



CENTRAL PENINSULA

**NEIGHBOURHOOD
CLIMATE
CHANGE
ADAPTATION
PLAN**

Neighbourhood Climate Change Adaptation Plan: Central Peninsula Summary Document

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PREFACE

Climate Change presents Saint John with generational challenges which will require our communities to question their established structures and ways of knowing. Working collaboratively to adapt to Climate Change, therefore, presents unique and exciting opportunities for the City to not only improve the quality of life for its residents but to build a growing community of resourceful and compassionate global citizens.

In order to become resilient to the effects of Climate Change our community's residents, ecosystems, businesses and systems must be able to survive, adapt and thrive despite the stresses and shocks caused by its impacts. Accomplishing this requires supporting and fostering an environment where residents of Saint John are well-connected to their neighbours and have social support systems in times of need. It will require physical environments, such as wetlands and urban forests, that help provide shade and passive cooling opportunities in the Summer and that reduce the impact of extreme cold in the Winter. It will require stormwater infrastructure that can handle larger storm events, and will require water resources which meet the timing and flow demands of humans and natural systems alike. It will require energy systems that can efficiently handle periods of high demand and buildings that rely less on energy sources such as electricity, oil, and natural gas. It will require affordable transportation systems that function throughout extreme weather events, and it will require land use capable of accommodating population shifts due to climate migration.

That is why ACAP Saint John has initiated AdaptSJ, a process where we will investigate, test and implement ways that climate adaptation can help our city meet its basic development needs, build equitable and vibrant neighbourhoods, and become the resilient, thriving community we all know it can be.

ACAP Saint John's team is committed to providing Saint John with the best available science and social policy, and to integrate the thoughts and ideas of the community, all of which come together to guide our plan forward. Because at its heart, ACAP has always been an environmental incubator, one that transforms and evolves our region's landscapes with the help of governments, companies and community collaborators. Our work is designed to be seen, felt and experienced throughout the environment – from our wetlands and coastlines to our streets and public spaces.

CLIMATE CHANGE OVERVIEW

1.1 PHYSICAL DIMENSIONS

Climate change is the greatest challenge facing human civilization today. It directly impacts fundamental resources like food, water, and shelter. Weather, or the fluctuating state of the atmosphere characterized by temperature, wind, precipitation, and clouds, is only predictable over hours, days, or weeks. Climate is the average weather or mean variability of these elements over time. Changes in climate can thus be observed over a period ranging from months to thousands or millions of years. The Intergovernmental Panel on Climate Change (IPCC) is a United Nations scientific body and foremost authority on climate change science. In its most recent and Fifth Scientific Assessment Report (AR5), the IPCC finds that warming of the climate system is “unequivocal”.

Climate change impacts are already being felt around the world, including warming atmospheres and oceans, diminishing snow and ice cover, and rising sea levels (IPCC, 2014). These changes are a result of a dramatic increase in greenhouse gas (GHG) emissions from human activities that trap heat from the sun in the atmosphere, an effect known as the Greenhouse Effect (Figure 1).

THE GREENHOUSE EFFECT

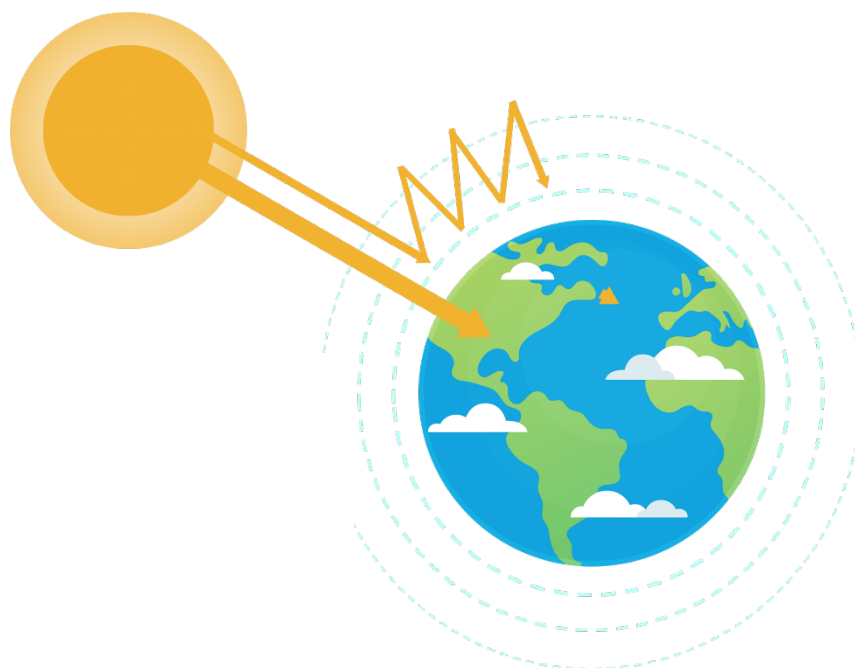


Figure 1: The Greenhouse Effect, where the sun’s heat is trapped in the atmosphere by higher quantities of greenhouse gas emissions (Mathematics of Planet Earth, 2012).

Higher concentrations of GHGs in the atmosphere have led to 2016 being the world’s hottest year on record (World Meteorological Organization, 2017). This aligns with a trend in global warming that has been observed over the last 60 years (Figure 2).

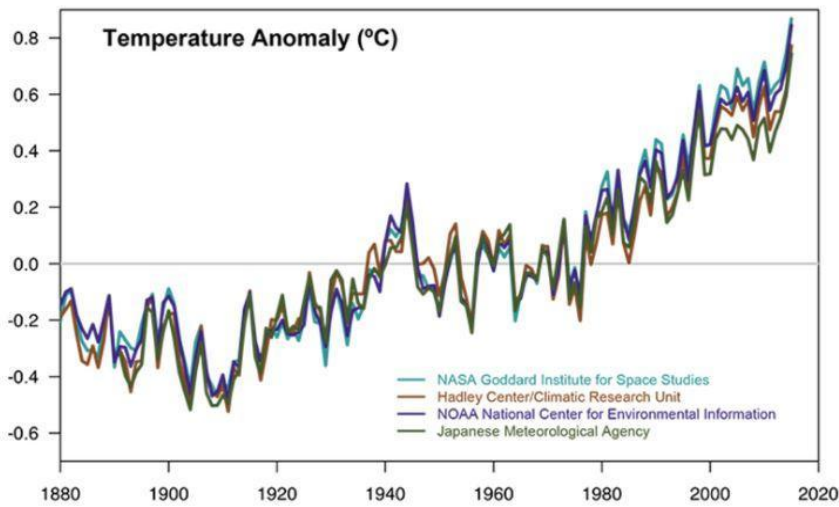


Figure 2: Temperature trends from 1880-2020 (National Aeronautics Space Administration, 2017)

In Canada the rate of warming is nearly twice the global average. Temperatures have increased by 1.3 degrees Celsius since 1948 and are projected to hit a 2 degree Celsius rise by 2050 and 4 degree Celsius rise by 2080 (International Council for Local Environmental Initiatives Canada, n.d.). Even with efforts to reduce GHG emissions (mitigation), climate change is already being felt in New Brunswick from rising temperatures, sea level rise, higher intensity precipitation

events, increased severity of inland and coastal flooding, accelerated rates of coastal erosion, and land loss that will continue to have negative impacts for the City if no adaptation occurs (NBDELG, 2014). Sea level rise, health risk from extreme heat, flooding, the spread of communicable diseases, urban water quality, and water availability will be the most pressing impacts to the Greater Saint John Area from climate change, requiring local initiative in the coming decades.

Flooding is the most frequent natural disaster in Atlantic Canada. Between 2007-2017 the Government of New Brunswick spent \$185 million on disaster recovery primarily from flooding events (NBDELG, 2018). As homeowners’ insurance generally does not cover overland flooding, flood protection requires combined responsibility by central government and the private sector to be successful (Vienna University of Technology, 2018). Local governments are linked to climate change issues such as flood protection because of their ability to make planned decisions about key services and infrastructure. Local governments also have the ability to understand flooding vulnerability on a neighbourhood scale, enabling buy-in from the community essential to successful planning implementation.

1.2 ADAPTATION FRAMEWORK

Infrastructure, parks, recreational activity, transportation, and public health and safety are all likely to be affected by climate change. The degree of these changes will depend on global emissions of GHGs over the next three decades, but the impact that climate change will have on our population can be lessened on a municipal scale through adaptation. Adaptation broadly refers to any adjustment that is made to respond to existing or anticipated impacts of climate change on human, natural, or built environments (Natural Resources Canada, 2007). The City of Saint John has a unique opportunity to prepare and respond to these

challenges by identifying the risks of climate change to its natural and built environments, and by taking advantage of the opportunities a changing climate may present.

A central adaptation toolkit, Building Adaptive and Resilient Communities, developed by the International Council for Local Environmental Initiatives (ICLEI-Canada, n.d.) has been implemented by municipalities in British Columbia, Ontario, and Newfoundland. ICLEI-Canada, Partners for Climate Protection and the Federation of Canadian Municipalities are working to guide similar adaptation planning in other Canadian municipalities which consists of five key milestones (Figure 3). This study will address the first three milestones: initiate research and plan and will inform a larger climate change adaptation plan that will apply to the City as a whole, along with the City of Saint John neighbourhood plans.

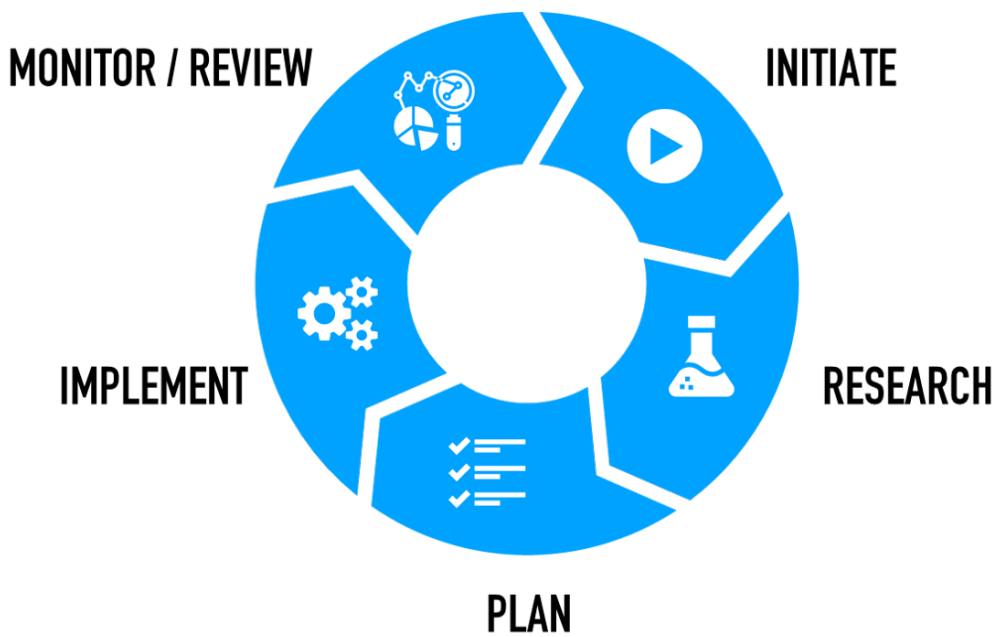


Figure 3: Five key milestones for climate change adaptation beginning with initiate, followed by research, plan, implement and monitor/ review (ICLEI-Canada, n.d.).

Adaptation is not without its challenges. The uncertainty of local weather projections means the necessity of addressing climate change is not made obvious until after effects are felt. To protect the public and city assets from its negative impacts, the city-wide climate change adaptation plan uses the precautionary principle, which is to communicate and plan for anticipated climate change impacts based on best available science until cause and effect relationships are fully established scientifically.

Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainability requires thinking about both the short and the long-term costs and benefits of current developments. Cities are complex systems and require holistic thinking to consider all sectors and environments. When dealing with complex systems, no one person can possess all the answers, which is why engaged discussion and a shared vision are vital to planning a sustainable and resilient city.

1.3 OBJECTIVES

Neighbourhood planning is scheduled to take place by the City of Saint John Department of Growth and Community Development Services that will address life in priority neighbourhoods in the City of Saint John. To accompany these plans, ACAP Saint John will study Saint John's three most vulnerable neighbourhoods (Central Peninsula, North End and Lower-West Side) to develop a feasibility plan for adaptation. The study neighbourhoods encompass four of Saint John's priority neighbourhoods where poverty rates exceed 30 % of the population (Plan SJ, 2010). Addressing how climate change will affect impoverished populations is important so adaptation practices do not negatively impact the residents of Saint John.

For each neighbourhood the study will identify vulnerabilities to populations, public health and safety, ecosystems and infrastructure due to climate change risks such as sea level rise, and extreme weather. Based on this information ACAP Saint John will outline recommendations for each neighborhood as they apply to climate change adaptation and neighbourhood planning. For example, using green infrastructure for stormwater management; limiting development in risk areas; or managing our urban forest to maximize ecosystem services. Three pilot projects will be recommended (one in each study neighbourhood) that will demonstrate to the City and to the public how climate change adaptation will look in practice in the City of Saint John.

LOCAL PROJECTIONS

2.1 SUMMARY

CATEGORY	PROJECTIONS
TEMPERATURE	<ul style="list-style-type: none"> • Mean annual temp. increases by 3.5°C by 2071-2100 compared to 1970-2000. • Average winter temp. above -1°C by 2071-2100. • Up to 70 annual very hot days (25°C+) by 2071-2100. • Annual freeze-thaw days increase from 82 to 87 by 2070.
PRECIPITATION	<ul style="list-style-type: none"> • Annual rainfall increases by 84.5 mm by 2080 compared to 1976-2005. • Precipitation patterns become more erratic and rainfall intensity will increase by 10 %. • Approximately 20 more days will be rain days by 2071-2100.
EXTREME WEATHER	<ul style="list-style-type: none"> • Increased severity, frequency of summer convective storms and ice storms. • Increased severity, frequency of flooding from extreme rainfall, mid-winter thaws, ice breakups and ice-jam flooding. • Forest fire occurrence increases by 25 % by 2030, 75-140 % by 2100. • Higher incidence, duration and severity of drought from earlier peak spring flows and very low to zero summer flows.
SEA LEVEL RISE	<ul style="list-style-type: none"> • Atlantic Canada sea level has risen by ~30 cm between 1911-2000. • Saint John sea level rise of 86 cm +/- 38 cm from 2010 to 2100. • Annual storm surge levels increase by 0.8 m compared to 2010. • 1 in 100-year storm levels increase by 1.3 m by 2100 compared to 2010. • Current coastal erosion rates of 0.59-0.99 m/yr.

Table 1: Climate Change Projections for the Greater Saint John Area (Roy and Huard, 2016; PCC, n.d.; Daigle, 2014)

NEIGHBOURHOOD PROFILE: CENTRAL PENINSULA

The Central Peninsula (Ward 3) is in the urban core of Saint John, and is the hub for employment, entertainment, and tourism. Since the Central Peninsula is a large employment area, many people commute from other parts of the city and outlying communities daily. There are a variety of land uses on the Central Peninsula, including transportation (railways, roadways and marine terminals), commercial, and residential. For example, as you move further eastward, land use shifts from commercial to residential. Zoning in the Central Peninsula includes waterfront commercial, urban center residential, major community facility zone, park, uptown commercial zone, high rise residential, commercial corridor, general commercial, business park commercial zone, mixed commercial.

The Central Peninsula has a varied topography overlaid with a grid street structure that has resulted in steep slopes on the streets leading up from the water. The topography affects how stormwater flows through the peninsula, the walkability of streets, and the amount of sunlight that reaches buildings, streets, and public spaces (Figure 4).



Figure 4: Central Peninsula neighbourhood boundaries.

Priority neighbourhoods within the Central Peninsula include Waterloo Village and the South End. Based on information from the 2006 census, the percentage of people living in poverty in the Waterloo Village stood at 56.1 %, and the South End was 37.5 % (Vibrant Communities, 2008). Neighbourhood groups in the Central Peninsula (Waterloo Village Association and People United in the Lower South End or P.U.L.S.E.) work to improve the lives of residents in the Central Peninsula by promoting food drives, healthy eating, community gardening, and public safety. Schools in the Central Peninsula include Saint John High, St. Malachy's High School, Prince Charles School, and St. John the Baptist-King Edward School.

The Central Peninsula is surrounded by water on three sides at the confluence of the Wəlastəkw and Marsh Creek Watersheds in the Saint John Harbour. These water features play a pivotal role in the culture and economy of the City, however, public access to the water is limited on the Central Peninsula. Industry, port activities, and brownfield sites block access and limit public use of the coast. Saint John Waterfront Development developed the Saint John Inner Harbour Development Plan in which envisions a fully accessible harbourfront from Long Wharf to Tin Can Beach by 2025. This plan would see new park spaces developed next to the coast guard site on Water Street and at Tin Can Beach, the former Lantic Sugar Refinery site, and a portion of the current port property.

3.1 BROWNFIELD REMEDIATION

Brownfield sites are areas that are derelict, abandoned, or underutilized former commercial and industrial sites that may contain toxins and contaminants due to their past uses. Many brownfield sites exist on the peninsula due to previous industrial and manufacturing activities. These sites have the potential to be restored to productive uses but are more complex to develop because of environmental and public safety concerns. Prominent brownfield sites on the Central Peninsula include the Fundy Quay, Long Wharf, the Coast Guard Site, the former Imperial Oil Tank Farm, and the former Lantic Sugar Refinery site. All of these sites are located along the waterfront and have complicated the redevelopment the City's waterfront into residential and commercial uses as envisioned in the Inner Harbour Land Use Plan and Plan SJ. Furthermore, the former Lantic Sugar Refinery and Imperial Oil Tank Farm sites are on the periphery of the peninsula away from other commercial uses and are surrounded by current industrial uses.

3.2 SAINT JOHN HARBOUR/BAY OF FUNDY

The Bay of Fundy is an internationally recognized natural asset and is designated as one of the seven wonders of North America due to its high tides, aquatic species, and geology. The Saint John Harbour and Wəlastəkw were crucial in the growth of the City and continue to support a working waterfront, tourism, and public spaces such as the Market Square Boardwalk, Harbour Passage, Loyalist Plaza, and Tin Can Beach. The harbour provides international shipping and transportation services and is a cultural asset to the City.

The Harbour Passage Trail follows the Saint John Harbour from Fort La Tour Drive to Water Street. This trail acts as an active transportation route between the North End and the Central Peninsula, and provides an opportunity to view the harbour, recreational space, and historical sites such as Fort La Tour. Fort La Tour (part of the North End neighbourhood) is located between Long Wharf and the Harbour Bridge.

3.3 TIN CAN BEACH

Tin Can Beach is a natural coastal area on the Central Peninsula that allows public access to the shoreline. It is often described as a “hidden gem” by residents who frequently visit and has gained broader recognition as a natural asset in the South End over the last four years. In 2014, ACAP Saint John planted thirty-three street trees along Sydney Street as it approaches the beach, with other vegetation, reintroducing native species that will create a windbreak between Sydney Street and the current snow dump. ACAP also reached out to the community in 2015 to ask what they wanted to see happen in the area and received 235 comments. Later that year, the city paved Sydney Street and brought down garbage bins and benches. Shortly thereafter, food trucks also began frequenting the area. In 2018, the City of Saint John initiated the next phase of Harbour Passage, which will extend down Sydney Street to the end of the right-of-way and further enhance this waterfront access.

3.4 COURTENAY BAY AND FOREBAY

Courtenay Bay is a mudflat ecosystem and the waterbody support a working waterfront with industry and transportation surrounding the shoreline. The Courtenay Bay Causeway was built in the 1960s and cut through the former extent of the Bay creating the Courtenay Forebay behind it. The sole public access to the Courtenay Forebay is from along a sidewalk on the causeway that has fallen into disrepair due to wave action.

The Courtenay Forebay is a man-made wetland on the East side of the Central Peninsula that captures the water flowing through the Marsh Creek watershed. The area was formerly mudflats and transitioned to a wetland after the causeway was built. Much of the former mudflats were also infilled to create land for industry. The Forebay is a significant naturalized stormwater capture area that mitigates flooding in the East Side by capturing runoff. The causeway mitigates coastal flooding in the East Side by holding back the Bay of Fundy tides. The Courtenay Forebay was formerly polluted by raw sewage and is now recovering post-Harbour Cleanup. There is now significant potential to reimagine this space as a valued natural asset for the City that can help connect the Central Peninsula to the East Side.

3.5 MARSH CREEK

Marsh Creek runs under Thorne Avenue to the East of the Peninsula and empties into the Courtenay Forebay. The Creek was formerly polluted by raw sewage before Harbour Cleanup and has experienced significant environmental improvement over the last two years. Marsh Creek and its surrounding areas have transformed into a valuable natural asset rather than an area to be avoided and has potential for active transportation and ecological restoration of lands next to the water.

3.6 URBAN PARKS AND FOREST

Urban parks on the Peninsula include King Square, Queen Square, Loyalist Graveyard, Chown Field, and Rainbow Park. These park spaces add to the ecology and urban forest of the Central Peninsula and contain the highest concentrations of mature trees in the neighbourhood. The parks are natural assets that are

valuable for recreation, culture, stormwater management, heat moderation, air purification, and carbon dioxide absorption. Saint John's urban forest includes all the trees in public spaces (street trees and parks) and on privately owned land. Plan SJ recognizes the importance of trees and landscaping to maintain vegetation for quality of life in the City and has policies to plant street trees on City rights-of-way and in public areas. On the Central Peninsula, mature trees are concentrated in the Uptown area along Germain Street, King Square, the Loyalist Burial Ground, and Queen Square. Each street on the peninsula has a distinct tree age and some streets still lack any trees, especially in the South End and Waterloo Village. The City is planting street trees as roads are upgraded to the current design guidelines and has recently planted trees in Chown Field and along Harbour Passage. These younger trees will eventually grow to provide more canopy cover on the Peninsula.

A formal inventory of trees - including height, diameter, species, condition, and proximity to utility lines, was conducted in 2017 to fully understand the sustainability of the urban forest in the neighbourhood. Approximately 1,541 trees were surveyed in the Central Peninsula. The inventory data showed that approximately 97 % of surveyed trees were identified to be in good condition in the Central Peninsula. This inventory suggests a significant proportion of the peninsula's urban forest is comprised of invasive or introduced species, primarily Norway Maple, which is prone to disease and limb failure during storm events. Additionally, ACAP's Street Tree Inventory found that some streets in the Central Peninsula have little to no trees present.

CENTRAL PENINSULA: SPECIES INVENTORY COMPOSITION

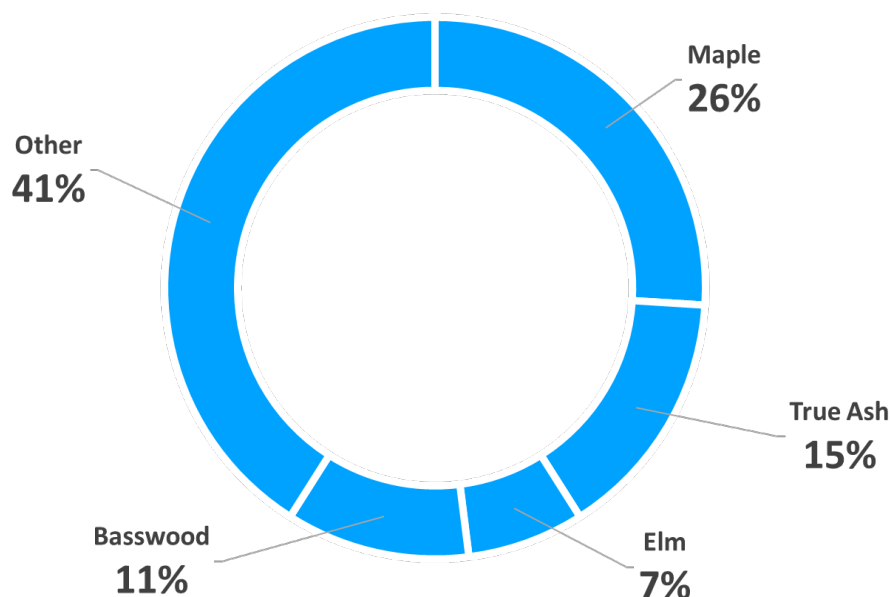


Figure 5: Percentage composition of the urban tree inventory within the Central Peninsula neighbourhood.

A sizable proportion (~15 %) of the Central Peninsula’s urban forest consists of Green Ash, Black Ash, or Red Ash, which have been known for their tolerance to urban environments (Figure 5). Until now, ash trees had very few diseases or problems with pests. The Emerald Ash Borer is a beetle that arrived in New Brunswick in the Spring of 2018 and trigger a 5-10-year terminal lifespan for these trees once infected.

The ecosystem services that the observed trees can provide to the neighbourhood have been calculated using the I-Tree Software developed by the USDA Forest Service (2006) (Table 2). In total, the residents and the City of Saint John saves approximately \$ 79.29 per tree in the Lower-West Side (Total \$122,185.89).

Table 2: Annual public benefits of urban street trees in the Central Peninsula (\$/tree) calculated using I-Tree Software (USDA Forest Service, 2006).

Annual Public Benefits of Trees in the Central Peninsula (\$/tree)					
Energy	CO ₂	Air Quality	Stormwater	Aesthetic/other	Total
12.83	1.73	0.95	10.02	53.76	79.29

3.7 COMMUNITY GARDENS

Community Gardens provide access to fresh, sustainable food and are especially valuable in low-income areas lacking access to nutritious food such as the South End and Waterloo Village. Plan SJ has a policy to encourage local food production and access to fresh food by supporting interest groups in developing community gardens. There are three community gardens run by community groups on the Central Peninsula that provide fresh produce to participating residents and educational opportunities for growing and maintaining a garden (Stephen Park, Rainbow Park and StreetHope Community Garden). An additional garden is located at Saint John High School where students run a garden as a part of their schooling.

RISK AND VULNERABILITY ASSESSMENT

4.1 PRIORITY RISKS AND IMPACTS

Saint John will be impacted by climate change in multiple ways, but in order to effectively plan and adapt to climate change, ACAP Saint John has chosen priority impacts that will have the most pronounced effect on the City. The priority risks of climate change in the coming decades will include 1. sea level rise and storm surges, and 2. severe weather that includes: heavy rainfall, stormwater runoff, early winter thaws that lead to more severe flooding, summer drought, negative health impacts of extreme temperature, and subsequent spread of communicable diseases. These impacts were chosen due to the existing social and environmental challenges in the City compared to local predicted impacts of climate change. The principal purpose of this neighbourhood adaptation plan is to protect the well-being and prosperity of the study neighbourhoods and its residents from these impacts. Each of these impacts will affect the city in different ways. For example, sea level rise will be a major impact in the Central Peninsula and Lower-West Side but will not affect the North End as drastically due to its location in the Harbour and topography.

4.2 PUBLIC ENGAGEMENT

ACAP Saint John used a draft version of New Brunswick's Coastal Hazard Flood Mapping (CHFM) that is set to be released in 2019 to identify coastal flood risk areas. This set of maps identifies sea level rise and storm surge risks in the future. The maps outline the current Higher High Water Low Tide [HHWLT] (4.6 m), HHWLT+1m (5.6 m) (the average predicted level of sea level rise by 2100), HHWLT+2m (6.6 m) (which models a Saxby Gale like event - post sea level rise), and a 1 in 100 year storm event in 2100 (6.8 m) from the CGVD28 datum based on projections from Daigle's 2017 Report *Sea Level Rise and Flooding Estimates for New Brunswick Coastal Sections* (Figure 6). These maps were used in our risk and vulnerability assessment and during our public information forums and to identify areas at risk from sea level rise and associated impacts.

ACAP Saint John participated in a Sea Level Rise Workshop in August 2018, held by the New Brunswick Environmental Network. The CHFM's were presented to workshop attendees and used to identify coastal infrastructure of importance, areas that are currently being affected by sea level rise, and areas that are at risk of future sea level rise impacts. Five maps were displayed during this workshop. For the purposes of this report, the maps from the representative study neighbourhood will be discussed (Table 3).

Table 3: Community feedback collected during ACAP Saint John's community engagement sessions in 2018.

Category	Central Peninsula
<p>Community assets</p>	<p>Recreational/Natural assets:</p> <ul style="list-style-type: none"> • Greenspace (Kings Square, Queen Square, Rainbow Park etc.) • Large number of flat roofs that could be turned into green roofs • Tin Can Beach • Waterfront access • Boardwalk /harbour passage area • Marsh Creek/Forebay <p>Transportation assets:</p> <ul style="list-style-type: none"> • Water Street/Broad Street (Near causeway) • Cruise ship terminals • Crown Street
<p>Areas experiencing climate change impacts</p>	<ul style="list-style-type: none"> • Harbour Bridge, increase in freeze thaw, catastrophic potholes annually • Boardwalk, flooding impacts • Haymarket Square, flooding impacts
<p>Areas of importance that may be at risk</p>	<ul style="list-style-type: none"> • Harbour Passage, potential flooding risks • Potash Terminal, potential flooding risks • Highway northwest of Harbour Station, potential flooding risks • Saint John Energy substation: potential flooding risks • Museum site, potential flooding risks • Severe wind concerns on the peninsula • Oil via rail near Marsh Creek • Courtenay Bay Causeway



Figure 6: Coastal hazard flood map, Central Peninsula.

4.3 SEA LEVEL RISE

Based on the CHFMs the City of Saint John’s GIS department compared projected sea level rise elevations to current infrastructure, emergency services, population statistics, and ecological parameters to identify risks in the study neighbourhoods. Based on the risks identified in the tables below, ACAP will be able to identify adaptation actions will address these risks.

Table 4: Sea level rise risk areas in the Central Peninsula.

CATEGORY	Current conditions: Sea Level Rise HHWLT (4.6m) Risks (Highly Probable in 2010)	Sea Level Rise HHWLT + 1 m (5.6m) Risk Events (1-2 % probability in 2010, 20-50 % probability in 2050, 50-100 % probability in 2100.	Sea Level Rise HHWLT+2m (6.6m) Risks (5-10 % possibility in 2100).	Worst Case Scenario: Sea Level Rise 2100 1-100 (6.8m) Risks (1 % possibility in 2100).
EVACUATION CONTROL POINTS	No areas affected	3 control points affected	7 control points affected	8 control points affected
EVACUATION ROUTES	No routes affected	Damage to infrastructure, isolation of populations (safety, food security). 35 routes affected by flooding (approximately 3.9 km)	Damage to infrastructure, isolation of populations (safety, food security). 61 routes affected by flooding (approximately 9.2 km)	Damage to infrastructure, isolation of populations (safety, food security). 62 routes affected by flooding (approximately 9.2 km)
BUILDINGS IMPACTED	Damage to one home or business (13.2 m ²)	Damage to 43 homes or businesses (33,503 m ²)	Damage to 75 homes or businesses (97,827 m ²)	Damage to 85 homes or businesses (100,053 m ²)
PROPERTIES IMPACTED	14 properties affected including 5 industrial properties	86 properties affected including 22 industrial properties	164 properties affected including 29 industrial properties	180 properties affected including 30 industrial properties

TOTAL POPULATION AFFECTED	18 % of the total population live in impacted areas	37 % of the total population live in impacted areas	41 % of the total population live in impacted areas	41 % of the total population live in impacted areas
LOW-INCOME POPULATIONS	7 % of people in flood impact areas are considered low-income	19 % of people in flood impact areas are considered low-income	20 % of people in flood impact areas are considered low-income	20 % of people in flood impact areas are considered low-income
SENIOR POPULATIONS	3 % of people in flood impact areas are seniors (65+)	6 % of people in flood impact areas are seniors (65+)	7 % of people in flood impact areas are seniors (65+)	7 % of people in flood impact areas are seniors (65+)
HABITAT-WETLAND	Coastal Squeeze approximately 1318 m ²	Coastal Squeeze approximately 6.4 ha	Coastal Squeeze approximately 6.4 ha	Coastal Squeeze approximately 6.4 ha
HABITAT-FORESTS	None	Loss of habitat approximately 361 m ²	Loss of habitat approximately 361 m ²	Loss of habitat approximately 361 m ²
PETROLEUM STORAGE SITES	Contamination: 1 site at risk of flooding	Contamination: 19 sites at risk of flooding	Contamination: 36 sites at risk of flooding	Contamination: 39 sites at risk of flooding

4.4 SEVERE WEATHER

Table 5: Severe Weather Impacts in the Central Peninsula.

RISK EVENT	CONSEQUENCE
HIGH WINDS	High exposure due to topography and height of office towers/churches. As surveyed in 2017 by ACAP Saint John, approximately 462 trees were contacting overhead utility lines and 297 trees could overhang utility lines which could result in future outages.
DROUGHT	Community gardens: Stephen Park, Rainbow Park, StreetHope, and Saint John High School could be negatively impacted.
TEMPERATURE EXTREMES: VULNERABLE POPULATIONS	Populations that could be negatively affected by extreme heat/cold include seniors (15 % above the age of 65) and low-income individuals (43 %).
TEMPERATURE EXTREMES: VECTOR BORNE DISEASE	Low amount of forested/ green space (2 %). Less likely for insect populations to thrive.
TEMPERATURE EXTREMES: INVASIVE SPECIES	Ash species consist of 15 % of street trees, at risk to damage/mortality from Emerald Ash Borer.
INCREASED RAINFALL: INLAND FLOODING	Low lying areas in the northern portion of the peninsula and along Marsh Creek may be at risk (Haymarket Square, City Road, Rothesay Avenue).
SPRING FRESHET: INLAND FLOODING	Areas along Marsh Creek (Rothesay Avenue, Crown Street) are at risk of riverine floods.

HEAT ISLAND EFFECT

Total green space is approximately 5 %. Urban heat island effect may be an issue due to a high number of dark surfaces.

NEIGHBOURHOOD PLAN RECOMMENDATIONS

The Central Peninsula is a densely developed area bounded by water to the east south and west. Areas along the waterfront (especially portions of reclaimed land) such as Long Wharf, Market Square, Fundy Quay, and Tin Can Beach/former Lantic Sugar Site will be vulnerable to sea level rise and storm surge, which can result in flooding and erosion of infrastructure. The coastal hazard flood maps predict that sea level rise could impact approximately 62 evacuation routes, 85 buildings, 180 properties, 39 petroleum storage sites, and 41 % of the residents of the Central Peninsula.

Any proposed development in waterfront areas of the Central Peninsula needs to consider the future impacts of sea level rise in site design. Additionally, any scheduled repairs to the sea wall along Water Street should include adjustments that will protect infrastructure from a potential rise in water levels of 2.2 m when considering projected sea level rise and storm surge. Areas that were noted as especially important during public consultation included Market Square/Slip, the Courtenay Bay Causeway, Courtenay Bay docks, Marsh Creek, Highway #1, Water Street, the Saint John Energy substation on Smythe Street, and Tin Can Beach.

Severe weather impacts in the Central Peninsula include high winds that could damage utilities and buildings, drought that could reduce food production in community gardens, higher temperature that has potential to impact aging and low-income populations, and inland flooding in low lying areas and along Marsh Creek.

ACAP Saint John’s urban forest inventory from 2017 identified approximately 462 trees that were contacting overhead utility lines and approximately 297 trees which could overhang utility lines creating the potential for future problems. These trees should be trimmed in order to avoid outages during high wind events and winter storms. Nine trees were also identified as dead, and fifteen were noted to be in poor condition. The City should investigate replacing or maintaining these trees. When Saint John becomes infected by the EAB, approximately 15 % of the Central Peninsula’s trees will be lost, resulting in an environmental, economic, and social issue to the urban forest. A comprehensive urban forestry plan is recommended for all three study neighbourhoods to accompany all public realm improvements street reconstruction efforts and public space investments. Establishing urban native tree nurseries in empty or vacant lots (for the planned replacement of ash tree species) would provide immediate beautification to city streets, while also providing end-of-life succession planning for threatened, introduced, and diseased urban trees. Increasing green space in the

Central Peninsula will help to reduce the urban heat island effect, provide shady spaces for relief from hot temperatures, and help to control stormwater. Improving and increasing the amount of green space and urban forests will push Saint John forward in climate change adaptation.

Upcoming neighbourhood planning in the Central Peninsula should address these above-mentioned climate change impacts. As outlined in the Municipal Plan (Plan SJ), detailed neighbourhood planning will support the implementation of the Municipal Plan and allow for public input on planning strategies on a community level basis (City of Saint John, 2011). The development of the Central Peninsula Neighbourhood Plan began in 2017 and City staff are working to complete the final version of the plan. The public has been involved through open houses and through CoUrbanize, an interactive map, where the public can leave comments and suggestions on the City's website. A draft list of strategy options for the plan were released in late 2017 to provide further public input. The components of the plan address arts, culture, and events; cleanliness and safety; community wellbeing; environment; growth; heritage and urban design; open spaces, parks and recreation; public realm, mobility, and infrastructure; and transportation and parking. Goals of the environmental portion of the Central Peninsula Neighbourhood Plan consist of:

1. Promote and incorporate green infrastructure into municipal infrastructure and new development.
2. Prepare for the impacts of climate change on the Central Peninsula.
3. Prepare a mix of both short and long-term site-specific strategies for remediation of high-profile contaminated sites in the Central Peninsula (City of Saint John, 2017).

The Draft Central Peninsula Neighbourhood Plan, along with the Heritage Report and the Draft Design Guidelines were released on May 30, 2018 for public review. Six themes were identified in the plan and include: City Prosperous, City Vibrant, City Beautiful, City Living, City Green, and City Connected.

The plan highlights softening city infrastructure such as sidewalks, creating more opportunities for stormwater management (i.e. rain gardens, green roofs), adapting to sea level rise, revitalizing a brownfield area near Tin Can Beach, supporting ACAP Saint John in restoring Marsh Creek, and modelling sea level rise.

As part of the consultation process, ACAP Saint John submitted recommendations in response to the publication of the Draft Central Peninsula Neighbourhood Plan. The following recommendations were submitted by ACAP Saint John.

CITY GREEN (CG)

The City Green goals include:

- "Increase greenery and landscaping of both the public and private realm.
- Prepare for the impact of climate change on the Central Peninsula.
- Remediate large, high profile environmentally contaminated properties.
- Realize the full potential of existing parks and open space networks" (City of Saint John, 2018).

A GREEN PUBLIC REALM

To increase greenery in both the public and private realm, the plan developed five policies and three actions to improve environmental conditions while enhancing aesthetic appeal in the Central Peninsula:

“Policies (CG)

1. Incorporate low maintenance, green infrastructure such as clover and other plant species in street design.
2. Explore potential for an adopt-a-tree program and crowd-funding public realm greening projects.
3. Working with community partners, adopt an urban forest program to guide tree planting in the Central Peninsula.
4. Encourage the development of rain gardens in the Central Peninsula to reduce stormwater runoff to municipal infrastructure.
5. Encourage where feasible, the greening of rooftops for new development and redevelopment projects.

Actions (CG)

6. Working with community partners, enhance existing or adopt new programs to encourage street level box planters and window box planters within the Business Improvement Area.
7. Develop a “Street Seats” program to allow businesses to reclaim portions of the street right-of-way and on-street parking spaces for flexible “green” patios, framed by box planters and greenery.
8. Create inventory of asphalt sidewalks and undertake infrastructure greening projects to improve the aesthetic appeal of residential neighbourhoods within the South End and Waterloo Village” (City of Saint John, 2018).

ACAP RECOMMENDATIONS

To incorporate low maintenance, green infrastructure (CG.1) a variety of low impact development approaches should be implemented i.e. permeable paver sidewalks/curb extensions, bioretention planters, etc. For example, the City of Toronto has incorporated rain gardens into green street demonstrations to reduce excess roadway space and manage stormwater (Figure 7). Adopting a green street design guideline could provide a comprehensive outline for consultants, designers, and contractors when implementing green infrastructure. A green street guideline, along with an urban forest program guide (CG.3) could make a stipulation for planting a diverse set of native trees and shrubs when adding greenery. A green street design guideline could also outline methods for completing various actions within the Community Green Goals and could add suggestions for rainwater management such as rain barrels/rain garden planters and green roofs. The City of Toronto has developed a Green Streets Technical Guideline (2017) as well as a chapter on Street Design for Green Infrastructure has been developed as part of Toronto’s Complete Streets Guidelines that could serve as references for a green street guideline for the City of Saint John (City of Toronto, 2017).



Figure 7: Rain garden parkette. (City of Toronto, 2017)

CLIMATE CHANGE ADAPTATION

To prepare for the impacts of climate change the neighbourhood plan identified three policies to support climate adaptation in the Central Peninsula:

“Policies (CG)

9. Support local environmental organizations in undertaking climate change and sea level rise modeling for the Central Peninsula.
10. Adapt land use and development regulations to mitigate the long-term potential impacts of sea level rise.
11. Work with the Province’s air quality monitoring program to promote clean air targets” (City of Saint John, 2018).

ACAP RECOMMENDATIONS

Adapting land use and development regulations (CG.10) such as the City of Saint John *Flood Risk Area By-law (CP-11)* to restrict development within risk areas is important in mitigating impacts associated with sea level rise. Currently the City of Saint John’s *Flood Risk Area By-Law* only includes a small portion of the City located along Marsh Creek and its tributaries, and not along areas of the Kennebecasis River, Wəlastəkw, or the Central Peninsula.

Although climate change mitigation efforts aim to decrease greenhouse gas emissions that can lead to air pollution, the effects of increasing temperatures could increase the rate at which chemicals react and create ground level ozone (smog), which in turn will increase the number of smog days per year (Fann et al., 2016). Since the introduction of the Clean Air Act in 1997, air quality in New Brunswick has been steadily improving (NBDELG, 2015). Ozone, however, does not seem to follow this trend in Saint John as it is influenced by regional air masses and local weather patterns. Promoting clean air targets is important in maintaining the health of citizens (CG.11). Specific measures and deadlines should be identified to ensure that air targets are reached.

GREEN PLACE MAKING

Green spaces such as parks, community gardens, passive recreational areas, and active transport routes establish a connection to the environment, creating a desire to steward the land. Five green place making policies, one action and one outreach method were proposed in the neighbourhood plan:

“Policies (CG)

12. As resources permit, complete the parks and open network outlined in Schedule X, the Public Realm and Mobility Map.
13. Encourage the establishment and growth of horticultural groups to expand community capacity to implement urban greening strategies of the Central Peninsula Neighbourhood Plan.
14. Encourage the establishment of small pocket parks and pop-up parks in both the South End and Waterloo Village as part of a greater coordinated strategy to revitalize neighbourhoods.
15. Encourage design competitions and projects for the repurposing of vacant properties in the Central Peninsula.
16. Encourage and support increased community based recreational programming in public spaces within the Central Peninsula.

Actions (CG)

17. Evaluate the potential for the development of a mobile or travelling pop-up park.

Outreach (CG)

18. Work with property owners to evaluate the potential to implement long term, natural remediation techniques such as urban orchards or urban forestry for the former Imperial Oil property along Broad Street. Encourage the design of such remediation strategies to provide visual screening of industrial properties south of Broad Street” (City of Saint John, 2018).

ACAP RECOMMENDATIONS

Small pocket parks will support climate adaptation as they will increase the amount of natural area on the peninsula and help manage stormwater, filter pollutants and create a more inviting neighbourhood (CG.14). Urban greening strategies should take into consideration planting native species and using an array of species to promote species diversity within the Central Peninsula (CG.13). The creation of a set of green street design guidelines (as mentioned above) would provide residents, horticultural groups and developers a resource for green space creation and restoration. Developing a diverse array of species will help protect vegetation from invasive species that may migrate to the area as temperatures escalate.

SUMMARY REVIEW

ACAP’s review of the rest of the Central Peninsula Neighbourhood Plan (excluding the City Green Section, detailed above) has been summarized into a list of aspects of the plan that will encourage resiliency and highlights areas of the plan that could be improved upon (Table 6).

Table 6: Summary review of the Central Peninsula Neighbourhood Plan (excluding City Green Section) (City of Saint John, 2018).

Central Peninsula Neighbourhood Plan (DRAFT)	
Pros	Cons
<ul style="list-style-type: none"> ● Goals for more walkable, pedestrian friendly streets (Guiding Principle #3) ● Improve sustainability of the Peninsula by promoting active transportation, green design, and support for environmental projects and educational opportunities (Guiding Principle #6) ● Naturalize the southern portion of the Lantic Sugar Site (Big Move #3) ● Develop the Barrack Green Armoury as a naturalized open space (Big Move #3) ● Establish Marsh Creek as a recreational amenity (Big Move #4) ● Promote sustainability through high-performance and low-impact materials that integrate well with the historic building materials of the Central Peninsula (Building Design Objective E) ● Promote community-stewarded open spaces for use as community gardens and for urban agriculture (CV.9) ● Connect harbour passage around the peninsula to Rockwood Park (CC.5) ● Area should maintain existing forest cover as much as possible, or should be replanted (Urban Design, Section 3.4) ● Landscape buffers between residential and commercial buildings (Urban Design Section, 3.4) ● Alternatives for pavement recommended (permeable pavement, pavers, etc.) (Urban Design, Sections 3.4, 3.6) 	<ul style="list-style-type: none"> ● Lantic Sugar (Big Move #3): <ul style="list-style-type: none"> ○ Paving site for concerts ○ Development of a commercial building would need to take sea level rise into consideration ○ No considerations for stormwater management on-site ● Long Wharf (Big Move #5): <ul style="list-style-type: none"> ○ Mixed/residential development in an area at risk of storm surge impacts and sea level rise ● No suggestions for low-impact development ● Does not make specification for native trees ● No design guidelines for green roofs (Section 3.2.3). How will these be encouraged? The City of Toronto has developed a Green Roof Construction Standard Supplementary Guidelines to act as a guideline for developers that wish to install a green roof. The guidelines are developed to comply with the Ontario Building Code. This standard is similar to a Leadership in Energy and Environmental Design (LEED) standards for reducing the heat island effect (Canada Green Building Council, 2014). ● No design guidelines for rain gardens (Section CG.4). How will these be encouraged?

PILOT PROJECT

Plan SJ has identified the city's many waterfronts as a priority in shaping future development with a desire to improve access. Creating better linkages between citizens and the city's natural ecosystems is also a priority for the city. This iteration of the city's municipal plan (the last being from the 1970s) has come after the city had lost over 25% of its population since the publication of its previous plan. Suburban sprawl and a severe decline in manufacturing such as the closure of the Lantic Sugar refinery has left the city with swaths derelict properties, and for a small city of about 70,000 residents it has proven to be difficult issue to manage. Yet, the success of rejuvenating these areas will be part and parcel with the success rebuilding the city itself.

"[Saint John will] strengthen its waterfronts - the rivers, Bay of Fundy, and lakes – ecologically through preservation, publicly by creating and maintaining access for all, and economically by promoting waterfront development in appropriate locations" (City of Saint John, 2011).

As part of the Draft Central Peninsula Neighbourhood Plan, the Lantic Sugar site was identified as a potential redevelopment area to create a new recreational and entertainment space. The City identified ACAP Saint John as a key partner in naturalizing this area to help create a new destination on the waterfront (City of Saint John, 2018). The former Lantic Sugar Refinery site is one of Saint John's many brownfield sites that has drawn attention in recent years for its possible uses such as parks and residential or commercial developments. The sugar refinery operated at the site at 330 Charlotte Street from 1915 to 2000, with all structures demolished in 2004. An environmental site assessment commissioned by the Province of New Brunswick and conducted by Stantec Inc. (2007) revealed the Lantic site is not suitable for residential use based on contaminants in the soil. The site itself is reclaimed lands filled largely by debris from the Great Saint John Fire of 1877. Test pits and wells showed contaminants on the site include hydrocarbons, lead, benzene, arsenic, nickel and more. For structures to be built they are required to be slab on grade with a minimum slab thickness of 300 mm, and an addition of a 1 ½ meter layer of clean soil would be required to contain contaminants.

ACAP Saint John will conduct a brownfield pilot project on a portion of this Site to determine the feasibility of the redevelopment of the former Lantic Sugar refinery site and other brownfield sites in the area. The addition of a layer of clean soil and hydroseed over the Lantic Site will cap the contaminants and allow the site to be used as a continuation of the Tin Can Beach recreational space. Native trees and shrubs will be planted on the site that will bioremediate the soil and improve the aesthetic appeal of the area. The property adjacent to the project site, Tin Can Beach, has seen an increase in popularity in recent years as efforts by groups such as ACAP Saint John and the City of Saint John have invested time and labour in small beautification projects such as repaving the end of Sydney Street, tree planting, and the placement of amenities such as picnic tables, trash cans, and public art installations. The continuation of this work onto the Lantic Sugar property will be a positive step toward creating a safe and inviting space for recreation and access to the waterfront.

As an initial step to creating a recreational hub for this area, ACAP is proposing developing a shipping container interpretative centre at Tin Can Beach with interpretive signage, a small lab for educational purposes and scopes for seal spotting which locals and tourists can visit (Figure 8). Visitors will be organized

for “biologist for-a-day” outings. ACAP biologists will talk on subjects including fish ecology, harbour seal biology, marine mammals, cartilaginous fishes, industrial and municipal effluents, environmental effects monitoring, baseline monitoring, climate change, ocean acidification, the crucial role of tidal wetlands, and microplastics in the environment. The guide[s] will sample for fish, identify and explain their life history and ecological roles. Life history of fishes observed, ecology of fish in the marine and estuarine food web, fish habitat, species at risk, invasive species, sustainable fisheries, socio-economics of fisheries in the Maritimes, bioaccumulation of contaminants, and climate change effects will be discussed.

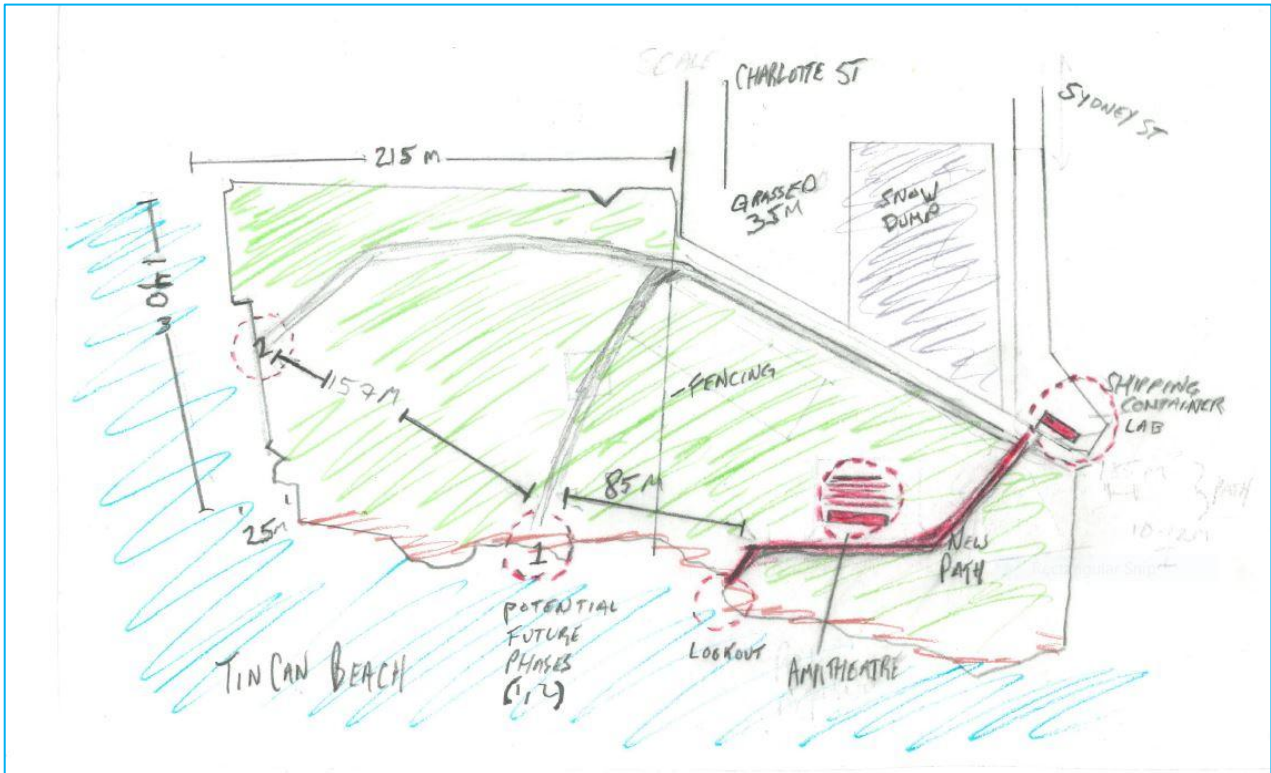


Figure 8: Proposed Tin Can Beach Restoration Site Plan

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