



# VERNON

Multi-disciplinary stakeholders participation in a drainage infrastructure prioritization project

*By Esther Lambert*

*Source: City of Vernon*

## THE SCIENCE

The climate resilience of a municipality's drainage system is key in preventing flooding during and after excessive rainfall. Municipal infrastructure that is designed and maintained to withstand expected increases in rainfall can save a city millions of dollars of damage to private property and other public infrastructure. Understanding the impact of projected climate scenarios on environmental processes such as erosion and sedimentation that impact drainage systems is crucial.

The City of Vernon recognized the need to investigate the vulnerabilities of its drainage infrastructure and to determine the level of risk for different regions. Projected increases in the magnitude and frequency of rainfall, especially extreme events, present a high risk for the City's drainage infrastructure. Studies that use risk and level of service assessments to inform upgrades and new construction are essential.

## THE TRIGGER

The City of Vernon's recent flood events of 2017 and 2018 highlighted the importance of drainage in the long-term sustainability objectives of the City. There had also been more frequent drainage issues related to rainfall, which indicated a need to prioritize investments for different components of the municipal water management system and set sustainable funding levels for stormwater. As such, a more thorough analysis of drainage impacts related to new development projects, especially hillside developments, was required. The City was also preparing a Climate Lens grant funding application for Infrastructure Canada. The Completion of a PIEVC assessment and Drainage Infrastructure Prioritization Plan and study satisfied a large component of the Climate Lens assessment requirement.

## THE APPROACH

The first comprehensive study completed to assess the capacity of Vernon's drainage infrastructure was the 2001 Master Drainage Plan. More recently, the Drainage Infrastructure Prioritization Plan was undertaken and aligns with the goals set out in City council's strategic plan of 2019-2022, which presents the undertaking of drainage studies, risk and threat assessments, related bylaw amendments, and developing and implementing asset management plans as priorities for the municipality.

The project team worked with staff from the Utilities and Development Engineering Departments to understand existing and past drainage issues. They identified existing drainage, capacity, operational, and maintenance issues. Once overland flow routes were generated using LiDAR (a digital mapping tool), staff was instrumental in fact checking these flow routes and identifying overlooked culvert locations. Besides investigating overland flow routes, the City carried out a full-day risk assessment workshop with regional stakeholders including City staff (managers), mayor of Vernon, regional district, the British Columbia Government (Section Head, Public Safety & Protection), Ministry of Transportation, and Vernon's Climate Action Committee. City



**Figure 7:** *The City of Vernon's most recent flood events of 2017 and 2018 highlighted the importance of drainage in the long-term sustainability objectives of the City.*  
(Source: City of Vernon)

staff also participated in watershed tours and flood risk mapping and assessment workshops hosted by the Okanagan Nation Alliance and the Okanagan Basin Water Board, respectively.

Technical issues encountered in the generation of overland flow routes and catchment areas using very high-resolution LiDAR data were overcome by utilizing open-source GIS software packages. Incorporating culverts and piped infrastructure into the overland flow routes also proved challenging as these conduits had to be “burned” into the existing elevation surface, so engineering judgement had to be incorporated.

In brief, the City put together a team with the capacity to provide a comprehensive assessment of the risk and identify a broad range of possible solutions. The diverse nature of the team assembled was critical to the success of the initiative.

## THE OUTCOME

Major climate-related risks and vulnerabilities were identified by the study. Projected increases in rainfall event magnitude and frequency, especially for more extreme events, present the highest risk for the City's drainage infrastructure. The Upper British Columbia Express Company (BX) Creek and its drainage infrastructure was identified as the most vulnerable to projected climate change. Vulnerabilities include higher peak flow rates and increased sediment production, transportation, and deposition due to climate change. Overland and natural drainage courses, which

typically flow through existing development, are also highly vulnerable to climate change. The impacts correspond to increased runoff from more extreme rainfall events, and high runoff, erosion, and sediment conveyance after wildfires. Lower BX Creek and Vernon Creek (Upper and Lower) are vulnerable to projected changes in more extreme rainfall events. The analysis also revealed that existing capacity deficiencies will be exacerbated as climate conditions change. Projected increases in wildfire potential and severity also present significant risks in the form of increased runoff, erosion, and sediment transport.

Important Council resolutions were triggered by the Drainage Infrastructure Prioritization Plan. First, Council requested an investigation of high priority overland flow routes to develop a strategy to incorporate overland flow path improvement and protection projects into the year's capital plan. This is reflected in the City's capital funding envelope for citywide drainage improvements, which addresses drainage issues identified in the Drainage Infrastructure Prioritization Plan/Study. Second, Council directed administration to identify amendments to the City's applicable bylaws to designate and protect overland flow routes as per Section 34 of the Community Charter and Section 744 of the Local Government Act.

A PIEVC assessment was conducted following the study, which confirmed that overland and natural drainage courses are highly vulnerable to climate change, with impacts corresponding to increased runoff from more extreme rainfall events, and high runoff, erosion, and sediment conveyance after wildfires.

## A WORD FROM VERNON

Geoff Mulligan, Infrastructure Management Technician for the City of Vernon, stressed the need for municipalities to invest time in understanding their unique needs and vulnerabilities. He recommended starting with building a strong foundation of knowledge to include understanding the infrastructure (minor and major drainage systems), understanding geography and climate (present and future), and understanding the risk. "This can be achieved through plans, risk assessments and workshops that include a variety of stakeholders," says Mr. Mulligan.

He further explained that this approach can be operationalized by "Making climate adaptation a part of the planning process by integrating climate vulnerability into a prioritization framework and using risk as a decision tool to make improvements to drainage infrastructure as well as to protect overland flow routes from development." He also highlighted the value of developing useful tools such as mapping for decision-makers, including field staff, so that the data derived from these plans are accessible and usable.