

### Executive Summary

This study aims to summarize what has been done to date in adapting stormwater and floodplain management practices to prepare for the impacts of climate change, both in Canada and elsewhere. The specific focus of this review was on identifying adaptive approaches to the planning and design of stormwater management and drainage infrastructure, as well as changes in land use and floodplain management practices to account for the potential impact of climate change on drainage infrastructure and flood vulnerable areas. However, adaptation plans or practices from other fields were also considered where it was felt such examples provided background support and commentary on the state of climate change adaptation practice. In addition to a review of the current literature, a survey of major Canadian municipalities was also conducted to establish the current state of stormwater and floodplain management adaptation response.

Increasingly, there is general local and worldwide awareness of climate change and its potential impacts, as well as an acceptance that action is necessary in order to reduce these impacts. However, the focus of climate change response to date has been on mitigation; measures to decrease the concentration of greenhouse gases in the atmosphere to reduce the rise in global average temperatures. There has been significantly less emphasis on adaptation, despite the recognition that a significant change in climate is inevitable over the next century or longer as a result of the greenhouse gases that have already been emitted. In the current review it was noted that there are few examples of climate change adaptation plans by government agencies, municipalities or other sectors that are both prescriptive and detailed. Progress to date has tended towards providing strategic direction and confirming the need for adaptation planning rather than developing more detailed adaptation plans and policies. As a result, adaptation related to specific issues or areas of practice, such as stormwater and floodplain management, have generally not yet been addressed.

The lack of progress in adaptation planning can be attributed in part to the lack of climate change projections of sufficient resolution to support adaptation decisions that must be made at the local and regional scales. While mitigation plans can be justified as long as climate change is accepted as occurring, adaptation plans or practices necessarily have to be developed in response to changes of definite magnitude. At this time, climate change predictions are derived from simulations on a global scale, which in many cases do not incorporate important smaller-scale processes that are important to the smaller spatial scales of regional or municipal adaptation planning.

Within Canada, the Federal government is engaged in limited partnership initiatives to research climate change impacts and practical adaptation, but it has been criticized for not providing the necessary federal guidance to support Canadians in adapting to climate change. There are many provincial climate change action plans that recommend undertaking infrastructure vulnerability studies assuming future climatic conditions will change, but there is little guidance available on how climate change impacts can be assessed or on specific adaptation. No federal or provincial initiatives were found that provide guidance or insights on climate change adaptation in stormwater or floodplain management. Only one example was located of a federally or provincially legislated requirement to consider climate change impacts in planning and design of infrastructure. The Canadian Environmental Assessment Act, (CEAA) mandates that the effect of climate change are to be evaluated on projects requiring approval under the CEAA to ensure impacts would not pose risks to the public and the environment. However, the CEAA only legislates that adaptation be considered and does not provide any specific guidance for adaptation planning or practices.

Progress in climate change adaptation varies widely between Canadian municipalities. With respect to stormwater and floodplain management, some municipalities have chosen to defer climate change adaptation planning until such time as climate projections with acceptable levels of confidence and local detail are available. In the absence of federal and provincial guidance and useful projections of future local climate, municipalities have incorporated basic or arbitrary assumptions about precipitation characteristics in a future climate and have incorporated this into policies and design practices. A common and definitive action on stormwater management is the promotion of innovative stormwater management measures, which are “no-regrets” measures that have a benefit regardless of the degree of future climate change. However, in general such programs were already being advanced to address other stormwater management issues and as such are not specific responses to climate change. No examples were found in Canada of a comprehensive impact assessment and adaptation planning process, specific to stormwater or floodplain management, that thoroughly examined the effects of a predicted future climate and recommended specific measures or practices in response.

Outside of Canada, the state of climate change adaptation planning is at a similar stage in the United States, Europe and the rest of the developed world, with most products consisting of high-level policy statements that recognize the need for specific adaptation response to climate change impacts and call for action. A notable exception related to floodplain is the Government of the Netherlands’ national strategy to conduct major improvements to its flood protection works along the Rhine River, to adapt to expected flow regime changes to the river as a result of climate changes. In other locations, similar examples of definitive action on the basis of the current climate change predictions were found for other types of infrastructure, such as the construction of wastewater treatment plants at increased elevations to account for projected rise in sea levels due to climate change.

Apart from a few examples, at all scales there appears to be a tendency for efforts at adaptation planning to focus on principles and guidelines rather than detailed direction or quantitative guidance. Common to most climate change adaptation action plans are recommendations for further work as data on local climate change becomes available. In the context of stormwater and floodplain management, such recommendations include updating design storm information, modifying infrastructure design standards, and including consideration of climate change in the land use planning process to account for impacts to drainage infrastructure and floodplains. However, there is little guidance available as to how this can be accomplished. Consistent and defensible methods for the use of future climate projections to assess impacts to stormwater and floodplain management infrastructure, and wide dissemination of the methods once they are developed, are required to advance climate change adaptation practice in these fields.