

Policy Brief #1: Freshwater sustainability and current flood infrastructure in BC's Lower Mainland Municipalities -A 21st century approach

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Issue

Pump stations, dikes, and floodgates separate the river from its floodplain and have negative impacts on water quality and fish species

Opportunity

Watershed Watch Salmon Society has mapped 1500 km of streams impacted in the Lower Fraser alone, Lower Fraser Flood Management Strategy opens an avenue for action

Action

Use available information to implement alternative flood management strategies that have multiple benefits to communities and ecosystems.

The Lower Fraser and Estuary

Long considered benign, current flood infrastructure results in significant negative ecological impacts to local waterways, changing fish communities and reducing water quality. Structures such as dikes, floodgates, and pumping stations isolate the river from its floodplain, reducing access to tidal creeks, side channels and sloughs, affecting socially, ecologically, and economically important species such as pacific salmon. Flood risk associated with climate change and sea-level rise is a pressing issue in the area, predicted to cost the Lower Mainland over \$9.5 billion to mitigate future risk from sea-level rise alone. Modern alternatives provide adaptability and will be discussed in this brief. Watershed Watch Salmon Society has mapped 1,500 kilometers of current or potential fish habitat within more than 100 waterways affected by 155 structures in the Lower Fraser alone.

Overview: Local Government

Federal, provincial, municipal and regional authorities, all play a role in defining laws and bylaws that influence the management of flood infrastructure; however, ownership and cost typically fall to local governments. Capital infrastructure such as flood protection structures like floodgates and pumping stations are highly expensive methods for protecting low-lying farmland and communities placing considerable financial burden on municipalities. Flood infrastructure significantly impacts local fish communities including important spawning areas for salmon in the Lower Fraser River, contributing to the decline of important local fish stocks. Municipalities across the region are currently partnered in the development of the Lower Mainland Flood Management Strategy and have the opportunity to create regional priorities around enhancing the environment. Phase 2 of the strategy is now underway, to develop a regional flood strategy report and recommendations for action, including cost-sharing options and alternative technologies. In May 2018 a resolution was unanimously voted on at the lower mainland local government association to upgrade flood infrastructure to consider fish and access to fish habitat. This shows strong support from leadership for progressive flood management and is applauded. Current flood control standards do not consider fish passage or healthy fish habitats, now is the time to address environmental considerations and flood infrastructure.

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Recommendations

- Prioritize alternatives, such as setback dikes, to the installation of new flood gates and pump stations
- Work with local stewardship groups to identify opportunities to reduce impacts of existing infrastructure
- Improve existing flood gates by replacing heavy top-mounted gates with self-regulating side mounted gates that open more often
- Keep gates open at all times except during freshet/high flows
- Reduce mortality at pump stations by installing "fish-friendly" pumps
- Add "pet doors" to tide gates
- Remove flood control structures where they are not required and implement bioengineering solutions
- Implement by-laws and drainage policies to consider fish habitat requirements
- Create integrated watershed management plans that secure funding for implementation
- Implement storm water user fees to fund green infrastructure projects
- Allow less productive agricultural areas to be inundated during spring freshets by providing tax incentives to landowners



Benefits to Local Government

- Restoring these waters would benefit riparian habitat and result in green ways which will have had demonstrable positive impacts on property values
- Connectivity improves freshwater quality of sloughs and streams that may be isolated from the main stem of the Fraser River addressing drainage concerns and aquatic invasive species
- Natural assets managed as part of city infrastructure provide ecosystem services such as flow regulation, water filtration, and habitat provision
- Increased access to various funding sources when looking to “green” the infrastructure (e.g. FCM Green Municipal Fund)
- Creative ways to improve efficiency, reduce energy use and improve habitats.
- Support to build recreation trails, greenways, blueways, parks and low intensity uses that can withstand flooding



Background

The Lower Fraser River delta in British Columbia is a highly settled floodplain in which flood control structures have become abundant in a historically productive ecological system. The Lower Fraser River is tidal for 115 km upstream of the mouth connecting an intricate floodplain of tidal freshwater creeks [1]. The Lower Fraser also historically supported one of the world's largest salmon (*Oncorhynchus* spp.) populations that have enormous local economic, social and cultural significance [1,2]. To protect settlements from seasonal flooding and coastal storm surge much of the floodplain is diked and there are an estimated 275 floodgates controlling flows. Floodgates remain closed for extended periods of time during the spring freshet, low flow periods, and high tide cycles [3,4]. Floodgates may be impacting fish communities either directly through acting as physical barriers to fish passage, or indirectly through reducing habitat quality. Fish passage in the lower Fraser is important for allowing adult salmon to reach spawning grounds, allowing juvenile salmon to access non-natal habitats, and allowing resident fish to accessing different habitats. Floodgates may also prevent juvenile salmon outmigration during the spring, when the operation of pumping stations may lead to mortality [5-7]. Connectivity to the floodplain is also a key element of the concept of environmental flows as it helps maintain the life processes of fish, waterfowl and other wildlife that rely on these aquatic ecosystems behind floodgates.



Top mounted floodgates on a tributary of the Lower Fraser River.

Recent Research

While the negative ecological impacts of large dams have been widely understood, the impacts of small scale infrastructure has been largely assumed to be benign. However, research from around the world has recently begun to demonstrate that floodgates are associated with a myriad of negative impacts on the aquatic habitats in which they are installed. Floodgates have been shown to be associated with reduced overhanging vegetation [8], greater nutrient concentrations, increased abundance of aquatic weeds [9] and reduced dissolved oxygen concentrations [10]. In estuarine systems, floodgates can be associated with reduced abundance of commercially valuable species [8], reduced fish passage [11] including delayed downstream migration of salmonids [12], reduced diversity of estuarine fish [13], and reduced abundance, biomass, and diversity of juvenile fish [8].

In the Lower Fraser, floodgates may act as physical barriers, limiting the ability of salmon to access stream habitats [5,6], many of which are important to the survival and productivity of juvenile chinook in the Fraser River [14]. Recent research conducted in the Lower Fraser has shown widespread impacts of flood structures on fish communities and their habitats. A study of 10 sites that compared streams with, and without, floodgates found that they are associated with decreased abundance of juvenile salmon including chum, coho and Chinook. They also found floodgates were associated with decreased abundance of native fishes like peamouth chub and prickly sculpin and an increased abundance of invasive fishes, potentially promoting their spread [15]. A further study of 22 sites found that floodgates throughout the Lower Fraser region remain closed for extended periods of time throughout the year such as during the spring freshet, completely blocking fish passage [4]. Another study of six sites in the Fraser Valley found dissolved oxygen levels at floodgate sites well below safe minimum levels for fish, and that this impact extended for at least 100 meters upstream of the floodgates [10]. It was also found that sites with gates which opened

infrequently had decreased fish species diversity and decreased dissolved oxygen concentrations compared with sites where gates opened more often [4].

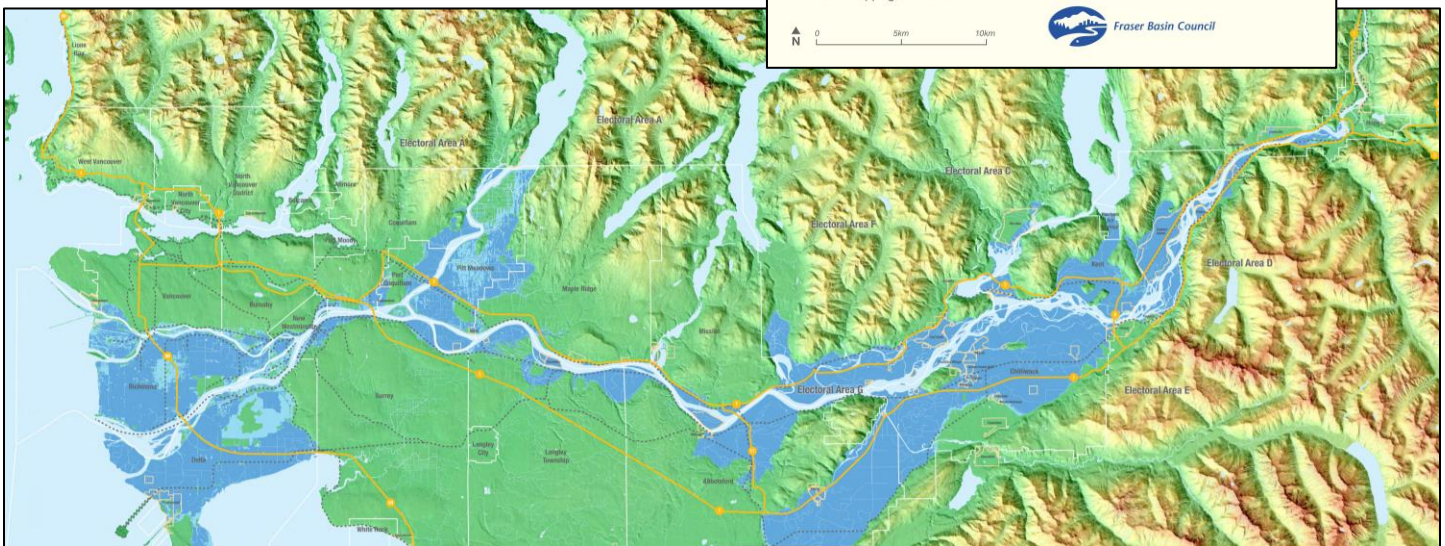
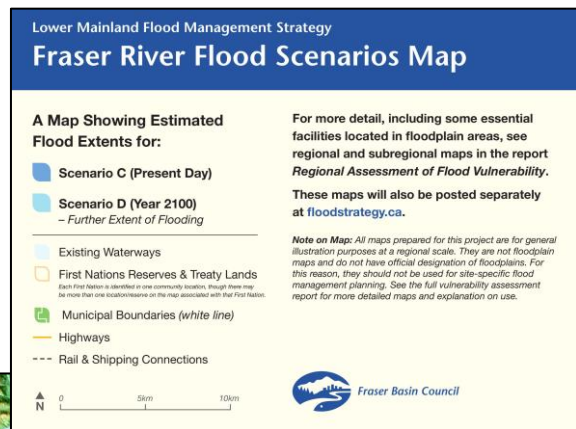
Overall this body of recent research demonstrates that floodgates are having a significant negative cumulative impact on freshwater ecosystems throughout the Lower Fraser River. Flood management is becoming increasingly challenging with climate change predicted to result in increased regularity of major flood events, therefore future freshwater sustainability in the Lower Fraser will rely on local governments choosing flood risk management approaches which promote and maintain ecological processes and protection.

Legal Considerations

Legal analysis conducted by University of Victoria’s Environmental Law Centre revealed that fish habitat behind dikes exists in a “grey area” of the law, with no level of government effectively overseeing it. We found that through municipal authority over drainage and flood management, local governments have the ownership, responsibility and control for the associated flood infrastructure. Using tools such as by-laws, local government can require improved standards such as creating their own riparian area regulations which several Lower Mainland municipalities have already put in place which protect habitats at a level beyond what is required by provincial legislation. Local government authority over drainage is directly related to control and management of flood control infrastructure. They also act as diking authorities.

Floodgates are having a significant negative cumulative impact on freshwater ecosystems throughout the Lower Fraser River

Through their authority over drainage and role as diking authority, local governments own flood control infrastructure and have full discretion to determine the type of infrastructure to be installed and upgraded. Therefore, while only the federal government can authorize activities which negatively impact fish habitat, it falls to local governments to make the ultimate choice when it comes to making flood control infrastructure fish friendly.



Lower Mainland Flood Management Strategy Phase 1 Flood Scenarios map. Blue areas demonstrate estimated flood extents in the present and future (2100). Map created for phase one of the Lower Fraser Flood Management Strategy [16] assessing regional flood vulnerabilities.

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