

The background of the cover is a photograph of a harbor scene. In the foreground, a wooden walkway with a railing runs along a rocky shoreline. The water is calm, reflecting the sky and the boats. Several sailboats are docked in the harbor, and a houseboat with a yellow and red exterior is prominent in the middle ground. In the background, more boats and buildings are visible under a clear blue sky. Large green trees are on the left side of the image.

Township of  
**ESQUIMALT**

# Adaptation Planning Guide

2020

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## Acknowledgements

The Adaptation Planning Guide was an initiative of the Development Services Department of the Township of Esquimalt, led by Tricia deMacedo (Policy Planner) with oversight by Bill Brown (Director of Development Services). ICLEI Canada provided ongoing support as part of their *Together for Climate Project* along with seven other local governments on Vancouver Island. Representatives from these local governments shared experiences and suggestions throughout the process.

Other Township of Esquimalt staff that participated in the project included:

- Laurie Hurst, Chief Administrative Officer
- Rick Daykin, Parks Manager
- Stephen Rennick, Engineering Manager
- Sara Jansen, Emergency Program Coordinator
- Karen Hay, Planner
- Janany Nagulan, Planner

In addition, the Adaptation Planning Guide benefitted from the input of community representatives and stakeholders including:

Adam Nicolson, Victoria Shipyards	Kaye Melliship, Greater Victoria Housing Society
Bill Johnston, Island Health	Kiki Fox, Esquimalt Chamber of Commerce
Carole Witter, Westbay Resident's Association	Laura Schlotterbeck, Public Services and Procurement Canada
Chris Edley, Esquimalt Chamber of Commerce	Louise Blight, BC Government, Ministry of Environment and Climate Change
David Lee, CFB Esquimalt	Mary Lynn McKenna, Esquimalt Neighbourhood House Society and Legion Senior's Group
Diana Studer, Resident	Melissa Piasta, Public Services and Procurement Canada
Dominique Sigg, BC Government, Climate Action Secretariat	Michelle Colussi, Legacy Housing Land Trust Society
Duncan Cavens, C2MP/Advisory Planning Commission	Paul Helston, Esquimalt Environmental Advisory Committee
Eleanor Calder, Esquimalt Neighbourhood House, Resident	Shayla Brown, PSPC - Esquimalt Graving Dock
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Erin Cassels, Huntingdon Manor	Stefanie Bendall, Public Services and Procurement Canada
Greg Kitchen, School District 61	Suzanne Sadler, Sunset Lodge
Jade Yehia, Island Health	Wendy Tyrell, Habitat Acquisition Trust

The Township also recognizes and appreciates the assistance of ICLEI Canada staff that were involved with the project including:

- Craig Brown, Manager BC Office
- Hana Lapp, Climate Change Program Manager
- Jennifer Lotz, Climate Change Project Assistant
- Summer Goulden, Climate Change Project Officer and BC Lead

### **Land Acknowledgement**

The Township of Esquimalt acknowledges and respects the Lekwungen-speaking Peoples within whose traditional territories we live, work, and play and the Songhees and Esquimalt First Nations whose historical relationships with the land continue to this day.

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ICLEI Canada acknowledges that the *Together for Climate* project is made possible with funding from the Real Estate Foundation of British Columbia.



## Executive Summary

Despite the best efforts of governments, businesses, and individuals to reduce carbon emissions, it is now acknowledged that we are experiencing, and will continue to experience, the effects of a changing climate. The climate trends in Canada depict a steady rise in both seasonal and annual temperatures, altered precipitation patterns, and an increase in the frequency, intensity, and duration of extreme weather. For British Columbia (BC) these changes generally mean hotter, drier summers, more frequent and intense heat waves, more frequent and intense rainfall events, increased wind and storms, and sea level rise.

Preparing ourselves and our communities for these coming changes is prudent from not only a financial perspective (avoiding the potential, much greater costs of dealing with disaster scenarios), but also for social and environmental reasons. This proactive approach to planning for the inevitable is not 'giving up' to climate change, but is a rational, measured, and responsible approach to take so that our children and grandchildren are not faced with insurmountable health, social, financial, and environmental burdens.

The Township recognizes that a changing climate threatens not only Esquimalt operations, infrastructure, and facilities but also residents' assets, health, and social wellbeing as well as the natural ecosystems that we cherish and depend on. For this reason, the Township enthusiastically joined ICLEI Canada's *Together for Climate* project, whereby ICLEI Canada assisted eight Vancouver Island communities in developing climate adaptation plans and strategies.

The Township invited stakeholders and residents with specific expertise and interest to join in the development of this plan. The actions included in this guide have come directly from the work of this group and Township and ICLEI staff. The working group met a total of four times to brainstorm the most important risks to the municipality, to identify where we are vulnerable to those risks, and to brainstorm what actions could help us address those risks. The final product is a set of six objectives, 19 strategies, and 40 actions that will help the municipality work towards becoming more resilient and prepared for a changing climate.

Each of the 40 actions are associated with their respective objective and span a number of different adaptation approaches, including education, changes in policy, infrastructure construction, protecting natural areas, and embedding climate change into planning and corporate culture.

This Adaptation Planning Guide gives the Township and its residents a framework for preparing for the impacts of climate change. Residents of Esquimalt will be given an opportunity to provide feedback on the actions in this guide as part of the Climate Action Plan (CAP) process that will be initiated this fall (2020). The CAP will guide us to realizing our targets for greenhouse gas (GHG) reduction and ensure that the climate actions that are most important to prepare our community for the impacts of climate change will be addressed. At the same time, Esquimalt can take advantage of the co-benefits associated with taking climate action such as reducing air pollution, creating social connectedness, reduced energy costs, healthy ecosystems, and sustainable development practices to becoming a 100% renewable and a more resilient community.

## Our Vision

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*The people of Esquimalt will come together and use their unique strengths and advantages to adapt to a changing climate while also seeking opportunities to co-create a healthy, diverse, and resilient community.*

---



## 1.0 Introduction

The world's climate is changing. The two hottest years on record for the planet occurred in 2018 and 2019. In fact, the 20 warmest years on record have all occurred within the past 22 years.<sup>1</sup> Canada is experiencing a rate of warming that is almost double the global average reported over the same period.<sup>2</sup> The primary cause of this warming is human activities (e.g., burning fossil fuels and changes in land-use) releasing greenhouse gases (GHG) into the atmosphere, with carbon dioxide (CO<sub>2</sub>) being one of the most significant GHGs. Despite global efforts to slow the rate of GHG release, CO<sub>2</sub> that has already been released to the atmosphere has 'locked-in' some climate change that cannot be reversed.<sup>3</sup>

Local governments have been at the forefront of planning for climate change around the world. Municipalities provide many services that already are, and will continue to be, affected by climate change, such as infrastructure, transportation, recreation programs and facilities, housing, and more. Local governments are also uniquely situated to respond to affected services at the community level. Preparing for extreme weather events, rising sea levels, community health concerns and other impacts allows local governments to reduce risk to their budgets while also improving the health and wellbeing of local residents. It also allows communities to take advantage of the unique opportunities that may arise that can foster a greener, resilient, and equitable society.

Esquimalt, like all communities, is already experiencing the effects of a warming climate. In the last few years, we have experienced hotter, drier summers causing drought, which has led to die-back of some native trees (e.g., western red-cedar). Drought also increases the likelihood of wildfires; in 2017 and 2018, wildfire smoke drifted in from other parts of BC and Washington State, causing poor air quality, forcing summer camps indoors, and affecting outdoor worksites. Heavy rain at the end of January 2020 caused sewage overflows and flooded basements. Low-lying areas in Esquimalt are also susceptible to the impacts of coastal storm flooding and sea level rise, with the most impacted areas being along the Gorge Waterway, West Bay, and on Department of National Defense (DND) lands in Esquimalt Harbour.<sup>4</sup>



Heavy rain has caused unstable ground and overflow in parts of the CRDD. (Black Press Media file photo)

### Heavy rain causes overflow and unstable ground for areas of Greater Victoria

CRD asks the public to avoid affected areas until further information is released

Photo: Wildfire smoke in Victoria Harbour, 2018



*"My building is contemplating air conditioning. We face the ocean and get great sea breezes, but with the smoke inundation of 2017 and 2018 combined with increasingly tropical summer nights, we're starting to consider alternatives to living through indoor temperatures in excess of 30°C and poor air quality."*

*~ William, Climate Ready: Preparing Together Website*

*"Increasingly, even on Vancouver Island, we've seen and been affected by smoke from extreme wildfires from the mainland, increasing episodes of aridity, polar vortex (notable in years when the Arctic sea ice is very low, like 2012 and this year) weather, atypical snowfall, changes in insects, changes in blooming of flowers, atypical frost events. While any one of these events might be natural, their clustering and frequencies is almost enough a person could notice it without checking written records, and not be wrong. We've had several seasons*

*of water shortage over the last few years, too.”*  
~ Rob, Climate Ready: Preparing Together Website

## 1.1 Together for Climate Project

Climate change impacts affect the Township's ability to provide core services and support its citizens, while also posing substantial risks to residents in the community. Thus, when ICLEI Canada approached the Township in early 2018 about a partnership that would assist Esquimalt to develop its own Adaptation Plan, Council enthusiastically endorsed the *Together for Climate* project. This two-year initiative engaged



eight communities across Vancouver Island to help them each develop an individualized climate adaptation strategy through the engagement of local stakeholders and following ICLEI Canada's successful Building Adaptive and Resilient Communities (BARC) program. This document, the Esquimalt Adaptation Planning Guide, is the end result of this project.

## 2.0 What is Adaptation?

Even if global efforts to halve all GHG emissions by 2030, as recommended by the International Panel on Climate Change (IPCC), are successful, the planet will still continue to experience warming of its surface and the climatic changes that are associated with that warming.<sup>5</sup> Therefore, while we must pursue efforts to slow the impacts of climate change through reduced GHG emissions, we must also prepare our communities for the inevitable changes that will occur regardless of mitigative efforts. Climate mitigation and climate adaptation are thus both necessary for holistic climate action (see Figure 1).

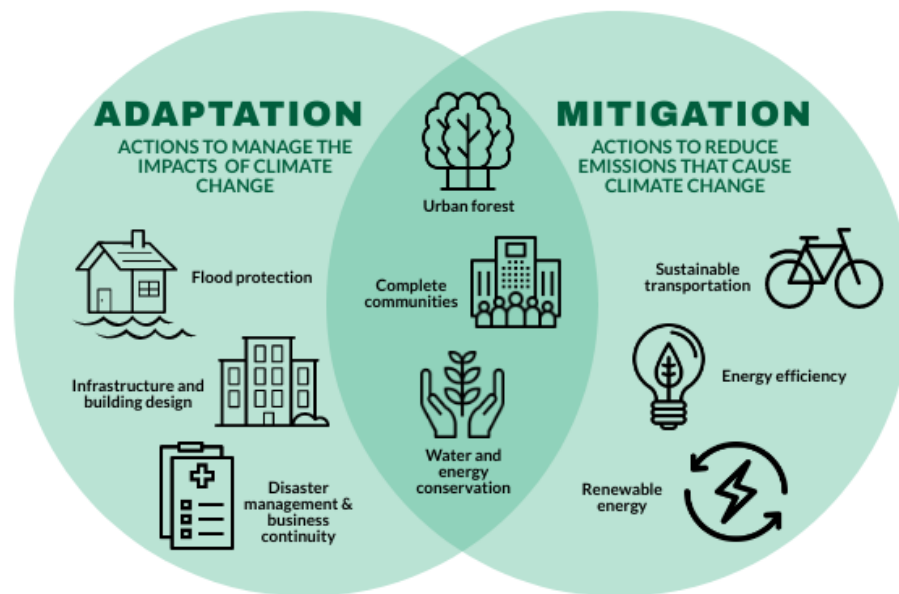
Climate mitigation strategies include actions such as clean air bylaws, building retrofits to conserve energy, economic approaches and instruments (e.g., price incentive to cut emissions), and transitioning to low-carbon energy sources. Climate adaptation on the other hand is about minimizing the inevitable impacts of climate change on natural and human systems. In the municipal context, adaptation efforts may focus on changing individual behaviour, updating municipal bylaws and policies, bolstering the capacity of physical infrastructure, and enhancing the multiple benefits of ecosystem services by enhancing the preservation of biodiversity and local ecosystems.

An example of a climate mitigation strategy in British Columbia is the electrification of heating systems; hydroelectricity is produced and consumed with very low GHG emissions and is considered a renewable resource. Electrifying heating is estimated to reduce GHG emissions from residential and commercial buildings by 98% in BC.<sup>6</sup> For this reason, the province has set a target of 160,000 new residential heat pumps for space heating instead of natural gas furnaces. A co-benefit of homeowners switching to a heat pump for heating is that they can also be used for cooling, thereby adapting the home for the higher summer temperatures we are already experiencing. Thus, the installation of electric heat pumps serves as both a climate

mitigation and a climate adaptation measure. Careful planning is required to ensure that adaptation and mitigation strategies work together and do not undermine each other. The approach of developing and prioritizing strategies which support both climate mitigation and climate adaption is called 'Low Carbon Resilience' (LCR). This is the approach that the Township of Esquimalt is taking through the development of our CAP. The CAP, when completed in late 2020, will incorporate the strategies developed through this Adaptation Planning Guide into a plan that uses an LCR approach to climate action.

**ADAPTATION = managing the unavoidable**

**MITIGATION = avoiding the unmanageable**



*Figure 1. Adaptation and Mitigation graphic, ICLEI Canada, 2019*

### 3.0 Policy Context

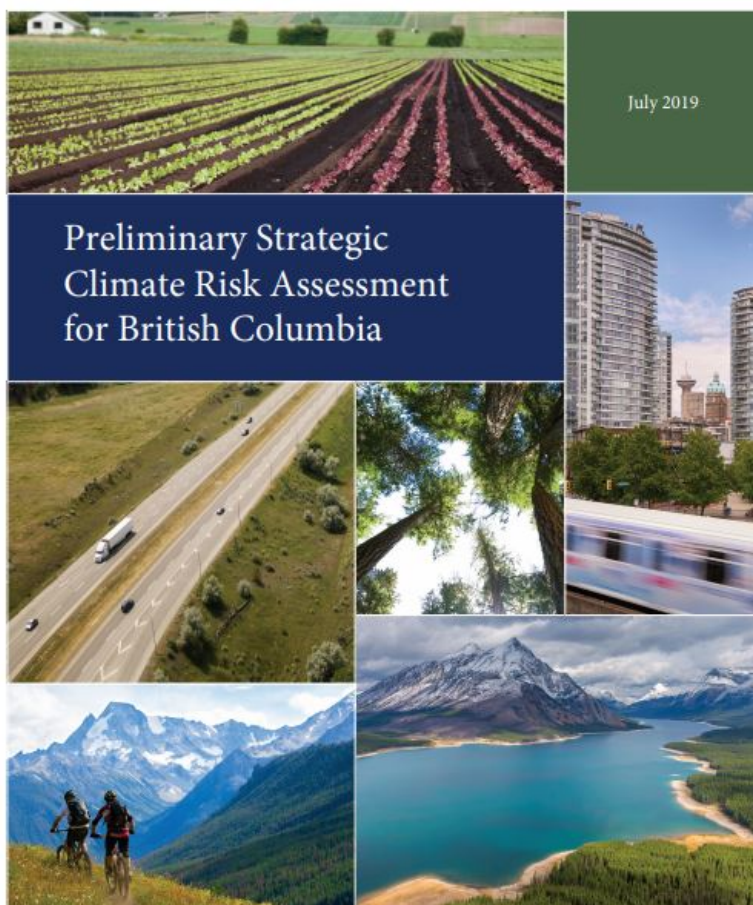
The federal government acts as the overarching voice on climate leadership in Canada and a strong commitment to climate action at this level supports climate leadership at the provincial and local levels of government.

Canada was one of 195 countries to sign the Paris Agreement in December 2015. The Agreement aims to keep the global temperature to well below 2.0 degrees Celsius, and to drive efforts to limit the temperature increase even further to 1.5 degrees Celsius above pre-industrial levels. In terms of adaptation, the Agreement seeks to enhance local adaptive capacity and

resilience while reducing vulnerability to global climate change in ways that align with a country's own national objectives.<sup>7,8</sup>

The Government of Canada has also produced several policy documents that support and guide the country's position on climate change adaptation. For example, in 2016 the Government of Canada released its Pan Canadian Framework on Clean Growth and Climate Change, which includes adaptation considerations and actions to improve climate resiliency.<sup>9</sup> Major focus areas include building climate resilience through infrastructure, protecting and improving human health and wellbeing, and reducing climate-related hazards and disaster risks. The framework recognizes the important role that Canadian municipalities will play in implementing climate solutions locally.

In 2019, the Province of British Columbia (BC) completed a Preliminary Strategic Climate Risk Assessment for BC as a first step to understanding climate-related risks in BC and to help develop appropriate measures to address those risks.<sup>10</sup> The assessment is being used to inform a provincial climate preparedness and adaptation strategy to help protect people, communities, and businesses from the impacts of climate change (set to be released in late 2020).



### KEY FINDINGS OF THE PROVINCIAL ASSESSMENT

- The greatest risks to BC are severe wildfire season, seasonal water shortage, heat wave, ocean acidification, glacier loss, and long-term water shortage.
- Other risks that have the potential to result in significant consequences include severe river flooding and severe coastal storm surge, although these events are less likely to occur.
- Nearly all risk event scenarios (except moderate flooding and extreme precipitation and landslide) would have major province-wide consequences in at least one category.





## CORPORATION OF THE TOWNSHIP OF ESQUIMALT

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### CERTIFIED RESOLUTION

#### **Township of Esquimalt: Declaration of Climate Emergency**

*“**WHEREAS** the Township of Esquimalt strives to be a green community and recognizes the great importance of our responsibility in caring for our planet's environment as well as our role in taking all necessary local and regional actions related to ensuring the well-being of our planet; and*

***WHEREAS** the Township of Esquimalt further recognizes the importance of our relationships within the region in working together with our neighbours in recognizing, responding to and rectifying the harms to our planet as a result of human caused global warming and climate change;*

**THEREFORE BE IT RESOLVED:**

1. **THAT** the Township of Esquimalt declare a Climate Emergency;
2. **THAT** the Township of Esquimalt collaborate with the Capital Regional District and other local governments to work towards achieving carbon neutrality within the region by 2030;
3. **THAT** the Mayor write a letter of response to the Capital Regional District that the Township has declared a climate emergency and commits to working jointly within the region towards carbon neutrality by 2030, and encourages the CRD to move quickly to identify and implement measures to reduce GHG emissions;
4. **THAT** the Capital Regional District provide the Township of Esquimalt with detailed information regarding specific actions and resources required to make the Capital Regional District's 2030 target possible, including the action and resources required to reach the targets of member communities;

5. **THAT** the Mayor write to the Provincial Minister of the Environment, assert the Township's support to help the Province close the 25% emissions gap in the CleanBC Plan, and call on the Province to provide the powers and resources to Local Governments to make the 2030 target possible;

6. **THAT** the Mayor write to the Federal Minister of the Environment, assert the Township's support to help Canada meet its Nationally Determined Contribution target made in the Paris Agreement and call on the federal government to provide the powers and resources to Local Governments to make the 2030 target possible;

7. **THAT** the Township request pro-bono assistance from West Coast Environmental Law in determining how the Township can accurately track the costs of climate change being incurred by our community; and

8. **THAT** the Township move as quickly as possible to create and implement a climate action plan and climate adaptation plan as per the draft 2019 – 2023 Strategic Plan”.

Certified correct:

A handwritten signature in black ink, appearing to read 'RDumas', with a stylized, cursive script.

Rachel Dumas  
Deputy Corporate Officer  
The Township of Esquimalt  
April 12<sup>th</sup>, 2019

Esquimalt is a signatory to the BC Climate Action Charter and as such is committed to becoming a carbon neutral community. The Township is also a member of the Partners for Climate Protection (PCP) and is working towards completion of the five milestones in the Federation of Canadian Municipalities (FCM) Partners for Climate Protection process.

In 2019, the Township of Esquimalt passed two resolutions; one to declare a climate emergency and one to endorse the target of becoming a 100% renewable community. A Climate Emergency Response Report has been developed and was presented to Council in early 2020. The development of a CAP with both mitigation and adaption strategies for the corporation itself and the community at large is the ultimate goal of the climate action planning process. The Township has been concurrently working on this *Together for Climate* adaptation guide and a mitigation strategy and both of these plans will be incorporated into the final CAP (see Figure 2).



Figure 2. Township of Esquimalt Climate Action Planning Process.

## 4.0 Climate Science

Human activities are having a direct impact on the Earth's climate.<sup>11</sup> The two main ways that these activities are affecting the Earth's climate are through changes in land-use (e.g., deforestation) and the combustion of fossil fuels.<sup>12</sup> Burning fossil fuels such as natural gas, oil, gasoline and coal produces carbon dioxide (CO<sub>2</sub>). Combined with other GHGs, such as methane from landfills, these gases are released into the atmosphere where they build up over time and function like a blanket, trapping heat.<sup>13</sup> This "blanket effect" is causing the planet's atmosphere to warm, which disrupts the stability of the climate system (see Figure 3).

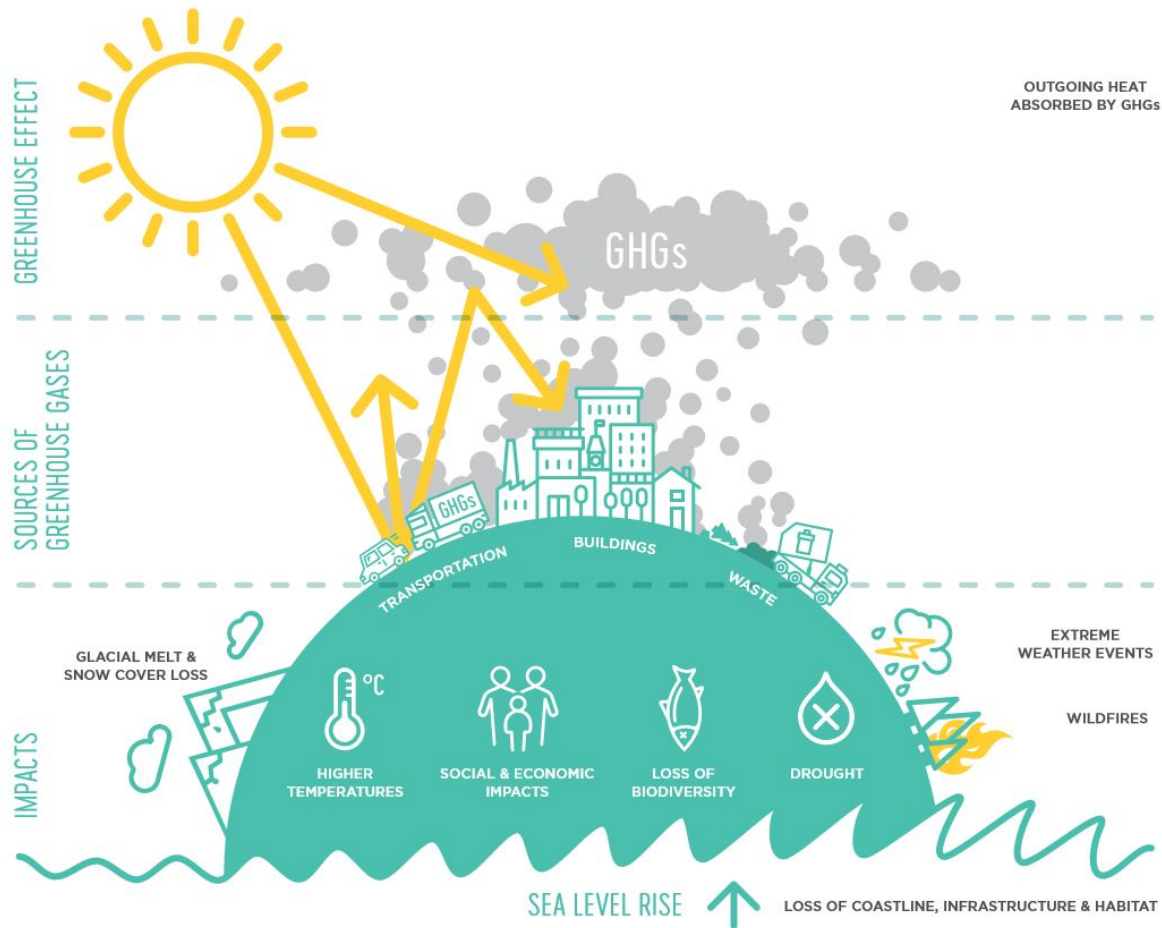


Figure 3. Image representing the sources, mechanisms, and impacts of climate change. Image retrieved with permission from the City of Victoria's Climate Leadership Plan (2018).<sup>14</sup>

## 5.0 Climate Projections for Esquimalt

Recent climatic events in and around Esquimalt are consistent with global climate predictions and trends. Local climate projections for Esquimalt are outlined below (Figures 4 and 5). A more detailed summary of these projections is included in Appendix A.

### 5.1 Temperature

By the 2050s, summer temperatures in Esquimalt are projected to be on average 3.3°C warmer and winter temperatures 2.4°C warmer, with an average increase in mean temperature of 2.7°C year-round. Projections also show an increase in the number of growing degree days and frost-free periods, which are both related to warming of the atmosphere. By the 2080s, the frost-free period is expected to be 50 days longer than it is presently, which has significant implications for natural ecosystems as well as the spread of invasive species and agricultural pests.<sup>15,16</sup>

Extreme temperatures are also anticipated to increase; extremely hot days (exceeding 30°C) are projected to occur over four times as often by the 2050s and eleven times as often by the 2080s. Cooling demands for buildings can be expected to increase significantly. Warmer temperatures have human health implications as well; additional consideration will need to be given to reducing the risk of heat-related illness among all populations.<sup>15</sup>

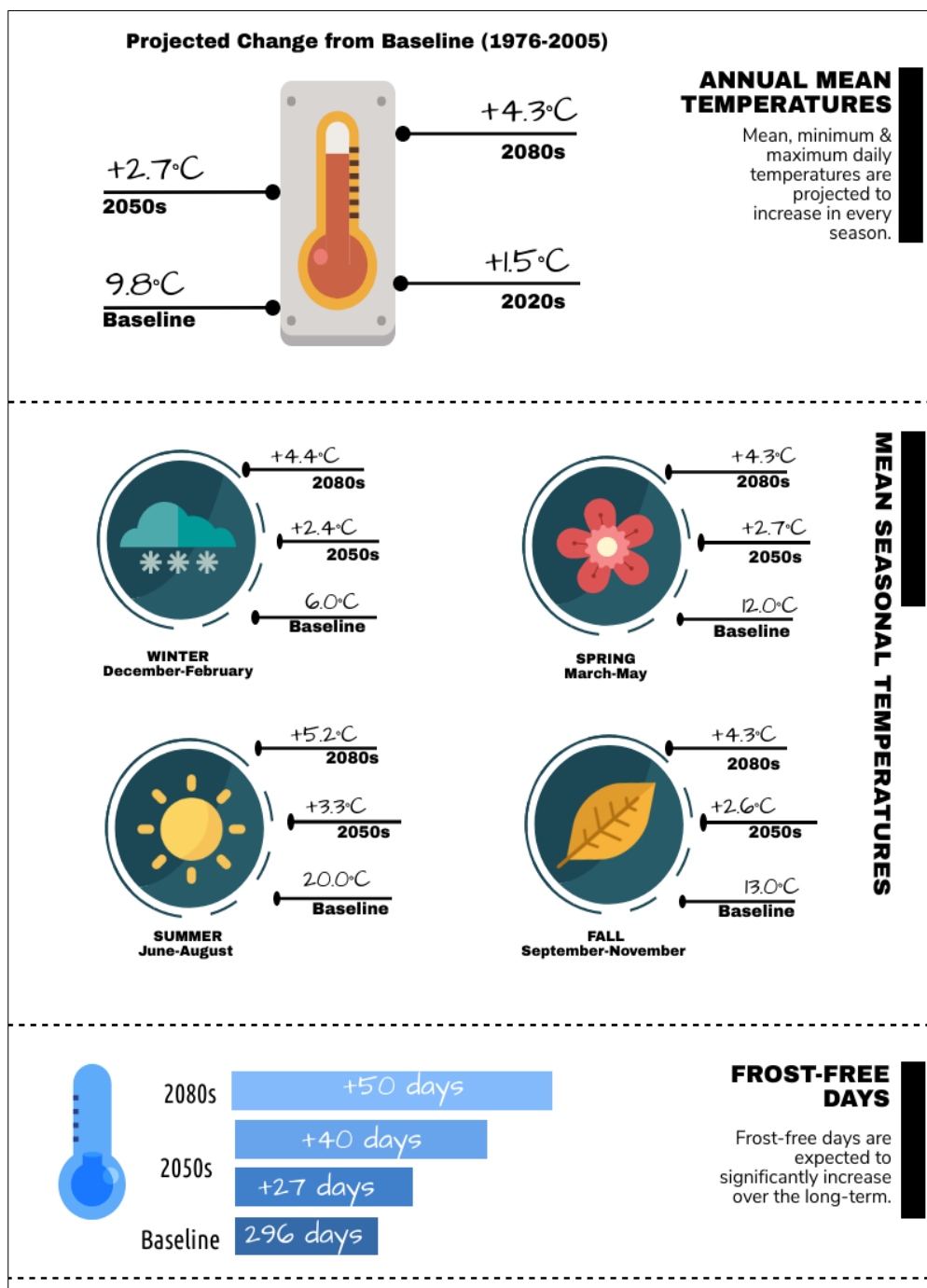


Figure 4. Temperature projections for Esquimalt.

## 5.2 Precipitation

The Capital Region is known for its 'Mediterranean-like' climate, with most of the rainfall occurring during the winter months. This will continue to be the case, but the difference will become more pronounced in the future. Summer months will experience about 18% less rain by the 2050s, and 26% less rain by the 2080s, resulting in longer periods of drought throughout the summer months. Although seasonal drought is a natural part of the climate in the Capital Region, the dry conditions will extend beyond historical norms for the region.<sup>15,16</sup>

Annual precipitation, however, is projected to increase with the majority of the precipitation occurring during winter, spring, and fall (particularly October through December). By the 2080s, the CRD can expect to see an additional 12% rainfall annually on average during these periods (21% in the fall).<sup>15,16</sup>

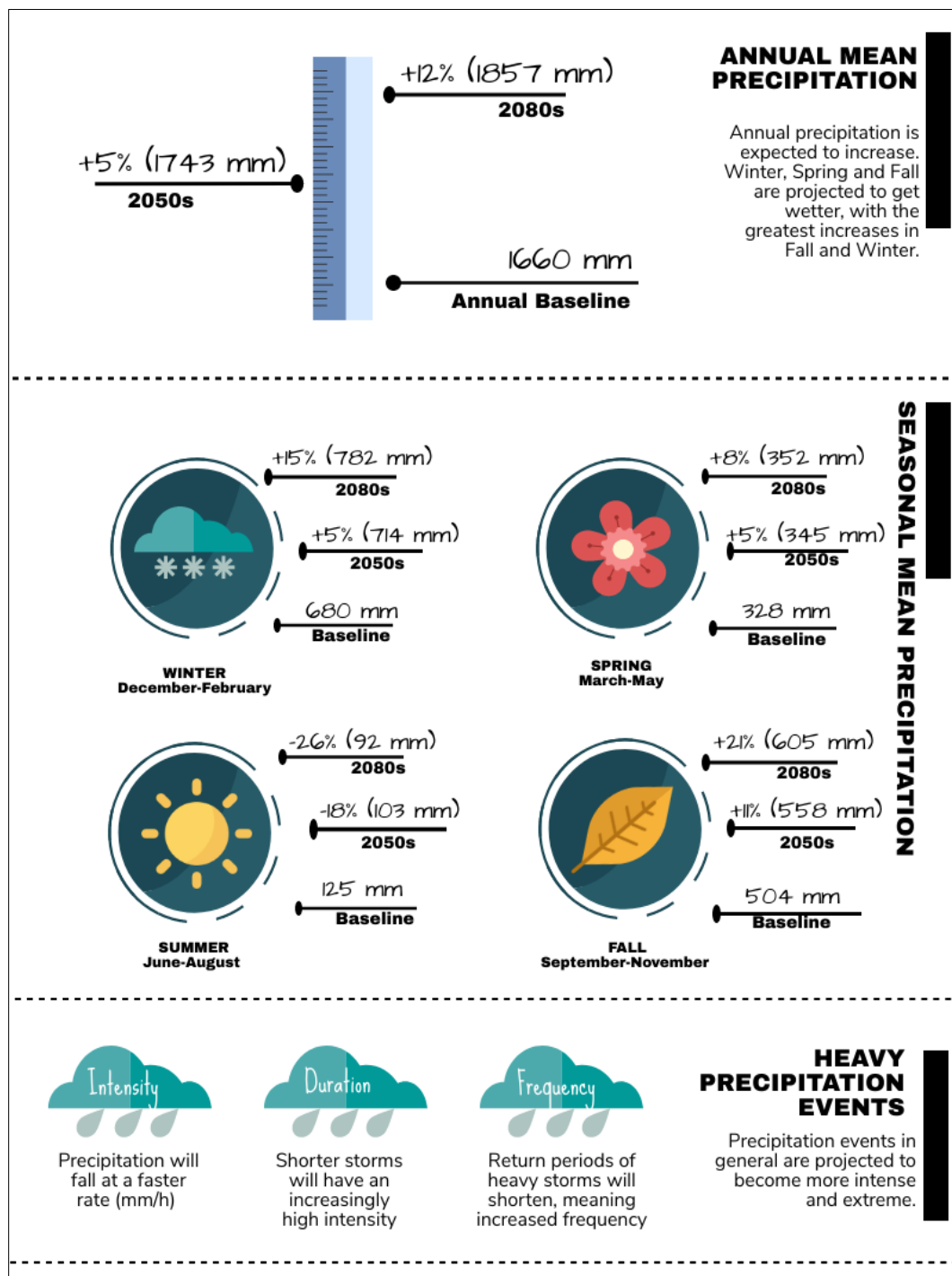


Figure 5. Precipitation projections for Esquimalt

The wettest days indicators measure the total rainfall on days that exceed the historic 95th and 99th percentile for precipitation. The wettest day of the year will see an average of 20% more rain by the 2050s, and 35% more rain by the 2080s.<sup>15</sup>

### 5.3 Sea Level Rise and Sea Temperature

Sea level rise (SLR) is another direct effect of climate change. Sea levels are rising due to thermal expansion of seawater combined with melting glaciers and sea ice. The average global rate of sea level rise between 2005-2015 was approximately 3.5 mm per year, however a recently released report by the IPCC concluded that SLR will accelerate substantially with climate change in coming decades.<sup>17</sup> The BC Ministry of Environment has recommended planning for a rate of 10 mm per year of SLR which translates to approximately 1m of SLR by 2100.<sup>18</sup> The Capital Regional District (CRD) has recently undertaken a study to better understand the combined effects of SLR with storm surge and wave effects during storms. This study is crucial to planning for SLR in Esquimalt and projects a local relative SLR rate of 8.8 mm per year.<sup>4</sup> Fortunately, much of the municipality is well above the 1 m contour, however some vulnerability to SLR does exist, particularly in areas such as Esquimalt Gorge Park, West Bay and DND lands in Esquimalt Harbour.<sup>4</sup> Local projections are summarized in Figure 6 below.

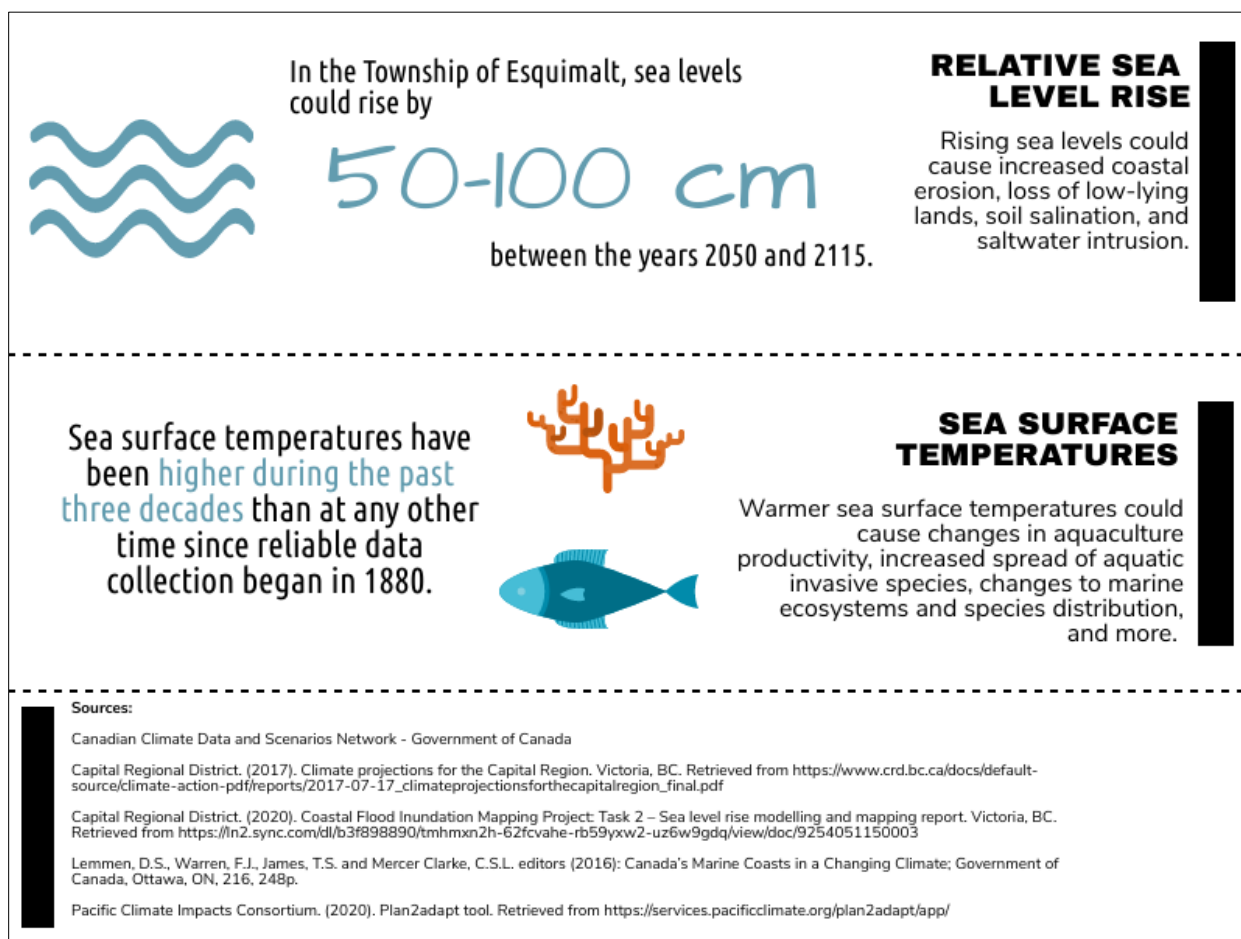


Figure 6. Relative sea level rise and sea surface temperature projections for Esquimalt area.<sup>4</sup>

## 6.0 The Planning Process

Following approval by Council, staff members from Development Services met with ICLEI Canada in the spring of 2018. The Township, through the Together for Climate Project, followed the first three steps of ICLEI Canada's five-milestone approach to climate change adaptation: Initiate, Research, Plan, Implement and Monitor (see Figure 7). This is a comprehensive planning methodology that guides municipalities through the process of researching and assessing climate impacts, action-setting, implementation planning, and monitoring and review strategies. For Esquimalt, the outcome of working through Milestones 1–3 has been the development of this Adaptation Planning Guide that identifies key strategy areas and a suite of actions to address the priority risks.



*Figure 7. ICLEI Canada's Building Adaptive and Resilient Communities Framework*



*Photo: Dellwood Road water access during high tide Nov 2011. Photo credit: Tina Neale.*

## 6.1 Milestone One: Initiate

Within this milestone, communities identify stakeholders to review and understand existing knowledge on how the regional climate is changing, followed by a brainstorming exercise to identify potential climate change impacts.

A crucial aspect of the planning process was the identification of internal and external partners to form the adaptation team. Esquimalt was fortunate to have the participation of stakeholders from the community including staff from the Department of National Defense, BC's Climate Action Secretariat, Island Health as well as residents, local social and environmental organizations, business, and industry that worked alongside Township staff to develop the report's recommendations. These stakeholders formed an ad-hoc working group, that participated in the workshops throughout the process. This multi-stakeholder engagement approach allows for climate impacts, risk and vulnerability, and solutions to be articulated and developed from the people most impacted by climate change and it allows for local knowledge to inform the outcomes.



*Photo: Stakeholder group for the Township of Esquimalt's climate adaptation planning.*

## 6.2 Milestone Two: Research

The second milestone is meant to further develop a community's understanding of climate change impacts and the major service areas which are likely to feel these impacts most acutely. Within this milestone, a municipality will scope the climate change impacts for the region and conduct both a vulnerability and risk assessment.

### Impact Identification

Climate change is expected to have impacts on a wide-range of sectors in and around Esquimalt, including healthcare, stormwater management, water supply, transportation, agriculture, and fisheries.<sup>15,16</sup> Within the Township of Esquimalt, climate impacts are expected to affect municipal service delivery across all departments and services.

In October 2018, ICLEI Canada facilitated a workshop to capture specific impacts of climate change in Esquimalt and to introduce participants to the Together for Climate project, climate adaptation planning strategies, and climate projections for the Township. Participants explored the regional climate projections in terms of identifying the impacts of climate change on built, natural, and socioeconomic systems. From here, participants began drafting climate impact statements intended to reflect the climate projections.

Impact statements consider projected climatic threats and their effects on built, natural, and human/social systems. During the workshop, participants were divided into groups and asked to devise impact statements for each system, thinking about the specific changes Esquimalt may experience. The group identified 45 impacts. The identified impacts were then used to inform the vulnerability and risk assessment in the next step of the planning process, where the impacts were further refined and prioritized.

### Vulnerability Assessment

A vulnerability assessment was conducted for each impact statement to determine the areas in which the Township should focus its efforts. A vulnerability assessment determines how susceptible we are to a changing climate (e.g., heatwaves, extreme weather, sea level rise) and how prepared we are for those changes. For example, urban trees may be affected by longer periods of summer drought, but if most urban tree species are not sensitive to these changing conditions, and there is a plan in place to affordably replace those species that are (with drought-tolerant native species), then the vulnerability is low. Conversely, if most city trees are sensitive to prolonged summer drought conditions and there is not a feasible plan in place to replace those trees, then the vulnerability is high. Vulnerability is thus a function of both sensitivity and adaptive capacity. As a result of the vulnerability assessment, 14 low-

#### Impact statements are intended to capture:

- A climatic threat/change (e.g., rising temperatures)
- The outcome of the climatic change (e.g., extreme heat event)
- The consequences associated with this outcome (e.g., heat stress)

---

**Sensitivity** is the degree to which a system is affected by climatic conditions (e.g., temperature increases) or a specific climatic change impact (e.g., increased flooding).

**Adaptive capacity** is the ability of built, natural, and social systems to adjust to climate change, to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

vulnerability impacts were removed, and similar impacts were combined to create an updated list of 26 *impact statements* to move forward to the risk assessment process.



*Photos: Climate Adaptation Working Group during ICLEI Canada's Together for Climate workshops. Workshop participants were guided through various workshops to identify impacts, assess vulnerability, and risk, and identify actions to mitigate prioritized risks.*



### **Risk Assessment: Top Climate Risks to Esquimalt**

The next step in the process was to analyze the risk associated with each of the 26 impact statements and prioritize which of these required an action plan. Risk is a function of likelihood and consequence. The project team determined a likelihood score for each impact statement and a second workshop was held in February 2019 with local stakeholders to complete the risk assessment process. The focus of this working session was to assign consequence scores for each social, economic, and environmental factor (see sidebar) to determine the overall risk score for each impact statement. The risk score (from low to extreme) assigned to each impact was later used to help prioritize adaptation strategies.

None of the impacts were calculated to be 'very high' or 'extreme' risk. Climate impacts that were assigned a low risk rating were removed and the remaining 13 impacts were brought forward to be addressed in the strategy development phase. Given that some actions may require little effort or could have valuable ancillary benefits, impacts with a medium-low or medium risk rating were included in the strategy development phase. The most significant climate risks to Esquimalt are summarized below (Table 1).

#### **SOCIAL**

Public Health & Safety  
Displacement  
Loss of Livelihood  
Cultural Aspects

#### **ECONOMIC**














Property Damage  
Local Economy & Growth  
Community Livability  
Public Administration

#### **ENVIRONMENTAL**

Air  
Water  
Soil  
Ecosystem Function



Table 1. Top climate risks for Esquimalt

	Impact Statement	Risk Rating
	More extreme rainfall events causing inflow and infiltration of rainwater into sanitary sewer systems.	High
	More extreme weather events and conditions increasing demand on public services (e.g. emergency responders and public works staff).	Medium-High
	More extreme weather and heat events increasing mortality and health issues, particularly for vulnerable populations (e.g. homeless, elderly, pregnant women).	Medium
	Rising annual temperatures and hotter drier summers negatively affecting city trees.	Medium
	Increase in extreme weather and high wind events causing damage to buildings, infrastructure, and utilities (e.g. electricity disruptions, impact on West Bay Marina and float homes).	Medium
	Rising annual temperatures and drier summers causing stress for native species populations, affecting biodiversity, and creating new opportunities for invasive species.	Medium
	Hotter and drier summers increasing PM 2.5, ground-level ozone, allergens, and smoke, leading to poor air quality.	Medium
	More extreme weather events and resulting impacts (e.g. erosion, contamination, coastal inundation) affecting access to recreational opportunities such as beach access, trail closures, etc.	Medium
	Hotter air and surface water temperatures increasing the incidence of vector-borne diseases (e.g., West Nile Virus, Lyme Disease).	Medium-low
	Hotter and drier summers increase the risk of wildland-urban fire in the region, affecting the Township's emergency response capacity. There is some risk to Esquimalt, but there are other regional risks that could affect Esquimalt (e.g., Saanich or Sooke Watershed).	Medium-low
	Sea level rise inundating historical and culturally significant sites.	Medium-low
	Drier summers and more extreme heat events causing erosion from drier conditions, affecting soil viability and absorption of stormwater.	Medium-low
	Rising annual temperatures and extreme heat events affecting water quality in the Gorge.	Medium-low

### 6.3 Milestone Three: Plan

The third milestone provides guidance on how to establish a vision, set adaptation goals and objectives, identify adaptation options, and examine possible constraints and drivers to various actions. From there, a community will draft a local adaptation strategy.

Following the risk assessment, an action planning workshop was held in October 2019, in which ICLEI Canada presented the results of the Vulnerability and Risk Assessment process, highlighting the priority actions as informed by these processes, and guided stakeholders through the process of moving from impacts to actions. A set of overarching objectives categorized these strategies and a smaller subgroup of stakeholders was formed to discuss each objective. The six objectives are:

1. Integrate Climate Change Thinking and Response
2. Strengthen Infrastructure Resiliency
3. Reduce Risk to Buildings and Property
4. Protect Biodiversity and Enhance Ecosystem Functions
5. Build Community Resilience
6. Protect Public Health and Safety

In July 2020 working group members refined the list of actions further through a series of online workshops. Once a refined list of actions was developed by each working group, preliminary discussions began on the feasibility of implementing each action based on criteria related to cost, potential mitigation co-benefits, urgency, political acceptability, and capacity. Some major considerations were that actions:

- Be implementable within the Township of Esquimalt and surrounding area.
- Address the priority impacts of climate change or extreme weather.
- Include non-municipal partners on planning and implementation where possible.

Beyond these parameters, workshop participants were asked to contribute information about action justification and current initiatives that are in alignment with the action; additional supporting actions; and lead and supporting organizations/departments. After the workshop, municipal and ICLEI staff worked to integrate stakeholder feedback and further flesh out these action implementation tables to reflect the stakeholder feedback (refer to Appendix B). These tables will be used in guiding the adaptation planning process for the Township of Esquimalt moving forward.

The following section outlines the key objectives, strategies, and actions that have been identified as priority areas for Esquimalt to prioritize in order to build adaptive capacity and socioecological resilience to the impacts of climate change.



## 7.0 Objectives, Strategies, and Actions

The six objectives, 19 strategies and 40 actions in this section are the culmination of the work presented in the process followed by the adaptation working group. The strategies and actions are organized under the six overarching objectives:

1. Integrate Climate Change Thinking and Response
2. Strengthen Infrastructure Resiliency
3. Reduce Risk to Buildings and Property
4. Protect Biodiversity and Enhance Ecosystem Functions
5. Build Community Resilience
6. Protect Public Health and Safety

Each section is prefaced by a description of the ‘current state’, or rationale why this objective is important to Esquimalt. The ‘risks addressed’ subsection provides information from the risk assessment that is pertinent to the objective.

Some implementation information for each action can be found in Appendix B. These details include lead department, supporting agencies, timeline for initiation and a rough estimate of the financial resources required for the action. This information will be used when these actions are compared and contrasted with GHG reduction strategies in the final CAP.

## Objective 1: Integrate Climate Change Thinking and Response

Having informed and involved staff and residents, taking part in ongoing conversations about climate impacts and how to prepare for them will be essential to on the ground action. The integration of climate change thinking into everyday decision-making is crucial for successful implementation of this and any future climate plans. Staff and community members will benefit from a better understanding of how to prepare for climate change as well as what measures they can personally undertake to reduce our GHG emissions to lessen these impacts especially for future generations. The actions in this section enable the rest of the strategies in this report and are primarily related to education, communication (including reporting out on our progress) and planning.

**Risks Addressed:** Enabling action

**Strategy 1.1: Incorporate climate change considerations into municipal operations and decision making.**

Action 1.1a: Complete municipal Climate Action Plan.

Potential Supporting Actions

- Prioritize actions from both climate mitigation and climate adaptation planning processes into one overarching plan.

Action 1.1b: Integrate climate change considerations into new and existing plans and policies, as well as Council reports and the Strategic Plan.

Potential Supporting Actions

- Update template for Council reports to include section on climate change analysis.
- Update Request for Proposal template to include opportunity for firms to detail company climate initiatives and certifications.
- Establish internal 'climate' working group to make recommendations to Directors on climate action initiatives.

Action 1.1c: Collaborate with local governments and First Nations with the CRD area to explore joint funding opportunities, research best practices and ensure consistency of policies.

- Support First Nations capacity building with regard to the implementation of climate adaptation actions, in a culturally meaningful way.

Action 1.1d: Complete implementation plan for adaptation planning.

Potential Supporting Actions

- Develop and report on indicators to measure progress on adaptation actions.

### Strategy 1.2: Increase community level of knowledge on Climate Change.

Action 1.2a: Enhance climate change education and awareness initiatives for Township residents and staff.

#### Potential Supporting Actions

- Update climate progress report annually and report to Council.
- Establish dashboard for climate action measures and progress.
- Use data to monitor the implementation of climate plans.
- Set goal of communicating on climate issues weekly and use compelling visuals and alternative forms of engagement to reach expanded audience.



**Tuesday May 29**  
**6:00-7:30pm**

## **NEW! Lasagna Gardening Workshop**

### **All materials provided!**

Join us in Anderson Park for an informative workshop on lasagna gardening. Participants will work with Dave (aka Mr. Organic) to build a lasagna garden bed. You will learn the various layers required to construct a successful garden. This workshop is best suited for adults or children 10+ with parental supervision.

**Location:** Anderson Park **Instructor:** Dave Friend, Mr. Organic

**Course ID:** 11102



## Objective 2: Strengthen Infrastructure Resiliency

Engineering and Public Works manages the sanitary, storm water, and transportation infrastructure for the municipality. Water supply is managed by Capital Regional District (CRD) and conveyed to Esquimalt buildings through the City of Victoria's water system. Esquimalt was one of the earlier municipalities in the CRD to develop and thus the infrastructure is older, with much of it installed during the 1940s and 1950s. Designed for the climatic conditions of that time, this infrastructure will need to be redesigned or retrofitted to withstand the more severe weather expected with a changing climate.

Infrastructure, particularly Esquimalt's underground pipe system, is particularly vulnerable to the effects of climate change. In fact, the only risk that was found to fall into the 'high' category for Esquimalt is extreme rainfall causing inflow and infiltration (I and I) into Esquimalt's sanitary sewer system (see Figure 8).

Did you know? Esquimalt maintains approximately 70 km of storm drains, 50 km of roads, 60 km of sidewalks and 60 km of sewer lines. There are also 11 sewer pump stations, 3300 sewer connections and 3 bridges maintained by the municipality.

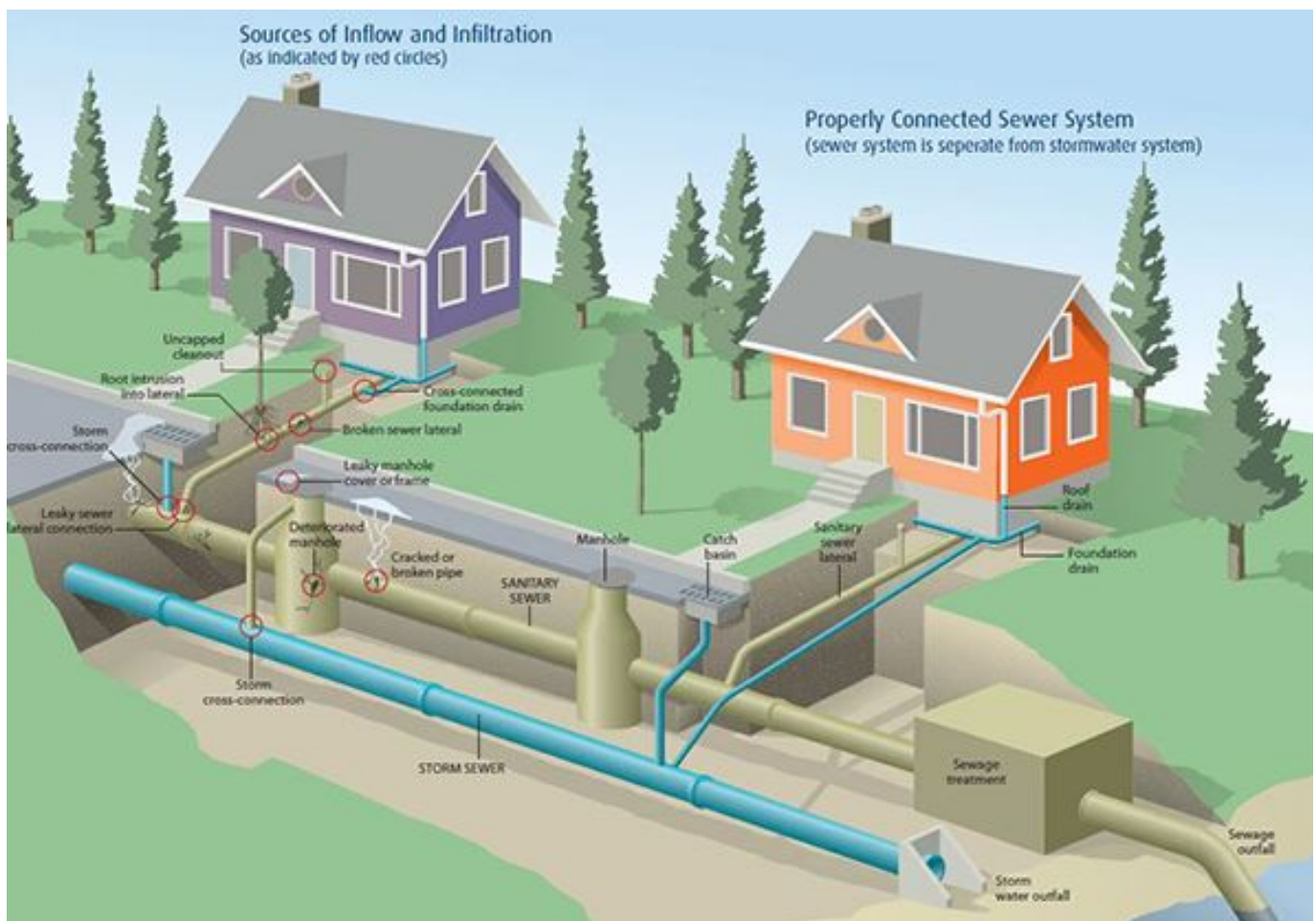





Figure 8. Sources of Inflow and Infiltration from residential buildings.

This is a particular problem for Esquimalt due to areas of the municipality where a number of storm drains are incorrectly connected to the sanitary system (and vice versa). In addition, older cracked pipes allow for infiltration of excess runoff into the sewer system. When this occurs, the sewer system can be overwhelmed, causing pump stations to overflow, which has implications for the ecological health of receiving bodies of water (e.g., Gorge Waterway, Strait of Juan de Fuca, Victoria Harbour, Esquimalt Harbour) and public health in swimming locations.

Extreme weather events such as wind and rain storms also carry the potential to cause tree damage, power outages, damage to BC Hydro's overhead wires, and overland flooding. In fact, basement flooding due to overwhelmed or clogged storm drains occurred to a number of homes this past winter (2019/20) in Esquimalt. Fortunately, Esquimalt does not face the same major overland flooding risks that many communities face. The municipality is also well situated to avoid major damage to roads from higher temperatures and freeze thaw cycles due to its proximity to the moderating influence of the ocean. Despite these strengths, the Township will need to seriously consider how climate change will impact infrastructure investments, in order to protect the community's assets for decades to come.

#### Risks Addressed:

	More extreme rainfall events causing inflow and infiltration of rainwater into sanitary sewer systems.	High Risk
	More extreme weather events and conditions increasing demand on public services (e.g. emergency responders and public works staff).	Medium-high Risk
	Increase in extreme weather and high wind events causing damage to buildings, infrastructure, and utilities (e.g. electricity disruptions due to falling trees).	Medium Risk
	More extreme weather events and resulting impacts (e.g. erosion, contamination, coastal inundation) affecting access to recreational opportunities such as beach access, trail closures,	Medium Risk

#### Strategy 2.1: Ensure infrastructure is designed and maintained for up to date climate projections.

##### Action 2.1a: Identify infrastructure most at risk for extreme weather impacts.

- Incorporate rainfall projections and updated intensity-duration-frequency (IDF) curves into the Subdivision Bylaw.
- Use network modelling to determine where improvements to stormwater system capacity are necessary.
- Complete asset management plan and conduct an asset level risk assessment, including beach accesses, bridges, and walkways.

Action 2.1b: Continually upgrade stormwater and sanitary systems to prevent inflow and infiltration.

- Increase capital request for storm sewer and sanitary system repair in utility budgets.
- Investigate potential sources of grant funding for stormwater management upgrades.
- Complete Inflow and Infiltration Control Plan.
- Implement Inflow and Infiltration Control Management Plan and evaluation of underground infrastructure.



Action 2.1c: Ensure public works has the necessary capacity to respond to extreme rainfall events that occur more frequently.

- Identify long term financial requirements for local services and infrastructure.
- Review staff resources required for flooded infrastructure response during extreme rain events.
- Promote opportunities to share services where operationally and financially beneficial.

Strategy 2.2: Create new capacity for rainwater absorption and slow runoff to allow stormwater system time to respond.

Action 2.2a: Incorporate green infrastructure considerations into development plans and policies.

- Support private developers to include onsite rainwater management in development projects.
- Minimize impervious surfaces such as parking lots, roads, and rooftops.

Action 2.2b: Encourage rainwater landscaping in small scale residential settings.

- Develop education materials to guide homeowners on completing rainwater management projects themselves, including benefits of onsite rainwater management.
- Communicate on low impact development guidelines to residents during permitting process.







### Objective 3: Reduce Risk to Buildings and Property

Buildings in Esquimalt are assessed at about 4 billion dollars of which 92% is residential. More frequent wind storms, rising sea levels, increasing rainfall and even drought have implications for buildings and property in Esquimalt. Extreme weather, including high wind events, can cause damage such as torn roofs and siding, flooded basements, trees falling on property, damage to wharves and boats, and potentially health and safety impacts. It is crucial that new buildings and infrastructure are designed and built with resilience to these events in mind. Sea level rise will also impact some sites which are lesser visible, such as culturally significant sites to the First Nations that live in the area. Middens, burial sites, and former village sites are often located along the shoreline and are vulnerable to erosion and salt intrusion from storms and SLR. To assess the risk, it will be important to work with First Nations determine how best to mitigate the effects of climate change on these sites.

#### Risks Addressed:

	Increase in extreme weather and high wind events causing damage to buildings, infrastructure, and utilities (e.g., electricity disruptions, impact on West Bay Marina and float homes).	Medium Risk
	Sea level rise inundating historical and culturally significant sites.	Medium-low Risk

#### Strategy 3.1: Prepare building stock for effects of more severe weather.

Action 3.1a: Encourage residents and building owners to maintain and upgrade their buildings to be more resilient to extreme weather events.

- Raise awareness of the risks of changing climate to residential and commercial buildings.
- Educate residents on the importance of stormwater management system maintenance to protection of their own buildings and property.
- Use flood risk mapping to identify targeted education campaigns.

#### Strategy 3.2: Prepare for the impacts of rising sea levels.

Action 3.2a: Increase knowledge about the localized effects of sea level rise and storm surges with Esquimalt residents and staff.

- Present report to Council on recent CRD sea level rise and tsunami study.
- Add sea-level rise information to the Township's Climate Action webpage.
- Develop an education and outreach plan to support the dissemination of sea level rise information.

Action 3.2b: Incorporate outputs of CRD's Coastal Sea Level Rise Risk Assessment and their Sea Level Rise Planning Approaches Project Report into regulation.

- Adopt a flood construction level bylaw using future SLR projections in conjunction with other CRD municipalities.
- Support regional policy and planning mechanisms that aim to reduce the risk of sea level rise and coastal inundation.

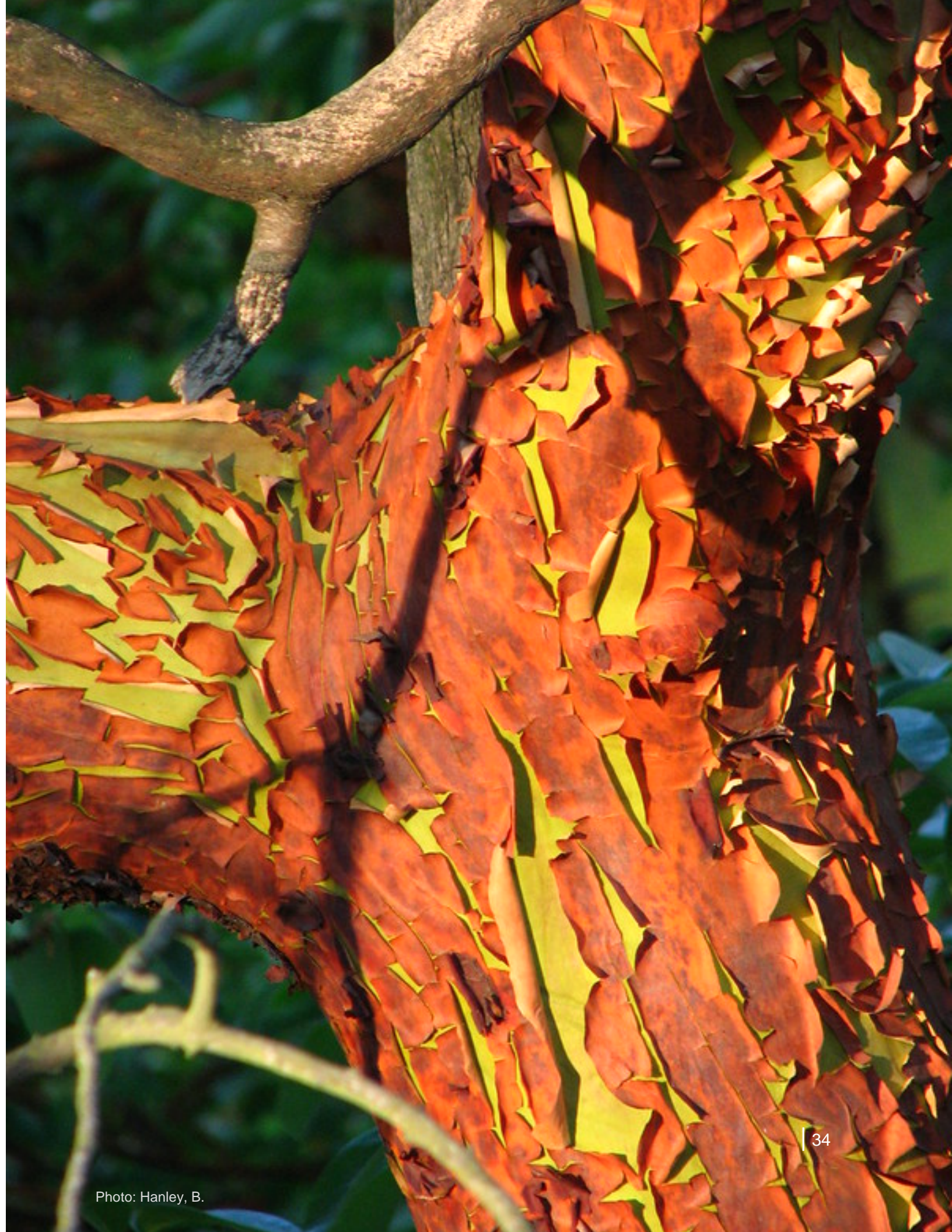
Action 3.2c: Develop mitigation plans for protection of culturally and historically significant sites in the Township.

- Work with First Nations, residents, and Esquimalt Archives to develop an inventory of culturally significant/historically significant areas within the Township that are vulnerable to sea level rise and coastal flooding.
- Work with local First Nations to explore culturally appropriate options to mitigate the impacts of sea level rise on cultural sites.
- Partner with local First Nations to establish opportunities to build public awareness of the importance of cultural sites to traditional cultures.

Action 3.2d: Ensure that municipal structures and facilities near water are built to withstand predicted conditions.

- Establish time period for planning purposes (lifespan of infrastructure) and design appropriately.
- Incorporate climate change scenarios into design and construction of structures near water.
- Continue using the Green Shores method to repair shoreline erosion.







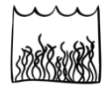

## Objective 4: Protect Biodiversity and Enhance Ecosystem Functions

The Township of Esquimalt has a variety of natural ecosystems within its borders, including marine shorelines and estuaries, Garry oak woodlands, Douglas-fir forests, coastal bluffs, and rocky outcrops, among others. Many of these areas have been protected within municipal parks, however some of the larger natural areas are on federal lands managed by the DND such as McLoughlin Point, Signal Hill, and Veteran's Drive areas. The most significant natural areas within the municipal parks system are in Saxe Point Park, Macaulay Point Park, Highrock Park, and Esquimalt Gorge Park, where sensitive ecosystems include herbaceous terrestrial area, coastal bluff, and older forest. In addition, Esquimalt Parks manages 12 beach access areas, six on the Gorge Waterway and six on the outer coast, and four greenways that incorporate natural areas alongside walking and biking trails. Esquimalt Parks Department also maintains approximately 5600 trees on boulevards, greenways, and open spaces within the municipality.

*"The cedar hedge trees in my back yard have started dying. I'm wondering if this is due to hot dry summers and if it's worth watering the remaining ones to prevent them from dying as well, or if it makes more sense to bite the bullet and replace them with a species that is more suitable for the climate we have now and will in the future, and won't require watering."*

~ Trevor, preparing together website

### Risks Addressed:

	Rising annual temperatures and hotter drier summers negatively affecting city trees.	Medium
	Rising annual temperatures and drier summers causing stress for native species populations, affecting biodiversity, and creating new opportunities for invasive species.	Medium
	Rising annual temperatures and extreme heat events affecting water quality in the Gorge.	Medium-low
	Drier summers and more extreme heat events causing erosion from drier conditions, affecting soil viability and absorption of stormwater.	Medium-low

## Strategy 4.1: Protect and expand the existing urban forest.

### Action 4.1a: Explore new ways of ensuring tree protection for new developments.

#### Potential Supporting Actions

- Explore economic mechanisms that encourage developers to ensure tree avoidance and preservation, as well as maintenance measures to be undertaken prior to commencement of site work.
- Establish tree preservation plan checklist and site inspection policy to enhance tree protection measures during construction.
- Update Tree Protection Bylaw in order to enhance protection of existing trees and to support a growth in canopy cover.
- Update Township's parking bylaw to address declining need for parking in certain zones in order to reduce competition between parking space needs and urban forest space needs.
- Ensure continued regulation of cutting or pruning of trees on private property, prohibiting tree damaging activities, setting requirements for replacement trees and for securities for the protection of trees to be retained during construction.
- Continue with the Townships' boulevard tree watering and mulching program.

Think of tree care as an investment. A healthy tree increases in value with age and pays big dividends by increasing property values, beautifying our surroundings, purifying our air, and saving energy by providing cooling shade from summer's heat and protection from winter's wind.

Regular preventative maintenance, designed to promote tree health and structural integrity, ensures a tree's value will continue to grow and prevents the development of more costly problems in the future. An effective maintenance program, including regular inspections and necessary follow-up care — pruning, mulching, fertilizing, and additional soil management — can identify problems and correct them before they become damaging or fatal.

Trees in Esquimalt's Gorge Park



Pruning large trees requires special equipment, training, and experience. If the pruning work requires climbing, the use of a chain or hand saw, or the removal of large limbs, the use of personal safety equipment, such as protective eyewear and hearing protection, is a must. Arborists can assist in performing the job safely and reducing the risk of personal injury and damage to your property. They can also determine which type of pruning is necessary to maintain or improve the health, appearance, and safety of your trees.

#### Removal

Although tree removal is a last resort, there are circumstances when it is necessary. Professionally trained arborists can help decide whether or not a tree should be removed and possess the skills and equipment to safely and efficiently remove trees.

Removal is recommended when a tree:

- is dead, dying, or considered irreparably
- is hazardous
- is causing damage to a home
- is crowding and causing harm to other trees and
- is to be replaced by a more suitable specimen
- should be removed to allow for construction.

With proper maintenance, trees can add aesthetic and economic value to your property. Poorly maintained trees, on the other hand, can be a significant liability. For more information on mature tree care, contact your local ISA Certified Arborist.



Protecting Esquimalt's Urban Forest



esquimalt.ca  
250.412.8500

esquimalt.ca | 250.412.8500

## Mature Tree Care



Learn procedures specific to a routine maintenance program for mature tree care, including tree inspection, mulching, fertilization, pruning, and tree removal.



Action 4.1b: Implement the recommendations of the Esquimalt Urban Forest Management Plan.

Potential Supporting Actions

- Conduct new canopy cover study and set target for tree cover and tree species diversity (40% recommended) and review targets, as necessary.
- Increase proportion of drought-tolerant and native trees in urban forest.
- Use resources available through local colleges and universities to engage in research related to urban forest management.

Action 4.1c: Expand boulevard tree planting and watering program to double the number of trees planted and maintained per year.

Potential Supporting Actions

- Explore the potential of developing a partnership with the Department of National Defense's Environmental Group for urban forestry on federal lands.
- Support community-led tree giveaway events in Esquimalt.
- Partner with local non-profit organizations to provide backyard tree planting services to residents at a subsidized cost. Work with SD61 to address maintenance of existing trees and to identify opportunities to plant additional trees on school grounds.

Strategy 4.2: Increase the number of trees planted on private property.

Action 4.2a: Continue to assist residents to grow and maintain healthy trees on private property.

Potential Supporting Actions

- Update brochures for tree planting and native trees.
- Continue public and citizen urban forestry educational outreach through the Branch Out program.
- Continue to include information on tree maintenance, planting and policies on municipal website, social media, and special event days.

Strategy 4.3: Use current best management practices for maintaining health of existing urban forest.

Action 4.3a: Update the UFMP and tree preservation bylaw to reflect changing industry standards due to climate impacts.

Potential Supporting Actions

- Identify and avoid planting tree species that are sensitive to drought or extreme winds. Review planting and maintenance standards with focus on climate adaptation.
- Consider use of rain gardens and absorptive landscaping in public rights-of-way as water conservation technique.



#### Strategy 4.4: Prevent the spread of invasive species.

Action 4.4a Continue to manage existing areas of invasive species within Esquimalt parks and public spaces.

##### Potential Supporting Actions

- Inventory and map invasive species and ecosystems most at risk due to climate change.
- Consider formalizing partnership with Greater Victoria Green Team for invasive species removal in municipal parks in annual budget.

Action 4.4b: Be proactive in managing emerging invasive species threats as they appear.

##### Potential Supporting Actions

- Engage with other local governments through the Capital Region Invasive Species Partnership (CRISP),
- Continue to participate in the Invasive Species Council of BC's Local Government Invasive Species Network (LGISN) to share information about, identifying needs for and sharing lessons learned from invasive species management programs and projects.

- Continue with existing program in partnership with the Department of National Defense to remove invasive species at Macaulay Point Park.

#### Strategy 4.5: Encourage community stewardship within natural areas in the Township.

Action 4.5a Empower local First Nations, ENGOs and other community groups to have the licence to take on advocacy, education, and ecological restoration of natural areas.

#### Potential Supporting Actions

- Roll out “Individual Stewardship Program” – starting in Saxe Point in September (aimed at neighbours in the area) (aim is to also expand out to Gorge Park) – Align with Tree Day in September (18th, 19th 2020)
- Establish formalized partnerships with local environmental organizations, community groups, and First Nations for various sustainability related programming – e.g. tree planting, shoreline cleanup, biodiversity management, citizen science programs, etc.
- Collaborate with CFB Esquimalt, school districts and other municipalities on efficiencies and partnerships in Parks and Recreation Services.



**Tuesday, Aug 14**

**10:00am—12:00 pm**

## ECO Champs—Highrock Park

Our ECO Educators are looking forward to welcoming you back for the 2nd year of our ECO Champs program.

This FREE, guardian involved, drop in program is specifically focused on teaching children to be ecologically focused and aware while providing a fun and inclusive learning environment.



Action 4.6a: Work together with other local government and the CRD to reduce the factors that could cause poor water quality in the Gorge.

## Potential Supporting Actions

- Develop coordinated messaging around responsible use of fertilizers and other residential sources of contamination (e.g., through surface runoff)
- Consider the use of natural stormwater cleaning and cooling techniques such as rain gardens, green roofs, and absorptive landscaping in all new developments.
- Work with the CRD to determine which outfalls to the Gorge have water quality issues and address any problem areas.
- Continue to reduce cross-connections with sewage laterals in the SW system.



## Objective 5: Build Community Resilience

Community resilience speaks to the ability of a community to not only ‘bounce back’ from such varied events such as economic recessions, health crises (e.g., Covid-19 pandemic), earthquakes, severe weather and more, but also to community vitality. Resilience and vitality can be fostered through renewed community networks and relationships (social connectedness), good governance and leadership, internal resources, preparedness, economic investment, local knowledge, a deepened sense of place, and a positive mental outlook.<sup>19</sup>


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*“Community Resilience’ is a measure of the sustained ability of a community to utilize available resources to respond to, withstand, and recover from adverse situations.” ~ Boshier, Lee; Chmutina, Ksenia \**

Esquimalt residents’ pride themselves on their supportive and connected community. Helping each other is part of their daily lives and should an emergency arrive, residents will be there to support each other. However, there are some members of the community that may be more vulnerable than others due to social isolation, age, or infirmity. Making sure that all residents feel connected and secure is crucial to improving local adaptive capacity and reducing risk.

Although it did not emerge as an identified risk, food security emerged as an important measure that working group members identified as a concern related to climate change. A significant portion (up to 50%) of food in BC is currently imported and living on an island makes residents even more susceptible to price increases and shortages of food. Additionally, up to 70% of food on Vancouver Island comes from California – which is itself a climatically vulnerable area.<sup>20</sup> Climate change is expected to make growing conditions much harder for farmers (e.g., drought, extreme storms, pests, etc.). Esquimalt residents would benefit from fostering locally sustainable and resilient food systems, including increasing individual self-sufficiency in food.

### Risks Addressed:

	More extreme weather events and conditions increasing demand on public services (e.g. emergency responders and public works staff).	Medium-High
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\* Boshier, L., & Chmutina, K. (April 3, 2017). *Disaster Risk Reduction for the Built Environment*. Hoboken, NJ: John Wiley & Sons.

Strategy 5.1: Empower and engage with Esquimalt residents and businesses on ways they can adapt to climate change and reduce their reliance on outside support and emergency responders during crises.

Action 5.1a: Encourage community social connectedness.

Potential Supporting Actions

- Complete OCP policy update for social connectedness.
- Complete social wellbeing checklist for developers.
- Utilize Township communication tools to promote and support community events.

Action 5.1b: Advance the work of reconciliation with the Esquimalt and Songhees First Nations.

Potential Supporting Actions

- Work to foster relationship based on mutual trust and respect between Esquimalt and Songhees and Esquimalt First Nations.
- Build relationships First Nations organizations that are aligned with climate planning already.
- Engage with the First Nation Health Authority on the intersection of community health and climate change.
- Explore potential joint research projects with indigenous learning at University of Victoria (or other post-secondary schools).
- Organize regular Community to Community forums

Action 5.1c: Look for opportunities to increase access to locally grown food.

Potential Supporting Actions

- Continue to support Esquimalt Farmer's Market program within Esquimalt Parks.
- Where feasible, consider inclusion of food plants in Township gardens and plantings.
- Continue with program to evaluate potential for deer contraception program in Esquimalt.
- Support local food growing initiatives through education and outreach.
- Encourage water conservation technologies and approaches for urban agriculture (e.g., rain barrels, soil building).
- Increase access to community garden plots on Township parkland.

Action 5.1d: Adapt emergency preparedness program to include climate event considerations.

Potential Supporting Actions

- Continue with neighbourhood preparedness program to assist residents to have a 72-hour emergency kit and plan. Consider preparing a heat and smoke response plan.
- Explore options to establish one or more vulnerable persons' registries to guide emergency responders and/or other assistance programs to reduce health impacts in extreme weather events.

Action 5.1e: Ensure essential and important community services and organizations are fully prepared for climate emergencies.

#### Potential Supporting Actions

- Explore opportunity for public safety building project in conjunction with McLoughlin amenity funds.
- Determine what community organizations are important to the functioning of the community in a power outage (e.g., long-term care homes, schools, churches, etc.).
- Ensure back-up power for essential and important services is not vulnerable to climate extremes (e.g., generators are not in basement where vulnerable to flooding, etc.) and that they have adequate fuel for extended power outages.
- Encourage community organizations to develop Business Continuity Plans that consider installing/maintaining backup power, cross-training of staff, identify alternative fuel/energy suppliers, storing vital information off-site, necessary communication protocols, etc.



## Objective 6: Protect Public Health and Safety

While public health and access to medical treatment is the responsibility of the provincial government and administrated in the CRD by Island Health, the social and environmental determinants of health are equally, if not more important. Access to clean air and water, nutritious food, safe and affordable housing, child development and social support networks are just a few of the important factors that contribute to a healthy population.

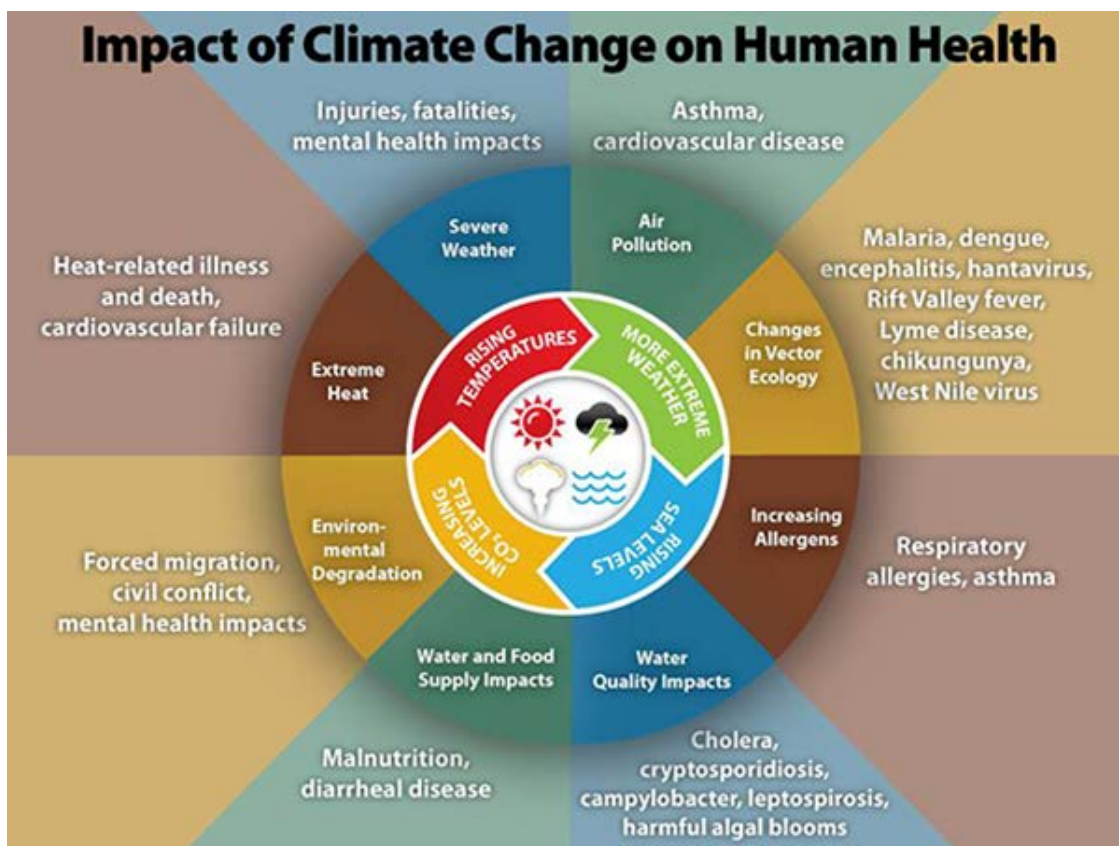






Figure 9. Impacts of Climate Change on Human Health.

As climate change alters our environmental and social conditions, some existing health threats will intensify, and new health threats will emerge (see Figure 9). Certain populations are more at risk than others; people with pre-existing conditions, the very young and the very old, low income individuals and people who are socially isolated are more likely to feel these impacts than others. Canadians are extremely fortunate that our geography and relative wealth leave us in a much better position than many other countries, however we have already experienced climate-related illnesses and deaths from conditions such as wildfires and wildfire smoke causing poor air quality, heat waves, floods, and severe storms. An emerging concern is the mental health impact of climate change, including anxiety and stress, and post-traumatic stress disorder related to experiencing climate related events such as wildfire or flooding. Eco-grief is

a common phenomenon that instills a sense of helplessness in the face of ecological and climatic crises; developing communications strategies that foster a sense of place, connectedness, and self-efficacy are imperative to overcoming this within society. Infectious disease specialists warn of an increased risk of tick-borne diseases, endemic and exotic mosquito-borne diseases, as well as foodborne diseases.<sup>21</sup> Luckily, one of the main co-benefits of taking climate action is improved health and wellbeing.

#### Risks Addressed:

	More extreme weather and heat events increasing mortality and health issues, particularly for vulnerable populations (e.g. homeless, elderly, pregnant women).	Medium
	Hotter and drier summers increasing PM 2.5, ground-level ozone, allergens, and smoke, leading to poor air quality.	Medium
	Hotter air and surface water temperatures increasing the incidence of vector-borne diseases (e.g., West Nile Virus, Lyme Disease).	Medium-low
	Rising annual temperatures and extreme heat events affecting water quality in the Gorge	Medium-low

#### Strategy 6.1: Ensure all residents have access to outdoor areas for cooling during extreme heat events.

Action 6.1a: Consider shade as a necessity in all public facilities and spaces.

##### Potential Supporting Actions

- Incorporate shade and access to drinking water into public spaces including parks, picnic areas, playgrounds, transit shelters and active transportation routes.
- Consider the use of artificial shade structures in heat vulnerable areas where natural shade is not feasible.

Action 6.1b: Set goals for parkland per capita or within 15-minute walk of residential development.

##### Potential Supporting Actions

- Consider the use of indicators such as ‘100% of residents have a park within a 5-minute walk of their home’ to evaluate progress towards the target.
- Continue to identify and implement alternative land procurement approaches.
- Engage with developers to identify new opportunities for park acquisition and procurement options



### Strategy 6.2: Ensure new residential buildings are climate-ready.

Action 6.2a: Encourage the use of passive construction techniques in new residential developments.

#### Potential Supporting Actions

- Consider incentives for Passive House certification for residential housing.
- Provide education on the need for natural ventilation and passive cooling techniques to residents and developers as part of climate outreach program.

Action 6.2b: Encourage deep home retrofits of existing buildings to improve both efficiency and comfort for residents.

#### Potential Supporting Actions

- Support fuel switching programs such as the oil tank to heat pump program to encourage the use of the most energy efficient cooling and heating systems.
- Seeking funding to address retrofit needs of vulnerable residents.

Strategy 6.3: Prepare to assist more vulnerable populations during extreme heat or other extreme weather events.

Action 6.3a: Integrate extreme weather protocols into existing emergency preparedness plans.

Potential supporting actions:

- Prepare extreme heat scenario response plan.
- Develop a long-term heat mitigation strategy.
- Work with public and private businesses to expand the number of publicly available spaces designated as emergency cooling shelters during times of excessive heat (e.g., warehouses, libraries, and community centres).

Action 6.3b: Consider the development of a convergent volunteer plan to enact during emergency events.

Strategy 6.4: Support efforts to reduce urban air pollution.

Action 6.4a: Advocate and support low emission transportation modes including active and public transportation as well as vehicle electrification.

Potential Supporting Actions

- Develop an active transportation plan
- Consider use of SRWs for creating bicycle and pedestrian trails off-road as development occurs.
- Seek funding opportunities to increase expenditures on active transportation projects.
- Incorporate active transportation infrastructure into new developments wherever possible.
- Amend parking bylaw to require bicycle parking and bike storage in new developments.
- Develop parking strategy, including review and update of parking bylaw.
- Update public bike parking inventory and fill gaps where necessary.
- Use BikeMaps.org data to inform safety upgrades in public realm.
- Work with CRD and adjacent business owners to establish lighting and beautification upgrades to the E&N rail trail to improve safety and comfort of riders.
- Continue to advocate for improvements to sustainable regional transportation initiatives.



Action 6.4b: Reduce air-borne allergens from public plantings.

Potential Supporting Actions

- Avoid planting wind-pollinated plants/trees (e.g., poplar).
- Incorporate general garden maintenance techniques that lower the disturbance of settled pollen (e.g., keep grass cut low to reduce production of pollen, mow when grass is wet, avoid gardening when it is windy or overly dry).

Strategy 6.5: Reduce potential habitat for vectors that cause disease

Action 6.5a: Provide education and outreach to the public to minimize the occurrence and spread of vector-borne diseases.

Potential Supporting Actions

- Promote existing information from Public Health and any tools or mechanisms that already exist to report sightings of certain vectors.
- Consider implementing signage program to warn the public of potential high-risk areas (e.g. high grass areas with increased tick exposure risk).

Action 6.5b: Utilize best management practices for vector borne disease prevention in municipally-owned infrastructure.

Potential Supporting Actions

- Ensure that Township infrastructure does not contribute to vector-borne diseases (e.g., Catch basins etc.).
- Encourage natural ecosystem solutions to vector controls.
- Develop protocols for the application of larvicides to municipally owned catch basins if it becomes necessary.

Examples of actions that can be taken to minimize the spread of West Nile Virus include:

- Remove standing water that collects in tire ruts, storage drums, tarps, flat roofs, etc.
- Clear decaying grass, leaves or other organic matter from drains, gutters or refuse areas
- Pump-out accumulated sludge in catch basins or trench drains (public and private property)
- Install fountains or aerators in bio-ponds or other artificial water bodies

Strategy 6.6: Ensure the public is notified should recreational swimming areas be contaminated or unsafe to use.

Action 6.6a: Ensure effective messaging protocol is in place to inform the public about unsafe swimming conditions in local waters.

Potential Supporting Actions

- Target messaging to residents who might be using Gorge waters recreationally.
- Continue to update local advisories via web, radio, print, bulletin board, etc. and to issue and rescind beach closures.

## 8.0 Next Steps

This guide is the first step towards preparing Esquimalt for climate change. There are 40 actions and several supporting actions associated with each of the six objectives detailed in the previous section. The working group of staff and stakeholders have presented us with their vision of the strategies and actions which could be undertaken and have given some consideration as to what priority they should be implemented.

However, work remains to be done. A full implementation plan will require much greater detail on the costs of each action, how these will be funded, what partnerships will be formed, who will track our progress and what indicators are the best measures for monitoring this progress. In addition, feedback from residents on the proposed actions will need to take place in conjunction with the concurrent work on a climate mitigation plan for the municipality. All of the actions for both adaptation and mitigation will be presented to residents later this year as part of the public engagement for the Climate Action Plan. The full set of climate actions will thus be prioritized against each other using the criteria below as a starting point:

- Whether the action has both mitigation and adaptation benefits.
- What influence the Township has over the proposed action.
- Staffing and financial resources required to implement the action.
- Whether the action is already identified in the strategic plan or other operational plans.
- Rapidity of the transformational change.

The final list of strategies and actions which will be included in the Climate Action Plan will have a complete implementation plan which will be the responsibility of the Development Services Department to oversee. This department will monitor and track progress on the actions and report to the Environmental Advisory Committee and to Council on an annual basis. The long-term success of the plan will depend on all of us doing our part. Although the actions in this guide are primarily the responsibility of the Township, individuals, businesses, and non-profits will also play a key role. Stakeholders and partner agencies are encouraged to continue this process by developing their own climate adaptation plans. Individuals need to pursue actions at home and in the community to prepare themselves, their homes, and workplaces for the effects of climate change. If we can all work 'Together for Climate', Esquimalt will be a much more prepared and resilient community for generations to come.



## 9.0 Appendices

### Appendix A: Summary Table of Climatic Changes for Esquimalt Area

RCP 8.5				
Climate Variable <sup>†</sup>	Season	Projected Change from 1961-1990 Baseline		
		Median 2020s (2010-2039)	Median 2050s (2040-2069)	Median 2080s (2070-2099)
Temperature (°C)	Annual	+1.5 °C	+2.7 °C	+4.3 °C
Precipitation (%)	Annual	+0.54%	+2.3%	+8.0%
	Summer	-7.3%	-11%	-19%
	Winter	+2.5%	+2.3%	+10%
Precipitation as Snow (%)	Annual	-75%	-86%	-92%
	Winter	-78%	-90%	-96%
	Spring	-67%	-69%	-100%
Growing Degree-days (degree-days)	Annual	+440 degree-days	+789 degree-days	+1330 degree-days
Heating Degree-days (degree-days)	Annual	-503 degree-days	-879 degree-days	-1360 degree-days
Frost-free days (days)	Annual	+27 days	+40 days	+50 days
Relative sea level rise <sup>‡</sup>	Average 8.8 <sup>§</sup> mm/yr	Relative sea level rise is expected to be 0.5 m by 2055; and 1.0 m by 2100s		
Water temperatures	Increasing at varying degrees in ocean and streams			

<sup>†</sup> The first six climate variables taken from PCIC (2020) summary table.

<sup>‡</sup> Sea level rise data retrieved from Province of BC Sea Level Rise Adaptation Primer (2013); Province of BC Amended Flood Hazard Area Land Use Management Guidelines; CRD's Coastal Flood Inundation Mapping Project: Task 2 – Sea level rise modelling and mapping report (2020).

<sup>§</sup> This value is based on the Provincial Guidelines SLR baseline year of 2000; an SLR increase rate of +10 mm/yr; a land uplift rate around Victoria of +1.2 mm/yr (10 mm/yr-1.2 mm/yr = 8.8 mm/yr).

## Appendix B: Climate Action Implementation Tables

The following tables outline some further details on implementation, such as ballpark costing, lead department or organization, supporting organization, time period to begin implementation and whether or not there is a co-benefit to GHG mitigation for the proposed action. The initiation timeline is a suggestion only and will be more refined through the public engagement process for the Climate Action Plan. To some extent, priority actions arose due to their potential for risk mitigation, whether or not the action is already in the strategic plan, whether there are co-benefits and the readiness of the municipality to undertake such an action.

DS	Development Services
CS	Corporate Services
CRD	Capital Regional District
CSS	Community Safety Services
CM	Communications
EPW	Engineering and Public Works
PR	Parks and Recreation
IH	Island Health
GVGT	Greater Victoria Green Team
	Initiated
\$	< \$50,000
\$	\$50,000 - \$100,000
\$	\$100,000 - \$250,000
\$	\$250,000 - \$500,000
\$	>\$500,000

### Objective 1: Integrate Climate Change Thinking and Response

Action		Mitigation Co-benefit	Lead	Supporting	Initiation Timeline	Financial
Strategy 1.1: Incorporate climate change considerations into municipal operations and decision making.						
1.1a	Complete Climate Action Plan for the municipality.	✓	DS	ALL		\$
1.1b	Integrate climate change considerations into new and existing plans and policies, as well as Council reports and the Strategic Plan.	✓	CS	ALL	2020-2024	\$
1.1c	Collaborate with local governments and First Nations within the CRD area to explore joint funding opportunities, research best practices and ensure consistency of policies.		CS	DS	2020-2024	N/A
1.1d	Complete implementation plan for adaptation planning.		DS		2020-2022	N/A
Strategy 1.2: Increase community level of knowledge on Climate Change.						
1.2a	Enhance climate change education and awareness initiatives for Township residents and staff.	✓	DS	CS	2020-2022	\$

## Objective 2: Strengthen Infrastructure Resiliency

Action		Mitigation Co-benefit	Lead	Supporting	Initiation Timeline	Financial Resources
Strategy 2.1: Ensure infrastructure is designed and maintained for up to date climate projections.						
2.1a	Identify infrastructure most at risk for extreme weather impacts.		EPW			\$\$
2.1b	Continually upgrade stormwater and sanitary systems to prevent inflow and infiltration.		EPW			\$\$\$\$\$
2.1c	Ensure public works has the necessary capacity to respond to extreme rainfall events that occur more frequently.		EPW	CS	2022-2024	TBD
Strategy 2.2: Create new capacity for rainwater absorption and slow runoff to allow stormwater system time to respond.						
2.2a	Incorporate green infrastructure considerations into development plans and policies.	✓	DS			N/A
2.2b	Encourage rainwater landscaping in small scale residential settings.	✓	DS	CM	2022-2024	N/A

## Objective 3: Reduce Risk to Buildings and Property

Action		Mitigation Co-benefit	Lead	Supporting	Initiation Timeline	Financial Resources
Strategy 3.1: Prepare building stock for effects of more severe weather.						
3.1a	Encourage residents and building owners to maintain and upgrade their buildings to be more resilient to extreme weather events.		DS		2022-2024	\$
Strategy 3.2: Prepare for the impacts of rising sea levels.						
3.2a	Increase knowledge about the localized effects of sea-level rise and storm surges with Esquimalt residents and staff.		DS	CM	2020-2022	\$
3.2b	Incorporate outputs of CRD's		DS		2022-	\$

	Coastal Sea Level Rise Risk Assessment and their Sea Level Rise Planning Approaches Project Report into regulation.				2024	
3.2c	Develop mitigation plans for protection of culturally and historically significant sites in the Township.		?		2026-2030	\$\$
3.2d	Ensure that municipal structures and facilities near water are built to withstand predicted conditions.		EPW	PR	2020-2022	\$\$\$\$

#### Objective 4: Protect Biodiversity and Enhance Ecosystem Functions

Action		Mitigation Co-benefit	Lead	Supporting	Initiation Timeline	Financial Resources
Strategy 4.1: Protect and expand the existing urban forest.						
4.1a	Explore new ways of ensuring tree protection for new developments.	✓	PR		DS	N/A
4.1b	Implement the recommendations of the Esquimalt Urban Forest Management Plan.	✓	PR		DS	\$\$
4.1c	Expand boulevard tree planting and watering program to double the number of trees planted and maintained per year.	✓	PR		2022-2024	\$\$
Strategy 4.2: Increase the number of trees planted on private property.						
4.2a	Continue to assist residents to grow and maintain healthy trees on private property.	✓	PR		Non-profits	\$
Strategy 4.3: Use current best management practices for maintaining health of existing urban forest.						
4.3a	Update the UFMP and tree preservation bylaw to reflect changing industry standards due to climate impacts.	✓	PR		2022-2024	\$
Strategy 4.4: Prevent the spread of invasive species.						
4.4a	Continue to manage existing areas of invasive species within Esquimalt parks and public		PR	GVGT, volunteers		\$

	spaces.					
4.4b	Be proactive in managing emerging invasive species threats as they appear.		PR	CRD	As required	
Strategy 4.5: Encourage community stewardship within natural areas in the Township.						
4.5a	Empower local First Nations, ENGOs and other community groups to have the licence to take on advocacy, education, and ecological restoration of natural areas.		PR	CS	2022-2024	\$
Strategy 4.6: Manage water quality runoff to reduce potential for algae blooms.						
4.6a	Work together with other local government and the CRD to reduce the factors that could cause poor water quality in the Gorge.		EPW	DS	2022-2026	\$\$

## Objective 5: Build Community Resilience

Action		Mitigation Co-benefit	Lead	Supporting	Initiation Timeline	Financial Resources
Strategy 5.1: Empower and engage with Esquimalt residents and businesses on ways they can adapt to climate change and reduce their reliance on outside support and emergency responders during crises.						
5.1a	Encourage community social connectedness.		DS	PR		N/A
5.1b	Advance the work of reconciliation with the Esquimalt and Songhees First Nations.		Council	CAO	2020-2022	\$
5.1c	Look for opportunities to increase access to locally grown food.	✓	PR	DS	2020-2022	\$\$
5.1d	Adapt emergency preparedness program to include climate event considerations.		CSS		2022-2024	\$
5.1e	Ensure essential and important community services and organizations are fully prepared for climate emergencies.		CSS			\$\$\$

## Objective 6: Protect Public Health and Safety

Action		Mitigation Co-benefit	Lead	Supporting	Initiation Timeline	Financial Resources
Strategy 6.1: Ensure all residents have access to outdoor areas for cooling during extreme heat events.						
6.1a	Consider shade as a necessity in all public facilities and spaces.		PR	DS EPW	2020-2022	\$
6.1b	Set goals for parkland per capita or within 15 min walk of residential development.		PR	DS	2024-2026	\$
Strategy 6.2: Ensure new residential buildings are climate-ready.						
6.2a	Encourage the use of passive construction techniques in new residential developments.	✓	DS	CSS	2022-2024	N/A
6.2b	Encourage deep home retrofits of existing buildings to improve both efficiency and comfort for residents.	✓	DS	CSS		\$
Strategy 6.3: Prepare to assist more vulnerable populations during extreme heat or other extreme weather events.						
6.3a	Integrate extreme weather protocols into existing emergency preparedness plans.		CSS	CM	2022-2024	N/A
6.3b	Consider the development of a convergent volunteer plan to enact during emergency events.		CSS	CM	2022-2024	\$\$
Strategy 6.4: Support efforts to reduce urban air pollution.						
6.4a	Advocate and support low emission transportation modes including active and public transportation as well as vehicle electrification.	✓	DS	Council		\$\$
6.4b	Reduce air-borne allergens from public plantings.		PR		2022-2024	N/A
Strategy 6.5: Reduce potential habitat for vectors that cause disease						
6.5a	Provide education and outreach to the public to minimize the occurrence		IH	CM	As required	

	and spread of vector-borne diseases.					
6.5b	Utilize best management practices for vector borne disease prevention for in municipally-owned infrastructure.		EPW	PR	As required	
Strategy 6.6: Ensure the public is notified should recreational swimming areas be contaminated or unsafe to use.						
6.6a	Ensure effective messaging protocol is in place to inform the public about unsafe swimming conditions in local waters.		IH	CRD CM		N/A

## Appendix C: Glossary of Terms

**95<sup>th</sup> percentile for precipitation:** The 95th-percentile wettest days precipitation indicator describes the total amount of precipitation that falls on the wettest days of the year, specifically on days when precipitation exceeds a threshold set by the annual 95th percentile of wet days during a baseline period.

**99<sup>th</sup> percentile for precipitation:** The 99th-percentile wettest days precipitation indicator points to the total amount of precipitation that falls on the wettest days of the year, specifically on days when precipitation exceeds a threshold set by the annual 99th percentile of wet days during a baseline period.

**Adaptation:** Includes any initiatives or actions in response to actual or projected climate change impacts and which reduce the effects of climate change on built, natural and social systems.

**Adaptive Capacity:** The ability of built, natural and social systems to adjust to climate change (including climate variability and extremes), to moderate potential damage, to take advantage of opportunities, or to cope with the consequences.

**Baseline:** A climatological baseline is a reference period, typically three decades (or 30 years), that is used to compare fluctuations of climate between one period and another. Baselines can also be called references or reference periods.

**Climate:** The weather of a place averaged over a period of time, often 30 years. Climate information includes the statistical weather information that tells us about the normal weather, as well as the range of weather extremes for a location.

**Climate Change:** Climate change refers to changes in long-term weather patterns caused by natural phenomena and human activities that alter the chemical composition of the atmosphere through the build-up of greenhouse gases which trap heat and reflect it back to the earth's surface.

**Climate Change Atlas of Canada:** The Climate Atlas of Canada is an interactive tool that combines climate science, mapping, and storytelling to depict expected climatic changes across Canada to the end of the century. The 250-layer map is based on data from 12 global climate models. Users are shown a baseline period of warming trends by region that spans from 1950 to 2005 and can toggle between two future projection periods, 2021 to 2050 and 2051 to 2080.

**Climate Projections:** Climate projections are a projection of the response of the climate system to emissions or concentration scenarios of greenhouse gases and aerosols. These projections depend upon the climate change (or emission) scenario used, which are based on assumptions concerning future socioeconomic and technological developments that may or may not be realized and are therefore subject to uncertainty.

**Climate Change Scenario:** A climate change scenario is the difference between a future climate scenario and the current climate. It is a simplified representation of future climate based on comprehensive scientific analyses of the potential consequences of anthropogenic climate change. It is meant to be a plausible representation of the future emission amounts based on a

coherent and consistent set of assumptions about driving forces (such as demographic and socioeconomic development, technological change) and their key relationships.

**Ensemble Approach:** An ensemble approach uses the average of all global climate models (GCMs) for temperature and precipitation. Research has shown that running many models provides the most realistic projection of annual and seasonal temperature and precipitation than using a single model.

**Extreme Weather Event:** A meteorological event that is rare at a place and time of year, such as an intense storm, tornado, hail storm, flood or heat wave, and is beyond the normal range of activity. An extreme weather event would normally occur very rarely or fall into the tenth percentile of probability.

**Greenhouse Gas (GHG) Emissions:** Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation, emitted by the Earth's surface, the atmosphere itself, and by clouds. Water vapour (H<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), ozone (O<sub>3</sub>), and chlorofluorocarbons (CFCs) are the six primary greenhouse gases in the Earth's atmosphere in order of abundance.

**Climate Impact:** The effects of existing or forecast changes in climate on built, natural, and human systems. One can distinguish between potential impacts (impacts that may occur given a projected change in climate, without considering adaptation) and residual impacts (impacts of climate change that would occur after adaptation).

**Impact Statement:** Climate-related impact statements are concise statements that outline locally-relevant projected threats and how those changes are expected to affect the built, natural, social, and economic systems of the municipality.

**Mitigation:** The promotion of policy, regulatory and project-based measures that contribute to the stabilization or reduction of greenhouse gas concentrations in the atmosphere. Renewable energy programs, energy efficiency frameworks and substitution of fossil fuels are examples of climate change mitigation measures.

**Representative Concentration Pathways:** Representative Concentration Pathways (RCPs) are four greenhouse gas concentration (not emissions) trajectories adopted by the IPCC for its fifth Assessment Report (AR5) in 2014. It supersedes Special Report on Emissions Scenarios (SRES) projections published in 2000.

**Resilience:** The capacity of a system, community or society exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure.

**Risk:** The combination of the likelihood of an event occurring and its negative consequences. Risk can be expressed as a function where  $\text{risk} = \text{likelihood} \times \text{consequence}$ . In this case, *likelihood* refers to the probability of a projected impact occurring, and *consequence* refers to the known or estimated outcomes of a particular climate change impact.

**Sensitivity:** Measures the degree to which the community will be affected when exposed to a climate related impact. Sensitivity reflects the ability of the community to function (*functionality*) as normal when an impact occurs.

**Vulnerability:** Vulnerability refers to the susceptibility of the community to harm arising from climate change impacts. It is a function of a community's sensitivity to climate change and its capacity to adapt to climate change impacts.

**Weather:** The day-to-day state of the atmosphere, and its short-term variation in minutes to weeks.

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