

Floodplain Mapping Funding Guidebook for BC Local Governments

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Executive summary

Floodplain maps provide visual information on where floodwaters are expected to go; therefore, they are the most logical first step in flood management and must be updated periodically. Since 2015, senior government funding programs helped many BC communities carry out flood mapping and related projects. However, those programs are short term, which means local governments will have to continue to be creative about their funding options, often using multiple strategies.

Discussions with municipalities, regional districts, industry groups, practitioners and researchers have resulted in a list of funding strategies that may be suitable for acquiring funding for floodplain mapping activities:

- Common funding options
 - General revenue
 - Grant programs
- Creative funding options
 - Development approval information areas
 - Development cost charges
 - Partnerships and collaborations
 - Civic crowd sourcing
- Innovative options
 - Floodplain authorities
 - Flood protection service or utility
 - Taxation

While the strategies presented in this guidebook are not exhaustive, they can form a starting point for communities to undertake floodplain mapping.

Introduction and purpose

Floodplain maps and other technical studies form a foundation to inform decisions about how and where communities grow. A 2015 survey found that only 21 per cent of communities surveyed in BC had floodplain maps that were updated in the previous ten years, while 31 per cent of communities surveyed did not have any floodplain maps.¹ There has been some additional floodplain mapping since the 2015 survey, in large part due to the National Disaster Mitigation Program.²

Across Canada, the implementation of flood mitigation measures is primarily the responsibility of provincial and municipal agencies. The federal government is involved in establishing national floodplain mapping requirements, as well as basic criteria for geospatial data acquisition, management and dissemination.³

In BC, legislative changes in 2003-2004 handed primary responsibility for flood management to local government. Unfortunately, this change was not supported with additional expertise or financial resources.⁴ During a workshop in March 2013, stakeholders identified three types of challenges that impede floodplain mapping projects: political, technical and financial.⁵

This guidebook compiles information about federal and provincial funding programs and also aims to help communities explore innovative funding strategies. While other funding programs may exist, and several options described represent untested directions that require further investigation, this report provides a basis for those investigations and a starting point to help communities overcome some of the financial obstacles to updating floodplain maps.

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Floodplain mapping funding overview

Understanding and preparing for risk posed by natural disasters is one of many important community efforts. Floodplain maps provide an essential technical tool for flood management, including mitigation strategies and emergency response. Simply put, floodplain maps provide visual information on where floodwaters are expected to go. The level of effort and cost required to develop floodplain maps varies according to the type and scale of map created. A summary of types, uses and costs is available on the BCREA website at <http://bit.ly/2TqgFx8>.

Floodplain mapping funding in British Columbia

Many of the floodplain maps developed in BC were prepared using funds from the Flood Damage Reduction Program (FDRP) that was actively funded from 1975 through 1998. This program led to BC-federal agreements in which federal and provincial governments equally shared the costs.⁶

¹ Parsons, 2015

² Public Safety and Emergency Preparedness Canada, 2018

³ Government of Canada, 2017

⁴ As well, while the *Local Government Act*, s. 910 provides local governments with the power to designate floodplains and create related bylaws and regulations, it does not require them to do so, meaning that the political impetus for floodplain management is left to be provided by local governments.

⁵ BC Real Estate Association, 2013

⁶ Institute for Catastrophic Loss Reduction, 2010

Federal participation in flood management was effectively withdrawn when the FDRP ended, leaving responsibility for floodplain mapping to the provinces. In BC, this responsibility was further devolved to local communities through legislative changes in 2003-2004.⁷

Fewer than ten municipalities and regional districts completed floodplain maps between 2008 and 2013, either as a response to extreme weather events or as a component of a risk reduction strategy. These projects were funded through a mix of grants, support from other levels of government and partnerships.

The National Disaster Mitigation Program (NDMP) was established by the federal government in 2015, resulting in an increase in floodplain mapping projects. The NDMP was a five-year, \$200 million cost-sharing program that provided funding for a variety of projects, including flood mapping.

Funding approaches in other provinces

Since the close of the FDRP, other provinces have either continued to fund floodplain mapping or, similar to BC, handed down responsibility to communities. The result of varying approaches to flood management in Canada is a patchwork of floodplain mapping across the country, with some jurisdictions having consistently-regulated and well-funded programs and others having very little oversight and support. While many of the approaches rely on provincial funds, others highlight opportunities for establishing dedicated agencies responsible for floodplain mapping and in forming strong collaborative partnerships.

In Ontario, for instance, Conservation Authorities are responsible for updating floodplain maps using funding from self-generated sources, municipal levies and provincial grants.⁸ Conservation Authorities stem from the 1946 *Conservation Authorities Act*, which created a mechanism for municipalities and the provincial government to form and partner with 36 Conservation Authorities. These authorities, based on watershed boundaries, have a mandate to administer flood control, recreation, education and watershed protection activities.

In Nova Scotia, New Brunswick and Prince Edward Island, municipalities have worked with local universities and colleges to undertake floodplain mapping projects using funding from Natural Resources Canada's Regional Adaptation Collaborative program for adaptation to climate change.

Mapping approaches in other countries

A scan of OECD countries indicates that nearly all have some form of national mapping program to identify flood risk. In the United States, for instance, the Federal Emergency Management Agency (FEMA) maintains two types of floodplain maps. Flood Hazard Boundary Maps identify hazards for emergency management, and Flood Insurance Rate Maps are the official source of flood risk data for communities. Funding for mapping efforts comes from FEMA's federally-funded Flood Hazard Mapping and Risk Analysis Program Budget and from the National Flood Insurance Program, which collects monthly premiums American households pay for flood insurance.⁹

⁷ Lyle & McLean, 2008

⁸ Conservation Ontario, 2013

⁹ US Federal Emergency Management Agency, 2018

In Europe, the EU Floods Directive¹⁰ mandates member states map flood extents and identify assets and humans at risk in these areas, and most European countries have responded with national floodplain mapping programs, funded from general revenues. The EU Flood Directive management plans were completed in December 2015.¹¹

A review of international mapping programs offers few funding approaches applicable to British Columbia, where mapping is the responsibility of local government. However, in a few cases, national governments have created standards and/or assembled the information needed to create floodplain maps, but left municipalities and regional districts to fund and carry out the mapping program. The Australian National Work Program for Flood Mapping was effective at improving quality and consistency across the country. The program undertook an analysis of gaps in coverage of existing maps, then prioritized future investments in flood mapping. The program ensured national consistency by developing principles and technical standards for flood mapping applied to all jurisdictions.¹²

The insurance industry in Austria, Germany, Italy and Czech Republic has taken leadership by producing floodplain maps.¹³ The HORA project in Austria provides a partnership example between the national insurance association and the Austrian government to jointly create national floodplain maps.¹⁴ The German Insurance Association and the Czech Republic national insurance association produce maps to determine insurance premiums, while the Italian national insurance agency also produces maps that identify damage potential.¹⁵

Understanding and minimizing the cost of floodplain maps

Broadly, the preparation of a floodplain map involves three steps:

1. Estimating the amount of water accumulated and discharged during a rain or other water inflow event.
2. A hydraulic model is then used to determine where the water might go.
3. Potential flood areas are mapped by combining water levels from a hydraulic model with a digital elevation model (a virtual interpretation of the topography) or base maps and surveys.

The process outlined above can be expensive if starting from nothing or a poor baseline. Costs can range from \$100,000 for a small community if there exists topographic and hydrometric data, to \$250,000 for a similarly-sized community with no base information, to many more times this for large areas with limited data.

Each floodplain mapping effort is unique to the area and local context, so no one solution works in every situation; however, the following are a few insights shared by municipalities, regional districts and practitioners.

- Focus first on high-priority areas — outcomes can be maximized, and costs minimized if a municipality or regional district considers its greatest areas of concern and focuses mapping activities on these areas first.

¹⁰ European Union, 2007

¹¹ Hedelin, 2016

¹² OECD, 2016

¹³ de Moel et al., 2009

¹⁴ Stiefelmeyer and Hlatky, 2008

¹⁵ Insurance Bureau of Canada, 2015

- Consider a less sophisticated map — municipalities and regional districts may consider employing a less sophisticated approach by using historical data (e.g., flood extents from previous flooding periods) and overlaying this data on existing floodplain maps or municipal GIS maps (for example, www.floodmap.net). This method has been used to represent sea level rise under changing climate conditions.¹⁶ In addition, these maps can prove viable for learning and creating support for more detailed maps, but may lack specific detail to support all land use decisions.
- Use GeoBC data – GeoBC is a provincial government agency that creates and manages geospatial information and products across all natural resource sector agencies, and may have data specific to municipalities and regional districts, including hydrometric and streamflow data.¹⁷
- Review recent work from British Columbia universities and colleges – graduate students often undertake small, but overlapping, research projects that may provide a foundation or data for creating and updating floodplain maps.

Funding strategies

Discussions and interviews with municipalities and regional districts, industry groups, practitioners and researchers in 2014 resulted in a list of strategies that may be suitable for acquiring funding for floodplain mapping activities. The list is organized by common, creative and innovative options:

- Common funding options
 - General revenue
 - Grant programs
- Creative funding options
 - Development approval information areas
 - Development cost charges
 - Partnerships and collaborations
 - Civic crowd sourcing
- Innovative options
 - Floodplain authorities
 - Flood protection service or utility
 - Taxation

¹⁶ Municipality of North Cowichan, 2012

¹⁷ GeoBC website: <https://bit.ly/2Sm4IsP>

Common funding options—build a case for using general revenue

Many municipalities and regional districts fund floodplain mapping exercises through general revenue sources, either integrating mapping work into capital improvement projects, operating budgets or utilizing existing tax revenues. There is simplicity in this approach, but it requires competing against other programs and projects. Floodplain mapping exercises are often viewed as additional costs, despite evidence that preparation and planning ahead of a disaster greatly reduces the costs and suffering incurred during and after a disaster event.¹⁸

Before floodplain mapping can occur, there must be interest in and support for the initiative. Practitioners in BC have taken several different approaches to gain support for floodplain mapping projects. Information garnered from interviews suggests communities that have recently been subjected to severe flooding events receive a great deal of political support for flood management, both locally and provincially. Other communities undertake mapping as part of broader climate change adaptation initiatives.

Taking the time to actively communicate with the public and politicians—about vulnerabilities, flood management guidelines and floodplain mapping projects—is a highly worthwhile investment. Involving many local departments in flood management, and not simply relegating the responsibility to one department (or even one individual), is seen as a good way to improve knowledge and raise the visibility of the issue, thereby increasing the chances of general revenue being made available for floodplain mapping.

One strategy for building the business case for floodplain mapping among other general revenue expenditures is to highlight future cost reductions to municipal accounting offices. One might do so by preparing a simple cost benefit analysis using information from recent studies and events. For example, Hinkel et al. highlights that flood mitigation is far more cost effective than cleaning up after flooding.¹⁹ Another is the North Carolina Floodplain Mapping Program: 2000 – 2008 Program Review, which states that floodplain mapping in North Carolina saved \$100 million per year in reduced flood damages.²⁰ In 2009, the National Research Council published *Improving Flood Map Accuracy*, which provides a table for measuring the costs and benefits associated with improved map accuracy.²¹ Some benefits include building restrictions matching risk, wise floodplain investment, including infrastructure, improved ecological diversity and more consistent insurance ratings through better information about risk.

Another ideal opportunity for floodplain mapping is during the development of an official community plan (OCP)²² or regional growth strategy. This ensures that the results of the floodplain mapping are fully integrated into the planning process, and that areas at risk can be appropriately identified in official plans.

¹⁸ Public Safety Canada, 2008

¹⁹ Hinkel et al., 2013

²⁰ State of North Carolina, 2008

²¹ National Research Council, 2009

²² District of North Vancouver, 2018

Common funding options—grant programs

While not all of the following granting programs are specific to floodplain mapping projects, an inventive funding application may produce a successful bid. As with all grant programs, local governments are wise to first contact the funding agency to confirm eligibility.

Gas Tax Fund (Strategic Priorities Fund)

Source: Federal government, under the New Building Canada Plan.

Description: The Gas Tax Fund provides local governments with predictable, long-term, stable funding to help build and revitalize local public infrastructure. Two of the program's three streams include disaster mitigation as an eligible expense: Community Works Fund and Strategic Priorities Fund. Municipalities and regional districts have been successful in applying for and receiving funds from this program. Intakes are facilitated by the Union of BC Municipalities.

Eligibility: Local governments are eligible for community works and/or strategic priorities funds, depending on their location.

Strengths: The Gas Tax Fund provides predictable, long-term funding to local governments. Gas Tax funding is legislated as a permanent source of federal infrastructure funding for municipalities and regional districts, but subject to program changes.

Weakness: There are competing demands for Gas Tax funds within municipalities and regional districts, as these monies are also used to finance critical infrastructure upgrades.

Contact: Union of British Columbia Municipalities, <http://bit.ly/2SSHoGE>.

Green Municipal Fund

Source: Federation of Canadian Municipalities, through an endowment from the federal government.

Description: The Green Municipal Fund (GMF) provides low-interest loans, usually in combination with grants, and knowledge services to support sustainable community development. Funding is allocated to plans, feasibility studies and pilot projects, and capital projects in five sectors of municipal activity: brownfields, energy, transportation, waste and water. GMF grants can cover up to 50 per cent of the total eligible costs, up to a maximum of \$175,000 (\$350,000 for pilot projects). Applications are accepted year-round, and funding decisions are made twice per year (February and September).

Eligibility: Local governments.

Strength: Specific to municipal studies and projects.

Weakness: Funding from this program requires matching. The GMF does not offer funding for stand-alone floodplain mapping, but it does fund neighbourhood sustainable plans that could include floodplain mapping as part of the more comprehensive sustainable plan.

Contact: Federation of Canadian Municipalities, <http://bit.ly/2sX5Ebf>.

National Disaster Mitigation Program

Source: Public Safety Canada, through Canada Economic Action Plan 2014.

Description: NDMP provided \$200 million over five years to build safer and more resilient communities. The NDMP was intended to address rising flood risks and costs and build the foundation for informed mitigation investments that could reduce, or even negate, the effects of flood events in the future. The program was implemented in April 2015 with a call for proposals in four funding streams: risk assessments, flood mapping, mitigation planning and investments in non-structural and small scale structural mitigation projects. The deadline to submit NDMP proposals for the last round of funding was October 31, 2018. Projects submitted must be completed by March 31, 2020. No replacement or successive program has been announced to take the NDMP's place.

Eligibility: Provincial and territorial governments, though they are not precluded from partnering with local governments.

Strength: Unlike many other senior government funding programs, the NDMP emphasizes technical studies and mitigation. The NDMP was good for applicants with higher cost projects, because it didn't have limits to the cost for risk assessments, flood mapping or mitigation planning projects.

Weakness: \$200 million over five years was not a significant investment for the entire country, and provinces and territories didn't receive allotments; that is, they had to compete for all available funds in a given year. Also, the NDMP didn't allow projects to use other funding sources.

Contact: Public Safety Canada, <http://bit.ly/2Gc0qjl>.

Community Emergency Preparedness Fund

Source: Union of BC Municipalities.

Description: The CEPF is a \$33.5 million program funded by the BC Government. Funding from CEPF is directed to flood mitigation projects and emergency management capacity and planning projects. The previous intake for flood risk assessment, flood mapping and flood mitigation projects closed on February 22, 2019. The next deadline for structural flood mitigation projects is October 25, 2019.

Eligibility: Local governments.

Strength: The CEPF allows eligible applicants to combine efforts towards a regional initiative, and the program will fund 100 per cent of the cost of eligible activities.

Weakness: This is a one-time funding program, and the maximum available funding is \$150,000.

Contact: Community Emergency Preparedness Fund, <http://bit.ly/2G1guW4>.

First Nation Adapt Program

Source: Indigenous Services Canada.

Description: In 2016, the federal government announced \$24.7 million over five years to identify and address climate change related impacts on infrastructure in First Nation communities on reserves. Total funding available for new projects in 2018-2019 was \$6 million and average yearly project costs are \$160,000. Community funding for floodplain mapping is available through 2021-2022.

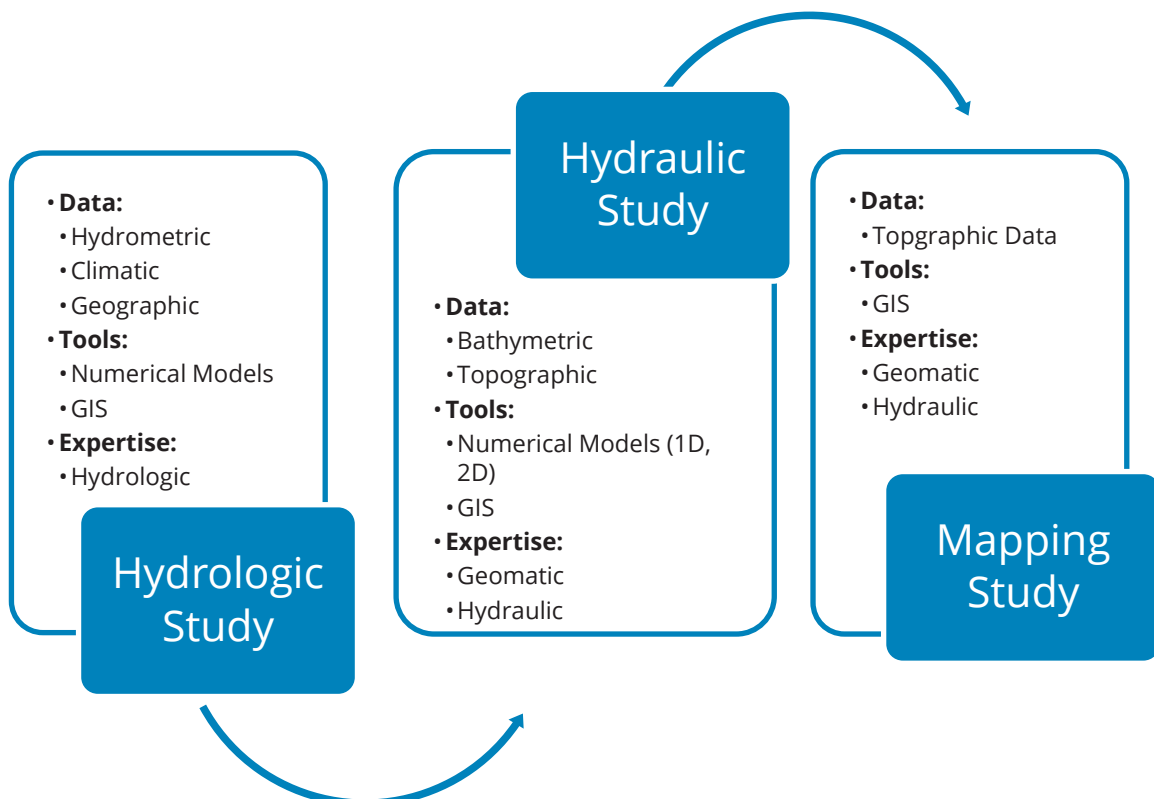
Eligibility: First Nation communities, band or tribal councils and Indigenous organizations.

Strength: The floodplain mapping portion of the program provides support for communities to participate in regional watershed management processes, collect and share regional watershed data, develop floodplain maps to identify flood risks to local infrastructure and develop best practices, tools and adaptation options for flood management.

Weakness: This is a one-time funding program and applications are reviewed on an ongoing basis until all funding is allocated. The funding available is unlikely to meet the needs of all First Nations communities.

Contact: Indigenous Services Canada, <http://bit.ly/2BPviDp>.

Summary of Resources Required for Floodplain Mapping, taken from BCREA's Floodplain Mapping Backgrounder



Creative funding options

This section describes several options and possibilities for funding floodplain mapping projects. Most of these options have yet to be applied in British Columbia for floodplain mapping, and further investigation by municipalities and regional districts would be required before implementation.

Development approval information areas

In addition to the authority to designate development permit areas (DPAs)²³ in their official community plans to protect development from hazardous conditions, such as floods,²⁴ local governments can designate areas where information related to the impact of development is required. Conceivably, a local government could create development approval information areas (DAIAs) where floodplain mapping information must be provided as part of a development application; for example, as part of the subdivision approval process, or in an application for rezoning.

A program of this nature is in place in the United Kingdom, where the UK Environmental Agency suggests new development undertake a Flood Risk Assessment for planning applications.²⁵ In BC, the Cowichan Valley Regional District can require new developments to utilize the region's hydraulic model to ensure the development does not increase the flood hazard for neighbouring areas. A similar approach used by the Squamish Lillooet Regional District requires proponents of new subdivisions to prepare and pay for integrated stormwater management plans for the watershed where the subdivision will be located, if one has not already been done.²⁶

Strength: A DAIA would effectively shift some of the costs of floodplain mapping to developers, which is a benefit from the perspective of local governments.

Weaknesses: Preexisting knowledge of the extent of the floodplain and flood-prone lands may be required to designate an area as a DAIA; alternatively, local governments may be tempted to designate large areas as DAIA's, even if they are not prone to flooding. There may also be a disincentive for a developer to make an application and pay the costs associated with floodplain mapping, which could increase the cost of housing. Issues of scale and costs may preclude requiring a floodplain map on land below a certain size, or by smaller developments. Even considering larger developments, DAIA's may lead to a patchwork of floodplain mapping efforts within a local jurisdiction.

Development cost charges

The *Local Government Act* has a strict definition of the current use of development cost funds. Funds collected are deposited in a separate special development cost charge (DCC) reserve fund and are

²³ The District of Saanich has a Floodplain DPA and other municipalities, such as the District of North Vancouver, have DPAs that address flood hazards.

²⁴ This DPA does not allow a local government to vary any existing floodplain specification under s. 910 of the *Local Government Act*.

²⁵ UK Environment Agency, 2012

²⁶ Squamish-Lillooet Regional District, 2002

²⁷ *Local Government Act*, s. 932.

restricted to capital costs that relate directly or indirectly to the development in respect of which the charge was collected. Capital costs, as defined by the *Local Government Act*, include planning, engineering and legal costs directly related to the work for which a capital cost may be incurred.²⁷

While there are no known bylaws requiring updating regional floodplain maps as part of new development in BC, the examples offered by the Cowichan Valley Regional District and the Squamish Lillooet Regional District provide a working precedent for consideration.

Strength: The opportunity to streamline floodplain map updates is substantial.

Weaknesses: Community-wide floodplain mapping is not explicitly an eligible cost for DCCs under the *Local Government Act*. DCCs are intended to enable municipalities and regional districts to provide infrastructure to development projects.

The use of DCC funds for floodplain mapping would be limited to new development and would need to be justified as directly related to the provision of infrastructure. A community-wide floodplain mapping analysis undertaken as a standalone project would not meet the requirements for DCC funding. If DCCs could be charged for floodplain mapping, the local government would have to cover the costs of the study and the infrastructure for the rest of the community, beyond the new development—by far, the majority of the costs.

In addition, DCCs are funding mechanisms that allow responding to development by providing infrastructure once a project has been approved. Whereas floodplain mapping should occur earlier in that process, during land use planning, to proactively inform the location of development.

Local governments already use DCCs to a considerable extent. Increasing the scope of this financing mechanism could negatively impact housing affordability. Also, as with DAIs, this approach may lead to a patchwork of floodplain mapping efforts within a local jurisdiction.zzz

Requirements: Flood protection infrastructure or services are not categories specified in the legislation, meaning that legislative reform would be required before DCCs could be used to fund floodplain mapping, as a planning service associated with flood protection infrastructure.

In addition, the case for direct benefit incurred from the DCCs, and the added cost of development, would need to be presented to developers and future buyers.

Partnerships and collaborations

Floodplains extend beyond the jurisdictional boundaries of many municipalities and regional districts, creating natural partnerships among municipalities, regional districts and key asset holders in the floodplain. Despite additional management requirements, some municipalities and regional districts have demonstrated success in forming partnerships in support of floodplain mapping work. For instance, the City of Vancouver enlisted financial support from Port Metro Vancouver, which has significant assets within floodplain areas and desire to understand their exposure to flood hazards.

The following are potential partners and collaborators. Not only can partners provide additional funding, but many funding programs described earlier require or give additional backing to

collaborative proposals.

Solicit support from large land owners – Identify owners of large public and private parcels of land along waterfront areas and seek their support.

Strength: Large land owners have a direct interest to protect their assets and may see benefit in supporting a regional floodplain mapping program.

Weakness: Some large asset owners may feel the municipality and province already have responsibility for assessing and providing flood management.

Partner with emergency management organizations – Organizations such as Emergency Management BC have a mandate to prepare for hazards and risks that could affect all or any part of BC and to prepare plans such as the BC Flood Response Plan. The BC Flood Response Plan indicates that, where there is the possibility of a significant flood event, cross-government working groups can be prepared on a range of issues, including mapping.²⁸ The City of Prince George has received funding for floodplain mapping from Emergency Management BC.

Strength: Emergency Management BC already has a goal to increase safety and resilience for individuals and communities and responds to flood risk, making it a natural partner in mapping flood risks.

Weakness: The general emphasis of emergency management is to respond to hazards; therefore, a case needs to be made that this includes proactive approaches to eliminate or reduce the hazard before a flood event.

Coordinate through regional districts – A regional district is a federation of municipalities and electoral areas for a geographical area, managed by a board that consists of appointees and a director elected from each electoral area. Regional districts are financed by property taxes and fees and, unlike municipalities, regional districts are required to match the benefits and costs of services to the people who pay the taxes.

Regional districts are mandated to provide region-wide services and inter-municipal services and to act as local governments for electoral areas. The inclusion of floodplain mapping as a regional district service would require a decision by the regional board. A specific project would also likely require a board decision to approve a budget and work plan, unless there is an existing budget envelope.

The Regional District of Central Okanagan recently undertook floodplain mapping to be used in every Central Okanagan government and First Nation. Funding came from grants from the Okanagan Basin Water Board, the federal gas tax fund and the regional district.²⁹

Strengths: Regional districts are advantageous organizations for floodplain mapping because their geographic scope is larger than municipalities; they offer opportunities for economies of scale and have existing governance and

²⁸ Government of British Columbia, 2013

²⁹ Okanagan Basin Water Board, 2016

³⁰ Cowichan Valley Regional District purchased LiDAR at the cost of \$375,000, a benefit over member municipalities purchasing LiDAR individually.

implementation systems for delivering collaborative projects. The provision of high-quality data is also an expensive component of floodplain mapping; municipalities and/or regional districts may be able to reduce costs by partnering to collect and/or purchase this data.³⁰

Weaknesses: The complexity of regional district governance can undermine the effectiveness of projects. For example, if one municipality has ambitious intentions, it may have to compromise those intentions as part of a regional project. Municipal representatives often govern regional governments, so municipal support for floodplain mapping must be obtained first.

Partner with insurance industry – To identify risk from flooding for particular buildings, the insurance industry requires an assessment of flood hazard at the building level. Municipalities and regional districts may consider discussing floodplain mapping projects with insurance industry representatives.

Strengths: Such collaborations already exist in Austria, Germany, Italy and many other jurisdictions. The insurance industry may be interested in partnering on a provincial or national approach, for example with the Federation of Canadian Municipalities or Union of BC Municipalities.

Weaknesses: Because insurers are looking for a solution allowing the measurement of flood risk posed by rivers and rainfall, the maps they create may be at a different resolution than those needed by local governments.

Partner with academic institutions – Partnerships with academic institutions have shown promise in other provinces, illustrating the possibility of establishing extended collaborations with groups across BC. The University of British Columbia's Forest Resources Management/ Landscape Architecture-Collaborative for Advanced Landscape Planning (CALP), Simon Fraser University's REM Water Research Group, and the University of Northern British Columbia's Natural Resources and Environmental Studies Institute are all groups that have worked on floodplain mapping related projects. Academic institutions may also bring additional funding to a floodplain mapping project through the Natural Sciences and Engineering Research Council of Canada and the MITACS research grant.

Strengths: Such collaborations provide opportunities to reduce costs through funding an appropriate number of graduate students. Further, academic institutions can facilitate the documenting and publishing of relevant hydrological data for use in flood forecasting protocols.

Weaknesses: Working with academic institutions can often be a time-intensive process, and there are risks that a given institution may not have graduate students working on floodplain mapping projects unless a multi-year funding program is established.

Civic crowdsourcing

Civic crowdsourcing is a growing option for communities faced with unanticipated costs. Civic crowdsourcing allows ordinary citizens to direct their money to local civic projects. There is some precedent for crowdsourcing information for public benefit in Canada. The city of Calgary has

³¹ Baker, 2017

³² Chan, 2018

undertaken self-regulating community standards, and has achieved 95 per cent compliance in resolving issues such as noise complaints.³¹ In BC, Vancouver and Surrey crowdsourced proposals for a provincial submission to the federal government's Smart Cities Challenge.³² Crowdsourcing funds for a floodplain mapping project would, however, require a significant effort to educate potential funders of the benefits of flood mapping.

Strength: Crowdsourcing has grown in popularity, providing a channel for matching investors and projects. And many crowdsourced projects include a return on investment beyond civic improvements.

Weakness: There is legal ambiguity as to whether municipalities and regional districts can collect and utilize funds through what are essentially online donations.

Innovative options

During the course of researching funding programs, several innovative options for funding floodplain mapping projects were identified. These are presented below as possibilities for British Columbia, recognizing that they describe new directions for BC and would require significant discussion at all levels of government before a municipality or regional district could utilize these funding approaches.

Floodplain authorities

The example from Ontario (see page 3) illustrates that regional authorities can be tasked with the responsibility for preparing and updating floodplain maps. It may be worthwhile considering authorities in British Columbia with the responsibility for coordinating and managing floodplain maps.

While there is some overlap with regional districts in BC, floodplain authorities can be unique in their mandate and be based on watersheds, whereas regional authorities are often tied to municipal boundaries.

One possible model is the Okanagan Basin Water Board, which was initially established by letters patent to carry out very specific and limited tasks, and which has taxing authority (it levies a parcel tax) within the regional districts where it functions.

Strength: A floodplain authority would provide for an efficient means for developing and maintaining floodplain maps. Floodplain authorities would partner with municipalities and regional districts within the authority area and collect fees on behalf of these partners. In this way, floodplain mapping costs could be distributed among all partners, potentially reducing the cost to any one municipality or regional district.

Weaknesses: Establishing a new regional government structure may result in some ambiguity between other regional government units. Funding for the authority would need to come from some sort of tax requisition authority (such as that held by the

Okanagan Basin Water Board), which some municipalities may be reluctant to support. Mapping carried out by multiple authorities could result in maps of varying detail and quality.

Flood protection service or utility

The *Community Charter* and *Local Government Act* provide municipalities and regional districts with the authority to provide a local service or utility within a municipality or regional district.³³ A municipal utility can be operated within existing operations, run through a subsidiary or operated on behalf of the municipality or regional district by the private sector. The utility can then charge user fees to homes or businesses that experience the benefit of the service or levy a property value tax or parcel tax to recover the costs of the service. While Local Improvement Charges are based on parcel or property taxes, fees are based on the provision of the service. Fees levied under either section 363 of the *Local Government Act* or 194 of the *Community Charter* must be justifiable to the public, and the municipality or regional district must provide a report detailing how the fee or charge was determined.

One possibility would be to establish a flood protection utility with a mandate to protect citizens from flooding. The utility would plan, design and implement strategies designed to mitigate damage to houses, businesses and infrastructure from flooding and charge a fee for that purpose. This mechanism makes explicit the relationship between the cost of mitigating the risk and the cost of locating in the area where the hazard is present.

Support of the electors within the area would be required and can be demonstrated through a proposal by council that is not opposed by petition or by elector assent. There must also be a connection between the cost of the service and the amount levied for it to be considered a fee, though precise matching is not required. In the case of regional districts, a new service can only be established where participants petition the regional district to have it, or assent to it. Property or parcel taxes may be used to fund the service.

While this approach has not been used as yet for floodplain mapping, similar approaches have been utilized in Denmark for flood protection³⁴ and in the US and BC for stormwater management. The City of Minneapolis has a stormwater utility that calculates its fee based on the impervious area of the property and issues reductions in the fee for actions to manage stormwater.³⁵ In BC, the City of Victoria has created a stormwater utility that aims to reward property owners who manage rainwater on site, and reduce the demand on conventional municipal infrastructure. One of the advantages of this approach, which separates the charge for the service from general

³³ *Community Charter*, Part 7, Division 5 - Local Service Taxes. *Local Government Act*, s. 14.2 (4), (5).

³⁴ Sørensen, 2016

³⁵ City of Minneapolis, 2014

property taxes, is that it allows property owners to see the cost savings benefit they are receiving when they manage their rainwater on site. Further, the City of Surrey drainage utility's contribution to floodplain mapping gives some precedence to local utilities broadening flood management activities. The Okanagan Basin Water Board also essentially fits this model, shared among three regional districts.

Strengths: This type of service is well suited to municipalities and regional districts, because they can make investments and undertake projects with longer time horizons and lower rates than private companies. Further, floodplain mapping is often most effectively carried out on a scale larger than some smaller municipalities are prepared for, requiring cooperation. The *Community Charter* provides for "inter-municipal services," providing greater flexibility than relying on a regional district-level service alone. That said, a regional district may also, through an establishing bylaw, create a service that would involve developing and maintaining floodplain maps in place of separate municipal utilities.

Weaknesses: Using a local area service to support floodplain mapping would likely require an outreach effort to develop public support for the proposal. It would also potentially provide a higher profile to floodplain mapping, which may or may not be a conversation that municipalities are prepared to have with their citizens, depending on the flood risk implications for existing development, and the level of preparedness of the municipality and the community. One other challenge may be in drawing the border of local area services prior to conducting floodplain mapping.

Further, the costs associated with this approach are borne directly by those who live or do business on the floodplain. And it can be argued that society as a whole benefits from good flood management and should, therefore, bear some of the costs. For example, major transportation routes that run through floodplains if flooded, cause disruption for all the neighbouring communities. Mapping and mitigating these damages benefits the wider community.

Taxation

Several tax avenues may provide for increased revenue and funding for floodplain mapping. These options include local improvement charges, consumption taxes and carbon tax redistribution.

Property Transfer Tax³⁶ – In BC, the Property Transfer Tax is currently imposed by the provincial government at a rate of 1 per cent on the first \$200,000 of fair market value, 2 per cent between \$200,000 and \$2 million, 3 per cent over \$2 million and, if the property is residential, a further 2 per cent over \$3 million. Municipal governments could request a portion of this tax be returned to them and used to finance floodplain mapping projects.

Strength: There is an existing structure for collecting the tax, which provides an easier path and lower overhead costs than other taxes.

Weaknesses: There is currently no framework for municipalities to utilize this tax. The difference in property values between municipalities in different floodplain areas would result in an uneven distribution of tax revenues, unless a specific

³⁶ The British Columbia Real Estate Association maintains the position that the Property Transfer Tax has a negative impact on housing affordability and is unfair to homebuyers.

fund was created to distribute floodplain mapping funds equally across BC. There is only a weak rationale for tying the cost of floodplain mapping to the purchase of real estate. Further, earmarking provincial PTT revenue for any reason has been dismissed by several provincial governments for more than 30 years.

Consumption taxes – Consumption taxes are imposed on specific goods and services, with the classic example being the tobacco tax. This tax is intended to act as a deterrent against tobacco use and to recover the social costs of tobacco use. Other examples include environmental levies on batteries, pesticides and disposable containers. In the context of floodplain mapping, a floodplain tax could be imposed on new dwellings located on floodplains. This tax could then be used to fund floodplain mapping and flood prevention strategies.

Strength: Directly imposes the cost of flood management on development within a floodplain area. A direct tax on new development in floodplain areas would discourage new construction in high-risk areas, resulting in a reduction of emergency management and recovery costs in the event of a flood

Weaknesses: Similarly, a direct tax on development could discourage development and possibly increase housing prices. This could be eased with a graduated tax based on flood risk. Administering a consumption tax could be costly and could create issues between municipalities and regional districts with different levels of taxes or no tax, influencing development in unintended ways. In addition, consideration of the legal flexibility of BC municipalities and regional districts to create such a tax would be required. As noted above, it can be argued that good flood management benefits the entire community.

Carbon Tax redistribution – The BC Carbon Tax collects \$35/tonne of carbon, increasing each year by \$5 per tonne until it reaches \$50 per tonne in 2021. The Carbon Tax is redistributed through tax reductions to households and businesses as a revenue neutral tax. There is an argument that the Carbon Tax revenues could be applied to efforts that reduce the generation of carbon in society and, as carbon goes down, the tax burden is reduced. There is a case to be made for using these funds to increase the resilience of society to climate change. The BC Government website says that the Carbon Tax will be used to “encourage new green initiatives,”³⁷ which could include floodplain mapping. In other words, tax the pollution and use the revenues to mitigate the impacts of the pollution.

Strength: Directly imposes the cost of flood management on contributing factors to increased flood risk; i.e., climate change.

Weaknesses: The Carbon Tax is currently revenue neutral, and employing carbon tax revenues for anything other than rebates may not be politically viable. Further, a method for transferring funds between the provincial government and the municipality or regional district for floodplain mapping would be needed.

Summary

Local governments clearly have many competing priorities and limited funds to carry out all of their responsibilities. While the federal and provincial governments have increased available funding since 2015, those programs are only offered for a few years at a time, rather than the long-term sustained approach that's needed. Financing has been cited as an obstacle to undertaking floodplain mapping

³⁷ Government of British Columbia, 2019

projects, and this guidebook confirms that only limited options are currently available. Even so, motivated local governments can make the most of these opportunities—with some ingenuity.

Creative and innovative funding options for floodplain mapping projects may be possible in the future, though they require further investigation, perhaps in the context of the technical and political obstacles that local governments face.

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