

SUNSHINE COAST REGIONAL DISTRICT

CLIMATE CHANGE VULNERABILITY & RISK ASSESSMENT REPORT

SPRING 2022



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INTRODUCTION

From flooding and extreme heat to increasing frequency and intensity of storms, the impacts of climate change are being experienced by municipalities across Canada and British Columbia. The Sunshine Coast has experienced its share of severe weather events. Recent heatwaves, drought, wildfires, and atmospheric river events have clearly shown the need for local action. To address these impacts and build its resiliency, the Sunshine Coast Regional District (SCRD) is embarking on the process of developing a climate change adaptation plan. This will form a pillar of the community's climate emergency action plan alongside a mitigation plan to reduce greenhouse gas emissions.

Climate change adaptation efforts that include the community ensures that those most affected by the impacts of climate change are involved in how risks are identified, assessed, and responded to. This report summarizes the most significant climate risks to the Regional District as identified by municipal staff and the broader community. This report serves as a valuable output as the SCRD continues the process of developing a climate change adaptation plan.

PROJECT BACKGROUND

Climate Adaptation Plan

The SCRD is pursuing the development of a practical and implementable climate change adaptation plan (hereby referred as The Plan). The purpose of The Plan is to scope and plan for the effects of a changing climate on the community as well as on local government managed infrastructure, assets, and services in order to reduce the risks climate change poses to Sunshine Coast's physical, economic, social, and ecological systems. A series of workshops and surveys were conducted throughout 2022 to identify climate change impacts and assess vulnerability and risk. This in turn will inform the identification of potential actions that the SCRD can take to address prioritized impacts. The Plan will recommend specific measures to enhance the SCRD's ability to address climate change impacts and assign agreed-upon responsibilities for undertaking related actions.

BARC Methodology

SCRD's climate adaptation work is guided by ICLEI's Building Adaptive and Resilient Communities (BARC) Framework. The BARC Framework guides municipalities through a comprehensive planning methodology that includes research and climate impact assessment, plan development, action-setting, implementation planning, and monitoring and review strategies. The BARC Framework is a proven methodology that has been implemented by hundreds of

municipalities across the country. A model of BARC's Milestone process is shown in Figure 1 below.

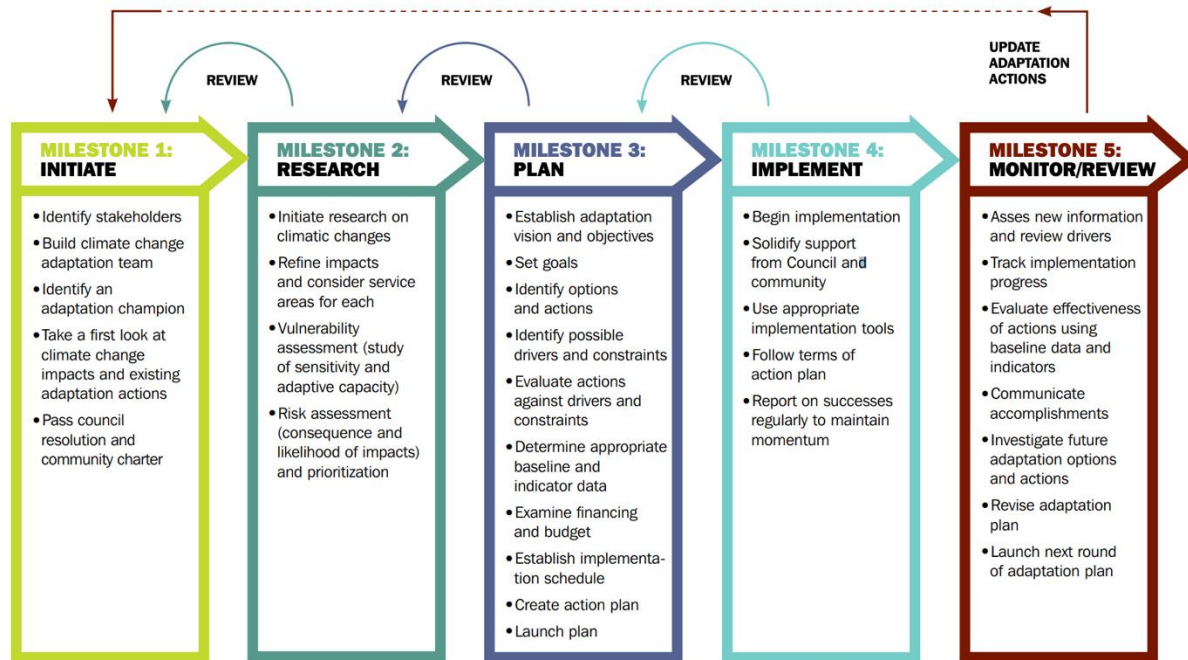


Figure 1: BARC 5-Milestone Framework

This project fulfills Milestones One, Two, and Three of the BARC Framework. Following the vulnerability and risk assessments outlined in this report, the Regional District will begin the planning stage (Milestone Three) process.

COMMUNITY ADAPTATION PLANNING PARTICIPANTS

In fulfilling the criteria of Milestone One, the SCRD worked with ICLEI Canada to identify relevant stakeholders to the adaptation planning process. The BARC framework allows for the individual examination of impacts, vulnerabilities, and risks to the Sunshine Coast. This process brings together a wide variety of corporate, community stakeholders, and First Nations, helping to build partnerships for long term and sustained climate action. Further, this allows us to learn of and capitalize on existing resources and programs within the region to support adaptation efforts.

The SCRD is also developing relations and processes to foster greater engagement with shíshálh Nation and Skwxwú7mesh Nation. Next steps in this climate adaptation planning will be congruent with and supportive of the existing work being undertaken by each Nation.

Stakeholders and First Nations

Through a process of identification and engagement, two groups were formed. The first is an Internal Project Team (IPT) comprised of Regional District staff. The second is a Community Project Team (CPT) encompassing stakeholders from agencies across the lower Sunshine Coast whose services are affected by climate change, as well as representatives from community and First Nations.

The IPT was formed to develop and shape the project direction and strategy and consists of the following members:

Division	Member
Sustainable Development	Raphael Shay (Project Lead)
Parks	Sam Adams
Planning	Julie Clark
Purchasing and Risk Management	Valerie Cropp
Protective Services	Jordan Pratt
Facilities	Allen van Velzen
Utilities	Shane Walkey
Strategic Initiatives	Alana Wittman

The CPT was formed to participate and aid in the development of this plan which includes identifying climate impacts to the community, and the scoring of these impacts. Members that continue to provide valuable direction and input for climate change adaptation planning include the following:

Department/Organization	Member
Ministry of Transportation and Infrastructure	Michael Braun
Vancouver Coastal Health	Craig Brown
Sunshine Coast Resource Centre	Katie Clogg
Ministry of Environment and Climate Change Strategy	Rob Dalziel
School District 46	Jenny Groves
Sechelt Chamber of Commerce	John Henderson
Loon Foundation	Michael Jackson
BC Hydro	Mabel Lai
District of Sechelt	Meghan Lee
Town of Gibsons	Michelle Lewis
Skwxwú7mesh Nation	Renata Rovelo
Sunshine Coast Conservation Association	Suzanne Senger
Átl'ka7tsem / Howe Sound Biosphere Region Society	Ruth Simons
Pender Harbour Chamber of Commerce	Annelise Sorg

Sḵwx̱wú7mesh Nation	Julia Stafford
Sunshine Coast Regional Economic Development Organization	Colin Stansfield
District of Sechelt	Marina Stjepovic
Shíshálh Nation	Jesse Waldorf
Sunshine Coast Tourism	Annie Wise

To date, the CPT has attended two virtual workshops and has participated in an online survey as part of the vulnerability assessment. The first workshop, held on February 22nd, 2022, was focused on presenting climate change projections for the lower Sunshine Coast as well as brainstorming climate change impacts, and assessing how climate change could affect the social, built, economic, and natural systems in the community. After this, the CPT participated in an online vulnerability assessment (through surveys) on the identified climate change impacts. Subsequently, a second workshop was held on April 13th, 2022, focused on presenting the results of the vulnerability assessment, and capturing the CPT's perceptions of risk associated with each climate change impact.

LOCAL CLIMATE CONTEXT

The Sunshine Coast is already experiencing the impacts of climate change. Some of these instances include drought and wildfires, extreme heat and the heat dome event of 2021, and extreme rainfall and the atmospheric river event of 2021. For example:

- Nine of the last thirteen summers have been below the summer precipitation average predicted for 2050 with climate change. This has resulted in the SCRD repeatedly implementing Stage 4 water conservation regulations and installing an emergency siphon at Chapman Lake for drinking water.
- Between June 25 and July 1, 2021, peaking on June 27 and 28, much of B.C. experienced an unprecedented heat event. This event included record-breaking day-time and night-time temperatures, and led to 526 heat-related deaths between June 25 and July 1, 2021, with 96% of these deaths occurring in a residential setting. (B.C. Coroners Service, 2021).
- Forest fires are increasingly affecting the Sunshine Coast. Fires in British Columbia and beyond have impacted local air quality for six of the last seven summers.
- Severe precipitation events, including the atmospheric rivers of November 2021, are increasingly damaging private and public infrastructure.

These recent events have highlighted the need to be prepared for ongoing challenges, especially as the Sunshine Coast's climate continues to change over the next century.

To gain an understanding of the changes to come and to help with adaptation planning and decision-making, ICLEI Canada worked with the SCRD to develop a climate science report. This report examines climate trends and projections on a global, national, and local scale. It further informs some of the climate change impacts that are expected to occur on the Sunshine Coast over the next century. Projections in this report are focused on temperature, precipitation, agricultural indices, freshwater indices, and extreme weather. A summary of these projections is outlined below (while a more complete graphic breakdown of these results is included within the Climate Science Infographic in Appendix A):

- **Temperature:** Temperature indices show significant warming across seasons, with an increase in the frequency of days above 30°C.
- **Precipitation:** Precipitation events in general are expected to become more intense. Annual precipitation is expected to increase, where winter and spring are projected to become significantly wetter, summers are expected to become drier.
- **Extreme weather:** Extreme weather events, including heavy storms are projected to become more frequent, last longer, and deliver more rain.
- **Growing season:** First frost dates will be later and last frost dates will be earlier contributing to a longer growing season.
- **Sea level rise:** The British Columbia Ministry of Environment suggests preparing for 0.5m of sea level rise by 2050, and 1.0m by 2080.

VULNERABILITY AND RISK ASSESSMENT

Analyzing both vulnerability and risk based on climate change projections for the Sunshine Coast is a key step in adapting to climate change and planning for the future. SCRD staff and community stakeholders went through a process of identifying existing weather stressors in the community, assessing how those could be exacerbated by climate change, and drafting a series of climate impact statements. These impact statements were then evaluated by the CPT through a vulnerability and risk assessment framework to create a prioritized list of impacts from which actions for each impact, or impact area, can be planned.

The assessment of vulnerability and risk was supplemented by additional external expert knowledge where necessary. The outcomes from the risk assessment reflect our current understanding of present climate conditions and consider anticipated climate projections for the community. The risk assessment will be revisited at regular future intervals as climate science and capacity to respond changes over time.

Impact Statements

Climate-related impact statements are the foundation of the vulnerability and risk assessment process and must be tailored to each municipality's context. These are

concise statements that outline locally relevant projected threats and how these changes are expected to affect the built, natural, social, and economic systems across the Sunshine Coast. They bring together knowledge of climate change and projected changes into the medium- and long-term as well as knowledge of the local conditions in the jurisdiction that is being studied. Impact statements are formed by answering the following questions:

- What are the climatic changes we are concerned about?
- What are the outcomes associated with these changes?
- What are the consequences associated with these outcomes?

At the first workshop, over 250 responses were initially identified by the CPT, and then revised into a long list of 43 impact statements. This list was further reviewed to more closely and concisely reflect the climatic changes that are expected to affect the community. Ultimately, through this triage and refinement process, 29 impact statements moved forward to the vulnerability assessment.

The impact statements cover a range of affected areas including infrastructure, natural environment, public health and safety, employee productivity, and more. The statements have been further organized by climate event to help the CPT better understand the focus and scope of each impact. Climate event categories include:

- Increased temperature (annual and seasonal)
- Drier conditions (summer)
- Increasing extreme summer temperatures and heatwaves
- Changes in precipitation (annual and seasonal) and changes in Intensity-Duration-Frequency (IDF)
- Increased extreme weather events (e.g., freezing rain, windstorms, thunderstorms, tornadoes, etc.)
- Changing water temperatures and water levels
- Increasing ocean temperatures and acidification
- Sea level rise

Vulnerability Assessment

Vulnerability refers to the susceptibility of a given asset, service, or group to harm arising from climate change impacts. Vulnerability is a function of two criteria – the **sensitivity** of the community to a given climate change impact, and its **adaptive capacity** (ability or access to resources to respond, recover and/or cope).

A vulnerability assessment necessitates an understanding of both biophysical and socioeconomic factors, as the focus is on understanding the processes involved with climate change impacts and the factors that influence sensitivity and adaptive

capacity. This understanding can help assist with the development of suitable adaptive actions later in the Milestone Three – planning stage.

To determine sensitivity, the degree to which the functionality of the community would be affected should the impact occur today is considered. This includes assessing how the impact would affect the community's ability to deliver and access services, maintain regular functionality, etc. In contrast, adaptive capacity refers to the ability of systems, institutions, individuals, and other assets to adjust to potential damage, to take advantage of opportunities, or to respond to consequences. To determine adaptive capacity, we consider the time and resources required to restore the community or assets to its previous functionality should the impact occur today, as well as consider any plans, policies, and actions already in place to address this issue.

The Sunshine Coast vulnerability assessment was carried out using online surveys and was completed by the CPT. The vulnerability assessment was broken down into three surveys based on impact areas: the built environment, the natural environment, and the socio-economic environment. CPT members ranked both sensitivity and adaptive capacity on a 5-point Likert scale displayed in the tables below:

Ranking	Definition
S1	Functionality will stay the same
S2	Functionality will likely stay the same
S3	Functionality is likely to get worst
S4	Functionality will get worse
S5	Functionality will become unmanageable

Figure 2: Sensitivity Legend

Ranking	Definition
AC1	Substantial costs and staff intervention (\$\$\$\$\$)
AC2	Significant costs and staff intervention (\$\$\$\$)
AC3	Some costs and staff intervention (\$\$\$)
AC4	Some slight costs and staff intervention (\$\$)
AC5	Little or no costs and staff intervention (\$)

Figure 3: Adaptive Capacity Legend

The scores for each impact were then entered into a vulnerability matrix (displayed below) to determine the overall vulnerability of the impact.

		Sensitivity: Low → High				
		S1	S2	S3	S4	S5
Adaptive Capacity Low ↓ High	AC1	V2	V2	V4	V5	V5
	AC2	V2	V2	V3	V4	V5
	AC3	V2	V2	V3	V4	V4
	AC4	V1	V2	V2	V3	V3
	AC5	V1	V1	V2	V3	V3

Figure 4: Vulnerability Matrix

As previously noted, a total of 29 impact statements were evaluated through the vulnerability assessment, the results of which are indicated below.

Vulnerability Ranking	Number of Impacts
V5	4
V4	15
V3	9
V2	0
V1	1

Figure 5: Vulnerability Assessment Ranking Distribution

The vulnerability assessment results provided a first look at prioritization of impacts before doing a more in-depth consideration of future risk. Vulnerability rankings of V4 and V5 indicate the impacts to which the Sunshine Coast is both *sensitive* and has low *adaptive capacity*. Therefore, impacts that received a V3 or lower were not carried forward into the risk assessment process, and are identified as “climate impacts to monitor” as the District advances the monitoring and evaluation of the forthcoming Adaptation Plan. The final 19 impacts were then further refined for clarity and consistency, as a result 15 impacts were carried through to the risk assessment.

Most of the low-ranking impacts were largely related to agricultural practices, or were social or recreational in nature (i.e., climate change and its consequences on recreational facilities, activities, and administrative programming), and do not pose a major threat to food security or public health and safety. Further these impacts related to aspects of the Sunshine Coast where adaptive capacity was deemed to be high by CPT members. Although these impacts should be monitored as the SCRD moves forward, workshop participants identified protocols in place to support response to these impacts.

Impacts ranked V4 or V5 represent threats that could cause the most severe disruption, damage, or resource costs if they were to occur. Key impacts to which the Regional District was highly *sensitive* or had low *adaptive capacity* to withstand are described below.

Impact ID	Climatic Threat	Impact Statement
#1	Increased annual precipitation	An increase in annual precipitation causing an overburdening of stormwater infrastructure resulting in overland and basement flooding (private property damage)
#2	Increased frequency and intensity of extreme weather events	An increase in the frequency and intensity of extreme weather events resulting in damage to critical infrastructure (roads, marinas, storm-water management systems, water system, powerlines, etc.), unsafe travel conditions, and interruptions to municipal services and the delivery of goods and services.
#3	Increased ocean temperatures and acidification	Increasing ocean temperatures and acidification resulting in biodiversity loss and species die off
#4	Increased frequency and intensity of extreme weather events	Increase in hot days, heatwaves, and drought, leading to health risks (e.g., cardiovascular disorders, heat stress, mental health effects) and heat related mortality, especially amongst vulnerable populations
#5	Increased hot days (>30°C)	Increase in hot days (>30°C) leading to stress and damage to transportation infrastructure (e.g., roads, bridges, etc.)
#6	Increased hot days (>30°C) average summer temperatures, and increased frequency of drought	An increase in hot days, average summer temperatures, and more frequent drought conditions leading to strain on water systems resulting in reduced water quality and quantity
#7	Sea level rise	Sea level rise damaging or washing out critical infrastructure (roads, marinas, storm-water management systems, water system, powerlines, etc.) resulting in increased maintenance and repair costs

#8	Increased hot days (>30°C) and average summer temperatures	An increase in hot days (>30°C) and average summer temperatures resulting in increased exposure of marine life (e.g., Shellfish, Seaweed, Salmon, etc.) during low tide resulting in the loss of marine life and biodiversity
#9	Increased annual and seasonal temperatures	An increase in annual and seasonal temperatures resulting in impacts to habitat, low creek flow, and shifting eco-regions resulting in unbalanced ecology, impacts to biodiversity, changes to local flora & fauna
#10	Increased annual and seasonal temperatures, decrease in summer precipitation	Increased annual and seasonal temperatures combined with decreased summer precipitation resulting in increased likelihood and frequency of wildfires
#11	Increased winter temperatures and fewer freezing days	Increased winter temperatures and fewer freezing days resulting in the survival and increase of invasive species (knotweed, ticks, pine beetle, etc.)
#12	Increased frequency and intensity of extreme weather	An increase in the frequency and intensity of extreme weather events resulting in damage to local vegetation and tree canopy
#13	Increased frequency and intensity of extreme weather	Increased frequency and intensity of extreme weather events resulting in the increased frequency of emergency response deployment, the redeployment of Regional District staff and resources, and the decreased capacity of emergency response and responders, resulting in an increased budget requirement.
#14*	Increased sea level rise and storm surge events	Increased sea level rise and storm surges causing damage or loss of cultural sites further exacerbating existing social inequities and increasing burden on mental health/well-being
#15*	Shifting patterns of seasonality, warming temperatures, and unstable precipitation patterns	Shifting patterns of seasonality, warming temperatures, and unstable precipitation patterns leading to changes of migration patterns of local flora/and fauna, damage to the natural environment, and a loss of biodiversity negatively impacting

		traditional practices, hunting, and harvesting for First Nations groups
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Figure 6: High Vulnerability Impacts

*In consultation with the Skwxwú7mesh and shíshálh Nations, these impacts were not evaluated in depth with the CPT during the risk assessment in order create space for a process that honours the spirit of reconciliation and meaningfully engages the Nations. Both the Skwxwú7mesh and Shíshálh Nations are undertaking Nation-led climate change planning and projects. The SCRD will continue to support and collaborate both the Skwxwú7mesh and Shíshálh Nations to develop adaptation actions that honour these traditional, unceded, and ancestral territories and those who call them home.

High-ranking impacts in the vulnerability assessment were related to summer temperatures and extreme heat days, increased heavy precipitation and flooding, increased extreme weather events, and sea level rise. Areas of concern were mainly spread across three categories, including impacts to the natural environment (e.g., biodiversity loss and ecosystem damage), the built environment (i.e., damage to municipal assets, private property, etc.), and threats to social systems (i.e., power/service interruptions, demand on emergency support, displacement, water quality, public health, and safety).

Risk Assessment

The risk assessment process is used to further analyze and prioritize which risks are most pertinent in a climate-adjusted future. Risk is the combination of the probability of an event occurring and its negative consequences. It can be expressed as a function of *likelihood* x *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.

Likelihood

The first part of the risk assessment involved determining *likelihood*. *Likelihood* was based on the probability of the projected impact occurring and considered more the outcome of the impact statement occurring rather than the climatic event itself (e.g., not whether there would be increased precipitation, but the likelihood of increased flooding and road washouts). This was informed by considering localized climate projections, historical weather events, anecdotal knowledge of past events and an understanding of how sensitive the Sunshine Coast is to the impact (i.e., by considering *sensitivity* from the vulnerability assessment).

Likelihood ratings were assigned to each of the identified impacts by the IPT prior to the risk assessment workshop and then reviewed by ICLEI Canada and the CPT. Likelihood ratings were adjusted in response to any additional expert input to

ensure they were as accurate and representative for the Regional District as possible. *Likelihood* was measured on a scale of 1–5, whereby 1 indicates a 'Rare' occurrence, and 5 indicates an 'Almost Certain' occurrence.

When determining *likelihood*, it was also important to identify if something would be a recurrent impact or a slow onset event. This helped to determine whether to assign a *likelihood* rating based on a probability of occurrence or a frequency of occurrence. A recurrent impact is something that can happen more than once – such as a flood event or infrastructure damage. A slow onset impact is one that evolves gradually from incremental changes occurring over many years or from an increased frequency or intensity of recurring events. This could include events such as a loss of biodiversity/endangered species or a permanent move of a population. The *likelihood* matrix is presented below.

Likelihood	Rating	Recurrent Impact	Slow Onset
Almost Certain	5	At least once per year (Annual chance: 100%)	Almost certain - 95% or greater chance of occurrence in next 50 years
Likely	4	Once in 1 to 5 years (Annual chance: 20%-100%)	Likely - 65% to 90% chance of occurrence in next 50 years
Possible	3	Once in 5 to 10 years (Annual chance: 10% to 20%)	Possible - 35%-65% chance of occurrence in next 50 years
Unlikely	2	Once in 10 to 50 years (Annual chance: 2% to 10%)	Unlikely - 5% to 35% chance of occurrence in next 50 years
Very unlikely	1	Once in 50 years or more (Annual chance: <2%)	Very unlikely - less than 5% chance of occurrence in next 50 years

Figure 7: Likelihood Matrix

Consequence

The second part of the risk assessment involved assigning *consequence* scores. This was completed by the CPT at the second workshop on risk assessment. Participants were asked to assign a *consequence* rating ranging from negligible (1) to catastrophic (5) for each of the *consequence* criteria, which were divided into social, economic, and environmental categories, as shown in the figure below. In addition to the numerical score, participants were asked to give written justifications for the rating they assigned to provide transparency for future reference. The detailed consequence tables can be found in Appendix B.

Social Factors	Economic Factors	Environmental Factors
Health and Safety	Property Damage	Air
Displacement	Local Economy and Growth	Soil and Vegetation
Loss of livelihood	Community Livability	Water
Cultural Aspects	Public Administration	Ecosystem Function

Figure 8: Consequence Categories

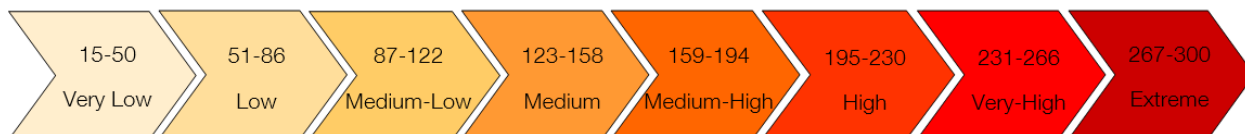
After the workshop, the IPT conducted any necessary follow ups with CPT members to either further expand on the risk scores and justifications or fill in some gaps. Additional external expert input was sought out where necessary to ensure that risks were scaled accurately and evaluated consistently. This process also provided the scoring for impact statements that the stakeholders deemed they were inadequately informed to provide scoring for.

Risk Spectrums

The evaluation of *likelihood* and *consequence* resulted in risk scores for each consequence category (e.g., social, economic, and environmental) as well as one overall risk score. The level of risk per consequence category was calculated using the spectrum below:



The total risk score (the sum of each risk category score multiplied by *likelihood* of the impact occurring) was obtained using the spectrum below:



The purpose of providing one overall risk score, as well as three category-specific risk scores, is to try and capture certain impacts that may score high in certain categories, but low in other categories. This is intended to ensure the impacts that may pose a high risk to certain aspects of the corporation will still be captured, despite having a lower overall risk score.

Limitations of the Risk Assessment

It is important to note that the risk assessment process is not an exact science; it is a subjective exercise that evaluates participants' opinions, based on either their professional expertise or their lived experience, of the risks that impacts pose to the Sunshine Coast's infrastructure, services, environment, or to the wider community. Outputs of the exercises are dependent on those that participated in the assessment. While great effort was made to engage key stakeholders throughout the Sunshine Coast, the exercise does not necessarily capture every possible perspective. It is also important to acknowledge that the impact statements themselves are also subjective, however, great effort was made to ensure the lists were both inclusive and exhaustive, and captured how climate change could impact the Sunshine Coast.

RISK ASSESSMENT RESULTS

For the Sunshine Coast, 13 impact statements were brought forward to the risk assessment. The final results are discussed below, with the complete breakdown of results shown in detail in Appendix C. The distribution of the risk assessment results is displayed in the figure below.

Risk Ranking	Number of Impacts
Extreme	0
High	2
Medium-High	4
Medium	3
Medium-Low	4
Low	0
Very Low	0

Figure 9: Risk Assessment Ranking Distribution

There were no "extreme" impacts identified. This is not unusual in the risk assessment process, as an impact will rarely rank high or extreme across all three risk categories (e.g., social, environmental, and economic). The highest overall risk scores were 230 and 200, relating to Impact 6: "An increase in hot days, average summer temperatures, and extended drought leading to strain on water systems resulting in reduced water quality and quantity" and Impact 10: "Increased annual and seasonal temperatures combined with decreased summer precipitation resulting in increased likelihood and frequency of wildfires", respectively. Justification for Impact 6 noted that drought has been experienced in the Regional District very frequently in the last 10 years resulting in stage 4 water restrictions, the closure of businesses, and extensive investment in infrastructure and time to combat water quality and quantity issues in the Regional District. Justification for Impact 10 included the increased likelihood of wildfire in the region and the very serious consequences it will have on the community; including

impacts to air quality and public health and safety; the potential displacement of residents and the loss of livelihood; impacts to community livability in relation to the local economy, service delivery, and property damages; and destruction of the natural environment.

The medium-high ranking impacts (2, 3, 7, 11) addressed the effects that climate change will have on the built environment and the natural environment. Impacts 2 and 7 highlight the consequences of increased frequency of extreme weather events (such as flooding as a result of atmospheric river events) and sea level rise will have on critical infrastructure including roads, marinas, storm-water management systems, powerlines, etc. Justifications provided included the very expensive nature of infrastructure repair or replacement, impacts to the delivery of goods and services, reduced access to emergency services, as well as the potential isolation of residents in remote settings. Further the failure of stormwater management systems in the event of extreme weather has the potential to result in flooding, impact water quality for residents, and could result in major impacts to the natural environment in the form of saltwater incursion, contaminated runoff, as well as erosion and washouts.

Impacts 3 and 11 cover how increasing temperatures (both summer and annual) will affect the natural environment in the form of biodiversity loss and an increase in invasive species (such as ticks, pine beetle, knotweed, and hogweed). The loss of ocean biodiversity has the potential to affect a wide variety of systems that include ecosystem function and water quality, as well as industry and recreational hunting and fishing. The incursion of knotweed, hogweed, and expansion of insects such as pine beetle or other diseases in the region can result in private property damage, damage to key infrastructure such as powerlines, and can upset ecological balance of the Sunshine Coast's natural systems. Additionally impacts 8 and 9 (ranked medium) were also related to changes in temperature and precipitation patterns and the resulting effects on the natural environment, shifting ecoregions, and the loss of biodiversity. Finally, Impact 4 addresses the effect that extreme heat and drought will have on the health of residents and especially vulnerable populations on the Sunshine Coast. The CPT noted that this impact poses both physical (heat stress, cardiovascular and respiratory disorders) and mental (eco-anxiety, depression) health risks, and is likely to become more frequent as temperatures rise and precipitation patterns become less predictable.

There were 4 impacts that scored medium-low. These impacts covered a diverse set of climate events and categories (e.g., social, environmental, or economically focused). The scores of these impacts reflect either a lower likelihood of occurrence or are impacts more readily managed or not necessarily presenting a high burden on the Sunshine Coast to manage in the long-term, and that likely result in minimal negative consequences on the corporation or community as a whole. Climate impact statements ranked medium-low will be monitored for any

changes in their likelihood and consequence and will be considered in future iterations of the Plan once re-evaluated.

Additional risks have been identified that are global in nature and difficult to quantify in terms of risk but will undoubtedly create impacts locally. These risks will be monitored when possible and actions will be designed to prepare for these risks and collect additional data where feasible. They include:

- Changes in global climate conditions creating an increase in climate migrants and refugees.
- Impacts to community liveability with regards to food security, job security, economic viability, insurance rates, and property values.

Impacts Moving Forward to Planning

The purpose of the vulnerability and risk assessment process was to prioritize impacts that pose a significant threat to the Sunshine Coast. It is intended that the impacts which scored the highest in the assessment process will be brought forward into Milestone Three (planning phase) of the BARC Framework, where the SCRD and the community will brainstorm adaptive actions to address them. Resources for adaptation planning should be directed towards the highest priority impacts first but designed to address as many impacts as possible whenever feasible.

When selecting priority impacts to be considered as part of the planning phase, the IPT included impacts that had an overall risk score of medium or higher. Additionally, the IPT reviewed the medium-low ranking impacts in greater depth to assess whether any of them should be brought forward into the planning stage. This was done to ensure that impacts that posed significant risk (i.e. medium-high or higher) to one or two specific consequences (e.g. certain individuals, groups, assets, natural areas, etc.) were not left out of the process.

The final list of 9 impacts to be brought forward to the planning phase are outlined below:

Impact Statement	Risk Ranking
Impact 6: An increase in hot days, average summer temperatures, and extended drought leading to strain on water systems resulting in reduced water quality and quantity	High
Impact 10: Increased annual and seasonal temperatures combined with decreased summer precipitation resulting in increased likelihood and frequency of wildfires	High

Impact Statement	Risk Ranking
Impact 7: Sea level rise damaging or washing out critical infrastructure (roads, marinas, storm-water management systems, water system, powerlines, etc.) resulting in increased maintenance and repair costs	Medium-high
Impact 3: Increasing ocean temperatures and acidification resulting in biodiversity loss and species die off	Medium-high
Impact 2: An increase in the frequency and intensity of extreme weather events resulting in damage to critical infrastructure (roads, marinas, storm-water management systems, water system, powerlines, etc.), unsafe travel conditions, and interruptions to service delivery and the delivery of goods and services.	Medium-high
Impact 11: Increased winter temperatures and fewer freezing days resulting in the survival and increase of invasive species (knotweed, ticks, pine beetle, etc.)	Medium-high
Impact 9: An increase in annual and seasonal temperatures resulting in impacts to habitat, low creek flow, and shifting eco-regions resulting in unbalanced ecology, impacts to biodiversity, changes to local flora & fauna	Medium
Impact 8: An increase in hot days resulting in increased exposure of marine life (e.g. Shellfish, Seaweed, Salmon, etc...) during low-tide resulting in the loss of marine life and biodiversity	Medium
Impact 4: Increase in hot days and heatwaves, drought, and back-to-back climate emergencies leading to health risks (e.g., cardiovascular disorders, heat stress, mental health effects) and heat related mortality, especially amongst vulnerable populations	Medium

Figure 10: Impacts Moving Forward to Planning

NEXT STEPS

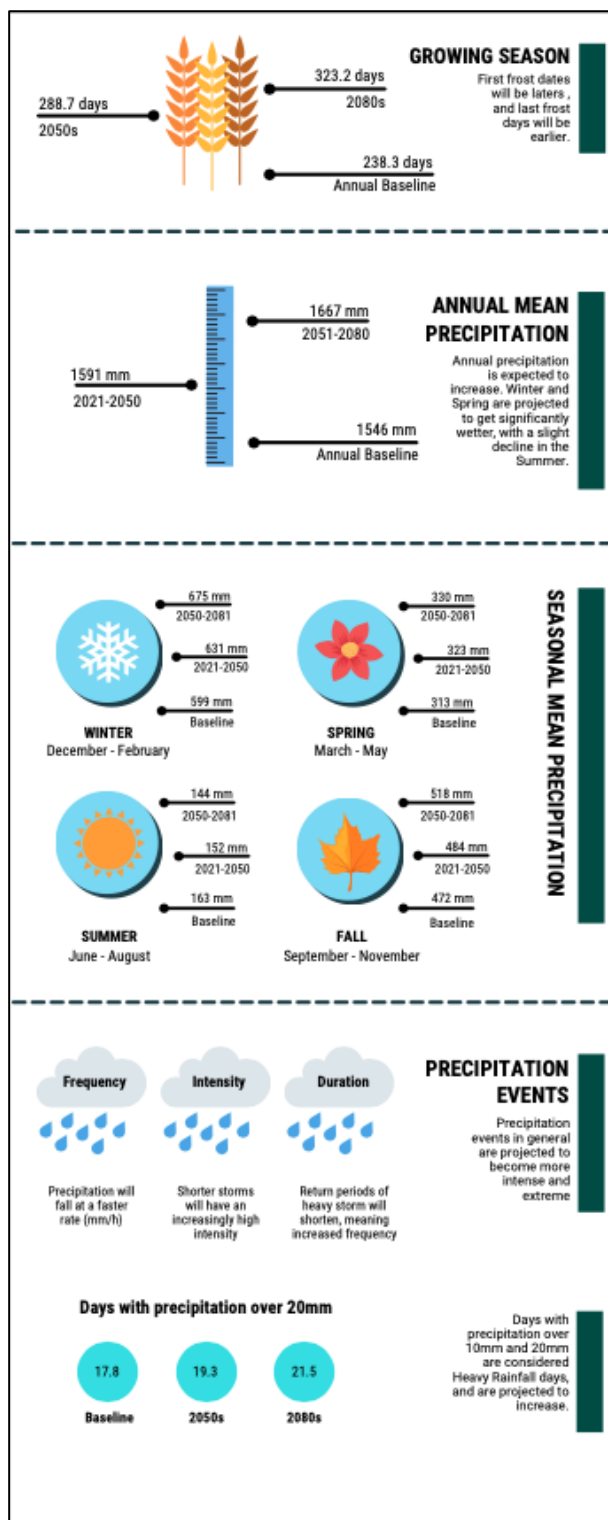
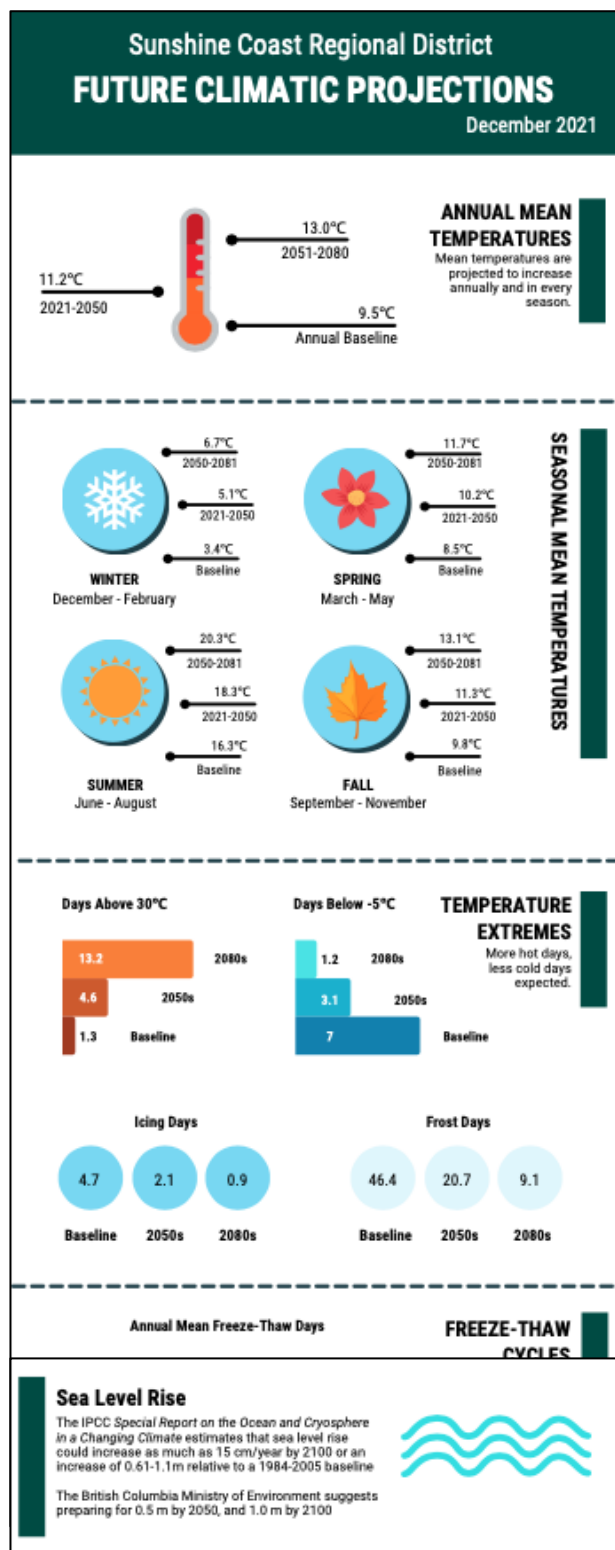
The risk assessment brings the SCRD to the completion of Milestone Two of the BARC Framework. The SCRD will now begin work on Milestone Three from June 2022 to May 2023. This phase will continue to embed community engagement as a core activity, starting with action identification and prioritization, with work in later stages to address implementation considerations.

The first step of this will be to develop a Vision along with a series of Themes, Objectives, and Actions for the Plan. This will be the goal of the next workshop hosted with the CPT, tentatively scheduled for mid-June. The SCRD will then carry out an activity to identify what actions need to be prioritized and in what time frame.

Following this, and a period of internal work to prioritize and consolidate actions, a workshop will be held on implementation. This workshop will serve to finalize appropriate adaptation actions and walk through the considerations and plans surrounding their implementation. The implementation plan will outline details such as supporting actions (to be taken to achieve the overarching action/strategy), timelines, leading and supporting actors and partners in implementation, and indicators to measure progress and allow for course correction as needed. Finally, a draft adaptation plan will be circulated for review towards the end of the year.

Alongside this process, collaboration with shíshálh and Skwxwú7mesh Nations will ensure that the Plan reflects and supports values and visions for this place. Several plans with guiding principles that should frame Milestone 3 already exist. Additionally, there are several projects underway at each Nation respectively that relate to climate adaptation. These in particular will be a focus for engagement as Milestone 3 progresses.

Appendix A – Climate Science Infographic



Appendix B – Risk Assessment Materials

CONSEQUENCE TABLES

Social Factors

CONSEQUENCE RATING	SOCIAL FACTORS			
	Public Health & Safety	Displacement	Loss of Livelihood	Cultural Aspects
Catastrophic	Large number of fatalities or serious injuries, or permanent illness	Large number of permanently displaced people on a widespread scale	Large disturbances leading to permanent changes in people's normal routines and way of life	Unprecedented loss of cultural identity (i.e. traditions and customary practices) across the wider community (i.e. cancellation of flagship annual event)
	5	5	5	5
Major	Isolated instances of fatalities or serious injuries, or long-term illness	Isolated instances of permanently displaced people on a widespread scale	Large disturbances leading to prolonged changes in people's normal routines and way of life	Significant loss of cultural identity (i.e. traditions and customary practices) for multiple social groups
	4	4	4	4
Moderate	Small number of injuries or cases of illness	Isolated instances of temporary displaced people on a widespread scale	Moderate disturbances leading to short-term changes in people's normal routines and way of life	Moderate impact on cultural identity (i.e. traditions and customary practices) for multiple social groups
	3	3	3	3
Minor	Near misses or minor injuries	Isolated instances of temporary displaced people in localized areas	Minor and short-term changes to people's normal routines and way of life	Minor impact on cultural identity (i.e. traditions and customary practices) for a small number of social groups
	2	2	2	2
Negligible	Appearance of a threat but no actual harm	Appearance of a threat but no actual displacement	No changes to people's normal routine and way of life	Appearance of a threat but no actual impact on cultural identity (i.e. traditions and customary practices)
	1	1	1	1

Economic Factors

CONSEQUENCE RATING	ECONOMIC FACTORS			
	Property Damage	Local Economy & Growth	Community Livability	Public Administration
Catastrophic	Catastrophic damage and costs incurred by the owner (\$\$\$\$\$)	City-scale decline leading to widespread business failure, loss of employment and hardship	Permanent decline in services, causing the city to be seen as very unattractive, moribund, and unable to support the community	Public administration would fall into decay and cease to be effective
	5	5	5	5
Major	Major damage and costs incurred by the owner (\$\$\$\$)	City-scale stagnation such that businesses are unable to thrive	Widespread and severe decline in services and quality of life within the community	Public administration would struggle to remain effective and would be in danger of failing
	4	4	4	4
Moderate	Moderate damage and costs incurred by the owner (\$\$\$)	Isolated areas of reduction in economic performance relative to current forecasts	Isolated but noticeable examples of decline in services	Public administration would be under severe pressure on several fronts
	3	3	3	3
Minor	Minor damage and costs incurred by the owner (\$\$)	Inconveniences that cause minor shortfall relative to current forecasts	There would be minor areas in which the community is unable to maintain its current services	There would be minor instances of public administration being under more than usual stress
	2	2	2	2
Negligible	No damage and costs incurred by the owner (\$)	No real impact to the local economy and growth	No real pressure on current services	No real stress on public administration
	1	1	1	1

Environmental Factors

CONSEQUENCE RATING	ENVIRONMENTAL FACTORS			
	Air	Water	Soil & Vegetation	Ecosystem Function
Catastrophic	Very frequent periods of reduced air quality.	Irreversible, widespread reduction in water quality/quantity	Irreversible, widespread impacts to soil or vegetation	Major and widespread loss of ecological functions and irrecoverable damage
	5	5	5	5
Major	Considerable increase in periods of reduced air quality in the medium term	Major, widespread reduction in water quality/quantity in the medium/long-term	Major, widespread impacts on soil or vegetation in the medium/long-term	Severe and widespread loss of ecological functions and damage that could be reversed with intensive efforts
	4	4	4	4
Moderate	Moderate increase in periods of reduced air quality in the short/medium term	Moderate, widespread reduction in water quality/quantity in the short/medium-term	Moderate, widespread impacts on soil or vegetation in the short/medium-term	Isolated but moderate instances of damage to the ecosystem that could be reversed with intensive efforts
	3	3	3	3
Minor	Minor increase in periods of reduced air quality in the short term	Minor, localized reduction in water quality/quantity in the short-term	Minor, localized impacts on soil or vegetation in the short-term	Isolated but minor instances of damage to the ecosystem that could be reversed
	2	2	2	2
Negligible	Appearance of a threat but no real impact to air quality	Appearance of threat but no real reduction in water quality/quantity	Appearance of threat but no real impacts on soil or vegetation	Appearance of a threat but no real damage to the ecosystem and its functions
	1	1	1	1

Appendix C – Detailed Vulnerability and Risk Assessment Results

Impact ID	Impact Statement	Vulnerability Ranking	Likelihood (/5)	Social Risk Score (/100)	Economic Risk Score (/100)	Environmental Risk Score (/100)	Total Risk Score (/300)	Overall Risk Ranking
1	An increase in annual precipitation causing an overburdening of stormwater infrastructure resulting in overland and basement flooding (private property damage)	5	3	30	39	36	105	Medium-low
2	An increase in the frequency and intensity of extreme weather events resulting in damage to critical infrastructure (roads, marinas, storm-water management systems, water system, powerlines, etc.), unsafe travel conditions, and interruptions to municipal services and the delivery of goods and services.	5	4	48	64	56	168	Medium-high
3	Increasing ocean temperatures and acidification resulting in biodiversity loss and species die off	5	5	45	45	80	170	Medium-high
4	Increase in hot days and heatwaves, drought, and back-to-back climate emergencies leading to health risks (e.g., cardiovascular disorders, heat stress, mental health effects) and heat related mortality, especially amongst vulnerable populations	5	5	65	55	20	140	Medium
5	Increase in hot days leading to stress and damage to transportation infrastructure (eg. roads, bridges, etc...)	4	4	32	36	24	92	Medium-low
6	Increased hot days (>30°C) and average summer temperatures and increased frequency of drought	4	5	75	85	70	230	High

7	Sea level rise damaging or washing out critical infrastructure (roads, marinas, storm-water management systems, water system, powerlines, etc.) resulting in increased maintenance and repair costs	4	4	64	76	32	172	Medium-high
8	An increase in hot days (>30°C) and average summer temperatures resulting in increased exposure of marine life (e.g., Shellfish, Seaweed, Salmon, etc.) during low tide resulting in the loss of marine life and biodiversity	4	4	44	40	60	144	Medium
9	An increase in annual and seasonal temperatures resulting in impacts to habitat, low creek flow, and shifting eco-regions resulting in unbalanced ecology, impacts to biodiversity, changes to local flora & fauna	4	4	40	40	68	148	Medium
10	Increased annual and seasonal temperatures combined with decreased summer precipitation resulting in increased likelihood and frequency of wildfires	4	4	68	64	68	200	High
11	Increased winter temperatures and fewer freezing days resulting in the survival and increase of invasive species (knotweed, ticks, pine beetle, etc.)	4	4	48	56	60	164	Medium-high
12	An increase in the frequency and intensity of extreme weather events resulting in damage to local vegetation and tree canopy	4	3	30	24	39	93	Medium-low
13	Increased frequency and intensity of extreme weather events resulting in the increased frequency of emergency response deployment, the redeployment of District staff and resources, and the decreased capacity of emergency response and responders, resulting in an increased budget requirement.	4	4	48	36	16	100	Medium-low