NOT WAITING FOR NOAH:

Advances in flood risk assessment for BC

By Anna Warwick Sears, Ph.D., Executive Director, Okanagan Basin Water Board;
and Yaheli Klein, Research Associate, Adaptation to Climate Change Team, Simon Fraser University

As BC's population grows, we need the best possible flood management and emergency response plans for farms and cities throughout BC, but what will these be based on? How will we account for the rapidly changing patterns in development and precipitation, along with sea level rise? Our communities are often scrambling to catch up.

A workshop on flood risk assessments, entitled *Not Waiting for Noah*, was held in Kelowna, BC on April 24, 2013, at the BCWWA annual conference. It brought together local and senior government representatives, and industry partners who share concerns about the social and economic costs of flooding related to climate and other forces of hydrological change. Many new models and tools are becoming available for risk assessment, as well as new strategies to update policies, upgrade infrastructure, enhance flood protections, or move out of harm's way. The workshop was an opportunity to share information and techniques, find areas for collaboration, and discuss paths for moving forward. This article reviews highlights and conclusions of that workshop. The full report and an appendix of resources are available at *act-adapt.org*

URGENT NEED TO UPDATE FLOODPLAIN MAPS

The summer 2013 issue of *Watermark* included an article on the urgent need to update floodplain maps in BC. Floodplain maps are the first step for understanding flood hazards, laying out the normal location of watercourses, surrounding land elevations, and the geographic extent of the floodplain – under a given return probability (usually 0.5% in any given year, or 1-in-200 years).

These floodplain maps illustrate where water will go, but to understand what's actually at risk, we need to know much more. The Great Flood of Calgary in June was only a 1-in-75 year flood, but its cleanup costs will be in the billions of dollars. According to Alberta WaterSmart, although this flood was only the fifth largest since record keeping began in 1879, it will likely be the most expensive natural disaster in Canada, because of the homes, businesses and infrastructure that were damaged or destroyed. True flood risk assessments account for the combined factors of the probability of flooding, where it will flood and what the damages may be.

There are few communities in BC that have up-to-date flood risk assessments, but even these are being called into question by climate, land-use and hydrological change. The current BC provincial flood management and mitigation legislation, policies, guidelines and programs were developed using traditional methods of hydrology, calculated from historical data. Until recently, the frequency of hydrologic events were considered to be relatively predictable. Today, however, changing climate patterns, including increased intensity and magnitude of precipitation (particularly in winter), more rain-on-snow events and accelerated sea level rise, all exacerbate the risk of flooding. In the not-too-distant future, events are projected to be increasingly variable and extreme. As a result, historical records no longer provide an accurate roadmap for planning and decision-making, because the past is no longer a good guide for future conditions.

The need for new approaches is particularly important because as floodplains in BC continue to develop at a rapid rate, assessments and mitigation planning need to keep up. The quickly changing risk-landscape demands new risk-based approaches. Recognizing this need, the Association of Professional Engineers and Geoscientists of BC (APEGBC) published new guidelines in 2012, emphasizing risk-analyses and the need to plan for hydrological change.

STORM DRAIN BACKUPS DRIVE RISK ASSESSMENT TOOLS

It's clear that different problems require different tools. Storm drain backups bring different risks than sea level rise or flooding from rain-on-snow events, and need a different kind of predictive model. Storm drain insurance has become, surprisingly, a major driver for advances in risk assessment. It is also an excellent example of how social roles are changing in response to the knowledge and policy gaps in climate change adaptation.

It is not possible for homeowners to purchase overland flood insurance in Canada, but in most areas, residents are insured for storm drain backups that happen during heavy rainfalls. But given the increase in the intensity, duration and frequency of storms (also known as IDF curves) with climate change, insurers are concerned that they can no longer adequately assess storm drain flood risk to set proper premiums. In response, the Insurance Bureau of Canada has developed a groundbreaking model, combining their highly-detailed records of insurance claims with IDF curves and municipal data about the state of their drainage infrastructure. The result – the Municipal Risk Assessment Tool (MRAT) – is a high-resolution risk map for storm drain flooding

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in developed areas, providing a tool both for the municipalities (who can use it to strategically target infrastructure repairs) and the insurance industry (to set premiums).

OTHER TOOLS TO ASSESS RISK

Another example is HAZUS – probably the most elaborate of the models covered in the workshop. It has evolved rapidly since the tragic hurricane and flooding of New Orleans in 2005. The HAZUS risk assessment model was developed by the US Federal Emergency Management Agency (FEMA), and was recently brought to Canada by Natural Resources Canada. This model uses science and engineering knowledge and GIS information to estimate hazard-related damage and loss before or after a disaster occurs. The model works for earthquakes, floods and hurricanes, and can estimate both economic and social losses based on census information, infrastructure maps and other input. HAZUS is a powerful tool, but is limited by the quality of data supporting it, and (because it is so elaborate) is most suitable for large communities with high-quality spatial data that are especially vulnerable to multi-hazard scenarios (such as an earthquake followed by tsunami).

At the other end of the spectrum, the Regional District of East Kootenay is working on a method to prioritize flood risk assessments across a large region with scarce data. It takes a three-phased approach: first, a flood hazard baseline study, then detailed flood risk assessments in key areas, and finally flood risk management strategies. The study provides a starting point based on existing conditions and identifies hazard intensity and potential for loss. Unlike a more detailed flood risk assessment, it doesn't estimate damage or loss for specific flood scenarios.

A number of other tools were also featured at the workshop, including the PIEVC protocol, developed by Engineers Canada to evaluate risks to infrastructure from climate change; the sea-level rise visualization models produced by the UBC Collaborative for Advanced Landscape Planning (CALP) with the Corporation of Delta; the Climate Action Secretariat's study, *Evaluation of BC Flood Policy Performance for Coastal Areas in a Changing Climate*; the BC Ministry of Agriculture's planning process for managing livestock during flood events in the Fraser Valley; and the initial stages of a project by the Fraser Basin Council to produce a business plan for a *Regional Flood Management Strategy* for the Lower Fraser.

ADDRESSING THE THREAT OF FLOOD AT THE PROVINCIAL LEVEL

Workshop participants spoke frankly about the policy changes needed to address the growing threat that flooding poses to BC's economy and communities. There was general concern that government may be underestimating the long-term risks caused by a combination of more extreme weather events and sea level rise. One idea was to centralize flood hazard management within the provincial government to ensure that flood risks are addressed systematically. Another proposal was to introduce a standards- and results-based approach where the province sets objectives that must be met, and then monitors for compliance. Ideally, these proposals would bring consistency to the fragmented system that currently exists from one local jurisdiction to another.

The three pillars of flood hazard management in BC are land use management, structural controls and flood response. Adapting to climate change will take the implementation and enforcement of existing legislation, policies and programs, and the strengthening of all three of these pillars, including flood response efforts.

Participants recommended there be a shift to proactive, preventive measures such as re-engineering landscapes and restoring ecosystems. The 1-in-100 and 1-in-200 year standards now in wide use will not provide the kind of protection required in rapidly changing hydro-climatic conditions. Furthermore, much of the province's present flood protection infrastructure does not even meet these standards. Large investments are needed to act on known risks – a recent report found that it will cost over $9.5 billion to protect the Lower Mainland alone from sea level rise and storm surges. Another challenge is how to communicate these growing risks to the public.

In conclusion, the central goals of the *Not Waiting for Noah* workshop were to build a community of practitioners, and discuss problems and solutions for flood management and mitigation in a changing climate. The workshop also aimed to highlight best practices and proactive strategies to address the changing risk landscape and the increasing number of vulnerable people and assets in flood prone areas. As we tackle such complex and evolving challenges, ongoing dialogue including as many perspectives as possible will be essential for progress.