	2.56
1:20	1.33	1.31	2.64
1:50	1.33	1.39	2.72
1:100	1.33	1.44	2.77
1:200	1.33	1.49	2.82
1:500	1.33	1.54	2.87

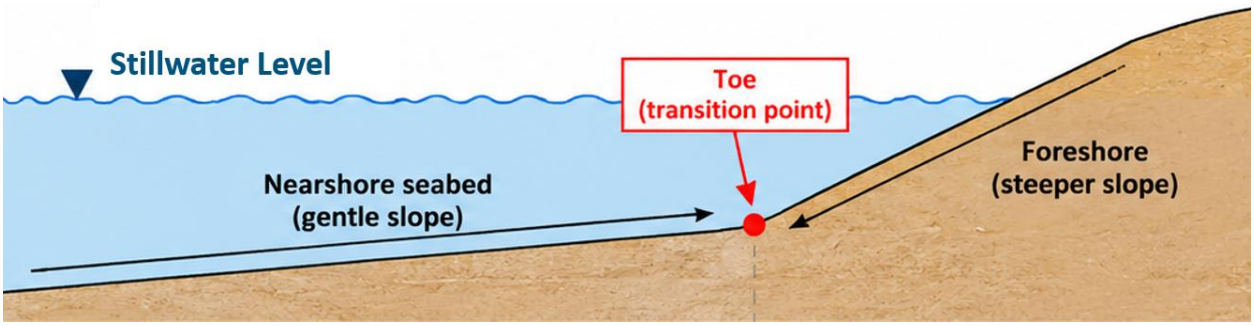
7.2 Wave Flood Hazard Level

The 2D wave modelling scenarios were simulated using the TOMAWAC model developed for each community (i.e., community-scale wave models). The offshore wave boundary conditions for each community were based on the EVA of significant wave height and peak wave period extracted from the Hudson Bay-wide hindcast wave model. The community-scale 2D wave models were run for the selected AEP events, and the resulting wave parameters, including significant wave height and peak wave period, were extracted at the toe of each 1D coastal transect and were used to calculate wave runup. The results of the community-scale wave models are presented in Appendix C.

7.2.1 Coastal Transect Analysis

The wave parameters from the 2D wave models were extracted at the pre-established transects in each community. For each transect, the toe extraction location was selected near the seaward base of the representative shoreline slope, where the profile transitions from the nearshore seabed to the steeper foreshore section (Figure 7-2). The location was identified from the combined topographic-bathymetric profile and was positioned seaward of the primary runup slope to represent incident wave conditions prior to significant runup development. The selected toe location is also generally consistent with the zone where depth-limited wave transformation and breaking begin to influence nearshore wave conditions.

Figure 7-2 Schematic definition of the toe extraction location along a representative coastal profile



The selected toe location was then used consistently to extract Hs and Tp from the community-scale TOMAWAC results for all AEP scenarios. EurOtop (2018) empirical equations were used to estimate R2%.

The EurOtop (2018) empirical equation (mean value approach) was used to estimate the 2% wave runup on relatively gentle slopes (i.e., slope of 1 vertical (1V): 2 horizontal (2H) or gentler). The maximum $R_{2\%}$ on relatively gentle slopes was calculated from the equation below:

$$\frac{R_{2\%}}{H_{m0}} = 1.0 \cdot \gamma_f \cdot \gamma_\beta \left(4 - \frac{1.5}{\sqrt{\gamma_b \cdot \xi_{m-1,0}}}\right)$$

where:

$R_{2\%}$ = 2% wave runup using EurOtop equation 5.2 (2018)

H_{m0} = significant wave height (assumed equal to H_s)

γ_f = influence factor for roughness = 1.0 (assumed smooth slopes)

γ_b = influence factor for berm = 1.0 (no berm)

γ_β = influence factor for oblique waves = 1.0 (no oblique wave effect)

$\xi_{m-1,0}$ = surf-similarity parameter or Iribarren's number (assumed defined by T_m)

TOMAWAC provides the peak wave period (T_p). The EurOtop (2018) wave-runup formulation uses the spectral wave period $T_{m-1,0}$in the calculation of the Iribarren number. Accordingly, $T_p$was converted using the EurOtop relationship $T_m = T_p/1.1$, prior to calculating wave steepness and the Iribarren number.

As a conservative approach, the wave runup calculations for all 1D coastal transects assumed that the slopes were smooth and that the waves are oriented along the transect so that the estimated runup values are conservative.

Where the runup slope on the 1D transects are steeper than 1V:2H, EurOtop (2018) equation 5.6 was used to estimate the 2% wave runup. Equation 5.6 provided below is used for steep slopes up to a vertical wall, where the runup is estimated as a function of the slope. The $R_{2\%}/H_{m0}$ from Equation 5.6 has a minimum and maximum prediction values of 1.8 and 3.0, respectively.

$$\frac{R_{2\%}}{H_{m0}} = 0.8 \cot \alpha + 1.6$$

where:

$R_{2\%}$ = 2% wave runup using EurOtop equation 5.6 (2018)

$\cot \alpha$ = cotangent of the slope angle

At each transect, a simplified (single) slope was assumed to compute for the surf-similarity parameter ($\xi_{m-1,0}$) in EurOtop Eq. 5.2 and the slope angle ($\cot \alpha$) in EurOtop Eq. 5.6. The elevation profile where the slope was derived was generated using combined shore topography and bathymetry data. In addition to the slope derived from the combined topographic and bathymetric data, a sensitivity analysis was conducted to evaluate the uncertainty associated with the topographic and bathymetric data by increasing and decreasing the slope by 20% to assess its effect on the estimated wave runup.

7.2.2 Coastal Flood Levels with Wave Runup

Table 7-5 summarizes the community-scale TOMAWAC wave model outputs for each transect and the various AEPs. The resulting significant wave height and peak wave period at each transect were used to calculate wave runup (i.e. $R_{2\%}$) for each community using equations discussed in Section 7.2.1. Flood Hazard Level (FHL) was calculated as the sum of the Storm Surge Flood Level (Section 7.1) and $R_{2\%}$ corresponding to each AEP.

Table 7-5 Flood Hazard Level and Wave Runup for Various AEPs

Community	Transect	Slope (%)	1:10 Year				1:20 Year				1:50 Year				1:100 Year				1:200 Year				1:500 Year			
			Hs (m)	Tp (s)	R2% (m)	FHL (m CGVD2013)	Hs (m)	Tp (s)	R2% (m)	FHL (m CGVD2013)	Hs (m)	Tp (s)	R2% (m)	FHL (m CGVD2013)	Hs (m)	Tp (s)	R2% (m)	FHL (m CGVD2013)	Hs (m)	Tp (s)	R2% (m)	FHL (m CGVD2013)	Hs (m)	Tp (s)	R2% (m)	FHL (m CGVD2013)
Arviat	AR-1	29.01	0.63	9.5	2.29	4.85	0.63	9.8	2.31	4.97	0.68	9.8	2.50	5.28	0.68	10.5	2.46	5.32	0.70	10.5	2.58	5.52	0.74	10.5	2.71	5.75
	AR-2	11.66	0.63	9.5	1.82	4.38	0.64	9.8	1.88	4.55	0.69	9.8	1.96	4.74	0.69	10.5	2.19	5.05	0.72	10.5	2.27	5.21	0.75	10.5	2.18	5.22
	AR-3	5.15	1.10	9.5	1.06	3.62	1.13	9.8	1.10	3.77	1.20	9.8	1.14	3.92	1.22	10.5	1.22	4.08	1.25	10.5	1.24	4.18	1.29	10.5	1.27	4.31
	AR-4	9.82	1.38	9.6	2.28	4.84	1.44	9.9	2.38	5.05	1.51	9.8	2.44	5.22	1.55	10.5	2.64	5.50	1.59	10.5	2.68	5.62	1.64	10.5	2.72	5.76
Whale Cove	WC-1	13.73	1.02	10.8	3.24	5.80	1.09	11.5	3.49	6.16	1.17	11.5	3.71	6.52	1.24	11.7	3.77	6.62	1.29	11.7	3.77	6.76	1.38	12.3	4.07	7.18
	WC-2	6.35	1.45	10.8	1.69	4.25	1.55	11.5	1.87	4.54	1.64	11.5	1.93	4.74	1.73	11.7	2.01	4.91	1.80	11.7	2.05	5.04	1.91	12.2	2.21	5.32
	WC-3	2.63	1.52	10.7	0.72	3.28	1.60	11.5	0.79	3.46	1.67	11.5	0.81	3.62	1.75	11.7	0.84	3.74	1.81	11.7	0.85	3.84	1.90	12.3	0.92	4.03
	WC-4	4.41	0.56	9.8	0.66	3.23	0.59	10.3	0.72	3.39	0.62	10.3	0.73	3.54	0.64	10.5	0.76	3.66	0.66	10.5	0.77	3.76	0.68	10.6	0.79	3.90
	WC-5	3.26	0.69	10.7	0.60	3.16	0.72	11.4	0.65	3.32	0.78	11.4	0.68	3.49	0.81	11.7	0.71	3.61	0.85	11.7	0.72	3.71	0.90	12.1	0.77	3.88
Chesterfield Inlet	CI-1	4.56	2.20	8.7	1.21	4.04	2.28	9.0	1.28	4.22	2.35	9.0	1.30	4.37	2.40	9.0	1.32	4.48	2.48	9.6	1.42	4.67	2.54	9.6	1.44	4.80
	CI-2	4.30	1.79	8.7	1.03	3.86	1.86	9.0	1.09	4.03	1.92	9.0	1.11	4.18	1.96	9.0	1.12	4.28	2.01	9.6	1.21	4.46	2.06	9.6	1.22	4.58
	CI-3	4.06	1.86	8.7	0.99	3.82	1.93	9.0	1.04	3.98	1.99	9.0	1.06	4.13	2.03	9.0	1.07	4.23	2.08	9.6	1.16	4.41	2.13	9.6	1.17	4.53
	CI-4	22.33	1.86	8.7	5.44	8.27	1.92	8.9	5.70	8.64	1.99	8.9	5.80	8.87	2.03	8.9	5.87	9.03	2.08	9.6	6.63	9.88	2.13	9.6	6.77	10.13
	CI-5	6.31	1.91	8.7	1.56	4.39	1.98	8.9	1.64	4.58	2.05	8.9	1.67	4.74 (4.70)[1]	2.10	8.9	1.69	4.85 (4.70)[1]	2.16	9.6	1.83	5.08 (4.70)[1]	2.21	9.6	1.85	5.21 (4.70)[1]
	CI-6	15.00	1.40	8.6	3.15	5.98	1.43	8.9	3.28	6.22	1.51	8.9	3.37	6.44	1.57	8.9	3.43	6.59	1.59	9.5	3.71	6.96	1.65	9.5	3.79	7.15
	CI-7	4.03	1.49	8.6	0.87	3.70	1.52	8.8	0.91	3.85	1.60	8.8	0.93	4.00	1.66	8.8	0.95	4.11	1.68	9.5	1.02	4.27	1.75	9.5	1.04	4.40
Coral Harbour	CH-1	10.62	1.13	7.2	1.68	4.24	1.19	7.2	1.72	4.36	1.25	8.1	1.98	4.70	1.29	8.1	2.01	4.78	1.31	8.5	2.12	4.89	1.36	8.4	2.13	5.00
	CH-2	0.72	0.39	6.8	0.06	2.62	0.43	7.5	0.07	2.71	0.46	8.5	0.09	2.81	0.49	8.5	0.09	2.86	0.51	8.9	0.09	2.91	0.54	8.9	0.10	2.97
	CH-3	0.87	1.36	8.0	0.17	2.73	1.41	8.0	0.17	2.81	1.46	8.6	0.19	2.91	1.49	8.6	0.19	2.96	1.52	9.0	0.20	3.02	1.55	9.0	0.20	3.07
	CH-4	3.14	1.34	8.0	0.60	3.16	1.39	8.0	0.61	3.25	1.45	8.6	0.67	3.39	1.48	8.6	0.68	3.45	1.51	8.9	0.71	3.53	1.55	8.9	0.72	3.59
	CH-5	3.25	0.67	3.8	0.21	2.77	0.71	3.9	0.22	2.86	0.75	4.0	0.23	2.95	0.77	4.1	0.24	3.01	0.79	4.1	0.24	3.06	0.82	4.2	0.26	3.13

Notes: [1] The estimated FHL at CI-5 exceeds the crest elevation of 4.7 m. Therefore, the FHL has been limited to the crest elevation (4.7 m), as wave runup cannot extend landward beyond the crest and would instead result in overtopping.

7.2.3 Sensitivity Analysis of Wave Runup

A sensitivity analysis was conducted on the calculated $R_{2\%}$ values to evaluate the uncertainty associated with the slope derived from the combined topographic and bathymetric data. This analysis was performed by increasing and decreasing the calculated slope by 20%. Table 7-6 summarizes the results of the uncertainty analysis for each transect and AEP. A review of the results of the sensitivity analysis indicates the following:

- Arviat: A 20% increase in slope results in an increase in $R_{2\%}$ ranging from 1% to 20%, while a 20% reduction in slope results in a decrease in $R_{2\%}$ ranging from 2% to 25%.
- Whale Cove: A 20% increase in slope results in an increase in $R_{2\%}$ ranging from 4% to 20%, while a 20% reduction in slope results in a decrease in $R_{2\%}$ ranging from 20% to 24%.
- Chesterfield Inlet: A 20% increase in slope results in an increase in $R_{2\%}$ ranging from 4% to 20%, while a 20% reduction in slope results in a decrease in $R_{2\%}$ ranging from 20% to 24%.
- Coral Harbour: A 20% increase in slope results in a 20% increase in $R_{2\%,}$ while a 20% reduction in slope results in a 20% decrease in $R_{2\%.}$

Overall, the sensitivity analysis indicates a direct relationship between wave runup and slope. Increasing the slope results in higher $R_{2\%}$ values, while decreasing the slope results in lower $R_{2\%}$ values; therefore, slope is a sensitive input for wave runup calculations.

Table 7-6 Sensitivity of $R_{2\%}$ to 20% Change to the Slope for Various AEPs

Community	Transect	1:10 Year					1:20 Year					1:50 Year					1:100 Year					1:200 Year					1:500 Year				
		0%	+20 %	Diff. (%)	-20 %	Diff. (%)	0%	+20 %	Diff. (%)	-20%	Diff. (%)	0%	+20 %	Diff. (%)	-20%	Diff. (%)	0%	+20 %	Diff. (%)	-20%	Diff. (%)	0%	+20 %	Diff. (%)	-20%	Diff. (%)	0%	+20 %	Diff. (%)	-20%	Diff. (%)
Arviat	AR-1	2.29	2.33	2.0	2.24	-2.0	2.31	2.34	2.0	2.25	-2.0	2.5	2.54	2.0	2.44	-2.0	2.46	2.49	1.0	2.4	-2.0	2.58	2.61	2.0	2.52	-2.0	2.71	2.75	2.0	2.65	-2.0
	AR-2	1.82	2.07	14.0	1.46	-20.0	1.88	2.12	12.0	1.51	-20.0	1.96	2.27	16.0	1.57	-20.0	2.19	2.29	4.0	1.67	-24.0	2.27	2.37	4.0	1.71	-25.0	2.18	2.48	13.0	1.75	-20.0
	AR-3	1.06	1.27	20.0	0.85	-20.0	1.1	1.33	20.0	0.88	-20.0	1.14	1.36	20.0	0.91	-20.0	1.22	1.47	20.0	0.98	-20.0	1.24	1.49	20.0	0.99	-20.0	1.27	1.52	20.0	1.01	-20.0
	AR-4	2.28	2.73	20.0	1.82	-20.0	2.38	2.86	20.0	1.9	-20.0	2.44	2.93	20.0	1.95	-20.0	2.64	3.17	20.0	2.11	-20.0	2.68	3.21	20.0	2.14	-20.0	2.72	3.27	20.0	2.18	-20.0
Whale Cove	WC-1	3.24	3.38	4.0	2.46	-24.0	3.49	3.64	4.0	2.72	-22.0	3.71	3.87	4.0	2.82	-24.0	3.77	4.26	13.0	3.02	-20.0	3.77	4.26	13.0	3.02	-20.0	4.07	4.54	12.0	3.26	-20.0
	WC-2	1.69	2.03	20.0	1.35	-20.0	1.87	2.24	20.0	1.5	-20.0	1.93	2.31	20.0	1.54	-20.0	2.01	2.42	20.0	1.61	-20.0	2.05	2.47	20.0	1.64	-20.0	2.21	2.65	20.0	1.77	-20.0
	WC-3	0.72	0.86	20.0	0.57	-20.0	0.79	0.94	20.0	0.63	-20.0	0.81	0.97	20.0	0.64	-20.0	0.84	1.01	20.0	0.67	-20.0	0.85	1.02	20.0	0.68	-20.0	0.92	1.1	20.0	0.73	-20.0
	WC-4	0.66	0.8	20.0	0.53	-20.0	0.72	0.86	20.0	0.57	-20.0	0.73	0.88	20.0	0.59	-20.0	0.76	0.91	20.0	0.61	-20.0	0.77	0.93	20.0	0.62	-20.0	0.79	0.95	20.0	0.64	-20.0
	WC-5	0.6	0.72	20.0	0.48	-20.0	0.65	0.78	20.0	0.52	-20.0	0.68	0.81	20.0	0.54	-20.0	0.71	0.85	20.0	0.56	-20.0	0.72	0.87	20.0	0.58	-20.0	0.77	0.93	20.0	0.62	-20.0
Chesterfield Inlet	CI-1	1.21	1.46	20.0	0.97	-20.0	1.28	1.54	20.0	1.03	-20.0	1.3	1.56	20.0	1.04	-20.0	1.32	1.58	20.0	1.05	-20.0	1.42	1.71	20.0	1.14	-20.0	1.44	1.73	20.0	1.15	-20.0
	CI-2	1.03	1.24	20.0	0.83	-20.0	1.09	1.31	20.0	0.87	-20.0	1.11	1.33	20.0	0.88	-20.0	1.12	1.34	20.0	0.89	-20.0	1.21	1.45	20.0	0.96	-20.0	1.22	1.46	20.0	0.98	-20.0
	CI-3	0.99	1.19	20.0	0.79	-20.0	1.04	1.25	20.0	0.83	-20.0	1.06	1.27	20.0	0.85	-20.0	1.07	1.29	20.0	0.86	-20.0	1.16	1.39	20.0	0.92	-20.0	1.17	1.4	20.0	0.94	-20.0
	CI-4	5.44	6.13	13.0	4.35	-20.0	5.7	6.35	11.0	4.56	-20.0	5.8	6.54	13.0	4.64	-20.0	5.87	6.67	14.0	4.69	-20.0	6.63	6.91	4.0	5.07	-23.0	6.77	7.06	4.0	5.14	-24.0
	CI-5	1.56	1.87	20.0	1.25	-20.0	1.64	1.96	20.0	1.31	-20.0	1.67	2	20.0	1.33	-20.0	1.69	2.02	20.0	1.35	-20.0	1.83	2.19	20.0	1.46	-20.0	1.85	2.22	20.0	1.48	-20.0
	CI-6	3.15	3.78	20.0	2.52	-20.0	3.28	3.93	20.0	2.62	-20.0	3.37	4.04	20.0	2.7	-20.0	3.43	4.12	20.0	2.75	-20.0	3.71	4.46	20.0	2.97	-20.0	3.79	4.55	20.0	3.03	-20.0
	CI-7	0.87	1.05	20.0	0.7	-20.0	0.91	1.09	20.0	0.72	-20.0	0.93	1.12	20.0	0.74	-20.0	0.95	1.14	20.0	0.76	-20.0	1.02	1.23	20.0	0.82	-20.0	1.04	1.25	20.0	0.84	-20.0
Coral Harbour	CH-1	1.68	2.02	20.0	1.35	-20.0	1.72	2.06	20.0	1.37	-20.0	1.98	2.37	20.0	1.58	-20.0	2.01	2.42	20.0	1.61	-20.0	2.12	2.55	20.0	1.7	-20.0	2.13	2.56	20.0	1.71	-20.0
	CH-2	0.06	0.08	20.0	0.05	-20.0	0.07	0.09	20.0	0.06	-20.0	0.09	0.1	20.0	0.07	-20.0	0.09	0.11	20.0	0.07	-20.0	0.09	0.11	20.0	0.08	-20.0	0.1	0.12	20.0	0.08	-20.0
	CH-3	0.17	0.2	20.0	0.13	-20.0	0.17	0.21	20.0	0.14	-20.0	0.19	0.22	20.0	0.15	-20.0	0.19	0.23	20.0	0.15	-20.0	0.2	0.24	20.0	0.16	-20.0	0.2	0.24	20.0	0.16	-20.0
	CH-4	0.6	0.72	20.0	0.48	-20.0	0.61	0.73	20.0	0.49	-20.0	0.67	0.8	20.0	0.54	-20.0	0.68	0.81	20.0	0.54	-20.0	0.71	0.85	20.0	0.57	-20.0	0.72	0.86	20.0	0.57	-20.0
	CH-5	0.21	0.25	20.0	0.17	-20.0	0.22	0.27	20.0	0.18	-20.0	0.23	0.28	20.0	0.19	-20.0	0.24	0.29	20.0	0.19	-20.0	0.24	0.29	20.0	0.2	-20.0	0.26	0.31	20.0	0.2	-20.0

7.3 Flood Hazard Extent

This section provides a brief description of flood risk areas for each community under varying AEPs and current climate scenario as observed from the coastal flood hazard maps provided in Appendix D. The spatial plots are mapped in NAD 1983 UTM Zone 5 coordinate system, with the Storm Surge Flood Level and FHL referenced to CGVD2013 vertical datum. The flood hazard extent (i.e., the combined effects of storm surge and wave action) was delineated by interpolating the FHL between adjacent transects.

The flooded areas described herein extend from the existing shoreline to the Flood Hazard Level extent. Roads, buildings and other infrastructure affected by the 1:10, 1:20, 1:50, 1:100, 1:200, and 1:500 AEP scenarios under current climate scenario were identified and described qualitatively in this study. Any quantification of affected buildings and facilities is based solely on preliminary flood assessments using available satellite imagery, and is intended to support comparative discussions on flood severity across increasing AEPs.

7.4 Arviat

The following summarizes flood hazard extent for Arviat for each AEP:

- 1:10 AEP: Flood Hazard Level within Arviat varies between 3.62 m CGVD2013 and 4.85 m CGVD2013. The 1:10 AEP flood extent is generally limited to low-lying coastal areas immediately adjacent to the shoreline. Flooding is primarily confined to undeveloped coastal land, with only localized encroachment onto shoreline roads and infrastructure situated at lower elevations. Most developed areas and buildings remain protected by the higher ground located landward of the shoreline.
- 1:20 AEP: Flood Hazard Level within Arviat varies between 3.77 m CGVD2013 and 5.05 m CGVD2013. The 1:20 AEP flood extent is generally limited to low-lying coastal areas immediately adjacent to the shoreline. Flooding is primarily confined to undeveloped coastal land, with only localized encroachment onto shoreline roads and infrastructure situated at lower elevations. Most developed areas and buildings remain protected by the higher ground located landward of the shoreline.
- 1:50 AEP: Flood Hazard Level within Arviat varies between 3.92 m CGVD2013 and 5.28 m CGVD2013. Buildings between the AR-2 and AR-3 transects are partially susceptible to flooding during the 1:50 AEP event. In the remaining areas, flooding is primarily confined to undeveloped coastal land, with only localized encroachment onto shoreline roads and infrastructure located at lower elevations.
- 1:100 AEP: Flood Hazard Level within Arviat varies between 4.08 m CGVD2013 and 5.50 m CGVD2013. Buildings between the AR-2 and AR-4 transects are partially susceptible to flooding during the 1:100 AEP event. In the remaining areas, flooding is primarily confined to undeveloped coastal land, with only localized encroachment onto shoreline roads and infrastructure located at lower elevations.

- 1:200 AEP: Flood Hazard Level within Arviat varies between 4.18 m CGVD2013 and 5.62 m CGVD2013. Buildings between the AR-2 and AR-4 transects are partially susceptible to flooding during the 1:200 AEP event with one building completely in the flood extent east of 1st Avenue. In the remaining areas, flooding is primarily confined to undeveloped coastal land, with only localized encroachment onto shoreline roads and infrastructure located at lower elevations.

- 1:500 AEP: Flood Hazard Level within Arviat varies between 4.31 m CGVD2013 and 5.76 m CGVD2013. The 1:500 AEP event represents an extreme coastal flooding scenario. Flooding extends beyond the immediate shoreline and affects a greater extent of low-lying coastal lands relative to more frequent events. Areas of community infrastructure, roads, and developed lands located along the coast are vulnerable to inundation where ground elevations are below the mapped flood hazard level. Buildings along the coast between the AR-2 and AR-4 transects are partially susceptible to flooding during the 1:500 AEP event, with a few buildings east of 1st Avenue becoming completely inundated.

7.5 Whale Cove

The following summarizes flood hazard extent for Whale Cove for each AEP:

- 1:10 AEP: Flood Hazard Level within Whale Cove varies between 3.16 m CGVD2013 and 5.80 m CGVD2013. The 1:10 AEP flood extent affects portions of the low-lying coastal fringe and may locally intersect shoreline roads and nearby developed areas where ground elevations are relatively low. However, the majority of community infrastructure and buildings are situated above the mapped 10-year flood extent. Roads along the shoreline between transects WC-1 and WC-4 are partially impacted during this event, with the most vulnerable areas located near transect WC-5.

- 1:20 AEP: Flood Hazard Level within Whale Cove varies between 3.32 m CGVD2013 and 6.16 m CGVD2013. Roads along the shoreline between transects WC-1 and WC-4 are partially impacted during this event, while areas located near transect WC-5 are inundated.

- 1:50 AEP: Flood Hazard Level within Whale Cove varies between 3.49 m CGVD2013 and 6.52 m CGVD2013. Roads along the shoreline between transects WC-1 and WC-4 are partially impacted during this event, while areas located near transect WC-5 are inundated. In addition, buildings along the shoreline between transects WC-2 and WC-3 are inundated during this event.

- 1:100 AEP: Flood Hazard Level within Whale Cove varies between 3.61 m CGVD2013 and 6.62 m CGVD2013. Roads and buildings along the shoreline between transect WC-1 and WC-4 are inundated during this event as well as areas near transect WC-5.

- 1:200 AEP: Flood Hazard Level within Whale Cove varies between 3.71 m CGVD2013 and 6.76 m CGVD2013. The extent of flooding is similar to the 1:100 AEP event, with increased flood depths affecting roads, buildings, and low-lying areas along the shoreline between transects WC-1 and WC-4 and near transect WC-5.

- 1:500 AEP: Flood Hazard Level within Whale Cove varies between 3.88 m CGVD2013 and 7.18 m CGVD2013. The flood extent remains generally similar to the 1:200 AEP event, with higher flood depths increasing the severity of inundation along the shoreline between transects WC-1 and WC-4 and in low-lying areas near transect WC-5.

7.6 Chesterfield Inlet

The following summarizes flood hazard extent for Chesterfield Inlet for each AEP:

- 1:10 AEP: Flood Hazard Level within Chesterfield Inlet varies between 3.70 m CGVD2013 and 8.27 m CGVD2013. The 1:10 AEP flood extent affects several low-lying coastal areas adjacent to the shoreline and harbour frontage. Inundation extends beyond the immediate coastal fringe in locations where relatively flat terrain provides pathways for inland flood propagation. As a result, portions of local roads, shoreline infrastructure, and some developed areas located nearest the coast may be susceptible to flooding during the 10-year event. Higher elevations further inland generally limit the overall extent of inundation. Buildings between transects CI-2 and CI-3, east of the road, and south of the road along transect CI-4 are inundated during this event.

- 1:20 AEP: Flood Hazard Level within Chesterfield Inlet varies between 3.85 m CGVD2013 and 8.64 m CGVD2013. The 1:20 AEP flood extent is similar to the 1:10 AEP event but expands slightly within low-lying coastal areas. Flooding affects developed lands between transects CI-2 and CI-3, including buildings east of the road. Additional inundations occur in the low-lying area east of the road near CI-4, with flooding also extending to developed areas south of the road along transect CI-4. Higher ground inland generally limits further flood propagation.

- 1:50 AEP: Flood Hazard Level within Chesterfield Inlet varies between 4.00 m CGVD2013 and 8.87 m CGVD2013. The 1:50 AEP flood extent expands further into low-lying coastal areas compared to the 1:20 AEP event. Flooding affects developed lands between transects CI-2 and CI-3, including buildings east of the road, while inundation extends more extensively into the low-lying area east of the road near CI-4. Flooding also affects developed areas south of the road along transect CI-4, with a greater extent of inundation in localized depressions adjacent to the shoreline.

- 1:100 AEP: Flood Hazard Level within Chesterfield Inlet varies between 4.11 m CGVD2013 and 9.03 m CGVD2013. Flooding extends further into low-lying coastal areas compared to the 1:50 AEP event. Buildings between transects CI-2 and CI-3 east of the road remain inundated, while flooding expands within the low-lying area east of the road near CI-4. Additional flooding occurs south of the road along transect CI-4, affecting a larger portion of the developed low-lying lands adjacent to the shoreline.

- 1:200 AEP: Flood Hazard Level within Chesterfield Inlet varies between 4.27 m CGVD2013 and 9.88 m CGVD2013. Flooding affects low-lying coastal areas throughout the community, including developed lands between transects CI-2 and CI-3 east of the road. Inundation also extends into the low-lying area east of the road near CI-4 and affects developed lands south of the road along

CI-4. Compared to more frequent events, flooding covers a larger portion of the low-lying coastal terrain adjacent to the shoreline.

- 1:500 AEP: Flood Hazard Level within Chesterfield Inlet varies between 4.40 m CGVD2013 and 10.13 m CGVD2013. Flooding affects extensive low-lying coastal areas throughout the community, including developed lands between transects CI-2 and CI-3 east of the road. Inundation expands further within the low-lying area near CI-4, affecting lands both east and south of the road and covering a larger portion of the developed shoreline area compared to more frequent events.

7.7 Coral Harbour

The following summarizes flood hazard extent for Coral Harbour for each AEP:

- 1:10 AEP: Flood Hazard Level within Coral Harbour varies between 2.62 m CGVD2013 and 4.24 m CGVD2013. The 1:10 AEP flood extent is concentrated along low-lying coastal areas and shallow depressions near the shoreline. Portions of coastal access roads and infrastructure adjacent to the coast may be affected during the 10-year event, while the majority of the community remains outside the mapped flood extent. The most vulnerable areas are located between the CH-2 and CH-3 transects, where the low-elevation beach and boat launch area are partially inundated. Buildings southwest of the community are also partially susceptible to flooding, with the southeasternmost building becoming inundated during this event.
- 1:20 AEP: Flood Hazard Level within Coral Harbour varies between 2.71 m CGVD2013 and 4.36 m CGVD2013. The most vulnerable areas are located between the CH-2 and CH-3 transects, where the low-elevation beach and boat launch area are partially inundated. Buildings southwest of the community are also partially susceptible to flooding, with the southeasternmost building becoming inundated during this event.
- 1:50 AEP: Flood Hazard Level within Coral Harbour varies between 2.81 m CGVD2013 and 4.70 m CGVD2013. The most vulnerable areas are located between the CH-1 and CH-3 transects, where the low-elevation beach and boat launch area are inundated. Buildings south of the Coral Harbour Airport Road and southwest and south of the community are also partially susceptible to flooding, with the southeasternmost building becoming inundated during this event.
- 1:100 AEP: Flood Hazard Level within Coral Harbour varies between 2.86 m CGVD2013 and 4.78 m CGVD2013. The most vulnerable areas are located between the CH-1 and CH-3 transects, where the low-elevation beach, boat launch area, and adjacent coastal lands are inundated. Flooding expands within the low-lying area south of Coral Harbour Airport Road, while buildings southwest and south of the community become increasingly susceptible to flooding. Additional inundations occur around the shoreline margins and localized coastal depressions.
- 1:200 AEP: Flood Hazard Level within Coral Harbour varies between 2.91 m CGVD2013 and 4.89 m CGVD2013. Flooding continues to expand within the boat launch and lagoon area between the CH-1 and CH-3 transects. The low-lying area south of Coral Harbour Airport Road

experiences more extensive inundation, and flooding affects a larger portion of the developed lands southwest and south of the community. Most of the community core remains at elevations above the mapped flood extent.

- 1:500 AEP: Flood Hazard Level within Coral Harbour varies between 2.97 m CGVD2013 and 5.00 m CGVD2013. Extensive flooding occurs within the low-lying coastal areas between the CH-1 and CH-3 transects, including the beach, boat launch, lagoon, and adjacent coastal lands. Flooding expands further south of Coral Harbour Airport Road and affects a larger portion of the low-lying developed area southwest of the community. While flood extents increase relative to more frequent events, inundation remains largely confined to low-elevation coastal terrain and localized depressions.

8 Limitations and Assumptions

The contents of this report are subject to the following limitations and assumptions:

- Flood extents are based on available topographic data and are subject to the accuracy and resolution of the underlying DTM.
- Local topographic features smaller than the DTM resolution (e.g., drainage ditches, berms, small embankments, building pads, and local depressions) may not be fully represented.
- Flood hazard levels were derived using a series of representative 1D transects and may not fully capture complex 2D flood pathways.
- Wave runup calculations are based on representative transect profiles and may not reflect localized shoreline irregularities between transects.
- Shoreline morphology and beach conditions were assumed to remain unchanged during storm events and future erosion was not considered.
- Flood extents do not account for debris accumulation, ice effects, drainage system performance, or blockage of flow paths.
- Localized wave transformation processes associated with small-scale coastal features, structures, and nearshore bathymetric variability may not be fully resolved.
- The analysis assumes static ground elevations and does not account for future landform changes, development, or infrastructure modifications.
- Building-scale flood impacts were not assessed; flood mapping is intended for community-level planning and screening purposes.
- Flood hazard levels and extents are subject to uncertainty associated with water level analyses, wave modelling, climate projections, topographic datasets, and model assumptions.

9 Conclusions and Recommendations

A regional coastal flood hazard assessment was completed for the Nunavut communities of Arviat, Whale Cove, Chesterfield Inlet, and Coral Harbour. The assessment evaluated coastal flooding associated with extreme water levels and wave conditions for different AEP events ranging from 1:10 to 1:500, and produced community-scale coastal flood hazard maps to support land-use planning, infrastructure management, emergency preparedness, and climate adaptation initiatives.

The assessment employed a nested modelling framework linking long-term regional wave and storm surge hindcasts to higher-resolution community-scale wave transformation analyses, empirical wave runup calculations, and GIS-based flood mapping. An 86-year regional wave hindcast model and an 86-year regional hydrodynamic model were developed to characterize offshore wave conditions and storm surge residuals throughout Hudson Bay. These datasets were used to derive stillwater level, wave heights, and wave periods for each project community.

Higher-resolution wave transformation modelling was completed for each community to evaluate nearshore wave conditions and their interaction with local bathymetry and shoreline characteristics. Representative shore-normal transects were established based on shoreline morphology, exposure conditions, and development patterns. Nearshore wave parameters extracted along these transects were used to estimate wave runup using EurOtop (2018) methodologies, and the resulting flood hazard elevations were mapped using available topographic data within a GIS environment.

The resulting flood hazard maps identify areas susceptible to coastal inundation under a range of different return period events and provide a regional dataset for the four study communities. In addition to supporting the current project, the regional wave and storm surge hindcasts developed as part of this study provide a transferable framework that can be applied to future coastal flood hazard assessments in other Nunavut communities.

The following activities are recommended to improve future coastal flood hazard assessments and support long-term resilience planning:

- Acquisition of higher-resolution topographic and bathymetric datasets in areas of interest, and resolving datum conversion uncertainties.
- Collection of long-term shoreline aerial imagery, water level, wave, wind, and sea ice observations to improve understanding of coastal processes.
- Community-specific shoreline erosion and shoreline change assessments.
- Detailed flood hazard assessments for critical infrastructure and high-risk assets.
- Periodic updates to flood hazard mapping as new datasets and improved climate information become available.

- Expansion of the regional modelling framework to additional Nunavut communities.
- Development of a centralized coastal hazard information system to support ongoing planning, emergency management, and adaptation activities.

The flood hazard maps developed for this study are intended to support community-level planning, screening, and development review. They can be used to identify areas where proposed development, infrastructure, or land-use changes may warrant additional site-specific assessment. Where development is proposed within or adjacent to mapped flood hazard areas, planning criteria should identify when more detailed coastal flooding, drainage, erosion, or geotechnical assessment is required. Over the longer term, the coastal flood mapping should be integrated with other relevant hazards, including overland, riverine, ice-jam, drainage, and locally identified flood mechanisms, to support more comprehensive land-use planning and development regulation.

10 Acknowledgements

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- **Community Engagement:** The project team gratefully acknowledges the contributions of community members whose knowledge and feedback informed the coastal flood mapping study.
- **Vertical Elevation Datum Conversion:** The project team acknowledges Fisheries and Oceans Canada (DFO) for providing the transformation information used to convert bathymetric elevations from Chart Datum to CGVD2013.

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Appendix A Community Outreach Discussion Point Location Maps



DRAFT

Title

Arviat

Client/Project

Government of Nunavut
Nunavut Regional Coastal Flood Mapping

Project Location

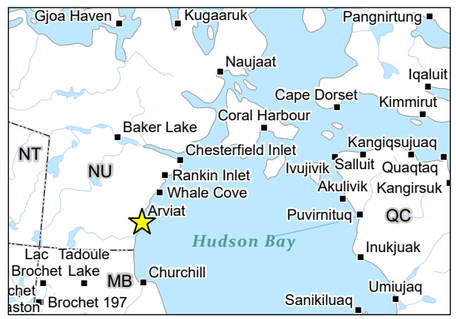
Nunavut - Arviat

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1:50,000

- Community Engagement Point
- Road
- Topographic Contour



Notes

1. Coordinate System: NAD83(CSRS)v7 UTM Zone 17N
2. Data Sources: CANVEC
3. Background: ESRI World Imagery

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DRAFT

Title

Whale Cove

Client/Project

Government of Nunavut
Nunavut Regional Coastal Flood Mapping

Project Location

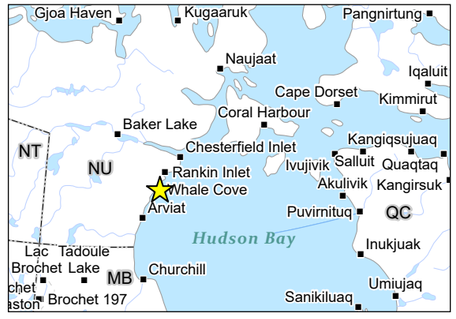
Nunavut - Whale Cove

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1:12,500

- Community Engagement Point
- Road
- Topographic Contour



Notes

1. Coordinate System: NAD83(CSRS)v7 UTM Zone 17N
2. Data Sources: CANVEC
3. Background: ESRI World Imagery

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DRAFT

Title

Chesterfield Inlet

Client/Project

Government of Nunavut
Nunavut Regional Coastal Flood Mapping

Project Location

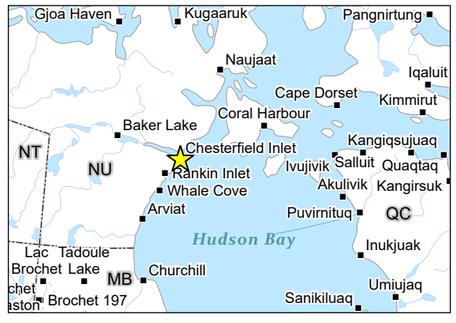
Nunavut - Chesterfield Inlet

N

0 200 Meters

(At original document size of 11x17)
1:10,000

Community Engagement Point
Road
Topographic Contour



Notes

1. Coordinate System: NAD83(CSRS)v7 UTM Zone 17N
2. Data Sources: CANVEC
3. Background: ESRI World Imagery

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DRAFT

Title

Coral Harbour

Client/Project

Government of Nunavut
Nunavut Regional Coastal Flood Mapping

Project Location

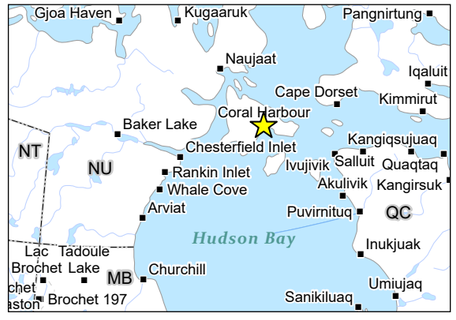
Nunavut - Coral Harbour

N

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(At original document size of 11x17)
1:25,000

- Community Engagement Point
- Road
- Topographic Contour



Notes

1. Coordinate System: NAD83(CSRS)v7 UTM Zone 17N
2. Data Sources: CANVEC
3. Background: ESRI World Imagery

NUNAMI
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U:\169051\09\51868\05_report_deliv\drawings_design\gis_mxd\20260805_Community_Engagement_Maps\fig_169051868_community_engagement.aprx Revised: 2026-08-06 By: jpoucher

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Appendix B Topography and Bathymetry Extents

Figure B.1 Available LiDAR coverage at Arviat

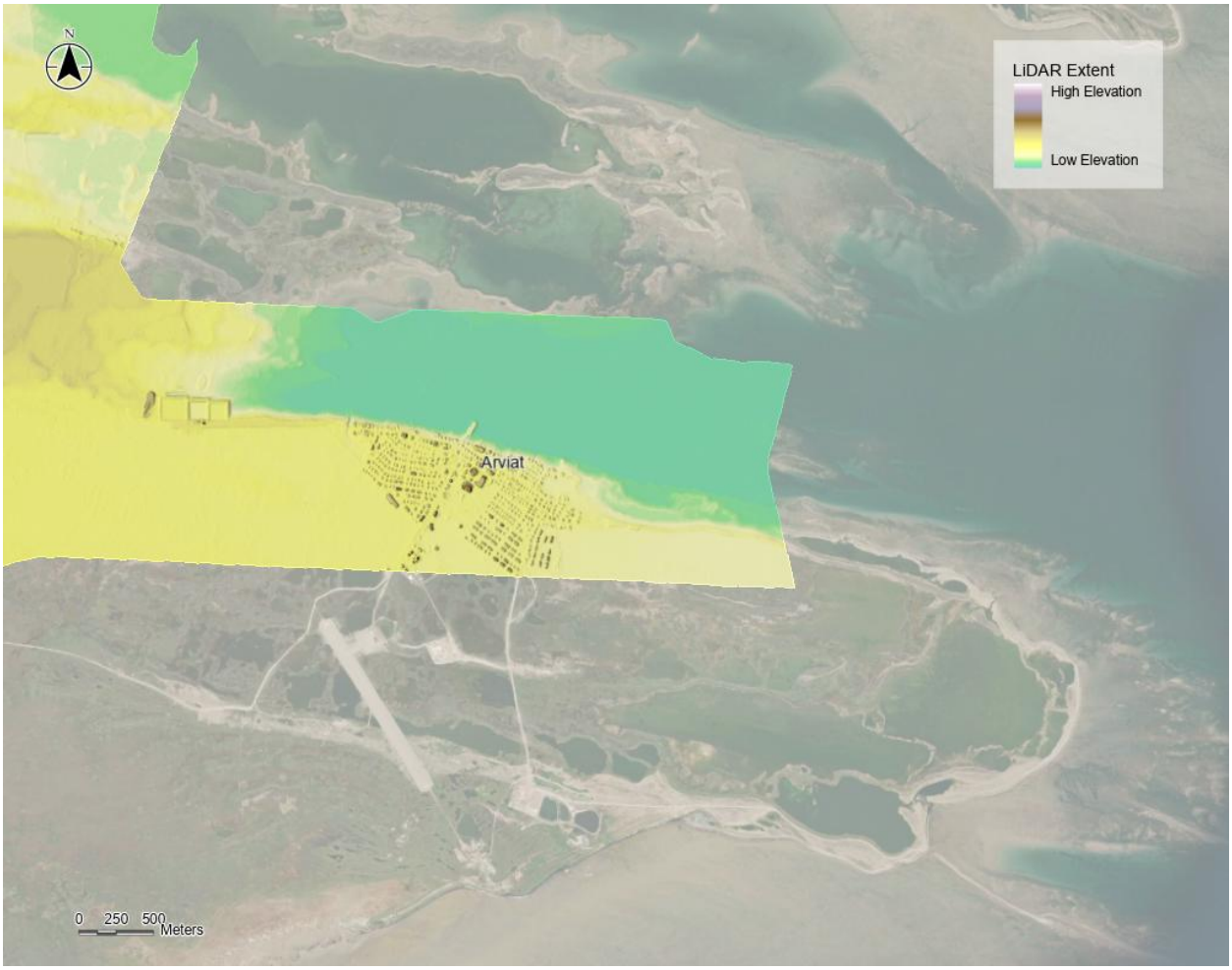


Figure B.2 Supplementary satellite-derived elevation coverage at Arviat

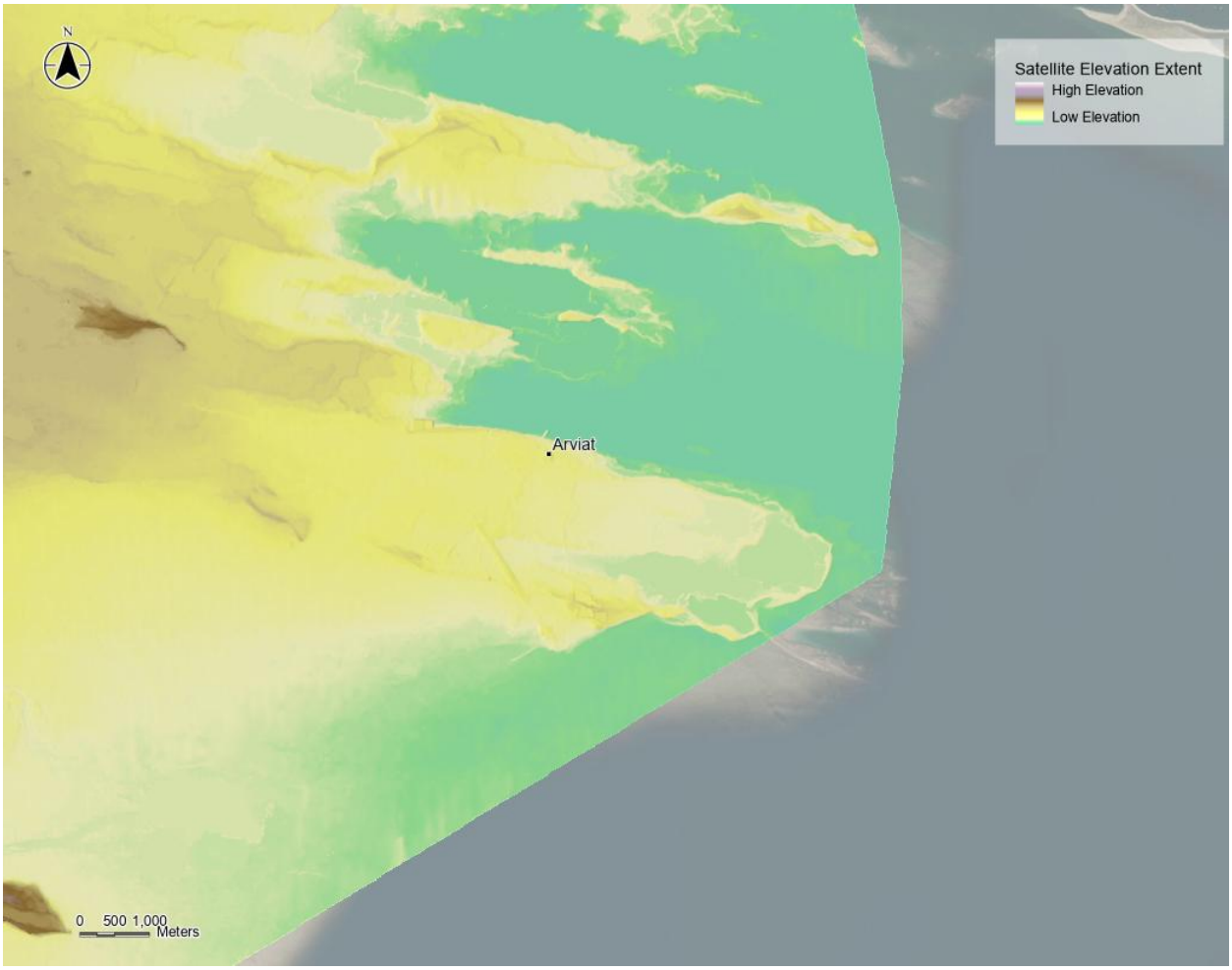


Figure B.3 Available LiDAR coverage at Whale Cove

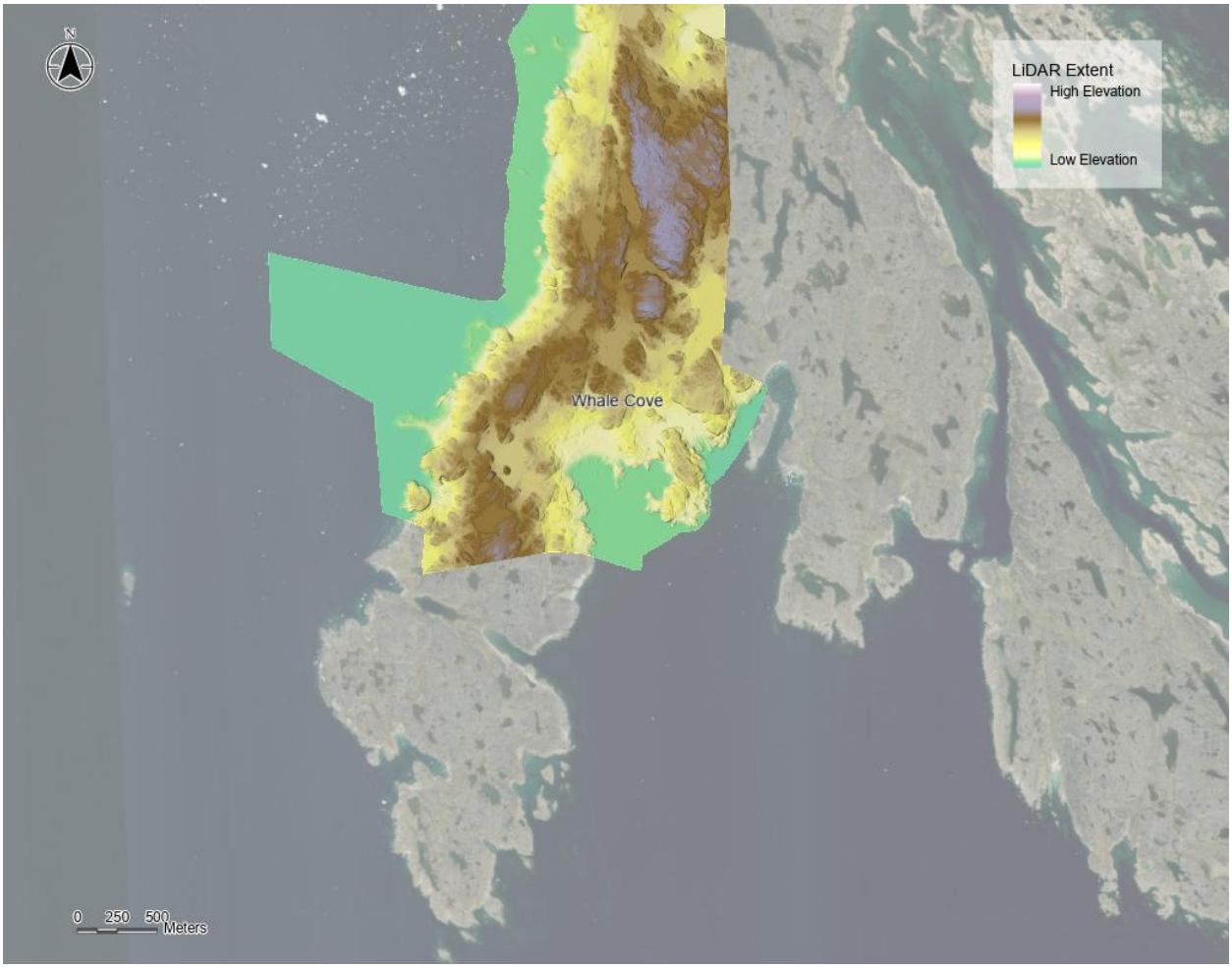


Figure B.4 Supplementary LiDAR coverage near Whale Cove Airport

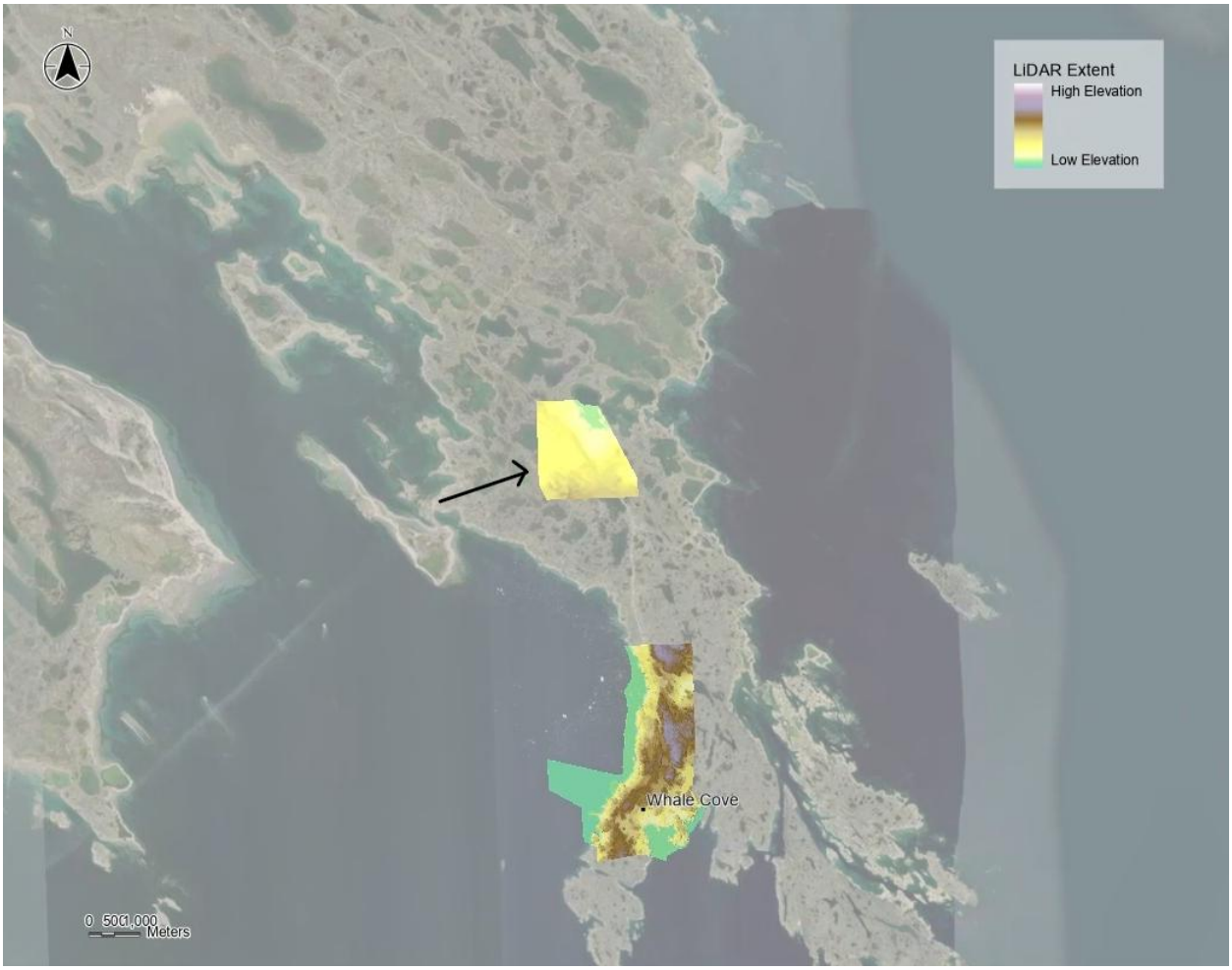


Figure B.5 Available LiDAR coverage at Chesterfield Inlet

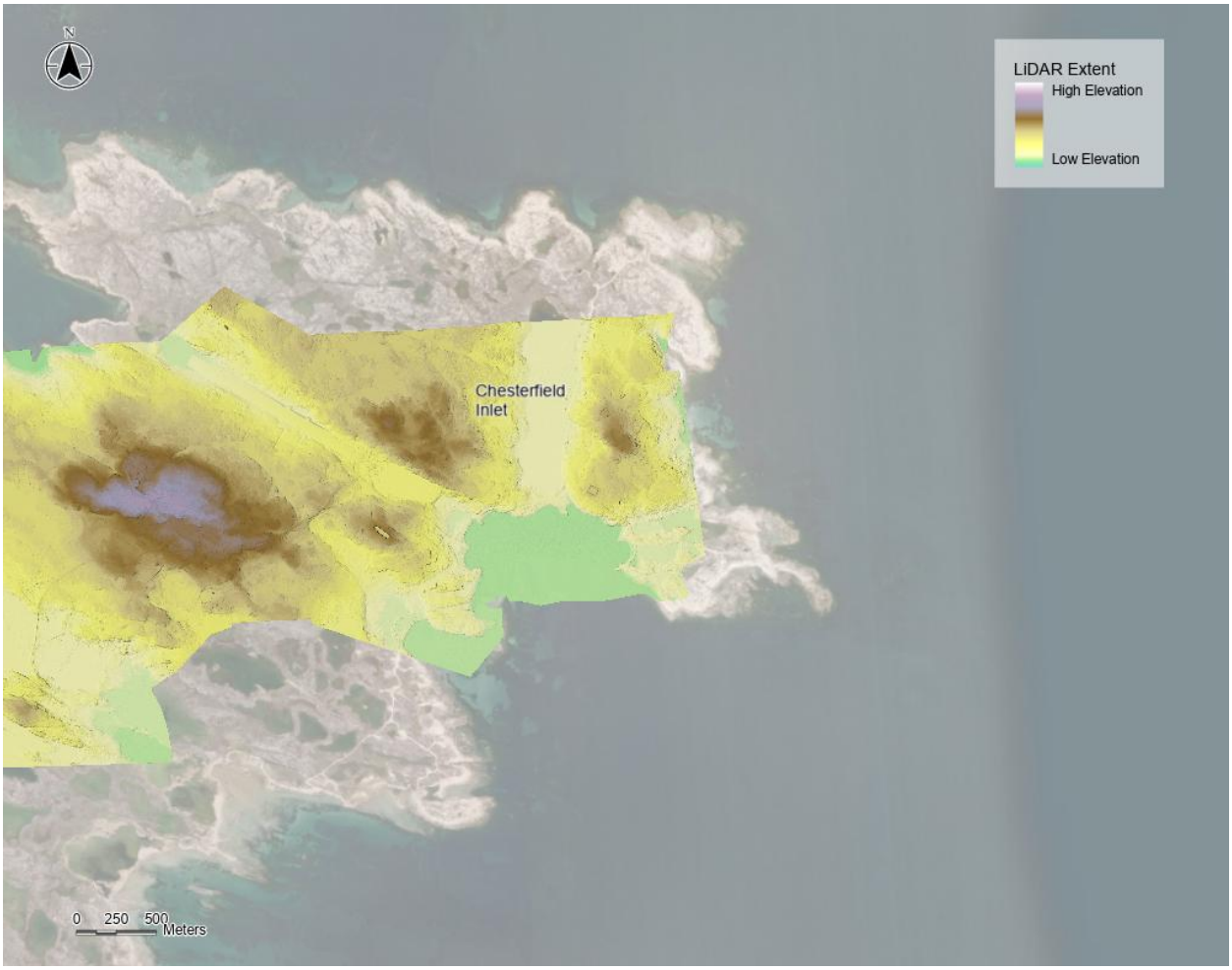


Figure B.6 Available terrestrial elevation coverage at Coral Harbour

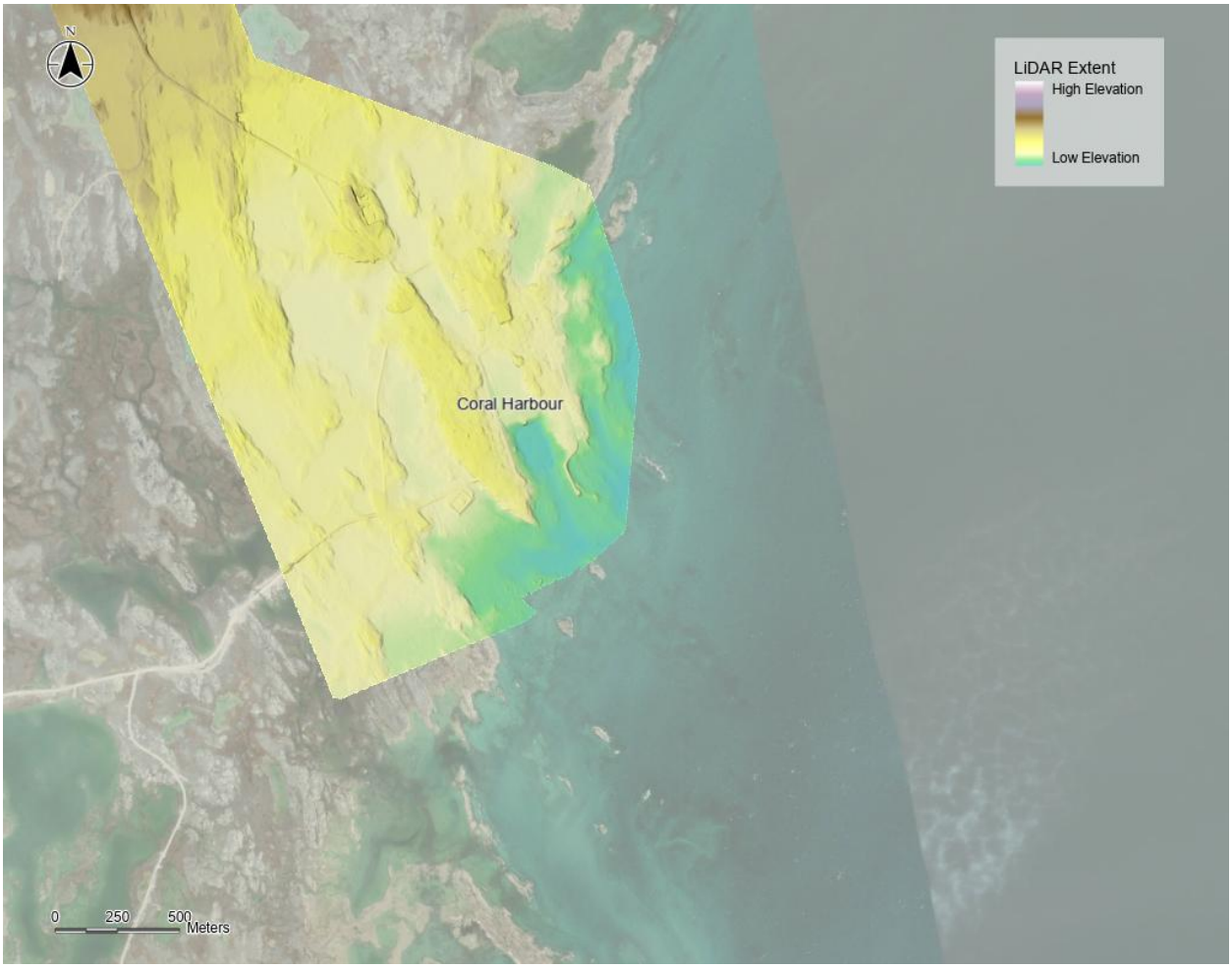


Figure B.7 Supplementary satellite-derived elevation coverage at Coral Harbour.

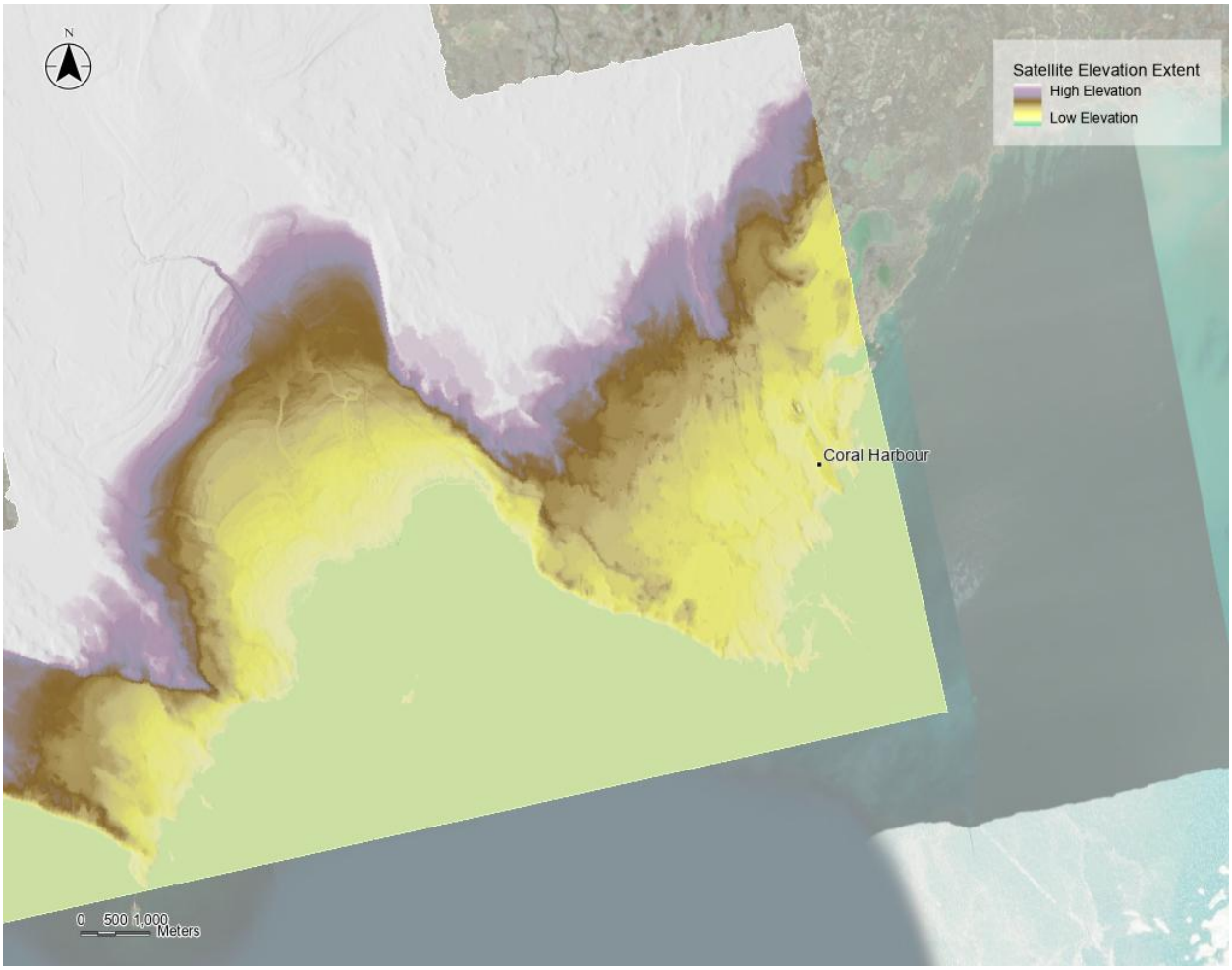


Figure B.8 CHS NONNA10 bathymetric coverage at Arviat.

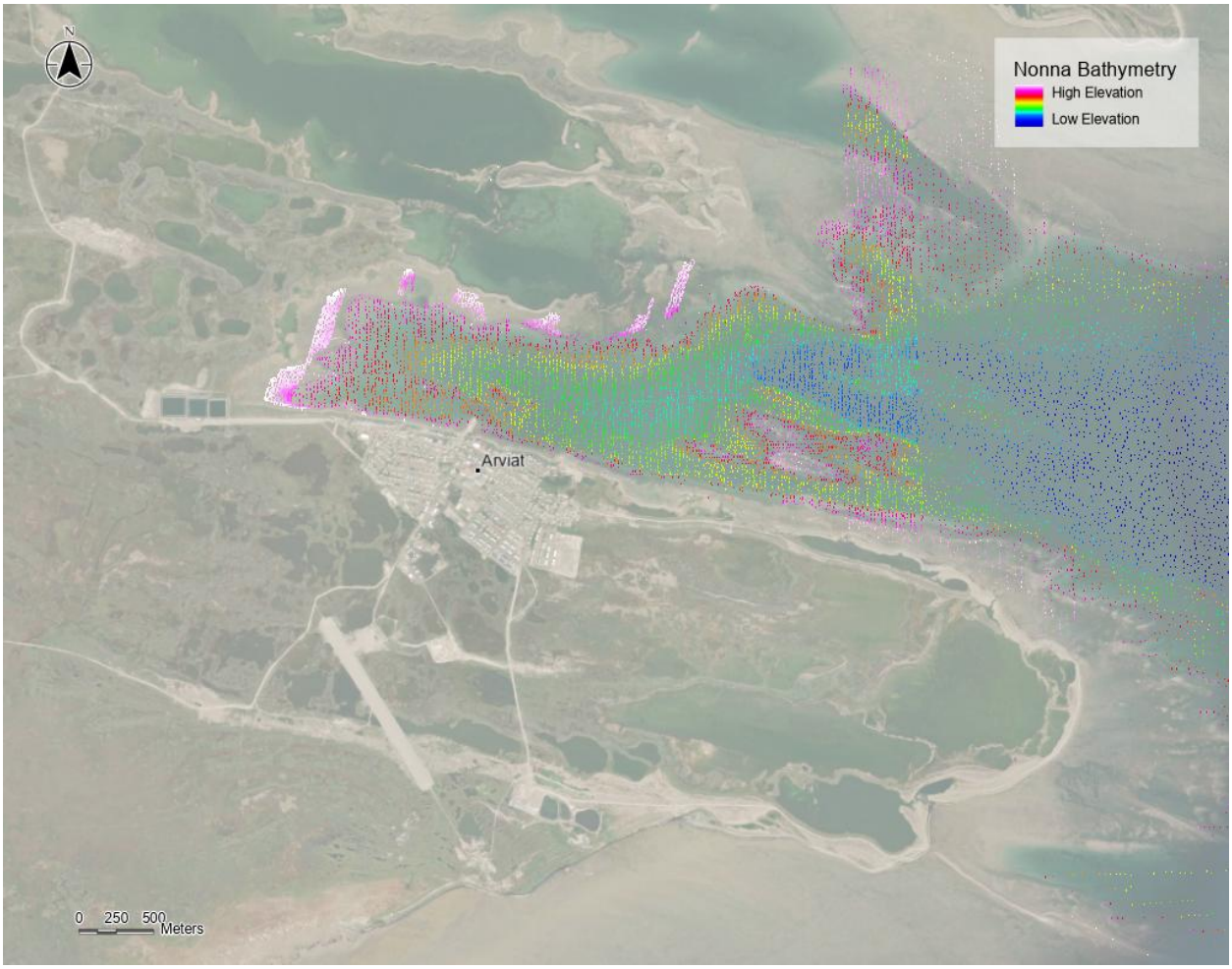


Figure B.9 CHS NONNA10 bathymetric coverage at Whale Cove.

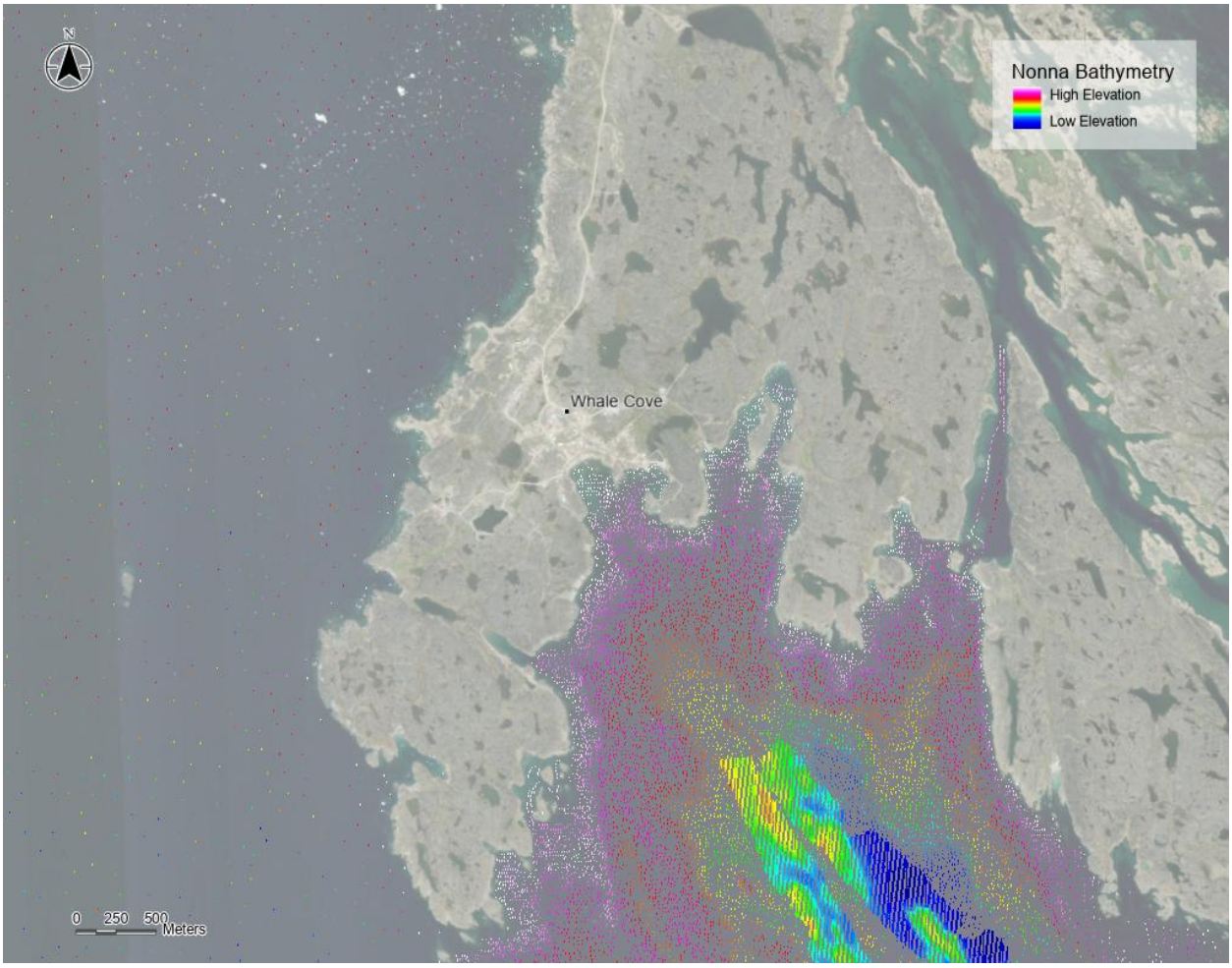


Figure B.10 CHS NONNA10 bathymetric coverage at Chesterfield Inlet.

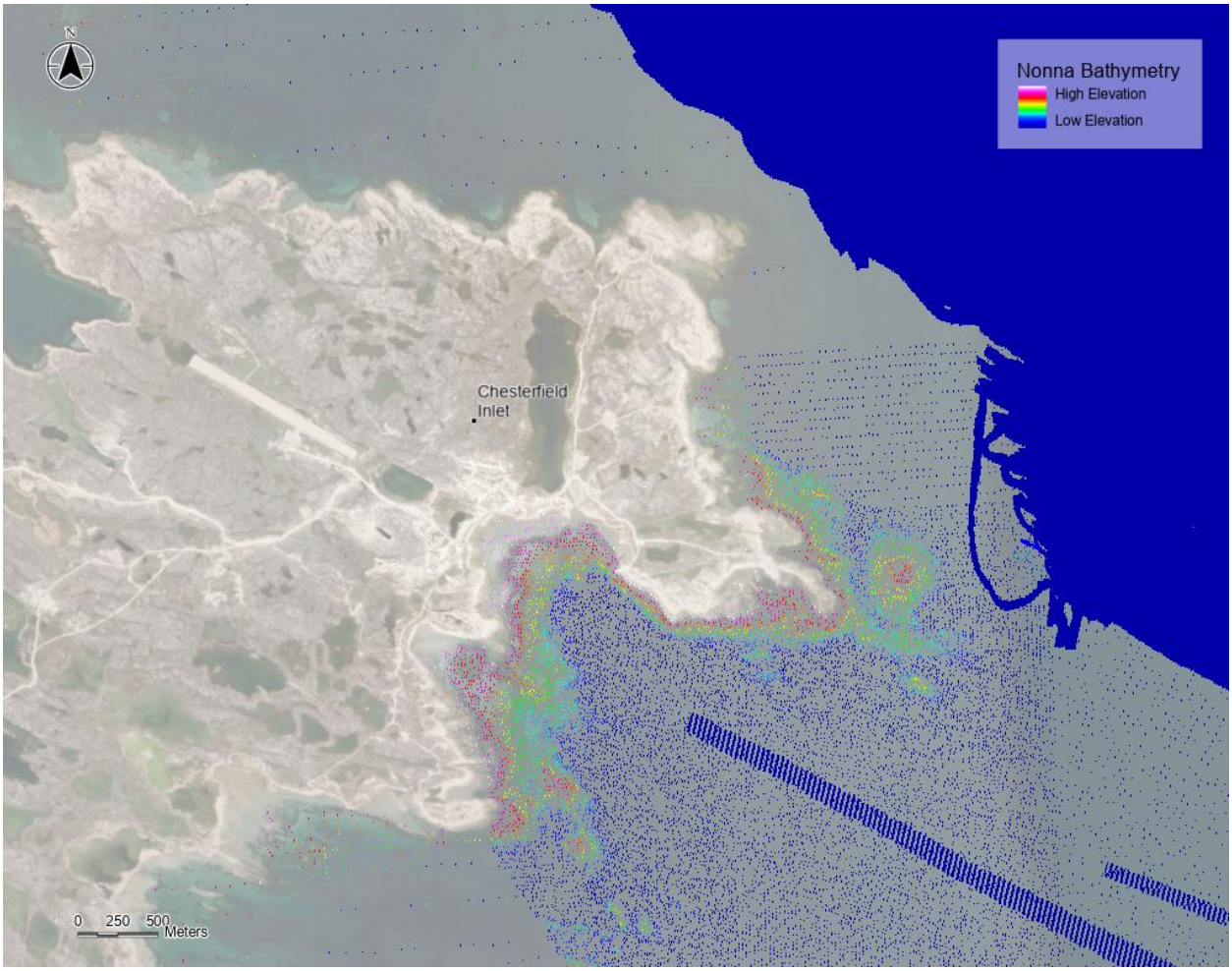


Figure B.11 CHS NONNA10 bathymetric coverage at Coral Harbour.

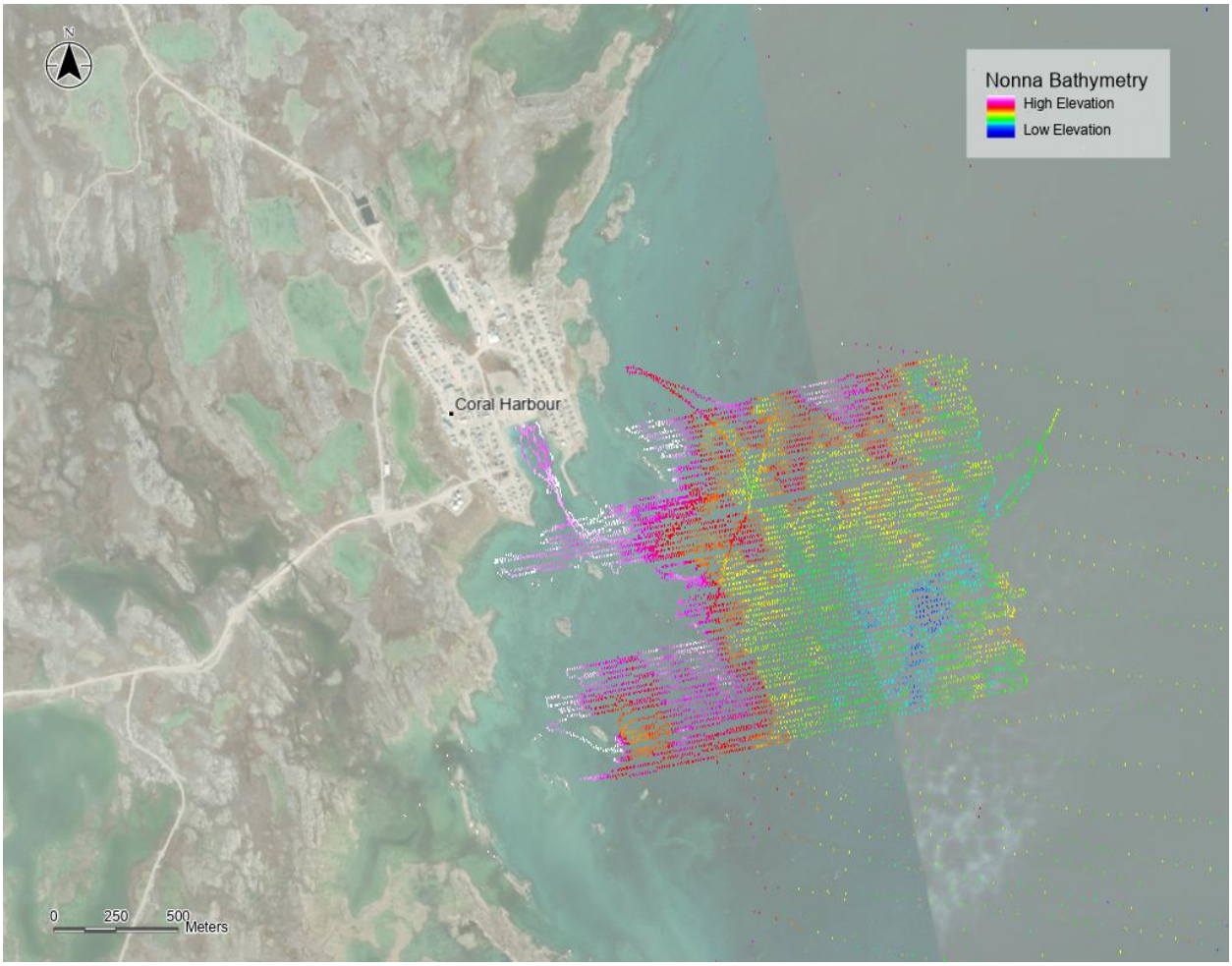


Figure B.12 CHS NONNA100 bathymetric coverage supplied for Coral Harbour

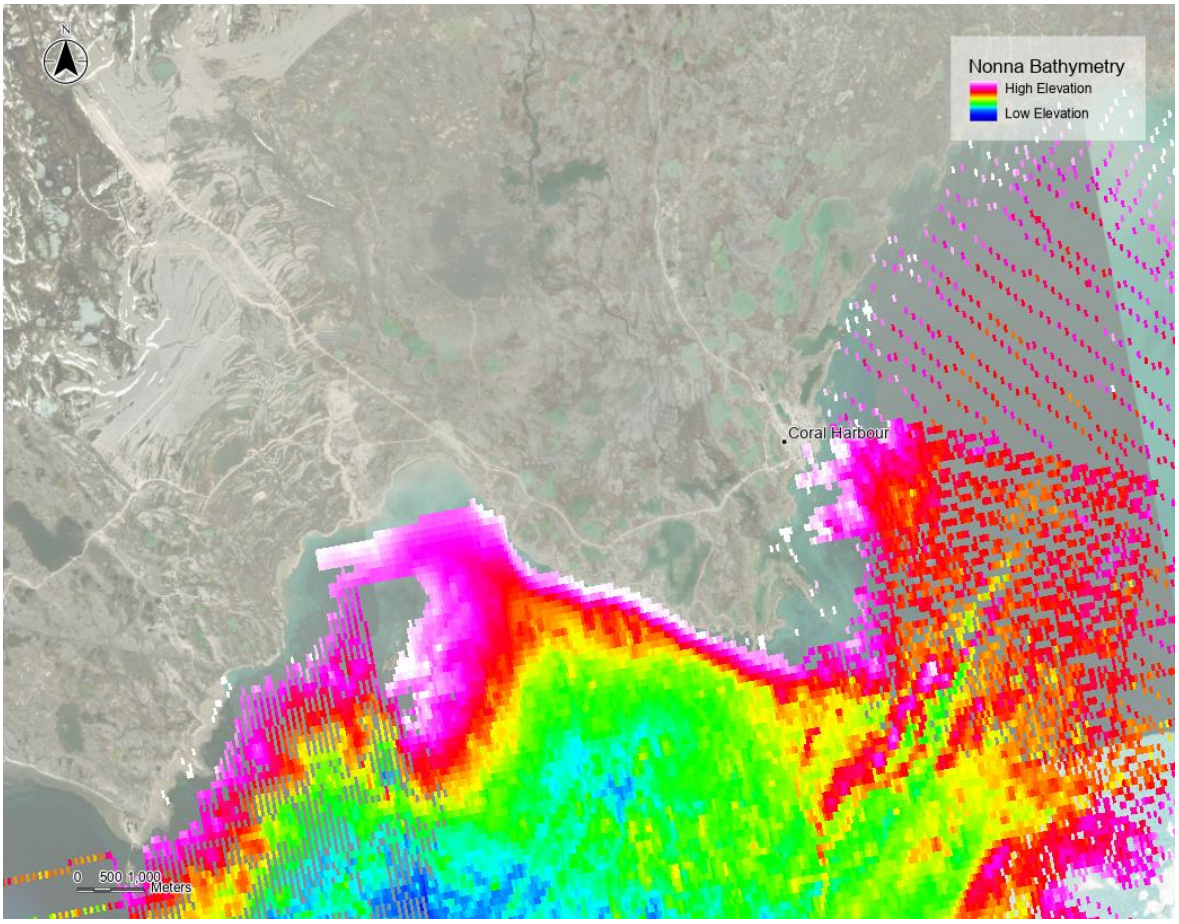


Figure B.13 DFO gauge locations for 4 communities



Appendix C Community-Scale: Transformed Wave Results

Figure C.1 Community-Scale, Hs map, Arviat, 10-Year

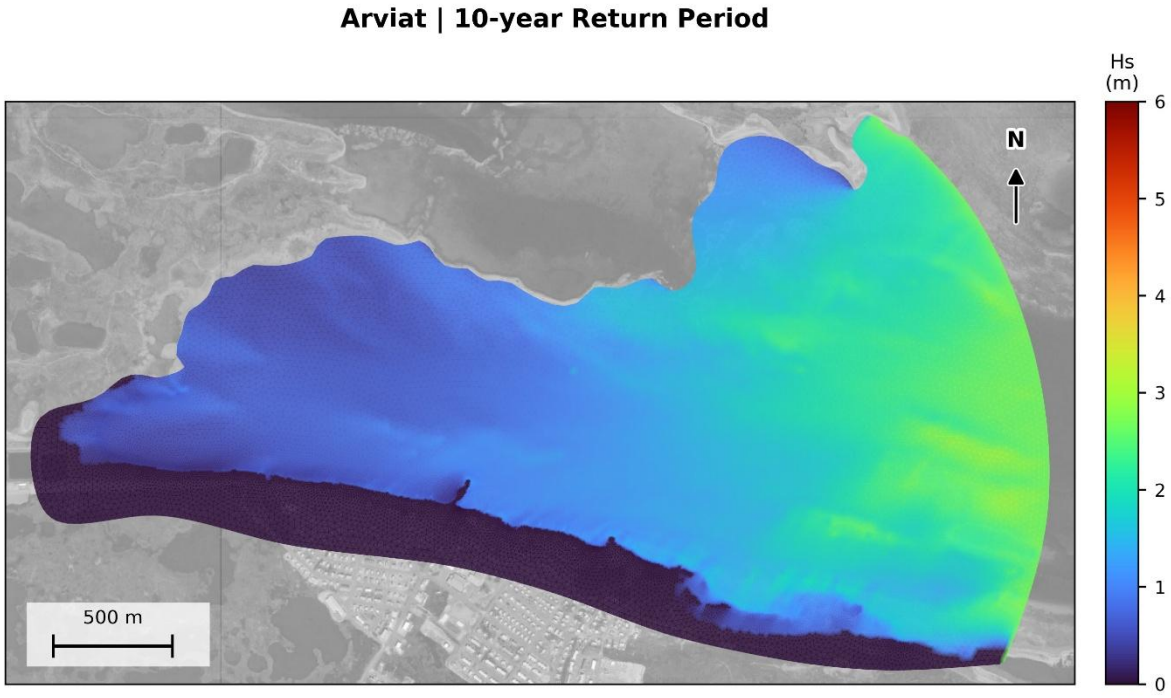


Figure C.2 Community-Scale, Hs map, Arviat, 20-Year

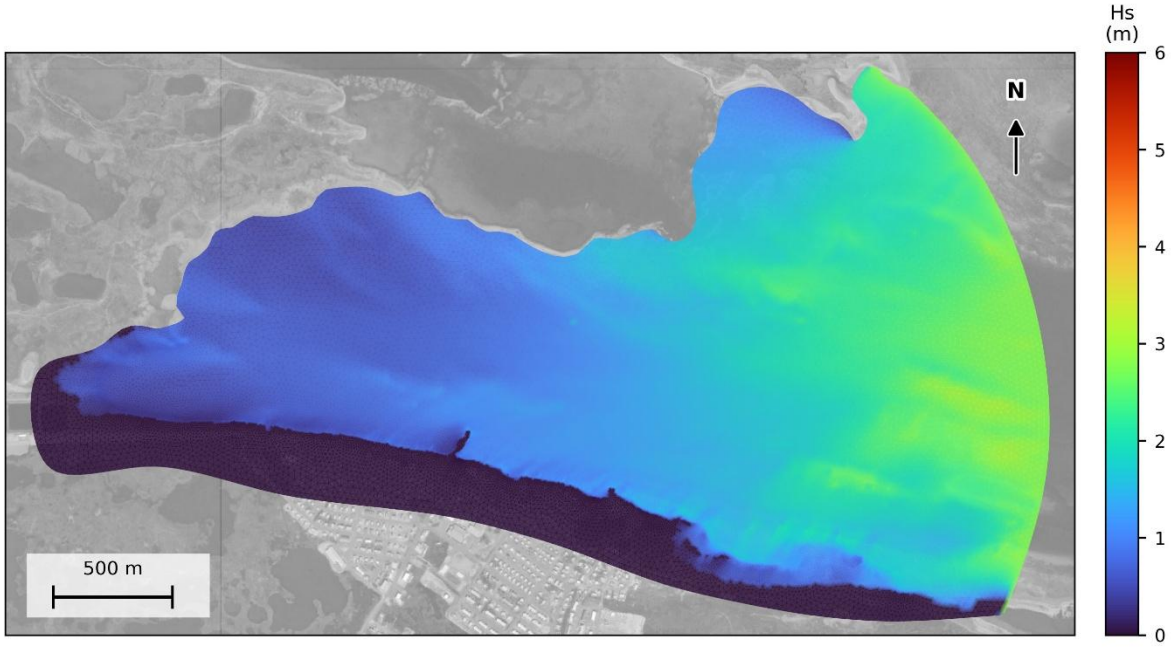


Figure C.3 Community-Scale, Hs map, Arviat, 50-Year

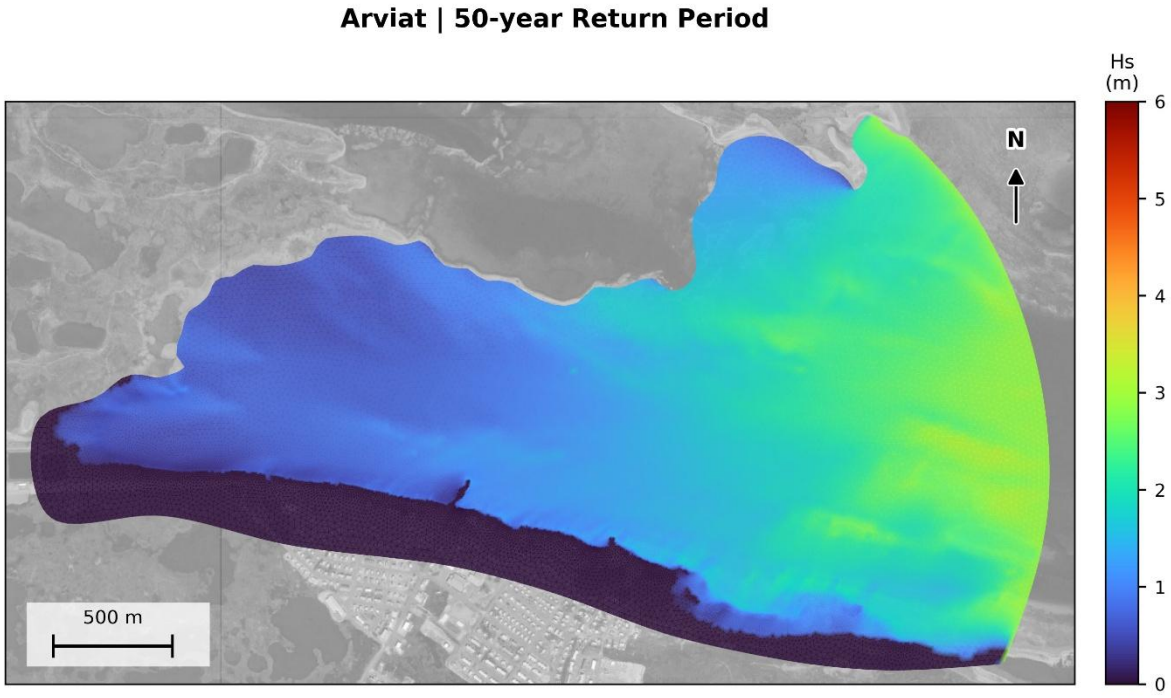


Figure C.4 Community-Scale, Hs map, Arviat, 100-Year

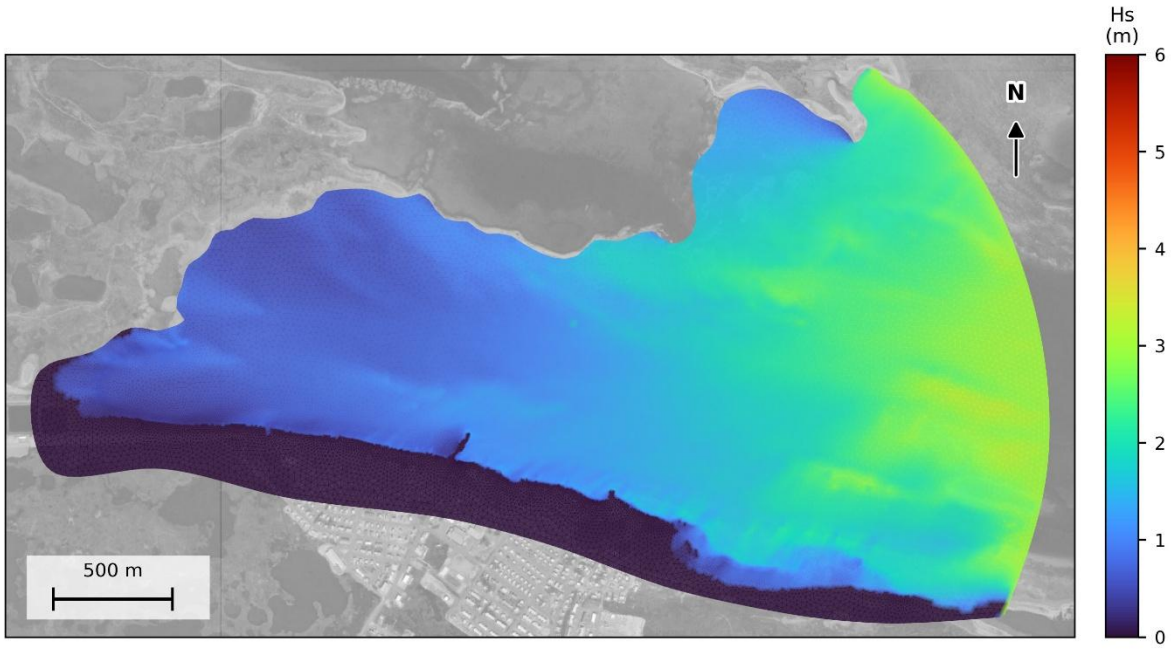


Figure C.5 Community-Scale, Hs map, Arviat, 200-Year

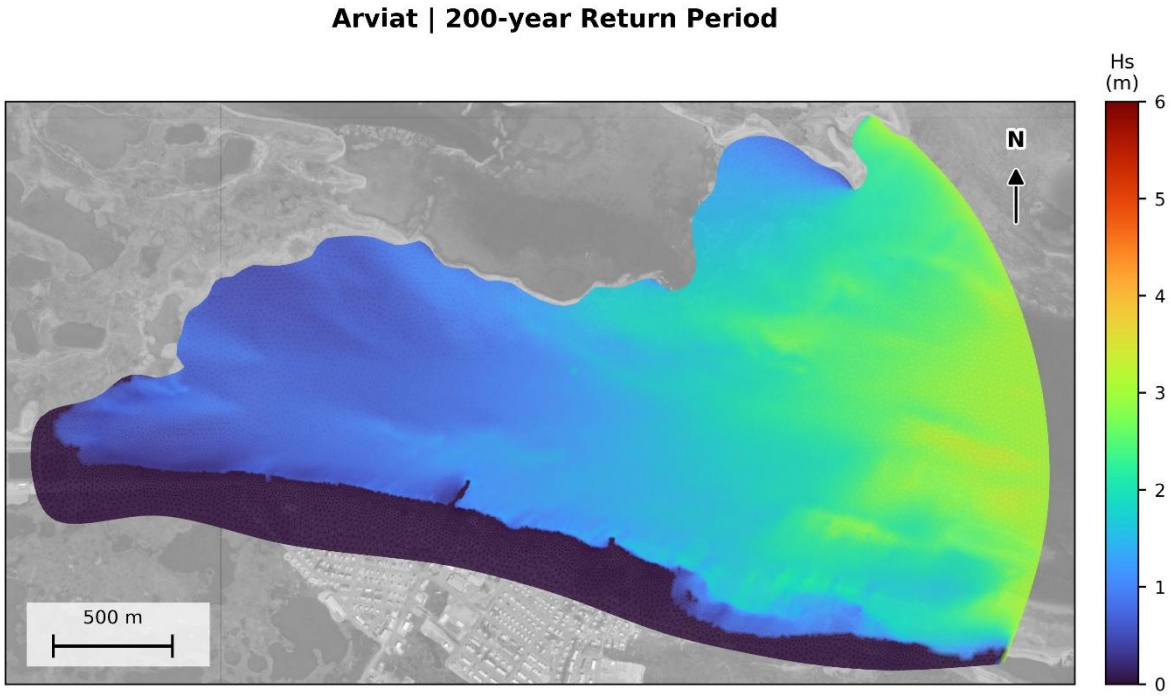


Figure C.6 Community-Scale, Hs map, Arviat, 500-Year

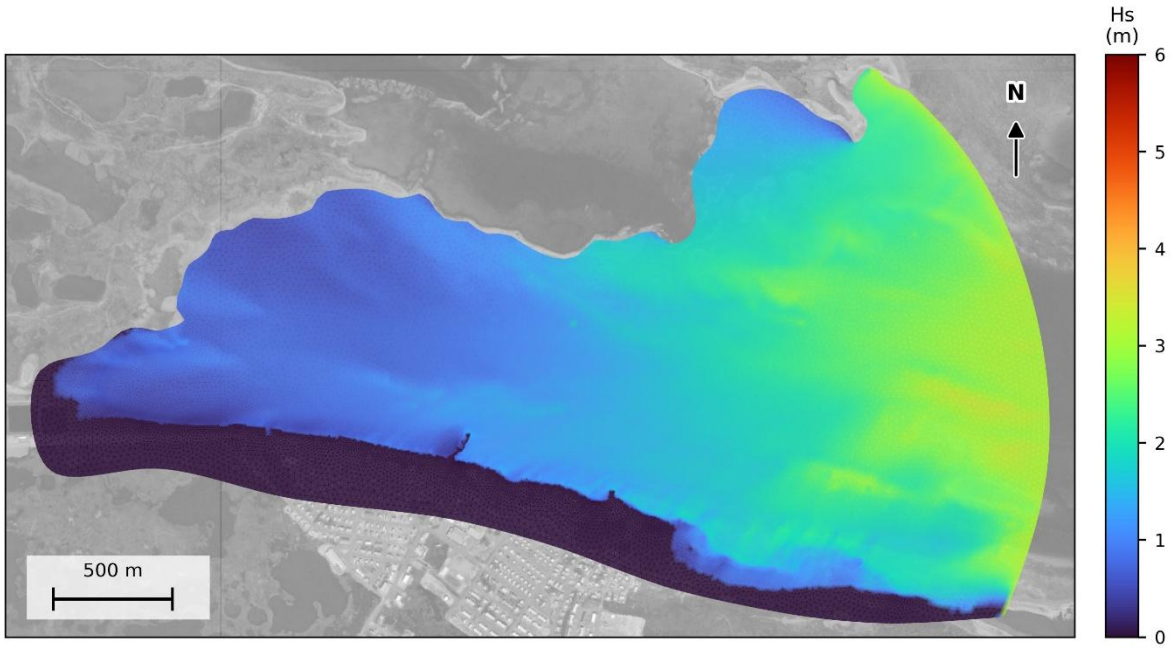


Figure C.7 Community-Scale, Hs map, Whale Cove, 10-Year

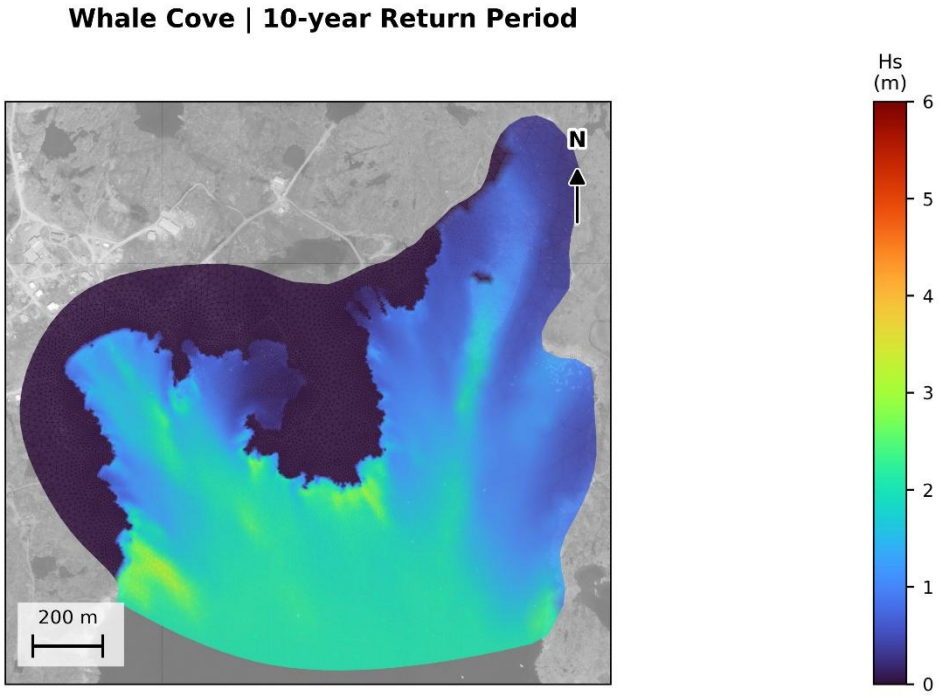


Figure C.8 Community-Scale, Hs map, Whale Cove, 20-Year

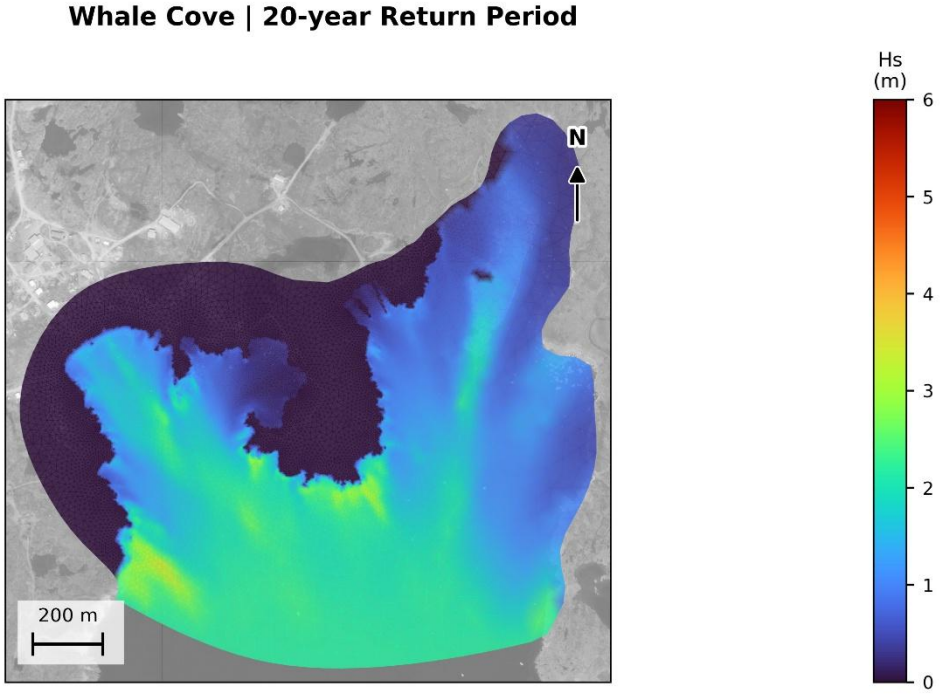


Figure C.9 Community-Scale, Hs map, Whale Cove, 50-Year

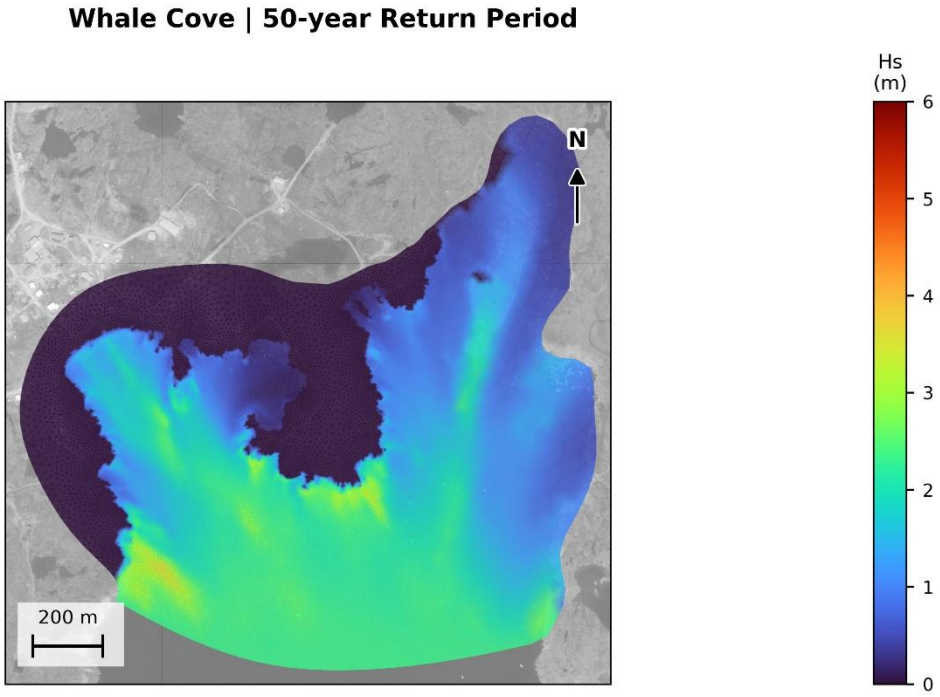


Figure C.10 Community-Scale, Hs map, Whale Cove, 100-Year

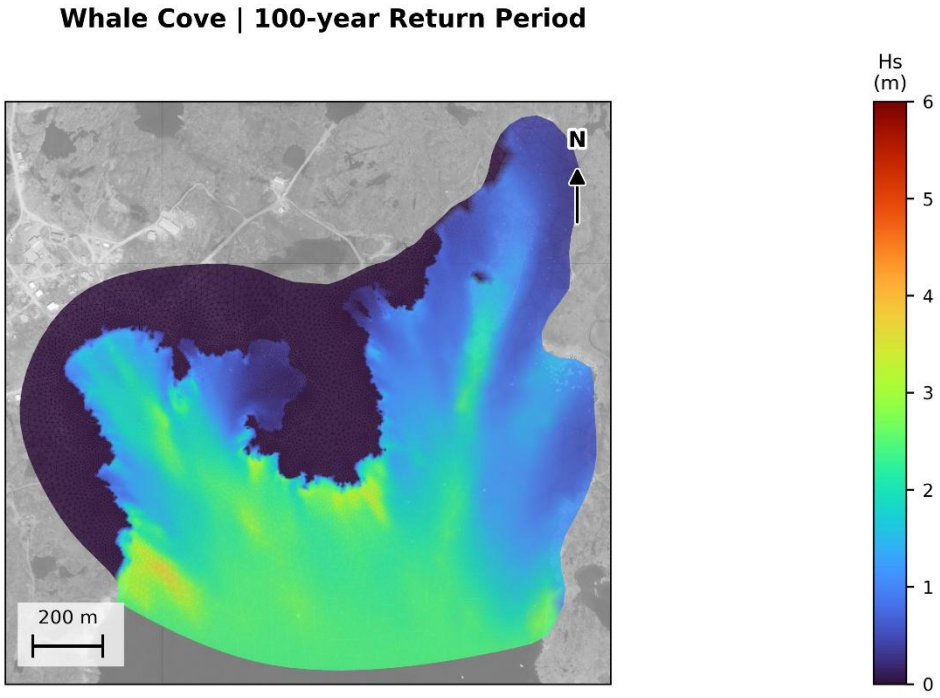


Figure C.11 Community-Scale, Hs map, Whale Cove, 200-Year

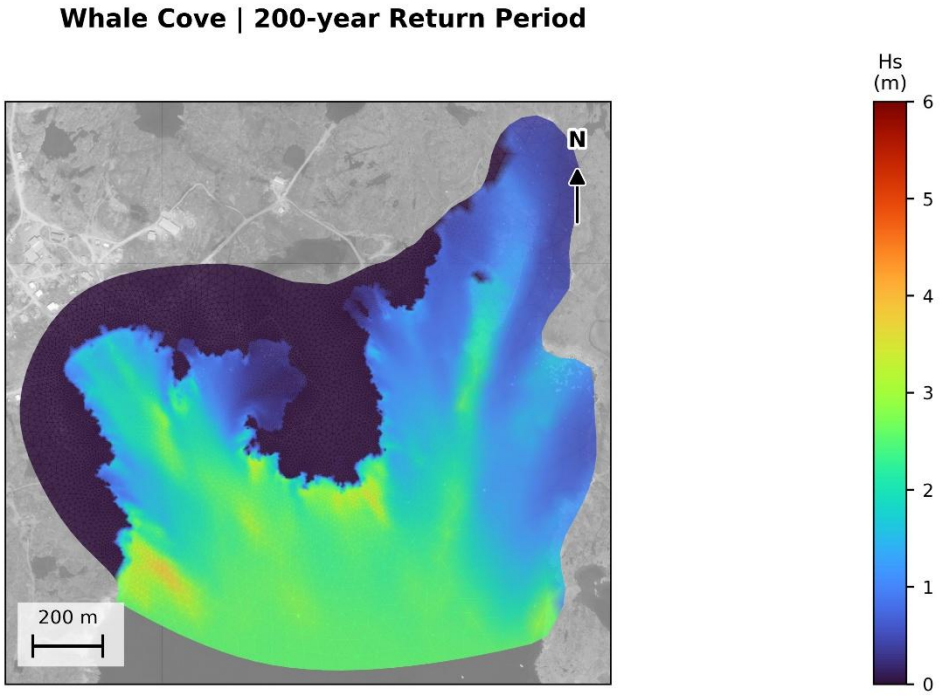


Figure C.12 Community-Scale, Hs map, Whale Cove, 500-Year

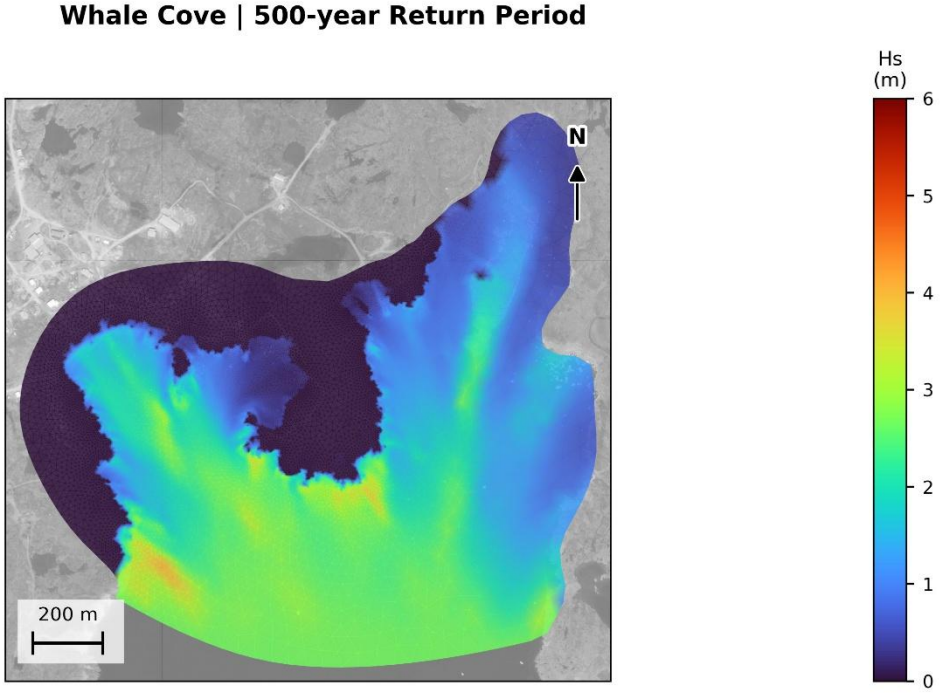


Figure C.13 Community-Scale, Hs map, Chesterfield Inlet, 10-Year

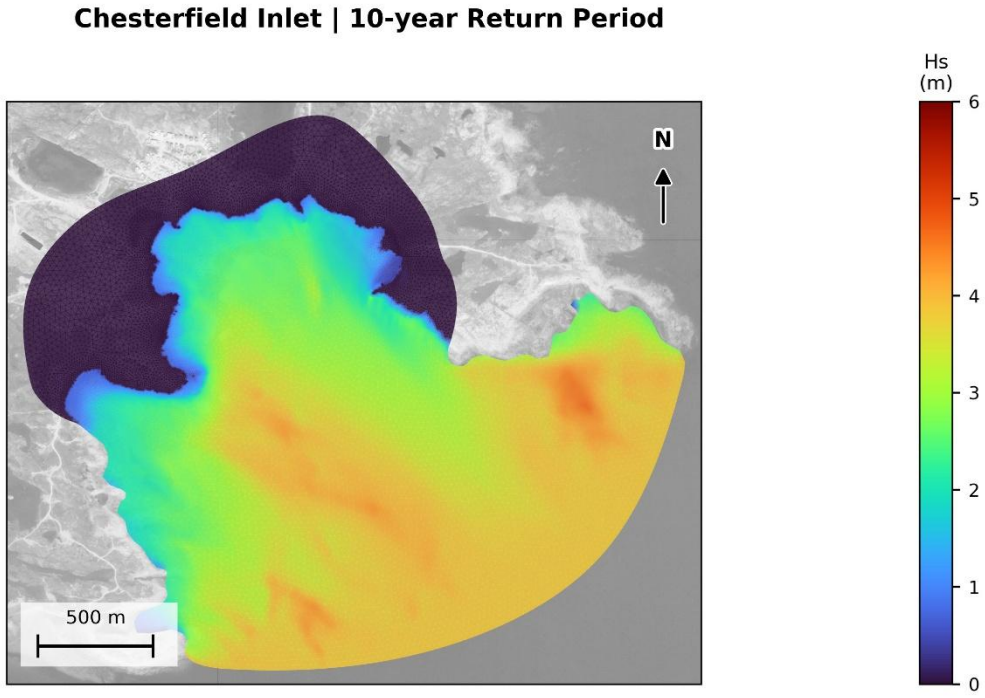


Figure C.14 Community-Scale, Hs map, Chesterfield Inlet, 20-Year

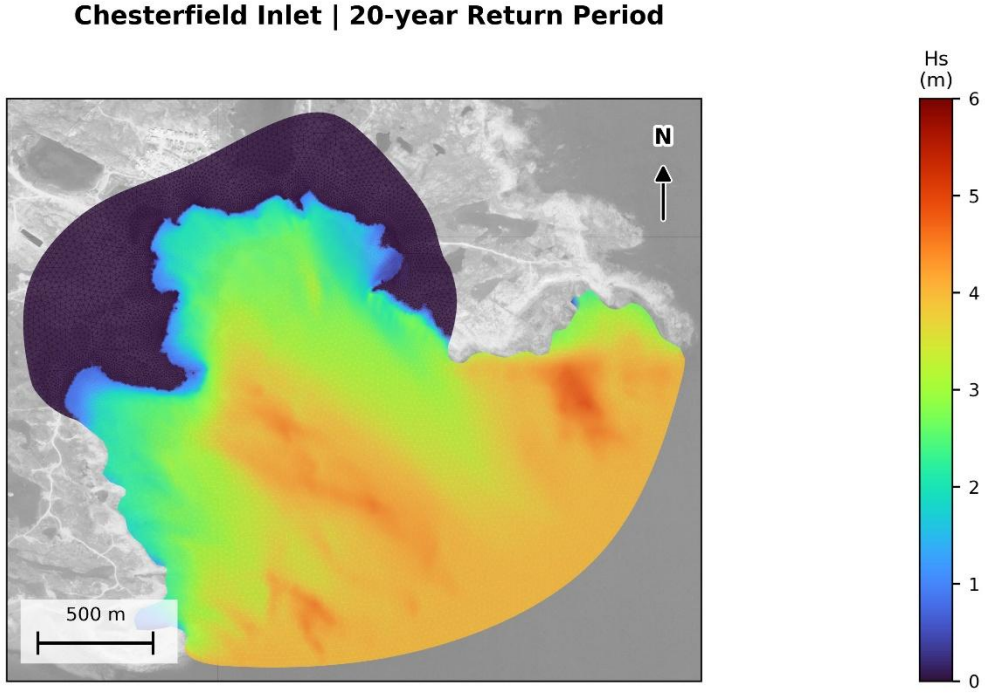


Figure C.15 Community-Scale, Hs map, Chesterfield Inlet, 50-Year

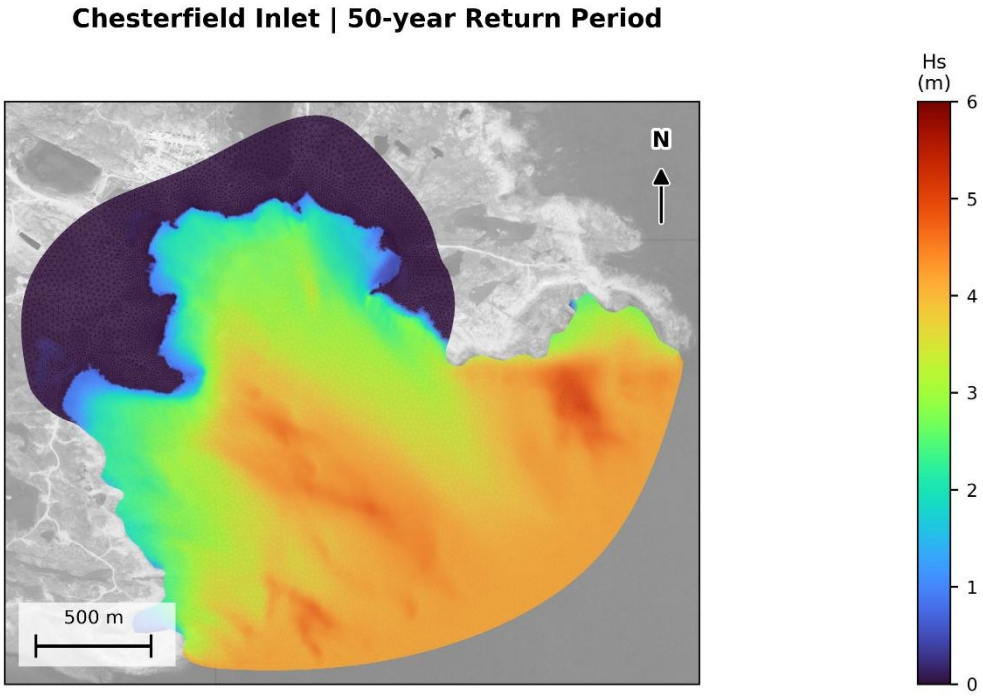


Figure C.16 Community-Scale, Hs map, Chesterfield Inlet, 100-Year

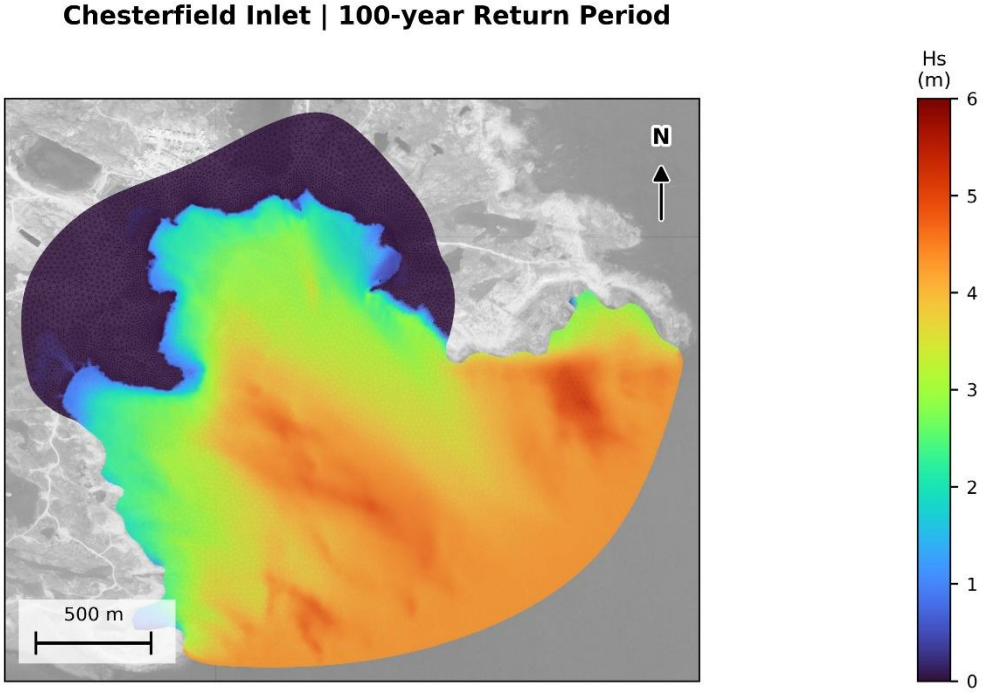


Figure C.17 Community-Scale, Hs map, Chesterfield Inlet, 200-Year

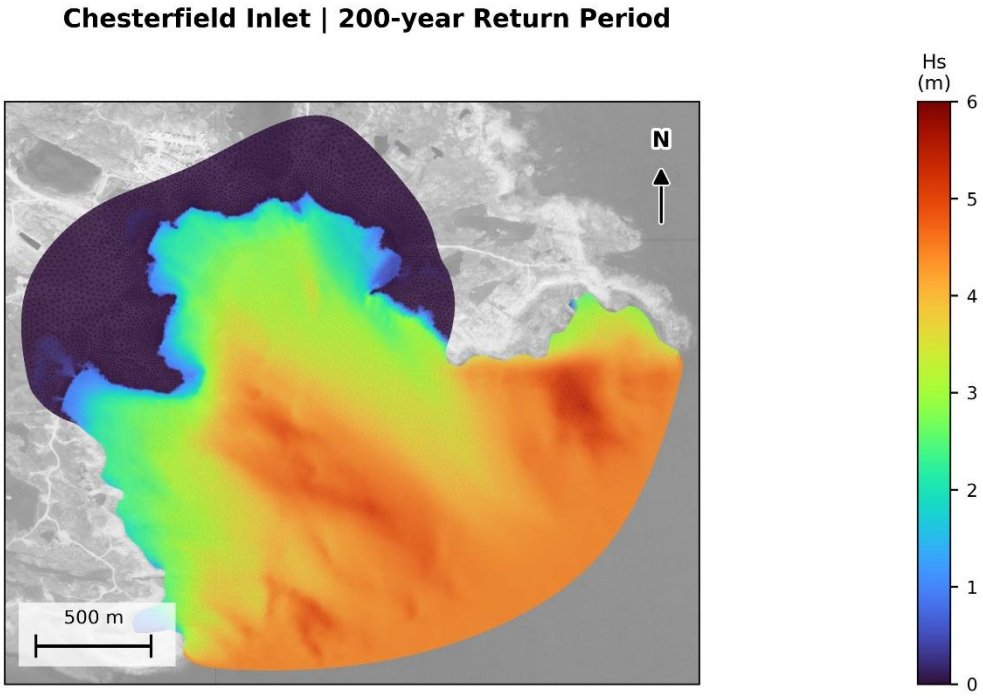


Figure C.18 Community-Scale, Hs map, Chesterfield Inlet, 500-Year

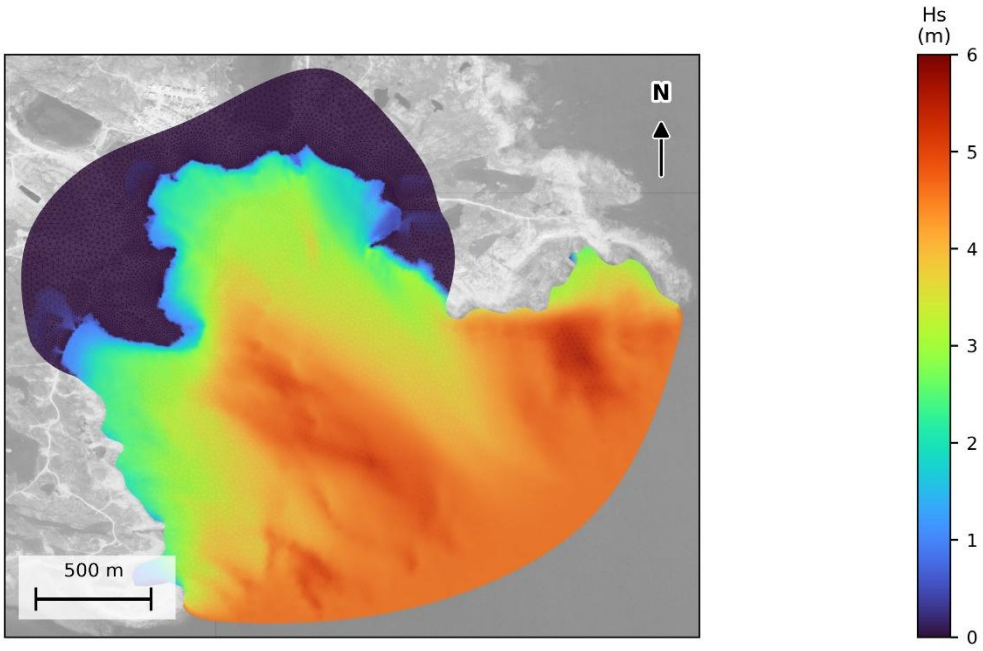


Figure C.19 Community-Scale, Hs map, Coral Harbour, 10-Year

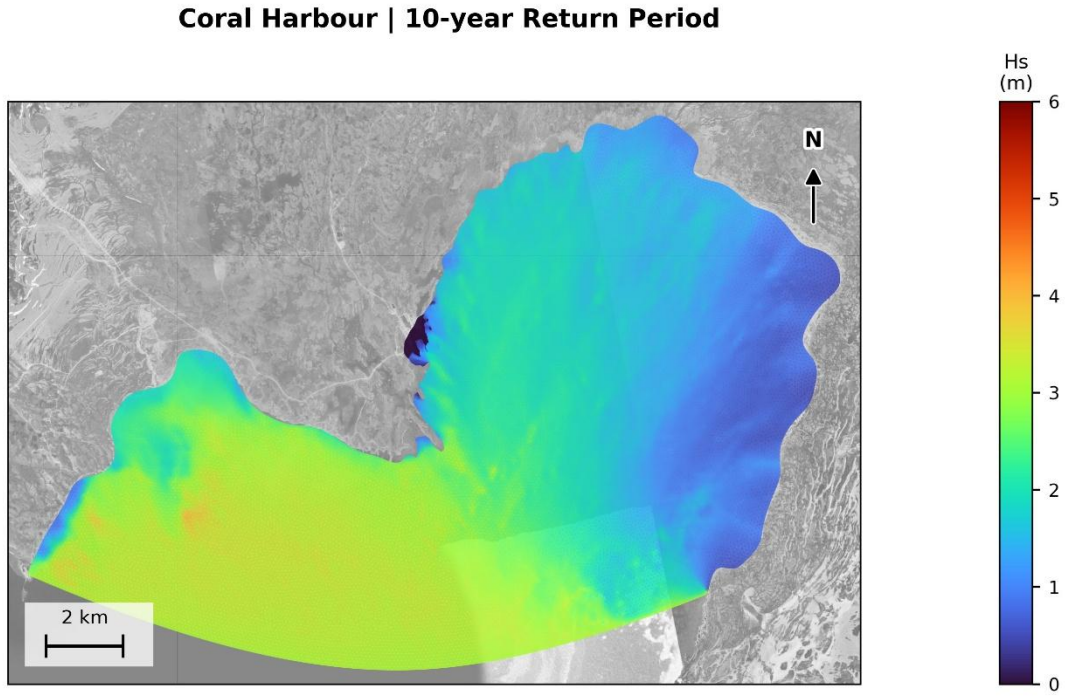


Figure C.20 Community-Scale, Hs map, Coral Harbour, 20-Year

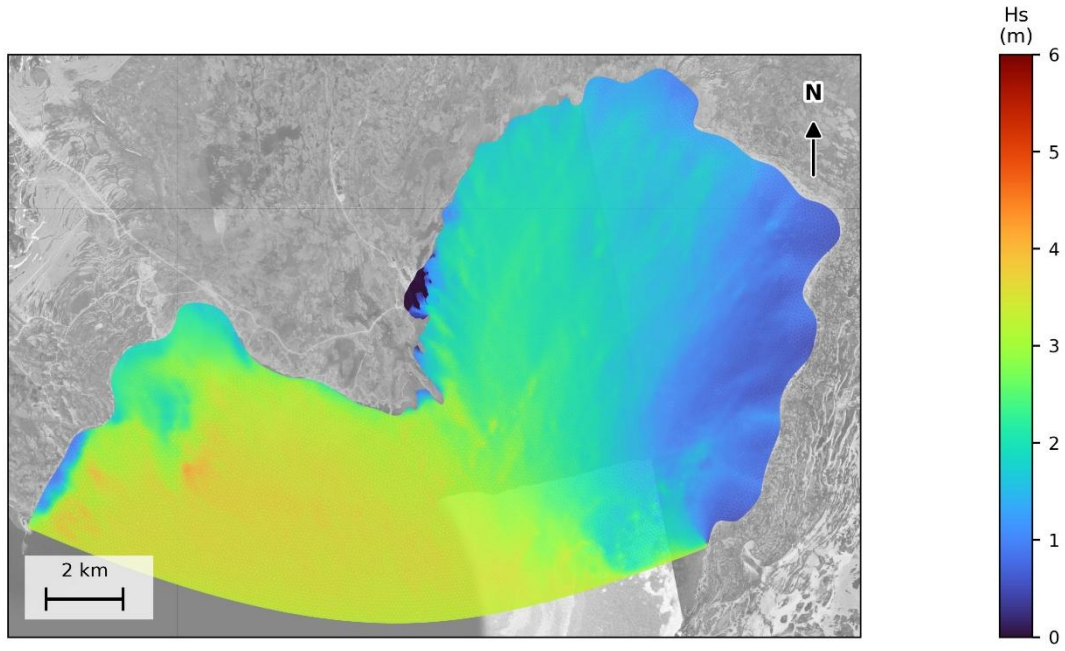


Figure C.21 Community-Scale, Hs map, Coral Harbour, 50-Year

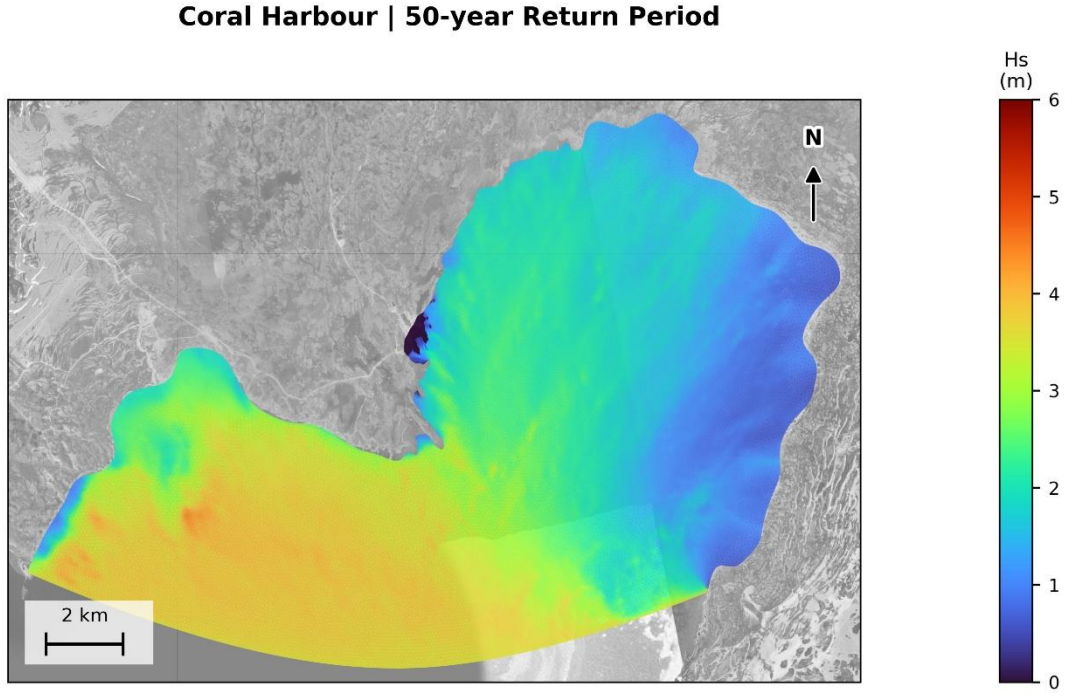


Figure C.22 Community-Scale, Hs map, Coral Harbour, 100-Year

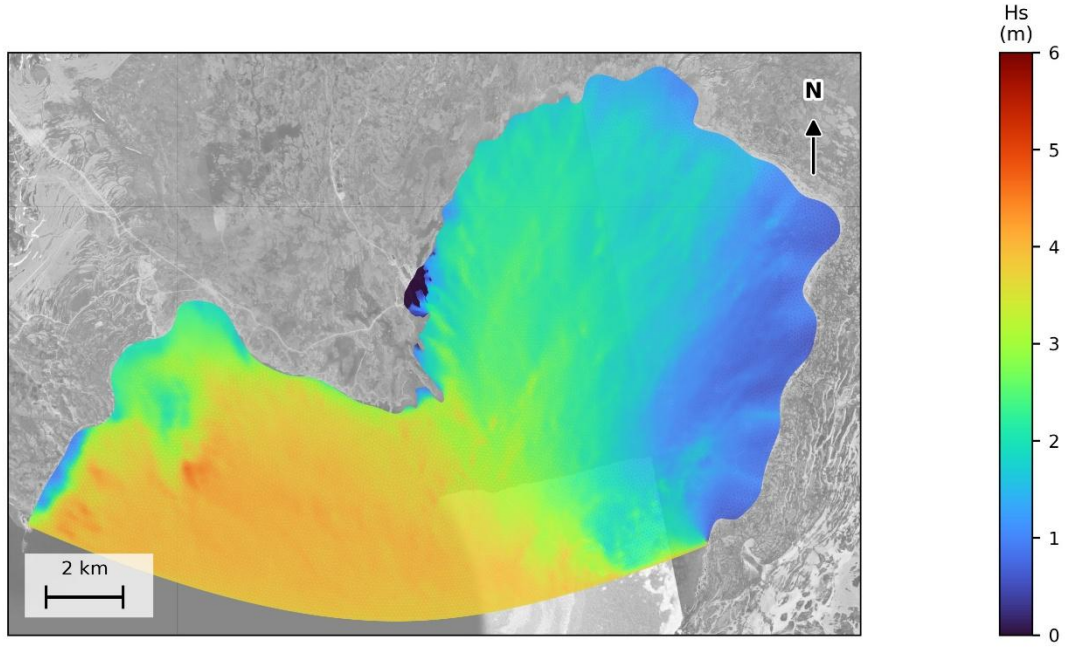


Figure C.23 Community-Scale, Hs map, Coral Harbour, 200-Year

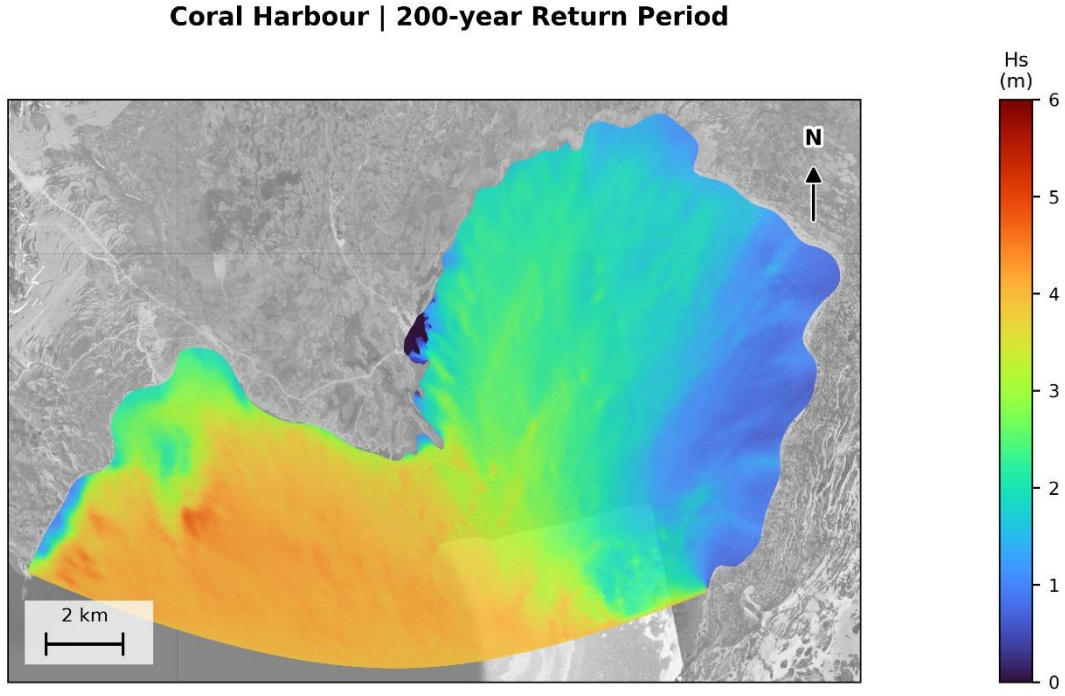
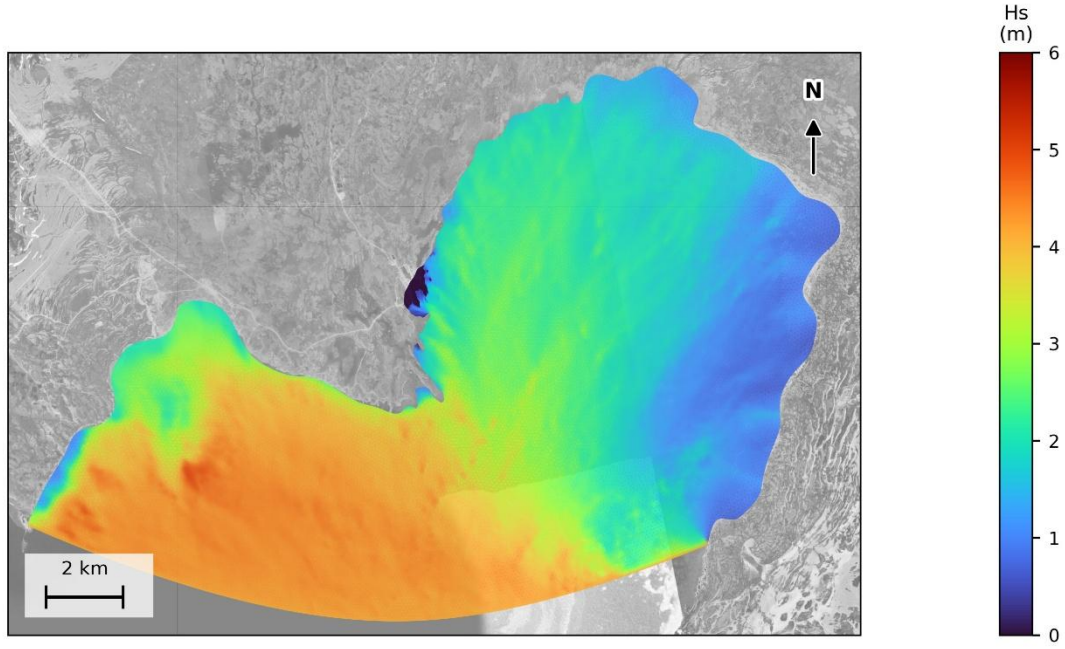
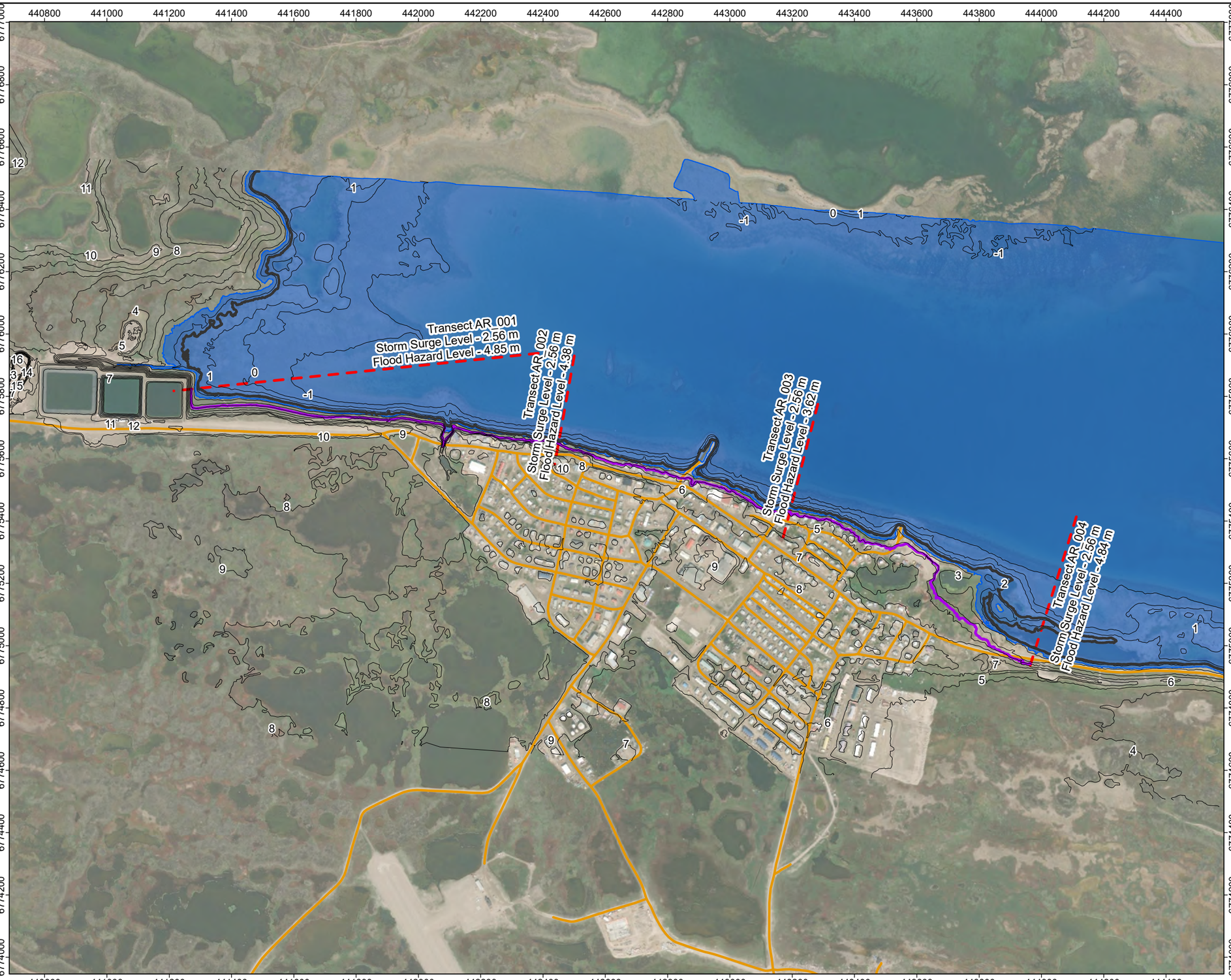


Figure C.24 Community-Scale, Hs map, Coral Harbour, 500-Year



Appendix D Communities Coastal Flood Hazard Maps



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Figure No.

AR00-10yr

Title

Arviat - 10yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

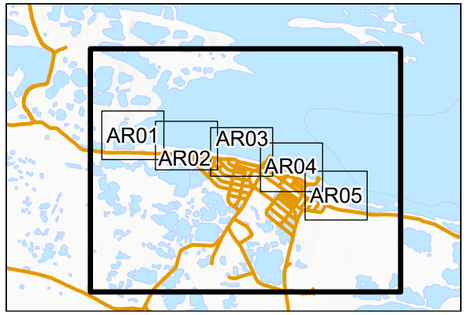
Prepared by MAINSLEY on 20260910
TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

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(At original document size of 11x17)
1:12,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 10 yr
- Storm Surge Level - 10 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

REGISTERED PROFESSIONAL ENGINEER
H. DASHTPEYMA
P.Eng.
2026-10-05
NT/NU

PERMIT TO PRACTICE
NUNAMI STANTEC LTD.
Signature
Date October 5, 2026
PERMIT NUMBER: P 1117
NT/NU Association of Professional Engineers and Geoscientists

Acknowledgements

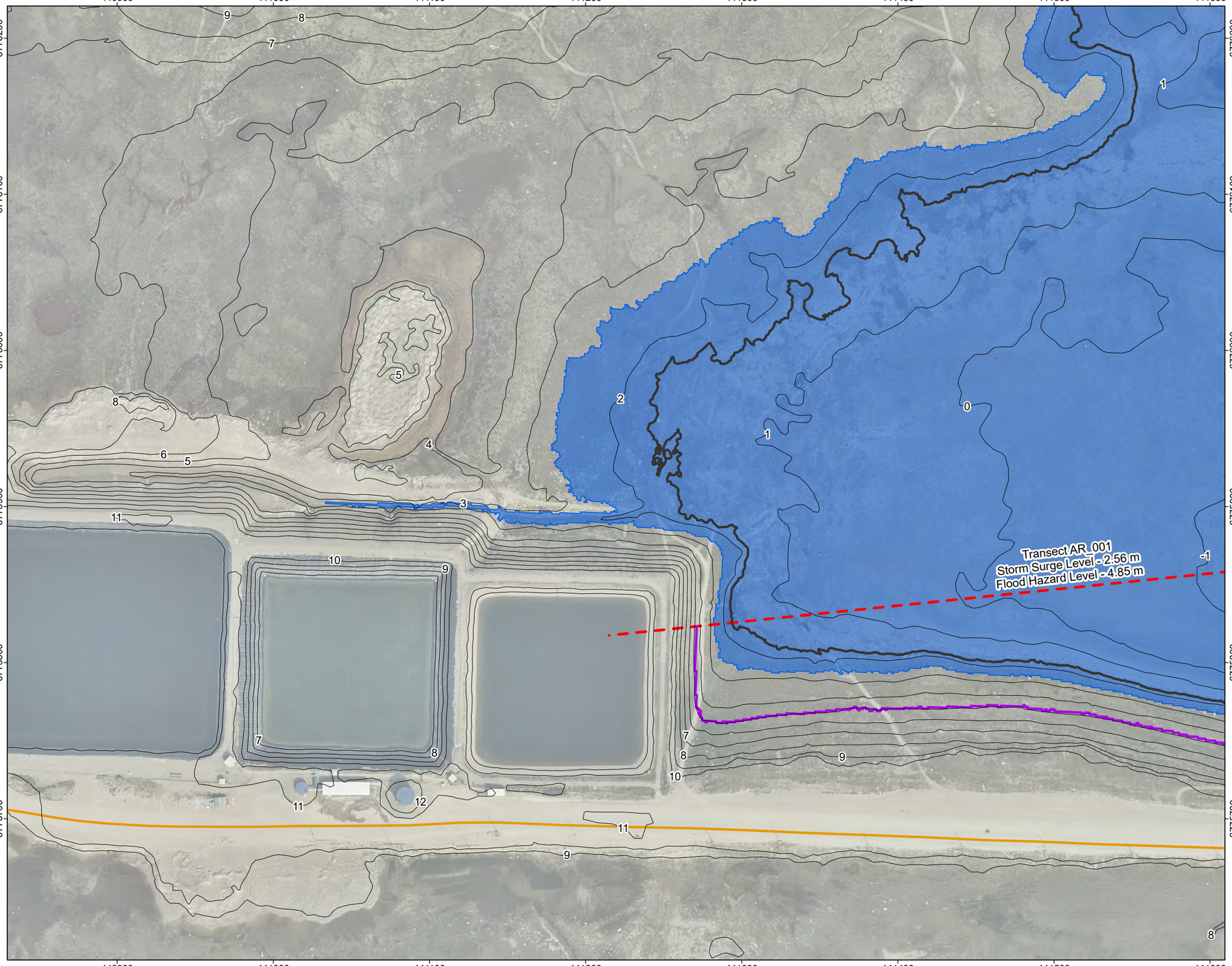
1. Funding: This project is funded [in part] by the Government of Canada through the Flood Hazard Identification and Mapping Program (FHIMP). This project is funded [in part] by the Government of Nunavut.
2. Community Engagement: The project team gratefully acknowledges the contributions of community members whose knowledge and feedback informed the flood mapping study.
3. Vertical Elevation Datum Conversion: The project team also acknowledges Fisheries and Oceans Canada (DFO) for providing the transformation grid used to convert bathymetric elevation data from Chart Datum to CGVD2013.

Canada

Nunavut

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Figure No.

AR01-10yr

Title

Arviat - 10yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

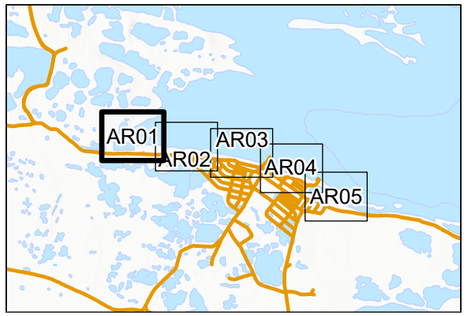
Prepared by MAINSLEY on 20260910
TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 10 yr
- Storm Surge Level - 10 yr
- Topographic Contours - 1 m
- Road



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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

REGISTERED PROFESSIONAL ENGINEERS
H. DASHTPEYMA
P.Eng.
2026-10-05
NT/NU

PERMIT TO PRACTICE
NUNAMI STANTEC LTD.
Signature
Date October 5, 2026
PERMIT NUMBER: P 1117
NT/NU Association of Professional Engineers and Geoscientists

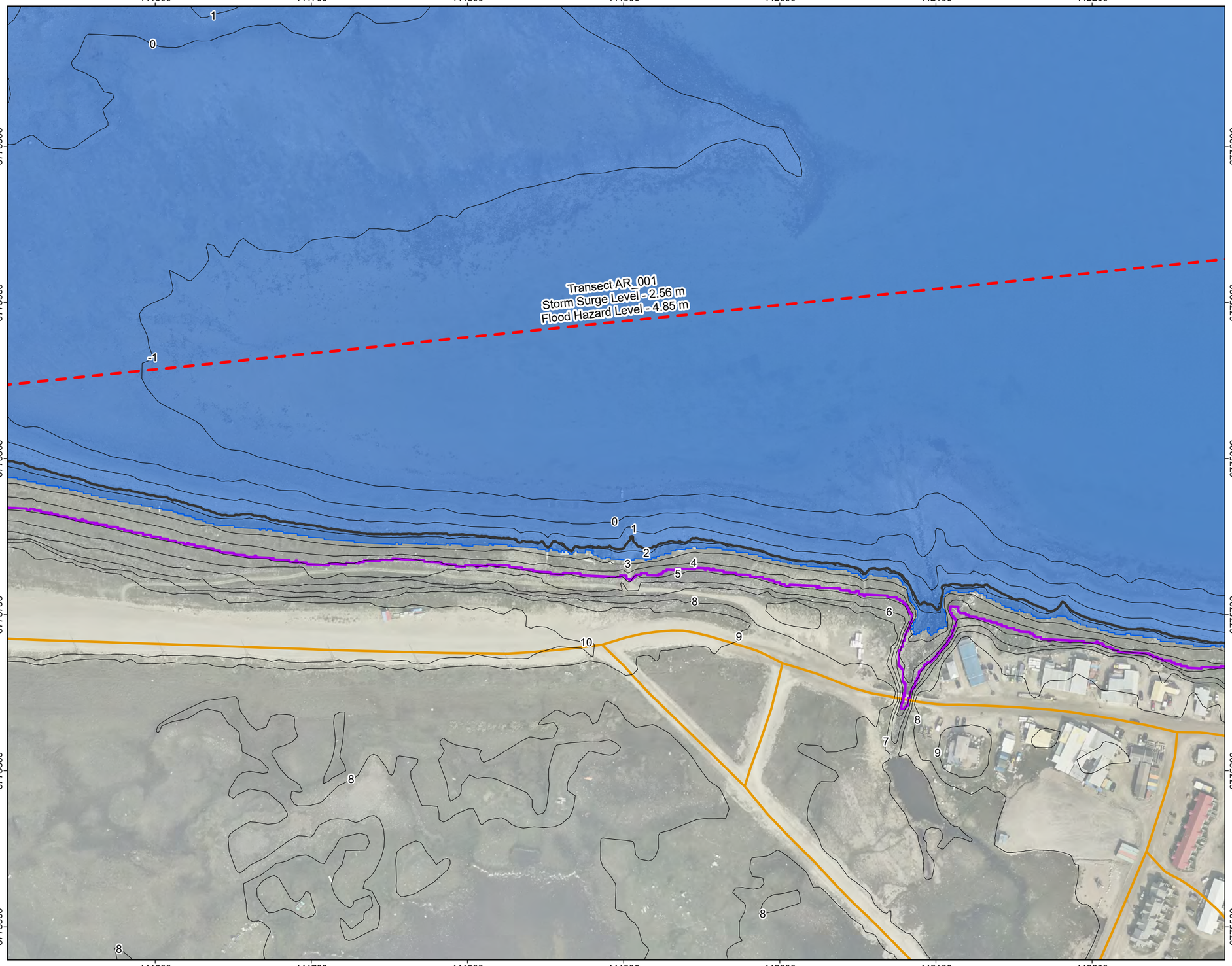
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Canada

Nunavut

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Figure No.

AR02-10yr

Title

Arviat - 10yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

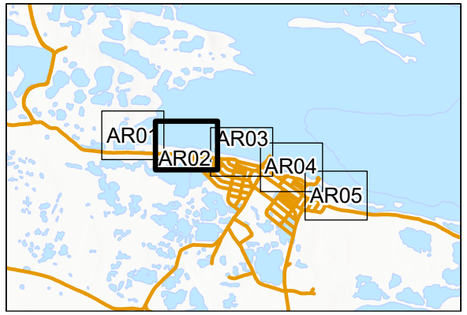
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TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

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(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 10 yr
- Storm Surge Level - 10 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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Date October 5, 2026
PERMIT NUMBER: P 1117
NT/NU Association of Professional Engineers and Geoscientists

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Nunavut

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Figure No.

AR03-10yr

Title

Arviat - 10yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

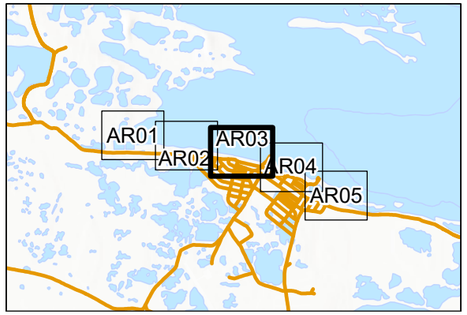
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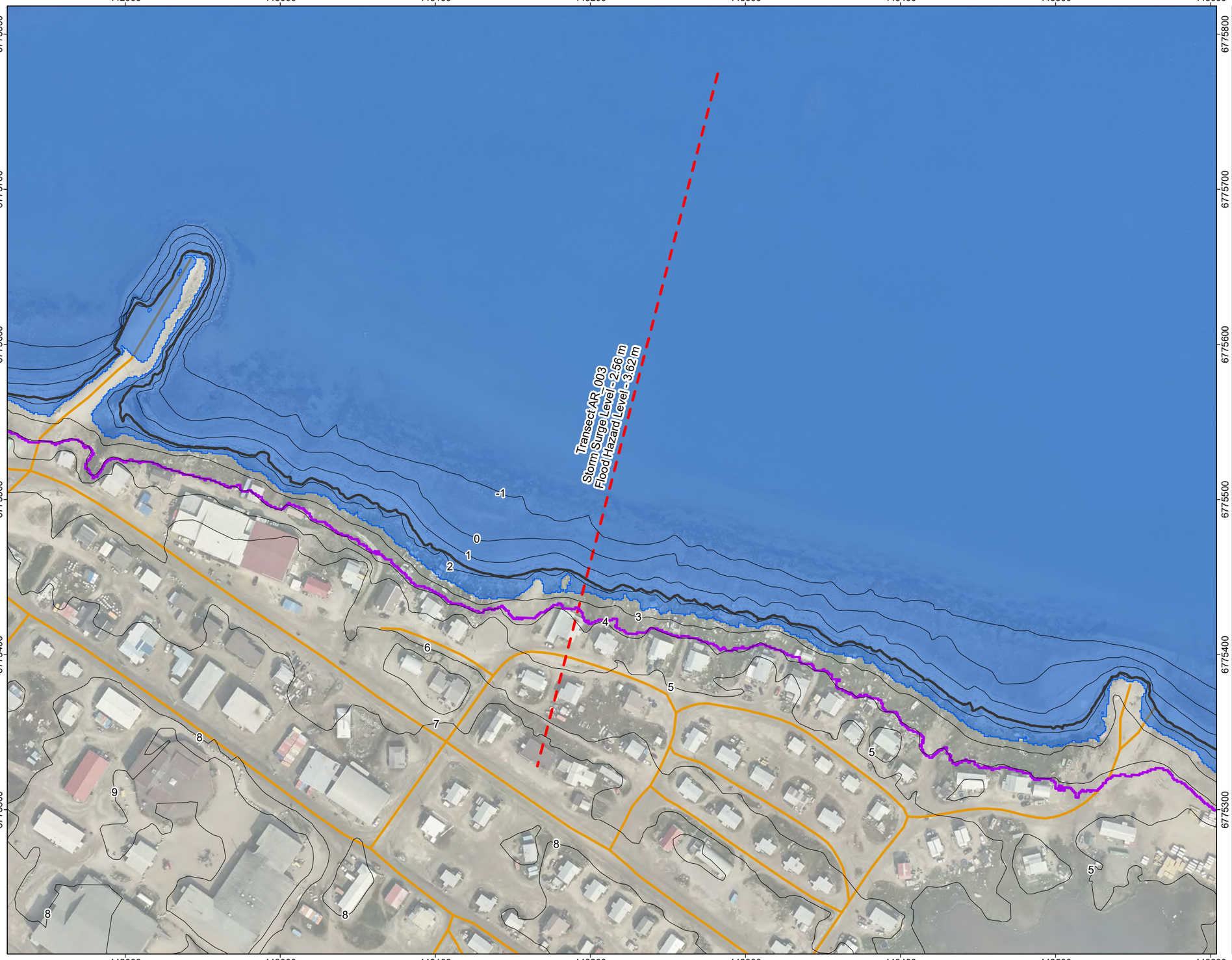
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Figure No.

AR04-10yr

Title

Arviat - 10yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

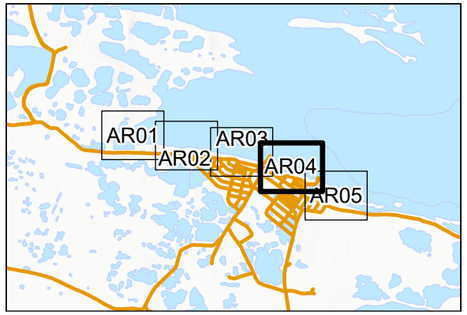
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- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 10 yr
- Storm Surge Level - 10 yr
- Topographic Contours - 1 m
- Road



Notes
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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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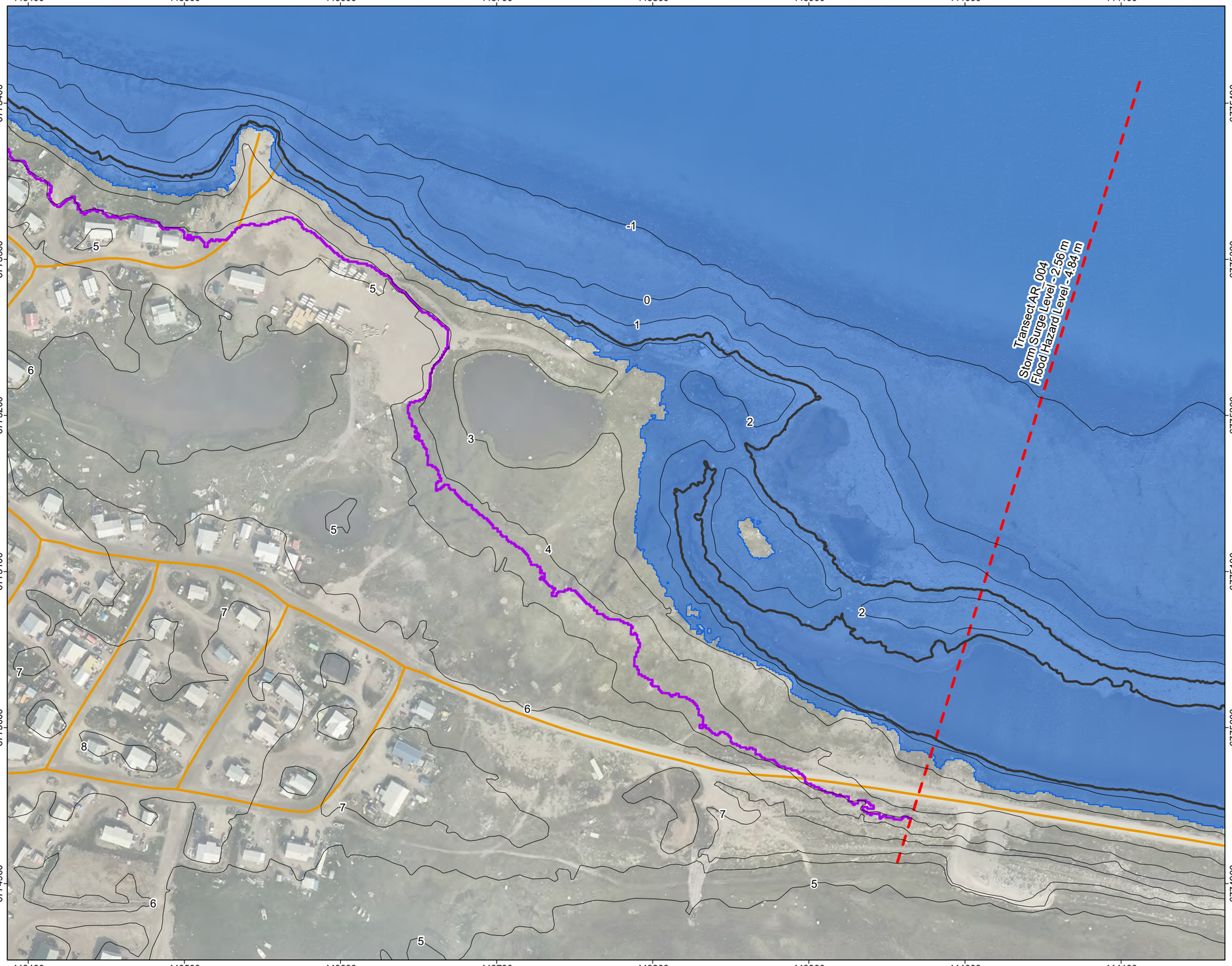
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Figure No.

AR05-10yr

Title

Arviat - 10yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4)
Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

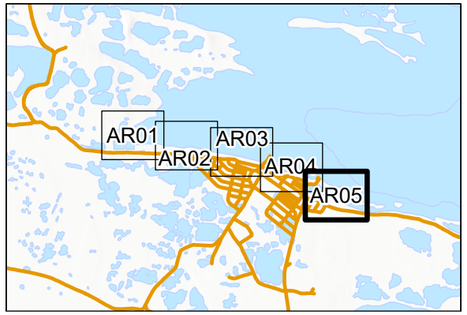
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IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 10 yr
- Storm Surge Level - 10 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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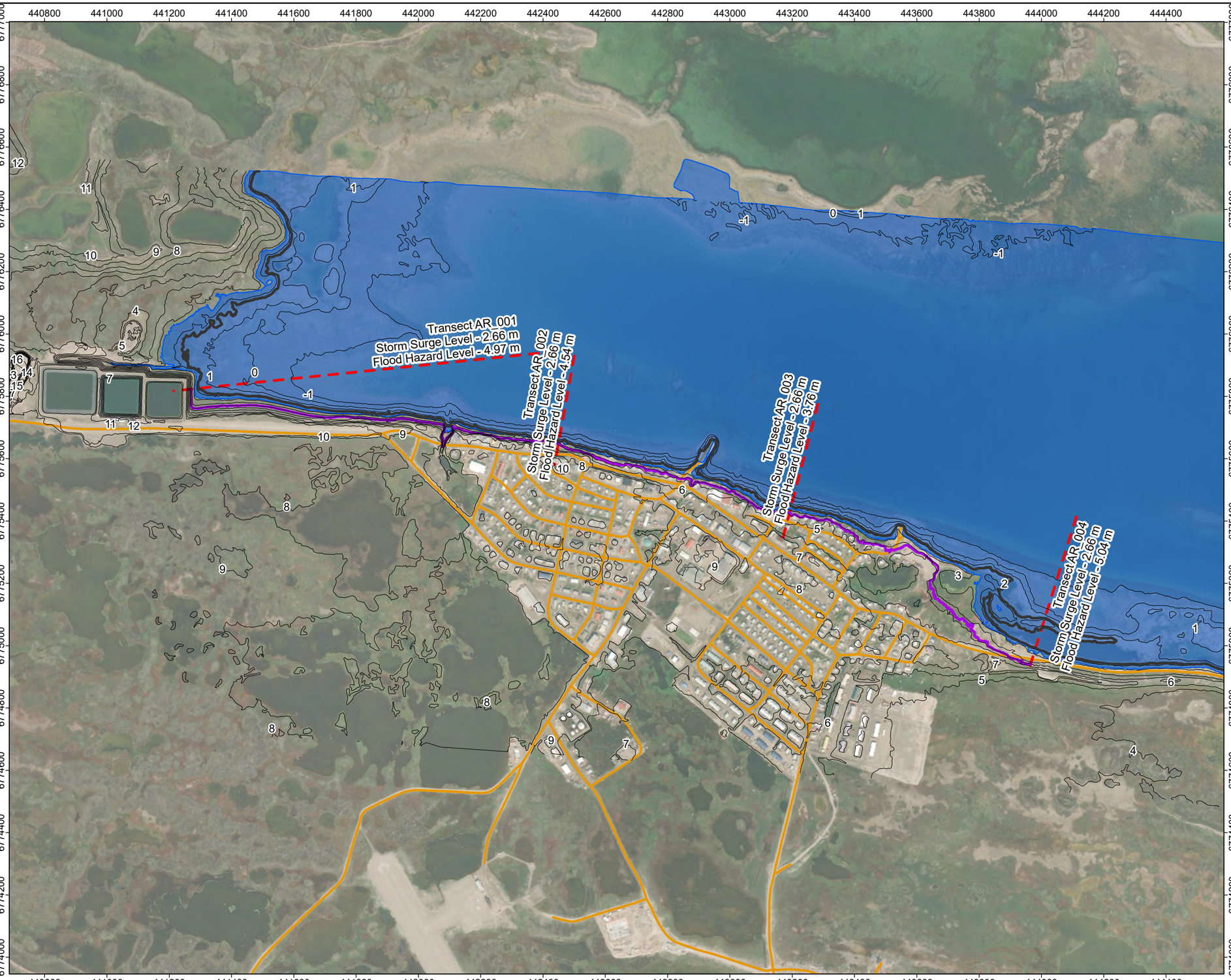
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Figure No.

AR00-20yr

Title

Arviat - 20yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

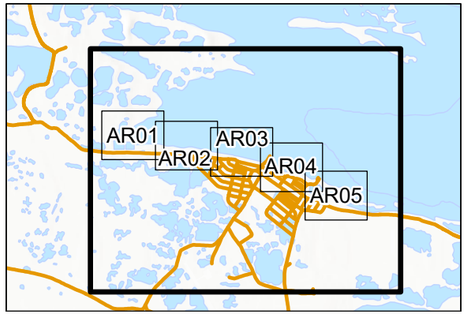
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N

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(At original document size of 11x17)
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- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 20 yr
- Storm Surge Level - 20 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2026-10-05
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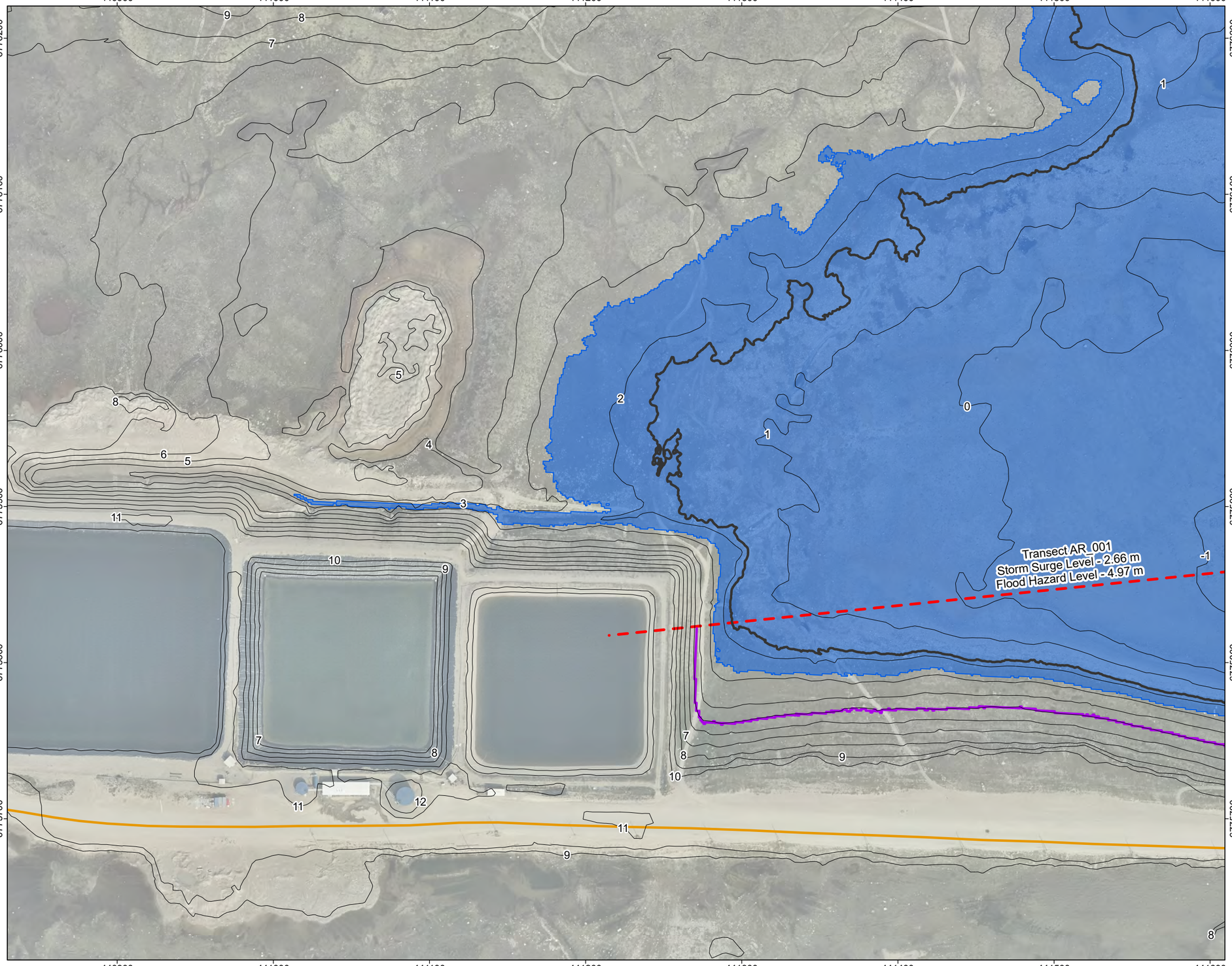
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Nunavut

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Figure No.

AR01-20yr

Title

Arviat - 20yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

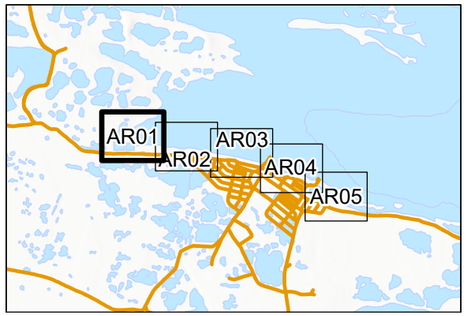
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- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 20 yr
- Storm Surge Level - 20 yr
- Topographic Contours - 1 m
- Road



Notes
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3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2026-10-05
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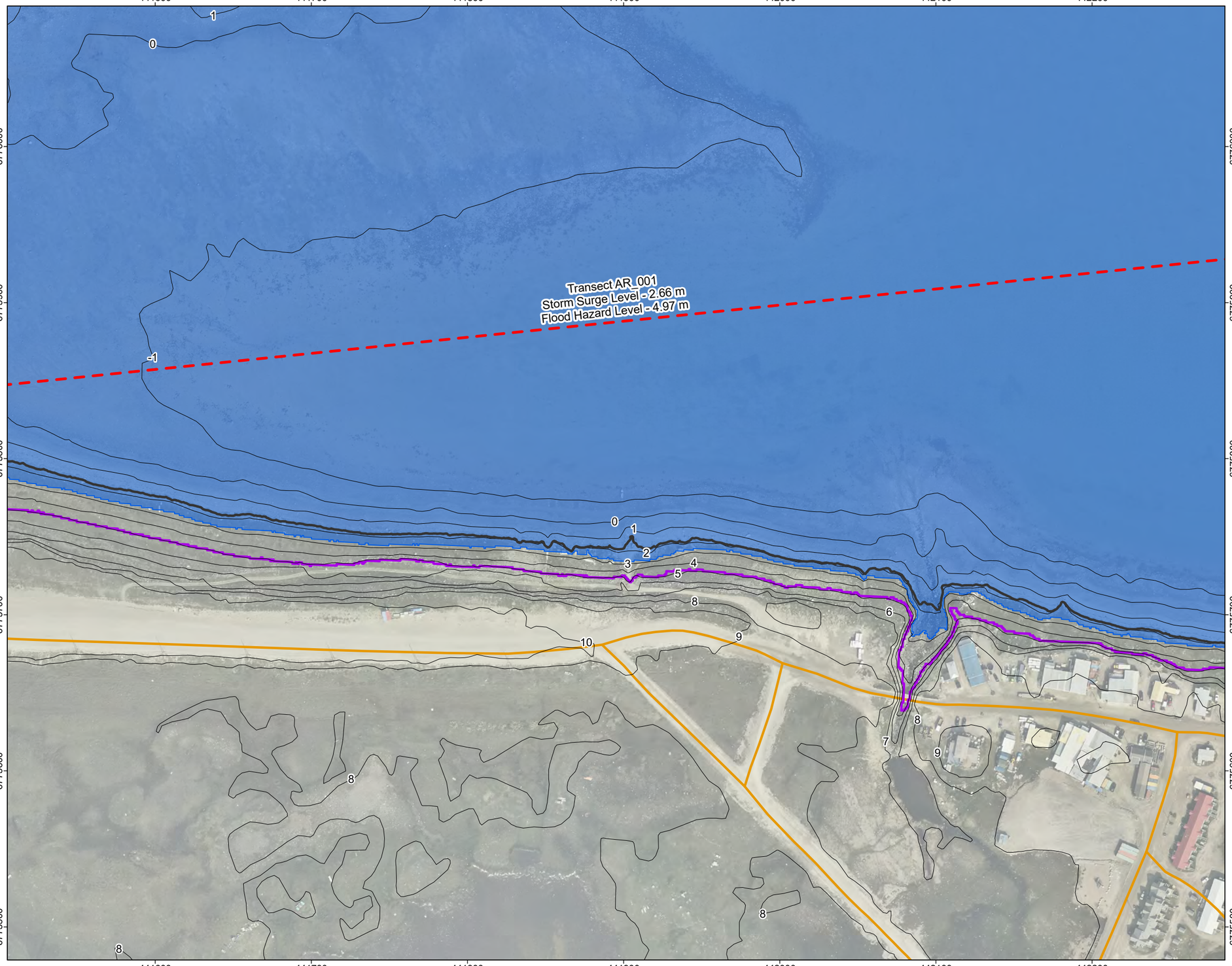
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Canada

Nunavut

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Figure No.

AR02-20yr

Title

Arviat - 20yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

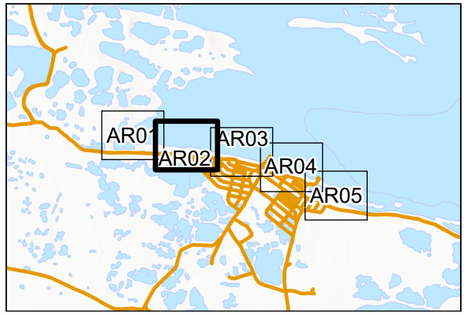
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- Topographic Contours - 1 m
- Road



Notes

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Figure No.

AR03-20yr

Title

Arviat - 20yr

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Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
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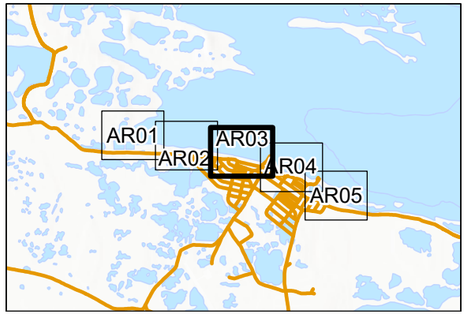
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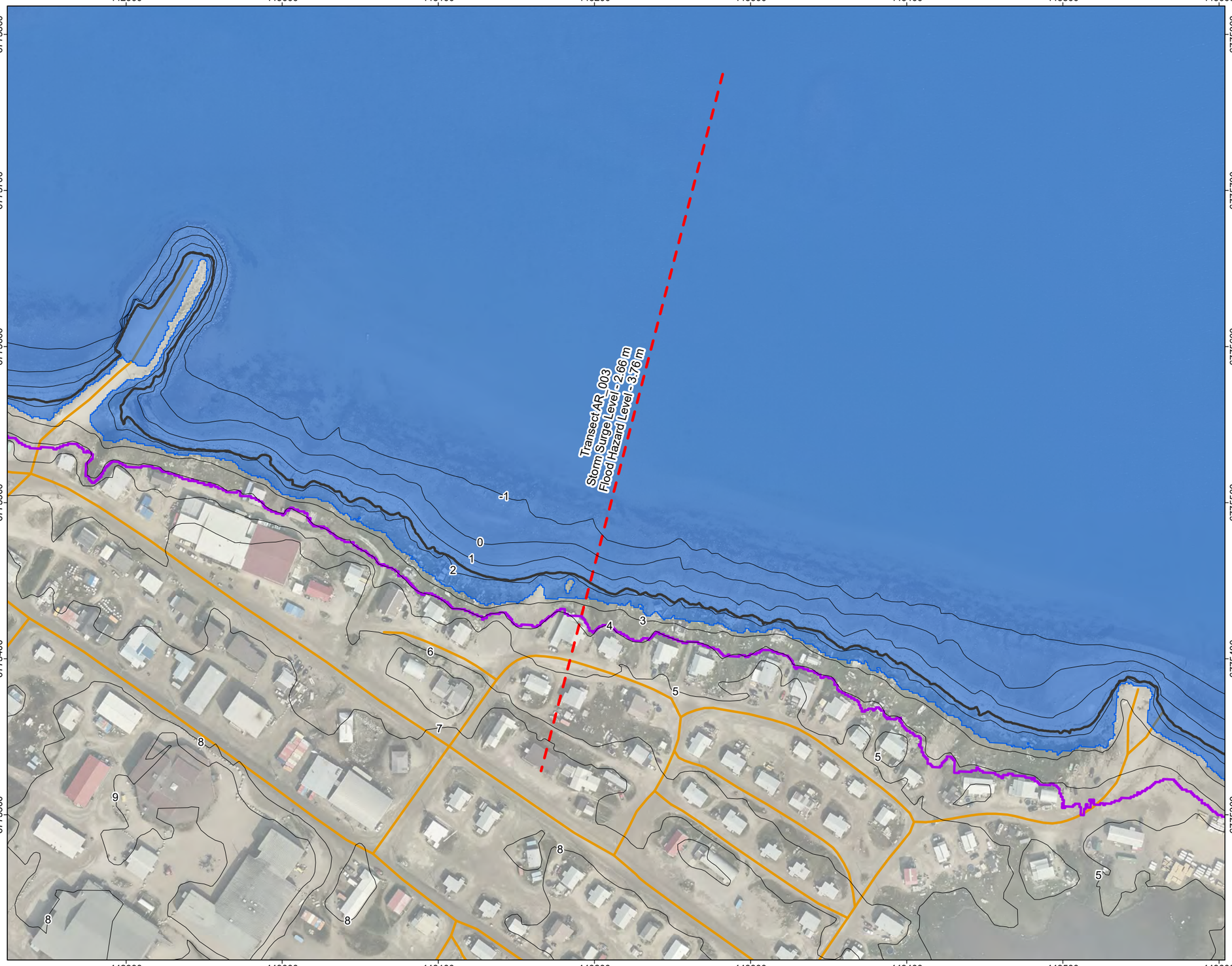
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STANTEC LIMITED

Figure No.

AR04-20yr

Title

Arviat - 20yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
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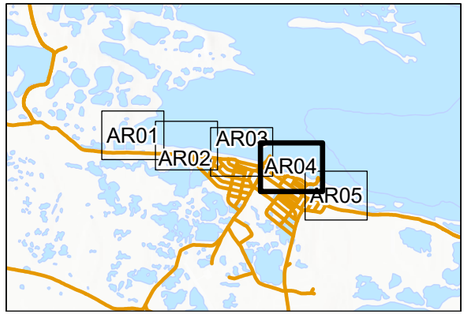
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- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 20 yr
- Storm Surge Level - 20 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2026-10-05
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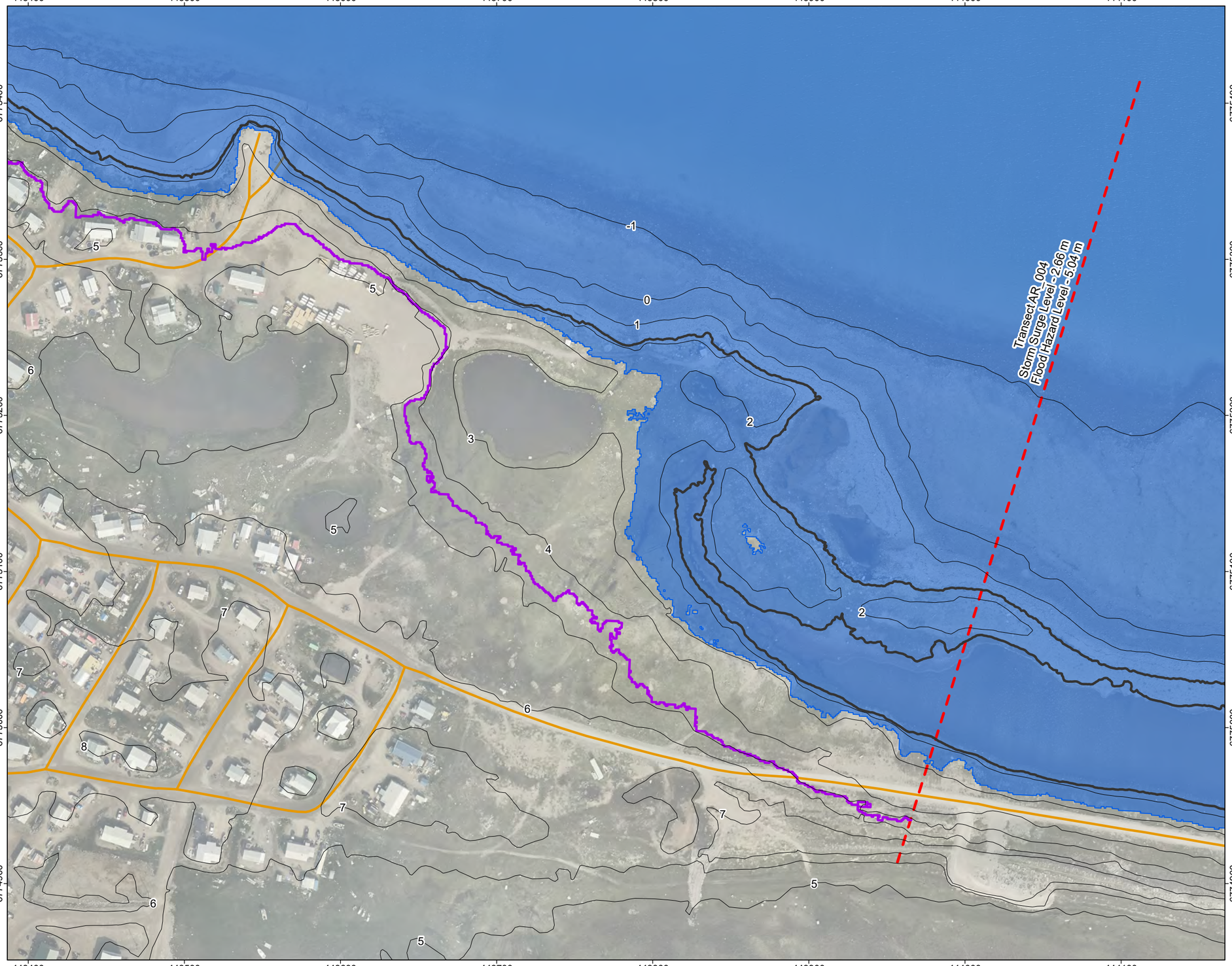
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Figure No.

AR05-20yr

Title

Arviat - 20yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4)
Nunavut Communities

Project Number: 160951868

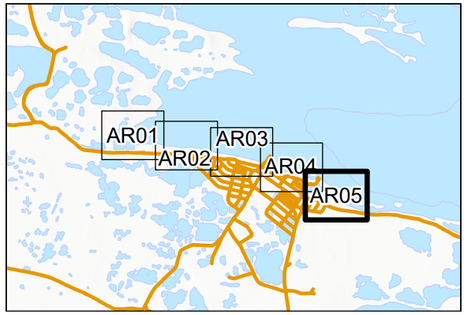
Project Location
Arviat, Nunavut

Prepared by MAINSLEY on 20260910
TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres
(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 20 yr
- Storm Surge Level - 20 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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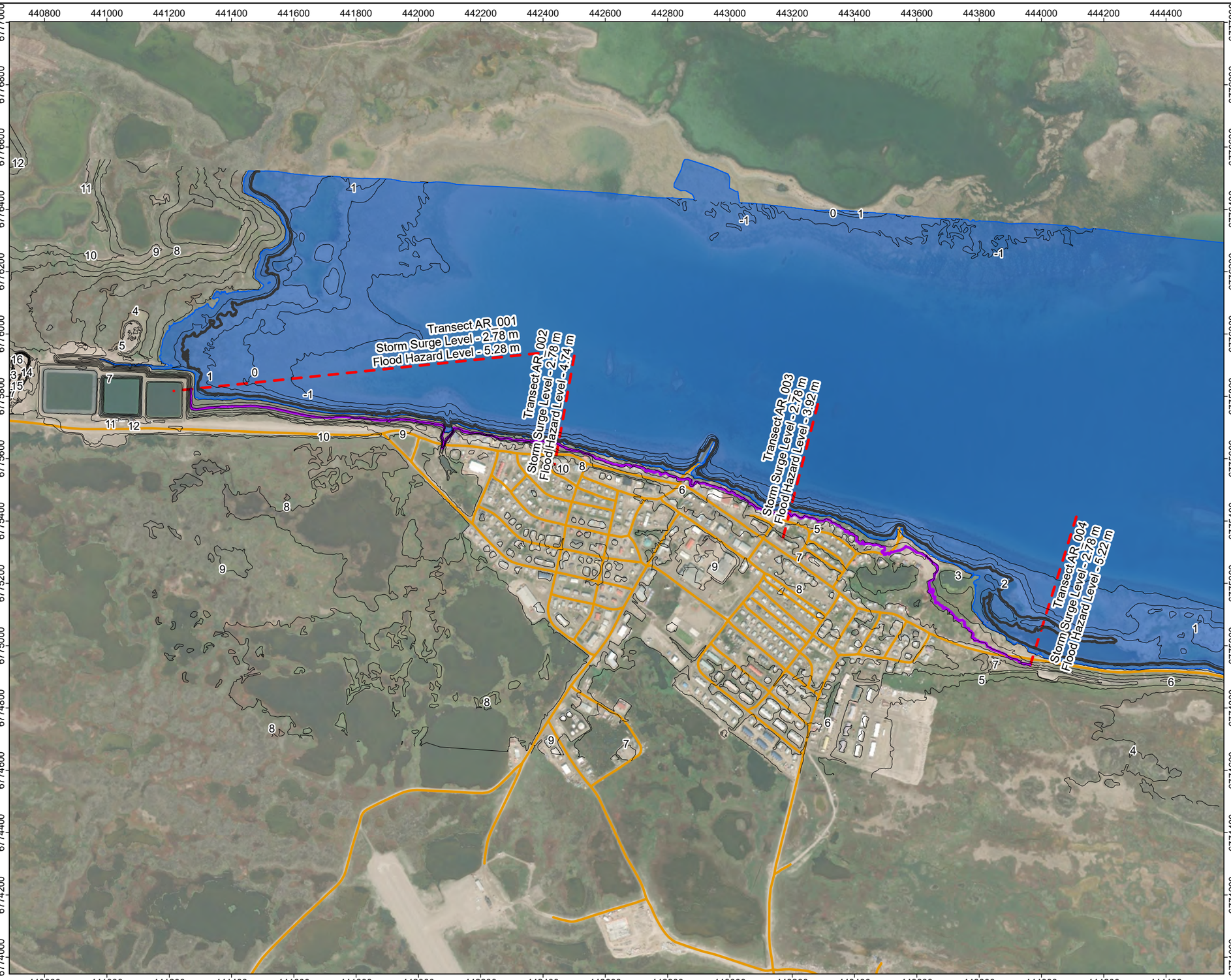
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Canada

Nunavut

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Figure No.

AR00-50yr

Title

Arviat - 50yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

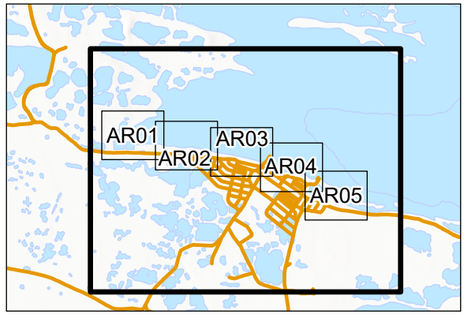
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TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 200 400 Metres

(At original document size of 11x17)
1:12,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 50 yr
- Storm Surge Level - 50 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2026-10-05
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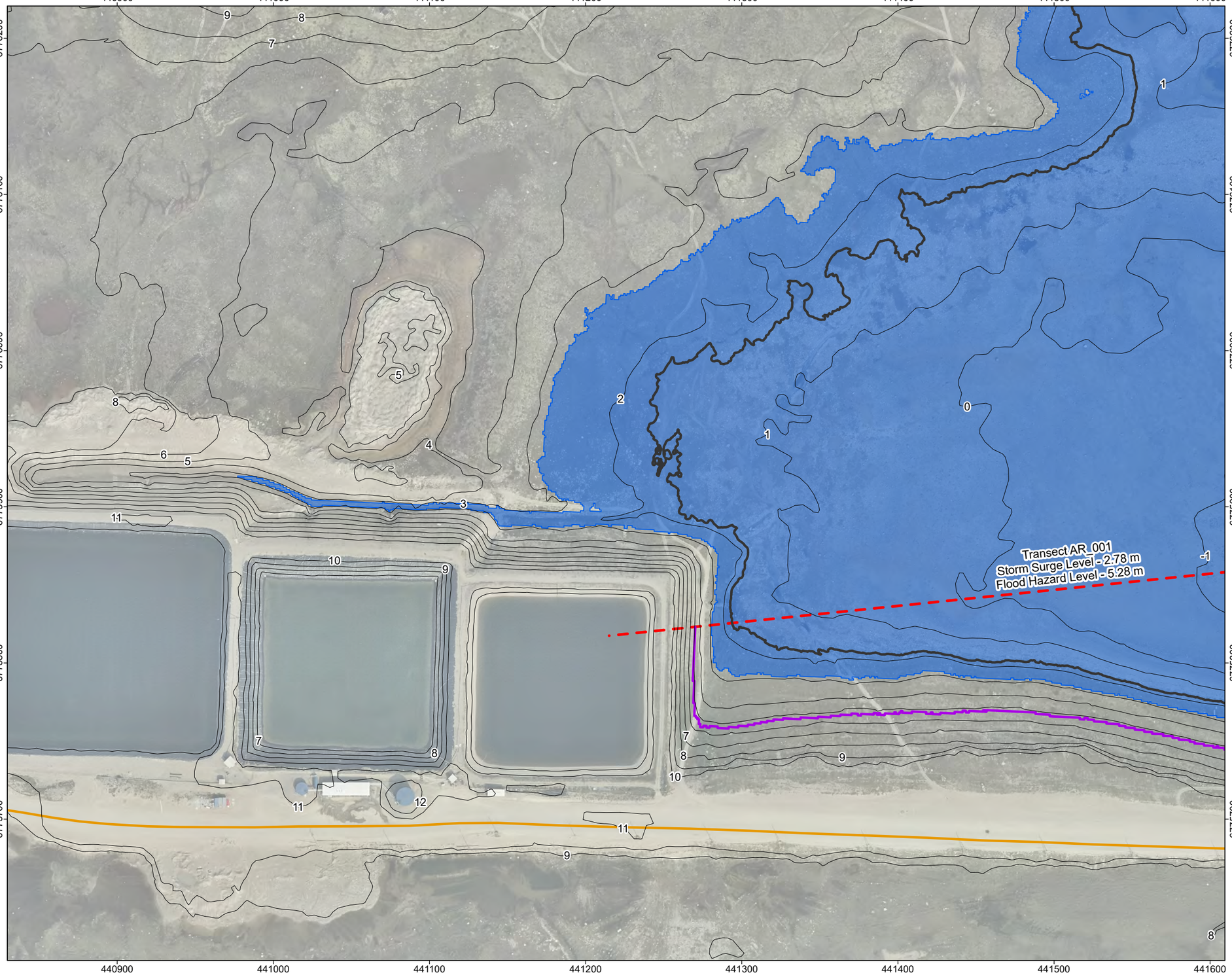
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Canada

Nunavut

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Figure No.

AR01-50yr

Title

Arviat - 50yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

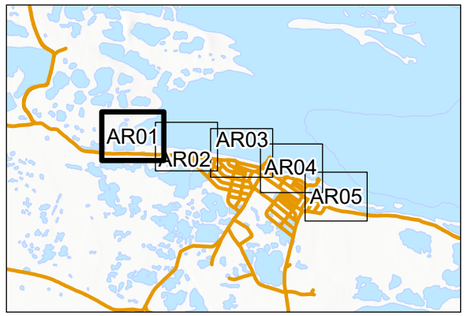
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IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 50 yr
- Storm Surge Level - 50 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2026-10-05
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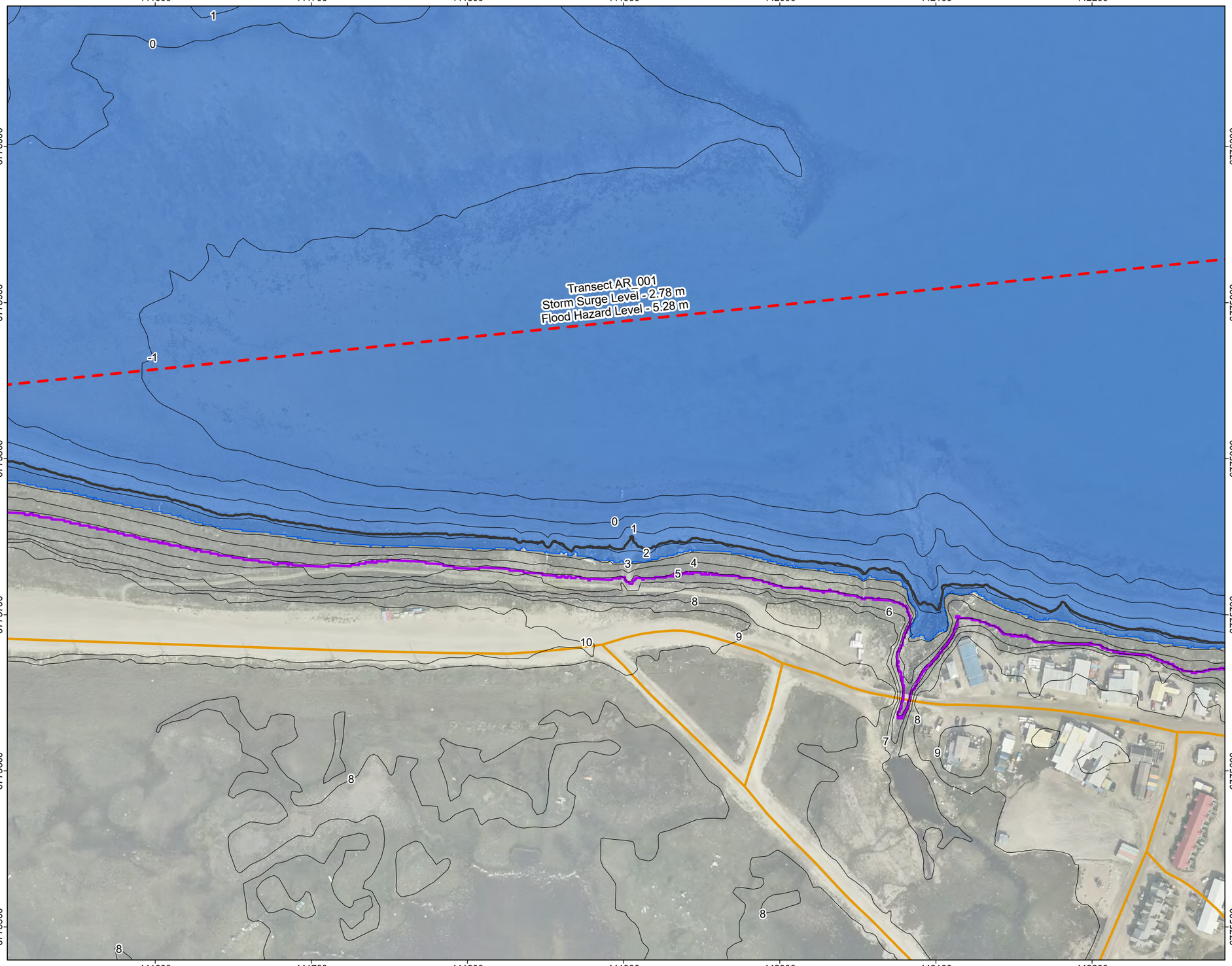
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Canada

Nunavut

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Figure No.

AR02-50yr

Title

Arviat - 50yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

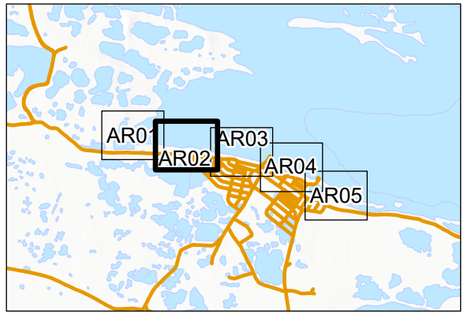
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IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 50 yr
- Storm Surge Level - 50 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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Nunavut

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STANTEC LIMITED

Figure No.

AR03-50yr

Title

Arviat - 50yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

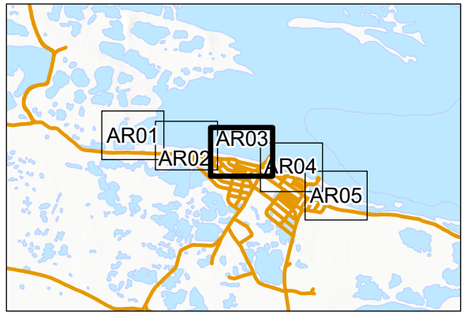
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N

0 50 100 Metres

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- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 50 yr
- Storm Surge Level - 50 yr
- Topographic Contours - 1 m
- Road



Notes
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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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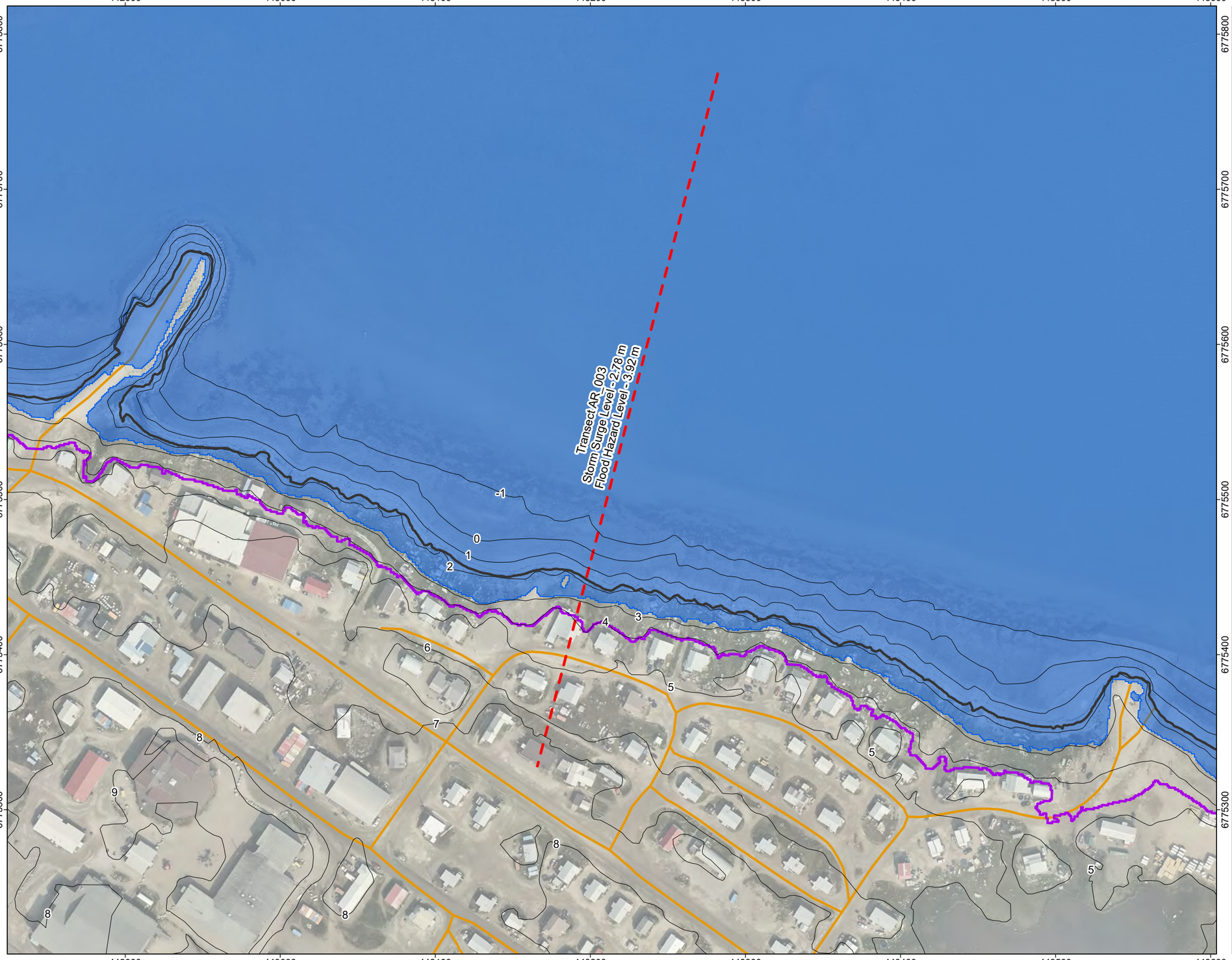
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Figure No.

AR04-50yr

Title

Arviat - 50yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

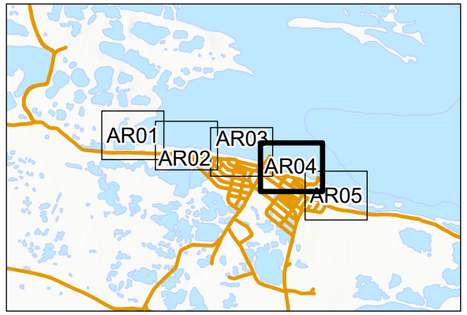
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N

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(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 50 yr
- Storm Surge Level - 50 yr
- Topographic Contours - 1 m
- Road



Notes
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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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NUNAMI
STANTEC LIMITED

Figure No.

AR05-50yr

Title

Arviat - 50yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4)
Nunavut Communities

Project Number: 160951868

Project Location
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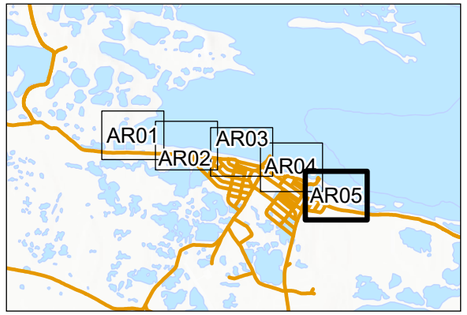
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- Topographic Contours - 1 m
- Road



Notes

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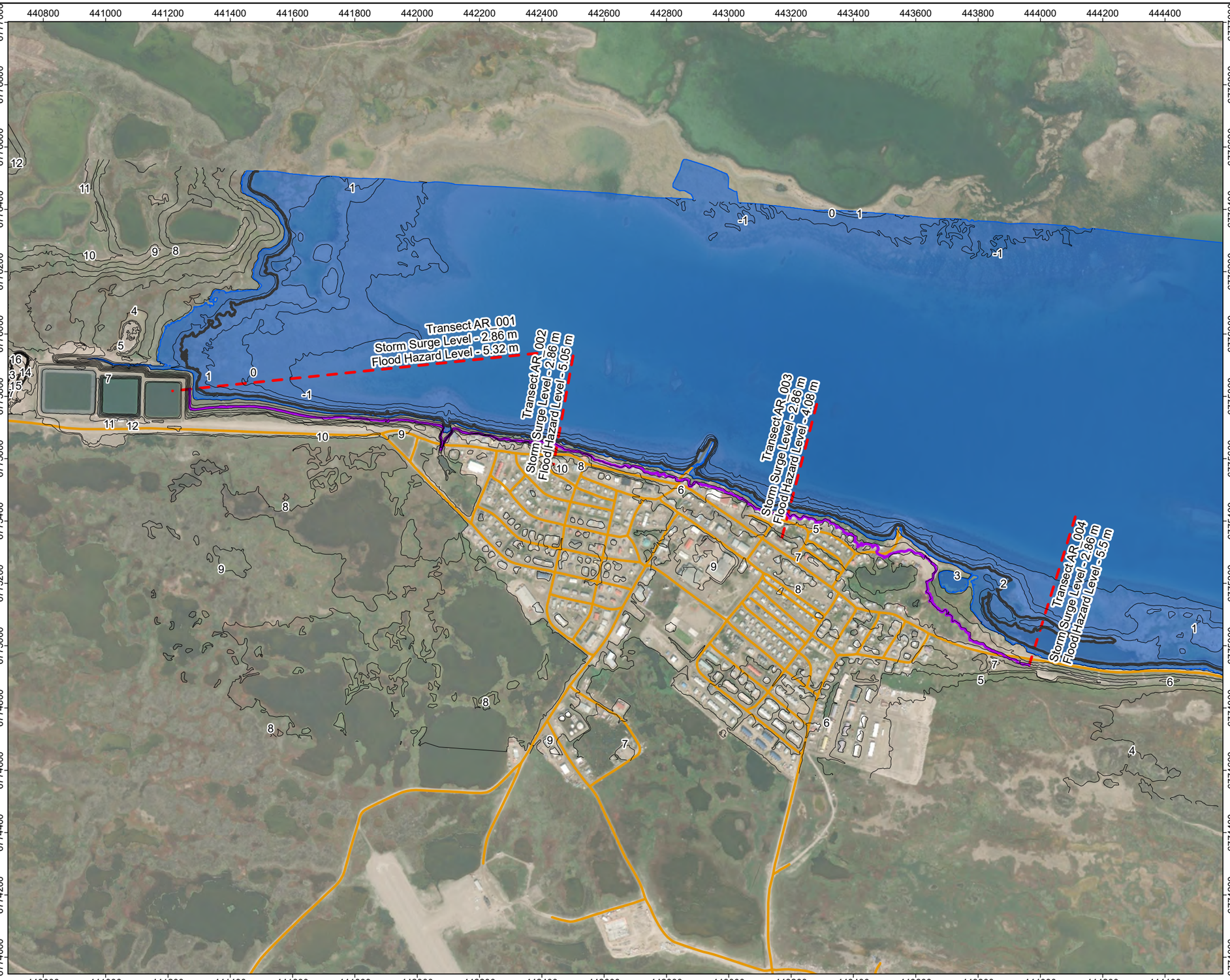
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Figure No.

AR00-100yr

Title

Arviat - 100yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

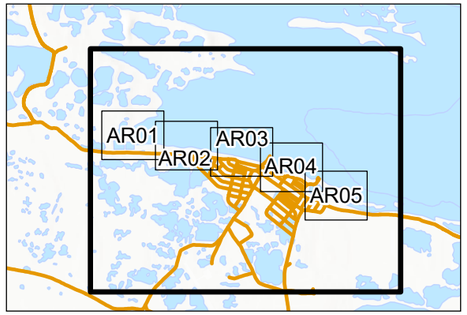
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- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 100 yr
- Storm Surge Level - 100 yr
- Topographic Contours - 1 m
- Road



Notes

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3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2025-10-05
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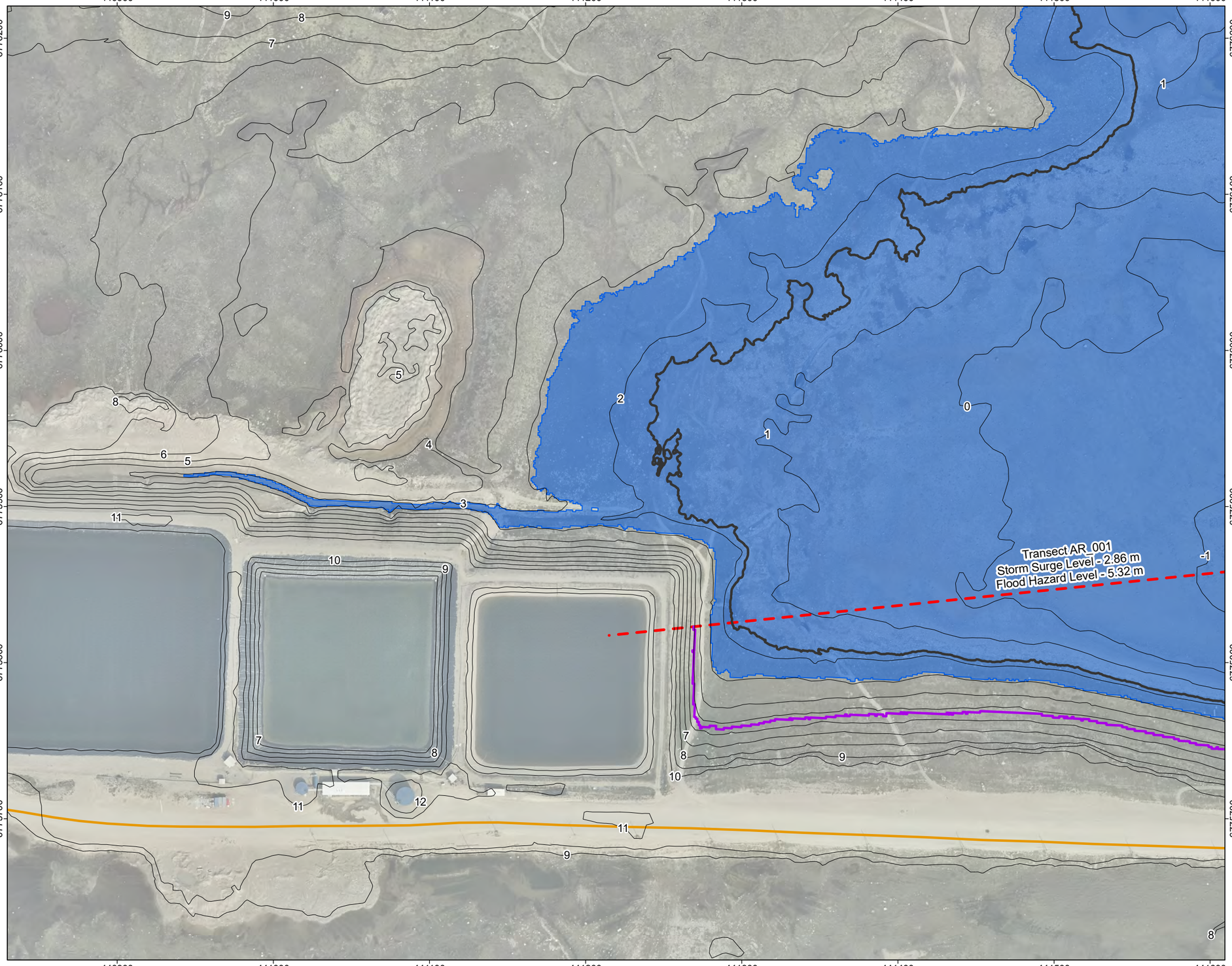
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Canada

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Figure No.

AR01-100yr

Title

Arviat - 100yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

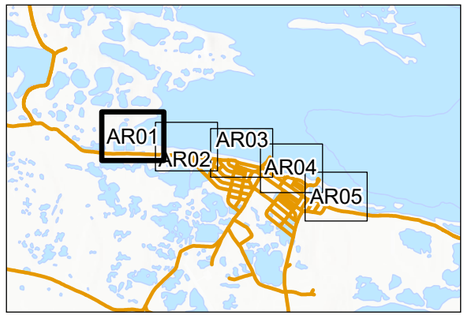
Prepared by MAINSLEY on 20260910
TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 100 yr
- Storm Surge Level - 100 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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Date October 5, 2026
PERMIT NUMBER: P 1117
NT/NU Association of Professional Engineers and Geoscientists

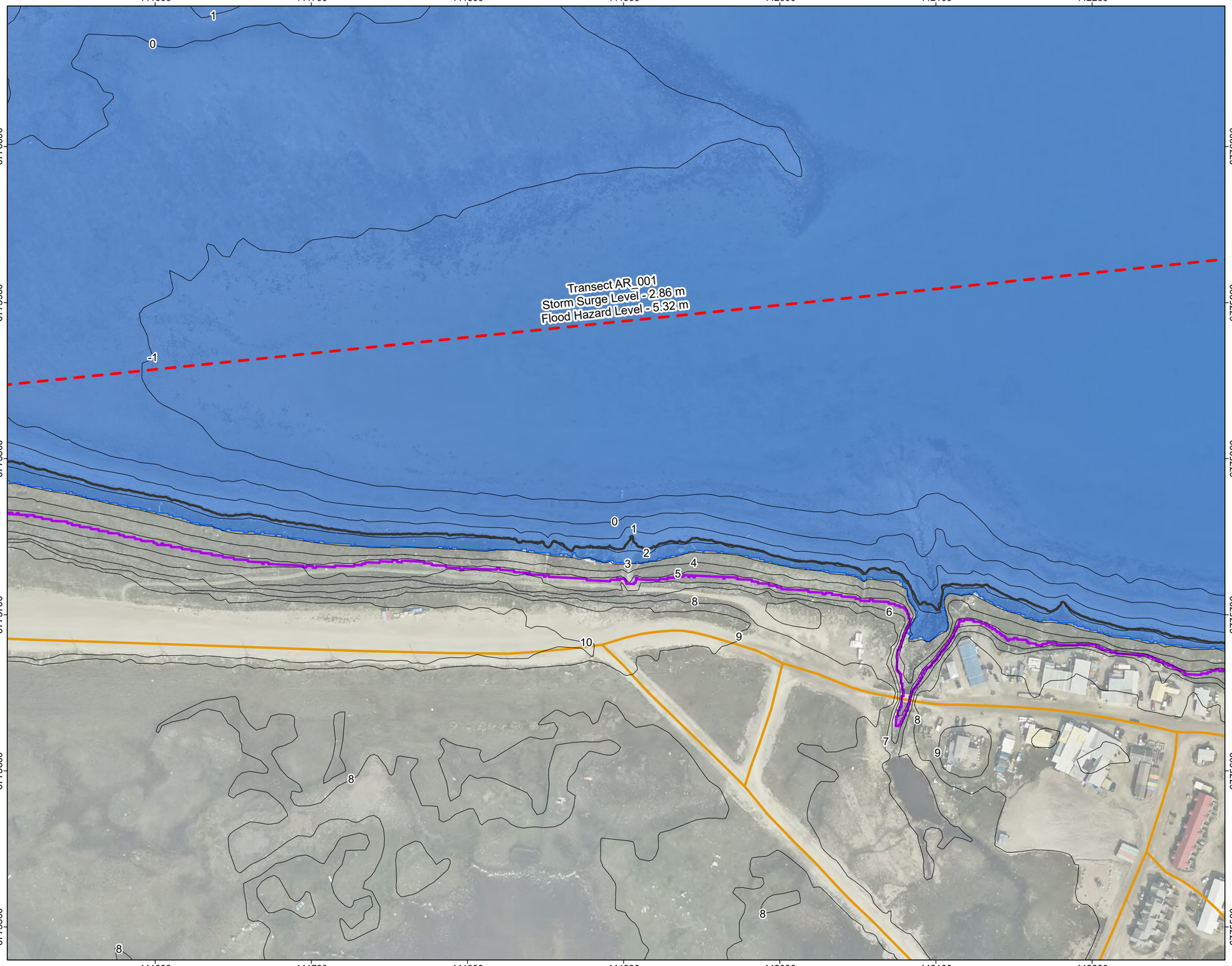
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Canada

Nunavut

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Figure No.

AR02-100yr

Title

Arviat - 100yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

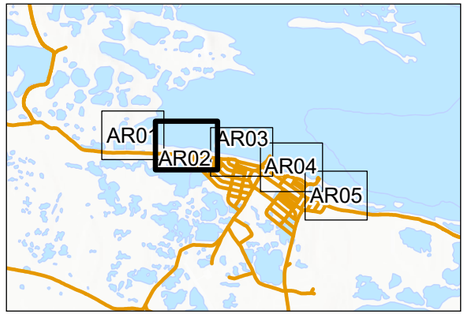
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TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 100 yr
- Storm Surge Level - 100 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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Nunavut

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Figure No.

AR03-100yr

Title

Arviat - 100yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

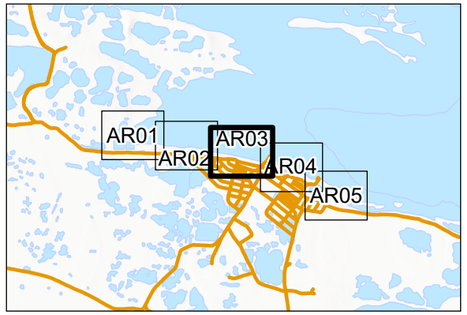
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(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 100 yr
- Storm Surge Level - 100 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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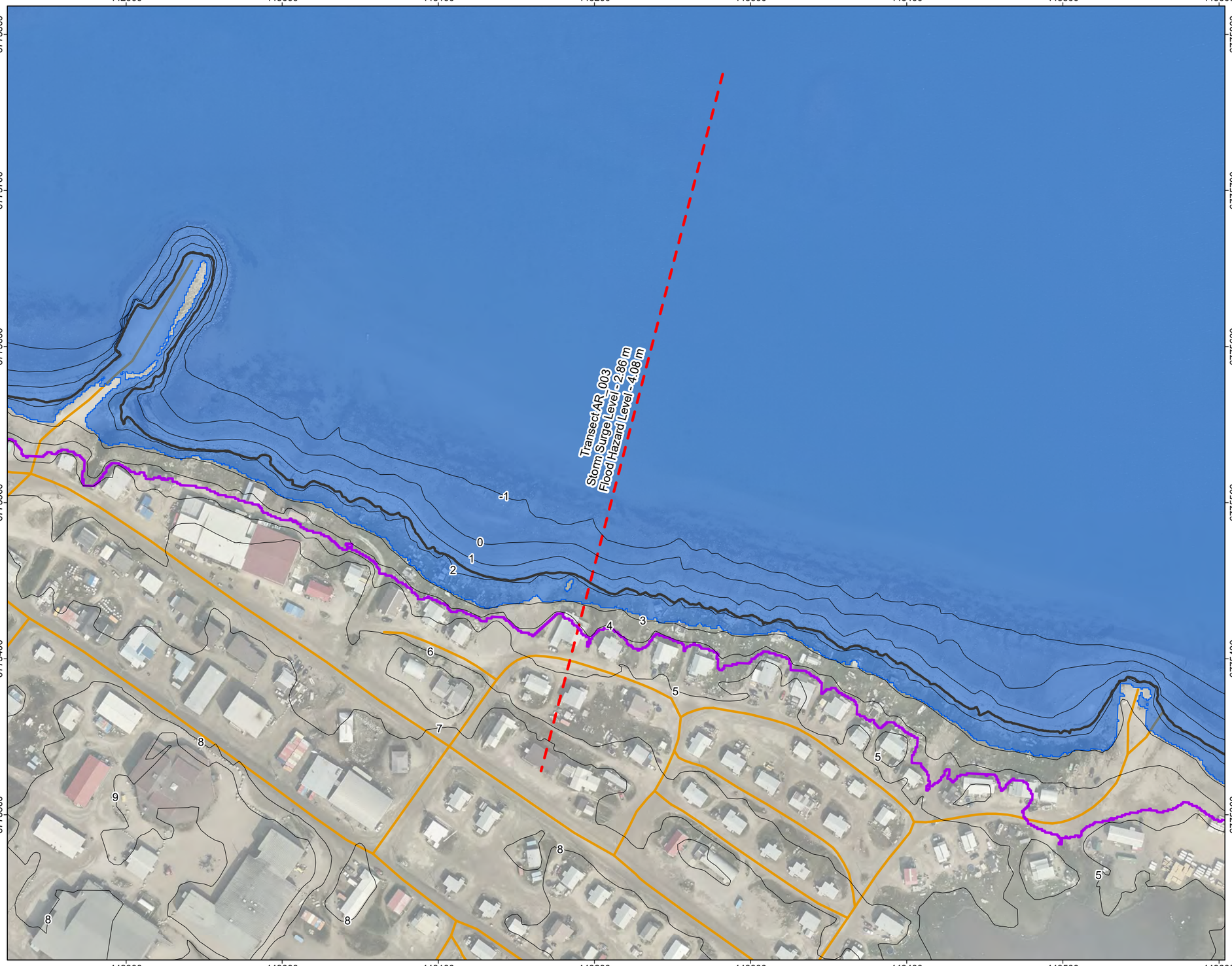
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Canada

Nunavut

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Figure No.

AR04-100yr

Title

Arviat - 100yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

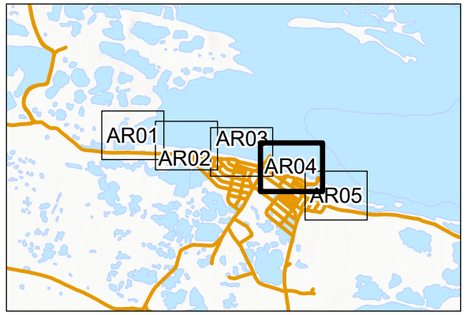
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IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 100 yr
- Storm Surge Level - 100 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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Figure No.

AR05-100yr

Title

Arviat - 100yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

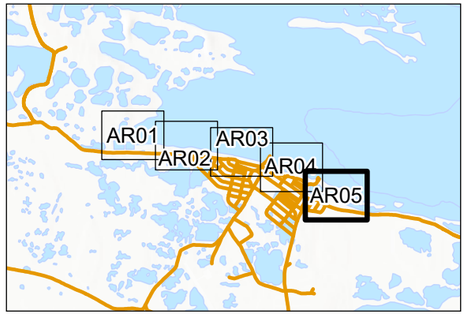
Project Location
Arviat, Nunavut

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TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres
(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 100 yr
- Storm Surge Level - 100 yr
- Topographic Contours - 1 m
- Road



Notes

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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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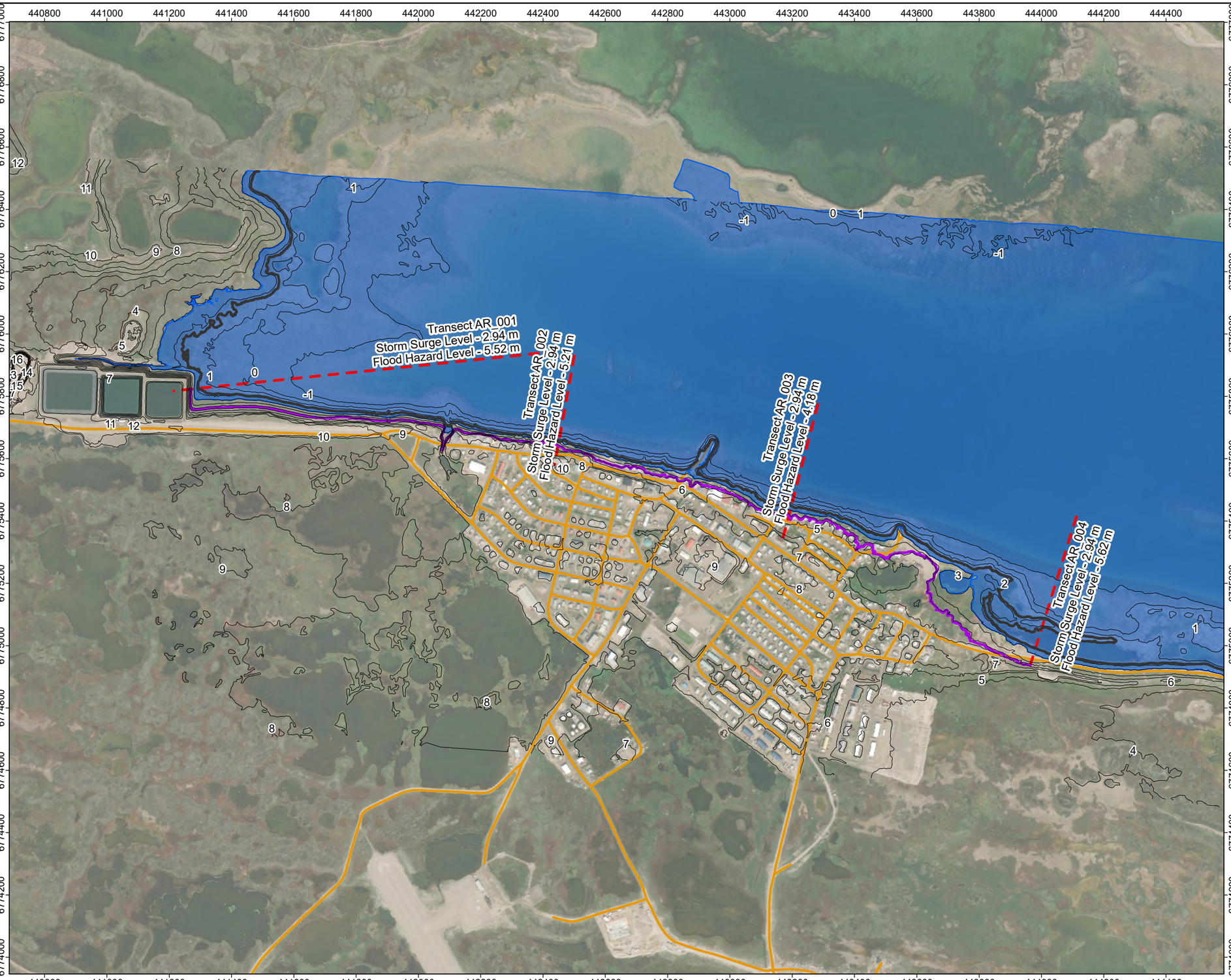
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Nunavut

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Figure No.

AR00-200yr

Title

Arviat - 200yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

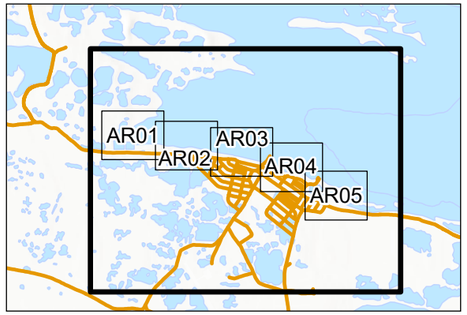
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IR by NKIMIAGHALAM on 20260910

N

0 200 400 Metres

(At original document size of 11x17)
1:12,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 200 yr
- Storm Surge Level - 200 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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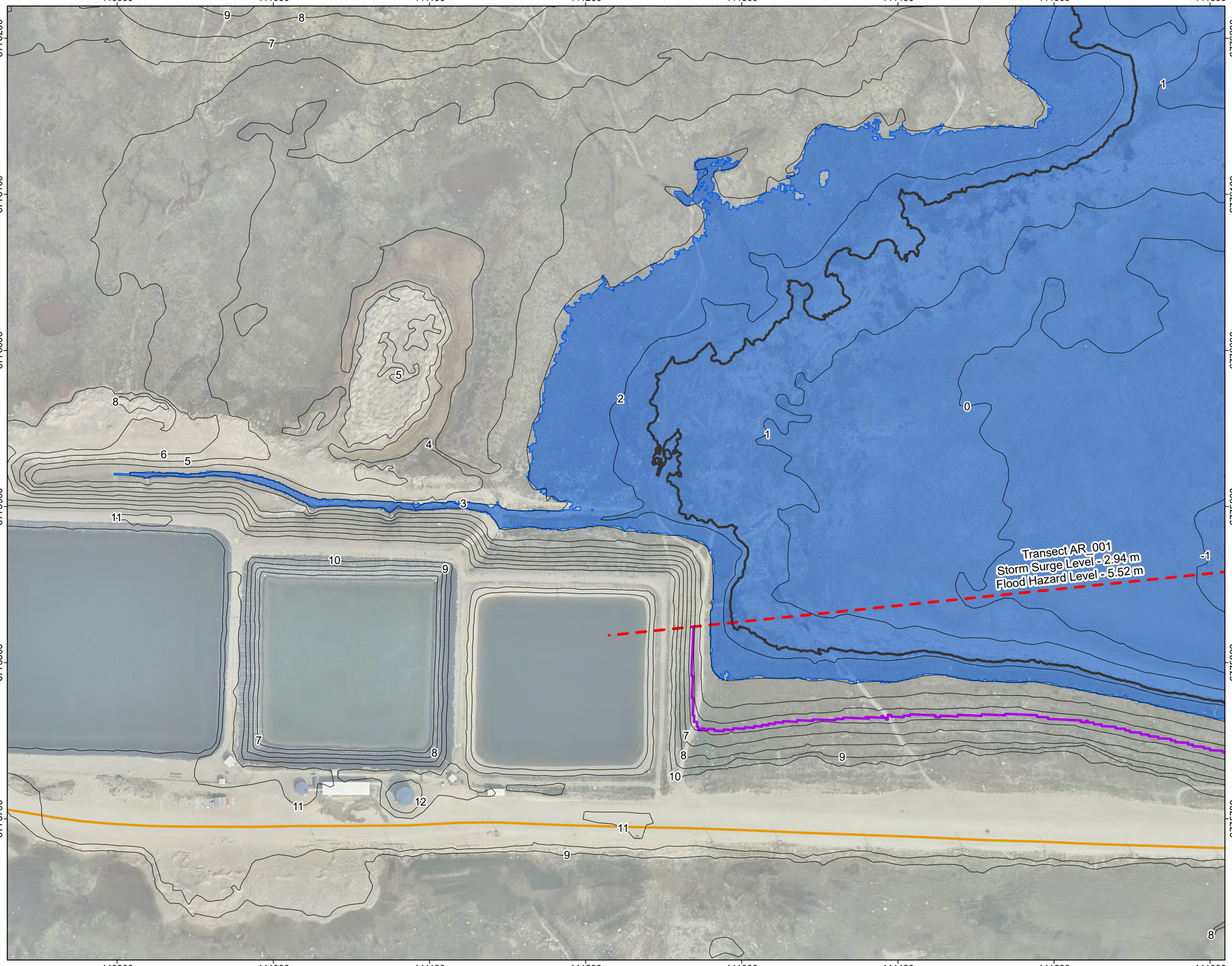
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Nunavut

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STANTEC LIMITED

Figure No.

AR01-200yr

Title

Arviat - 200yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

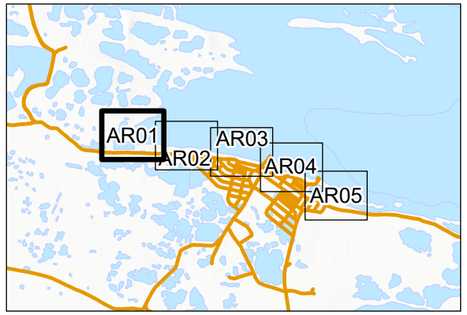
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N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 200 yr
- Storm Surge Level - 200 yr
- Topographic Contours - 1 m
- Road



Notes
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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

REGISTERED PROFESSIONAL ENGINEER
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2026-10-05
NT/NU

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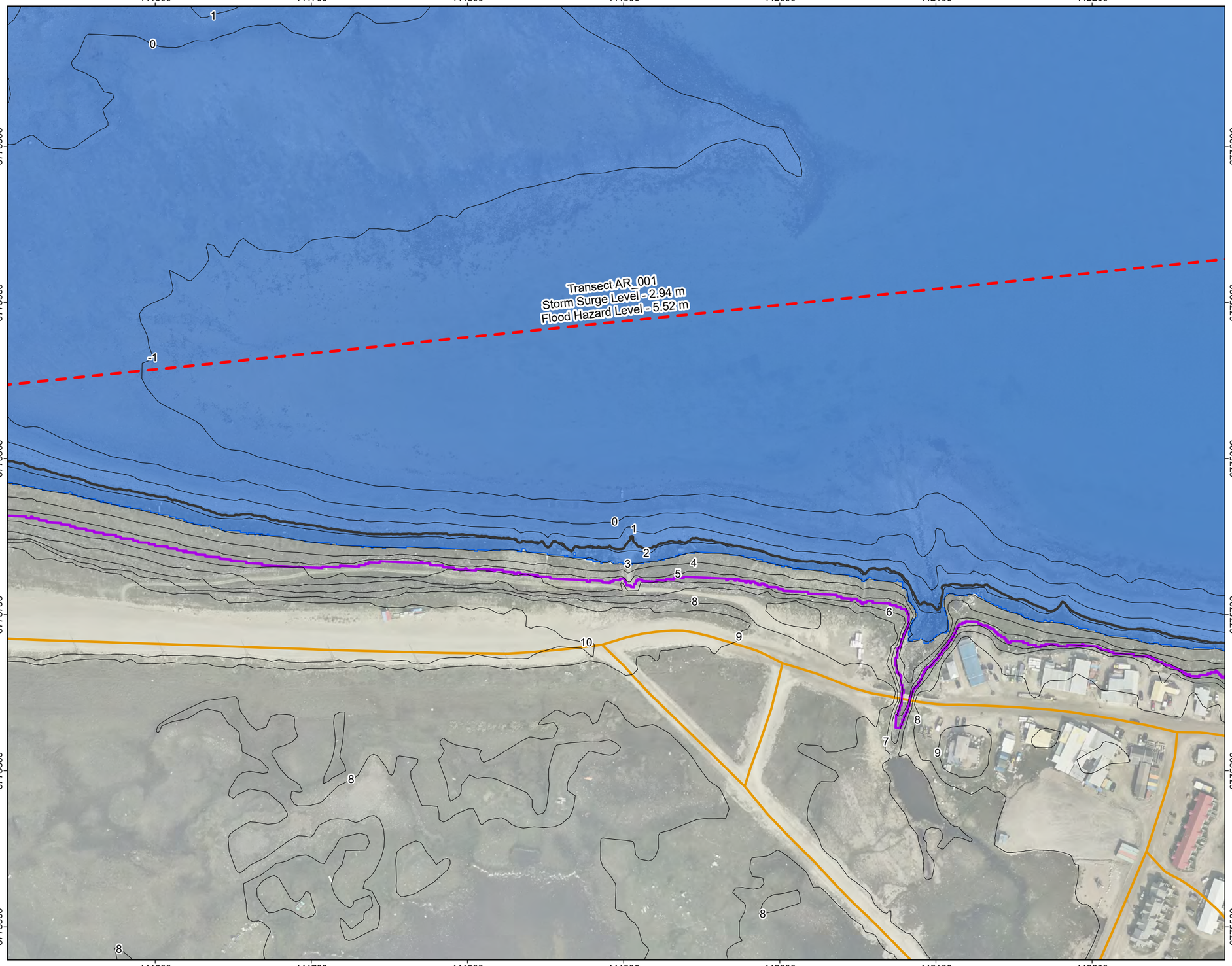
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Canada

Nunavut

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Figure No.

AR02-200yr

Title

Arviat - 200yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

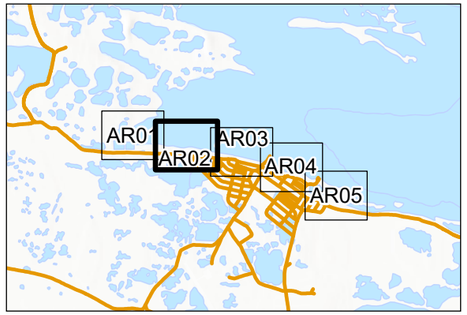
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N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 200 yr
- Storm Surge Level - 200 yr
- Topographic Contours - 1 m
- Road



Notes

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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

REGISTERED PROFESSIONAL ENGINEER
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P.Eng.
2026-10-05
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Figure No.

AR03-200yr

Title

Arviat - 200yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

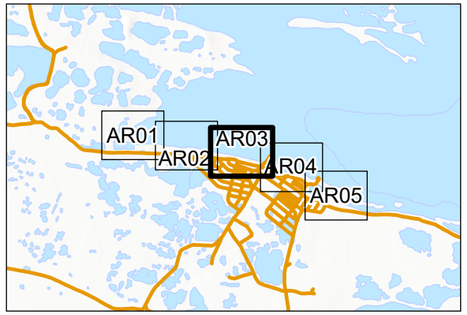
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0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 200 yr
- Storm Surge Level - 200 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2025-10-06
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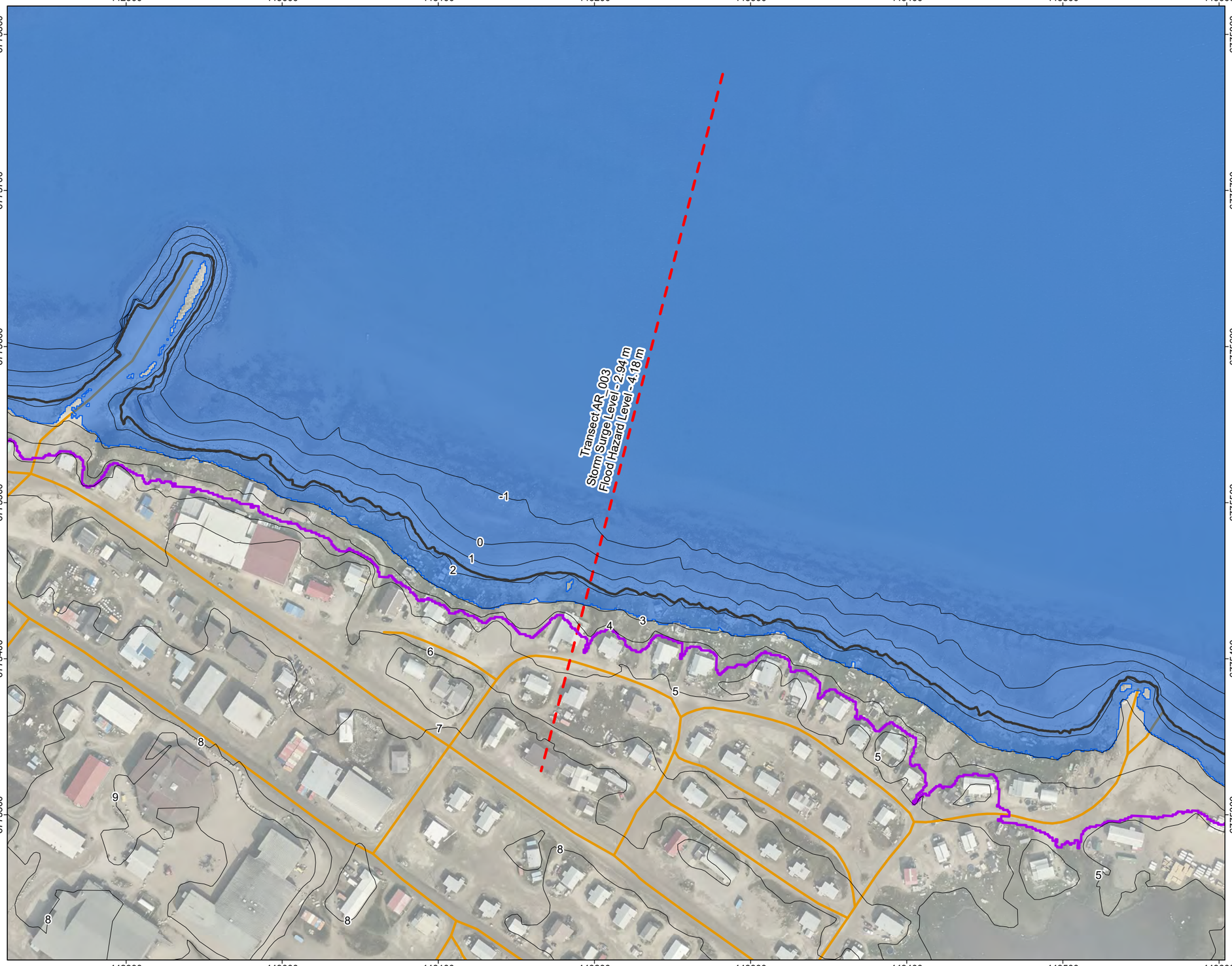
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Canada

Nunavut

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STANTEC LIMITED

Figure No.

AR04-200yr

Title

Arviat - 200yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

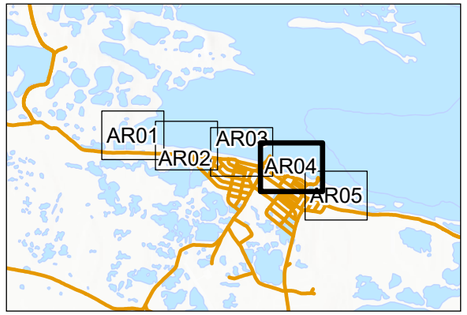
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TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 200 yr
- Storm Surge Level - 200 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2026-10-05
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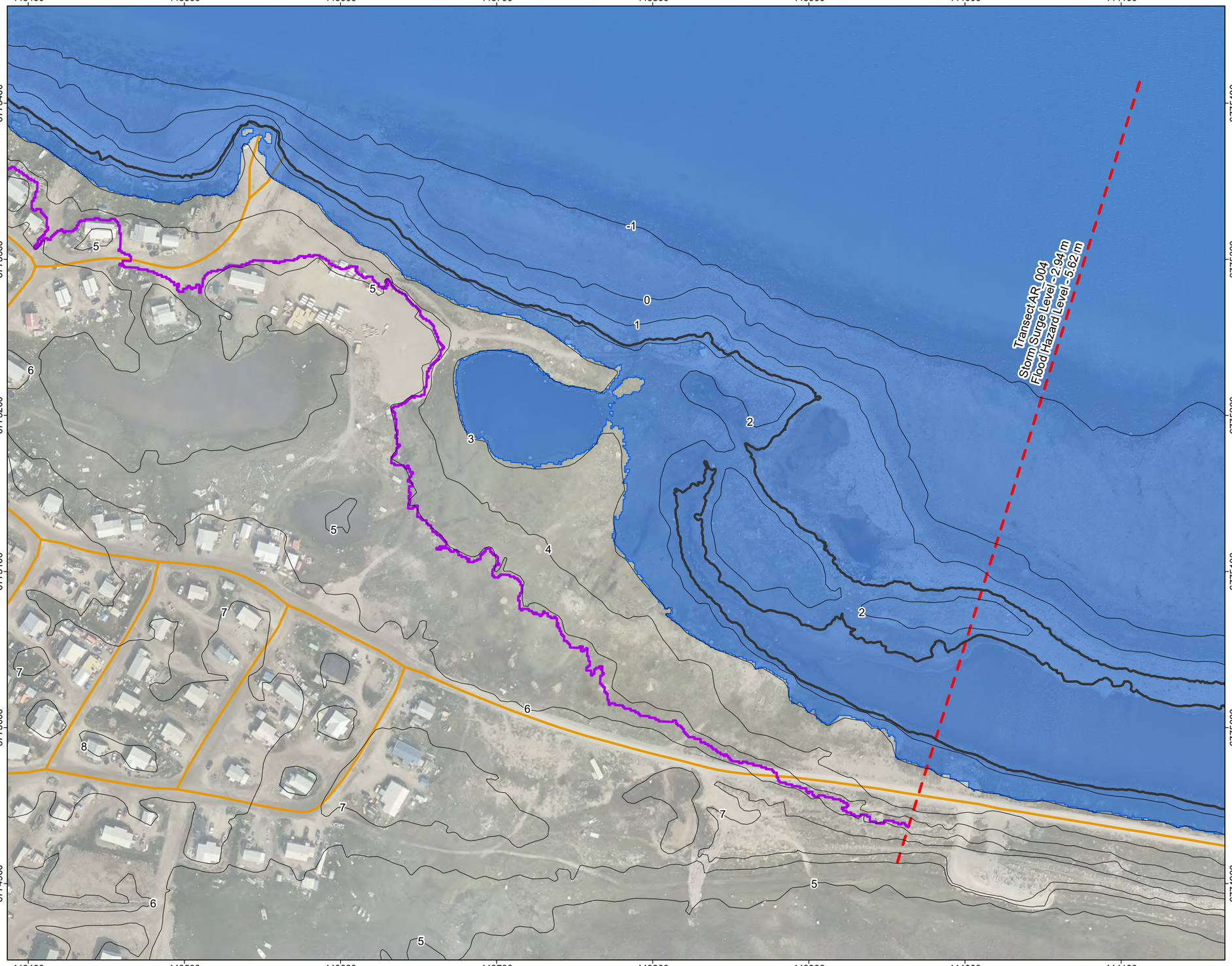
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Canada

Nunavut

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STANTEC LIMITED

Figure No.

AR05-200yr

Title

Arviat - 200yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

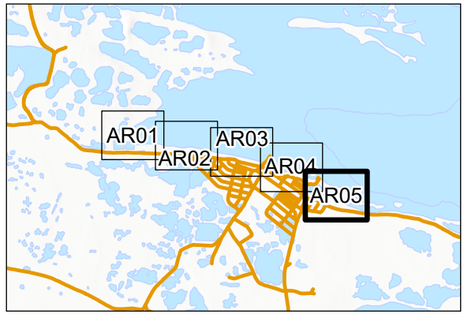
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TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 200 yr
- Storm Surge Level - 200 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2026-10-05
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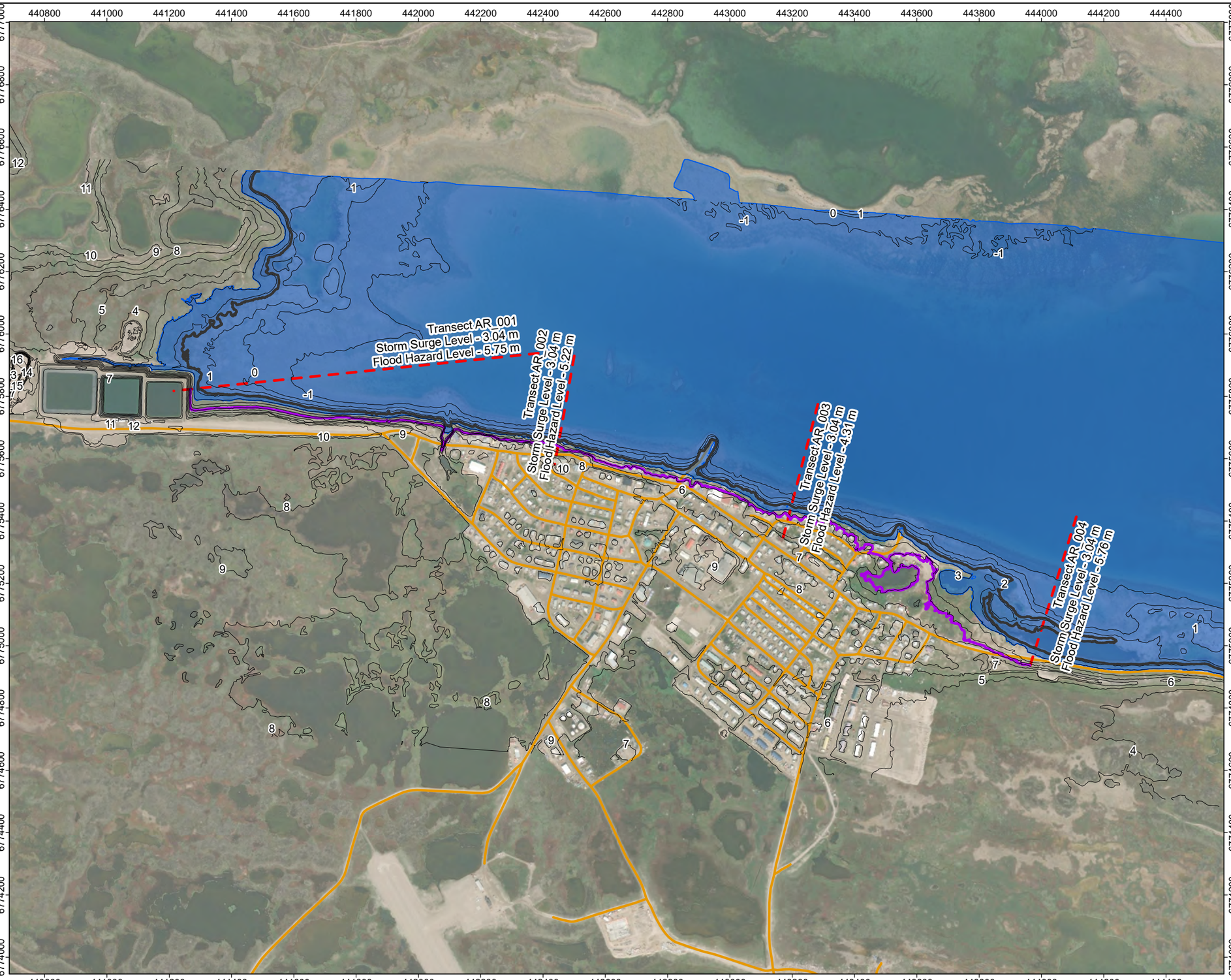
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Canada

Nunavut

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Figure No.

AR00-500yr

Title

Arviat - 500yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

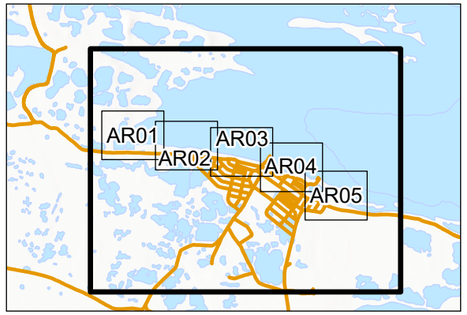
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TR by HDASHTPEYMA on 20260910
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N

0 200 400 Metres

(At original document size of 11x17)
1:12,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 500 yr
- Storm Surge Level - 500 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2026-10-05
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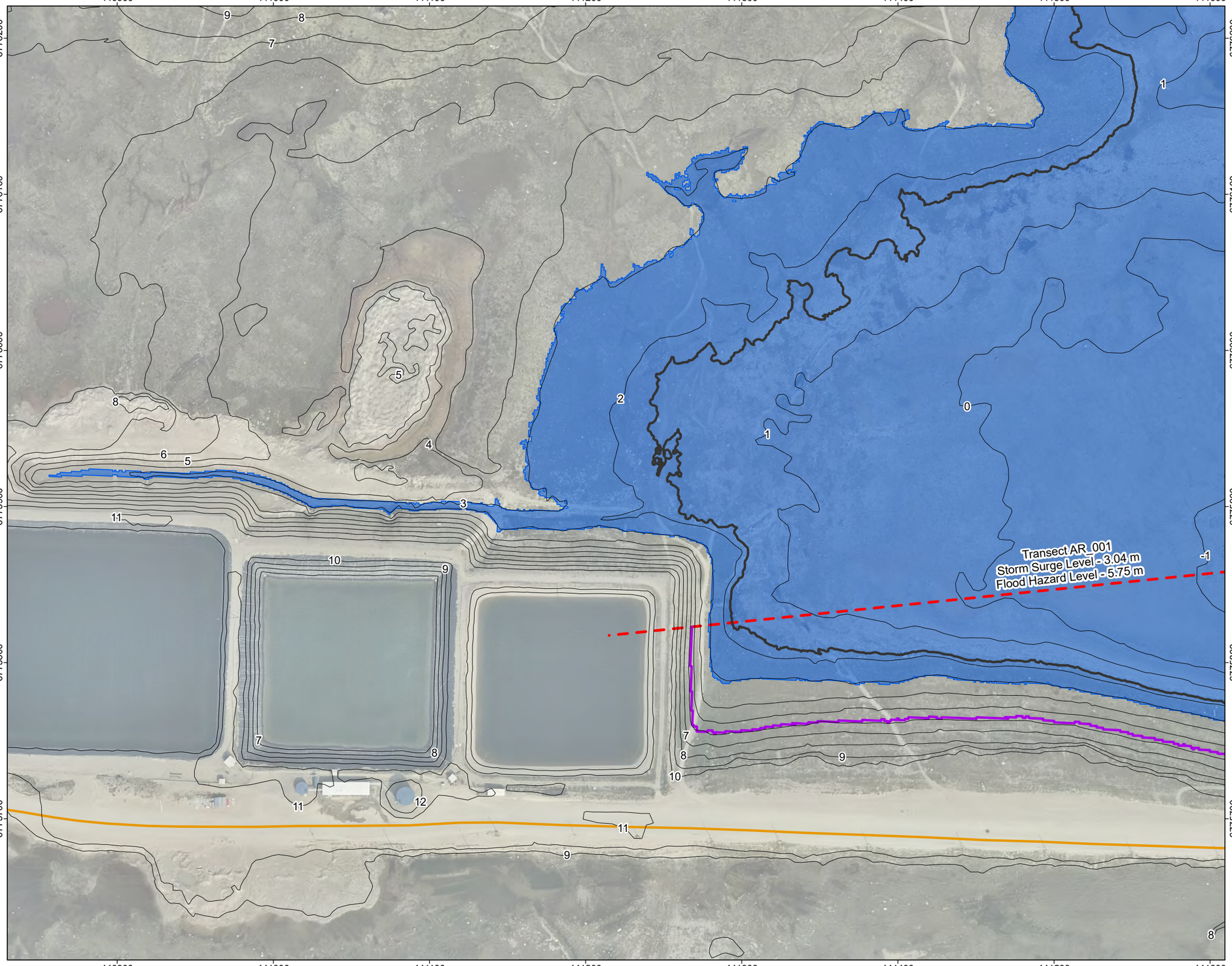
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Canada

Nunavut

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Figure No.

AR01-500yr

Title

Arviat - 500yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

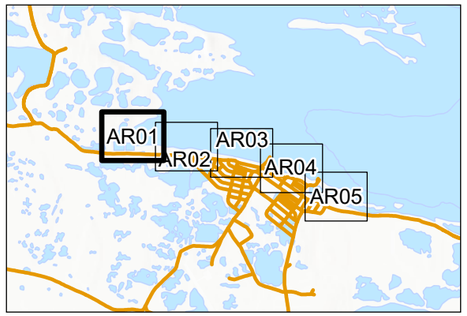
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TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 500 yr
- Storm Surge Level - 500 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2026-10-05
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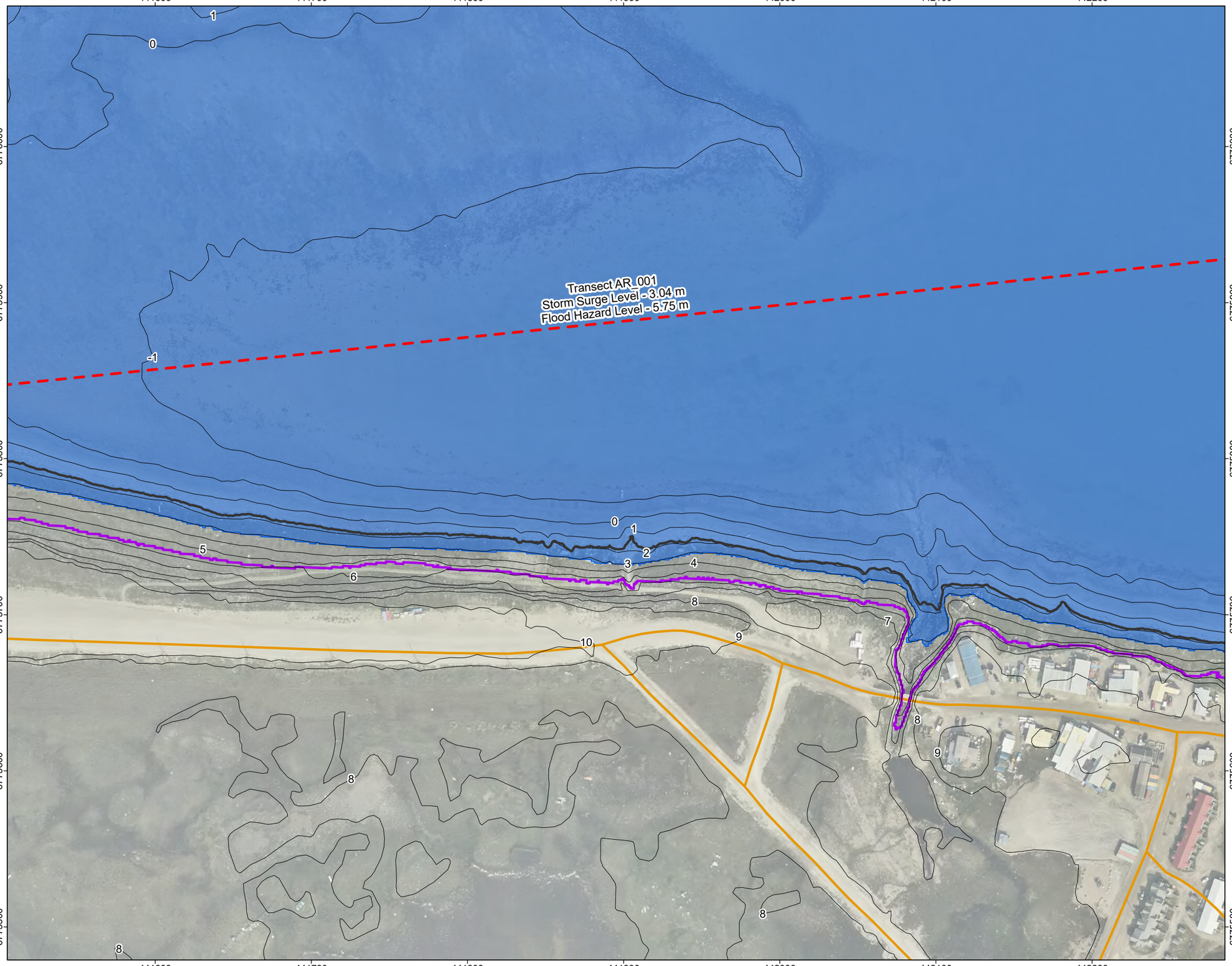
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Canada

Nunavut

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Figure No.

AR02-500yr

Title

Arviat - 500yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

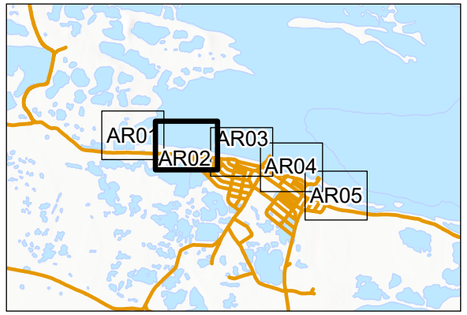
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IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 500 yr
- Storm Surge Level - 500 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2026-10-05
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NT/NU Association of Professional Engineers and Geoscientists

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Nunavut

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STANTEC LIMITED

Figure No.

AR03-500yr

Title

Arviat - 500yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

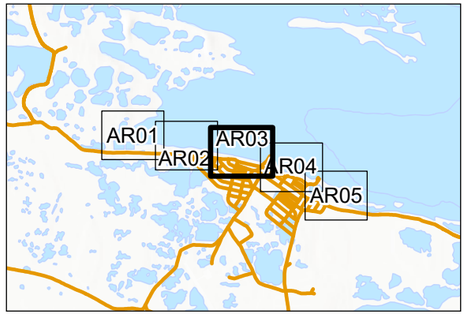
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N

0 50 100 Metres

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1:2,500

- Modelling Transect
- HHWLT (1.67 m)
- Flood Hazard Level - 500 yr
- Storm Surge Level - 500 yr
- Topographic Contours - 1 m
- Road



Notes
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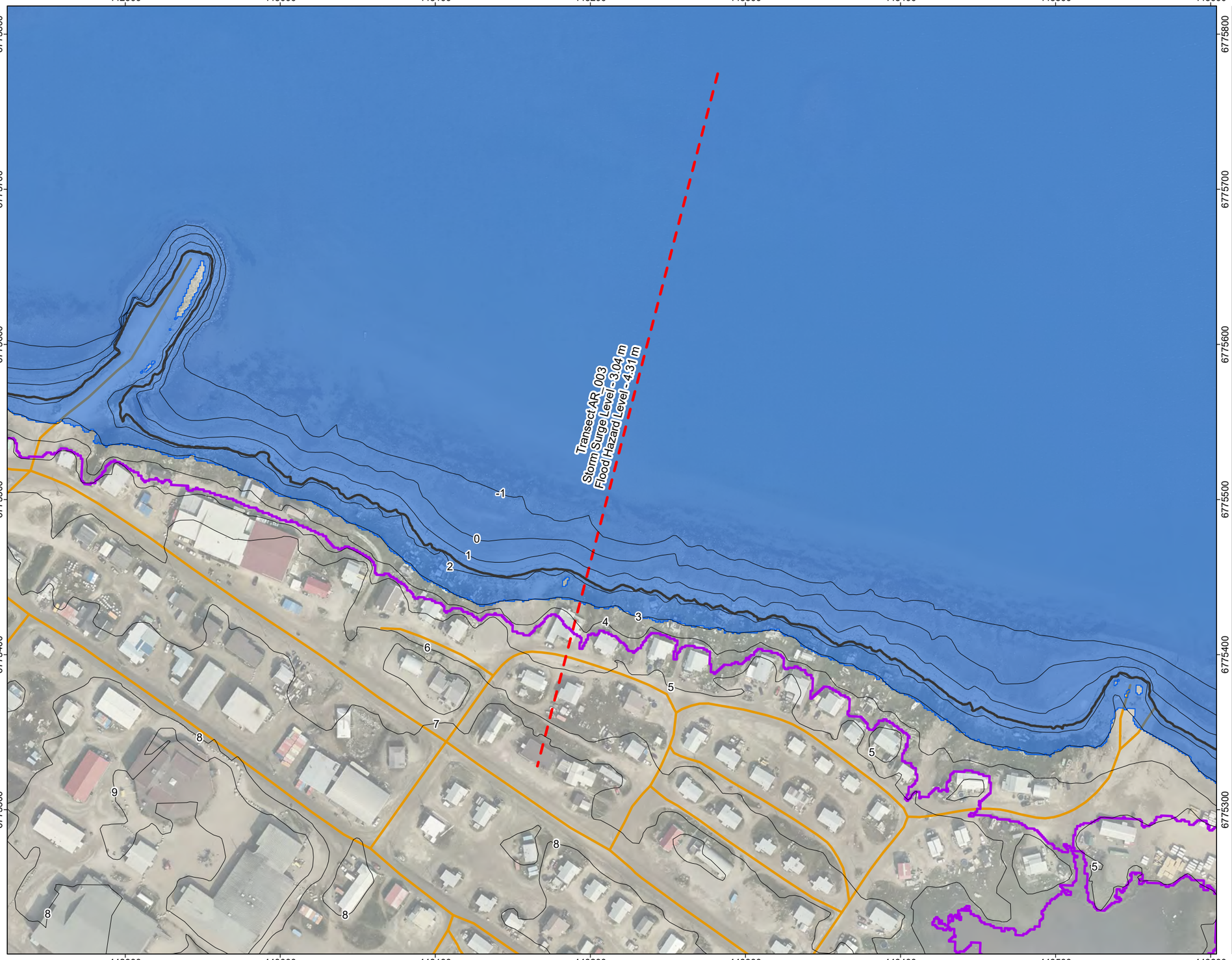
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Canada

Nunavut

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STANTEC LIMITED

Figure No.

AR04-500yr

Title

Arviat - 500yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Arviat, Nunavut

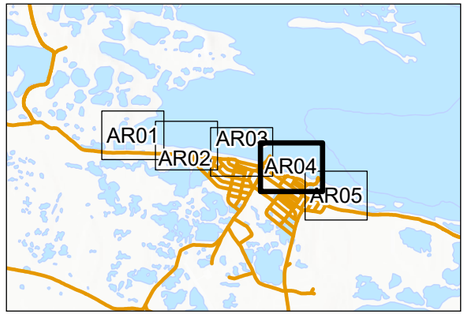
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- Storm Surge Level - 500 yr
- Topographic Contours - 1 m
- Road



Notes
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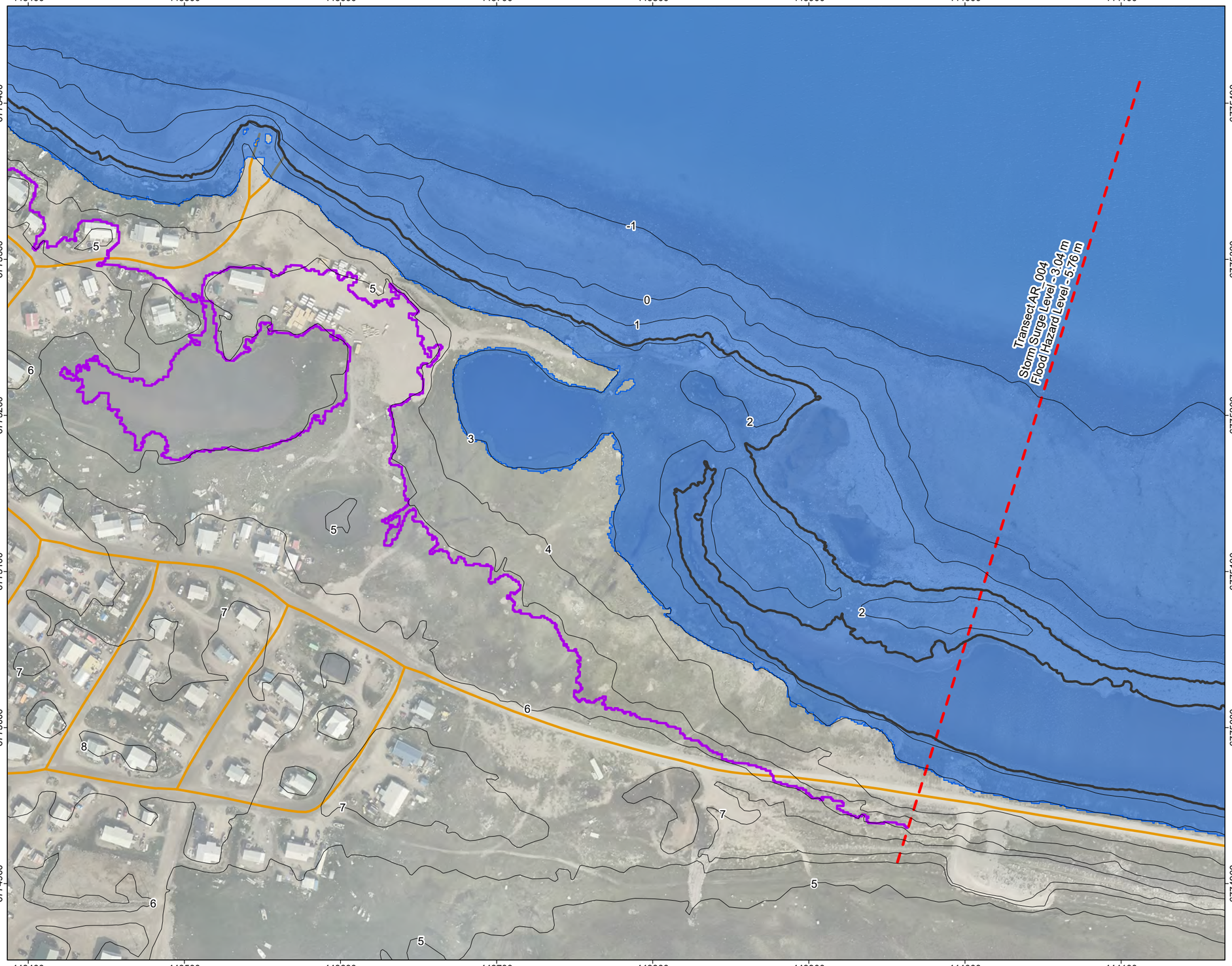
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Canada

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NUNAMI
STANTEC LIMITED

Figure No.

AR05-500yr

Title

Arviat - 500yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

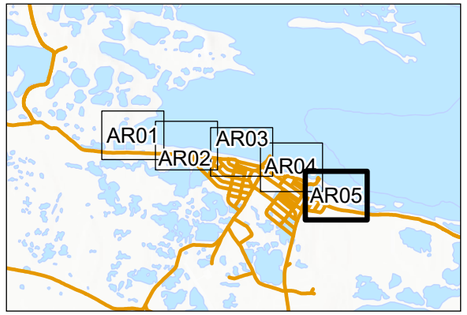
Project Location
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Notes

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Canada

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Figure No.

CH00-10yr

Title

Coral Harbour - 10yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

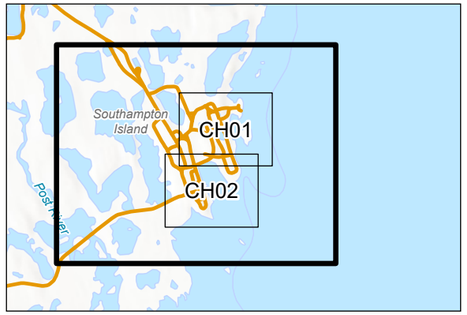
Project Location
Coral Harbour, Nunavut

Prepared by MAINSLEY on 20260910
TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 100 200 Metres
(At original document size of 11x17)
1:7,500

- Modelling Transect
- HHWLT (1.33 m)
- Flood Hazard Level - 10 yr
- Storm Surge Level - 10 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 17N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Stantec Consulting Orthoimagery

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2026-10-05
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Signature
Date October 5, 2026
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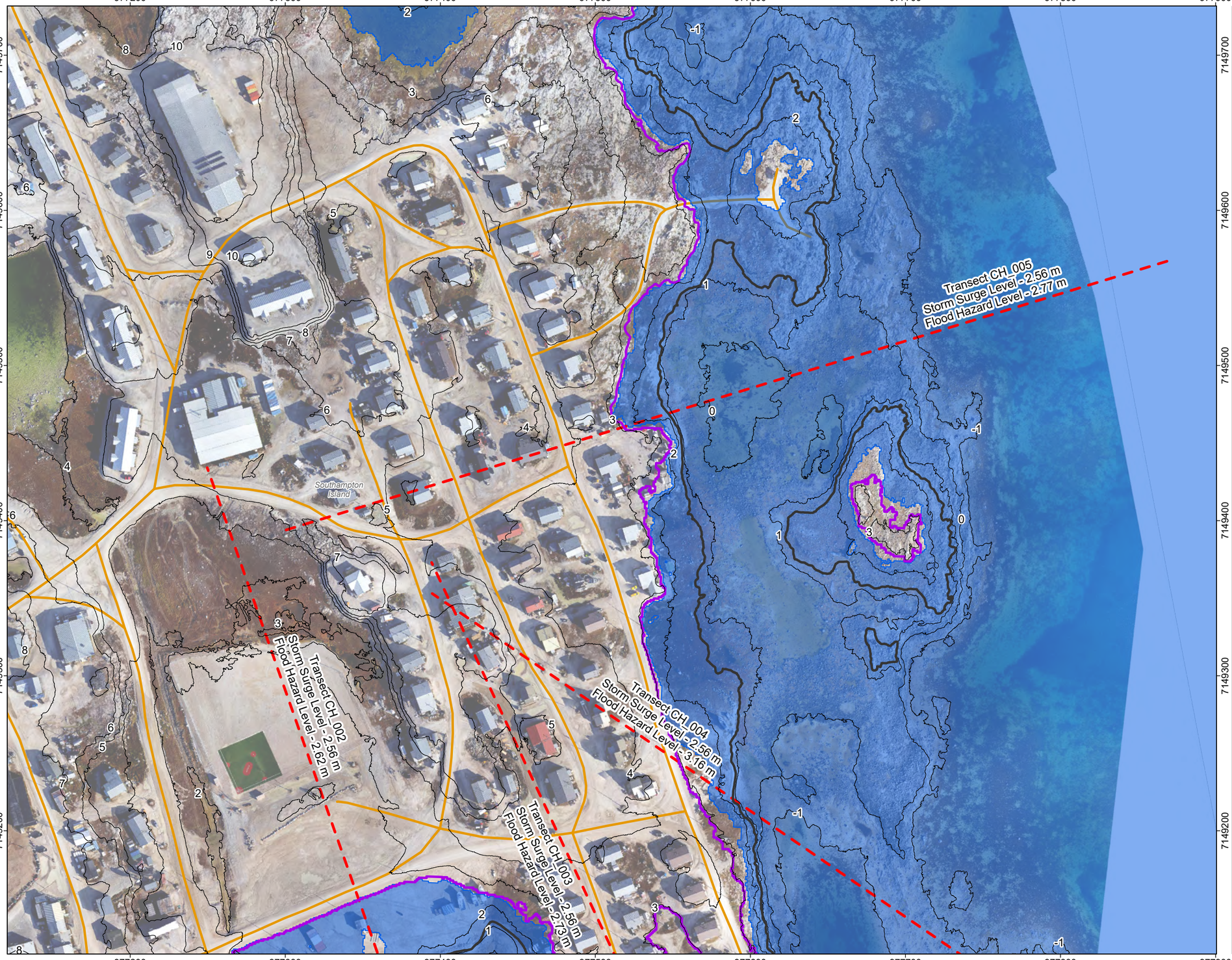
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Canada

Nunavut

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Figure No.

CH01-10yr

Title

Coral Harbour - 10yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Coral Harbour, Nunavut

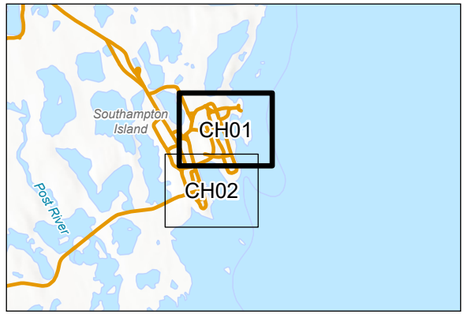
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- Modelling Transect
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- Topographic Contours - 1 m
- Road



Notes
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2026-10-05
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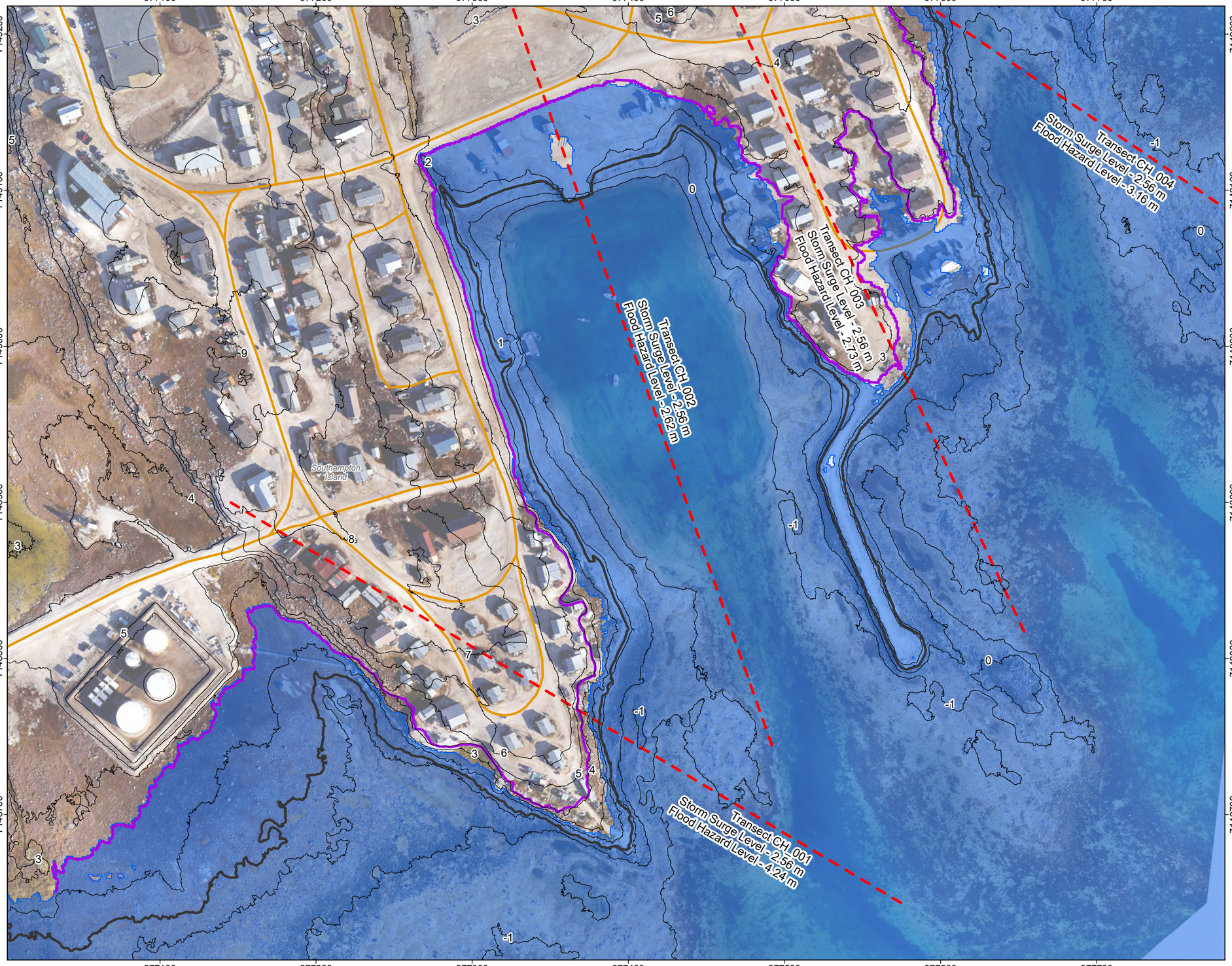
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STANTEC LIMITED

Figure No.

CH02-10yr

Title

Coral Harbour - 10yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Coral Harbour, Nunavut

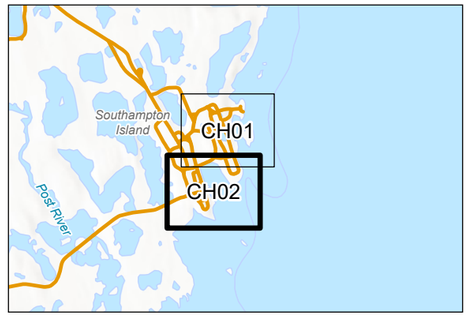
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- Modelling Transect
- HHWLT (1.33 m)
- Flood Hazard Level - 10 yr
- Storm Surge Level - 10 yr
- Topographic Contours - 1 m
- Road



Notes

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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Stantec Consulting Orthoimagery

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Figure No.

CH00-20yr

Title

Coral Harbour - 20yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

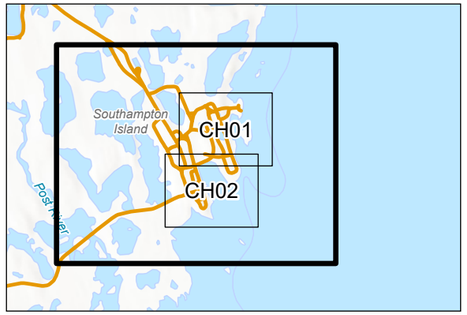
Project Location
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- Modelling Transect
- HHWLT (1.33 m)
- Flood Hazard Level - 20 yr
- Storm Surge Level - 20 yr
- Topographic Contours - 1 m
- Road



Notes
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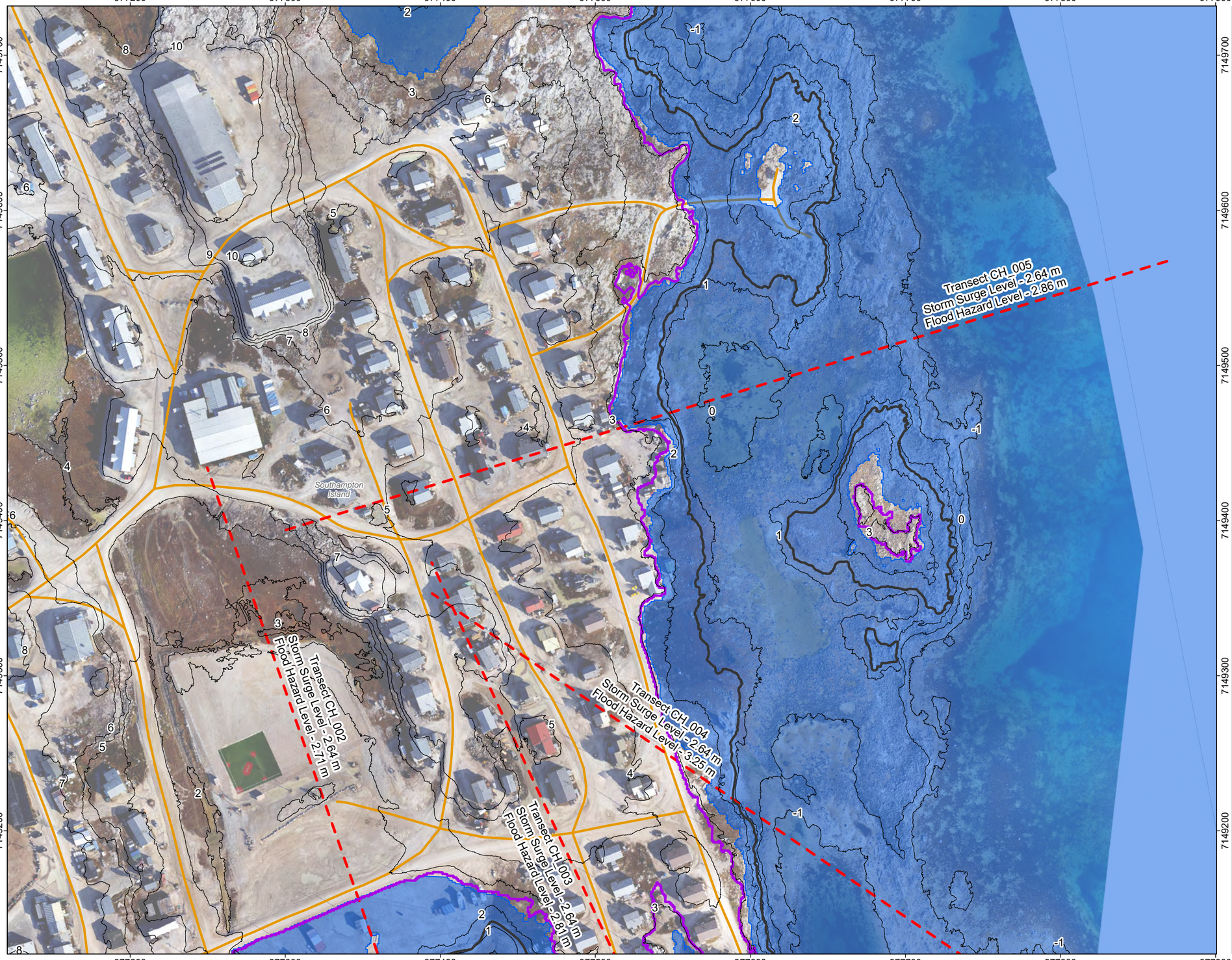
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Figure No.

CH01-20yr

Title

Coral Harbour - 20yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Coral Harbour, Nunavut

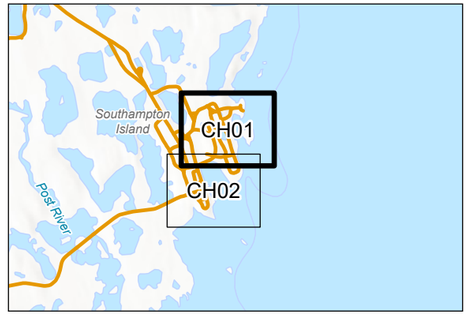
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- Modelling Transect
- HHWLT (1.33 m)
- Flood Hazard Level - 20 yr
- Storm Surge Level - 20 yr
- Topographic Contours - 1 m
- Road



Notes

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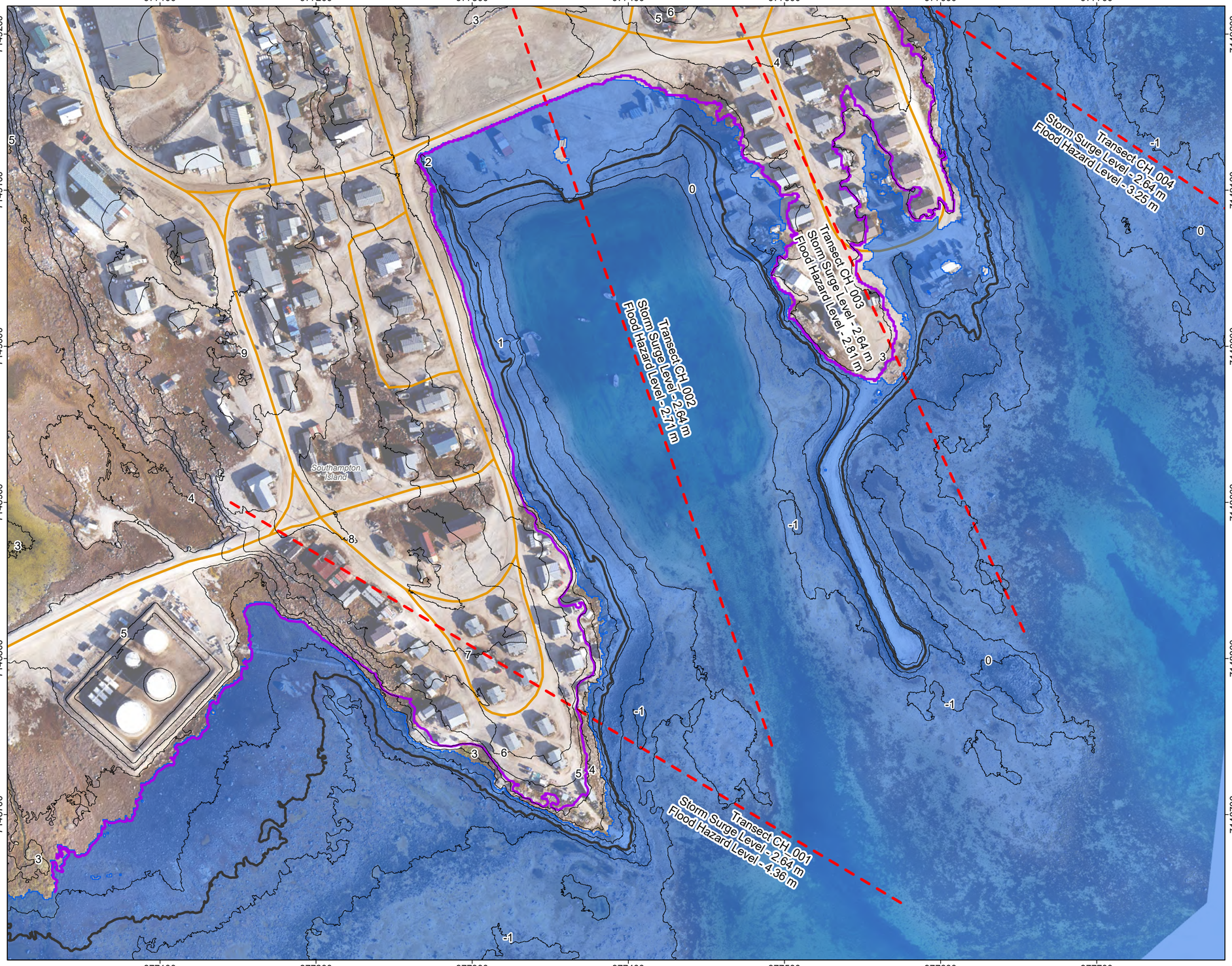
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Nunavut

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Figure No.

CH02-20yr

Title

Coral Harbour - 20yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Coral Harbour, Nunavut

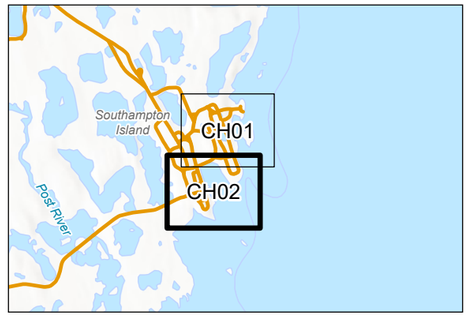
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(At original document size of 11x17)
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- Modelling Transect
- HHWLT (1.33 m)
- Flood Hazard Level - 20 yr
- Storm Surge Level - 20 yr
- Topographic Contours - 1 m
- Road



Notes

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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Stantec Consulting Orthoimagery

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2025-10-06
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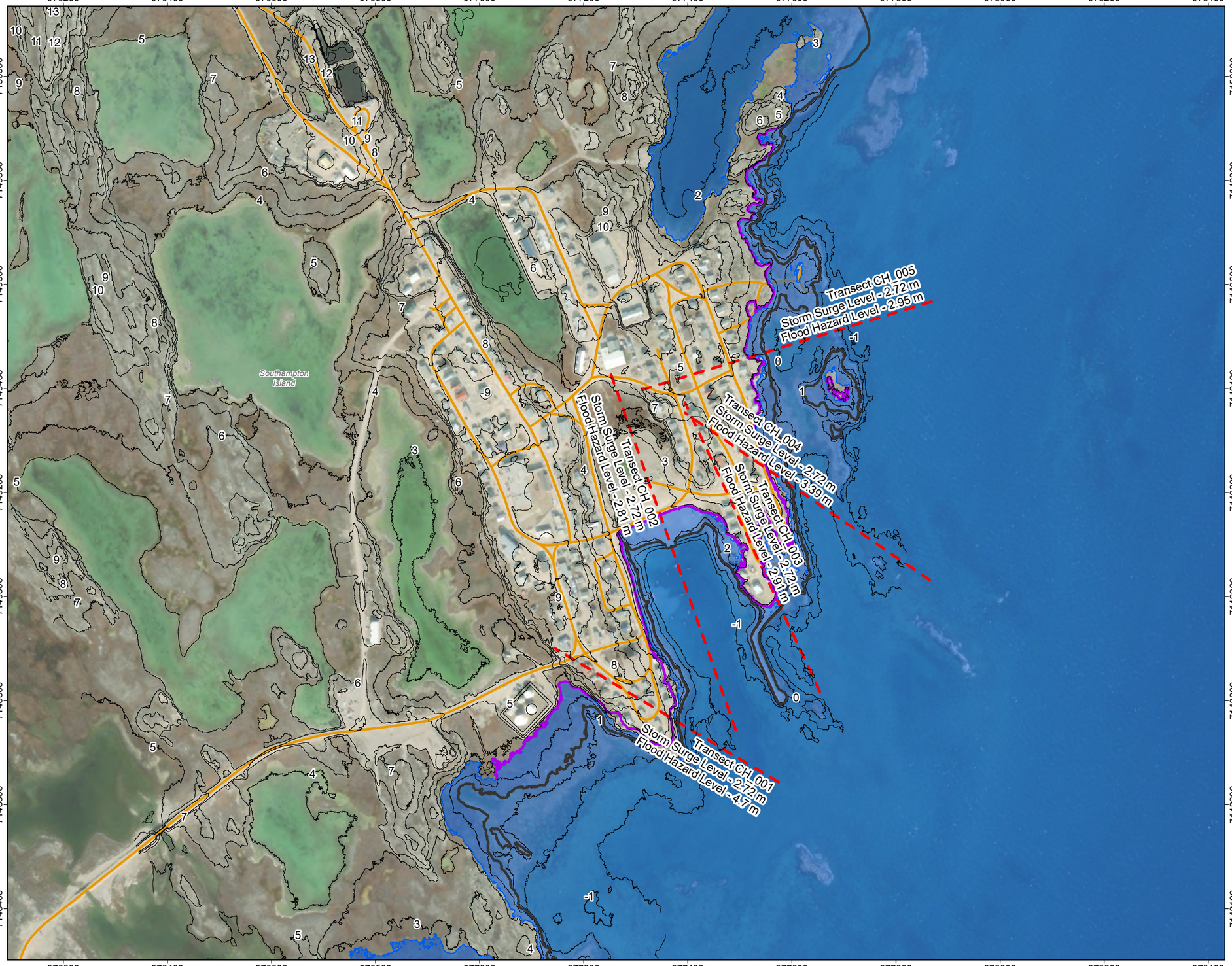
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STANTEC LIMITED

Figure No.

CH00-50yr

Title

Coral Harbour - 50yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

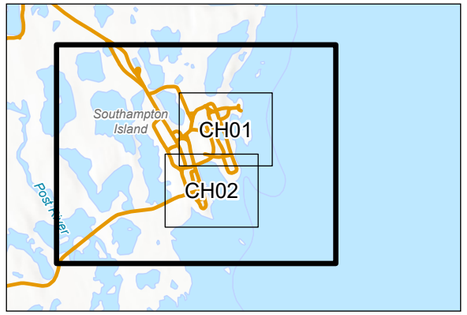
Project Location
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- Modelling Transect
- HHWLT (1.33 m)
- Flood Hazard Level - 50 yr
- Storm Surge Level - 50 yr
- Topographic Contours - 1 m
- Road



Notes
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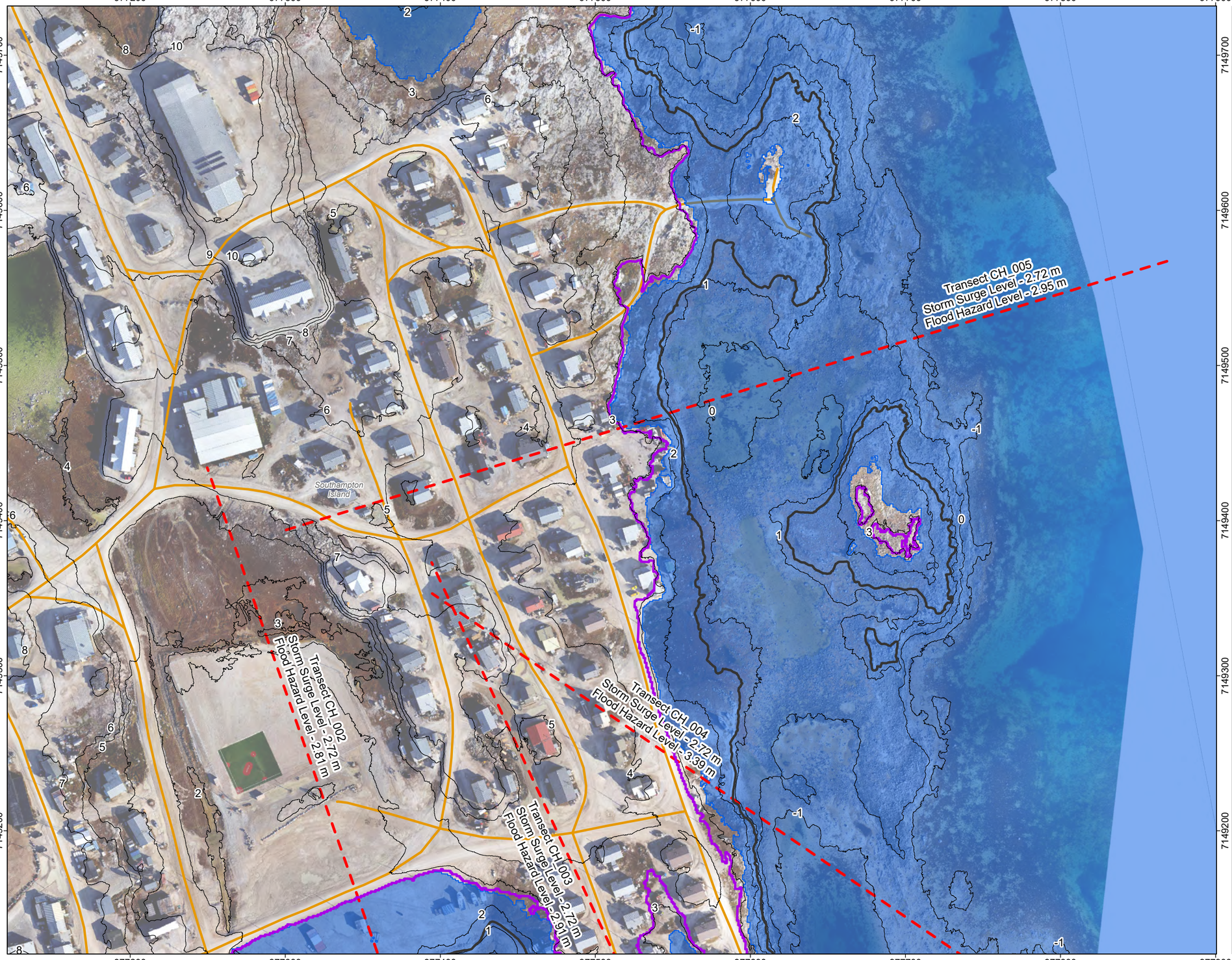
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Figure No.

CH01-50yr

Title

Coral Harbour - 50yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Coral Harbour, Nunavut

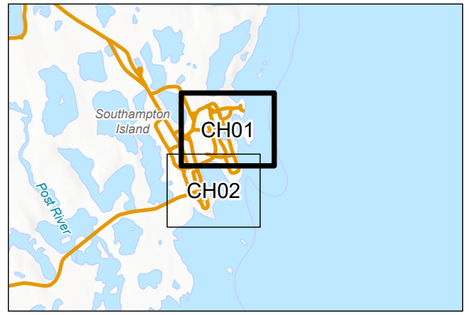
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- Modelling Transect
- HHWLT (1.33 m)
- Flood Hazard Level - 50 yr
- Storm Surge Level - 50 yr
- Topographic Contours - 1 m
- Road



Notes
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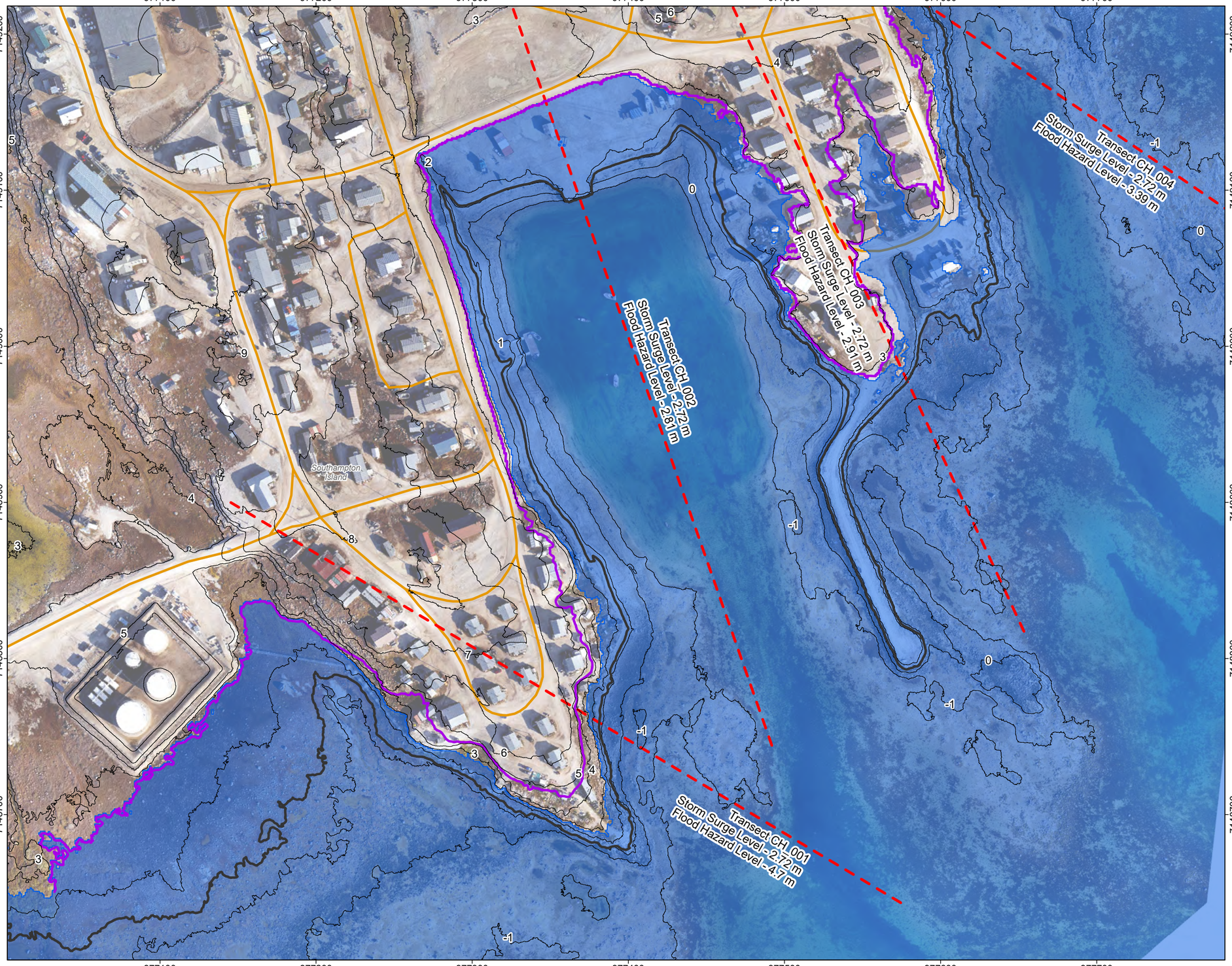
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Figure No.

CH02-50yr

Title

Coral Harbour - 50yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Coral Harbour, Nunavut

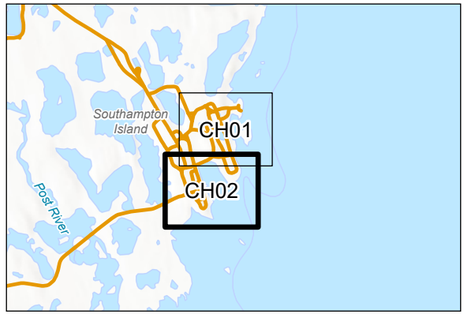
Prepared by MAINSLEY on 20260910
TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.33 m)
- Flood Hazard Level - 50 yr
- Storm Surge Level - 50 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 17N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Stantec Consulting Orthoimagery

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Date October 5, 2026
PERMIT NUMBER: P 1117
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Figure No.

CH00-100yr

Title

Coral Harbour - 100yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

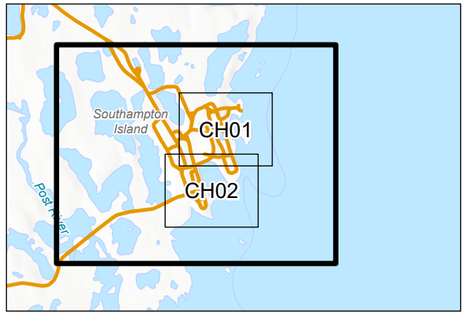
Project Location
Coral Harbour, Nunavut

Prepared by MAINSLEY on 20260910
TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 100 200 Metres
(At original document size of 11x17)
1:7,500

- Modelling Transect
- HHWLT (1.33 m)
- Flood Hazard Level - 100 yr
- Storm Surge Level - 100 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 17N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Stantec Consulting Orthoimagery

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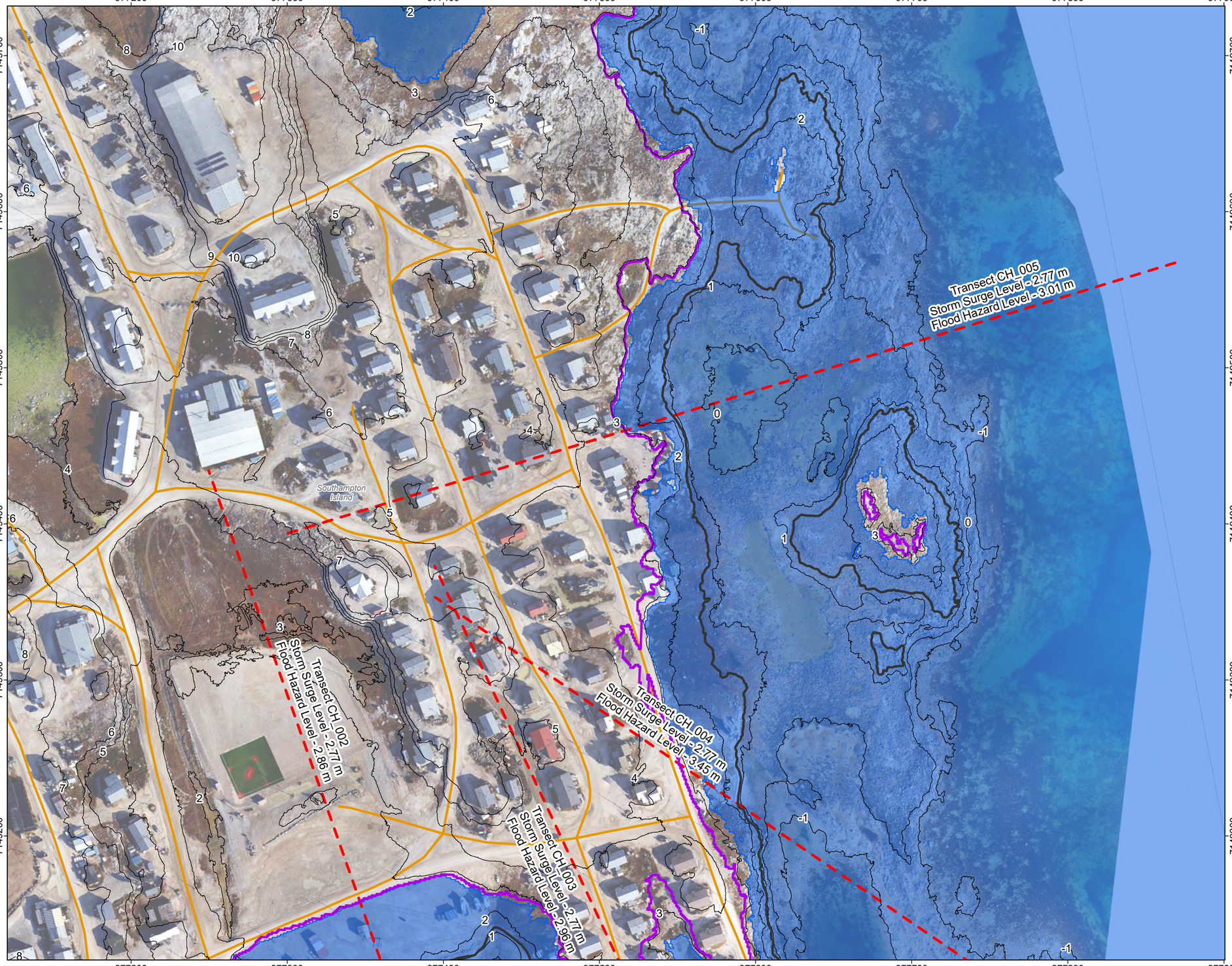
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Canada

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Figure No.

CH01-100yr

Title

Coral Harbour - 100yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Coral Harbour, Nunavut

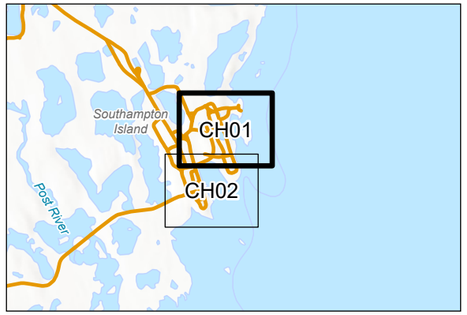
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- Modelling Transect
- HHWLT (1.33 m)
- Flood Hazard Level - 100 yr
- Storm Surge Level - 100 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 17N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Stantec Consulting Orthoimagery

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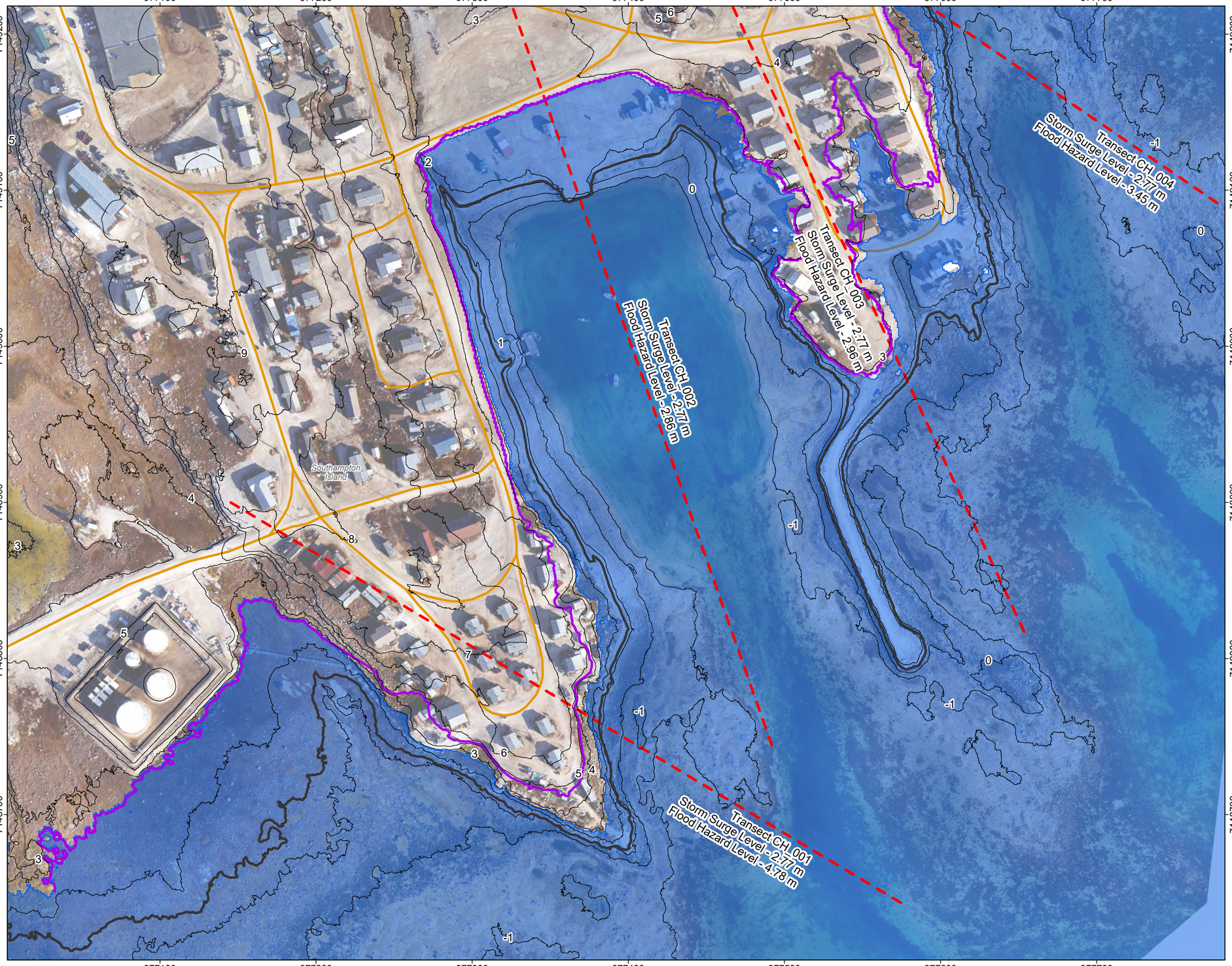
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Figure No.

CH02-100yr

Title

Coral Harbour - 100yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Coral Harbour, Nunavut

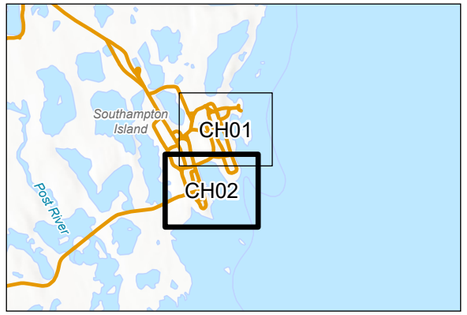
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TR by HDASHTPEYMA on 20260910
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N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.33 m)
- Flood Hazard Level - 100 yr
- Storm Surge Level - 100 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 17N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Stantec Consulting Orthoimagery

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2025-10-06
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Figure No.

CH00-200yr

Title

Coral Harbour - 200yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

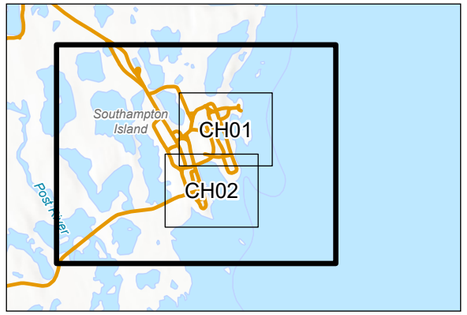
Project Location
Coral Harbour, Nunavut

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(At original document size of 11x17)
1:7,500

- Modelling Transect
- HHWLT (1.33 m)
- Flood Hazard Level - 200 yr
- Storm Surge Level - 200 yr
- Topographic Contours - 1 m
- Road



Notes
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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Stantec Consulting Orthoimagery

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Canada

Nunavut

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Figure No.

CH01-200yr

Title

Coral Harbour - 200yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Coral Harbour, Nunavut

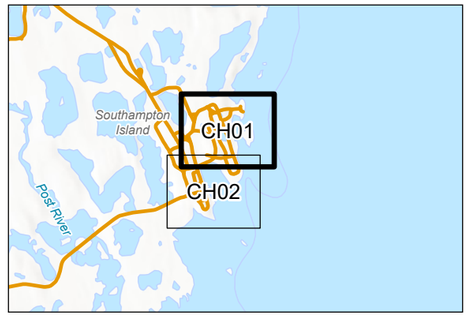
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- Modelling Transect
- HHWLT (1.33 m)
- Flood Hazard Level - 200 yr
- Storm Surge Level - 200 yr
- Topographic Contours - 1 m
- Road



Notes

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3. Data Sources: CANVEC 50k
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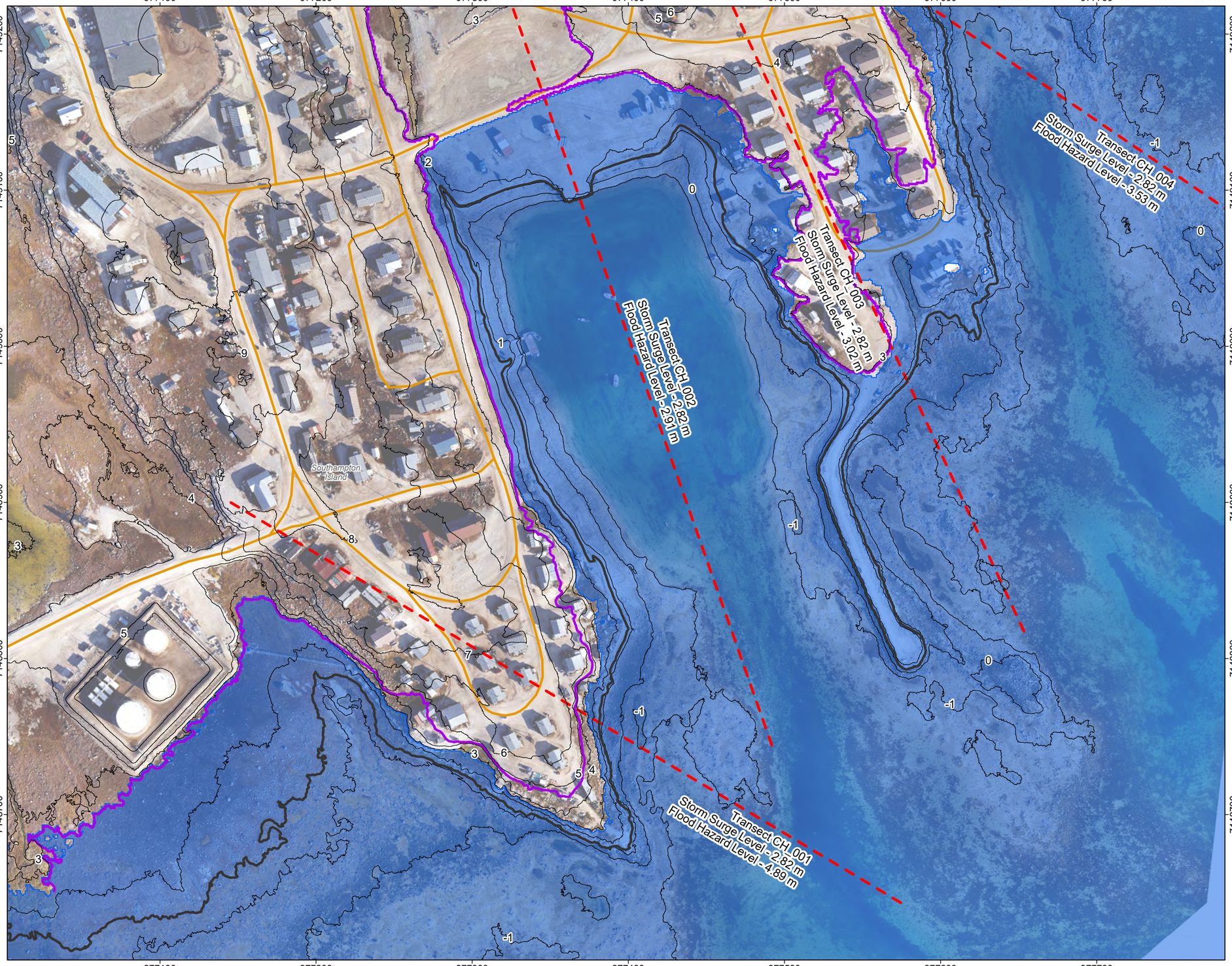
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Figure No.

CH02-200yr

Title

Coral Harbour - 200yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Coral Harbour, Nunavut

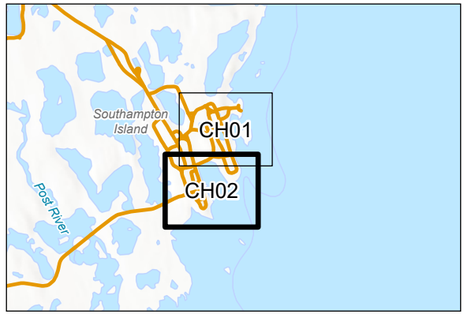
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N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.33 m)
- Flood Hazard Level - 200 yr
- Storm Surge Level - 200 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 17N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Stantec Consulting Orthoimagery

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Figure No.

CH00-500yr

Title

Coral Harbour - 500yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

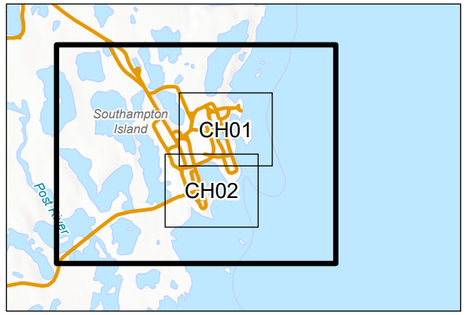
Project Location
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(At original document size of 11x17)
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- Modelling Transect
- HHWLT (1.33 m)
- Flood Hazard Level - 500 yr
- Storm Surge Level - 500 yr
- Topographic Contours - 1 m
- Road



Notes
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Figure No.

CH01-500yr

Title

Coral Harbour - 500yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Coral Harbour, Nunavut

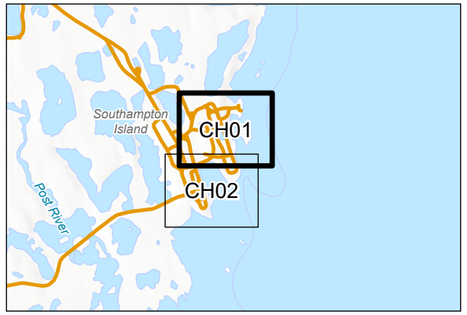
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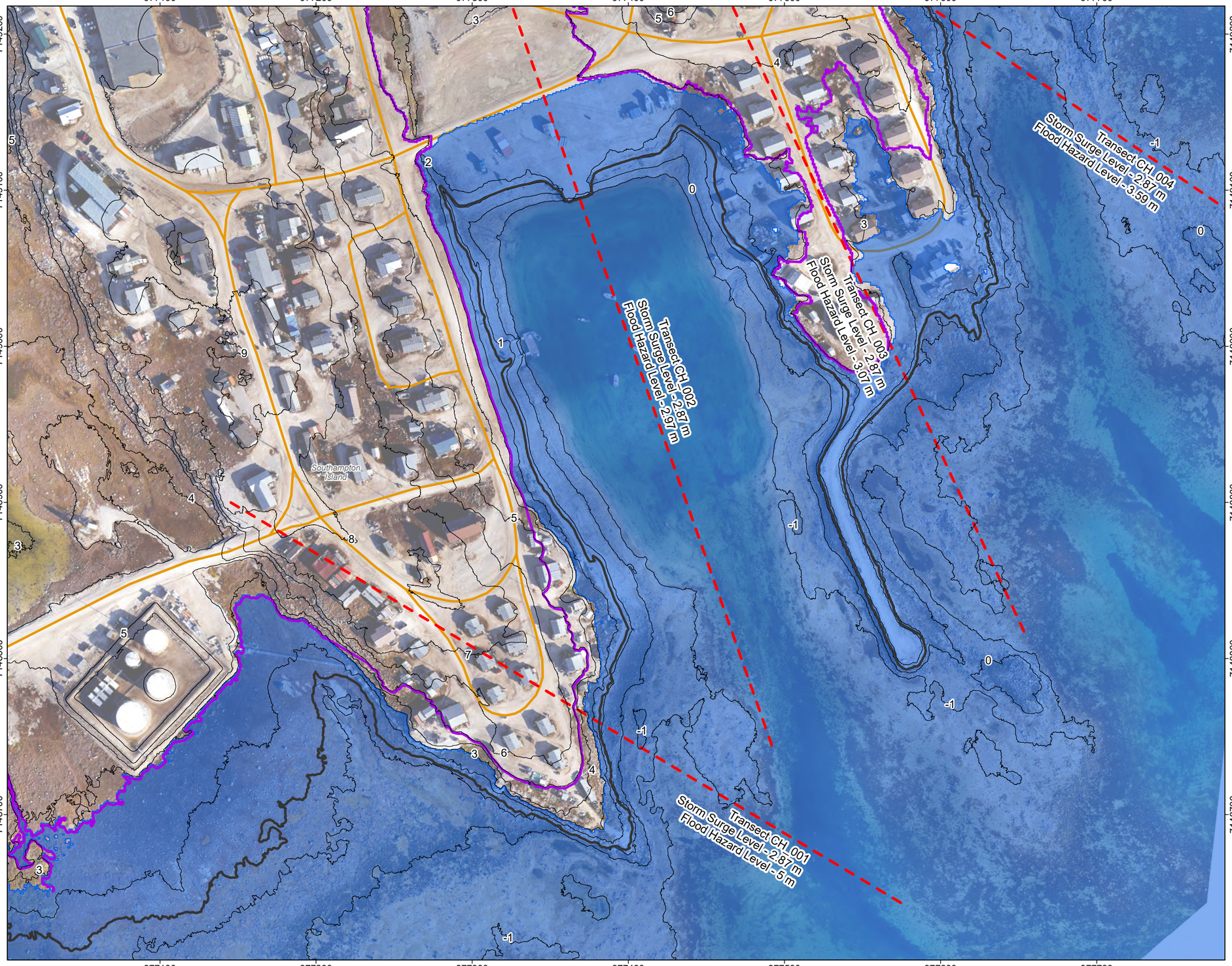
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Canada

Nunavut

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Figure No.

CH02-500yr

Title

Coral Harbour - 500yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Coral Harbour, Nunavut

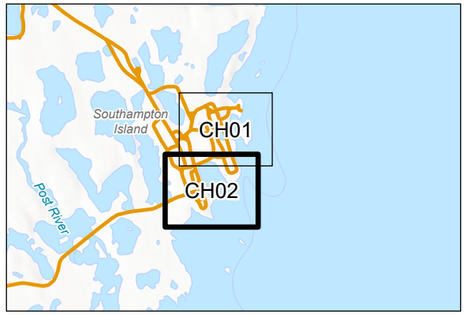
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TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.33 m)
- Flood Hazard Level - 500 yr
- Storm Surge Level - 500 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 17N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Stantec Consulting Orthoimagery

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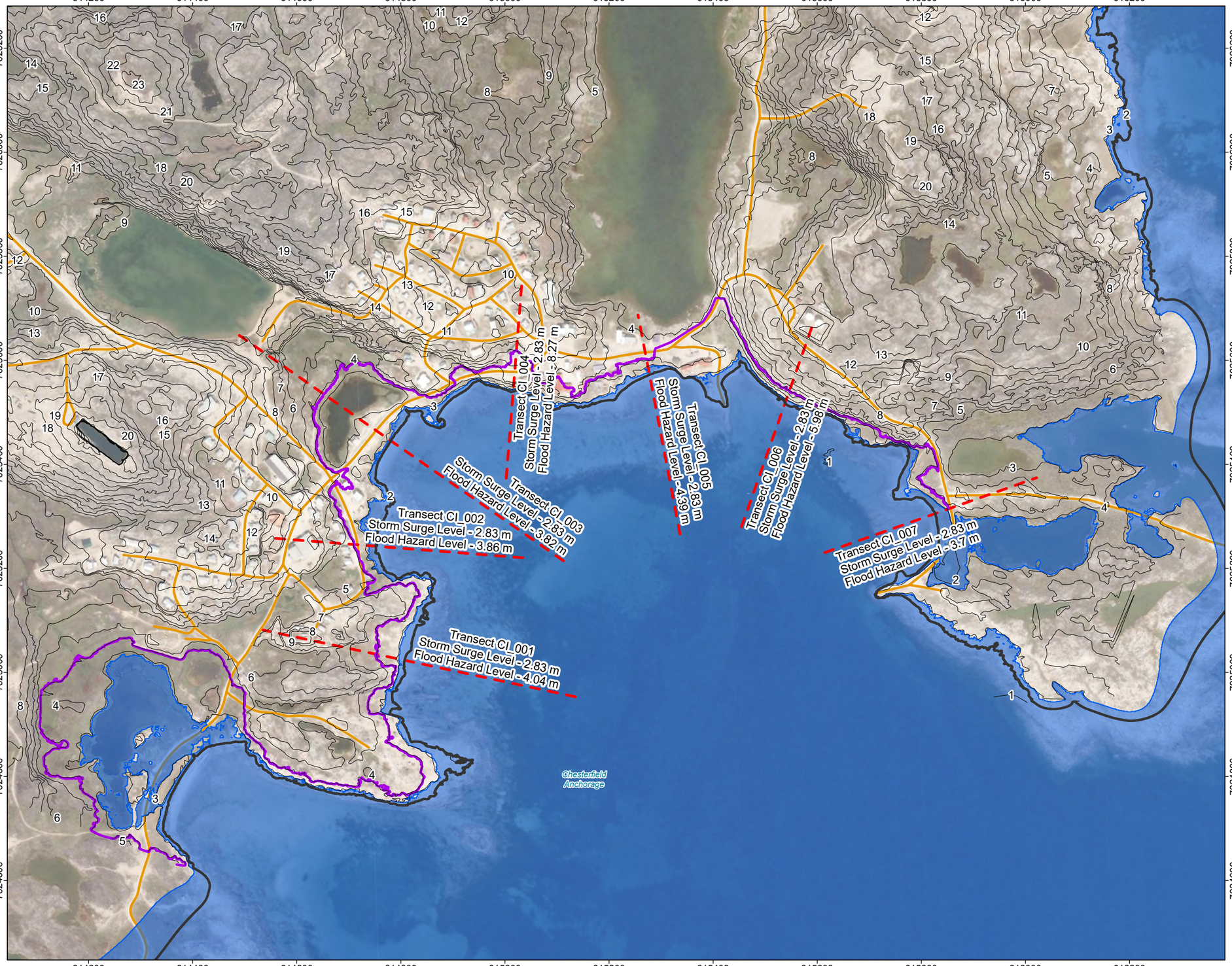
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Canada

Nunavut

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Figure No.

CI00-10yr

Title

Chesterfield Inlet - 10yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

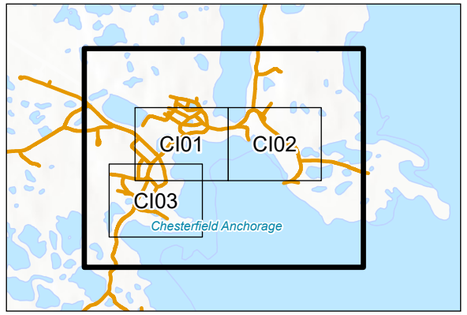
Project Location
Chesterfield Inlet, Nunavut

Prepared by MAINSLEY on 20260910
TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 100 200 Metres
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- Modelling Transect
- HHWLT (1.97 m)
- Flood Hazard Level - 10 yr
- Storm Surge Level - 10 yr
- Topographic Contours - 1 m
- Road



Notes
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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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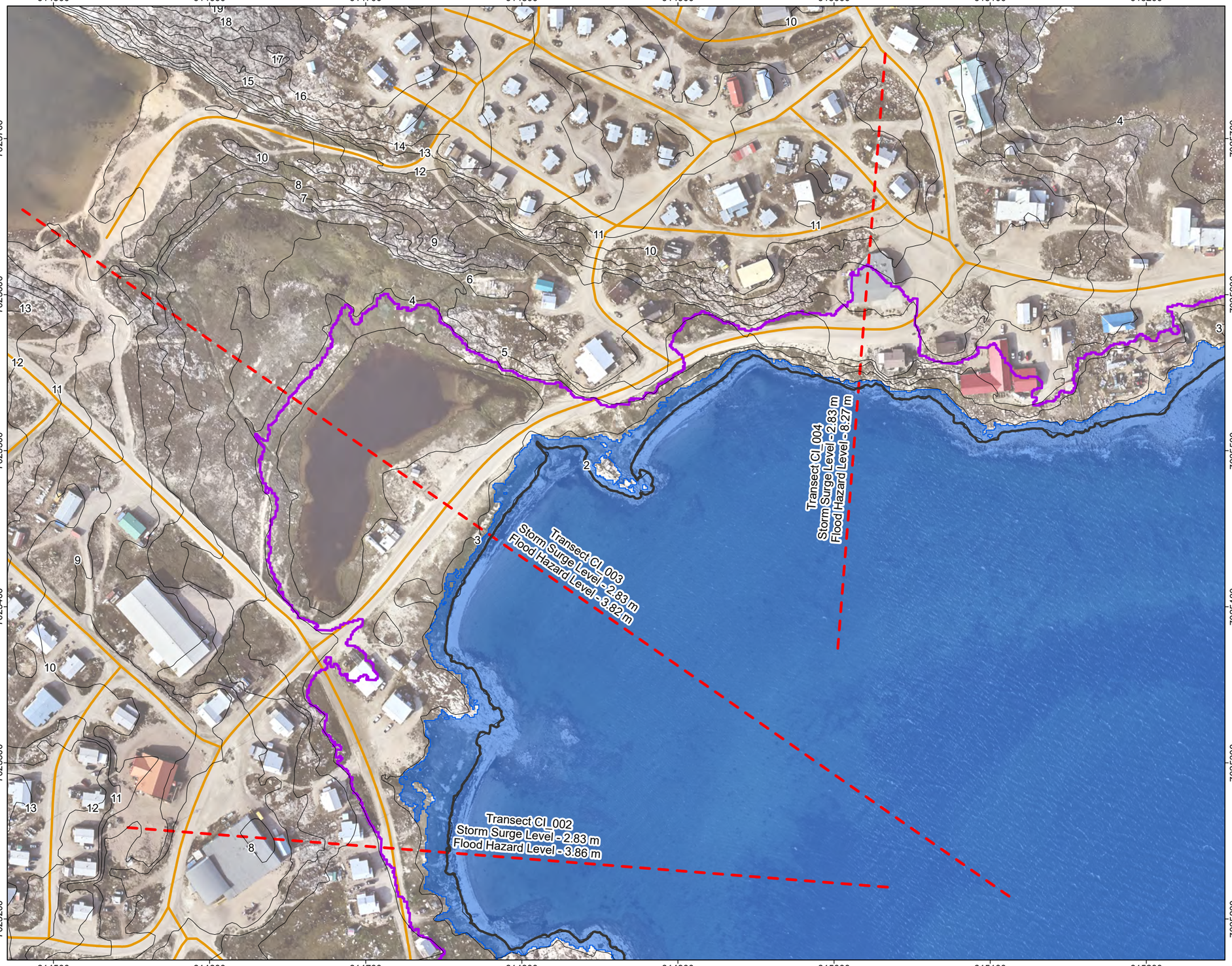
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Canada

Nunavut

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Figure No.

CI01-10yr

Title

Chesterfield Inlet - 10yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

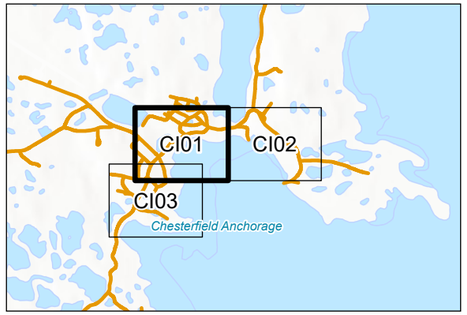
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- Flood Hazard Level - 10 yr
- Storm Surge Level - 10 yr
- Topographic Contours - 1 m
- Road



Notes
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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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615300 615400 615500 615600 615700 615800 615900 616000

7025700 7025600 7025500 7025400 7025300 7025200

Transect CI_005
Storm Surge Level - 2.83 m
Flood Hazard Level - 4.39 m

Transect CI_006
Storm Surge Level - 2.83 m
Flood Hazard Level - 5.98 m

Transect CI_007
Storm Surge Level - 2.83 m
Flood Hazard Level - 3.7 m

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Figure No.

CI02-10yr

Title

Chesterfield Inlet - 10yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

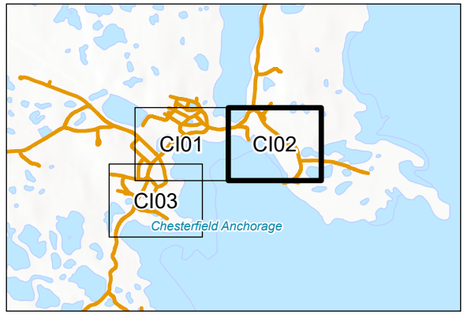
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- Road



Notes

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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
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Figure No.

CI03-10yr

Title

Chesterfield Inlet - 10yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

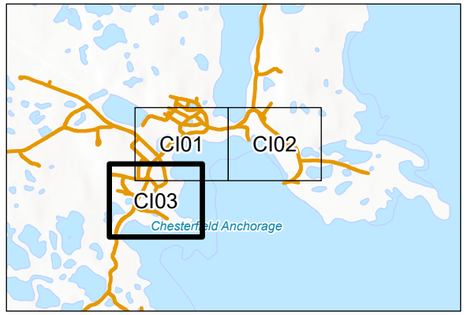
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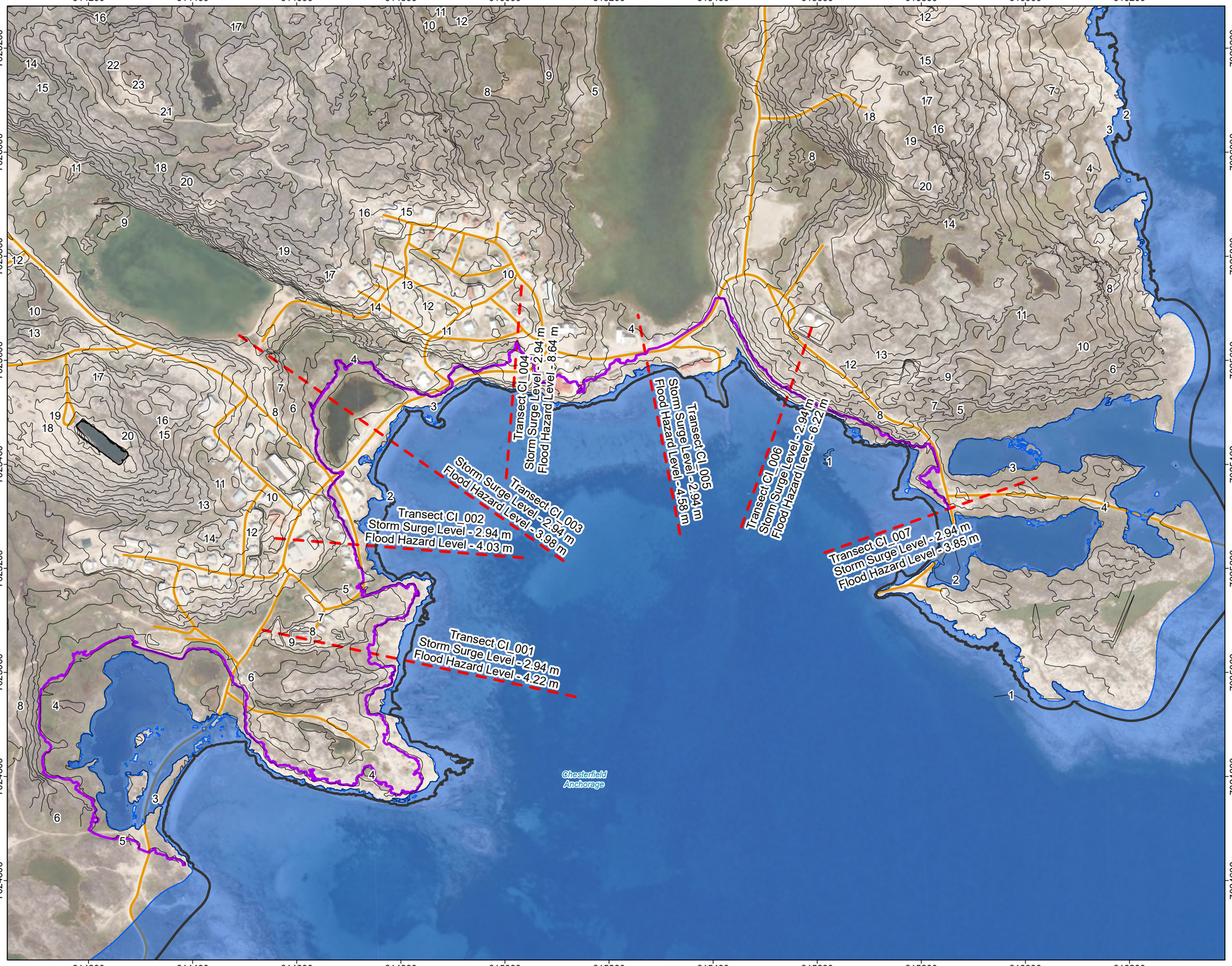
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Figure No.

CI00-20yr

Title

Chesterfield Inlet - 20yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

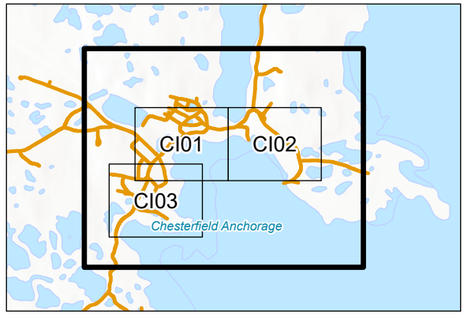
Project Location
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- Road



Notes
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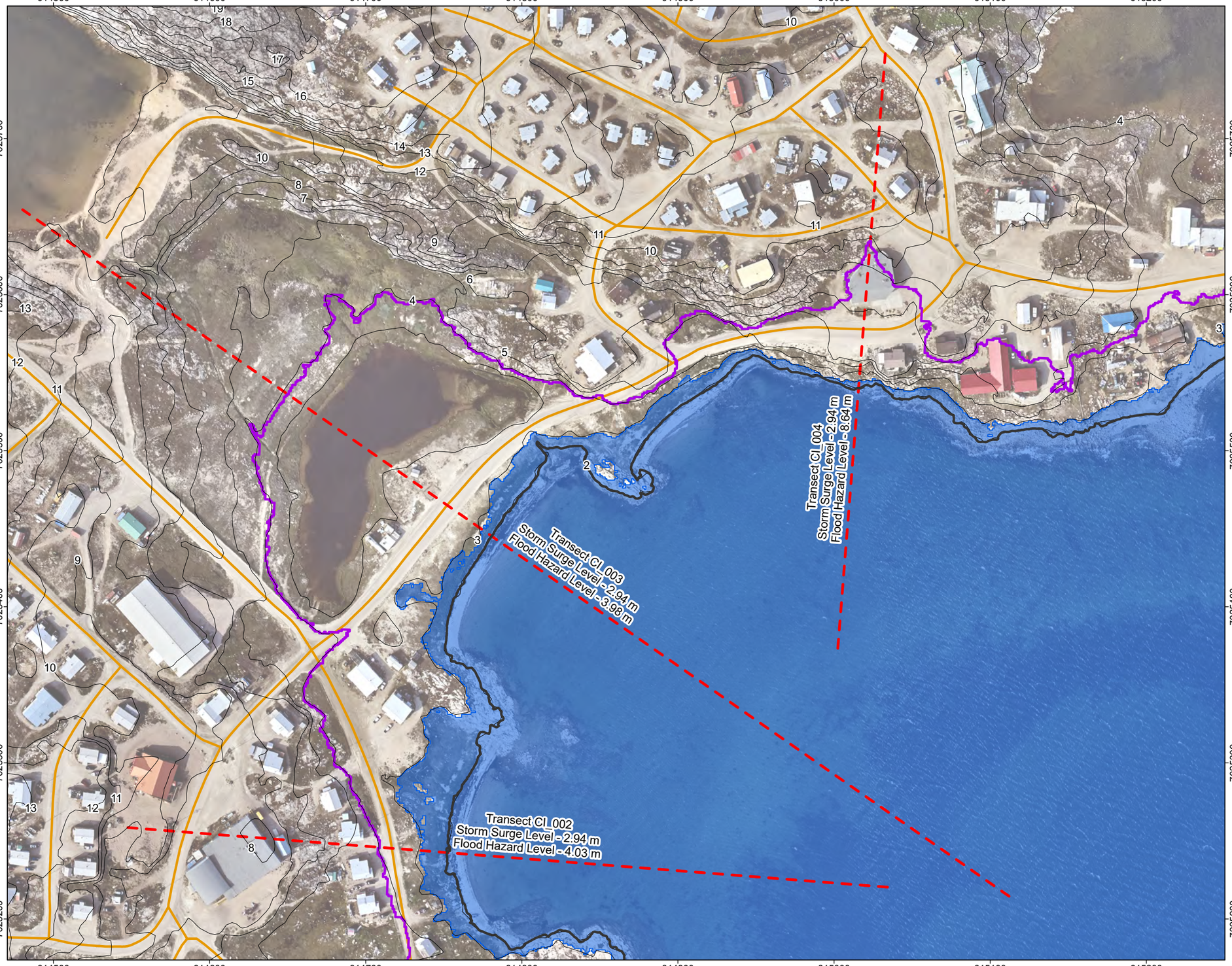
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Figure No.

CI01-20yr

Title

Chesterfield Inlet - 20yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

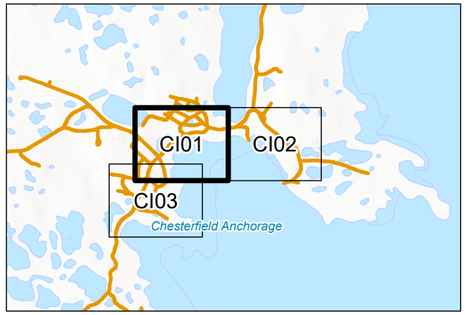
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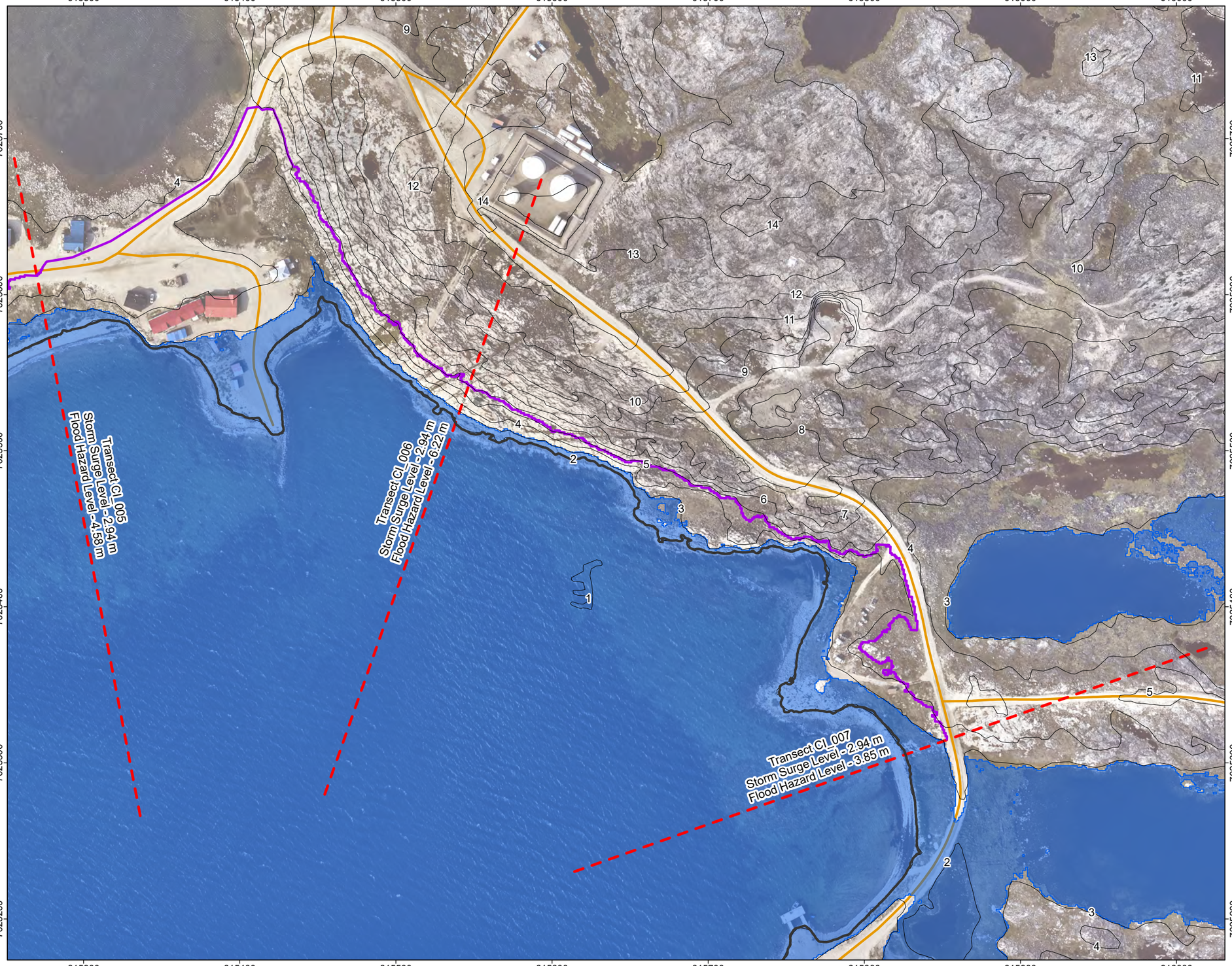
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Figure No.

CI02-20yr

Title

Chesterfield Inlet - 20yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

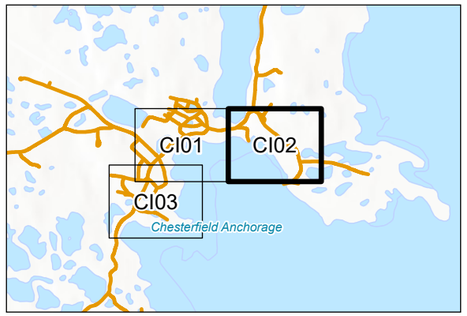
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Figure No.

CI03-20yr

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Chesterfield Inlet - 20yr

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Project Number: 160951868

Project Location
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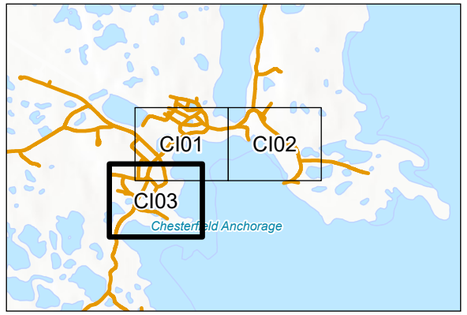
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IR by NKIMIAGHALAM on 20260910

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0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.97 m)
- Flood Hazard Level - 20 yr
- Storm Surge Level - 20 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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Date October 5, 2026
PERMIT NUMBER: P 1117
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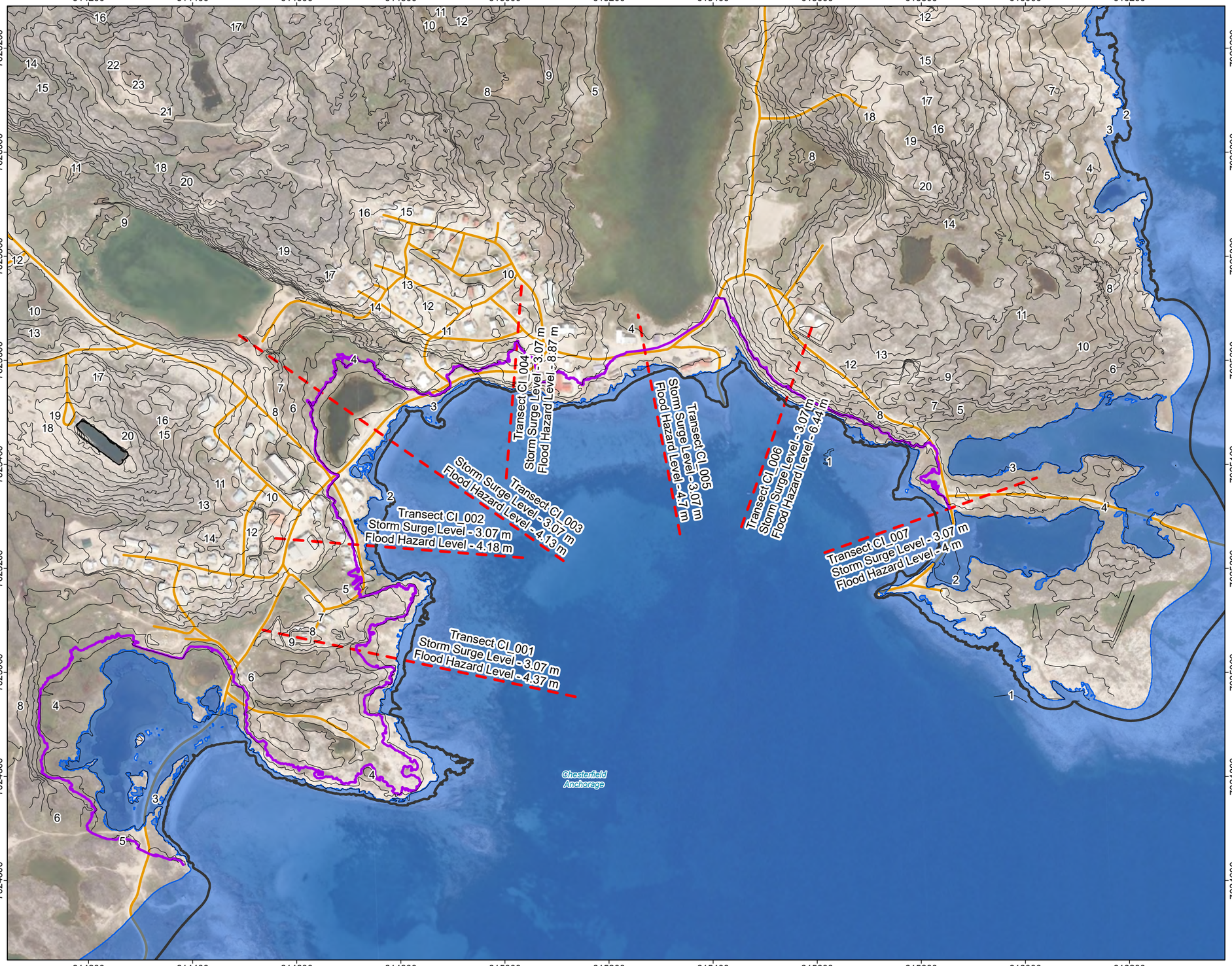
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Canada

Nunavut

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Figure No.

CI00-50yr

Title

Chesterfield Inlet - 50yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

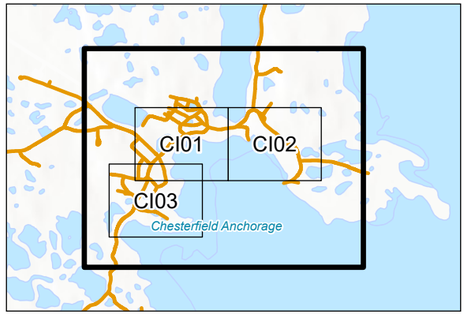
Project Location
Chesterfield Inlet, Nunavut

Prepared by MAINSLEY on 20260910
TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 100 200 Metres
(At original document size of 11x17)
1:7,500

- Modelling Transect
- HHWLT (1.97 m)
- Flood Hazard Level - 50 yr
- Storm Surge Level - 50 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

REGISTERED PROFESSIONAL ENGINEER
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2026-10-06
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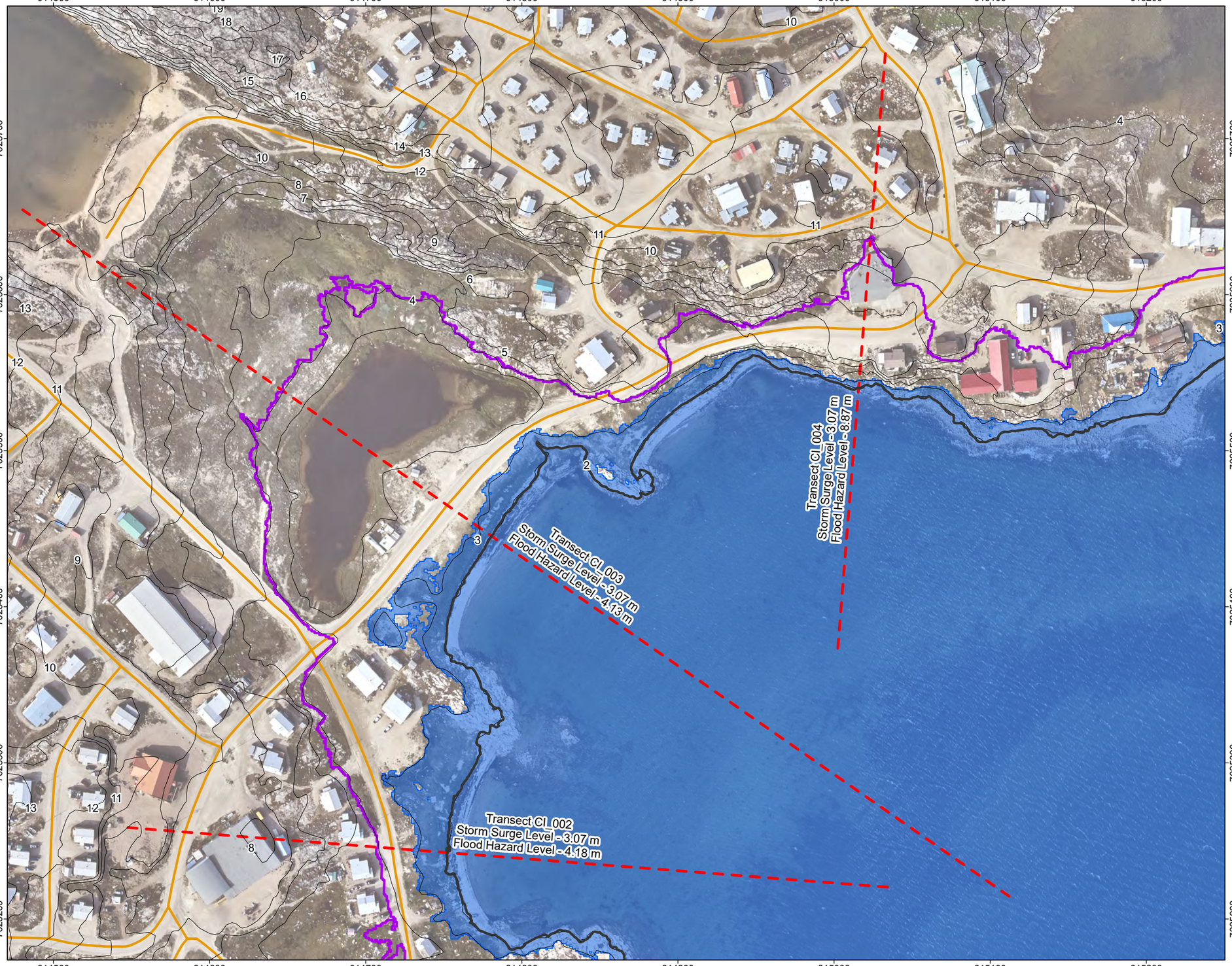
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Canada

Nunavut

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Figure No.

CI01-50yr

Title

Chesterfield Inlet - 50yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

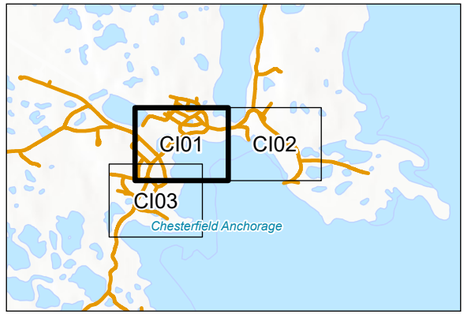
Prepared by MAINSLEY on 20260910
TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.97 m)
- Flood Hazard Level - 50 yr
- Storm Surge Level - 50 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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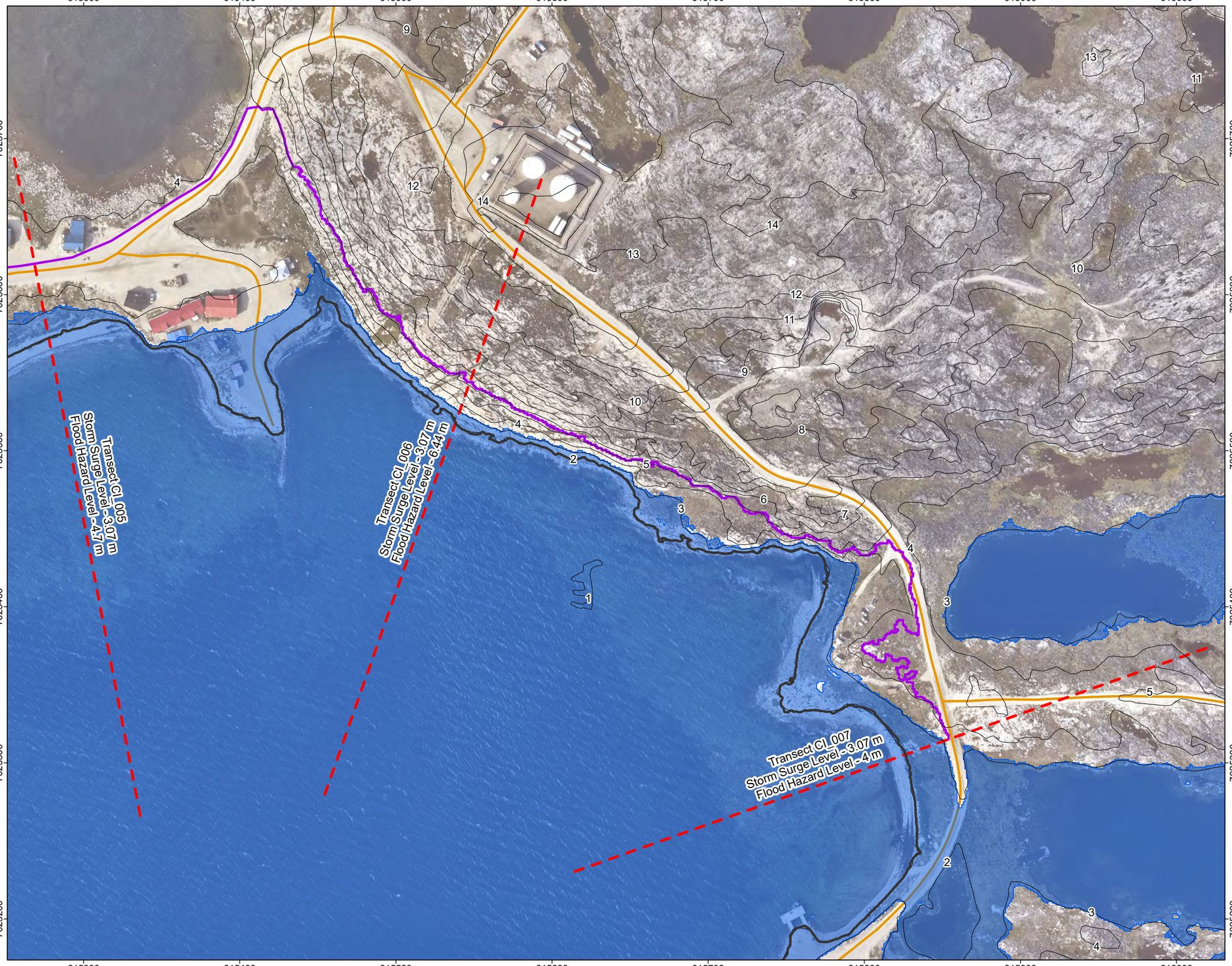
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Canada

Nunavut

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Figure No.

CI02-50yr

Title

Chesterfield Inlet - 50yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

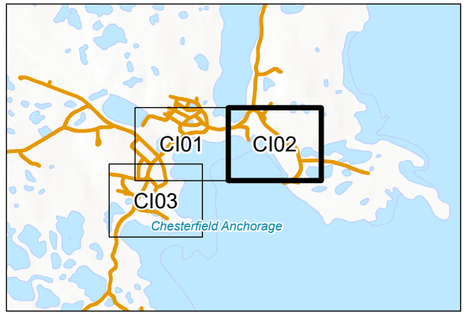
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IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.97 m)
- Flood Hazard Level - 50 yr
- Storm Surge Level - 50 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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Canada

Nunavut

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Figure No.

CI03-50yr

Title

Chesterfield Inlet - 50yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

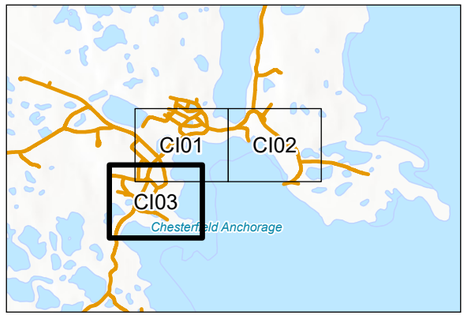
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N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.97 m)
- Flood Hazard Level - 50 yr
- Storm Surge Level - 50 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2025-10-06
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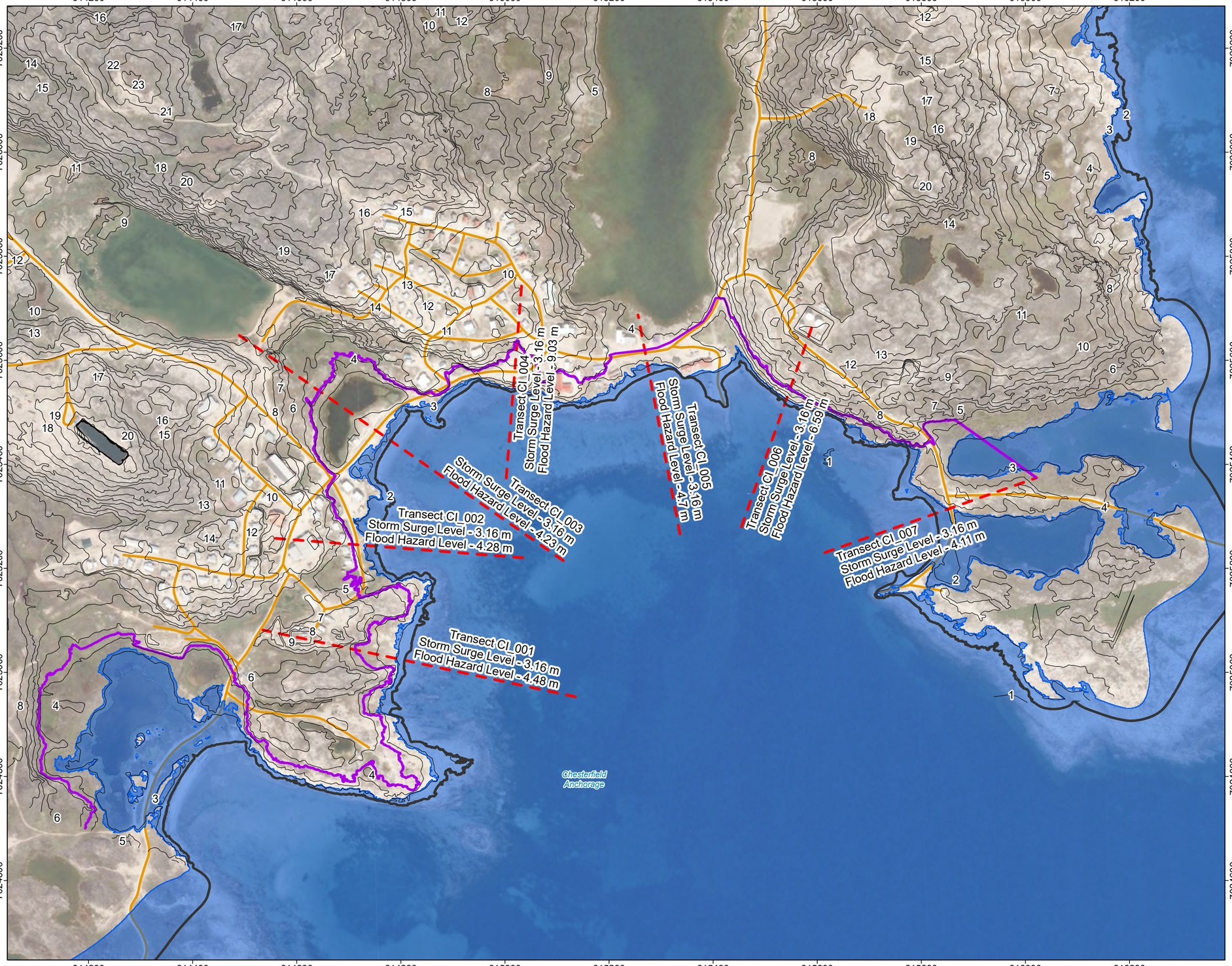
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Canada

Nunavut

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Figure No.

CI00-100yr

Title

Chesterfield Inlet - 100yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

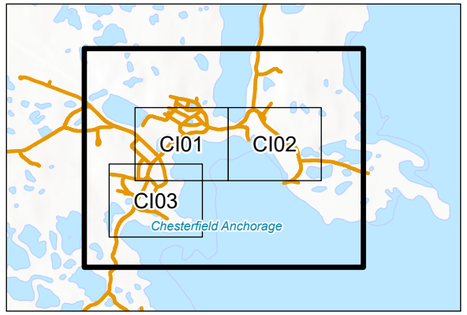
Project Location
Chesterfield Inlet, Nunavut

Prepared by MAINSLEY on 20260910
TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 100 200 Metres
(At original document size of 11x17)
1:7,500

- Modelling Transect
- HHWLT (1.97 m)
- Flood Hazard Level - 100 yr
- Storm Surge Level - 100 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2026-10-06
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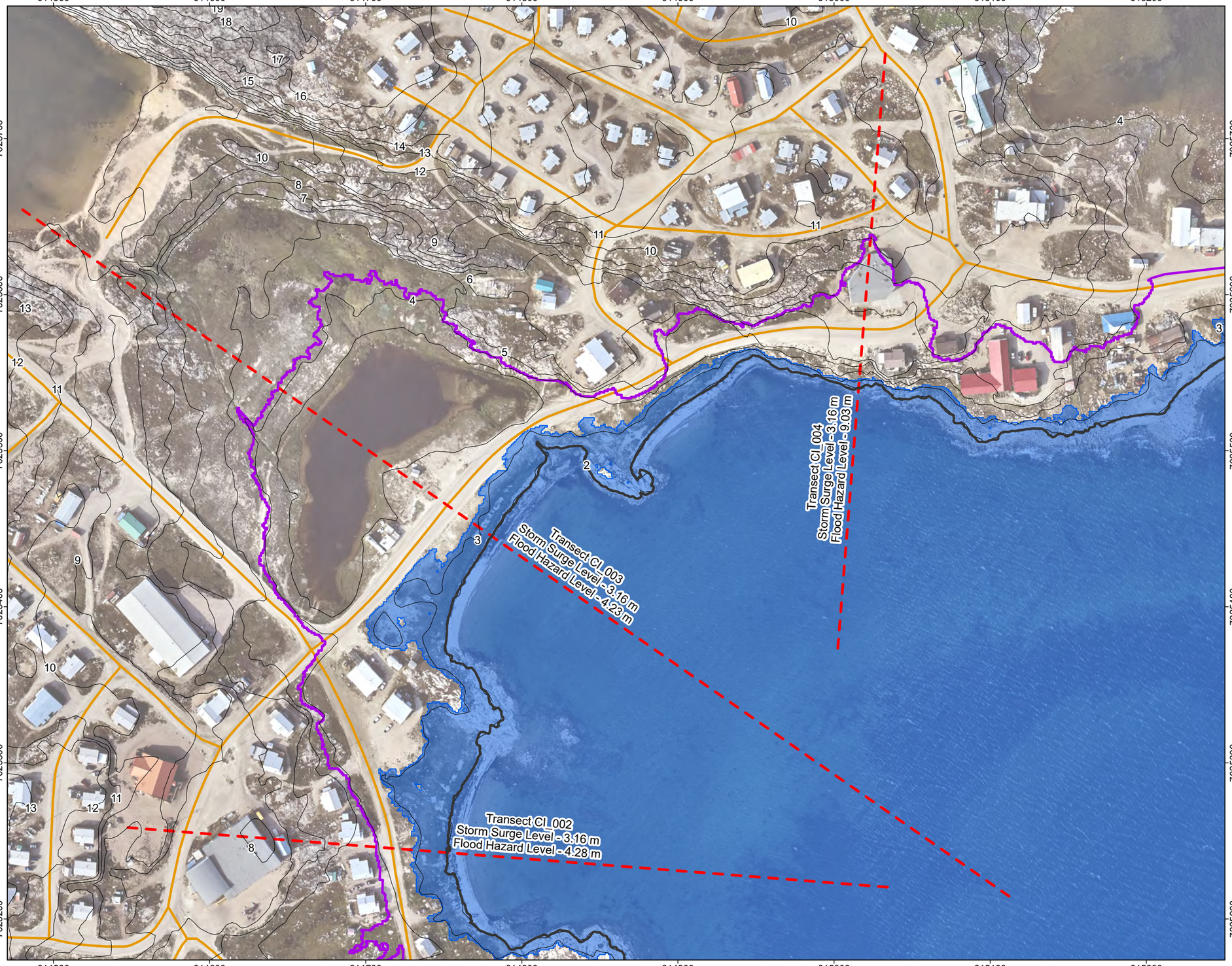
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Canada

Nunavut

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Figure No.

CI01-100yr

Title

Chesterfield Inlet - 100yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

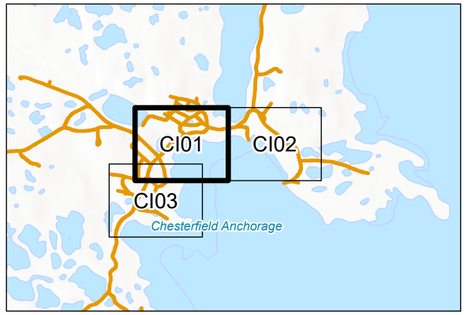
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N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.97 m)
- Flood Hazard Level - 100 yr
- Storm Surge Level - 100 yr
- Topographic Contours - 1 m
- Road



Notes
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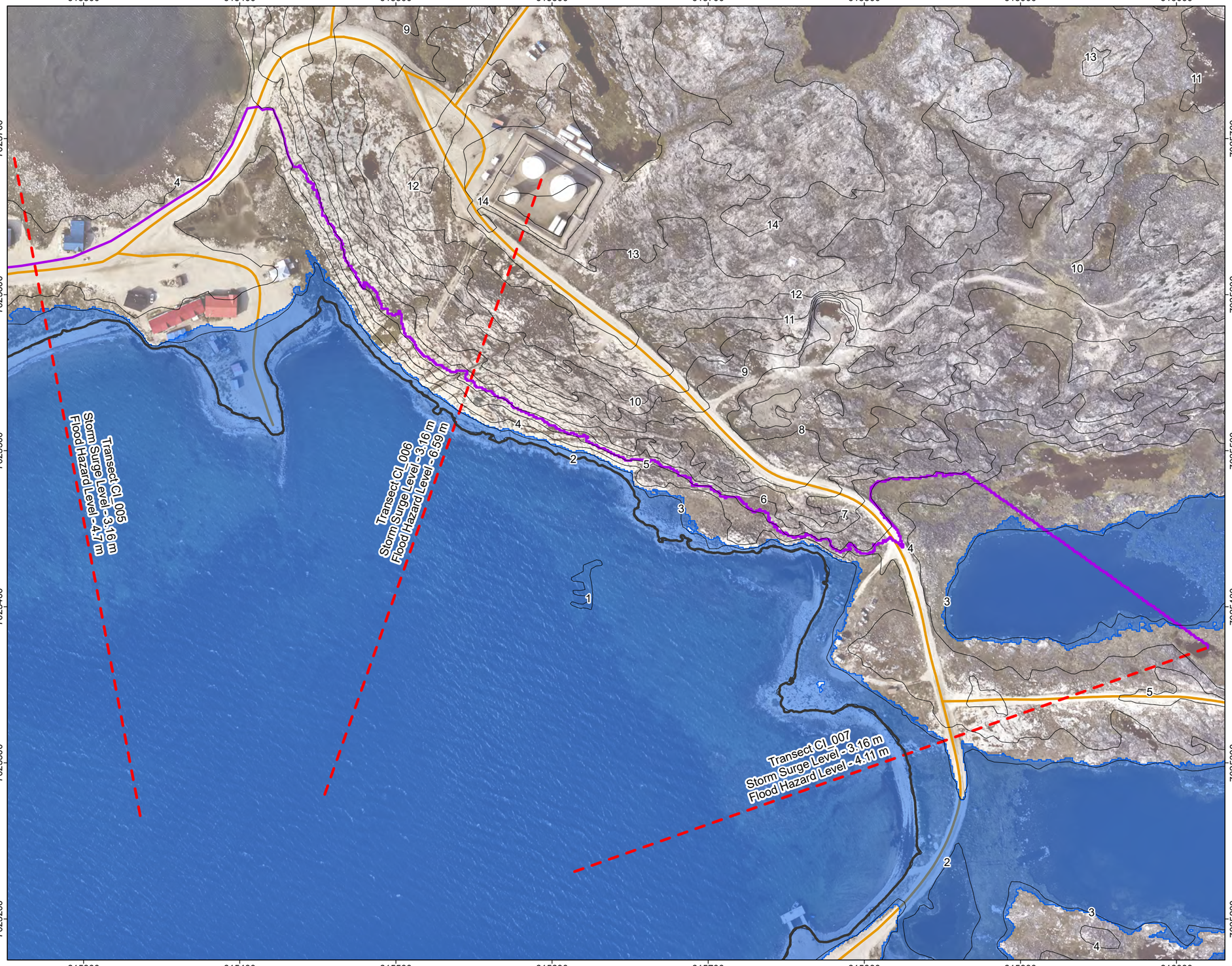
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Canada

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Figure No.

CI02-100yr

Title

Chesterfield Inlet - 100yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

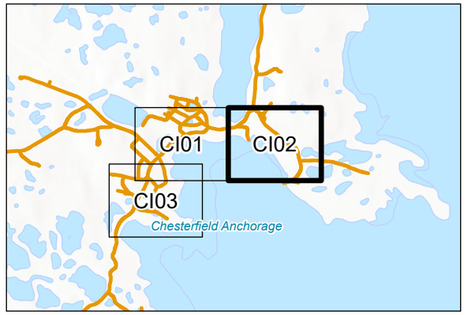
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N

0 50 100 Metres

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- Modelling Transect
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- Flood Hazard Level - 100 yr
- Storm Surge Level - 100 yr
- Topographic Contours - 1 m
- Road



Notes
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Figure No.

CI03-100yr

Title

Chesterfield Inlet - 100yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

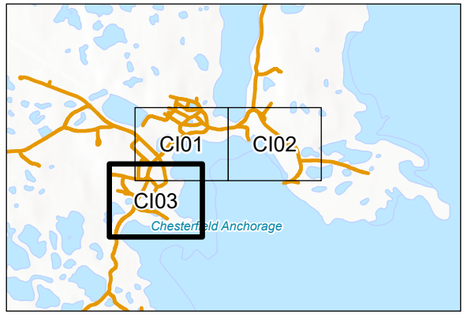
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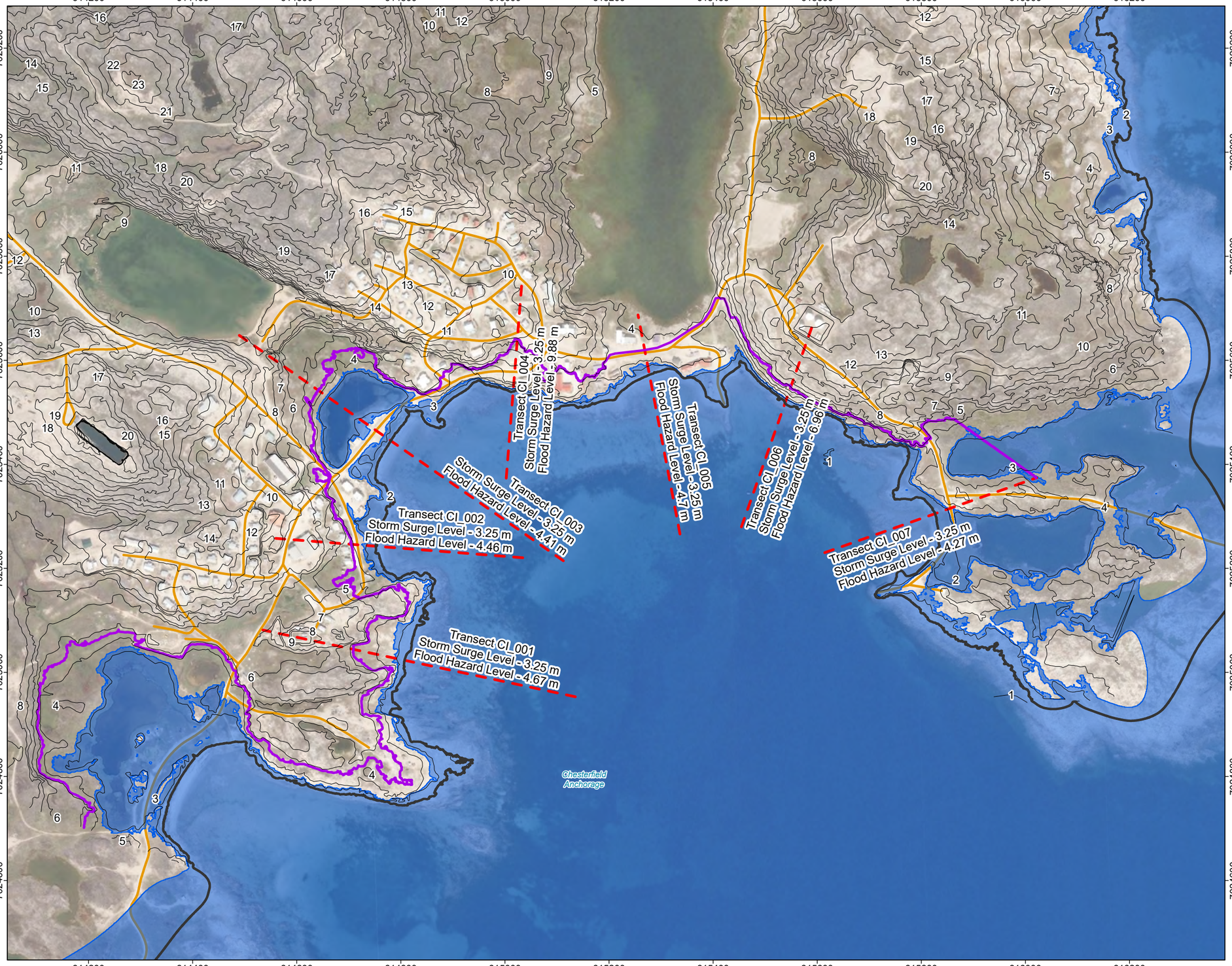
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Canada

Nunavut

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Figure No.

CI00-200yr

Title

Chesterfield Inlet - 200yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

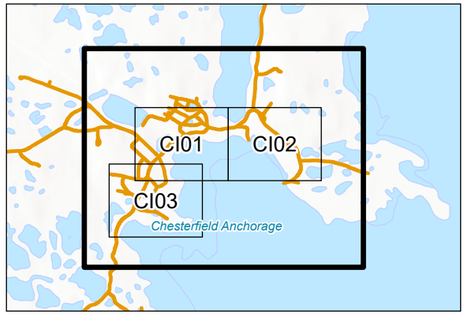
Project Location
Chesterfield Inlet, Nunavut

Prepared by MAINSLEY on 20260910
TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 100 200 Metres
(At original document size of 11x17)
1:7,500

- Modelling Transect
- HHWLT (1.97 m)
- Flood Hazard Level - 200 yr
- Storm Surge Level - 200 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2026-10-06
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Date October 5, 2026
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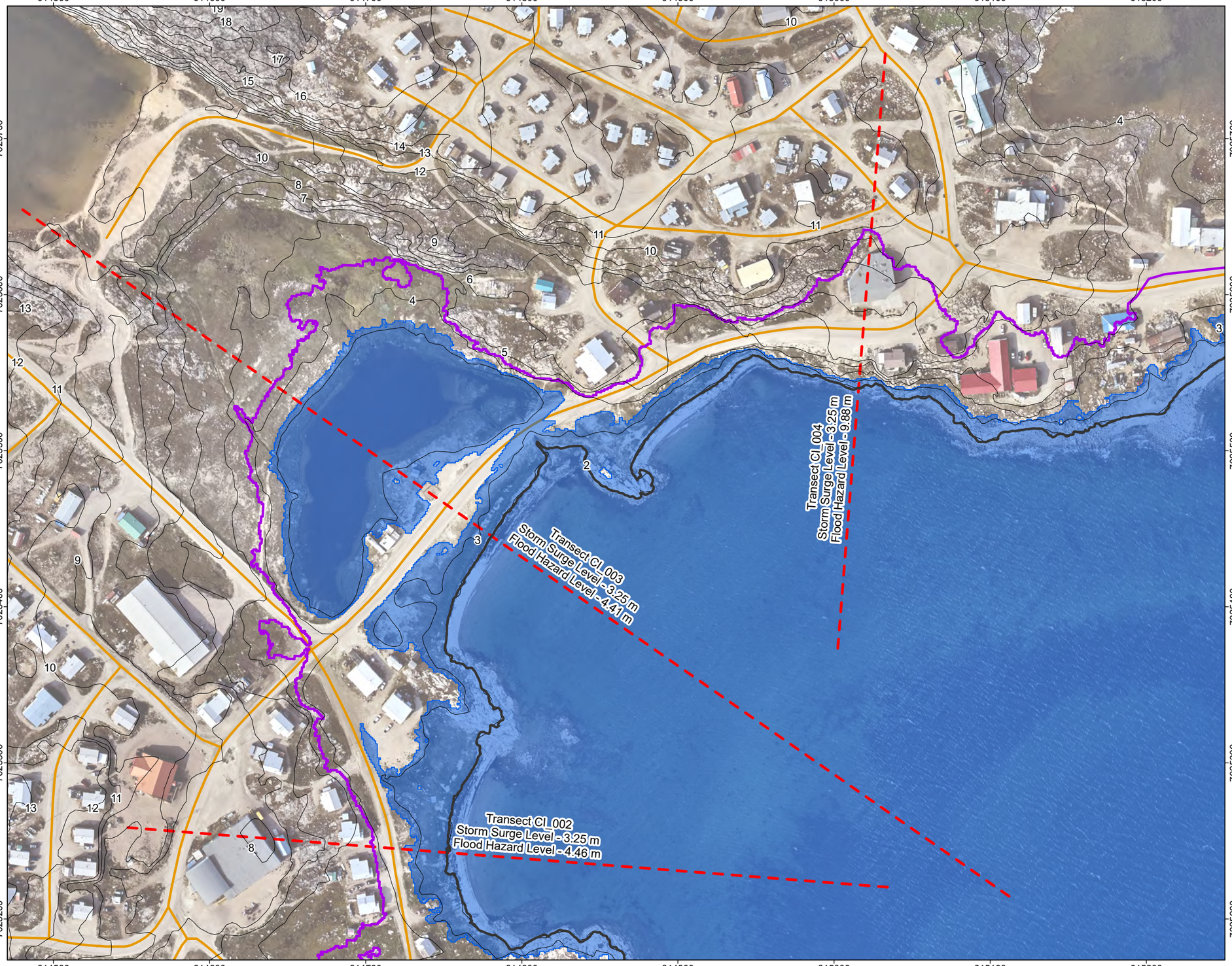
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Canada

Nunavut

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Figure No.

CI01-200yr

Title

Chesterfield Inlet - 200yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

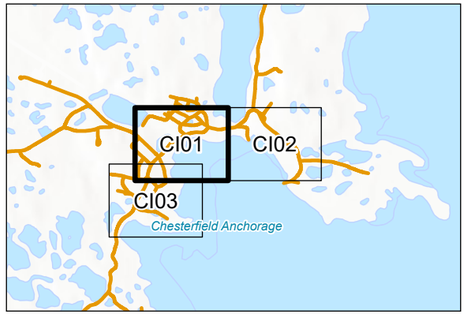
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TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

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0 50 100 Metres

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- Modelling Transect
- HHWLT (1.97 m)
- Flood Hazard Level - 200 yr
- Storm Surge Level - 200 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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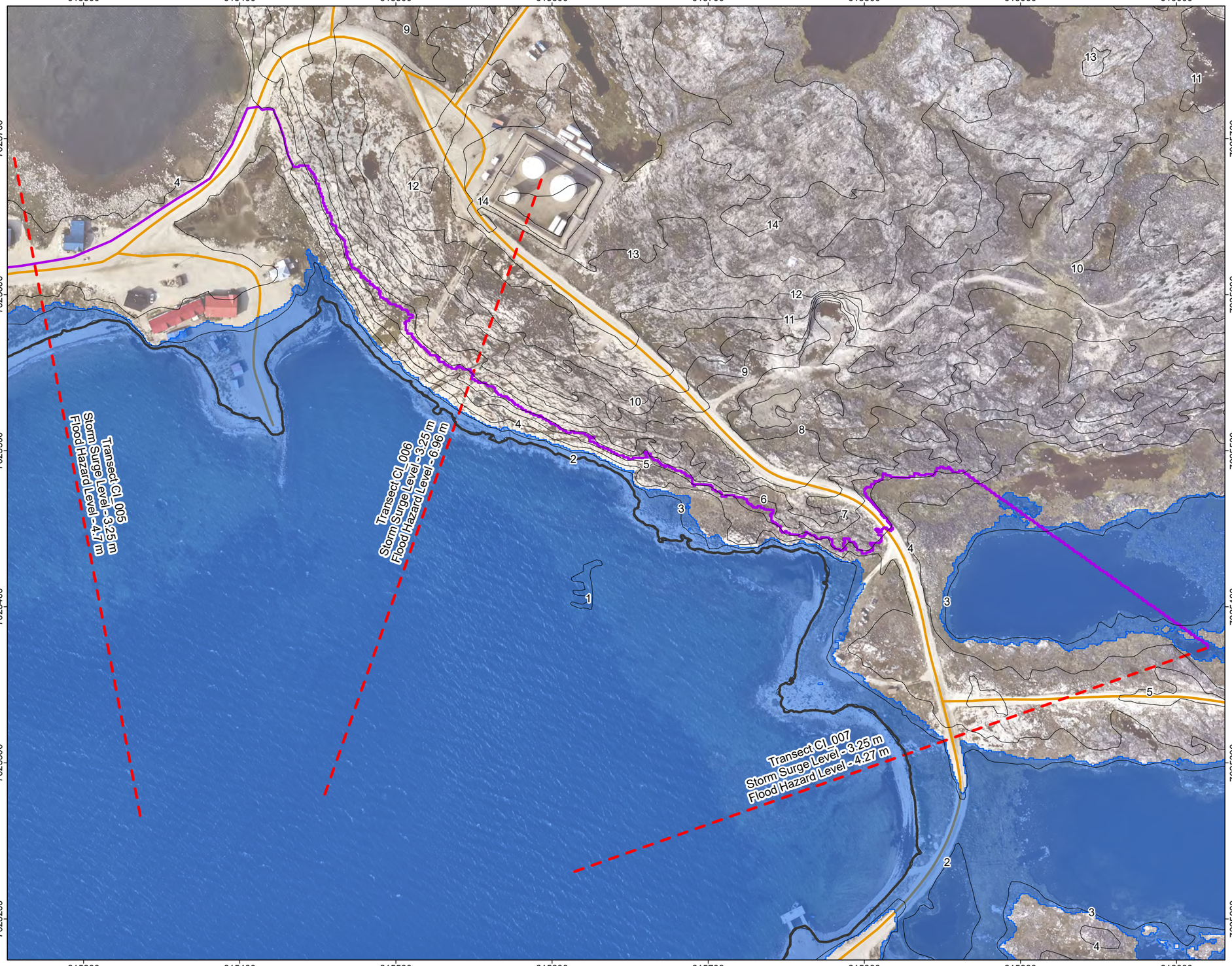
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Figure No.

CI02-200yr

Title

Chesterfield Inlet - 200yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

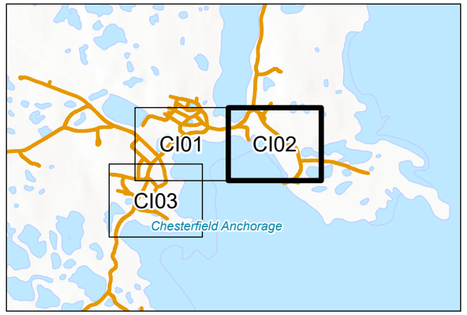
Prepared by MAINSLEY on 20260910
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IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres

(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.97 m)
- Flood Hazard Level - 200 yr
- Storm Surge Level - 200 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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Figure No.

CI03-200yr

Title

Chesterfield Inlet - 200yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

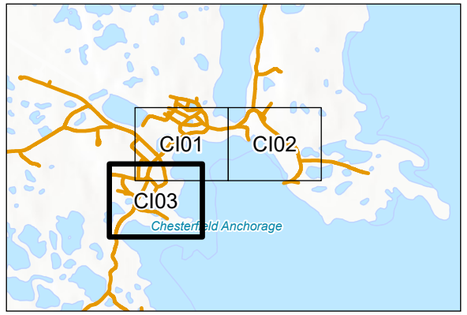
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1:2,500

- Modelling Transect
- HHWLT (1.97 m)
- Flood Hazard Level - 200 yr
- Storm Surge Level - 200 yr
- Topographic Contours - 1 m
- Road



Notes

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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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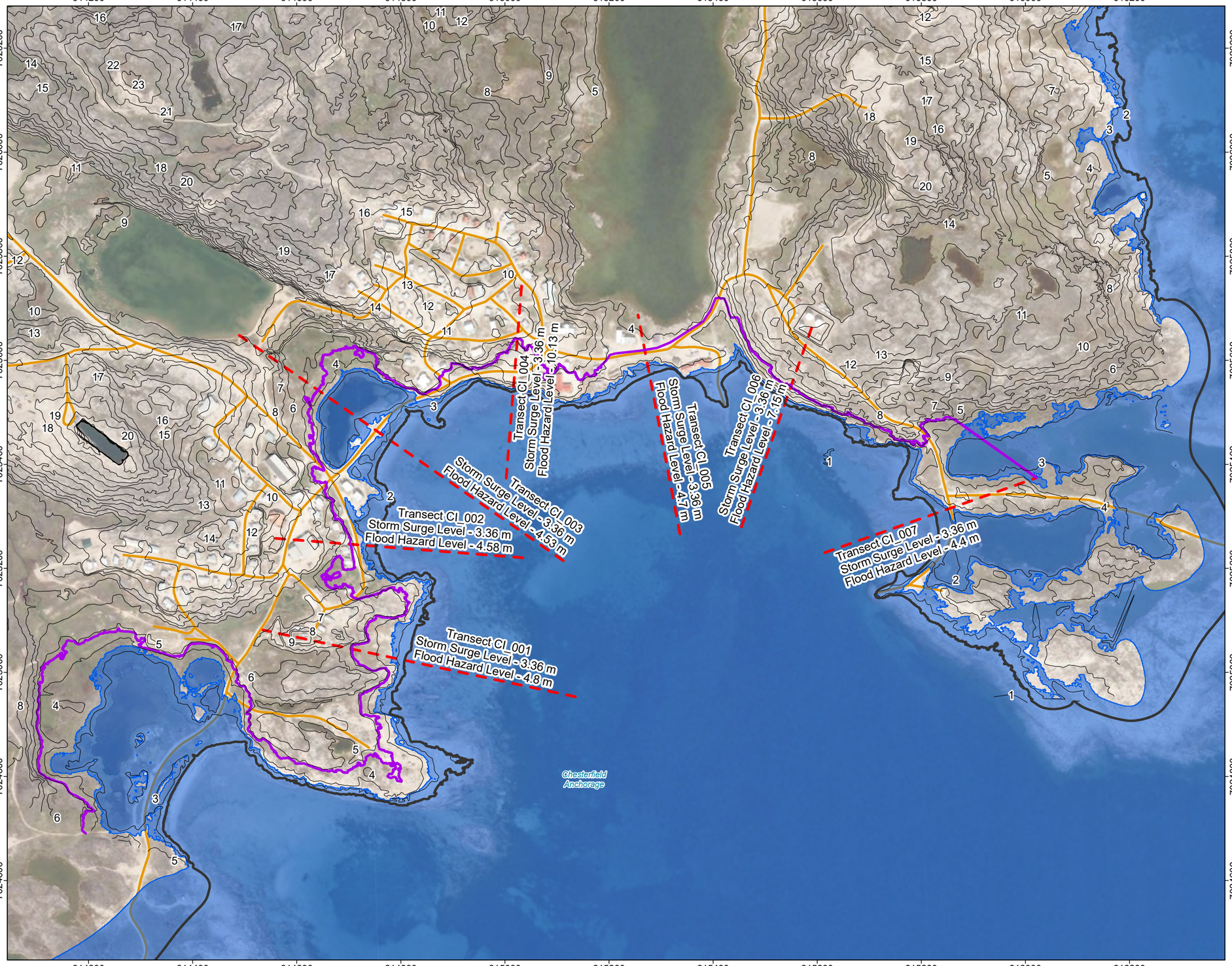
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Canada

Nunavut

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Figure No.

CI00-500yr

Title

Chesterfield Inlet - 500yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

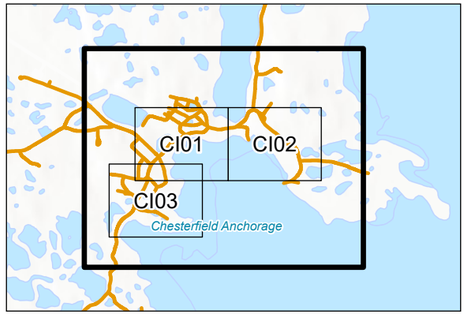
Project Location
Chesterfield Inlet, Nunavut

Prepared by MAINSLEY on 20260910
TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 100 200 Metres
(At original document size of 11x17)
1:7,500

- Modelling Transect
- HHWLT (1.97 m)
- Flood Hazard Level - 500 yr
- Storm Surge Level - 500 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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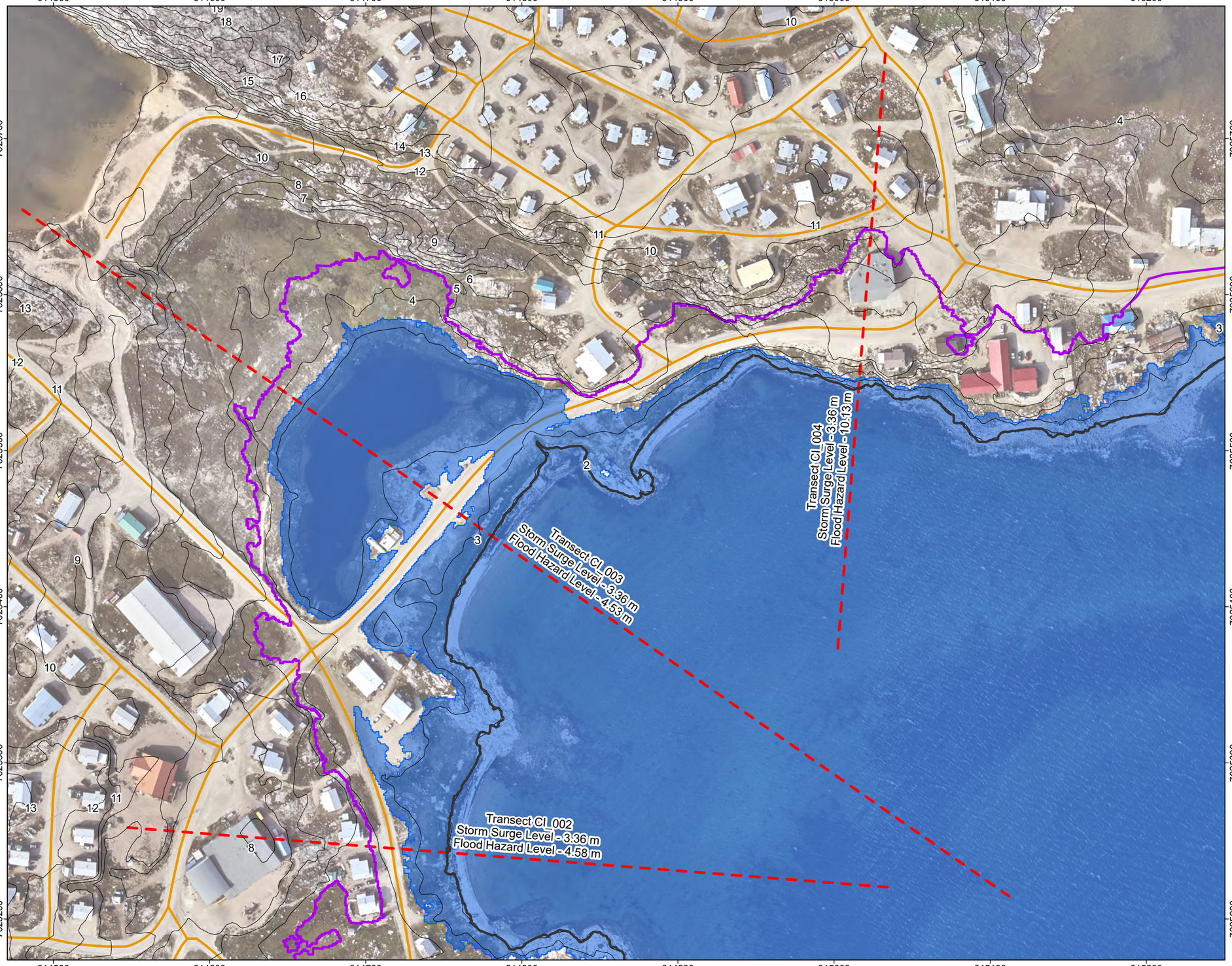
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Nunavut

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Figure No.

CI01-500yr

Title

Chesterfield Inlet - 500yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

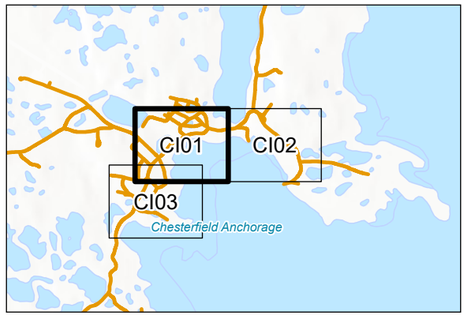
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N

0 50 100 Metres

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1:2,500

- Modelling Transect
- HHWLT (1.97 m)
- Flood Hazard Level - 500 yr
- Storm Surge Level - 500 yr
- Topographic Contours - 1 m
- Road



Notes
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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2025-10-06
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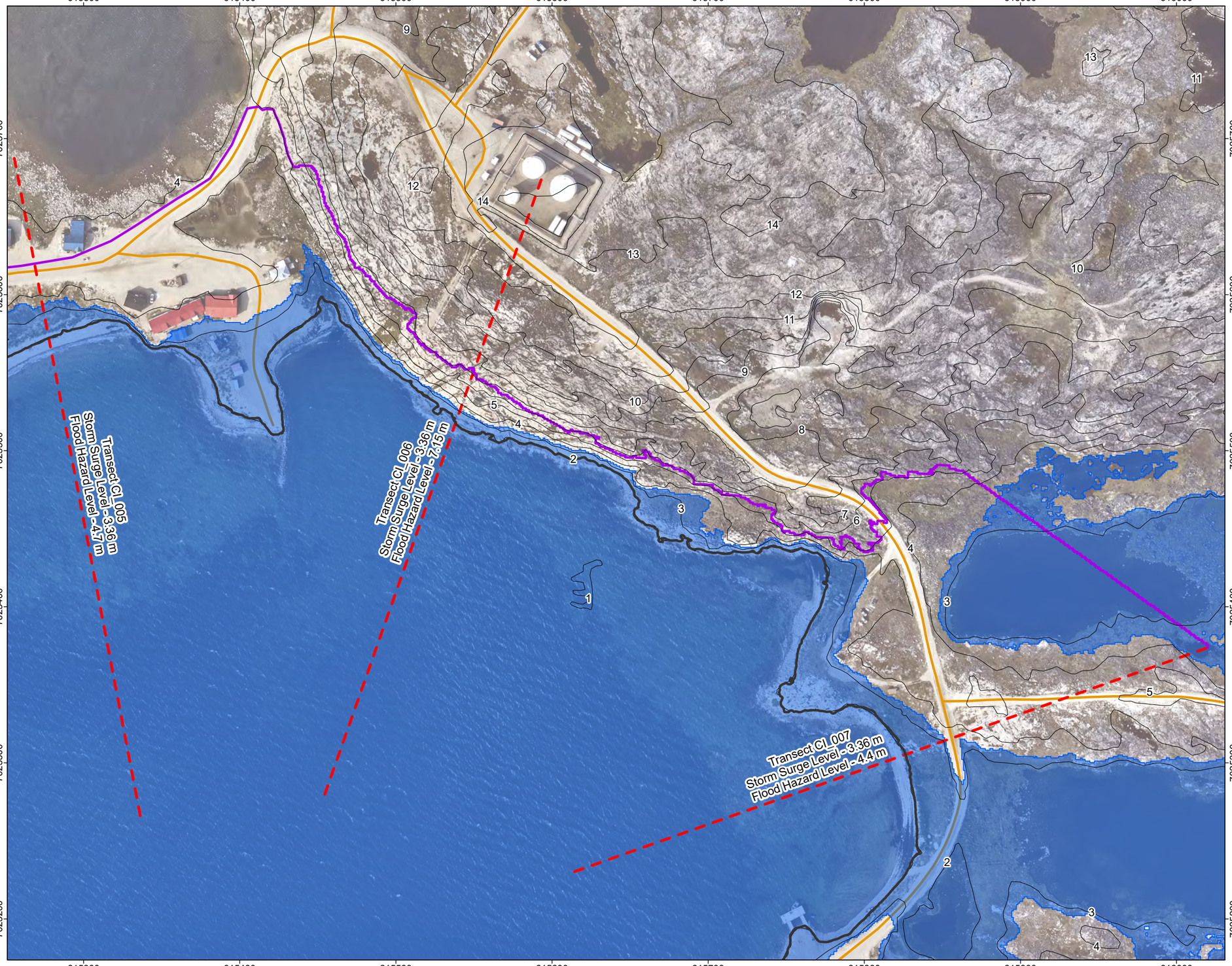
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Figure No.

CI02-500yr

Title

Chesterfield Inlet - 500yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

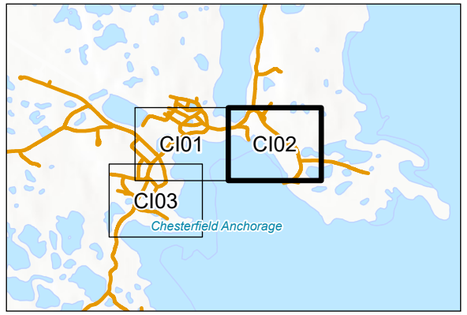
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0 50 100 Metres

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- Modelling Transect
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- Flood Hazard Level - 500 yr
- Storm Surge Level - 500 yr
- Topographic Contours - 1 m
- Road



Notes
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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2026-10-05
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Figure No.

CI03-500yr

Title

Chesterfield Inlet - 500yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Chesterfield Inlet, Nunavut

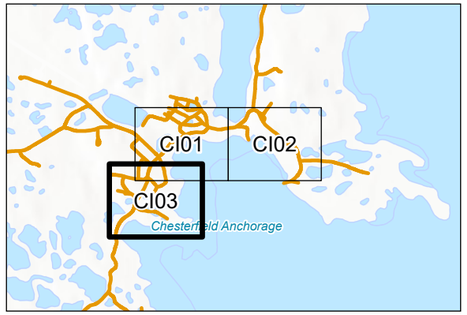
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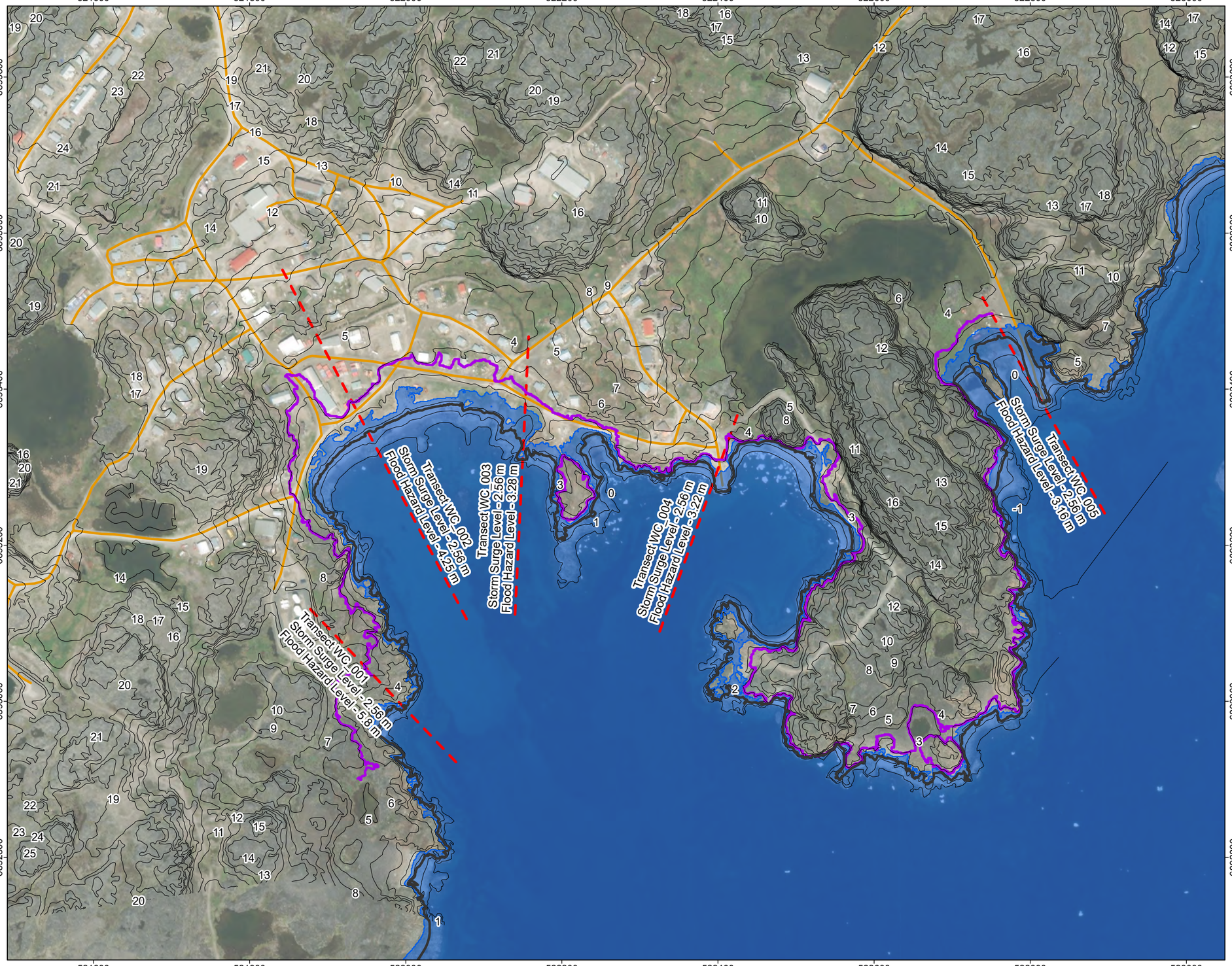
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Canada

Nunavut

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Figure No.

WC00-10yr

Title

Whale Cove - 10yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

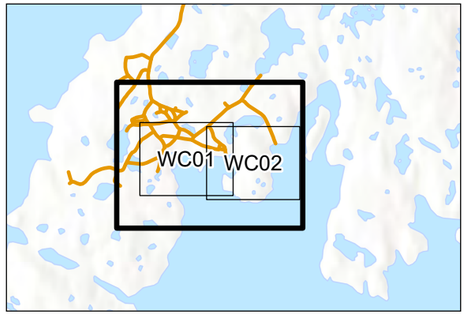
Project Location
Whale Cove, Nunavut

Prepared by MAINSLEY on 20260910
TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres
(At original document size of 11x17)
1:5,000

- Modelling Transect
- HHWLT (1.69 m)
- Flood Hazard Level - 10 yr
- Storm Surge Level - 10 yr
- Topographic Contours - 1 m
- Road



Notes

1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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Date October 5, 2026
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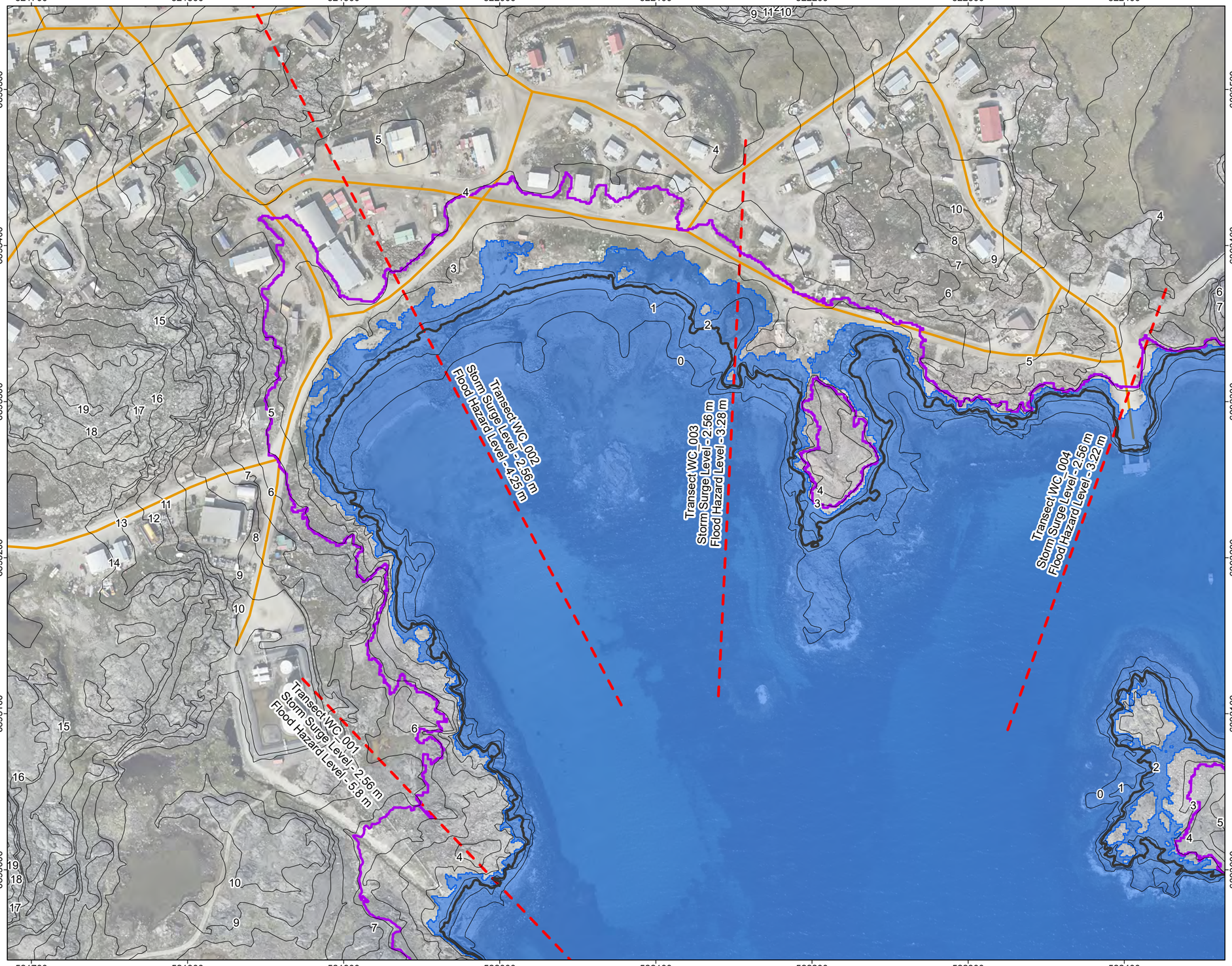
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Figure No.

WC01-10yr

Title

Whale Cove - 10yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Whale Cove, Nunavut

Prepared by MAINSLEY on 20260910
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- Flood Hazard Level - 10 yr
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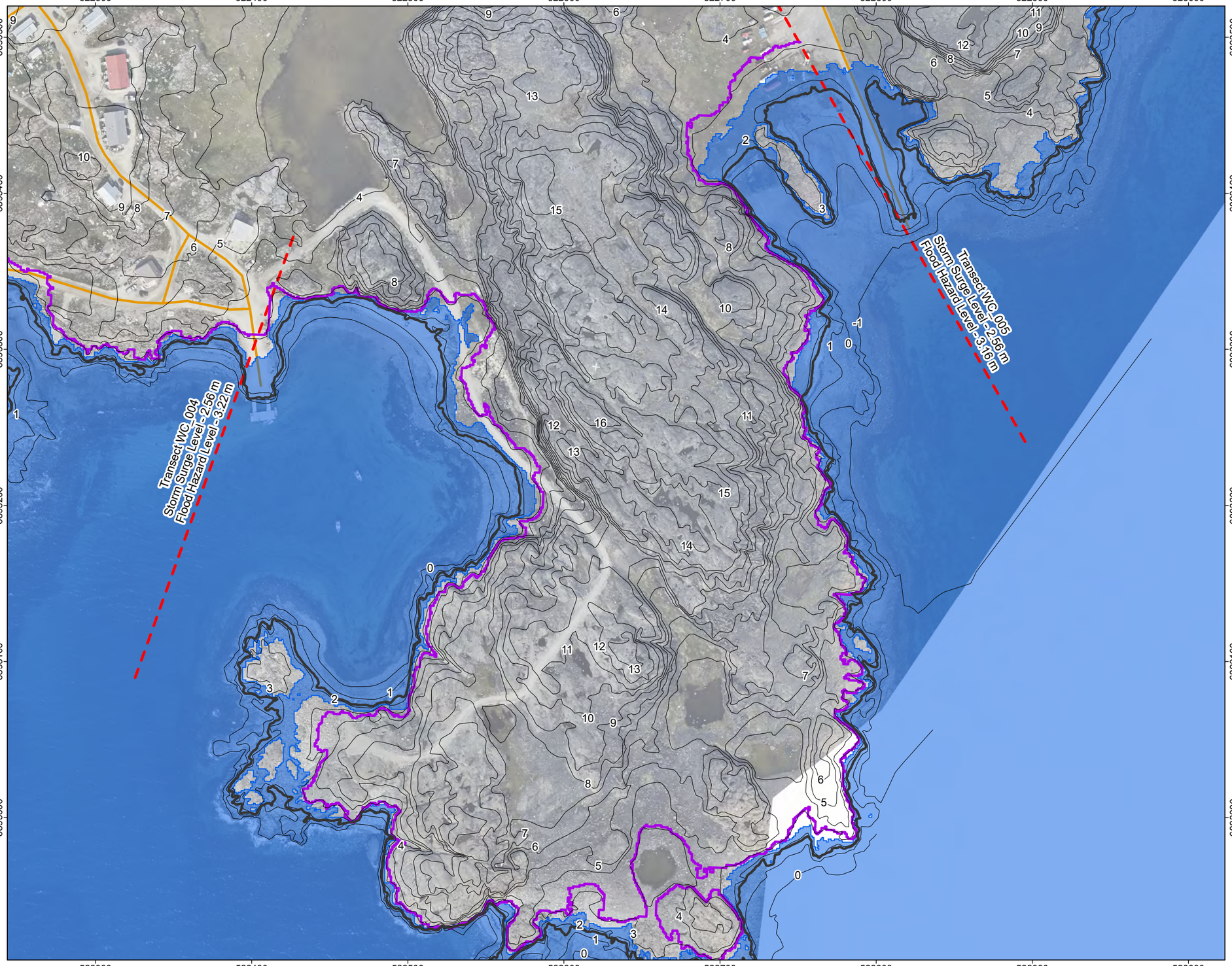
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Figure No.

WC02-10yr

Title

Whale Cove - 10yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

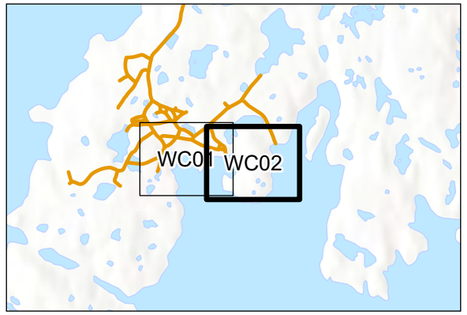
Project Location
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- Modelling Transect
- HHWLT (1.69 m)
- Flood Hazard Level - 10 yr
- Storm Surge Level - 10 yr
- Topographic Contours - 1 m
- Road



Notes
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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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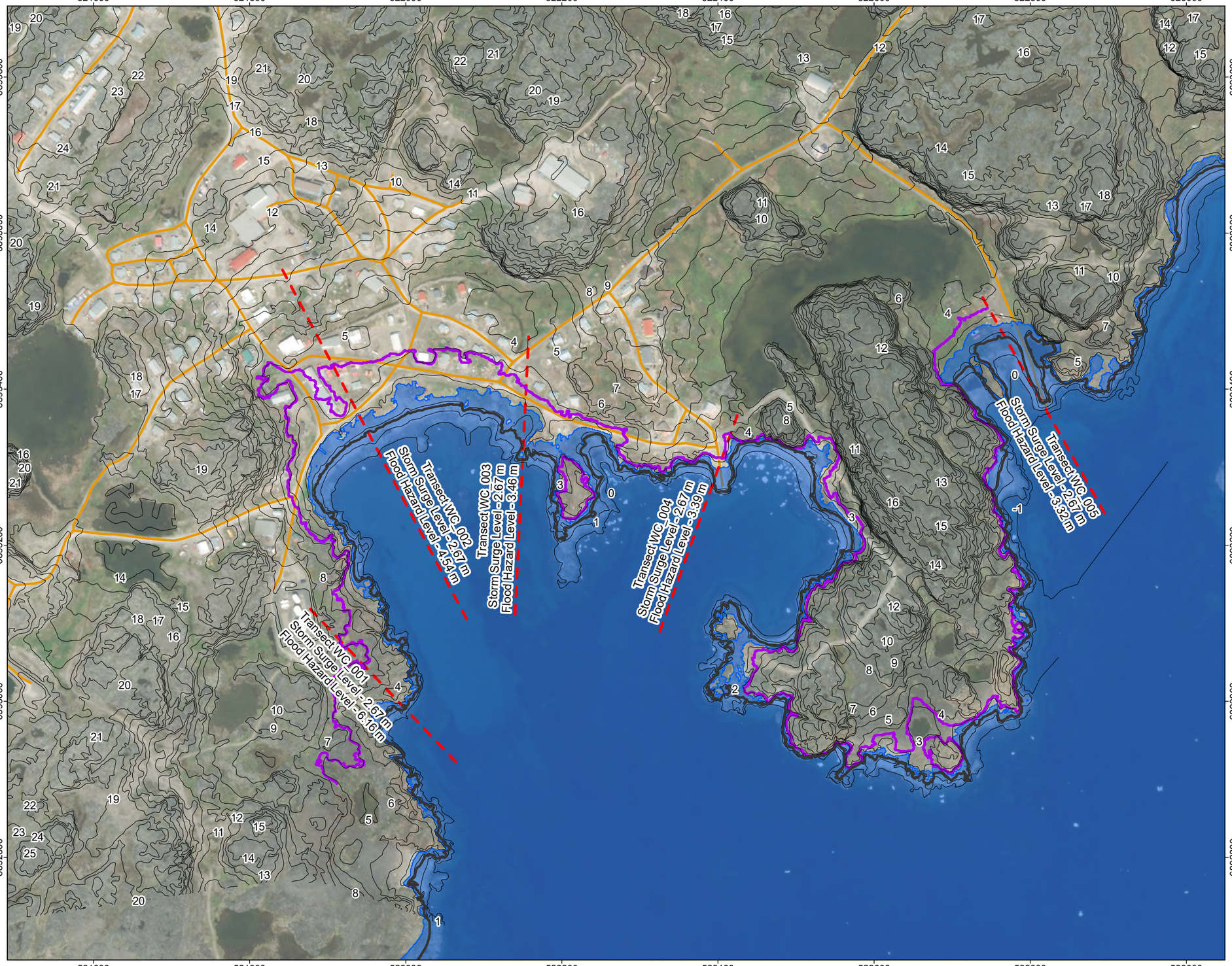
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Figure No.

WC00-20yr

Title

Whale Cove - 20yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

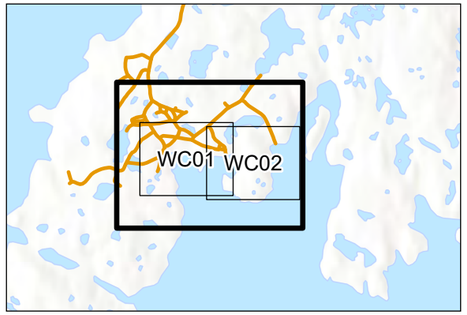
Project Location
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- Modelling Transect
- HHWLT (1.69 m)
- Flood Hazard Level - 20 yr
- Storm Surge Level - 20 yr
- Topographic Contours - 1 m
- Road



Notes
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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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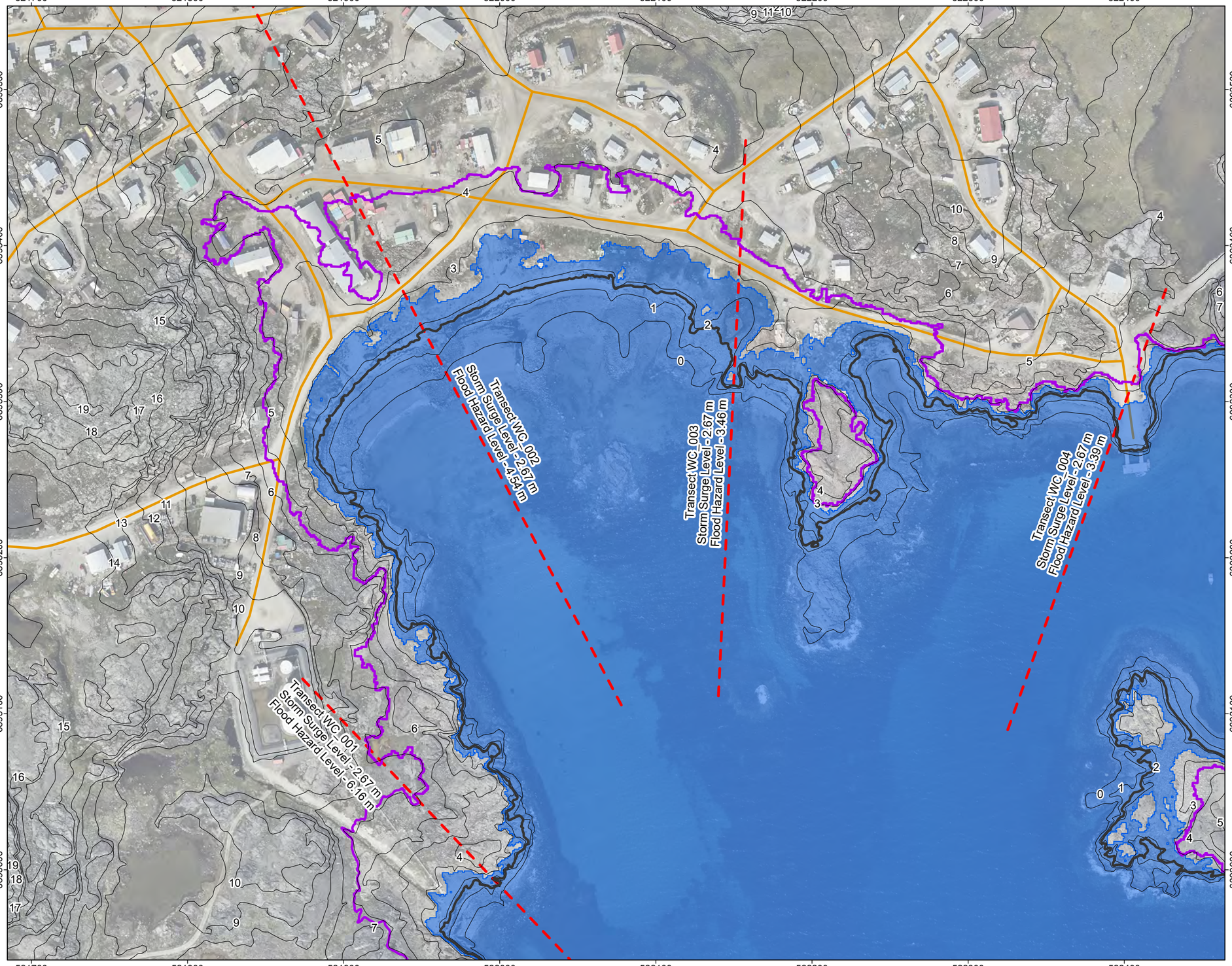
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Figure No.

WC01-20yr

Title

Whale Cove - 20yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Whale Cove, Nunavut

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- Road



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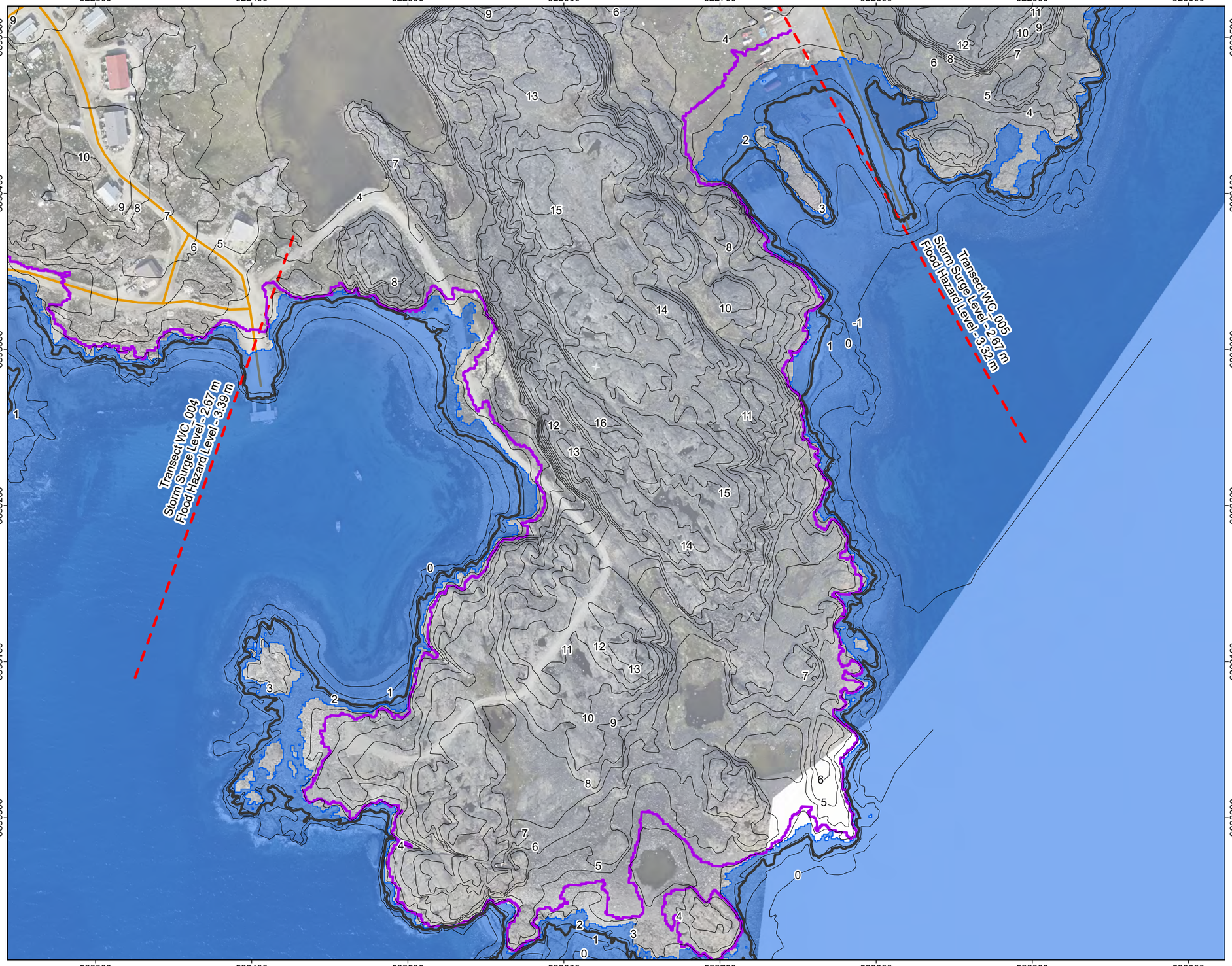
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Figure No.

WC02-20yr

Title

Whale Cove - 20yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Whale Cove, Nunavut

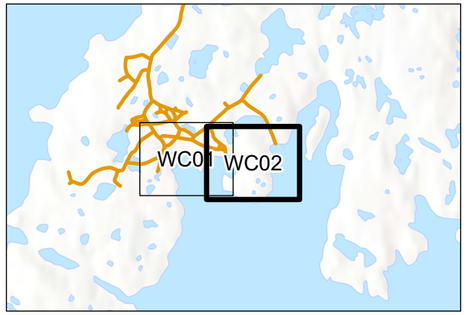
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N

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(At original document size of 11x17)
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- Modelling Transect
- HHWLT (1.69 m)
- Flood Hazard Level - 20 yr
- Storm Surge Level - 20 yr
- Topographic Contours - 1 m
- Road



Notes

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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

REGISTERED PROFESSIONAL ENGINEER
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2026-10-05
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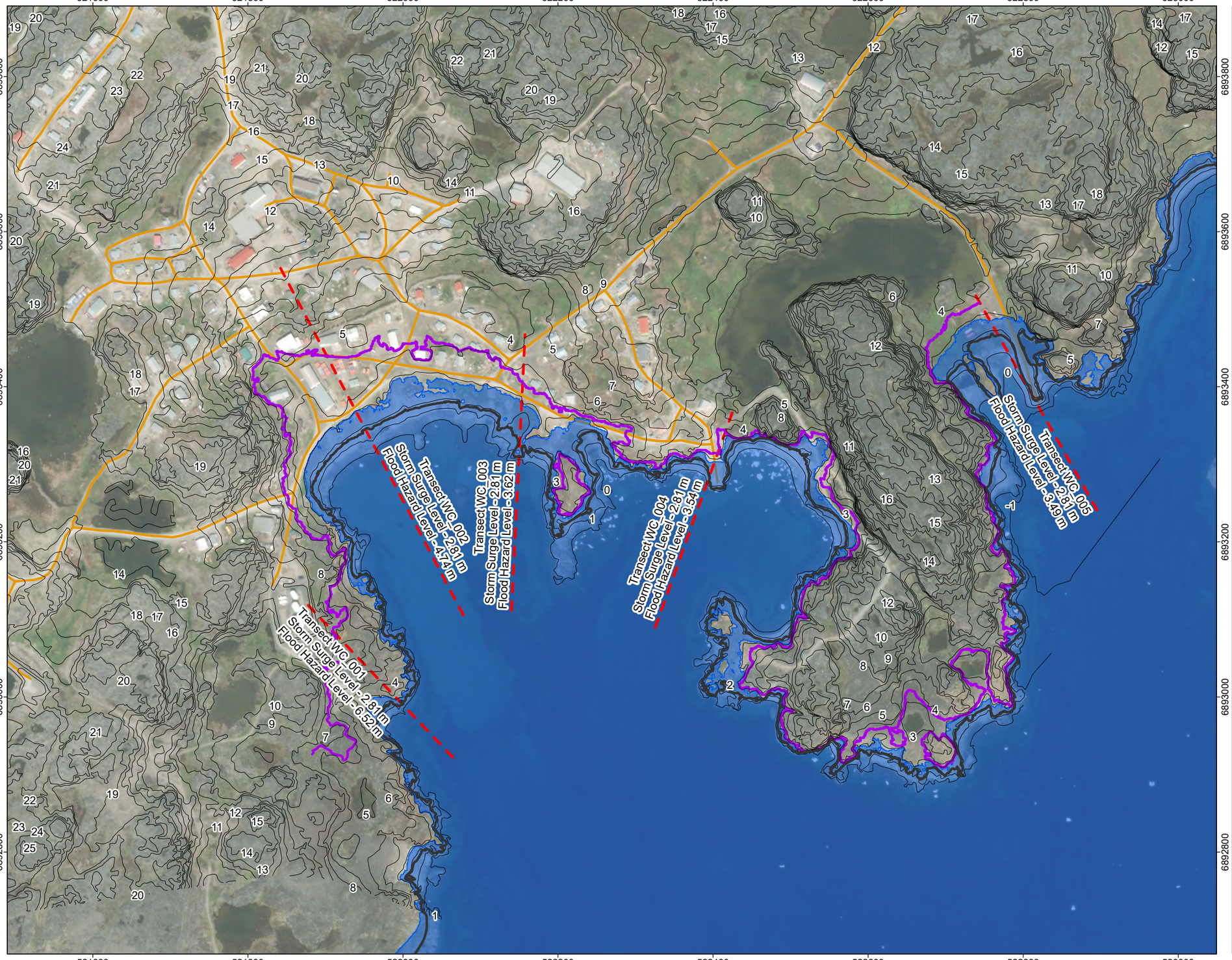
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Figure No.

WC00-50yr

Title

Whale Cove - 50yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

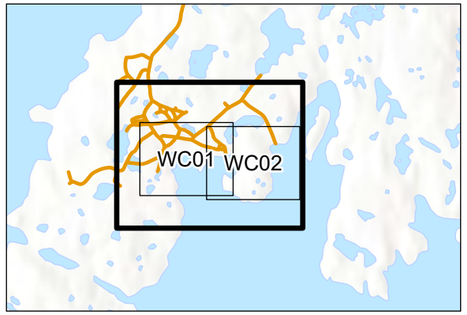
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- Modelling Transect
- HHWLT (1.69 m)
- Flood Hazard Level - 50 yr
- Storm Surge Level - 50 yr
- Topographic Contours - 1 m
- Road



Notes
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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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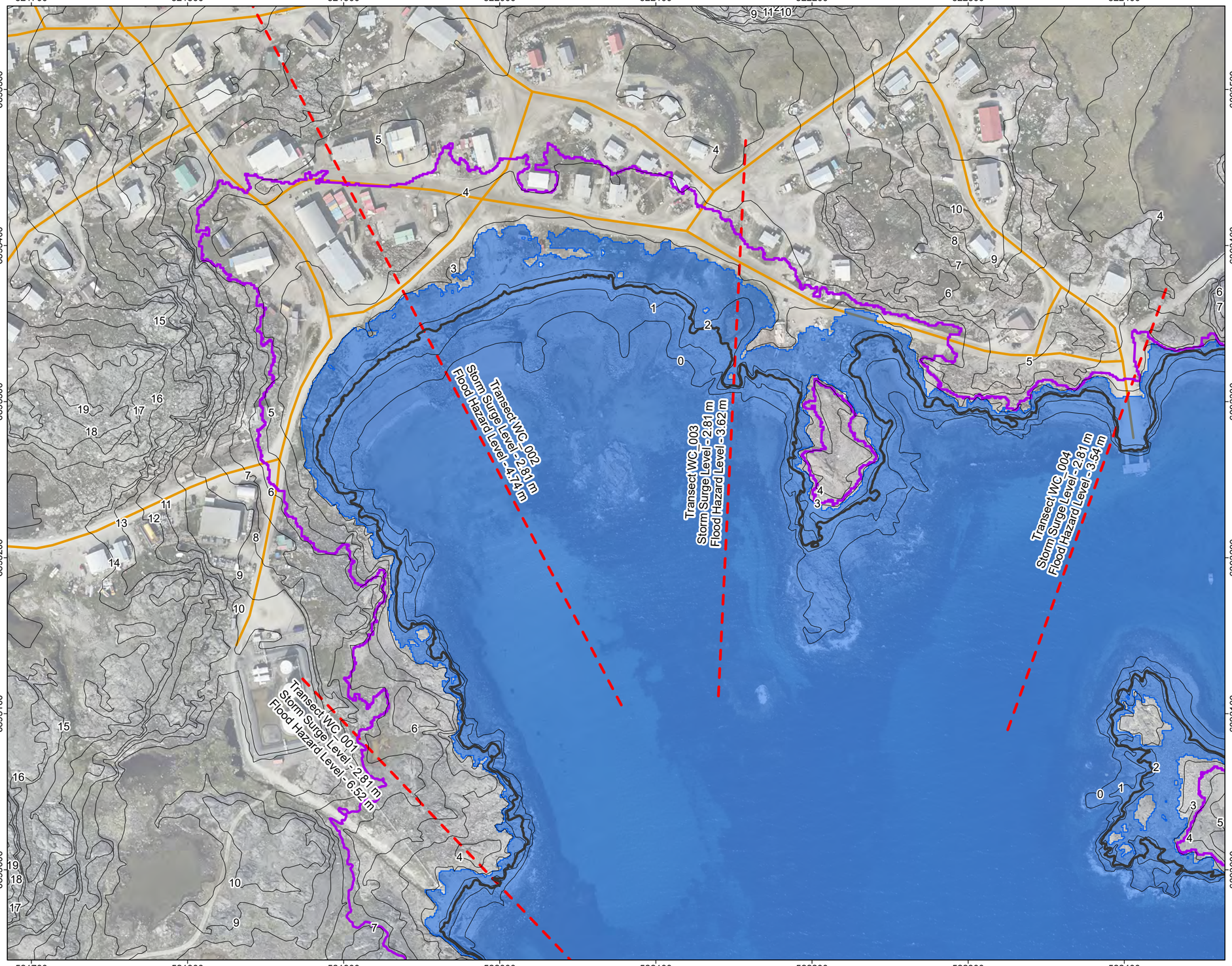
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Figure No.

WC01-50yr

Title

Whale Cove - 50yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Whale Cove, Nunavut

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- Road



Notes
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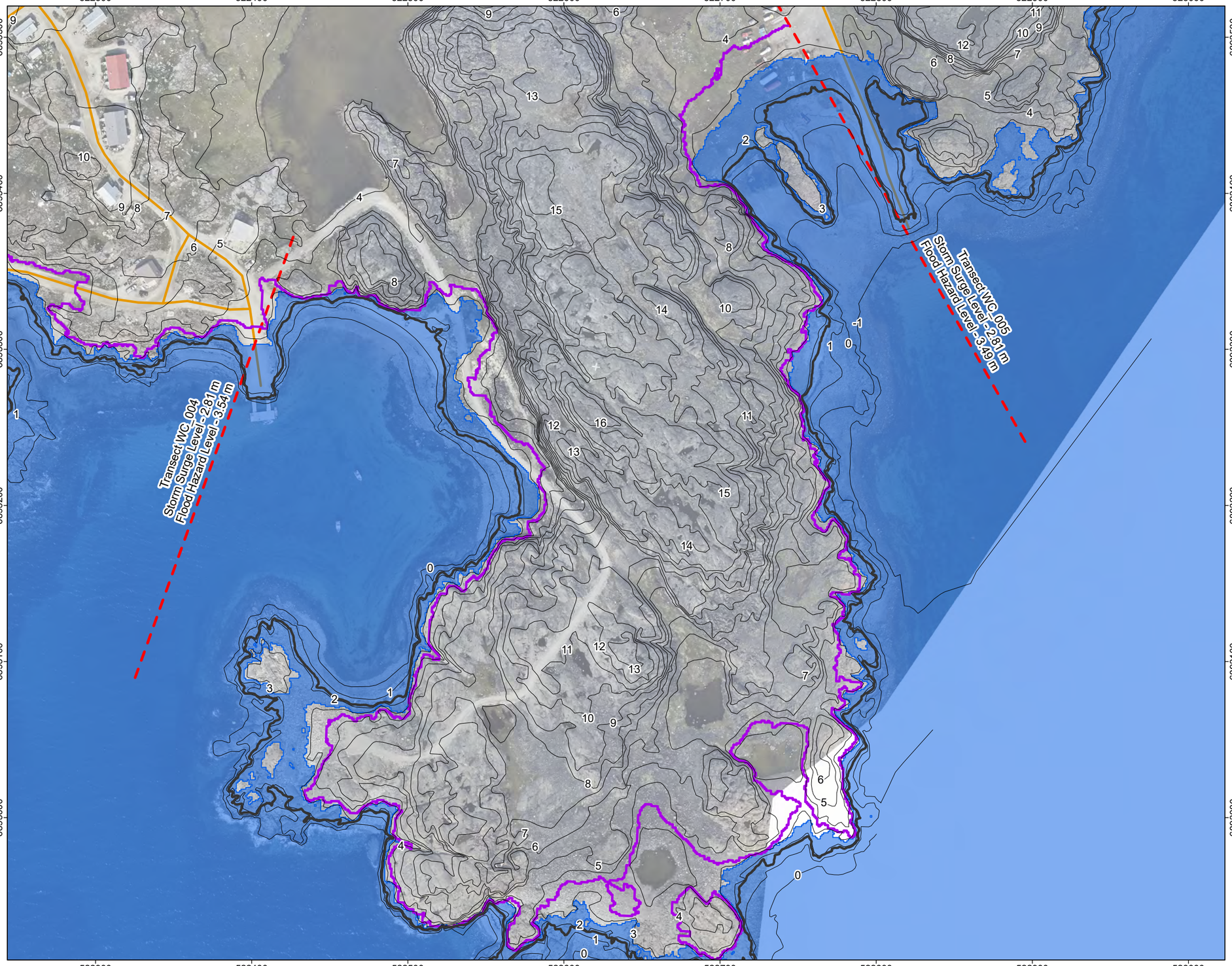
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Figure No.

WC02-50yr

Title

Whale Cove - 50yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Whale Cove, Nunavut

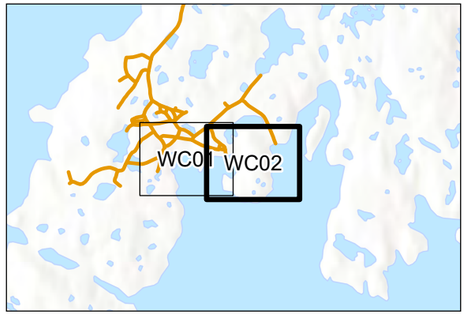
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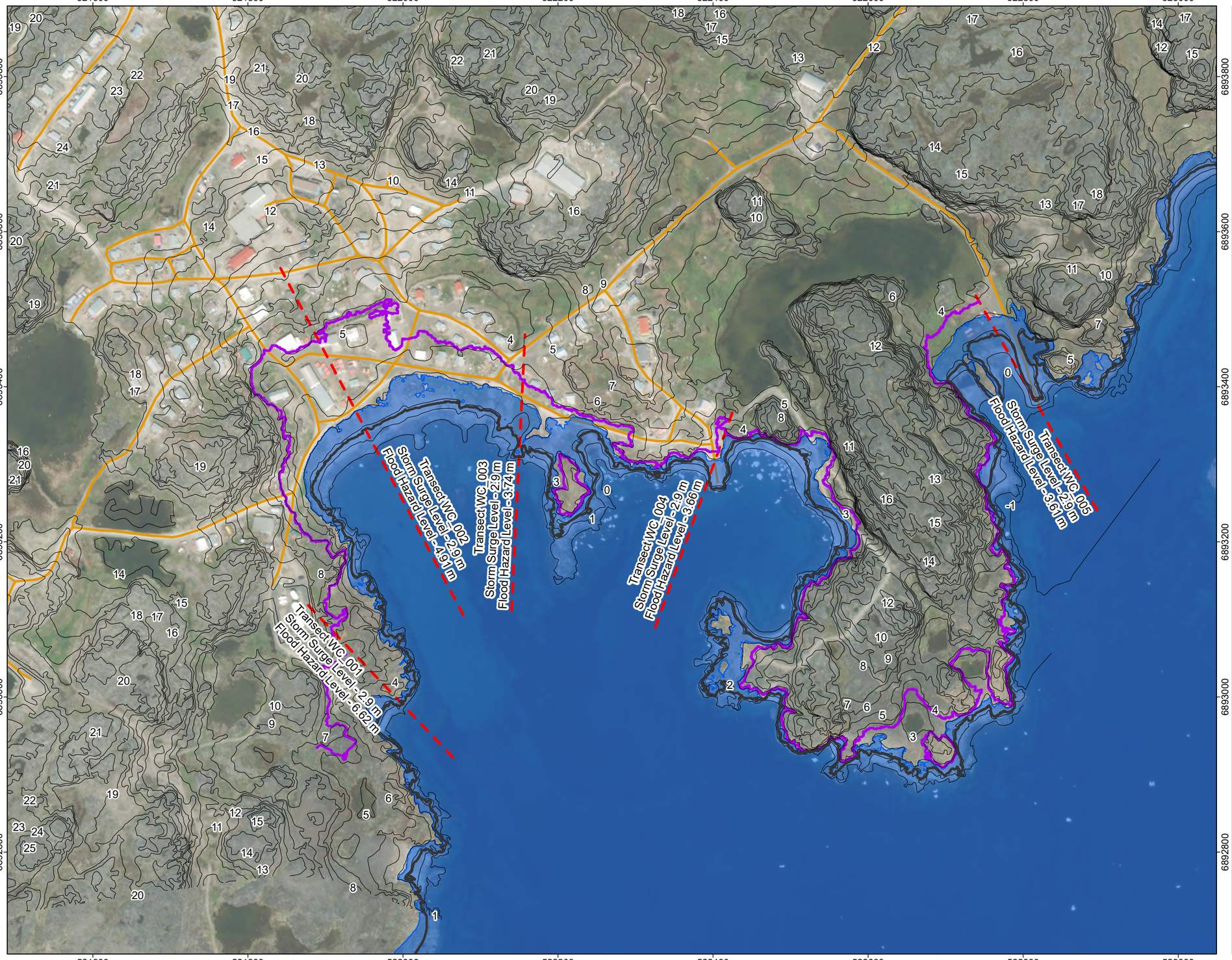
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STANTEC LIMITED

Figure No.

WC00-100yr

Title

Whale Cove - 100yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

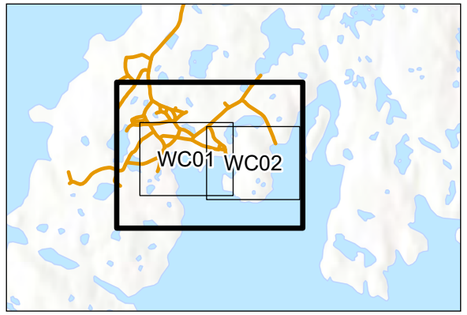
Project Location
Whale Cove, Nunavut

Prepared by MAINSLEY on 20260910
TR by HDASHTPEYMA on 20260910
IR by NKIMIAGHALAM on 20260910

N

0 50 100 Metres
(At original document size of 11x17)
1:5,000

- Modelling Transect
- HHWLT (1.69 m)
- Flood Hazard Level - 100 yr
- Storm Surge Level - 100 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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Date October 5, 2026
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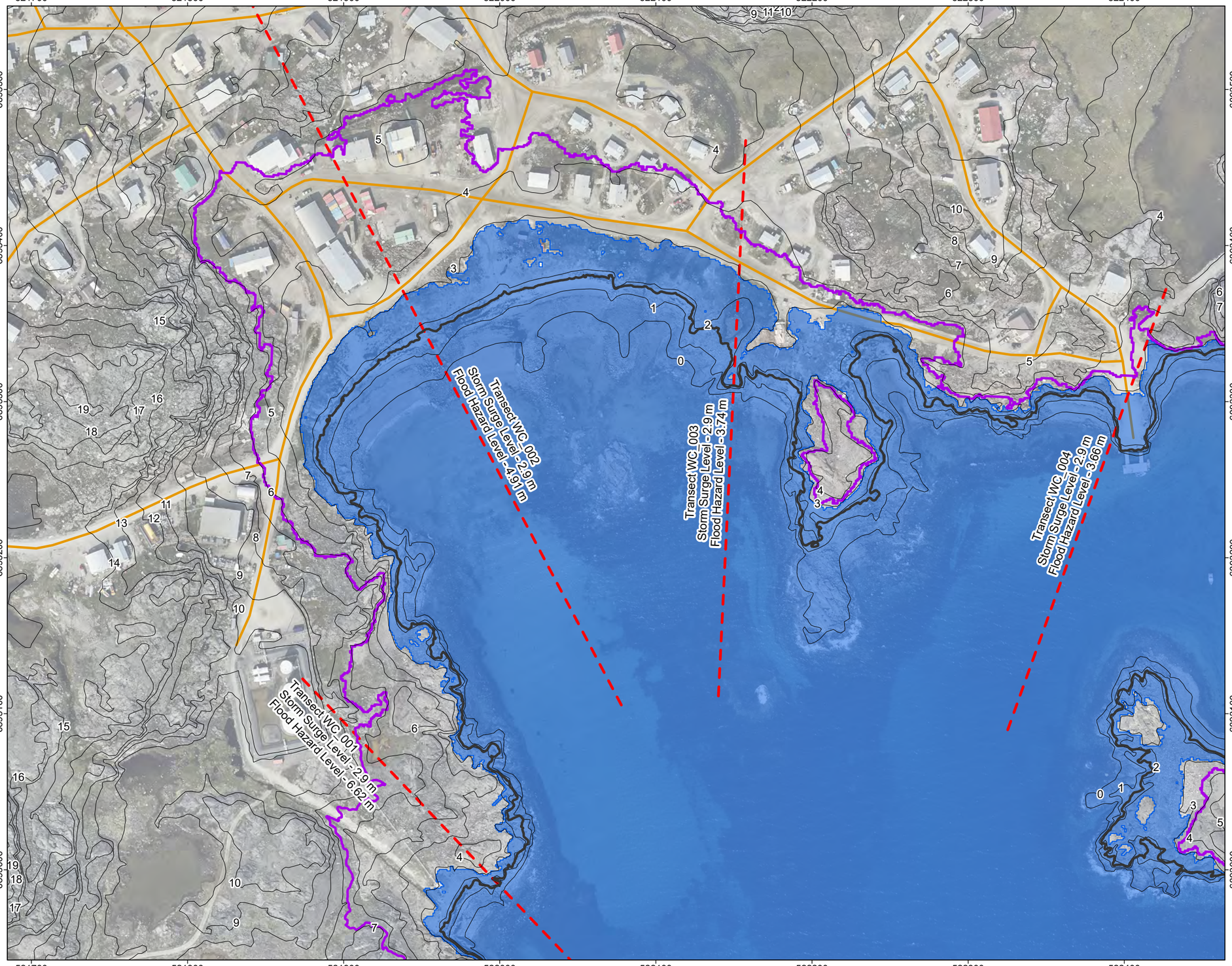
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STANTEC LIMITED

Figure No.

WC01-100yr

Title

Whale Cove - 100yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Whale Cove, Nunavut

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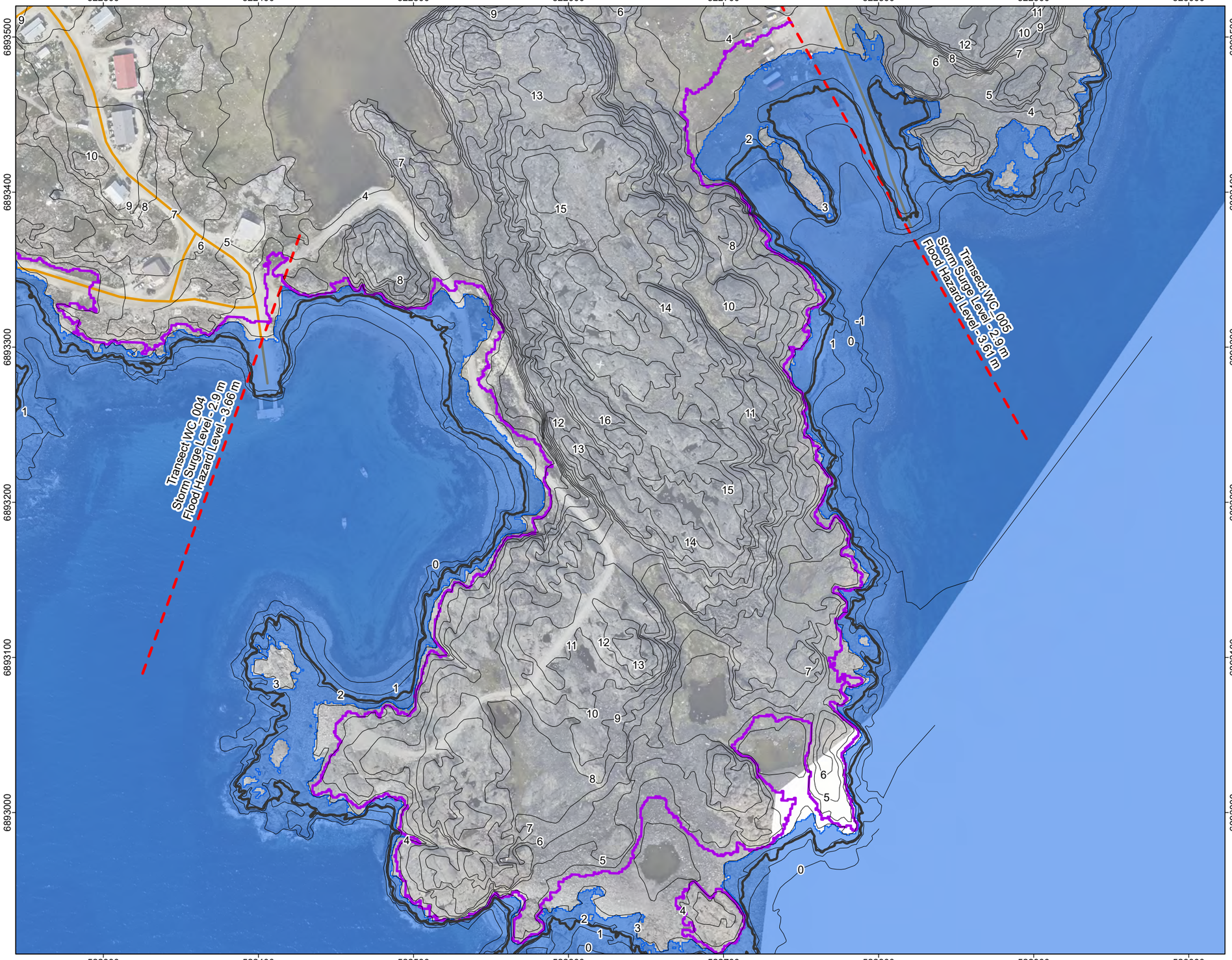
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NUNAMI
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Figure No.

WC02-100yr

Title

Whale Cove - 100yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Whale Cove, Nunavut

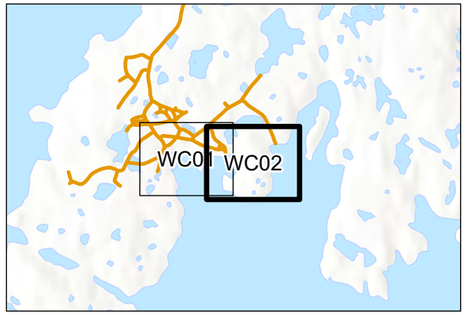
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- Modelling Transect
- HHWLT (1.69 m)
- Flood Hazard Level - 100 yr
- Storm Surge Level - 100 yr
- Topographic Contours - 1 m
- Road



Notes

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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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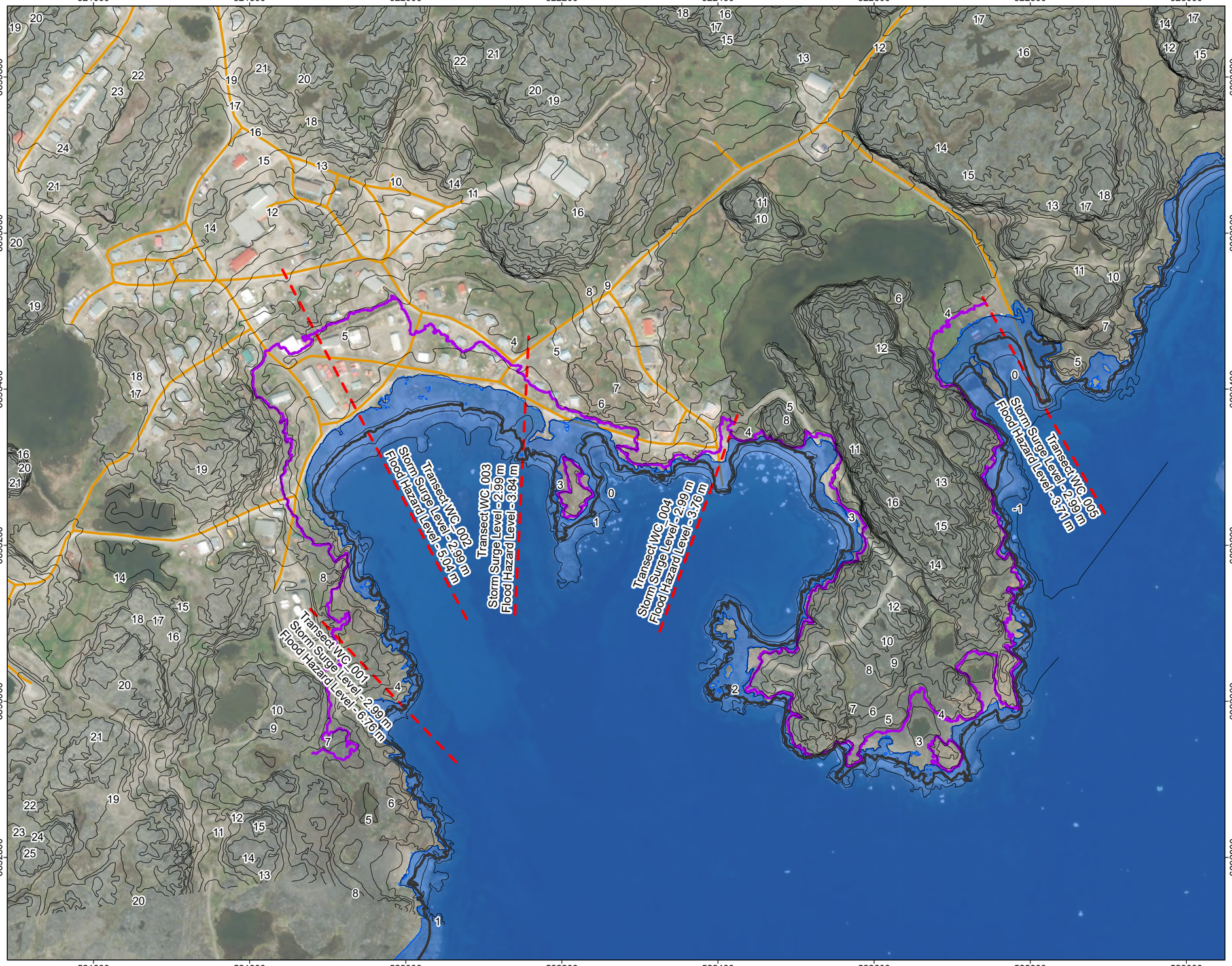
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Figure No.

WC00-200yr

Title

Whale Cove - 200yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

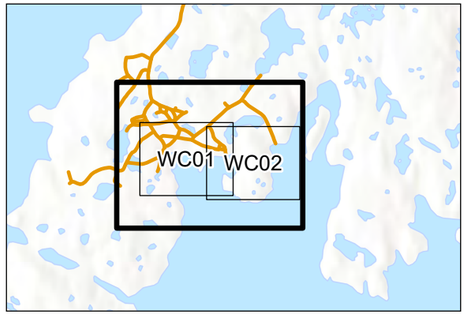
Project Location
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(At original document size of 11x17)
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- Modelling Transect
- HHWLT (1.69 m)
- Flood Hazard Level - 200 yr
- Storm Surge Level - 200 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2026-10-05
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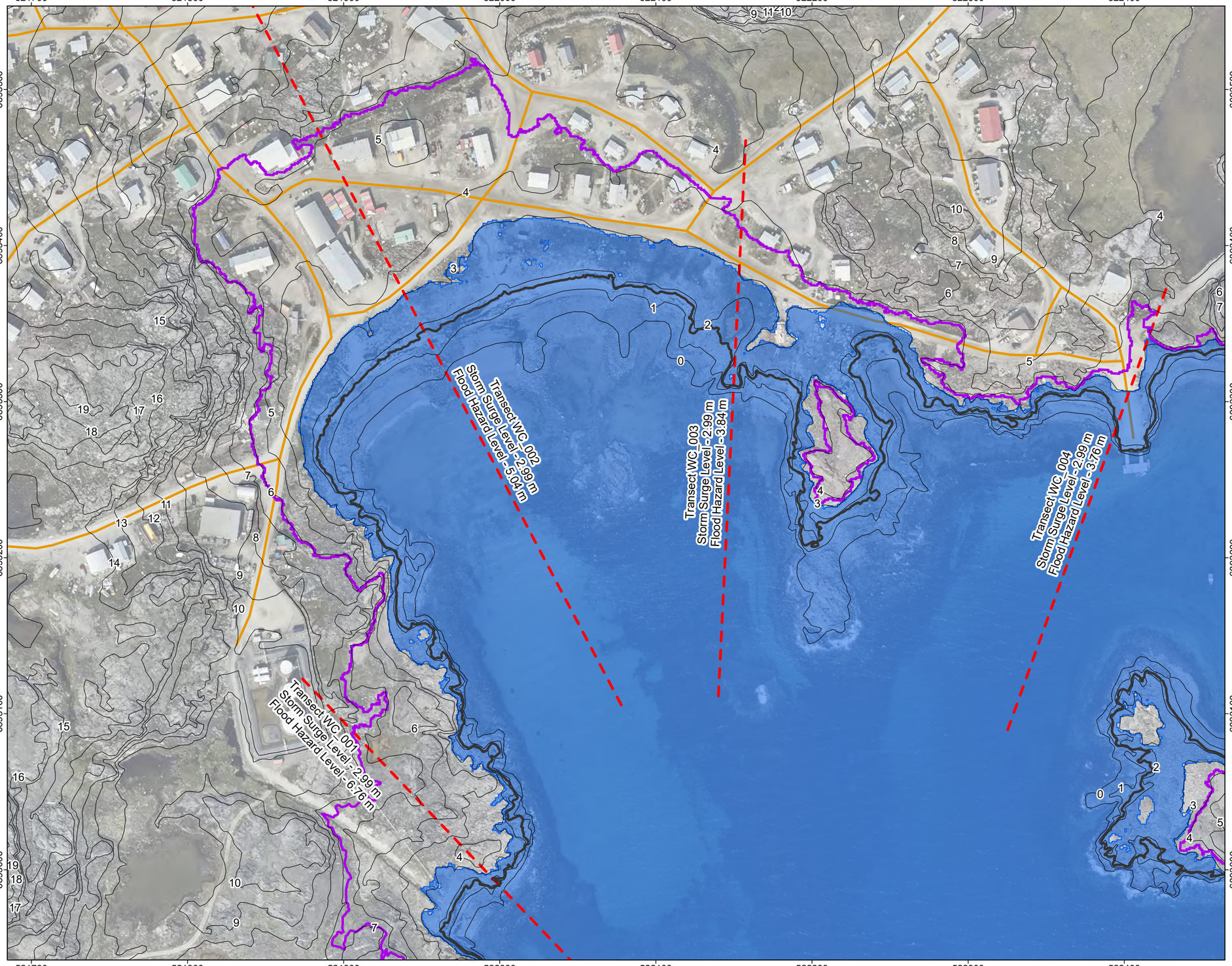
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STANTEC LIMITED

Figure No.

WC01-200yr

Title

Whale Cove - 200yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Whale Cove, Nunavut

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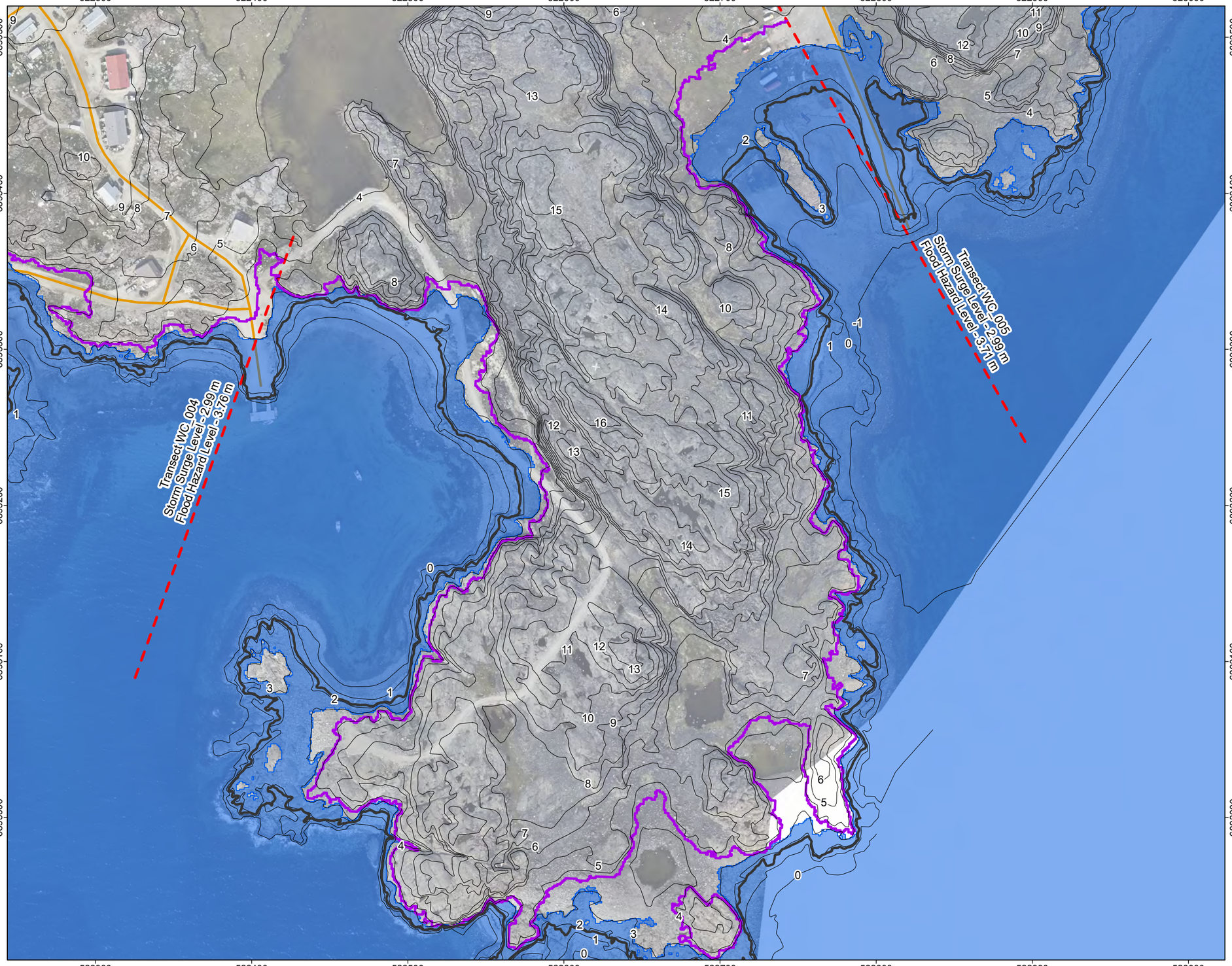
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Figure No.

WC02-200yr

Title

Whale Cove - 200yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
Whale Cove, Nunavut

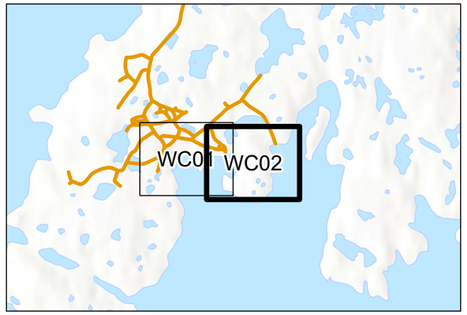
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(At original document size of 11x17)
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- Modelling Transect
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- Flood Hazard Level - 200 yr
- Storm Surge Level - 200 yr
- Topographic Contours - 1 m
- Road



Notes

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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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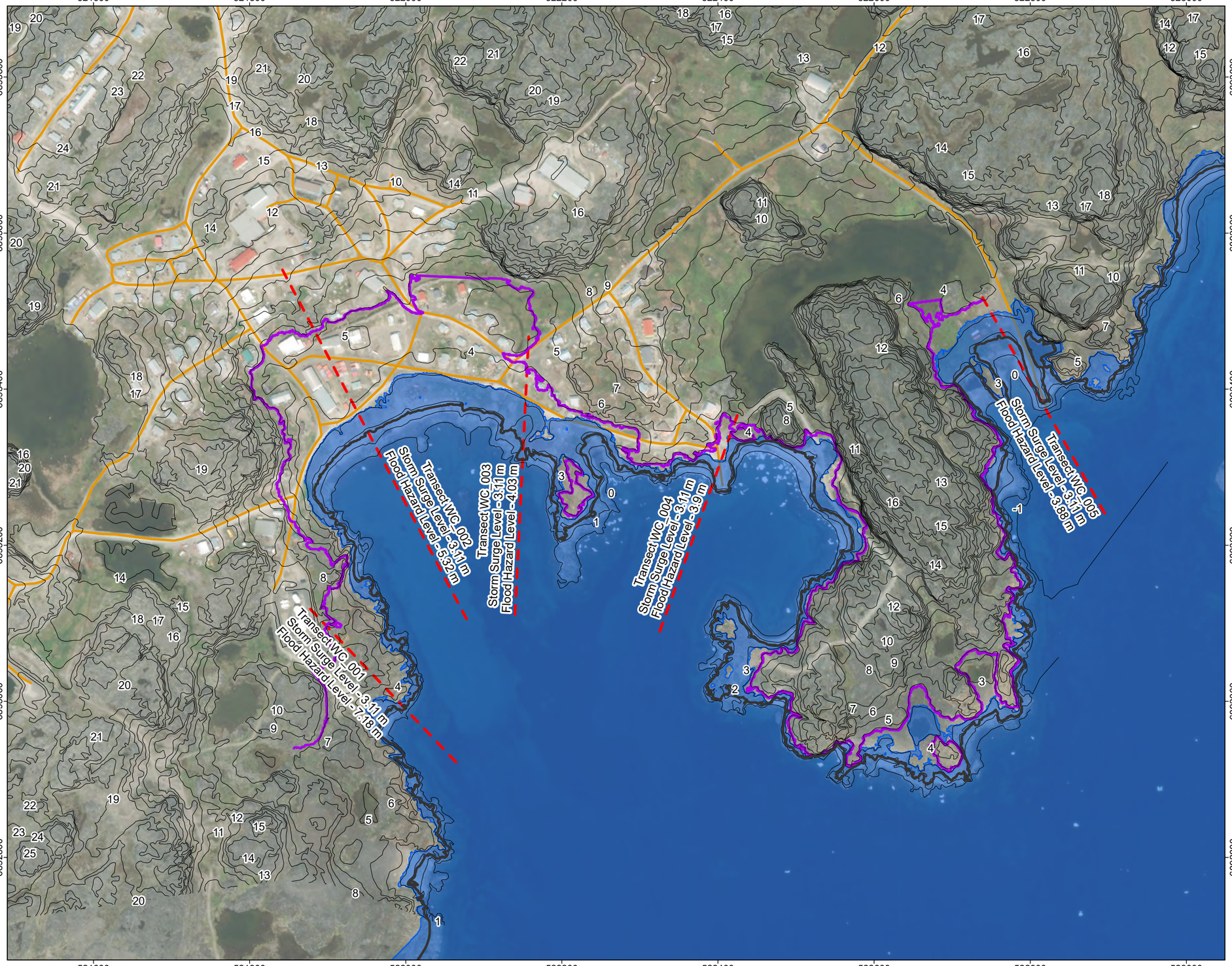
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STANTEC LIMITED

Figure No.

WC00-500yr

Title

Whale Cove - 500yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

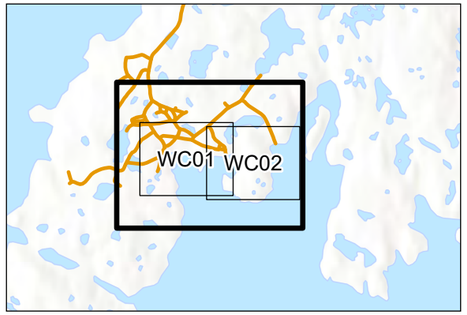
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(At original document size of 11x17)
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- Flood Hazard Level - 500 yr
- Storm Surge Level - 500 yr
- Topographic Contours - 1 m
- Road



Notes
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Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

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2026-10-05
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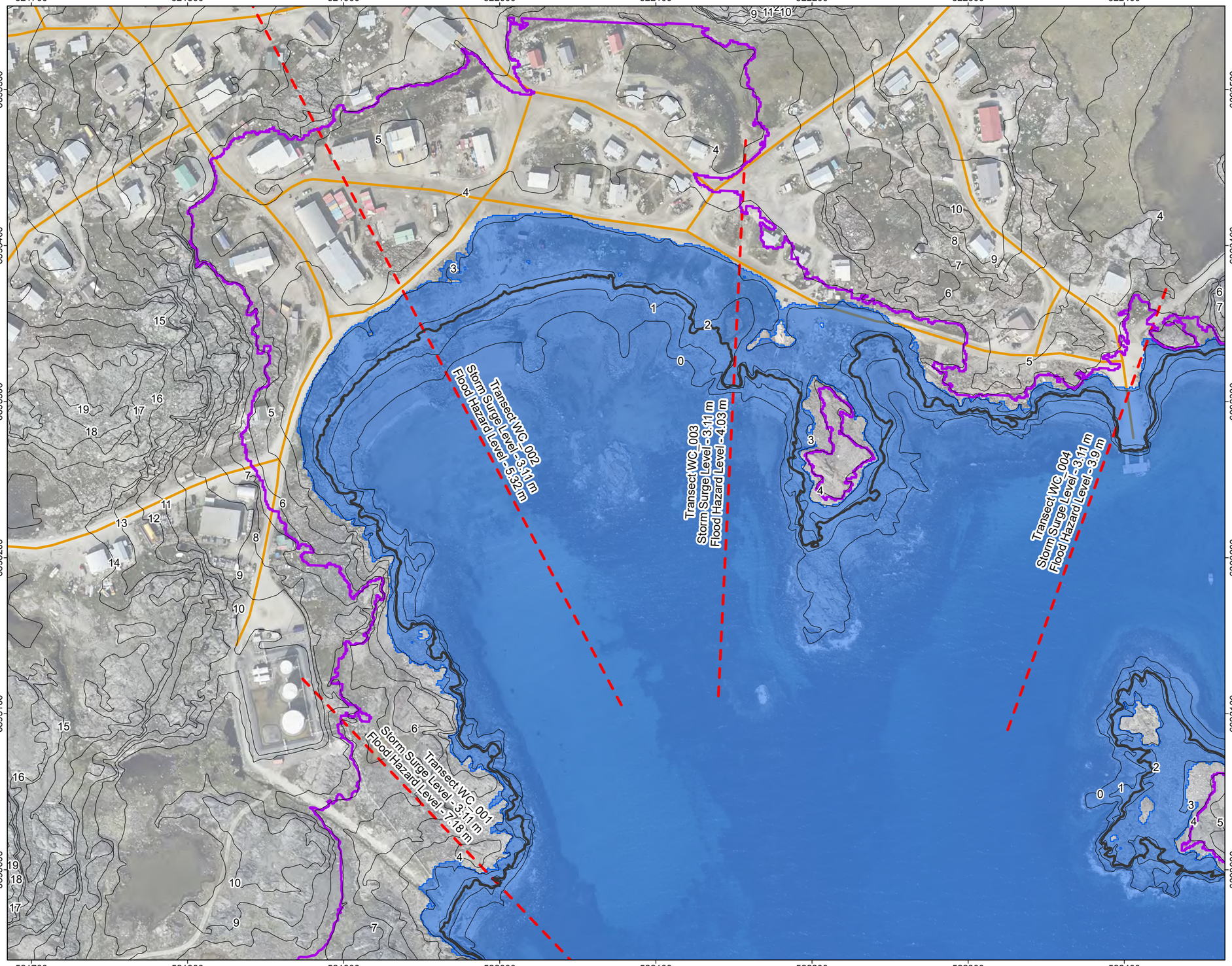
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STANTEC LIMITED

Figure No.

WC01-500yr

Title

Whale Cove - 500yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

Project Location
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- Modelling Transect
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- Flood Hazard Level - 500 yr
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Notes

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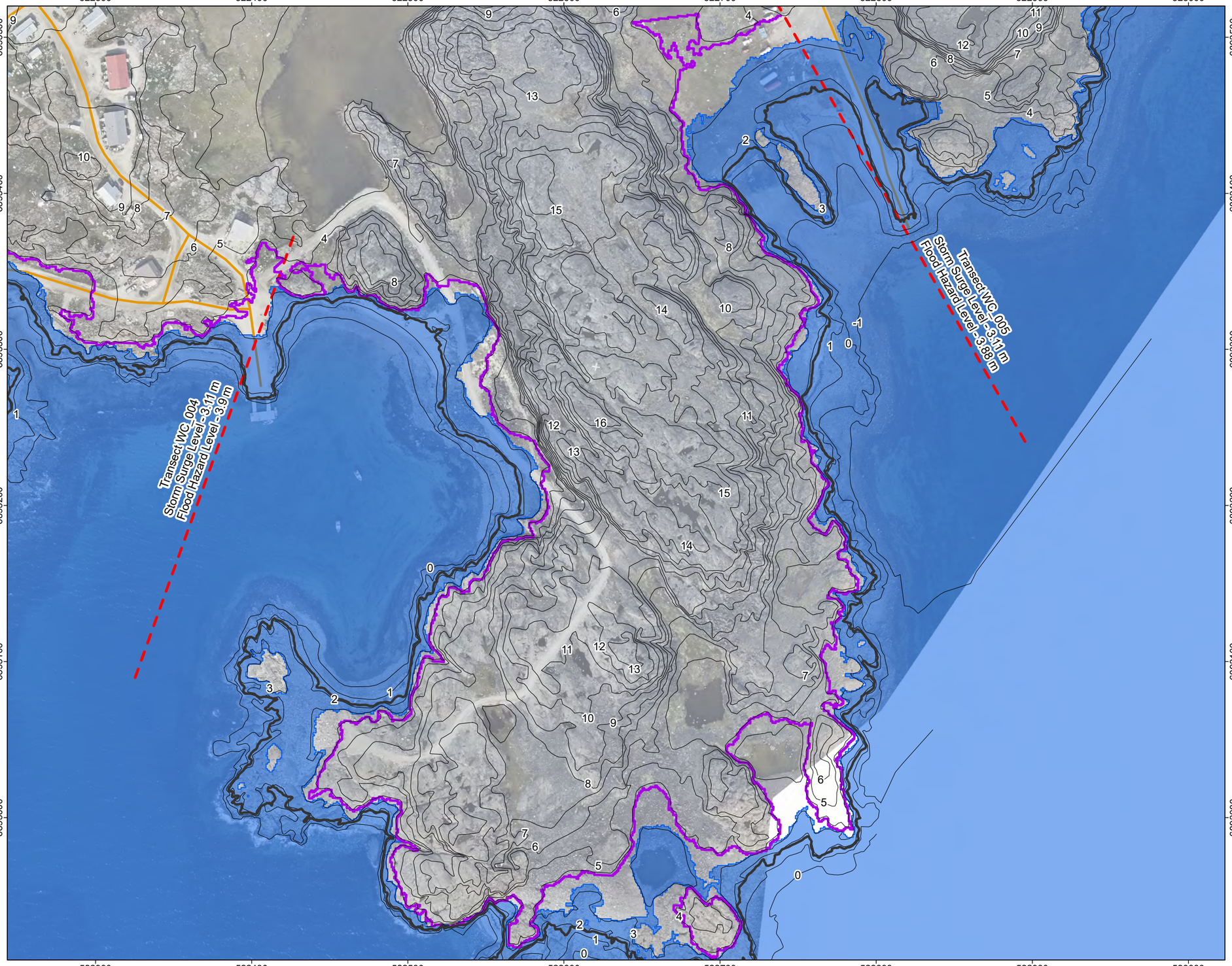
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Figure No.

WC02-500yr

Title

Whale Cove - 500yr

Client/Project
Government of Nunavut
Regional Coastal Flood Mapping for four (4) Nunavut Communities

Project Number: 160951868

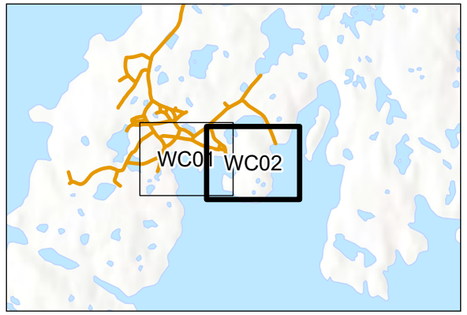
Project Location
Whale Cove, Nunavut

Prepared by MAINSLEY on 20260910
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N

0 50 100 Metres
(At original document size of 11x17)
1:2,500

- Modelling Transect
- HHWLT (1.69 m)
- Flood Hazard Level - 500 yr
- Storm Surge Level - 500 yr
- Topographic Contours - 1 m
- Road



Notes
1. Horizontal Datum / Projection: NAD83(CSRS) Epoch 2010.0 / UTM Zone 15N.
Vertical Datum / Geoid Model: CGVD2013 / CGG2013a.
3. Data Sources: CANVEC 50k
4. Background: ESRI World Imagery, Eagle Mapping Orthoimagery

REGISTERED PROFESSIONAL ENGINEER
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2026-10-05
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PERMIT TO PRACTICE
NUNAMI STANTEC LTD.
Signature
Date October 5, 2026
PERMIT NUMBER: P 1117
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3. Vertical Elevation Datum Conversion: The project team also acknowledges Fisheries and Oceans Canada (DFO) for providing the transformation grid used to convert bathymetric elevation data from Chart Datum to CGVD2013.

Canada

Nunavut

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