
Saanich Stormwater Series
October 8th 2004
“Do you know where you really are in the shifting paradigms of stormwater management?”

1. Run it in Ditches
2. Run it in Pipes
3. Run it in Stormwater Pipes
4. Keep it from Stormwater Pipes
5. Well, Just Don’t Cause Flooding
6. Oh, and Don’t Pollute Either
7. It’s the Ecology, Stupid
8. Water is Water is Watershed
9. Green and Bear It
10. Build the Vision, Create the Legacy
Building a Vision & Creating a Legacy

**Issue:** How We Manage Population Growth

**Impact:** Growth Resulting in Densification
(Smaller Lots; More Condos)

**Sustainability:** Means Design with Nature

**Built Environment:** We Can Improve It

**Natural Environment:** We Can Protect It

**Cumulative Benefits:** Accrue Over Time

**Outcome:** Sustain Community Livability
Presentation Road Map

- Context & Website Tour (Laura Maclean)
- Why the Water Balance Model (Kim Stephens)
- Case Study Demonstration (Doug Backhouse)
- Future Directions (Laura Maclean)
Continuum of Water Use – Everything is Connected!
Universal Issues

- Population Surge
- Landscape Transformed
- Natural Hydrology Altered
- Wetlands / Creeks Trashed
Inter-Governmental Partnership: Vision

To promote changes in land development practices so that:

- The built environment will preserve and/or restore the natural water balance over time.
- Performance targets will be achieved for runoff volume and flow rate reduction at the source, where rain falls.
Inter-Governmental Partnership: Mission

Provide Local Governments & Landowners with a ‘Decision Support / Scenario Modeling Tool’ To Help Meet Performance Targets for Runoff Volume Reduction
Stormwater Planning

The Water Balance Model has been developed as an extension of the Guidebook methodology

The Water Balance Model helps you...

- Visualize the ‘how to’ details of source control implementation
- Model scenarios at the site, neighbourhood and watershed scales
- Make decisions through a scientifically defensible, interactive, and transparent process
Inter-Governmental Partnership: Key Partnerships

Real Estate Foundation of BC
Urban Development Institute
BC Water and Waste Association
• Public Domain
• Web-based
• Interactive
• Decision Support

www.waterbalance.ca
Presentation
Road Map

- Context & Website Tour
- Why the Water Balance Model
- Case Study Demonstration
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Start with an understanding of the ‘Modeling Hierarchy’

- Policy Evaluation
- Decision Support
- Scenario Modeling
- Master Planning
- Pre-Design
How the Water Balance Model will be used to make better decisions:

- **Local Governments** - when communicating with the public
- **Planners and Engineers** – when setting performance targets
- **Developers and their Consultants** - when testing scenarios
- **Environmental Agencies** - when monitoring watershed health
Context is Everything!

- Historical Perspective
- Need for a New Tool
- Application of the WBM
By 1969, we had put a man on the moon... but we did not truly understand how urban land use changes degrade streams.
The Missing Link in Watershed Planning has been...

A tool that quantifies the benefits – in terms of reducing rainwater runoff volume - of installing source controls under different land use, soil and climate conditions.
A new modeling tool was needed because...

- Traditional hydrology models reflect the fixation on “peak flow thinking” at a watershed or ‘macro’ scale
- The hydrology engines are essentially based on 1930s and 1940s science
- Contemporary software focus has been on the user interfaces for ‘twisting the dials on black boxes’

“It was almost as though we stopped thinking circa 1975”
- Tom Debo, Author & Professor Emeritus
The Manning Formula (1895) illustrates how ‘engineering belief’ becomes accepted as ‘science’

“...no equation for open channel flow has been advanced that has displaced the Manning equation for practicing Engineers. This seems remarkable for a rather simple equation that was rejected by its author who was an accountant-turned-self-taught-engineer as a result of the Irish famine.”

Source: US Army Corps of Engineers
Ecosystem Management and Restoration Research Program
Percentage of Annual Volume

RAINFALL SPECTRUM
- Light Showers: 75%
- Heavy Rain: 20%
- Extreme Storms: 5%

INTEGRATED STRATEGY
- SITE
  - Keep Rain on Site
- NEIGHBOURHOOD
  - Delay the Runoff
- WATERSHED
  - Reduce Flooding

Water Infiltrates and Moves Slowly Through Soil

Water Balance Modeling

Conventional Hydraulic Modeling
The hydrology engine is built around a continuous Soil Moisture Simulation

Evapotranspiration  

Rainfall

Model tracks soil moisture fluctuation

Infiltration rate is a function of soil moisture (limited by hydraulic conductivities)

Runoff when soil is saturated

The hydrology engine reflects the wisdom of an international Expert Panel, incorporates established soil science principles, and provides a full accounting of the ‘water balance’
Our Expert Panel comprised individuals who are pioneering source-control applications and/or research

- John Argue
- Peter Coombes
- Dan Medina
- Charlie Miller
- Patrick Condon
- Bill Derry
- David Reid

- Infiltration Technology
- Stormwater Re-Use
- Low Impact Development
- Green Roof Technology
- Urban Site Design
- Best Management Practices
- Landscape Architecture
The Big Picture: Current Trends

The chart illustrates the annual rainfall as runoff (%) from 1999 to 2050. The ideal condition is shown in blue, and the impacts from climate change and growth are indicated by arrows. The graph shows an increase in runoff as years progress, highlighting the need for water management strategies.
The Big Picture: Watershed Targets

Target is Specific to each Watershed as determined in each Watershed Plan

Annual Rainfall as Runoff (%)

0 10% 20% 30% 40% 50% 60% 70% 80%

1999 2010 2020 2030 2040 2050

Watershed Target (varies)
Chilliwack is a community of 70,000 in the Fraser Valley.

Georgia Basin / Puget Sound BioRegion

3 million people in British Columbia

4 million people in Washington State
Providing Developers with Guidance

Stormwater Planning: A Guidebook for BC

Chilliwack Manual for Surface Water Management

Design Guidelines for Developers
The Goal - Solutions that:

- Are Integrated
- Solve Problems
- Achieve Multiple Objectives
- Promote Liveability
- Are Affordable
The Design Objective is to Infiltrate the First 30mm of Rainfall
City’s Current Landscaping Requirements Can Also Accommodate Infiltration

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Percentage of Land Needed for Infiltration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Deep Infiltration Systems</td>
</tr>
<tr>
<td>Little area is needed for source control infiltration. The galleries can be installed under landscape or asphalt parking.</td>
<td>2.5%</td>
</tr>
<tr>
<td>Commercial / Industrial</td>
<td>2.2%</td>
</tr>
<tr>
<td>Institutional</td>
<td>1.4%</td>
</tr>
<tr>
<td>Residential – Low Density</td>
<td>2.3%</td>
</tr>
<tr>
<td>Residential – Medium/High Density</td>
<td>2.3%</td>
</tr>
</tbody>
</table>
Building Block #5:

“Rainfall and Flow Monitoring for the First Two Demonstration Projects Has Confirmed That Infiltration Systems Do Work”
“A High Degree of ‘Runoff Control’ is Being Achieved in Both Subdivisions”
Lessons Learned?

- Provide Minimum Soil Depth
- Promote Landscaping / Rain Gardens
- Control Driveway Drainage
“Sea of Roofs”
Livability and Streetscape Design: We Have Choices

Will Streets Be Sterile and Uninviting, Or Green and Inviting?

City of Seattle Street Edge Alternatives Program
Key Messages

- ‘Break the connection’
- Encourage ‘rain gardens’
Water Balance Model Perspectives

- **Planners**: Tool for Better Use of Space
- **Engineers**: Tool for Infiltration Pre-Design
- **Landscape Architects**: Tool for Green Solutions
Source control technologies are relatively mature. What is lacking is knowledge on how to implement source control technologies to the best advantage of the community.

Dr. Peter Coombes
University of Newcastle, Australia
Presentation

Road Map

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Presentation

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The Water Balance Model is ‘Going National’...
and the layout will be similar to the Stewardship Canada website.
The Water Balance Model is about a way of thinking.
Integrated Rainwater Management Planning

From TRADITIONAL to

- Drainage Systems
- Reactive (Solve Problems)
- Engineer-Driven
- Protect Property
- Pipe and Convey
- Unilateral Decisions
- Local Government Ownership
- Extreme Storm Focus
- Peak Flow Thinking!

INTEGRATED:

- Ecosystems
- Proactive (Prevent Problems)
- Interdisciplinary Team-Driven
- Protect Property and Habitat
- Mimic Natural Processes
- Consensus-Based Decisions
- Partnerships with Others
- Rainwater Integrated with Land Use
- Volume-Based Thinking!
And in conclusion…

‘Designing with Nature’ means:

👍 Create Greener Communities
👍 Achieve Higher Levels of Wetlands / Stream Protection