

**From disaster recovery to whole-of-society resilience:
The impact of the 2021 British Columbia atmospheric rivers event
on flood risk management policy and governance**

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Flooding poses significant risks to the safety, well-being, and long-term security of many Canadian communities. In recent years, extreme weather events, as a result of a changing climate, have cost Canadians billions in insured and uninsured losses annually, and such losses do not encapsulate the various social, ecological, and health impacts that are difficult to quantify. In addition to climate change, misaligned land-use planning, intensified development in floodprone areas, fragmented risk governance, gaps in funding and policy, and an over-reliance on protective structures continue to place many Canadians in harm's way, while creating barriers for proactive adaptations at the watershed scale. Major disasters, like the 2021 atmospheric rivers floods in British Columbia, underscore the need for transformative flood risk management [FRM] policy and governance by highlighting the systemic drivers of flood risk, namely a FRM system that was never designed to withstand the dynamic realities of the present day. Such focusing events—relatively rare, sudden, and impactful events like disasters—are often critical in generating significant public interest around a focal issue, garnering political will to advance policy agendas, and enabling governance actors to advocate for policy reform. In the post-disaster landscape, coalitions of policy actors can seek to leverage these emergent ‘windows of opportunity’ to advance a paradigm shift in how various public issues, like disaster risk reduction and climate change adaptation, are understood and managed, who is involved in decision-making processes, and what solutions are considered socially-acceptable and politically-feasible. Actors are most likely to be successful in advancing agenda items if enabled by the institutional environments that policy processes are embedded within, and if there is an existing foundation of collaboration among others within the broader policy community. This research, utilizing a case study of a major Canadian flood disaster, evaluates the ways in which policy champions, advocacy coalitions, and institutional actors have sought to leverage existing relationships, prior learnings, and post-disaster momentum to advance shifts in FRM policy and governance at the local, regional, and provincial scales. Semi-structured key informant interviews provide insights into how the disaster manifested as a focusing event, what enabling conditions contributed to the creation of a window of opportunity for policy change, and how recent shifts in British Columbia's flood governance and policy regimes have been shaped by longer-term institutional developments and interjurisdictional partnerships. This research illustrates the transformational nature of adaptive learning and multi-scalar governance, and is intended to assist FRM decision-makers, policymakers, and practitioners in advancing resilience.

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This study was reviewed by and has received clearance from the University of Waterloo's Research Ethics Committee (#44110).

Dedication

To the water that is the lifeblood of our communities,
that sustains our livelihoods and nourishes all of us.
To the ebbs and flows that have shaped this planet for eons,
never static—always moving, endlessly changing course.
To the slow meandering streams birthed from glacial headwaters,
and the mighty rapids that carve out valleys from stone.
To the wetlands and shorelines that support a diversity of life,
and the rivulets of relationships that merge into one another.
To the ancient oceans that harness the power of the skies,
and the coastal nutrients that feed old-growth forests.
To the rain and snow that cares for thirsty soil,
nurturing seedlings and providing sustenance.
To the tributaries that connect together, a confluence of
freshwater veins flowing through the same body.

To water, in its past, present, and future forms.
To water, a living pulsing being that we exist alongside.

To the lasting resilience of the Pacific and the Fraser Basin,
and to the never forgotten spirit of Semá:th Xó:tsa.
To all those, human and more-than-human,
who call these waterways home.

I dedicate this thesis to Water:
my namesake and my deepest calling.
I am forever in awe and gratitude
of your coursing strength
and endless flow.

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List of Abbreviations

Abbreviation	Definition
AR	Atmospheric river
BC	British Columbia
BCWA-ECC	British Columbia-Washington Environmental Cooperation Council
CAD	Canadian dollar
CCA	Climate change adaptation
CoA	City of Abbotsford
DRIPA	Declaration on the Rights of Indigenous Peoples Act
DRR	Disaster risk reduction
EDMA	Emergency and Disaster Management Act
ECCS	Ministry of Environment and Climate Change Strategy
EMBC	Emergency Management British Columbia
EMCR	Ministry of Emergency Management and Climate Readiness
EPS	Emergency Planning Secretariat
FBC	Fraser Basin Council
FEMA	Federal Emergency Management Agency
FRM	Flood risk management
FVRD	Fraser Valley Regional District
IAP2	International Association for Public Participation
KI	Key informant
LFFC	Lower Fraser Floodplains Coalition
LFMP	Long-term Flood Mitigation Plan for Sumas Prairie
LMFMS	Lower Mainland Flood Management Strategy
LWW	Living with Water
NRITF	Nooksack River International Task Force
PICS	Pacific Institute for Climate Solutions
PSC	Public Safety Canada
WA	Washington
WLRS	Ministry of Water, Land, and Resource Stewardship
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
USA	United States of America
USD	United States dollar

Chapter 1: Introduction

1.1 Problem context

Throughout history, humanity has always been innately connected to water. Close proximity to waterbodies offers numerous sociocultural, economic, and ecological benefits (Di Baldassarre et al., 2013). However, widespread settlement along coastlines and within floodplains has exposed many Canadian communities to the variability of flood regimes, now worsened by climate change and human-induced pressures (Public Safety Canada [PSC], 2023). Nearly 80% of Canadian cities have either coastal or riverine floodplains within their boundaries, placing many neighbourhoods at risk of 1-in-100-year flooding (PSC, 2019; Chakraborty et al., 2021a). Indeed, 8% of all residential properties are considered high-risk (Golnaraghi et al., 2020). Furthermore, of Canada's 6.5 million coastal residents (Golnaraghi et al., 2020), an estimated 320,000 to 600,000 are currently vulnerable to the effects of sea level rise and coastal flooding (Wade, 2022). Yet many Canadian communities continue to permit waterfront and floodplain development (e.g., Kovacs & Sandink, 2013; Bryant et al., 2021; McClearn, 2022). Rapid population growth and intensified development are among the leading drivers of rising urban flood risk, allowing for a growing concentration of assets within areas at risk of amplified flooding and climate variability (Winsemius et al., 2016; PSC, 2022).

With many urban and economic hubs located within floodprone areas, flooding is Canada's most common and costly natural peril (PSC, 2023). Floods are the leading cause of infrastructure damage (Parliamentary Budget Officer, 2016), and account for the majority of property insurance claims and government-funded disaster relief payments (Henstra et al., 2019a; Golnaraghi et al., 2020). Insured catastrophic losses, as a result of all extreme weather events, now frequently reach \$2 billion per year (Insurance Bureau of Canada [IBC], 2023). Flood damages alone amount to nearly \$1.5 billion annually, characterized by hefty insured (~\$700 million) and uninsured (~\$800 million) losses (PSC, 2022). As current risk management practices stand, Canada is projected to lose half of its future economic growth to annual coastal flood losses, amounting to \$30 billion by mid-century (Withey et al., 2016; GHD Group, 2022). Despite the projected climate impacts to come, the economic toll of flooding is already proving to be substantial.

Aside from financial implications, floods pose substantial risks to community health, wellbeing, and livelihoods. Major floods are accompanied by the disruption of normal routines, the exacerbation of socioeconomic inequalities, and profound experiences of loss, grief, and uncertainty (Walker-Springett et al., 2016; Fulton & Drolet, 2018). Post-flood health risks range from physical

ailments, such as disaster-related injuries and the spread of waterborne illnesses, to adverse mental health impacts, such as anxiety, depression, and post-traumatic stress disorder (Alderman et al., 2012; Goldmann & Galea, 2014). The psychological harm and collective trauma experienced during a disaster can extend far beyond the initial event, leading to chronic mental health challenges (Carroll et al., 2009). As disaster recovery is often a lengthy process, affected households may be displaced for prolonged periods of time, struggle to secure affordable or suitable living arrangements, and/or face heightened economic insecurity (Burton et al., 2016). Adverse outcomes are amplified for those already experiencing socioeconomic marginalization (e.g., older adults, persons with disabilities, low income households) or systemic inequalities (e.g., racism, colonialism) (e.g., Cutter et al., 2003; Chakraborty et al., 2020; Chang et al., 2020; Bouikidis & Tynan, 2022; Partners for Action, 2024).

With climate change, flooding is becoming a pressing reality for many Canadians. Flood hazard profiles are changing rapidly due to shifts in existing streamflow, precipitation, and temperature regimes, leading to more frequent and intense fluvial (riverine), pluvial (rainfall), and coastal flooding (Bush & Lemmen, 2019). Perhaps most noticeably, climate change is amplifying the effects of extreme weather events (e.g., heavy precipitation, severe storms), which are becoming more recurrent and severe (Gosselin et al., 2022). Globally, extreme weather events have increased fivefold over the past fifty years (World Meteorological Organization, 2024). This surge in disasters is exacerbated by the growing prevalence of cascading and compounding hazards (Glasser, 2019). Disasters produce cascading effects when an initial event triggers a chain reaction of secondary crises and impacts (Ahamed et al., 2023). Similarly, simultaneous and consecutive hazard events can amplify disaster impacts and further constrain community response and recovery capabilities (Ahamed et al., 2023).

In the face of climatic uncertainty and rising flood risks, adaptation is imperative. Implementing proactive risk reduction measures is often much more cost effective and socially beneficial than responding to adverse impacts in the aftermath of a disaster event (Kelman, 2013; Tenzing, 2020; Serra-Llobet et al., 2022). Each dollar invested today in adaptation measures is projected to save \$13 to \$15 in future avoided losses (Canadian Climate Institute, 2022a). Climate disasters are estimated to cost Canada \$15.4 billion in average annual losses by 2030, notwithstanding the costs associated with non-disaster-related climatic impacts (Government of Canada [GC], 2023). If no actions are taken, climate change is anticipated to slow Canadian economic growth by 50% as early as 2025 (GC, 2023). As such, Canada's *National Adaptation Strategy* recognizes that “innovative,

equitable, and transformational” adaptation is essential to strengthen community resilience, to reduce disproportionate impacts, and to transition Canada towards a climate-ready future (GC, 2023: p.17).

The Federal Task Force on Flood Insurance and Relocation has concluded that “Canadians must learn to live with water” (PSC, 2022: p.19). Yet in many locations, flood risk management [FRM] approaches remain ill-equipped to reduce current risks, let alone adapt to climatic changes. Persistent policy gaps continue to enable at-risk floodplain development and heightened hazard exposure, allowing for increased conflict between flooded communities and the hydrological systems that they occupy (de Loë, 2000; Di Baldassarre et al., 2013; Rajabali & Agrawal, 2022). Furthermore, traditional FRM strategies have centered around structural interventions, such as dikes and dams, which aim to protect assets against floodwaters (Doberstein et al., 2019; Henstra et al., 2019a). However, protective infrastructure often redistributes risks (Hawley et al., 2012) and lends to a false sense of security that promotes further floodplain development, in turn reproducing and magnifying existing flood risks (Burton & Cutter, 2008; Wachinger et al., 2013; Wiering et al., 2017; Jongman, 2018). The recurrent failure of defensive structures during highwater events calls into question the long-term viability of these strategies to adequately mitigate risk in a changing climate (Jongman, 2018; Doberstein et al., 2019). Hence, many FRM scholars agree that a greater diversification of both structural and non-structural interventions is needed, recognizing that all FRM approaches convey different benefits and trade-offs (e.g., Doberstein et al., 2019; Peck et al., 2022).

While successful FRM requires that risk management roles and responsibilities be shared among all private and public actors, the devolution of Canadian water management to local authorities—without an overarching strategy, proper multi-stakeholder and interjurisdictional coordination, and sufficient resources—has created governance challenges (e.g., de Loe & Kreutzwiser, 2007; Saunders & Wenig, 2007; Lyle & McLean, 2008; Henstra et al., 2019a; Morrison et al., 2019; Deschamps et al., 2023). Local governments and Indigenous authorities often struggle to maintain existing infrastructure, possessing limited capacity to invest in costly and complex adaptation measures (Amundsen et al., 2010; Burch, 2010; Thistlethwaite & Henstra, 2017; Oulahen et al., 2018; Fayazi et al., 2020). Simultaneously, there has been limited uptake among property owners to engage in household-level flood risk reduction efforts (Thistlethwaite et al., 2018; Henstra et al., 2019a). Despite high hazard exposure and rising financial impacts, Canadians still tend to underestimate flood risk (Thistlethwaite et al., 2018). A 2020 nationwide survey found that 94% of respondents were unaware that their household lived within a designated flood risk area (Ziolecki et al., 2020). Low public risk

awareness and preparedness is linked to gaps in risk disclosure, education, and communication, as well as the various socioeconomic, demographic, and situational determinants that shape a person's willingness and capacity to engage in risk reduction actions (Haney & McDonald-Harker, 2016; Thistlethwaite et al., 2018; Ziolecki et al., 2020; Oubennaceur et al., 2022; PSC, 2022; Wright et al., 2022; Partners for Action, 2024).

Likewise, the policy gaps within Canadian FRM are well-documented. A broad spectrum of challenges have been identified related to the transparency, availability, reliability, and consistency of risk information (e.g., flood maps, climate models, property disclosure) (Jakob & Church, 2013; Henstra et al., 2019b; Thistlethwaite et al., 2020; Council of Canadian Academies, 2022), market failures in regard to public-private risk sharing mechanisms (e.g., insurance) (Thistlethwaite & Henstra, 2017; PSC, 2022), misaligned land-use planning and development incentives (PSC, 2022; Deschamps et al., 2023), siloed and fragmented governance (Nowlan & Bakker, 2007; Ebbwater Consulting Inc., 2021; Henstra, 2022; PSC, 2022), a disproportionate reliance on protective structures (Doberstein et al., 2019), and barriers that constrain or disincentivize household-level risk reduction efforts (Evans & Feltmate, 2019). Furthermore, decision-makers must navigate numerous institutional, financial, sociopolitical, regulatory, and legislative obstacles which perpetuate the use of established strategies over novel approaches, such as green infrastructure and retreat from at-risk areas, and which limit opportunities to improve resilience during post-disaster reconstruction (Jakob & Church, 2013; Oulahen et al., 2018; Saunders-Hastings et al., 2020; Swanson et al., 2021; PSC, 2022).

Strong collaborative and adaptive institutional mechanisms are key to addressing the complex FRM challenges of the 21st century (Sabatier et al., 2005). However, recent flood disasters—such as those in Alberta (2013), Quebec, Ontario, and New Brunswick (2019), British Columbia (2021), and Atlantic Canada (2022)—reveal the systemic weaknesses underpinning current FRM practices, policies, and governance in Canada. Because flood risk intersects various environmental, socioeconomic, land-use planning, community development, and institutional spheres, flood adaptation must be coordinated across the entirety of society and government (Cardona et al., 2012). Consistent with global shifts in best practices, many scholars and practitioners working at the intersection of climate change adaptation [CCA] and disaster risk reduction [DRR] advocate for a reformed FRM paradigm that better reflects current social and environmental realities (e.g., La Loggia et al., 2020; Mach et al., 2022; Peck et al., 2022). However, despite the need for climate-adaptive solutions, critical challenges remain in transforming Canadian flood risk management policy and governance systems.

Transforming established FRM systems will require institutional and societal shifts in flood governance accompanied by well-designed policy solutions that challenge underlying values, norms, and assumptions (Pelling, 2011; La Loggia et al., 2020; Mach et al., 2022). Such interventions are often incompatible within the parameters of existing sociopolitical, institutional, legal, regulatory, and financial systems, and thus require collaborative learning and system-wide restructuring, as opposed to incremental adjustments (Stafford Smith et al., 2011; Park et al., 2011; Pelling, 2011). In institutional systems, such as FRM, where knowledge, expertise, policies, and professional practices are acutely ingrained within a particular paradigm, transformation calls for deep reflexivity and ‘organizational unlearning’ to envision new pathways forward (Tsang & Zahara, 2008; Tosey et al., 2011). As such, successful flood adaptation necessitates a critical re-examination of the values, norms, and institutional arrangements that determine (1) how flood management problems are defined and prioritized, and by whom, (2) what solutions are considered feasible and legitimate, and (3) how decision-making processes are structured.

Flood disasters provide critical opportunities to evaluate the success of present FRM strategies, to learn from failures, and to prompt shifts in governance, policy, and practice. Firsthand disaster experiences can play an invaluable role in confronting both decision-makers and the public with the evolving realities of socioecological change, particularly as it relates to the ‘new normal’ of climate change (e.g., Birkland, 1997; Pelling & Dill, 2010; Sharpe, 2016; Nohrstedt et al., 2021; Sloggy et al., 2021). Within the CCA and DRR literature, there is ample evidence to suggest that major natural hazard events can contribute to crucial openings, or “policy windows,” to advance alternative policy proposals, to shift public risk perceptions, and to catalyze political action (e.g., Birkland, 1997; Birkmann et al., 2010; Nohrstedt, 2022). Globally, there are many examples of flood disasters which have contributed to this burgeoning FRM paradigm shift, offering novel opportunities to engage in policy-oriented learning, to accelerate climate adaptation efforts, to build collaborative partnerships, and to enhance the sociopolitical acceptance of transformative FRM strategies (e.g., Birkmann et al., 2010; Sapat et al., 2011; van Buuren et al., 2016; Surminski & McCraine, 2019; Tortajada et al., 2021; Maurischa et al., 2023).

Despite the potential for enhanced learning and action, post-disaster policy change is neither guaranteed nor without its challenges (Birkland, 2009). Flood-affected communities face the dual challenge of addressing immediate recovery needs, while critically needing to reduce the underlying vulnerabilities that contributed to the flood risks in the first place. As such, the post-disaster pressure

to respond and rebuild often constrains a community's capacity and foresight to implement proactive flood adaptations (Surminski & McCraine, 2019; Finucane et al., 2020). In some cases, a disaster can accelerate decision-making and policy implementation, expediting policy solutions that were already in the planning stages, rather than prompting the adoption of novel or alternative approaches (Surminski & McCraine, 2019). Hence, the disaster may result in the coupling of perceived problems with pre-determined solutions, rather than manifest as a genuine policy learning opportunity (Birkland, 2009). Nonetheless, post-disaster policy responses provide unique insights into the enabling conditions and barriers that influence path dependency and change within FRM systems.

1.2 Research gap and rationale

Globally, there is a rich foundation of research surrounding the influence of natural hazard events on disaster risk reduction strategies. In recent years, there has been an increasing emphasis on the integration of DRR and CCA in research, policy, and practice, arising out of a need to address the dynamic, multi-hazard challenges of the 21st century. In many cases, adapting to climate change uncertainty and complexity will require significant transformations in current flood risk management systems; however, further research is needed to better understand the levers of policy change within the context of a shifting FRM paradigm. Historically within the Canadian context, many past flood disasters were relatively localized in terms of scale and impact, and in some instances, these events served to further entrench maladaptive FRM approaches, which provide short-term protections at the expense of longer-term resilience and future adaptations. Research that examines how major Canadian floods shape FRM decision-making and institutional priorities can be utilized to help improve the efficacy of policy programs, funding mechanisms, governance arrangements, and legislation. Empirical research centered around the shifting flood policy and governance landscape is high in demand and well-aligned with provincial and federal mandates on climate action and disaster resilience.

Within the scope of climate change adaptation and flood risk management, those seeking transformative changes (i.e., deviating from the status quo) often must contend with the historical path dependencies and institutional inertia that constrain the speed and extent of change possible, creating unique challenges for policy actors. Available literature on policy change, as discussed in Chapter 2, suggests that proponents, in an attempt to transition to a new policy paradigm, seek to leverage emergent opportunities, such as perceived or actual crises, prior institutional learnings, and/or

collaborative governance arrangements. This study assesses the mechanisms of post-disaster policy change in a Canadian case study through the application of a multi-framework policy analysis lens.

This research focus is particularly salient in the British Columbia [BC], Canada context where subsequent years of climate emergencies have highlighted an urgent need to address longstanding disaster risk management gaps. Through a case study of the 2021 flood disaster, this study examines the manner in which governance actors, operating across various networks and institutions, sought to influence post-disaster policymaking and advance a FRM paradigm shift. In mid-November 2021, a series of atmospheric rivers [AR]—seasonal moisture flows that result in brief, intense precipitation events—provoked a provincial state of emergency. Triggered by the extreme rainfall conditions, the resulting catastrophic floods and debris flows impacted seventeen regional districts and forty-two First Nations communities throughout southern and central BC (Judd, 2021a; Litke, 2022). Among the communities severely impacted was Sumas Prairie, a rural neighbourhood of the City of Abbotsford, which quickly became a symbol of failed flood risk management within the province.

The case of the 2021 AR floods is significant for numerous reasons and provides multi-scalar insights into BC's flood risk management policy and governance landscape. Firstly, disaster impacts transcended beyond the local and regional scales, provoking FRM policy and governance responses at the provincial, national, and international levels. This has created strategic opportunities for enhanced inter- and intra-governmental coordination. Secondly, BC's unique institutional and legislative environments, related to the Province of British Columbia's relatively progressive stance on climate action and reconciliation with First Nations, makes the Province well-positioned to engage in transformative FRM reforms. At the local level, the case of Sumas Prairie, a community now situated upon a former lakebed, lends valuable insight into the contested legacy of colonial FRM systems. This case has been especially significant in raising key questions pertaining to how socioecological systems are managed for certain stakeholder and land-use values at the expense of others. Finally, the emergent post-disaster regional and transboundary flood governance initiatives continue to influence the shifting FRM solutions space nearly three years following the disaster. Lessons learned from this event can provide valuable insights on how to foster collaborative and future-oriented adaptation decision-making processes, not only in the post-disaster period, but also proactively, before more catastrophes occur.

1.3 Research aims and purpose

Using qualitative methods, this study explored the impact of a major disaster in British Columbia, Canada, and the extent of its influence on flood risk management policy and governance at various scales. Here, policy refers to the strategies used by decision-makers to solve a perceived issue and achieve a particular outcome. Governance, on the other hand, refers to the processes by which decisions are made, actions are implemented, and systems are managed. This study aims to document the post-disaster state of BC's flood risk management landscape as it relates to notable shifts in policy and governance, as well as any missed opportunities that have failed to gain traction within the public, policymaking, and/or political spheres. Through a multi-scalar analysis of post-flood decision-making, institutional learning, and actor-network convening, this thesis aims to provide a critical examination of BC's path to post-flood recovery and resilience. The overarching purpose of this research is to enrich understandings of how disaster learnings may be leveraged to advance systemic paradigm shifts within the context of Canadian flood adaptation.

1.4 Research questions

Research questions are as follows:

1. To what extent, and how, did the November 2021 atmospheric river events and subsequent flood disaster prompt formal and informal changes within BC flood risk management policy and governance?
2. In the post-disaster period, how have various governance actors and institutions engaged in collaborative planning and decision-making processes, and with what degree of success?

1.5 Thesis structure

This thesis is structured into six chapters. Chapter 1 introduces the reader to the current challenges in Canadian flood risk management and outlines the research problem, questions, and objectives that will be explored. Chapter 2 comprises a literature review on the key concepts and theories that underpin this research, including critical insights on mechanisms of public policy change and systems transformation within the context of DRR and CCA. An evaluative framework for assessing post-disaster policy change as situated within both short-term policy windows and longer-term processes of institutional learning is presented. This literature review was iterative, reflective of the dynamic realities of conducting research on an ongoing and rapidly changing case study context.

While the literature review informed the initial research design and methods, it was also further shaped by the results as new themes emerged from the interviews and emergent initiatives, prompting a second round of review into supplementary bodies of literature. Chapter 3 details the research design and methods. Chapter 4 provides an overview of the case study context. Chapter 5 begins with a narrative account of the atmospheric river event. Next, Chapter 5 presents the research results, beginning with overview of the disaster's impacts and significance, followed by an analysis of its implications for flood policy agendas, institutional learning, and governance shifts in BC. Integrated within these results is a discussion of key research insights on the enabling conditions for transformative, post-disaster policy and governance reforms. Chapter 6 concludes these findings and provides future recommendations.

Chapter 2: Literature Review

2.1 Chapter overview

Public policy is a crucial avenue for advancing climate-resilient flood risk management (FRM) policy and governance. Chapter 2 begins by framing adaptation as a critical sociopolitical challenge, one that requires collaborative whole-of-society governance and transformative policy solutions. Next, the chapter explores how actors and institutions interact within a given policy subsystem, such as FRM, to frame public problems, to propose solutions, and to advance action through the process of agenda setting. Policies that are consistent with sociopolitical norms and values, institutional practices, and established knowledge systems fall within the dominant policy paradigm. Actors seeking to advance CCA and DRR objectives may be constrained by past dependencies and institutional barriers; as such, they may attempt to leverage emergent opportunities to shift the overarching policy paradigm. What follows is a review of the literature I used to frame and understand my research problem, and which forms the basis of an evaluative framework for assessing how actors, working both within and across institutions, leverage critical ‘policy windows,’ such as disaster events, as well as pre-existing governance relationships and prior learnings, in order to mobilize changes at the systemic, institutional, and decision-making levels.

2.2 Climate adaptation

2.2.1 The adaptation imperative

Climate change is the planet’s most pressing threat (Parry, 2007). Shifting environmental baselines, as a result of human interference in environmental regimes and the global climate system, are undermining social and ecological well-being. Population displacement, economic disruption, resource scarcity and conflict, food and water insecurity, health crises, and disasters—all related to climate change—are rapidly becoming indicative of humanity’s future given current trajectories. Despite international pledges to reduce greenhouse gas emissions, overall carbon emissions increased by 1.1% between 2021 and 2022 as a combined result of increasing fossil fuel usage, land-use changes (e.g., deforestation), and the decreasing capacity of natural sinks (e.g., oceans) to store and transport carbon (National Oceanic and Atmospheric Administration [NOAA], 2023a). Given these trends, Earth will likely reach a planetary warming of 1.5°C above industrial levels by the 2030s (Carrington, 2022; NOAA, 2023a). Abundant scientific evidence has established that surpassing this threshold will

culminate in significant, irreversible climatic changes that will impact all life on Earth in varying capacities.

In many places throughout Canada, climate change is manifesting through shifting precipitation and temperature regimes, leading to more frequent and intense extreme weather events (Bush & Lemmen, 2019). In 2021 alone, extreme weather events cost Canadians \$2.1 billion in insured losses (IBC, 2022a) with uninsured losses further adding to this total. Yet such circumstances can no longer be considered anomalies and indicate a growing trend in disaster-related losses, shown in **Figure 1**. In both 2022 and 2023, these annual insured losses had ballooned to \$3.1 billion (IBC, 2023 & 2024a). Slow progress on the climate mitigation front makes the imperative for adaptation even more timely to alleviate growing climatic risks and related losses.

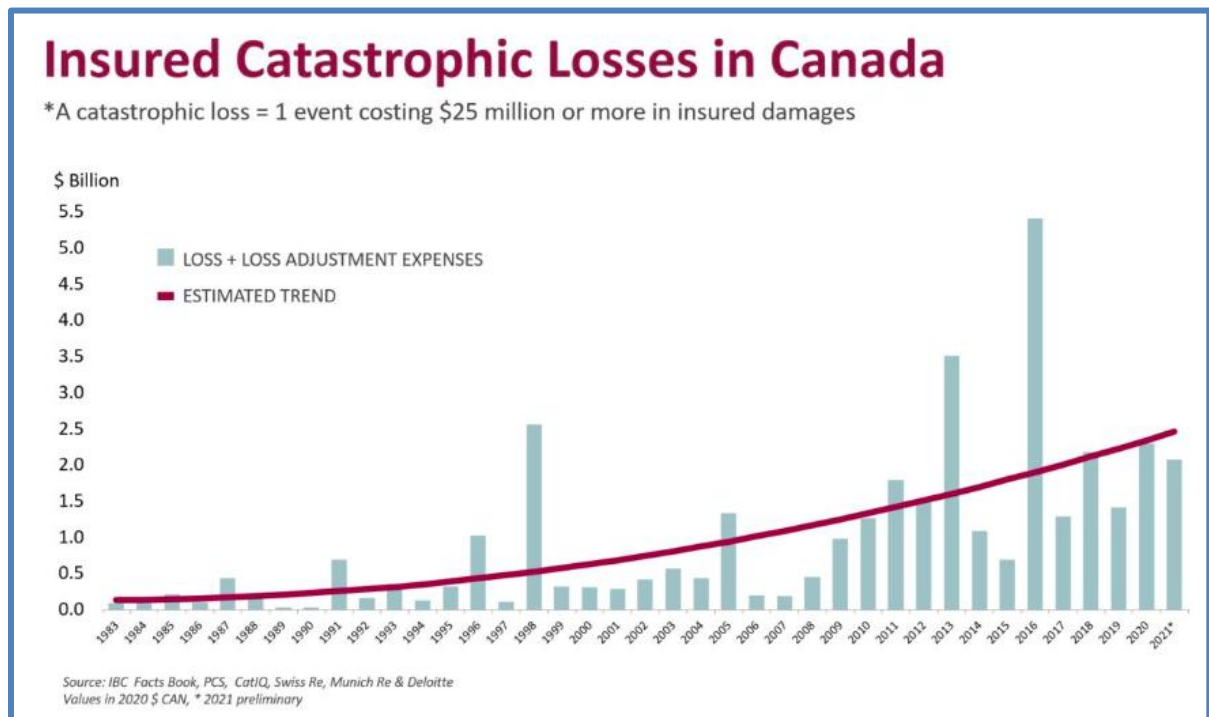


Figure 1: Insured catastrophic losses in Canada (IBC, 2022a)

Adaptation is commonly defined as the social, ecological, or economic adjustments made in response to actual and/or projected climate impacts (United Nations Framework Convention on Climate Change [UNFCCC], 2023). Adaptive actions refer to the intentional “changes in processes, practices, and structures” that aim to mitigate harms and leverage potential opportunities that may arise as a result of climatic changes (UNFCCC, 2023). Successful adaptation both requires incremental adjustments

that advance near-term objectives, coupled with longer-term transformations in the norms, values, and relationships that underpin current sociopolitical, economic, and legal systems (Kates et al., 2012). Because climate change is a ‘wicked problem,’ meaning that it is highly complex and difficult to solve due to a variety of factors—including uncertainty, irreversibility, a lack of clear or widely agreed-upon solutions, and barriers to action (Fitzgibbon & Mensah, 2012)—climate adaptation requires coordinated policy solutions and integrated actions across all orders of government, across society, and between sectors (Finnegan, 2022; Henstra, 2022).

2.2.2 Opportunities and challenges for adaptation policy

Despite the urgency for action, CCA is underpinned by uncertainty, complexity, and sociopolitical contestation, posing challenges for implementation (Fitzgibbon & Mensah, 2012). These include issues related to institutional and regulatory compatibility, lack of community or political buy-in, knowledge and expertise deficits, capacity and resource gaps, finite finances, fragmented or absent leadership, and unclear roles and responsibilities (e.g., Adger et al., 2007; Burch, 2010; Measham et al., 2011; Clar et al., 2013). Adaptation barriers can manifest across all stages of the policy cycle: agenda setting, policy formation, policy implementation, and monitoring and evaluation (Clar et al., 2013). However, the same is true of the enabling conditions conducive for institutional change. Some scholars reason that these conditions should not be viewed through the binary lens of ‘barriers’ versus ‘enablers,’ but rather as a continuum of interactions, occurring at varying degrees and timeframes, as leveraged by different actors (Jones, 2023). Thus, it is necessary to identify the enabling institutional conditions and critical points of intervention that are conducive for adaptation (Clar et al., 2013).

Because climate change is an inherently sociopolitical challenge, scholarship on public policy and institutional development processes provides a rich foundational basis for understanding how so-called incremental and transformational adaptation policies may emerge or not (Dovers & Hezri, 2010). Public policies are important instruments for addressing collective problems, steering behaviour, and advancing objectives (Pal, 2006). Policies are shaped by the values and priorities of the actors and institutions authorized to make decisions and implement changes (Pal, 2006). At the same time, policy development is dependent on the sociopolitical, historical, and institutional contexts that actors are embedded within. As such, policy analysis can lend insight into the drivers of path dependency (i.e., resistance to change), while helping to identify the intervening variables and critical openings that can

enable transformative adaptation. In this thesis, the latter—mechanisms of policy change—is the primary focus of analysis, while noting the duality inherent within studies of path change and stability.

2.3 Public policy as a venue for change

2.3.1 Policy paradigms: The guiding epistemological foundations of policymaking

Decision-makers attempt to address perceived problems by way of public policies. A policy is any framework that guides government action, or inaction, and serves as a mechanism for advancing certain objectives, behaviours, and outcomes within a particular jurisdiction (Pal, 2006). More often than not, policies aim to address clusters of interrelated problems, rather than isolated issues, allowing governments to maximize spending and impact (Pal, 2006). In theory, policy design should be rational or evidence-based; however, policy choices are inseparable from the values and goals of the actors and the institutions responsible for authorizing and implementing policy solutions (Bromley & Paavola, 2002; Pal, 2006). How a policy problem is identified, defined, and understood will in turn influence the policy tools that are chosen to address the issue, as well as the motivations and objectives that underpin these actions (Kingdon, 2003/1984; Pal, 2006). As such, policy landscapes evolve over time, not only as a result of advancements in technical solutions, but also due to the shifting norms, values, rules (both formal and informal), and knowledge systems that continuously influence sociopolitical priorities (Jones & Baumgartner, 2005; Pal, 2006).

Together, these elements form a particular ‘policy paradigm’—the guiding beliefs and assumptions that underpin policy actions and processes (Hogan & Howlett, 2015). Paradigms comprise the epistemological foundations, or deepest held core beliefs, that influence how people understand and interact with the world around them (Meadows, 2008). Within policy studies, scholars have defined the policy paradigm as a relatively well-established set of ideas that are broadly shared among the actors and institutions working to solve a given policy problem (e.g., Carson, 2004; Baumgartner, 2014; Daigneault, 2014; Hogan & Howlett, 2015). The “ideational constructs” which comprise policy processes are dynamic and fluid, continuously evolving as actors, communities, institutions, and societies all respond to the changing world around them (Hogan & Howlett, 2015: p.5).

2.3.2 Policy subsystems: The action arena that actors engage in

Although policy processes are influenced by macro-level forces to an extent, policy research tends to focus on policy subsystems as the unit of analysis (Lemke et al., 2023). A ‘policy subsystem’

refers to the network of actors and institutions working to address a specific subset of issues through coordinated policy advocacy and design (Ingold et al., 2017). Because many policy issues are interrelated, policy subsystems do not exist in isolation and can overlap or be nested within other subsystems. In this thesis, flood risk management [FRM] is the primary policy subsystem of focus, but is also nested within the broader contexts of climate change adaptation [CCA], disaster risk reduction [DRR], and emergency management. Yet flood policy can also be linked to many other policy subsystems, such as housing and land-use policies for instance. Policy subsystems are generally limited by the geographic and/or political boundaries within which governance actors are able to meaningfully influence specific issues (Lemke et al., 2023).

While a policy subsystem refers to the particular issue area of focus (in this case, flood risk management), a policy paradigm can be much broader and often extends across multiple subsystems. For example, FRM in many places was historically dominated by top-down governance, engineered solutions, and Western scientific knowledge that prioritized the values of settler-society, such as private property protection, agricultural production, and industrial enterprises (Yumagulova, 2020; Parson & Fisher, 2022), as discussed further in section 4.2.3.2. Yet this paradigm, rooted in colonial and capitalist ways of knowing and being, extends to many other policy subsystems beyond FRM. Because policy issues are often interrelated (Pal, 2006), policy paradigms are fluid, non-linear, and co-occurring across multiple policy domains. Thus, broad epistemological shifts can filter down through different policy subsystems, changing how issues are perceived and how solutions are framed by decision-makers, policy-makers, and the general public. Inversely, transformations in one policy domain can influence shifts elsewhere.

2.3.3 Policy instruments: The strategies used to solve a perceived problem

Policy instruments are the tools and techniques employed by governments to achieve desired objectives; they exist across all stages of policy development (Singh Bali et al., 2021). Simply put, these are means to address a problem and to achieve the end goals of the policy (Singh Bali et al., 2021; Lang, 2022). Policy instruments include both substantive and procedural tools. The former refers to instruments and levers, such as regulations or subsidies, used to implement policies and to directly steer outcomes (Singh Bali et al., 2021). The latter encapsulates the ‘softer’ measures used to influence the processes and manner in which policies are designed and implemented (Singh Bali et al., 2021). These can include governance arrangements (e.g., advisory committees), institutional reforms (e.g.,

ministerial restructuring), and administrative processes (e.g., access to freedom of information requests) (Klijn & Koppenjan, 2015; Singh Bali et al., 2021). In sum, procedural tools are process-oriented and used to influence actor-network relations (e.g., participation, incentives for collaboration) within the policy subsystem, while substantive tools are used to enable action, to enforce compliance, and to directly influence behavioural outcomes (Lang, 2022). While procedural tools have been historically overlooked in both policy studies and policy integration, these are critical instruments for dealing with complexity, uncertainty, and values pluralism (Lang, 2022).

When addressing complex policy issues (i.e., those with multiple goals, varying needs, and many actors involved), policymakers will often bundle together a variety of instruments to create a mixed suite of tools to be deployed, either simultaneously or in stages, to achieve common objectives (Singh Bali et al., 2021). This is referred to interchangeably in the literature as a ‘policy package,’ a ‘policy mix,’ a ‘policy bundle,’ and a ‘toolkit’ (Singh Bali et al., 2021). Policy actors will also package together ideas about preferred policy interventions and proposed solutions, herein referred to as a ‘policy proposal’ (Birkland, 2020). Actors advocating for transformative changes (i.e., a radical departure from the dominant policy paradigm) will seek to broaden the so-called ‘solution space’ by expanding the toolkit that policymakers and decision-makers have to choose from. When policy instruments, ‘the means,’ are in alignment with desired outcomes, ‘the ends,’ the result is a coherent, integrated policy domain and effective institutional arrangements (Howlett et al., 2009; Lang, 2022).

2.3.4 Institutional fit: Choosing the right tools to achieve desired outcomes

This coherence between problem-solving mechanisms and desired outcomes is known as ‘institutional fit’ (Young, 2002). In other words, institutional responses to social and environmental challenges must be appropriate in meeting the context-dependent needs of the perceived problem (Epstein et al., 2015). According to Epstein et al. (2015), achieving institutional fit means that:

- (a) governance strategies adequately reflect the scale of the issue and account for system interdependencies;
- (b) interventions are timely, responsive, and dynamic;
- (c) chosen policy means and ends align with social norms and values, as well as institutional and operational rules; and
- (d) actors and institutions are able to effectively mobilize resources, build capacities, and engage in multi-scalar actions towards solving the problem.

2.3.5 Agenda setting: The framing and packaging of problems and solutions

Because governments must balance finite resources (e.g., staff capacity, budget) with many competing demands, decision-makers prioritize institutional attention and policy action through the process of agenda setting (Jones & Baumgartner, 2005; Howlett et al., 2009). As the first and arguably most important element of the policy cycle, agenda setting is the means by which public issues, and their attached solutions, gain the attention of the public and decision-makers (Howlett et al., 2009). Through this process, various actors attempt to gain support for preferred policy interventions and elevate these solutions to the institutional and decision-making agendas (Birkland, 2020). Here, an agenda refers to “a collection of problems, and the different understandings of causes, symbols, [and] solutions” associated with a public issue (Birkland, 2020: p.211). Agendas can be either formal (e.g., a proposed legislative bill) or informal (e.g., preferences for how public issues are managed), and exist across all levels of government (Birkland, 1997). How an agenda is framed ultimately informs how policies are formulated, which actors are involved in the decision-making process, what implementation tools are chosen, and how success is defined and evaluated (Howlett et al., 2009).

Within the broader ‘agenda universe,’ where any and all ideas may be discussed, there are three primary spheres wherein a policy issue may gain traction among the masses and the elites: the systemic agenda, the institutional agenda, and the decision-making agenda (Birkland, 1997 & 2020). Depicted in **Figure 2**, the systemic, institutional, and decision-making agendas are distinguished by varying levels of government attention and commitment (Birkland, 1997). Any idea or perceived issue that is up for policy debate, provided that it is rational and feasible within normative contexts, exists within the systemic agenda (Birkland, 2020). The systemic agenda encapsulates a broad range of competing interests and proposed solutions, not all of which will gain widespread sociopolitical support (Howlett et al., 2009). Where the ‘systemic agenda’ signifies all public issues that are vying for government attention, the ‘institutional agenda’ represents the public issues that governments believe they are responsible for addressing and, critically, have the time and resources to do so (Birkland, 1997). Finally, policy packages can reach the ‘decision-making agenda,’ culminating in government action, such as legislative changes or budgetary allocations towards specific programs (Birkland, 2020).

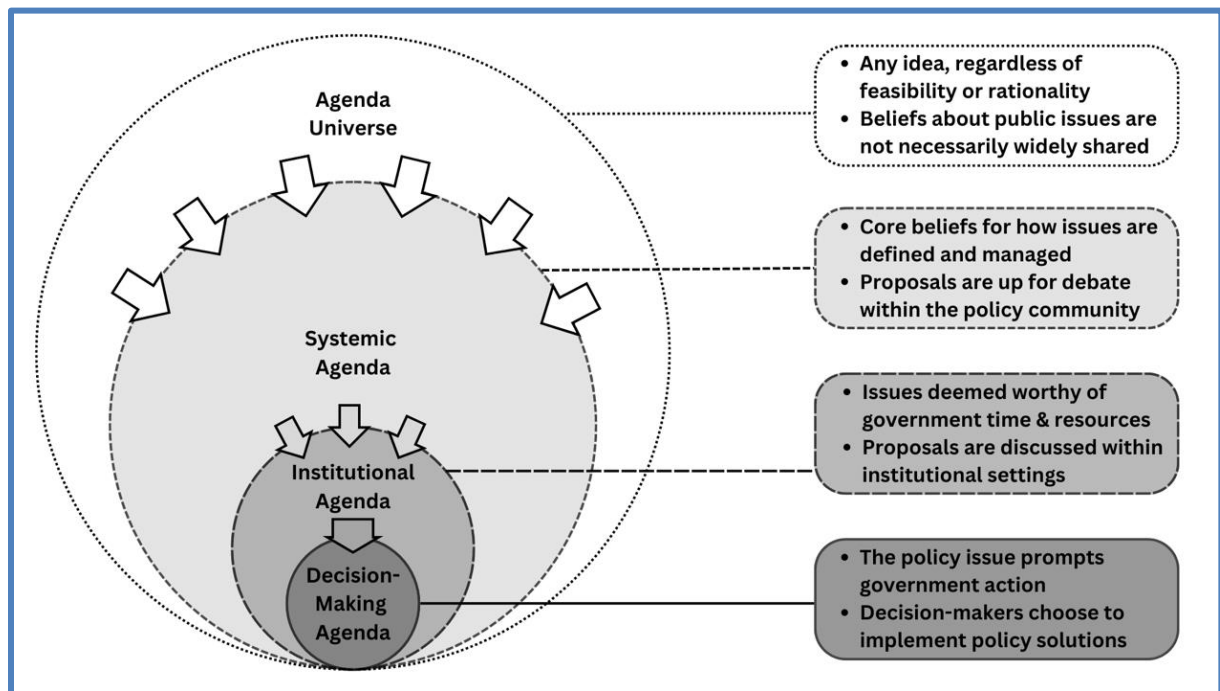


Figure 2: Levels of agenda setting (adapted from Birkland, 1997 & 2020)

2.3.6 Issue attention: Why some public issues may be prioritized over others

The boundaries between the systemic and institutional agendas can be fluid, overlapping, or even misaligned. Overlap occurs when there is simultaneous public and political interest in solving a particular policy issue (Gil, 2019). Existing research shows links between public opinion and policy decisions, indicating that governments are usually responsive to the systemic agenda (Wlezien, 2017). However, governments do not always act in accordance with public pressure and may make decisions that contradict the broader systemic agenda (Gilens & Page, 2014; Wlezien, 2017). For instance, Gilens & Page (2014: p.575) found that citizen preferences had a “near-zero, statistically non-significant impact” on American public policy decisions, which were more likely to be influenced by wealthy elites and organized interest groups (i.e., lobbyists). Accordingly, while many scholars contend that public opinion and issue attention does indeed play a key role in policymaking, agenda setting processes are also contingent on factors such as macropolitical and economic conditions, institutional characteristics, and power dynamics, as well as the specific circumstances surrounding the policy issue (Jones & Baumgartner, 2005; Wlezien, 2017).

Some scholarship suggests that decision-makers may be most inclined to act on the systemic issues that are both highly salient among the public and coupled with relatively cohesive, actionable solutions (e.g., Jones & Baumgartner, 2005; Howlett et al., 2009; Busemeyer et al., 2020). In contrast, highly salient issues which are not attached to concrete solutions, or which lack broad agreement on preferred policy pathways, are more susceptible to having the agenda setting process dominated by politicians and elites (Busemeyer et al., 2020). Low-interest issues are the least likely to advance to the institutional and decision-making agendas altogether (Busemeyer et al., 2020). Because governments must navigate a constant influx of information, respond to competing interests, and recognize and interpret system signals, the agenda setting process, which determines how issues are understood and framed, is critical in helping governments decide how to process new information, prioritize issues, and allocate finite time and resources (Jones & Baumgartner, 2005). As such, issue visibility and the policy proposals put forth by actors are both critical components of the agenda setting process.

2.4 Governance within the policy subsystem

2.4.1 Actors and networks: The players involved in the policy process

Actors play an integral role in generating policy solutions and in influencing institutional priorities, both formally (e.g., as public servants) and informally (e.g., through grassroots advocacy) (Bolukbasi & Yildirim, 2022). Among the actors involved in setting the policy agenda, three important distinctions can be made between politicians, policymakers, and policy communities. In Canada, politicians are democratically elected officials with the legislative authority to enact new policies, to allocate government spending, and to set the institutional mandates that policymakers follow. Policies are then developed by policymakers, the nonpartisan civil servants who work within governing institutions to define policy problems, to set policy-specific goals, and to develop the means by which problems are tackled (Pal, 2006). Policymakers serve as a critical link between ‘policy-takers,’ the political officials tasked with policy implementation, and the broader ‘policy community,’ the actors working both independently and through coordinated networks to address issues within a specific domain, such as flood risk management (Kingdon, 2003/1984; Pal, 2006). Within a given policy subsystem, there are three primary scales of actor-network interactions of note: policy communities, advocacy coalitions, and policy champions, shown in **Figure 3**.

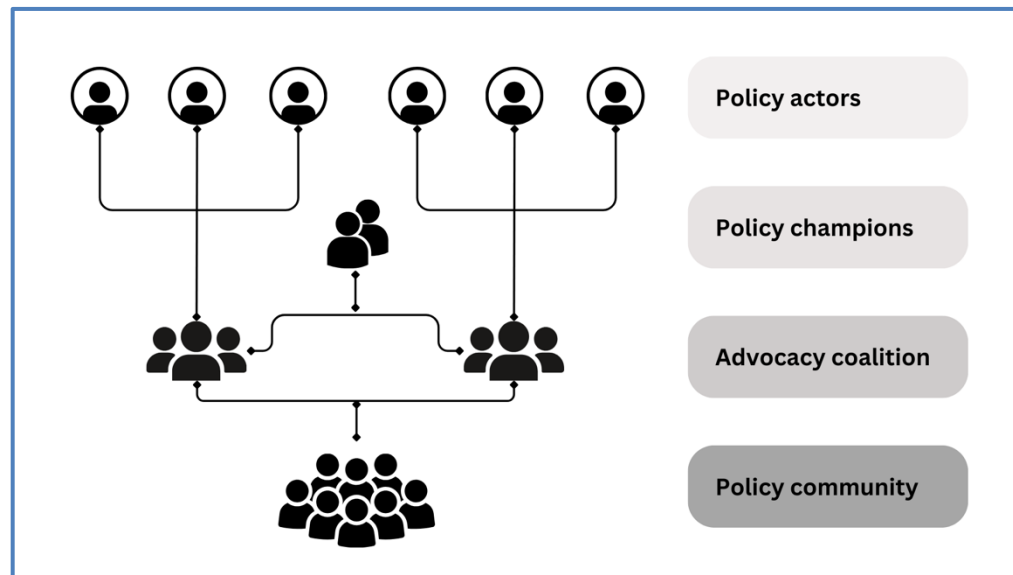


Figure 3: A simplified depiction of actor-network relationships across scales
(adapted from Kingdon 2003/1984; Sabatier & Weible, 2007)

2.4.2 Policy communities: Broad involvement in a particular policy domain

A policy community is a group of specialists (e.g., analysts, subject matter experts, community leaders, practitioners) who are concerned with a particular policy domain (e.g., flooding, health, housing) and operate both within and outside of formal governing institutions, such as government agencies (Pross, 1995; Kingdon, 2003/1984; Pal, 2006). Through regular interactions within the policy subsystem, members within a given policy community are broadly familiar with one another's "ideas, proposals, and research" (Kingdon, 2003/1984: p.117). Actors share some commonalities (e.g., conceptual understanding, terminology), but may disagree on preferred policy solutions (Pal, 2006). Through their interactions, actors within the policy community explore potential strategies and propose viable policy solutions (Kingdon, 2003/1984). This continuous exchange of ideas ultimately produces a "short list" of options for decision-making authorities to consider (Kingdon, 2003/1984: p.139).

Policy communities vary in terms of overall cohesiveness (Kingdon, 2003/1984), and can include a diversity of nested sub-group networks and coalitions (Howlett et al., 2009). When policy communities are highly integrated, meaning that most actors share common paradigm beliefs and broadly agree upon preferred policy approaches, this tends to create stability within the policy subsystem, leading to the establishment of a policy monopoly (Kingdon, 2003/1984; Howlett et al.,

2009). A ‘policy monopoly’ refers to a relatively stable or cohesive policy subsystem wherein there is general agreement on how issues are defined and managed, leading to the entrenchment of policy paradigms over time through the institutionalization of certain ‘policy images’ (i.e., how public issues and their associated solutions are framed) (Baumgartner & Jones, 1993; Howlett et al., 2009). In contrast, a high degree of fragmentation—which manifests through conflicting ideas, competing values, and disagreement over preferred approaches—can lead to instability as dominant policy paradigms become challenged (Kingdon, 2003/1984). Consequently, policy subsystems that are highly competitive, fragmented, or unstructured are more prone to volatility and abrupt agenda shifts, as opposed to those that are more cohesive or hegemonic (Kingdon, 2003/1984).

Within a policy subsystem, influence over decision-making processes is exerted through the “building up of distinctive policy cultures” (Healey, 1998: p.1536). This can be achieved through various means, such as through the establishment of cohesive policy images. A policy image can be defined as the “empirical information and emotive appeals” (Pal, 2006: p.125), discursive symbols, and causal stories that frame and give meaning to public issues (Stone, 1989; Kukkonen et al., 2017). Relatedly, ‘causal stories’ refer to the socially constructed narratives used to attribute an issue to a perceived underlying cause and to communicate the issue to others (Stone, 1989; Kingdon, 2003/1984; Pal, 2006; Howlett et al., 2009).

Policy cultures can also be cultivated through the creation of informal networks that connect various actors both laterally and horizontally across governance scales (Pal, 2006; Howlett et al., 2009). As one example, communities of practice are informal networks that engage in a culture of social learning and collectively build upon shared identities, values, and objectives—creating opportunities for the multi-scalar exchange of knowledge and ideas, as opposed to top-down knowledge transmission (Wenger, 2010). Policy communities create discursive spaces that can facilitate reciprocal learning processes, as actors engage in the continuous exchange of ideas (Kingdon, 2003/1984) and as formal governing institutions both seek to learn from and on behalf of society (Schön, 2010).

2.4.3 Advocacy coalitions: Coordinated advocacy around shared values

Within the broader policy community, alliances may emerge between likeminded individuals who possess a history of coordinated advocacy efforts and who seek to collectively advance preferred policy instruments and proposals (Sabatier & Weible, 2007). Thus, advocacy coalitions are groups of policy actors that convene around shared worldviews, core policy beliefs, and causal stories. These

actors will collaborate to share resources, to coordinate strategies, and to develop alliances in an attempt to advance common objectives and to compete for ideological dominance within the broader agenda-setting process (Sabatier & Weible, 2007).

Because advocacy coalitions are informally governed by their shared core values and beliefs, competing coalitions may misunderstand one another, while on the other end of the spectrum, highly cohesive groups may fall victim to a ‘groupthink’ mentality (Sabatier & Weible, 2007; Wiering et al., 2017). This can result in conflict, polarization, or stagnation (i.e., lack of innovation) within the policy subsystem at large (Sabatier & Weible, 2007; Wiering et al., 2017). In response, actors and institutions may attempt to mediate conflict and bridge silos through a variety of tactics, such as seeking compromises (Birkland, 2020), facilitating cross-coalition learning (Jenkins-Smith et al., 2018), fostering collaboration (Gabehart et al., 2022), ‘softening up’ decision-makers, the public, and other policy actors to new ideas (Kingdon, 2003/1984), and enacting institutionalized veto points (Ingold & Varone, 2021). These actions are grounded in the desire either to reach a stable equilibrium within the policy subsystem or to create favourable conditions for policy formation. This is typically achieved when all necessary actors have been meaningfully involved in policy development, contributing to their specific role within the process (Sabatier & Weible, 2007), and when the sociopolitical climate is receptive to addressing the policy issue at hand (Kingdon, 2003/1984). A network’s success in achieving common objectives is typically attributed to its size, complexity, self-steering capacity, degree of fragmentation, and costs of involvement (Adam & Kriesi, 2007).

2.4.4 Policy champions: Thought leaders and collaborative conveners

Within a policy community, certain actors may play more pivotal roles than others in advancing policy innovation or reform due to their ability to successfully leverage resources, knowledge and expertise, social and political capital, ideological and discursive trends, and strategic opportunities (Mintrom, 2019; Capano & Galanti, 2020). These actors are interchangeably referred to as policy ‘entrepreneurs,’ ‘champions,’ ‘advocates,’ and ‘brokers’ in the literature (e.g., Kingdon, 2003/1984; Zahariadis, 2007; Gore, 2014). For consistency, the term ‘champion’ is used in this thesis. However, within the British Columbia flood risk management space, the term ‘solution seeker’ is sometimes used with a similar connotation and is also used in the discussion of study results where appropriate.

Champions are trusted members of the broader policy community and regularly participate in related programs and initiatives, often in an organizer or facilitator capacity (Gore, 2014). Such

individuals play an important role in catalyzing “mutual learning, trust [-building], and joint problem-solving” opportunities (Gore, 2014: p.310). Champions are critical in bridging inter-agency siloes (Gore, 2014), mediating differences (Birkland, 2020), building trusted and reciprocal partnerships (Leach & Sabatier, 2005), translating new ideas into actionable goals (Roberts & King, 1991), distilling complex issues into easy-to-interpret information, repackaging policy solutions to be more socially and politically palatable (Gore, 2014), convening diverse groups around common objectives (Gabeheart et al., 2022), and fostering collaborative learning spaces (Gore, 2014; Jenkins-Smith et al., 2018). Often, there are multiple champions involved in these processes, each of whom may play different, but equally critical, roles (e.g., negotiator, mediator, convener) depending on their skillsets and the specific needs of the initiative (Roberts & King, 1991; Gore, 2014; Jones, 2023).

Policy change is thought to be most likely to occur when policy champions, faced with a specific issue, are successfully able to elevate alternative solutions to the institutional and decision-making agendas (Wiering et al., 2017). In other words, champions act as “facilitators of choice” (Zahariadis, 2016: p.5), influencing how problems and solutions are framed, packaged, and prioritized. Policy champions, and the advocacy coalitions they are embedded within, often seek critical opportunities to couple problems with proposed solutions and political will, leveraging internal shifts (e.g., new administration) and external shocks (e.g., a disaster) in an effort to showcase the salience of the issue, to garner support for policy proposals, and to influence the decision-making agenda (Kingdon, 2003/1984). If successful in gaining public and/or institutional support, policy champions may become empowered in their efforts to expand the existing solution space (Kingdon, 2003/1984).

Institutions play a significant role in shaping power relations within the policy community, providing formal backing and resources to coalitions that align with institutional priorities (Bolukbasi & Yildirim, 2022). As alternative policy pathways become institutionalized, normalized, and reinforced over time, the policy subsystem ultimately transitions to a new paradigm and reaches a stable equilibrium (Kingdon, 2003/1984). As discussed in the next section, institutional context factors into whether or not an alternative policy proposal will gain traction among decision-makers (Bolukbasi & Yildirim, 2022). This is namely in terms of the proposal’s technical feasibility to be implemented within existing institutional structures, as well as its values acceptability (Kingdon, 2003/1984; Spohr, 2016).

2.5 Institutional dependencies

2.5.1 Institutions: The rules that govern actions within the policy subsystem

Institutions form the critical link between social and ecological systems, governing how societies interact with environmental regimes, such as through natural resource management, environmental legislation, and land-use planning regulations (Berkes & Folke, 1998). Institutions can be broadly defined as “the rules of the game in a society” (North, 1990: p.3), and can be either formal or informal in structure (Herrfahrdt-Pähle & Pahl-Wostl, 2012). Formal institutions refer to the codified rules (e.g., legislation, organizational mandates) and decision-making structures (e.g., government agencies, policies), while informal institutions describe ideological, cultural, and social norms (Herrfahrdt-Pähle & Pahl-Wostl, 2012; Kaufmann et al., 2018). In essence, institutions are the means by which sociocultural, political, legal, and economic relationships are structured (Dovers & Hezri, 2010). The term ‘institutional arrangements’ commonly refers to formal government organizations and the structures, policies, and processes that underpin their actions (United Nations Development Programme, 2009). For simplification, however, the term ‘institution’ is used in this thesis to refer to the formal governing bodies (e.g., the Province of British Columbia, local government) with the authority to make policy decisions and implement solutions. Because this research seeks to examine post-disaster policy and governance changes, formal governing institutions are the focus of analysis.

2.5.2 Path dependency within institutional systems

2.5.2.1 Entrenchment and self-reinforcement: The creation of institutional stability

Formal institutions—and the values systems that underpin them—are generally slow-to-change, providing both challenges and opportunities for policy development. As policy pathways gain widespread sociopolitical acceptance and legitimacy, they become embedded within institutional frameworks and legislation, societal norms, professional practices and standards, and accrued sociotechnical expertise and knowledge (Levin et al., 2012). Institutional stability is a necessary precondition for well-functioning sociopolitical systems. Institutional checks-and-balances create democratic oversight and policy continuity, making it difficult, for example, for new administrations to reverse prior policy decisions and reducing the volatility of government turnover (Beunen & Patterson, 2019). The streamlining and standardization of policies and practices is known as ‘entrenchment,’ and

leads to durable policy monopolies that yield increasing returns on investment over time (Levin et al., 2012).

Historical institutionalists hypothesize that institutions become entrenched within self-reinforcing patterns and behaviours, and over time this begets path dependency (Pierson, 2000; Beunen & Patterson, 2019). Path dependent systems are those wherein future decisions are significantly informed and constrained by historically determined conditions, making it increasingly difficult to alter course (Pierson, 2000). For example, many communities developed around waterbodies, leading to investment in flood mitigation infrastructure, such as dikes, to protect residential, commercial, and public assets. Such protective measures can serve to promote further floodplain development, known as the “levee effect” (Burton & Cutter, 2008; Ding et al., 2023), creating a self-reinforcing cycle that is both financially and socio-politically difficult to reverse by future planners and decision-makers.

Path dependency and its mechanisms explain why certain policy trajectories are more likely to endure, gaining so-called ‘sticking power,’ while others fail to gain mass uptake or are more easily replaced (Barnett et al., 2015). Many barriers to adaptation are driven by existing path dependencies, which limit institutional capacity to adjust to changing climatic conditions in a timely manner (Barnett et al., 2015). Path dependency manifests in at least four ways (Pierson, 2000; Levin et al., 2012; Hanger-Kopp et al., 2022; Goldstein et al., 2023; Seebauer et al., 2023):

- (1) technological, institutional, and societal lock-in as a result of interwoven and self-reinforcing dependencies;
- (2) self-reinforcement as policy reversal becomes less financially and/or physically feasible over time;
- (3) increasing returns as cumulative investments, gains in expertise and knowledge, and sociotechnical advancements accrue benefits and efficiencies over time; and
- (4) positive feedback loops that continue to entrench socio-ecological systems within a particular pathway as policy monopolies continue to expand in influence and reach.

2.5.2.2 Institutional inertia: Why institutional systems are slow-to-change

Institutional inertia is an offshoot of path dependency and has been identified as a key barrier to enacting transformative climate and environmental policies (Munck af Rosenschöld et al., 2014; Barnett et al., 2015). Defined as the resistance of institutions to change, ‘institutional inertia’ reflects how institutions are constrained by, yet simultaneously reproduce existing values, rules, and knowledge systems (Munck af Rosenschöld et al., 2014). As mentioned prior, institutional inertia can act as a

protective factor. However, institutions may also become entrenched within counter-productive, or ‘maladaptive,’ rigidity traps that constrain policy learning, innovation, and evolution (Méndez et al., 2019; Beunen & Patterson, 2019). In such cases, institutions become so highly integrated within a particular paradigm that they become locked into a self-reinforcing cycle that is increasingly difficult to alter (Tidball et al., 2016). Rigidity traps are reinforced by deeply engrained interconnections between norms, values, and rules that discourage deviation from the status quo (Polterovich, 2008). Hence, the persistence of maladaptive institutional arrangements, as a result of path dependencies, can also be described as ‘perverse resilience’ (e.g., Phelan et al., 2013; Tidball et al., 2016).

2.5.3 Duality of structure: Actors both conform to and challenge institutional rules

Because policymaking does not operate within a vacuum, actors are both constrained and empowered by the formal and informal institutional contexts that they operate within (Bolukbasi & Yildirim, 2022). This ‘duality of structure’ means that governance actors are limited in their agency to enact change and must conform to what is considered legitimate and feasible within geopolitical, sociocultural, economic, technological, and epistemological contexts (Sewell Jr., 1992; Beunen & Patterson, 2019). However, despite these constraints, institutional actors (e.g., public servants) can simultaneously leverage institutional resources, professional capital, and positions of authority to shape policies and priorities within their own spheres of influence (Bolukbasi & Yildirim, 2022). Thus, institutional actors are important agents in transforming path dependent systems, but it is important to recognize that change can be slow moving, since institutional dependencies slow this process.

Therefore, because some degree of path dependency exists in all institutional systems, it is important to situate policy outcomes within a temporal context (Capoccia, 2015; Pierson, 2015; Thelen & Mahoney, 2015). Policy outcomes are the result of a multitude of causal events and processes, which can unfold both in parallel and/or in sequence, independently and/or in relation to one another, gradually and/or abruptly, and visibly and/or outside of the public periphery (Capoccia, 2015; Pierson, 2015; Thelen & Mahoney, 2015). As such, many scholars affirm the need to situate policy processes within a longitudinal context (i.e., 10+ years) of institutional development (e.g., Mortensen, 2007; Sabatier & Weible, 2007; Schlager, 2007; Capoccia, 2015; Thelen & Mahoney, 2015). According to Capoccia (2015), the temporal dimension of policy processes manifests in three important ways:

- (1) A focusing event and subsequent ‘critical juncture’—wherein path-defining decisions are made—may prompt transformative changes over a relatively brief time period.

- (2) The same event, however, can also produce outcomes that are consistent with or constrained by past decisions, further entrenching existing institutional pathways, or otherwise limiting the extent of transformation that is possible.
- (3) Policy outcomes, which may at first appear to be the result of shorter-term dynamics (e.g., a focusing event), may also be situated within longer-term institutional processes and connected to the cumulative effects of earlier decisions.

2.6 Mechanisms of policy change

2.6.1 Overview

Policy change is often a combined result of 1) policy-oriented learning or 2) an emergent policy window, resulting from a focusing event or a shift in the governing coalition. The first primary mechanism of change, policy-oriented learning, occurs when incremental shifts in behavioural and thought processes, as a result of new experiences, information, and/or relationships, prompt institutional actors to revise policy objectives and institutional mandates (Sabatier & Weible, 2007). The second primary mechanism of change emerges when a shock or crisis, known as a ‘focusing event,’ results in the destabilization of the dominant policy paradigm, creating novel opportunities for policy champions to intervene in agenda setting (Baumgartner & Jones, 1993; Kingdon, 2003/1984; Sabatier & Weible, 2007). While institutional learning typically occurs gradually and quietly behind the scenes, resulting in incremental shifts in policy and practice as knowledge and experience accumulates (Thelen & Mahoney, 2015), a focusing event can prompt immediately visible results, opening a brief ‘window of opportunity’ where public and political attention to the issue is heightened (Birkland, 1997; Kingdon, 2003/1984). Finally, critical shifts in power dynamics, such as through the establishment of a new governing coalition or the election of a new administration, can fundamentally impact the receptiveness of decision-makers to alternative proposals and can radically shift subsystem priorities and objectives (Kingdon, 2003/1984; Bolukbasi & Yildirim, 2022; Heinmiller, 2023). This third mechanism of change is interrelated to the first two and can either emerge as a result of policy-oriented learning and/or the occurrence of a policy window, or it may trigger a policy window itself.

As discussed in the following sections, these mechanisms of policy change are consistent among the literature on public policy change. These comprise the foundational pillars of the evaluative framework to be presented in this thesis. Each is linked to shifts in the core beliefs and relationships of the actors involved in the policy community and/or the framing of problem-solving objectives within

the policy subsystem, as well as the redistribution of resources, power, and influence among policy actors.

2.6.2 Change as a result of policy-oriented learning within institutional systems

2.6.2.1 Gradual institutional change: Evidence of incremental policy reform

Formal governing institutions set the rules of engagement within a policy subsystem, setting the parameters that determine what policy choices are available, who is able to make decisions, and how policies are implemented and enforced (North, 1990). As such, institutional arrangements both shape the policy subsystem and constrain the extent of change that is possible at a given time (Schlager, 2007). Although institutional arrangements are typically slow to change, providing necessary stability and continuity (Roland, 2004; Plein 2019), institutions are also dynamic and fluid (North, 1990). Institutions, like all complex systems, possess adaptive and evolutionary capacities, allowing for gradual changes to occur over time (Rammel et al., 2007; Meadows, 2008; Thelen & Mahoney, 2015).

Scholars have shown the ability of gradual institutional changes to elicit policy reform through four main mechanisms: layering, drift, conversion, and replacement (e.g., Thelen, 2004; Pierson, 2004 & 2005; Hacker, 2004a; Streeck & Thelen, 2005; Mahoney & Thelen, 2010; Rocco & Thurston, 2013). **Table 1** outlines these literature-consistent processes and their subsequent outcomes for policymaking. The degree to which actors can engage in transformative action varies, with layering and drift being the least conducive to change, conversion allowing for reform with existing institutional bounds, and replacement having the greatest potential for deep change (Howlett et al., 2009; Hacker et al., 2015).

Table 1: Processes and policy outcomes of institutional change, as identified by policy scholars

Process	Definition	Potential policy outcomes
Layering	Newly created institutions are layered upon existing institutions, adding new policy instruments and objectives without altering existing ones (Howlett et al., 2009; Rocco & Thurston, 2013).	This can result in misaligned, inconsistent, and/or ineffective policies (Howlett & Rayner, 1995; Rayner et al., 2001; Howlett et al., 2009).
Drift	An institution's objectives and priorities gradually stray from its original function, often as a result of policy inaction (Rocco & Thurston, 2013). Existing policies and institutions remain, despite no longer aligning	This can result in effective policies whereby the means (i.e., policy instruments) are incompatible with achieving desired policy outcomes

	with shifting political and economic circumstances (Thelen & Mahoney, 2015).	(Torenvlied & Akkerman, 2004; Howlett et al., 2009).
Conversion	An existing institution is converted, or adapted, to serve a new purpose that radically departs from its original mandate (Rocco & Thurston, 2013; Thelen & Mahoney, 2015).	Despite the attempt to adjust the means to reflect current policy objectives, this can still lead to incoherent policy outcomes (Hacker, 2004b; Howlett et al., 2009).
Replacement	Outdated institutions are phased out and replaced by emergent institutions (Rocco & Thurston, 2013). The terms ‘replacement,’ ‘redesign,’ and ‘displacement’ are used interchangeably in the literature.	Redesigning a policy regime to intentionally align policy means and goals is considered the most effective and coherent form of institutional development (Howlett et al., 2009).

According to Howlett et al. (2009), many policy systems have developed “haphazardly through layering” (p.205), and while this can allow for continuity between existing and new policy objectives and tools, layering can also produce “suboptimal policy mixes” (p.204) that may ultimately fail to adequately address the issue at hand. Rather, layering can result in incoherent policy instruments that do not reinforce policy objectives (Cejudo & Michel, 2021), redundant or siloed initiatives, inconsistent policy implementation, and fragmentation within the policy community (Howlett et al., 2009). Similarly, drift can be characterized as a failure to update formal institutional rules as social-environmental conditions evolve (Hacker et al., 2015). Such failures can undermine the legitimacy of existing policy monopolies, rendering policy subsystems more susceptible to shocks (i.e., a major flood disaster) and potentially creating openings for policy-oriented learning to occur, as institutions learn from policy system failures and attempt to engage in corrective actions (Howlett et al., 2009). When assessing change within a given policy subsystem, it is important to not only consider what new policy instruments or strategies are being proposed and implemented, but also to identify how, if at all, the corresponding institutional arrangements have shifted. Because institutions determine the ‘rules’ of the policy sub-system, policies will be most effective in meeting desired outcomes when these are compatible with the institutional system within which policymaking is situated.

2.6.2.2 Policy-oriented learning: A key driver of institutional change

Social learning is a critical component of effective, adaptive, and collaborative environmental and climate governance (Tompkins & Adger, 2004; Keen et al., 2005; Armitage et al., 2008a & 2008b; Pahl-Wostl, 2009). Social learning refers to the ways in which people interpret social and environmental cues, internalize this information, and adapt behaviour accordingly; through this process, societal

norms, values, and beliefs are collectively constructed (Haunschild & Chandler, 2008; Kumler & Lemos, 2008). Social learning can lead to shifts in best practices, sociotechnical innovations, and corrective, or adaptive, actions, in turn influencing future institutional development pathways (Armitage et al., 2008a; Meadows, 2008; Cundill et al., 2011). The co-evolution of social learning and institutional change has been well-documented within the study of adaptive water governance, providing insights into how social learning both contributes to institutional reform and is further reinforced by it (e.g., Kumler & Lemos, 2008; Pahl-Wostl et al., 2009; Adamowski et al., 2013; Medema et al., 2014; Johannessen et al., 2019). Social learning is a fundamental component of policy development, influencing how actors perceive proposed policy pathways and make decisions under conditions of uncertainty (Folke et al., 2005; Pahl-Wostl et al., 2008; Armitage et al., 2008b).

Social learning at the institutional level is expressed through policymaking (Heclo, 1974; Moysen et al., 2017). Policy-oriented learning (i.e., social learning within the context of public policy) is the process through which governments continually make decisions, implement policy actions, evaluate outcomes, and adjust behaviour accordingly (Sabatier & Jenkins-Smith, 1999; Moysen et al., 2017). Through this process, policy actors obtain, process, and share new information, which they then attempt to reconcile with their policy beliefs (Moysen et al., 2017). This can lead to the reinforcement of or departure from existing beliefs surrounding how public issues are framed, defined, and managed (Moysen et al., 2017). Policy-oriented learning is considered a key mechanism of incremental change (Moysen et al., 2017), particularly as it relates to shifting how policy actors position themselves in favour of or against different policy proposals, and how actors frame the underlying root causes of the policy issue to begin with (Sabatier & Jenkins-Smith, 1993).

Policy-oriented learning takes a variety of forms and can occur across scales of governance, within and across institutions, coalitions, and policy subsystems, and through both informal and formal channels, which collectively feed into the decision-making agenda (Moysen et al., 2017; Jenkins-Smith et al., 2018). Learning is often facilitated and mobilized by key policy champions (Pahl-Wostl et al., 2013; Gore, 2014). Learning is commonly thought to be triggered by events or circumstances that signal the presence of an issue (Jordan & O’Riordan, 1995) or highlight past policy failures (Sabatier, 1988; Bennett & Howlett, 1992), ongoing trial and error processes (Hanger-Kopp et al., 2022), advances in scientific and sociotechnical knowledge (Jordan & O’Riordan, 1995), the diffusion new or alternative knowledge and ideas into a policy subsystem (Pahl-Wostl et al., 2013; Cejudo & Trein, 2023), and

shifts in actor-network power dynamics (Wiering & Arts, 2006)—all of which also shape the ways in which policy issues are framed and the policy tools (i.e., solutions) available to decision-makers.

Learning is most constrained and shaped by past policy decisions (Hall, 1993), meaning that new policy ideas are slow to become institutionalized and difficult to change thereafter (Schön, 2010). However, learning is simultaneously considered among the most powerful mechanisms for overcoming path dependencies. This duality has been well-documented, for instance, with respect to shifting flood risk management paradigms through adaptive and collaborative processes (e.g., Wiering & Arts, 2006; Pahl-Wostl et al., 2013; van Burren et al., 2016; Wiering et al., 2017; Hanger-Kopp et al., 2022). Evidence of policy-oriented learning is reflected in the policy changes that follow; likewise, the absence of policy change in the face of new information is indicative of the failure, or resistance, of governing institutions to engage in deeper forms of learning (Hall, 1993; Pahl-Wostl et al., 2013).

2.6.2.3 Evidence of policy-oriented learning within institutional systems

Because policy-oriented learning typically occurs gradually and in a non-linear manner, such institutional learnings may be less visible in the near-term, yet more apparent when assessing policy change within the context of longer-term patterns and processes of institutional development. Based on this literature review, I have identified three primary components, outlined in **Table 2**, as providing evidence of policy-oriented learning within an institutional context:

- 1) the revision of policy goals;
- 2) the expansion of the solution space; and
- 3) the empowerment of champions working to advance change.

Table 2: Evidence of policy-oriented learning within institutional systems

Component	Description	Examples
Institutions revise policy goals	Governing institutions intentionally revise policy objectives, as grounded in evidence and prior experiences. This manifests when: ○ Existing institutions adopt new goals and mandates; ○ New institutions are formed to carry out these goals; ○ Previously peripheral goals gain greater priority and compete with existing objectives and functions; <i>and/or</i>	○ Governments create a new agency, department, or task force to scope the problem and/or propose solutions, as underpinned by the new objective ○ Institutions adopt a new mandate to govern their actions ○ Funding agencies embed the new policy goals within funding criteria

	Resources (funding, staff capacity) are allocated towards investigating, revising, or addressing policy objectives, where such institutional support was previously minimal or non-existent	Programs and policies are intentionally designed with these goals in mind
(E.g., Sabatier & Jenkins-Smith, 1999; Sabatier & Weible, 2007; Howlett et al., 2009; Hacker et al., 2015; Rocco & Thurston, 2013; Moysen et al., 2017; Hanger-Kopp et al., 2022)		
Institutions expand the solution space	Governing institutions engage in the exploration, development, testing, and/or implementation of new or revised policy instruments. Governing institutions may develop these instruments with either an intentional focus or through the basis of trial and error, but ultimately, these shifts are grounded in evidence and prior experiences, and are undertaken with the purpose of improving mechanisms to meet desired goals.	- Institutions engage in pilot projects to experiment with new tools and methods - Institutions engage in research and data-gathering to advance the state of knowledge - Funding agencies support the research and adoption of new methods and tools
(E.g., Hall, 1993; Wiering & Arts, 2006; Howlett et al., 2009; Pahl-Wostl et al., 2013; van Burren et al., 2016; Wiering et al., 2017; Cejudo & Trein, 2023)		
Institutions empower champions	Formal governing institutions are responsive to the policy community, empowering both internal and external actors in their quest to advance revised policy goals and to expand policy solutions. This manifests through funding and resource allocation, organizational capacity-building, access to policy staff and decision-makers, and enabling financial, legislative, and institutional mechanisms.	- Formal agencies provide funding to coalitions, initiatives, and organizations to carry out the work - Formal agencies engage and collaborate with policy champions - Government enacts legislation that supports policy changes - The governing coalition shifts (e.g., a new administration is elected, new actors are empowered)
(E.g., Kingdon, 2003/1984; Wiering & Arts, 2006; Thelen & Mahoney, 2015; Spohr, 2016; Bolukbasi & Yildirim, 2022)		

2.6.3 Change as a result of policy window formation

2.6.3.1 Policy windows: The alignment of systemic, institutional, and decision-making agendas

Policy subsystems generally experience prolonged periods of relative stability, punctuated by brief instances of instability, during which time actors may seek to either defend or challenge the dominant policy paradigm (Sabatier, 1988; Kingdon, 2003/1984; Jones & Baumgartner, 2005; True et al., 2007). These periods, called ‘policy windows’ or ‘windows of opportunity,’ represent opportune times where social, political, and/or institutional conditions are most favourable for champions and

coalitions to intervene in the agenda setting process and promote their values, ideas, and objectives (Kingdon, 2003/1984). Due to their infrequent nature, policy windows rapidly generate an abnormal amount of flux within the system before returning to normal or transitioning to a new stable paradigm (Jones & Baumgartner, 2005). Within the DRR literature, major disasters are thought to be significant policy window contributors, prompting post-disaster changes that may otherwise have been unlikely to have occurred without the preceding disaster experience (Birkland, 1997).

Kingdon (2003/1984) theorized that during extraordinary circumstances, like disasters, the three domains of policymaking—the problem, policy, and political streams—converge, creating the enabling conditions for actors to refocus the policy agenda and direct mass attention to a particular issue (i.e., the problem), to advance a proposed set of solutions (i.e., policies), and to secure institutional and decision-making supports (i.e., through political mobilization). These streams, in essence, represent the systemic, institutional, and decision-making agendas. Under normal circumstances, these three streams act largely independently, although parallel, of one another subsystem (Béland & Howlett, 2017). The streams converge periodically when public pressure and political will coalesce, and when supported by the enabling institutional conditions that allow for solutions to become anchored within the policy subsystem (Béland & Howlett, 2017). Kingdon (2003/1984) posited that this coupling can arise through political events (e.g., the election of a new administration), pressing problems that can no longer be ignored (e.g., the climate crisis), or finally, when triggered by an external ‘focusing event’ (e.g., a major disaster). The latter refers to unanticipated perturbations that disrupt system stability (Baumgartner, 2006), which are similarly referred to as ‘punctuations’ and ‘critical junctures,’ depending on which policy analysis framework is being employed. Here, the term focusing event is used for consistency.

Policy windows are temporary, existing only for finite period of time, before political agendas shift, policy hegemonies stabilize, and public attention wanes (Jones & Baumgartner, 2005; Brundiers & Eakin, 2018). Thus, the duration and scale of policy windows are limited, and change is not guaranteed, meaning that actors must act quickly in their attempts to mobilize action. Despite these limitations, these brief openings, such as in the immediate disaster recovery phase, can allow for otherwise peripheral systemic agenda items to rapidly advance to the institutional and decision-making agendas. For instance, the public pressure to address a perceived flood problem following a major disaster can elicit a political response, which can help to shape FRM goals and to garner support for transformative, controversial, or underutilized policy instruments or strategies (Kingdon, 2003/1984;

Birkmann et al., 2010). Alternatively, staff working within governing institutions may leverage this opportunity to secure political support towards accelerating policy development, strengthening internal capacity, and expanding existing interventions (Surminski & McCraine, 2019). A constant feature within the literature is the potentially transformative potential of a policy window when successfully leveraged by champions (Arts & Van Tatenhove, 2004; Cairney, 2013).

2.6.3.2 Focusing events: Catalysts for agenda setting and policy learning

Focusing events are defined as rare, unanticipated occurrences that result in highly concentrated or widespread damages, losses, or otherwise harmful impacts (Birkland, 1997). Examples of focusing events include terrorist attacks, warfare, technological disasters (e.g., dam failure, nuclear meltdown), natural hazard events (e.g., hurricane), and environmental disasters (e.g., oil spill) (Birkland, 1997). Focusing events occur as an acute shock to the system, as opposed to a gradual (e.g., sea level rise) or chronic stress (e.g., poverty) (Birkland, 1997). These events are sometimes referred to as ‘potential focusing events’ because the occurrence of such a crisis neither guarantees the emergence of a policy window nor ensures that meaningful change will occur (Birkland, 1997). Nonetheless, due to its severity and suddenness, a focusing event has the potential to overwhelm a system’s ability to absorb and cope with stress, and can lead to cascading failures, long-term recovery challenges, and the exacerbation of pre-existing vulnerabilities (Birkland, 1997; Brundiers & Eakin, 2018). Broadly speaking, to be classified as a potential focusing event, the event must (Birkland, 1997; Kingdon, 2003/1984):

- 1) constitute a rare, sudden occurrence;
- 2) have impacts that occur across an extensive or relatively significant scale; and
- 3) result in highly concentrated or severe impacts.

Because of the shocking and often traumatic outcomes of these events, disasters (e.g., a major flood) and other perceived crises can act as ‘tipping points’ for change by drawing broad-sweeping attention to a system’s underlying weaknesses and creating openings to challenge the dominant policy paradigm (Baumgartner & Jones, 1993; Birkland, 1997; Kingdon, 2003/1984; Meadows, 2008; Pelling, 2011). Disasters can prompt the general public to question the efficacy of status quo interventions, re-evaluate their relationships with the built and natural environments, and re-evaluate both the means achieving desired policy outcomes and the underlying policy objectives themselves (Brundiers, 2018; Brundiers & Eakin, 2018; Birkmann et al., 2010). This can result in heightened public attention to the

issue and prompt ruptures in existing policy pathways, knowledge systems, risk perceptions, and professional practices (Birkland et al., 1997; Repetto, 2006; Birkmann et al., 2010;). Disasters and crises can also initiate policy-oriented learning, as decision-makers seek to learn from past policy failings and take corrective actions (Sabatier, 1988; Bennett & Howlett, 1992; Albright, 2011). Furthermore, policy windows can encourage the uptake of scientific knowledge and new information among policymakers, providing opportunities to disrupt institutional inertia (Rose et al., 2020).

Focusing events can result in rapid policy actions, occurring as a combined result of the bottom-up and top-down learnings and approaches that culminate in a new policy trajectory (Nohrstedt, 2022). While disasters may invoke an intentional and intensive period of policy-oriented learning, such learning is contingent on the capacity of policy actors to interpret environmental signals, to critically examine their own values systems, and to adapt their beliefs and practices to reflect new evidence (Nohrstedt, 2022). This can lead to transformative DRR and CCA strategies, such as deciding to not rebuild following a disaster (i.e., managed retreat) or reforming rules and structures in order to steer behaviour toward a different pathway (i.e., ‘build back better’) (Brundiers & Eakin, 2018; Nohrstedt, 2022).

2.6.3.3 Policy window constraints: Why post-disaster change can be limited

The occurrence of a potential focusing event and the emergence of a policy window do not necessarily result in transformative change, or even change at all. Those aiming to uphold the dominant paradigm may engage in incremental policy changes, vis-à-vis adjustments to existing policies, structures, and processes that do not fundamentally challenge the dominant paradigm, meaning that there is no substantial change in how public issues are perceived and how solutions are framed and, in turn, implemented (Kingdon, 2003/1984; Birkland, 2020). This is, in part, because actors and institutions working within these normative bounds are generally empowered and resourced by governing bodies (i.e., through funding streams and access to political capital) (Bolukbasi & Yildirim, 2022). In contrast, those seeking transformative changes are often tasked with the challenge of garnering both public and political support for alternative, lesser-established proposals, while contending with the self-reinforcing mechanisms of past policy legacies and institutional inertia (Méndez et al., 2019).

In some cases, a focusing event may actually reinforce maladaptive existing pathways (e.g., a flood disaster which leads to the reinforcement of dike infrastructure), rather than generate

opportunities for deep learning and change (Wiering et al., 2017). The drive to develop immediate solutions, rather than long-term investments in policy learning, stakeholder engagement, and institutional reform, may incidentally lead to maladaptive policies (Anderson et al., 2018; Nohrstedt, 2022). In other cases, a disaster may not lead to any changes at all. This may be attributed to declining interest in policy reform as attention eventually shifts to other priorities (Jones & Baumgartner, 2005; Nohrstedt, 2022). Decision-makers may perceive that the relative costs associated with policy solutions outweigh the benefits, or other policy issues may take precedence over time (Nohrstedt, 2022). Consequently, many disasters have resulted not in transformative policy changes, but rather in the implementation of symbolic, and often more cost-effective, implementations which do not fundamentally reduce underlying risks (Nohrstedt, 2022).

Alternatively, policy change may be constrained by the inherent tensions and trade-offs that exist between short-term disaster response and recovery needs, and longer-term resilience-building (Nohrstedt, 2022). Decision-makers may be further constrained when responding to “compounded, or consecutive, disaster events that overlap spatially and temporally” (Zscheischler et al., 2018; Ruiter et al., 2020; Ridder et al., 2020; Hassan & Mahmoud, 2021—as cited in Nohrstedt, 2022: p.431). While there is some evidence to suggest a lack of correlation between disaster frequency and policy action (e.g., Nohrstedt et al., 2021), other scholars posit that frequent instability, as a result of recurrent or cascading disaster events, can hinder longer-term goals (e.g., sustainable development) in favour of addressing immediate priorities (e.g., reconstruction of damaged infrastructure, economic recovery) (Delaney & Schrader, 2000; Pelling, 2003; Smith, 2019; Yadav et al., 2021; Nohrstedt, 2022).

Despite these constraints, several factors have been identified which can amplify a focusing event’s potential to produce a policy window. These include the social, institutional, and political cultures, geographic extent, location, scale of impact, timing, event singularity, presence of compounding or cascading pressures, and collective disaster memory (Birkland, 1997; Birkmann et al., 2010; de Vries et al., 2017; Surminski & McCraine, 2019; Nohrstedt, 2022). The extent and manner of policy transformation that is possible is further dependent on a variety of factors—including political will and priorities, social acceptability, technical and financial feasibility, and the broader institutional environment that policymaking is situated within (Birkland, 1997; Schön, 2010; Bolukbasi & Yildirim, 2022).

2.6.3.4 Enabling conditions for leveraging a post-disaster policy window

The occurrence of a major disaster does not, in itself, guarantee that a post-disaster policy window will emerge; rather, conditions within the systemic, institutional, and decision-making agendas must also be conducive for actors to advance policy solutions. For example, meaningful post-disaster change is unlikely to occur if public interest is low, if decision-makers are unreceptive, if the policy community is highly fragmented, if no viable alternatives are proposed, and/or if overall perceptions of the risk and its root causes remain unchanged. Through this literature review, I have identified five conditions that can enable governance actors to leverage an emergent policy window towards advancing policy objectives, as linked to the three levels of agenda-setting discussed earlier in section 2.3.5. As summarized in **Table 3**, these literature-consistent enabling conditions are as follows:

- (1) There is heightened public attention to the issue;
- (2) The issue is framed in a new or nuanced way;
- (3) There is political will and resources to act;
- (4) Actors and coalitions are able to engage in collective action; and
- (5) Feasible policy solutions are readily available.

Table 3: Enabling conditions that enable actors to leverage emergent policy windows

Component	Description of agenda setting outcome	Examples
There is heightened public attention to the issue	The focusing event results in unusually high public awareness of and interest in the perceived problem. The issue is both highly visible and salient, and garners significant media attention. <i>As opposed to: Public attention quickly wanes, and the issue does not persist long in the media.</i>	○ There is a significant uptick in media coverage of the issue. ○ The public places pressure on decision-makers to act due to widespread dissatisfaction with the damages wrought by the disaster.
(E.g., Birkland, 1997 & 2020; Kingdon, 2003/1984; Jones & Baumgartner, 2005; Brundiers & Eakin, 2018; Nohrstedt, 2022)		
The issue is framed in a new or nuanced way	The focusing event highlights the deficiencies of the status quo system, and provides an opening for thinking about the problem, and its solutions, in new or nuanced ways. <i>As opposed to: The same narrative is attached to the problem, reinforcing the status quo.</i>	○ There is a clear causal image and narrative (i.e., in the media, in dialogue) surrounding the roots of the problem and how this relates to current ways of addressing the problem.

(E.g., Baumgartner & Jones, 1993; Birkland, 1997 & 2020; Sabatier & Weible, 2007; Howlett et al., 2009)		
There is political will and resources to act	The focusing event prompts leadership to not only react to the crisis, but also to engage in proactive, solutions-oriented action—meaning that they enact formal institutional and policy changes, as opposed to inaction. <i>As opposed to: Leadership is unresponsive to the policy community and their constituents.</i>	○ Ministers establish a working group to evaluate policy options. ○ Politicians commit funding towards addressing the perceived problem. ○ Leaders express and maintain interest in solving the problem.
(E.g., Kingdon, 2003/1984; Birkland, 1997 & 2020; Gilens & Page, 2014; Béland & Howlett, 2017; Busemeyer et al., 2020)		
Actors and coalitions are able to engage in collective action	Post-event, policy champions are quick to leverage existing resources, social networks, and political capital (i.e., access to decision-makers) to promote core policy beliefs, to build collaborative partnerships, to mobilize knowledge, and to develop shared understandings of the public issue and its attached solutions. <i>As opposed to: There is an absence of cooperation within the community.</i>	○ Policy champions convene together actors and organizations who may be working in silos. ○ A grassroots initiative forms in response to the event in order to address a perceived governance or service gap. ○ Actors and organizations create spaces for dialogue and learning.
(E.g., Sabatier & Weible, 2007; Gore, 2014; Cairney, 2013; Wiering et al., 2017; Capano & Galanti, 2020)		
Feasible policy solutions are readily available	Policy champions have cohesive, actionable policy packages to propose to decision-makers. <i>As opposed to: The policy community is fragmented, lacks cohesive solutions, and is unable to propose a clear pathway forward.</i>	○ Actors seek an audience with decision-makers to propose agenda items and policy solutions. ○ Actors seek to promote these ideas (e.g., through the media).
(E.g., Birkland, 1997; Kingdon, 2003/1984; Schön, 2010; Surminski & McCraine, 2015; Nohrstedt, 2022)		

2.7 Situating focusing events within longer-term institutional change

2.7.1 Policy change as a long-term, non-linear, and fluid process

Some studies suggest that policy windows are more likely to occur when preceded by other cumulative, cascading, and compounding shocks and stressors, as compared to one-off events (O'Donovan, 2017; DeLeo et al., 2021). In a study of flood buyout policy in the United States of America [USA], O'Donovan (2017) found that state-level policy change tends to occur not after a singular event, but as a result of cumulative flood experiences occurring over the duration of three to ten years. Such findings indicate that major policy changes are more likely to occur as a result of

recurrent events and persistent stressors as opposed to in response to singular, rare events. This aligns with longitudinal policy analysis frameworks which assess policy changes within the context of multi-year patterns and processes (e.g., Sabatier & Weible, 2007; Capoccia, 2015; Thelen & Mahoney, 2015).

These findings are also consistent with Nohrstedt's (2022) conceptualization of 'lagged effects,' which situates post-disaster policymaking within a longer-term timeframe, indicative of the time necessary to engage in policy-oriented learning and development, agenda setting, and coalition building. This framing aligns with Birkland's (1997: p.23) assertion that the focal nature of an event should be perceived of in terms of a continuum (i.e., more or less focal), as opposed to a dichotomy (i.e., focal or not focal). As such, the immediate effects of a disaster event on policymaking may not always be visibly apparent, but rather, transformation and reform can be situated within a broader continuum of historical context and continuous policy development (Birkland, 1997; Nohrstedt, 2022). As policy-oriented learning is the result of accumulated knowledge and experiences, rather than the sole result of singular event, policy reform can manifest slowly with the associated learnings being reinforced both over time and in the immediate aftermath of a major shock event (Birkland, 2009; O'Donovan, 2017; Nohrstedt, 2022).

Consequently, changes that do occur as a result of a focusing event are rarely linear, but rather occur as part of a spectrum of formal (e.g., updated legislation, new funding programs) and informal (e.g., household disaster preparedness, changing risk perceptions) actions occurring across varying timescales and levels of governance (Birkmann et al., 2010). Post-disaster responses can be linked to both direct (e.g., flood damages) and indirect (e.g., supply chain disruptions) disaster impacts to varying degrees (Birkmann et al., 2010). Changes may occur as both an unplanned response to a current hazard event or as a preventative measure in preparation for future events (Birkmann et al., 2010). The scale of the disaster, both in terms of geographic distribution and the level of calamity, and event singularity will influence the extent of institutional and organizational change possible (Birkmann et al., 2010).

Finally, policy success, and transformation, is highly dependent on the actors and institutions involved, particularly as it relates to who is empowered to influence agenda setting and to make path-defining decisions, how and to what degree they are able to meaningfully engage, and who is excluded from these processes. Studies in urban sustainability and transformation highlight the power of collaborative actor networks (e.g., communities of practice) in building institutional and governance capacities at the local and regional scales (e.g., Healey, 1998; Innes & Booher, 2003; Wolfram, 2016).

However, integral attributes of effective policy communities, such as collaborative trust-based relationships, synergistic objectives, and shared values, norms, and identities, (Kingdon, 2003/1984), take time and coordination to develop (e.g., Fast & Mabee, 2015; Hall, 1999). Because the core beliefs of actors and coalitions evolve over time alongside dynamic socioecological realities, it is important to examine policy trends and feedback loops over longer timeframes (Sabatier & Weible, 2007; Schmid et al., 2019). Shifts in the governing coalition—those within a policy subsystem who are empowered to influence institutional priorities, to engage in agenda setting processes, and/or to make decisions—thus fundamentally influence the receptiveness of sociopolitical actors to new policy ideas.

2.8 Paradigm shifts: A whole-of-society and whole-of-government effort

Although policy-oriented learning and focusing events can each play an important role in shifting policy paradigms, it is necessary to examine how these processes intersect with and co-evolve alongside the dynamic relationships of the policy subsystem. Firstly, the general public typically only becomes acutely aware of the policy agenda when highly salient and visible issues emerge, such as via a disaster, leading to a rise in public pressure to solve the perceived issue. Secondly, policy champions and advocacy coalitions are actively involved in cultivating distinctive policy cultures at the interface of the systemic and institutional agendas through collective learning and relationship-building. These groups are critical in mobilizing action in the event of a policy window, such as following a shift in the governing coalition (e.g., after an election) or a focusing event (e.g., in the post-disaster period). Thirdly, institutional actors (e.g., public servants) routinely engage with the public and the broader policy community in an effort to develop the institutional agenda. Fourthly, decision-makers prioritize which public issues to allocate funding and resources to, and implement policy instruments (e.g., through legislation) within the decision-making agenda. Based on this literature review, **Figure 4** illustrates how policy actors respond to and/or leverage mechanisms of change, within their own spheres of influence, to intervene in the agenda setting process to advance particular objectives.

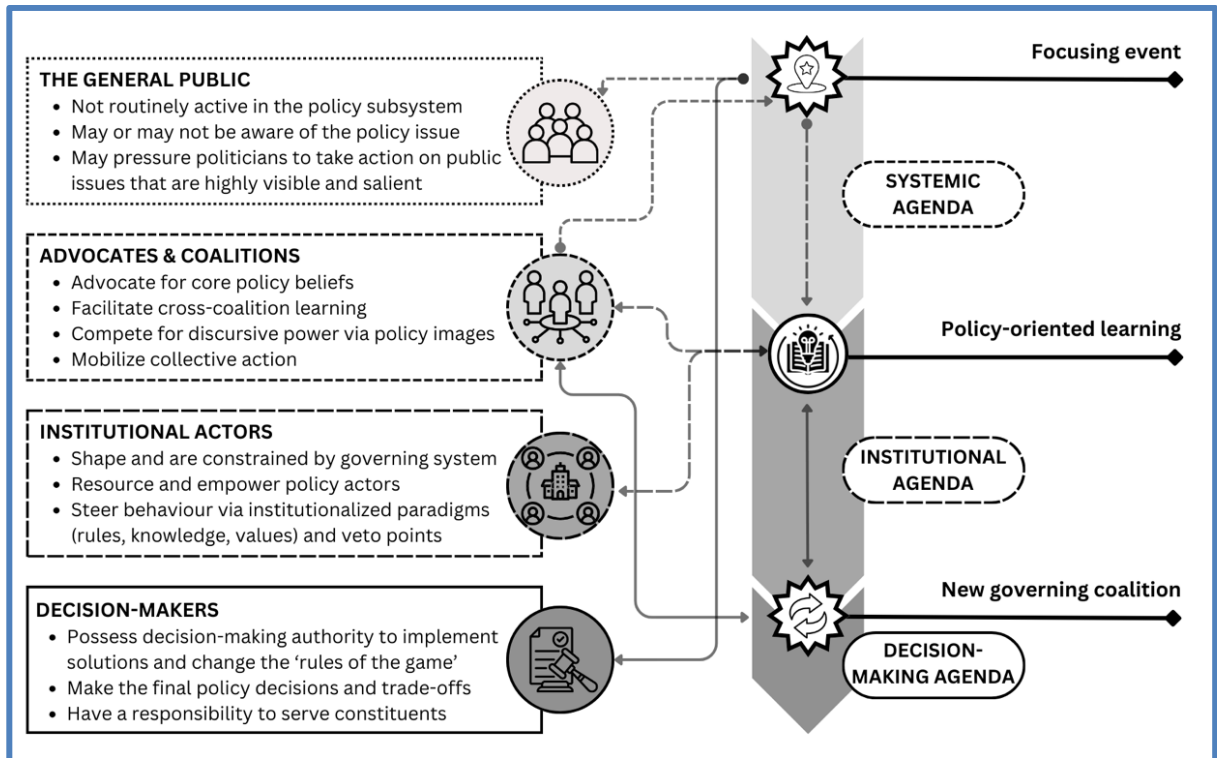


Figure 4: Actors, agenda setting processes, and mechanisms of policy change
(adapted from Birkland, 1997 & 2020; Kingdon, 2003/1984; Sabatier & Weible, 2007;
Howlett et al., 2009; Birkmann et al., 2010; Gore, 2014)

2.9 An evaluative framework for assessing post-disaster policy change

Through an examination of the relevant scholarly literature on public policy formation and change, the following bodies of literature were identified as being particularly salient within the context of transforming FRM, CCA, and DRR policy and governance regimes: (1) focusing events and policy windows, (2) systems-thinking, (3) path dependency and historical institutionalism, (4) policy-oriented learning and gradual institutional development, and (5) policy champions and advocacy coalitions. As described further in Chapter 3, this literature review was an iterative process. Through preliminary interviews and fieldwork, I identified the need to expand upon an initial focus on focusing events and policy windows to better reflect the longer-term processes of institutional learning and development that also contribute to policy changes. As such, this literature review revealed three interrelated mechanisms of policy change:

- (1) a policy window triggered by a focusing event,
- (2) institutional development through policy-oriented learning, and
- (3) changes in relationships among governance actors.

Findings from the literature were used to construct an evaluative framework, shown below in **Table 4**, for assessing post-disaster policy change. This framework is employed in Chapter 5 to evaluate the potential impact of a major Canadian flood to influence policy and governance at multiple scales. This evaluative framework is used to identify the presence or absence of conditions that provide evidence of one or more of the following, as applicable to different post-disaster outcomes and processes:

- (1) that a potential focusing event has occurred,
- (2) that a policy window has formed, and/or
- (3) that policy-oriented learning has occurred or is occurring.

Table 4: An evaluative framework for assessing post-disaster policy change

	Condition	Description	Present?
Evidence of a potential focusing event	<i>Rarity</i>	The event is rare and occurs suddenly with little to no warning	Y/N
	<i>Scale</i>	The event is high in magnitude	Y/N
	<i>Impact</i>	The event produces severe impacts that may be highly concentrated	Y/N
Evidence of policy window formation	<i>Issue attention</i>	The policy issue is both highly visible and salient, receiving relatively more attention as compared to prior to the event	Y/N
	<i>Issue framing</i>	The perceived problem, its root causes, and potential solutions is framed in a new, nuanced, or compelling way	Y/N
	<i>Collective action</i>	There is relatively substantial collective interest and momentum within the policy community to engage in solution-seeking and policy advocacy, as compared to prior to the event	Y/N
	<i>Available solutions</i>	There are feasible policy solutions readily available to be considered by policymakers and/or decision makers.	Y/N
	<i>Commitment to action</i>	Decision-making authorities commit time and resources towards solving the perceived problem	Y/N
Evidence of policy-oriented learning	<i>Empowerment of solution seekers</i>	Decision-making authorities empower institutional and non-institutional actors to engage in governance activities, and are generally receptive to the feedback of the policy community	Y/N
	<i>Expansion of the existing solution space</i>	Governing institutions engage in the exploration, development, testing, and/or implementation of new or revised policy instruments	Y/N
	<i>Revision of policy goals</i>	Governing institutions revise policy objectives—and the mechanisms used to achieve these intended outcomes—as a result of new evidence and/or experiences	Y/N

Chapter 3: Research Design and Methods

3.1 Overview

This study utilized qualitative research methods to document the outcomes of the 2021 BC atmospheric rivers flood event, and to assess the disaster's subsequent influence on local, regional, and provincial flood risk management policy and governance. Empirical methods included semi-structured interviews (N=31), observational fieldwork (e.g., site visits, public events), and a traditional (i.e., narrative) review of scholarly literature and secondary sources (e.g., media reports, policy documents).

3.2 Research paradigm and positionality

3.2.1 Living with Water

This study is situated within the Pacific Institute for Climate Solutions [PICS] funded Coastal Adaptation: Living with Water [LWW] project, a multi-year, multidisciplinary research partnership between scholars and 'solution seekers' (i.e., non-academic partners) working to advance coastal adaptation within BC. Project partners include the University of Waterloo, University of British Columbia, Simon Fraser University, Wageningen University & Research, Tsleil-Waututh Nation, Squamish Nation, City of Vancouver, City of Surrey, District of Squamish, West Coast Environmental Law, and Ducks Unlimited Canada/Nature Force. Living with Water's core objectives, as detailed in **Figure 5**, aim to advance a FRM paradigm shift in British Columbia by:

- (1) centering Indigenous and local community values and knowledges within flood adaptation;
- (2) advancing the uptake of novel flood risk management approaches (e.g., managed retreat, nature-based solutions/green infrastructure); and
- (3) supporting the development of inclusive, collaborative, and integrated models of regional flood governance (LWW, 2022a).

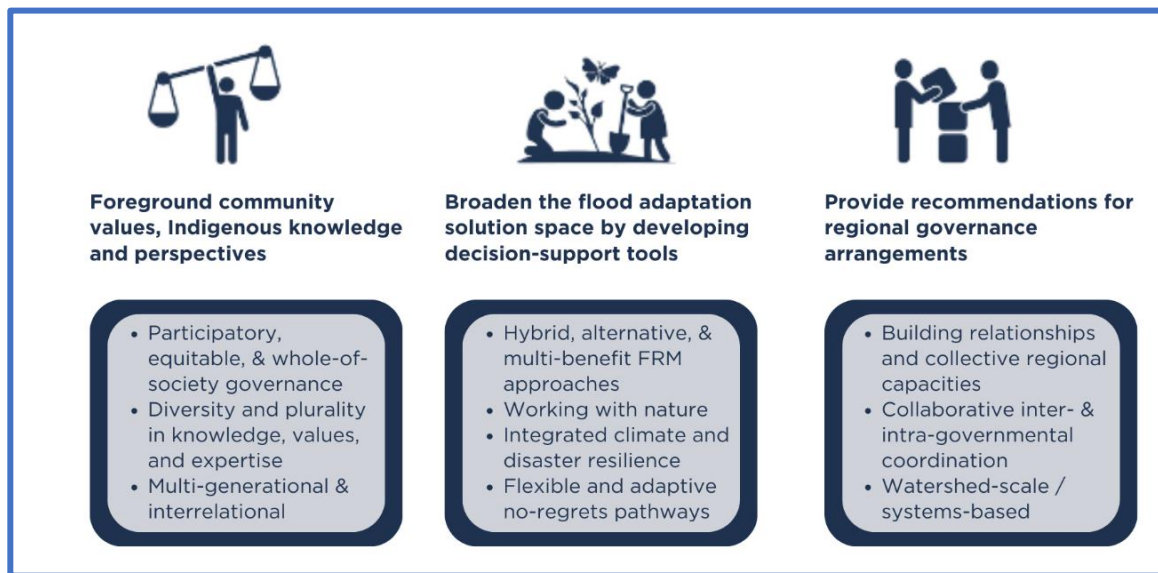


Figure 5: The Living with Water research paradigm (LWW, 2022a & b)

LWW fundamentally informed this study’s research design. The project fostered a collaborative discursive space that enabled knowledge sharing, collective learning, and the co-creation of values and objectives across all project partners and case studies. Reflexivity is a central tenet of the LWW research paradigm, since all researchers are influenced by their own identities, experiences and worldviews and can bring unconscious biases into the research (Katz, 1994; Darwin Holmes, 2020; Lokot, 2021). When left unaddressed, this can result in the exclusion of certain knowledges, values, and perspectives, create power imbalances between researchers and study participants, and lead to extractive research practices (Katz, 1994; Lokot, 2021; Tuhiwai Smith, 2012; Öz & Timur, 2023). Subsequently, many scholars across various disciplines advocate for reflexivity, activism, allyship, and pragmatism within academia (e.g., decolonial research; participatory action research) to reduce potential harms and to better serve local communities (Williston, 2016; Wong et al., 2020; Dierckx et al., 2021). As such, the LWW team was encouraged to reflect upon personal values, to confront underlying assumptions, and to integrate diverse, multi-disciplinary perspectives. To achieve this goal, the LWW team undertook various experiential learning activities (e.g., interactive workshops, guided fieldtrips, book club), as well as personal and group reflections (e.g., writing exercises, theme-group sessions).

A core LWW objective is to advance the ‘Indigenization’—the act of foregrounding and integrating “Indigenous ways of knowing, being, doing, and relating” (University of Waterloo, n.d.)—

of flood adaptation. This focus arises from the fact that many disciplines and sectors are rooted in Western colonial traditions, often resulting in the (re)production of certain knowledges, expertise, values, and methodologies over others (Tuhiwai Smith, 2012). Many Canadian FRM systems, including those within the LWW study area, emerged as both an outcome and an act of colonization, and thus continue to perpetuate power imbalances, socioeconomic inequities, and Western ways of knowing and doing (e.g., the separation of land, water, and people). Thus, this study aims to explicitly detail the settler-colonial history of Sumas Prairie and BC more broadly. An example of these values being put into practice is the foregrounding of Halq'eméylem language throughout this text. Western place names tend to take precedence over Indigenous ones, which are often excluded entirely or given a secondary designation (e.g., footnotes, brackets, italicization) (Webster, 2017; Tuhiwai Smith, 2012). Yet language is an essential way of connecting to and honouring place, history, identity, and relationships (Anderson, 1983; Webster, 2017).

Similarly, LWW sought to promote values-based CCA approaches. Values refer to the core beliefs or preferences influencing how an individual or group interprets information, prioritizes choices, and behaves accordingly (Goddard et al., 2016; Reid et al., 2023). As such, the values of institutions and their actors, in addition to informal rules (e.g., societal norms, practices), formal rules (e.g., legislation, regulation), and knowledge systems (e.g., evidence-based, experiential), underpin all decision-making processes (Goddard et al., 2016). While values are often conceived of as being economic (e.g., cost-benefit analysis), welfare-oriented (e.g., personal freedoms), or universal (e.g., security), such approaches neglect the diversity of subjective, intangible, and intrinsic values held within a given community (O'Brien & Wolf, 2010; Goddard et al., 2016).

Rather than taking a top-down or expert-driven approach to climate adaptation planning, values-based planning approaches encapsulate diverse local perspectives, experiences, and knowledges to better tailor adaptation solutions to specific place-based contexts (O'Brien & Wolf, 2010; Omondi, 2020; Reid et al., 2023). Through participatory processes, community members and decision-makers can engage in the co-production of shared values, new meanings, and nuanced understandings of diverse or conflicting perspectives (Armitage et al., 2011; Sheppard et al., 2011; Cone et al., 2013; Omondi, 2020; Reid et al., 2023). In doing so, CCA strategies can better align with local and institutional contexts, gain social acceptability and community buy-in, and promote equitable and just outcomes through the meaningful inclusion of disproportionately-impacted and historically disenfranchised groups (O'Brien & Wolf, 2010; Armitage et al., 2011).

Living with Water’s emphasis on the role of values-based coastal adaptation planning processes prompted the development of internal and public facing values statements in the early project phases. Developed through an iterative and collaborative process, the values statement aims to centre core values and streamline overarching objectives across the project. The central LWW values that informed this research are shown in **Figure 6**.



Figure 6: Living with Water’s project-wide core values (LWW, 2022b)

3.2.2 Positionality statement

As an external researcher and a guest on ancestral and unceded territories, it is my responsibility to be aware of potential power imbalances and divergent perspectives. Throughout the research process, I wanted to ensure that I was engaging with local communities, knowledge holders, and flood-affected groups in a culturally competent and trauma-informed manner. As such, I sought to be intentional in (1) what research problem(s) I was most capable of addressing, (2) whose perspectives I was best suited to represent based on my own positionality, (3) what gaps could be supplemented through other means, and (4) how my research can contribute to tangible outcomes (e.g., amplifying underrepresented voices, supporting existing local initiatives, providing policy recommendations).

My research paradigm is two-fold. Firstly, my ontological and epistemological framework generally lies within the realms of post-modern constructivism and pragmatism. In other words, social realities are subjective, non-static, context-dependent, and co-constructed; hence, these realities can be critically examined through the use of mixed methods and various discursive and narrative approaches

that allow for multiple truths and ways of knowing (Moon & Blackman, 2014; Patel, 2015). As such, I apply an interdisciplinary, systems-based lens to research. Secondly, because academia creates unique opportunities to access and influence decision-making spaces, I have an obligation to contribute to positive social change by ensuring that my research is action-oriented, aligns with local initiatives, and is accessible and useful to practitioners and decision-makers (Hobson, 2006; Dierckx et al., 2021).

In addition to this research, opportunities to contribute to complementary initiatives and support these objectives (e.g., enhancing collaboration, advancing FRM solutions) continue to allow me to contribute to tangible outcomes and ground-truth my research findings. Through my involvement with the Living with Water project and in my professional experience working for Partners for Action, a research initiative with the University of Waterloo's Faculty of Environment, I have had multiple opportunities to volunteer with the Lower Fraser Floodplains Coalition [LFFC], a collective of organizations working to advance holistic and collaborative flood governance in BC. Through semi-structured key informant interviews, I first became aware of the LFFC, known as the 'Build Back Better Together Collaborative' at the time, and their plans to host a 'Build Back Better, Together Forum' in Abbotsford, BC in the summer 2022. Because British Columbia's FRM policy community is relatively small and tight-knit, there is overlap between Living with Water-affiliated researchers, solution seekers, and board members and the LFFC (e.g., the University of British Columbia's School of Architecture and Landscape Architecture, West Coast Environmental Law, Resilient Waters). Similarly, there is overlap between the LFFC's ongoing work and that of Partners for Action.

Consequently, I have been involved in numerous LFFC initiatives to date, which have informed my research paradigm and my own understanding of BC's FRM policy and governance landscape. In 2022, I volunteered as a notetaker at the Build Back Better, Together Forum; since then, I have volunteered as a notetaker, technical moderator, and breakout room facilitator in subsequent virtual FRM-related workshops organized by the LFFC, including the Designing for Flood Resilience workshop series (2022-2024) and the Lower Fraser Floodplains Dialogue for Regional Action: Mid & Up River Gathering (2024). These experiences have been invaluable in enhancing my personal understanding of the case study context and the evolving flood risk governance landscape in BC, and have enabled me to centre local priorities and perspectives within my research paradigm. However, it is important to note that this thesis does not contain any insights or details from these events and processes that were not already made publicly available at the time of thesis submission. All reported findings related to the LFFC's work are grounded in interview data and public outputs (e.g., reports).

This research was conducted independently of these other initiatives. As a researcher, I was free to choose my own topic within the broad coastal climate change adaptation mandate of the Living with Water project. Research design, case study selection, methods of inquiry, and analysis of results were in no ways influenced or guided by Partners for Action or the Lower Fraser Floodplains Coalition.

3.3 Research methods

3.3.1 Case study selection criteria

I chose to examine a case study of Sumas Prairie, Abbotsford for the following reasons: (1) the municipality's proximity to the Living with Water project study area; (2) the region's complex flood risk management history and interjurisdictional challenges; (3) the magnitude of disaster impacts experienced by the community in 2021; and (4) the locality's influence on broader regional and provincial priorities (e.g., agricultural sector). Refer to Chapter 4 for a detailed description of the case study community context. The case can be situated within LWW's focus on regional coastal, deltaic, and riverine flood risk management and governance, which includes case studies spanning across the British Columbian [BC] south coast and the Fraser Basin. Additionally, although this research focuses on flood risk management policy and governance within the BC context, the province shares a number of watersheds and basins with Washington State, including the Sumas and Nooksack Rivers. As such, some impacts in Sumas Prairie can be traced back watershed conditions across the border; therefore, limited research was also conducted on Whatcom County, Washington to gain a base understanding of the risk drivers and disaster impacts in this jurisdiction, as well as the transboundary governance arrangements that preceded and emerged from the event.

3.3.2 Semi-structured key informant interviews

3.3.2.1 Participant sampling and recruitment

I conducted semi-structured key-informant [KI] interviews (N=31 interviews with N=30 key informants) intermittently from May 2022 to May 2023. Through an assortment of open- and closed-ended questions, as well as follow-up inquiries, this format facilitates a conversational exchange of dialogue between both parties (Adams, 2015). Semi-structured interviews are beneficial in establishing rapport and in building trust among participants and researchers, and allow for the flexibility to delve into new streams of inquiry based on real-time answers (Adams, 2015). Open-ended inquiry can lead

to more detailed answers, as compared to close-ended questioning, while permitting participants to explore a broader range of potential responses based on their own subjective experiences (Desai & Reimers, 2019; Hansen & Świdarska, 2024). As such, some questions were left intentionally broad and open to individual interpretation as to not introduce researcher bias that could influence participant answers. Interview questions varied among participants, as no two key informants had the exact same guide; however, certain themes and key questions were consistent across all interviews, and these were guided by the literature review outlined in Chapter 2. A sample guide can be found in **Appendix A**.

I identified KIs through a stratified sampling method to include representation from a broad array of decision-making and organizational bodies, as guided by the literature and a scan of the various organizations and actors working within the BC FRM policy space. I recruited participants primarily through email or internet sources (e.g., staff directory, publicly named in news article). Initial contact included an email script accompanied by an attached formal recruitment letter. If prospective KIs expressed interest in the research, an information and consent letter was sent, and an interview was scheduled. A sample email script, recruitment letter, and information and consent letter can be found in **Appendices B, C, and D**, respectively. In some cases, participants were identified by their colleagues, with whom contact was initiated by the researcher. Additional organizations were identified through snowball sampling as the research unfolded and relevant staff were then able to be recruited.

I conducted interviews with government staff and elected officials (e.g., local, provincial, federal), non-governmental organizations (e.g., community, environmental, agricultural), and experts on flood risk management, disaster risk reduction, and climate change adaptation (e.g., engineers, emergency management). Inclusion criteria were as follows: (1) affiliation to an organization with public or policy influence; (2) knowledge of flood response and recovery, flood risk management, emergency preparedness, water governance, watershed planning, flood infrastructure, climate change adaptation, and/or specific sectors (e.g., agriculture); (3) knowledge of the 2021 atmospheric rivers event; and (4) some knowledge of the affected case study community (Sumas Prairie, Abbotsford) or the wider regional (Fraser Valley) and provincial (British Columbia) contexts. Some key informants represented multiple strata (e.g., local resident + subject matter expert) or were able to speak to multiple scales of governance; however, questions focused on the KI's primary professional affiliation.

Thirty individuals participated in this study for a total of thirty-one distinct interviews. During recruitment, I sought to obtain a balance of perspectives, aiming for two to five participants from each

stratum in an effort to understand how post-disaster FRM policy and governance was being perceived across the whole-of-society and government; however, representation was ultimately dependent on recruitment responses. **Figure 7** shows a strata breakdown, related to the KI's primary organizational affiliation (left) and jurisdictional scale of perspective they could speak to (right). A total of seventy-seven individuals were either contacted by the researcher or directly referred by a colleague. Of these, thirty individuals agreed to participate in the study, seven made referrals within their organization, eight declined to be interviewed, and thirty-two did not respond. Potential challenges for participation in this study during this time period may have included ongoing legal constraints, the occurrence of flood and wildfire activations, and capacity constraints; however, efforts were made to bridge any gaps in strata and interviews concluded once the responses became saturated. **Appendix E** provides anonymized participant descriptions for context.

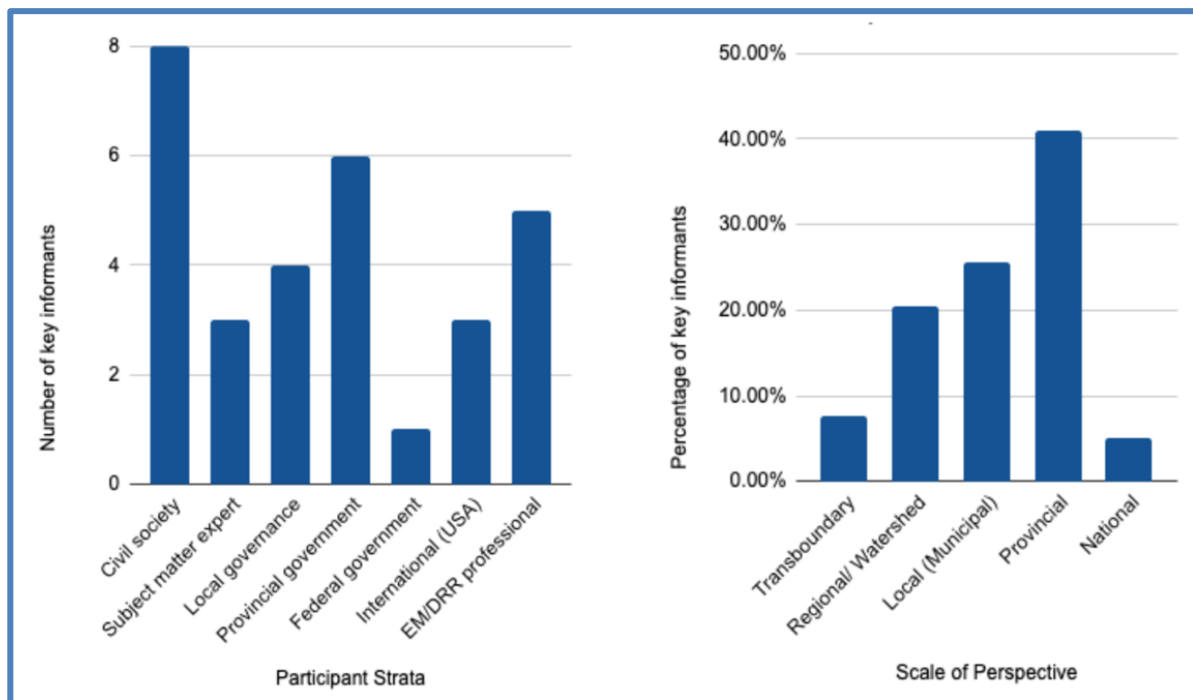


Figure 7: Key informant strata distribution

Regarding strata representation, three points should be noted. Firstly, this study did not seek to interview homeowners, landowners, or First Nations community members affected by the floods. Instead, key agencies (e.g., community, agricultural, and First Nations-led organizations) were identified to provide broad insights, which were supplemented through secondary sources. Secondly,

City of Abbotsford staff and elected officials declined to participate. The City’s ongoing involvement with the *Sumas Flood Class-Action Lawsuit*—filed by Sumas Prairie landowners against the City, Fraser Valley Regional District, and Province of BC—was the reason given. Hearings commenced in May 2024 (Slater Vecchio LLP, 2024), thus interviewing city representatives was not feasible within this study’s timeline. Finally, provincial government staff were split into two strata. Although members of the BC Public Service, three KIs were classified as “EM/DRR professional” to reflect their specific training, expertise, and work within the disaster risk reduction and emergency management fields. All other provincial participants, including KIs working on FRM and CCA, are classified as “provincial government.” Despite sizeable provincial representation, KIs were chosen to provide diverse internal perspectives relating to their involvement in specific programs, divisions, and departments across various ministries

3.3.2.2 Data collection, coding, and analysis

Verbal consent was obtained at the beginning of each interview, and a detailed information and consent form was provided to KIs in advance. The verbal consent script is listed in **Appendix F**. Interviews ranged from thirty to sixty minutes. All participants opted for virtual interviews conducted through either Zoom or Microsoft Teams.

Interviews were audio-recorded and transcribed verbatim through a two-step process. First, the audio file was uploaded to *Otter.ai*, an online transcription software to generate a baseline transcript. Next, I manually verified the accuracy of the generated transcript by listening to the audio playback while following along with the text and making necessary edits. Following this process, the transcript was cleaned by removing unnecessary repeated or filler words and adding punctuation for enhanced readability. Answers often reflected an informal stream of consciousness, rather than grammatically correct responses; however, no major alterations were made in terms of overall wording and sentence structure. During transcript cleaning, I redacted identifying characteristics and other disclosures of personal information that were unrelated to the interview itself. Upon the completion of transcription, all associated audio and video files were deleted.

Clean interview transcripts were circulated back to KIs within approximately 72 hours of the interview, allowing key informants to review the transcript, to confirm the accuracy of the data reported, to redact or clarify the initial statements made, and/or to add additional context while the interview was still fresh in their memory. This process, known as member checking or participant validation, seeks to

reduce researcher bias, validate the results, reduce the potential for misinterpretation, and ensure that KIs are actively engaged in the research process and fully comfortable with the data shared (Doyle, 2007; Birt et al., 2016). Furthermore, member checking gives key informants the opportunity to revisit and reflect upon their research contributions, enabling them to expand upon their earlier statements, to clarify points that are vague or may be easily misinterpreted, and to remember new information that they feel may be beneficial to include in the study (Doyle, 2007). This expectation was introduced as part of the pre-interview consent documentation process and reaffirmed when cleaned transcripts and the post-interview feedback letter, found in **Appendix G**, were returned to KIs. At this time, KIs were advised that if no changes were necessary, there was no further follow-up requirement.

Of the thirty-one interviews conducted, only five KIs responded with modifications to the original transcript, while one responded that they had reviewed the transcript and no changes were required. The remainder of key informants did not respond with any feedback. Among the member-checked transcripts, no major redactions or alterations took place. Several key informants chose to add additional context and links to resources that would help to triangulate their responses, thus enabling them to “co-construct new meanings” from the data (Birt et al., 2016: p.1804). For instance, KIs who returned transcripts, with track-changes enabled, had the opportunity to correct inaccuracies (e.g., specific dates or figures) that were misspoken in the moment, while others chose to add URL links, attachments, and additional context that further validated their experiences and subject matter expertise.

Key informants were given the option for their study data to remain anonymized, attributed, or to take a hybrid approach. Several KIs indicated that, by being given this choice, they felt more comfortable speaking freely during the interview, knowing that they would have the opportunity afterwards to review the transcript and to determine which quotes should be anonymized. KIs identified select portions of the transcript that they wished to be anonymized, and were made aware that if the researcher wished to include any attributed content, additional consent would be obtained.

Although it was the intention to anonymize most, if not all, direct quotes used in this text, gaining consent for potential attributions from the onset was done for two reasons. Firstly, it allowed the researcher to gauge participant preferences, as KIs can sometimes feel strongly in favour of attribution (Akuffo, 2023). Giving key informants this option contributes to the democratization of research processes and respects a participant’s autonomy to choose how their data, and in turn voice, is represented (Akuffo, 2023). Secondly, while anonymity aims to protect research integrity and

participant safety, it also bears the risk of decoupling valuable contextual information from the KI's answers (Nespor, 2000; Akuffo, 2023). Some KIs agreed to the use of attributed quotes where the identification of the speaker's background was necessary to provide context and meaning, or where the inclusion of certain details could reasonably lead to deductive identity disclosure because of the highly-specialized nature of the KI's work and the information they are privy to (Kaiser, 2009).

Finalized transcripts were inputted into the computer-assisted qualitative data analysis software, Nvivo, to code the data and to identify common themes. During the first coding cycle, a mixture of descriptive (topic) and simultaneous coding was utilized, providing a categorized inventory to serve as the foundation for the second coding cycle (Saldãna, 2009). Descriptive coding is a bottom-up approach used to identify specific topics, such as *Disaster Financial Assistance Arrangements*, and to relate these topics to overarching themes, such as *Funding*. Where passages contained multiple overlapping topics, simultaneous coding was used to distinguish themes and to identify emergent patterns and relationships (Saldãna, 2009). For instance, a passage referring to post-disaster changes in the cost-sharing of disaster financial assistance between governments may be coded under multiple categories, such as *Disaster Financial Assistance Arrangements*, *Jurisdictional Roles & Responsibilities*, and *Post-Disaster Changes*. Following an initial round of coding, redundant codes were merged, and sub-codes became nested under a primary parent code (e.g., *Funding > Disaster Financial Assistance Arrangements*). A second round of theoretical (selective) coding was used to thematically link categories to core concepts, such as *path dependency* or *enabling conditions*, in order to ground theory (Saldãna, 2009). The first round of coding was guided by my initial literature review, while the second round of coding was informed by the conceptual framework that emerged from the first pass. **Figure 8** outlines this process.

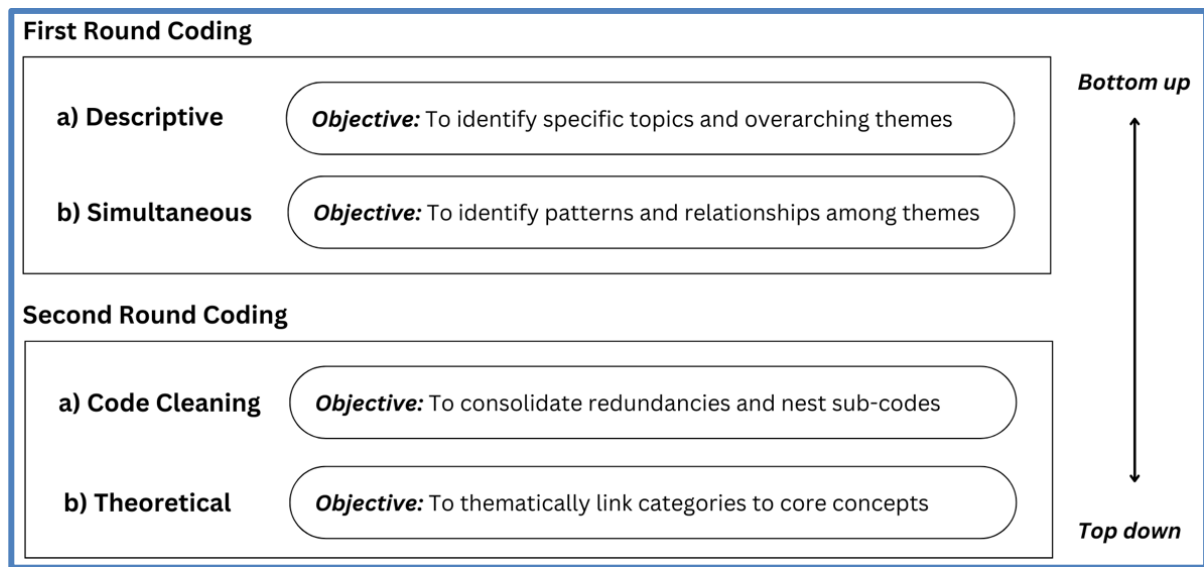


Figure 8: Coding process overview

3.3.3 Secondary source materials

Secondary sources (approximately n=300) were used to gain additional context, to triangulate data, and to access updates on local and provincial disaster recovery as these processes evolved in real-time. Materials included policy documents and white papers (e.g., *BC Flood Strategy*, *Climate Preparedness and Adaptation Strategy*), news coverage from reputable local (e.g., Fraser Valley Current, Vancouver Sun) and national newspapers (e.g., Globe and Mail, CBC News), and government news releases (e.g., live webcasts). These were not coded line-by-line in NVivo, but rather, organized and tagged in folders related to sub-themes. No primary research was conducted in collaboration with First Nations due to time and feasibility constraints related my ability to meaningfully co-develop non-extractive research in accordance with the First Nations Principles of Ownership, Control, Access, and Possession. As such, publicly available sources, such as news interviews with First Nations leaders and information hosted on First Nations government websites, provided invaluable Stó:lō and Coast Salish perspectives.

3.3.4 Field visits and observations

I conducted in-person fieldwork in the Fraser Valley between May and August of 2022. General observations of flood damages (e.g., homes, roads, bridges), public infrastructure (e.g., Sumas diking system, Barrowtown Pump Station), recovery efforts (e.g., field remediation), and relevant

waterways (e.g., Vedder Canal, Nooksack River) were documented and photographed. I carried out site visits by foot and/or vehicle throughout the Sumas Prairie, Abbotsford and Whatcom County, Washington regions. I also embarked on an informal driving tour of Highways 1, 5, and 7 with a transportation professional familiar with the affected areas. The guide, a long-haul semi-truck driver who has routinely travelled these routes for 25+ years, was able to point out newly damaged infrastructure, debris flow sites, and stream channel changes. These first-hand observations, which included the 2021 flood and wildfire damages to Merritt and Lytton, respectively, provided crucial insights into my understanding of the full extent of the disaster. **Figure 9** shows the primary field study area extending between the Fraser (north) and Nooksack (south) Rivers (left), as well as Highways 1, 5, and 7—all of which were damaged by the AR event. Since Highway 8 between Merritt and Spences Bridge was still inaccessible at that time, a detour was made via Highway 97C to Ashcroft.

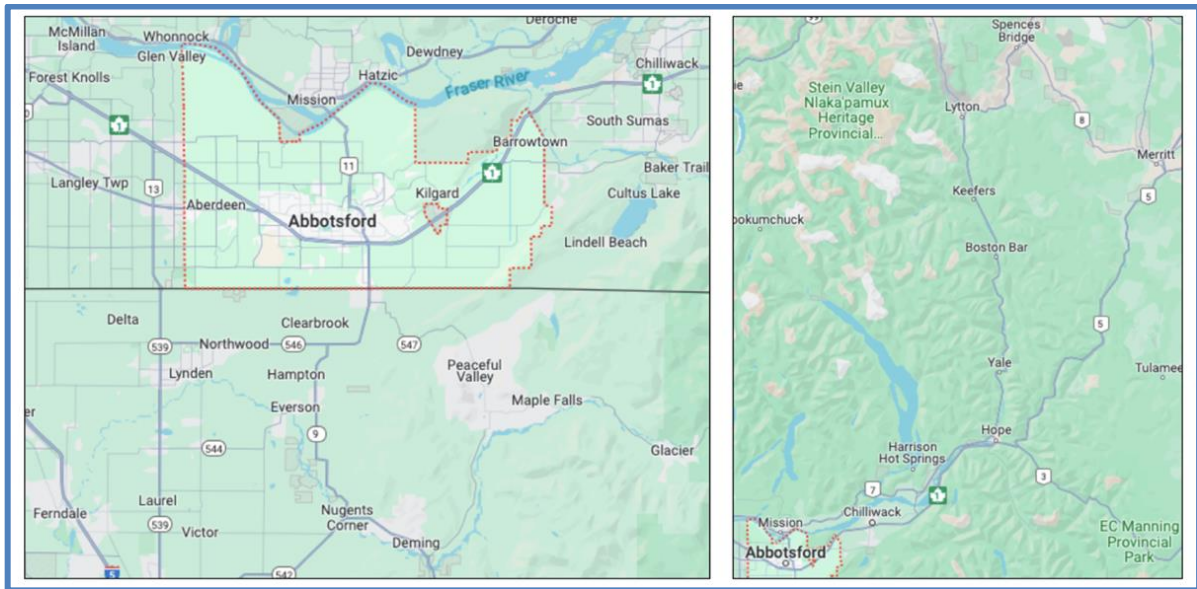


Figure 9: Map of field site and broader regional area affected by the disaster (Google Maps)

I attended a public information session on Abbotsford’s *Long-term Flood Mitigation Plan* for Sumas Prairie in May 2022. Another in-person event attended in May 2022 was the museum exhibition, *Semá:th Xō:tsa: Great Gramma’s Lake*, on display at the Evergreen Cultural Centre in Coquitlam, BC. The exhibition provided a Stó:lō perspective on the AR event, conveying Sumas Prairie’s rich cultural heritage and ecological significance through art and storytelling, shown in **Figure 10**. Finally, I

virtually attended relevant public meetings, such as City of Abbotsford council meetings and Whatcom County's Integrated Floodplain Planning sessions, throughout the duration of this study (2022-2024).



Figure 10: The exhibition at Evergreen Cultural Centre (Watterodt, May 2022)

3.3.5 Literature review

I conducted a traditional (narrative), non-systematic literature review (Grant & Booth, 2009; University of Toronto Library & Information Services, n.d.) on relevant scholarly research. Policy analysis often involves an iterative process of identifying, defining, specifying, and making sense of the perceived policy problem (Coulthart, 2017). Similarly, the literature review process was iterative, beginning with a review of literature on post-disaster policy change and path dependencies within flood risk management. Initial interview themes and questions centered around the significance of the 2021 AR event as a focusing event for post-disaster change, using Multiple Streams Approach as guiding theoretical basis. However, throughout the interview process, key informant responses revealed additional themes (i.e., institutional learning, collaborative governance) and subsequent interview guides were adjusted to incorporate these emergent themes, while retaining the earlier identified themes and the standard questions posited to all KIs. This prompted a second round of literature review that occurred both simultaneously and following the interview period.

3.4 Framework development and results validation

Because of the complexity and diversity of public policy issues, many scholars consider policy analysis to be an inherently interdisciplinary field of inquiry, necessitating the use of mixed methods and/or multiple theoretical frameworks to accurately assess policy problems (e.g., Arts & Tatenhove, 2004; Hogan & Howlett, 2015; Coulthart, 2017). Policy problems are socially-constructed, meaning that public issues are subjectively interpreted, experienced, and understood, depending on factors such as the actors involved, the scale of analysis, and the processing of identifying, scoping, and defining the perceived problem (Coulthart, 2017). Robust policy research takes into account multiple ways of framing and assessing policy problems, recognizing that each theoretical framework conveys different strengths and weaknesses (Howlett, 2009; Hogan & Howlett, 2015; Coulthart, 2017). Accordingly, this research seeks to apply multiple understandings of policy change and stability to the specific situational, place-based, and institutional contexts of the case study.

As results emerged from interview responses, secondary sources, and an iterative literature review process, I identified the importance of utilizing methodological pluralism this in analysis. My initial line of inquiry was grounded in the literature on Multiple Streams Approach, focusing on the impact of the atmospheric river flood event on flood risk management policy and governance. While these questions and themes remained consistent throughout all interviews, it became apparent early in the interview process that the disaster, or potential focusing event, was not the only important factor influencing British Columbia's post-disaster recovery landscape. Through open-ended inquiry—and guided by a coinciding iterative literature review process, field observations, and ongoing policy and governance developments—I engaged in further questioning pertaining to organizational/institutional learning and collaborative governance arrangements. Although these themes organically emerged in all of the earliest interviews, I was able to systematically integrate these complementary themes into all successive interviews through a further review of supplementary literature review.

Specifically, I drew upon literature on policy-oriented learning within institutional systems, as well as on how policy advocacy is coordinated among likeminded coalitions, to supplement the literature on Multiple Streams Approach. These framings are discussed in Chapter 2: Literature Review. The three core themes, which emerged from this process, formed the basis of my evaluative framework for assessing post-disaster policy and governance change: (1) focusing events, (2) changes in actor-network relationships, and (3) gradual institutional development via policy-oriented learning. This

iterative framework, presented in Chapter 2, guided my assessment of the case study of the 2021 British Columbia atmospheric rivers flood disaster. Semi-structured key informant interviews were triangulated with a supplementary review of secondary source materials (e.g., publicly available reports) and field observations (e.g., public information sessions, council meetings).

Chapter 4: Case Study

4.1 Community context

4.1.1 City of Abbotsford and the Fraser Valley Regional District

Located in southwestern British Columbia, the City of Abbotsford is bordered by the Fraser River, Washington State [WA], the Township of Langley, and the City of Chilliwack. The municipality is situated within the Fraser Valley, a lowland region extending from the Fraser Canyon near Hope to the Pacific Ocean, as shown in **Figure 11** (Nature Conservancy of Canada, n.d.). Surrounded by the Coast Mountains and Cascade Range, the Fraser Valley is characterized by the fertile floodplains of the Fraser River and its tributaries, as well as the coastal temperate rainforests of the Pacific Maritime Ecozone (Nature Conservancy of Canada, n.d.). The Fraser River Basin covers nearly a quarter of BC's total landmass, making it the province's largest watershed (Fraser Basin Council [FBC], 2016). The basin includes twelve major sub-basins and provides water to the nearly three million people who inhabit the region (FBC, n.d.-a). Within the Lower Fraser River watershed, an estimated 315,000 people reside on the floodplain and are directly exposed to flooding (Ebbwater Consulting Inc., 2015).

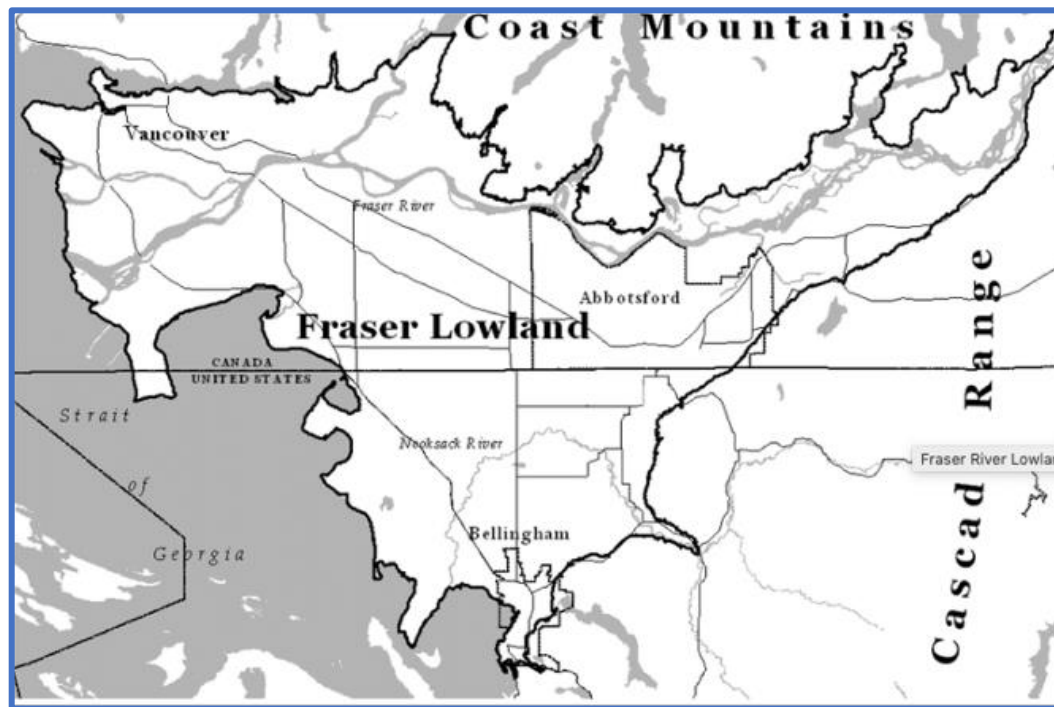


Figure 11: Map of the Fraser Lowland region (Buckley et al., 2015)

The City of Abbotsford [CoA] is British Columbia’s fifth most populous municipality, home to a population of 153,524 people as of 2021 (Statistics Canada, 2022). Encompassing a land cover area of 375.33 square kilometers, the city boasts the province’s largest municipal area (CoA, 2021a; Statistics Canada, 2022). Abbotsford is one of six municipalities, along with eight electoral areas, that form the Fraser Valley Regional District [FVRD] (FVRD, 2023a), as shown in **Figure 12**.

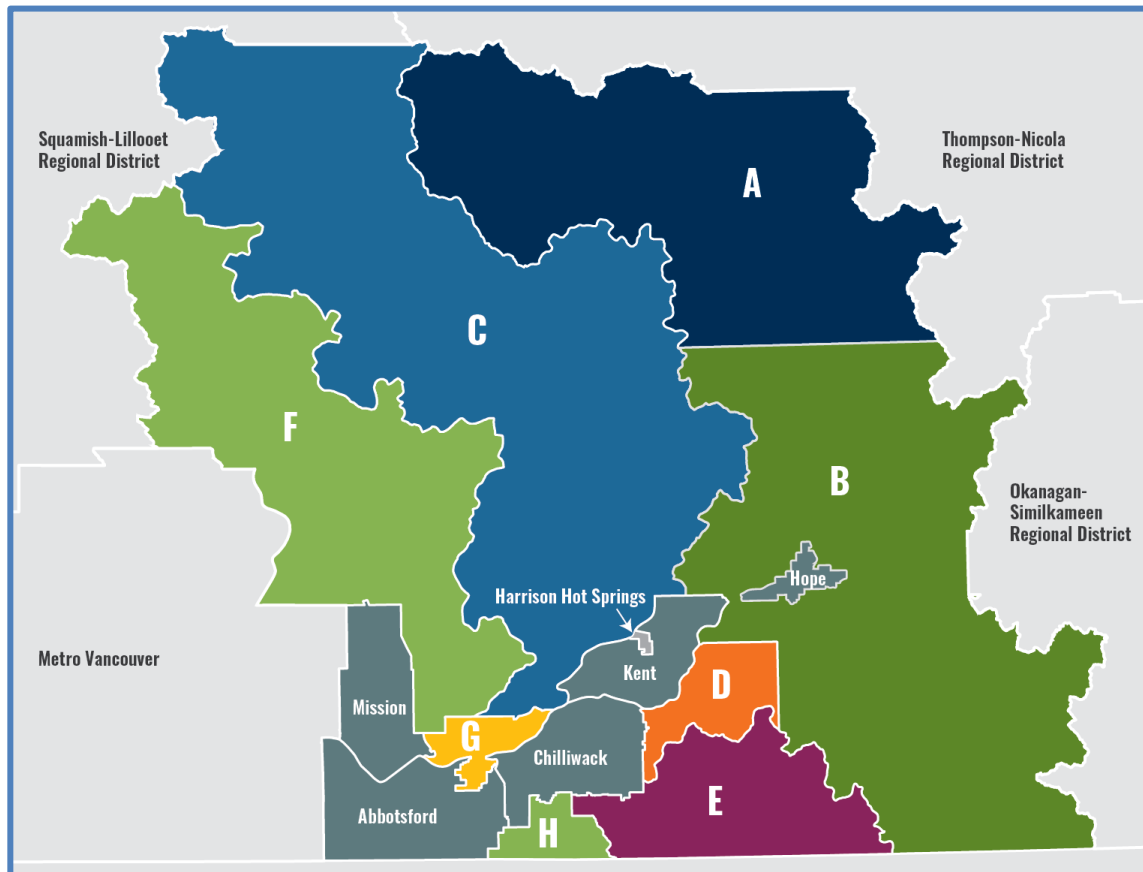


Figure 12: Map of the Fraser Valley Regional District (FVRD, n.d.)

Spanning an area of 13,361 square kilometers, the FVRD is governed by twenty-four elected and appointed officials, serving the interests of the Fraser Valley’s 337,000 inhabitants (FVRD, 2023a & b). In BC, regional districts are a form of local government, designated under the *Local Government Act* and *Community Charter*, that share responsibility for administering region-wide services, providing amenities to unincorporated rural areas (e.g., wastewater management, emergency management), and engaging in strategic development and planning initiatives (Government of British Columbia [Gov. BC], 2023a). Located in close proximity to Metro Vancouver, the FVRD is a rapidly expanding region that

is expected to reach a population of 500,000 by 2050 (FVRD, 2023b). The region is home to thirty First Nations communities, with whom the FVRD currently has twenty-three service agreements in place related to waste collection, water provision, public transit, and fire protection (FVRD, 2023b).

4.1.2 Regional agribusiness

Although the Fraser Valley Regional District contains only 2.3% of BC's total farmland, regional agribusiness accounts for 14.7% of the province's total agricultural operations and nearly a quarter of all farm-related employment (Abbotsford Chamber of Commerce, 2022). Over the past fifteen years, the sector has rapidly expanded, reporting an annual growth rate (3.49%) that is currently surpassing population growth (1.26%) (Abbotsford Chamber of Commerce, 2022). As a regional economic hub, Abbotsford agribusinesses generate \$3.83 billion in economic activity and support 16,670 full-time equivalent jobs (Abbotsford Chamber of Commerce, 2022). Agriculture within the Fraser Valley is supported by favourable growing conditions, including fertile lowland soils, a relatively mild year-round climate, and an extended growing season (FVRD, 2017). The industry benefits from the region's close proximity to the Metro Vancouver area, as well as convenient access to both national and international markets via transportation networks such as the TransCanada Highway 1, the Port of Vancouver, and railway infrastructure (FVRD, 2017).

A key to the agribusiness industry's success lays within Abbotsford's Sumas Prairie region, home to a diverse assemblage of 1,282 farms which employ over 7,000 workers (CoA, 2020). The 'Prairie,' as it is often colloquially called by its 3,300 residents, is a rural community with land-use predominantly characterized by agricultural production (86.7%) and residential dwellings (12.6%) (CoA, 2014 & 2020). Crops primarily consist of hay and fodder (34%), fruits and berries (29.6%), corn (17.5%), vegetables (9%), and alfalfa (4.6%) (CoA, 2014). Over ten million livestock, primarily dairy cattle, poultry, and hogs, are reared in Sumas Prairie (CoA, 2014). Nearly 66% of farm tenure is privately-owned, while the remaining lands are leased, rented, or crop-shared (CoA, 2014). Nearly 4,600 parcels of land, or seventy-five percent of Abbotsford's total land area, are classified as Agricultural Land Reserve, a provincial zoning designation which restricts non-agricultural land uses (CoA, 2016a). Farms within Abbotsford's Agricultural Land Reserve produce a third of all chickens provincially, and 50% of all eggs and turkey, while providing the Lower Mainland region with 40% of its milk and 80% of its raspberries (CoA, 2016a)—making Abbotsford a critical food security hub for the province.

4.2 Engineering a flood hazard: The case of Sumas Prairie

4.2.1 Colonial context

The City of Abbotsford's Sumas Prairie was severely impacted by the 2021 flood disaster; however, the recent catastrophe must be understood within the context of the region's complex colonial development and flood management history over the last 150+ years. In 1858, British Columbia's interior regions experienced a gold rush, bringing an influx of settlers into the Fraser Valley (CoA, 2016b). Following this boom, British authorities established a greater mainland presence, appointing Governor Douglas to oversee the mainland colony and calling in the Royal Engineers, a military detachment of surveyors, engineers, and officers tasked with developing townsites and upholding colonial rule (Woodward, 1975). By the 1870s, the Royal Engineers had established the core trade routes and transportation infrastructure that prompted community development (CoA, 2016b). Following waves of European settlement in the 1860s and 1880s, the Districts of Sumas and Matsqui were established in 1892, much later amalgamating with the Village of Abbotsford in 1972 (Heritage Abbotsford, 2022). The subsequent District of Abbotsford later joined the District of Matsqui to form the present-day City of Abbotsford in 1995 (Heritage Abbotsford, 2022).

The current community is situated on the unceded traditional and ancestral territories of the Stó:lō (pronounced “stah-lo”) peoples, primarily the Máthxwi (Matsqui), Leq'á:mel, and Semá:th (Sumas), who have inhabited the S'ólh Téméxw (Fraser Valley) since time immemorial (Buker, 2011). Meaning “people of the river” in Halq'eméylem, a Coast Salish dialect, the Stó:lō possess long-standing place-based connections to the Fraser River Basin, traditionally known as the Stó:lō River (Buker, 2011). Sumas First Nation, Leq'á:mel First Nation, and Matsqui First Nation are all members of Stó:lō Nation, which provides programs and services to eleven Stó:lō communities (Stó:lō Nation, 2018). The remaining eight communities comprise the Stó:lō Tribal Council (Gov. BC, 2023b). Two reserves are located within Sumas Prairie: Sumas First Nation's 234.7 hectare Upper Sumas 6 Reserve, governed under the *Sumas First Nation Land Code*, and Leq'á:mel First Nation's Aylechootlook 5 Reserve (Sumas First Nation, 2024a; Stó:lō Xwexwilmexw Treaty Association, n.d.). Under the *Framework Agreement on First Nation Land Management Act*, community land codes legally replace the 44 lands-related sections of the colonial *Indian Act*, allowing for self-determination over reserve lands and natural resources (First Nations Land Management Resource Centre, n.d.).

4.2.2 Semá:th Xó:tša

Since time immemorial, the Stó:lō have adapted to living with the seasonal flooding of Semá:th Xó:tša,¹ a shallow fertile lake surrounded by seasonally inundated wetlands, pictured in **Figure 13**, and the valley's adjoining rivers (Sumas First Nation, n.d.; Leung, 2021). Semá:th Xó:tša is also known by the settler name of Sumas Lake (Reimer, 2018). Situated between the Sumas and Vedder mountains, the lake receives its primary inflow from the Stótelō ("Little Creek" or Sumas River) and Chilliwack Rivers and is drained through Q'élem ("Came, Rest" or Saar Creek) and the Sumas Drainage Canal, later connecting to the Fraser River via the Vedder Canal at the Barrowtown Pump Station (Sumas First Nation, 2013; Reimer, 2018). Prior to colonial FRM interventions, the lake would also capture overflow from the Fraser and Nooksack Rivers (Reimer, 2018). The headwaters of the Sumas and Nooksack Rivers are located in Whatcom County, Washington, and although the Nooksack typically does not flow through the Fraser Valley, occasionally the river overflows into the Canadian side of the valley (Hobson, 2022). The transboundary nature of this river system means that watershed interactions happening upstream in Whatcom County have the potential to create downstream impacts in the Sumas Prairie region where Semá:th Xó:tša historically acted as a natural drainage system.



Figure 13: Semá:th Xó:tša prior to its 1920s drainage (The Reach Gallery Museum, n.d.).

¹ An audio pronunciation guide, provided by the Reach Gallery Museum (2020), can be accessed [here](#).

Prior to the 1920s, spring and autumn high water conditions caused fluctuations in the lake's coverage, which encompassed an average area of between 3,640 to 6,475 hectares and an average depth of 2.7 to 5.5 metres (Reimer, 2018). During major flood years, such as in 1894 and 1903, the lake could even expand to 12,140 hectares and a depth of 9.5 metres (Reimer, 2018). **Figure 14** shows the lake's former location and its expanded boundaries during flood years, as denoted by the dotted line.

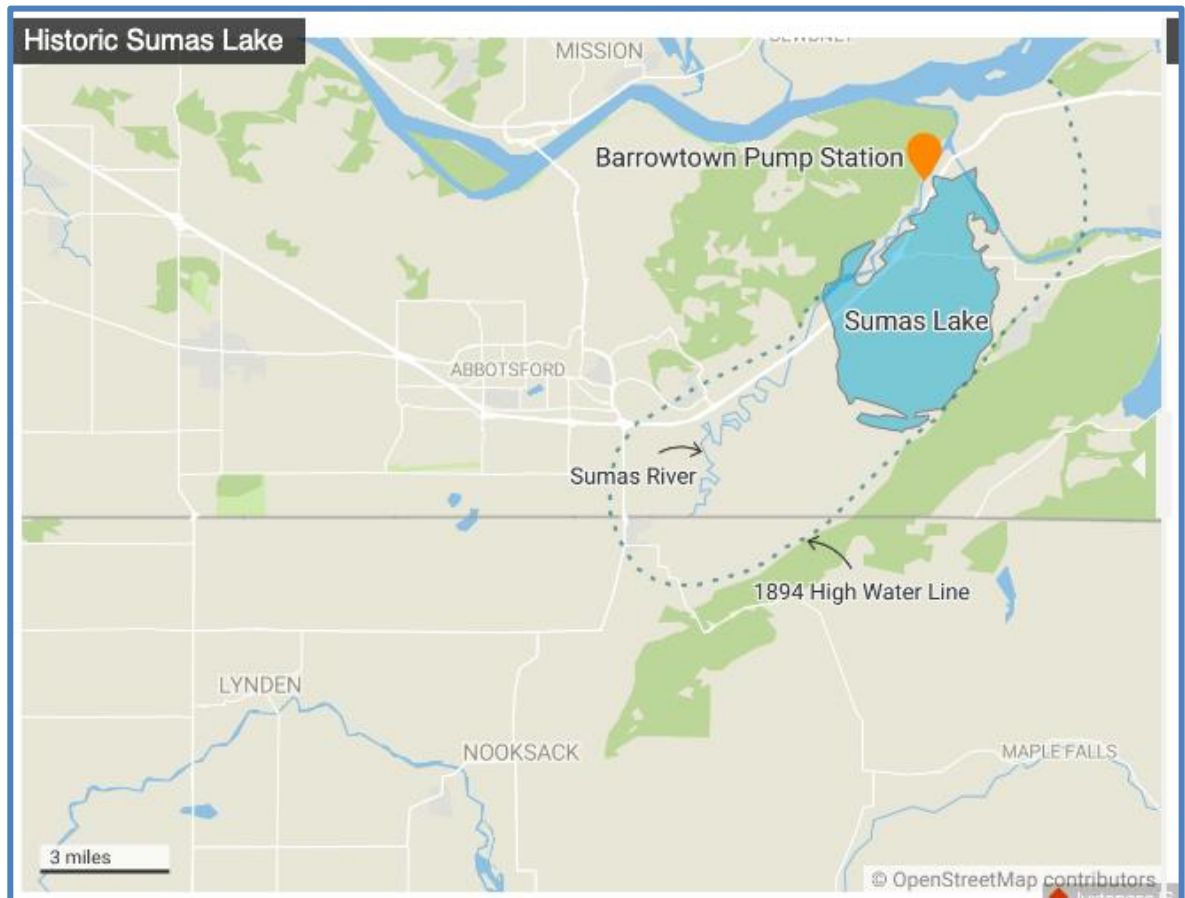


Figure 14: Map depicting the historic boundaries of Semá:th Xó:tsa (Hobson, 2022)

The pre-1920s cultural and ecological importance of Semá:th Xó:tsa cannot be overstated. The biodiverse landscape was culturally, spiritually, and materially integral to the well-being of Stó:lō peoples (Silver et al., 2022). The lake, its small islands, and surrounding grassland and wetland ecosystems supported a diverse assemblage of wildlife including salmon, trout, sturgeon, freshwater mussels, crayfish, migratory waterfowl, sandhill cranes, swans, bald eagles, grebes, grouse, deer, elk, bears, wolves, muskrats, beavers, racoons, rabbits, berries, wapato and camas bulbs, and medicinal plants [**Figure 15**] (Reimer, 2018; Silver et al., 2021; McSheffrey, 2021a). The lake was a critical food

source for local Coast Salish communities, sustaining 85% of the traditional Semá:th diet (Morgan, 2023). In addition to providing food security and key resources, the lake served as a central site for trading and social gathering within Coast Salish territory (Sumas First Nation, 2024b).



Figure 15: Illustration of medicinal plants found in the surrounding marshes (Silver et al., 2021)

During this time period, seasonal floods were a natural part of Stó:lō community life. The ninth month of the Stó:lō calendar, Temqoqo (mid-June to mid-July), meaning “high water time,” signified the spring snowmelt which both raised water levels in the Fraser River and its tributaries and inundated the surrounding grasslands (Coqualeetza Cultural Educational Centre, 2010; Reimer, 2018). The Semá:th built their permanent housing structures on the higher grounds of Vedder Mountain, beyond the range of floodwaters (Morgan, 2023). During the summer months, Salí:ts, a seasonal village consisting of shelters raised above the water via stilts, as depicted in **Figure 16**, could be accessed by canoe and provided respite from the shore’s mosquito population (Silver et al., 2022; Morgan, 2023).



Figure 16: Illustration depicting Salí:ts housing (Silver et al., 2022)

For Stó:lō peoples, ‘living with water’ was not simply an adaptive response to seasonal flooding, but rather, an integral part of Stó:lō spirituality, cultural identity, and well-being (Stelkia et al., 2020). Stó:lō Elders have described this intergenerational connection to land and water as being intrinsically rooted in “ancestral knowledge, stories, and ways of being” (Stelkia et al., 2020: p. 363). Stó:lō scholar Buker (2011) described the Stó:lō River and Halqeméylem language as integrated living systems, meaning that Stó:lō epistemology, ontology, and pedagogy are all inseparable from the “stories of the river, the language of the river, and the culture of the river” (p.8). Stó:lō worldviews perceive water as a sacred kin and interconnected entity—a relational foundation that is commonly shared among many diverse Indigenous societies around the world (Stelkia et al., 2020; Buker, 2011; Wilson & Inkster, 2018; Neville & Coulthard, 2019). As such, Stó:lō and broader Coast Salish water stewardship practices embody the values of relationality, reciprocity, and social-ecological balance, which are embedded within traditional laws, customs, and teachings (e.g., Buker, 2011; Stó:lō Research and Resource Management Centre, 2014; Stelkia et al., 2020; Lower Fraser Fisheries Alliance, 2021; Martin et al., 2023).

4.2.3 The Sumas Reclamation Project

4.2.3.1 Draining Semá:th Xó:tsa

The case of Sumas Prairie can be situated within broader efforts by settlers to ‘tame’ and ‘control’ the unpredictable flood regimes of the Fraser River and its tributaries, which wreaked havoc on lowland colonial settlements (Murton, 2008; Leung, 2021). Despite the long-standing cultural history and ecological significance of Semá:th Xó:tsa, settler efforts to drain the lake date back to the 1870s (Reimer, 2018). For over fifty years, the settler community engaged in various failed schemes to ‘reclaim’ the land for agricultural use, characterizing the ephemeral wetlands as an unproductive wasteland (Reimer, 2018). These plans ranged in scope from the complete dewatering of the valley to other partial drainage schemes that would have preserved the lakebed itself but resulted in the diking of the adjacent floodplain (Reimer, 2018). Following the passage of the *Sumas Drainage, Dyking, and Development Act*, a complex system of dikes—including the Sumas Dike, the Vedder and Sumas River Canals, diversion ditches, sluiceways, and pumps, in addition to the Sumas River Dam, were constructed between 1920 to 1924 (CoA, 2013; Reimer, 2018). The project repurposed 13,355 hectares of former lakebed land for Crown-related settlement and agriculture; however, from the onset, Sumas Prairie was plagued with challenges, including mineral deficient soil, inflated property values, and lofty debts incurred from the Sumas Drainage works, which had ballooned to \$9.1 million CAD by 1944 (Reimer, 2018)—equivalent to \$240 million in 2024. **Figure 17** depicts present-day agricultural land use within the former lake bottom.

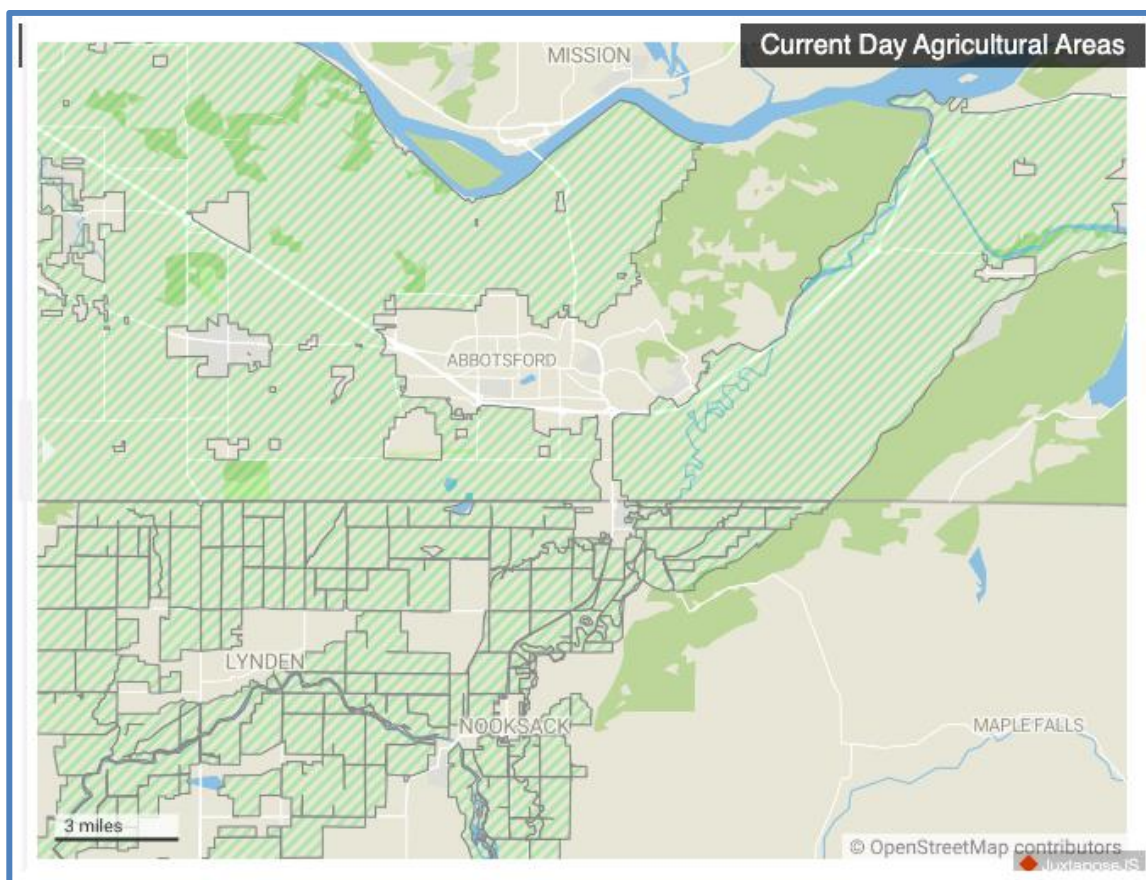


Figure 17: Map depicting present-day agricultural land use within the region (Hobson, 2022)

While colonial settlements viewed floods as disasters, the drainage of Semá:th Xó:tsa was a disaster in its own right (McSheffrey, 2021a). The resulting devastation to local ecosystems and biodiversity adversely impacted the traditional livelihoods of the Semá:th people (Reimer, 2018). Many species dependent on Semá:th Xó:tsa's freshwater ecosystem and grassland floodplain disappeared, while migrating salmon were diverted through the Vedder Canal, which connects the Chilliwack and Vedder Rivers to the Sumas River (Reimer, 2018). According to Sumas First Nation Chief Dalton Silver, elders described the loss of food sovereignty as equivalent to "taking away our supermarket, our shopping centre" (McSheffrey, 2021a). To preserve settler sportfishing, the Stó:lō were prohibited from accessing the Vedder Canal, further reducing access to traditional fisheries, as well as cutting off riverine transportation routes (Reimer, 2018). The Sumas Reclamation Project also coincided with further land dispossession as the colonial government made parcels of former lakebed land available for settler purchase (Seymour-Hourie & Carlson, 2021). Through the drainage scheme, Sumas First

Nation lost 64.75 hectares of reserve land, as well as usage of the former grassland commons that surrounded the lake (Smith & Verstraten, 2013; Reimer, 2018). In 2013, this became the subject of the land claim, *Failure of Crown to Protect Sumas Lake and Lands* (Smith & Verstraten, 2013).

4.2.3.2 Colonial control over flood risk management

This story is not unique to the Fraser Valley and reflects a broader systemic pattern of colonial control over natural resources that persists both nationally and abroad. Canadian FRM has been deeply rooted in settler-colonial values, with many legacy FRM systems having coincided with European settlement patterns, economic development (e.g., hydroelectricity, agriculture), and the dispossession of Indigenous land, rights, and titles (e.g., Lovisek et al., 1995; Matsui, 2009; Sam & Armstrong, 2015; Thompson, 2015; Hall, 2016; Yumagulova, 2020; Atleo & Boron, 2022). Under the doctrine of discovery, early flood risk management systems were designed to uphold the settler-colonial pursuits of navigation, territory expansion, land acquisition, industrial development, and control over natural resources (Weil, 2006; O'Neill, 2006; Parsons & Fisher, 2022; O'Donnell, 2023).

In many places, FRM has been dominated by a desire to manage isolated hydrological processes for various purposes without consideration of the broader social-ecological system (Harden, 2012; Parsons & Fisher, 2022). Colonial 'command-and-control' models of natural resource governance both stem from and further perpetuate a "geographic imaginary" (Gregory et al., 2009: p.282) that perceives humans as being separate from nature (Holling & Meffe, 1996; Wall Kimmerer, 2013). In FRM, this has manifested through the technocratic governance of flood risk and the widespread absence of integrated systems-wide approaches to date. Top-down technocratic approaches, wherein decisions are made by technical experts and governing agencies, can limit opportunities for meaningful stakeholder participation, at the expense of incorporating local realities, community values, and social-equity considerations within FRM planning (Wesselink et al., 2016; Mehring et al., 2018). This approach has led to the prioritization of Western scientific and technical knowledges (e.g., engineering) and values (e.g., economic, private property), while neglecting local and Indigenous knowledge, values, and governance systems (Parsons & Fisher, 2022). In spite of the colonial legacy, the assertion of First Nations Title and Rights, cultural values, and traditional knowledge surrounding land and water stewardship is widely recognized today as a necessary component of transformative climate adaptation (e.g., Whyte, 2017; Parsons et al., 2019; Gram-Hanssen et al., 2022; Yumagulova et al., 2023; Reed et al., 2024).

4.2.3.3 Impacts on flood storage

Antithetically, the Sumas Lake drainage project inadvertently worsened regional flooding. Semá:th Xó:tsa had previously acted as a natural flood mitigation system for the Fraser Basin (Reimer, 2018). When the Fraser River and its tributaries flooded, the lake was able to absorb excess water and lessen flood impacts downstream (Reimer, 2018). These hydrological changes were particularly evident in the spring of 1948, when catastrophic Fraser River flooding led to the evacuation of 16,000 people, damages to 2,300 buildings, and the inundation of over 20,200 hectares of the Fraser Valley (Reimer, 2018; Mackie, 2021). The flood prompted the Province to invest heavily in further dike infrastructure; however, pre-1948 defensive infrastructure, coupled with the loss of natural flood water repositories such as Semá:th Xó:tsa, had contributed to the scale of the disaster (Reimer, 2018; Gandolfo-Lucia, 2022). Despite the post-1920s interventions, Sumas Prairie still flooded several times prior to the 2021 event, including in 1990 (Norman & Bakker, 2005).

4.2.4 Present-day flood control infrastructure

Today, Sumas Prairie relies on an extensive network of defensive infrastructure to control flooding, including the 16.7 kilometre Sumas Dike system and the Barrowtown Pump Station (CoA, 2019; Reimer, 2018). Barrowtown plays a critical role in maintaining a dry Sumas Prairie, acting as the primary defense mechanism to prevent the lakebed from refilling (CoA, 2013). Covering a drainage area of ninety-five square kilometres, the station pumps 2.3 million litres of water per minute, all day long for 365 days of the year (CoA, 2013; Larsen, 2021). Water is pumped from the Sumas Lake Canal into the now channelized Sumas River, which then joins the Vedder Canal before flowing into the Fraser River (SNC-Lavalin Inc., 2022). If the Barrowtown pumps were to fail, such as through the inundation of the station or an extended power failure, the lake would refill within a projected timespan of two to seven days without human intervention (CoA, 2013).

To maintain present land use within Sumas Prairie, Abbotsford must operate this flood control infrastructure, shown in **Figure 18**, in perpetuity. According to a recent cost-benefit analysis conducted by the Lower Fraser Fisheries Alliance, maintaining status-quo FRM interventions is expected to cost an estimated \$4.5 billion CAD (Martin et al., 2022). This figure includes repairs to Sumas and Matsqui diking systems, and upgrades and operational costs for the Barrowtown Pump Station (Martin et al., 2022). As of 2016, operation of the pump station cost \$500,000 annually (Olsen, 2016).



Figure 18: Barrowtown Pump Station and the Vedder Canal (Watterodt, May & June, 2022)

As an alternative potential pathway, the Lower Fraser Fisheries Alliance offered the possibility of a \$3 billion managed retreat scenario that accounts for the partial restoration of Semá:th Xó:tsa, the removal or modification of FRM infrastructure, and \$1 billion in property buyouts using 2020 land parcel value assessments (Martin et al., 2022; Finn et al., 2024). Disputing this figure, the City of Abbotsford estimated that the cost of land acquisition alone would be closer to \$2.25 billion when using current market values (Currie, 2024), which is the literature-consistent best practice for implementing socially-acceptable retreat programs (Thistlethwaite et al., 2023). Nonetheless, such analyses raise critical questions around how land use within Sumas Prairie could evolve—or be forced to adapt—in the future as a result of the changing climate.

Chapter 5: Results and Discussion

5.1 Overview

Chapter 5 assesses the extent to which the British Columbian atmospheric river [AR] event can be considered a potential focusing event, the manner in which the disaster initiated a policy window, and how post-disaster shifts in FRM policy and governance can be linked to both event-based learning and broader trends in institutional development within the province. Firstly, this chapter presents a broad overview of AR events that spanned from November 14th to December 2nd, 2021, concentrating on the event's rarity, scale, and disaster-related impacts for affected communities, as situated within both local and broader multi-jurisdictional scales. Secondly, post-disaster outcomes are assessed related to transforming FRM policy and governance in BC, providing qualitative evidence to demonstrate the focal nature of the event and subsequent influence in setting flood policy agendas. Finally, current initiatives are situated within the context of the collaborative policy networks and iterative institutional learnings that emerged both prior to and as a direct result of the disaster.

Based on the evaluative framework presented in Chapter 2, the evolution of British Columbia's FRM policy and governance is explored within the context of an emergent post-disaster policy window and the enabling conditions that allow actors and coalitions to engage in policy advocacy. Research results indicate that post-disaster interactions within the broader policy community are further contingent on the ability of governing institutions to revise policy goals, to expand the existing solution space, and to empower champions to collectively advance a paradigm shift. This framework, shown in **Table 5** and outlined in further detail in Chapter 2, provides a guideline for assessing how potential focusing events, emergent policy windows, and policy-oriented learning coalesce to inform agenda-setting processes and contribute to shifting policy paradigms over time.

Table 5: An evaluative framework for assessing post-disaster policy change

	Condition	Present?
Evidence of a potential focusing event	<i>Rarity</i>	Y/N
	<i>Scale</i>	Y/N
	<i>Impact</i>	Y/N
Evidence of policy window formation	<i>Issue attention</i>	Y/N
	<i>Issue framing</i>	Y/N
	<i>Collective action</i>	Y/N
	<i>Available solutions</i>	Y/N
	<i>Commitment to action</i>	Y/N
Evidence of policy-oriented learning	<i>Empowerment of solution seekers</i>	Y/N
	<i>Expansion of the existing solution space</i>	Y/N
	<i>Revision of policy goals</i>	Y/N

5.2 The 2021 atmospheric rivers disaster as a potential focusing event

5.2.1 Event overview

In November and December 2021, high intensity rainfall conditions, triggered by three consecutive atmospheric river events, resulted in devastating floods, debris flows, and erosion throughout southern and central British Columbia and northern Washington. On November 13th, an atmospheric river began making its way inland in a process known as landfalling; however, the storm's precise orientation could not yet be determined at this time (Sekhon, 2022). By mid-day November 14th, the Province of BC issued travel and streamflow advisories, and by the following morning, the deluge had prompted a state of emergency for several communities (Schmunk, 2021a). A provincial state of emergency was declared soon thereafter, remaining in effect from November 17th, 2021, to January 18th, 2022 (Emergency Management British Columbia [EMBC], 2022). Two additional ARs compounded the earlier impacts (Weichel & Daflos, 2021), creating further challenges for response and recovery. What follows is a description of the AR event and subsequent impacts.

5.2.2 Atmospheric rivers in BC

ARs are not a new phenomenon and are colloquially referred to as ‘pineapple expresses’ on the North American west coast. ARs are large, narrow bands of condensed water vapour moving from the tropics towards the poles (Pacific Climate Impacts Consortium [PCIC] et al., 2013; NOAA, 2023b). On average, ARs range in width from 400 to 600 kilometres (NOAA, 2023b), and can be upwards of 1,000 kilometres in length (PCIC et al., 2013). ARs carry an average volume of between twelve to twenty-four trillion litres of water, or an equivalent depth of three to six centimetres, across the entirety of the central moisture stream; this is called vertical integrated water vapour (PCIC et al., 2013). Cumulatively, the total amount of water contained in a single AR can be equivalent to fifteen times the discharge of the Mississippi River into the Gulf of Mexico at approximately 251,880 cubic metres per second (NOAA, 2023b; National Park Service, n.d.). When ARs rise above mountain ranges, the water vapour rapidly cools and discharges as either snowfall or rainfall (NOAA, 2023b). ARs are typically driven by winds above thirty-five kilometres an hour, leading to brief but intense precipitation; however, ARs can become stalled above a region, resulting in prolonged discharge (PCIC et al., 2013).

British Columbia typically experiences two flood seasons: the first comprising of autumn pluvial flooding and winter coastal storm surge flooding, and the second resulting from snowmelt and rainfall during the spring freshet flooding (PCIC et al., 2013). ARs are essential hydrological processes, generating 33% of the annual precipitation for the Pacific Northwest region, and are necessary for building snowpack and recharging groundwater systems (PCIC et al., 2013; Sharma & Déry, 2020). However, because landfalling ARs discharge such a substantial volume of precipitation within a short time span, these events often result in high watershed runoff which can trigger flood conditions (Gillett et al., 2022). ARs account for 90% of extreme rainfall conditions in coastal BC and contributed to 78% of all floods occurring between 1978 and 2016 (Sharma & Déry, 2020; Gillett et al., 2022).

Because of climate change, landfalling ARs in the Fraser River Basin are projected to increase fourfold in frequency over the next century (Curry et al., 2019). The probability of an AR event occurring with a similar magnitude and westerly orientation as the 2021 AR is now 1-in-11.8 years—marking a 60% decrease in the mean recurrence interval since pre-industrial times, which is estimated at 1-in-20.7 years (Gillett et al., 2022). Warming air temperature is one factor contributing to heavier precipitation flows; for every degree of warming, air moisture potentially increases by 7% (United Nations Office of Disaster Risk Reduction, 2021). Another contributing factor is the trend towards longer and more frequent La Niña and El Niño episodes (Tasoff, 2023). Periodically, variations in the

normal Pacific trade wind and water circulation regimes, known as the El Niño-Southern Oscillation cycle, produce exceptionally cold-wet (La Niña) or hot-dry (El Niño) conditions in the Pacific Northwest (NOAA, 2020). Historically, episodes lasted nine to twelve months and occurred every two to seven years; however, shifts in ocean circulation patterns—related to salinity (Olson et al., 2022), atmospheric winds (McMonigal et al., 2023), and warmer water temperatures (Abraham et al., 2013)—are resulting in slower transitions, in addition to more severe extremes (NOAA, 2020; Rizk, 2024).

5.2.3 Event rarity

While the magnitude of the initial 2021 atmospheric river event was not necessarily unusual, what was unprecedented was the storm’s timing and its heightened impact on watershed hydrology following a preceding series of climate disasters. Because of climate change, winter storms are now occurring earlier in the season and more frequently (Office of the Auditor General of BC [OAG BC], 2018). Although it was previously uncommon for ARs to occur before November, BC experienced five prior AR storms in 2021, beginning as early as September (CBC News, 2021a; McSheffrey, 2021b).

This extreme rainfall was compounded by earlier, consecutive climate disasters, including a 1-in-1000-year extreme heat event which claimed 619 lives, as well as over 1,600 wildfires and the destruction of 140 properties in the Village of Lytton and Lytton First Nation (Gov. BC, 2022a & n.d.-a; Village of Lytton, 2021). The resulting lost forest cover and diminished soil permeability further reduced the capacity of affected watersheds to absorb excess runoff from rainfall and snowmelt, while also undermining soil stability (Zhang & Wei, 2014; Baum & McClearn, 2021; Clague, 2021). These factors contributed to the extent of flooding and debris flows experienced in November 2021.

From November 14th to 15th, BC experienced a two-day cumulative rainfall amount surpassed only by historic conditions in 1955, 1968, and 2003 (Gillett et al., 2022). Within forty-eight hours, Abbotsford recorded 541 millimeters of rainfall, surpassing both monthly and seasonal records, while Victoria, Nanaimo, and Vancouver also exceeded seasonal records (CBC News, 2021b). According to one provincial employee, the realization that “a day or two of intense rainfall [could] precipitate a major disaster” was perceived as a ‘wake-up call’ that “broke some psychological view of the world” (KI 21).

Heavy rainfall facilitated extensive snowmelt in the Coast Mountains and Cascade Range, prompting extreme streamflow conditions throughout several major river basins, including the Nooksack, Chilliwack, Similkameen, Tulameen, Coquihalla, and Coldwater Rivers (Black & Simons, 2022; Gillett et al., 2022). The resulting two-day precipitation totals and streamflow conditions

amounted to 1-in-50-year and 1-in-100-year events in several locations (Gillett et al., 2022). Upstream from Abbotsford in the Fraser River, the Merritt hydrometric station recorded a water volume that was three times above the historic daily record (Cable Public Affairs Channel, 2021). Critically, the Fraser River did not breach its banks; however, had a major Fraser flood occurred, this could have exacerbated damages by tenfold and resulted in between \$20 to \$30 billion in estimated losses (FBC, 2016; Black & Simons, 2022).

5.2.4 Scale of disaster

The 2021 AR event was the most devastating flood in recent BC history, producing widespread impacts that extended far beyond the seventeen regional districts and forty-two First Nations which were directly affected (Judd, 2021a; Litke, 2022). Affected local authorities included Merritt, Princeton, Abbotsford, Chilliwack, Hope, Kent, Mission, the Cowichan Valley Regional District, the FVRD, and the Thompson-Nicola Regional District (Ministry of Municipal Affairs, 2022). Affected First Nations included the Coldwater, Cook's Ferry, Kanaka Bar, Lower Nicola, Lower Similkameen, Nicomen, Nooaitch, Okanagan Indian Band, Shackan, Siska, Skuppah, Boston Bar, Chawathil, Leq'ámel, Lil'wat, Lytton, Matsqui, Musqueam, Seabird, Semiahmoo, Shxwh:ay, Skwahlook, Soowahlie, Spuzzum, Sts'Ailes, Sumas, Union Bar, Cowichan Tribes, Dzawada'enuxw, Esquimalt, Halalt, Malahat, Pauquachin, Penelakut, Snuneymuxw, and W̱SÁNEĆ (BC Assembly of First Nations, 2021).

The AR event triggered unprecedented levels of displacement across many communities. Nearly 17,775 people were either temporarily displaced or placed under evacuation order (Ministry of Public Safety and Solicitor General [PSSG], 2021), with 3,300 experiencing prolonged displacement (Ministry of Emergency Management and Climate Readiness [EMCR], 2022). Some communities, such as Merritt, were entirely evacuated due to flood risks and the failure of critical water and sanitation infrastructure (City of Merritt, 2024). Others, such as Nooaitch First Nation, became isolated when road access points were washed out (Garcha & McSheffrey, 2021). In Abbotsford, 1,100 households were evacuated with 200 residents requiring search and rescue services (Abbotsford News, 2022).

The AR's extensive geographic scope and severity added to the complexity of emergency response and post-disaster recovery, overwhelming normal response capacities (KIs 21, 27). According to one KI, some response agencies found it challenging to provide timely, adequate supports due to having limited personnel and resources at their disposal to deploy: "[The Province of BC] sent forty-five provincial employees to work in the...Abbotsford Emergency Operations Centre... If [BC] had

multiple local authorities asking for the same level of support, there's no way [BC] could provide that" (KI 21). While communities typically provide mutual aid to one another during an emergency, barriers related to limited road access and stretched finite resources across all affected regions amplified response challenges (KIs 21, 27, 28; Calian Emergency Management Services, 2022). Multi-jurisdictional complexity, such as authority over road networks and decentralized information sharing, further constrained local authorities' response capacities (KI 27; FVRD, 2022; Klassen et al., 2023).

Although the disaster is often referred to as the 'BC floods,' the province experienced a range of hazards and impacts including overland and riverine floods, landslides and other debris flows, streambank erosion, road and rail washouts, community isolation, and supply chain disruptions. According to a local emergency management professional, "this wasn't a flood. It was three atmospheric rivers causing a number of different impacts. Merritt and Abbotsford certainly faced flooding, but those floods were specifically as a result of other engineered failures and built environment challenges" (KI 27). As such, the term 'atmospheric river' is used here to broadly describe the provincial disaster, as distinguished from locality-specific flood impacts.

5.2.5 Significance of disaster impacts

5.2.5.1 Economic losses

The disaster was among the most expensive in Canadian history. In April 2022, the Province estimated that preliminary response and recovery costs had surpassed \$4 billion CAD, neither including the costs of permanent repairs and debris clean up under the *Highway Reinstatement Program* nor the funding of local recovery plans (PSSG, 2022a). Independent estimates place economic losses in the range of \$8.7 to \$14.2 billion (Hunter, 2022; Lee & Parfitt, 2022). These include \$675 million in insured private losses and \$1.575 to \$4.95 billion in non-insured private losses (IBC, 2022b), \$285 million in agricultural losses (Black & Simons, 2022), \$5.52 to \$7.02 billion in repairs to public infrastructure (e.g., roads, dikes) (Lee & Parfitt, 2022), and \$867 million to \$1.531 billion in income-related losses due to displacement and disruption (Lee & Parfitt, 2022). In 2022, estimated civic costs (i.e., repairs to public infrastructure) for Abbotsford (\$1 billion), Merritt (\$100 million), and Princeton (\$25 million) alone exceeded \$1.125 billion (Hunter, 2022). Estimated repair costs for Highways 1, 5, and 8 range from \$1 to \$1.5 billion (Canadian Press, 2023a). Provincially, permanent repairs could cost upwards of \$6.2 billion, in addition to the \$200 million spent on emergency Highway 5 repairs (Hunter, 2022).

Beyond direct impacts, the AR had widespread implications for national trade and economic activity. Critically, the closure of the Port of Vancouver, which moves \$1 of every \$3 of all Canadian imports and exports outside of North America, reported an estimated economic impact of \$2.5 billion (Hunter, 2022). The Port of Vancouver was closed for eight days and unable to move cargo, which typically amounts to 250,000 tonnes or \$323 million in daily shipments (Hunter, 2022). Cumulatively, BC's 2021 disaster season cumulatively resulted in between \$10.6 and \$17.1 billion in total economic losses, equivalent to 3% to 5% of provincial gross domestic product (Lee & Parfitt, 2022).

5.2.5.2 Critical infrastructure damage

Damage to critical infrastructure disconnected BC's most populous regions, Metro Vancouver and the FVRD, from the rest of Canada by road and rail. All major highways in these regions experienced extensive damage and/or blockages related to flooding, debris flows (e.g., rockslides, mudslides), riverbank erosion, and embankment failures, as depicted in **Figure 19** (Gov. BC, 2024a; Sepúlveda et al., 2023). A federal policymaker wondered "[I don't know] if there's ever been an incident where it was so clearly shown how much public infrastructure plays in the fabric of a community" (KI 22), owing to how the AR highlighted the fragility of transportation and supply chain infrastructure (KIs 3,12,15). Debris flows scoured highway surfaces and deposited sediment and debris on roadways and in water channels, while floodwaters overwhelmed culverts and eroded streambanks (Sepúlveda et al., 2023). Abbotsford, alone, experienced twenty-one landslide incidents (CoA, 2022a).



Figure 19: Damage to critical transportation corridors (BC Ministry of Transportation, 2021)

Critical infrastructure damages had widespread provincial impacts, leading to travel restrictions and supply chain disruptions. Rail washouts and the partial derailment of a CN Rail locomotive disrupted trade coming in from the Port of Vancouver (Mangione, 2021). On Highway 99, a mudslide caused five motorist fatalities (Parfitt, 2022). Road closures stranded nearly 1,200 travelers in Hope (DeSorcy, 2022; EMCR, 2022). Rerouting traffic through the United States became a “logistical nightmare” due to Covid-19 mandates (KI 12) and damaged transportation infrastructure in Washington (Associated Press, 2021). Detouring through the US was also not a viable option for many Canadian commercial transport trucks due to discrepancies in maximum gross weight roadway allowances (Park, 2021). Fuel and travel restrictions of varying degrees limited highway usage to essential vehicles only (Olsen, 2021a). Supply chain disruptions extended throughout BC and Canada (Herring, 2021; KI 12), and even internationally to an extent (Wheatley, 2021). While permanent repairs had been completed for most of the major highway conduits impacted by the event, shown in **Figure 20**, some repairs and upgrades were still ongoing as of Spring 2024 (Gov. BC, 2024a).



Figure 20: BC transportation corridors impacted by the initial AR event (Gov. BC, 2024a)

Locally, Abbotsford experienced extensive damage to critical public infrastructure. The storms damaged 1,100 metres of water main line, thirteen bridges, and eighty-four municipal road sites, in addition to other municipal assets, including a cemetery and nineteen city parks and trails (CoA, 2022a). According to the City of Abbotsford’s October 2023 flood recovery update, the municipality had completed two-thirds of all infrastructure repair projects (CoA, 2023a).

5.2.5.3 Agricultural losses

Flooding impacted 15,000 hectares of farmland and over 1,000 farms (Black & Simons, 2022). Several agricultural sectors—namely blueberries, pork, dairy, and eggs—experienced significant losses related to crop loss, livestock deaths, equipment damage, soil degradation, land remediation, and supply chain disruptions (Schmunk, 2021b; Daflos, 2021; Black & Simons, 2022; KIs 3, 12, 21). Of the 2.5 million livestock affected by the disaster, over 640,000 animals either perished in the floodwaters or had to be euthanized by farmers who were unable to transport their livestock to safety (Black & Simons, 2022; Eccles & Stoddard, 2023; KI 12). BC dairy farmers have estimated losses between \$22 and \$100 million (Black & Simons, 2022). The provincial broiler hatching egg industry, which supplies 14% of all Canadian eggs, suffered a loss of 71,000 hens (BC Farm Industry Review Board, 2023; Black & Simons, 2022). 110 beehives were also impacted (Litke, 2022). In addition to these losses, the flooding

posed risks to water and soil quality due to the spread of contaminants (e.g., pesticides, fertilizers, fuel, manure) and other debris (e.g., metals, asbestos) (Bains, 2021; Ross et al., 2022).

Many agricultural producers refused to evacuate, remaining on their properties to care for their livestock (KI 21; Goodyear, 2021; Canadian Press, 2021a), and faced numerous challenges during and after the event. Producers struggled to secure feed, clean water, fuel for generators, and veterinary services due to extended supply chain issues, road closures, and damage to critical infrastructure (KI 3; Robinson, 2021; Black & Simons, 2022). Those stranded without road access relied on the delivery of supplies by way of watercraft, kayaks, and helicopters (CBC News, 2021c; Canadian Press, 2021a). Although trucks hauling feed were among the essential traffic first allowed into Sumas Prairie when the highways reopened (Fletcher, 2021), the AR exacerbated the existing feed shortages and affordability challenges experienced by producers (Wells, 2021; KIs 3, 12, 21).

BC's agricultural sector has been "lurching from one emergency to the next," according to one provincial policymaker (KI 21). Earlier in 2021, extreme heat and drought conditions in Western Canada decimated crops, causing a nation-wide feed shortage and forcing cattle producers to import corn from the US—a measure that had not occurred at this magnitude since the 2002 drought (Stephenson, 2022). In 2021 and 2022, consecutive agricultural emergencies included a mink farm outbreak, spring floods, a heat dome, wildfires, the atmospheric rivers, and then an avian influenza (KI 21). The November losses, in addition to the compounding pressures of climate change and global market disruptions, prompted some producers to leave the industry following the floods (KIs 3, 12, 21).

The 2021 AR event highlighted how critical agricultural and food supply chain infrastructure (e.g., processing plants, feed mills) had been relatively undervalued in terms of emergency planning and business continuity, as compared to other critical infrastructure networks (e.g., utilities, highways) (KIs 3, 12, 21). Post-disaster, one KI's impression was that "people have woken up and [realized that] this is a vulnerable sector" (KI 21). Due to road closures and delays, producers were unable to transport goods to processing plants, feed mills, and consumer markets in a timely manner, exacerbating financial losses (Black & Simons, 2022; KIs 12, 21). For example, a normal two-hour commute to transport raw dairy to a processing facility took twelve to sixteen hours (Black & Simons, 2022). Dairy farmers in the North Okanagan were forced to discard upwards of 12,000 litres of milk per batch due to the region's dependence on milk processing plants located in Alberta and BC's Lower Mainland (KI 21; Femia, 2021; Hanson, 2021). These supply chain disruptions also produced cascading impacts for areas

of the province such as the Metro Vancouver area, which was less directly impacted by flooding, but nonetheless experienced food and gas shortages as a result of road closures and panic-induced buying during the immediate post-disaster period (KI 22; Canadian Press, 2021b; Huang-Taylor, 2022).

Another sector greatly impacted by the floods was the blueberry industry. Because the perennial crops do not begin to produce berries until after first five growing seasons and often do not reach full maturity for ten years, recovering from crop losses can be a multi-year ordeal for blueberry producers (BC Blueberry Council, 2022). Over 1,011 hectares of blueberry bushes were impacted by the floods, many of which are located in Sumas Prairie (BC Blueberry Council, 2022). Direct flood-related losses are estimated to be \$34,000 per acre or 0.4 hectares; however, this projection increases to \$120,000 per acre when ten-year income losses are included (Black & Simons, 2022).

5.2.5.4 Localized disaster impacts in Abbotsford, BC

Abbotsford is often considered the “epicentre” of the disaster (Canadian Press, 2023b). Between November 15th and November 21st, floodwaters inundated low-lying land in the former lakebed of Semá:th Xó:tsa (Sumas Lake) (Olsen, 2021a). The community’s location, situated atop the lakebed and at the intersection of the Fraser, Sumas, and Nooksack river systems exacerbated drainage issues. Prior rainfall events had saturated the soil, limiting rainwater absorption capacity during BC’s wettest autumn on record (BCG Engineering Inc., 2022). Adding to the intense rainfall conditions, the Nooksack River breached its banks on November 15th, and within twelve hours, overflow from the Nooksack began to pool in the lakebed, weakening structural integrity of the Sumas River dike (Olsen, 2021a; KI 12). Simultaneous high water levels in the Fraser River meant that the excess water flowing in from the Nooksack could not be released through the Barrowtown floodgates, where pumping was constrained to 1/7th of normal capacity (Peters, 2022; KI 12). Neither the pump station nor the dike was designed to withstand this flood magnitude, and both contained known structural and operational deficiencies (NHC, 2015; CoA, 2018; KIs 10, 12). A local elected official described the collective shock experienced in the community when “a twenty-foot wall of water went across the eastern portion” (KI 12) of the lakebed on November 16th following a 100 metre dike breach, denoted on **Figure 21**.

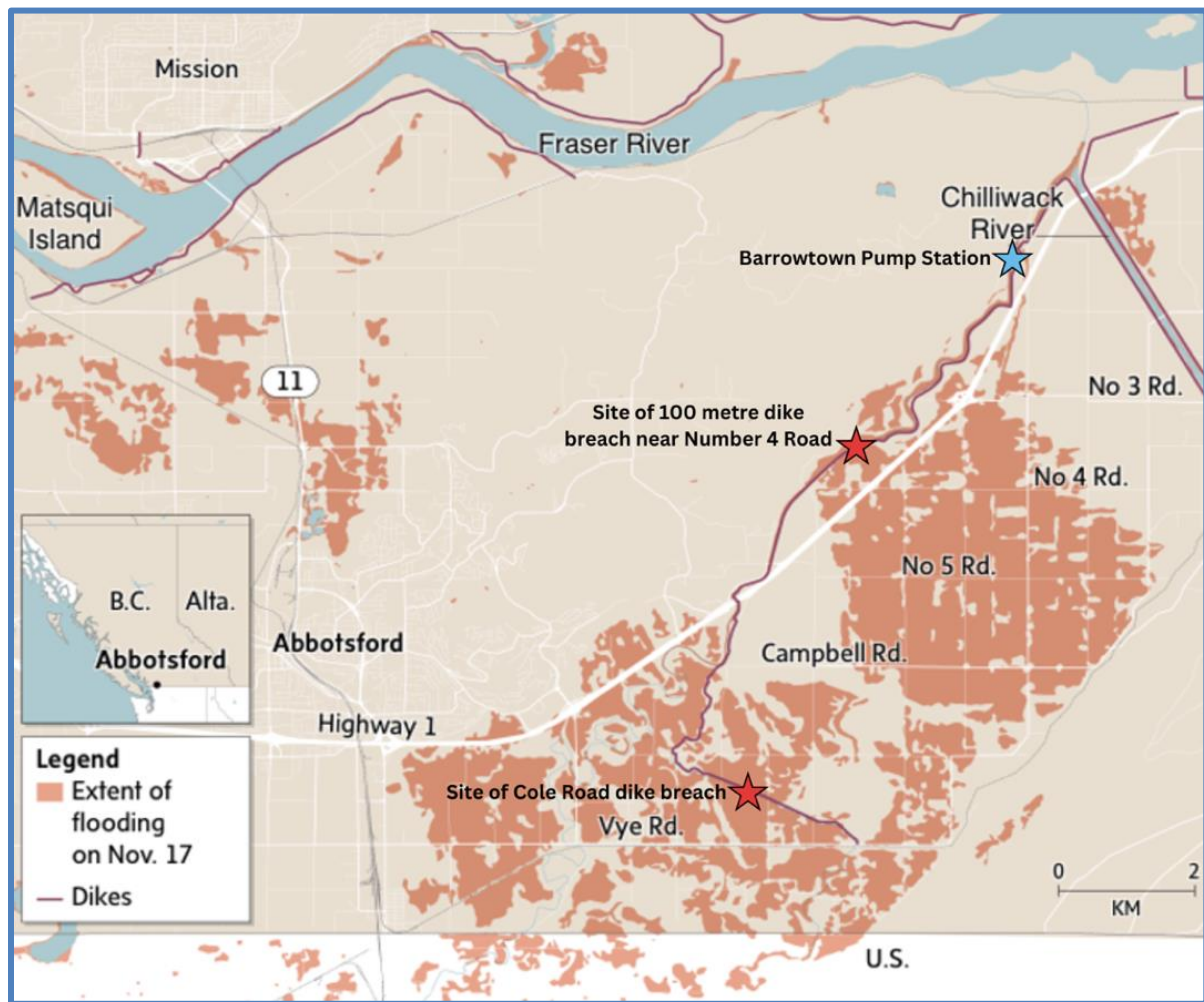


Figure 21: Flood extent in Sumas Prairie (McClearn & Hunter, 2022)

During the initial response, the City of Abbotsford briefly considered a plan to expropriate twenty-two flooded properties to construct a 2.5-kilometre long emergency levee; however, floodwaters began to recede, allowing for temporary dike repairs (Olsen, 2021a). On November 20th, the Barrowtown floodgates were partially opened, releasing water into the Fraser River (Olsen, 2021a). By November 21st, emergency response crews, with support from the Canadian Armed Forces, had placed a tiger dam across the TransCanada Highway 1 to prevent further flooding (Carrigg, 2021). On November 22nd, the highway partially reopened, allowing essential traffic, such as feed transport trucks, into the area (Olsen, 2021a). **Figure 22** shows an inundated field (left) and temporary dike repairs at the breach site on Sumas Dike, which separates the farmland from the Vedder Canal (right).



Figure 22: Flooded farmland at dike breach site (Watterodt, June 2022)

A critical concern was the potential failure of the Barrowtown Pump Station, which would cease operations if flooded. Initially, Abbotsford crews could not access the station because of extensive flooding on North Parallel Road and Highway 1; as a result, over 200 staff and volunteers from Chilliwack and the surrounding area worked to maintain the station's operational capacity (City of Chilliwack, 2021; Sawyer, 2021). Volunteers constructed a twenty-five-metre long emergency makeshift dam of sandbags and tarps to protect the station, while Abbotsford residents created an impromptu road on top of the Sumas Dike to restore access (City of Chilliwack, 2021; Sawyer, 2021). According to former Abbotsford mayor, Henry Braun, had the pump station indeed failed, Highway 1 would have been covered by an additional three metres of water, which may have taken up to a year to fully drain (Sawyer, 2021). Furthermore, this failure would have also inundated the neighbouring Chilliwack community of Yarrow (City of Chilliwack, 2021).

5.2.5.5 Disaster impacts in Whatcom County, Washington

Impacts also extended to Whatcom County, USA, which is located directly upstream from Sumas Prairie. Following a month of relentless rainfall, four major rivers—the Chehalis, Nooksack, Skagit, and Calawah—reached record water levels that were exacerbated by a series of ARs and winter storms (Patel et al., 2021; Cappucci & Samenow, 2021). These conditions culminated in floods, landslides, and eighty kilometres per hour windspeeds (Cappucci & Samenow, 2021), forcing the closure of the Sumas/Abbotsford-Huntington border crossing and critical highway infrastructure (Associated Press, 2021). In January 2022, President Joe Biden issued major disaster declarations for

Whatcom, Clallam, Skagit, Jefferson, Lewis, Island, and San Juan counties, and the Lummi, Nooksack, Quileute, Swinomish, and Hoh tribes (Federal Emergency Management Agency [FEMA], 2022a&b). An American FRM expert (KI 24) recounted:

It could have been the biggest flood that the Nooksack has seen, but I caveat that with the fact that in the early 1910s-1930s, the gauging wasn't very good, and the documentation wasn't that great. A lot of people weren't living where they were in November 2021. But there were extensive impacts to our small communities of Nooksack, Everson, and Sumas, and one fatality. It was devastating and traumatic to a lot of people.

The AR culminated in \$150 million USD in total financial damages, a reported 1,600% increase in economic losses compared to the 1990 Nooksack flood (Whatcom County Sheriff's Office, 2022; World Renew, 2024). The flood resulted in one drowning-related fatality, 500 evacuations, and 1,998 damaged properties (Whatcom County Sheriff's Office, 2022). Damages included \$42 to \$45 million USD for businesses, \$31 million USD for public assets, \$45 million USD for residential properties, \$27 million USD for the agricultural sector, and \$7.2 million USD for transportation assets (Whatcom County, n.d.-a; Whatcom County Sheriff's Office, 2022). In the low-lying border community of Sumas, WA, 85% of all residential structures were damaged (World Renew, 2024), as shown in **Figures 23 and 24**.



Figure 23: Visible water line on a flood damaged home in Sumas, WA (Watterodt, June 2022)



Figure 24: Home repairs were ongoing in Sumas, WA over 1 year post-AR (Watterodt, June 2022)

5.2.6 Issue attention: Visibility and salience of FRM issues among the public

5.2.6.1 Post-disaster media attention related to stories of lived experiences

The 2021 AR event garnered prolific national news attention, lending to the high visibility and salience of BC's flood risk management issues not only among local residents, but also across all scales of government and the broader Canadian public. The lived experiences of those directly impacted by the 2021 AR event played a significant role in garnering public and media attention. In addition to widespread displacement and material losses, the disaster led to tragic losses of human and animal life on both sides of the border (KI 12, 23, 24; Judd, 2021b; Whatcom County Sherriff's Office, 2022).

Imagery of flooded Sumas Prairie fields and farmers leading their cattle through floodwaters, shown in **Figure 25**, was featured prominently in the media and became a quasi-symbol of the disaster for many Canadians. According to two Abbotsford locals, the stories coming out of Sumas Prairie, many linked to agricultural livelihoods, played a powerful role in humanizing the disaster, bringing awareness to local experiences, and in raising \$4.4 million CAD in public donations via the Abbotsford Relief Fund (KIs 2, 12; UFV Today, 2022). Since then, first-hand disaster accounts continue to be shared through various platforms, including a mini documentary, *Stronger Together* (AgSafe BC,

2023), the Climate Disaster Project (CDP, 2023), the Flood Stories Project (University of the Fraser Valley, n.d.), a book of testimonies (Crouse, 2022), and news features (e.g., Garrett & Nassar, 2024).

A local non-profit worker (K2) described how the disaster provoked an emotional response:

It really tugged at people's heart strings to think of all the folks out in Sumas Prairie that were flooded. They weren't just flooded a little bit. They were under six to eight feet [~1.8-2.4 metres] of water. Their homes...[and] farms were destroyed. Animals were killed and drowned. People had all these different mixed emotions about animals, about people, about food security.

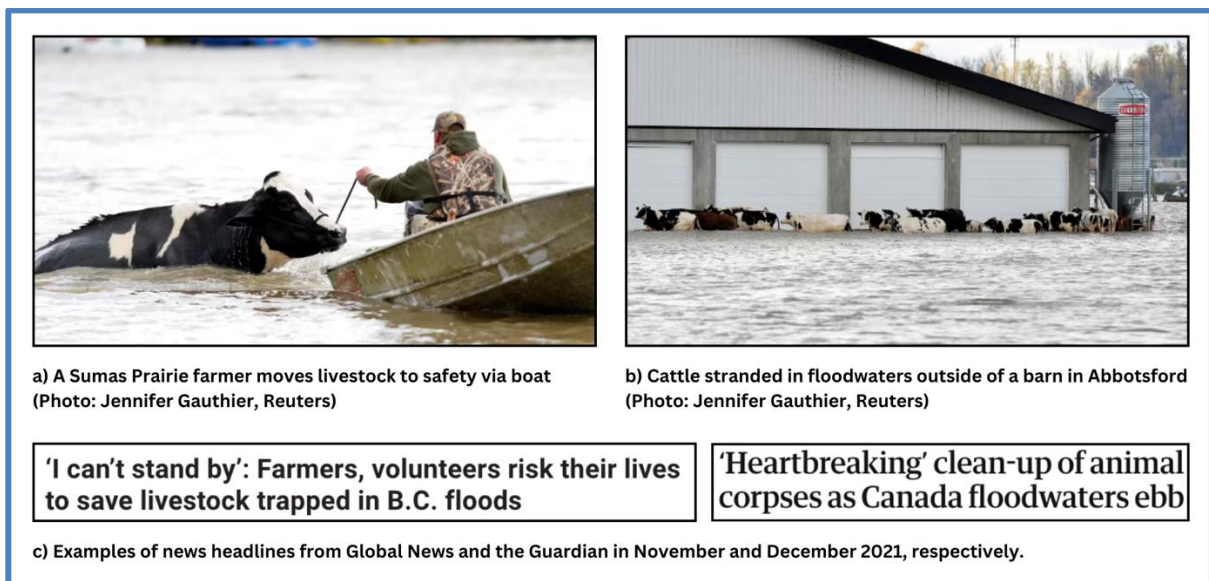


Figure 25: Examples of the imagery and news headlines circulating during the disaster

5.2.6.2 Post-disaster influence on risk awareness and disaster memory

Heightened risk awareness and extended disaster memory, related to the 2021 AR event and BC's multi-hazard landscape, emerged as a common interview theme. This theme is important because losses in collective and institutional memories over time can lead to missed learning opportunities, increased overall risk tolerance, and complacency in between events (KIs 2, 3, 10, 23; Monteil et al., 2020; Rice & Jahn, 2020). According to one provincial employee, more frequent hazard events can sometimes be better understood among citizens and public officials (KI 21) as compared to infrequent or localized events (KI 17, 21), potentially leading to more stable funding and consistent risk awareness. From this KI's perspective, BC's prolific wildfire seasons were seen as examples of how disaster memory and lived experiences continue to shape risk understandings, as most BC residents have

experienced the impacts of wildfires in some capacity (e.g., evacuation, air quality) (KI 21). In contrast, the Fraser and Nooksack Rivers had not experienced major flooding since 1948 and 1990, respectively, and other provincial flood events, such as in Grand Forks (2018) and the Okanagan (2017, 2018), were fairly localized in terms of scale and impact (KI 17).

While multiple KIs noticed a post-2021 increase in both flood risk awareness and FRM policy engagement (KIs 18, 21, 23, 29), others also referred to BC's underappreciated seismic risks as an example of how short-sighted disaster memory can influence policy and behavioural decisions (KIs 2, 11, 21, 29). The province is underprepared for earthquakes, despite the 30% odds of a major Cascadia earthquake occurring within the next fifty years (OAG BC, 2014; Cecclo, 2021)—a disaster with the potential to devastate the Lower Mainland and cripple the Canadian insurance industry and economy (Nelson & Silcoff, 2016). With the projected \$9.5 billion cost of upgrading BC's dike infrastructure, as of 2012 estimates (Ministry of Forests, Lands, and Natural Resources, 2012), the nearly \$2 billion already spent on reinforcing seismically at-risk schools (CBC News, 2014; KI 21), and the \$1 billion price-tag affixed to annual wildfire suppression efforts in Western Canada (Forest Practices Board, 2023), decision-makers are often forced to make budgetary trade-offs. This means that decision-makers may choose to invest in disaster risk reduction or recovery efforts that address an immediate risk, rather than making proactive DRR investments with an uncertain return on investment, particularly with respect to less frequently experienced hazards (KIs 9, 30).

While BC has experienced localized spring floods and less significant ARs in the years following the 2021 AR event (CP, 2023c; Little, 2024), it is possible that the '2021 flood window' is closing and the 'drought and wildfire window' is opening instead, indicative of the cyclical nature of hazard seasons. BC has been in the midst of a prolonged drought related to the warm, dry conditions brought on by El Niño and exacerbated by climate change (Weichel, 2024). In March 2024, snowpack levels across the province were 66% below the 1991-2020 average, following a 1.5 year-long precipitation deficit (Weichel, 2024; EMCR, 2023a). Despite the respite from flooding, these conditions have exacerbated wildfire risks, prompting the Province to expand the BC Wildfire Service into a permanent, year-round organization (EMCR, 2023a). The 2023 wildfire season was another record-breaking year with 2,245 wildfires, 2.84 million hectares burned, \$817 million in suppression costs, and 185,900 people placed under evacuation order or alert (Gov. BC, 2023c). This was nearly double the magnitude of prior record-breaking seasons, which amounted to losses of 1.35 million (2018), 1.21 million (2017), and 869,270 (2021) hectares of forest and land cover (EMCR, 2023a). While BC has

always experienced a “flood and fire disaster cycle” (Cruickshank & Winter, 2018), rapid shifts in seasonal weather patterns and yearly climate variations are increasing the likelihood of consecutive, longer, and less predictable disaster seasons (OAG BC, 2018; NOAA, 2020). These shifts are likely to further extend and amplify emergent policy windows by keeping the need for climate-resilient adaptation front and centre in both the public and political peripheries.

5.2.7 Characterization of the 2021 AR disaster as a focusing event

5.2.7.1 Key informant perceptions of the ‘focal’ nature of the disaster

Through open-ended questioning, key informants (N=30) interpreted their experiences and knowledge of the November 2021 AR event and its influence on policy, practice, and decision-making within the context of their affiliated organization and/or the broader FRM policy and governance landscape. Key informants expressed their perceptions of most significant post-disaster outcomes and reported whether or not they considered the disaster to be a ‘focal event.’ Because key informants hailed from different organizational and professional backgrounds, this line of questioning was left intentionally broad (e.g., what constituted a ‘significant outcome’), enabling KIs to reflect upon their own subjective experiences working within distinct professional and institutional contexts. For some key informants, ‘significant outcomes’ referred to the post-disaster implementation of specific policy interventions, related shifts in organizational structures and institutional mandates, and/or the emergence of new governance initiatives. Others offered their perspectives on how the AR may have influenced broader trends within professional practice, sociopolitical values acceptability, and risk management and governance regimes. Answers varied between scales (e.g., local versus federal perspective) and organizational affiliations (e.g., practitioner versus policymaker). Responses were coded as “yes,” “mixed response,” “unsure,” or “no,” as depicted in **Figure 26**.

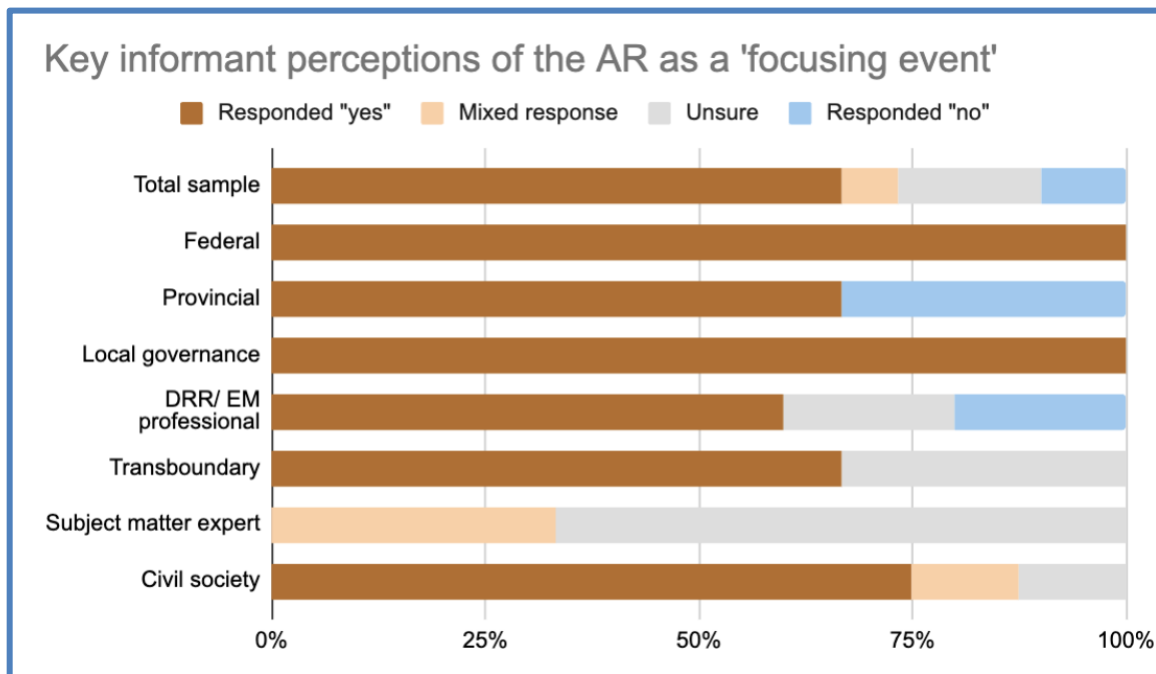


Figure 26: KI perceptions of the AR as a ‘focusing event’

The majority of KIs (67%) perceived the disaster to be a significant focusing event. Key informants who agreed (“yes”) that the AR event was a focusing event gave numerous reasons. These included how the 2021 BC atmospheric rivers event had:

- shifted public flood risk awareness and receptiveness,
- enhanced the visibility of the climate crisis (e.g., through the combined impacts of 2021’s consecutive disasters),
- accelerated and influenced flood policy development and organizational structures within institutional contexts,
- highlighted regional and sector-specific flood vulnerabilities,
- bridged inter- and intra-governmental silos,
- spurred political attention and commitment at federal and provincial levels,
- prompted collaborative and innovative conversations about FRM, and
- either directly resulted in or influenced specific programs and initiatives.

An additional two KIs (KIs 7, 9) believed that: a) the event had been focal in some respects (e.g., media coverage, public and academic interest), but less so in terms of policy- and decision-making, and/or; b) the event had briefly opened a policy window, but that the window had closed without amounting to meaningful long-term governance changes. When KIs perceived both significant

wins and missed opportunities, as expressed in the quote below, these responses were coded as “mixed”:

I mean, I think very briefly it did. I think the wins are certainly the interest from folks like yourself, like the researchers...along with the media...That's very sustained. That has never happened before... The [2007 Calgary floods] window was really short. That was like a four to six week window. And now, we're a year into it [following the 2021 AR] and people are still really engaged and wanting to understand what the problems are, and what are some of the solutions, and understanding the systemic nature of it all. So I think that is a super big win in terms of potential for policy change because we need the public on our side to be able to push decision makers to make different choices...But in terms of any governance shifts, it's all completely collapsed... So the answer is no. Nothing's really changed except for that public and media piece (K 9).

Compared to other strata, local, provincial, and federal governance actors were most likely to view the AR as a focusing event, with the exception of two provincial employees and one DRR/EM professional. Rather, these three outliers believed that the disaster had served to reinforce existing goals and initiatives but did not fundamentally alter policy directions within their organizations (KIs 16, 17, 27). One policymaker believed that the earlier heat dome, rather than the AR event, had been the focusing event, prompting a “significant shift in thinking” about extreme heat (KI 17). In contrast to KIs working in government agencies, individuals involved in community-level or sector-specific initiatives (e.g., NGO staff, industry professionals) were less confident in their ability to assess the focusing nature of the disaster. These KIs were likely to report that it was too early to assess the potential for long-term change, or expressed skepticism around whether or not the AR would amount to meaningful policy and/or governance shifts, as opposed to incremental changes or symbolic political gestures, and were thus coded as “unsure.”

5.2.7.2 A potential focusing event for policy change

Based on the literature definition of a focusing event (i.e. a rare or sudden, high magnitude event), the 2021 BC atmospheric rivers event can be classified as such [**Table 6**]. In general, both key informants (e.g., KIs 3, 12, 15, 17, 21, 22, 24, 27, 28) and secondary sources (e.g., news articles, government media releases, after-action reports) considered the AR event to be unprecedented for a number of reasons. These included: the shifting timing, frequency, and intensity of atmospheric rivers as a result of climate change, the severity of impacts—which not only extended across the province’s most populous region, but also resulted in interjurisdictional and transboundary outcomes—and the

range of cascading and compounding shocks and stressors that exacerbated both hazard exposure and community vulnerability both prior to and during the event. For these reasons, the 2021 atmospheric rivers event constituted a highly visible and salient event that captured public and media attention, both influenced and reinforced institutional policy-oriented learning, prompted political action, and catalyzed opportunities for champions to advance collective action and co-learning within BC's broader FRM policy community.

Table 6: Evidence of a focusing event in the case of the 2021 BC atmospheric rivers disaster

	Condition	Description	Present?
Evidence of a potential focusing event	<i>Rarity</i>	The event is rare and occurs suddenly with little to no warning	Yes
	<i>Scale</i>	The event is high in magnitude	Yes
	<i>Impact</i>	The event produces severe impacts that are highly concentrated	Yes

5.3 A post-disaster window of opportunity for FRM policy and governance

5.3.1 An overview of post-disaster changes in BC flood risk management

Research findings indicate that the 2021 AR disaster directly influenced flood risk management policy and governance in British Columbia in several ways and at different scales. At the local scale, the event prompted the City of Abbotsford to develop a proposed *Long-Term Flood Mitigation Plan for Sumas Prairie*, a strategy that has continued to evolve in the years following its initial inception as a result of other related regional, provincial, and transboundary priorities and initiatives. Next, the AR resulted in the multi-jurisdictional convening of formal governing institutions (i.e., First Nations and Tribal governments, local authorities, provincial and state agencies) on both sides of the Canada-USA border. This has manifested through the post-disaster development of a *Sumas River Flood Mitigation Collaborative Framework*, which aims to promote regional planning in the Sumas Prairie watershed, and the revitalization of transboundary flood governance via the *Transboundary Flood Initiative*, which has expanded opportunities for collaborative planning within the Nooksack River watershed.

Likewise, the post-disaster period has been simultaneously influenced by and further contributed to institutional shifts and accelerated policy-oriented learning both within the provincial government and among regional governance actors, such as through the convening of the *Lower Fraser Floodplains Coalition*. This can particularly be seen at the provincial scale where legislative changes,

ministerial restructuring, and the development of the *BC Flood Strategy* in subsequent years have had a profound impact on the post-disaster FRM landscape. Although many of these shifts were already underway prior to the 2021 atmospheric rivers disaster, these have nonetheless contributed to the FRM policy and governance transformation that is well underway within the province.

The following sections explore these initiatives within the interrelated contexts of prior and post-disaster policy-oriented learning, and identifies enabling conditions and barriers for shifting the FRM paradigm in BC, both from top-down initiatives and bottom-up advocacy. The following results capture post-disaster shifts policy and governance at the local, regional, transboundary, and provincial scales. As outlined in **Table 7**, there is evidence to suggest that the 2021 AR event has led to a window of opportunity for governance actors to engage in policy-oriented learning and action.

Table 7: Evidence of an emergent post-disaster policy window in British Columbia

	Condition	Description	Present?
Evidence of policy window formation	<i>Issue Attention</i>	The policy issue is both highly visible and salient, receiving relatively more attention than prior to the event	<i>Across all scales:</i> Yes
	<i>Issue Framing</i>	The perceived problem, its root causes, and potential solutions is framed in a new or nuanced way	<i>Local:</i> To a limited extent
			<i>Regional:</i> Yes
			<i>Transboundary:</i> Yes
			<i>Provincial:</i> In some contexts (e.g., agriculture), yes
	<i>Collective Action</i>	There is relatively substantial collective interest and momentum within the policy community to engage in solution-seeking and policy advocacy, as compared to prior to the event	<i>Across all scales:</i> Yes
	<i>Available Solutions</i>	There are feasible policy solutions readily available to be considered by policymakers and/or decision makers.	<i>Across all scales:</i> Yes
	<i>Commitment to action</i>	Decision-making authorities commit time and resources towards solving the perceived problem	<i>Across all scales:</i> Yes

5.4 Shifts in FRM policy and governance at the local scale

5.4.1 The City of Abbotsford's Long-Term Flood Mitigation Plan for Sumas Prairie

5.4.1.1 The development of a post-disaster flood risk mitigation policy proposal

Due to the high profile damages and losses experienced in Sumas Prairie and mounting public pressure to resolve FRM issues, the City of Abbotsford was relatively quick to propose policy actions in the aftermath of the AR event. In April 2022, five months after the disaster, municipal staff presented four policy proposals for Abbotsford's *Long-Term Flood Mitigation Plan* [LFMP] to Council (CoA, 2024). Ranging in cost from \$209 million to \$2.8 billion CAD, the proposed mitigative actions included upgrading the Barrowtown Pump Station, adding new pump stations along Sumas River, Marshall Creek, and Saar Creek, creating a flood overflow channel via dike setbacks, and hardening protective infrastructure through the construction of new, raised, and reinforced dikes (CoA, 2022b). **Figure 27** compares these proposals, shown as Options 1 through 4. The City also identified various mitigation options that fall outside of municipal jurisdiction which include upgrading Chilliwack's Vedder dike, raising railways and the TransCanada highway, drilling a tunnel through Sumas Mountain for enhanced Sumas River conveyance, and constructing new levees along the Nooksack River (CoA, 2022c).

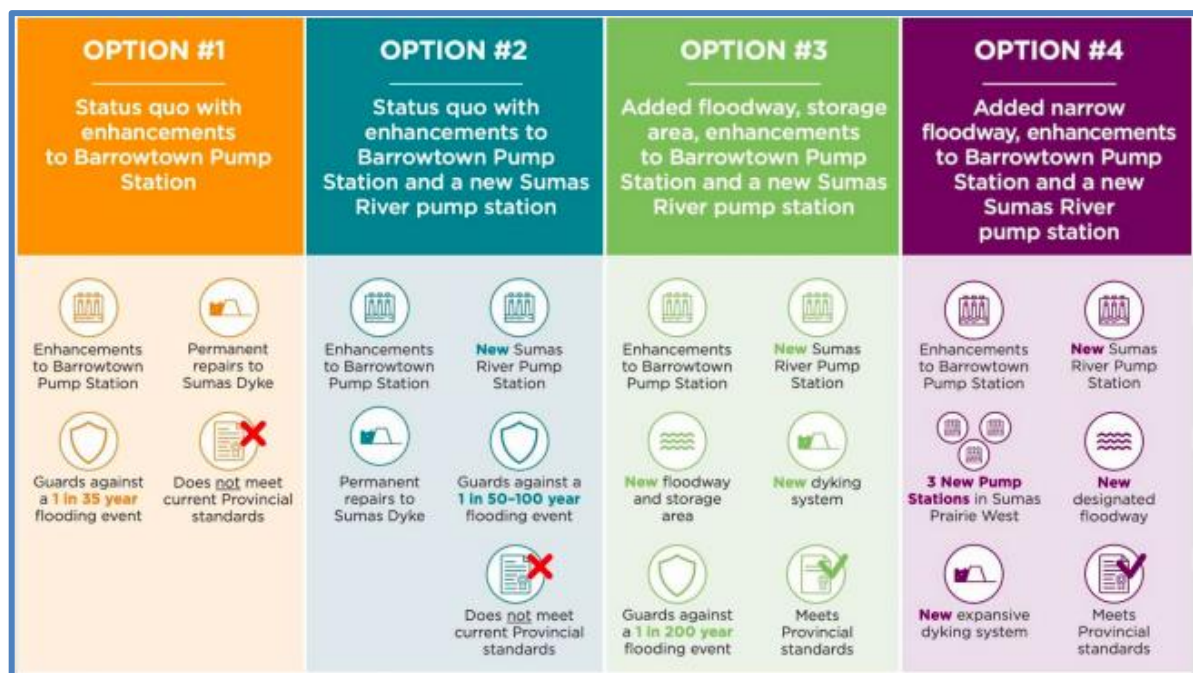


Figure 27: Initial FRM options proposed by the City of Abbotsford (IdeaSpace Consulting, 2022)

Although the City framed the options as being either “Status Quo (Option 1),” “Status Quo with a Build Back Better component (Option 2),” and “Build Back Better (Options 3 and 4)” (CoA, 2022b), the extent to which these options can be considered ‘better,’ and for whom, is contested. While there are promising provisions for improved fish passage and enhanced conveyance, what constitutes “appropriate land-use” (CoA, 2022b), for example, is ambiguous. The City of Abbotsford’s (2022b) principles for building back better include:

- (1) ensuring dikes meet minimum provincial standards for a 200-year flood return period and for seismic risks;
- (2) protecting critical infrastructure;
- (3) maintaining agricultural capacity;
- (4) creating floodways through dike setbacks and appropriate land-use management;
- (5) maintaining or enhancing flood protection in the lake bottom;
- (6) implementing fish-friendly infrastructure;
- (7) addressing existing stormwater drainage issues;
- (8) prioritizing climate-resilient solutions; and
- (9) providing financial restitution for any farms located within designated floodways.

In June 2022, a mere six months after the floods, Council approved a hybrid of Options 3 and 4, calling this the ‘Preferred Option,’ shown in **Figure 28**. This option included retrofitting the Barrowtown Pump Station to improve station redundancy, in addition to building a new pump station on Sumas River, multiple new dikes, including one bordering the Sumas First Nation reserve, and a series of designated floodways, flood storage areas, and overflow channels (CoA, 2022 b & d). Critically, this option seeks to protect private property and agricultural lands within the lakebed (CoA, 2022d), echoing the same underlying values that led to the drainage of Semá:th Xó:tsa in the 1920s. However, these results are perhaps unsurprising, given that City reportedly failed to meaningfully collaborate with adjacent First Nations governments from the onset of developing the LFMP (KIs 4, 9; da Silva, 2022). A comparison chart between all proposed LMFP options is provided in **Appendix H**.

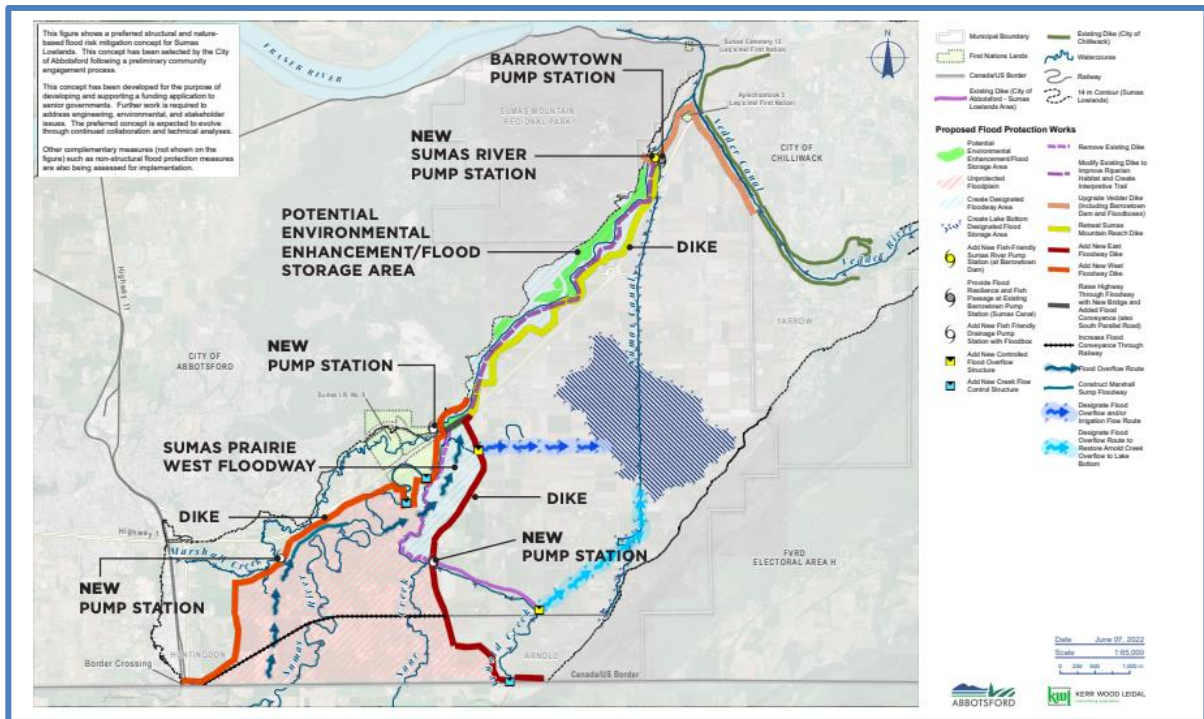


Figure 28: The Preferred Option approved by City Council in June 2022 (CoA, 2022d)

In June 2023, the City announced updated plans to engage in near-term ‘urgent works,’ related to enhancing pumping capacity via Barrowtown Pump Station upgrades (\$66 million) and creating a new Sumas River Conveyance System (\$870 million), as well as creating a flood storage area and engaging in associated habitat enhancement work (\$120 million) (Hopes, 2023; CoA, 2023c). The City submitted a \$1.6 billion application to the federal *Disaster Mitigation and Adaptation Fund*, which funds up to 40% of eligible project costs (Hopes, 2023; Infrastructure Canada, 2023), but was ultimately unsuccessful in the bid for federal funding due to the application reportedly failing to meet merit-based criteria and the project exceeding the scope of the funding stream (Bosch, 2024; Joannou, 2024). Earlier in 2024, while the City awaited these results, the Province announced \$76.6 million in up-front funding to complete urgent works (Gov. BC, 2024b). This installment brings total provincial funding for Abbotsford’s recovery and FRM planning to \$180 million (Gov. BC, 2024b), which includes \$3.2 million for earlier Barrowtown upgrades and \$5.38 million for additional recovery projects (Gomez, 2023). However, other longer-term flood mitigation actions were reportedly put on hold in the near-term to prioritize developing a collaborative regional framework for flood resilience (KI 19).

5.4.1.2 Limited public engagement and First Nations consultation in the LFMP

Early public engagement efforts in the LFMP development process occurred on a relatively short timeline, leading three KIs (1, 8, 9), as well as several Abbotsford residents involved in the process (IdeaSpace Consulting, 2022), to criticize the City of Abbotsford for excluding First Nations Rights Holders and key stakeholders, such as local community organizations, from the onset. Engagement efforts related to the Abbotsford LFMP spanned just forty-one days and centered around three public information sessions, held between May 3-10, 2022, and online engagement via two surveys on the ‘Let’s Talk Abbotsford’ platform (CoA, 2024). Online engagement, which closed on May 15th, centered around two surveys—one for Sumas Prairie residents and business owners, and the other open to the broader Abbotsford public (CoA, 2024; IdeaSpace Consulting, 2022). The former survey generated 142 total responses; seventy-five people preferred Option 4, forty-two preferred Option 2, and twenty and five chose Options 3 and 1, respectively (IdeaSpace Consulting, 2022). At this time, the City also reported the start of intergovernmental conversations with Sumas, Matsqui, and Leq’á:mel (CoA, 2024), yet then announced the preferred option just four weeks later.

Abbotsford’s relatively rapid and limited public engagement process was described by two KIs who had detailed knowledge of the process as “tokenistic” (KIs 1, 9). The process did not meaningfully empower residents to exercise agency in envisioning longer-term community futures, neither did the City engage with local organizations involved in the AR response and recovery, nor did the City collaborate First Nations Rights Holders from the onset of plan development. One community advocate expressed that they felt that this was a missed opportunity to connect with community-based networks and incorporate inclusive disaster preparedness into the largely infrastructure-focused plan (KI 8), although local businesses were later engaged in an emergency preparedness workshop (CoA, 2023b).

Under the globally recognized International Association for Public Participation Canada [IAP2] “Spectrum for Public Participation,” shown in **Figure 29**, Abbotsford’s public engagement process represents the framework’s two least participatory categories: “inform” and “consult” (IAP2 Canada, n.d.). One KI, an engineering consultant, suggested that Abbotsford’s public engagement fell substantially short of achieving best practices (KI 9). In contrast, the values-based processes utilized by other BC local authorities (e.g., City of Vancouver, 2018 & 2022; City of Surrey, 2019) provide alternative examples of more inclusive, collaborative, and participatory approaches (KI 28; Osler & Demsar, 2020; Jones, 2023; Okamoto, 2023; IAP2 Canada, 2024).

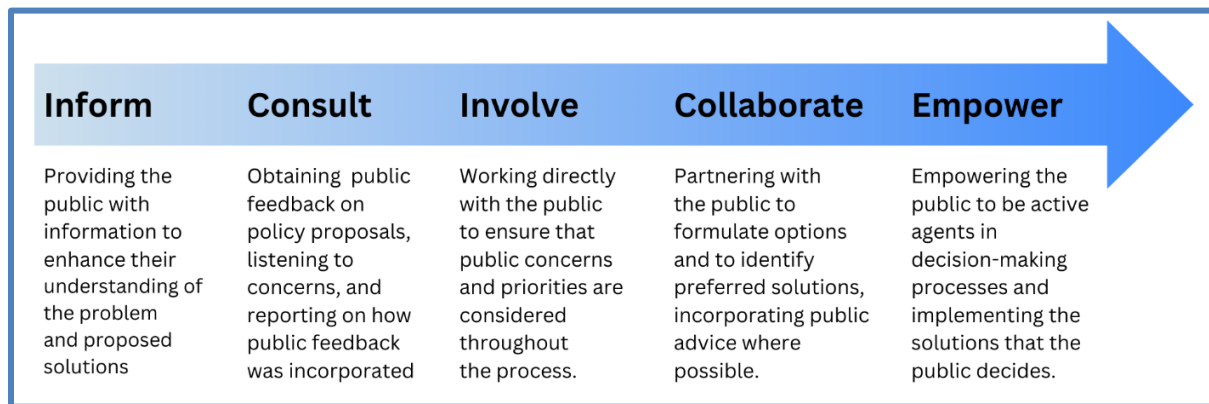


Figure 29: IAP2 Spectrum on Public Participation (adapted from IAP2 Canada, n.d.)

Field observations of a public information session held on May 10, 2022 at the Upper Sumas Elementary School in Abbotsford supported these findings. During these sessions, staff and hired consultants guided the public through the four pre-determined proposals, answered questions, and encouraged feedback to be shared on post-it notes, shown in **Figure 30**. While Sumas Prairie residents and business owners did have the opportunity to speak directly with municipal staff and officials, the observed engagement process was relatively passive. Municipal representatives and hired consultants were positioned to answer questions at four primary stations, one for each proposed option. At each station, information about the proposed option was visually presented alongside a blank board where the public could provide commentary via anonymous post-it notes. The information panels sought to “inform” the public on the proposed solutions, while the message boards and in-person dialogue allowed the City of Abbotsford to “consult” the public. However, participant observation revealed no attempt made to directly involve public stakeholders in the development of FRM solutions or to collaborate with the public in an interactive manner, as is considered best practice for participatory engagement (e.g., Sheppard et al., 2011; Cone et al., 2013; O’Brien & Wolf, 2010; Omondi, 2020; Reid et al., 2023). For example, the City neither engaged in the iterative workshopping of proposed policy ideas nor sought to elicit community values beyond what was already pre-determined by city staff.

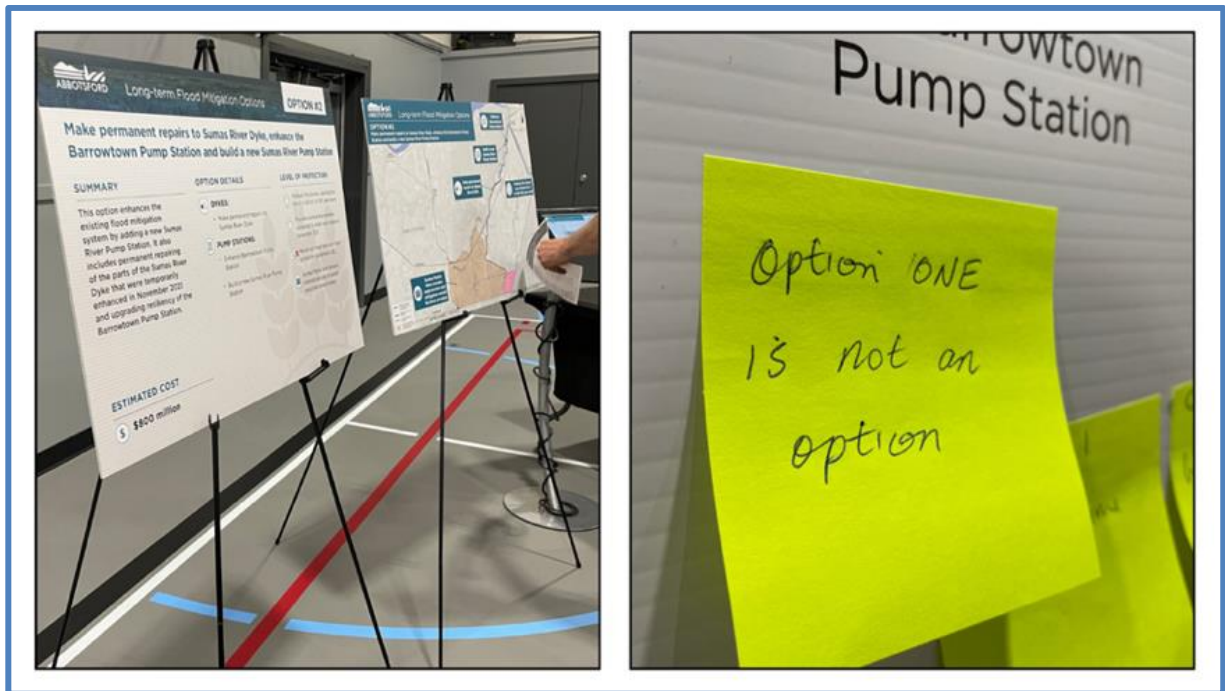


Figure 30: Signage and commentary at the May 10th public information session (Watterodt, 2022)

The observed absence of an iterative and interactive public engagement process was reflected in the City of Abbotsford’s narrow scoping of community priorities and potential policy solutions (CoA, 2022e), and was reflected in the many outstanding questions and concerns reported by the public in the City’s subsequent engagement report (IdeaSpace Consulting, 2022). In June 2022, the City of Abbotsford reported that the preferred LFMP plan was chosen in alignment with the three primary community priorities (i.e., values) identified from this limited feedback: (1) avoiding future property and infrastructure damages, (2) preserving food security and agricultural land, and (3) “maximizing” agricultural opportunities (CoA, 2022e). Ranked community priorities, shown in **Figure 31**, were presented in the engagement report along with other survey results. However, as mentioned above, the City did not engage in any participatory activities to elicit priorities beyond the three public information sessions, and the closed-ended multiple choice options in the two surveys. In the surveys, for instance, residents ranked these pre-determined priorities as being “Not Important,” “Somewhat Important,” “Important,” or “Very Important,” while other questions required simple yes/no answers (CoA, 2022b).

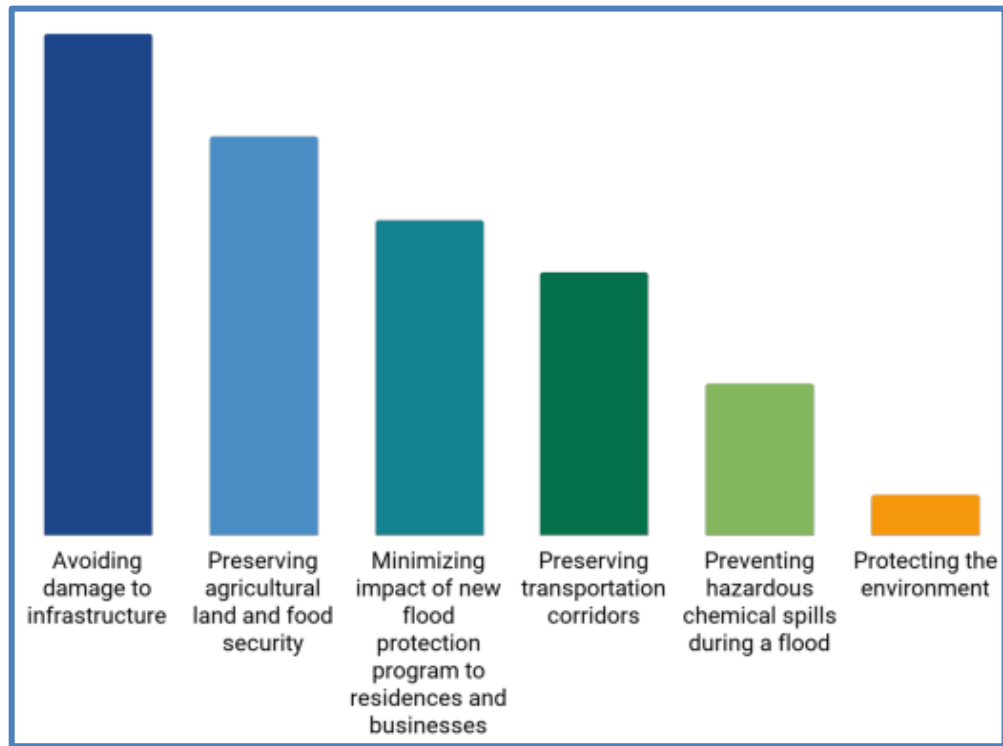


Figure 31: Survey results on community FRM priorities (IdeaSpace Consulting, 2022)

5.4.1.3 Exploring FRM strategies: A missed opportunity for managed retreat?

It can also be argued that, within the scope of the LFMP, the City of Abbotsford’s emphasis on maintaining existing flood protection and agricultural land-use within the former lakebed may constrain opportunities for transformative adaptations, such as widespread managed retreat, and is indicative of the region’s complex, deeply-entrenched path dependencies. Many initially proposed FRM strategies were not necessarily new considerations, but rather, reflect the recommendations of earlier studies dating all the way back to the 1990 Nooksack flood response (CoA, 2018; Kerr Wood Leidal, 2020). According to one FRM professional, Abbotsford’s LFMP had simply “recycled ideas [from] 30 years ago” (KI 9), rather than necessarily exploring innovative or alternative pathways. This sentiment was echoed in the media and among advocacy groups, such as the Lower Fraser Fisheries Alliance (e.g., Olsen, 2021b; da Silva, 2022; Martin et al., 2022; Finn et al., 2024). Some, for instance, called for the “return of Sumas Lake” (Finn et al., 2024), a managed retreat strategy that could involve the buyout of lake-bottom properties and the subsequent restoration of former aquatic and floodplain ecosystems.

In response to these criticisms, the City of Abbotsford maintained that the four initially proposed options were chosen as being the “most appropriate [strategies] for public engagement,” but alleged that the City had internally considered a broader range of FRM options (Currie, 2024: p.3). The municipality asserted that the preferred strategy draws upon “all the tools in the toolbox,” which includes a proposed funding allocation of \$150 million to acquire the most at-risk lands in the lake bottom and river corridor (Currie, 2024: p.3). While earlier plans implied a limited element of retreat through the creation of a designated floodway and controlled overflow to the lake bottom (CoA, 2022b), the updated plan, released in June 2023 and shown in **Figure 32**, now provides specific language around this mixed suite approach; here, areas are designated as “protect,” “accommodate,” “retreat,” and “accept risk,” and the plan includes provisions for natural flood storage solutions through habitat enhancement work (CoA, 2023c).

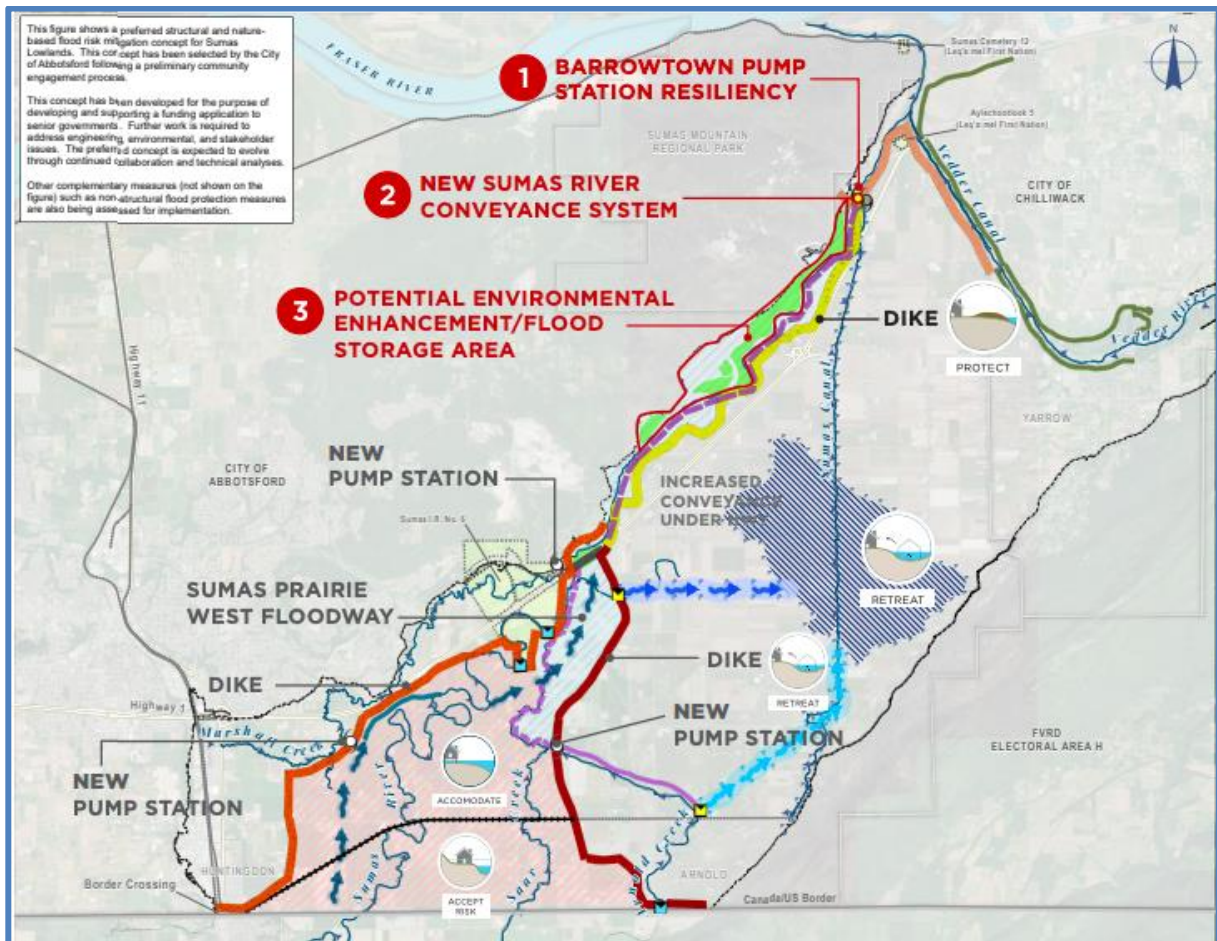


Figure 32: Updated Long-term Flood Mitigation Plan for Sumas Prairie (CoA, 2023c)

The terminology used by the City of Abbotsford is consistent with current research (e.g., Doberstein et al., 2019; Mach & Siders, 2021) suggesting that climate-resilient flood adaptation will increasingly require the integration of a variety of FRM strategies including:

- (1) engineered architecture and defensive infrastructure designed to **protect** against floodwater (e.g., dikes, sea walls);
- (2) adaptative measures that **accommodate** floodwaters (e.g., wetproofing, home elevation);
- (3) regulatory measures that seek to **avoid** future floodplain development (e.g., amended zoning, restricted development); and
- (4) opportunities for **managed retreat**, or relocation, from areas of risk (e.g., property-buyouts, infrastructure re-alignment, conservation easements) (Doberstein et al., 2019).

The City of Abbotsford's caution in committing to a managed retreat scenario is perhaps unsurprising given the highly complex and challenging nature of relocation policy development, which varies significantly by local context. Despite its transformative potential as a flood adaptation strategy (Mach & Siders, 2021), managed retreat is often applied reactively, inequitably, and without post-retreat land use considerations, making it a socially and politically contentious FRM option (Ajibade et al., 2022; Leilani Main et al., 2022; Thistlethwaite et al., 2023). Although many scholars contend that retreat is likely to play a more prominent role in future flood adaptation for communities facing recurrent and elevated flood risks (Koslov, 2016; Mach & Siders, 2021; Mach et al., 2022), there has been an overarching absence of decision-making supports, as well as limited applications of retreat, within the Canadian context (Le Geyt, 2022; Cottar & Wandel, 2024).

A comparison of post-disaster FRM policy and planning in British Columbia and Washington highlights the value of pre-established policy mechanisms and governance arrangements in enabling post-flood investment in transformative adaptations. In Whatcom County, post-disaster FEMA funding was secured for home elevations, property buyouts, and levee setbacks (Whatcom County, n.d.-b; KIs 23, 24). The County had already been engaging in these actions as part of two prior strategic watershed initiatives: a) the Floodplain Integrated Planning Committee, and b) Floodplains by Design, a public-private partnership for advancing integrated floodplain management (KIs 23, 24, 25). Post-AR, ninety-two new households expressed interest in participating in either property buyouts or home elevations; however, securing the \$40 million USD necessary for program implementation was a challenge (WCSO, 2022; KIs 23, 24). The incentive for Whatcom County residents to engage in buyout programs is in part due to USA federal regulations that prohibit people from rebuilding non-agricultural structures and homes within designated floodways when damage exceeds 50% of a home's pre-flood value (KI

24). Presidential Executive Orders 11988 and 11990 also mandate that when engaging in post-flood reconstruction in wetland and floodplain areas, FEMA must first assess opportunities to strategically relocate at-risk structures or to otherwise reduce risks (e.g., floodproofing, elevation) (FEMA, 2022b). KIs (14, 16, 17, 20) identified the absence of similar funding programs, decision-support tools, and regulatory statutes as barriers to engaging in post-disaster managed retreat in the BC context.

Additionally, there has been limited exploration to date of the interplay between managed retreat, other FRM approaches, and dynamic adaptation pathways (Lawrence et al., 2020; Mach & Siders, 2021), wherein FRM measures are implemented in phases and can be adapted over time when triggered by a certain set of conditions (e.g., reaching a flood threshold, decommissioning end-of-life infrastructure). However, this is starting to shift, both within scholarly research and professional practice. For instance, several local authorities in the vicinity of Abbotsford are currently exploring holistic and unconventional ways of gradually ‘retreating’ from flood risk, while meeting other multi-benefit targets, such as water quality improvements, cultural revitalization, and shoreline accessibility (e.g., Metro Vancouver, 2021; City of Vancouver, 2022; Elder et al., 2024). Similarly, the City of Abbotsford disputes that retreat must be an “all or nothing” approach; rather, retreat may be integrated where technically and economically feasible in tandem with other interventions (Currie, 2024: p.3).

Still, critical questions surround the long-term viability of maintaining current agricultural operations in high-risk areas of BC. For instance, the blueberry farms in Sumas Prairie and dairy farms located on Nicomen Island in the Fraser River both continue to be at risk of future floods, while possessing limited adaptive capacity (KI 21). Potential mitigative options include relocating these operations or rezoning floodprone lands to restrict farming to more tolerant crops (e.g., switching from blueberries to cranberries); however, despite benefits for DRR and CCA, managed retreat, in particular, is generally cost prohibitive and lacks political support, according to one provincial policymaker (KI 21). Likewise, engineering consultants working on Abbotsford’s LFMP have cited a range of concerns associated with a full lake-bottom retreat scenario, including the loss of agricultural productivity and associated impacts on BC’s overall food security, impacts to critical infrastructure (e.g., Highway 1, utility lines), and uncertainties related to aquatic health, lake inflow, and sediment management within the broader FRM system (Currie, 2024).

5.4.1.4 Did the event trigger policy learning in Abbotsford?

Despite the City of Abbotsford's (2022b) promise to "prioritiz[e] climate resilient solutions" in the LFMP, climate resilience and sustainability have continued to be somewhat poorly represented within other recent Abbotsford-area land-use planning decisions, namely the McKee Neighbourhood Plan. In June 2023, at the same time as the updated LMFP was released, Council approved this plan to guide the future development of up to 9,600 primarily single-family homes at the base of Sumas Mountain (CoA, 2023d). The plan states an intention to "work with nature" and create "adaptive neighbourhoods" (CoA, 2023d). However, the plan has been criticized for its potential to perpetuate urban sprawl and car-dependency (as opposed to high-density infill), to block public access to recreational greenspaces, to threaten cultural and archaeological sites, and to impact biodiversity within sensitive forest and riparian ecosystems (Olsen, 2023a; CoA, 2023e; Fraser Valley Conservancy, 2023; Abbotsford Policy Corner, 2023). Regarding FRM priorities, additional losses in Abbotsford forest cover, pervious surfaces, streams, and wetlands could exacerbate downstream flood risks for Sumas Prairie and Sumas First Nation (CoA, 2023e; Fraser Valley Conservancy, 2023; Abbotsford Policy Corner, 2023). This limited integration of climate-resilient planning is unsurprising given that, as of 2024, the City does not have a climate action plan, citing barriers related to staff capacity, finances, and higher-level supports, although in 2022, a risk assessment was reportedly underway (CoA, 2023f).

5.4.1.5 Local FRM planning as situated in an evolving multi-jurisdictional context

The evolution of Abbotsford's FRM planning is situated within the context of ongoing multi-jurisdictional and regional governance initiatives, provincial oversight and steering, and the shifting eligibility requirements of federal and provincial funding streams. Since the initial FRM plan development, the City of Abbotsford has engaged in various collaborative other governance initiatives. Concurrently, the Province has also undertaken substantial steps to streamline flood risk management, disaster risk reduction, and climate adaptation efforts, both across ministries and between levels of government. For instance, provincial and federal funding programs are increasingly requiring recipients to bridge silos and integrate co-benefit considerations into project proposals and design, which can help to steer local government action in ways that align with higher-level priorities, such as decolonization (KIs 20, 22, 26, 29). Although many of these actions were underway prior to the 2021 AR event, there was overall consensus among key informants that the disaster had influenced the advancement of whole-of-society and whole-of-government approaches to flood governance by:

- enhancing partnerships and alignment between local, First Nations, sub-national and federal governments, and across agencies (KIs 7, 14, 18, 19, 20, 22, 23, 24, 29, 30);
- strengthening community and regional networks (KIs 2, 7, 8, 11, 12);
- expanding public-private partnerships (e.g., enhanced participation of insurance and agricultural sectors in flood governance) (KIs 3, 6, 9, 21); and
- bringing “federal and provincial ministers together with Indigenous leadership in a way that...hadn't really happened before” (KI 18).

5.5 Shifts in FRM policy and governance at the regional scale

5.5.1 Sumas River Flood Mitigation Collaborative Framework

5.5.1.1 Post-disaster advances in multi-jurisdictional flood risk governance

Although the City of Abbotsford failed to meaningfully engage First Nations in the initial development of the municipality’s LMFP, the post-disaster period has nonetheless produced critical openings for enhancing government-to-government relations and engaging in multi-jurisdictional watershed planning. This has been largely due to provincial steering and the presence of other regional governance initiatives. Prior to legislative changes in 2023 (as discussed in section 5.6.2.4), local authorities did not have a legal obligation to engage First Nations governments in the co-development of emergency management and DRR policies (Pritchard et al., 2023). At the provincial level, however, provincial authorities are required to align provincial laws and policies with the United Nations Declaration on the Rights of Indigenous Peoples, which includes obtaining free, prior, and informed consent and empowering First Nations to exercise self-determination in decision-making processes (Gov. BC, 2020). Since Abbotsford had not meaningfully involved local First Nations in the initial LFMP development, the Province’s role in the post-disaster period was to provide strategic oversight and to ensure that local authorities respected inherent Indigenous Rights and Title (KI 19).

Post-disaster, the Semá:th (Sumas) First Nation Community Recovery Table and the Sumas Prairie Recovery Table were convened in January and February of 2022, respectively (KI 19). Building on these early recovery tables, staff and leadership representatives from the Province of BC, the City of Abbotsford, the City of Chilliwack, Sumas First Nation, Leq’á:mel First Nation, and Matsqui First Nation convened to develop a Memorandum of Understanding among the parties (KI 19). This convening sought to build upon an existing Memorandum of Understanding between Abbotsford, Sumas First Nation, and the Province (KI 19), which arose in 2019 after emergency bank stabilization

measures had damaged traditional fishing sites and critical fish habitat (Michaels, 2019). The parties' first overarching objective was to build relationships, align interests, and determine how to best utilize Abbotsford's earlier flood planning work (KI 19).

In April 2023, the parties signed a multi-government agreement, the Sumas River Flood Mitigation Collaborative Framework, which will support collaborative FRM planning within the Sumas watershed (EMCR, 2023b). Chief Alice Thompson of Leq'á:mel First Nation described the Framework as an “innovative approach founded in a respect for and recognition of our Indigenous rights, both as individual First Nations and as a collective” (EMCR, 2023b). Key priorities of the three First Nations include ensuring the long-term sustainability of the S'ólh Téméxw (Fraser River Basin/ Fraser Valley), strengthening collective emergency preparedness capacities, integrating community values into FRM planning, and ensuring that reserve lands and infrastructure are adequately protected (EMCR, 2023b). The Framework marks an important milestone towards developing integrated regional solutions and systems-based FRM approaches (EMCR, 2023b). The Province also allocated \$4 million CAD to support the Framework and its technical team, which aims to guide best practices (EMCR, 2023b).

5.5.2 Transboundary Flood Initiative

5.5.2.1 The evolution of transboundary flood governance from 1990 to 2021

Similarly, the 2021 AR event produced significant shifts transboundary flood governance, acting as a catalyst for revitalizing cross-border FRM planning between Canadian and American partners; however, these current developments build on an earlier history of post-flood transboundary governance initiatives that began in the aftermath of the 1990 Nooksack River flood. Following the 1990 disaster, the Nooksack River International Task Force [NRITF] was convened to address cross-border flood risks. In 1992, the NRITF was integrated within the BC-WA Environmental Cooperation Council [BCWA-ECC], a framework for collaborating on transboundary environmental issues related to air and water quality, flooding, water resource management, waste management, and habitat protection (Gov. BC, 1992; Jefferies & Hager, 2023). The BCWA-ECC has enabled BC and Washington to develop shared technical and bureaucratic capacities through knowledge sharing and joint project implementation, creating a forum for local actors to engage in complex transboundary environmental issues (Carruthers, 2007).

Despite this, both the BCWA-ECC and NRITF possessed limited decision-making influence due to jurisdictional challenges, absent political engagement, gaps in institutional memory, funding constraints, and limited First Nations involvement (Carruthers, 2007; Jefferies & Hager, 2023; KIs 12, 23, 24, 30). Despite intermittent attempts by Abbotsford and the BC Ministry of Environment to “reinvigorate the Task Force” (KI 23), the NRITF largely remained on hiatus in the years leading up to the 2021 AR (KI 23, 24). Notably, the NRITF was technically-focused and did not include representation from state-level policymakers in Washington, while the Province of BC’s oversight eventually waned due to staff turnover and the loss of key policy champions (KIs 23, 24).

Furthermore, NRITF did not involve Indigenous Rights Holders on either side of the border, resulting in a myopic focus on technical solutions without consideration of other sociocultural, ecological, political, and legal priorities (Jefferies & Hager, 2023). For example, early studies centered around sediment management; however, dredging the Nooksack River would adversely impact ecosystem functions and infringe upon the Lummi Nation and Nooksack Tribe’s inherent treaty rights (KI 24; Jefferies & Hager, 2023). Furthermore, this short-term solution would not address the underlying drivers of increasing flood risks, such as floodplain development, loss of natural riparian storage mechanisms, and climate change (Bush, 2022). Under climate change, for instance, the Nooksack’s streamflow rate is expected to increase by 30% (Kerr Wood Leidal, 2020).

Additional geopolitical complexity, related to Washington’s sole authority over FRM actions within the Nooksack watershed and disparities between upstream and downstream communities, has undermined consensus and cooperation (Olsen, 2022). Both Sumas, WA and various Canadian governance actors have long advocated for Whatcom County to build a levee near Everson, WA to prevent cross-border overflow from the Nooksack (Vanderklippe, 2021; Brunoro, 2022). However, this politically-infeasible intervention could potentially exacerbate downstream flooding (Olsen, 2023b).

5.5.2.2 Post-disaster revitalization of transboundary FRM governance

Post-2021 AR disaster, Canadian and American partners sought to revitalize the transboundary FRM governance within the Nooksack and Sumas River watersheds that had been initiated in 1992 but had waned in the following decades (KIs 19, 23, 24). In 2022, cross-border dialogue commenced between local authorities, First Nations and Tribal governments, and provincial and state agencies (EMCR, 2023c). In October 2023, the Province of British Columbia, the City of Abbotsford, Sumas First Nation, Leq’á:mel First Nation, Matsqui First Nation, the State of Washington, Whatcom County,

the Nooksack Indian Tribe, and Lummi Nation signed a multi-government agreement to develop the collaborative Transboundary Flood Initiative (EMCR, 2023c). The Transboundary Flood Initiative's three primary objectives are to address collective flood risks, to restore vital aquatic ecosystems and fish habitat, and to strengthen intergovernmental relations (EMCR, 2023c). The Initiative aims to promote data and knowledge sharing among parties, as well as leverage emergent opportunities to invest in watershed-scale FRM (EMCR, 2023c).

5.5.2.3 Learning from prior shortcomings

What is promising about the new Initiative is its three-tiered governance structure, which now includes policy and leadership experts, in addition to the technical experts who previously comprised the NRITF (EMCR, 2023c). While preserving the continuity of existing technical expertise, this new structure aims to address the earlier shortcomings related to the NRITF's prior inability to report to and access higher-level governments, perceived by one provincial KI (19) as necessary for sustaining a "durable collaboration between the Province [of BC] and the State [of Washington]." In Washington, the AR has reportedly elevated local FRM concerns, prompting greater buy-in and leadership at the state level (KI 23). The Initiative also marks a critical milestone in the advancement of Indigenous self-determination over FRM priorities and actions within traditional territories (KIs 12, 30; EMCRC, 2023c).

While it is too early to evaluate the efficacy of the Transboundary Flood Initiative, it appears to address many of the barriers inherent to the NRITF and to sustaining collaborative transboundary governance more broadly. Commonly cited transboundary FRM barriers include fragmented or ad hoc roles and responsibilities, gaps in knowledge translation and data access, absent leadership, limited financial resources, limited institutional capacity, mistrust among parties, the exclusion of key stakeholders (e.g., First Nations, nonstate actors), misaligned funding and legal systems, insufficient spatial boundaries for addressing complex environmental issues (e.g., local versus watershed scales), and unequal risk distribution between stakeholders (e.g., KIs 5, 6, 24; Norman & Bakker, 2005 & 2009; Nowlan & Bakker, 2007; Carruthers, 2007; Simms et al., 2016; Heinrich & Penning-Rowsell, 2022; Jefferies & Hager, 2023). Notably, the new Initiative aims to foster capacity-building and guide watershed-scale FRM. Furthermore, BC can benefit from learning opportunities and the infusion of new ideas from Washington's own efforts to advance integrated, participatory watershed planning, such as through Whatcom County's Floodplains Integrated Planning process and Washington's Floodplains by Design program (KIs 9, 28); correspondingly, the latter is referenced in the *BC Flood Strategy*.

5.5.3 Regional watershed governance: The Lower Fraser Floodplains Coalition

5.5.3.1 A history of policy advocacy and collective learning within the Fraser Basin

The AR event injected new momentum into a steadily growing movement towards developing a regional watershed governance model which was already underway prior to the November 2021 event. These efforts were initially kickstarted in 1990 when the Federal government identified a need for interjurisdictional watershed management in the Fraser River and estuary to address water quality issues, subsequently establishing the Fraser River Management Board in 1992 (FBC, n.d.-b). Evolving from this predecessor, the Fraser Basin Council formed in 1997, and has since worked to convene BC communities around issues of sustainability, climate resilience, and watershed governance (FBC, n.d.-b). Beginning in 2014, the Fraser Basin Council facilitated the Lower Mainland Flood Management Strategy [LMFMS] Initiative, which aimed to support the co-development of a regional FRM strategy between Lower Mainland communities, industry stakeholders, and partners (FBC, n.d.-c). In 2023, the Initiative concluded with a technical synthesis report (FBC, 2023) and a *Pathways to Action* report, which summarizes relevant flood-initiatives to date and provides recommendations for advancing multi-jurisdictional collaboration (Leadership Committee of the LMFMS, 2023).

While the LMFMS Initiative did not ultimately manifest in a regional strategy, it produced a rich repository of technical knowledge (e.g., flood scenario analysis, vulnerability and risk assessments, flood maps and models) within the context of the Lower Mainland, as well as established the need for a collaborative regional strategy that is co-created with First Nations and aligns with provincial policies (FBC, n.d.-c; KIs 1, 14). Although progress was made towards integrated and collaborative FRM, the Initiative was reportedly constrained by its limited funding, its early focus on technical solutions rather than on governance, and its failure to meaningfully engage Coast Salish partners from the onset (KIs 1, 9, 10, 16, 28). Notwithstanding this, the Initiative produced foundational insights into regional vulnerabilities and governance gaps, and initiated a series of network-building and collective learning processes that continue to this day (LFFC & Emergency Planning Secretariat [EPS], 2024)

Throughout these processes, the need for a co-governance model between First Nations and local authorities became apparent (KI 1). In response to the gaps in regional flood risk governance, the Emergency Planning Secretariat—an Indigenous-led NGO focused on enhancing emergency planning and preparedness among the region's thirty-one Mainland Coast Salish communities (EPS, 2020)—formed under the auspices of the Lower Fraser Fisheries Alliance (KI 28). During 2019 and 2020, the

Secretariat led a series of workshops to engage First Nations in regional flood governance planning (KI 28). Since then, the Emergency Planning Secretariat has worked to co-develop a Disaster Resilience Regional Action Plan grounded in Coast Salish values and knowledge with Mainland Coast Salish communities (EPS, 2020). The plan, Hílekw Sq'eq'o—which means “get ready together” in Halq'eméylem—represents an all-hazards, Sendai Framework-informed approach to DRR (EPS, 2020).

5.5.3.2 The post-AR disaster movement to ‘Build Back Better, Together’

Perhaps the most impactful post-disaster outcome for regional flood governance was the emergence of a collaborative grassroots movement to ‘Build Back Better, Together’ (LFFC, 2022), which built upon the foundations of these earlier initiatives to effectively reinvigorate watershed planning efforts in the post-disaster period. In July 2021, a group of governance actors, experts, and champions—each working to advance flood resilience in BC—convened with the idea of developing workshops and educational materials, and successfully applied for funding to support these activities through the Make Way Foundation’s Resilient Waters project (KI 7). However, post-AR, the group “quickly pivoted” and sought to leverage the post-disaster momentum to advance a “better approach to flood recovery” (KI 7). The group envisioned two possible post-disaster pathways forward (LFFC, 2022). The first represented a continuation of the status quo, further entrenching BC in a maladaptive cycle of piecemeal FRM approaches disproportionately driven by investment in protective strategies (e.g., rebuilding larger dikes) (KIs 4, 7, 14). Alternatively, members saw an opportunity to envision a more collaborative flood governance model—one that would not only reduce underlying risks, but also provide multi-benefit solutions for communities, agriculture, and the environment (KIs 4, 7, 14). It was out of this AR-influenced environment that the ‘Build Back Better, Together’ movement and its steward, the Lower Fraser Floodplains Coalition [LFFC], emerged (KIs 4, 7, 14; LFFC, 2022).

While this is not the first attempt to develop a regional governance model, the LFFC has successfully gained buy-in from all orders of government and leveraged post-disaster opportunities to facilitate constructive, action-oriented dialogue among diverse stakeholders and Rights Holders. The LFFC’s mission is to promote a “holistic, collaborative, and just approach” to flood risk governance (Resilient Waters, n.d.-a). The Coalition aims to achieve this by convening regional stakeholders, guiding constructive dialogue, and coproducing shared understandings around the diverse values that co-exist within the Fraser Basin (LFFC, 2022; KI 4, 7, 15). LFFC consists of several partner organizations: Resilient Waters, the Emergency Planning Secretariat, West Coast Environmental Law,

Stó:lō Tribal Council, Ebbwater Consulting, Watershed Watch Salmon Society [WWSS], UBC's Coastal Adaptation Lab, Floodplains by Design, Farmland Advantage, and Kerr Wood Leidal—the engineering consultancy working on Abbotsford's LFMP (Resilient Waters, n.d.-a; WCEL, 2024).

In July 2022, the LFFC hosted a regional recovery forum in Abbotsford, convening 158 attendees from fourteen local governments, sixteen First Nations, seven provincial ministries, six federal departments, and the Union of BC Indian Chiefs (LFFC, 2022). The 'Build Back Better, Together Forum,' funded by EMBC and Indigenous Services Canada, provided an opportunity for local authorities and First Nations to discuss collective challenges, to find common ground in shared values, to build consensus around regional priorities, and to develop better interjurisdictional working relationships (LFFC, 2022). Co-chaired by Stó:lō leadership and local government officials, the Forum sought to build equal partnerships between First Nations and local authorities—providing a tangible example of putting reconciliation into practice and of bridging local, scientific, and Indigenous knowledges (LFFC, 2022).

Through the Forum, the LFFC sought to strengthen regional mechanisms for watershed-scale collaboration and to influence how disaster recovery funding would be allocated (KIs 7, 28). In a post-forum summary report, the LFFC (2022) noted that provincial and federal funding mechanisms should “address legacy problems, not perpetuate them” (p.3). Critically, communities raised issues related to being forced to rapidly develop recovery plans and compete for oversubscribed funding streams, all within the context of outdated funding parameters that often precluded opportunities to build back better and invest in regional-scale FRM actions (LFFC, 2022). Furthermore, many local communities reported that they felt constrained in their ability to rebuild in ways that would improve future resilience due to insufficient capacity and resources (LFFC, 2022). These concerns align with the ongoing provincial and federal discussions, as reported by multiple KIs, which center around how to best steer recovery through funding conditions that promote, rather than hinder, climate-resilient reconstruction (KIs 20, 22, 26, 29). Key themes that emerged from the forum dialogue shown in **Figure 33**, were synthesized in an outcomes report (LFFC, 2022).



Figure 33: Graphic recording of the July 2022 forum discussions (Resilient Waters, n.d.-a)

In contrast to the City of Abbotsford’s LFMP public engagement process, LFFC facilitators fostered a collaborative learning environment via the use of brainstorming activities, open-ended reflections, and presentations which aimed to build shared understandings of existing dependencies, lived disaster experiences, and best practices within the field of FRM (LFFC, 2022). Forum participants co-constructed objectives related to 1) advancing proactive DRR, 2) fostering regional collaboration, and 3) modernizing funding programs to promote reconciliation and resilience within flood recovery (LFFC, 2022). Recognizing the importance of co-developing and clearly defining a regional vision of resilience (KI 14), the LFFC worked with participants to elicit community values and develop shared framework for advancing flood resilience. Together, participants defined what ‘building back better, together’ could entail for the region and co-developed guiding principles (i.e., values) around this (Resilient Waters, n.d.-b; LFFC, 2022). Through subsequent regional engagement efforts, the LFFC

has expanded upon these initial principles to provide a regional vision for flood resilience, depicted in **Table 8**.

Table 8: The LFFC regional vision of flood resilience for the Lower Fraser

Building back better means:	5 Guiding Principles for Working Together:
(1) “Reducing risk and adapting to climate change;	(1) “Understanding and reducing risk and adapting to climate change in accordance with the Sendai Framework on Disaster Risk Reduction;
(2) Advancing reconciliation;	(2) Advancing reconciliation, with particular attention to Articles 18, 19, 29, and 30 of [the] United Nations Declaration on the Rights of Indigenous Peoples [UNDRIP];
(3) Thriving salmon and salmon ecosystems;	(3) Ensuring that salmon and coastal and freshwater ecosystems they depend on are thriving;
(4) Sustainable economies and resilient communities;	(4) Sustainable economies and resilient communities for the long term—we need a shared vision for the future and a plan to measure progress and ensure accountability;
(5) Everyone in part of the solution.”	(5) Everyone is part of the solution—there are many siloes in planning, decision-making, and actions on the ground in the lower Fraser, and a more holistic and collaborative approach to managing flood risks is needed.”
Source: Resilient Waters, n.d.-b	Source: LFFC & EPS, 2024

5.5.3.3 Sustaining momentum beyond the initial policy window

Initially, the LFFC hoped that government agencies would leverage the momentum of the 2021 AR event, and subsequent 2022 forum, and assume the leadership role in stewarding forward and self-sustaining the movement (KI 7). However, the Coalition soon perceived that BC’s flood governance void was not being actively filled, leading the LFFC to invest in longer-term organizational capacity-building in order to be able to continue to carry out vital partnership convening, policy advocacy, and knowledge mobilization work (KI 7). Since then, the LFFC has convened five regional and sub-regional forums and led various workshops, including a ‘Designing for Flood Resilience’ series to support the uptake of fish-friendly flood infrastructure (Carvallo Aceves, 2023; Resilient Waters, n.d.-a).

Since the LFFC’s post-disaster inception, the Coalition has continued to act as a key policy broker for regional flood governance, leading collaborative learning and working sessions with diverse groups of stakeholders and Rights Holders. In February 2023, the LFFC convened fifty representatives from eight First Nations, eight farm associations, the BC Ministry of Agriculture, and the First Nations Summit to build understanding around the disproportionate flood exposure of both farm and reserve

lands and to explore multi-benefit solutions (LFFC, 2023a). In June 2023, a second Lower Fraser Floodplains Forum convened 152 representatives from all orders of government, as well as agricultural associations, and included the sharing of best practices from Washington (LFFC, 2023b). Through facilitated dialogue, forum participants identified five regional priorities related to 1) understanding risk and developing long-term solutions that are climate-adaptive, equitable, and multi-benefit, 2) developing shared understandings of critical infrastructure, 3) restoring river systems, 4) enhancing food security, and 5) streamlining FRM planning and decision-making (LFFC, 2023b). Attendees identified strategic near-term regional priorities related to developing regional flood risk assessment and management tools (e.g., data-sharing protocols, vulnerability and technical studies, mapping), creating a regional FRM framework through the establishment of interim Floodplain Advisory Committees, and advancing sub-regional projects, relationships, and collective learning (LFFC, 2023b). Forum highlights, captured by a graphic recorder, are shown in **Figure 34**.

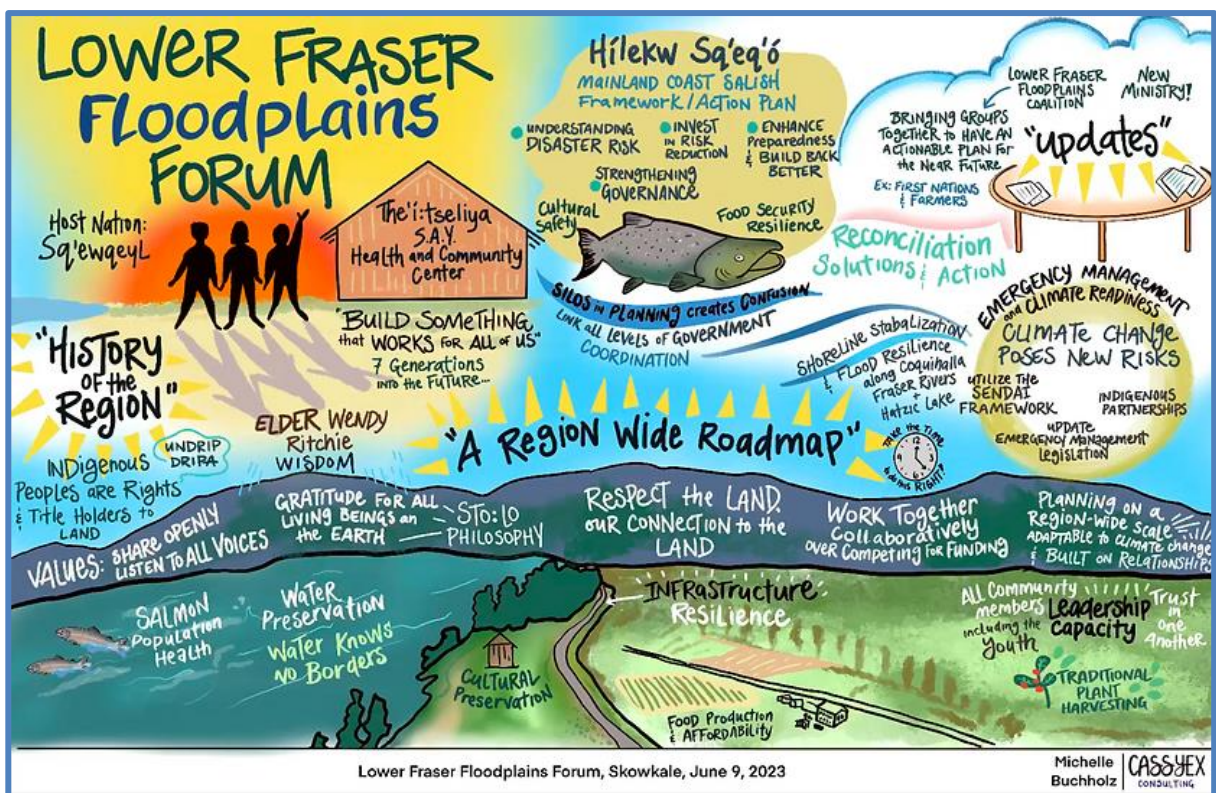


Figure 34: Graphic recording of the June 2023 forum discussions (Resilient Waters, n.d.-a)

In addition to regional forums, the LFFC convened two sub-regional flood resilience forums—one for mid- and up-river communities and the other for coastal and tidal river communities—in March

2024 with a focus on strengthening relationships, bridging awareness gaps related to ongoing FRM projects, and understanding critical infrastructure impacts (LFFC, 2024). Related to this work, the LFFC supported a successful application, led by the Emergency Planning Secretariat, for \$1.7 million in federal funding through the Climate Resilient Coastal Communities Fund (LFFC, 2024). This 3.5-year funded project will enable the Emergency Planning Secretariat and partners to continue flood resiliency work within a Coastal and Tidal River Hub, which will include hosting a second sub-regional forum in November 2024, engaging in technical work (e.g., vulnerability and risk assessments), and investigating opportunities for nature-based solutions (LFFC, 2024).

Since the initial post-disaster forum in 2022, the LFFC's continued policy advocacy and coalition-building work has been instrumental in revitalizing regional FRM governance and in sustaining the momentum that had been generated by the atmospheric rivers event. The LFFC has continued to maintain buy-in from local, First Nations, and provincial governments, as is reflected in the Coalition's ability to catalyze multi-year initiatives and attract institutional support (e.g., provincial funding and willingness to engage). For instance, following the 2023 forum, the Province funded the initial development of a *2024-2027 Workplan for Regional Flood Resilience*, created by the LFFC and Emergency Planning Secretariat in collaboration with First Nations, local elected officials, and provincial staff (LFFC & EPS, 2024). The workplan outlines the following five key objectives to be achieved by 2027 (LFFC & EPS, 2024):

- (1) developing a strong foundation for regional coordination through multi-scalar and multi-jurisdictional collaboration;
- (2) identifying risks and interdependencies related to critical infrastructure and essential services, as well as scoping and securing funding for relevant projects;
- (3) establishing a Regional Knowledge and Learning Hub to enable co-learning and knowledge-sharing between communities and partners, to provide decision-supports and foster cultural competencies, and to bridge existing gaps and siloes;
- (4) catalyzing a “steady flow of flood and ecosystem resilience projects” (p.6); and,
- (5) empowering Coast Salish communities with the capacity, resources, and recognition necessary to uphold inherent rights to exercise self-determination, self-governance, and free, prior, and informed consent with respect to make integrated water management decisions in their traditional territories.

5.6 Shifts in FRM policy and governance at the provincial scale

5.6.1 New post-disaster investments in internal capacity building

According to multiple provincial KIs, one significant institutional outcome of the 2021 disaster was the unprecedented investments made within the BC public service, which both supported and accelerated existing institutional developments (KIs 18, 21, 20, 29). Provincial budgetary allocations enabled EMBC to double in size, before later being restructured as the Ministry of Emergency Management and Climate Readiness, a transition that was already in the making, while new policy teams and executive positions related to CCA and DRR were created across a variety of ministries (KIs 18, 21, 20, 29). When asked if the AR had been focal for policymaking, one provincial employee responded: “Absolutely. There’s no question something changed in the BC government and in the public service” (KI 30). Multiple policy staff acknowledged that post-disaster opportunities to increase staff capacity, to invest in advanced staff training, to develop specialized policy teams, and to collaborate more easily across various departments and ministries had left them feeling better equipped, more optimistic, and more empowered in their ability to advance integrated CCA-DRR solutions (KIs 16, 18, 20, 21, 30).

5.6.2 Longer-term institutional shifts: The evolution of provincial policy objectives

5.6.2.1 Influence of prior institutional learning on the current post-disaster landscape

Although the 2021 disaster was directly responsible for producing several shifts in FRM policy and governance at the local and regional scales, not all recent developments can be directly linked the disaster itself. Rather, several post-AR disaster policy and governance changes can be situated within a co-occurring longer-term trend of institutional change and policy learning within the provincial government. This section explores the dynamics of gradual institutional development and policy-oriented learning that has been ongoing since at least 2017. Key informants working within the BC public service have identified several notable institutional milestones that have favourably positioned policymakers to advance a broad-sweeping paradigm shift, not only in the FRM policy subsystem, but also across other synergistic and interrelated policy domains. This has led to significant institutional reforms related to reducing ministerial silos, consolidating and redefining roles and responsibilities, and adopting new mandates aimed at improving climate and disaster resilience. Although many of these developments had been initiated prior to the 2021 AR event, several key informants indicated that the

disaster had both directly and indirectly contributed to this burgeoning paradigm shift. Conversely, prior institutional learnings had reportedly been foundational in guiding post-disaster provincial policymaking. Such findings indicate that the Province of BC is currently transitioning from one policy pathway to another, and that prior institutional learnings, combined with an emergent policy window, have produced a self-reinforcing effect towards ‘entrenching’ this new paradigm, assessed in **Table 9**.

Table 9:Evidence of policy-oriented learning within the BC Government

	Condition	Description	Present?
Evidence of policy-oriented learning	<i>Empowerment of solution seekers</i>	Decision-making authorities empower institutional and non-institutional actors to engage in governance activities, and are generally receptive to the feedback of the policy community	<i>Yes</i>
	<i>Expansion of the existing solution space</i>	Governing institutions engage in the exploration, development, testing, and/or implementation of new or revised policy instruments	<i>Yes</i>
	<i>Revision of policy goals</i>	Governing institutions revise policy objectives—and the mechanisms used to achieve these intended outcomes—as a result of new evidence and/or experiences	<i>Yes</i>

5.6.2.2 Moving towards a climate-resilient, all-hazards lens

Within the BC public service, the disaster reportedly reinforced the urgency of CCA and DRR, accelerating and expanding the existing provincial policy agenda, rather than fundamentally changing it (KIs 1, 16, 17, 26, 29). Nonetheless, several champions saw the AR event as an opportunity to enhance public risk awareness, to strengthen inter- and intra-governmental partnerships, and to secure political support for investing in CCA and DRR (KIs 5, 15, 16, 17, 18, 29, 30). One senior provincial policymaker interviewed perceived that, “without this event to gel things, it seems less likely that some of these policy changes would have a fighting chance” (KI 18). Another commented that CCA was “starting to lose attention” politically prior to the events of 2021 (KI 5). Three KIs noted that the AR had since elevated CCA on the provincial and federal agendas (KIs 5, 15, 22), while another believed that the event had “solidified funding and support” for CCA policy development (KI 17).

Although the 2021 AR event was thought to have produced “a bigger shift [that was] more commensurate with the scale of impact” (KI 17), the 2017 and 2018 flood and wildfire seasons were commonly cited as the earlier catalysts for enhancing flood risk awareness and climate literacy in BC

and strengthening sociopolitical support for integrated CCA-DRR policies (KIs 13, 15, 16, 17, 18, 19, 20, 29, 30). According to one policymaker, 2017 and 2018 laid the groundwork for “creating an institutional recognition that there needed to be [an Interim Disaster Recovery Framework] and formalized approach to multi-ministry involvement” (KI 18). This caused the Province to expand its CCA-DRR focus, commencing numerous studies, engaging in policy-oriented learning, and developing and adopting numerous policy frameworks and tools, shown in **Table 10**. Select institutional milestones (e.g., ministerial restructuring) and key policy developments (e.g., the *BC Flood Strategy*), as identified by key informants as being significant, are discussed in subsequent sections.

Table 10: Provincial policy developments from 2017 to July 2024

Year	Related institutional milestones and policy developments, 2017 to July 2024
2017	• The Province outlines <i>Draft Principles</i> to guide reconciliation efforts (Gov. BC, 2020). • The Province establishes the Community Emergency Preparedness Fund, and has invested \$369 million to date (EMCR, 2024). • Premier John Horgan establishes the Ministry of Environment and Climate Change Strategy [ECCS], replacing the previous Ministry of Environment (Horgan, 2017). • The Province establishes the Climate Solutions Council, a public sector organization under the auspices of ECCS, to provide strategic recommendations on climate action (ECCS, 2024).
2018	• The BC Flood and Wildfire Review shares independent findings on the 2017 flood and wildfire disasters in the ‘Abbott/Chapman Report’ (Abbott & Chapman, 2018). • The Auditor General releases a report on <i>Managing Climate Change Risks</i> (OAG BC, 2018). • The Province adopts the <i>Sendai Framework</i> and begins modernization of the 1996 <i>Emergency Program Act</i> (Gov. BC, 2024c). • The Province integrates Gender-based Analysis Plus into policymaking (Gov. BC, n.d.-b). • The Province introduces the Community Resiliency Investment program (Gov. BC., 2023d). • The Province amends the <i>Flood Hazard Area Land Use Management Guidelines</i> to incorporate sea level rise (Gov. BC, 2024d).
2019	• The Province releases the <i>Government’s Action Plan: Responding to Flood and Wildfire Risks</i> (EMBC & Ministry of Forests, Lands, Natural Resource Operations, and Rural Development [MFLNRO], 2019). • The Province establishes an <i>Interim Disaster Recovery Framework</i> (BC Ombudsperson, 2023). • ECCS (2019) releases a <i>Preliminary Climate Risk Assessment</i>. • The MFLNRO (2019) releases the <i>Provincial Flood Emergency Plan</i>. • The Union of BC Municipalities and EMBC jointly establish the <i>Flood Wildfire Advisory Committee</i> to facilitate local-provincial dialogue and knowledge transmission (Singh, 2021).

	• The Province legislates the <i>Declaration Act on the Rights of Indigenous Peoples</i> [DRIPA] (Gov. BC, 2024e). • The Province signs the <i>Tripartite Memorandum of Understanding</i> with the Federal government and the First Nations Leadership Council—which represents the political interests of the BC Assembly of First Nations, First Nations Summit, and Union of BC Indian Chiefs; the Tripartite Emergency Management Working Group is established to support self-determination in emergency management (Valois et al., 2019; TEMWG, 2020). • The Province and Government of Canada jointly launch the \$142.85 million five-year BC Salmon Restoration and Innovation Fund to support the restoration of aquatic ecosystems, habitats, and fish populations (Department of Fisheries and Oceans, 2023).
2020	• The Province begins development of the <i>BC Flood Strategy</i> and establishes a cross-government working group (KIs 16, 19). • MFLNRO (2020) releases the <i>Together for Wildlife Strategy</i> which aims to improve habitat conservation and collaborative wildlife stewardship in BC.
2021	• EMBC reports that 92% of <i>Abbott/Chapman Report</i> recommendations have been incorporated into the new <i>Emergency and Disaster Management Act</i> (Ball, 2021) • The Province releases the <i>BC Flood Strategy Intentions Paper</i> for public comment (Gov. BC, 2022b). • The Province invests \$20.7 million in a Climate Adaptation Program related to climate resilient highways (Ministry of Transportation and Infrastructure [MOTI], 2021). • The atmospheric rivers event occurs in November causing a state of emergency.
2022	• BC elects a new administration under New Democratic Party leader, Premier David Eby. • The Province establishes the Ministry of Emergency Management and Climate Readiness [EMCR], replacing EMBC, which previously operated as a division of the Ministry of Public Safety and Solicitor General, as a new standalone ministry (Eby, 2022). • The Province establishes the new Ministry of Water, Land, and Resource Stewardship [WLRS]; the MFLNRO becomes a standalone Ministry of Forests [MoF] (Gov. BC, 2024f). • The Province begins co-development of the <i>BC Coastal Marine Strategy</i> (Gov. BC, 2024g). • ECCS releases the <i>Climate Preparedness and Adaptation Strategy: Actions for 2022-2023</i> (Gov. BC, 2022a). • The Province amends cost-sharing agreements for Disaster Financial Assistance, reducing the proportion paid by local authorities and enabling up-front payment transfers (PSSG, 2022b). • The Province announces two new joint provincial-federal funding streams: the \$81.8+ million Adaptation, Resilience, and Disaster Mitigation program and the Disaster Risk Reduction Climate Adaptation stream (Gov. BC, 2024h; UBCM, 2024a). While the former was in development prior to the AR and included eligibility requirements related to fish-friendly infrastructure, the disaster reportedly served as a catalyst for the latter, which includes parameters to support the adoption of Sendai-informed, all-hazards DRR (KI 29).
2023	• The Province launches the <i>Climate Ready BC</i> platform (Verster, 2023). • The Province transfers all flood-related functions from the Ministry of Forests to the Ministry of Water, Land, and Resource Stewardship (KI 19, <i>personal communication, March 2024</i>)

	• WLRS releases the <i>Watershed Security Strategy and Fund Intentions Paper</i> for public comment (Gov. BC, 2023e). • The new <i>Emergency and Disaster Management Act</i> comes into effect (Gov. BC, 2024i). • The Province establishes an \$18 million Indigenous Engagement Requirements Funding Program, which allocates \$45,000 to First Nations and between \$40,000 and \$60,000 to local authorities to support EDMA implementation (EMCR, 2023e; Kitteringham, 2023). • The Province amends the <i>Wildfire Act</i> to support cultural and prescribed burning practices for wildfire management (Gov. BC, 2024j). • The Province consolidates responsibilities for administering the <i>Water Sustainability Act</i> within WLRS (WLRS, 2024). • The Province extends the BC Wildfire Service to a year-round agency (EMCR, 2023a). • The Province invests \$100 million to co-establish the Watershed Security Fund with the BC First Nations Water Table (Watershed Security Fund, 2023). • The BC Ombudsperson (2023) releases a report entitled <i>Fairness in a changing climate: Ensuring disaster supports are accessible, equitable, and adaptable</i>. • The Province establishes an Expert Task Force on Emergencies (Office of the Premier, 2023).
2024	• WLRS releases the <i>BC Flood Strategy</i> (Gov. BC, 2024k). • WLRS releases the <i>BC Coastal Marine Strategy</i> (Gov. BC, 2024g). • Infrastructure Canada and the BC Ministry of Transformation and Infrastructure (2024) jointly release the <i>Systems-based approaches to climate resilient infrastructure</i> guidebook.
TBD (as of July 2024)	• The Province is slated to release a <i>Flood Resilience Plan</i> in 2024 (UBCM, 2024b). • In-depth regional risk assessments, under the Disaster and Climate Risk and Resilience Assessments program, are anticipated to begin in 2025 (Gov. BC, 2024l). • The Province is currently engaged in the modernization of land use planning processes with the aim of co-developing a shared resource stewardship model with First Nations (e.g., through Indigenous Protected and Conserved Areas) and integrating water sustainability and forest landscape planning (Gov. BC., 2024m).

5.6.2.3 Gradual institutional change through ministerial restructuring

5.6.2.3.1 The Ministry of Emergency Management and Climate Readiness

Prior to the AR event, the Province was in the process of reforming emergency management at the institutional level. Legislative changes and an enhanced institutional focus on integrated CCA-DRR strategies contributed to the restructuring of EMBC from a division within the Ministry of Public Safety and Solicitor General to a standalone ministry in 2022 (KIs 19, 20). The shift began prior to the 2021 AR when an Assistant Deputy Minister was appointed to lead DRR within EMBC (KI 20; PSSG, 2022b). Through the process of reforming the *Emergency Program Act* to align with Sendai and the

Declaration Act on the Rights of Indigenous Peoples [DRIPA], the Province recognized that EMBC's structure, as a nested division primarily focused on emergency response and recovery, was no longer sufficient to address the cascading and compounding risks of the 21st century (KI 20, 30). Because flood and wildfire activations have become more frequent, leading to consecutive and longer disaster seasons, the previous approach of seconding public sector workers and volunteers during times of need was becoming increasingly infeasible (KIs 21, 27). Staff and volunteers had reported experiencing burn-out, while public sector workers were stretched thin due to back-to-back activations (KIs 21, 27).

In Fall 2022, changes in provincial administration under New Democrat Party leader Premier David Eby catalyzed the transition. Premier Eby (2022) established the Ministry of Emergency Management and Climate Readiness [EMCR] as the province's lead coordinating agency for implementing cross-ministerial, integrated climate and disaster resilience. Although ministries occasionally evolve and restructure, EMCR represents an important milestone in BC's transition towards proactive, systems-based approaches. While EMBC had a reactive focus on response and recovery, EMCR presents a novel means to advance proactive CCA-DRR, bridge existing governance siloes, and streamline government actions (Eby, 2022). EMCR is currently stewarding the development of a provincial Disaster and Climate Risk and Resilience Assessments program (Gov. BC, 2024l).

5.6.2.3.2 The Ministry of Water, Land, and Resource Stewardship

Similarly to the provincial restructuring of disaster risk reduction and emergency management functions, the Province of BC has undergone significant organizational shifts related to FRM roles and responsibilities in recent years. Although the extent to which these changes were underway prior to the 2021 AR event is unclear, such shifts provide further evidence of ongoing institutional learning and development within provincial agencies. Prior to Fall 2023, flood functions were siloed between various ministries, including the Ministry of Forests (e.g., River Forecast Centre; Dike Inspector), the Ministry of Public Safety and Solicitor General (e.g., EMBC), and the Ministry of Water, Land, and Resource Stewardship [WLRS] (e.g., *BC Flood Strategy*) (KIs 16, 19, 20). However, functions within the Ministry of Forests have since been folded into WLRS (KI 19, *personal communication, May 2024*).

This is significant because it now means that the provincial staff working on flood policy initiatives are within the same ministry responsible for implementing BC's *Watershed Security Strategy* and *Coastal Marine Strategy*, as well as fish and aquatic habitat conservation initiatives (KI 19, *ibid.*). The former, according to the Government of BC's (2023e) *Watershed Security Strategy and Fund*

Intentions Paper, would seek to advance holistic, collaborative, and integrated watershed governance in alignment with the *Water Sustainability Act*. The latter underwent co-development and public engagement throughout 2022 and 2023 and was released in July 2024. Place-based Coast Salish values guide the *Coastal Marine Strategy*, which centers around four key foci: marine ecosystem health, coastal climate resilience, sustainable livelihoods, and integrated governance (Gov. BC, 2024g). Although it is too early to assess the implementation of these three strategies, the consolidation of water-related functions under the auspices of one ministry is promising for the coordination of systems-based approaches and suggests that the Province of BC is intentionally attempting to improve policy coherence by aligning policy means (i.e., instruments for implementation) and ends (i.e., objectives).

5.6.2.4 Revising and implementing key policy instruments

5.6.2.4.1 *The Emergency and Disaster Management Act*

Another key legislative tool that was in development prior to the 2021 AR event, but which is indicative of a broader trend of policy-oriented learning within the provincial government is the *Emergency and Disaster Management Act* [EDMA]. In November 2023, the new legislation came into effect with the aim of integrating the Sendai principles and better reflecting the dynamic challenges of the 21st century, such as climate change, critical security, and health emergencies (Gov. BC, 2024i). Through the establishment of a multijurisdictional emergency management organizations framework, EDMA seeks to advance community-driven, intergovernmental partnerships (EMCR, 2023d). Under this framework, communities are not required to have individual Emergency Management Organizations, but rather, can pool resources and collectively address legislative requirements (e.g., response and recovery actions, emergency management plans, risk assessments) (EMCR, 2023d). The changes aim to build regional capacity and streamline interjurisdictional collaboration (EMCR, 2023d). Notably, local authorities, public agencies, and critical infrastructure operators must now develop business continuity plans for essential service delivery (Schafer, 2024).

As one of the first legislations to be co-developed under DRIPA, EDMA aimed to advance meaningful government-to-government relations in BC (Pritchard et al., 2023). While the prior EPA did not mandate provincial or local authorities to consult with First Nations governments, who were not formally recognized as decision-making authorities in emergency management, EDMA now sets provisions for Indigenous governing bodies to exercise self-governing authority (Pritchard et al., 2023). EDMA established four new mechanisms—Coordination Agreements, Specified Coordination

Agreements, Decision-Making Arrangements, and Statutory Power Agreements—to advance engagement and collaboration between Indigenous governing bodies and local authorities (Pritchard et al., 2023). Local authorities must obtain free, prior, and informed consent, ensure that risk assessments and emergency management plans are developed with Indigenous governing bodies, and integrate cultural safety and Indigenous knowledge (EMCR, n.d.).

Not all observers agree that EDMA has been purely positive. Criticism of EDMA includes concerns that the legislation has downloaded more responsibilities from the provincial to local level, that local authorities will incur significant expenses in the implementation of EDMA, that feedback from provincial engagement sessions was not adequately incorporated, that regulatory requirements are not clearly defined, and that the Act contains a clause that can be used to supersede all other provincial regulations, including DRIPA (Fionda, 2023; Depner, 2023; Kitteringham, 2023; Summer, 2024; Schafer, 2024). EDMA has not explicitly addressed outstanding concerns related to BC’s overreliance on volunteers, lack of longer-term evacuee supports, inadequate funding, and need for standardized, professional training programs to build local emergency management capacities (Fionda, 2023; KIs 13, 21, 27), although some are priorities of other initiatives (e.g., the Expert Task Force on Emergencies).

5.6.2.4.2 The Declaration Act on the Rights of Indigenous Peoples

The Province of BC’s ongoing efforts to decolonize provincial policymaking was another key interview theme that emerged as evidence of a broader institutional trend of policy-oriented learning. At the same time as BC was re-evaluating emergency management, the Province began the process of reconciling relations with First Nations, beginning in 2017 with *Draft Principles* that outlined the Province’s commitment to upholding inherent Indigenous rights (i.e., free, prior, and informed consent, self-determination) (Gov. BC, 2020). In 2019, the Province legislated the *Declaration Act*, modelled after the *United Nations Declaration on the Rights of Indigenous Peoples* and the Truth and Reconciliation Commission’s *94 Calls to Action* (Gov. BC, 2024e). According to multiple KIs, advances in reconciliation and equity-informed decision-making have transformed BC’s policy landscape, setting the foundations for holistic risk governance (KIs 16, 17, 18, 19, 26, 29, 30).

A senior provincial staff member emphasized the significance of these policy advances when combined with the multiple events of 2021: “It’s like [there were] these little openings along the way. So it’s like, we started laying seeds, and then when the Declaration Act happened, that changed everything...Then the final massive opening, which won’t be a surprise, was not just the [AR] events.

It was the heat dome, and then the [AR]” (KI 29). These shifts have not gone unnoticed among BC’s FRM policy community (KIs 4, 6, 7). One policy champion commended the Province’s increasing willingness to engage in holistic and collaborative FRM policy design, commenting that one colleague had reportedly observed more advancements in 2022 alone than over the prior two decades (KI 7).

5.6.2.4.3 *The BC Flood Strategy*

Another key policy instrument that is indicative of policy-oriented learning at the provincial scale is the *BC Flood Strategy*, which was released in 2024 under the auspices of the Ministry of Water, Land, and Resource Stewardship (Gov. BC, 2024k). The *BC Flood Strategy* aims to serve as a cohesive, strategic vision for province-wide flood risk management and resilience (Gov. BC, 2024k). The Strategy seeks to advance all-of-society, Sendai-informed FRM, and has served as an opportunity to advance DRIPA through a transformational ‘Sharing the Pen’ approach that enabled First Nations partners to co-develop the strategy (Gov. BC, 2024k). According to the Province, the *BC Flood Strategy* aims to prioritize reconciliation, environmental sustainability, enhanced public safety, and economic stability within FRM, and is guided by the following eight values: holistic, proactive, place-based, accountable, collaborative, transparent, fair, and risk-informed (Gov. BC, 2024k).

Although policy development was underway prior to the 2021 AR event, the disaster reportedly influenced this process by “generat[ing] the political will to give [the Strategy] a real chance to make some real governance changes” (KI 18), advancing existing policy work (KI 17, 29), and impacting engagement processes (KIs 16, 19). In development since 2020, the *BC Flood Strategy* emerged from earlier CCA and DRR work, following which the Province convened a cross-government working group (KI 16, 19). In 2021, the Province hosted workshops with Indigenous Rights and Title holders to identify strategic priorities; these learnings were reported in the *Bridging Our Knowledge* report and later incorporated into a *Discussion Paper* that was then reviewed by local governments and First Nations in the spring and summer of 2021 (KI 19). While engagement with additional stakeholders (e.g., industry, experts) was slated for Fall 2021, this was paused to allow for disaster recovery (KIs 16, 19). However, the delay allowed for further internal review and engagement with a Tripartite Emergency Management Working Group (KI 19), which includes technical and policy representatives from the First Nations Leadership Council, EMBC, First Nations Emergency Services Society, Indigenous Services Canada, and BC Wildfire (TEMWG, 2020).

In 2022, the Province released a pre-cursor to the 2024 Strategy, the *BC Flood Strategy Intentions Paper*, which was reviewed by First Nations advisors and then workshopped with stakeholders; this was in addition to receiving feedback through online surveys and written submissions (KI 19). The Sharing the Pen process translated this Intentions Paper and feedback into the final BC Flood Strategy released in March 2024 (KI 19). Two provincial KIs (16, 18) noted that many of themes identified through earlier engagement have held true in the aftermath of the AR, namely related to the need for holistic FRM that goes beyond status quo protective infrastructure and piecemeal investments.

According to various KIs working within the provincial government, expanding the FRM toolkit via the 2024 *Flood Strategy* involves an expanded policy focus on (1) retreating from high-risk areas, (2) rezoning or restricting land-uses within floodplains, (3) investing in flood resiliency, (4) promoting climate-resilient reconstruction, (5) accommodating floodwaters, and (6) incorporating co-benefits (e.g., for salmon habitat, agriculture) (KIs 16, 17, 19, 21, 29, 30). The Province aims to advance whole-of-society flood governance through improved risk communications and education, local capacity-building, equity-informed decision-making, and formal recognition of First Nations' inherent rights to self-govern (KIs 16, 19, 29, 30; Gov. BC, 2024k). Action items include developing robust provincial flood mapping, risk assessment, and dike regulatory programs, integrating FRM planning across sectors (e.g., forestry), establishing First Nations and Ministry Flood Resilience Advisory Circles, investigating the creation of regional watershed hubs, updating regulations, and expanding funding parameters (Gov. BC, 2024k).

The Strategy's reception has been mixed, reflecting the complexity of adapting to climatic uncertainty and transforming BC's legacy FRM systems within the bounds of institutional and political constraints. The Strategy has been commended for its promising direction in advancing whole-of-society governance, multi-benefit FRM approaches, and government-to-government relations between the Province and First Nations, as well as for the Province's increased strategic oversight over FRM (e.g., West Coast Environmental Law, 2024; Insurance Bureau of Canada, 2024). Stó:lō Nation Tribal Chief Tyrone McNeil described the co-development process as "the very first time [that First Nations have] actually sat next to officials and shared the pen, passed the pen back and forth, until [First Nations and the Province] reached common ground" (Ball, 2021). Despite this, the BC Flood Strategy has also been criticized for not addressing outstanding concerns related to the absence of predictable, sustainable funding and capacity gaps that constrain local-level actions (e.g., Azeez, 2024; UBCM, 2024b). The Union of BC Municipalities, a policy-based organization representing local government interests,

expressed concerns that the strategy “continues to reinforce the Province’s position” that FRM should remain to be locally-led (UBCM, 2024b). Similarly, the LFFC asserted that the *BC Flood Strategy* is a “good plan on paper,” but lacks the mechanisms necessary for effective implementation (Azeez, 2024). To some, the Strategy maintains a competitive and piecemeal funding model (Azeez, 2024).

While the Strategy represents promising shift towards watershed-scale governance, some critics maintain that these efforts have yet to be integrated into broader land-use planning and resource management practices (e.g., deforestation, floodplain development), which undermine future resiliency and exacerbate flood impacts (KI 28; Johnson & Alila, 2023). Internally, three KIs working within the BC Public Sector suggested that there is broad organizational recognition of the need for regional landscape-scale planning to address the many complex and often contradictory decisions being made around water and land management; however, these same KIs also cited the challenges associated with inheriting an entrenched, legacy colonial system (KIs 20, 21, 30). Nonetheless, diffuse responsibility over critical infrastructure between ministries is one such governance gap that provincial policy staff aim to address through enhanced inter-agency cooperation, according to one KI (20). As such, some commentators believe that the *BC Flood Strategy* should be a “living document” that adapts as climate conditions and best practices evolve over time (First Nations Summit, 2024). The *BC Flood Strategy* will see a phased implementation guided by a forthcoming *Flood Resilience Plan* (UBCM, 2024b).

5.7 Perceived barriers and enablers to policy change

5.7.1 Institutional constraints and opportunities

Although all provincial staff who were interviewed demonstrated an overall rich understanding of BC’s multi-faceted FRM policy and governance challenges and supported the need to expand BC’s portfolio of FRM solutions, KIs noted several institutional barriers related to transforming the policy paradigm. Multiple key informants reported that there is broad internal support within the provincial government for innovative, hybrid, and alternative FRM strategies that create ‘room for the river,’ promote community and ecosystem co-benefits, and reduce risk exposure and liabilities (e.g., through nature-based solutions, land-use planning, managed retreat) (KIs 16, 17, 19, 21, 29, 30). However, various provincial staff noted that their ability to advance change was constrained by short-term political cycles, partisan politics, competing priorities, no authority over provincial finances, budgetary uncertainty, departmental and ministerial silos, staff capacity and turnover, legislative constraints, and limited institutional memory (KIs 15, 17, 18, 19).

5.7.1.1 Institutional capacity and readiness

KIs identified institutional capacity as a major constraint with respect to transforming FRM policy and governance. At the same time as the Province devolved FRM responsibilities to local authorities back in 2003, the provincial agencies previously responsible for these actions were downsized and defunded, leading to gaps in institutional infrastructure (KIs 9, 10, 20, 28). Because disaster memory plays a critical role in determining institutional priorities, there is often divestment in DRR programs during non-disaster times, followed by reactionary, event-based funding, or re-investment when disasters do occur (KIs 9, 10, 30). This trend is suggestive of the challenges faced by governments to balance finite budgets amidst competing policy issues (Jones & Baumgartner, 2005).

While many existing EMBC staff transitioned into new roles within EMCR, carrying forward prior institutional learnings and knowledges, the organization is still being actively developed, creating unique challenges and opportunities (KIs 9, 18, 20, 30). It takes time to hire and onboard staff, to coordinate existing and new strategic policy directions, and to develop streamlined processes for inter-ministerial and interdepartmental collaboration (KIs 18, 20, 30). Additionally, two KIs (9, 20) noted that the BC Public Service has experienced declining organizational readiness related to a high proportion of staff who are either at the beginning (e.g., new graduates) or late (e.g., nearing retirement) stages of their careers, in addition to retention challenges. Building and rebuilding this capacity takes time, and this can limit an institution's capacity to effectively leverage policy windows (KIs 18, 20).

5.7.1.2 Policy window timeframe

Provincial staff also discussed the challenges of advancing policy solutions within a limited timeframe. Two policy staff reported that they typically have a two-year window following an event to advance items on the policy agenda (KIs 20, 29). Critically, the consecutive heat, wildfire, and flood disasters of 2021, as well as the other flood and wildfire emergencies experienced in the past five years, were thought to have expanded this window by collectively keeping climate risks near the forefront of public and political attention (KIs 1, 11, 15, 17, 18, 20, 21, 29). However, the window could also be constrained by BC's upcoming Fall 2024 election, influencing how issues are framed and the extent of staff agency (KI 20). A policymaker described the inherent uncertainties of public sector work: "If we had another bad year, then we'd feel way more confident about that policy window being really open post-election too because whoever is in government will have to help with the recovery and response" (KI 20).

BC's ongoing climate disaster experiences in the years following the 2021 disaster may help extend this window. In the aftermath of the 2023 wildfire season, the Province established an Expert Task Force on Emergencies, which will focus on how the Province can better support front-line workers, evacuees, and local and First Nations governments in responding to increasing wildfire, heat, drought, and flood hazards (Office of the Premier, 2023). While the Task Force indicates the Province's commitment to taking an integrative all-hazards approach to DRR and CCA (Office of the Premier, 2023), there is some skepticism that previous after-action reviews did not always amount to meaningful changes (Ball, 2021; Pawson, 2023). Rather, many of the same barriers (i.e., related to communications, mitigation, and cooperating with First Nations) persist today with some earlier recommendations having yet to be incorporated into provincial disaster response and recovery programs (Pawson, 2023). As such, the Task Force has been criticized by some commentators as being a top-down, "bureaucratic exercise" that fails to incorporate previous disaster learnings and local experiences (Pawson, 2023).

5.7.2 Funding constraints and opportunities

Key informants identified several limitations of the current merit-based competitive funding models which local authorities rely on to support investments in FRM and CCA-related infrastructure and projects. Firstly, funding streams are highly oversubscribed and lack sufficient available funding to meet growing demands (KIs 1, 4, 8, 14, 15, 16, 20, 21, 22). Secondly, it is difficult for small municipalities, regional districts, and First Nations to complete necessary precursory work (e.g., asset inventories, risk assessments), to navigate complex funding requirements, and to apply for funding (KIs 12, 15, 17, 20, 27, 29). Variations in community size and related capacity constraints (e.g., financial, staff, and technical resources) have led to inequities in how funding is distributed. This often results in well-resourced communities disproportionately receiving grants (Jost et al., 2020; Cappell et al., 2022; Fila et al., 2023; Headwaters Economics, 2023). Thirdly, funding streams were described as reactive and short-term in nature, making it challenging to invest in ongoing and proactive adaptation (KIs 5, 6, 13). Fourthly, competitive funding programs often limit opportunities for integrated watershed-scale investments and can lead to piecemeal approaches (KIs 1, 4, 6, 14, 28; FBC, 2021). Finally, funding parameters may be misaligned with local realities. For instance, funding cycles may not align with budgetary cycles and project timelines (KI 27) or allow for damaged infrastructure to be rebuilt to improved standards (e.g., fish-friendly, climate resilient) (KI 4).

Despite these challenges, multiple KIs acknowledged ongoing efforts to update funding models to be more inclusive and equitable, to integrate Sendai and DRIPA, to promote climate resilience, to integrate co-benefits, to support the uptake of ‘alternative’ FRM strategies (e.g., retreat), and to streamline investment (KIs 16, 17, 18, 19, 20, 26, 29). For instance, the provision of dedicated funding to support FRM initiatives, such as the Transboundary Flood Initiative and the Sumas River Flood Collaborative Mitigation Framework, is significant as funding has long been a major barrier to fostering local and regional flood resilience in BC (e.g., Lyle & McClean, 2008; FBC, 2021; LFFC, 2022). Similarly, the Province is currently investigating the creation of a Watershed Security Fund and associated strategy to guide longer-term investment in watershed-scale initiatives (Gov. BC, 2023e).

Provincial and federal governments leverage funding parameters to steer local-level actions towards desired outcomes, such as integrating equity or incorporating nature-based solutions into project design (KIs 22, 26, 29). As such, policymakers were likely to report on the internal review and revision of current funding mechanisms to foster regional collaboration, co-governance with First Nations, and systems-based approaches (KIs 16, 17, 18, 19, 20, 22, 26, 29). Because of the intersectionality of policy issues and the finite funding available, there is a need for governments to become “smart investors” through intentional funding program design that systemically achieves social, environmental, and economic outcomes (KI 22). One provincial KI noted that provincial-federal alignment on perceived policy issues related to climate change and reconciliation has enhanced opportunities to collaborate on innovative policy and funding solutions (KI 30).

5.8 Discussion

5.7.1. Overview of key findings

British Columbia’s flood policy and governance landscape can be situated within the evolving and interconnected context of various policy drivers, legislative and institutional developments, and shifts in collective learning, values acceptability, and best practices occurring across scales. In BC’s Lower Mainland and Fraser Valley regions, post-disaster efforts to strengthen regional and transboundary flood governance reflect an iterative process of collective learning and relationship-building that began long before the 2021 atmospheric rivers event and established the necessary foundations for policy champions to catalyze on post-disaster momentum. Although governing authorities had predominantly lacked a strategic vision for collaborative multi-jurisdictional risk governance prior to the 2021 event, significant progress has been made towards this objective in the

three years following the disaster. Research findings provide evidence of policy-oriented learning occurring both prior to and in response to the 2021 AR event, and in conjunction with other multi-hazard events experienced in BC, such as the 2021 heat dome and multiple years of severe wildfires. Key findings, related to the evaluative framework presented earlier in Table 5, are synthesized below.

5.7.2. Enabling conditions are in place to support a FRM paradigm shift in BC

5.8.1.1 Case study results are consistent with key findings from the literature analysis

Public policy research emphasizes the importance of agenda setting—the process whereby decision-makers identify and prioritize public issues to be addressed—in determining not only which issues receive institutional and political backing, but also how problems and solutions are framed (Howlett et al., 2009; Birkland, 2020). In turn, this framing informs the values, rules, and knowledge systems that comprise a particular policy paradigm (Hogan & Howlett, 2015), underpinning all other aspects of the policy development process—from the actors involved to the instruments chosen to achieve a desired outcome (Pal, 2006; Howlett et al., 2009; Singh Bali et al., 2021; Lang, 2021). Once a policy paradigm becomes well-established within governing institutions, it becomes stable, or entrenched within self-reinforcing patterns and processes that continue to uphold this dominant paradigm (Pierson, 2000; Beunen & Patterson, 2019). Despite this, both policy subsystems and the institutions that govern over them are fluid and dynamic, responding to changing macro- and micro-level conditions as social-ecological systems evolve over time (North, 1990; Hogan & Howlett, 2015). Shifts in core beliefs, advancements in collective knowledge, changes in power dynamics, and opposition to prevailing rules can destabilize an existing paradigm, providing openings for new ideas and actors to enter the policymaking arena (Kingdon, 2003/1984; Sabatier & Weible, 2007; Geels; 2011; Pahl-Wostl et al., 2013).

When the dominant ways of knowing and doing no longer serve the present and future needs of the public, such an epistemological rupture can lead to systemic transformations, which often manifest as a combined result of gradual, incremental shifts and rapid, discontinuous changes (Repetto, 2006; Kates et al., 2012; Thelen & Mahoney, 2015). The former mechanism of change is closely linked to policy-oriented learning (Sabatier & Weible, 2007; Moysen et al., 2017), while the latter is associated with reaching a tipping point or critical juncture, whereby the long-term sustainability of the status-quo system becomes irrefutably challenged (Baumgartner & Jones, 1993; Birkland, 1997; Kingdon, 2003/1984; Pelling, 2011). Within the literature, the causal nature of policy outcomes is a source of

debate, lending itself to numerous theories and frameworks that tend to isolate and emphasize certain interactions within the policy subsystem; however, many scholars argue that policy development is non-linear, context-dependent, and occurs at intersection of shorter-term dynamics and longitudinal processes (e.g., Mortensen, 2007; Sabatier & Weible, 2007; Schlager, 2007; Capoccia, 2015; Pierson, 2015; Thelen & Mahoney, 2015).

Case study research on the influence of the 2021 atmospheric rivers flood disaster on British Columbian flood risk management policy and governance supports these findings. All three mechanisms of change identified in the literature—an emergent post-disaster policy-window, a preceding foundation of policy-oriented learning and institutional development, and an evolution in actor-network relationships through coalition-building and shifting power dynamics—were observed as being present in the BC context. Through early key informant interviews, it became apparent that while the 2021 AR event had been significant catalyst and accelerant of post-disaster change in many respects, such changes were highly dependent on prior coalition-building and policy-oriented learning efforts within the policy community. Cumulatively, these conditions indicate that a FRM paradigm shift is well underway within the province, setting a relatively strong foundation for governance actors to advance meaningful, inclusive, and transformational FRM policy and governance changes.

5.8.1.2 Post-disaster policy windows produce a broad spectrum of changes

Key informant responses were fairly consistent with the existing literature on post-disaster policy change, which suggests that these changes are rarely linear and can be situated as part of a spectrum of formal and informal actions moving across scales (e.g., Birkmann et al., 2010; Bolukbasi & Yildirim, 2022; Nohrstedt, 2022). Even among those who did not perceive the AR to be a focusing event, all key informants offered reasons throughout the interview as to why the disaster had been ‘significant’ in some capacity. According to the literature, such KI responses do, in fact, support the idea that the 2021 BC atmospheric rivers disaster constitutes a focusing event, as discussed below.

Firstly, key informants who were hesitant to classify the disaster as a focusing event expressed uncertainty around perceiving longer-term institutional impacts, but either explicitly referenced or implicitly alluded to changes occurring at the broader systemic level. Reasons unrelated to formal policy changes include increased media coverage, expanded public risk awareness and issue attention, increased academic interest, and strengthened community cohesion. The literature suggests that these outcomes, while not necessarily directly linked to the higher decision-making levels, can play an

important role in shifting values, setting public expectations about risk management, garnering social acceptability for proposed risk management solutions, and framing how the policy subsystem is broadly perceived (e.g., Birkland, 1997; Birkmann et al., 2010; Ross et al., 2023). This is because disasters can open a window of opportunity for social learning related to shared experiences of disaster response and recovery, foregrounding risk management issues within recent collective memory (Ross et al., 2023). Disasters have the potential to act as “transitional ruptures” (Ross et al., 2023: p.1534), offering critical opportunities for social learning and the reframing of community objectives (Birkmann et al., 2010; Brundiers, 2018; Brundiers & Eakin, 2018). However, this process can be time-consuming; thus, impacts are not necessarily visibly apparent in the near-term, instead ‘lagging’ behind the disaster as actors engage in adaptive learning over time (Birkland, 2009; O’Donovan, 2017; Nohrstedt, 2022).

Secondly, key informants who reported that the disaster had amplified existing initiatives, rather than prompting fundamental shifts, highlighted the need to examine post-disaster change within the context of longer-term institutional development. The literature suggests that while post-disaster changes may not necessarily represent transformative shifts in policy and practice, focusing events may nonetheless allow actors to reaffirm their policy positions, to advocate for greater institutional resources to advance existing initiatives, and to accelerate program development (e.g., Surminski & McCraine, 2019; Bolukbasi & Yildirim, 2022). Many policy scholars, thus, support the need to situate policy development within a longitudinal context, asserting that policy reform is more likely the compounding result of a series of events and processes over time, rather than as a direct response to singular event (Sabatier & Weible, 2007; Howlett et al., 2009; Capoccia, 2015; Thelen & Mahoney, 2015; O’Donovan, 2017).

Consequently, this study offered key insights into how the same potential focusing event may permeate through different scales of governance and decision-making in a variety of ways, meaning that a single disaster can produce a wide range of formal (i.e., top-down, institutionally-driven) and informal (i.e., bottom-up, decentralized) outcomes. These outcomes can further be classified as being either a newly emergent outcome that occurred as a direct response to the disaster or as a pre-existing phenomenon that was indirectly influenced by the event in some capacity. **Figure 35** explores the extent and manner to which post-disaster outcomes may (a) be situated within the systemic, institutional, and decision-making agendas, and/or (b) constitute a direct post-disaster response, as opposed to being indirectly influenced by the event. Likewise, **Table 11** provides select case study examples of this.

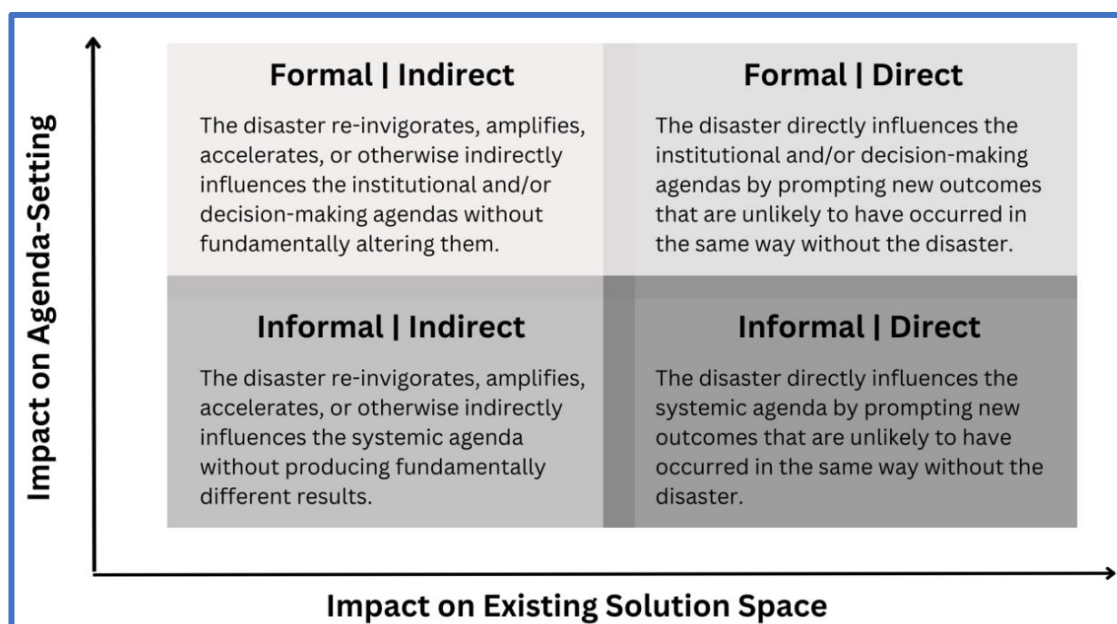


Figure 35: A spectrum of post-disaster change as a result of a focusing event

Table 11: Examples of the 2021 AR's influence on BC FRM policy and governance

Formal (i.e., Institutional, Decision-Making Agendas) Indirect Influence	• Influenced flood policy development (e.g., the BC Flood Strategy) • Influenced ministerial restructuring (e.g., Ministry of Water, Lands, and Resource Stewardship; Ministry of Emergency Management and Climate Readiness) • Influenced CCA policy development (e.g., Provincial Disaster and Climate Risk and Resilience Assessments; BC Climate Preparedness and Adaptation Strategy) • Influenced the modernization of DRR legislation (e.g., Emergency and Disaster Management Act)
Formal (i.e., Institutional, Decision-Making Agendas) Direct Outcome	• Prompted the development of a Long-Term Flood Mitigation Plan for Sumas Prairie • Prompted the development of a Sumas River Collaborative Flood Mitigation Framework • Prompted the development of new Transboundary Flood Initiative • Prompted investment in institutional capacity (e.g., budgetary allocations, new executive positions and new policy teams related to CCA and DRR)
Informal (i.e., Systemic Agenda) Indirect Influence	• Referenced in the post-disaster outputs (e.g., reports) of pre-existing regional flood governance and planning initiatives, such as the Fraser Basin Council's Lower Mainland Flood Management Strategy Initiative

Informal (i.e., Systemic Agenda) Direct Outcome	• Catalyzed the formation of the Lower Fraser Floodplains Coalition and the creation of the ‘Build Back Better, Together’ movement, which has resulted in multiple regional forums, workshops, and planning initiatives • Enhanced public flood risk awareness and receptiveness to alternative FRM solutions • Highlighted regional and sector-specific flood-related vulnerabilities
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5.8.1.3 The Province of BC possessed a strong prior foundation of policy-oriented learning

Although all provincial-affiliated key informants agreed that the 2021 atmospheric rivers event had influenced their organizations in some capacity (e.g., reinforcing the importance of current policy work, influencing decision-making mandates, prompting budgetary allocations towards expanding staff capacity to conduct related policy work), these KIs also referenced the importance of numerous earlier and ongoing institutional developments and initiatives unrelated to the disaster. Results suggest that ongoing institutional developments (e.g., the modernization of the Emergency Program Act; advances in reconciliation and climate action; changes to ministerial mandates and functions) have been critical in setting the necessary foundation for meaningful FRM policy change. A further scan of institutional developments ranging from 2017 to June 2024, as shown earlier in Table 10, further validated these results, demonstrating that the Province of BC has long been engaged in a gradual transition towards a new policy paradigm—one that goes beyond simply flood risk management to integrate systems-based approaches and inclusive governance throughout multiple policy subsystems.

Policy-oriented learning is a necessary pre-cursor to shifting a policy paradigm, as this allows formal governing institutions to assess underlying values, rules, and knowledge systems, to revise policy objectives, and to employ the necessary substantive and procedural instruments that help to ensure that policy goals and outcomes are in alignment with these priorities. Semi-structured interviews with provincial policy staff and other KIs, as triangulated with relevant policy documents and developments, demonstrated that the Province of BC has been consistently moving towards a new policy paradigm since at least 2017 through an iterative process of policy-oriented learning and subsequent changes in provincial mandates, organizational structures, and processes. Reflected in provincial policy documents and institutional mandates, the Province of BC has made significant progress in moving towards a whole-of-government approach that centers climate resilience, reconciliation, and equity. Although there is still much progress to be made in fully departing from past path dependencies and reconciling with historical inequities, the Province of BC is among the relatively few Canadian sub-national governments leading the way on:

- a) actively decolonizing Crown-Indigenous relations as guided by UNDRIP and DRIPA,
- b) advancing Sendai-informed and climate-resilient risk reduction policies, and
- c) adopting a systems-based, whole-of-government approach that extends beyond the scope of FRM to the institutional level.

Furthermore, although many institutional shifts were in development prior to the AR event, it is in the post-AR disaster landscape that the significance of prior and ongoing institutional learnings have become most apparent to the broader policy community. For instance, despite incremental progress being made towards integrating CCA and DRR within provincial policymaking since 2017, FRM remained siloed between multiple agencies until recently in 2023 when the newly-established Ministry of Water, Land, and Resource Stewardship became the leading authority not only on FRM, but also water sustainability, coastal and marine management, and integrated land and natural resource management. Although the Province of BC underwent incremental adjustments in the past (i.e., through institutional layering and drift) producing suboptimal or incoherent policy mixes that did not enable transformation, these processes coincided with institutional learning that deepened over time, eventually leading to the replacement of outdated institutions, such as Emergency Management BC, with newly emergent institutions, such as the Ministry of Emergency Management and Climate Readiness, which are intended to advance the new policy paradigm. This harmonization of policy instruments and priorities, as well as ongoing efforts to update legislative and funding tools to further steer public and private behaviour towards meeting these objectives, demonstrates the Province of BC's commitment to policy-oriented learning and the ongoing transition toward a new policy pathway.

5.8.1.4 Cumulative climate disasters in 2021 accelerated provincial policy-oriented learning

The research suggests that the combined climate-related emergencies of 2021—in addition to subsequent wildfire disasters, the alignment of federal-provincial policy priorities, increased sociopolitical buy-in for CCA and DRR, and a groundswell of policy advocacy—has accelerated this transition towards new policy paradigm by providing enhanced opportunities to engage in collaborative policy-oriented learning. Key informants commonly referenced the 2021 heat dome and wildfires as having a significant impact on both public risk perceptions and provincial policymaking. Overall, KIs believed that these events, in conjunction with the AR event, helped to demonstrate the multi-hazard reality of climate change and to have likely extended the policy window by keeping climate change top of mind among both the public and political leaders. Results indicate that the increasing frequency, severity, and unpredictability of climate-related hazards may influence the willingness of decision-

makers to invest in proactive DRR and CCA measures, particularly if successive governments continue to inherit multi-year disaster recovery programs and subsequent emergency responses.

5.8.1.5 Inclusive and participatory processes are critical for effective governance

Nearly all key informants discussed the importance of fostering trusted, reciprocal relationships across institutions, between governments, and among public and private stakeholders. Within the context of post-disaster flood policy and governance in BC, this theme manifested in several ways. Firstly, the juxtaposition of engagement processes between (a) the City of Abbotsford's *Long-term Flood Mitigation Plan* and (b) both the Lower Fraser Floodplains Coalition's 'Build Back Better, Together' movement and the Sumas River Collaborative Flood Mitigation Framework highlights the importance of participatory and inclusive decision-making processes. Such processes enhance stakeholder buy-in and socio-political acceptability related to exploring novel FRM solutions, enable the co-development of shared values, and promote watershed-scale interventions, as opposed to piecemeal FRM approaches.

Similarly, this research highlights the value of enabling, nurturing, and maintaining collaborative networks within the policy subsystem. Relationship-building takes time—and resources—to develop, meaning that results are not always visibly apparent in the near-term; however, once networks are established, governance actors are able to self-organize themselves and mobilize action in a relatively rapid period, making them better positioned to leverage critical windows of opportunity. This was observed in the ability of Lower Fraser Floodplains Coalition members to successfully capitalize upon prior governance initiatives (i.e., the Lower Mainland Flood Management Strategy) to collectively advocate for post-disaster change. Finally, evidence of policy-oriented learning related to earlier transboundary governance initiatives (e.g., the Nooksack River International Task Force, the BC-WA Environmental Cooperation Council) is reflected in the new Transboundary Flood Initiative, which aims to empower historically-excluded actors to meaningfully engage in decision-making and to streamline multi-jurisdictional FRM through an enhanced policy-focus.

Furthermore, the manner in which the City of Abbotsford developed their LFMP highlights the tensions and trade-offs that can manifest between meeting shorter-term disaster recovery needs and engaging in longer-term resilience planning. Decision-makers make choices related to the prioritization of short- and long-term gains, the (de)centralization of decision-making processes, and the trade-off between a speedy recovery and the allocation of necessary time for meaningful and participatory

engagement (Tuhkanen et al., 2017; Surminski & McCraine, 2019; Torres Cordero, 2020). Whether or not the ‘ends justify the means’ has been debated by equity and justice scholars who underscore that, despite often constituting a quicker and more streamlined policy process (Cattapan et al., 2020), top-down decision-making carries the risk of producing unintended adverse consequences, such as further perpetuating systemic harms (e.g., Tuhkanen et al., 2017; Meerow et al., 2019; Okamoto, 2023; Ryder et al., 2023). In participatory processes, progress towards meeting policy objectives can be constrained by the speed of building trusted relationships, especially when existing connections are not already present (Cattapan et al., 2020). However, meaningful, inclusive, and fair community engagement enhances the likelihood of achieving equitable and socially-acceptable outcomes (Mohtat & Khirfan, 2021; Ryder et al., 2023).

5.8.2 Institutional barriers continue to constrain the transformative change

5.8.2.1 Provincial actors are dually empowered and constrained by their institutions

Despite a consistent trend of policy-oriented learning and institutional development within the Province of BC, KIs identified several barriers that constrain the speed and extent of possible change. Perceived constraints included uncertain short-term political cycles, competing priorities that divide staff capacity and taxpayer funds, gaps in organizational readiness and institutional memory, and importantly, the time necessarily to engage in collaborative learning, to establish trusted relationships, and to co-develop equitable solutions. Such constraints are not impossible to overcome and indeed, all provincial-affiliated KIs felt confident that the Province of BC was taking necessary internal steps to bridge these gaps, while noting that such progress often occurs outside of the public periphery and may be less apparent in the near term—as supported by the literature (Capoccia, 2015). In general, key informants perceived that the 2021 AR focusing event had left provincial agencies better resourced and empowered to advance these changes and/or that the disaster had underscored the importance of earlier foundational work, both politically and among the public, thus accelerating the development of subsequent policies. As such, research findings were consistent with the literature on the ‘duality of structure’ that institutional actors face, being both empowered and constrained in their abilities to advance policy change as a result of the institutional bounds within which they operate (Sewell Jr., 1992; Beunen & Patterson, 2019; Bolukbasi & Yildirim, 2022).

5.8.2.2 Challenges remain with overcoming institutional inertia at the local scale

The City of Abbotsford's post-disaster development of a *Long-Term Flood Mitigation Plan* for Sumas Prairie provides further insights into the challenges of overcoming institutional inertia. In contrast to the provincial government, the City of Abbotsford does not possess a longstanding history of policy-oriented learning related to systems-based approaches, climate action, and decolonization. This is reflected in the municipality's limited collaboration with First Nations Rights Holders and lack of participatory processes in the LMFP, the absence of climate-related policy development to date, the persistent silos across policy domains (e.g., housing and development versus flood risk management), and the relatively limited exploration of alternative FRM pathways (e.g., managed retreat, nature-based solutions). Thus, research findings suggest that possessing a culture of organizational learning and prior multi-jurisdictional relationships are both key components that empower formal governing bodies, like municipalities, to seek out new policy pathways and overcome prior institutional inertias.

Despite these limitations, there is evidence to suggest that, since the initial LMFP development, the City of Abbotsford has made progress towards engaging in policy-oriented learning, although it is too early to evaluate extent of this progress at this time. Since the release of the LMFP in June 2022, several notable developments in BC's flood risk management policy subsystem have occurred. Firstly, the City of Abbotsford has been engaged in multi-jurisdictional initiatives, namely the Sumas River Flood Collaborative Mitigation Framework and the Transboundary Flood Initiative. Such formal initiatives, under provincial steering, not only promote regional collaboration between municipal and First Nations partners across the Canada-US border, but also serve to align local FRM policies with broader provincial objectives, such as upholding inherent Indigenous rights to free, informed, and prior consent as legislated by DRIPA and integrating the Sendai principles for DRR. Secondly, in this time period, the post-disaster emergence of a strong regional movement to 'Build Back Better, Together,' characterized by a series of collaborative regional visioning and policy-oriented learning activities, is continuing to shape the culture of FRM planning in the Lower Mainland and Fraser Valley regions. It is likely that these ongoing regional governance initiatives will continue to inform municipal FRM.

5.9 Implications for research, policy, and practice

5.9.1 Post-disaster policy change must be assessed within longitudinal contexts

This study emphasizes the need to assess post-disaster policy change within broader long-term institutional contexts—a perspective that may be lost when assessing disaster outcomes in the immediate recovery period (i.e., the emergent policy window). Research findings suggest that transforming policy paradigms and departing from prior path dependencies is a non-linear and co-evolutionary process. When viewing various FRM policies and processes in isolation from one another, at first glance, it may appear that many prior initiatives were not entirely effective in meeting desired policy and governance objectives, leading to incoherent or misaligned policy regimes. However, when prior institutional ‘failures’ are situated within the context of longer-term adaptive learning, a different narrative emerges. The post-disaster policy and governance outcomes outlined in this chapter allow for a comparative analysis of how actors and their institutions engage in collective learning in an attempt to learn from past failures, to revise policy means and objectives, and to challenge or advance a particular policy paradigm. The case study findings explored in this chapter provide a unique multi-scalar lens that shows path change as a non-linear, multi-causal process.

5.9.2 Collaborative, sustained learning is a critical enabler for transformation

Critically, this study identified several enabling conditions which can allow policy champions to leverage key policy windows at times when social, political, and institutional conditions are most conducive to accelerate institutional development and to advance preferred policy solutions. This research supports the broad consensus within the literature which highlights the importance of social learning for transformative change. The case study examples provided in this thesis highlight the value of fostering collaborative spaces (e.g., regional gatherings or communities of practice) and formal governance structures (e.g., multi-scalar initiatives, ministerial working groups) where shared learning, constructive dialogue, and conflict resolution may occur between and within organizations. Because policy-oriented learning is an iterative long-term process, ensuring that there are appropriate mechanisms and resources (e.g., staff capacity, sustainable funding) in place is necessary to sustaining cross-coalition learning and coordinating multi-jurisdictional actions. In an era of increasing climate emergencies, it is recommended that formal decision-making institutions ensure the continuity of emergent post-disaster governance initiatives in non-disaster times. Doing so has the potential to improve organizational readiness, to promote innovative and inclusive policy development, and to

strengthen the multi-stakeholder, multi-scalar relationships necessary for effective disaster response, recovery, and risk reduction.

Chapter 6: Conclusion

6.1 Chapter overview

This thesis sought to identify the enabling conditions which support the development of innovative, multi-jurisdictional, and multi-benefit disaster risk reduction and climate change adaptation solutions. This thesis presents a literature-derived evaluative framework for assessing policy change within the dual contexts of short-term focusing events and longer-term institutional development. Through the use of semi-structured key informant interviews, document analysis, and observational research, this evaluative framework was applied in a multi-scalar case study setting to understand the drivers of and barriers to flood policy change in the aftermath of the 2021 British Columbia atmospheric rivers flood disaster. This chapter revisits research questions and objectives, provides a synthesis of key findings as these relate to scholarly contributions and practical policy and governance-oriented applications within the DRR, CCA, and FRM fields, and concludes with recommendations for further advancing this work.

6.2 Research purpose and objectives

Through a case study analysis of a major flood event that produced multi-sectoral, multi-jurisdictional, and transboundary disaster impacts in British Columbia, Canada, and Washington, USA, this study sought to understand the manner in which large-scale system-wide shocks, such as disasters, influence policy, practice, and governance. While the study's initial aim was to assess the extent to which flood disasters prompt windows of opportunity for policy change in the post-disaster response and recovery landscape, preliminary modes of inquiry revealed the equally critical roles of collaborative governance arrangements and mechanisms of institutional development in enabling post-disaster change, thus expanding the research scope. Although the initial research scope centered around post-disaster decision-making in Sumas Prairie, Abbotsford, as situated within the community's broader regional governance landscape, the research revealed the dynamic multi-scalar, cross-border, and longitudinal evolution of FRM policy and governance within the study area. As such, this research provided key insights into the following:

- 1) The extent to which a major flood disaster directly and indirectly influenced flood risk management policy, governance, and practice at multiple scales in BC, and the enabling institutional conditions that contributed to these changes and developments; and,

- 2) The ways in which governance actors (e.g., policymakers, policy champions) and formal institutions (e.g., government agencies) engaged in collaborative planning and decision-making processes in the post-disaster period to advance a FRM paradigm shift.

6.3 Synthesis and salience of major findings

Within the case-study context of British Columbia, the research revealed that although governance actors continue to experience challenges related to fragmented flood risk governance, siloed risk management approaches, and institutional resource and capacity gaps, there is ample evidence to suggest that a paradigm shift towards multi-benefit FRM solutions, collaborative governance, and integrated climate and disaster resilience planning was well underway prior to the 2021 atmospheric rivers event, and that the 2021 event served to accelerate change already underway. The majority of key informants perceived the disaster to be a major focusing event that amplified public attention to FRM problems, enabled policy champions and institutional actors to advance longstanding policy priorities, and prompted political leaders to commit funding and resources to addressing the issue. However, pre-conditions in place before the disaster—such as iterative policy-oriented learning and pre-existing actor-network relationships—enabled policy champions to effectively leverage the focusing event in an effort to advance progressive policy reforms.

Within the complementary fields of climate change adaptation, disaster risk reduction, and water governance, this research supports the broad consensus among researchers and practitioners that climate-resilient, sustainable resource stewardship necessitates collaborative whole-of-government and whole-of-society governance, as well as a diversified suite of strategies, policy instruments, and decision-support tools. This research focus is particularly salient because Canadian communities are increasingly finding the need to adapt to the new normal of climate change—a changing, multi-hazard reality that necessitates proactive risk reduction measures and coordinated multi-level actions. In many cases, achieving flood resilience will require that existing flood governance systems undergo both incremental and transformative changes to ensure ‘institutional fit,’ meaning that desired policy solutions are compatible with the institutions responsible for implementing them. Although path dependencies and institutional inertias can constrain the ability of policy actors and formal governing institutions to advance systemic shifts in the values, rules, and knowledge systems that underpin all policy and practice, these findings reveal that such paradigm shifts result from the co-evolution of the following events and processes:

- 1) Incremental adjustments as formal governing institutions both learn from and, on behalf of society through policy-oriented learning, gradually adapting policy instruments and objectives in response to changing stimuli;
- 2) Rapid shifts that emerge as a result of system-wide shocks and stresses, serving as a tipping point whereby previous ways of doing and knowing are no longer considered feasible or acceptable by the broader public, policy community, and/or leadership; and,
- 3) Dynamic and collaborative modes of social learning that allow for the expansion of the so-called ‘solution space’ over time, as new ideas gain sociopolitical acceptance, experiential knowledge is consolidated, silos are bridged, and new governing coalitions come to dominate the policy community.

6.4 Scholarly and practical contributions

Through a multi-scalar case study analysis of informal and formal governance arrangements at the local, regional/watershed, and provincial scales, this study contributes empirical, conceptual, and applied policy insights into how actors and institutions may leverage critical windows of opportunity, such as disasters, to (1) advance novel climate change adaptation and disaster risk reduction strategies, (2) engage in social learning to expand the policy solution space and bridge governance silos, and (3) collaboratively codevelop shared visions of resilience that coincide with actionable strategies. Although this study centers around policy change within flood risk management and governance, core findings related to mechanisms of policy and institutional change, social learning, and collaborative governance are likely transferable to some extent to other policy domains, particularly within the context of catalyzing social change in path-dependent systems.

This study contributes empirical insights into the current state of flood risk management and governance at the local (i.e., Sumas Prairie, Abbotsford), regional (i.e., Fraser Valley, Lower Mainland), watershed (i.e., transboundary Nooksack River, Lower Fraser Basin), and provincial (i.e., British Columbia) scales. Through primary data collection and an analysis of secondary source materials, this thesis provides a comprehensive overview of the 2021 atmospheric rivers event, the post-disaster recovery landscape, and the evolution of flood policy and governance in the nearly three years following the event. Furthermore, Chapter 5 provides critical insights into longer-term patterns and processes of institutional development within the BC Government, indicating that provincial authorities have been consistently trending towards a decolonial, systems-based, whole-of-government, and

whole-of-society policy paradigm since at least 2017. Finally, this study provides empirical insights into the grassroots development of regional flood governance initiatives, including a discussion of how current collaborations are the result of past learnings and relationship-building actions. Such findings indicate that policy and governance transformations may be a product of non-linear and iterative learnings that continue to expand and evolve over time, as opposed to a sudden discontinuous or radical shift.

In addition to case-specific contributions, this research presents conceptual, scholarly contributions, and applied policy recommendations. Chapter 2 proposes a conceptual framework for assessing post-disaster policy change (see Table 5) that integrates three interrelated mechanisms of policy change—external shocks, longitudinal changes, and shifts in power dynamics—with theories on social and policy-oriented learning, agenda-setting, and institutional development. The blending of policy change and systems change literature allows for a rich discussion of the elements (e.g., actors, institutions, policy instruments), interconnections (e.g., relationships between system elements, governance arrangements), and functions (e.g., policy means, actor/institutional values) that underpin flood risk management systems, and how various shifts within these domains contribute, either indirectly or directly, to transformational changes at the systemic level. Chapter 5 applies and tests this conceptual framework in the case-study context of the BC atmospheric river floods, allowing for an iterative refinement of the framework, and providing applied policy insights for policymakers, practitioners, policy champions, and decision-makers seeking to advance a policy paradigm shift. Five of the most salient applied policy insights stemming from this study are outlined in the next section.

6.5 Recommendations

6.5.1 Empower collaborative non-governmental coalitions and initiatives

Leadership and funding authorities should ensure that champion organizations and collaborative multi-stakeholder initiatives are adequately resourced and actively engaged in decision-making processes. Such collaboratives play an instrumental role in mobilizing on-the-ground actions, fostering social learning and building relationships between diverse stakeholders, and in identifying critical gaps in knowledge, practice, and policy. While policy champions and coalitions are essential players in advancing innovation and transformation within policy subsystems, advocacy efforts are often undertaken in a volunteer capacity or in addition to existing work. There is a need for leadership and funders to recognize the integral, but often costly and time-consuming, nature of relationship- and

capacity-building enterprises, and to ensure that procedural tools and processes are not overlooked in policy development and funding mechanisms.

6.5.2 Leverage existing networks and relationships, and continue to strengthen these during non-disaster times through active and ongoing engagement

The research revealed the importance of leveraging pre-existing relationships in order to mobilize action quickly and effectively. Relationship-building processes between actors, organizations, and jurisdictions are often slow, developed at the speed of trust and reinforced through ongoing collaboration, transparent communications, and consistent actions. However, once these relationships are well-established, actors and agencies will be better positioned to leverage their network connections in times of crisis and uncertainty, ensuring that disaster response, recovery, and risk reduction actions are coordinated amongst partners in a timely manner. In non-disaster times, maintaining these networks through active and ongoing engagement can help to drive innovation and learning within the policy community, and can help to advance whole-of-society and whole-of-government governance.

6.5.3 Take an integrated multi-benefit and multi-hazard approach to FRM, CCA, and DRR—as incentivized by policy and funding

As shown in the case of the 2021 British Columbia atmospheric rivers event and subsequent flood risk reduction planning, adapting to the uncertainties and complexities of climate change, responding to the cascading and compounding shocks and stressors of multiple hazards, and addressing other social, economic, and political disruptions (e.g., pandemic, economic downturn, unrest) means that policy solutions should take integrated, multi-solving approaches. Because governments must allocate finite resources to competing priorities, leadership should ensure that funding streams, public investments, and policy instruments possess targeted, mandatory provisions for achieving multiple co-benefits. Within FRM, for instance, this could involve the integration of other priorities besides flood protection, such as ecosystem enhancements, food security, sustainable forest management, habitat restoration, water quality improvements, community access to recreational and outdoor spaces, and reconciliation with Indigenous communities. Additionally, decision-makers, policymakers, and practitioners should take a multi-hazard approach to assessing and adapting to risks, ensuring that hazard interdependencies are appropriately planned for.

6.5.4 Adopt a systems-based approach to institutional policymaking and create dedicated mechanisms for bridging siloes within and across institutions

Although a degree of cohesion is necessary for maintaining stability within a policy subsystem, policy communities, as well as the institutions responsible for governing them, can become highly siloed and homogenous to the detriment of cross-agency and cross-sectoral innovation, collaboration, and integration. This can lead to unintended consequences when the interdependencies between and within nested systems are neglected, and this has been particularly evident in terms of human interference in the global climate system. Governing complex social-environmental systems, such as in the case of human-water relations, necessitates that policy development and decision-making processes adopt a systems-based lens. Concurrently, institutional and organizational silos must be broken down in order to facilitate shared understandings, bridge knowledge gaps, and improve institutional fit.

6.5.5 Develop sustainable long-term funding mechanisms that incentivize proactive watershed-scale action and multi-jurisdictional collaboration

There is a need for innovative and nuanced funding mechanisms that promote proactive flood adaptation and allow for ambitious multi-jurisdictional projects that tackle resiliency challenges at the watershed or regional scales, as opposed to ad-hoc smaller-scale interventions. Funding mechanisms that are able to effectively incentivize collaborative resource-sharing, capacity-building, and problem-solving across jurisdictions can help to align local actions with a unified regional vision, reduce unintended consequences to neighbouring or downstream jurisdictions, and effectively allocate finite funds. Furthermore, adding an element of longevity and predictability to funding streams can help to support municipalities and First Nations in engaging in longer-term, phased projects. Transformative change takes time to achieve and often relies on iterative processes; thus, funding mechanisms must reflect this.

6.6 Study limitations and avenues for future research

Although this study endeavored to assess multi-scalar policy and governance changes in the aftermath of the 2021 atmospheric rivers event, primary data collection was challenging in certain jurisdictions. Firstly, due to ongoing litigation involving the City of Abbotsford during the study's timeframe (2022-2024), city officials and staff declined to participate in semi-structured key informant interviews; instead, publicly-available municipal documents, field observations at City of Abbotsford events and meetings, and interviews with individuals knowledgeable about the City's role in local and

regional FRM planning initiatives were relied upon. Secondly, as a result of the absence of pre-existing community relationships, the researcher's own positionality, and upon the advice of individuals with working relationships with these communities, staff of local First Nations governments were not interviewed. Rather, interviews with staff of First Nations-led organizations were supplemented with publicly available documentation and a Stó:lō exhibition. Future research, conducted by or in partnership with Mainland Coast Salish First Nations communities and organizations, that examines the evolution of flood policy and governance as situated within opportunities to advance decolonization, self-determination, and self-governance would be highly valuable.

Furthermore, there are limitations related to the novelty and rapidly evolving nature of this case study. Because of the relatively recent occurrence of the 2021 atmospheric rivers event and the dynamic shifts occurring within the BC flood policy subsystem, there are likely to be a number of further policy developments in the coming years. As such, a continuation of this research, via a longitudinal study of post-disaster flood policy development in BC or through additional empirical research on governance and decision-making within other affected communities and regions, could provide valuable insights into the drivers of policy change in an era of climatic uncertainty. These limitations illustrate the complexity of assessing both recent events and multi-jurisdictional policy challenges; nonetheless, this research provides critical empirical and conceptual insights into the pre- and post-disaster conditions that enable collaborative governance and innovative policy solutions.

6.7 Concluding remarks

Globally, many decision-makers, policymakers, practitioners, researchers, industry partners, and community champions alike are seeking innovative pathways to adapt current policy subsystems to the dynamic realities of a changing climate. Transforming deeply-embedded values, rules, and knowledge systems is a challenging, but wholly necessary, endeavour if humankind wishes to reduce systemic vulnerabilities, strengthen socio-ecological resiliency, and co-create an equitable and just future for all people. Doing so will require formal governing institutions to create dedicated spaces for collaborative learning to occur between sectors, jurisdictions, agencies, and diverse stakeholder groups, and to ensure that policy instruments are tailored towards advancing integrated multi-benefit solutions. As this study suggests, finding a balance between top-down and decentralized governance and developing cohesive policy solutions requires the adequate resourcing of existing grassroots and locally-led initiatives, the intentional alignment of policy means and ends, and the long-term

sustainment of participatory processes that allow for the iterative co-development, exchange, and testing of ideas across the whole-of-government and whole-of-society.

Reference List

- Abbotsford Chamber of Commerce. (2022). *Canada's agricultural hub: An economic impact analysis of agriculture in Abbotsford*. <https://www.abbotsfordchamber.com/canadas-agricultural-hub-report-2022/>
- Abbotsford News, The. (2022, November 17). *Stronger together. The flood: One year later*. https://www.abbynews.com/editions/?iid=i2022111702564491505&&headline=Tm92ZW1iZXIzMtcsIDlwMjIjQWJib3RzZm9yZCBOZXdz&&doc_id=221117113449-04d66b1845bd5e8a900930f879f4f7f9&&pid=p20120309121148491
- Abbotsford Policy Corner. (2023, February 28). *McKee Neighbourhood Plan (opinion)*. <https://www.abbotsfordspolicycorner.com/2023/02/mckee-neighbourhood-plan-opinion.html>
- Abbott, G., & Chapman, M. (2018). *Addressing the new normal: 21st century disaster management in British Columbia. Report and findings of the BC Flood and Wildfire Review: An independent review examining the 2017 flood and wildfire seasons*. <https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/bc-flood-and-wildfire-review-addressing-the-new-normal-21st-century-disaster-management-in-bc-web.pdf>
- Abraham, J.P., Baringer, M., Bindoff, N.L., Boyer, T., Cheng, L.J., Church, J.A., Conroy, J.L., Domigues, C.M., Fasullo, J.T., Gilson, J., Goni, G., Good, S.A., Gorman, J.M., Gouretski, V., Ishii, M., Johnson, G.C., Kizu, S., Lynman, J.M., Macdonald, A.M.,... & Willis, J.K. (2013). A review of global ocean temperature observations: Implications for ocean heat content estimates and climate change. *Reviews of Geophysics* 51 (3): 450-483. <https://doi.org/10.1002/rog.20022>
- Adam, S., & Kriesi, H. (2007). "The network approach" In P.A. Sabatier (Ed.), *Theories of the policy process* (2nd ed., pp.129-154). Routledge.
- Adams, W.C. (2015). "Conducting semi-structured interviews." In K.E. Newcomer, H.P. Hatry, & J.S. Wholey (Eds.), *Handbook of Practical Program Evaluation* (4th Ed., pp. 492-505). John Wiley & Sons Inc. <https://doi.org/10.1002/9781119171386>
- Adamowski, J.F., Zyla, C., Cuenca, E., Medema, W., Clamen, M., & Reig, P. (2013). *Integrated and adaptive water resources planning, management, and governance*. Water Resources Publications LLP.
- Adger, W.N., Agrawala, S., Mirza, M.M.Q., Conde, C., O'Brien, K., Pulhin, J., Pulwarty, R., Smit, B., & Takahashi, K. (2007). Assessment of adaptation practices, options, constraints and capacity. In M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden, & C.E. Hanson (Eds.), *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 717-743). Cambridge University Press. <https://www.ipcc.ch/site/assets/uploads/2018/02/ar4-wg2-chapter17-1.pdf>
- AgSafe BC. (2023, January 30). *Stronger together* [Video]. YouTube. <https://www.youtube.com/watch?v=FLOFhk8BORE>
- Ahamed, M.S., Sarmah, T., Dabral, A., Chatterjee, R., & Shaw, R. (2023). Unpacking systemic, cascading, and compounding risks: A case based analysis of Asia Pacific. *Progress in Disaster Science* 18: 100285. <https://doi.org/10.1016/j.pdisas.2023.100285>
- Ajibade, I., Sullivan, M., Lower, C., Yarina, L., & Reilly, A. (2022). Are managed retreat programs successful and just? A global mapping of success typologies, justice dimensions, and trade-offs. *Global Environmental Change* 76. <https://doi.org/10.1016/j.gloenvcha.2022.102576>
- Akuffo, A.G. (2023). When the researched refused confidentiality: Reflections from fieldwork experience in Ghana. *Journal of Academic Ethics* 21: 567-589. <https://doi.org/10.1007/s10805-023-09471-x>
- Albright, E.A. (2011). Policy change and learning in response to extreme flood events in Hungary: An advocacy coalition approach. *Policy Studies Journal* 39 (3): 485-511. <http://doi.org/10.1111/j.1541-0072.2011.00418.x>
- Alderman, K., Turner, L. R., & Tong, S. (2012). Floods and human health: A systematic review. *Environmental International* 47: 37-47. <https://doi.org/10.1016/j.envint.2012.06.003>

- Amundsen, H., Berglund, F., Westskog, H. (2010). Overcoming barriers to climate change adaptation—a question of multilevel governance? *Environment and Planning C: Government and Policy* 28: 276–289. <https://doi.org/10.1068/c0941>
- Anderson, B. (1983). *Imagined communities: Reflections on the origin and spread of nationalism*. Verso.
- Anderson, S.E., Bart, R.R., Kennedy, M.C., MacDonald, A.J., Moritz, M.A., Plantinga, A.J., Tague, C.L. & Wibbenmeyer, M. (2018). The dangers of disaster-driven responses to climate change. *Nature Climate Change* 8 (8): 651–53. <https://doi.org/10.1038/s41558-018-0208-8>
- Armitage, D.R., Plummer, R., Berkes, F., Arthur, R.I., Charles, A.T., Davidson-Hunt, I.J., Diduck, A.P., Doubleday, N.C., Johnson, D.S., Marschke, M., McConney, P., Pinkerton, E.W., & Wollenberg, E.K. (2008a). Adaptive co-management for social-ecological complexity. *Frontiers in Ecology and the Environment* 7 (2): 95–102. <https://doi.org/10.1890/070089>
- Armitage, D., Marschke, M., & Plummer, R. (2008b). Adaptive co-management and the paradox of learning. *Global Environmental Change* 18: 86–98. <https://doi.org/10.1016/j.gloenvcha.2007.07.002>
- Armitage, D., Berkes, F., Dale, A., Kocho-Schellenberg, E., & Patton, E. (2011). Co-management and the co-production of knowledge: Learning to adapt in Canada's Arctic. *Global Environmental Change* 21 (3): 955–1004. <https://doi.org/10.1016/j.gloenvcha.2011.04.006>
- Arts, B., & Van Tatenhove, J. (2004). Policy and power: A conceptual framework between the ‘old’ and ‘new’ policy idioms. *Policy Sciences* 37 (3–4): 339–356. <https://doi.org/10.1007/s11077-005-0156-9>
- Associated Press. (2021, November 27). ‘Atmospheric rivers’ threaten new floods in hard-hit Washington state. *The Guardian*. <https://www.theguardian.com/us-news/2021/nov/26/atmospheric-rivers-floods-washington-state>
- Atleo, C., & Boron, J. (2022). Land is life: Indigenous relationships to territory and navigating settler colonial property regimes in Canada. *Land* 11 (5): 609. <https://doi.org/10.3390/land11050609>
- Azeez, L. (2024, March 26). B.C. Flood Strategy – A good plan on paper. *Watershed Watch Salmon Society*. <https://watershedwatch.ca/stories/bc-flood-strategy-2/>
- Ball, D.P. (2021, July 19). Warnings, lessons about B.C. wildfires were all in 2018 report, authors say. *CBC News*. <https://www.cbc.ca/news/canada/british-columbia/bc-wildfires-2018-review-warnings-1.6105778>
- Bains, C. (2021, December 16). Cars, couches, fridges, and fuel tanks among ‘mountains’ of debris requiring disposal. *CBC News*. <https://www.cbc.ca/news/canada/british-columbia/bc-floods-2021-cleanup-abbotsford-merritt-princeton-1.6288008>
- Barnett, J., Evans, L.S., Gross, C., Kiem, A.S., Kingsford, R.T., Palutikof, J.P., Pickering, C.M., & Smithers, S.G. (2015). From barriers to limits to climate change adaptation: Path dependency and the speed of change. *Ecology and Society* 20 (3): 5. <https://www.jstor.org/stable/26270227>
- Baum, K., & McClearn, M. (2021, November 17). From fire to ‘atmospheric river’: Why B.C. is trapped in a world of climate extremes. *The Globe and Mail*. <https://www.theglobeandmail.com/canada/article-first-fire-now-floods-why-bc-is-trapped-in-a-world-of-climate-extremes/>
- Baumgartner, F.R. (2006). “Punctuated equilibrium theory and environmental policy.” In R. Repetto (Ed.), *Punctuated equilibrium and the dynamics of U.S. environmental policy* (pp. 24–46). Yale University Press.
- Baumgartner, F.R. (2014). Ideas, Paradigms, and Confusions. *Journal of European Public Policy* 21(3): 475–480. <https://doi.org/10.1080/13501763.2013.876180>
- Baumgartner, F.R., & Jones, B.D. (1993). *Agendas and instability in American politics*. University of Chicago Press.
- BC Assembly of First Nations. (2021, December 5). *Impacted Indigenous communities report #20*. https://www.bcafn.ca/sites/default/files/docs/reports-presentations/05DEC2021_%20IndigenousImpactsReport.pdf
- BC Blueberry Council. (2022, February 8). *BC Blueberry Council flood recovery program-statement*. <https://www.bcblueberry.com/bc-blueberry-council/news/bc-blueberry-council-flood-recovery-program-statement-feb-8-2022>
- BC Farm Industry Review Board. (2023, October). *B.C. broiler hatching egg industry 2021*. Government of British Columbia. <https://www2.gov.bc.ca/assets/gov/british-columbians-our->

- [governments/organizational-structure/boards-commissions-tribunals/bc-farm-industry-review-board/regulated-marketing/hatching_eggs_2021_industry_snapshot.pdf](#)
- BCG Engineering Inc. (2022, May 20). *Frequency-magnitude relationship for the Coldwater River*. Prepared for the Fraser Basin Council. https://www.fraserbasin.bc.ca/Library/TR_Flood/tr_frequency-magnitude-coldwater_draft_may_2022_web.pdf
- BC Ministry of Transportation. (2021). *Emergency flooding event- November 2021* [Album]. Flickr. <https://flic.kr/s/aHsmX7z3bp>
- BC Ombudsperson. (2023, October). *Fairness in a changing climate: Ensuring disaster supports are accessible, equitable, and adaptable*. Special report no. 54. https://bcombudsperson.ca/assets/media/OMB-FireFlood_report_web.pdf
- Béland, D., & Howlett, M. (2017). The role and impact of multiple-streams approach in comparative policy analysis. *Journal of Comparative Policy Analysis: Research and Practice* 18 (3): 221-227. <https://doiorg.proxy.lib.uwaterloo.ca/10.1080/13876988.2016.1174410>
- Bennett, C.J., & Howlett, M. (1992). The lessons of learning: Reconciling theories of policy learning and change. *Policy Sciences* 25: 275-294. <https://doi.org/10.1007/BF00138786>
- Berkes, F., & Folke, C. (1998). Linking social and ecological systems for resilience and sustainability. In F. Berkes & C. Folke (Eds.), *Linking social and ecological systems: Management practise and social mechanisms for building resilience* (pp. 1-25). Cambridge University Press.
- Beunen, R., & Patterson, J.J. (2019). Analyzing institutional change in environmental governance: Exploring the concept of 'institutional work.' *Journal of Environmental Planning and Management* 62 (1): 12-29. <https://doi.org/10.1080/09640568.2016.1257423>
- Birkland, T.A. (1997). *After disaster: Agenda setting, public policy, and focusing events*. Georgetown University Press.
- Birkland, T.A. (2009). Disasters, lessons learned, and fantasy documents. *Journal of Contingencies and Crisis Management* 17 (3): 146-156. <https://doi.org/10.1111/j.1468-5973.2009.00575.x>
- Birkland, T.A. (2020). *An introduction to the policy process: Theories, concepts, and models of public policy making* (5th Ed.). Routledge.
- Birkmann, J., Buckle, P., Jaeger, J., Pelling, M., Setiadi, N., Garschagen, M., Fernando, N., & Kropp, J. (2010). Extreme events and disasters: A window of opportunity for change? Analysis of organizational, institutional, and political changes, formal and informal responses after mega disasters. *Natural Hazards* 55: 637-655. <https://doi.org/10.1007/s11069-008-9319-2>
- Birt, L., Scott, S., Cavers, D., Campbell, C., & Walter, F. (2016). Member checking: A tool to enhance trustworthiness or merely a nod to validation? *Qualitative Health Research* 26 (13): 1802-1811. <https://doi.org/10.1177/1049732316654870>
- Black, R., & Simons, P. (2022, October). *Treading water: The impact of and response to the 2021 British Columbia floods*. Report of the Standing Senate Committee on Agriculture and Forestry. https://sencanada.ca/content/sen/committee/441/AGFO/reports/2022-10-27_B.C.Floods_AltText_e.pdf
- Bolukbasi, H.T., & Yildirim, D. (2022). Institutions in the politics of policy change: Who can play, how they play in multiple streams. *Journal of Public Policy* 42 (3): 509-528. <https://doi.org/10.1017/S0143814X2100026X>
- Bosch, M.V. (2024, June 26). MP Brad Vis says B.C. NDP government partly responsible for Abbotsford not getting disaster funding. *Fraser Valley Today*. <https://fraservalleytoday.ca/2024/06/26/mp-brad-vis-says-b-c-ndp-govt-partly-responsible-for-abbotsford-not-getting-disaster-funding/>
- Bouikidis, A., & Tynan, K. (2022). Social infrastructure and community resilience. In S. Safaie, S. Johnstone, & N. Hastings (Eds.), *Resilience pathways report: Co-creating new knowledge for understanding risk and resilience in British Columbia*. Geological Survey of Canada, Open File 8910. <https://doi.org/10.4095/330521>
- Bromley, D.W., & Paavola, J. (Eds.). (2002). *Economics, ethics, and environmental policy: Contested choices*. Blackwell Publishing.
- Brundiers, K. (2018). Disasters as opportunities for sustainability: The case of Christchurch, Aotearoa New Zealand. *Sustainability Science* 13 (4):1075-1091. <https://doi.org/10.1007/s11625-017-0523-4>

- Brundiers, K., & Eakin, H. (2018). Leveraging post-disaster windows of opportunities for change towards sustainability: A framework. *Sustainability* 10: 1-18. <https://doi.org/10.3390/su10051390>
- Brunoro, M. (2022, November 17). 'We can't make them build a levee': Frustration over Nooksack River flooding on both sides of border. *CTV News Vancouver*. <https://bc.ctvnews.ca/we-can-t-make-them-build-a-levee-frustration-over-nooksack-river-flooding-on-both-sides-of-border-1.6158436>
- Bryant, S. P., Davies, E. G. R., Sol, D., & Davis, S. (2022). The progression of flood risk in southern Alberta since the 2013 flood. *Journal of Flood Risk Management* 15 (3): 1-18. <https://doi.org/10.1111/jfr3.12811>
- Buckley, P., Belec, J., & Levy, J. (2015). Environmental resource management in borderlands: Evolution from competing interests to common aversions. *International Journal of Environmental Research and Public Health* 12 (7): 7541-7557. <http://doi.org/10.3390/ijerph120707541>
- Buker, L.L. (2011). *Walking backwards into the future with our stories: The Stō:lō is a river of knowledge, Halq'eméylem is a river of stories* [Doctoral dissertation, Simon Fraser University]. Summit Research Repository, Simon Fraser University. https://summit.sfu.ca/flysystem/fedora/sfu_migrate/11724/etd6662_lBuker.pdf
- Burch, S. (2010). Transforming barriers into enablers of action on climate change: Insights from three case studies in British Columbia, Canada. *Global Environmental Change* 20: 287-297. <https://doi.org/10.1016/j.gloenvcha.2009.11.009>
- Burton, C.G., & Cutter, S.L. (2008). Levee failures and social vulnerability in the Sacramento-San Joaquin Delta Area, California. *Natural Hazards Review* 9 (3): 136-149. [https://doi.org/10.1061/\(ASCE\)1527-6988\(2008\)9:3\(136\)](https://doi.org/10.1061/(ASCE)1527-6988(2008)9:3(136))
- Burton, H., Rabito, F., Danielson, L., & Takaro, T. (2016). Health effects of flooding in Canada: A 2015 review and description of gaps in research. *Canadian Water Resources Journal* 41 (1-2): 238-249. <https://doi.org/10.1080/0701184.2015.1128854>
- Busemeyer, M.R., Garritzmann, J.L., & Neimanns, E. (2020). *A loud but noisy signal? Public opinion and education reform in western Europe*. Cambridge University Press.
- Bush, E., & Lemmen, D.S. (2019). *Canada's changing climate report*. Government of Canada. <https://changingclimate.ca/CCCR2019/>
- Bush, E. (2022, September 23). The flooding of Everson, Washington. *NBC News*. <https://www.nbcnews.com/specials/the-flooding-of-everson-washington/index.html>
- Cable Public Affairs Channel. (2021, November 17). *B.C. flooding: Premier John Horgan declares provincewide state of emergency—November 17, 2021* [Video]. YouTube. https://www.youtube.com/watch?v=Gc0WcB_i2UE
- Cairney, P. (2013). Standing on the shoulders of giants: How do we combine the insights of multiple theories in public policy studies. *Policy Studies Journal* 41 (1): 1-21. <https://doi.org/10.1111/psj.12000>
- Calian Emergency Management Solutions. (2022, August). *Regional District of Okanagan Similkameen 2021 atmospheric river flooding: After action review*. Prepared for the Regional District of Okanagan Similkameen. <https://pub-rdos.escrimetings.com/filestream.ashx?DocumentId=5666>
- Canadian Climate Institute. (2022a, September). *Damage control: Reducing the costs of climate impacts in Canada*. <https://climateinstitute.ca/reports/damage-control/>
- Canadian Climate Institute. (2022b). *Under water: The costs of climate change for Canada's infrastructure*. <https://climateinstitute.ca/reports/under-water/>
- Canadian Press, The. (2021a, November 19). B.C. sending helicopters to deliver water to flooded farms: agriculture minister. *Ladysmith Chemainus Chronicle*. <https://www.ladysmithchronicle.com/news/b-c-sending-helicopters-to-deliver-water-to-flooded-farms-agriculture-minister-906720>
- Canadian Press, The. (2021b, November 17). Empty shelves, higher prices expected as B.C. floods disrupt supply chains. *The Abbotsford News*. <https://www.abbynews.com/news/empty-shelves-higher-prices-expected-as-b-c-floods-disrupt-supply-chains-1818099>
- Canadian Press, The. (2023a, November 15). Making highways resilient to extreme weather is the 'new normal,' B.C. transport minister says. *CBC News*. <https://www.cbc.ca/news/canada/british-columbia/bc-highway-repairs-2021-atmospheric-river-1.7029475>

- Canadian Press, The. (2023b, February 23). Federal disaster aid program for 2021 B.C. floods now tops \$1B. *CTV News Vancouver*. <https://bc.ctvnews.ca/federal-disaster-aid-program-for-2021-b-c-floods-now-tops-1b-1.6285951>
- Canadian Press, The. (2023c, May 6). Parts of Grand Forks, B.C., under evacuation order as floodwaters rise across Interior. *CBC News*. <https://www.cbc.ca/news/canada/british-columbia/flooding-british-columbia-saturday-may-6-2023-1.6835039>
- Capano, G., & Galanti, M.T. (2020). From policy entrepreneurs to policy entrepreneurship: Actors and actions in public policy innovation. *Policy & Politics* 49 (3): 321-342. <https://doi.org/10.1332/030557320X15906842137162>
- Capoccia, G., & Kelemen, R.D. (2007). The study of critical junctures: Theory, narrative, and counterfactuals in historical institutionalism. *World Politics: A Quarterly Journal of International Relations* 59 (3): 341-369. <https://doi.org/10.1017/s0043887100020852>
- Capoccia, G. (2015). "Critical junctures and institutional change." In J. Mahoney & K. Thelen (Eds.), *Advances in comparative-historical analysis* (pp.147-179). Cambridge University Press.
- Cappell, E., Johnston, S., Winter, J., Eidelman, G., Hachard, T., & Slack, E. (2022, August). *Municipal role in climate policy*. Institute on Municipal Finance and Governance, University of Toronto. https://imfg.org/wp-content/uploads/2022/08/imfgwdw_no3_climatepolicy_august_25_2022.pdf
- Cappucci, M., & Samenow, J. (2021, November 15). Atmospheric river slams western Washington with record rains, flooding and high winds. *Washington Post*. <https://www.washingtonpost.com/weather/2021/11/15/atmospheric-river-seattle-vancouver-flooding/>
- Cardona, O.D., van Aalst, M.K., Birkmann, J., Fordham, M., McGregor, G., Perez, R., Pulwarty, R.S., Schipper, E.L.F., & Sinh, B.T. (2012). Determinants of risk: exposure and vulnerability. In *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. [Field, C.B., Barros, V., Stocker, T.F., Qin, D., Dokken, D.J., Ebi, K.L., Mastrandrea, M.D., Mach, K.J., Plattner, G.K., Allen, S.K., Tignor, M., & Midgley, P.M. (Eds.)]. *A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change* (pp.65-108). Cambridge University Press. https://www.ipcc.ch/site/assets/uploads/2018/03/SREX-Chap2_FINAL-1.pdf
- Carrigg, D. (2021, November 29). B.C. flood: What is a Tiger Dam—and why did they spend all night building one in Abbotsford? *Vancouver Sun*. <https://vancouversun.com/news/local-news/b-c-flood-what-is-a-tiger-dam>
- Carrington, D. (2022, October 27). Climate crisis: UN finds 'no credible pathway to 1.5C in place.' *The Guardian*. <https://www.theguardian.com/environment/2022/oct/27/climate-crisis-un-pathway-1-5-c>
- Carroll, B., Morbey, H., Balogh, R., & Araoz, G. (2009). Flooded homes, broken bonds, the meaning of home, psychological processes and their impact on psychological health in a disaster. *Health & Place* 15 (2): 540-547. <https://doi.org/10.1016/j.healthplace.2008.08.009>
- Carruthers, J.C. (2007). *Collaborative planning as a catalyst for better international transboundary environmental governance* [Master's thesis, University of British Columbia]. Library and Archives Canada. https://central.bac-lac.gc.ca/.item?id=NR26692&op=pdf&app=Library&oclc_number=445208747
- Carson, M. (2004). *From common market to social Europe?: Paradigm shift and institutional change in European Union policy on food, asbestos and chemicals, and gender equality*. Stockholm University.
- Carvalho Aceves, M. (2023, August). *Designing for flood resilience: Workshop series summary reports and infographics*. Prepared for Resilient Waters and Watershed Watch Salmon Society. https://sustain.ubc.ca/sites/default/files/2023-042a_Designing%20for%20flood%20resilience%20SummaryReport_Carvalho%20Aceves.pdf
- Cattapan, A., Acker-Verney, J.M., Dobrowolsky, A., Findlay, T., & Mandrona, A. (2020). Community engagement in a time of confinement. *Canadian Public Policy* 46 (3): 287-299. <https://doi.org/10.3138/cpp.2020-064>
- CBC News. (2014, March 28). School districts to pay half the costs of seismic upgrades. *CBC News*. <https://www.cbc.ca/news/canada/british-columbia/school-districts-to-pay-half-the-costs-of-seismic-upgrades-1.2590704>

- CBC News. (2021a, November 25). Storm system set to soak regions of B.C. recovering from floods and mudslides. *CBC News*. <https://www.cbc.ca/news/canada/british-columbia/wyntk-bc-floods-nov-25-1.6261951>
- CBC News. (2021b, December 1). November rainfall broke records in several B.C. communities. *CBC News*. <https://www.cbc.ca/news/canada/british-columbia/bc-rain-records-november-2021-1.6269863>
- CBC News. (2021c, December 25). Kayakers deliver supplies to farm cut off by floods in Chilliwack, B.C. <https://www.cbc.ca/news/canada/british-columbia/kayakers-chilliwack-1.6297268>
- Cecclo, L. (2021, December 19). The Big One: Canada floods show British Columbia is not ready for a powerful earthquake. *The Guardian*. <https://www.theguardian.com/world/2021/dec/19/big-one-canada-floods-show-british-columbia-not-ready-earthquake>
- Cejudo, G.M., & Michel, C.L. (2021). Instruments for policy integration: How policy mixes work together. *SAGE Open* (July-September): 1-10. <https://doi.org/10.1177/21582440211032161>
- Cejudo, G.M., & Trein, P. (2023). Pathways to policy integration: a subsystem approach. *Policy Sciences* 56: 9-27. <https://doi.org/10.1007/s11077-022-09483-1>
- Chakraborty, L., Rus, H., Henstra, D., Thistlethwaite, J., & Scott, D. (2020). A place-based socio-economic status index: Measuring social vulnerability to flood hazards in the context of environmental justice. *International Journal of Disaster Risk Reduction* 43: 101394. <https://doi.org/10.1016/j.ijdr.2019.101394>
- Chakraborty, L., Thistlethwaite, J., & Henstra, D. (2021a). *Flood vulnerability and climate change: Improving flood risk assessment by mapping socioeconomic vulnerability in a mid-sized Canadian city*. Canadian Climate Institute. <https://climateinstitute.ca/publications/flood-vulnerability-and-climate-change/>
- Chang, S., Yip, J., Conger, T., Oulahen, G., Gray, E., & Marteleira, M. (2020). Explaining communities' adaptation strategies for coastal flood risk: Vulnerability and institutional factors. *Journal of Flood Risk Management* 13 (4): e12646. <https://doi.org/10.1111/jfr3.12646>
- Clague, J. (2021, November 18). The science behind the 'atmospheric river' that drenched British Columbia. *The Narwhal*. <https://thenarwhal.ca/bc-flooding-atmospheric-river/>
- City of Abbotsford. (2013). *Business Case: DDI—Barrowtown Pump Station—Circuit Breaker (Total Project: \$200K. City's Portion: \$54K)*. Submitted by Rob Isaac. <https://abbotsford.civicweb.net/document/39032/>
- City of Abbotsford. (2014). *City of Abbotsford 2014 demographic profiles: Sumas Prairie*. https://www.abbotsford.ca/sites/default/files/docs/business-development/2014%20Sumas%20Prairie%20Demographic%20Profile_spreads.pdf
- City of Abbotsford. (2016a, October 3). *AgRefresh background research report, September 2016*. <https://www.abbotsford.ca/sites/default/files/2021-02/AgRefresh%20Stage%201%20Background%20Research%20Report%20Presentation.pdf>
- City of Abbotsford (2016b). "Schedule A- Part 1- Chapter 4: Context and existing conditions." In *By-law No. 2600-2016, Official Community Plan By-law, 2016*. <https://laws.abbotsford.ca/civix/document/id/coa/coabylaws/ocp14>
- City of Abbotsford. (2018, June). *Engineering and regional utilities master plans: Drainage, city sewer, city water*. <https://www.abbotsford.ca/sites/default/files/2021-02/2018%20Utilities%20Master%20Plans%20-%20Drainage%20-%20Wastewater%20-%20Water.pdf>
- City of Abbotsford. (2019, November 21). *Report No. ENG 037-2019: Geotechnical Seismic Assessment of Abbotsford Dykes*. Submitted by Stella Chui and Tony Seibert. <https://abbotsford.civicweb.net/document/55789/>
- City of Abbotsford. (2020). *City of Abbotsford 2020 demographic profiles: Sumas Prairie*. <https://www.abbotsford.ca/sites/default/files/2021-02/2020%20Sumas%20Prairie%20Profile%20-%20spreads%20final.pdf>
- City of Abbotsford. (2021a, February). *Community boundaries map new* [Map]. https://www.abbotsford.ca/sites/default/files/2021-02/Community_Boundaries_Map_New.pdf
- City of Abbotsford. (2022a, March). *2022 recovery update*. https://www.abbotsford.ca/sites/default/files/2022-03/2022%20Flood%20Recovery%20Update%20FINAL_linked_0.pdf
- City of Abbotsford. (2022b, April 1). *Committee of the Whole*. <https://abbotsford.civicweb.net/document/56889>

- City of Abbotsford. (2022c, June). *Long-term flood mitigation options: Other considerations*. https://ehq-production-canada.s3.ca-central-1.amazonaws.com/8812976c2a70f0790fe905fd8b352bcedec6a814d/original/1649287265/84bc99e3044fa4b0f27da611ff95b4a1_Long-term_Flood_Mitigation_Options_-_Other_Considerations.pdf?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIA4KKNQAKIOR7VAOP4%2F20240413%2Fca-central-1%2Fsa-east-1%2Faws4_request&X-Amz-Date=20240413T172239Z&X-Amz-Expires=300&X-Amz-SignedHeaders=host&X-Amz-Signature=dd0bfe524525bd87cd90bc3dc8c4fef97d707f6c1336628e96990842e629ffd0
- City of Abbotsford. (2022d, June). *Long-term flood mitigation options: Preferred option*. <https://www.abbotsford.ca/sites/default/files/2022-06/Preferred%20Option.pdf>
- City of Abbotsford. (2022e, June 10). *Sumas Prairie flood mitigation preferred option presented to Council following community feedback*. News bulletin. <https://www.abbotsford.ca/city-hall/news-media/sumas-prairie-flood-mitigation-preferred-option-be-presented-council-following>
- City of Abbotsford. (2023a, October). *2023 recovery update*. https://www.abbotsford.ca/sites/default/files/2023-10/2023%20Flood%20Recovery_4%20Page%20Spread_FINAL.pdf
- City of Abbotsford. (2023b, November 8). *City hosting joint emergency engagement workshop for local businesses* [Webpage]. <https://www.abbotsford.ca/city-hall/news-media/city-hosting-joint-emergency-engagement-workshop-local-businesses>
- City of Abbotsford. (2023c, June). *Sumas River Watershed Flood Mitigation Plan- Urgent Works*. Public Information Meeting, June 20 and 22. https://ehq-production-canada.s3.ca-central-1.amazonaws.com/0ab6b34dc66b92be4f2e784c29d3fcd4aa0ea047/original/1687298718/2015561b0b6b8e5e09246e21bcf77156_Flood_Mitigation_2023_Information_Panels.pdf?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIA4KKNQAKIOR7VAOP4%2F20240728%2Fca-central-1%2Fsa-east-1%2Faws4_request&X-Amz-Date=20240728T181405Z&X-Amz-Expires=300&X-Amz-SignedHeaders=host&X-Amz-Signature=2a604c4e95a2f689c8c5c429d75804deec228858a861e64382bcf0caeeb025cd
- City of Abbotsford. (2023d, April 20). *Council Report No. PDS 078-2023: McKee Neighbourhood Plan*. Submitted by M. Comb to the Executive Committee. https://ehq-production-canada.s3.ca-central-1.amazonaws.com/f0ea9b2b2d574365948325f6244425ec41cdf6cf/original/1682438819/8f0f1e7f58418b2b6286dbc2d286e42a_Stage_4_Council_Report_%28Report_No._PDS_078-2023%29.pdf?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIA4KKNQAKIOR7VAOP4%2F20240416%2Fca-central-1%2Fsa-east-1%2Faws4_request&X-Amz-Date=20240416T171628Z&X-Amz-Expires=300&X-Amz-SignedHeaders=host&X-Amz-Signature=e668e32453a33f01e295a17da29b11d65082e073077c7670e82f11217bfe22bc
- City of Abbotsford. (2023e, March 6). *March 6, 2023 public hearing, unofficial transcript*. https://ehq-production-canada.s3.ca-central-1.amazonaws.com/f6d2e07c32df2dae800fda24c91ec1dc6cc29ecc/original/1684362065/0c9cabf27d588b1b5e481739209cfc33_Unofficial_Draft_Transcript_-_March_6_2023_Public_Hearing.pdf?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIA4KKNQAKIOR7VAOP4%2F20240416%2Fca-central-1%2Fsa-east-1%2Faws4_request&X-Amz-Date=20240416T170004Z&X-Amz-Expires=300&X-Amz-SignedHeaders=host&X-Amz-Signature=6ce031bb7b804219e40123a2425d1ad90984035af8bcd4969aefa69e06f60764
- City of Abbotsford. (2023f, July). *Local government climate action program: Survey report for 2022*. <https://www.abbotsford.ca/sites/default/files/2023-08/2022%20LGCAP%20Survey%20Report-Final.pdf>
- City of Abbotsford. (2024, January 23). *Long-term flood mitigation plan* [Webpage]. <https://letstalkabbotsford.ca/abbotsfordfloodresponse>

- City of Chilliwack. (2021, November 17). *Press release: Situation update for Yarrow evacuation*. <https://www.chilliwack.com/main/page.cfm?id=37&prshow=details&prid=493>
- City of Merritt. (2024). *2021 flood: Review and repair* [Webpage]. <https://www.merritt.ca/flood/>
- City of Surrey. (2019, Vancouver). *Coastal Flood Adaptation Strategy*. <https://www.surrey.ca/sites/default/files/media/documents/CFASFinalReportNov2019.pdf>
- City of Vancouver. (2018, December). *Coastal Adaptation Plan: Fraser River Foreshore. Final report*. <https://vancouver.ca/files/cov/coastal-adaptation-plan-final-report.pdf>
- City of Vancouver. (2022, November). *Sea2City Design Challenge: Project Report*. <https://vancouver.ca/files/cov/sea2city-design-challenge-project-report.pdf>
- Clar, C., Prutsch, A., & Steurer, R. (2013). Barriers and guidelines for public policies on climate change adaptation: A missed opportunity of scientific knowledge-brokerage. *Natural Resources Forum* 37 (1): 1-18. <https://doi.org/10.1111/1477-8947.12013>
- Climate Disaster Project. (2023). *Stories archive* [Webpage]. <https://climatedisasterproject.com/stories-archive/>
- Cone, J., Rowe, S., Borberg, J., Stancioff, E., Doore, B., & Grant, K. (2013). Reframing engagement for climate change adaptation. *Coastal Management* 41: 345-360. <https://doi.org/10.1080/08920753.2013.803926>
- Coqualeetza Cultural Education Centre. (2010, June 7). *Language is culture, culture is language* [Webpage]. <http://coqualeetza.com/home.html>
- Cottar, S., & Wandel, J. (2024). Municipal perspectives on managed retreat and flood mitigation: A case analysis of Merritt, Canada after the 2021 British Columbia flood disaster. *Climatic Change* 177 (3). <https://doi.org/10.1007/s10584-024-03707-4>
- Coulthart, S. (2017). What's the problem? Frameworks and methods from policy analysis for analyzing complex problems. *Intelligence and National Security* 32 (5): 636-648. <https://doi.org/10.1080/02684527.2017.1310983>
- Council of Canadian Academies. (2022). *Building a resilient Canada: The expert panel on disaster resilience in a changing climate*. <https://cca-reports.ca/wp-content/uploads/2022/01/Building-a-Resilient-Canada-web-EN.pdf>
- Crouse, C. (2022). *The waters are rising: Stories of inspiration and hope from the Sumas, Washington flood of November 2021*.
- Cruikshank, A., & Winter, J. (2018, June 19). For B.C., fire and flood disaster cycle won't let up anytime soon—and may get worse. *Toronto Star*. https://www.thestar.com/vancouver/for-b-c-fire-and-flood-disaster-cycle-won-t-let-up-anytime-soon-and/article_9a4e51bc-ee3d-5bf1-80ad-27429ed01e4c.html
- Cundill, G., Cumming, G.S., Biggs, D., & Fabricius, C. (2011). Soft systems thinking and social learning for adaptive management. *Conservation Biology* 26 (1): 13-20. <https://doi.org/10.1111/j.1523-1739.2011.01755.x>
- Cutter, S.L., Boruff, B.J., & Shirley, L. (2003). Social vulnerability to environmental hazards. *Social Sciences Quarterly* 84 (2): 242-261. <https://doi.org/10.1111/1540-6237.8402002>
- Currie, M. (2024, June 19). *Reclaiming the Xhotsa. Technical commentary on article published in Frontiers in Conservation Science, Our File 0510.210-300*. Technical memorandum, Kerr Wood Leidal. Prepared for the City of Abbotsford. https://www.abbotsford.ca/sites/default/files/2024-06/20240619_RestoringSumasLake_TechMemoCommentary_Final_Rev1.pdf
- Curry, C., Islam, S., Zwiers, F., & Déry, S. (2019). Atmospheric rivers increase future flood risk in Western Canada's largest Pacific River. *Geophysical Research Letters* 46 (3): 1651-1661. <https://doi.org/10.1029/2018GL080720>
- Daflos, P. (2021, December 4). Millions in damage and losses, years to recover: A B.C. family's flood story. *CTV News*. <https://bc.ctvnews.ca/millions-in-damage-and-losses-years-to-recover-a-b-c-family-s-flood-story-1.5694176>
- Daigneault, P.-M. (2014). Puzzling about policy paradigms: Precision and progress. *Journal of European Public Policy* 21 (3): 481-484. <https://doi.org/10.1080/13501763.2014.893080>
- Darwin Holmes, A.G. (2020). Researcher positionality: A consideration of its influence and place in qualitative research—A new researcher guide. *International Journal of Education* 8 (4): 1-10. <https://doi.org/10.34293/>

- da Silva, S. (2022, June 12). Rebuild or retreat? B.C. communities face tough choices after catastrophic floods. *CBC News*. <https://www.cbc.ca/news/canada/british-columbia/managed-retreat-grand-forks-abbotsford-1.6475580>
- Delaney, P., & Shrader, E. (2000). *Gender and post-disaster reconstruction: The case of Hurricane Mitch in Honduras and Nicaragua*. World Bank.
- DeLeo, R.A. (2021). During disaster: Refining the concept of focusing events to better explain long-duration crises. *International Review of Public Policy* 3 (1): 5-28. <https://doi.org/10.4000/irpp.1868>
- de Loë, R. (2000). Floodplain management in Canada: Overview and prospects. *The Canadian Geographer* 44 (4): 355-368. <https://doi.org/10.1111/j.1541-0064.2000.tb00718.x>
- de Loe, R., & Kreutzweiser, R. (2007). "Challenging the status quo: The evolution of water governance in Canada." In K. Bakker (Ed.), *Eau Canada: The future of Canada's water* (pp. 85-104). UBC Press.
- Department of Fisheries and Oceans Canada. (2023, July 26). *British Columbia Salmon Restoration and Innovation Fund* [Webpage]. <https://www.dfo-mpo.gc.ca/fisheries-peches/initiatives/fish-fund-bc-fonds-peche-cb/index-eng.html>
- Depner, W. (2023, October 13). B.C.'s new emergency management legislation getting muted support. *Campbell River Mirror*. <https://www.campbellrivermirror.com/news/bcs-new-emergency-management-legislation-getting-muted-support-5888437>
- Desai, S.C., & Reimers, S. (2019). Comparing the use of open and closed questions for web-based measures of the continued-influence effect. *Behavioural Research Methods* 51: 1426-1440. <https://doi.org/10.3758/s13428-018-1066-z>
- Deschamps, B., Bourdeau-Brien, M., & Boudreault, M. (2023). *How can municipalities in British Columbia and Quebec contribute to flood risk reduction?* IMFG Papers on Municipal Finance and Governance (No. 64), Institute on Municipal Finance and Governance. <https://riisq.ca/wp-content/uploads/2023/02/Flood-Risk-Reduction.pdf>
- DeSorcy, T. (2022, November 9). *2021 atmospheric rivers: the story of Hope*. [Conference presentation]. Emergency Planning and Business Continuity 2022 Conference, Vancouver, BC, Canada.
- de Vries, D.H. (2017). Temporal vulnerability and the post-disaster 'window of opportunity to woo': A case study of an African-American floodplain neighborhood after Hurricane Floyd in North Carolina. *Human Ecology* 45: 437-448. <https://doi.org/10.1007/s10745-017-9915-4>
- Di Baldassarre, G., Viglione, A., Carr, G., Kuil, L., Salinas, J.L., & Blöschl, G. (2013). Socio-hydrology: Conceptualising human-flood interactions. *Hydrology and Earth System Sciences* 17 (8): 3295-3303. <https://doi.org/10.5194/hess-17-3295-2013>
- Dierckx, C., Hendricks, L., Coemans, S., & Hannes, K. (2021). The third sphere: Reconceptualising allyship in community-based participatory research praxis. *Qualitative Research in Psychology* 18 (4): 473-497. <https://doi.org/10.1080/14780887.2020.1854402>
- Ding, M., Lin, P., Gao, S., Wang, J., Zeng, Z., Zheng, K., Zhou, X., Yamazaki, D., Gao, Y., & Liu, Y. (2023). Reversal of the levee effect towards sustainable floodplain management. *Nature Sustainability* 6: 1578-1586. <https://doi.org/10.1038/s41893-023-01202-9>
- Doberstein, B., Fitzgibbons, J., & Mitchell, C. (2019). Protect, accommodate, retreat, or avoid (PARA): Canadian community options for flood disaster risk reduction and flood resilience. *Natural Hazards* 98: 31-50. <https://doi.org/10.1007/s11069-018-3529-z>
- Dovers, S.R., & Hezri, A.A. (2010). Institutions and policy processes: The means to the ends of adaptation. *WIREs Climate Change* 1: 212-231. <https://doi.org/10.1002/wcc.29>
- Doyle, S. (2007). Member checking with older women: A framework for negotiating meaning. *Health Care for Women International* 28: 888-908. <https://doi.org/10.1080/07399330701615325>
- Ebbwater Consulting Inc. (2015). *People living in BC floodplains* [Webpage]. <https://www.ebbwater.ca/people-living-in-bc-floodplains/>
- Ebbwater Consulting Inc. (2021, May). *Investigations in support of flood strategy development in British Columbia—Issue A: Flood risk governance*. Prepared for the Fraser Basin Council and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development. https://www.fraserbasin.bc.ca/Library/Water_Flood_BC/A-

- [1_Flood_Risk_Governance.pdf?utm_source=surrey%20now-leader&utm_campaign=surrey%20now-leader%3A%20outbound&utm_medium=referral](#)
- Eby, D. (2022, December). *Ministerial mandate letter for Ministry of Emergency Management and Climate Readiness*. Office of the Premier. https://www2.gov.bc.ca/assets/gov/government/ministries-organizations/premier-cabinet-mlas/minister-letter/emcr_-_ma.pdf
- Eggertsson, T. (2005). *Imperfect institutions: Possibilities and limits of reform*. University of Michigan Press.
- Eccles, S., & Stoddard, L. (2023). *Canadian producers and farm animals in a changing climate: The Abbotsford flood of 2021*. World Animal Protection. https://www.worldanimalprotection.ca/sites/default/files/media/Abbotsford_Full_Report_%282023%29_formatted_V3%5B7%5D_23_11_17.pdf
- Elder, C., Sundin, S., & Baumgarten, K. (2024, April 29). *Climate adaptation- Flood risk and shoreline impacts* [Webinar presentation]. Whatcom Watersheds Information Network Speaker Series. <https://www.whatcomwin.org/speaker-series>
- Emergency Management British Columbia. (2022, January 18). *Provincial state of emergency expired January 18, 2022*. Government of British Columbia. <https://www.emergencyinfbc.gov.bc.ca/provincial-state-of-emergency-expired-jan-18-2022/>
- Emergency Management British Columbia & the Ministry of Forests, Lands, Natural Resource Operations, and Rural Development. (2019, October). *Government's action plan: Responding to wildfire and flood risks* https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/abbott-chapman_action_plan_update_october_2019.pdf
- Emergency Planning Secretariat. (2020). *About us* [Webpage]. <https://www.emergencyplanningsecretariat.com/about-us>
- Epstein, G., Pittman, J., Alexander, S. M., Berdej, S., Dyck, T., Kreitmair, U., Raithwell, K. J., Villamayor-Tomas, S., Vogt, J., & Armitage, D. (2015). Institutional fit and the sustainability of social-ecological systems. *Current Opinion in Environmental Sustainability* 14: 34-40. <https://doi.org/10.1016/j.cosust.2015.03.005>
- Evans, C., & Feltmate, B. (2019, April). *Water on the rise: Protecting Canadian homes from the growing threat of flooding*. Intact Centre on Climate Adaptation. <https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2019/04/Home-Flood-Protection-Program-Report-1.pdf>
- Fast, S., & Mabee, W. (2015). Place-making and trust-building: The influence of policy on host community responses to wind farms. *Energy Policy* 81: 27-37. <https://doi.org/10.1016/j.enpol.2015.02.008>
- Fayazi, M., Bisson, I.-A., & Nicholas, E. (2022). Barriers to climate change adaptation in Indigenous communities: A case study on the Mohawk community of Kanasatake, Canada. *International Journal of Disaster Risk Reduction* 49: 101750. <https://doi.org/10.1016/j.ijdr.2020.101750>
- Federal Emergency Management Agency. (2022a, January 5). *Preliminary damage assessment report. Washington—Flooding and mudslides: FEMA-4635-DR*. https://www.fema.gov/sites/default/files/documents/PDAREport_FEMA4635DR-WA.pdf
- Federal Emergency Management Agency. (2022b, February 8). *4635-DR-WA Public Notice 001*. <https://www.fema.gov/disaster-federal-register-notice/4635-dr-wa-public-notice-001>
- Femia, V. (2021, November 29). Highway closures force Okanagan dairy farmers to dump milk as it can't get to Coast for processing. *Castanet*. <https://www.castanet.net/news/Vernon/353062/Highway-closures-force-Okanagan-dairy-farmers-to-dump-milk-as-it-cant-get-to-Coast-for-processing>
- Fila, D., Fünfgeld, H., & Dahlmann, H. (2023). Climate change adaptation with limited resources: adaptive capacity and action in small- and medium-sized municipalities. *Environment, Development, and Sustainability* 26: 5607-5627. <https://doi.org/10.1007/s10668-023-02999-3>
- Finn, R., Ned-Kwilosintun, M., Ballantyne, L., Hamilton, I., Kwo, J., Seymour-Hourie, R., Carlson, D., Walters, K.E., Grenz, J., & Martin, T.G. (2024). Reclaiming the *Xhotsa*: Climate adaptation and ecosystem restoration via the return of Sumas Lake. *Frontiers in Conservation Science* 5: 1380083. <https://doi.org/10.3389/fcosc.2024.1380083>
- Finnegan, J.J. (2022). Institutions, climate change, and the foundations of long-term policymaking. *Comparative Political Studies* 55 (7): 1198-1235. <https://doi.org/10.1177/00104140211047416>

- Finucane, M.L., Acosta, J., Wicker, A., & Whipkey, K. (2020) Short-term solutions to a long-term challenge: Rethinking disaster recovery planning to reduce vulnerabilities and inequities. *International Journal of Environmental Research and Public Health* 17 (2): 482. <https://doi.org/10.3390/ijerph17020482>
- Fionda, F. (2023, October 23). What will B.C. do when disaster strikes again? *The Narwhal*. <https://thenarwhal.ca/bc-emergency-disaster-management-act/>
- First Nations Land Management Resource Centre. (N.d.). *Framework Agreement* [Webpage]. <https://labrc.com/framework-agreement/>
- First Nations Summit. (2024, March 21). FNS pleased with BC's commitment to flood preparedness. *Cision*. <https://www.newswire.ca/news-releases/fns-pleased-with-bc-s-commitment-to-flood-preparedness-863036100.html>
- FitzGibbon, J., & Mensah, K.O. (2012). Climate change as a wicked problem: An evaluation of the institutional context of rural water management in Ghana. *Sage Open*: 1-14. <https://doi.org/10.1177/2158244012448487>
- Fletcher, T. (2021, November 19). Animal feed airlift coming to flooded Fraser Valley farms, minister says. *Maple Ridge-Pitt Meadow News*. <https://www.mapleridgenews.com/news/animal-feed-airlift-coming-to-flooded-fraser-valley-farms-minister-says-2662505>
- Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources* 30: 441-473. <https://doi.org/10.1146/annurev.energy.30.050504.144511>
- Forest Practices Board. (2023, June). *Forest and fire management in BC: Toward landscape resilience*. <https://www.bcfpb.ca/wp-content/uploads/2023/06/SR61-Landscape-Fire-Management.pdf>
- Fraser Basin Council. (N.d.-a). *About the basin* [Webpage]. https://www.fraserbasin.bc.ca/about_fraser_basin.html
- Fraser Basin Council. (N.d.-b). *About us* [Webpage]. https://www.fraserbasin.bc.ca/about_fbc_history.html
- Fraser Basin Council. (N.d.-c). *Lower Mainland Flood Management Strategy Initiative* [Webpage]. https://www.fraserbasin.bc.ca/water_flood.html
- Fraser Basin Council. (2016, May). *Lower Mainland Flood Management Strategy: Phase 1 Summary Report*. https://www.fraserbasin.bc.ca/Library/Water_Flood_Strategy/FBC_LMFMS_Phase_1_Report_Web_May_2016.pdf
- Fraser Basin Council. (2021, July). *Summary report: Investigations in support of flood strategy development in British Columbia*. https://www.fraserbasin.bc.ca/Library/Water_Flood_BC/BC_Flood_Investigations_Summary_2021.pdf
- Fraser Basin Council. (2023). *Lower Mainland Flood Management Strategy: Synthesis of technical analysis*. https://www.fraserbasin.bc.ca/Library/Water_Flood_Strategy/LMFMS_Synthesis_of_Technical_Analysis_Summer_2023_web.pdf
- Fraser Valley Conservancy. (2023). *Speak for the peak* [Webpage]. <https://fraservalleyconservancy.ca/programs/speak-for-the-peak/>
- Fraser Valley Regional District. (N.d.). *Electoral areas* [Webpage]. <https://www.fvrd.ca/EN/main/about-the-fvrd/electoral-areas.html>
- Fraser Valley Regional District. (2017). *Agricultural economy in the Fraser Valley Regional District*. Regional Snapshot Series: Agriculture. <https://www.fvrd.ca/assets/About~the~FVRD/Documents/RGS/AgricultureSnapshot.pdf>
- Fraser Valley Regional District. (2022, March). *2021 extreme weather and flooding survey report*. Emergency Management Program. <https://www.fvrd.ca/assets/Government/Documents/Document~Library/2022-03-25%20FVRD-Extreme-weather-response-survey.pdf>
- Fraser Valley Regional District. (2023a, February 7). *What is the FVRD?* [Webpage]. <https://www.fvrd.ca/EN/main/about-the-fvrd/what-is-the-fvrd.html>
- Fraser Valley Regional District. (2023b, April). *Fraser Valley Regional Growth Strategy: Monitoring report*. <https://www.fvrd.ca/assets/About~the~FVRD/Documents/RGS/2023%20RGS%20Monitoring%20Report.pdf>

- Fulton, A., & Drolet, J. (2018). Responding to disaster-related loss and grief: Recovering from the 2013 flood in Southern Alberta, Canada. *Journal of Loss and Trauma* 23 (2): 140-158.
<https://doi.org/10.1080/15325024.2018.1423873>
- Gabehart, K.M., Nam, A., & Weible, C.M. (2022). Lessons from the Advocacy Coalition Framework for climate change policy and politics. *Climate Action* 1 (13): 1-14. <https://doi.org/10.1007/s44168-022-00014-5>
- Gandolfo-Lucia, N. (2022). *Infrastructures of vulnerability, or, how the Fraser Valley flooded twice*. [Master's thesis, University of British Columbia]. Open Collections, UBC Library.
<https://open.library.ubc.ca/media/stream/pdf/24/1.0421881/4>
- Garcha, N., & McSheffrey, E. (2021, November 19). 'Pretty emotional': Nooaitch First Nation grapples with isolation, impact of B.C. floods. *Global News*. <https://globalnews.ca/news/8389037/pretty-emotional-nooaitch-first-nation-grapples-with-isolation-impact-of-b-c-floods/>
- Garrett, C., & Nassar, H.M. (2024, January 29). Abbotsford on flood prep as storms bring back memories of 2021. *City News Vancouver*. <https://vancouver.citynews.ca/2024/01/29/abbotsford-flood-preparations-rain/>
- Geels, F.W. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions* 1 (1): 24-40.
<https://doi.org/10.1016/j.eist.2011.02.002>
- GHD Group. (2022). *Canada: A land of extremes* [Webpage]. <https://aquanomics.ghd.com/en/canada.html>
- Gil, C.M. (2019). *Systemic and institutional agendas can overlap: the case of economics and the 114th Congress* [Master's thesis. California State University]. Scholarly Works.
<https://scholarworks.calstate.edu/downloads/028710160>
- Gilens, M., & Page, B.I. (2014). Testing theories of American politics: Elites, interest groups, and average citizens. *Perspectives on Politics* 12 (3): 564-581. <https://doi.org/10.1017/S1537592714001595>
- Gillett, N., Cannon, A., Malinina, E., Schnorbus, M., Anslow, F., Sun, Q., Kirchmeier-Young, M., Zwiers, F., Seiler, C., Zhang, X., Flato, G., Wan, H., Li, G., & Castellan, A. (2022). Human influence on the 2021 British Columbia floods. *Weather and Climate Extremes* 36: 100441.
<https://doi.org/10.1016/j.wace.2022.100441>
- Glasser, R. (2019). The compounding and cascading consequences of hazards. In R. Glasser (Ed.), *Special report: Preparing for the era of climate disasters* (pp. 8-11). Australian Strategic Policy Institute.
<https://www.jstor.org/stable/resrep23057>
- Glenn, C., & Enoch, J. (2010). "Invigorating historiographic practices in rhetoric and composition studies." In A.E. Ramsey, W.B. Sharer, B. L'Eplattenier, & L.S. Mastrangelo (Eds.), *Working in the archives: Practical research methods for rhetoric and composition* (pp. 11-27). Southern Illinois University Press.
- Goddard, R., Colloff, M.J., Wise, R.M., Ware, D., & Dunlop, M. (2016). Values, rules and knowledge: Adaptation as change in the decision context. *Environmental Science & Policy* 57: 60-69.
<https://doi.org/10.1016/j.envsci.2015.12.004>
- Goldmann, E., & Galea, S. (2014). Mental health consequences of disasters. *Annual Review of Public Health* 35: 169-183. <https://doi.org/10.1146/annurev-publhealth-032013-182435>
- Goldstein, J.E., Neimark, B., Garvey, B., & Phelps, J. (2023). Unlocking "lock-in" and path dependency: A review across disciplines and socio-environmental contexts. *World Development* 161: 106116.
<https://doi.org/10.1016/j.worlddev.2022.106116>
- Golnaraghi, M., Thistlethwaite, J., Henstra, D., & Stewart, C. (2020, December). *Flood risk management in Canada: Building flood resilience in a changing climate*. The Geneva Association.
https://www.genevaassociation.org/sites/default/files/research-topics-document-type/pdf_public/frm_canada_web.pdf
- Gomez, M. (2023, April 28). Province to provide \$8.5 million for Abbotsford flood recovery projects. *CBC News*. <https://www.cbc.ca/news/canada/british-columbia/abbotsford-flood-recovery-1.6826673>
- Goodyear, S. (2021, November 19). B.C. agriculture minister asks farmers not to risk their lives to reach flood-stranded animals. *CBC Radio*. <https://www.cbc.ca/radio/asithappens/as-it-happens-the-friday-edition->

- [1.6255441/b-c-agriculture-minister-asks-farmers-not-to-risk-their-lives-to-reach-flood-stranded-animals-1.6255444](#)
- Gore, T. (2014). The role of policy champions and learning in implementing horizontal environmental policy integration: Comparative insights from European structural fund programmes in the U.K. *Administrative Sciences* 4: 304-330. <https://doi.org/10.3390/admsci4030304>
- Gosselin, P., Campagna, C., Demers-Bouffard, D., Qutob, S., & Flannigan, M. (2022). "Natural hazards." In P. Berry & R. Schnitter (Eds.), *Health of Canadians in a changing climate: Advancing our knowledge for action*. Government of Canada. <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>
- Government of British Columbia. (N.d.-a). *Wildfire season summary*. <https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-history/wildfire-seasonsummary>
- Government of British Columbia. (N.d.-b.). *Gender-based analysis plus*. <https://www2.gov.bc.ca/assets/gov/british-columbians-our-governments/services-policies-for-government/gender-equity/factsheet-gba.pdf>
- Government of British Columbia. (1992). *Environmental Cooperation Agreement between the Province of British Columbia and the State of Washington*. <https://www2.gov.bc.ca/assets/gov/environment/natural-resource-policy-legislation/environmental-policy/bcwaccord.pdf>
- Government of British Columbia. (2020). *Draft principles that guide the Province of British Columbia's relationship with Indigenous Peoples*. https://www2.gov.bc.ca/assets/gov/careers/about-the-bc-public-service/diversity-inclusion-respect/draft_principles.pdf
- Government of British Columbia. (2022a). *Climate Preparedness and Adaptation Strategy: Actions for 2022-2025*. <https://www2.gov.bc.ca/assets/gov/environment/climatechange/adaptation/cpas.pdf>
- Government of British Columbia. (2022b, October). *From flood risk to resilience in BC: An intentions paper*. <https://engage.gov.bc.ca/app/uploads/sites/797/2022/10/From-Flood-Risk-to-Resilience-in-B.C.pdf>
- Government of British Columbia. (2023a, November 2). *Regional districts in B.C.* [Webpage]. <https://www2.gov.bc.ca/gov/content/governments/local-governments/facts-framework/systems/regional-districts>
- Government of British Columbia. (2023b, December 27). *Stó:lo Tribal Council* [Webpage]. <https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/consulting-with-first-nations/first-nations-negotiations/first-nations-a-z-listing/st-lo-tribal-council>
- Government of British Columbia. (2023c, December 7). *Wildfire Season Summary* [Webpage]. <https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-history/wildfire-season-summary>
- Government of British Columbia. (2023d, May 8). *Community Resiliency Investment program* [Webpage]. <https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/funding-for-wildfire-prevention/crip>
- Government of British Columbia. (2023e, March). *Watershed Security Strategy and Fund intentions paper*. Ministry of Water, Land, and Resource Stewardship. <https://engage.gov.bc.ca/app/uploads/sites/722/2023/03/WSSF-Intentions-Paper-March2023.pdf>
- Government of British Columbia. (2024a). *B.C. highway flood recovery projects: Transportation and infrastructure projects*. <https://www2.gov.bc.ca/gov/content/transportation-projects/bc-highway-flood-recovery>
- Government of British Columbia. (2024b, February 14). *Keeping people safer from flooding in Sumas Prairie* [Video]. YouTube. <https://www.youtube.com/watch?v=q0A9VXgeeEY>
- Government of British Columbia. (2024c, February 20). *Modernized emergency management legislation* [Webpage]. <https://www2.gov.bc.ca/gov/content/safety/emergency-management/emergency-management/legislation-and-regulations/modernizing-epa>
- Government of British Columbia. (2024d, March 20). *Flood hazard land use management* [Webpage]. <https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/drought-flooding-dikes-dams/integrated-flood-hazard-management/governance/flood-hazard-land-use-management>

- Government of British Columbia. (2024e, January 18). *Declaration on the Rights of Indigenous Peoples Act* [Webpage]. <https://www2.gov.bc.ca/gov/content/governments/indigenous-people/new-relationship/united-nations-declaration-on-the-rights-of-indigenous-peoples>
- Government of British Columbia. (2024f, May 30). *Ministry of Water, Land, and Resource Stewardship* [Webpage]. <https://www2.gov.bc.ca/gov/content/governments/organizational-structure/ministries-organizations/ministries/water-land-and-resource-stewardship>
- Government of British Columbia. (2024g, July). *B.C. Coastal Marine Strategy*. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/coastal-marine-strategy/coastal_marine_strategy.pdf
- Government of British Columbia. (2024h, March 22). *Adaptation, resilience, and disaster mitigation program* [Webpage]. <https://www2.gov.bc.ca/gov/content/safety/emergency-management/local-emergency-programs/financial/ardmp>
- Government of British Columbia. (2024i, June 28). *Modernized emergency management legislation* [Webpage]. <https://www2.gov.bc.ca/gov/content/safety/emergency-management/emergency-management/legislation-and-regulations/modernizing-epa>
- Government of British Columbia. (2024j, March 27). *Cultural and prescribed fire resources* [Webpage]. <https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/prescribed-burning/resources>
- Government of British Columbia. (2024k). *From flood risk to resilience: A B.C. Flood Strategy to 2035*. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/integrated-flood-hazard-mgmt/bc_flood_strategy.pdf
- Government of British Columbia. (2024l, July 25). *Disaster and climate risk and resilience assessments* [Webpage]. <https://www2.gov.bc.ca/gov/content/environment/climate-change/adaptation/disaster-and-climate-risk-and-resilience-assessment>
- Government of British Columbia. (2024m). *Land use planning in British Columbia: Frequently asked questions*. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/factsheets/mlup_factsheet_faqs_may2024.pdf
- Government of Canada. (2023). *Canada's National Adaptation Strategy: Building resilient communities and a strong economy*. Environment and Climate Change Canada. https://publications.gc.ca/collections/collection_2023/eccc/en4/En4-544-2023-eng.pdf
- Gram-Hanssen, I., Schafenacker, N., & Bentz, J. (2022). Decolonizing transformations through 'right relations.' *Sustainability Science* 17: 673-685. <https://doi.org/10.1007/s11625-021-00960-9>
- Grant, M., & Booth, A. (2009). A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Information and Libraries Journal* 26 (2): 91-108. <https://doi.org/10.1111/j.1471-1842.2009.00848.x>
- Gregory, D., Johnston, R., Pratt, G., Watts, M.J., & Whatmore, S. (Eds.). (2009). *The dictionary of human geography* (5th ed.). Wiley-Blackwell.
- Hacker, J.S. (2004a). Privatizing risk without privatizing the welfare state: The hidden politics of social policy retrenchment in the United States. *American Political Science Review* 98 (2): 243-260. <https://doi.org/10.1017/S0003055404001121>
- Hacker, J.S. (2004b). "Reform without change, change without reform: The politics of US health policy reform in comparative perspective." In M.A. Levin & M. Shapiro (Eds.), *Transatlantic policymaking in an age of austerity: Diversity and drift* (pp.13-63). Georgetown University Press.
- Hacker, J.S., Pierson, P., & Thelen, K. (2015). "Drift and conversion: Hidden faces of institutional change." In J. Mahoney & K. Thelen (Eds.), *Advances in comparative-historical analysis* (pp.180-208). Cambridge University Press.
- Hall, J. (2016). High freshets and low-lying farms: Property law and St. John River flooding in colonial New Brunswick. *Dalhousie Law Journal* 39 (1): 195-219. <https://digitalcommons.schulichlaw.dal.ca/cgi/viewcontent.cgi?article=2054&context=dlj>
- Hall, C.M. (1999). Rethinking collaboration and partnership: A public policy perspective. *Journal of Sustainable Tourism* 7 (3-4): 274-289. <https://doi.org/10.1080/09669589908667340>

- Hall, P.A. (1993). Policy paradigms, social learning, and the state: The case of economic policymaking in Britain. *Comparative Politics* 25: 275–296. <https://doi.org/10.2307/422246>
- Haney, T.J., & McDonald-Harker, C. (2016). “The river is not the same anymore”: Environmental risk and uncertainty in the aftermath of the High River, Alberta flood. *Social Currents* 4 (6): 594-612. <https://doi.org/10.1177/2329496516669351>
- Hanger-Kopp, S., Thaler, T., Seebauer, S., Schinko, T., & Clar, C. (2022). Defining and operationalizing path dependency for the development and monitoring of adaptation pathways. *Global Environmental Change* 72: 102425. <https://doi.org/10.1016/j.gloenvcha.2021.102425>
- Hansen, K., & Świdarska, A. (2024). Integrating open- and closed-ended questions on attitudes towards outgroups with different methods of text analysis. *Behaviour Research Methods* 56: 4802-4822. <https://doi.org/10.3758/s13428-023-02218-x>
- Hanson, P. (2021, November 27). *Our first time to dump milk in the Interior North Okanagan during BC atmospheric river* [Video]. YouTube. https://www.youtube.com/watch?v=FSd950_UKks
- Harden, C. (2012). Framing and reframing questions of human-environment interactions. *Annals of the Association of American Geographers* 102 (4): 737-747. <https://www.jstor.org/stable/23275505>
- Hassan, E.M., & Mahmoud, H.N. (2021). Orchestrating performance of healthcare networks subjected to the compound events of natural disasters. *Nature Communications* 12 (1): 1338. <https://doi.org/10.1038/s41467-021-21581-x>
- Haunschild, P., & Chandler, D. (2008). “Institutional-level learning: Learning as a source of institutional change.” In R. Greenwood, C. Oliver, R. Suddaby, & K. Sahlin (Eds.), *The Sage handbook of organizational institutionalism* (pp. 624-649). Sage Publications.
- Hawley, K., Moench, M., and Sabbag, L. (2012). *Understanding the economics of flood risk reduction: A preliminary analysis*. Institute for Social and Environmental Transition—International. <https://reliefweb.int/report/world/understandingeconomics-flood-risk-reduction-preliminary-analysis>
- Headwaters Economics. (2023, September 5). *FEMA’s BRIC program continues to fund innovative risk reduction – but community capacity limits access* [Webpage]. <https://headwaterseconomics.org/headwaters/femas-bric-program-continues-to-fund-innovative-risk-reduction-but-community-capacity-limits-access/>
- Healey, P. (1998). Building institutional capacity through collaborative approaches to urban planning. *Environment and Planning A: Economy and Space* 30 (9): 1531-1546. <https://doi.org/10.1068/a301531>
- Heclo, H. (1974). *Modern social politics in Britain and Sweden: From relief to income maintenance*. Yale University Press.
- Heinmiller, B.T. (2023). Advocacy coalitions, power, and policy change. *Policy & Politics* 51 (4): 1-19. <http://doi.org/10.1332/030557321X16569341758199>
- Heinrich, D.F., & Penning-Rowsell, E.C. (2022). Flood risk management under uncertainty in transboundary basins: A delicate balancing act. *International Journal of River Basin Management* 20 (2): 215-224. <https://doi.org/10.1080/15715124.2020.1837845>
- Henstra, D., Thistlethwaite, J., Brown, C., & Scott, D. (2019a). Flood risk management and shared responsibility: Exploring Canadian public attitudes and expectations. *Journal of Flood Risk Management* 12 (1): e12346. <https://doi.org/10.1111/jfr3.12346>
- Henstra, D., Minano, A., & Thistlethwaite, J. (2019b). Communicating disaster risk? An evaluation of the availability and quality of flood risk maps. *Natural Hazards and Earth System Sciences* 19: 313-323. <https://doi.org/10.5194/nhess-19-313-2019>
- Henstra, D. (2022). A whole-of-government approach to climate adaptation. *Canadian Climate Institute*. <https://climateinstitute.ca/wp-content/uploads/2022/07/A-whole-of-government-approach-to-climate-adaptation.pdf>
- Heritage Abbotsford. (2022). *A history of Abbotsford* [Webpage]. <https://heritageabbotsford.ca/about-us/>
- Herrfahrdt-Pähle, E., & Pahl-Wostle, C. (2012). Continuity and change in social-ecological systems: The role of institutional resilience. *Ecology and Society* 17 (2): 8. <https://doi.org/10.5751/ES-04565-170208>
- Herring, J. (2021, November 16). Supply chain woes from B.C. flooding to reverberate in Alberta. *Calgary Herald*. <https://calgaryherald.com/news/local-news/supply-chain-woes-from-b-c-flooding-to-reverberate-in-alberta>

- Hobson, K. (2006). Environmental responsibility and the possibilities of pragmatist-orientated research. *Social and Cultural Geography* 7 (2): 283-298. <https://doi.org/10.1080/14649360600600734>
- Hobson, O. (2022, November 17). A river's history: Lost connections between Nooksack, Fraser rivers and Sumas Lake. *Cascadia Daily News*. <https://www.cascadiadaily.com/2022/nov/17/a-rivers-history-lost-connections-between-nooksack-fraser-rivers-and-sumas-lake/>
- Hogan, J., & Howlett, M. (2015). "Reflections on our understanding of policy paradigms and policy change." In J. Hogan & M. Howlett (Eds.), *Policy paradigms in theory and practice: Discourses, ideas, and anomalies in public policy dynamics* (pp. 3-18). Palgrave Macmillan.
- Holling, C.S., & Meffe, G.K. (1996). Command and control and the pathology of natural resource management. *Conservation Biology* 10 (2): 328-337. <https://doi.org/10.1046/j.1523-1739.1996.10020328.x>
- Hopes, V. (2023, October 27). Abbotsford applies for \$1.6B in federal flood-mitigation funds. *The Abbotsford News*. <https://www.abbynews.com/local-news/abbotsford-applies-for-16b-in-federal-flood-mitigation-funds-6527769>
- Horgan, J. (2017, July 18). Ministerial mandate <https://www2.gov.bc.ca/assets/gov/government/ministries-organizations/premier-cabinet/mlas/minister-letter/heyman-mandate.pdf>
- Howlett, M., & Rayner, J. (1995). Do ideas matter? Policy subsystem configurations and policy change in the Canadian forest sector. *Canadian Public Administration* 38 (3): 382-410. <https://doi.org/10.1111/j.1754-7121.1995.tb01055.x>
- Howlett, M., Ramesh, M., & Perl, A. (2009). *Studying public policy: Policy cycles and policy subsystems*. Oxford University Press.
- Hunter, J. (2022, February 19). Cost of rebuilding B.C. after flooding nears \$9 billion. *Globe and Mail*. <https://www.theglobeandmail.com/canada/british-columbia/article-costof-rebuilding-bc-after-november-storms-nears-9-billion/>
- Huang-Taylor, D. (2022, November 9). *Emergency food banking: Food insecurity in times of Covid, fire, and floods* [Conference presentation]. Emergency Planning and Business Continuity 2022 Conference, Vancouver, BC, Canada
- IdeaSpace Consulting. (2022, June). *City of Abbotsford Long-term Flood Mitigation Plan Engagement Program final report*. Prepared for the City of Abbotsford. <https://www.abbotsford.ca/sites/default/files/2022-06/City%20of%20Abbotsford%20Long-term%20Flood%20Mitigation%20Plan%20Engagement%20Program%20Final%20Report%20with%20APPENDIX.pdf>
- Infrastructure Canada. (2023, July 20). *Disaster Mitigation and Adaptation Fund: Program details* [Webpage]. <https://www.infrastructure.gc.ca/dmaf-faac/details-eng.html>
- Infrastructure Canada & the BC Ministry of Transportation and Infrastructure. (2023, August). *A guide to implementing systems-based approaches to climate resilient infrastructure*. https://www2.gov.bc.ca/assets/gov/driving-and-transportation/environment/climate-action/guide_to_implementing_systems-based_approaches_to_climate_resilient_infrastructure.pdf
- Ingold, K., & Varone, F. (2011). Treating policy brokers seriously: Evidence from the climate policy. *Journal of Public Administration Research and Theory* 22 (2): 319-346. <https://doi.org/10.1093/jopart/mur035>
- Ingold, K., Fischer, M., & Cairney, P. (2017). Drivers for policy agreement in nascent subsystems: an application of the advocacy coalition framework to fracking policy in Switzerland and the UK. *Policy Studies Journal*, 45(3), 442–463. <https://doi.org/10.1111/psj.12173>
- Innes, J., & Booher, D. (2003). The impact of collaborative planning on governance capacity. *IURD Working Paper Series*. Institute of Urban and Regional Development, University of California, Berkeley.
- Insurance Bureau of Canada. (2022a, January 18). *Severe weather in 2021 caused \$2.1 billion in insured damage*. <https://www.ibc.ca/news-insights/news/severe-weather-in-2021-caused-2-1-billion-in-insured-damage>
- Insurance Bureau of Canada. (2022b, June 15). *Insured losses from 2021 floods in BC now \$675 million*. <http://www.ibc.ca/bc/resources/media-centre/media-releases/insured-lossesfrom-2021-floods-in-bc-now-675-million>
- Insurance Bureau of Canada. (2023, January 18). *Severe weather in 2022 caused \$3.1 billion in insured damage—making it the 3rd worst year for insured damage in Canadian history*.

- <https://www.ibc.ca/news-insights/news/severe-weather-in-2022-caused-3-1-billion-in-insured-damage-making-it-the-3rd-worst-year-for-insured-damage-in-canadian-history>
- Insurance Bureau of Canada. (2024a, January 8). *Severe weather in 2023 caused over \$3.1 billion in insured Damage: Over 1.5 million high-risk households cannot obtain affordable flood insurance*. <https://www.ibc.ca/news-insights/news/severe-weather-in-2023-caused-over-3-1-billion-in-insured-damage>
- Insurance Bureau of Canada. (2024b, March 21). *IBC commends BC government on release of the BC flood strategy* [Webpage]. <https://www.ibc.ca/news-insights/news/ibc-commends-bc-government-on-release-of-the-bc-flood-strategy>
- International Association for Public Participation Canada. (N.d.). *IAP2 Spectrum*. [https://iap2canada.ca/Resourcess/Documents/0702-Foundations-Spectrum-MW-rev2%20\(1\).pdf](https://iap2canada.ca/Resourcess/Documents/0702-Foundations-Spectrum-MW-rev2%20(1).pdf)
- International Association for Public Participation Canada. (2024, January 15). *Sea2City Design Challenge: Pioneering coastal planning through innovation and inclusivity*. <https://iap2canada.ca/News-&-Updates/13301355>
- Jakob, M., & Church, M. (2013). The trouble with floods. *Canadian Water Resources Journal* 36 (4): 287-292. <https://doi.org/10.4296/cwrj3604928>
- Jefferies, R., & Hager, K. (2023). Learning from the past: Governing transboundary Nooksack River flooding. *Border Policy Research Institute Publications* 113. Western Washington University. https://cedar.wvu.edu/bpri_publications/133?utm_source=cedar.wvu.edu%2Fbpri_publications%2F133&utm_medium=PDF&utm_campaign=PDFCoverPages
- Jenkins-Smith, H.C., Nohrstedt, D., Weible, C.M., & Ingold, K. (2018). “The Advocacy Coalition Framework: An overview of the research program.” In H.C. Jenkins-Smith, D. Nohrstedt, C.M. Weible, & K. Ingold (Eds.), *Theories of the Policy Process* (4th Ed., pp. 135-171). Routledge.
- Joannou, A. (2024, June 4). ‘A slap in the face’: B.C. mayors decry being rejected for federal disaster relief. *Vancouver Sun*. <https://vancouversun.com/news/bc-mayors-decry-being-rejected-for-federal-disaster-relief>
- Johannessen, A., Gerger Swartling, A., Wamsler, C., Andersson, K., Arran, J.T., Hernández Vivas, D.I., & Stenström, T.A. (2019). Transforming urban water governance through social (triple-loop) learning. *Environmental Policy and Governance* 29 (2): 144-154. <https://doi.org/10.1002/eet.1843>
- Johnson, R.S.H., & Alila, Y. (2023). Nonstationary stochastic paired watershed approach: Investigating forest harvesting effects on floods in two large, nested, and snow-dominated watersheds in British Columbia, Canada. *Journal of Hydrology* 625 (A): 129970. <https://doi.org/10.1016/j.jhydrol.2023.129970>
- Jones, B.D., & Baumgartner, F.R. (2005). *The politics of attention: How governments prioritize problems*. The University of Chicago Press.
- Jones, D. M. (2023). *Growing pains: Overcoming barriers to nature-based coastal adaptation projects through collaboration* [Master’s thesis. University of Waterloo]. *UW Space*. <https://uwspace.uwaterloo.ca/handle/10012/19947>
- Jongman, B. (2018). Effective adaptation to rising flood risk. *Nature Communications* 9 (1): 1-3. <https://doi.org/10.1038/s41467-018-04396-1>
- Jordan, A., & O’Riordan, T. (1995). *Institutional adaptation to global environmental change (I): Social institutions, policy change, and social learning*. CSERGE Working Paper GEC 95-20, Centre for Social and Economic Research on the Global Environment.
- Jost, F., Dale, A., Newell, R., & Robinson, J. (2020). Climate action assessment in three small municipalities in British Columbia: Advancements vis-à-vis major neighboring cities. *Current Research in Environmental Sustainability* 2: 100010. <https://doi.org/10.1016/j.crsust.2020.100010>
- Judd, A. (2021a, November 21). B.C. flooding map 2021 shows areas affected by atmospheric river. *Global News*. <https://globalnews.ca/news/8387747/b-c-flooding-map-2021/>
- Judd, A. (2021b, November 25). 5th victim of deadly B.C. mudslide identified as 36-year-old man. *Global News*. <https://globalnews.ca/news/8402055/fifth-victim-bc-mudslide-highway-99/>
- Kaiser, K. (2009). Protecting respondent confidentiality in qualitative research. *Qualitative Health Research* 19 (11): 1632-1641. <https://doi.org/10.1177%2F1049732309350879>

- Kates, R.W., Travis, W.R., & Wilbanks, T.J. (2012). Transformational adaptation when incremental adaptations to climate change are insufficient. *The Proceedings of the National Academy of Sciences* 109 (19): 7156-7161. www.pnas.org/cgi/doi/10.1073/pnas.1115521109
- Katz, C. (1994). Playing the field: Questions of fieldwork in geography. *The Professional Geographer* 46 (1): 67-72. <https://doi.org/10.1111/j.0033-0124.1994.00067.x>
- Kaufmann, W., Hooghiemstra, R., & Feeney, M.K. (2018). Formal institutions, informal institutions, and red tape: A comparative study. *Public administration* 96: 386-403. <https://doi.org/padm.12397>
- Keen, M., Brown, V.A., & Dyball, R. (2005). *Social learning in environmental management: Towards a sustainable future*. Earthscan.
- Kelman, I. (2013). *Disaster mitigation is cost effective*. The World Bank. <https://hdl.handle.net/10986/16341>
- Kerr Wood Leidal. (2020b, November). *Nooksack River Overflow Flood Mitigation Plan: Final report- revised*. Prepared for the City of Abbotsford. <https://www.abbotsford.ca/sites/default/files/2021-02/Nooksack%20Overflow%20Final%20Report.pdf>
- Klassen, C., Tatla, I., Raible, C., Jessiman, L., & Beaulieu, L. (2023, April). *After the flood: Community response and recovery*. Community Health and Social Innovation Hub, University of the Fraser Valley & Archway Community Services. <https://archway.ca/wp-content/uploads/2023/08/After-the-Flood-Report-Final.pdf>
- Kingdon, J.W. (2003/[1984]). *Agendas, alternatives, and public policies* (2nd Ed.). New York: Longman.
- Kitteringham, M. (2023, December 19). SRD not impressed with provincial emergency management act. *Campbell River Mirror*. <https://www.campbellrivermirror.com/local-news/srd-not-impressed-with-provincial-emergency-management-act-7288043>
- Klijn, E.H., & Joppenjan, J. (eds.) (2015). *Governance networks in the public sector*. Routledge.
- Koslov, L. (2016). The case for retreat. *Public Culture* 28 (2): 359-387. <https://doi.org/10.1215/08992363-3427487>
- Kovacs, P., & Sandink, D. (2013, September). *Best practices for reducing the risk of future damage to homes from riverine and urban flooding: A report on recovery and rebuilding in southern Alberta*. ICLR research paper series no. 53, Institute for Catastrophic Loss Reduction. <https://www.iclr.org/wp-content/uploads/PDFS/best-practices-for-reducing-the-risk-of-future-damage-to-homes-from-riverine-and-urban-flooding.pdf>
- Kukkonen, A., Ylä-Anttila, T., & Broadbent, J. (2017). Advocacy coalitions, beliefs and climate change policy in the United States. *Public Administration* 95 (3): 713-729. <https://doi.org/10.1111/padm.12321>
- Kumler, L.M., & Lemos, M.C. (2008). Managing waters of the Paraíba do Sul River Basin, Brazil: A case study in institutional change and social learning. *Ecology and Society* 13 (2): 22. <http://www.ecologyandsociety.org/vol13/iss2/art22/>
- La Loggia, G., Puleo, V., & Freni, G. (2020). Floodability: A new paradigm for designing urban drainage and achieving sustainable urban growth. *Water Resources Management* 34: 3411-3424. <https://doi.org/10.1007/s11269-020-02620-6>
- Lang, A. (2022). "The need to understand and integrate procedural and substantive tools." In M. Howlett (Ed.), *The Routledge handbook of policy tools*, 1st ed. (pp. 47-58). Routledge.
- Larsen, K. (2021, November 17). Abbotsford mayor says catastrophic flood danger averted for now, as water levels drop: Overnight, city staff and volunteers built a dam to protect at-risk Barrowtown station. *CBC News*. <https://www.cbc.ca/news/canada/british-columbia/sumas-prairie-catastrophe-averted-for-now-1.6252084>
- Lawrence, J., Boston, J., Bell, R., Olufson, S., Kool, R., Hardcastle, M., & Stroombergen, A. (2020). Implementing pre-emptive managed retreat: Constraints and novel insights. *Current Climate Change Reports* 6: 66-80. <https://doi.org/10.1007/s40641-020-00161-z>
- Leach, W.D., & Sabatier, P.A. (2005). "Are trust and social capital the keys to success? Watershed partnerships in California and Washington." In P.A. Sabatier, W. Focht, M. Lubell, Z. Trachtenberg, A. Vedlitz, & M. Matlock (Eds.), *Swimming upstream: Collaborative approaches to watershed management* (pp.233-258). The MIT Press.
- Leadership Committee of the Lower Mainland Flood Management Strategy Initiative. (2023). *Pathway to action for flood risk reduction and resilience*.

- https://www.fraserbasin.bc.ca/Library/Water_Flood_Strategy/Pathways_to_Action_Summer_2023.pdf
- Lee, M., & Parfitt, B. (2022, November). *A climate reckoning: The economic costs of BC's extreme weather in 2021*. Canadian Centre for Policy Alternatives- BC Office. https://policyalternatives.ca/sites/default/files/uploads/publications/BC%20Office/2022/11/ccpabc_Climate-Reckoning_web.pdf
- Le Geyt, M.J. (2022). *Expanding the adaptation toolbox: exploring managed retreat in Grand Forks, BC* [Master's thesis, University of Waterloo]. UWSpace, University of Waterloo. <http://hdl.handle.net/10012/18261>
- Leilani Main, K., Hiser, R., Woods, V., Kumasaka, O., Tsang, M., & Stein, I. (2021). *What do we do with the land left behind: XSP for floodplain buyout parcels*. Working paper, Lincoln Institute of Land Policy. <https://www.lincolninst.edu/publications/working-papers/what-do-we-do-land-left-behind/>
- Lemke, N., Trein, P., Varone, F. (2023). Agenda-setting in nascent policy subsystems: Issue and instrument priorities across venues. *Policy Sciences* 56: 633-655. <https://doi.org/10.1007/s11077-023-09514-5>
- Leung, A. (2021). An 'othered' land reclamation: Decolonization in anticipation of another great flood. *Journal of Architectural Education* 75 (2): 170-183. <https://doi.org/10.1080/10464883.2021.1947671>
- Levin, K., Cashore, B., Bernstein, S., & Auld, G. (2012). Overcoming the tragedy of super wicked problems: Constraining our future selves to ameliorate global climate change. *Policy Science* 45: 123-154. <https://doi.org/10.1007/s11077-012-9151-0>
- Litke, S. (2022, September 15). *Lessons from an atmospheric river: Insights for local government*. Fraser Basin Council. Presented to at the Union of BC Municipalities Convention. <https://www.ubcm.ca/sites/default/files/2022-09/6%20Thr%201430-1630%20Rainbow%20Steve%20Litke%20Atmospheric%20River.pdf>
- Little, S. (2024, January 25). B.C.'s South Coast braces for soaking with atmospheric rivers inbound. *Global News*. <https://globalnews.ca/news/10251555/bc-rain-atmospheric-rivers/>
- Living with Water. (2022a). *What we do* [Webpage]. <https://www.livingwithwater.ca/what-we-do>
- Living with Water. (2022b). *Placing values at the centre of coastal adaptation* [Webpage]. <https://www.livingwithwater.ca>
- Lokot, M. (2021). Whose voices? Whose knowledge? A feminist analysis of the value of key informant interviews. *International Journal of Qualitative Methods* 20: 1-8. <https://doi.org/10.1177/1609406920948775>
- Lovisek, J., Waisberg, L.G., Holzkamm, T.E. (1995). "Deprived of part of their living: Colonialism and nineteenth-century flooding of Ojibwa lands." In D.H. Pentland (Ed.), *Papers of the Twenty-Sixth Algonquian Conference* 26: 226-239. University of Manitoba. <https://ojs.library.carleton.ca/index.php/ALGQP/article/view/588>
- Lower Fraser Floodplains Coalition. (2022). *Flood recovery, resiliency, and reconciliation in the Lower Fraser—Reporting back: Build Back Better Together—July 14, 2022 Forum*. Resilient Waters. https://www.resilientwaters.ca/files/ugd/9288ab_a57f28dac1724c73937d351d4fe439bd.pdf
- Lower Fraser Floodplains Coalition. (2023a, February 14). *Floodplains dialogue: First Nations and farmers in the Lower Fraser Valley*. https://www.resilientwaters.ca/files/ugd/9288ab_cdc6940c29c949fc899b60dc6739cf0a.pdf
- Lower Fraser Floodplains Coalition. (2023b, June 9). *Lower Fraser Floodplains Forum: 2023 dialogue on regional action*. https://www.resilientwaters.ca/files/ugd/9288ab_9947268ef61f4351907b9fb99febdac9.pdf
- Lower Fraser Floodplains Coalition. (2024, July 12). *Lifelines in the Fraser Estuary: Taking care of each other in a changing climate*. Presentation to Metro Vancouver. <https://metrovanancouver.org/boards/FloodResiliency/FRE-2024-07-12-PPT.pdf>
- Lower Fraser Floodplains Coalition & Emergency Planning Secretariat. (2024). *2024-2027 work plan for regional floodplains resilience* (v.2). https://drive.google.com/file/d/1RjbxvbD5ZaIN9XfTwkUHVpzf_m837SmL/view
- Lower Fraser Fisheries Alliance. (2021, April). *Revitalizing Indigenous law with the Lower Fraser Fisheries Alliance: Legal traditions of the peoples of the Lower Fraser*. <https://www.lffa.ca/initiatives/relaw>

- Lyle, T., & McLean, D.G. (2008). British Columbia's flood management policy window—Can we take advantage? In *Proceedings of the 4th International Symposium on Flood Defence: Managing Flood Risk, Reliability, and Vulnerability*. Toronto, Canada: May 6-8, 2008. <https://www.ebbwater.ca/wp-content/uploads/2022/06/Lyle-McLean-2008-British-Columbias-Flood-Management-Policy-Window-Can-We-Take-Advantage.pdf>
- Mach, K., & Siders, A. (2021). Reframing strategic, managed retreat for transformative climate adaptation. *Science* 372: 1294-1299. <https://doi.org/10.1126/science.abh1894>
- Mach, K.J., Hino, M., Siders, A.R., Koller, S.F., Kraan, C.M., Niemann, J., & Sanders, B.F. (2022). From flood control to flood adaptation. *Oxford Research Encyclopedia of Environmental Science*. <https://doi.org/10.1093/acrefore/9780199389414.013.819>
- Mackie, J. (2021, November 19). This week in history: 1894 and 1948 the Fraser Valley is inundated in a great flood. *Vancouver Sun*. <https://vancouversun.com/news/this-week-in-history-1894-1948-the-fraser-valley-is-inundated-in-a-great-flood>
- Mahoney, J., & Thelen, K. (2010). "A theory of gradual institutional change." In J. Mahoney & K. Thelen (Eds.), *Explaining Institutional Change: Ambiguity, Agency and Power* (pp. 1-37). Cambridge University Press.
- Mangione, K. (2021, November 16). Track washout to blame for partial derailment of train in BC: CN Rail. *CTV News Vancouver*. <https://bc.ctvnews.ca/track-washout-to-blame-for-partial-derailment-of-train-in-b-c-cn-rail-1.5667613>
- Martin, T. (2022, May 2). *Sumas Lake: Sumas, Stó:lō, and "flood" management* [Presentation]. Living with Water Annual Workshop, Vancouver, BC.
- Martin, T., Balantyne, L., Carlson, D., Finn, R., Hamilton, I., Kwo, J., Ned, M., Seymour-Hourie, R., & Walters, K. (2022, April 19). Restoring Sumas Lake is an important step in B.C. flood recovery, climate adaptation, and reconciliation. *Raincoast*. <https://www.raincoast.org/2022/04/restoring-sumas-lake-is-an-important-step-in-b-c-flood-recovery-climate-adaptation-and-reconciliation/>
- Matsui, K. (2009). *Native peoples and water rights: Irrigation, dams, and the law in Western Canada*. McGill-Queen's University Press. <https://doi.org/10.1515/9780773576582>
- Maurischa, S.D., Fahmi, F.Z., & Suroso, D.S.A. (2023). Transformative resilience: Transformation, resilience, and capacity of coastal communities in facing disasters in two Indonesian villages. *International Journal of Disaster Risk Reduction* 88: 103615. <https://doi.org/10.1016/j.ijdr.2023.103615>
- McClearn, M. (2022a, May 30). Building on river floodplains has proven costly and devastating to Canadians. A new Globe analysis reveals which cities are at most risk. *The Globe and Mail*. <https://www.theglobeandmail.com/canada/article-development-floodplains-150-canadian-cities/>
- McClearn, M., & Hunter, J. (2021, December 2). Were B.C.'s dikes ever up to the job of stopping floods like these? *The Globe and Mail*. <https://www.theglobeandmail.com/canada/article-were-bcs-dikes-ever-up-to-the-job-of-stopping-floods-like-these/>
- McCracken, K., & Hogan-Stacey, S.-S. (2023). *Decolonial archival futures*. Society of American Archivists & American Library Association Neal-Schuman.
- McMonigal, K., Larson, S., Hu, S., & Kramer, R. (2023). Historical changes in wind-driven ocean circulation can accelerate global warming. *Geophysical research letters* 50 (4): e2023GL102846. <https://doi.org/10.1029/2023GL102846>
- McSheffrey, E. (2021a, November 18). Sumas First Nation chief reflects on 'disaster' B.C. flooding where lake used to be. *Global News*. <https://globalnews.ca/news/8385289/sumas-lake-reflection-first-nations/>
- McSheffrey, E. (2021b, November 15). B.C.'s record-breaking rainfall generates 'mind-boggling' data: Environment Canada. *Global News*. <https://globalnews.ca/news/8375229/bc-atmospheric-river-data-environment-canada/>
- Meadows, D.H. (2008). *Thinking in Systems: A Primer* (D. Wright, Ed.). Chelsea Green Publishing.
- Measham, T.G., Preston, B.L., Smith, T.F., Brooke, C., Gorddard, R., Withycombe, G., & Morrison, C. (2011). Adapting to climate change through local municipal planning: Barriers and challenges. *Mitigation and Adaptation Strategies for Global Change* 16: 889-909. <https://doi.org/10.1007/s11027-011-9301-2>

- Medema, W., Wals, A., & Adamowski, J. (2014). Multi-loop social learning for sustainable land and water governance. *NJAS - Wageningen Journal of Life Sciences* 69 (23): 38. <https://doi.org/10.1016/j.njas.2014.03.003>
- Meerow, S., Pajouhesh, P., & Miller, T. R. (2019). Social equity in urban resilience planning. *Local Environment* 24 (9): 793–808. <https://doi.org/10.1080/13549839.2019.1645103>
- Mehring, P., Geoghegan, H., Cloke, H.L., & Clark, J. (2018). What is going wrong with community engagement? How flood communities and flood authorities construct engagement and partnership working. *Environmental Science and Policy* 89: 109–115. <https://doi.org/10.1016/j.envsci.2018.07.009>
- Méndez, P.F., Amezaga, J.M., & Santamaria, L. (2019). Explaining path-dependent rigidity traps: Increasing returns, power, discourses, and entrepreneurship intertwined in social-ecological systems. *Ecology and Society* 24 (2): 30. <https://www.jstor.org/stable/26796953>
- Metro Vancouver. (2021, January). *Water and wastewater infrastructure: Discussion paper to support Climate 2050*. Metro Vancouver. <https://metrovancover.org/services/air-quality-climate-action/Documents/climate-2050-water-waste-water-infrastructure-discussion-paper.pdf>
- Michaels, R. (2019, July 3). MOU between Sumas First Nation, the Province & City of Abbotsford. 98.3 *Star FM*. <https://www.starfm.com/2019/07/03/mou-between-sumas-first-nation-the-province-city-of-abbotsford/>
- Ministry of Emergency Management and Climate Readiness. (N.d.). *Emergency and Disaster Management Act: Interim guidance on Indigenous engagement requirements*. Government of British Columbia. https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/legislation/ier_primer.pdf
- Ministry of Emergency Management and Climate Readiness. (2022, November 14). *Minister's statement on one-year anniversary of atmospheric river*. Government of British Columbia. <https://news.gov.bc.ca/releases/2022EMBC0063-001700>
- Ministry of Emergency Management and Climate Readiness. (2023a, March 18). *Province takes early action to prepare for wildfire, drought season*. Government of British Columbia. <https://news.gov.bc.ca/releases/2024EMCR0015-000376>
- Ministry of Emergency Management and Climate Readiness. (2023b, April 28). *Flood mitigation framework, projects make Abbotsford region more resilient*. Government of British Columbia. <https://news.gov.bc.ca/releases/2023EMCR0022-000629>
- Ministry of Emergency Management and Climate Readiness. (2023c, October 20). *Governments come together to build flood resilience in Nooksack, Sumas watersheds*. Government of British Columbia. <https://news.gov.bc.ca/releases/2023EMCR0060-001630>
- Ministry of Emergency Management and Climate Readiness. (2023d, November 27). *Factsheet: Multijurisdictional Emergency Management Organization*. Government of British Columbia. <https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/legislation/fs-mjmemo.pdf>
- Ministry of Emergency Management and Climate Readiness. (2023e, December). *Emergency and Disaster Management Act: Indigenous Engagements Requirement Funding Program*. Government of British Columbia. https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/legislation/fs-indigenous_engagement_requirements_funding_program.pdf
- Ministry of Emergency Management and Climate Readiness. (2024, July 17). *Funding provided for local emergency operations centres*. Government of British Columbia. <https://news.gov.bc.ca/releases/2024EMCR0036-001139>
- Ministry of Environment and Climate Change Strategy (2019). *Preliminary Strategic Climate Risk Assessment for British Columbia*. Government of British Columbia. <https://www2.gov.bc.ca/assets/gov/environment/climate-change/adaptation/prelim-strat-climate-risk-assessment.pdf>
- Ministry of Environment and Climate Change Strategy. (2024, February). *2024/25- 2026/27 service plan*. <https://www.bcbudget.gov.bc.ca/2024/sp/pdf/ministry/env.pdf>

- Ministry of Forests, Lands, and Natural Resources. (2012, October). *Cost of adaptation—sea dikes and alternative strategies: Final report*. Government of British Columbia. https://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/cost_of_adaptation-final_report_oct2012.pdf
- Ministry of Forests, Lands, Natural Resource Operations, and Rural Development. (2019, May). *Provincial flood emergency plan*. Government of British Columbia. <https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/provincial-emergency-planning/provincial-flood-emergency-plan.pdf>
- Ministry of Forests, Lands, Natural Resource Operations, and Rural Development. (2020, August). *Together for wildlife: Improving wildlife stewardship and habitat conservation in British Columbia*. Government of British Columbia. <https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/together-for-wildlife/together-for-wildlife-strategy.pdf>
- Ministry of Municipal Affairs. (2022, April 14). *Flood-affected communities benefit from recovery funding*. Government of British Columbia. <https://news.gov.bc.ca/releases/2022MUNI0016-000582>
- Ministry of Public Safety and Solicitor General. (2021, November 17). *Provincial state of emergency declared*. Government of British Columbia. <https://news.gov.bc.ca/releases/2021PSSG0073-002190>
- Ministry of Public Safety and Solicitor General. (2022a, April 28). *Province strengthens Disaster Financial Assistance*. Government of British Columbia. <https://news.gov.bc.ca/releases/2022PSSG0026-000664>
- Ministry of Public Safety and Solicitor General. (2022b, October 28). *Assistant Deputy Minister, Emergency Management BC, Ministry of Public Safety and Solicitor General, Victoria, BC*. Government of British Columbia. https://www.dri.ca/docs/Oct_28_ADM_Disaster_Risk_Management_EMBC_Ad_Copy-FINAL.pdf
- Ministry of Transportation and Infrastructure. (2021, February 12). *Economic recovery funding helps address effects of climate change*. Government of British Columbia. <https://news.gov.bc.ca/releases/2021TRAN0017-000212>
- Ministry of Water, Land, and Resource Stewardship. (2024, May). *British Columbia drought and water scarcity response plan*. Government of British Columbia. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/drought-info/drought_response_plan_final.pdf
- Mintrom, M. (2019). *Policy entrepreneurs and dynamic change*. Cambridge University Press.
- Mohtat, N., & Khirfan, L. (2021). The climate justice pillars vis-à-vis urban form adaptation to climate change: A review. *Urban Climate* 39: 100951. <https://doi.org/10.1016/j.uclim.2021.100951>
- Monteil, C., Barclay, J., & Hicks, A. (2020). Remembering, forgetting, and absencing disasters in the post-disaster recovery process. *International Journal of Disaster Risk Science* 11: 289-299. <https://doi.org/10.1007/s13753-020-00277-8>
- Moon, K., & Blackman, D. (2014). A guide to understanding natural science research for natural scientists. *Conservation Biology* 28 (5): 1167-1177. <https://doi.org/10.1111/cobi.12326>
- Morgan, L. (2023, December 19). Sumas Lake: A once (and future?) feature of the border. *Salish Current*. <https://salish-current.org/2023/12/19/sumas-lake-once-and-future-feature-of-the-border/>
- Morrison, A., Noble, B.F., & Westbrook, C. (2019). Flood risk management in Canada's prairie provinces: An analysis of decision-maker priorities and policy preferences. *Environmental Management* 64 (1-2): 1-18. <https://doi.org/10.1007/s00267-019-01208-0>
- Mortensen, P.B. (2007). Stability and change in public policy: A longitudinal study of comparative subsystem dynamics. *Policy Studies Journal* 35 (3): 373-394. <https://doi.org/10.1111/j.1541-0072.2007.00229.x>
- Moyson, S. (2017) Cognition and policy change: The consistency of policy learning in the advocacy coalition framework. *Policy and Society* 36 (2): 320–344. <https://doi.org/10.1080/14494035.2017.1322259>
- Munck af Rosenschöld, J., Rozema, J.G., & Frye-Levine, L.A. (2014). Institutional inertia and climate change: A review of the new institutionalist literature. *WIREs Climate Change* 5: 639-648. <https://doi.org/10.1002/wcc.292>
- Murton, J. (2008). Creating order: The Liberals, the landowners, and the draining of Sumas Lake, British Columbia. *Environmental History* 13 (1): 92-125. <https://www.jstor.org/stable/25473195>

- National Oceanic and Atmospheric Administration. (2020, November 9). *How will climate change change El Niño and La Niña*. <https://research.noaa.gov/2020/11/09/new-research-volume-explores-future-of-el-niño-under-influence-of-climate-change/>
- National Oceanic and Atmospheric Administration. (2023a, December 5). *Record carbon emissions impede progress on meeting climate goals*. <https://research.noaa.gov/2023/12/05/record-fossil-carbon-dioxide-emissions-impeding-progress-on-meeting-climate-goals-report/>
- National Oceanic and Atmospheric Administration. (2023b, March 31). *What are atmospheric rivers*. <https://www.noaa.gov/stories/what-are-atmospheric-rivers>
- National Park Service. (n.d.). *Mississippi River facts*. U.S. Department of the Interior. <https://www.nps.gov/miss/riverfacts.htm#:~:text=Using%20this%20measure%20the%20Mississippi,in%20the%20Gulf%20of%20Mexico.>
- Nature Conservancy of Canada. (N.d.). *Lower Mainland (#196)*. https://www.natureconservancy.ca/assets/documents/nat/casc/Lower-Mainland_ERS.pdf
- Nelson, J., & Silcoff, S. (2016, August 3). Financial fault lines. *The Globe and Mail*. <https://www.theglobeandmail.com/report-on-business/how-earthquake-affect-canada-financial-system/article31231187/>
- Nespor, J. (2000). Anonymity and place in qualitative inquiry. *Qualitative Inquiry* 6(4): 546–569. <https://doi.org/10.1177/107780040000600408>
- Neville, K.J., & Coulthard, G. (2019). Transformative water relations: Indigenous interventions in global political economies. *Global Environmental Politics* 19 (3): 1-15. https://doi.org/10.1162/glep_a_00514
- Nohrstedt, D., Mazzoleni, M., Parker, C.F., & Di Baldassarre, G. (2021). Exposure to natural hazard events unassociated with policy change for improved disaster risk reduction. *Nature Communications* 12 (1): 1–11. <https://doi.org/10.1038/s41467-020-20435-2>
- Nohrstedt, D. (2022). When do disasters spark transformative change and why? *Policy & Politics* 50 (3): 425-441. <https://doi.org/10.1332/030557321X16508834302815>
- Norman, E., & Bakker, K. (2005, November). *Drivers and barriers of collaborative transboundary water governance: A case study of western Canada and the United States*. https://watergovernance.sites.olt.ubc.ca/files/2010/06/Gordon_Foundation_Transboundary_Report.pdf
- Norman, E., & Bakker, K. (2009). Transgressing scales: Water governance across the Canada–U.S. borderland. *Annals of the Association of American Geographers* 99 (1): 99-117. <https://doi.org/10.1080/00045600802317218>
- North, D. (1990). *Institutions, institutional change, and economic performance*. Cambridge University Press.
- Northwest Hydraulic Consultants. (2015, July). *Lower Mainland Dike Assessment: Final Report*. Prepared for Ministry of Forests, Lands, Natural Resource Operations, and Rural Development. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/integrated-flood-hazard-mgmt/nhc_final_lower_mainland_dike_assessment.pdf
- Nowlan, L., & Bakker, K. (2007, November). *Delegating water governance: Issues and challenges in the BC context*. Prepared for the BC Water Governance Project, a partnership of the Fraser Basin Council, Ministry of Environment, Fraser Salmon and Watershed Program, Georgia Basin Living Rivers Program, and Fisheries and Oceans Canada <http://www.tonydorcey.ca/597/Posts/FBCwatergovernancefinal2.pdf>
- O'Brien, K., & Wolf, J. (2010). A values-based approach to vulnerability and adaptation to climate change. *WIREs Climate Change* 1 (2): 232-242. <https://doi.org/10.1002/wcc.30>
- O'Donnell, E. (2023). Water sovereignty for Indigenous Peoples: Pathways to pluralist, legitimate, and sustainable water laws in settler colonial states. *PLOS Water* 2 (11): e0000144. <https://doi.org/10.1371/journal.pwat.0000144>
- O'Donovan, K. (2017). An assessment of aggregate focusing events, disaster experience, and policy change. *Risk, Hazards & Crisis in Public Policy* 8(3): 201-219. <https://doi.org/10.1002/rhc3.12116>
- Office of the Auditor General of British Columbia. (2014, March). *Catastrophic earthquake preparedness*. https://www.bcauditor.com/sites/default/files/publications/2014/report_15/report/OAG%20Catastrophic%20Earthquake_FINAL.pdf

- Office of the Auditor General of British Columbia. (2018, February). *Managing climate change risks: An independent audit*.
https://www.bcauditor.com/sites/default/files/publications/reports/Climate_Change_FINAL.pdf
- Office of the Premier. (2023, September 11). *Premier's statement on launch of expert task force on emergencies*. Government of British Columbia. <https://news.gov.bc.ca/releases/2023PREM0061-001433>
- Okamoto, T. (2023). *Evaluating equity and justice in urban coastal adaptation planning* [Master's thesis. Simon Fraser University]. *Summit Research Repository*. <https://summit.sfu.ca/item/37973>
- Olsen, T. (2016, November 19). Keeping the lake at bay: How an engineering marvel defeats gravity to keep Sumas Prairie dry. *The Abbotsford News*. <https://www.abbynews.com/news/keeping-the-lake-at-bay-in-abbotsford-1753450>
- Olsen, T. (2021a, November 21). The Fraser Valley flood as it happened. Our flood coverage from the week following 2021's (first) atmospheric river. *Fraser Valley Current*. <https://fvcurrent.com/p/the-fraser-valley-flood-as-it-happened/>
- Olsen, T. (2021b, November 22). A doomed Sumas dike failed as predicted. Many other levees could be next. *Fraser Valley Current*. <https://fvcurrent.com/p/fraser-valley-unacceptable-dikes/>
- Olsen, T. (2022, October 6). Why stopping Sumas Prairie from flooding is 'not politically feasible.' *Fraser Valley Current*. <https://fvcurrent.com/p/nooksack-river-canada-us-politics/>
- Olsen, T. (2023a, March 24). One last sprawl: Why the McKee Peak plan exists. *Fraser Valley Current*. <https://fvcurrent.com/p/mckee-plan-sprawl/>
- Olsen, T. (2023b, October 23). What an international Nooksack agreement means (and doesn't mean). *Fraser Valley Current*. <https://fvcurrent.com/p/transboundary-nooksack-agreement>
- Olson, S., Jansen, M.F., Abbot, D.S., Halevy, I., & Goldblatt, C. (2022). The effect of ocean salinity on climate and its implications for Earth's habitability. *Geophysical Research Letters* 49 (10): e2021GL0955748. <https://doi.org/10.1029/2021GL0955748>
- Osler, M., & Demsar, T. (2020). Engineering meets public participation on the coast in Surrey, British Columbia. *Coastal Management* 2019: 169-181. <https://doi.org/10.1680/em.65147.169>
- Omondi, L.A. (2020). Learning together: Participatory rural appraisal for coproduction of climate change knowledge. *Action Research* 21 (2): 198-210. <https://doi.org/10.1177/1476750320905901>
- O'Neill, K.M. (2006). *Rivers by design: State power and the origins of U.S. flood control*. Duke University Press.
- Oubennaceur, K., Chokmani, K., Lessard, F., Gauthier, Y., Baltazar, C., & Toussaint, J.P. (2022). Understanding flood risk perception: A case study from Canada. *Sustainability* 14 (5): 3087. <https://doi.org/10.3390/su14053087>
- Oulahen, G., Klein, Y., Mortsch, L., O'Connell, E., & Harford, D. (2018). Barriers and drivers to planning for climate change adaptation across three levels of government in Canada. *Planning Theory and Practice* 19 (3): 405-421. <https://doi.org/10.1080/14649357.2018.1481993>
- Öz, G., & Timur, S. (2023). Issues of power and representation in/of the local context: The role of self-reflexivity and positionality in design research. *The Design Journal* 26 (2): 252-269. <https://doi.org/10.1080/14606925.2022.2088097>
- Pacific Climate Impacts Consortium, Pacific Institute for Climate Solutions, & Ministry of Environment. (2013). *Atmospheric rivers state of knowledge report*. <https://www.pacificclimate.org/sites/default/files/publications/Atmospheric%20Report%20Final%20Revised.pdf>
- Pahl-Wostle, C., Mostert, E., & Tàbara, D. (2008). The growing importance of social learning in water resources management and sustainability science. *Ecology and Society* 13(1): 24. <http://www.ecologyandsociety.org/vol13/iss1/art24/>
- Pahl-Wostle, C. (2009). A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change* 19 (3): 354-365. <https://doi.org/10.1016/j.gloenvcha.2009.06.001>

- Pahl-Wostle, C., Becker, G., Knieper, C., & Sendzimer, J. (2013). How multi-level societal learning processes facilitate transformative change: A comparative case study analysis on flood management. *Ecology and Society* 18 (4): 58. <http://doi.org/10.5751/ES-05779-180458>
- Pal, L.A. (2006). *Beyond policy analysis: Public issue management in turbulent times* (3rd Ed.). Thomson Nelson.
- Parfitt, B. (2022, June 16). Five people died in a landslide. BC wants to know why. *The Tyee*. <https://thetyee.ca/News/2022/06/16/Five-People-Died-Landslide-BC/>
- Park, J. (2021, April 16). How Canada's heavy truck weights and dimensions evolved. *Truck News*. <https://www.trucknews.com/features/how-canadas-heavy-truck-weights-and-dimensions-evolved/>
- Park, S.E., Marshall, N.A., Jakku, E., Dowd, A.M., Howden, S.M., Mendham, E., & Fleming, A. (2011). Informing adaptation responses to climate change through theories of transformation. *Global Environmental Change* 22 (1): 115–126. <https://doi.org/10.1016/j.gloenvcha.2011.10.003>
- Parliamentary Budget Officer, Office of the. (2016, February 25). *Estimate of the average cost of disaster financial assistance arrangements due to extreme weather*. https://qsarchive-archives.qs.pbo-dpb.ca/web/default/files/Documents/Reports/2016/DFAA/DFAA_EN.pdf
- Parry, E.J. (2007). The greatest threat to global security: Climate change is not merely an environmental problem. *United Nations Chronicle* 44 (2). <https://www.un.org/en/chronicle/article/greatest-threat-global-security-climate-change-not-merely-environmental-problem>
- Parsons, M., & Fisher, K. (2022). Decolonising flooding and risk management: Indigenous Peoples, settler colonialism, and memories of environmental injustices. *Sustainability* 14 (18): 11127. <https://doi.org/10.3390/su141811127>
- Parsons, M., Nalau, J., Fisher, K., & Brown, C. (2019). Disrupting path dependency: Making room for Indigenous knowledge in river management. *Global Environmental Change* 56: 95-113. <https://doi.org/10.1016/j.gloenvcha.2019.03.008>
- Partners for Action. (2024). *Inclusive resilience: A socio-economic vulnerability index to map flood risk for targeted communications and disaster risk reduction*. Waterloo, Ontario: University of Waterloo. https://uwaterloo.ca/partners-for-action/sites/default/files/uploads/documents/june-2024_p4a-sovi-report_en_final.pdf
- Patel, K., Coletta, A., Samenow, J., & Karklis, L. (2021, November 18). First fires, now floods: British Columbia and Washington reeling from atmospheric river. *The Washington Post*. <https://www.washingtonpost.com/weather/2021/11/18/british-columbia-washington-floods-climate/>
- Patel, S. (2015, July 15). The research paradigm—methodology, epistemology, and ontology—explained in simple language. https://salmapatel.co.uk/academia/the-research-paradigm-methodology-epistemology-and-ontology-explained-in-simple-language/#google_vignette
- Pawson, C. (2023, September 11). B.C. Premier David Eby announces expert task force to better respond to emergencies. *CBC News*. <https://www.cbc.ca/news/canada/british-columbia/b-c-wildfires-september-11-2023-1.6962748>
- Peck, A.J., Adams, S.L., Armstong, A., Bartlett, A.K., Bortman, M.L., Branco, A.B., Brown, M.L., Donohue, J.L., Kodis, M., McCann, M.J., & Smith, E. (2022). A new framework for flood adaptation: Introducing the Flood Adaptation Hierarchy. *Ecology & Society* 27 (4): 5. <https://doi.org/10.5751/ES-13544-270405>
- Pelling, M. (2003). *Natural disaster and development in a globalizing world*. Routledge.
- Pelling, M. (2011). *Adaptation to climate change: From resilience to transformation*. Routledge.
- Pelling, M., & Dill, K. (2010). Disaster politics: Tipping points for change in the adaptation of sociopolitical regimes. *Progress in Human Geography* 34 (1): 21-37. <https://doi.org/10.1177/0309132509105004>
- Peters, J. (2022, November 18). Holding back the water in Abbotsford. *The Chilliwack Progress*. <https://www.theprogress.com/news/holding-back-the-water-for-abbotsford-1935147>
- Phelan, L., Henderson-Sellers, A., & Taplin, R. (2012). The political economy of addressing the climate crisis in the Earth system: Undermining perverse resilience. *New Political Economy* 18 (2): 198-226. <https://doi.org/10.1080/13563467.2012.678820>
- Pierson, P. (2000). Increasing returns, path dependence, and the study of politics. *The American Political Science Review* 94 (2): 251-267. <https://doi.org/10.2307/2586011>

- Pierson, P. (2004). *Politics in time: History, institutions, and social analysis*. Princeton University Press.
- Pierson, P. (2015). "Power and path dependence." In J. Mahoney & K. Thelen (Eds.), *Advances in comparative historical analysis* (pp.123-146). Cambridge University Press.
- Plein, C. (2019). Resilience, adaptation, and inertia: Lessons from disaster recovery in a time of climate change. *Social Science Quarterly* 100 (7): 2530-2541. <https://doi.org/10.1111/ssqu.12658>
- Polterovich, V. (2008). "Institutional trap." In S.N. Durlauf & L.E. Blume (Eds), *The new Palgrave dictionary of economics online*. Palgrave Macmillan.
- Pritchard, T., Singh, S., Wright, L., & Gloeckler, B. (2023, November 13). B.C. provides Indigenous nations larger role in emergency management. *Bennett Jones*. <https://www.bennettjones.com/Blogs-Section/BC-Provides-First-Nations-Larger-Role-in-Emergency-Management>
- Pross, A.P. (1995). "Pressure groups: Talking chameleons." In M.S. Whittington & G. Williams (Eds.), *Canadian Politics in the 1990s* (p.252-275). Nelson Canada.
- Public Safety Canada. (2019). *Emergency Management Strategy for Canada: Toward a Resilient 2030*. <https://www.publicsafety.gc.ca/cnt/rsrscs/pblctns/mrgncy-mngmnt-strtg/index-en.aspx>
- Public Safety Canada. (2022, August). *Adapting to rising flood risk: An analysis of insurance solutions in Canada. A report by Canada's Task Force on Flood Insurance and Relocation*. <https://www.publicsafety.gc.ca/cnt/rsrscs/pblctns/dptng-rsng-flt-rsk-2022/dptng-rsng-flt-rsk-2022-en.pdf>
- Public Safety Canada. (2023a, May 11). *Backgrounder: Floods*. <https://www.publicsafety.gc.ca/cnt/mrgnc-mngmnt/ntnl-rsk-prfl/bckgrndr-flts-en.aspx>
- Rajabali, R. & Agrawal, N. (2022). Taming the flow, then and now: A Canadian case of floodplain management. *Frontiers in Water* 4: 931214. <https://doi.org/10.3389/frwa.2022.931214>
- Rammel, C., Stagl, S., & Wilfing, H. (2007) . Managing complex adaptive systems—A co-evolutionary perspective on natural resource management. *Ecological Economics* 63: 9-21. <http://dx.doi.org/10.1016/j.ecolecon.2006.12.014>
- Rayner, J., Howlett, M., Wilson, J., Cashore, B., & Hoberg, G. (2001). Privileging the sub-sector: Critical sub-sectors and sectoral relationships in forest policy-making. *Forest Policy and Economics* 2 (3-4): 319-332. [https://doi.org/10.1016/S1389-9341\(01\)00038-7](https://doi.org/10.1016/S1389-9341(01)00038-7)
- Reach Gallery Museum, The. (N.d.). *Archival photo of Semá:th Xo:tsa/ Sumas Lake* [Photo]. <https://thereach.ca/exhibition/semath-xotsa-great-grammas-lake/>
- Reach Gallery Museum, The. (2020, September 24). *Semá:th Xo:tsa: Halq'eméylem pronunciation guide*. <https://www.youtube.com/watch?v=FJoKS9YyU5w>
- Reed, G., Fox, S., Littlechild, D., McGregor, D., Lewis, D., Popp, J., Wray, K., Kassi, N., Ruben, R., Morales, S., & Lonsdale, S. (2024). *For our future: Indigenous resilience report*. Ottawa, ON.
- Reid, M.G., Hamilton, C., Reid, S.K., Trousdale, W., Hill, C., Turner, N., Picard, C.R., Lamontagne, C., & Matthews, H.D. (2023). Indigenous climate change adaptation using a values-focused approach: A case study with the Gitga'at Nation. *Journal of Ethnobiology* 34 (3): 401-424. <https://doi.org/10.2993/0278-0771-34.3.401>
- Reimer, C. (2018). *Before we lost the lake: A natural and human history of Sumas Valley*. Caitlyn Press.
- Repetto, R. (2006). "Introduction." R. Repetto (Ed.), *Punctuated Equilibrium and the Dynamics of U.S. Environmental Policy* (pp. 1-23). Yale University Press.
- Resilient Waters. (N.d.-a). *Lower Fraser Floodplains Coalition* [Webpage]. <https://www.resilientwaters.ca/floodresilience>
- Resilient Waters. (N.d.-b). *5 Guiding Principles*. Lower Fraser Floodplains Coalition. https://www.resilientwaters.ca/_files/ugd/9288ab_c13b2b44a44148a2877a935cc430120a.pdf
- Rice, R.M., & Jahn, J.L.S. (2020). Disaster resilience as communication practice: Remembering and forgetting lessons from past disasters through practices that prepare for the next one. *Journal of Applied Communication Research* 48 (11): 136-155. <https://doi.org/10.1080/00909882.2019.1704830>
- Ridder, N.N., Pitman, A.J., Westra, S., Ukkola, A., Do, H.X., Bador, M., Hirsch, A.L., Evans, J.P., Di Luca, A., & Zscheischler, J. (2020). Global hotspots for the occurrence of compound events. *Nature Communications* 11(1): 5956. <https://doi.org/10.1038/s41467-020-19639-3>

- Rizk, B. (2024, March 27). Drought and wildfire concerns rise as Canada navigates a shift from El Niño to La Niña. *University of Ottawa*. <https://www.uottawa.ca/en/news-all/drought-wildfire-concerns-rise-canada-navigates-shift-el-nino-nina>
- Roberts, N.C., & King, P. (1991). Policy entrepreneurs: Their activity structure and function in the policy process. *Journal of Public Administration Research and Theory* 1 (2): 147-175. <http://doi.org/10.1093/oxfordjournals.jpart.a037081>
- Robinson, K. (2021, November 23). ‘I can’t stand by’: Farmers, volunteers risk their lives to save livestock trapped in B.C. floods. *Global News*. <https://globalnews.ca/news/8393291/farmers-volunteers-save-livestock-floods-bc/>
- Rocco, P., & Thurston, C. (2013). From metaphors to measures: Observable indicators of gradual institutional change. *Journal of Public Policy* 34 (1): 35-62. <https://doi.org/10.1017/S0143814X13000305>
- Roland, G. (2004). Understanding institutional change: Fast-moving and slow-moving institutions. *Studies in Comparative International Development* 38 (4): 109-131. <https://doi.org/10.1007/BF02686330>
- Rose, D.C., Mukherjee, N., Simmons, B.I., Tew, E.R., Robertson, R.J., Vadrot, A.B.M., Doubleday, R., & Sutherland, W.J. (2020). Policy windows for the environment: Tips for improving the uptake of scientific knowledge. *Environmental Science and Policy* 113: 47-54. <https://doi.org/10.1016/j.envsci.2017.07.013>
- Ross, H., Emdad Haque, C., & Berkes, F. (2023). Transmission of knowledge and social learning for disaster risk reduction and building resilience: A Delphi study. *Sustainable Development* 32 (2): 1525-1537. <https://doi.org/10.1002/sd.2685>
- Ross, P.S., Walters, K.E., Yunker, M. & Lo, B. (2022). *A lake re-emerges: Analysis of contaminants in the Semá:th Xó:tsa (Sumas Lake) region following the BC floods of 2021*. Raincoast Conservation Foundation. www.raincoast.org/reports/flood-water/
- Ruiter, M.C., Couasnon, A., Homberg, M.J.C., Daniell, J.E., Gill, J.C., & Ward, P.J. (2020). Why we can no longer ignore consecutive disasters. *Earth’s Future* 8 (3): e2019EF001425. <https://doi.org/10.1029/2019EF001425>
- Ryder, S., Walker, C., Batel, S., Devine-Wright, H., Devine-Wright, P., & Sherry-Brennan, F. (2023). Do the ends justify the means? Problematizing social acceptance and instrumentally-driven community engagement in proposed energy projects. *Socio-Ecological Practice Research* 5: 189-204. <https://doi.org/10.1007/s42532-023-00148-8>
- Sabatier, P.A. (1988). An advocacy coalition framework of policy change and the role of policy-oriented learning therein. *Policy Sciences* 21: 129-168. <https://doi.org/10.1007/BF00136406>
- Sabatier, P.A., Focht, W., Lubell, M., Trachtenberg, Z., Vedlitz, A., & Matlock, M. (2005). “Collaborative approaches to watershed management.” In P.A. Sabatier, W. Focht, M. Lubell, Z. Trachtenberg, A. Vedlitz, & M. Matlock (Eds.), *Swimming Upstream: Collaborative Approaches to Watershed Management* (pp. 3-21). The MIT Press. <https://doi-org.proxy.lib.uwaterloo.ca/10.7551/mitpress/6577.003.0005>
- Sabatier, P.A., & Jenkins-Smith, H. (Eds.). (1993). *Policy change and learning: An advocacy coalition approach*. Westview Press.
- Sabatier, P.A., & Jenkins-Smith, H.C. (1999). “The advocacy coalition framework: An assessment.” In P.A. Sabatier (ed.), *Theories of the policy process* (1st ed.). Boulder, CO: Westview Press.
- Sabatier, P.A., & Weible, C.M. (2007). “The Advocacy Coalition Framework: Innovations and Clarifications.” In P.A. Sabatier (Ed.), *Theories of the policy process* (2nd ed., pp.189-220). Routledge.
- Saldaña, J. (2009). *The coding manual for qualitative researchers*. SAGE Publications Ltd.
- Sam, M., & Armstrong, J. (2015). “Indigenous water governance and resistance: A Syilx perspective.” In J.R. Wagner (Ed.), *The Social Life of Water* (pp. 239-254). Berghahn Books.
- Sapat, A., Li, Y., Mitchell, C., & Esnard, A.-M. (2011). Policy learning and policy change: Katrina, Ike, and post-disaster housing. *International Journal of Mass Emergencies and Disasters* 29 (10): 26-56. <https://par.nsf.gov/biblio/10057046>
- Saunders, J.O., & Wenig, M.M. (2007). “Whose water? Canadian water management and the challenges of jurisdictional fragmentations.” In K. Bakker (Ed.), *Eau Canada: The future of Canada’s water* (pp. 119-142). UBC Press.

- Saunders-Hastings, P., Barnard, M., & Doberstein, B. (2020). *Planned retreat approaches to support resilience to climate change in Canada*. Prepared for Natural Resources Canada. <https://doi.org/10.4095/328323>
- Sawyer, E. (2021, December 23). Barrowtown residents saved pump station from being swamped, Abbotsford mayor says. <https://www.cbc.ca/news/canada/british-columbia/barrowtown-residents-saved-pump-station-1.6294127>
- Schafer, T. (2024, February 27). New EDMA from Province prompts letter of ‘concern’ from RDCK. *The Nelson Daily*. <https://thenelsondaily.com/2024/02/new-edma-from-province-prompts-letter-of-concern-from-rdck/>
- Schlager, E. (2007). “A comparison of frameworks, theories, and models of policy processes.” In P.A. Sabatier (Ed.), *Theories of the policy process* (2nd ed., pp. 293-320). Routledge.
- Schmid, N., Sewerin, S., & Schmidt, T. (2019). Explaining advocacy coalition change with policy feedback. *Policy Studies Journal* 48 (4): 1109-1134. <https://doi.org/10.1111/psj.12365>
- Schmunk, R. (2021a, November 20). In a single week: A timeline of how once-in-a-century flooding unfolded across B.C. *CBC News*. <https://newsinteractives.cbc.ca/longform/bc-flooding-2021-timeline-how-once-in-a-century-flooding-unfolded>
- Schmunk, R. (2021b, November 28). Fraser Valley farmers won’t know for weeks how floodwaters have affected prized soil. *CBC News*. <https://www.cbc.ca/news/canada/british-columbia/bc-flooding-sumas-prairie-soil-testing-1.6261829>
- Schön, D. (2010). Government as a learning system. In C. Blackmore (Ed.), *Social learning systems and communities of practice* (pp. 5-16). Springer. https://doi.org/10.1007/978-1-84996-133-2_1
- Seebauer, S., Thaler, T., Hanger-Kopp, S., & Schinko, T. (2023). How path dependency manifests in flood risk management: Observations from four decades in the Ennstal and Aist catchments in Austria. *Regional Environmental Change* 23: 31. <https://doi.org/10.1007/s10113-023-02029-y>
- Sekhon, B. (2022, November 9). *Meteorological perspective of the November 2021 atmospheric rivers* [Conference presentation]. Emergency Planning and Business Continuity 2022 Conference, Vancouver, BC, Canada.
- Sepúlveda, S.A., Ward, B.C., Cosman, S.B., & Jacobs, R. (2023). Preliminary investigations of ground failures highway corridors triggered by the mid-November 2021 atmospheric river event along the southwestern British Columbia. *Canadian Geotechnical Journal* 60 (4): 580-586. <https://doi.org/10.1139/cgj-2022-0093>
- Serra-Llobet, A., Jähnig, S.C., Geist, J., Kondolf, G.M., Damm, C., Scholz, M., Lund, J., Opperman, J.J., Yarnell, S.M., Pawley, A., Shader, E., Cain, J., Zingraff-Hamed, A., Grantham, T.E., Eisenstein, W., & Schmitt, R. (2022). Restoring rivers and floodplains for habitat and flood risk reduction: Experiences in multi-benefit floodplain management from California to Germany. *Frontiers in Environmental Science* 8: 778568. <https://doi.org/10.3389/fenvs.2021.778568>
- Sewell Jr., W.H. (1992). A theory of structure: Duality, agency, and transformation. *American Journal of Sociology* 98 (1): 1-29. <http://www.jstor.org/stable/2781191>
- Seymour-Hourie, R., & Carlson, D. (2021, December 15). Listening to the lessons of the lake: Re-imagining flood management in BC. *West Coast Environmental Law*. <https://www.wcel.org/blog/listening-lessons-lake-re-imagining-flood-management-bc>
- Sharma, A.R., & Déry, S.J. (2020). Contribution of atmospheric rivers to annual, seasonal, and extreme precipitation across British Columbia and Southeastern Alaska. *Journal of Geophysical Research: Atmospheres* 125 (9): 1-21. <https://doi.org/10.1029/2019JD031823>
- Sharpe, J. (2016). Understanding and unlocking transformative learning as a method for enabling behavioural change for adaptation and resilience to disaster threats. *International Journal of Disaster Risk Reduction* 17: 213-219. <https://doi.org/10.1016/j.ijdrr.2016.04.014>
- Sheppard, S.R.J., Shaw, A., Flanders, D., Burch, S., Wiek, A., Carmichael, J., Robinson, J., & Cohen, S. (2011). Future visioning of local climate change: A framework for community engagement and planning with scenarios and visualizations. *Futures* 43: 400-412. <http://doi.org/10.1016/j.futures.2011.01.009>
- Silver, T.C., Victor, X.C., Foulds, K., & Schneider, L. (2022). *Semá:th Xó:tsa: Sts’ólemqwelh Sxó:tsa, Great-Gramma’s Lake*. The Reach Gallery Museum. <https://thereach.ca/exhibition/semath-xotsa-great-grammas-lake/>

- Simms, R., Harris, L., Joe, N., & Bakker, K. (2016). Navigating the tensions in collaborative watershed governance: Watershed governance and Indigenous communities in British Columbia, Canada. *Geoforum* 73: 6-16. <https://doi.org/10.1016/j.geoforum.2016.04.005>
- Singh, A. (2021, August). *Flood and Wildfire Advisory Committee*. Union of British Columbia Municipalities. <https://www.ubcm.ca/sites/default/files/2021-08/02-Arjun%20Singh-Flood%20and%20Wildfire%20Advisory%20Committee.pdf>
- Silver, T.C., Victor, X.C., Foulds, K., & Schneider, L. (2022). *Semá:th Xó:tsa: Sts'ólemqwelh Sxó:tsa, Great-Gramma's Lake*. The Reach Gallery Museum. <https://thereach.ca/exhibition/semath-xotsa-great-grammas-lake/>
- Singh Bali, A., Howlett, M., Lewish, J.M., & Ramesh, M. (2021). Procedural policy tools in theory and practice. *Policy and Society* 40 (3): 295-311. <https://doi.org/10.1080/14494035.2021.1965379>
- Slater Vecchio LLP. (2024). *Class action: Sumas Flood Class Action Lawsuit* [Webpage]. <https://www.slatervecchio.com/class-action/sumas-flood-class-action/>
- Sloggy, M.R., Suter, J.F., Rouhi Rad, M., Manning, D.T., & Goemans, C. (2021). Changing opinions on a changing climate: The effects of natural disasters on public perceptions of climate change. *Climatic Change* 168 (25). <https://doi.org/10.1007/s10584-021-03242-6>
- Smith, J. (2019). Overcoming the 'tyranny of the urgent': Integrating gender into disease outbreak preparedness and response. *Gender & Development* 27 (2): 355-369. <https://doi.org/10.1080/13552074.2019.1615288>
- Smith, E., & Verstraten, K. (2013, May 6). Sumas First Nation seeks compensation for its lost lake. *Vancouver Sun*. <https://vancouver.sun.com/news/sumas-first-nation-in-bc-canada-seeks-compensation-for-its-lost-lake-taken-90-years-ago>
- SNC-Lavalin Inc. (2022, June 29). *Preliminary regional risk assessment for contamination related to the 2021 atmospheric river flood event: Sumas Prairie study area*. Prepared for the BC Ministry of Environment and Climate Change Strategy. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/flood-response-and-the-environment/water-quality/sumas_prairie_preliminary_regional_risk_assessment_report.pdf
- Spohr, F. (2016). Explaining path dependency and deviation by combining Multiple Streams Framework and Historical Institutionalism: An analysis of German and Swedish labour market policies. *Journal of Comparative Policy Analysis, Research, and Practice* 18 (3): 257-272. <https://doi.org/10.1080/13876988.2015.1122210>
- Stafford Smith, M., Horrocks, L., Harvey, A., & Hamilton, C. (2011). Rethinking adaptation for a 4°C world. *Philosophical Transactions of the Royal Society A* 369: 196-216. <https://doi.org/10.1098/rsta.2010.0277>
- Statistics Canada. (2022, December 16). *Focus on geography series, 2021 Census of population: Abbotsford, city* [Webpage]. <https://www12.statcan.gc.ca/census-recensement/2021/as-sa/fogs-spg/page.cfm?lang=E&topic=1&dguid=2021A00055909052>
- Stelkia, K., Beck, L., Manshadi, A., Jensen Fisk, A., Adams, E., Browne, A.J., Dixon, C., McEachern, D., Ritchie, W., McDonald, S., Henry, B., Marsden, N., Behn-Smith, D., & Reading, J. (2020). Letsemot, "togetherness": Exploring how connection to land, water, and territory influences health and wellness with First Nations Knowledge Keepers and youth in the Fraser Salish region of British Columbia. *International Journal of Indigenous Health* 16 (2): 356-369. <https://doi.org/10.32799/ijih.v16i2.33206>
- Stephenson, A. (2022, January 21). Feed shortages reaching crisis levels for Canadian cattle producers. *Global News*. <https://globalnews.ca/news/8529897/canadian-cattle-feed-shortages-crisis/>
- Stó:lō Nation. (2018). *Our history* [Webpage]. <https://www.stolonation.bc.ca/history>
- Stó:lō Research and Resource Management Centre. (2014). *S'ólh Téméxw use plan policy*. https://www.srrmcentre.com/files/File/stup_public_policy_v1.0_20141219_final.pdf
- Stó:lō Xwexwilmexw Treaty Association. (N.d.). *Where we live- Aylechootlook 5* [Webpage]. https://www.sxta.bc.ca/about-us/sxta-villages/interactive-map/leqamel/leqamel_aylechootlook_5/#primary
- Stone, D.A. (1989). Causal stories and the formation of policy agendas. *Political Science Quarterly* 104 (2): 281-300. <https://doi.org/10.2307/2151585>

- Streeck, W., & Thelen, K. (Eds). (2005). *Beyond continuity: Institutional change in advanced political economies*. Oxford University Press.
- Suddaby, R., & Greenwood, R. (2009). "Methodological issues in researching institutional change." In D.A. Buchanan & A. Bryman (Eds.), *The SAGE Handbook of Organizational Research Methods* (pp. 176-195). SAGE Publications Ltd.
- Sumas First Nation. (2013). *Sema:th Land Use Plan*. <https://sumasfirstnation.com/wp-content/uploads/2021/06/13-10-30-Sumas-LUP.pdf>
- Sumas First Nation. (n.d.). *Our past* [Webpage]. <https://sumasfirstnation.com/about-sumas-first-nation/our-past/>
- Sumas First Nation. (2024a). *Land governance* [Webpage]. <https://sumasfirstnation.com/lands/land-governance/>
- Sumas First Nation. (2024b). *Chief's message* [Webpage]. <http://www.sumasfirstnation.com/>
- Summer, T. (2024, January 26). Northern B.C. regional district fed up with new emergency act legislation. *Prince George Citizen*. <https://www.princegeorgecitizen.com/bc-news/northern-bc-regional-district-fed-up-with-new-emergency-act-legislation-8165654>
- Surminski, S. & McCraine, S. (2019). Understanding decisions and disasters: A retrospective analysis of Hurricane Sandy's 'focusing power' on climate change adaptation policy in New York City. *Centre for Climate Change Economics and Policy Working Paper No. 360 ISSN 2515-5709 (Online)*. <https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2019/11/working-paper-328-McCraine-Surminski.pdf>
- Swanson, D., Murphy, D., Temmer, J., & Scaletta, T. (2021, July). *Advancing the climate resilience of Canadian infrastructure: A review of literature to inform the way forward*. International Institute for Sustainable Development. <https://www.iisd.org/system/files/2021-07/climate-resilience-canadian-infrastructure-en.pdf>
- Tasoff, H. (2023, August 23). El Niño and La Niña multi-year events could become more common. *The Current, UC Santa Barbara*. <https://news.ucsb.edu/2023/021177/el-nino-and-la-nina-multi-year-events-could-become-more-common>
- Tenzing, J. (2020). Integrating social protection and climate change adaptation: A review. *WIREs Climate Change* 11: e626. <https://doi.org.10.1002/wcc.626>
- Thelen, K. (2004). *How institutions evolve. The political economy of skills in Germany, Britain, the United States, and Japan*. Cambridge University Press.
- Thelen, K., & Mahoney, J. (2015). "Comparative-historical analysis in contemporary political science." In J. Mahoney & K. Thelen (Eds.), *Advances in comparative-historical analysis* (pp.3-38). Cambridge University Press.
- Thistlethwaite, J., & Henstra, D. (2017). Municipal flood risk sharing in Canada: A policy instrument analysis. *Canadian Water Resources Journal* 42 (4): 349-363. <https://doi.org/10.1080/07011784.2017.1364144>
- Thistlethwaite, J., Henstra, D., Brown, C., & Scott, D. (2018). How flood experience and risk perception influences protective actions and behaviours among Canadian homeowners. *Environmental Management* 61: 197-208. <https://doi.org/10.1007/s00267-017-0969-2>
- Thistlethwaite, J., Henstra, D., Brown, C., & Scott, D. (2020). Barriers to insurance as a flood risk management tool: Evidence from a survey of property owners. *International Journal of Disaster Risk Science* 11: 263-273. <https://doi.org/10.1007/s13753-020-00272-z>
- Thistlethwaite, J., Le Geyt, M., Martin, G., Cottar, S., & Whittaker, L. (2023, April). *Buying out the floodplain: Recommendations for strategic relocation programs in Canada*. Partners for Action, University of Waterloo. https://uwaterloo.ca/partners-for-action/sites/default/files/uploads/documents/buyingoutthefloodplainreport_en_1.pdf
- Thompson, S. (2015). Flooding of First Nations and environmental injustice in Manitoba: Case studies of the impacts of the 2011 flood and hydroelectric development in Manitoba. *Manitoba Law Journal* 38 (2): 220-259. https://ocul-wtl.primo.exlibrisgroup.com/permalink/01OCUL_WTL/3b6rcr/cdi_rmit_agispt_search_informit_org_doi_10_3316_agispt_20220119060508
- Tidball, K., Frantzeskaki, N., & Elmqvist, T. (2016). Traps! An introduction to expanding thinking on persistent maladaptive states in pursuit of resilience. *Sustainability Science* 11: 861-866. <https://doi.org/10.1007/s11625-016-0398-9>

- Tompkins, E.L., & Adger, W.N. (2004). Does adaptive management of natural resources enhance resilience to climate change? *Ecology and Society* 9 (2): 10.
<http://www.ecologyandsociety.org/vol9/iss2/art10>
- Tortajada, C., Koh, R., Bindal, I., & Lim, W.K. (2021). Compounding focusing events as windows of opportunity for flood management policy transitions in Singapore. *Journal of Hydrology* 599: 126345.
<https://doi.org/10.1016/j.jhydrol.2021.126345>
- Torenvlied, R., & Akkerman, A. (2004). Theory of ‘soft’ policy implementation in multilevel systems with an application to social partnership in the Netherlands. *Acta Politica* 39: 31-58.
<https://doi.org/10.1057/palgrave.ap.5500046>
- Torres Cordero, A.L. (2020). What is possible? Policy options for long-term disaster recovery in Puerto Rico. *Centro Journal* 32 (3): 199-223.
- Tortajada, C., Koh, R., Bindal, I., & Lim, W.K. (2021). Compounding focusing events as windows of opportunity for flood management policy transitions in Singapore. *Journal of Hydrology* 599: 126345.
<https://doi.org/10.1016/j.jhydrol.2021.126345>
- Tosey, P., Visser, M., & Saunders, M.N.K. (2011). The origins and conceptualizations of ‘triple-loop’ learning: A critical review. *Management Learning* 43 (3): 291-307. <https://doi.org/10.1177/1350507611426239>.
- Tripartite Emergency Management Working Group. (2020, August 11). *Tripartite Emergency Management Working Group terms of reference v.1: Draft—for discussion*.
https://d3n8a8pro7vhm.cloudfront.net/ubcic/pages/4404/attachments/original/1622508415/5.4.5.Terms_of_Reference_-_Tripartite_EM_Working_Group_-_2020-08-12_%28002%29.docx?1622508415
- True, J.L., Jones, B.D., & Baumgartner, F.R. (2007). “Punctuated equilibrium theory: Explaining stability and change in public policymaking.” In P.A. Sabatier (Ed.), *Theories of the policy process* (2nd ed., pp. 155-188). Routledge.
- Tsang, E.W.K., & Zahra, S.A. (2008). Organizational unlearning. *Human Relations* 61 (10): 1435-1462.
<https://doi.org/10.1177/0018726708095710>
- Tuhiwai Smith, L. (2012). *Decolonizing methodologies* (2nd ed.). Zed Books.
- Tuhkanen, H., Han, G., Rosemarin, A., & Davis, M. (2017). *How do we prioritize when making decisions about development and disaster risk?: A look at five key trade-offs*. Discussion brief prepared for the Stockholm Environmental Institute. <https://www.jstor.org/stable/resrep02840>
- UFV Today. (2022, November 8). One year later: Abbotsford Disaster Relief Fund making a difference through \$4.44 million fund. *University of the Fraser Valley*. <https://blogs.ufv.ca/blog/2022/11/one-year-later-abbotsford-disaster-relief-fund-making-a-difference-through-4-44-million-fund/>
- Union of BC Municipalities. (2024a). *Disaster risk reduction-climate adaptation* [Webpage].
<https://www.ubcm.ca/cepf/disaster-risk-reduction-climate-adaptation>
- Union of BC Municipalities. (2024b, March 27). *Province introduces B.C. Flood Strategy* [Webpage].
<https://www.ubcm.ca/about-ubcm/latest-news/province-introduces-bc-flood-strategy>
- United Nations Development Programme. (2009). *Capacity development: A UNDP primer*.
https://www.undp.org/sites/g/files/zskgke326/files/publications/CDG_PrimerReport_final_web.pdf
- United Nations Framework Convention on Climate Change. (2023). *Adaptation and resilience* [Webpage].
<https://unfccc.int/topics/adaptation-and-resilience/the-big-picture/introduction#adaptation>
- United Nations Office for Disaster Risk Reduction. (2021). *Policy brief: Disaster risk reduction and climate change*. <https://www.undrr.org/publication/policy-brief-disaster-risk-reduction-and-climate-change>
- University of the Fraser Valley. (N.d.). *The Flood Stories Project*. Food and Agricultural Institute.
<https://www.ufv.ca/media/assets/food-and-agriculture-institute/pdfs/The-Flood-Stories-Project.pdf>
- University of Toronto Library and Information Services. (n.d.). *Summary of five types of reviews*.
https://guides.hsict.library.utoronto.ca/ld.php?content_id=35353500
- University of Waterloo. (n.d.). *Indigenization and reconciliation at Waterloo* [Webpage]. Faculty Association.
<https://uwaterloo.ca/faculty-association/faculty-guide/indigenization-and-reconciliation-waterloo>
- Valois, J., Indigenous Services Canada, Turner, J., & Braker, C. (2019, April 27). *Canada, British Columbia, and First Nations Leadership Council sign Tripartite Memorandum of Understanding to improve emergency management services for BC First Nations*. Government of British Columbia.

- <https://news.gov.bc.ca/stories/canada-british-columbia-and-first-nations-leadership-council-sign-tripartite-memorandum-of-understan>
- van Buuren, A., Ellen, G.J., & Warner, J.F. (2016). Path-dependency and policy learning in the Dutch delta: Toward more resilient flood risk management in the Netherlands? *Ecology and Society* 21 (4): 43. <https://www.jstor.org/stable/26270023>
- Vanderklippe, N. (2021, December 3). U.S. rebuffed B.C.'s pleas to shore up dike for \$29-million. Now, flood damage will hit \$1-billion. *The Globe and Mail*. <https://www.theglobeandmail.com/world/article-bc-flooding-marks-most-severe-consequence-of-dike-dispute-between/>
- Verster, L. (2023, February 21). BC government investing in climate emergency readiness. *Vernon Matters*. <https://vernonmatters.ca/2023/02/21/b-c-government-investing-in-climate-emergency-readiness/>
- Village of Lytton. (2021, October). *Draft short-term recovery plan*. https://lytton.ca/wp-content/uploads/2021/10/DRAFT_2021-10-27_Village-of-Lytton_Short-TermRecovery-Plan_Final.pdf
- Wachinger, G., Renn, O., Begg, C., & Kuhlicke, C. (2013). The risk perception paradox— Implications for governance and communication of natural hazards. *Risk Analysis* 33 (6): 1049-1065. <https://doi.org/10.1111/j.1539-6924-2012-01942.x>
- Wade, T. (2022, August). *Overview of Canadian communities exposed to sea level rise*. National Collaborating Centre for Environmental Health. <https://ncceh.ca/resources/evidence-reviews/overview-canadian-communities-exposed-sea-level-rise>
- Wall Kimmerer, R. (2013). *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge, and the Teachings of Plants*. Milkweed Editions.
- Walker-Springett, K., Butler, C., & Adger, W.N. (2016). Wellbeing in the aftermath of floods. *Health and Place* 43: 66-74. <https://doi.org/10.1016/j.healthplace.2016.11.005>
- Watershed Security Fund. (2023). *Home* [Webpage]. <https://watershedsecurityfund.ca/>
- Webster, A.K. (2017). Why Tséhootsooí does not equal "Kit Carson Drive": Reflections on Navajo place names and the inequalities of language. *Anthropological Linguistics* 59 (3): 239-262. <https://www.jstor.org/stable/26528942>
- Weichel, A. (2024, March 18). B.C. could face another 'very challenging' wildfire season, officials say. *CTV News Vancouver*. <https://bc.ctvnews.ca/b-c-could-face-another-very-challenging-wildfire-season-officials-say-1.6812251>
- Weichel, A., & Daflos, P. (2021, November 21). 'Parade of storms' heading for B.C., including 2 more atmospheric rivers: Environment Canada. *CTV News Vancouver*. <https://bc.ctvnews.ca/parade-of-storms-heading-for-b-c-including-2-more-atmospheric-rivers-environment-canada-1.5675977>
- Weil, B. (2006). The rivers come: Colonial flood control and knowledge systems in the Indus Basin, 1840s-1930s. *Environment and History* 12 (1): 3-29. <https://www.jstor.org/stable/20723561>
- Wells, N. (2021, December 10). Heat wave, flooding in B.C. may force some to leave dairy industry entirely. *CTV News Vancouver*. <https://bc.ctvnews.ca/heat-wave-flooding-in-b-c-may-force-some-to-leave-dairy-industry-entirely-1.5702399>
- Wenger, E. (2010). "Communities of practice and social learning systems: The career of the concept." In C. Blackmore (Ed.), *Social learning systems and communities of practice* (pp. 179-198). Springer Link. https://doi.org/10.1007/978-1-84996-133-2_11
- Wesselink, A., Kooy, M., & Warner, J. (2017). Socio-hydrology and hydrosocial analysis: Toward dialogues across disciplines. *Wiley Interdisciplinary Reviews: Water* 4: e1196. <https://doi.org/10.1002/wat2.1196>
- West Coast Environmental Law. (2024, March 22). *Statement from the Lower Fraser Floodplains Coalition on B.C.'s new Flood Strategy* [Webpage]. <https://www.wcel.org/media-release/statement-lower-fraser-floodplains-coalition-bcs-new-flood-strategy>
- Whatcom County. (N.d.-a). *Flood recovery information*. <https://www.whatcomcounty.us/3827/Flood-Recovery-Information>
- Whatcom County. (N.d.-b). *2021 flood look-back*. <https://www.whatcomcounty.us/4288/2021-Flood-Look-back>
- Whatcom County Sheriff's Office. (2022, July). *Whatcom County Council November 2021 flood briefing*. <https://www.whatcomcounty.us/DocumentCenter/View/69557/2022-07-26-DEM-Council-Presentation>

- Wheatley, G. (2021, December 22). Flooding in B.C. led to fry shortage at McDonald's in Japan, company says. *CBC News*. <https://www.cbc.ca/news/business/small-fries-japan-mcdonalds-flooding-1.6293768>
- Whyte, K. (2017). Indigenous climate change studies: Indigenizing futures, decolonizing the Anthropocene. *English Language Notes* 55 (1-2): 153-162. <https://doi.org/10.1215/00138282-55.1-2.153>
- Wiering, M., & Arts, B.J.M. (2006). Discursive shifts in Dutch river management: 'Deep' institutional change or adaptation strategy? *Hydrobiologia* 565: 327-338. <https://doi.org/10.1007/s10750-005-5923-2>
- Wiering, M., Liefferink, D., & Crabbé, A. (2017). Stability and change in flood risk governance: On path dependencies and change agents. *Journal of Flood Risk Management* 11 (3): 230-238. <https://doi.org/10.1111/jfr3.12295>
- Williston, B. (2016). "Environmental pragmatism." In B. Williston (Ed.), *Environmental ethics for Canadians*. Oxford University Press.
- Wilson, N.J., & Inkster, J. (2018). Respecting water: Indigenous water governance, ontologies, and the politics of kinship on the ground. *Environment and Planning E: Nature and Space* 1 (4): 516-538. <https://doi.org/10.1177/2514848618789378>
- Withey, P., Lantz, V.A., & Ochuodho, T.O. (2016). Economic costs and impacts of climate-induced sea-level rise and storm surge in Canadian coastal provinces: a CGE approach. *Applied Economics* 48 (1): 59-71. <https://doi.org/10.1080/00036846.2015.1073843>
- Winsemius, H.C., Aerts, J.C.J.H., van Beek, L.P.H., Bierkens, M.F.P., Bouwman, A., Jongman, B., Kwadijk, J.C.J., Ligtoet, W., Lucas, P.L., van Vuuren, D.P., & Ward, P.J. (2016). Global drivers of future river flood risk. *Nature Climate Change* 6: 381-385. <https://doi.org/10.1038/nclimate2893>
- Wlezien, C. (2017). Public opinion and policy representation: On conceptualization, measurement, and interpretation. *Policy Studies Journal* 45 (4): 561-582. <https://doi.org/10.1111/psj.12190>
- Wolfram, M. (2016). Conceptualizing urban transformative capacity: A framework for research and policy. *Cities* 51: 121-130. <https://doi.org/10.1016/j.cities.2015.11.011>
- Wong, C., Ballegooyen, K., Ignace, L., Johnson, M.J.G., & Swanson, H. (2020). Towards reconciliation: 10 calls to action to natural scientists working in Canada. *FACETS* 5: 769-783. <https://doi.org/10.1139/facets-2020-0005>
- Woodward, F.M. (1975). The influence of the Royal Engineers on the development of British Columbia. *BC Studies* 24: 3-51. <https://doi.org/10.14288/bcs.v0i24.817>
- World Renew. (2024, February 9). *Finding recovery from repeated storms*. <https://worldrenew.ca/our-stories/washington-response>
- Wright, J., Bogdan, E., Hamilton, S., Krueger, R., & Andrey, H. (2022). *Inclusive resilience: Reducing disaster risks for Canadians*. Partners for Action, University of Waterloo.
- World Meteorological Organization. (2024). *Extreme weather* [Webpage]. <https://wmo.int/topics/extreme-weather>
- Yadav, P., Saville, N., Arjyal, A., Baral, S., Kostkova, P., & Fordham, M. (2021). A feminist vision for transformative change to disaster risk reduction policies and practices. *International Journal of Disaster Risk Reduction* 54: 102026. <https://doi.org/10.1016/j.ijdrr.2020.102026>
- Young, O.R. (2002). *The institutional dimensions of environmental change: Fit, interplay, and scale*. The MIT Press. <https://doi.org/10.7551/mitpress/3807.001.0001>
- Yumagulova, L. (2020). Disrupting the riskscape of inequities: A case study of planning for resilience in Canada's Metro Vancouver region. *Cambridge Journal of Regions, Economy, and Society* 13 (2): 293-318. <https://doi.org/10.1093/cjres/rsaa029>
- Yumagulova, L., Parsons, M., Yellow Old Woman-Munro, D., Dicken, E., Lambert, S., Vergustina, N., Scott, J.C., Michell, P., & Black, W. (2023). Indigenous perspectives on climate mobility justice and displacement-mobility-immobility continuum. *Climate and Development*. <https://doi.org/10.1080/17565529.2023.2227158>
- Zahariadis, N. (2007). "The multiple streams framework: Structure, limitations, prospects." In P.A. Sabatier (Ed.), *Theories of the policy process* (2nd ed., pp. 65-92). Routledge.
- Zahariadis, N. (2016). Delphic oracles: Ambiguity, institutions, and multiple streams. *Policy Sciences* 49: 3-12. <https://doi.org/10.1007/s11077-016-9243-3>

- Zhang, M., & Wei, X. (2014). Alteration of flow regimes caused by large-scale forest disturbance: A case study from a large watershed in the interior of British Columbia Canada. *Ecohydrology* 7: 544-556. <https://doi.org/10.1002/eco.1374>
- Ziolecki, A., Thistlethwaite, J., Henstra, D., & Scott, D. (2020, September). *Canadian voices on flood risk: Findings from a national survey about how we should manage an increasingly costly and common peril*. Partners for Action, University of Waterloo. https://uwaterloo.ca/partners-for-action/sites/default/files/uploads/files/finalreport_nationalsurvey_sept20.pdf
- Zscheischler, J., Westra, S., Van Den Hurk, B.J.J.M., Seneviratne, S.I., Ward, P.J., Pitman, A., Aghakouchak, A., Bresch, D., Leonard, M., Wahl, T., & Zhang, X. (2018). Future climate risk from compound events. *Nature Climate Change* 8 (6): 469–477. <https://doi.org/10.1038/s41558-018-0156-3>

Appendix A: Semi-structured interview guide

Sample introduction:

- Can you share about your role and a little more about the work that you do within your organization?
- Can you tell me about your prior experience working on [X] initiative?

Sample organization-specific questions:

- How is your organization working to incorporate climate resiliency into your programming?
- How is your organization working to reduce flood and disaster impacts to [X]?
- On [date], your organization released a statement on [X]. Are you able to provide an update and elaborate on what progress has been made on this initiative since then?
- Prior to the November 2021 AR, had your organization tried implementing any new strategies to improve climate resiliency or flood risk reduction?
 - New policies/ procedures/ instruments/ strategies
- Can you please share how your organization is working to advance flood/ climate resiliency (locally or provincially)?
- Can you please tell me about [X] program/ initiative/ strategy?
 - Next steps, updates
 - Key themes, lessons learned, surprises
 - Challenges, obstacles, opportunities
- Can you elaborate on how your organization is working to address watershed governance challenges in [region]?
- Can you elaborate on how your organization is working to incorporate local and Indigenous knowledges, values, and leadership in regional flood management?
- How is your organization is working with [other organization(s)] to advance flood resiliency in BC?

Sample event-specific questions:

- Can you describe your experience of the 2021 AR event? / Can you describe your organization's role in responding to the disaster?
- Within your organization, have you noticed any changes as a direct result of the event?
- How has your work been informed by the events of last fall?
- Has the 2021 AR event prompted the emergence of any new opportunities or challenges for the work you are doing?
- Has this event influenced long-term climate change planning within your organization?
- Has this event resulted in any shifts in your organization's roles and responsibilities?
- In your opinion, did anything set the 2021 AR event apart from previous flood events experienced by the province?
- Between November 2021 and this current freshet season, have you noticed any changes in how the province is preparing for potential flooding from the Fraser River?
- Have you seen any shifts in public awareness/ political will/ collaboration/etc. since the 2021 AR event?

- Following the 2021 AR event, have you seen or do you foresee any new funding or governance arrangements coming out of it?
- Since the 2021 AR event (or in recent years), have you noticed any shifts in expanding the flood adaptation toolbox beyond structural solutions (e.g., nature-based solutions, managed retreat, working with water)?
- Do you think that BC experiencing three climate disasters—heat dome, Lytton wildfire, AR floods—within the span of 6 months has influenced how the 2021 AR event unfolded [i.e., *response, recovery, impact*], as opposed to if BC had not experienced those other events or if these events were spread out over a longer timeframe?

Sample general policy landscape/theme-specific questions:

- In your opinion, what are some of the things that need to be done to help move us from that reactive state to a proactive long-term planning, resilience-thinking framework?
- From your perspective, what is currently missing from flood management in BC?
- From your perspective, what needs to be done to improve community resilience in Sumas Prairie/ British Columbia?
- In your opinion, what does building back better mean for BC and what is needed to achieve this?
- Over the course of your career, have you noticed any shifts in flood risk management/ emergency management/ climate literacy/ public risk perceptions/ etc.?
- In your experience, is it easier for local governments to obtain funding for flood mitigation/adaptation works after a major flood disaster, as opposed to when seeking to implement proactive measures and updates?
- Have you noticed any differences or shifts in the way that decision-makers/ the public/etc. responded to the 2021 disasters in comparison to the 2017/2018 season?

Sample core questions that I asked all participants:

- Do you think that the Nov. 2021 flood event has acted as a focal point in policy- and decision-making in British Columbia, and in what ways?
- In your opinion, what has been the most significant outcome of the 2021 AR event?

Sample conclusion:

- Is there anything that you would like to add to our conversation today that I haven't asked you about yet or you'd like to revisit again?
- Are there any documents/ organizations that you would recommend I look into?

Appendix B: Recruitment email

Sample 1: Email script—addressed to a specific recipient; allowed for attachments

Hello [Name],

I am reaching out to you regarding your instrumental role in disaster risk reduction and climate resilience as the [Job Title] of [Organization].

I am a Master of Environmental Studies student at the University of Waterloo currently conducting research on the November 2021 atmospheric river flood event. My thesis, focusing on a case study of Sumas Prairie, will examine to what extent the recent flood has influenced flood mitigation, emergency management, climate change adaptation, and disaster risk reduction policies within the province, as well as prompted any new governance or funding opportunities.

Based on your wealth of expertise on the subject, I would like to interview you about your perspectives on how the November 2021 floods may have influenced emergency preparedness, flood mitigation, and climate change adaptation within [*e.g.*, specific sector/ program/ region], as well as any current initiatives that [Organization] is involved in.

If you would be interested in speaking with me and have 30-60 minutes to spare, I would love to schedule a time to meet with you. If so, I am happy to connect virtually through Zoom.

More information about this project can be found in the **attached recruitment letter**. Interviews may be either anonymized or attributed, depending on your preference, and a copy of the interview would be sent back to you to allow for statements to be reviewed, redacted, or revised.

Thank you for your time and consideration,

Felicia Watterodt

Sample 2: Contact box script—general contact page; did not allow for attachments

Hello, I am a Master of Environmental Studies student at the University of Waterloo currently conducting research on the November 2021 atmospheric river flood event. My thesis will examine to what extent recent climate and flood disasters have influenced policymaking and governance. I am interested in interviewing a representative of [Organization] about your organization's policy advocacy and programs around [*e.g.*, climate/flood resiliency]. In particular, I am interested in speaking about [Organization]'s work around [specific strategy], disaster mitigation, and investments in resilient and built infrastructure. If a representative of [Organization] would be willing to speak with me or would like to learn more information about my study, please reach out to me at felicia.watterodt@uwaterloo.ca. I appreciate your time and consideration. Sincerely, Felicia Watterodt

Appendix C: Recruitment letter



[Date]

Dear [Name],

My name is Felicia Watterodt and I am a Master of Environmental Studies student working in the Department of Geography and Environmental Management at the University of Waterloo. I am currently conducting research under the supervision of Dr. Brent Doberstein on the Pacific Institute for Climate Solutions' [Living with Water project](#). As part of my research on flood adaptation, I am conducting interviews with professionals, experts, and community leaders to discover their perspectives on the recent November 2021 atmospheric river flood event and how this disaster has influenced policy, funding, and governance at the local, provincial, and federal scales.

As you play an instrumental role in climate change adaptation and disaster mitigation through your work with [Organization], I would like to speak with you about your perspectives on the recent flood disaster and its impact on flood risk management policies and governance within British Columbia. We are currently inviting people to participate in this study. Your contact information was obtained through your organization's website.

Participation in this study involves answering a series of questions in a semi-structured interview pertaining to your relevant experience and expertise on the subject matter. The interview can be conducted either in-person, over the phone, or through a virtual platform, such as Zoom, depending on your preference and convenience. Participation in this study is expected to take approximately 30-60 minutes of your time. To ensure transparency and allow you to redact or revise any statements provided during the interview, you will be provided a copy of the interview transcript within 72 hours of the interview and given the opportunity to review the transcript.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Board.

The following time slots are available to participate in this study:

- June- July, Monday-Friday, 9:00 am- 5:00 pm

If you are interested in participating, please contact me at felicia.watterodt@uwaterloo.ca and list your availability to schedule a meeting. I will then send a confirmation email indicating that you have been signed up for one of those times and provide you with further information concerning the location of the study. If you have to cancel your appointment, please email me at felicia.watterodt@uwaterloo.ca

Sincerely,

Felicia Watterodt

A handwritten signature in cursive script that reads "Felicia Watterodt".

University of Waterloo, Department of Geography and Environmental Management

Appendix D: Information and consent letter



University of Waterloo

[Date]

Dear [Name]

This letter is an invitation to consider participating in a research study that I am conducting as part of my Master of Environmental Studies degree in the Department of Geography and Environmental Management at the University of Waterloo under the supervision of Professor Brent Doberstein. I would like to provide you with more information about this project and what your involvement would entail if you decide to take part.

This study will examine the post-disaster recovery of Sumas Prairie, Abbotsford and seek to understand how the November 2021 British Columbia flood event may influence disaster risk management approaches and climate change adaptation policies. The research will focus on a case-study of Sumas Prairie, while situating this community within the regional context of the Fraser Valley and Lower Mainland, as well as the Province of British Columbia's responses to the flood event. The purpose of this research is to understand to what extent this 2021 flood disaster may prompt formal and informal adaptation responses, and what post-disaster lessons can be learned as affected municipalities recover, rebuild, and plan for future floods. The expected outcome of this study is to contribute new insights into the connections between flood risk reduction and climate change adaptation, as communities seek to balance short-term recovery with long-term proactive solutions in order to strengthen overall resilience. The data collected during interviews will contribute insights into the recovery policies, flood adaptation planning, and community risk perceptions that emerge in the post-disaster landscape.

Therefore, I would like to include your organization as one of several organizations to be involved in my study. I believe that, based on your involvement and expertise in flood recovery/adaptation, you are best suited to speak to the various issues related to my project.

Participation in this study is voluntary. It will involve an interview of approximately 30-60 minutes in length to take place in-person or virtually, depending on your preference. In-person interviews will take place in a mutually agreed upon location in accordance with appropriate Covid-19 social distancing protocols. Virtual interviews will be conducted over an online platform, Zoom. Zoom has implemented technical, administrative, and physical safeguards to protect the information provided via the Services from loss, misuse, and unauthorized access, disclosure, alteration, or destruction. However, no internet transmission is every fully secure or error free.

You may decline to answer any of the interview questions if you so wish. Further, you may decide to withdraw from this study, without any negative consequences, before June 2023, by advising the researcher; however, once data is published, it may not be possible to pull your data from the study. With your permission, the interview will be audio recorded to facilitate collection of information, and later transcribed

for analysis. Shortly after the interview has been completed, I will send you a copy of the transcript to give you an opportunity to confirm the accuracy of our conversation and to add or clarify any points that you wish. Your identity will be confidential. Your name will not appear in any thesis or report resulting from this study, unless you express wishes otherwise for your quotes to be attributed; however, with your permission anonymous quotations may be used. You may choose whether your organization remains anonymous or is attributed. Data collected during this study will be retained for at least 7 years in an encrypted file. Only researchers associated with this project will have access to the data. Overall results of this project may be shared with researchers involved the overarching Pacific Institute for Climate Solutions' *Living with Water* project, associated with this master's thesis. When results are being shared with the Living with Water project, participant confidentiality will be maintained, and no identifying details of the participant or organization will be shared, unless consent is otherwise provided to be specifically attributed. There are no known or anticipated risks to you as a participant in this study.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Board (REB #44110). If you have questions for the Board, contact the Office of Research Ethics, at 1-519-888-4567 ext. 36005 or reb@uwaterloo.ca.

For all other questions or if you would like additional information to assist you in reaching a decision about participation, please contact me by email at felicia.watterodt@uwaterloo.ca. You can also contact my supervisor, Dr. Brent Doberstein at 519-888-4567 ext. 43384 or email bdoberst@uwaterloo.ca.

I hope that the results of my study will be of benefit to those organizations directly involved in the study, other community members and organizations not directly involved in the study, as well as to the broader research community.

I very much look forward to speaking with you and thank you in advance for your assistance in this project.

Yours Sincerely,

Felicia Watterodt

CONSENT FORM

By signing this consent form, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

I have read the information presented in the information letter about a study being conducted by Felicia Watterodt of the Department of Geography and Environmental Management at the University of Waterloo. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.

I am aware that I have the option of allowing my interview to be audio recorded to ensure an accurate recording of my responses.

I am also aware that excerpts from the interview may be included in the thesis and/or publications to come from this research, with the understanding that the quotations will be anonymous.

I was informed that I may withdraw my consent at any time without penalty by advising the researcher.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Board (REB #44110). If you have questions for the Board contact the Office of Research Ethics, at 1-519-888-4567 ext. 36005 or reb@uwaterloo.ca.

For all other questions contact Felicia Watterodt at felicia.watterodt@uwaterloo.ca

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

☐ YES ☐ NO

I agree to have my interview audio recorded.

☐ YES ☐ NO

I agree to the use of anonymous quotations in any thesis or publication that comes of this research.

☐ YES ☐ NO

Participant Name: _____ (Please print)

Participant Signature: _____

Witness Name: _____ (Please print)

Witness Signature: _____

Date: _____

Appendix E: Anonymized list of interview participants

Stratum	Code	Individual Role	Primary Affiliation
Civil society	1	Director	Environmental Organization
	2	Executive Director	Community Organization
	3	Manager	Agricultural Organization
	4	Manager	Environmental Organization
	5	Director	Environmental Organization
	6	Director	Environmental Organization
	7	Manager	Environmental Organization
	8	Manager	Community Organization
Subject matter expert	9	Senior Engineer	Engineering Consultant
	10	Senior Engineer	Engineering Consultant
	11	Researcher, Practitioner	BC University
Local governance	12	Elected Official	Political Organization
	13	Senior Policy Analyst	Municipal Governance Organization
	14	Elected Official	Regional Governance Organization
	15	Policy Advisor	Municipal Governance Organization
Provincial government	16	Manager	Provincial Government
	17	Director	Provincial Government
	18	Executive Director	Provincial Government
	19	Executive Director	Provincial Government
	20	Director	Provincial Government
	21	Director	Provincial Government
Federal government	22	Director	Federal Government
International (USA)	23	Senior Engineer	Municipal Government
	24	Manager	Municipal Government
	25	Director	Environmental Organization
Emergency management / DRR professional	26	Director	Provincial Government
	27	Manager	Regional Governance Organization
	28	Manager	First Nations Organization
	29	Senior Staff Member	Provincial Government
	30	Executive Lead	Provincial Government

Appendix F: Verbal consent script

Introduction:

Hello. I'm Felicia Watterodt. I am conducting research about flood adaptation and post-disaster recovery following the November 2021 British Columbia flood event. This interview is part of my master's research at the University of Waterloo. I'm working under the supervision of Dr. Brent Doberstein of the University of Waterloo's department of Geography and Environmental Management. Thank you for your interest in participating in my research.

Have you had time to read the Letter of Information and Consent that I sent you?

Option 1 [Yes]:

If the LOI was provided in advance and the participant responds that they have read the LOI:

Great, then I would like to take a moment to review some main points from the Letter of Information before we continue.

Proceed to review the highlights of the LOI, be sure to include risks and what will happen with their data and confirm the important points about voluntary participation and withdrawal listed below.

- Your participation in this study is voluntary. If you do not want to answer some of the questions you do not have to, but you can still be in the study.
- You can decide to stop at any time, even part-way through the interview for whatever reason.
- If you decide to stop during the interview, we will ask you how you would like us to handle the data collected up to that point, whether returning it to you, destroying it or using the data collected up to that point.
- You can ask to remove your data from the study up until approximately June 2023. After the data is published, it may not be possible to pull out your data. Data collected during this study will be retained for at least 7 years in an encrypted file and only researchers associated with this project will have access to the data.
- This study has been reviewed and received clearance from a University of Waterloo Research Ethics Board.

Do you have any questions or want me to go over any study details again?

Option 2 (No):

If the participant responds that they did not read the LOI in advance, then proceed to go through the full LOI in detail with the participant and confirm the important points about voluntary participation and withdrawal listed below.

- I'm going to start with a project overview and then provide you with some information about what your involvement will entail if you decide to proceed with the interview.
- This study will examine the post-disaster recovery of Sumas Prairie, Abbotsford and seek to understand how the November 2021 British Columbia flood event may influence disaster risk management approaches and climate change adaptation policies. The purpose of this research is to understand to what extent this 2021 flood disaster may prompt formal and informal adaptation responses, and what post-disaster lessons can be learned as affected municipalities recover, rebuild, and plan for future floods. The expected outcome of this study is to contribute new insights into the connections between flood risk reduction and climate change adaptation, as communities seek to balance short-term recovery with long-term proactive solutions in order to strengthen overall resilience. The data collected during interviews will contribute insights into the recovery policies, flood adaptation planning, and community risk perceptions that emerge in the post-disaster landscape.
- Your participation in this study is voluntary. If you do not want to answer some of the questions you do not have to, but you can still be in the study.
- You can decide to stop at any time, even part-way through the interview for whatever reason.
- With your permission, the interview will be audio recorded to facilitate collection of information, and later transcribed for analysis. Shortly after the interview has been completed, I will send you a copy of the transcript to give you an opportunity to confirm the accuracy of our conversation and to add or clarify any points that you wish.
- Your identity will be confidential. Your name will not appear in any thesis or report resulting from this study, unless you express wishes otherwise for your quotes to be attributed; however, with your permission anonymous quotations may be used. You may choose whether your organization remains anonymous or is attributed.
- If you decide to stop during the interview, we will ask you how you would like us to handle the data collected up to that point, whether returning it to you, destroying it or using the data collected up to that point.
- You can ask to remove your data from the study up until approximately June 2023. After the data is published, it may not be possible to pull out your data. Data collected during this study will be retained for at least 7 years in an encrypted file and only researchers associated with this project will have access to the data.
- Overall results of this project may be shared with researchers involved the overarching Pacific Institute for Climate Solutions' *Living with Water* project, associated with this master's thesis. When results are being shared with the Living with Water project, participant confidentiality will be maintained, and no identifying details of the participant or organization will be shared, unless you express consent to have your organization or name specifically attributed.
- There are no known or anticipated risks to you as a participant in this study.
- This study has been reviewed and received clearance from a University of Waterloo Research Ethics Board.

Consent questions:

Great, I'd like to go over a few consent questions verbally and document your answers.

1) Do you agree to participate in this study?

→ If yes, proceed with further questions.

→ If no, "Thank you for your time."

2) You have a choice of remaining anonymous or having your quotes attributed to you/your organization. Do you wish to be identified in the report/results or remain anonymous?

→ *If the participant wishes to remain anonymous, explain that their identity will remain confidential and will only be referred to in the study results using a randomly generated numerical code (e.g., 001).*

→ *If the participant wishes to be attributed, specifically clarify how they wish to be identified:*

Do you want your quotations to be attributed using your name and/or role within your organization?

→ *Remind the participant that they will have an opportunity to review the interview transcript and may ask for any quotations to be removed, revised, or anonymized if they choose.*

3) Do you agree to allow your [anonymized/attributed] study data to be stored and used for future research as described in the Letter of Information and Consent?

4) Do you agree to audio recording?

5) Would you like a copy of the study results? If yes, where should we send them (email, mailing address)?

Appendix G: Feedback letter



[Date]

Dear [Name],

I would like to thank you for your participation in this study entitled **Community adaptation and climate disaster: the 2021 British Columbia floods as a focusing event for policy change**. As a reminder, the purpose of this research is to understand to what extent this 2021 flood disaster may prompt formal and informal adaptation responses in the region, and what post-disaster lessons can be learned as municipalities recover, rebuild, and plan for future floods.

The data collected during interviews will contribute to a better understanding of flood adaptation and community risk perception in the Abbotsford and surrounding Fraser Valley area, and will provide vital insight into how to strengthen regional climate resilience. Thank you for your contribution to this knowledge.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Board (REB #44110). If you have questions for the Board, please contact the Office of Research Ethics, at 1-519-888-4567 ext. 36005 or reb@uwaterloo.ca.

For all other questions contact Felicia Watterodt at felicia.watterodt@uwaterloo.ca

Your identity will be confidential and all data will remain anonymous, although with your permission, attributed quotes may be used in the published study results. Once all the data are collected and analyzed for this project, I plan on sharing this information with the research community through seminars, conferences, presentations, and journal articles. If you are interested in receiving more information regarding the results of this study, or would like a summary of the results, please provide your email address, and when the study is completed, I will send you the information. In the meantime, if you have any questions about the study, please do not hesitate to contact me by email as noted below.

Sincerely,

A handwritten signature in cursive script that reads "Felicia Watterodt".

Researcher:

Felicia Watterodt
MES Candidate, University of Waterloo
Department of Geography and Environmental Management
felicia.watterodt@uwaterloo.ca

Supervisor:

Dr. Brent Doberstein
Associate Professor, University of Waterloo
Department of Geography and Environmental Management
bdoberst@uwaterloo.ca

Appendix H: Long-term Flood Mitigation Options Comparison Chart (City of Abbotsford, 2024)

 COMPARISON CHART					
Long-term Flood Mitigation Options COMPARISON CHART					
	OPTION #1	OPTION #2	OPTION #3	OPTION #4	PREFERRED OPTION
DIKES					
Permanently repair parts of Sumas Dike (make temporary repairs from November 2021 permanent only)	✓	✓	✓	✓	✓
Reinforce and raise parts of Sumas Dike			✓	✓	
Reinforce and raise parts of Vedder Dike			✓	✓	✓
Modify parts of existing Sumas Dike					✓
Relocate part of Sumas Dike and setback to allow for flood overflow channel, east of Sumas First Nation Reserve			✓	✓	✓
New relocated dike along north side of Hwy 1 (from Atkinson Rd to floodboxes)			✓	✓	✓
New dike to protect Huntingdon area to Hwy 1			✓		
New dike along Saar Creek, extending along border			✓		
New dike on both sides of Sumas River (through Sumas Prairie West - extends along border and protects Huntingdon area)				✓	
New dikes through Sumas Prairie West, extending along the border and to protect Huntingdon area and Arnold area					✓
New dike around Sumas First Nation Reserve			✓	✓	✓
Remove Interceptor Dike in Arnold area (to restore flow to Lake Bottom)				✓	
PUMP STATIONS					
Upgrade resiliency of Barrowtown Pump Station	✓	✓	✓	✓	✓
New Sumas River pump station		✓	✓	✓	✓
New pump stations in Sumas Prairie West at Marshall Creek (2 locations) and Saar Creek				✓	✓

 COMPARISON CHART Long-term Flood Mitigation Options COMPARISON CHART					
	OPTION #1	OPTION #2	OPTION #3	OPTION #4	PREFERRED OPTION
DESIGNATED FLOODWAYS					
Designated temporary flood storage area in the Lake Bottom			✓		✓
Sumas Prairie West				✓	✓ (smaller)
Sumas Prairie North from Atkinson Rd to Barrowtown Pump Station floodboxes north of Hwy 1			✓	✓	✓
CONTROLLED OVERFLOWS					
Create controlled overflow locations in Lake Bottom (via flood overflow path)			✓ (less than one in 200 years)	✓ (only for events over one in 200 years)	✓ (less than one in 200 years)
Create controlled flows at border to Saar Creek and Arnold Slough			✓ Arnold Slough only	✓	✓ Arnold Slough only
Create flood overflow route around the Angus Campbell Road area					✓
UNPROTECTED FLOODPLAIN					
Sumas Prairie West (private mitigation only)	✓	✓	✓		✓
SUPPORTING INFRASTRUCTURE (BY PROVINCE)					
Hwy 1 expected to be raised			✓ from Hwy 11 to Atkinson Rd	✓ from east of Sumas First Nation Reserve to Atkinson Rd	✓ from east of Sumas First Nation Reserve to Atkinson Rd
Southern Railway raised				✓	
LAKE BOTTOM PROTECTION LEVEL (NOOKSACK)					
Approximate protection level provided**					
*NOTE: While the size of a flooding event is projected to occur once in so many years, they may occur more frequently.	Up to a one in 35 year event	Up to a one in 50-100 year event	Up to a one in 200 year event	Up to a one in 200 year event	Up to a one in 200 year event
**NOTE: with climate change consideration					
COSTS (ESTIMATIONS)					
Nooksack/Sumas Prairie Protection & Resiliency	\$100M	\$800M	\$2B	\$2.3B	\$2.5B
Clayburn Village Resiliency	\$32M	\$32M	\$32M	\$32M	\$32M
New Water Source Resiliency	\$77M	\$77M	\$77M	\$77M	\$84M*
Matsqui Dike Resiliency	—	\$388M	\$388M	\$388M	\$388M
TOTAL ESTIMATED COST	\$209M	\$1.297B	\$2.497B	\$2.797B	\$3.004B
*In 2022, the BC Government provided a \$62M grant to support this work.					
For more information visit www.letstalkabbotsford.ca/abbotsfordfloodresponse					