



Sustainable Rainwater Management: Mimic the Water Balance!

Learn How to Use Effective Green Infrastructure, Lighten the 'Water Footprint',
Achieve More at Less Cost, Adapt to Climate Change and Protect Stream Health



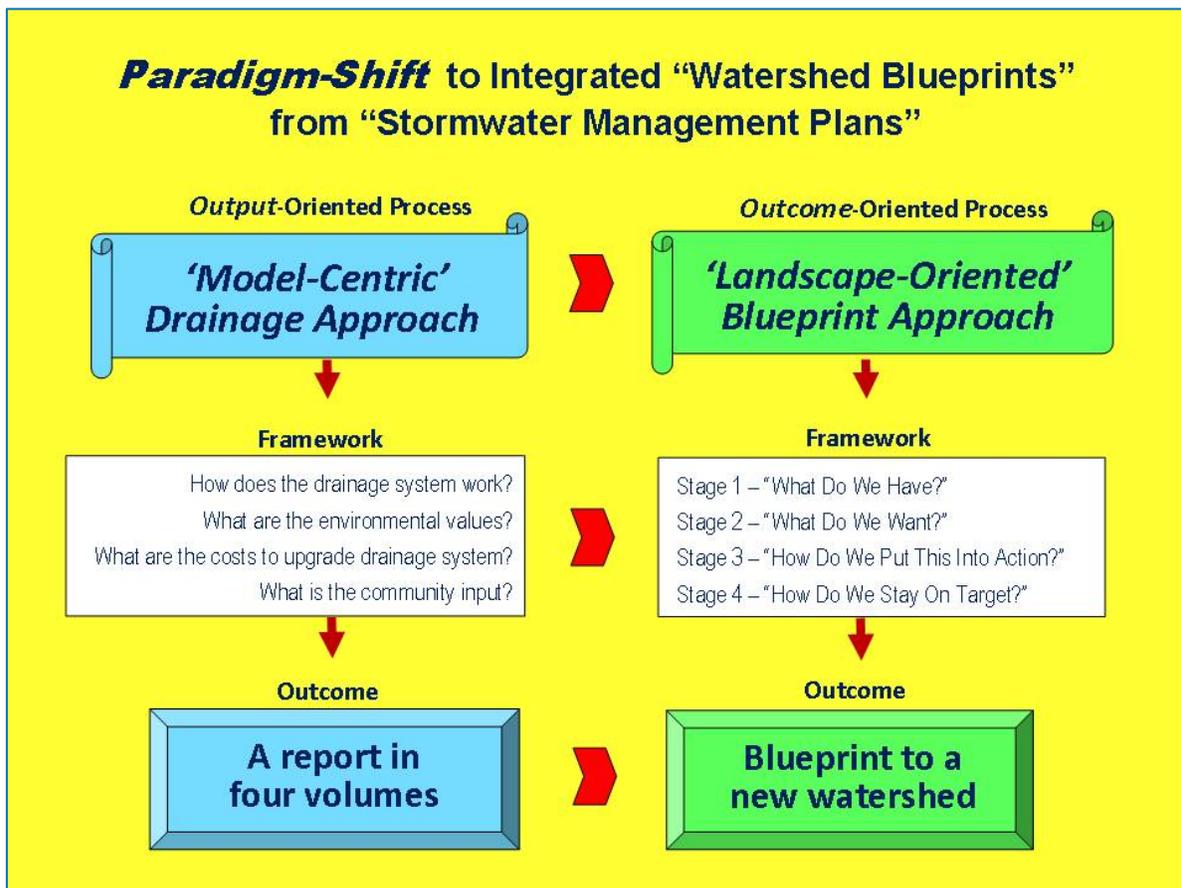
A Water Balance Model Workshop on "Integrating the Site with the Watershed and Stream"

Hosted by the Capital Regional District on November 29
and featuring District of North Vancouver case study experience

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Integrating the Site with the Watershed and the Stream

An Outcome-Oriented Approach to Mimicking the Water Balance
is Guided by this Way-of-Thinking



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2012 Capital Region Water Balance Model Workshop	
Regulatory Context:	<ul style="list-style-type: none"> <input type="checkbox"/> “By 2012, all land and water managers will know what makes a stream healthy, and therefore be able to help land and water users factor in new approaches to securing stream health and the full range of stream benefits.” (p. 43 of Living Water Smart, BC’s Water Plan) <input type="checkbox"/> “Adapting to climate change and reducing our impact on the environment will be a condition for receiving provincial infrastructure funding.” (p. 63 of Living Water Smart, BC’s Water Plan)
Abstract:	<ul style="list-style-type: none"> <input type="checkbox"/> In Metro Vancouver, the Minister of Environment has required that municipalities protect watershed health by connecting the dots between land use planning and on-site rainwater management. The District of North Vancouver’s Hastings Creek Watershed Blueprint illustrates what “integrating the site with the watershed and stream” means; and is a provincial demonstration application for two web-based tools: Water Balance Model Express for Landowners; and Drainage Infrastructure Screening Tool. <input type="checkbox"/> The Express can help local governments implement performance targets that link rainfall capture to stream health. The Express is interactive and is an efficient and enjoyable way to rapidly test alternative rainwater control types and sizes. It is no more complex than the dash board of a typical car, stripping the problem down to a few sliders and gauges. <input type="checkbox"/> The Drainage Infrastructure Screening Tool can save local governments money because it eliminates expensive and unnecessary modeling of every pipe in a drainage conveyance system, provides relevant information for capital planning and affordable budgets, and assesses system resiliency to accommodate redevelopment and/or climate change.
Teaching Team:	<ul style="list-style-type: none"> <input type="checkbox"/> Kim A Stephens, M.Eng., P.Eng., Executive Director, Partnership for Water Sustainability <input type="checkbox"/> Richard Boase, P.Geo., Environmental Protection Officer, District of North Vancouver <input type="checkbox"/> Jim Dumont, P.Eng., Engineering Applications Authority, Water Balance Model Partnership
Structure for an Interactive Knowledge-Sharing and Training Session	
Part One <i>What Everyone Should Know</i> (0930 - 1030) <i>Demonstration Applications</i> (1030 - 1200)	<p>Scope: Introduce core concepts that underpin the mantra: “Mimic the Water Balance”. Explain why BC looks at rainfall differently. View through the regulatory, historical and science lenses.</p> <p>Educational Objective: <i>Participants will have a common understanding of WHY the Water Balance Methodology and HOW it is being implemented in British Columbia.</i></p> <hr/> <p>Scope: Elaborate on how the Hastings Creek Watershed Blueprint will achieve this goal: “After redevelopment, each site will function as it did before, or better!” The Lynn Valley Town Centre redevelopment is the catalyst for early action by the District. The Blueprint is assembling the pieces that will achieve the vision for restoration of watershed function. It is GIS-enabled, interactive, and is already informing operational actions and current as well as future planning.</p> <p>Educational Objective: <i>Participants will understand how to establish and implement performance targets for rainfall capture on sites and flow rates in streams</i></p>
Part Two (1300 - 1500) <i>Online Experience &</i> <i>“Ah-Ha” Reflections</i>	<p>Scope: Lead the group step-by-step through application of the WBM Express. Demonstrate how to do scenario comparisons and achieve pre-set performance targets at the SITE scale.</p> <p>Educational Objective: <i>Participants will understand the capabilities of the WBM Express and will be able to generate outputs</i></p> <hr/> <p>Scope: Share ‘Ah-Ha Moments’ and describe how you will apply what you have learned.</p> <p>Educational Objective: <i>Participants will be able to talk knowledgeably about the Express.</i></p>

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Attachment A:

PowerPoint Slides

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Attachment B:

Guidelines for Setting Performance Targets for use in Water Balance Model Express



the partnership
for water sustainability in bc

Convening for Action in British Columbia

Water Balance Model Express: Guidance for Setting Performance Targets to Limit Erosion and Protect Stream Health

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August 12th 2012

Integrating the Site with the Watershed and the Stream

Water Balance Model Express: Guidance for Setting Performance Targets

Message from the Chair

*The Water Balance Model Express is the latest building block in a decade-long program that builds on the technical foundation provided by **Stormwater Planning: A Guidebook for British Columbia**, released in June 2002. The target audience for the Express is landowners. Hence, the tool must be intuitive and easy to use.*

To advance development of this tool, the Partnership is collaborating with six local governments to demonstrate HOW to implement watershed-specific performance targets for rainwater management at the SITE scale. Collaboration works two ways:

- *On the one hand, our local government partners are providing the Water Balance Model team with case study applications. Their value is that they prove out the approach and the methodology that underpin the Express – for example: through its Hastings Creek process, the District of North Vancouver is playing an influential role.*
- *On the other hand, the team is a resource to our partners. This means we are available to help them accomplish their individual missions and mandates.*

This guidance document is a primer. It is also succinct and to the point in providing instructions on how to establish target values. The document comprises two parts: a brief front-end; and a supporting appendix. The key message is that there are three inter-linked performance targets. In engineering terms, all three are needed to reduce or limit stream erosion.

*Ted van der Gulik, PEng,
Chair
Water Balance Model Partnership
August 2012*



Six local governments will be the initial demonstration applications



Integrating the Site with the Watershed and the Stream

Water Balance Model Express: Guidance for Setting Performance Targets

Introduction

The Water Balance Model Express is a stand-alone application of the Water Balance Methodology. Each local government Partner will have a customized Express. Primary access will be via the Partner's website. Secondary access will be via the waterbalance.ca website. The Express has four principal components, namely:

- A. Front-end Website
- B. Pop-Up Map / Pre-Set Targets
- C. User Options and Choices
- D. Calculator to Drive a Pass/Fail Dial

The focus of this document is on Component B. It provides guidance so that Partners can establish watershed-specific performance targets for integration into the Express. The Water Balance Methodology is science-based and integrates the site with the watershed and stream. The goal is to reduce or limit stream erosion. A secondary benefit is protection of stream water quality. **KEY PRINCIPLE:** Establish targets in a logical and consistent manner for capturing rain where it falls. *Refer to Appendix A for a step-by-step and streamlined explanation of the methodology genesis and application.*

Model Framework: The mind-map presented below illustrates the vision for a cascading set of model platforms for systematic application of the Water Balance Methodology. The primary driver for different models is that different types of users have different needs. The knowledge of each user type is a defining consideration.

The starting point for modeling is the Watershed Vision and the Blueprint to implement the Vision. Information application evolves in this sequence:

- From the complex at the watershed scale, where the goal is to establish Performance Targets that mimic the Water Balance;
- To simpler at the neighbourhood scale - because the vision and targets are set, such that the technical focus is on the evaluation and evolution of alternatives;
- To the lot scale, where only the application of on-site systems for rainfall capture is needed to realize the vision and achieve the targets.

The over-arching goal in developing the Express is to guide landowners down the most practical pathway for achieving the pre-set targets.

This mind-map is the future framework for applying the **Water Balance Methodology** to establish, implement and verify Performance Targets at three scales

	Planning Function	Engineering Function	Landowner Application
Watershed		WBM Expert System (coming in 2013)	
Neighbourhood Development	WBM Version 2.1 (existing)	WBM Expert System	
Individual Property	WBM Version 2.1		WBM Express (coming later in 2012)

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Water Balance Model Express: Guidance for Setting Performance Targets

Watershed-Specific Targets

The desired outcome in establishing Watershed Targets is that developed areas will mimic their natural contribution of flows to the headwater streams that predominantly characterize BC landscape conditions. The contribution of flow in the stream prior to development occurs through several pathways and over different time scales. These are described in Appendix A.

Pre-Set Values: The Express integrates three performance targets: these are watershed-specific; they link rainfall to stream health. Each local government establishes the target values. When the landowner clicks on a pop-up location map, analogous to those for garbage collection schedules, this action automatically pre-sets the targets for the zone (sub-watershed) in which the subject property is located.

Because targets are pre-set, landowner attention is solely on selecting an effective combination of site enhancements that will achieve the targets. The Express guides the landowner through an iterative PASS/FAIL process to select and test options and choices.

This process allows the landowner to select the most appropriate, most desirable and least costly alternative to achieve the targets established by the municipality. The solution may include either a single component or multiple components which can be readily incorporated into the landscape of the subject property.

Need for Interim Target Values: As stated in the Introduction, the focus of this document is on Component B – that is, we provide Partners with guidance so that each of you can create a pop-up map and populate an associated matrix with target numbers by zone for the three performance targets (see image below).

We recognize that Partners will not have done prior research to establish watershed-specific targets. Hence, it will be necessary for you to estimate interim values. We provide you with a reasonable starting point and a direction for analyses. Over time, interim estimates would be refined as part of an ongoing adaptive management program for each watershed as and when Blueprints / ISMPs are completed.

WBM Express incorporates a calculator that *integrates* three watershed-specific performance targets



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

Storage Volume
(cubic metres per hectare)

Infiltration Area
(is a function of millimetres per hour)

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

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Water Balance Model Express: Guidance for Setting Performance Targets

Interim Target Values

Summarized below is a defensible starting point for initializing each Partner's Express. A critically important message is that stream health is a function of how the three performance target parameters interact to mimic the water balance. In engineering terms, the objective is to manage stream energy to reduce or limit stream erosion, while at the same time protecting water quality.

The three target values are represented by a retention volume, an infiltration area, and a baseflow release rate – all as described in Appendix A.

Retention Storage Volume: All rainwater management systems include some form of retention volume. Since release of the Stormwater Guidebook in 2002, the rule of thumb for volume has been half of the Mean Annual Rainfall (MAR).

Several studies have indicated a somewhat smaller value may be appropriate when optimized in combination with the two remaining Watershed Target Values.

A preliminary estimate of the **Target Value for Retention Storage Volume** can be applied from previous studies. Reported values range from as low as 150 m³/ha to as high as 300 m³/ha.

Surface Area for Dedicated Infiltration: Rainwater needs to have an area over which it can infiltrate into the ground. As development occurs, the area available for infiltration is reduced. Replacement of the infiltration capacity can be concentrated into dedicated areas set aside specifically to enhance the natural infiltration that would occur.

Several studies have indicated that if these concentrated infiltration areas are distributed throughout the development, the natural watershed infiltration volumes can be maintained. These concentrated infiltration areas would be in addition to any pervious surface enhancement such as increased top soil depth.

The **Target Value for Dedicated Infiltration Area** will likely be in the range from 5% to 10% of the total development area.

Baseflow Release Rate: All streams require a small baseflow to maintain the aquatic habitat and fisheries resource. As development occurs, this disturbs or destroys the large natural shallow surface sponge that captures rainwater then releases it over the span of a season or year. This is known as INTERFLOW.

The natural interflow process cannot be replicated by additional infiltration into deep groundwater because that can take years or decades or more to reach a stream. To mitigate this loss, a small release from the retention storage system is created. When combined with the remaining absorbent surface storage, this system will feed a baseflow to the stream.

The **Target Value for Baseflow Release Rate** can be established in one of two ways:

- When a watershed or catchment has a streamflow gauging station, simply divide the watershed's MEAN ANNUAL FLOW by the tributary Watershed Area to obtain the watershed-specific "Lps/ha" value.
- If there is no gauging station, use records from comparable watersheds or catchments and complete a REGIONAL ANALYSIS to establish a Baseflow Rate on a per hectare basis. An appropriate level-of-effort would be a couple of hours.

In terms of hydrologic function, and to provide clarity of purpose, the Baseflow Release Rate is also described as the INTERFLOW REPLICATOR RATE.

Adaptive Approach

The Partnership will work with the partners to help them customize the Express and determine appropriate interim target values. At this point in the process, the significant step forward is the recognition that all three design parameters interact to mimic the water balance and limit stream erosion. Over time, the Partnership looks to all partners to refine interim values as watershed understanding grows.

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Attachment C:

**Article in Stormwater Magazine
November 2011**