

Integrating the Site with the Watershed and the Stream

A Watershed Blueprint for Hastings Creek: Creating the Future in the District of North Vancouver

8. Water Balance Model Express for Landowners

In 2012, the Metro Vancouver Regional Board provided a grant to help fund development of the Water Balance Model Express. The Board recognized that the 'WBM Express' will help Metro Vancouver members better deliver on regulatory compliance (reference: Figure 6), and in particular the Minister's conditions of approval.

"The \$50,000 from Metro Vancouver leveraged over \$250,000 in cash and in-kind contributions," reports Ted van der Gulik. "A key to a successful outcome is the critically important part that North Vancouver is playing. The Hastings Blueprint is the demonstration application for implementing *watershed-based* performance targets at the site scale as individual properties redevelop."



"The WBM Express represents a bold leap forward in the practice of urban drainage. At last local governments have a tool that integrates the SITE with the WATERSHED and the STREAM. The Express strips the challenge of setting and implementing targets to its essence."



Watershed Health is a Shared Responsibility:

"The calculation engine in the Express integrates three performance targets that are pre-set by the District," explains Richard Boase. "These targets link rainfall to stream health. This frees users to focus solely on selecting rainfall capture measures that will achieve the pre-set targets. The WBM Express is a tool that will enable every landowner to do their part to protect and restore watershed health over time. Achieving the Water Balance Goal is a shared responsibility."

WBM Express is an Interactive Tool

"The WBM Express solves the vast majority of common problems faced by a landowner exploring ways to implement rainfall capture in accordance with a watershed plan, and without requiring use of tools designed for more complex situations," states the Florida-based Dr. Charles Rowney.

Charles Rowney is a Canadian and is the internationally recognized Scientific Authority for the Water Balance Model Partnership. In the mid-



1980s, he developed the QUALHYMO hydrologic calculation engine for the Ontario Ministry of Environment. This public domain engine powers the continuous simulation Water Balance Model. Charles Rowney and Jim Dumont collaborated to develop the Express.

Colourful, Effective and Fast: "The calculation engine in the WBM Express integrates three pre-set performance targets using a science-based methodology developed by Jim Dumont, Engineering Applications Authority specifically for the WBM Express. The underlying technical approach is precedent-setting."

"The Express interface is also innovative (Figure 20). It uses modern web technologies to guide the landowner through a simple and visually oriented set of sizing options, with outcomes displayed in real time."

"The interface is colourful, effective, fast and no more complex than the dash board of a typical car, stripping the problem down to a few sliders that drive gauges (or dials). We anticipate that both homeowners and professionals will find this interactive tool to be an efficient and enjoyable way to rapidly test alternative rainwater control types and sizes," concludes Charles Rowney.

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The screenshot displays the 'WATER Balance MODEL express' software interface. On the left, three circular dials show 'Stream' (0.45), 'Site Volume' (7.06), and 'Site Infiltration Area' (8.11). The 'Site Builder' section on the right lists available components: Building, Hard Surface (Driveway, Patio, Path), Landscaping, Infiltration Swale, Rain Garden, and Planter Box. Below these are project details for '3828 Hoskins Rd' and a list of selected components. A red arrow points from the text 'Click and drag to define a property' to the 'Landscaping' button. Another red arrow points from the text 'User choices drive the dial readings' to the 'Site Infiltration Area' dial. A third red arrow points from the text 'Sliders dynamically and instantly drive the dials in response to user selections' to the 'Rain Garden - With Storage' configuration panel, which includes sliders for Volume, Infiltration Area, Sand Material, and Sand Material Depth.

'Click and drag' to define a property

User choices drive the dial readings

Sliders dynamically and instantly drive the dials in response to user selections

Make Choices that Mimic the Water Balance
Figure 20

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WBM Express Integrates Three Performance Targets

Figure 21 presents the Water Balance Targets that have been developed for Hastings Creek. There are three design parameters: volume of rainwater retained on a site; rate at which some of that volume infiltrates into the ground; and rate at which the remaining volume is slowly released to the pipe system to maintain stream baseflow.

Prevent Erosion and Protect Stream Health:

“Under natural conditions, flow in a stream reaches the stream through several pathways and over different time scales. The process starts with the ability of the landscape to absorb rainfall. It continues with movement of water through the ground. Replicating these conditions in an integrated manner holds the key to restoring the Water Balance over time,” explains Jim Dumont.

“In engineering terms, the design objective is to manage stream energy to reduce or limit stream erosion, while at the same time protecting water quality. Erosion is caused by the combination of volume and flow duration. The cause-and-effect relationship boils down to this equation: *less volume equals less erosion*. However, too little flow means no fish.”



“The desired outcome in implementing Water Balance Targets for the Hastings Creek drainage system is that redeveloping areas would restore their natural contributions of flow to the many tributary streams that pass through Lynn Valley. This would be achieved one property at a time, over time. Redevelopment is an opportunity to achieve cumulative benefits. This contrasts with the cumulative impacts that are currently being experienced,” continues Richard Boase.



WBM Express is Aligned with Other Regulatory Tools

“DNV’s Development Servicing Bylaw provides a relevant frame of reference for implementing the WBM Express. The bylaw references use of the Water Balance Model. The bylaw also contains language that clearly identifies that flood risk and erosion be maintained at rates that approximate the natural forested watershed,” observes Steve Ono, Deputy General Manager (Engineering Services).



“It is implicit in the bylaw language that the Water Balance of developed conditions should also meet that of the natural forested watershed. This means that both infiltration to ground and flows in the stream should be maintained, or restored. The proposed targets (Figure 21) would do this.”

Policy Framework in Official Community Plan:

“The WBM Express is a tool that both supports and enables implementation of the environmental and infrastructure policy framework that is laid out in the OCP,” reports Richard Boase.

“The OCP contains language that describes desired outcomes that are embodied in a **Water Balance Restoration Strategy** – for example, in Section 9 on Environmental Management, rainwater interception is recognized as an ecological service and: ‘*The District’s objective is to protect and improve the ecological health of our natural systems*’. Clear policy direction related to protection of soil, trees and hydrologic function means the Water Balance Goal can be achieved.”




“The rainwater management framework for the Lynn Valley Town Centre demonstrates how planning, engineering and environment can align our efforts to achieve the Water Balance Goal. We have science-based understanding. We have technically solid policies. We have practical tools to restore the Water Balance.”

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Water Balance Model Express for Landowners

INNOVATION: Calculator *integrates* three watershed-specific performance targets



The targets for each ZONE are pre-set by the District:

Baseflow Release Rate
(i.e. Interflow Replicator Rate)
(litres per second per hectare)

Storage Volume
(i.e. Interflow Storage Replicator)
(cubic metres per hectare)

Infiltration Area
(i.e. Groundwater Storage Recharge)
(is a function of area of contact with native ground)

Target Parameter	Lynn Valley Town Centre	Rest of Watershed
Baseflow <i>(Lps per hectare)</i>	0.5	0.5
Volume <i>(m³ per hectare)</i>	1150	280
Area	3%	3%

Water Balance Targets for Hastings Creek Watershed
Figure 21