



PLANNED RETREAT APPROACHES TO SUPPORT RESILIENCE TO CLIMATE CHANGE IN CANADA

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Executive Summary

Planned retreat forms an essential component of minimizing the adverse consequences of climate change and its impacts. However, relatively little is known about how this can be done to best protect, preserve and promote individual and community well-being. To advance knowledge in this area, Natural Resources Canada (NRCan), in collaboration with Gevity Consulting Inc. and a broad team of planned retreat practitioners and subject matter experts from academia, government and industry, produced this report. The aim of this report is not to arrive at a concrete set of best practices, as this space is still rapidly evolving and very context dependent. Rather, the report seeks to identify success factors and common pitfalls that are likely to extend more broadly across planned retreat efforts.

Climate change impacts are increasing in frequency and severity, outpacing preparedness and increasing costs for Canadians and businesses. At the time of preparing this report, the world is responding to a coronavirus pandemic, and this crisis reinforces the value of proactive planning to reduce risks and increase resilience. While the impacts of climate change may be slower and, sometimes, less visible than those of the COVID-19 pandemic, the same disastrous impacts on our health, our communities and our economies are possible. Across the globe, resiliency measures are being put to the test.

The effects of climate change are exacerbating the impacts of natural and human-caused disasters affecting communities across Canada. For example, the coronavirus is currently affecting our ability to deal with people put at disproportionate risk by the impacts of climate change. Opening emergency shelters for flood victims is not advisable or recommended. Planned cooling shelters for increasingly hot summers put those most vulnerable at risk of exposure to COVID-19. Disasters do not recognize each other's boundaries, and so we must adapt and become resilient to them.

Ceding homes, communities and land uses to nature is very difficult, yet may be necessary. Climatic changes continue to accelerate, and even optimistic emission reduction scenarios suggest that significant impacts and challenges will manifest over the longer term. However, planned retreat may offer a sustainable cost-effective option for reducing the risks of climate change by moving people, buildings, critical infrastructure and land uses to lower-risk locations where they can thrive.

There are excellent examples of planned retreat globally, with New Zealand providing a particularly strong example of how to communicate and implement retreat. This strength in risk communication has extended beyond the context of planned retreat, with New Zealand also being praised for its leadership in response to the ongoing COVID-19 pandemic. While lessons can be learned from New Zealand, insights from the United States, Europe and, most especially, Canada are also of relevance to informing practice. Too often, planned retreat occurs only after multiple disasters have rolled through a community, at great human and economic expense. Too often, retreat occurs as a patchwork, with deep inequities within and between communities. Too often, retreat takes far too long to be implemented, with people living on the brink of the next disaster but unable to adapt. In 2020, four homes in Tuktoyaktuk were successfully moved to a lower-risk area, being relocated from the disappearing coastline to inland locations. However, the process of planned retreat has been underway in Tuktoyaktuk since the 1960s and is still far from complete.

A review of retreat approaches in Canada and relevant international contexts revealed that retreat is most often implemented as a reactive measure, typically following a natural disaster such as a flooding event. It was found that economics can drive retreat as an option, both for homeowners and communities, when full accounting of the cost of persisting in place, with rebuilding accommodations, is double or more the cost of retreat, along with the cost of health and emergency services. Retreat also lacks standardization, with communities in close proximity to each other often having disparate responses. In the Ottawa-Gatineau region, affected homeowners in Quebec received buyouts following two record floods in April 2017 and May 2019, while residents in Ottawa received no buyouts. Inequity based on socioeconomic status and systemic marginalization is a persisting problem. In the United States, affluent, mostly white communities were able to garner state and federal support for mass

movement or for enhanced protections. Bureaucracy can also be a second disaster for affected communities, with municipalities, businesses and individuals often wading through multiple agencies and bureaucratic processes to gain support and aid, even as they are coping with rebuilding.

This report is primarily intended for practitioners and community stakeholders considering the difficult choice of planned retreat in the context of climate change adaptation. Retreat can be a painful process for individuals, who have to give up their attachment to place in support of the broader community well-being. This process is challenging, stressful and hard—but making sacrifices on behalf of others can also be an enriching opportunity.

The case studies in this report (summarized in Table E1) highlight a number of good practices, such as the benefits of a transparent process and coordinating effectively with relevant stakeholders when considering a complex and potentially life-changing approach such as planned retreat. Top-down approaches may facilitate rapid retreat, but retreat without effective community engagement can have health, financial and social consequences for affected individuals and communities. While pursuing a collaborative approach with communities may slow down the retreat process, strong community engagement and ownership, alongside consideration of the areas to which affected communities will relocate, are essential to protecting and promoting the health and well-being of those affected. A summary of good practices and considerations for leaders and practitioners to consider are summarized in Table E2.

Table E1. Summary of Canadian retreat case study examples, focusing on planned and reactive approaches.

Case Study	Summary
Surrey, BC	<p>With a population of 520,000, Surrey, BC is one of the municipalities that is part of the Greater Vancouver Area. Up to 20% of the land area lies within the coastal flood zone. The Semiahmoo First Nation lies geographically within Surrey’s boundaries and includes part of the coastal floodplain. Historically, Surrey has employed an “avoid and protect” strategy that evolved from both coastal and riverine flooding that occurred in 1948 and 1972. More recently, Surrey has developed a Coastal Flood Adaptation Strategy (CFAS) due to a recognition of the possibility of enhanced hazards due to climate change. The CFAS included planned retreat as an adaptation strategy in three distinct planning areas: Mud Bay, Crescent Beach and Semiahmoo Bay. The CFAS was a long-term visioning process in which there was significant stakeholder engagement throughout the five-phase process. One of the most innovative aspects of the public engagement process was collaborative development of public “values criteria.” Seven values were eventually agreed upon:</p> <ul style="list-style-type: none"> • Residents: Number of people permanently displaced by the option and related health/safety impacts • Agriculture: Amount of agricultural land permanently lost due to the option • Environment: Anticipated environmental impact (positive/negative) expected from the option • Infrastructure: Transportation/utilities disruptions expected from the option • Economy: Permanent loss of businesses expected from the option • Recreation: Recreation opportunities (positive/negative) expected from the option • Culture: Semiahmoo First Nation cultural impacts expected from the option <p>Use of these values criteria for adaptation decision-making marks a significant empowerment of Surrey residents and the Semiahmoo First Nation, and this, combined with the extensive public engagement generally, allowed for greater acceptance of and support for project decisions.</p>
High River, AB	<p>Located 40 km south of Calgary on the Highwood River, High River, AB has experienced at least 12 floods of high magnitude since the late 1800s. In 2013, the community experienced its highest ever flood event, which occurred a mere eight years after the</p>

	<p>previous high flood event in 2005. The Town of High River had begun preliminary flood reduction planning after the 2005 event, which led to the plan to “build back better” after the 2013 event. Planned retreat became a method of adaptation when the Alberta provincial government launched the Floodway Relocation Plan for six southern Alberta communities in 2013. This announcement came after the province’s new regulations on floodway development and related restriction on the Disaster Recovery Fund (DRF) eligibility. In total, 94 High River homes were purchased by the Alberta government under this program and a CP railway bridge was removed that created a “choke point.” The planned retreat process in High River can be characterized as a primarily top-down, non-collaborative process in which Provincial and Town officials largely decided on planned retreat for the community. Most of the retreat land has not been repurposed and only basic naturalization has been completed. The lack of community engagement led to a retreat process that resulted in anger, confusion and additional stress on the residents. Rapid retreat was realized with the top-down approach; however, there was little trust or transparency in the retreat process to foster buy-in and well-being from the residents. Utilizing a slower consultation approach within flood-affected communities would likely generate longer-term community-driven approaches to resilience.</p>
<p>Great Lakes, ON</p>	<p>Over the last seven years, increased lake levels have triggered significant coastal and bluff erosion and coastal flooding along a 60 km stretch from Eriean to Leamington on Lake Erie’s northern coastline. Lake Erie water levels fluctuate seasonally and over longer time periods in response to inflows from Lake St. Clair/Huron, rain and snow events over the lake, and inflows from the many smaller rivers which drain directly into the lake. Thousands of waterfront cottages, homes, estate homes, farms and tourist accommodations dot the waterfront, many less than 2 m above the long-term average (LTA) lake level. Onshore winds and storm events, as well as ice shoves, magnify the impact of high water levels, and typical storm events can increase lake levels locally by more than 0.5 m and accelerate erosion. There are now several current or future planned realignment projects. Local authorities have reactively realigned some stretches of coastal roads and are proactively considering the realignment of additional roads. Erie Shore Drive near Eriean, has flooded repeatedly since 2017 which has resulted in recent studies that have identified planned retreat as one disaster risk reduction option. Towards Leamington, several planned retreat projects are already completed, and more are at the proposal phase. The main lesson learned from this case is that reactive post-erosion retreat can be used constructively as a trigger and signal about the need for proactive climate change adaptation.</p>
<p>Pointe Gatineau, QC</p>	<p>Pointe Gatineau, QC has been in existence in one form or another for over 200 years. Located at the confluence of the Gatineau and Ottawa rivers, the community has had a long history of flooding. Although the construction of upstream locks (1911) and hydropower dams (1920 and 1964) reduced the frequency of flooding, significant flood events continued to be experienced by the community, including in 1926, 1947, 1951, 1974 and 1976. Portions of the Pointe Gatineau community are established in what is now considered to be a 1:20-year floodplain. After an approximately 40-year quiet period, two record floods occurred in April 2017 and May 2019, inundating the community and triggering planned retreat via two successive waves of home buyouts that continue to this day. Following the 2017 flood, provincial legislation banned home reconstruction in the 1:20 floodplain, and within weeks, the Quebec government facilitated planned retreat through a special 2017 flood-related program that expanded on its standard “Financial Assistance for Disaster Victims” program. Further refinements to the buyout program were announced in 2019, to cap the maximum amount of the buyouts to encourage flood victims to relocate elsewhere. Planned retreat in the Pointe Gatineau community can best be summarized as being carried out reactively in the face of repeated flood disasters, funded by a combination of municipal, provincial and federal government funding. Retreat</p>

	mainly involving single detached homes, featured a mix of voluntary and involuntary elements of choice, and has been followed up by a promising community engagement and redevelopment process.
Tuktoyaktuk, NT	The Hamlet of Tuktoyaktuk is located on the Beaufort Sea in the Western Canadian Arctic on a low-lying peninsula on the delta of the Mackenzie River. The original permanent settlement was established in 1934 and was affected by rapid erosion early in its history. Starting in 1974, several erosion mitigation techniques were tried before effective adaptation measures were found. Erosion protection was implemented between 1998 and 2001. However, sea-level rise and melting permafrost has increased the rate of erosion. In 2003, researchers projected that coastal erosion would cause the tip of the peninsula to disappear within 10 years (Atkinson, 2005). This community has historically relied upon winter roads for transportation as well as marine traffic for supplies. In 2017, the Inuvik-Tuktoyaktuk highway opened, the first overland year-round transportation route to the community. In March 2019, an engineering report named Tuktoyaktuk Coastal Erosion Study was completed by W.F. Baird & Associates Coastal Engineers Ltd. This pointed to the need for the inclusion of planned retreat in Tuktoyaktuk’s adaptation plan, which could now be possible because the all-weather road expands the range of options available for retreat and relocation. Planned retreat is understood to be necessary to adapt to these hazards. The Hamlet of Tuktoyaktuk is now entering its next phase where the preliminary results have helped the community to decide on a hybrid structural option to mitigate the coastal erosion of the peninsula. Despite some progress in Tuktoyaktuk, persistent challenges—particularly those related to funding availability, relocation destination planning and timelines, as well as the lack of technical (e.g. engineering) expertise in the community—have been identified as important issues.
Truro, NS	The Town of Truro, Nova Scotia, now a regional centre of approximately 12,000 residents, has faced flooding on an almost annual basis since records began. A Truro flood risk study commissioned in 2017 suggested that past flooding did not appear to trigger significant risk reduction efforts. This changed significantly following major flooding in 2012 caused by a storm associated with remnants of tropical Storm Leslie. With a policy window for change now open, the Joint Flood Advisory Committee (comprised of the Town of Truro, County of Colchester, and Millbrook First Nation) commissioned a comprehensive flood risk study for the region. The Truro-Onslow dyke project emerged out of the Flood Risk Study as a project which would not only add floodplain capacity but would also reduce dyke maintenance costs, by realigning dykes inland, and adding new riverine and salt marsh habitats. The project is an example of the voluntary retreat of dyke infrastructure and the conversion of agricultural land into salt marsh habitat. Potentially affected landowners were consulted, and the wider public was engaged on the Flood Risk Study that raised the realignment possibility. Other than compensation for land purchases, no overt incentives were used in the ultimate decision to realign the dyke. Landowners were free to reject purchase offers or to vote against the dyke realignment plan. As such, this project represents an excellent model for voluntary, community-engaged disaster risk reduction and climate change adaptation.

Table E2. Summary of good practices and considerations for leaders and practitioners to consider

Practice	Considerations
Communication Good Practices	
Communicate early and often	Establish a list of stakeholders, title and rights holders early. Update it as necessary. Communicate regularly both individually and in appropriate groups.
Include planned retreat as an option	Over the past five years, awareness and acceptance of the need for planned retreat to be considered have grown substantially.

Choose terminology carefully	Planned retreat can be referred to as, amongst other options, planned relocation or proactive retreat. Decide with trusted advisors what the right language is for the community.
Put planned retreat in context of adaptation	Planned retreat is not a separate discussion, but part of a long-term assessment of options to deal with climate vulnerability; this includes building awareness and capacity, mobilizing resources, and assessing and implementing adaptation actions.
Consider culture	Where a community's culture is tied to place —most notably in the case of First Nations—this must be taken into consideration during planning, consultation and implementation of adaptation.
Leave time for planned retreat discussions	Planned retreat consensus-building takes longer than other adaptation options.
Computer graphics are persuasive	Good visualizations, often animated, have helped communities to understand and internalize the challenges they face in a way that spreadsheets and maps may not. Try to have them established in the adaptation process.
Governance Good Practices	
Communities decide	Decisions for planned retreat of residences or infrastructure need to be made with and preferably by the community, for the community.
Pick leader(s) and champion(s) carefully	The people who take on the mantle of leading the long and sometimes contentious process of adaptation, resilience building and retreat are taking on an important role; as such, the continuity and traits of such people are key.
Establish and fund a program and roles	Adaptation processes often last longer than municipal, provincial, territorial and federal governments. Establish approaches and funding processes that support programs able to sustain activities for years.
Start funding efforts early	There is currently no targeted Canadian budget and funding model for planned retreat. Each instance assembles provincial and federal funding for municipalities.
Manage the tax base	Losing high-value waterfront properties and residents can be mitigated through proactive planning and rezoning.
Process Good Practices	
Adaptation and building resiliency are a cyclical process	Retreat may feel unavoidable but may not be accepted at present. There will likely be an opportunity to re-introduce it as an option later.
Start early	Risk analysis and planning takes time and effort. If adaptation assessments and discussions have not yet started, start soon. Key resources are often booked in advance.
Protect and promote physical and mental health	Many engaging in retreat discussions or affected by retreat have suffered through disasters and have physical and mental health concerns. Regardless, this process is sure to be stressful.
Plan a future for the retreated properties	In the best case, create a community green space with memorials of the sacrifices made by those affected in support of broader community well-being. At minimum, demolish buildings and return the property to nature. Do not resell to developers.
Get universities and granting agencies to help	Many areas where there is a need for expert assessment have university programs specifically focused on the topic. Contact them and see if research grants will pay for grad students and PhDs to provide value for the community.
Get professional assistance	There are Canadian firms in landscape architecture and planning industries that have expertise in adaptation, resilience building and planned retreat. There are

	also agencies and consultants that specialize in public consultation and engagement that can support communities through the public consultation process.
Be creative in retreat solutions	Land swaps, buy and leaseback, and shifting service costs to residents and businesses that choose to remain in place have all been used by different communities.
Be inclusive and use an all-hazards approach when identifying and monitoring hazards.	Use an all-hazards approach that assesses all potential risks, e.g., sea-level rise, coastal erosion, river and lake hazards (water-level fluctuations, flooding, etc.), landslides, and tsunamis, any of which may be affected by climate change.
Consider overlapping disasters as a risk	Wildfires followed immediately by flooding are occurring. Pandemics preventing emergency shelters and cooling stations are a reality. Do not assess risks in isolation, but in likely combinations.
Plan for municipal, provincial, territorial and federal elections	Changes in governments are mostly scheduled, and with them can come changes in priorities. Tailor the plan to avoid, where possible, critical decision points or funding lapses directly before or after elections.

Planned or proactive retreat can address current risks as well as climate change impacts contextualized within the broader climate change adaptation process of “protect, accommodate, retreat and avoid.” By identifying populations and infrastructure assets that are most likely to be exposed and vulnerable to particular climate impacts and hazards, communities can begin weighing the social, economic, and health costs of persisting in place versus relocating to another location. What is clear from an overview of international contexts is that the entire space of planned retreat is still emergent and few proactive retreat examples exist.

This report provides a broad analysis of planned retreat processes, including triggers, sources of resistance, common considerations and key enablers and barriers. The most common trigger for planned retreat was experience with a disaster, which tended to open “policy windows” for planned retreat activities. However, proactive action is preferable, with multiple sources, including the Global Commission on Adaptation and the Insurance Bureau of Canada, stating that investments in community resilience have a return on investment of \$2–\$10 in future averted losses for every \$1 spent proactively (Global Commission on Adaptation, 2019). There are numerous sources of resistance to planned retreat, which may vary widely and include psychological resistance to retreat, financial resistance, community cohesion resistance, resistance due to concerns for individual well-being, and resistance due to political concerns.

This report provides the reader with a comprehensive analysis of the use of planned retreat as an adaptation mechanism for climate change. Both domestic and international approaches to planned retreat are examined. Five case studies from various parts of Canada are presented including discussion of the programs and processes that were used in each of the case studies to achieve desired results. Planned retreat is evolving as an adaptation approach in Canada and may prove to be a sustainable and preferred approach under continued climate change.

1. Introduction

Canada’s climate has warmed and will warm further in the future, driven by human influence (Bush and Lemmen, ed. 2019). Climate change—together with its many, multisectoral and cross-jurisdictional impacts—presents one of the critical challenges of the 21st century. Despite major international efforts to curb emissions and slow climate change, mitigation efforts have been insufficient to eliminate the impacts and risks associated with climate change. In recent years, Canada has produced a series of national climate assessments, including sector- and location-specific reports (Bush & Lemmen, 2008; Lemmen et al., 2008; Warren et al., 2014; Maxwell et al., 1997). Across these assessments, numerous threats and risks to Canadians and communities have been identified, pointing to the need for proactive planning to improve resilience. A report by the Council of Canadian Academies (2019)

identified 12 major areas of risk associated with climate change in Canada, with critical infrastructure, coastal communities, and human health being amongst the most acute.

Climate change adaptation planning can be conceptualized into five general stages (Lemmen et al., 2016):

1. Understand climate impacts
2. Assess vulnerability
3. Identify and select adaptation options
4. Implement actions
5. Monitor/adjust

Within the context of adaptation options, this report considers the broader PARA framework (Protect, Accommodate, Retreat and Avoid) (Doberstein et al., 2019). Planned retreat has been gaining increasing attention as a potential option, out of recognition that there are cases where the impacts of climate change are too disruptive, costly, or uncontrollable to sufficiently protect human health or infrastructure; in these cases, it may be necessary to abandon the area altogether. However, there is relatively little guidance available for retreat in the Canadian context. Natural Resources Canada (NRCan) initiated a process to address this knowledge gap.

This report is intended to inform proactive planning and implementation of planned retreat approaches that consider future climate change impacts. In Canada, insured catastrophe losses have been increasing steadily, rising from 405 million annually between 1983 and 2008 to over CAD 1.8 billion between 2009 and 2018, primarily from flooding events (Golnaraghi et al., 2020). A proactive adaptive management approach is more likely to reduce risks and costs long-term, allowing communities to seize opportunities and overcome barriers. Proactive retreat planning can also be more cost-effective and facilitate a more organized approach, fully engaging communities and a broad range of stakeholders and decision makers, with the goal to prevent future risks from natural hazards and build climate resilience.

Planned retreat is situated within the wider context of human migration, disaster risk reduction, and climate change adaptation. The overall aim of this Analysis Report is to orient practitioners and community leaders to the common themes and research results in planned retreat including from government publications and key informant interviews. While emphasis is placed, where possible, on considerations for proactive, forward-looking retreat, insights from retreat in response to disaster events are also included.

The term “managed retreat” is commonly used to describe the retreat process. However, “managed” has connotations of being imposed by others, while the term “retreat” itself can have strong negative connotations associated with surrender and loss. Further, the Canadian history of forced relocation, particularly of Indigenous groups, can make “retreat” conversations especially difficult and painful. In the spirit of Reconciliation with Indigenous peoples, it is fundamental to incorporate the following considerations in the process:

- Honouring treaties;
- Acknowledging and respecting Indigenous rights and titles;
- Recognizing the role Indigenous peoples have held in the creation of Canada;
- Recognition and support of the deep connections Indigenous peoples have to the land; and
- Building relationships.

It is important to consider community-driven and community-owned retreat and to use language and terminology that is responsive and sensitive to the contexts in which retreat is being considered. “Planned retreat” was identified as the preferred term, though others—including “planned relocation,” “climate migration,” and “planned migration”—may be more appropriate in some contexts. However, regardless of the term being used, retreat and relocation discussions are likely to be difficult and painful for those affected and require substantial time to foster effective local engagement and ownership.

This report deals specifically with planned retreat in the context of climate change adaptation. A number of climate change reports relevant to the implementation of planned retreat have been published in recent years, including [Canada's Changing Climate Report](#), [Canada's Marine Coasts in a Changing Climate](#), [Case Studies on Climate Change in Floodplain Mapping](#), the [Canadian Centre for Climate Services](#) provides Canadians access to climate information and support.

1.1. Project Goals & Objectives

The overall goal of this Report is to analyze the current state of planned retreat approaches and policies in Canada and internationally, in order to generate a series of good practices and considerations which can help guide Canadian practitioners and community stakeholders engaged in or exploring proactive planned retreat.

The following guiding principles informed the design, execution and synthesis of this project:

1. Long-term time horizon – A longer-term view of risk assessment and management planning in the context of a changing climate was taken in order to support proactive adaptation planning.
2. Risk-Based – Recommendations and considerations in this report were developed by taking into account hazards, exposures, vulnerabilities, probabilities and consequences as they relate to populations and infrastructure assets; this should support evidence-informed recommendations.
3. Equity – Recommendations considered social justice with regard to the equitable distribution of costs and benefits, aiming to promote fairness in retreat processes.
4. Collaborative – The importance of multi-stakeholder collaboration in the planning and implementation of retreat has been emphasized throughout this report in an effort to support local ownership of retreat discussions.

1.2. Target Audience

This report is generally intended for a broader audience of practitioners and community stakeholders that may be considering planned retreat as a potential adaptation option. The intent is to advance discussions of good practices in planned retreat in hopes that these may be useful in future retreat efforts. As such, authors have sought to avoid the more technical and scientific details of climate change adaptation and planned retreat, which may be of less interest to this audience.

1.3. Methodology

This report is informed by a broader environmental scan of the current state of planned retreat, both in Canada and relevant international contexts. Data collection efforts targeted peer-reviewed literature, government publications, and specific organizations with mandates relevant to climate change adaptation and planned retreat. Findings of this scan are described in additional detail in **Section 2**.

This descriptive analysis was leveraged alongside a series of key informant interviews with planned retreat practitioners and subject matter experts from government, industry and academia to inform this analysis effort. Informants are kept anonymous, but included city managers, provincial and federal program managers, university researchers, and consultants. A thematic analysis was conducted to integrate findings and elicit key themes and recommendations (**Sections 4–6**).

1.4. Report Outline

This report is organized into seven sections. **Section 1** introduces the projects and its overall goals and objectives. **Section 2** provides some useful background related to the current state of planned retreat, both in Canada and internationally. **Section 3** provides six detailed case studies of Canadian retreat. **Section 4** synthesizes key findings of the analysis, related to triggers, sources of resistance, common approaches and enablers and barriers of planned retreat. **Section 5** is dedicated to a detailed analysis of the direct and long-term health impacts of retreat. **Section 6** offers a discussion of some good practices and considerations for proactive retreat. **Section 7** concludes the report with a closing statement.

2. Background

As mentioned above, a broad environmental scan was conducted to assess the current state of planned retreat in Canada and in relevant international contexts. The scan sought to understand three primary questions:

1. What are some of the key approaches and pathways currently being used to implement planned retreat, both in Canada and internationally?
2. What climate adaptation practices and contexts present viable opportunities for planned retreat as a preferred option?
3. What are some of the most common applications and approaches for planned retreat?

Key findings from the environmental scan and analysis are summarized in the sections below.

2.1. Retreat in the Context of Climate Change Adaptation

Climate change impacts are increasing in frequency and severity, outpacing preparedness and increasing costs for Canadians and businesses. Temperature change projections to 2040 are fairly consistent across modelling scenarios and assumptions, while those more distant vary more broadly; for example, global temperature increases for low-emission and high-emission scenarios range from 1.8 to 6.3 °C by 2100 (Flato et al., 2019).¹ Canada has been warming at a rate more than twice that of the global average, as the loss of snow and sea ice drives further surface warming, amplifying warming at high northern latitudes (Flato et al., 2019). Northern Canada is expected to continue experiencing stronger warming than the rest of Canada, especially in the winter. In the Canadian North, the impacts of higher temperatures are already severe and will intensify in coming decades. These changes include the extent and duration of snow and ice cover, sea-level changes, permafrost degradation, temperature changes, freshwater availability, fire weather, other extremes of weather and climate. In Canada, precipitation patterns are also expected to change, with larger projected increases in annual precipitation in Northern Canada. Northern Canada is unique in having communities and infrastructure built on permafrost, or subsurface permanently frozen soil. Thawing permafrost has direct and indirect challenges for northern communities, infrastructure and even basic research. Mass movement hazards, including slope instability, feature in a number of managed retreat cases both internationally and in Canada. Canadian communities including North Vancouver BC, Chilliwack BC, Fort McMurray AB, and Lemieux ON, have each been exposed to mass movement hazards that necessitated the relocation of residents and demolition of houses. In Canada, shifts in precipitation patterns will increase wildfire risks, mostly in the western portion of the country. Both the Fort McMurray fire and the Australian fires have been partially attributed to climate change, and the communities affected were built in areas with a higher likelihood of risk from wildfires.

Relative sea level is projected to decrease across much of Northern Canada as a result of vertical land motion (uplift) due to postglacial rebound. Major population centres located in southern Canada, such as Halifax and Vancouver, will experience a rise in sea level at or greater than the global average (Lemmen et al., 2016). By 2050,

¹ Detailed projections of projected climatic changes, both globally and in Canada, are outside the scope of this analysis and are described in detail in other publications (Dresser & Phillips, 2014; Flato et al., 2019; Lemmen et al., 2016).

sea-level rise and storm surge are expected to impose \$4–17 billion per year in flood damages to homes along Canada’s coastlines (Lemmen et al., 2016). Climate change includes significant changes to precipitation patterns, variations of which are already occurring and have been impacting Canadian communities. Precipitation patterns have changed more due to climate change than other factors and riverine flooding was a greater pre-existing risk than other common hazards facing Canadian communities. Meanwhile, lake and river-level increases have been observed, pointing to potential increases in erosion and flooding. The majority of hurricane-related impacts on Canada are more pertinently categorized into coastal flooding—including storm surge and king tide events—and riverine flooding.

Taking these factors into consideration, it is likely that existing vulnerabilities will be exacerbated by climate change (Derksen et al., 2018; Lemmen et al., 2016). Adaptation efforts that are sufficient and locally appropriate now may be inadequate to protect populations in the future. Put simply, the hazards driving the need for adaptation, locations in need of adaptation, and scope of adaptation policies and programs are likely to shift and expand, requiring ongoing monitoring and adjustment. Climate change impacts are highly location specific, and it is important to work with climate service providers to obtain the most relevant information for the community that can be understood and considered within the broader risk and impact assessment and adaptation planning contexts. Proactive adaptation investments, including retreat, tend to provide overall economic savings. Multiple sources, including the Global Commission on Adaptation and the Insurance Bureau of Canada, calculate that investments in community resilience have a return on investment of \$2–\$10 in future averted losses for every \$1 spent proactively (Global Commission on Adaptation, 2019).

It is important to note that planned retreat occurs within a broader climate change adaptation framework. As summarized in **Figure 1**, climate change adaptation generally occurs in a cyclical, five-step process:

- **Understand climate impacts:** locally specific environmental monitoring is essential to understanding the impacts of climate change on a specific community or region.
 - **Assess risks and vulnerabilities:** risk assessments that are founded in best practices are useful tools for identifying populations and infrastructure assets that are most likely to be exposed and vulnerable to particular climate impacts and hazards, while capacity to adapt and improve resilience can also be assessed. This is useful for prioritizing areas and sectors for intervention.
- Identify and select adaptation options:** based on knowledge of climate impacts and community vulnerabilities, local stakeholders must decide which adaptation options are reasonable and acceptable for their circumstances. It is important to evaluate social, environmental and economic considerations for each option for informed decision-making. Options include:
- **Protect:** reduce likelihood of exposure to climate change hazards and impacts (such as floods)
 - **Accommodate:** reduce vulnerability (or increase resilience) of population or infrastructure
 - **Retreat:** relocate at-risk populations or infrastructure to low-risk areas
 - **Avoid:** use community plans and zoning by-laws to build future housing, businesses and critical infrastructure preferentially (or only) in lower-risk areas
- **Implement actions:** proper planning, design and execution of adaptation policies and programs often requires a lengthy process, including steps to obtain funding and implement changes.
 - **Monitor/adapt:** adaptation efforts require monitoring and evaluation plans developed *a priori*, allowing the community and users to evaluate success, respond to changes, and foster accountability.

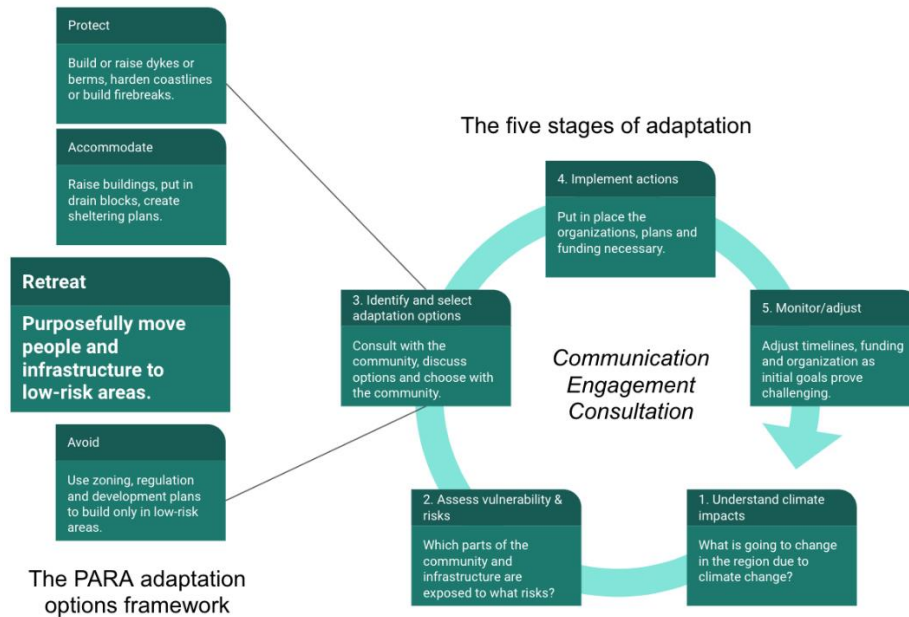


Figure 1. Climate change adaptation framework

This PARA framework is well established and has been applied both in Canada (British Columbia Ministry of Environment, 2013; Harford, 2016) and internationally (Dronkers et al., 1990; Eichhorst et al., 2011; Rijke et al., 2012), most commonly in the context of preparation for coastal flooding. For example, the Netherlands has historically been a leader in “protect” approaches, including dykes and storm walls, but has more recently incorporated other adaptation options such as home buyouts and retreat to elevated grounds (Rikke et al., 2012). However, researchers contend that the PARA framework is more broadly applicable to proactive adaptation planning for other climate change hazards (Doberstein et al., 2019). It offers a useful suite of adaptation options, the most appropriate of which will be determined on a case-by-case basis and specific to community contexts, risks and values. While the scope of our analysis is limited to planned retreat, more specific analysis of other adaptation options—as well as Canadian case studies—is available in a recent report by Doberstein et al (2019).

Good practices for planned retreat are not limited to just the identification phase. As mentioned throughout this report, regular, active communication is an essential good practice for effective planned retreat activities. Establishing your list of title and rights holders and other stakeholders, and communicating regularly with them, starts at the very beginning of the adaptation cycle and is repeated throughout. Finding funding for the chosen adaptation option(s)—including retreat—is an ongoing effort, with sources of funding ending or opening over time. Provincial and federal adaptation programs and practices are much longer than any community’s assessment of adaptation options.

Planned retreat in Canada will be driven by various and increasing climate risks, particularly those associated with acute emergency or disaster situations. Planned retreat for long-term climate change adaptation often proceeds along a very different timetable as compared to retreat for disaster-related reasons, and the “pathways approach” has been developed to provide guidance for this. The pathways approach is a “strategic, flexible and structured decision-making” approach (CoastAdapt, 2020), which allows decision makers and communities to design adaptive climate change strategies that are resilient to unexpected changes or future developments (Zandvoort et al., 2017). One of the key hallmarks of climate change is the high degree of uncertainty surrounding future climatic conditions and associated hazards. The term “pathways” conjures up the image of communities navigating a journey into this uncertainty, taking a single step at a time, pausing to scan the new surroundings, and then choosing the most promising next steps on the pathway. When communities adopt a pathways approach, climate change adaptation decisions become “a sequence of manageable steps or decision points over time” (CoastAdapt,

2020) rather than a single one-time comprehensive plan. Another way of viewing the approach is as a repetitive series of smaller climate change adaptation decision cycles (see **Figure 1**) rather than one large decision cycle.

When putting a pathways approach into action, communities map out a series of possible climate change-related thresholds and decision triggers that will guide the “steps” communities take over time. Thresholds (sometimes also called “tipping points”) may be environmental (e.g. formerly healthy coastal ecosystems are now dying due to sea-level rise-induced saltwater intrusion), social (e.g. flooding is causing damage in the community once every three years on average) or adaptation options-related (e.g. an existing seawall is no longer high enough to contain rising sea levels) (CoastAdapt, 2020; Zandvoort et al., 2017). Once a threshold has been reached, a series of options are examined to see how they perform against plausible futures (e.g. the next 10–15 years of expected climate change) and a community-engaged decision-making process then leads to the choice of the option that will make up “the next step.” Another key part of the pathways approach is being careful to avoid maladaptation (CoastAdapt, 2020), taking steps that lead communities down a pathway towards loss of resilience or closed off future options (e.g., building a massive and expensive seawall or dyke that forecloses other future options). Researchers who have examined the pathways approach have concluded that it is best applied at a local/community level, and its use depends on community consensus about both the adaptation “problem” and the thresholds that will trigger the various steps along the climate change pathway (Zandvoort et al., 2017).

The advice of the report pertains to all causes of planned retreat, but examples are dominated by coastal and riverine flooding, which are most commonly referenced in this report. We expect more planned retreats in the face of other hazards in the coming decades.

2.2. Scan of Planned Retreat in Canada

Most efforts to date in both Canada and internationally have focused on adaptation in place and infrastructure hardening. This is being done in the context of the five stages of adaptation: understand climate impacts, assess vulnerability, identify and select adaptation options, implement actions, and monitor/adjust. Increasingly, an option being put forth is planned retreat away from areas where the impacts of climate change are too disruptive to prevent significant risk to human lives or where infrastructure is too costly to be made more resilient.

The social and economic costs associated with climate change impacts in Canada are high and projected to grow. Planned retreat needs to be included in adaptation option discussions and is likely to be an increasingly viable and desirable approach as climate change progresses. Municipalities and local leaders need guidance alongside strong and coordinated support from provincial and federal organizations to manage the fraught process of deciding on and implementing retreat.

Prior to this report, there were no summaries of good practices for planned retreat in the Canadian context. Furthermore, emergent risks such as potential retreat from areas more subject to wildfires have not been considered as of yet. For many communities, gaining sufficient insight into the specific risks that they face is time consuming, expensive and difficult. Key themes and insights from the Canadian context are summarized in Table 2.

Table 2. Insights from environmental scan of current state of planned retreat

Insight	Discussion
Retreat is reactive	Retreat is still being done almost entirely reactively to disasters (particularly flooding) as opposed to proactively. Communities experiencing repeat riverine or coastal flooding events often delay retreat actions. The Truro area flooding, for example, occurred multiple times with flooding overtopping dykes before retreat was considered seriously.
No standard approaches	Retreat lacks standardization, with communities in close proximity to each other often having disparate responses. In the Ottawa-Gatineau region, affected homeowners in Quebec

Insight	Discussion
	received a buyout, but hunting lodge and vacation property owners did not. Across the Ottawa River in Ontario, no buyout was provided at all.
Varying governmental support	Municipalities have put varying degrees of emphasis on retreat, with some municipalities actively promoting waterfront development for the tax base. Every province’s approach is different. There is no tailored federal funding program currently available. However, Quebec has asked for and received federal funding for buyouts, while Ontario has not.
Adaptation overlaps political cycles	The process of adaptation, including retreat, generally extends beyond normal political timelines. In BC, the Surrey Coastal Flooding Adaptation Strategy (CFAS) process overlapped political cycles and the actual implementation of the currently chosen options may take decades.
Increased awareness of retreat	Between 2010 and 2015, awareness of retreat being a serious option and acceptance of the need to consider it increased sharply. This is true in the United States, with Superstorm Sandy driving awareness, and in Canada, where the Surrey CFAS process was surprised by very broad and deep citizen support for retreat.
Retreat language is fraught	The language used to introduce and describe planned retreat can itself be a source of conflict and resistance. “Managed” has connotations of being imposed by others. “Retreat” has connotations of giving up and losing. Other language has historical precedents that can be challenging, especially for Indigenous peoples.
Inequity persists	Inequity in retreat based on socioeconomic status and systemic marginalization is a persisting problem. In the United States, affluent, mostly white communities were able to garner state and federal support for mass movement or for enhanced protections. Communities with lower socioeconomic status, often communities of colour, frequently encountered patchwork retreat as individual homeowners worked through the challenges of federal paperwork to garner buyouts. In both countries, some disadvantaged communities persist in the most at risk areas, while more affluent homeowners see larger buyouts.
Retreat is an economic decision	In the end, economic factors drive retreat as an option, both for homeowners and communities. While retreat is difficult, when full accounting of the cost of persisting in place with rebuilding and accommodations double or more the cost of retreat, valuing the real estate accurately is hard to do. Communities and provinces have the additional burden of health and emergency services costs to consider.
Communities decide	Community engagement and collaboration are essential to ethical and successful planned retreat. The best examples of well-done retreats in Europe and North America have the community deciding after extended discussion amongst themselves and affected parties what the right choice of action is. Higher levels of government are best understood as a source of funding, regional coordinators and governance.
Retreat impacts health	Both the physical and mental health of people considering and undertaking retreat can be adversely impacted. Typically, individuals have been through successive stressful and sometimes physically debilitating disasters before retreat is strongly considered and undertaken. For many, place attachment is strong, and leaving their family home is very challenging emotionally.
Bureaucracy can be a second disaster	In a post-disaster setting, the bureaucracy surrounding retreat can delay action and become a “second disaster.” Municipalities, businesses and individuals have to wade through multiple agencies and bureaucratic processes to gain support and aid, even as they are coping with rebuilding. In many cases, programs and governments changed and the entire bureaucratic process had to be restarted. This has been the case for several in the Gatineau region of Quebec with the home buyout program.

Insight	Discussion
Good practices are scattered	Good practices in planned retreat exist, but these are scattered and often highly context specific. Often guidance is highly specific to portions of retreat or specific programs that do not exist in other countries or even neighbouring states or provinces.

2.3. Scan of Planned Retreat in Relevant International Contexts

This section provides a high-level overview of the current state of planned retreat in international contexts of relevance to Canada. Europe has focused on ecosystem and coastal transformation under the term “managed realignment.” While precipitation patterns in Europe have been changing and have climate change links, this has not yet led to well-documented shifts in infrastructure or communities. While considerations and best practices in managed realignment may not always be applicable to planned retreat processes—given that realignment may not involve retreating farmland, communities and infrastructure—several Canadian case studies on managed realignment were considered in this report, including realignment efforts in the Great Lakes region and Truro, Nova Scotia. As European communities tend to be older than Canadian communities, development patterns have shifted out of the highest-risk zones for normal flooding events over centuries, and coastal hardening had been put in place, again often centuries in the past. Much of the practices are concerned with making coastal areas more resilient with increased marshland, along with removal of coastal hardening efforts.

In the United States, a number of retreat approaches were implemented following Superstorm Sandy in the New York City region. Both New York and New Jersey coastal communities have seen a patchwork of buyouts with little guidance provided to families and businesses about where to relocate. As a result, those relocating have often ended up moving to areas which are at equal or greater risk a few kilometres away. These programs provide useful insights on social justice concerns, legal ramifications and analogous policy and program impacts on planned retreat.

New Zealand, as a Pacific island state which expects to be heavily impacted by sea-level rise, has been active in developing and implementing policies to deal with the impact of climate change, including planned retreat. Material from this country provides insights on language use, social implications, and policy alignment.

Australia provides an informative counterexample to New Zealand. Having initially been a leader on climate-related policies—such as the introduction of a carbon tax in 2012—and good practices on planned retreat, the country has recently experienced political challenges, and climate adaptation approaches such as planned retreat have been leveraged for political gain by opponents of climate action. There are crucial lessons here which can be brought to the Canadian context.

A wide variety of tactics for implementing planned retreat have been identified. These include, but are not limited to: rolling easements, increased risk sharing with homeowners who choose to persist in place, changes to flood and other insurance coverages to shift the insurance burden to homeowners who wish to persist, purchase and leaseback of at-risk properties to homeowners in preparation for eventual movement, federal home purchase programs, and community amenity building on retreated land.

For two of the key concerns in the Canadian context—permafrost thaw and wildfire risks—no international examples were found. One exception to this is the relocation of numerous Alaskan coastal Indigenous communities, but arguably this is more due to coastal erosion than to generalized permafrost thaw.

What is clear from an overview of international contexts is that the entire space of planned retreat is still emergent. Globally, we are still learning from attempts and failures in different contexts, but to date there has been no attempt to synthesize this information into a prescriptive guidebook that can be adapted and adopted for Canadian use.

2.4. Scope of Planned Retreat

The focus of this report is on proactive planned retreat of human communities and critical infrastructure in the context of a changing climate.

Within the scope of this report, “human communities” include people, houses, neighbourhoods, human land uses, and businesses in increasingly at-risk areas. “Critical infrastructure” includes coastal roads, rail lines, transmission lines, bridges, dykes, hospitals, ambulance and police stations, fire halls, emergency operation centres, electrical substations, water storage and treatment facilities, sewage treatment plants, and pipelines in increasingly at-risk areas.

While past examples of retreat in Canada have been dominated by repeated riverine flooding or long-lasting coastal erosion, these were mostly due to communities being located in areas where they were exposed to long-established patterns of environmental hazards, rather than emerging or increased hazards brought about by climate change. This report is informed by these examples of retreat and by ongoing and projected changes to hazards brought about by climate change. The goal is to enable Canadian communities and other key groups to engage in proactive planning for effective adaptation to climate-change induced hazards.

3. Canadian Case Studies

This section reviews a series of recent Canadian cases in which planned retreat has played a role in either disaster risk reduction or climate change adaptation, or a combination of both. The overall aim of this section is to examine the variable realities of recent and, in some cases, ongoing planned retreat actions in Canadian communities. The five cases are intended to represent diversity across a number of dimensions, including:

- Geography: coastal, northern, and interior regions
- Physical “triggers”: rapid onset (e.g. flooding) vs. slow onset (e.g. coastal erosion)
- Timelines: rapid retreat vs. slow/incremental retreat
- Degree of choice: spectrum from involuntary to voluntary
- Approach: reactive vs. proactive
- Assets involved: households, neighbourhoods, infrastructure
- Community types: remote northern, highly urbanized, coastal

It should be noted that these case studies do not represent the full breadth of planned retreat examples available or considered in this study. For example, the province of Prince Edward Island (PEI) faces challenges associated with sea-level rise, storm surge, and coastal erosion, as well as planned retreat linked to these challenges. Recent studies show that some PEI coastlines are eroding an average of 28 cm per year (Welsh, 2019). A UPEI Climate Lab assessment of infrastructure at risk from erosion over the next 90 years found that 1,000 houses, 17 lighthouses, 146 commercial buildings, and 50 km of roads were vulnerable (Fenech, 2014).

Numerous small-scale retreat initiatives have already been undertaken, including the Cape Egmont lighthouse about 20 years ago, and lighthouses in East Point and Cape Bear. More ambitiously, PEI’s 2019 Climate Change Action Plan identifies planned retreat as an adaptation option, particularly for vulnerable coastal infrastructure across the Province. Using the term “relocate” rather than retreat, one of eight provincial action plan items is to “Retrofit, *relocate*, or protect critical and vulnerable public infrastructure to address the impacts of climate change, as is feasible and cost-effective” (Government of Prince Edward Island, 2019). Relocation is being considered for “new and existing provincially owned roads, bridges, buildings and other assets” at risk from climate change.

This report identified and examined a representative sample of planned retreat case studies across Canada, in conjunction with insights from document review and key informant interviews to develop recommendations on good practices.

3.1. Surrey, BC

With a population of approximately 520,000, Surrey, BC is the second largest of the 21 municipalities making up Metro Vancouver (City of Surrey, 2020). Although separate administratively, the Semiahmoo First Nation lies geographically within Surrey's boundaries, and the Semiahmoo Bay coastal floodplain forms part of the First Nation territory (City of Surrey, 2019).

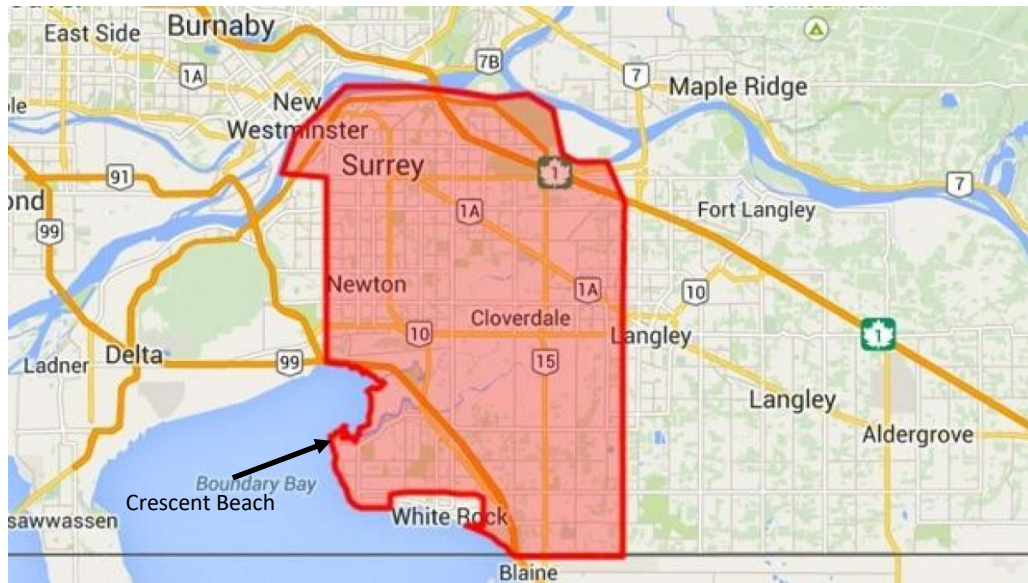


Figure 2. Map of Surrey, British Columbia²

Surrey's history with coastal and riverine flooding (e.g. Fraser River flooding of 1948 and 1972) led the City to pursue a combined "avoid" and "protect" strategy for flood risk reduction. The "avoid" approach includes zoning and development restrictions on large areas of the floodplains in Surrey, while the "protect" approach includes multiple sea dams, breakwaters, and BC's largest municipal dyking system, a comprehensive network of over 150 km of coastal and riverine dykes (City of Surrey, 2019). However, the "avoid and protect" approaches have increasingly been seen as inadequate for the changing nature of hazards under climate change. About 20% of the City is considered to be within the coastal floodplain (City of Surrey, 2019), and thus the main climate change-related hazards of concern are sea-level rise and associated coastal erosion and storm-related flooding, as well as potentially enhanced riverine and pluvial flooding.

As a coastal city experiencing the effects of climate change, Surrey is facing the possibility of several enhanced hazards, and this led municipal officials to include the possibility of planned retreat as a part of the City's Coastal Flood Adaptation Strategy (CFAS, City of Surrey, 2020). The CFAS planning process, covering the area considered to be within the coastal floodplain, ran from 2016 to 2019, with project implementation expected to span from 2020 to 2100. The stated goal of the CFAS was identifying "the current and potential impacts of climate change on Surrey's large coastal floodplain area and developing a long-term strategy to reduce climate change-driven coastal flooding risks now and into the future." Funding in the amount of \$76 million for the study—and the associated 13 climate adaptation projects identified through the CFAS—was provided through the federal Disaster Mitigation and Adaptation Fund (DMAF), which will be augmented by \$61.3 million from the City of Surrey and another \$49.1 million in third-party funding for an expected final investment of \$187 million (City of Surrey et al., 2019).

² Image source: Maps Surrey. (2020). Available at <https://maps-surrey.com/surrey-street-map>

Although the CFAS exercise was designed to address all parts of Surrey’s coastal floodplain, there were two areas where planned retreat was considered more seriously: these are referred to in the CFAS as “distinct Planning Areas” and encompass Mud Bay and Crescent Beach.

The CFAS process was conceived of as a long-term visioning exercise in which Surrey stakeholders and the wider public would provide significant input and direction on the City’s overall climate change adaptation vision and associated projects and initiatives (City of Surrey, 2020). Public engagement and incorporation of local knowledge were core project objectives running throughout the five main phases of CFAS (Figure 3), although these were perhaps more prevalent in Phases 1, 3 and 5 (i.e. Phases 2 and 4 involved city-led technical or design planning). Phase 1 had CFAS staff present community stakeholders with plausible climate change futures, focusing on the projected effects of sea-level rise and coastal flooding on low-lying and flood-prone coastal communities and valued infrastructure. Phase 2 and 3 involved developing adaptation alternatives and soliciting feedback via a broad array of community stakeholder engagement events and a citywide survey. Phases 4 and 5 were based on the results of community engagement preferences expressed in the previous phase and involved the selection of preferred adaptation options prior to a final round of community engagement and feedback.



Figure 3. CFAS planning process (City of Surrey, 2019)

A wide variety of public engagement methods were used in the project, which ensured that numerous different community stakeholders’ perspectives were represented in project outcomes. These stakeholders included “First Nations, community and environmental organizations, business associations and groups, senior levels of government, farmers and the agricultural community, and neighbouring jurisdictions” (City of Surrey, 2018). One of the most innovative aspects of the public engagement process was collaborative development of public “values criteria”—the important elements of “life in Surrey” that residents collectively agreed were most important to maintain or enhance through climate change adaptation. Seven values were eventually agreed upon, and formed the criteria by which various adaptation options, including planned retreat, were assessed in Phase 3 of the project (City of Surrey, 2019):

- **Residents:** number of people permanently displaced by the option and related health/safety impacts
- **Agriculture:** amount of agricultural land permanently lost due to the option
- **Environment:** anticipated environmental impact (positive/negative) expected from the option
- **Infrastructure:** transportation/utilities disruptions expected from the option
- **Economy:** permanent loss of businesses expected from the option
- **Recreation:** recreation opportunities (positive/negative) expected from the option
- **Culture:** Semiahmoo First Nation cultural impacts expected from the option

Use of these values criteria for adaptation decision-making marks a significant empowerment of Surrey residents and the Semiahmoo First Nation, and this, combined with the extensive public engagement generally, allowed for greater acceptance of and support for project decisions (City of Surrey, 2019), including the consideration of planned retreat. The final community engagement statistics for CFAS are > 100,000+ Social Media Impressions, > 1,750 online surveys completed, > 200 youth engaged, and 18 workshops conducted. Over 30 distinct institutions and more than 2,000 stakeholders participated in engagement events over the three years of the project (City of Surrey, 2019). Additional details on the CFAS planning process are contained in the 100-page final report and in the project's public engagement summary report (City of Surrey, 2018).

Planned retreat as an adaptation option was featured in a variety of CFAS phases as well as for several communities and infrastructure assets. For example, one of four shortlisted adaptation options for the Mud Bay CFAS Planning Area was described as "Managed Retreat: removing dykes over time" (City of Surrey, 2018), while the other three options were variations of enhanced or new dyking. Importantly, the retreat/dyke removal option was also acknowledged to go hand-in-hand with the planned retreat of farmhouses, farming infrastructure and neighbourhoods currently protected by Mud Bay dykes. Similarly, in the Crescent Beach CFAS Planning Area, a 400-home seaside residential community, one of four shortlisted adaptation options was simply "Move (managed retreat)." Although planned retreat was initially ranked the second most preferred option for Crescent Beach, it was eventually removed after further public engagement, the reason given being that it was "not the right timing" for this option, although planned retreat may be brought back for further discussion in subsequent cycles of the climate change adaptation process. Planned retreat was not featured as a shortlisted option for the Semiahmoo First Nation CFAS Planning Area, although one of the preferred options was "raising or relocating Beach [road]" (City of Surrey, 2018) and it is uncertain whether road relocation would also trigger the retreat of houses.

When examining planned retreat, it is important to trace the degree of choice associated with the retreat decision. Under the CFAS, it is clear that planned retreat is not currently proceeding in any of the Planning Areas or wider coastal floodplain, and that these decisions were made voluntarily under a transparent public engagement process. There did not appear to be any coercive measures used in reaching these decisions (e.g. penalties, incentives, political or peer pressure). However, it is also worth pointing out that the decision against retreating could potentially be reopened in future cycles of the climate change adaptation process.

Perhaps the single most important "lesson learned" from the CFAS process is that transparent and broad public engagement which devolves significant power to the public is crucial when considering a complex and potentially life-changing climate change adaptation approach such as planned retreat. Public engagement in the CFAS was built into the project's core objectives and permeated every aspect of the three-year planning process. Planned retreat was ultimately not pursued under this cycle of adaptation, but the option could be revisited down the road as climatic conditions change, the community makeup evolves, and direct community experiences with the impacts of climate change continue to be experienced.

3.2. High River, AB

High River is located 40 km south of the Calgary city limits and is named after the Highwood River that flows through the community. The area surrounding what is now known as the Town of High River was a common First Nations gathering place for centuries, with the Blackfoot First Nation referring to the site as Ispitzee ("place of high trees along running water"). The town has a total of 5,560 dwelling units (i.e. single detached homes, duplexes, townhouses and apartments) with the majority of residential development located on the south side of Highwood River (Statistics Canada, 2020).

Highwood River floods are driven primarily by spring snowmelt, rain-on-snow, or heavy rainfall events in the upper Rocky Mountain and foothills catchment (Amec Foster Wheeler & Advisian, 2017). Since the late 1800s, there have been at least 12 floods of high magnitude affecting the High River area, while the 2013 event was by far the largest discharge amount ever recorded and the most damaging flood in High River’s history. Characterized as a stalled low-pressure system, a total of over 200–300 mm of rain fell in the upper catchment in just 2–3 days, triggering rapidly rising downstream water levels that some described as a “flash flood.” With only a few hours’ notice, the entire town of High River was issued a mandatory evacuation order, forcing 13,000 people to leave their homes for several weeks following the flood. Post-flood damage assessments revealed that over 6,300 buildings were damaged and approximately 60% of the town was affected to some degree by floodwaters (**Figure 4**) (Darwish, 2018).



Figure 4. High River at peak flood, June 2013³

Once floodwaters receded, questions about how to “build back better” by reducing the town’s exposure to flood damages and building flood resilience began to permeate recovery discussions. Previous flood events (including in 2005) had already triggered preliminary flood risk reduction planning by the town, and these plans allowed local planners and officials to move forward relatively quickly with funding requests for a combination of structural flood protection (including construction of temporary and permanent dykes, berms, and berm/dyke/road upgrades), and enhanced emergency preparedness upgrades (Darwish, 2018). The question of planned retreat for some of the damaged neighbourhoods and infrastructure also came up in the immediate post-flood period, and this would prove to be the most contentious component of High River’s flood recovery.

Planned retreat in High River was clearly reactive to the 2013 flood disaster. Approximately two months after the floodwaters receded, Municipal Affairs Minister Doug Griffiths announced a Floodway Relocation Program whereby the Government would offer buyouts to approximately 250 homeowners in six flood-affected southern Alberta communities, including High River, stating “We want to give homeowners the choice to relocate to safer areas” (CBC News, 2013a). The program offered compensation equal to the most recent tax assessment of eligible properties, as well as demolition and site remediation costs. At the time of the initial announcement, it was estimated that up to 102 High River properties—initially those located in designated floodways—would be eligible for buyouts (CBC News, 2013a). It is worth noting that, one month after the 2013 floods (but a month before the

³ Image source: Global News. (2014). 15 compelling images of High River in the 2013 flood. Available at <https://globalnews.ca/news/1338253/15-compelling-images-of-high-river-in-the-2013-flood/>.

buyout program announcement), the Alberta Government issued new provincial regulations about floodway development and related restrictions on Disaster Recovery Fund (DRF) eligibility. These two new provincial announcements are examples of the Alberta Government’s first attempts to use planned retreat to reduce exposure to flood risks.

In High River, two communities—Beachwood Estates and Wallaceville—were the focus of buyouts, although the timing of buyout offers (or what some homeowners described as buyout “pressure” and “coercion”) differed significantly for the two communities. The Beachwood Estates community was deemed by the Province to be located in a floodway and, almost immediately, 31 homeowners—many with homes worth over \$1 million—were offered a buyout. Although the buyouts were “offered” (i.e. the homes were not expropriated), the new provincial regulations made it clear that if homeowners chose to rebuild instead, eligibility for DRF funding would cease for Beachwood Estates properties affected by any future flood event (Alberta WaterPortal Society, 2020). Thus, the buyout was widely seen as a “one time only” offer. By contrast, Wallaceville residents faced a very different timeline for their buyout offers. The community was not considered by the Province to be located in a floodway, so flooded homeowners were told that they were not eligible for a buyout offer. However, four months later, the same residents were offered a provincial buyout, as the land was deemed critical to flood mitigation works (e.g. river channel widening) (CBC News, 2013b). In those four months, some Wallaceville residents had begun to rebuild, yet the buyout offer they received only covered the most recent tax assessment, not any of their cleanup or rebuilding costs. When several residents suggested that they might wait for town expropriation, the Mayor suggested that this would not be in the homeowner’s best interest given that expropriation would be done at post-flood market value, and that they should “take a buyout or they’re on their own in any future flood event” (High River Online, 2013). In total, 94 High River homes were purchased by the Alberta government for a total of \$92.9 million (National Post, 2017). Five and a half years after the flood, the planned retreat process was complete: 54 homes had been demolished, 26 were deemed salvageable and auctioned off, and another 14 homes remain standing but are uninhabited. In addition to these homes, a Canadian Pacific Railway bridge was also removed in order to unblock a river “chokepoint” (CBC News, 2013c).

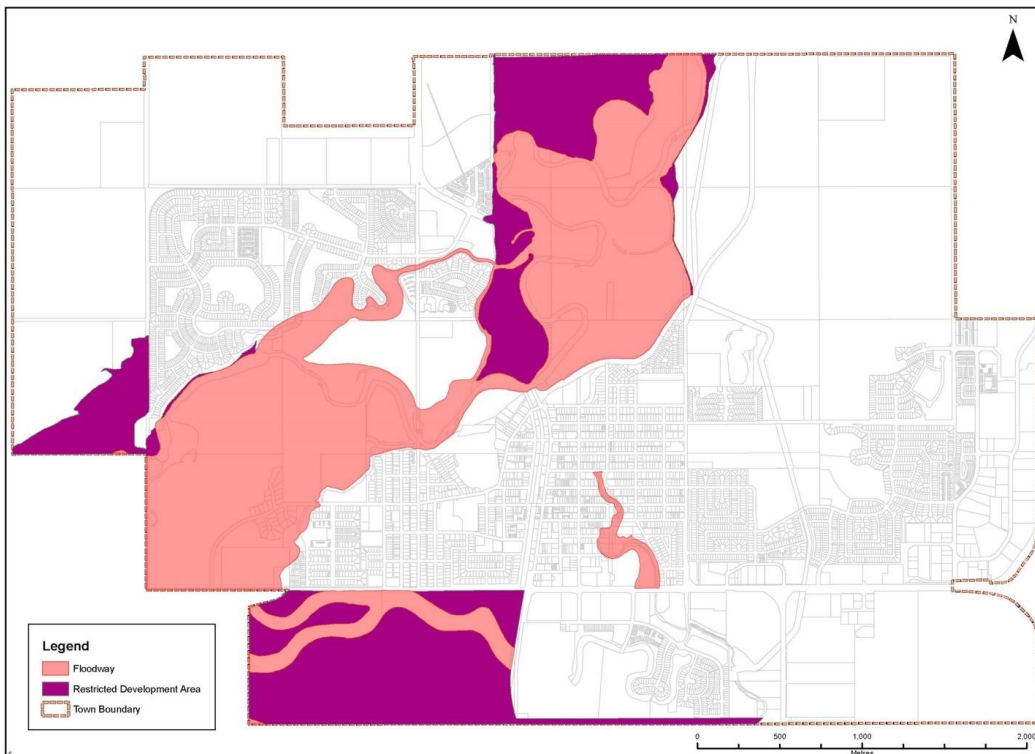


Figure 5. High River boundary with flood hazard overlay⁴

⁴ Image source: High River Land Use Bylaws Section 3.3 Index. Available at https://highriver.ca/land-use-bylaws/2_MapsAndOverlays.html.

Although difficult to state conclusively, the planned retreat process in High River can be characterized as a primarily top-down, non-collaborative process in which provincial and town officials largely decided on planned retreat for—rather than with—the community. The province’s Floodway Relocation Program led directly to a provincial announcement that Beachwood Estates homeowners would be bought out, and then, months later, Wallaceville residents—who were initially denied a buyout and had spent months and thousands of dollars rebuilding their homes—were suddenly advised by town officials to either accept a buyout or risk being expropriated at post-flood market value. Research examining the High River post-disaster public engagement process indicates that much of that engagement was basic public education, cosmetic urban design feedback, and a significant amount of “anger management” (Bogdan & McDonald-Harker, 2018). This was in lieu of more powerful forms of engagement such as decision-making about planned retreat or providing inputs on a collective community vision for post-flood resiliency. Communication was similarly top-down, with provincial and town officials tending to feed information and decisions to the public rather than facilitating a two-way flow of information in pursuit of collaborative decision-making.

There has not been a significant attempt to revitalize or repurpose the “retreated lands” left over after home demolition or removal, but, of course, this may still occur sometime in the future. All but 14 of the bought-out homes have now been removed, and only basic naturalization of the two sites has been completed; most of the built features (e.g. homes, sidewalks, paved roads) have been removed, and the lots have been graded and hydroseeded with grass (Town of High River, 2020). In an unusual twist, the Mayor who advised Wallaceville residents to accept buyouts in 2013 is lobbying the provincial Government to sell the 14 homes that are still standing back to the Town of High River so they can be fixed up and put back on the market (CBC News, 2019a).

Lessons learned from the High River planned retreat process are threefold. Firstly, lack of community engagement on the part of both provincial and town officials appears to have led to a retreat process that triggered significant confusion, anger, and additional mental health stress for a community already reeling from the flood disaster. Secondly, top-down approaches that feature significant coercive elements may facilitate rapid retreat, but the trade-off is that these approaches will likely add to mental health consequences and other challenges for flooded homeowners. Trust and transparency in the retreat process are essential to fostering public buy-in and promoting well-being. There is no evidence that town or provincial officials assisted homeowners with the buyout decision-making process (e.g. by providing on-the-ground support workers or mental health counsellors) or in identifying new homes in safer locations. This approach to planned retreat is therefore best described as unsupported “involuntary retreat.” Thirdly, pursuing a broadly consultative approach with flood-affected communities may slow down the planned retreat approach, but will likely pay longer-term dividends in generating a community-wide post-flood resilience approach and vision.

3.3. Great Lakes, ON

Over the last seven years, the Great Lakes have experienced record lake levels that show no signs of peaking (CBC News, 2019b). Along Lake Erie’s northern coastline, particularly the portion stretching from Rondeau Provincial Park/Erieau to Point Pelee National Park/Leamington, there are now several current or future planned realignment projects, while large-scale future planned retreat of households, farms, and related infrastructure near the lake is a possibility (Zuzek & Mortsch, 2020).

The primarily rural region in question stretches approximately 70 km from the community of Erieau (population of approximately 500) (CBC News, 2020a) to the municipality of Leamington (population of approximately 32,990) (Statistics Canada, 2020). Local roads and highways, including Erie Shore Drive (Highway 10) and Talbot Drive (Highway 3) hug the coastline along this stretch of Lake Erieau, in some places set back less than 10 m from the lakefront. Hundreds if not thousands of waterfront cottages, homes, estate homes, farms, and tourist accommodations dot the waterfront, many less than 2 m above the long-term average (LTA) lake level.

Lake Erie water levels fluctuate seasonally and over longer time periods in response to inflows from Lake St. Clair/Huron, rain and snow events over the lake, and inflows from the many smaller rivers that drain directly

into the lake. Beginning in about 2013, Lake Erie water levels began a steady rise above the LTA lake level of 174.15 m, and as of July 2019, had risen almost one metre to 175.14 m, their highest levels ever recorded (Zuzek & Mortsch, 2020). Onshore winds and storm events, as well as ice shoves, magnify the impact of high water levels, and typical storm events and the seiche effect (from standing waves in enclosed bodies of water) can increase lake levels locally by more than 0.5 m and accelerate erosion. Although it is difficult to predict future lake levels, there is a possibility that Lake Erie levels could rise further under climate change (**Figure 6**).

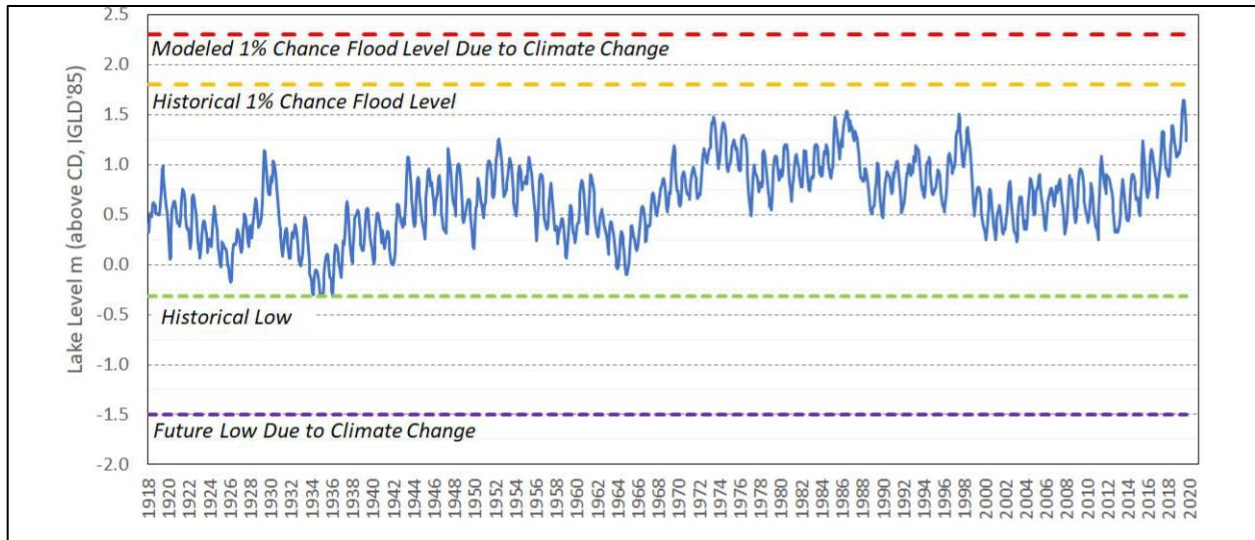


Figure 6. Lake Erie historical lake levels (1918–2019) and future extremes due to climate change (Zuzek & Mortsch, 2020)

Over the last seven years, the increased lake levels have triggered significant coastal erosion, bluff erosion and coastal flooding in many locations along the 60 km stretch from Eriean to Leamington. This has led local authorities to reactively realign some stretches of coastal roads, to proactively consider the realignment of additional roads, and to consider the possibility of both reactive and proactive planned retreat for coastal homeowners and farmers. One portion of Talbot Trail, stretching 30 km westward from Erie, was realigned in 2010 by the Municipality of Chatham-Kent at a cost of \$200,000 (Chatham Daily News, 2019), and another portion of the Trail is currently closed due to erosion damage and will be realigned as soon as possible (CTV News, 2019). There are also proposals being put forward to realign the majority of the remainder of Talbot Trail (BT Engineering, 2020) at an estimated cost of \$31–40 million (Zuzek & Mortsch, 2020). One recent assessment for this stretch suggests that up to 439 primary or secondary buildings will likely be affected by coastal erosion within 50 years or less, with a total assessed value of \$59.7 million (Zuzek & Mortsch, 2020).

Planned retreat is actively being considered as a proactive climate change adaptation option for many of these properties. One area of immediate concern, Erie Shore Drive near Eriean, has flooded repeatedly since 2017 (Zuzek & Mortsch, 2020). This roadway was built on top of a protective dyke from the 1920s, and homes and cottages were then built between the dyke/road and lake. Concerns about a possible dyke breach in the winter of 2019–2020—which could have flooded hundreds of hectares of land north of Eriean—led to the emergency closure of the road, and homeowners were not allowed access to their homes for up to four weeks. Recent studies have identified planned retreat as one disaster risk reduction option for the Erie Shore Drive homes, which have a collective assessed value of \$20 million (Zuzek & Mortsch, 2020); a planned retreat program featuring home buyouts would likely cost at least the assessed home value. An additional 11 portions of coastal roads are also at threat from erosion, and these sections are under consideration for realignment.

Towards Leamington, several planned retreat projects are already completed, and more are at the proposal phase. One 500 m portion of a bluff top road known as Bluff Line was realigned approximately 75 m inland due to nearby rapid bluff erosion of 1.4 m/year (**Figure 7**). Additionally, the flat farmland immediately north of Point Pelee

National Park and east of Leamington is at risk of inundation and coastal erosion as lake levels rise. Flood protection dykes that currently prevent inundation of this area during high water events are in need of significant repair, as they do not presently meet minimum provincial standards. Dyke repair costs plus the additional cost to add height to the dykes currently protecting approximately 5,000 acres of farmland may be more than the land is worth, leading to the possibility that the planned retreat of hundreds of current rural residents may be inevitable if lake levels continue to rise.⁵

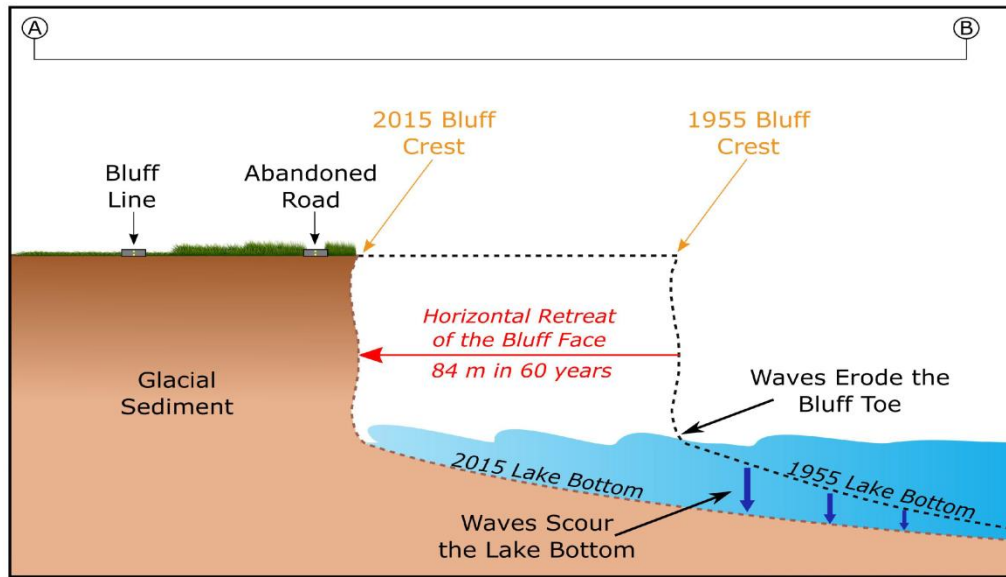


Figure 7. Impact of bluff erosion on Bluff Line road (Zuzek & Mortsch, 2020)

The process leading to the planned retreat cases mentioned above has varied depending on the category of asset under consideration. Although specific details are not available about the processes used to reactively realign portions of Bluff Line and Talbot Trail, it is assumed that a standard transportation planning approach was used for both (e.g. identify a preferred rerouting option, carry out environmental assessment studies, acquire land, and then realign the road). The process used to identify proactive planned retreat as an option for multiple portions of roadway stretching from Erieau and Leamington is described in a 2020 report produced by consultants Zuzek and Mortsch entitled *Chatham-Kent Lake Erie Shoreline Study*. Once the areas at risk were identified, a series of adaptation options were identified using the familiar PARA framework, and a cost-benefit analysis was carried out for each option. A class environmental assessment entitled “Talbot Trail Environmental Assessment Study” is now being carried out for the multiple portions of Talbot Trail that will need to be realigned (BT Engineering, 2020).

The process used to identify the planned retreat option for the 439 lakefront buildings between Erieau and Leamington is also well documented in the Zuzek and Mortsch report (Zuzek & Mortsch, 2020). A dedicated website (“Let’s Talk Chatham-Kent”) was used for information-sharing, public engagement and feedback about climate change adaptation options. Nine public meetings over a seven-month period were also held with almost 1,000 participants to introduce the study, generate ideas about possible adaptation approaches, and solicit feedback on the various options identified by the consultants. Two roundtables were also held with municipal officials, conservation authority staff, and senior provincial and federal government officials.

It is still too early to know whether planned retreat will be chosen as an adaptation option for the sites identified, and this leaves many questions. How will the planned retreat of buildings deal with the issue of compensation (e.g. assessed value vs. market value)? Will an effort be made to support homeowners, farmers and building

⁵ Zuzek, P, and Mortsch, L. (2020). Personal Communication. March 30, 2020.

owners throughout all stages of the retreat process? To what extent will retreated lands need to be remediated before coastal erosion or coastal inundation consumes the land left behind?

The main lesson learned from this case is that reactive post-erosion retreat can be used constructively to trigger and signal the need for proactive climate change adaptation. Once several assets were threatened by erosion, the Chatham-Kent authorities commissioned future-oriented hazard assessment studies that allowed them to proactively identify planned retreat as a viable climate change adaptation option.

3.4. Pointe Gatineau, QC

Pointe Gatineau, QC, is a community that has been in existence, in one form or another, for over 200 years. Now part of the larger Gatineau municipality as “Pointe Gatineau electoral district,” the community became a city in 1959 and was amalgamated into the larger City of Gatineau in 1975 (The French-Canadian Genealogist, nd). The most recent census indicates a population of 13,935 (Ville de Gatineau, 2020).

Located at the confluence of the Gatineau and Ottawa rivers, the community has had a long history of flooding. In the late 1800s and early 1900s, the community experienced regular (and, some sources suggest, “annual”) flooding, the most severe of which (1876) swept away 30 houses and caused another 200 houses to be abandoned. Although the construction of upstream locks (1911) and hydropower dams (1920 and 1964) reduced the frequency of flooding, significant flood events continued to be experienced by the community, including in 1926, 1947, 1951, 1974 and 1976 (The French-Canadian Genealogist, nd). Portions of the Pointe Gatineau community are established in what is now considered to be a 1:20-year floodplain (CBC News, 2017).

After an approximately 40-year quiet period, two record floods occurred in April 2017 and May 2019, inundating the community and triggering planned retreat via two successive waves of home buyouts that continue to this day. Approximately 1,800 homes were affected by flooding in the wider Gatineau municipality during the spring 2017 floods, with the Pointe Gatineau neighbourhood being hit particularly hard, and flooding in the spring of 2019 exceeded the record set in 2017.

Following the 2017 flood, provincial legislation banned home reconstruction in the 1:20 floodplain and, within mere weeks, the Quebec government facilitated planned retreat through a special 2017 flood-related program that piggybacked on its standard “Financial Assistance for Disaster Victims” program. The special program offered up to \$200,000 in home buyout funding to residents whose homes were significantly damaged, with an additional \$50,000 for the lot/land (Canadian Underwriter, 2017). Within four weeks post-flood, the City of Gatineau mobilized to assist homeowners by waiving administration fees and speeding up the application process for demolition and construction permits.

In mid-April 2019, just as record spring flooding again began to inundate Pointe Gatineau, the province announced a new disaster relief program expressly facilitating planned retreat by setting “hard caps on the amount of compensation available to homeowners in flood zones, with the goal of encouraging them to move elsewhere” (CBC News, 2019c). The 2019 flood program stipulated that, once home flood damages surpassed 50% of the home’s value or exceeded \$100,000, homeowners would be offered either up to \$100,000 to rebuild or \$200,000 plus \$50,000 to relocate to another property. If homeowners were outside the 1:20-year floodplain and chose to rebuild, the \$100,000 compensation became a lifetime limit on flood compensation (i.e. the limit would apply to the home title in perpetuity, and any future flood damages would only be compensated if the home had not yet reached the \$100,000 limit).

As of November 2019, over 185 home and condominium owners in Pointe Gatineau or the wider Gatineau municipality had accepted buyouts, and empty lots currently dot low-lying areas of the community in what is often called a “Swiss-cheese pattern” of retreat (**Figure 8**). Although the planned retreat in Pointe Gatineau has primarily involved single detached homes, the record flooding of spring 2019 structurally damaged a 16-unit condominium that was subsequently bought out and demolished, with all residents moving to other properties.



Figure 8. Pointe Gatineau Home Buyouts (lots outlined in pink) as of February 2019⁶

The final cost of the planned retreat/buyout programs in Pointe Gatineau has not yet been tallied, given that buyouts continue, but using the \$250,000 maximum compensation per property and multiplying by the 185 properties that have already been bought out, a figure surpassing \$30–50 million would not be unexpected. The Quebec government has approached the Federal government through its Disaster Financial Assistance Arrangements (DFAA) program for help in offsetting the cost of the community’s ongoing retreat efforts (CP24, 2019).



Figure 9. Flooded condominium and post-buyout home demolition signs⁷

Planned retreat in Pointe Gatineau has unfolded slowly and with limited guidance and support for residents wishing to relocate. The initial round of 2017 buyout applications was completed several months after the spring floods, yet many residents reported that they still had not had their applications processed by the following winter of 2018, with some reporting delays that lasted into 2019. One woman whose 2017 application had not been approved before the subsequent 2019 floods had to begin the process all over again due to 2019 program

⁶ Image Source: CBC News. (2019). Pointe-Gatineau residents to pitch ideas for revitalizing flood-ravaged community. Available at <https://www.cbc.ca/news/canada/ottawa/pointe-gatineau-flood-neighbourhood-revitalization-1.5012624>.

⁷ Image source: Doberstein, B. (2019). Personal photos.

changes. Delays were also introduced simply due to the sheer scale of the flood disaster, as it took many months for Quebec public safety department inspectors to examine all flooded properties and issue the damage assessment paperwork needed to initiate buyout applications. Local municipal officials suggested that they were able to intervene and provide support in a small number of especially problematic cases, but they acknowledged that their influence was limited.

Other than the aforementioned municipal assistance (i.e. waiving fees, speeding up demolition permits), there is no evidence to suggest that flooded homeowners had significant ongoing support or assistance throughout the planned retreat process. For example, residents were not offered assistance in deciding which relocation home to purchase. Rather, once home buyout compensation was paid out, it appears that residents turned individually to the real estate market to decide where to move. Similarly, there did not appear to be any formal assistance to help residents decide whether to relocate individually or as a group/neighbourhood, nor any attempt to assist residents with purchasing homes in “safer” locations. The lengthy program delays have generally been ascribed to a combination of a convoluted/bureaucratic application process, lack of guidance or on-the-ground support for applicants and, in some cases, long turnaround times once applications were submitted.

The Pointe Gatineau community continues to work on a plan for the land that is currently vacant. In mid-2018, the City of Gatineau began a series of community engagement and visioning events focused on post-retreat community redevelopment for what might be called the “retreated lands,” meaning the empty lots and deurbanized landscape left behind by the planned retreat. Pointe Gatineau residents were invited to meet with representatives from community-based organizations, municipal services and a landscape architecture firm. One of these events involved a community walk in which residents were encouraged to think about how to reimagine the post-flood, post-retreat landscape for community benefit and livability. This was followed up with a community workshop in February 2019, in which community members were shown what had been done in other communities facing similar flood-related planned retreat (e.g. Hurricane Katrina in New Orleans, Hurricane Sandy in Coastal New York/New Jersey), and then residents began to brainstorm land uses that both respected the ongoing flood hazard and conferred benefits to the community.

A community redevelopment committee was formed, and the committee began to identify low-cost initiatives that could be implemented relatively quickly (e.g. removing damaged asphalt, building a walking path, creating an arboretum and community garden, establishing a commemoration site). This work was put on hold when the spring 2019 floods again inundated the community, but work picked up again later that year and an \$80,000 grant was secured by the committee to develop an initial community redevelopment plan. Longer term, local municipal representatives have indicated that the City will apply for funding to carry out the more expensive process of implementing the redevelopment plan through changes to infrastructure, landscape and, likely, official zoning.

Planned retreat in the Pointe Gatineau community can best be summarized as being carried out reactively in the face of repeated flood disasters, funded by a combination of municipal, provincial and federal government funding. Retreat mainly involving single detached homes, featured a mix of voluntary and involuntary elements, and has been followed up by a promising community engagement and redevelopment process. Some flooded residents were forced to move (completely involuntary retreat) if their homes were located in the 1:20-year floodplain, while others faced the difficult choice to either rebuild in a risky location (knowing that future flood damages would not be covered) or accept a buyout (coerced retreat). As with many disaster-related retreat programs, a post-disaster environment is a chaotic time in which to plan retreat and, in Pointe Gatineau, this has led to significant gaps in program implementation, unmet community needs, and elements of what might be called “unplanned planned retreat.”

Lessons learned in this case are twofold. Firstly, government officials implementing a post-disaster planned retreat program should expect that impacted homeowners will need significant support and guidance to navigate program requirements and the retreat process generally. This might include the provision of dedicated on-the-ground support staff to help homeowners with their retreat decision, walk homeowners through every step of the buyout process, assist homeowners with their search for new homes, and navigate unexpected roadblocks in the application process. Secondly, a municipal process that engages the community in transparent decision-making

about post-retreat lands and the resulting community landscape can go a long way towards helping communities maintain resiliency in the face of both disaster and planned retreat.

3.5. Tuktoyaktuk, NWT

Located on a low-lying, narrow peninsula reaching out into the Arctic Ocean, Tuktoyaktuk is one of six communities located in the Inuvialuit Settlement Region of the western Canadian Arctic (**Figure 10**). According to the most recent Canadian Census, Tuktoyaktuk has a population of approximately 900 people (mean age: 31.9 years), comprised primarily of Inuvialuit (Statistics Canada, 2019). The community economy combines elements of subsistence harvesting—important both culturally and as a source of food—and wage employment in sectors such as health, government, social services and construction (Andrachuk & Smit, 2012). The unemployment rate in Tuktoyaktuk far exceeds the national average, generally standing near 30% with total median income at \$21,984.

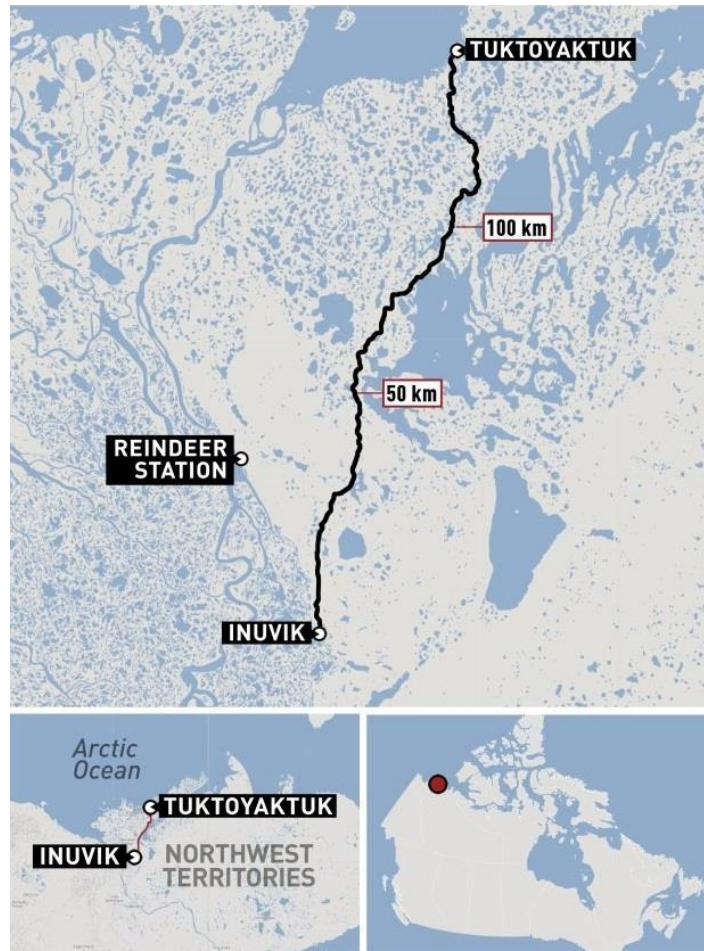


Figure 10. Map of Tuktoyaktuk⁸

The western Canadian Arctic has experienced notable climatic changes in the past half century. Warming of 2–3 °C has resulted in changes to sea-ice thickness and distribution, permafrost degradation, wind patterns, and wildlife distribution (Berkes & Jolly, 2001). It is expected that Tuktoyaktuk will experience warmer temperatures, increased precipitation (especially in winter), increased storm frequency (especially in the fall), and greater variability in weather (Forbes, 2011; Lemke et al., 2007; Sou & Flato, 2009).

⁸ Image source: CBC News. (2017). New Arctic coast highway opens up remote Tuktoyaktuk. Available at <https://www.cbc.ca/news/canada/north/new-arctic-coast-highway-opens-up-remote-tuktoyaktuk-1.4363029>.

A broad, community-based vulnerability assessment that sought to benefit from local knowledge to identify hazards in Tuktoyaktuk found that coastal erosion and permafrost degradation were threatening infrastructure, municipal services, the local economy, and the health and well-being of the population (Andrachuk & Smit, 2012). Tuktoyaktuk appears to be particularly vulnerable to coastal erosion as a result of the shoreline characteristics, relative sea-level rise, temperatures and intensity of storms (Manson & Solomon, 2007).

Storms blowing in from the northwest across the Beaufort Sea are eroding the land of the original permanent settlement, which was established in 1934 and affected by rapid erosion early in its history. Systematic investigations of shoreline erosion in Tuktoyaktuk started in 1974 and continued for 20 years before effective adaptation measures were identified. During this time, several experimental adaptation options were tested with little success. Tuktoyaktuk received funding from the territorial government to import large boulders, placing them along the northwest shoreline to limit erosion (Andrachuk & Smit, 2012).

In 2003, researchers projected that coastal erosion would cause the tip of the peninsula to disappear within 10 years, damaging or destroying 15 buildings within 25 years (Atkinson, 2005). However, shoreline protection measures appear to have slowed erosion rates. Moving forward, it is unclear how these protection measures—combined with increasing frequency of fall storm events accelerating erosion—may affect erosion (Johnson et al., 2003). It remains clear, however, that the northern tip of the community is particularly vulnerable to the consequences of erosion (Andrachuk & Smit, 2012).

Erosion protection works were also implemented between 1998 and 2001, yet coastal erosion remains an ongoing concern for the community, as sea level continues to rise as well as rates of erosion. In addition, over the years, the Hamlet has been relocating and/or removing infrastructure that was particularly at high risk. Gradual relocation of the community was the most inexpensive option identified and, since that time, sporadic relocations have gradually moved some residents further inland or to areas less threatened by erosion.

There remain, however, pervasive challenges for the relocation of residents and buildings. Costs are high and resources are limited, as individuals, families and the municipal government lack the resources required to protect or relocate properties. As such, the community is reliant on funding from the territorial and federal government. Limited financial resources have been identified as a primary roadblock to climate change adaptation in the ISR (Pearce et al., 2020).

Although the Hamlet of Tuktoyaktuk has received federal funding over the last decade, the funds are limited compared to the substantial costs needed to develop and implement the adaptation measures. The Northwest Territories Government received federal funding of \$240,000 through Public Safety Canada's National Disaster Mitigation Program to develop a coastal erosion mitigation plan, including enhancement of public safety and reduction of future erosion damage through the identification of coastal erosion hazards. Various stakeholders were involved, including the territorial government, indigenous government, local authorities and the public. The resulting class I engineering report titled "Tuktoyaktuk Coastal Erosion Study" was completed by W.F. Baird & Associates Coastal Engineers Ltd. in March 2019.

This report pointed to the need for the inclusion of planned retreat in Tuktoyaktuk's adaptation plan, an option that had long been discussed but began in earnest only recently, given that the community has an all-weather road, the Inuvik–Tuktoyaktuk Highway, that was officially opened in 2017. It allows year-round movement of traffic inland and eliminates reliance on winter roads, which was the former means of overland access. The all-weather road expands the range of options available for retreat and relocation (CBC News, 2020b). The Inuvialuit Settlement Region, which includes Tuktoyaktuk, is a well-researched area in the context of environmental and climate vulnerability. The impacts of projected climate change to physical infrastructure in Tuktoyaktuk are well documented and understood. This contributes to proactive adaptation, which required an understanding of risks, vulnerabilities, hazards and adaptive capacity (Pearce et al., 2010).

Recently, the Northwest Territories Government and Hamlet of Tuktoyaktuk received a combined funding of \$892,000 from Crown-Indigenous Relations and Northern Affairs' Climate Change Preparedness in the North

Program to support the relocation of four homes at highest risk on the peninsula to a different subdivision located in the community that has higher elevation (CBC News, 2020b). However, this major endeavour experienced challenges in identifying suitable destinations for relocation, particularly for affected elderly individuals at risk of being relocated away from easy access to community services. This has led to some resistance among the affected population, and improvements in early planning and consultation processes could have helped build consensus on a pathway forward.

The Hamlet of Tuktoyaktuk is now entering its next phase, the preliminary results of which have helped the community to decide on a hybrid structural option to mitigate the coastal erosion of the peninsula. The current funding of \$2.84 million by the Climate Preparedness in the North Program will assist the Hamlet and the Government of Northwest Territories to establish the final coastal design conditions, develop the preliminary design, complete physical model testing, undertake required field work, complete the final design, provide opinion of probable cost, preparation of construction drawings and specifications, prepare permit applications, development of a monitoring program, assist with tendering and provide on-site construction services for this proposed hybrid option.

The local community has been involved in the discussions from the outset through town hall meetings at which risks and relocation plans are presented. More broadly, the process has been owned and led by the community leaders, in adherence with the 1984 Inuvialuit Final Agreement and 2008 United Nations Declaration on the Rights of Indigenous Peoples. There are also challenges in preparing the “receiving” lands to which individuals are meant to relocate. In the case of Tuktoyaktuk, access roads and bridges, in addition to construction of community infrastructure, is needed. Political, emotional and funding challenges have resulted in the migration process being extended over a long period of time.

Despite some progress in Tuktoyaktuk, persistent challenges—particularly those related to funding availability, relocation destination planning and timelines, as well as the lack of technical (e.g. engineering) expertise in the community—have been identified as important issues. It has been noted that planned retreat in Indigenous communities must take into account the risk of irreplaceable cultural loss, suggesting that cultural sites and social networks should be preserved to the extent possible (Pearce et al., 2010). Long-term and proactive adaptation planning that supports preservation of Inuvialuit culture as well as traditional/local livelihood is essential for a successful and sustainable planned retreat.



Figure 11. Makeshift coastal barriers to protect from erosion in Tuktoyaktuk⁹

⁹ Image source: CBC News. (2019). “They’re trying to rush us”: Tuktoyaktuk relocating homes too soon, says resident. Available at <https://www.cbc.ca/news/canada/north/tuktoyaktuk-relocating-homes-erosion-1.5239765>.

3.6. Truro, NS

Nova Scotia's coastal areas have long been a site of human occupation and modification, from pre-colonial Mi'kmaq settlement, to Acadian French settlers in the 1600s, to later settlers and modern-day communities and farmers (Sherren et al., 2019). The Acadian settlers in particular used extensive dyking and one-way drains (*aboiteau*) to block seawater intrusion and allow freshwater drainage, enabling coastal riverine and tidal wetlands to be used for farming (Graham et al., 2018; Sherren et al., 2019). Dyking of this nature near Truro, NS has recently been the focus of a managed realignment project called the "Onslow-North River Dyke Realignment and Tidal Wetland Restoration Project" (referred to hereafter as the "Truro-Onslow Dyke project"). This project was designed to widen the artificially constricted tidal/riverine floodplain, reduce flood risks for the Town of Truro and surrounding regions, reduce dyke maintenance costs, and as much as possible, regain the benefits of the wetland ecosystems that existed before dyking through nature-based adaptation (CBWES 2020; Graham et al., 2018; Sherren et al., 2019).

The Town of Truro, now a regional centre of approximately 12,000 residents, has faced flooding on an almost annual basis since records have been kept, with one flood documented as far back as 1792 and up to five floods recorded in one single year (1979) (CBCL, 2017). Located largely within the Salmon River floodplain at the confluence of the Salmon and North rivers, the Town faces ongoing and increasing flood risks due to the combined effect of its floodplain location, loss of floodplain due to past dyking, upstream land use change, exposure to both riverine and tidal flooding, periodic ice jam flooding, and a combination of regional tectonic subsidence and climate change-related sea-level rise (CBCL, 2017; Sherren et al., 2019). A Truro flood risk study commissioned in 2017 suggested that past flooding historically did not appear to trigger significant flood risk reduction efforts: "...development within the floodplain has historically increased following large flooding events. Memories of the events fade, other priorities arise, and budgets are focused on other more immediate needs" (CBCL, 2017). This changed significantly following major flooding in 2012 caused by a storm associated with remnants of tropical Storm Leslie (Sherren et al., 2019); suddenly, Truro had its policy window for change.

With a policy window for change now open, the Joint Flood Advisory Committee (comprised of the Town of Truro, County of Colchester, and Millbrook First Nation) commissioned a comprehensive flood risk study for the region (CBCL, 2017; Sherren et al., 2019). Funding for the \$400,000 study was provided jointly by the Nova Scotia Environment Climate Change groups' Flood Assessment Fund, Town of Truro and County of Colchester. The main goals of the study were: "reviewing historic data and reports, developing models of current and future events, identifying potential flood mitigation projects, proposing changes to existing policies and bylaws, and identifying short/long-term maintenance plans" (Municipality of Colchester, 2020). The study explicitly incorporated climate change projections to 2100 into modelling (Sherren et al., 2019), so although the impetus for the study and its recommendations can be interpreted as being reactive to the 2012 flood disaster, there was a proactive, forward-looking element as well. The study incorporated a limited public engagement process (i.e. a meeting with councillors from the County of Colchester and Town of Truro, one public open house, and a stakeholder consultation meeting which included Millbrook First Nation) which identified public "flood protection priorities" (CBCL, 2017). These ranged from aspects related to human health and safety, to land use, and infrastructure services. A ranked list of the public priorities identified through this process is found in **Figure 12** below, with protection of existing dyke/marshland infrastructure identified in red as "low priority."

Summary of Results from Public Consultation					
Human Health and Safety	Rank	Land Use	Rank	Infrastructure Services	Rank
Protection of Life	1	Protection of Hospital	1	Protection of Water Supply / Treatment	1
Preservation of Access to Emergency Facilities	2	Protection of Residential Properties	2	Protection of Communication Infrastructure	2
Access to Necessities of Life	3	Protection of Senior Homes	3	Protection of Power Supply	2
Protection of Livelihood	3	Protection of Schools	4	Protection of Potable Water Infrastructure	3
Protection of Environment from Contamination	4	Protection of Industrial Lane Properties	5	Protection of Roads	4
Maintenance of Access to an Area	5	Protection of Agricultural Land	6	Protection of Wastewater Treatment Infrastructure	4
Social Justice	6	Protection of Retail Properties	7	Protection of Bridges	5
Protection of Regional Access Routes	7	Protection of Office Uses	8	Protection of Marsh Land Infrastructure (Dykes, Aboiteaux)	6
		Protection of Recreational Facilities	8		

Figure 12. Summary of public consultation results (CBCL 2017)

The study examined a wide range of PARA flood risk reduction options, ultimately finding that no one “magic bullet” would solve Truro’s flood problem (CBCL, 2017; Sherrin et al., 2019). One of the most cost-effective partial solutions was identified as the managed realignment and habitat restoration of a portion of the Truro-Onslow Dyke (see **Figure 13**), the protection of which had been assigned a low priority in the public consultation process. This was referred to in the report as “widening the dykes to restore some of the river floodplain” (CBCL, 2017). Additional details on the flood risk study are contained in the 106-page final report (CBCL, 2017).

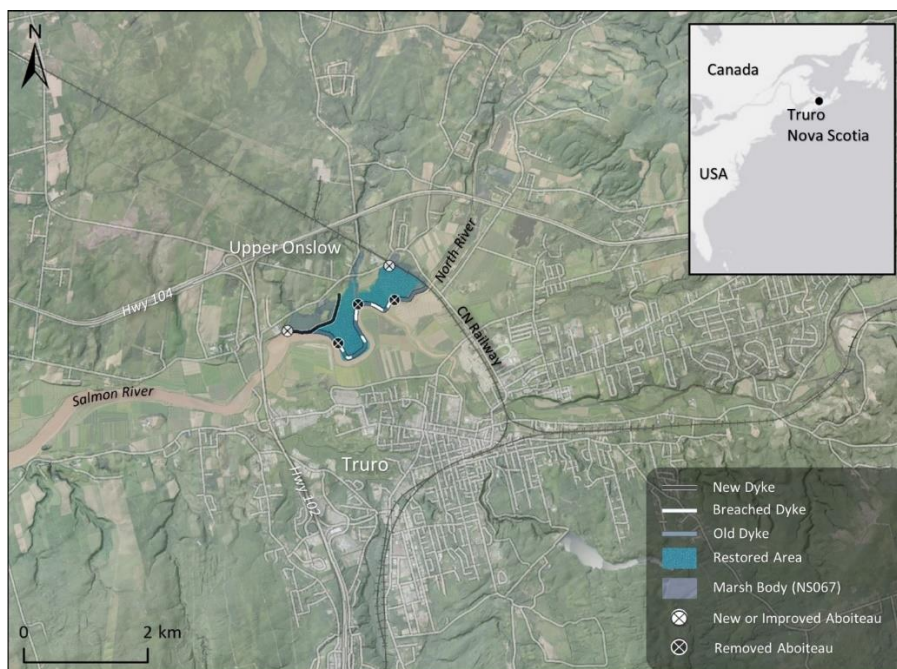


Figure 13. Truro-Onslow map¹⁰

¹⁰ Provided by Danika Van Proosdij, Saint Mary’s University.

The Truro-Onslow Dyke project emerged out of the Flood Risk Study as a project which would not only add floodplain capacity but would also reduce dyke maintenance costs and add to a bank of salt marsh “habitat credits” available for future Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) infrastructure projects (Sherren et al., 2019). On NSTIR projects where salt marsh damage was unavoidable, NSTIR could draw on the Truro-Onslow Dyke project credits already “banked” to neutralize the overall impact of the new project. Dyke realignment and restoration design work for a 135-ha wetland site was carried out by CB Wetlands & Environmental Specialists (CBWES) consultants in partnership with Saint Mary’s and Queen’s University researchers (Graham et al., 2018; Sherren et al., 2019). Design work included determining the location of the newly aligned dyke (approximately 1.5 km over two sections), designing the size and location of dyke breaches in the old dyke, and designing a restoration plan for the soon-to-be unprotected former agricultural lands (Sherren et al., 2019). Dyke managed realignment (\$1.66 million estimated cost) rather than dyke reconstruction and maintenance to 2055 (\$2.18 million estimated cost) was estimated to save CAD 520,000 in 2018 dollars and those savings are only calculated for the actual site itself (Sherren et al., 2019). Funding for the project was split between NSTIR (50%), NDMP (National Disaster Mitigation Program, 25%) and NSDA (Nova Scotia Department of Agriculture, 25%) (Sherren et al., 2019). A full cost-benefit analysis has not been conducted, but it is plausible to also assume additional savings from reduced future flood damages in the Town of Truro and from less tangible wider ecosystem benefits and carbon sequestration.¹¹

Once design work was complete, a complex public engagement process was again entered into. Under Nova Scotia’s Marshland Act, proposed marshland changes must involve consultations with the local Marsh Body, bordering landowners, and companies with infrastructure on the site (for the Truro-Onslow Dyke project, Nova Scotia Power and CN Rail) (Sherren et al., 2019). A series of meetings ranging from town hall-style meetings to individual stakeholder meetings were organized by project staff in an effort to arrive at a consensus on the final project parameters. One significant concern was that the newly flooded/formal agricultural lands would become a mosquito breeding ground, but this concern was eventually addressed through a specialized mosquito management plan (*ibid.*). Under the Marshland Act, marshland owners were required to vote on the proposed realignment plan, a vote which carried unanimously (Sherren et al., 2019).

The Truro-Onslow Dyke project idea first emerged after the 2012 flood event, became more organized as a project under the 2014–2017 Flood Risk Study, was modified and further refined to incorporate additional benefits in the post-2017 period, and is currently under construction with an expected 5-year post-construction monitoring period (CBCL, 2017; Graham et al., 2018; Sherren et al., 2019). The timeline from idea to implementation and then monitoring and possibly fine-tuning is therefore approximately 15 years. As mentioned, the 2012 Truro floods galvanized action for this project and created the policy “window of opportunity” that allowed the project to be implemented and to contribute to both flood risk reduction and climate change adaptation. The land that will be left unprotected once the old dyke is breached will return to floodplain status and will form new riverine and salt marsh habitats, albeit still physically modified in places by existing infrastructure (power/rail) and remnants of the old dyke.

The project is an example of almost purely voluntary managed realignment. Potentially affected landowners were consulted, the wider public was engaged in the Flood Risk Study that raised the realignment possibility, and other than compensation for landowner land purchases, no overt incentives or coercive elements were seen in the ultimate decision to realign the dyke. Landowners were free to reject purchase offers or to vote against the dyke realignment plan. As such, this project represents an excellent model for voluntary, community-engaged disaster risk reduction and climate change adaptation. With benefits for the community, environment and government, it has been described as a “win-win-win project” (CBWES, 2020).

¹¹ It is worth noting that, unlike the other five cases studies profiled in this report, the Truro-Onslow Dyke project is labelled differently—neither homes nor infrastructure threatened by flooding were relocated as part of the project, so, in keeping with international terminology it is a “managed realignment” rather than “planned retreat” project.

4. Key Findings

The subsections below explore the common triggers for planned retreat (4.1), sources of resistance (4.2), considerations and approaches (4.3), and enablers and barriers (4.4).

4.1. Triggers for Planned Retreat

By far the most common trigger for planned retreat—both in Canada and internationally—is experience with disaster. The majority of disasters that trigger retreat are rapid onset disasters. As mentioned previously, the physical hazards most commonly associated with rapid onset disasters and related retreat include riverine flooding, ice jam flooding, pluvial/urban flash flooding, coastal storm surge/king tide flooding, tsunamis, volcanic eruptions, wildfires, and mass movements (i.e. landslide, mud/debris flow). Less frequently, planned retreat is associated with more gradual onset hazards such as lake flooding, coastal inundation and erosion, soil erosion, and drought.

When compared to “normal conditions,” the post-disaster time period often contains a combination of factors that triggers a highly supportive environment or “policy window” for planned retreat. Political attention is suddenly focused on the affected community or infrastructure, and there may be significant political benefits to being seen to take decisive action. The declaration of a “State of Emergency” may further facilitate action. As the scale of the disaster is revealed and initial damage assessments are generated, there are often multiple agencies and constituencies calling for an end to the costly cycle of disaster/rebuild/disaster/rebuild, especially if the disaster-affected area has had similar past disasters. If a cost-benefit analysis shows that a one-time buyout or retreat program is significantly cheaper than additional rebuild/disaster cycles, this may lead to the announcement of a formal buyout “package” or program, with an associated budget dedicated solely to funding buyouts or retreat actions. Homeowners and sometimes infrastructure owners are often critical voices during the post-disaster phase, lobbying for financial assistance and government support during their time of need. Overall, this combination of sudden political attention, desire for cost-effective disaster response, multiple voices in disaster-affected communities calling out for assistance, and a dedicated funding “pot,” is often enough to trigger planned retreat in disaster-affected communities.

Calls for planned retreat for disaster-affected communities/infrastructure are increasingly being influenced by a combination of disaster experience and concerns about hazards affected by climate change, so the planned retreat “triggers” in these cases are expectations of greater numbers or costs of future disasters. Even when a location has not had experience with repeat disasters, there are often calls to think about the changing nature of hazard exposure under climate change (e.g. increased disaster severity, costs, or frequency). Perhaps the clearest example of this relates to sea-level rise and the associated hazards of storm-related coastal inundation and coastal erosion. Multiple communities worldwide are now actively considering planned retreat even though they may have only had “modest disasters” or a single disaster experience.

In Canada and internationally, there are also a relatively smaller number of planned retreat cases where retreat discussions did not emerge in direct response to a disaster experience, but rather as one option among others in a proactive climate change adaptation strategy. For example, Squamish, BC leveraged local 2050 climate change projections from the Pacific Climate Impacts Consortium (2013) to inform the development and execution of their adaptation plan, which incorporated recommendations for elements of planned retreat (Picketts & Hamilton, 2016). The District produced a new Integrated Flood Hazard Management Plan—incorporating input from technical experts, the Squamish Nation and community stakeholders—recommending over 100 specific strategies for mitigating flood risk spread across the four elements of the PARA framework; this included retreating vulnerable development from areas where current risks are not acceptable, with particular application to critical

Key Messages

- By far the most common trigger for planned retreat is experience with rapid-onset disaster.
- Post-disaster “policy windows” create supportive conditions for planned retreat.
- Planned retreat is now often included as an option in proactive climate change adaptation strategies.
- Planned retreat may be triggered by understanding the broader societal benefits of retreat—everything from the creation of additional green space to the avoided costs of multiple future disasters.

facilities (District of Squamish, 2017). Under the PARA framework, retreat forms one of the four core options (protect, accommodate, retreat and avoid) that climate change adaptation practitioners often consider when initiating climate change adaptation planning for communities and regions, especially for flood and sea-level rise-related hazards. In the cases reviewed for this report, a common challenge when considering retreat for climate change adaptation purposes is that local community members may not all be on the same page when it comes to understanding the implications of climate change on hazards, and so may want to proceed with a “wait-and-see” attitude rather than decide to retreat now.

In some cases, planned retreat was triggered in part by expected “broader society benefits” rather than solely the benefits accruing to the households or infrastructure being relocated (Hino et al., 2017). These include expectations of retreated lands being turned into community space, parks or green infrastructure (e.g. wetlands), acknowledgement that relocation may reduce the community burden of disaster and disaster response/recovery, and recognition of the wider societal benefits provided in the new location (e.g. better services, infrastructure, and housing in the new location). As shown in **Figure 14**, cases where there is likely to be the most acceptance and buy-in for planned retreat are those where the affected residents initiate the move, but where broader benefits of retreat are accrued by the broader community or population. Land left vacant following the buyout programs in Pointe Gatineau, for example, is currently envisaged as primarily green space and recreational space as well as space for future floodwaters to expand onto, and so retreated lands will eventually confer broad recreational and risk reduction benefits to the community as a whole.

There are significant community and higher-level costs to responding to repeat disasters (e.g. the costs to deploy first responders, the military, and mental health staff to disaster sites) as well as direct and indirect costs to disaster recovery. As such, the desire to avoid these societal costs can trigger planned retreat. When moving people and infrastructure out of harm’s way, such “avoided costs” spread broadly across many levels of society and multiply with every future disaster avoided (**Figure 15**). In cases of planned retreat where large portions of or even entire communities are moved, both those in imminent danger and those who might only be inconvenienced by the next disaster may benefit from the new community and its service and infrastructure. One example of this is the 900-resident town of Valmeyer, Illinois which relocated to a higher elevation site following the Mississippi 1993 floods: relocation removed the floodplain building restrictions holding back developers, and the new Valmeyer boomed with new development (Koslov, 2016). In the more specialized case of the planned retreat of infrastructure, avoiding service interruptions by retreating infrastructure to a safer location provides broad societal benefits that go far beyond the safety of the infrastructure itself.

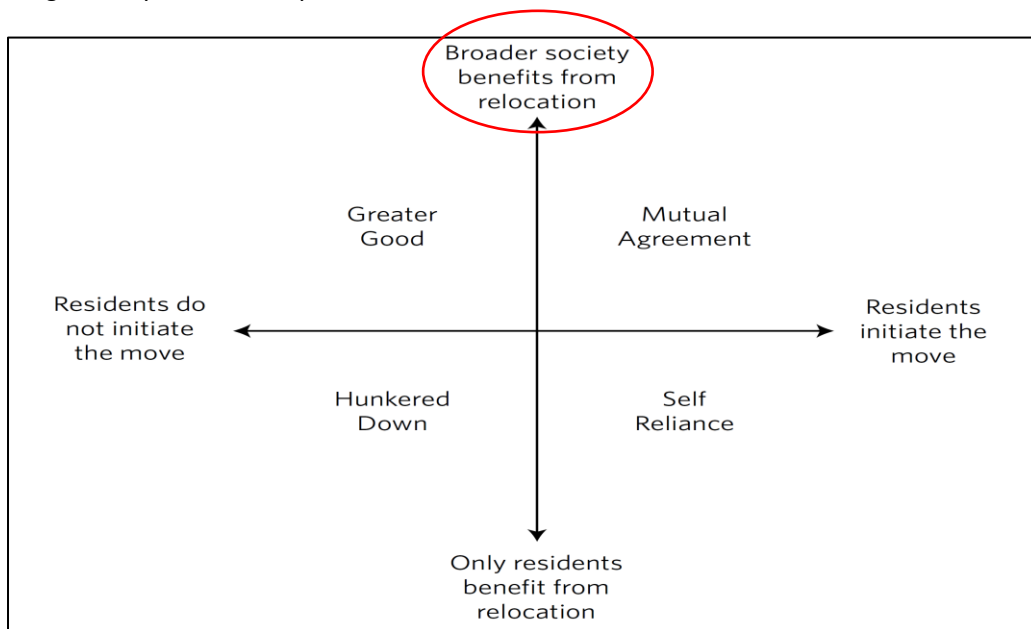


Figure 14. Benefits to the broader community as a trigger for planned retreat (Hino et al., 2017)

4.2. Sources of Resistance to Retreat

Planned retreat efforts are strongly resisted in many instances, but the sources of resistance vary widely. Understanding the specific causes of this resistance supports efforts to address these openly, transparently and consistently. It should also be recognized that many of these sources of resistance and concern may eventually be present even if planned retreat is *not* pursued and disaster ensues. For example, it might be decided that planned retreat of a 250-year-old riverside heritage community will not be pursued due to significant place-based significance and concerns about cost, and then the following year that community is destroyed by a major flood. Some sources of resistance are outlined below.

- **Psychological resistance to “retreat as failure”:** Perhaps one of the most powerful sources of resistance to planned retreat comes from the very notion that retreat is, in and of itself, an admission of human failure. Phrases like “retreat is like defeat” were commonly used by individuals opposed to the planned retreat of coastal communities post Hurricane-Sandy (Koslov, 2016). The idea of disaster-affected communities “rising from the ashes” is a powerful disaster response metaphor. Politicians, local officials and community leaders alike have used this psychological framing to great effect when trying to polarize and disrupt discussions about whether to retreat or not. Retreat is likened to “giving up,” “backing down,” or “surrendering” to the forces of nature. Often, the idea of “building back better” becomes conflated with the idea of not retreating in the face of a challenge, and this then leads to discussions of protecting communities from a hazard via engineered/structural approaches rather than retreating from that hazard.
- **Financial & taxation resistance:** Financial concerns related to planned retreat are common and create significant resistance, spanning a range from concerns from “who pays what” to the benefit/cost ratio of planned retreat, to localized concerns about the loss of municipal revenues from property taxes. Planned retreat is not normally funded through a single, regularized retreat program (i.e. a program that has an annual budget and has been expressly set up to fund retreat projects). As a result, most examples of retreat have been funded opportunistically and often through multiple sources and levels of funding (e.g. some combination of federal, provincial or municipal post-disaster assistance funding, hazard mitigation funding, infrastructure funding or climate change adaptation funding). Resistance to planned retreat based on cost-benefit ratio concerns is often driven by a lack of full cost accounting (i.e. not factoring in the wider societal costs of disasters and disaster response and recovery, or the possibility of future repeat disasters and higher magnitude disasters under climate change). **Figure 15** provides a succinct overview of the main benefits and costs associated with planned retreat of buildings, from a more complete cost accounting perspective. Resistance to retreat is also linked to concerns about loss of municipal tax revenues, especially for “hands off/free market” forms of retreat that provide little guidance or support to homeowners as they search for affordable properties under limited retreat compensation packages.

Key Messages

- There are multiple sources of resistance to planned retreat.
- Not retreating in the face of disaster is a powerful psychological and political post-disaster framing.
- Concerns about the costs of retreat create significant resistance, but full cost accounting of expected future disaster/rebuild cycles and climate change effects can reduce concerns.
- Loss of municipal tax revenue is a significant concern but can be allayed if residents are supported to find appropriate housing in the original community.
- Unless done carefully, planned retreat can disturb community cohesion, social networks and residents’ place attachment.
- Planned retreat is often resisted due to concerns about planning and decision-making processes (including concerns about coercion, rights, and degrees of community involvement).
- Planned retreat is often politically contentious or unpopular and may not line up with political timelines.

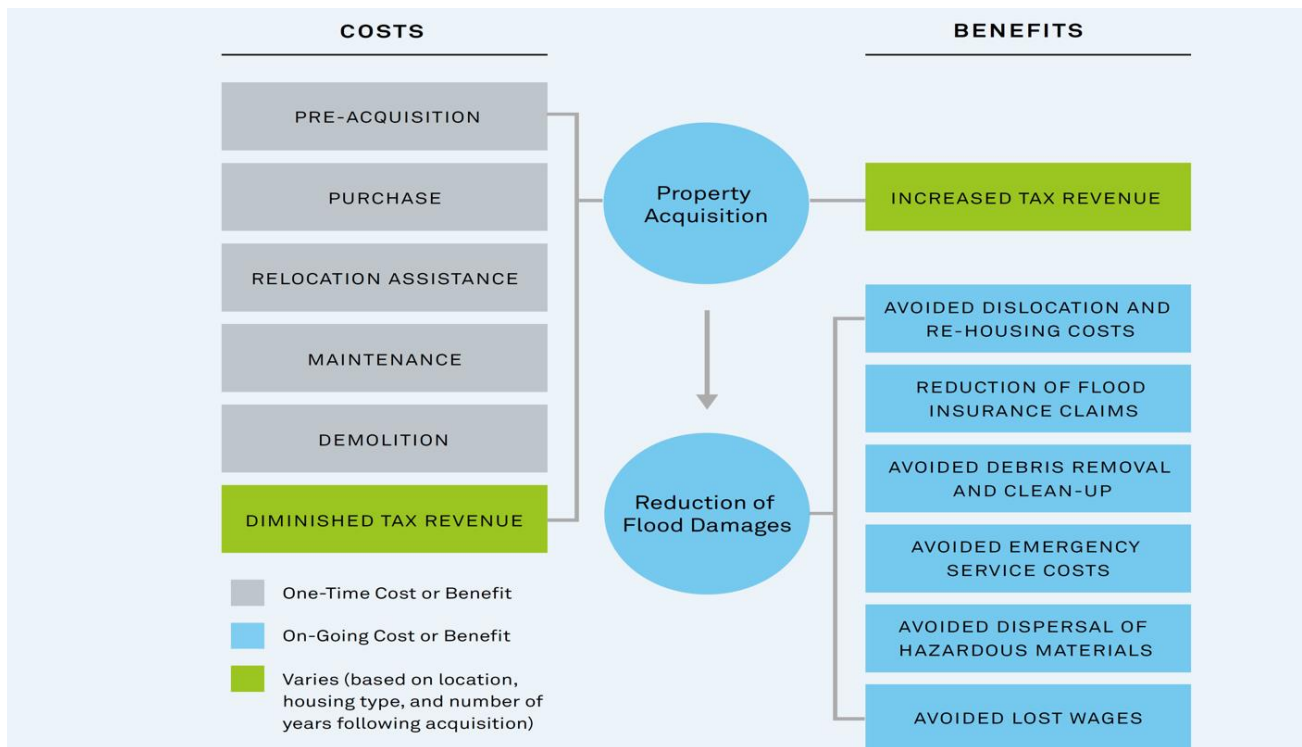


Figure 15. Costs and benefits of planned retreat¹²

- Community cohesion resistance:** Concerns related to the possibility that planned retreat will disrupt or destroy community cohesion are common and are often based on associated concerns about disturbing residents' place attachment or social bonds and networks. The importance of place attachment, identity and dependence may vary within and across communities being considered for planned retreat, but there are often concerns that these place-based attachments will be destroyed or significantly degraded by a move to a new location, especially if the original place is strongly tied to a person's identity or livelihood. Most members of a community form social bonds over time, and these bonds are sometimes hyper-local (e.g. strong ties to a particular environment, neighbourhood, social network, house, or even the plot of land on which a home is standing). Unless planned retreat practitioners pay careful attention to preserving these place-based bonds, significant disruption and emotional anguish may result. Globally, a lengthy history of highly unsuccessful relocations involving First Nations and other Indigenous peoples suggests that place matters, potentially in a multitude of ways, and that retreating from one place to another can trigger significant community problems. Several examples of planned retreat also show the links between infrastructure relocation (e.g. a bridge, lighthouse or road) and disturbances to social bonds and community cohesion, suggesting that it is not just the planned retreat of residents and their homes that should be of concern. These sources of resistance to planned retreat have been addressed to some extent in cases where communities have been moved *en masse* to a new location that approximates the previous location, and where there has been support in helping communities maintain their social networks and establish new place-based ties.
- Planning and decision-making process resistance:** This dimension encapsulates issues associated with "arbitrary" decisions (whether real or perceived) about who receives buyouts and who does not. It also includes the issues associated with more coercive approaches to planned retreat. The agencies and political institutions normally responsible for planned retreat are justifiably resistant to the idea of retreat

¹² Image source: Lincoln Institute of Land Policy. (2016). Buy-In for Buyouts: The Case for Managed Retreat from Flood Zones. Available at <https://www.lincolninst.edu/sites/default/files/pubfiles/buy-in-for-buyouts-full.pdf>.

for a number of procedural, rights-based and legal reasons. Procedurally, it is often difficult to decide who should initiate the discussion about planned retreat, especially when a disaster has not created a “window of opportunity.” In democratic countries like Canada, there are also significant concerns about the rights of property owners and taxpayers relative to the government, and these concerns can lead to approaches where individual homeowners are given retreat “offers,” but there is no attempt to relocate entire neighbourhoods or communities involuntarily due to rights concerns. Similarly, planned retreat is often fraught with legal concerns over expropriation, compensation levels, land ownership, land zoning changes, and the rights of and obligations to those who choose not to retreat. There are many additional procedural questions that often have no clear answers and may encourage resistance to planned retreat. These include:

- At what point should the community be involved, and how significantly?
 - Which agency(ies) should take the lead?
 - Should a voluntary, involuntary or hybrid process be pursued?
 - What happens if different levels of government disagree on the use of planned retreat?
- **Concerns for individual well-being:** Retreat can be an extremely stressful and painful process for those affected. This is especially true for those with a particularly strong attachment to place or for areas with strong cultural heritage. Retreat in Indigenous communities may be particularly difficult, given powerful attachment to the current location (which may include subsistence hunting) and a cultural history of forced relocation and colonization. There are also economic concerns associated with retreat; individuals considering retreat may have concerns about being able to maintain their livelihoods (whether because of reliance on subsistence hunting or proximity to work location) or lack the financial resources to retreat to a location of equal quality as their existing home. These issues can compound and result in both physical and mental health impacts for those either considering or undergoing retreat. These impacts are discussed in greater detail in **Section 5** but are likely to contribute to resistance to planned retreat.
 - **Political concerns:** Planned retreat is often contentious or unpopular. The affected population may not want to move and local politicians may be concerned about losing support or tax revenue (discussed above). Furthermore, the process of retreat is expensive, time-consuming and complex, and municipal governments likely lack the financial and institutional capacity to undertake this effort in isolation (Bronen & Chapin, 2013). Taking this in conjunction with the long-time horizons of both the retreat process and the risks driving the retreat discussions, politicians may opt for more short-term protective actions intended to “stall” rather than “solve” the issue. This repeatedly surfaced in key informant interviews— including in discussion of planned retreat in the United States and the Ontario Great Lakes region—where respondents discussed a “political dissonance” or “political mismatch” between federal and provincial agencies responsible for responding to disasters (pro-retreat) and local politicians seeking to maintain support and tax revenue (anti-retreat). Even within municipal governments, turnover of politicians often resulted in previous decisions being reopened and, sometimes, reversed.
 - **The special challenge of industrial retreat:** There are examples worldwide where large industries are faced with encroaching hazards that threaten their ability to continue operations (e.g. a water treatment plant located next to a flood-prone river, or a petrochemical plant or nuclear power plant sited on a coastline affected by sea-level rise). A recent report examining sea-level rise in the United States found that a 30 cm sea-level rise would threaten 60 wastewater treatment plants across the country, and in California alone, a 75 cm sea-level rise would flood wastewater treatment plants in Silicon Valley, Palo Alto, San Mateo, and Union City, while a 125 cm rise would flood an additional five plants including the plant sited at San Francisco International Airport (Hummel et. al. 2018). Similarly, analysis of US nuclear power plants located within two miles of a seacoast found that five out of nine plants were at “high” or “very high” risk of inundation from future projected sea-level rise (Kopytko 2015). For these examples, it would be exceedingly difficult to contemplate actual retreat of the plants without interrupting operations for long periods of time. More likely, additional protection in the form of seawalls or dykes would be added in an attempt to squeeze out another decade or two of operations before plant

closure, or new plants would be developed concurrently in safer locations and old plants gradually retired and decommissioned as new plants began operations. In some cases, industrial plants also have a legacy of toxic or hazardous wastes on site (e.g. old settling ponds, or waste dumps) and these wastes would also have to be treated in situ or retreated to another location. During Hurricane Sandy, eight toxic superfund sites were inundated by storm surge floodwaters, contaminating surrounding neighbourhoods with PCBs and heavy metals (Marcantonio et. al. 2019).

4.3. Common Considerations and Approaches

Analysis of findings from an environmental scan and key informant interviews identified a broad range of considerations and approaches that are likely to be common across contexts. These are summarized below:

- Decision-making models/processes:**
 Examples of planned retreat from Canada and internationally have revealed an array of different decision-making models used to initiate and facilitate retreat (Figure 16). At the simplest end of the spectrum, a “bottom-up” model has been used, whereby the community itself—after many years of repetitive disaster or environmental degradation (e.g. repeat flooding, coastal erosion, shoreline retreat)—makes an appeal for assistance in planned retreat. Government agencies then facilitate the community’s request through funding or logistical support, but for the most part, the community coordinates the retreat process. The opposite of that process is the classic “top-down” model, wherein a government authority makes the planned retreat decision(s) and then implements that decision through its authority, funding, and power over lower-level implementing agencies or community partners. A third model, referred to here as a “collaborative model,” reaches a planned retreat decision and maps out the mechanics of the retreat process through a collaborative and iterative process involving several different levels of government, the private sector, community-based organizations, and community stakeholders. Especially complex or multi-jurisdictional planned retreat programs are often hyper-collaborative (tens or hundreds of entities involved), a model sometimes referred to as “polycentric decision-making.” In this model, a multitude of government agencies at multiple levels may collaborate with a similar multitude of private sector, non-governmental and community-based organizations, developers, homeowners and the general public, without any one agency seeming to be strongly in charge of the process.

Key Messages
<ul style="list-style-type: none"> Planned retreat decision-making models include bottom-up, top-down, and collaborative approaches. Retreat ranges from voluntary to involuntary, with grey areas and some elements with different degrees of community choice. Planned retreat efforts benefit from a sensitive consideration of the geographical and cultural context. A fair, transparent and feasible framework for home buyouts, including fair home valuation, is beneficial. Localized flood plain maps, decision-support tools and visualizations help communities move from risk assessment to adaptation. Poor governmental coordination and layers of bureaucracy hinder retreat, and more effort is required to address this issue. Identifying a successful retreat is difficult, as every community sets different goals. Time horizons for retreat range from 5 years or less for disasters to > 30 years for climate change adaptation. Perspectives on retreat range from it being just another option in the PARA toolkit to it being an extreme last resort.

Models of decision-making

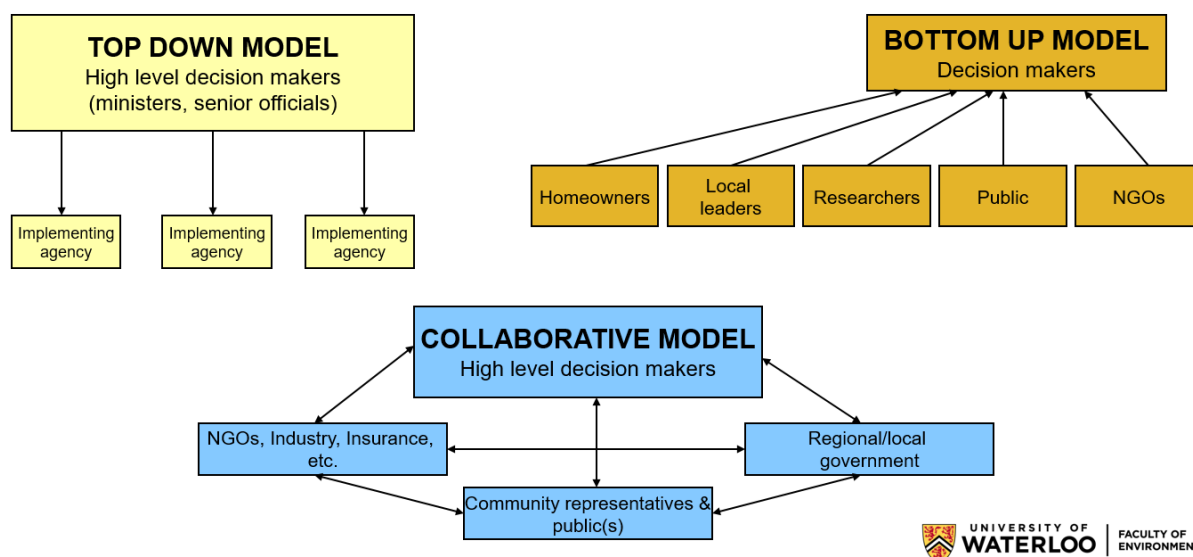


Figure 16. Models of decision-making for planned retreat¹³

- Degrees of individual/community choice:** Throughout this report, we have referred to two ends of a continuum of choice that ranges from “voluntary planned retreat” to “involuntary” or “forced” planned retreat. However, the reality is that there is often a large grey zone in the middle where the choice to retreat may fall somewhere between purely voluntary and purely involuntary. Similarly, there may be different stages or elements of retreat that have different degrees of choice. For example, it is common for individual homeowners to be offered the choice to move or not (i.e. by accepting a buyout offer or rejecting that offer), but often the offer itself will have no negotiability or element of choice to it (e.g. the homeowner is offered the tax assessment value of their home). Similarly, in some cases, homeowners are forced to retreat, either by a decision to expropriate or by deteriorated environmental conditions, but will then have almost total choice over where to retreat. Generally, greater choice is viewed more positively by the affected public and leads to more satisfactory outcomes for the individual or community being relocated, compared to options with lesser choice. However, there is a trade-off for retreat program managers who may find that too much choice in the hands of those facing retreat may lead to partial or incomplete retreat. There are many examples where retreat is envisaged for perhaps several hundred homes in a community, but because individuals have the choice to say “no” to buyout offers, an incomplete checkerboard or “Swiss-cheese” pattern of retreat ensues.
- Context specificity in retreat design:** Planned retreat efforts benefit from consideration of the context in which they are to occur. For example, in an interview with a planned retreat expert from New Brunswick, it was noted that planned retreat for many at-risk homes has been done by simply moving houses inland on the same lot. This approach was especially impactful when coupled with protected measures to elevate their houses, therefore moving houses in *and* up from the floodplain without disrupting community cohesion or attachment to place. Meanwhile, it was also noted that 50% of New Brunswick is owned by the Crown, so more aggressive retreat efforts could benefit from easier coordination of

¹³ Image source: Doberstein, B., Rutledge, A., and Tadgell, A. 2019. Managed retreat in the coastal zone: who decides when enough is enough? Presentation at the “At What Point Managed Retreat? Resilience Building in the Coastal Zone” conference, June 19–21, 2019. Columbia University, New York.

property trades, potentially with conditions such as the owner retaining some privileges for the existing property for a certain period (e.g. until flooding or death). Programs designed to be appropriate within and responsive to their context will improve the positive impacts of planned retreat efforts.

- **Economic considerations:** As mentioned above, populations undergoing retreat discussions or processes may have already undergone significant economic hardship. A challenge noted in the discussion of retreat due to flooding hazards in the City of Grand Forks, British Columbia, was that there was insufficient attention to the socioeconomic impacts of buyouts or the vulnerability of the affected group. Local governments likely have insufficient resources to deal with these challenges. In the North Ruckle neighbourhood, for example, people are either there because it is a good place for a starter home, they are renting and vulnerable to homelessness, or they are seniors with a limited income. Grand Forks did not have the tools necessary to navigate these conversations. Additional guidance on pragmatic ways to minimize the economic impact on affected populations in assessing the value of homes to be bought out (particularly their ability to obtain a viable replacement home) is needed. This challenge in developing a fair, transparent and feasible framework for home valuation was noted by several experts interviewed.
- **Decision-support tools:** Informants repeatedly spoke to the importance of local decision-support tools, whether this was in the context of community-based environmental monitoring (noted as being particularly essential in Indigenous communities) or multi-criteria decision-support tools. Communities should have access to strong hazard mapping capabilities (e.g. floodplain mapping) and adaptable decision-support tools or processes to move from risk assessment to adaptation planning. As small rural communities may not have the capacity to develop these tools, more generalizable tools that can be adapted and applied in local contexts hold significant value.
- **Political coherence:** As mentioned above, different priorities across government levels and jurisdictions can impede progress on retreat. Decision support from senior levels of government is often lacking. This is often overlooked at higher/federal levels, which tend to push all responsibility to municipalities (that may be reluctant to undertake retreat efforts). Municipal, provincial/territorial and federal governments must work to foster collaboration and coherence in both their messaging and approach to planned retreat. There have been encouraging signs that this is underway, including the activity identified in Ontario's recent Flood Strategy to "support the development of federal flood insurance and relocation programs," including working to support development of "a national action plan to assist homeowners with potential relocation for those at highest risk of repeat flooding" (Government of Ontario, 2020). However, more effort is required to outline how such cross-jurisdictional collaborations can be developed and advanced.
- **Framing the discussion:** In discussion with an adaptation expert from Nova Scotia, it was emphasized that the way in which conversations are framed will have an important impact on the community perception and degree of collective action. There is ongoing debate regarding whether retreat should be framed primarily or only in a positive lens (e.g. opportunity-oriented) or more negatively (such as the wartime mobilization language used in the context of COVID-19). It is likely that both hold value, and practitioners may want to consider what framings have worked in their community in the past.
- **Transparency:** The topic of transparency in planned retreat discussions and processes was a recurrent theme in key informant interviews. Experts mentioned the lack of trust that affected communities may feel, either towards the government officials or scientific processes suggesting that there is a risk. It was also mentioned that affected and unaffected populations may be distrustful of each other, having differing views of the level of risk and fair compensation for relocation (as one informant put it, "no one wants to end up being the schmuck"). Even in situations such as Surrey, BC, where all relevant resources were made available online in a single space, the affected population sought less transparency, via "behind closed doors" discussions. A transparent process is essential to fostering public trust and buy-in, and resources should be made available in a format that is accessible and understandable for the broader community (whether this is online, in a local newspaper, or via other means). However, a two-stage

process may be more appropriate, whereby draft materials go to the affected community for comment before being distributed more broadly. This is a very time-consuming process, but one likely to be important in promoting public trust.

- **Defining success:** It became clear that there is not—and should not be—a single definition of “success” for planned retreat. One criterion that has been used to evaluate success in the United States is whether it created a checkerboard (failure) or continuous plot of land (success): this is a good metric in some cases and not a good metric in others. For example, the work of the Nature Conservancy in Houston specifically pursues “clusters” to create habitat pockets rather than completely continuous land for wetland restoration. Success depends on the goals of a particular project, which will in turn determine what actions are needed. Planned retreat can be viewed as an opportunity to consider and pursue a broader range of goals about what individuals want their community to be 50 to 100 years in the future.
- **Time horizon:** A commonly observed challenge or weakness was short-sightedness in adaptation planning efforts, which sometimes only planned 5 years ahead. This is likely to be insufficient and risks undertaking actions that will be insufficient or obsolete in the near future. In the context of retreat, individuals could go through a painful relocation process only to find themselves in an area at equal or greater risk in the future. The common refrain was that adaptation discussions should consider a minimum time horizon of 30 years (i.e. at least covering the duration of a home mortgage).
- **Cascading adaptations:** Retreat was characterized by some as a “last resort” to be undertaken when other adaptation options were insufficient or infeasible (e.g. cost-prohibitive). Others viewed it as a useful tool that could be implemented in conjunction with other elements of the PARA framework. One important consideration is to pair retreat efforts with “avoid” processes, such as zoning bylaws to prohibit new builds in at-risk areas (Siders, 2013). This was noted in several key informant interviews, where experts suggested that new developments were occurring in at-risk areas faster than retreat efforts could be implemented. This is problematic for a number of reasons, as it may increase resistance to retreat and decrease the protective impacts. Retreat should, at the least, be paired with “avoid” adaptations, which can be seen as an extension of proactive retreat efforts.

4.4. Enablers and Barriers

The complexity of most planned retreat initiatives requires that numerous enabling conditions exist at a variety of levels.

- **Funding:** One key enabler, **funding to support planned retreat**, has already been discussed in several of the Canadian case studies as emerging from a number of sources and levels. Ideally, if funding is available through one or more government programs that facilitate community disaster recovery, risk reduction or climate change adaptation (e.g. Canada’s federal Disaster Mitigation and Adaptation Fund, Alberta’s Floodway Relocation Fund, or Nova Scotia’s Disaster Financial Assistance program), then planned retreat is enabled as a feasible option.
- **Policy window:** A second key enabler, discussed in **Section 4.1**, is the **presence of a policy window**. Policy windows can be opened due to direct experience with disaster, convincing climate change projections

Key Messages
<ul style="list-style-type: none"> • Funding to support planned retreat, ideally through an ongoing program rather than one-time support, is a key enabler. • The emergence of a policy window often facilitates retreat where this may have been impossible previously. • Modern communications networks enable planned retreat community members to navigate program bureaucracy and may help maintain (somewhat) pre-retreat community ties. • Planned retreat of infrastructure and communities is enabled by availability of appropriate land and/or equivalent homes. • Planned retreat will not succeed unless possible barriers (e.g. distorted risk perceptions, desire to perpetuate the status quo, lack of political will) can be identified and reduced/eliminated.

about imminent hazards that could affect communities or infrastructure, a new political priority (e.g. climate change adaptation) or funding program, or occasionally, requests for retreat coming directly from a community experiencing a hazard.

- **Communications:** A third key enabler which has become important recently is that of **modern communications (e.g. internet, social media) that allow community members to maintain their social networks** post-retreat without necessarily having to be physically close to former community members and enables them to navigate retreat bureaucracy remotely. Although planned retreat can disrupt social networks, especially when retreat is done piecemeal or through voluntary buyout programs, modern communications options still allow existing social networks to be maintained to some degree, even if community members end up dispersed to different locations.
- **Alternative locations:** Another key enabler, the **presence of a viable retreat location or alternative**, is perhaps most evident when considering the planned retreat of infrastructure. Taking the example of a coastal highway or railway line, there must be a viable alternative route (i.e. land available for purchase or acquisition) that can be connected to the existing network for planned retreat to even be an option. Similarly, when considering the planned retreat of an entire community threatened by coastal erosion or flooding, alternative land of roughly equivalent size, amenity and, sometimes, cultural and spiritual significance must be available. Although funding for planned retreat is a key enabler, land-rich jurisdictions may be able to compensate for program funding shortfalls by providing land at no cost to homeowners considering a buyout at less-than-market prices or to infrastructure owners.
- **Support:** Lastly, a key enabler that has been identified in several Canadian case studies is the **presence of a support or guidance system for planned retreat**: the case workers, technical staff, community-based organizations and sometimes political champions who assist homeowners and communities in navigating the often complex, time-consuming and bureaucratic retreat process. These support systems can also enable retreat through efforts to reduce bureaucracy, shorten timelines and simplify retreat processes.

In addition to the sources of resistance to planned retreat discussed in **Section 4.2**, there are several other barriers to planned retreat that are worth mentioning. It is very common to find **distorted perceptions about the true nature of hazard risks**, both currently and under climate change. For example, the public consultation process which followed Peterborough's two consecutive 1:100-year and 1:290-year floods (2002 and 2004 respectively) revealed significant confusion about these two events, "which were 'supposed' to occur only once in a lifetime or more" (Oulahen & Doberstein, 2012), happening within two years of each other. Effectively communicating climate change information and long-term risk to communities is key. Research suggests that coastal community residents often perceive sea-level rise as being a minimal or far-off concern because the levels of rise (e.g. 30–40 mm by 2050) sounds inconsequential, but these perceptions fail to incorporate understanding of non-linear change. Additionally, the combined effects of sea level rise, rising water tables, and coastal erosion and storm events leading to a "wait and see" attitude can trap communities in cycles of ineffective "protect" measures instead of fostering buy-in for retreat (Treuer, 2018).

There is also a common desire among community members and political leaders alike to **perpetuate the status quo** (i.e. not retreat even in the face of hazards). Planned retreat is a complex and disruptive event with often uncertain outcomes, and this forms a powerful barrier to action, particularly for proactive forms of retreat where a "disaster" has not yet happened. Linked to this, there is often a **lack of political will to uproot communities or move infrastructure** until a clear danger has been established, often through the experience of one or more disasters.

One final barrier, particularly evident in densely populated urban centres and on First Nations reserves, is that **there may not be available land to retreat to** that is safer and equivalent in amenity, size and cultural significance, while also being affordable. Constraints on land availability are thus a powerful barrier to planned retreat (Doberstein et al., 2020).

5. Planned Retreat and Health

The health impacts of climate change are complex and are the subject of intensive research efforts. Less well understood, however, are the potential health consequences and impacts that can be associated with adaptation efforts meant to protect populations from these impacts. This is in part because relatively little research has been done to assess the health status of populations before and after retreat, making it difficult to monitor changes relative to an established baseline (Siders, 2019).

The physical and mental well-being of communities undergoing discussions about—and the action of—planned retreat is an important consideration. Often, both physical and mental health are degraded prior to any discussion of retreat due to disasters that ultimately prompt such discussions. This can make individuals and communities vulnerable to exacerbating health impacts, potentially occurring in parallel with impacts on—and disruption of—health and healthcare infrastructure and services. Discussing the possibility of retreat is very challenging and painful, especially for communities with multi-generational family and community ties and strong emotional bonds. Stress-related mental health issues arise, and communities must be supported throughout this process.

Many people in areas where retreat is possible or necessary are in lower socioeconomic classes. These populations may be more vulnerable to physical and mental health impacts and have less access to both the financial resources to adapt individually and the political voice to advocate on their own behalf. Many rural communities are addressing pressing issues related to substance abuse, aging populations and rural economic decline, leading to challenges in addressing slower-moving issues such as climate change or slow-onset disasters.

This section seeks to explore these potential health consequences in additional detail. The subsections below outline the potential adverse health outcomes that can be associated with planned retreat, especially when insufficient time or effort is dedicated to active and prolonged community engagement.

5.1. Direct Health Impacts

The direct (i.e. short-term and immediate) impacts of planned retreat have been assumed to be similar to those observed for displacement or relocation in other contexts, such as post-disaster relocation or forced relocation due to conflict (Dannenberg et al., 2019). This may overestimate the direct health burden associated with planned retreat given that—when done well—retreat should afford affected populations more time to process the change and a greater degree of choice and agency than those in disaster or conflict settings. However, the general patterns are likely similar.

People usually do not want to retreat, either because they enjoy living in the area, depend on the location for their livelihood, or have emotional ties to the home or location (Siders, 2019). It is well established that attachment to place can be a key factor in personal identity (Costas et al., 2015). Conversely, the inability to retreat or relocate among those desiring to do so—but who may lack the financial resources or support necessary—is also likely to cause important health impacts.

Direct health impacts of planned retreat may include mental health consequences, loss of social capital, increased exposure to environmental hazards, food insecurity (particularly in cases where there was a previous reliance on subsistence foods), and health service disruption (McMichael et al., 2010). Displacement from locations and social networks to which individuals are deeply attached can be quite stressful and painful, leading to issues such as substance abuse and suicide (Asugeni et al., 2015; Tores and Casey, 2017; Uscher-Pines, 2009). Meanwhile, relocation that does not take sufficient account of the location to which individuals are moving can result in increased exposure to environmental hazards (such as unsafe drinking water), injury and drowning during the relocation process, with issues being compounded by disruptions in health services that may be either unfamiliar or unavailable to affected individuals (Dannenberg et al., 2019).

Efforts to counter these risks must incorporate substantial community engagement well in advance of retreat implementation (ideally from the outset) and sophisticated planning to consider how risks can be minimized during and *after* relocation. One success story was the roll-out of case-based psychosocial support services in the City of Grand Forks prior to and during the retreat process. While funding and on-the-ground capacity may inhibit the ability to provide case management, especially outside of immediate emergency or crisis situations, proactive planned retreat efforts are still likely to occur within the context of compounding vulnerabilities; this should be considered in planning efforts.

5.2. Long-Term Individual Impacts

Many of the health impacts of planned retreat persist over the longer term. When done well, retreat can result in a long-term, sustained, protective effect as affected populations are moved out of at-risk areas. When retreat is done improperly, however, i.e. with insufficient attention to proper processes or the area to which populations are to be relocated, adverse consequences can persist for years, and even across generations.

Many of the long-term health impacts are tied to social determinants of health (Office of Disease Prevention and Health Promotion, 2018). These include housing, earning potential, social capital and access to essential services (including education and health) (Dannenberg et al., 2019). When one or more of these are not in place, the results can be very problematic. For example, housing insecurity or quality issues can compound existing stress and mental health vulnerabilities, leading to a wide range of negative health outcomes. Similarly, protracted interruptions in school attendance or work disruptions can increase vulnerability and impact future earning potential.

When considering planned retreat, there is often insufficient attention to the area designated for relocation. For example, in a study of a home buyout program in Staten Island, New York, it was found that 98% of relocating households were moving to an area with a higher poverty rate (McGhee, 2017). Relocation to lower-income areas has been found to impact the economic well-being of both the affected and subsequent generations (Chetty and Hendren, 2018). It is also important to consider the hazard context of the areas designated as relocation sites. The evaluation of the Staten Island home buyout program, for example, concluded that 20% of the affected population moved to an area at equal or higher risk of future flooding (Chetty and Hendren, 2018). Such oversights can, at best, limit the positive impact of planned retreat programs and, at worst, expose affected populations to increased health risks associated with climate hazards and social determinants of health.

5.3. Long-Term Community Impacts

In considering the long-term community impacts of planned retreat, it is appropriate to consider the impacts of decision-making both for land being retreated *from* and land being retreated *to*. For land from which buildings or populations are being retreated, land made available following retreat can be redesigned to both protect the community from the impacts of climate change and build community cohesion (e.g. parks, playgrounds, gardens) (Siders, 2019). As shown in the Truro case study, this land can be restored to natural habitats that provide wider ecosystem benefits (e.g. wetlands providing aquatic habitat and water filtration benefits) and flood risk reduction benefits (i.e. by becoming additional tidal or riverine floodplain). However, missed opportunities in this regard result in wasted space going unused and uncared for; in situations where the result is a run-down empty lot, this can further damage social cohesion and housing values. There is likely to be an economic component to which neighbourhoods convert retreated lands into public spaces and which do not.

For land being retreated *to*, it is important to consider what efforts might support the maintenance of social capital and community cohesion. In situations where retreat is done piecemeal—thereby breaking the community up entirely there can be a very painful loss of community identity. Conversely, if the affected community moves as a group, social capital and cohesion can more easily be preserved (Albert et al., 2017). Meanwhile, selecting a new area that is close (e.g. walking distance) to the old area may also preserve place attachment and reduce the long-term impacts on the individual and broader community (Dannenberg et al., 2019).

In ideal scenarios, retreat processes and land use planning will take into consideration how community cohesion can be supported both in the initial and destination locations. Such efforts can support positive community impacts in both environments.

6. Good Practices and Considerations for Proactive Planned Retreat

Adapting to climate change risks requires collaboration and the use of multidisciplinary approaches. Municipal, provincial and federal leaders and champions need to work together over an extended period of time to ensure that necessary programs, discussions and action are seen through. The following section highlights good practices gathered from Canadian and international examples of planned retreat, some more broadly applicable to adaptation but worth repeating, and others specific to planned retreat. Some are the results of painful lessons and cautionary tales rather than successes to be celebrated and copied. These practices are summarized by theme in **Tables 3–5**, then discussed more broadly in terms of how they relate to municipal, provincial and federal leaders.

Table 3. Communication good practices

Practice	Considerations
Communicate early and often	Establish a list of stakeholders and title and rights holders early on in the process. Update it as necessary. Communicate regularly both individually and in appropriate groups.
Include planned retreat as an option	Over the past five years, awareness and acceptance of the need for planned retreat to be considered have grown substantially.
Choose terminology carefully	Planned retreat can be referred to as, amongst other options, planned relocation or proactive retreat. Decide with trusted advisors what the right language is for the community.
Put planned retreat in context of adaptation	Planned retreat is not a separate discussion, but part of a long-term assessment of options to deal with climate vulnerability and risks which must include consideration of social, environmental and economic factors; this includes building awareness and capacity, mobilizing resources, and assessing and implementing adaptation actions.
Consider culture	Where a community’s culture is tied to place—most notably in the case of Indigenous communities—this must be taken into consideration during planning, consultation and implementation of adaptation.
Leave time for planned retreat discussions	Planned retreat consensus-building takes time and may be longer than other adaptation options.
Computer graphics are persuasive	Good visualizations, often animated, have helped communities to understand and internalize the challenges they face in a way that spreadsheets and maps may not. Try to include them in the adaptation process.

Table 4. Governance good practices

Practice	Considerations
Communities decide	Decisions for planned retreat of residences or infrastructure need to be made with and preferably by the community, for the community.
Pick leader(s) and champion(s) carefully	The people who take on the mantle of leading the long and sometimes contentious process of adaptation, resilience building and retreat are taking an important role; as such, the continuity and traits of such people are key.

Practice	Considerations
Establish and fund a program and roles	Adaptation processes often last longer than municipal, provincial, territorial and federal governments. Establish approaches and funding processes that support programs able to sustain activities for years.
Start funding efforts early	There is currently no established Canadian budget and funding model for planned retreat. Each instance assembles provincial and federal funding for municipalities.
Manage the tax base	Losing high-value waterfront properties and residents can be mitigated through proactive planning and rezoning.

Table 5. Process good practices

Practice	Considerations
Adaptation and building resiliency are a cyclical process	Retreat may feel unavoidable but not be accepted at present. There will likely be an opportunity to re-introduce it as an option later.
Start early	Risk analysis and planning takes time and effort. If adaptation assessments and discussions have not yet started, start soon. Key resources are often booked in advance.
Protect and promote physical and mental health	Many engaging in retreat discussions or affected by retreat have suffered through disasters and have physical and mental health concerns. Regardless, this process is sure to be stressful.
Plan a future for the retreated properties	In the best case, create a community green space with memorials of the community and citizens affected. At minimum, demolish buildings and return the property to nature. Do not resell to developers.
Get universities and granting agencies to help	Many areas where there is a need for expert assessment have university programs specifically focused on the topic. Contact them and see if research grants will pay for grad students and PhDs to provide value for the community.
Get professional assistance	There are Canadian firms in landscape architecture and planning industries that have expertise in adaptation, resilience building and planned retreat. There are also agencies and consultants that specialize in public consultation and engagement that can support communities through the public consultation process.
Be creative in retreat solutions	Land swaps, buy and leaseback and shifting service costs to residents and businesses that choose to remain in place have all been used by different communities.
Be inclusive and use an all-hazards approach when identifying and monitoring hazards.	Use an all-hazards approach that assesses all potential risks, e.g. sea-level rise, coastal erosion, landslides, tsunamis, any of which may be affected by climate change.
Consider overlapping disasters as a risk	Wildfires followed immediately by flooding is occurring. Pandemics preventing emergency shelters and cooling stations are a reality. Do not assess risks in isolation, but likely in combinations.
Plan for municipal, provincial, territorial and federal elections	Changes in governments are mostly scheduled, and with them can come changes in priorities. Tailor the plan to avoid, where possible, critical decision points or funding lapses directly before or after elections.

6.1. Good Practices for Municipal and Community Leaders

For municipal leaders, urban planners or climate adaptation practitioners, planned retreat can be one of the most challenging subjects to address. The intent of this section is to provide plain-language guidance about how planned retreat fits into adaptation planning, about how to effectively talk about it, and about key techniques and guidance that can facilitate the process.

Let's start with a clear definition:

Planned retreat is the purposeful movement of people and/or infrastructure and land uses from areas at high risk of flooding, slope destabilization and other risks made worse by climate change to areas that are at lower risk and/or more resilient.

If the community has spent any time considering planned retreat, some will notice that this report does not use “managed retreat” as the language of choice. There is a reason for this. It is deeply emotional for people to consider leaving their homes, which may have been in their families for generations. Given this, beginning community engagement and communications as neutrally as possible is worthwhile.

One of the early steps is to choose the phrase that is right for the community. For this report, we have settled on “planned retreat,” but other choices include “planned relocation” or “adaptive retreat.” “Relocation” is more neutral than “retreat,” but carries a negative connotation for some communities. Think about the community, think about the community groups, and pick the language that makes most sense locally. We recommend having a discussion with a few key leaders of the groups in question to ensure that there are not sensitivities that are overlooked and may be stumbled over later.

Some will also notice that we are focusing on planned retreat in the context of climate change and its associated hazards. There are many reasons why the community might choose to relocate people and infrastructure, but this guidance is more narrowly focused on climate change. However, some lessons learned and good practices are likely to be more broadly generalizable across planned retreat endeavours.

There are many people who represent different and often competing interests and who need to be given the opportunity to be part of the discussion about the choices the community makes. One of the key ongoing activities is to establish and update a complete list of local groups, community organizations, Indigenous people, businesses and governmental organizations that should be engaged in discussions of climate change adaptation processes, options, decisions and plans. These stakeholders are likely to include:

- Town council and Mayor
- Chamber of Commerce
- Residency associations
- Indigenous people
- Major employers
- Faith group leaders
- Recreational organizations
- Provincial program leaders
- Neighbouring municipal adaptation leaders
- Potentially affected property owners



A good practice is to establish a complete list, plan a communication agenda that gets to all of them on a regular schedule, and update the list annually (at minimum). Another good practice is to spend time privately with the leaders of these communities to understand their values and perspectives, to identify pitfalls early, and to be able to test and discuss different options and risks as they emerge. Regular, active communication is essential to the success of planned retreat activities.

To be done well, adaptation planning and practices require long time horizons (Bush and Lemmen, 2014). This is especially true for planned retreat, given the added complexity of relocating individuals and infrastructure. It is important to account for this in scheduling. Planned retreat efforts in the past have been compromised by two biases—the planning fallacy and optimism fallacy—that push planners and practitioners to underestimate the time and money required to complete tasks.

Pick the accountable leader(s) and champion(s) in the community carefully. Continuity of leadership over an extended period of time is very useful. One existing leader to consider would be an emergency services leader, such as the fire chief. The longstanding role of fire services in communities has been one of prevention, rezoning, education and inspections to avoid being only responsive to fires, and the traits of the individuals are often complementary with those needed for someone to discuss adaptation planning (including retreat). For smaller communities that share services, perhaps the shared organization leader might be the right choice.

In terms of understanding climate impacts, while climate change is global, every impact is local. Sometimes knowledge is better, sometimes worse (Warren and Lemmen, 2014). Locally specific and current risk assessments are essential to informing adaptation discussions. Get expert localized assessments of what is going to change and how. Do not depend on global data sets for coastal elevation, for example, as they are only approximations. This can take months or years, and the expert resources who know how to do this are often booked well in advance. Get started on these assessments now, if they have not been started already.

Community-based monitoring of identified risks and hazards is crucial, as is local knowledge in understanding vulnerabilities (Andrachuk and Smit, 2012). Community stakeholders will be able to identify vulnerable and resilience areas, but it is important to remember that climate change is likely to shift and expand at-risk zones and the types of hazards being faced. For example, just because a portion of road did not get washed out in the last flood does not necessarily mean that it is safe from the next, while homes that have never flooded could fall within an expanding floodplain. Community knowledge should be integrated with scientific evidence and community-based monitoring to understand how risk profiles may be shifting over time.

Be broad in what is considered for risks and vulnerabilities. Landslides can increase in frequency and severity with more precipitation, so homes and infrastructure on or at the bottom of less stable slopes should be considered for adaptation planning. Similarly, in areas subject to increased drought, look at homes and infrastructure that might be more vulnerable to wildfires. Coastal erosion might increase due to increased freshwater levels or sea-level rise, so consider areas that have experienced erosion and assess increases in vulnerability (Doberstein et al., 2019). Homes and infrastructure on permafrost are also at risk and impacts are likely already being felt.

Identification and selection of adaptation options require difficult discussions with the affected population. Figuring out what is at risk is different than deciding what to do about it. Community stakeholders should receive clear communications—in the formats most accessible and digestible to them—to explain both the risks being faced and their adaptation choices. Depending on the situation, this could include retreat, alongside other elements of the PARA framework (Protect, Accommodate, Retreat or Avoid) of adaptation options. In the most serious situations, it may be the case that retreat is truly the *only* sustainable option; this should also be communicated clearly. In the past five years, there has been an increasing recognition and acceptance of the importance and, sometimes, inevitability of planned retreat.

Do not be afraid to introduce planned retreat as one of the options to consider, and do not be surprised if communities choose it over other options. Practitioners in Surrey, BC were surprised to discover that planned retreat was the preferred choice among the broader community, and even directly impacted residents ranked it highly among other adaptation options (City of Surrey, 2019).

Remember that adaptation and building resiliency is a cyclical process. There are going to be areas where planned retreat appears to be an inevitable endpoint, but it may not be accepted immediately. Work to ensure that health risks and economic costs are fully explained and remember that if the community does not accept retreat immediately, that does not mean that it will not accept it in the next cycle. That being said, there has been a strong

pattern globally of only retreating after multiple disasters have driven home the inevitability, and efforts should be taken to avoid this as much as possible (Hino et al., 2017).

Graphic visualizations of the impacts of climate change can be important tools in helping people understand what raw data may not. One strong example is the Delta-RAC Sea Level Risk Adaptation Visioning Study, developed by the University of British Columbia Collaborative for Advanced Landscape Planning (2020). The tool leverages adaptation scenarios—including retreat—and 3D landscape visualizations to assess adaptation options and support decision-making in response to sea level rise. Data visualization tools are increasingly affordable (or free) and user-friendly, and organizations have had good results by providing local animations of water-level rise (including before and after imagery).

Expect difficulties and delays in getting funding. Most municipalities do not have the financial resources necessary to cover the costs of retreat but are equally unable to deal with the costs of disasters to homes and other infrastructure. While some countries have clear federal programs for funding proactive retreat (which have their own challenges), Canada does not (Siders, 2013). Work with the appropriate provincial agency to identify funding opportunities and expect them to work with federal counterparts. These efforts will require time and energy to navigate.

Planned retreat can negatively impact the physical and mental health of those affected (Dannenberg et al., 2019). It is important to be aware of these risks and, as feasible, put in place programs that protect and promote the health of those affected; this may include case officers to provide individual counselling to those affected. The subject itself is stressful for many of the residents who will need to leave their homes. In many cases, they will have been previously exposed to disaster events and already experiencing the effects of chronic stress. In some cases, those disasters left them with additional physical health issues, either directly due to the impacts or due to mould and mildew that developed following the event. Consider the municipal and provincial physical and mental health resources and helplines that may help provide the financial or program resources to support the affected community.

There are many ways to implement planned retreat for homes. Some communities are buying the properties in advance and leasing them back to the homeowners until new locations are prepared or retreat is essential. Others slowly shift the burden of costs to residents and businesses that choose to remain in place, reducing municipal services for sewage and road repair as they become economically non-viable. Some communities are doing land swaps, trading municipally owned land elsewhere in the community for the retreated land. Many are creating rolling easement zoning, where property lines automatically adapt to changing coastlines as sea level progresses, reducing administrative overhead in redrawing property lines. The most appropriate solutions will be dependent on context and will likely require both critical and creative thinking.

Consider where residents will go. Many planned retreat programs in the United States found that—without careful attention and guidance—many people end up in areas at equal or greater risk than those they just left. Furthermore, the new location must be able to support the livelihoods of those affected as well as the maintenance of essential services (such as access to healthcare and education). Plan for where the people will go and ensure that the destination is resilient.

Avoid losing the community's tax base, if at all possible. One of the persistent challenges of shoreline retreat programs is that municipalities pay for many services for the community as a whole based on expensive recreational or part-year properties on the waterfront. Another is that if people receive a buyout package, they choose to relocate to another community entirely. When planning retreat, consider creating a new high value area and work to establish zoning for new residential properties within the community boundaries.

Plan for what happens to the properties that are retreated from. Globally, people have shown themselves willing to give up properties for the sake of the larger community (Koslov, 2016). Some communities chose simply to allow developers to buy the properties and develop new, raised homes. For community cohesion, the properties should remain, at a minimum, vacant. Plan for and ensure demolition of buildings on the properties and at least minimal

restoration. Retreated lands also present opportunities for new shared community amenities and memorials. The best cases globally were those in which the properties were turned into public, resilient, green spaces with walking paths and often memorial signage about the residences and buildings that had been there before. Highlighting individual sacrifices can help create a shared good that improves overall community cohesion and well-being (in addition to resilience).

Expect changes of government during the planned retreat process. The process of adaptation and resilience building is likely to exceed election cycles. Federal, provincial and municipal elections will all bring changes of priorities, programs and funding. For communities in the process of retreat, this can be disruptive, but can be managed if such changes are expected and understood. Create specific long-lasting programs and roles with committed funding. Assess the risks of provincial and federal government elections on the community's adaptation process. Do not expect to get anything approved in the months leading up to or immediately following an election.

Take advantage of universities and research grants. For many of the assessments and options, there are graduate students looking to establish expertise and granting agencies willing to fund them. Contact nearby (and even distant) universities to see if they would be interested in a research effort that would align with local needs. There are also several Canadian professional firms with expertise in adaptation assessments and planned retreat efforts. However, this should not be at the expense of local knowledge, community ownership or action (i.e. "analysis paralysis").

Expect concerns about inequity. Community members in areas not being considered for retreat may not be sympathetic to those facing retreat, as they are receiving buyouts that may be above the value of the rest of the properties within community. Neighbouring communities within the same province or just across provincial boundaries often receive different treatment. Expect this challenge and deal with it proactively whenever possible.

6.2. Good Practices for Provincial and Regional Leaders

There are a number of key considerations for decision makers at the regional or provincial level. Some of these are outlined below.

There may be many municipalities and infrastructure sites facing potential planned retreat within a larger geographic area. They could be in the middle of sometimes multi-decade processes of transformation and relocation. They will each be at a different stage in the process, will have made different choices and, in many cases, use different language to describe the same realities. They may have engaged different university and professional services firms to enable them to assess what risks they face and what to do about them. Lastly, they may have insufficient funding to undertake the full scope of adaptation options desired or needed.



To help navigate this complexity, consider creating a common portfolio framework for the status of adaptation initiatives within the jurisdiction, if one does not already exist. Establish a regular reporting schedule. The framework could include a common regional or provincial set of terminology so that the organization and others can understand and discuss the risks faced by the community or infrastructure, the stages and current state of adaptation processes as well as the associated cost so that funding decisions are made more consistently. Broader guidance on adaptation planning is outside the scope of this report—which focused more specifically on planned retreat—but a concerted effort is likely required to track ongoing efforts at various stages of maturity and urgency. Adaptation planning should consider the appropriate geographic scale (e.g. managing water quantity and quality is best done at a watershed scale) and may require the coordination of multiple adjacent jurisdictions.

Whenever possible, work to align this portfolio framework with neighbouring regions, provinces and the federal government. This may require iterative discussions and, perhaps, an annual review process, but offers a useful collaboration opportunity to align and mainstream adaptation planning across government jurisdictions.

Establish a regular status and reporting schedule with each municipality considering or undertaking significant adaptation efforts. Topics could include communication plans (especially those which the organization can support or in which it can participate), funding requirements and status, and key upcoming risk periods that could require attention or present an opportunity to unlock prioritized funding and transformation.

Establish regular communications, whenever possible, with all of the federal departments concerned with the planned retreat of communities and infrastructure (e.g. Infrastructure Canada). This will vary over time as the federal government changes and as funding programs come and go from different departments. Most planned retreat efforts involve federal funding and it may be necessary to spend significant time lobbying for funding for the provincial portfolio.

Proactive retreat is meant to adapt and mitigate risks before disasters occur. However, policy windows most commonly open following a disaster. At the very least, try to have plans in place in advance of any disaster, such that funding can be obtained in the immediate aftermath and adaptation efforts can hit the ground running.

There is currently no Canadian federal funding program that consistently funds planned retreat. In the United States, FEMA does have a flooding buyout program, but this has its own challenges as it is an individual owner-focused buyout program (Siders, 2013). This has led to the slow dissolution of some communities as they are hollowed out lot-by-lot. As the organization works to gain funding for the adaptation portfolio, consider targeting funding that is sufficient for larger adaptation rather than one-off buyout programs.

Canadian land ownership varies within Canada. The primary systems are the Common-Law system used outside of Quebec, the Civil Law property rights structure within Quebec and Indigenous rights and titles and Land Claim Agreements. The potential complexity for this is high—and not the focus of this report. Suffice it to say that, for communities bordering Quebec or overlapping with Indigenous land—whether ceded or unceded—there will likely be variances in funding and timelines as well as feelings of inequity within the different neighbouring and overlapping communities. Be aware of these situations and sensitive to them. At present, for example, homeowners on the Quebec side of the Ottawa River have received buyout packages at market value, while there have been no buyouts for Ontario homeowners affected by the same flooding (CBC News, 2017). This can lead to political concerns that in some cases can be avoided through attention and awareness.

While provinces are one of the primary funders of adaptation and resilience, this does not mean that provincial leaders should consider themselves decision makers, especially in the context of planned retreat. This is a process that should be owned and led by the community. It can be very useful for the provincial or territorial government to facilitate cross-municipal and cross-provincial discussions and joint planning. Similarly, it is key to provide clarity to municipalities about funding programs that they could access, the likely limitations, as well as potential destinations for relocation. Work on having an engaged role in discussions of adaptation options but respect the importance of community decision-making in the process.

With each annual budget cycle, work to gain provincial commitment for increased adaptation and resilience funding, including planned retreat. Specify programs and initiatives surrounding the portfolio for investment. Work with municipal leaders to establish funding needs.

If a leader is taking over a long-running adaptation portfolio, be aware that attitudes and awareness can (and have) changed substantially over time. Options, such as planned retreat that were considered contentious or off the table at one time may experience renewed enthusiasm or acceptance as values or contexts shift. As awareness of climate change risks increases, so does the acceptance of the need for adaptation actions.

6.3. Good Practices for National Leaders

The focus of this study was on planned retreat within local contexts. As such, relatively little analysis was dedicated to good practices at the national level. However, a few themes and insights emerged that are of relevance to national leaders considering planned retreat.

The first was the need for significant federal funding available under a clear program for supporting local planned retreat initiatives, with budgets that span extended time frames. The goal of the study was not to quantify or define what that funding and its governance would look like. Rather, a gap was identified with regard to funding for proactive (pre-disaster) retreat, which could limit implementing adaptation actions moving forward. It was also suggested that tailored funding and approaches would be required for retreat in Indigenous communities. More research is needed to better understand the resources and needs of Indigenous communities with respect to planned retreat.



Second, it was recognized that the federal government could play an important role in coordinating broader stakeholder groups to advance planned retreat such as developing guidance, adopting good practices and ensuring a sound scientific bases for strategic and effective policies, regulations and programs. However, planned retreat leadership and ownership should remain with more local levels.

The third was that there is a need for guidance on a legal framework that could guide communities considering or dealing with relocation of properties and land uses such as the potential expropriation of land, forced buyouts and similar legally complex situations. Furthermore, this would involve a collaborative approach with all levels of government and Indigenous organizations. This would consider the multiple title and rights holder legal situations in different jurisdictions. The role for a legal framework became evident after reviewing substantial U.S. guidance and positions related to addressing retreat.

7. Conclusion

This project sought to build upon a scan of the current state of planned retreat in Canada and relevant international contexts to begin a discussion of some of the key enablers, challenges and opportunities for local proactive planned retreat. As the impacts of climate change are expected to increase in the coming decades, communities need long-term adaptation plans designed to promote resilience to key risks in a changing climate. In some cases, planned retreat may surface as the preferred sustainable solution and it may be part of a broader plan with multiple actions implemented incrementally over a longer time frame. Although the road may be long and winding, it is important to initiate these efforts proactively and well in advance of—rather than directly after—a natural disaster.

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Appendix 1: Glossary

Term	Definition
All-hazards approach	The process of identifying and monitoring all hazards present in a particular location.
Climate Change	Climate change is a long-term shift in the average weather conditions of a region, such as its typical temperature, precipitation, and windiness.
Climate Change Adaptation	Actions that reduce the negative impact of climate change, while taking advantage of potential new opportunities.
Climate Change Impact	The positive or negative effects of a changing climate on built, natural, and human systems.
Critical Infrastructure	Processes, systems, facilities, technologies, networks, assets and services essential to the health, safety, security or economic well-being of society.
Coastal	Land and marine/lake areas bordering a shoreline.
Disaster	An event caused by a naturally or human induced hazard (e.g. flood, landslide) resulting in loss and damage.
Displacement	An event when people are forced to leave their homes or communities due to sudden-onset events (such as tsunamis, landslides, and flood events), or slow-onset processes (such as desertification and sea-level rise).
Drought	A shortage of precipitation (or sometimes, available moisture) over an extended period, usually a season or more.
Easement	Legal limits to development placed on a portion of a plot of land (sometimes called a “negative easement”).
Erosion	The geological process in which soil, sand, sediment or rock are worn away and transported by natural forces such as wind, water or gravity.
Hazard	A hazard is any source of potential damage, harm or adverse health effects to something or someone.
Home buyouts	The process whereby homeowners are offered incentives (usually tied to the tax or market value of the home) to sell and move, usually by a government agency which then takes possession of the home for its own purposes.
Infrastructure	The fundamental services, facilities and systems serving a community. In planned retreat, often meaning physical infrastructure (e.g. roads, bridges, dykes, etc.).
Inundation	Temporary or permanent flooding of a location.
Managed retreat	The purposeful movement of people and/or infrastructure or land uses from areas at high risk of flooding, slope destabilization and other risks made worse by climate change to areas that are at lower risk and/or more resilient. Synonyms included planned relocation, planned retreat and proactive relocation.
Managed realignment	Movement or removal of river, estuary or coastal defences. Managed realignment may be associated with planned retreat if the removal or movement of defences also triggers the relocation of a community, infrastructure, or other land uses.
Memorial	A recognition of past disaster events or communities which no longer exist.
Disaster Mitigation	Disaster mitigation measures are those that eliminate or reduce the impacts and risks of hazards through proactive measures taken before an emergency or disaster occurs.
Permafrost	Permafrost is soil or rock that remains frozen for two or more consecutive years and is an important component of the northern Canadian landscape.
Planned relocation	The purposeful movement of people and/or infrastructure from areas at high risk of flooding, wildfire, slope destabilization and other risks made worse by climate change to areas that are at lower risk and/or more resilient. Synonyms included “managed retreat,” “planned retreat” and “proactive relocation.”
Pluvial flooding	Surface flooding produced by intense, localized rainfall and independent from an overflowing water body (lake, river), often linked to “hardened” urban environments.

Term	Definition
Policy window	Forces and events that combine to allow for a “window of opportunity” for policy change.
Public engagement	The process by which public input is solicited and incorporated into hazard risk reduction and climate change adaptation plans. Engagement can range from limited public education and consultation, to partnerships, delegated decision-making and citizen control.
Proactive retreat	The purposeful movement of people, infrastructure and land uses from areas at high risk of flooding, wildfire, slope destabilization and other risks made worse by climate change to areas that are at lower risk and/or more resilient. Synonyms included planned relocation, planned retreat and managed retreat.
Reactive retreat	The movement of people, infrastructure and land uses following major hazard events and their associated damage.
Relocate	To move from one location to another, either voluntarily or as a result of incentives or force.
Relocation	The process of changing the location of a residence, business or infrastructure, or land use.
Resilience/Resiliency	The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation.
Risk	The combination of the likelihood of an event occurring and its negative consequences.
Risk Assessment	Appraisal and analysis of hazard or climate change vulnerabilities, exposure, likelihood and consequences.
Seiche effect	Local, repetitive fluctuations in water levels of semi- or fully enclosed water bodies (i.e. lakes) caused by wind and storms.
Subsidence	Downward motion of the land surface caused by human drivers (e.g. loading, drainage, mining activities) or natural processes as land once under and around a continental ice sheet is still falling (or rising) in reaction to its ice-age burden.
Subsistence	An activity such as hunting or food gathering that meets day-to-day household or community food requirements but does not produce a surplus for commercial sale.
Sustainable	Capable of persisting over the long term in a manner that meets community needs.
Trigger	The event or condition which initiates an action or process.
Tsunami	An extremely long frequency sea wave usually resulting from an undersea earthquake or landslide. Capable of rapid, destructive coastal flooding.
Vulnerability	The degree to which a system or jurisdiction is susceptible to harm arising from hazards or climate change, as a function of a community’s hazard sensitivity and capacity to adapt.