



Designing for flood resilience:

Workshop Series Summary Reports and Infographics

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Disclaimer

This report was produced as part of the UBC Sustainability Scholars Program, a partnership between the University of British Columbia and various local governments and organizations in support of providing graduate students with opportunities to do applied research on projects that advance sustainability across the region.

This project was conducted under the mentorship of staff from Resilient-Waters (a project of MakeWay) and the Watershed Watch Salmon Society. The opinions and recommendations in this report and any errors are those of the author and do not necessarily reflect the views of Resilient-Waters, the Watershed Watch Salmon Society or the University of British Columbia.

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The 'Designing for flood resilience' workshops seek to bring relevant stakeholders together to discuss issues related to watershed management as well as flood control infrastructure and its impacts on the land, the environment, and the people of the Lower Fraser River. The intention is that this work will help amplify the voices of First Nations in these conversations, whose lands are particularly vulnerable to flood risks and who have historically been excluded from decisions involving land management in the Lower Fraser.

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Executive Summary

Nearly 200 years since European settlement around the Lower Fraser River began, there have been significant consequences on the hydrological and natural processes of the river's ecosystems. Vast stretches of valuable floodplain salmon habitat in the Lower Fraser have become inaccessible due to flood control infrastructure across the region such as floodgates, pump stations and dikes. As existing infrastructure nears the end of its lifespan, there is a window of opportunity to implement more sustainable alternatives. Resilient-Waters, along with partner organizations, prepared the 'Designing for flood resilience' series of workshops, seeking to bring stakeholders together and spark discussions for transformative change that will benefit both ecosystems and communities.

The first workshop ("Challenges and recommendations for flood infrastructure") was originally intended to discuss issues related to the implementation of more fish-friendly alternatives to flood gates. The discussion in breakout groups and the virtual mural board was broadened to cover issues related to implementing flood infrastructure in general. Emerging themes were identified, and issues associated with every phase of project implementation were discussed. Participants voted on which issues they felt were most important to address first. The challenges related to permitting were further explored in subsequent interviews with practitioners, which highlighted the need to coordinate with various agencies and levels of government, as well as the complexity of evaluating permitting applications given the need for site-specific considerations.

The second workshop focused on discussing the removal of in-stream barriers in order to restore salmon habitat. Speaker presentations focused on approaches being used in different places to help determine which barriers to prioritize for removal, as well as a specific habitat restoration project led by local First Nations. Participants were able to join a team exercise with a simplified watershed model for discussing and prioritizing barrier for removal considering multiple factors and budget constraints.

Results from the workshops and interviews reflect that there is a good understanding of the problems and ideal flood infrastructure solutions. Future discussions could focus more on determining how to move towards that vision. The desired transformation needs to be accompanied with significant changes in legislation and collaboration between levels of government in order to improve financial support for communities, providing design guidance, and creating incentives for the implementation of flood control infrastructure projects, including more fish-friendly alternatives.

Introduction

The Lower Fraser River is one of the world's most important salmon rivers. However, significant stretches of valuable floodplain habitat have become inaccessible due to an extensive network of flood control infrastructure across the region such as floodgates, pump stations and dikes. As existing infrastructure ages and nears the end of lifespan, there is a window of opportunity to implement more sustainable alternatives, developed in meaningful collaboration with First Nations rightsholders and other relevant stakeholders, that ensure flood protection while offering potential for habitat enhancement.

Resilient Waters, along with partner organizations such as the Watershed Watch Salmon Society (WWSS), brings expertise and resources to boost capacity-building activities in communities across the Lower Mainland. They seek to bring stakeholders together and spark discussions for transformative change that will benefit both ecosystems and communities.

The author worked under the supervision of Dan Straker (Resilient Waters) and Lina Azeez (WWSS) in the spring and summer 2023 as part of UBC's Sustainability Scholars program. The work during the internship mainly consisted of assisting in the facilitation of two workshops part of the "Designing for flood resilience" series, as well as producing reports and media content to summarize the findings and the discussions that took place.

Background

European settlement in the area around the Lower Fraser River began in 1827 as urbanization and agricultural development began transforming the landscape. Forest cover was reduced from 71% to 50% in 1930. In a similar way, wetland areas decreased from 10% to only 1% over the same period. Initial development was followed by diking of the riverbanks in the 1860s. By the 1930s, much of the area around the delta and lowlands of the Fraser River had been taken over by urbanization and agriculture (Boyle et al., 1997).

The development that occurred over the past 200 years had significant consequences on the hydrological and natural processes of the river ecosystems. Diking infrastructure has limited flow conveyance along the floodplains, increasing both the flood risks at specific points in the watershed as well as the consequences of a flooding event in case of dike failure. First Nations communities are disproportionately affected. Across Canada, around 81% of indigenous land reserves are located within flooding risk hot spots, exacerbating social vulnerability and

threatening food security, livelihoods, as well as cultural practices (Adriano, 2022; Resilient Waters, 2020; WWSD, 2018).

Urbanization and development of the area has also had significant ecological consequences across the region. Based on land surveys from the second half of the 19th century, it is estimated that around 85% of historical salmon habitat along the Lower Fraser has been destroyed by development or disconnected due to the implementation of flood control infrastructure, such as dikes, flood gates and pumping station (Basu, 2021). This aggravates the problem of already declining stocks of salmon in the Lower Fraser. A 2021 DFO (2021) report estimated that 2019 and 2020 were consecutively the lowest years of Lower Fraser sockeye returns on record.

One of the main problems associated with some of the flood control infrastructure designs that have been widely used in the past relates to how often and for how long they allow water to flow freely between upstream and downstream reaches. For instance, conventional top-mounted flood gates, which help maintain a safe water level upstream if waters rise too much in the main branch downstream, do allow for the gates to open and for upstream and downstream branches to connect. However, the mechanism and weight of the lid result in the gate being open only during a relatively short periods of time, which may not coincide with those when fish are trying to swim upstream. This can drastically reduce the habitat that is reachable during spawning season. Other forms of flood control infrastructure face similar issues. For instance, conventional pump stations may harm or even kill fish that get sucked in it. Advances in engineering design have allowed alternatives to be developed that allow for better fish passage and upstream-downstream connectivity, while still offering flood protection in the case of emergency. Self-regulated gates, for example, may use counter-balance mechanisms, side-mounted gates, as well as remote sensors or floats that allow the gate to remain opened for longer periods of time (Kuntz, 2013).

The existing flood infrastructure is aging and may eventually need to be replaced or retrofitted in order to meet current standards. This has created a window of opportunity for transformative change into a more sustainable watershed management that takes into consideration the health of the ecosystems, the social impacts and the economic development of the area. Transitioning away from the way development has unfolded since European settlement in the region requires building a shared vision for the future through meaningful dialogue and collaboration including all relevant stakeholders, especially voices that had been historically excluded and marginalized. The 'Designing for flood resilience' workshop series seeks to contribute to these conversations,

bringing people together to discuss challenges and solutions together. (City of Surrey, 2019 ; Resilient Waters, 2020)

Methodology

Formal planning for each of the workshops was carried out by Dan Straker and partners from the WWSA and University of Waterloo's Partners4Action. Preparation for the events included attending meetings for facilitators ahead of each of workshop in order to review the agenda, activities, facilitators roles, means of communication during the event, and an overview of shared resources (e.g., note taking templates, figures that would be used for activities, etc.).

All workshops organized as part of the 'Designing for Flood Resilience' were held virtually over Zoom. Invitations to participants were sent out by Dan Straker and included a short registration poll to get a sense of the sectors participants were coming from (e.g., local or provincial governments), and their main areas of interest for the event. The following sections describe the different events in which the author participated and the kind of outputs that were produced in each case.

Workshop 1: Challenges and recommendations for flood infrastructure

The first workshop took place on **April 13th, 2023**. The event was originally intended to discuss issues related to the implementation of more fish-friendly flood control infrastructure (such as floodgates) and included a presentation from the City of Surrey on the state of the municipality's infrastructure and one brief presentation on some fish-friendly designs that have been used in various places. However, the discussion organically expanded to cover issues related to the implementation of flood infrastructure in general. Participant interactions consisted of breakout groups for discussing issues related to three main phases of infrastructure implementation (planning and collaboration, design and construction, and operation and maintenance). A virtual mural board allowed participants to write down notes, and participants were able to vote on which issues were the most pressing to address. Facilitators moderated the breakout groups, helped organize the notes written on the virtual mural board, and took separate summary notes. A full, separate report and infographics are available for consultation.

Workshop 2: Prioritizing in-stream barrier removal

The second workshop in the ‘Designing for Flood Resilience’ series was held on **June 1st, 2023**, and focused on discussing the removal of in-stream barriers in order to restore salmon habitat. The first part of the event consisted of a series of presentations on approaches being used in different places to help determine which barriers to prioritize for removal. Two members of local First Nations also talked about a specific habitat restoration project, and the kinds of challenges their communities are facing to help advance flood infrastructure plans. The second part of the workshop consisted of a team exercise where participants were presented with a simplified watershed model and then they discussed in breakout rooms which of the barriers shown in the model they would choose to remove with a given budget level. A full, separate report and infographics are available for consultation.

Lower Fraser Floodplains Forum

The scholar was invited to participate as a note taker at the **Lower Fraser Floodplains Forum**, which took place in-person at the The’í:tselíya- S.A.Y Health and Community Centre at Skowkale on **June 9th**. The event was organized by the Lower Fraser Floodplains Coalition, a group of organizations and experts working together to help the region achieve better outcomes with its flood recovery and management efforts. The group is comprised of leaders from Mainland Coast Salish First Nations, academia, environmental and agricultural organizations (WWSS, 2023).

Participants were able to join one of multiple discussion tables set for the event, each one focusing on a specific geographical sub-region of the Lower Fraser. Discussions at each table were led by facilitators, encouraging participants to build a shared long-term vision for the Lower Fraser, identifying how that differs from the current situation, determining the first set of short-term actions to take, and how different stakeholders would contribute to that vision. The scholar sat at the table facilitated by Dan Straker and proceeded to take notes for the duration of the event. Notes were later collected by the staff from the Lower Fraser Floodplains coalition. No additional output for this event was prepared by the scholar following the event.

Future Op-Ed on infrastructure permitting issues

The testimonies shared during Workshop 1 (Challenges and recommendations for flood infrastructure) indicated that participants considered permitting issues to be a significant challenge to advancing and implementing flood control infrastructure projects. Practitioners from different communities across the Lower Mainland were contacted in order to get a better

understanding of how the permitting process is impacting projects. Short, informal, and anonymous interviews took place in July 2023. The notes from these meetings were compiled to identify common themes and experiences across the different communities. Given how all comments were kept anonymous, as well as the fact that they represented personal experiences and ideas from the different practitioners, it was decided that the best format to communicate the findings was by preparing an Op-Ed or blogpost that could be shared online. However, given the timeline of the Sustainability Scholars program, the actual publishing and sharing of the document will happen sometime in the future (see supplementary files for the latest draft).

Conclusions and recommendations

The discussions that took place over the various events reflect that participants have overall a good understanding of the problems associated with flood infrastructure, as well as a relatively clear vision for an “ideal” future. The challenge appears to be determining how to start moving towards that vision. However, communities and First Nations may not be able to achieve that vision just on their own. The envisioned transformation needs to be accompanied with significant changes in legislation and collaboration between levels of government focusing on the kind of financial support that could be offered to communities, providing design guidance, and creating incentives for facilitating the implementation of flood control infrastructure projects (including more fish-friendly alternatives). As such, future discussions could focus more on developing detailed suggestions and identifying the first concrete actions that could be taken to bring about the desired changes. This sentiment was also echoed by some participants in the various events, who believed it was time to move on from discussing the problem to developing solutions. The window of opportunity to transition to a more sustainable management of the Lower Fraser remains open. Continuing building capacity through events such as the ones discussed in this report will be key to improving collaboration and developing solutions.

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