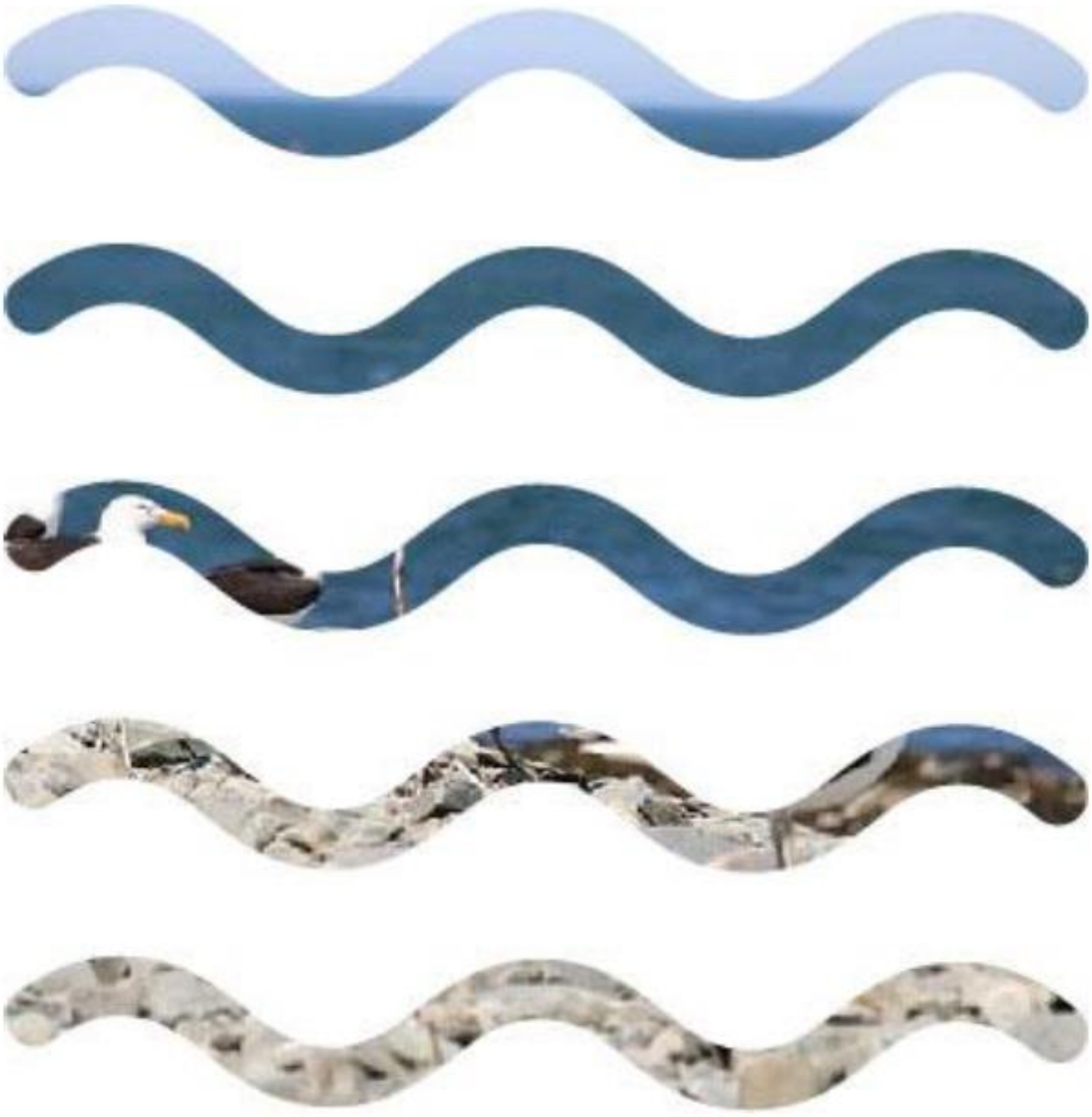

Coastal Protection Plan

Update and Review of Municipal Planning Strategy

Date: February 2025

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Reviewed by: Caroline Robertson LPP, MCIP

C+D community design

Report Overview	
Review of the Existing MODY Coastal Protection Measures	
Description	In 2019, the Nova Scotia government introduced the Coastal Protection Act to create coastal protection zones, establish building setbacks, and promote adaptation measures aimed at protecting coastal developments. This Act was later replaced by "The Future of Nova Scotia's Coastline: The Plan to Protect People, Homes, and Nature from Climate Change Along Our Coast." While the original Act outlined strict requirements for municipalities, the new plan provides a more adaptable framework, enabling municipalities to implement coastal protection strategies tailored to the specific needs and resources of each municipality. This approach aligns with the provincial guidelines on flood risk and infrastructure resilience. ***Sept 17, 2024, at a meeting of the Planning Advisory Committee*** ***It was moved by Councillor Nick Hilton, seconded by Citizen Representative Alex Graham to have MODY staff engage with NSFM Coastal Land Use Coordinator to develop an issue report on new coastal regulations.*** This report examines the new provincial coastal plan and the current climate change adaptation strategies implemented by the Municipality of the District of Yarmouth (MODY). The updated plan provides municipalities and community members with essential data, including flood hazard maps that project the impacts of sea-level rise for the year 2100. However, other critical information, such as erosion assessment resources, is still under development and may not be available until 2030. Staff, with guidance from the Nova Scotia Federation of Municipalities, explored four potential approaches to strengthen MODY's resilience to climate-related impacts and enhance protective measures against climate change. These approaches range from maintaining existing policies to developing new coastal regulations based on the updated data. Each approach considers current limitations and potential benefits to MODY's adaptive capacity, aiming to balance immediate action with the evolving availability of provincial data. After a thorough review, staff have determined that MODY has already completed several studies related to coastal protection and has adopted policies for these regions. We believe it would be beneficial for the Planning Advisory Committee and Council to review and understand the current options. However, we feel that maintaining the status quo until further data is received from the province is the best path forward. MODY is already a leading Municipality in coastal and water protection policy. For this reason, this report is offered as information and knowledge for the Planning Advisory Committee and Council as we await further data and guidance from the Province.

	**This report and its recommendations were developed in consultation with the Nova Scotia Federation of Municipalities and their appointed Coastal Land Use Planning Coordinator, Gordon Smith.
Recommendation	Maintain Current Sensitive Environment and Floodplain Policies It is recommended that the Planning Advisory Committee recommend to Council that they retain the existing policies in the MPS and LUB regarding sensitive environments, floodplains, and watercourses while awaiting updated data from the Province. This option would avoid immediate changes to the current framework.
Relevant Policies and Legislation	Municipal Planning Strategy (2023) Land Use By-Law (2023)

Contents

Introduction

The phenomenon of climate change can no longer be ignored, as its impact can be seen with more extreme weather events, rising sea levels, melting ice caps, and shifts in ecosystems. Coastal regions like the peninsula of Nova Scotia severely feel the impacts of climate change due to its proximity to rising sea levels and increasing storm severity. Global warming is accelerating ice melt and thermal expansion, resulting in sea-level rise, which in turn is leading to more frequent and intense coastal flooding, erosion and storm surges. Sea levels around Nova Scotia are expected to rise by up to one (1) metre by the end of the twenty-first century, increasing the risk of coastal flooding[1]. Hurricane Fiona, which occurred in September 2022, is an example of a type of storm that will become more frequent in Nova Scotia due to climate change. Communities, infrastructure, and ecosystems along the coastline are increasingly at risk, with the potential for significant economic losses, particularly in key sectors like aquaculture, agriculture, and tourism, along with the health and safety of residents.

Nova Scotia has 13,300km of coastline, with 70% of the population living in coastal communities at high risk of rising sea levels due to climate change[2]. Of the 13,300km province wide MODY has 570km of coastline. In response to the increasing impact of climate change on coastal regions, the Nova Scotian government has taken several actions, such as completing the provincial climate change risk assessment, creating the Sustainable Communities Challenge Fund, supporting flood line mapping, launching the CLIMAtlantic data services center, establishing the Climate Adaptation Leadership Program, designating Owls Head as a provincial park, upgrading 60 km of dykeland to prevent flooding and passing the Coastal Protection Act in 2019.

Background

A significant advancement in coastal protection by the province was the Coastal Protection Act, which was intended to establish coastal protection zones, building setbacks and coastal adaptation approval from experts for development within coastal zones. However, the Act was replaced by "*The Future of Nova Scotia's Coastline: The Plan to Protect People, Homes and Nature from Climate Change Along Our Coast*." While the Coastal Protection Act originally proposed strict policies for municipalities in Nova Scotia, the new *Future of Nova Scotia's Coastline: The Plan to Protect People, Homes, and Nature from Climate Change* offers greater flexibility. This approach allows municipalities and communities to implement innovative coastal

[1] Our Climate, Our Future Nova Scotia's Climate Change Plan for Clean Growth, 2022
[2] Weathering What's Ahead: Climate Change Risk and Nova Scotia's Well-being, 2022

protection measures tailored to their unique capabilities and available resources, which aligns with the statements of provincial interest regarding flood risk areas and infrastructure.

Nova Scotia Coastal Protection Act

The Coastal Protection Act was passed in 2021 to reduce future threats of coastal flooding, erosion, and frequent storm surges for existing and new development. The Coastal Protection Act aimed to regulate all development on lands near the coastline through property-specific assessments carried out by designated professionals under the act.

Property owners looking to develop within the coastal zone would receive a minimum horizontal setback from the water and must meet minimum building elevation above sea level standards[3]. The Act was intended to reduce erosion caused by man-made structures while also protecting these structures from damage caused by rising sea levels and encouraging commercial and private builders to make risk-informed decisions when building near the coast.

The act also considered Nova Scotia's important coastal features, such as wetlands, dunes, and estuaries. While also preserving nature, habitats, wildlife, flora and fauna. The objectives of the Coastal Protection Act are summarised as follows:

- New coastal protection zones and maps outlining specific zones for different topography locations, including a minimum building elevation within coastal protection zones.
- Ecosystem protection for structures placed in the water.
- Horizontal building setbacks are to be determined by a designated professional for those who wish to build in the coastal protection zone.
- A risk assessment report with designated horizontal setback and ensuring compliance by inspections.

Overall, the Act was designed to preserve natural features, ensuring that future generations can experience and enjoy these environments while promoting sustainable development. However, this Act was not adopted and was replaced by "*The Future of Nova Scotia's Coastline: The Plan to Protect People, Homes and Nature from Climate Change Along Our Coast.*"

[3] https://ecologyaction.ca/our-work/coastal-water/coastal-protection-act

The Future of Nova Scotia's Coastline: The Plan to Protect People, Homes and Nature from Climate Change Along Our Coast.

The Future of Nova Scotia's Coastline represents a comprehensive, forward-looking approach to coastal protection. It seeks to balance immediate needs with long-term sustainability, leveraging technology, community engagement, and provincial leadership to adapt to the realities of climate change. The plan recognizes the vulnerability of Nova Scotia's coastline and the dangers that climate change poses to homes, communities, infrastructure, and natural ecosystems. The plan builds on Nova Scotia's *Environmental Goals and Climate Change Reduction Act* (2021), which set 28 goals for sustainable prosperity. The plan identifies coastal protection as essential for adapting to climate change, especially in regions most at risk from rising sea levels and storm damage. The plan acknowledges that parts of the coast will change dramatically over the next century due to climate impacts, requiring a proactive, long-term strategy to adapt to these changes. The proposed strategies[4] include:

Providing Data for Informed Decision Making

The plan aims to provide Nova Scotians, including municipal governments and communities, with clear and accessible information about coastal risks. This includes:

- **Coastal Hazard Map**: An online tool that allows property owners to see future sea-level rise and storm surge scenarios by 2100, helping residents, developers, and planners make better decisions about where to build or how to protect existing structures.
- **CLIMAtlantic**: A resource for climate services in Atlantic Canada, offering a Coastal Adaptation Toolkit that helps communities find appropriate engineering and land-use planning strategies to reduce coastal flooding and erosion.
- **Safeguarding Your Coastal Property**: An educational guide that provides property owners with practical steps to protect their investments and explains key coastal hazards like erosion and flooding.
- **Flood Warning Signage**: Signs placed on roads and bridges prone to flooding to increase public awareness and safety.

[4] The Future of Nova Scotia's Coastline: The Plan to Protect People, Homes and Nature from Climate Change Along Our Coast, 2024

Supporting Municipal Responsibilities

The plan acknowledges municipalities' critical role in implementation and provides support to help them:

- **Land-Use Bylaws and Guidelines**: Sample bylaws and texts will be provided to help municipalities regulate coastal development and integrate climate-resilient practices.
- **Erosion Risk Assessments**: The provincial government is conducting erosion risk assessments using aerial capture, identifying the geological makeup of different areas along the province's coastline as different geological materials erode differently. This will help expand flood line mapping and guide zoning decisions to reduce risk. Consultation with the Nova Scotian Federation of Municipalities (NSFM) coastal coordinator indicates this data may not be available until the year 2030.
- **Flood Risk Mapping:** Investments in municipal flood mapping will continue, providing high-resolution maps to guide zoning and flood management. A dedicated Flood Management and Adaptation Lead and Stormwater Engineer will work closely with municipalities.
- **Sustainable Communities Challenge Fund:** A provincial grant that supports community-driven climate adaptation projects and promotes sharing successful initiatives across communities.

Aligning Resources with Coastal Protection

The plan ensures that the province's financial and human resources are equitably and strategically allocated throughout the province and plan implementation

- **Departmental Adaptation Strategies**: Provincial departments are developing climate adaptation plans to ensure continued operations and services despite climate risks.
- **Funding Tied to Coastal Hazard Consideration**: Municipalities seeking provincial funding must show they have considered coastal hazard data, ensuring sustainable, resilient infrastructure investments.
- **Disaster Relief Fund Changes**: The province is capping disaster relief funding to discourage rebuilding in high-risk areas, encouraging long-term adaptation instead of short-term fixes.

In conclusion, The Future of Nova Scotia's Coastline offers a forward-thinking, well-rounded approach to coastal protection. Balancing short-term needs with long-term sustainability by using technology, engaging communities, and guiding provincial leadership to address the

challenges of climate change. By promoting informed decision-making, strengthening municipal leadership, and effectively aligning resources, the plan aims to safeguard Nova Scotia's coastline, protect its people and economy, and build a climate-resilient future for future generations.

MODY Strategic Interventions for Addressing Climate Change Impacts.

The Municipality of the District of Yarmouth is known for its natural stunning waters that attract residents and tourists to the municipality. The Yarmouth region is recognized globally for its unique natural resources, comprising the UNESCO-designated Southwest Nova Biosphere Reserve. MODY recognizes the devastating risk its shorelines and other inland water bodies face due to climate change impacts and has set up several strategies to reduce the effects of climate change within the municipality and province at large.

The Integrated Community Sustainability Plan (ICSP)

In 2010, the Integrated Community Sustainability Plan (ICSP) was developed to help guide sustainable development within MODY. Parts of its Environmental Health Goals include:

Discouraging Development in Sensitive Areas prone to periodic flooding and erosion, including coastal zones vulnerable to climate change impacts. This is supported by MODY's Municipal Planning Strategy (MPS) policies in **section 5.11**, which protect wetlands, coastal habitats, floodplains, beaches, and nature reserves.

The use of riparian buffers *(a vegetated area that borders a body of water)* in coastal areas to prevent erosion, protect water quality, and maintain natural coastal processes. The MPS enforces this through watercourse protection **policy 4-6**, prohibiting development within 12 metres of the high-water mark. For example, the land-use bylaw (LUB) requires addressing riparian buffers for development in the Lakeside Residential zone.

Create Broad Brook Watershed Protection Zone to protect the Broad Brook Watershed, which is located between the Town boundary and its outfall at Kelleys Cove. Such efforts include setbacks and buffers to mitigate the impact of development on the natural environment. MPS **policy 5-52** establishes a floodplain zone surrounding Broad Brook, where soil removal, infilling, and other unnatural development are prohibited. This is followed through in the LUB and best illustrated by *Flood Plain Schedule A: Zoning Map 1* (Appendix A).

MODY's Municipal Climate Change Action Plan (MCCAP)

The Municipal Climate Change Action Plan (MCCAP) for MODY, titled *"Thriving Amidst Uncertainty,"* was developed in 2013. It addresses strategies for adapting to climate change through land use planning and emergency preparedness. It identifies key hazards such as inland flooding, tropical storms, winter storms, wildfires, drought, extreme heat, coastal flooding, and erosion. The analysis highlights that coastal flooding, wildfires, and winter storms need urgent action before 2055 due to their risks to public safety, property, infrastructure, and the local economy. The report provided coastal flooding and erosion susceptibility maps, focusing on Pinkney's Point, Cape Frochu and Pembroke. These maps have helped inform zoning and land use policies in MODY.

The plan also outlines thirty-three (33) adaptive measures to reduce climate change impact hazards. Amongst these include land use measures such as:

Using a new elevation standard (vertical setback) of 6.5m above sea level to delineate (zone) areas at risk of coastal flooding due to sea level rise and storm surges. The committee running the MCCAP chose to convert sea level data recorded in Chart Datum which is used in nautical charts to Canadian Geodetic Vertical Datum (CDVD28) which is used in terrain mapping. This gave an elevation of 4.78m for high tide. A number of factors including sea level rise, plat subduction, and change sin tidal resonance throughout the Bay of Fundy were taken into account to arrive at an estimated increase by 0.71m and 1.27m. The MCCAP committee chose to use a median value of 1.01 metres at high tide in the year 2100, putting high tide at 4.78m CDVD28. The MCCAP team then added 10% to that value based on recommendations from EMO to account for Storm Surge which gave a value of 6.36m, the MCCAP committee then chose to round to 6.5m CDVD28 for the purpose of mapping capabilities and practicality. The resulting Coastal Flooding maps are attached in Appendix B of this report.

The development of a coastal erosion assessment map for MODY focused on submerging and eroding areas within MODY, such as the west side of Yarmouth Harbour and parts of Chebogue River, Pembroke Cove, and Crawleys Island. According to the MCCAP report, these areas are at risk of flooding during extreme storms. Maps were created to categorize the severity of coastal erosion within these areas. While these maps might help create a starting point for setting up horizontal setbacks, it should be noted that these maps are outdated, as the report was reviewed in 2013, and likely, the risk has increased.

Other strategies include developing policies to restrict development in high-risk areas, strengthening emergency response systems, and ensuring municipal services and infrastructure sustainability. Policy 4-26, Policy 4-77, Policy 4-87, and Section 5.11 of the MPS help achieve this.

Existing Municipal Planning Strategy Policies (MPS) and Land Use By-Law (LUB) Regulations on Climate Change Adaptation and Coastal Protection in the Municipality of the District of Yarmouth

Through the MPS and LUB regulations, the Development Department has explored several policies to help guide development away from sensitive areas, including vulnerable coastal areas, and promote policies that help preserve these environments. Such interventions include:

Watercourse buffers

Watercourse buffers help protect watercourses from adjacent development and protect development from flooding in areas where it occurs. The MPS provides minimum 12 horizontal metres from the high-water mark of all watercourses, except for uses that require direct access to water bodies. The LUB **regulation 6.31** also provides policies limiting soil or vegetation removal and infill around water buffer zones. LUB **regulation 6.32.1** further reinforces that by mandating lots with any part covered by water, marsh, or located beyond the edge of a riverbank or watercourse, or situated between the top and bottom of a cliff or steep slope with an incline of 30% or more, the setback shall be measured from the closest wall of the main building on the lot to the edge of the water, marsh, riverbank, or the top of the cliff or slope, if it is closer than the property line.

Sensitive environment zone

The zone within the Municipal Planning Strategy (MPS) includes specific policies (outlined in **section 5.11**) designed to protect natural features such as wetlands, sensitive coastal habitats, floodplains, dykelands, wilderness areas, beaches, and nature reserves from development that could jeopardize these environments or any structures within them. Within the Sensitive Environment Zone, three specific zones—floodplain, dykeland, and sensitive environment—have been established to implement tailored protection policies for each area, as detailed in **sections 26, 27, and 28** of the Land Use Bylaw (LUB).

Floodplain Zone

This zone is intended to prevent development that could harm the natural floodplain's ability to reduce the impact of flooding during heavy rain. Within this zone is the Broad Brook watershed as defined in the ICSP, for which development (except natural trails), and removal of soil and infilling are prohibited to protect community members, the natural environment and the built environment from flooding. The LUB further reinforces these policies by subjecting expansion of non-conforming use and adaptive re-use of the institution or heritage buildings within this zone to site plan approval and development agreement, respectively.

Dykelands Zone

The Dykelands Zone comprises coastal marshlands with high salt content, making them exceptionally valuable for agriculture. This zone is strictly designated for non-building agricultural uses, prohibiting the construction of new buildings and the expansion of existing structures. Within the municipality, the designated dykelands include the Brown Salt Pond Marsh and Chegoggin Marsh, generally bounded by the communities of North Cheboggin, Milton Highlands, Overton, and Pembroke. *Like the floodplain above,* the LUB further reinforces these policies by subjecting expansion of non-conforming use and adaptive re-use of the institution or heritage buildings within this zone to site plan approval and development agreement, respectively.

Sensitive Environment Zone

This zone protects coastal wetlands, marshes, and beaches, which are very sensitive to the effects of human development. The MPS recognizes that the municipality's coastline is essential to the community's character and the diverse habitats and ecosystem systems present within these coastal areas. To protect the sensitive habitats of these areas, the MPS prohibits non-natural development that could potentially harm these areas while permitting parks and conservation uses subject to additional criteria. The MPS also encourages limited disturbance in these areas by giving a waiver for public road access as long as other requirements for that zone are met.

While the MPS includes efforts to minimize the environmental impact of development on sensitive zones and has established general regulations to protect watercourses and floodplains, it currently lacks a dedicated section addressing coastal erosion and climate change adaptation measures. This gap exists as Council, like many other municipalities in Nova Scotia, awaited the provincial Coastal Protection Act regulations, which were expected to establish uniform standards across Nova Scotian municipalities. *Although the new plan aims to equip municipalities with data to create policies and regulations specific to their needs, the province has yet to provide all the necessary data to do so*. This data is essential for developing MPS policies and LUB regulations to guide development in coastal zones based on scientific evidence. It is, therefore, up to MODY to decide whether to gather the necessary data to create coastal zone policies within the MPS or to keep the current approach while waiting for more information from the provincial government.

Provincial Tools and Resources Available

Coastal hazard map: this is an interactive map in which property owners and municipal staff can see what areas/properties along shorelines are at risk of flooding based on worst-case scenario of what sea level rise and storm surge at the highest tide of 1 meter could look like in the year

2100. The map shows information for areas 100 meters inland along the province's coastline. The province continues to publish more data and is currently working on projections data for the year 2050.

Coastal adaptation toolkit: this CLIMAtlantic climate change information hub, where community members and municipal planning staff can identify effective engineering and land use planning strategies that reduce coastal flooding and erosion concerns at specific sites.

Safeguarding Your Coastal Property: An educational guide that provides property owners with practical steps to protect their investments and explains key coastal hazards like erosion and flooding.

Next Steps

Maintain Current Sensitive Environment and Floodplain Policies

Retain the existing policies in the MPS and LUB regarding sensitive environments, floodplains, and watercourses while awaiting updated data from the Province. This will avoid immediate changes to the current framework, while we await additional data sets and land use regulation guidance from the province. For this reason, staff recommend the Planning Advisory Committee recommend Council maintain the current policies, which are comprehensive in comparison to other municipalities, while they await the recommended land-use by-law regulations that are currently being developed.

Thoughts Moving Forwards

Changes to the existing MODY planning documents are not required at this time to align with the Province's Coastal Plan. If Council wishes to implement more detailed coastal protection measures and initiate a policy change, it should be noted that a Municipal Planning Strategy amendment would be necessary. The current planning documents lack policies regarding horizontal setbacks and do not account for unique property conditions related to coastal erosion and storm impact, which will be crucial in the future for further protecting coastal land and guiding coastal development. However, without the necessary data and sample draft policies, it would be challenging for staff and Council to develop the most suitable policies for the Municipality.

The municipality is currently working with Dillon Consulting on Sea Level Rise/Storm Surge risk assessment for the Cape Forchu property. This work has highlighted the fact that the MCCAP values reflect a generalized worst-case scenario. Dillon's wave analysts have indicated these numbers are unlikely to come to fruition and that the general nature of the study does not account for variables like site-specific bathymetry. Responding to the Province's decision to put Coastal Planning on municipalities by imposing new regulations based on existing data may be premature and could unnecessarily hamper development.

In 2024, the province engaged with coastal property owners, including residents of Southwest Nova Scotia. The feedback revealed substantial support for establishing designated coastal zones and for permitting municipalities to determine suitable regulations within these zones, as long as decisions are based on scientific evidence and provide a degree of flexibility.

For these reasons, it is recommended that Council wait for further direction and data from the province.

Additional Reading

Municipal Planning Strategy

4.3.4 Watercourse buffers

The natural areas where the land meets water (the “riparian zone”) are incredibly important as natural habitat, as natural filters to stop pollutants before they enter waterways, and as buffers against flooding. For example, many fish species depend on the riparian zone as a safe space for young to grow, sheltered from predators. The riparian zone also helps to regulate the temperature of adjacent watercourses and provides aesthetic value to the municipality. Development that harms the riparian zone can cause serious damage to the health of our waterways. Watercourse buffers help protect watercourses from adjacent development, and protect development from flooding in areas where it occurs. Retaining riparian buffers around watercourses is important to water quality, plant and animal communities, and the protection of property from the natural hazards of flooding.

Policy 4-6 Council shall, through the Land Use By-law, prohibit development within 12 horizontal metres from the high-water mark of watercourses, with some exceptions for uses and structures that require direct access to the water.

4.4.6 Telecommunications Systems

Policy 4-26 Council shall not support the locating of telecommunications towers in the Floodplain, Dykeland, Sensitive Environment, and Lightstation Heritage Zones.

Policy 4-77 Council shall, on the zoning map of the Land Use By-law, permit the Recreation Zone in all designations except the Airport Designation, Watershed Designation, and Sensitive Environment Designation.

Policy 4-87 Council shall, through the Land Use By-law, permit institutional uses in all zones except industrial zones, the Airport Noise Restriction Zone, the Dykeland Zone, the Watershed Zone, the Floodplain Zone, and the Sensitive Environment Zone.

Sensitive Environment Designation

5.11.1 Sensitive Environment Designation

The communities within the municipality are home to many natural features with important ecological value. These include the wetlands, sensitive coastal habitat, floodplains, dykeland, wilderness areas,

beaches, and nature reserves, among others. While many of these features are protected by other legislation or by ownership, it is important to communicate the value these lands have for a sustainable future. As a result, Council has established the Sensitive Environment Designation to apply to these areas.

Policy 5-50 Council shall, on Schedule 'A', the Future Land Use Map, designate as "Sensitive Environment" lands intended to protect the natural environment.

Policy 5-51 Council shall, on the zoning map of the Land Use By-law, permit the following zones within the Sensitive Environment Designation:

a) Floodplain Zone
b) Dykelands Zone
c) Sensitive Environment Zone

5.11.2 Floodplain Zone

The lower Broad Brook floodplain is located between the Town boundary and its outfall at Kelleys Cove. This floodplain has been identified as an area where the effects of development could detrimentally affect the ability of the natural floodplain to mitigate the effects of flooding during extreme rainfall events. Council wishes to protect community members, the built environment, and the natural environment from potential flooding by limiting development within the Broad Brook floodplain.

Policy 5-52 Council shall, through the Land Use By-law, establish the Floodplain Zone within the Broad Brook floodplain. This zone is intended to protect the natural floodplain and mitigate negative impacts of potential flooding.

Policy 5-53 Council shall, through the Land Use By-law, prohibit development within the Floodplain Zone, except for nature trails.

Policy 5-54 Council shall, through the Land Use By-law, prohibit the removal of soils and infilling within the Floodplain Zone.

Land-Use Bylaw

6.31 Watercourse Buffer

6.31.1 For *development* in any *zone* an undisturbed buffer of 12.0 metres shall be maintained between any *structure* or developed portion of the *lot* and the ordinary high water mark of all *watercourses*. For greater clarity, buffers greater than 12.0 metres may be required in some zones (check zone standards).

6.31.2 Infilling or removal of material shall not be permitted within the *watercourse* buffer except for minimal disturbance incidental to a permitted undertaking.

6.31.3 In the *watercourse* buffer area, the natural flora and fauna shall remain substantially undisturbed except for penetrations for *developments* permitted by Subsection 6.31.5, below. Good ecological practices designed to minimize disturbance of natural shoreline areas shall be encouraged for all activities and *developments* within the buffer and all *developments* on properties abutting *watercourses* in the *Municipality*.

6.31.4 On any *lot* subject to the requirements of Subsection 6.31.1, above, the required buffer supersedes any minimum setback requirement which may be less than the required buffer.

6.31.5 Notwithstanding Subsection 6.31.1, the following *developments* are permitted within the *watercourse* buffer area (subject to *zone* requirements for permitted *uses*):

(a) *boathouses*, fishing gear, sheds, docks, wharves, piers, and slipways;
(b) boardwalks, walkways, and trails with a maximum width of 3.0 metres;
(c) pumphouses;
(d) scientific research *structures*;
(e) the removal of vegetation and alterations to *grade* necessary to erect erosion control and flood control measures above the ordinary high-water mark. Where excess vegetation has been removed within the *watercourse* buffer area, natural vegetation shall be restored;
(f) the removal of windblown, diseased, or dead trees deemed to be hazardous or unsafe;
(g) the limbing of tree branches for improved view plane and ventilation;
(h) safety fences that do not exceed a *height* of 1.9 metres;
(i) *public streets* and public infrastructure; and
(j) *development* in the Marine Industrial Zone and Watershed Zone.

6.31.6 Notwithstanding Subsection 6.31.1, *existing buildings* located within a *watercourse* buffer may be reconstructed, renovated, repaired, moved, or replaced provided that the work does not increase the *building's* footprint within the buffer or reduce the depth of the shoreline buffer and all other applicable requirements of this By-law are met.

6.32 Setback Requirements Measured from Watercourses, Wetlands, or Slopes

6.32.1 Where, in this By-law, *a front, side, or rear setback* is required and part of the area of the *lot* is usually covered by water or marsh, or is beyond the rim of a river bank or *watercourse* or between the top and toe of a cliff or embankment having a slope of thirty percent (30%) or more from the horizontal, then the required *setback* shall be measured from the nearest *main wall* of the *main building* or *structure* on the *lot* to the edge of said area covered by water or marsh, or to the rim of said river bank or watercourse, or to the top of said cliff or embankment if such area is closer than the *lot line*.

26 SENSITIVE ENVIRONMENT ZONE (SE)

26.1 Intent

26.1.1 This *zone* is intended to protect *development* from potential hazards in these low-lying, marshy, or unstable areas while at the same time protecting these sensitive habitats from potential negative impacts of *development*.

26.2 Permitted Main Uses

26.2.1 The following uses shall be permitted as a main use in the Sensitive Environment (SE) Zone subject to the requirements of this By-law:

None

26.3 Developments Permitted Subject to Other Requirements

26.3.1 The following *uses* are permitted as main uses in the Sensitive Environment Zone subject to all applicable requirements of this By-law, and to use-specific requirements found either in Chapter 7 of this By-law or the special *zone* requirements:

(a) *Parks and Playgrounds* – Section 7.9
(b) *Trails and Conservation Uses* – Section 7.13
(c) *Utilities* – Section 7.14

26.4 Developments Permitted by Site Plan Approval

26.4.1 The following *uses* are permitted by *site plan approval* in the Sensitive Environment Zone subject to *the site plan approval* criteria of Chapter 31 of this By-law:

(a) Expansion of non-conforming uses

26.5 Developments Permitted by Development Agreement

26.5.1 The following *uses* are permitted by *development agreement* in the Sensitive Environment Zone subject to the indicated *Municipal Planning Strategy* policy:

(a) Adaptive re-use of former institutional buildings – MPS Policy 4-88
(b) Adaptive re-use of registered heritage properties – MPS Policy 4-83

26.6 Special Zone Requirements

None

27 FLOODPLAIN ZONE (FP)

27.1 Intent

This *zone* is intended to protect the natural floodplain and mitigate negative impacts of potential flooding.

27.2 Permitted Main Uses

27.2.1 The following uses shall be permitted as a main use in the Floodplain (FP) Zone subject to the requirements of this By-law:

None

27.3 Developments Permitted Subject to Other Requirements

27.3.1 The following *uses* are permitted as main uses in the Floodplain Zone subject to all applicable requirements of this By-law, and to use-specific requirements found either in Chapter 7 of this By-law or the special *zone* requirements:

(a) *Parks and Playgrounds* – Section 7.9
(b) *Trails and Conservation Uses* – Section 7.13
(c) *Utilities* – Section 7.14

27.4 Developments Permitted by Site Plan Approval

27.4.1 The following *uses* are permitted by *site plan approval* in the Floodplain Zone subject to the *site plan approval* criteria of Chapter 31 of this By-law:

(a) Expansion of non-conforming uses

27.5 Developments Permitted by Development Agreement

27.5.1 The following *uses* are permitted by *development agreement* in the Floodplain Zone subject to the indicated *Municipal Planning Strategy* policy:

(a) Adaptive re-use of former institutional buildings – MPS Policy 4-88
(b) Adaptive re-use of registered heritage properties – MPS Policy 4-83

27.6 Special Zone Requirements

27.6.1 Removal of soils and infilling (including for the purpose of trail *development*) is prohibited within the Floodplain Zone (FP).

28 DYKELANDS ZONE (DL)

28.1 Intent

This *zone* is intended to preserve dykelands while permitting non-building agricultural *uses*.

28.2 Permitted Main Uses

28.2.1 The following uses shall be permitted as a main use in the Dykelands (DL) Zone subject to the requirements of this By-law:

None

28.3 Developments Permitted Subject to Other Requirements

28.3.1 The following *uses* are permitted as main uses in the Dykelands Zone subject to all applicable requirements of this By-law, and to use-specific requirements found either in Chapter 7 of this By-law or the special *zone* requirements:

(a) *Trails and Conservation Uses* – Section 7.13
(b) *Utilities* – Section 7.14

28.4 Developments Permitted by Site Plan Approval

28.4.1 The following *uses* are permitted by *site plan approval* in the Dykelands Zone subject to the *site plan approval* criteria of Chapter 31 of this By-law:

(a) Expansion of non-conforming uses

28.5 Developments Permitted by Development Agreement

28.5.1 The following *uses* are permitted by *development agreement* in the Dykelands Zone subject to the indicated *Municipal Planning Strategy* policy:

(a) Adaptive re-use of former institutional buildings – MPS Policy 4-88
(b) Adaptive re-use of registered heritage properties – MPS Policy 4-83

28.6 Special Zone Requirements

28.6.1 New *buildings* and *structures* are prohibited in the Dykelands Zone.

Chapter 28 Changelog

MCCAP Coastal flooding and Erosion Report

4. Hazard Impact Analyses

4.1 Coastal Flooding

Storm surge, sea level and tide level are three factors that culminate to create conditions for flooding. Flooding from storm surge may be combined with river flooding, thus increasing the flood severity. It is important to note that coastal flooding is different from river flooding, which is generally caused by severe precipitation. (Storm Surge and Coastal Inundation)

A storm surge is the difference between the observed water level and the predicted astronomical tide. The surge can be created by meteorological conditions including low atmospheric pressure, strong winds or swells that can be caused by tropical cyclones (such as hurricanes), by mid-latitude extratropical storms (such as Nor'easters), or by any severe weather conditions. (Storm Surge and Coastal Inundation)

At this time, there is inconclusive evidence that Nova Scotia will experience an increase in the frequency of weather that drives up water levels. Despite high levels of uncertainty about storm tracks and frequency, there is strong evidence that the intensity of storms is increasing and will continue to do so. This trend is evident through shifts in storm return periods.

Storm return periods are the average time between occurrences of an event exceeding a given level / magnitude. For example, a 100-year return period storm is defined by storm characteristics that have a 1% chance of occurring in any given year, or a 1% annual exceedance probability (Table 7). The advantage of using the language of annual exceedance probabilities instead of return periods is that people may erroneously assume that an event called a 100-year storm will happen once every 100 years.

Table 7 Storm Return Periods Expressed as Annual Exceedance Probabilities

10 year return period = 10% annual exceedance probability
25 year return period = 4% annual exceedance probability
50 year return period = 2% annual exceedance probability
100 year return period = 1% annual exceedance probability

The observed climate trend is that the amount of time between storms of a given magnitude has decreased. Said another way, the annual exceedance

probabilities are increasing. For example, the meteorological conditions that used to be associated with a storm with a 1% annual exceedance probability based on statistics from the 20th century may have a 4% annual exceedance probability by the 2040s. This means that in the next 30 years or so, our '100-year storms' will be our '25-year storms'.

Even if storms (both hurricanes and nor'easters) do not grow in severity, **coastal flooding will become more frequent as sea level rises**. Thus, a smaller surge would lead to coastal flood levels equivalent to that produced by a major storm today. Sea level rise is usually expressed as the average increase in the global mean sea level. Recent research from the Bedford Institute of Oceanography (BIO) suggests that, "mean sea level rise in most of the Atlantic Basin is projected to be higher than global estimates" (Yin et al. 2012, Xu and Perrie, 2011). This is in large part due to glacial isostatic adjustment (geological process that cause land uplift or subsidence) and changes in dynamic sea level (changes stemming from ocean circulation patterns). Indeed, observations confirm this, showing a doubling of global mean sea level rise in certain Atlantic Canada study sites (Forbes et al. 2009). Given these considerations, the potential relative sea level rise in the southern part of the Atlantic basin on the 50-year time scale is 0.4-0.7m, and could be as high as 0.9 meters in some seasons and at some locations (personal communication, BIO Research Scientist, November 2012). On the 100-year time scale, relative sea level rise in the Atlantic Basin is projected to range from 0.9-1.6m (personal communication, BIO Research Scientist, November 2012).

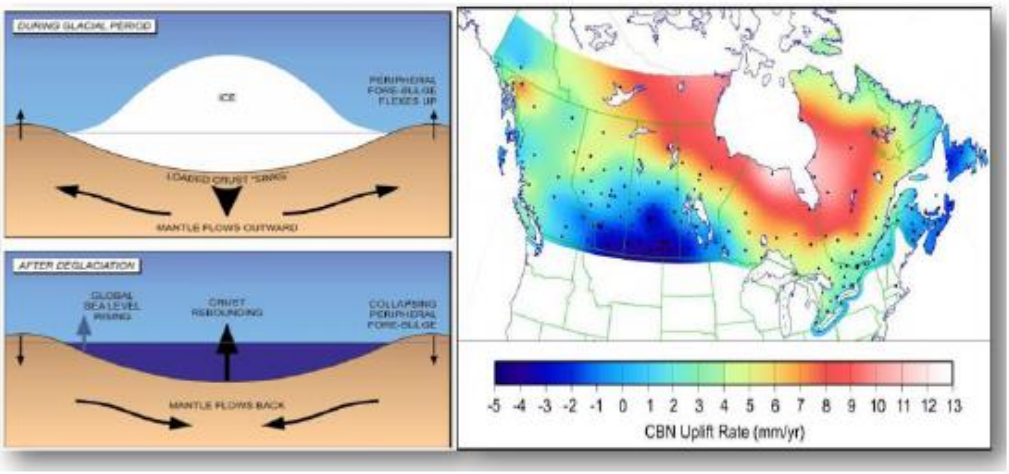


Figure 1 Glacial Isostatic Adjustment

The geological adjustment (change) that is occurring in MoDY is one of subsidence/sinking. This is a result of the post-glacial vertical motion of the earth's crust. There is a rebound (maximum in the Hudson Bay area) and a corresponding subsidence (sinking) along coastlines in response to a depression

of the earth's crust caused by the immense weight of continental ice sheets during the last Ice Age (Figure 1). The Richards and Daigle report (2012) provided localized sea level rise projections that combined sea level rise and glacial isostatic adjustment in the 'Total Sea Level Rise' projection.

Richards and Daigle also reported an Extreme Total Sea Level that combines Total Sea Level Rise, high tide, and storm surge levels generated during benchmark storms for four different annual exceedance probabilities (Table 8). For its coastal flooding analysis, MoDY's Climate Change Committee choose to focus on Extreme Total Sea Level projections for a 1% annual exceedance probability by the end of the century (Table 8).

Table 8 Richards and Daigle (2012) Water Level Scenarios: CHS Site Yarmouth

	2000	2025	2055	2085	2100
Total Sea Level Rise (m)		0.15 ± 0.03	0.43 ± 0.15	0.83 ± 0.36	1.06 ± 0.48
Extreme TSL - 10 Yr Ret Period	5.84 ± 0.10	5.99 ± 0.13	6.27 ± 0.25	6.67 ± 0.46	6.90 ± 0.58
Extreme TSL - 25 Yr Ret Period	5.91 ± 0.10	6.06 ± 0.13	6.34 ± 0.25	6.74 ± 0.46	6.97 ± 0.58
Extreme TSL - 50 Yr Ret Period	5.96 ± 0.10	6.12 ± 0.13	6.40 ± 0.25	6.80 ± 0.46	7.03 ± 0.58
Extreme TSL - 100 Yr Ret Period	6.02 ± 0.10	6.18 ± 0.13	6.46 ± 0.25	6.86 ± 0.46	7.09 ± 0.58

The water level scenarios presented by Williams and Daigle are referenced to Chart Datum: the plane of reference used for nautical charts. In Chart Datum, the lowest normal tide is the 'zero point'. In non-tidal waters, a low water level is adopted as datum. Because the zero point reference for Chart Datum is not the same as the zero point reference for terrain maps, the Climate Change Committee had to convert Chart Datum to Canadian Geodetic Vertical Datum (CDVD28). This conversion required subtracting an offset to account for the difference between these two mapping systems because Chart Datum is lower than CDVD28. The offset for MoDY is 2.31. After accounting for this difference, the elevation used to delineate the area of increasing coastal flood risk in MoDY was 4.78m.

A phenomenon that the Richards and Daigle estimates did *not* incorporate into water level scenarios was the shortening of the resonant period of the Bay of Fundy—Gulf of Maine system due to rising sea levels. As a result, the amplitude of the M2 tide (primary lunar tide of the day) is increasing (Greenburg et al., 2012). The effect that this would have on water levels in MoDY is that the high tide could be between .71 and 1.27m higher by 2100 (Table 9). Therefore, MoDY's Climate Change Committee added the middle estimate —1.01m—to the Extreme Total Sea Level Projection of 4.78m for a new water level scenario of 5.79m for a 1% annual exceedance probability by the end of the century.

The Richards and Daigle report as well as the Atlantic Storm Prediction Centre under Environmental Canada's Meteorological Services Centre based in Dartmouth, Nova Scotia, is quick to remind EMO personnel that water level scenarios do not account for wave action. Wave run up can cause significant

damage. Therefore, if winds are shore facing, EMO personnel are advised to add 10% to storm surge estimates. Being an EMO led MCCAP, as well as a municipality that still remembers the Saxby Gale and sees the wisdom of employing the precautionary principle, a factor of 10% was added to the 5.79m water level scenario, resulting in a new factor of 6.36m. For purposes of mapping practicality and capabilities, this Committee rounded up to 6.5m as the new 'line' to delineate coastal land increasingly vulnerable to coastal flooding impacts.

Table 9 Dr. Greenburg et al. (2012)

TABLE 5. The predicted increase in tidal high water in metres at selected locations for the years 2055, 2085 and 2100. The values reflect tectonic influence, ice melt, steric effects and changing M_2 tides. Maximum and minimum values are obtained from tidal runs using our estimated existing sea level trend and the extreme values of the ice and steric inputs.

	2055			2085			2100		
Time	min	mid	max	min	mid	max	min	mid	max
Boston	0.35	0.51	0.69	0.57	0.75	1.05	0.68	0.98	1.23
Portland	0.29	0.46	0.63	0.48	0.66	0.96	0.57	0.87	1.13
Saint John	0.33	0.50	0.68	0.54	0.73	1.04	0.64	0.95	1.21
Cobequid Bay	0.41	0.60	0.79	0.66	0.87	1.20	0.79	1.12	1.40
Yarmouth	0.37	0.54	0.71	0.60	0.78	1.08	0.71	1.01	1.27
Halifax	0.36	0.58	0.69	0.57	0.76	1.04	0.68	0.97	1.22

Table 10 shows "predicted increase in tidal high water in metres at selected locations for the years 2055, 2085 and 2100. The values reflect tectonic influence, ice melt, steric effects and changing M_2 tides. Maximum and minimum values are obtained from tidal runs using estimated existing sea level trend and the extreme values of the ice and steric inputs (Greenburg et al., 2012)"

4.1.2 Coastal Flooding Rationale

Mapping for MoDY and historical data from coastal flooding events, indicates warning of a Total Water Volume (predicted surge plus existing high tide level) of over 1m may trigger infrastructure and public safety concerns. Therefore, the need to account for coastal flooding impacts in municipal and emergency planning is indisputable.

4.1.3 Coastal Flooding Mapping

GIS Technician, Alix d'Entremont, prepared ten coastal flood maps for MoDY. The first is a 1:47,500 scale map of the municipality in its entirety. The other nine maps are 1:15,000 scale maps are 'zoomed in' versions that, collectively, illustrate the entire coastline of the municipality. The nine maps, which can be found in Appendix B are:

1. Pembroke
2. Overton
3. Cape Forchu
4. Sand Beach
5. Arcadia
6. Melbourne 1
7. Melbourne 2
8. Pinkney's Point
9. Sandford

4.8 Coastal Erosion

Coastal erosion is the process whereby geological materials comprising the coast are loosened, dissolved, or worn away and simultaneously moved from one place to another. Forces at play include long-term erosion, erosion from storms, and erosion from changing water levels and associated wave action.

4.8.1 Coastal Erosion Rationale

The shoreline of MoDY can be divided into two distinct areas based on the coasts physical response to long term sea level rise and land subsidence.

The area along the west side of Yarmouth Harbour, the area east of Overton, the area north of Chebogue Point and the lower reaches of Chebogue River, and the Little River and Little River Harbour areas are slowly submerging and exhibit little or no erosion. In these areas, extensive salt marsh (Class N2) front the coast. During large storms with or without large storm surges these areas will be submerged. As the areas are sheltered, wave action and thus erosion is limited. Risk to infrastructure is predominantly from coastal flooding. However, this is only the case during extreme, low probability events where infrastructure is located less than 2–3m above the high, high water (tide) mark.

The rest of MoDY has a coastline characterized by non-erodeable bedrock (on multi-generation and/or human life spans) or coast composed of low or absent bedrock outcropping within the intertidal zone or supra-tidal zone. The areas where unconsolidated sediment is found, e.g. till, beach sand or cobble bars, respond to rising sea level and subsidence by eroding at various rates.

Cobble-sand beaches and cobble bars are relatively stable features even along transgressive shorelines where there is an adequate supply of sediment from other eroding landforms, e.g. a drumlin headland. At Pembroke Cove there is an actively eroding drumlin that supplies sediment to a large cobble beach that separates a lake from the ocean. This drumlin, however, will completely erode in the future. This may impact the stability of the cobble beach (defined as Class H1) though other sources of sediment may be sufficient to maintain the stability of the cobble beach. A similar situation exists on Crawleys Island where eroding drumlins (e.g. Garden Head) maintain a spectacular cobble beach (defined as Class H1) between the two drumlin headlands. These drumlins will survive for many decades though this can be influenced by a very large storm event. Ultimately these drumlins will erode at which point the joining cobble beach will disappear. There is no infrastructure at risk in this instance.

Along the west facing shore of the Municipality, north of Yarmouth, segments of actively eroding shoreline are mapped as Class H2. The classification is

qualitative. Determination of a specific yearly or average decadal rate of erosion, which may vary from area to area, would require a specifically designed project and establishment of carefully sited long term monitoring stations. However, it is obvious that infrastructure built close to the shore face in these areas is at considerable risk on multi-year to multi-decade time scales. This presents problems from a land use planning and potentially from a permitting perspective.

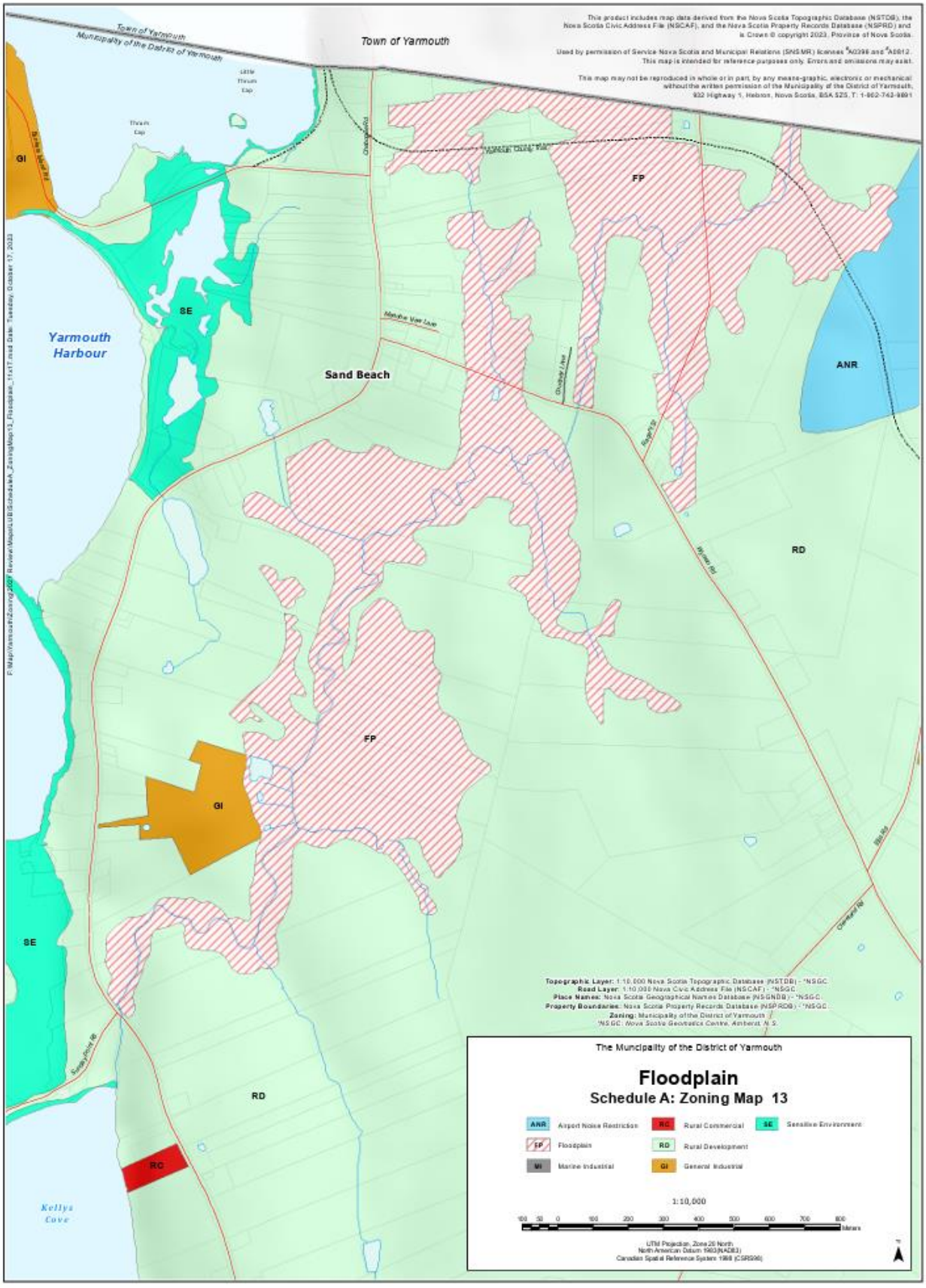
Areas mapped as Class M1 present issues similar to Class H2, however the areas with higher rates of apparent erosion are interspersed with areas that are more stable. It is not possible to differentiate between these areas at the scale of the present MCCAP mapping.

Areas mapped as Class L1 appear to be stable as evidenced by the presence of steep vegetated slopes without apparent slumping and/or erosion at the base of the slopes. However, this apparent stability may not be accurate. These slopes may in fact respond poorly to a major storm event (e.g. a direct hurricane impact at high tide). In such an instance, the vegetation could be quickly stripped and significant erosion could occur. It is not possible to quantify the probability of this occurring.

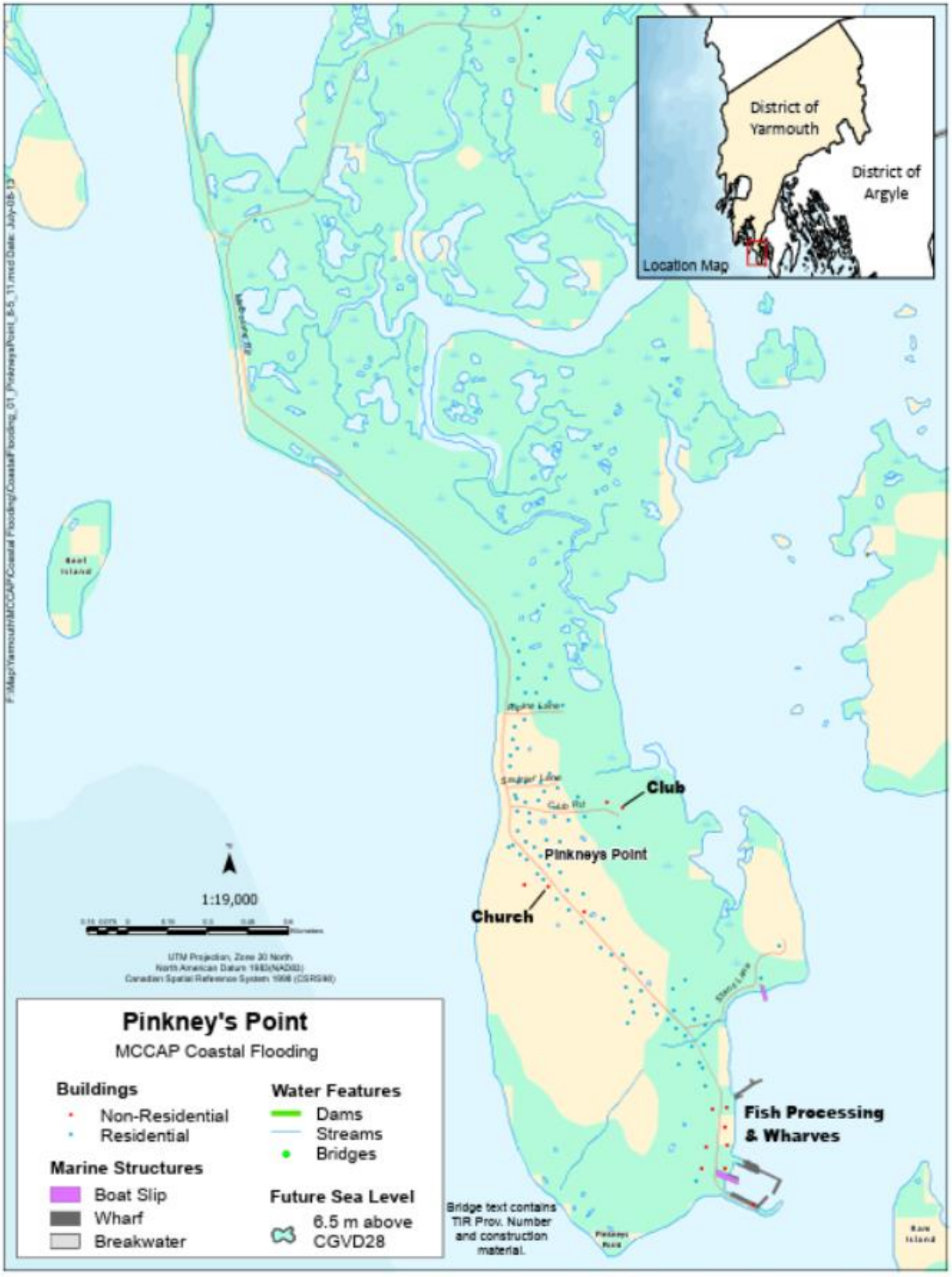
4.8.2 Coastal Erosion Mapping

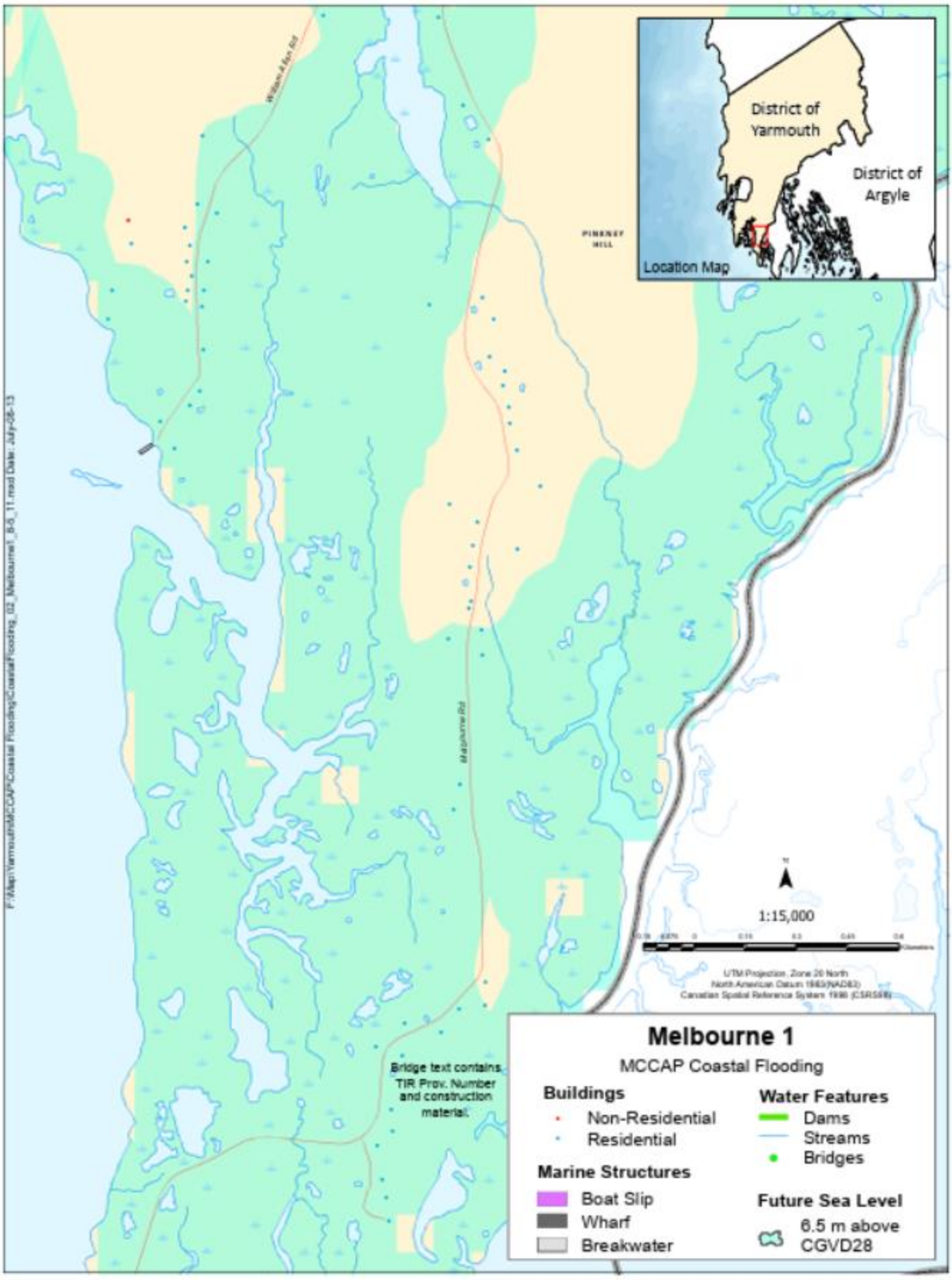
As part of the MCCAP process, Geoscientist, Philip Finck, completed a high level, qualitative assessment of susceptibility to coastal erosion based on existing geological mapping and a visually assessment of the coast. GIS Technician, Alix d'Entremont (Yarmouth-Agyle-Barrington District Planning Commission) converted Mr. Finck's work into a digital map (Appendix D).

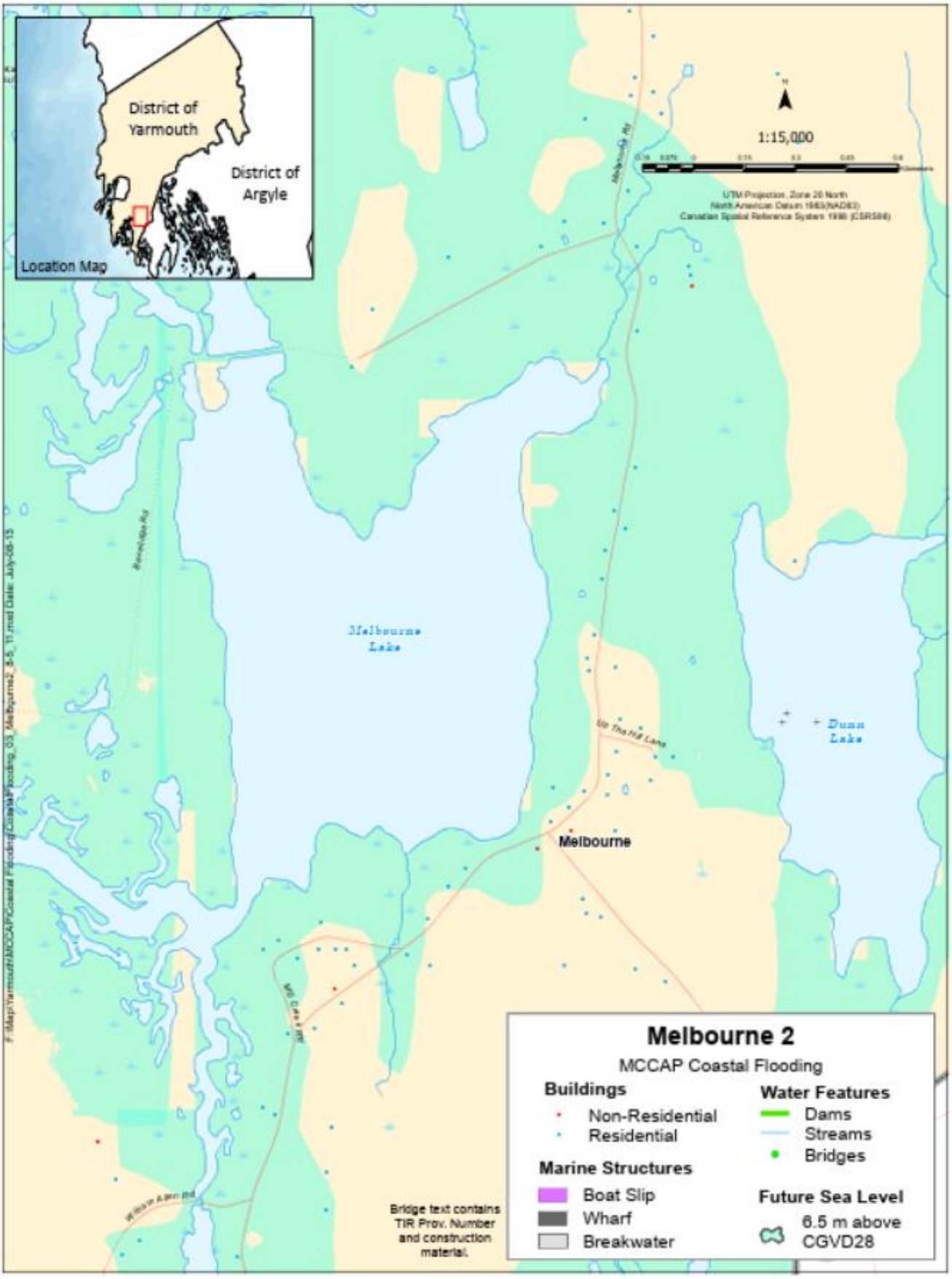
Appendix A: LUB Floodplain Zone

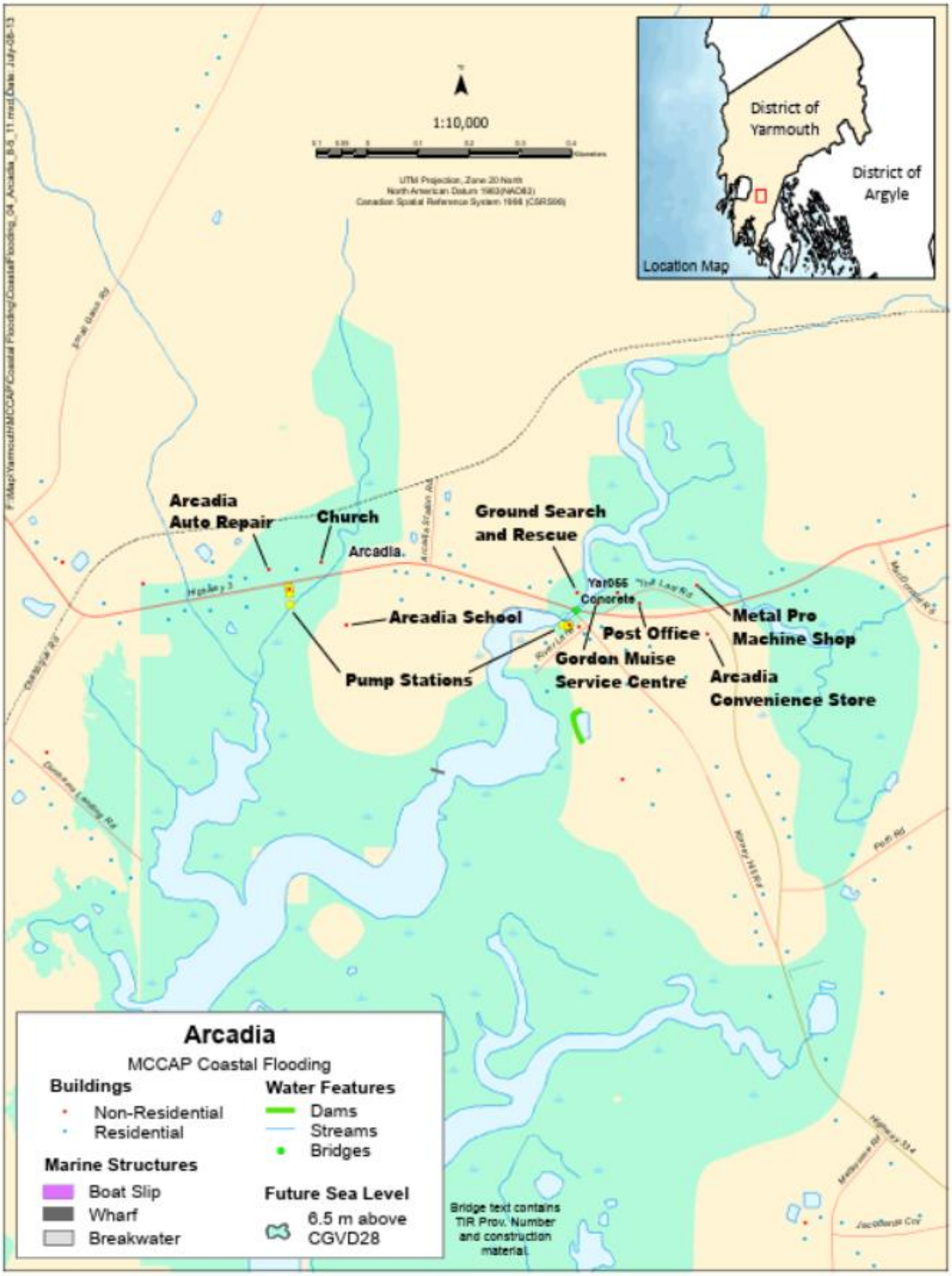


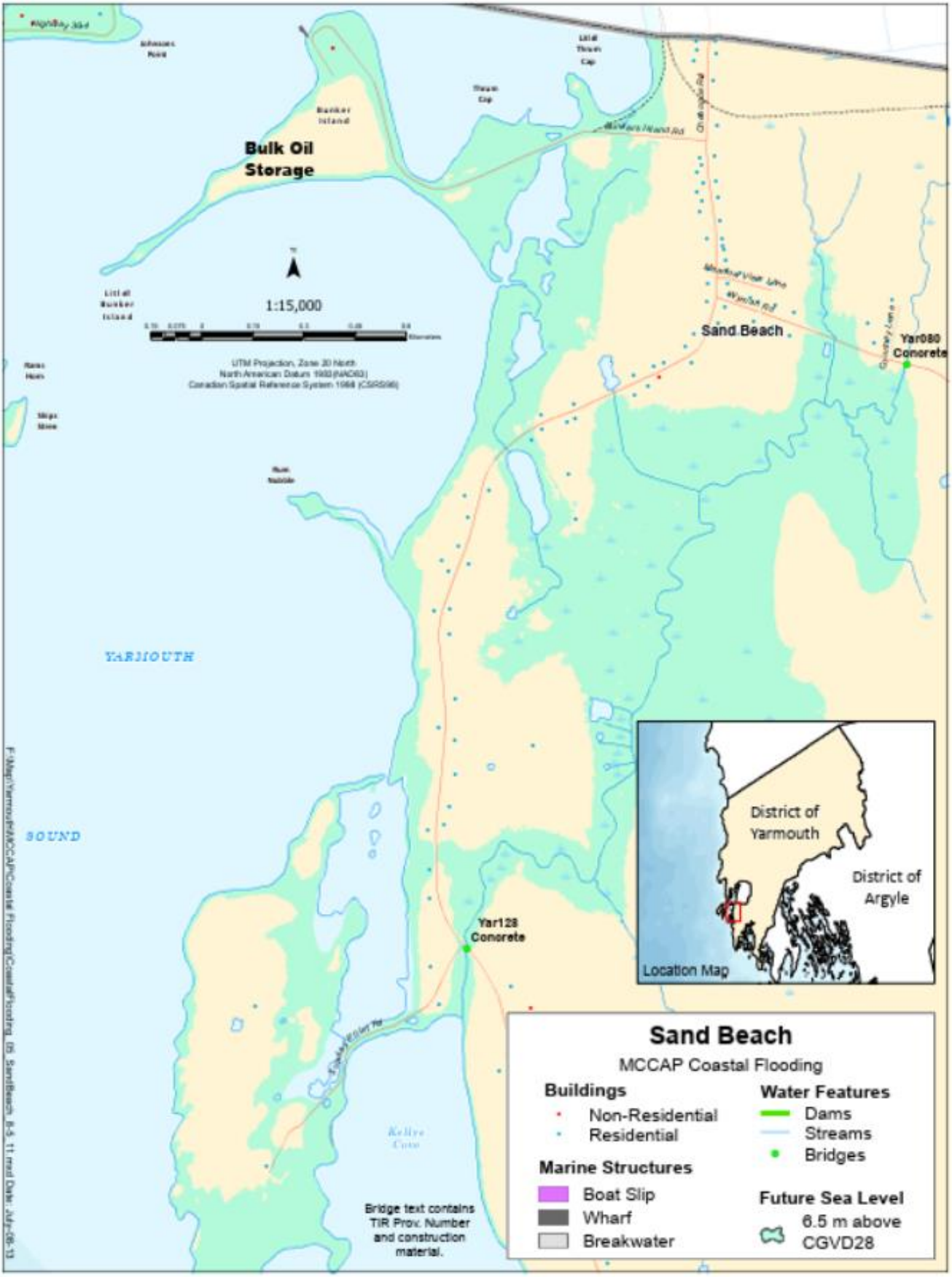
Appendix B: MCCAP Coastal Flooding Maps

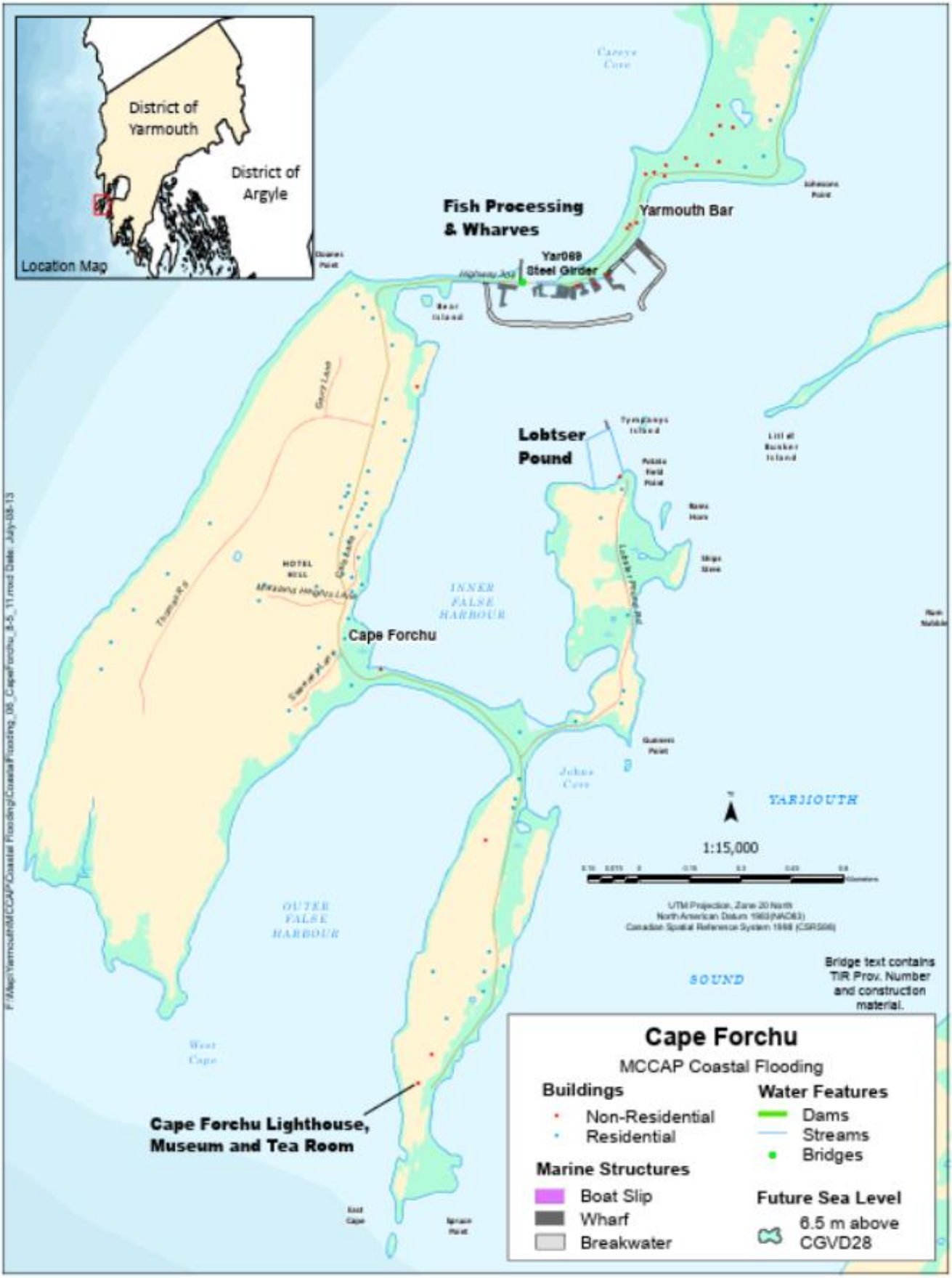


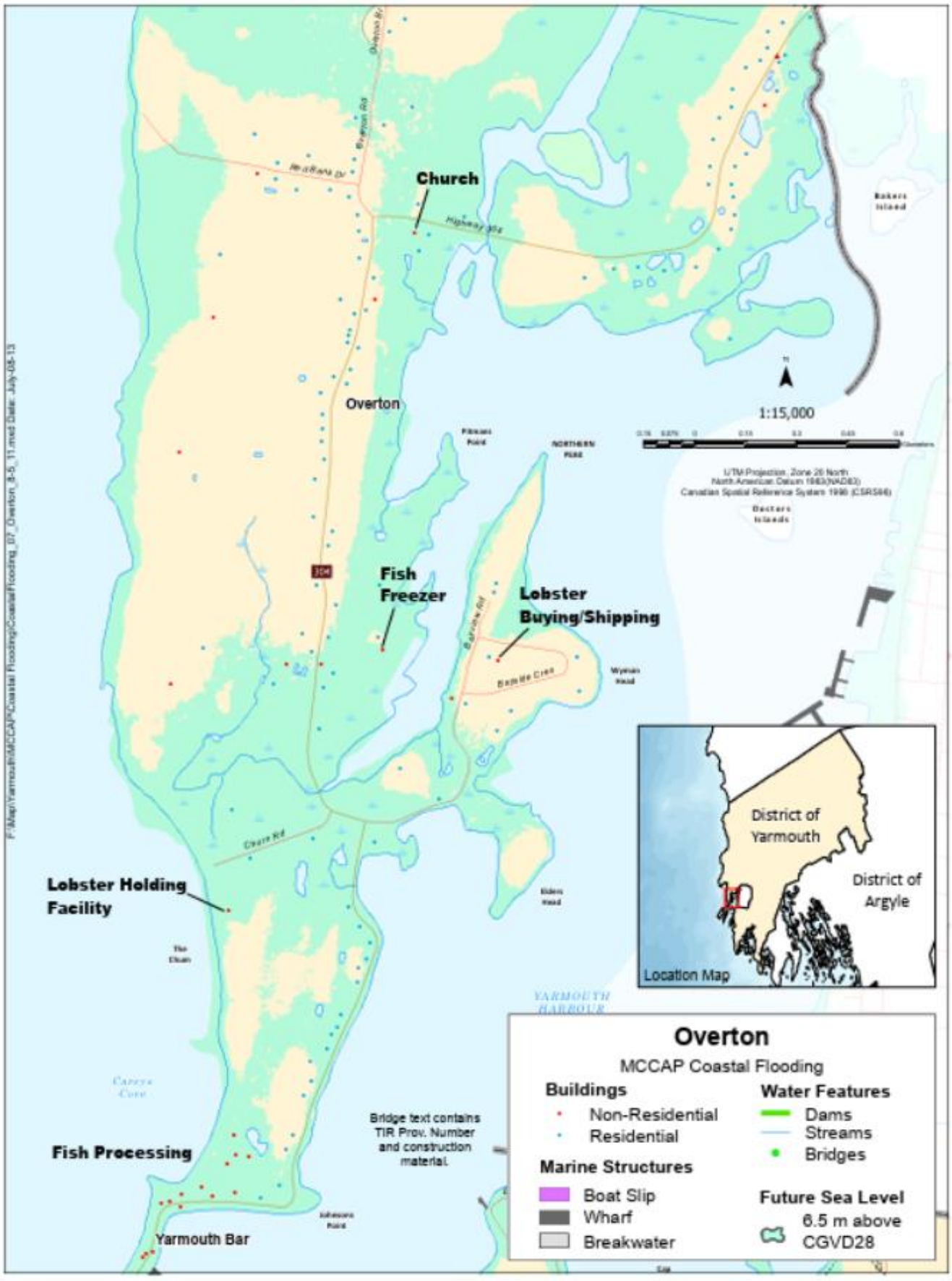

District of Yarmouth
District of Argyle
Location Map
PINKNEY HILL
Williams Mun Rd
Maplevale Rd
1:15,000
Bridge text contains TIR Prov. Number and construction material.
Melbourne 1
MCCAP Coastal Flooding
Buildings
Non-Residential
Residential
Marine Structures
Boat Slip
Wharf
Breakwater
Water Features
Dams
Streams
Bridges
Future Sea Level
6.5 m above CGVD28

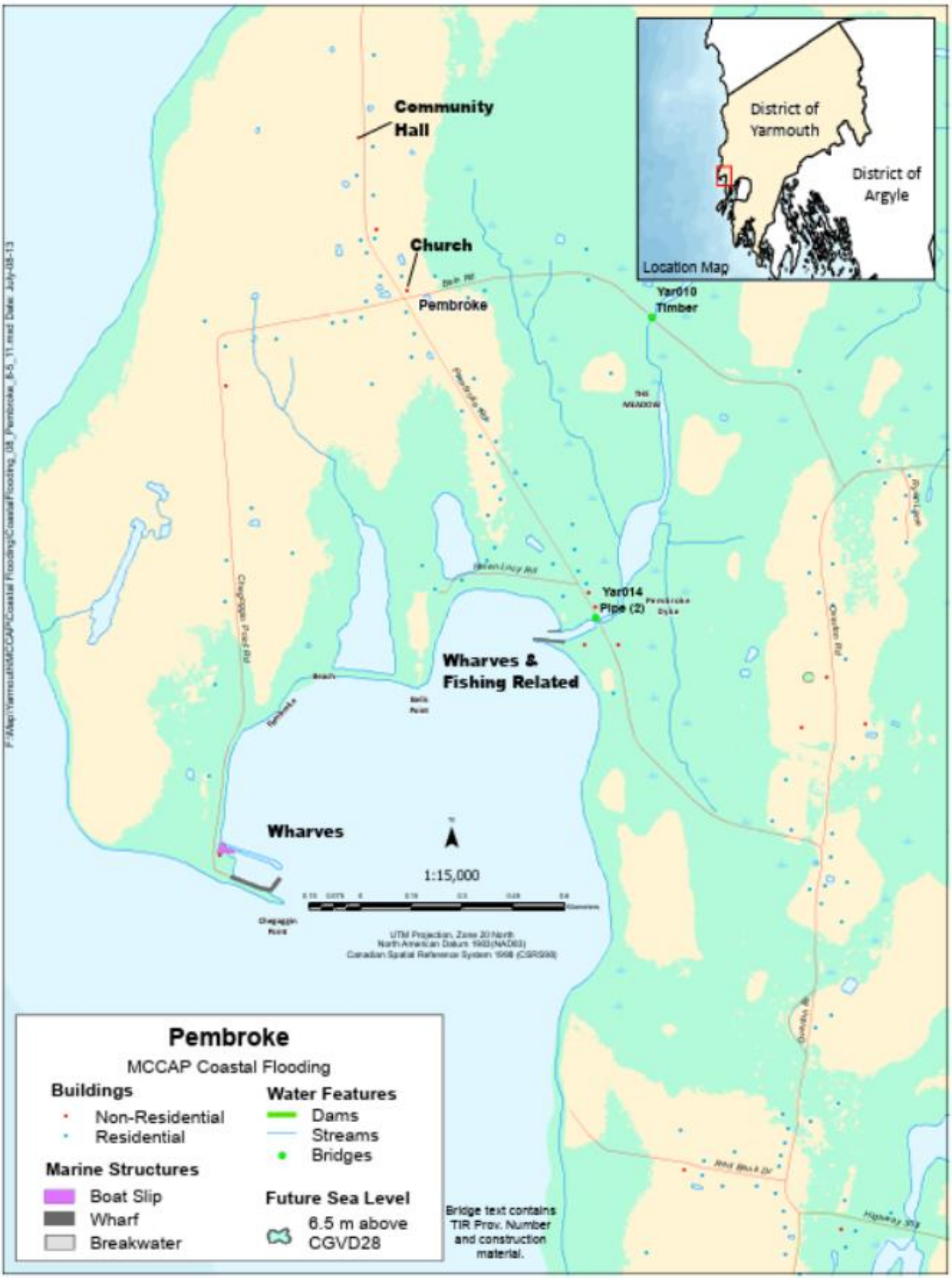

District of Yarmouth
District of Argyle
Location Map
1:15,000
Melbourne Lake
Dunn Lake
Melbourne
Melbourne 2
MCCAP Coastal Flooding
Buildings
Non-Residential
Residential
Marine Structures
Boat Slip
Wharf
Breakwater
Water Features
Dams
Streams
Bridges
Future Sea Level
6.5 m above CGVD28
Bridge text contains TIR Prov. Number and construction material.

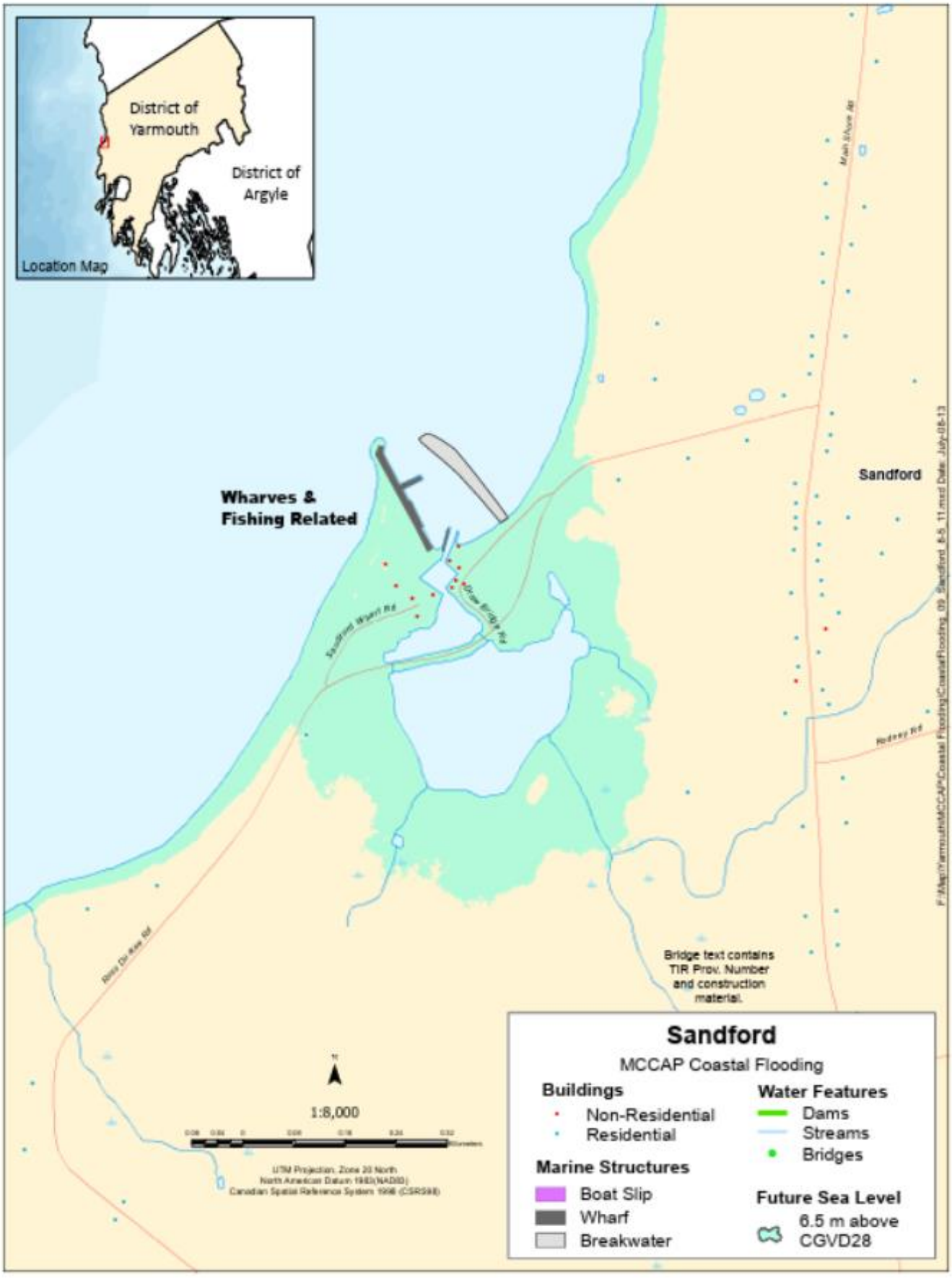

1:10,000
District of Yarmouth
District of Argyle
Location Map
Arcadia Auto Repair
Church
Arcadia
Ground Search and Rescue
Arcadia School
Pump Stations
Yar055 Concrete
Post Office
Gordon Muise Service Centre
Metal Pro Machine Shop
Arcadia Convenience Store
Arcadia
MCCAP Coastal Flooding
Buildings
Non-Residential
Residential
Marine Structures
Boat Slip
Wharf
Breakwater
Water Features
Dams
Streams
Bridges
Future Sea Level
6.5 m above CGVD28
Bridge text contains TIR Prov. Number and construction material


Bulk Oil Storage
1:15,000
UTM Projection, Zone 20 North
North American Datum 1983 (NAD83)
Canadian Spatial Reference System 1998 (CSRS98)
Sand Beach
Yar080 Concrete
YARMOUTH
SOUND
Yar128 Concrete
District of Yarmouth
District of Argyle
Location Map
Sand Beach
MCCAP Coastal Flooding
Buildings
Non-Residential
Residential
Marine Structures
Boat Slip
Wharf
Breakwater
Water Features
Dams
Streams
Bridges
Future Sea Level
6.5 m above CGVD28
Bridge text contains TIR Prov. Number and construction material.


District of Yarmouth
District of Argyle
Location Map
Fish Processing & Wharves
Yarmouth Bar
Yar069 Steel Girder
Lobtser Pound
Cape Forchu
INNER FALSE HARBOUR
OUTER FALSE HARBOUR
SOUND
YARMOUTH
1:15,000
Cape Forchu Lighthouse, Museum and Tea Room
Bridge text contains TIR Prov. Number and construction material.
Cape Forchu
MCCAP Coastal Flooding
Buildings
Non-Residential
Residential
Marine Structures
Boat Slip
Wharf
Breakwater
Water Features
Dams
Streams
Bridges
Future Sea Level
6.5 m above CGVD28


Church
Overton
1:15,000
Fish Freezer
Lobster Buying/Shipping
Lobster Holding Facility
Fish Processing
Yarmouth Bar
Bridge text contains TIR Prov. Number and construction material.
District of Yarmouth
District of Argyle
Location Map
Overton
MCCAP Coastal Flooding
Buildings
Non-Residential
Residential
Marine Structures
Boat Slip
Wharf
Breakwater
Water Features
Dams
Streams
Bridges
Future Sea Level
6.5 m above CGVD28


Community Hall
Church
Pembroke
Yar010 Timber
Yar014 Pipe (2)
Wharves & Fishing Related
Wharves
1:15,000
District of Yarmouth
District of Argyle
Location Map
Pembroke
MCCAP Coastal Flooding
Buildings
Non-Residential
Residential
Marine Structures
Boat Slip
Wharf
Breakwater
Water Features
Dams
Streams
Bridges
Future Sea Level
6.5 m above CGVD28
Bridge text contains TIR Prov. Number and construction material.


District of Yarmouth
District of Argyle
Location Map
Wharves & Fishing Related
Sandford
Bridge text contains TIR Prov. Number and construction material.
Sandford
MCCAP Coastal Flooding
Buildings
Non-Residential
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Marine Structures
Boat Slip
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1:8,000