

A topographic map of a watershed area, showing a network of rivers and streams. The terrain is color-coded by elevation, with green representing lower elevations and brown/purple representing higher elevations. A large, dark blue area on the left side of the map represents a body of water, likely a bay or inlet. The map is overlaid with a dark blue rectangular box containing the main title.

A 'Design with Nature' Approach
to Rainwater Management:
The Water Balance Model for BC

Saanich Stormwater Series
October 8th 2004

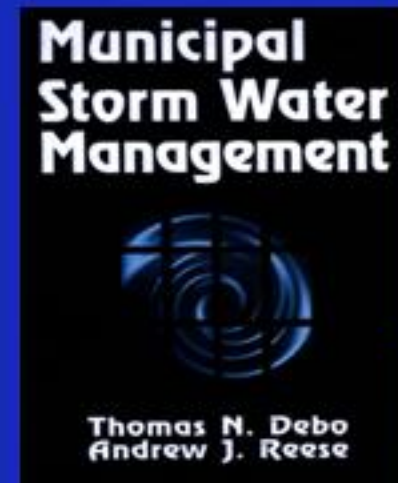


Andy Reese

“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

An aerial photograph of a suburban neighborhood with a road map overlay. The map shows a network of roads in white and yellow, with a prominent road running vertically through the center. The surrounding area is a mix of green fields, trees, and residential buildings.

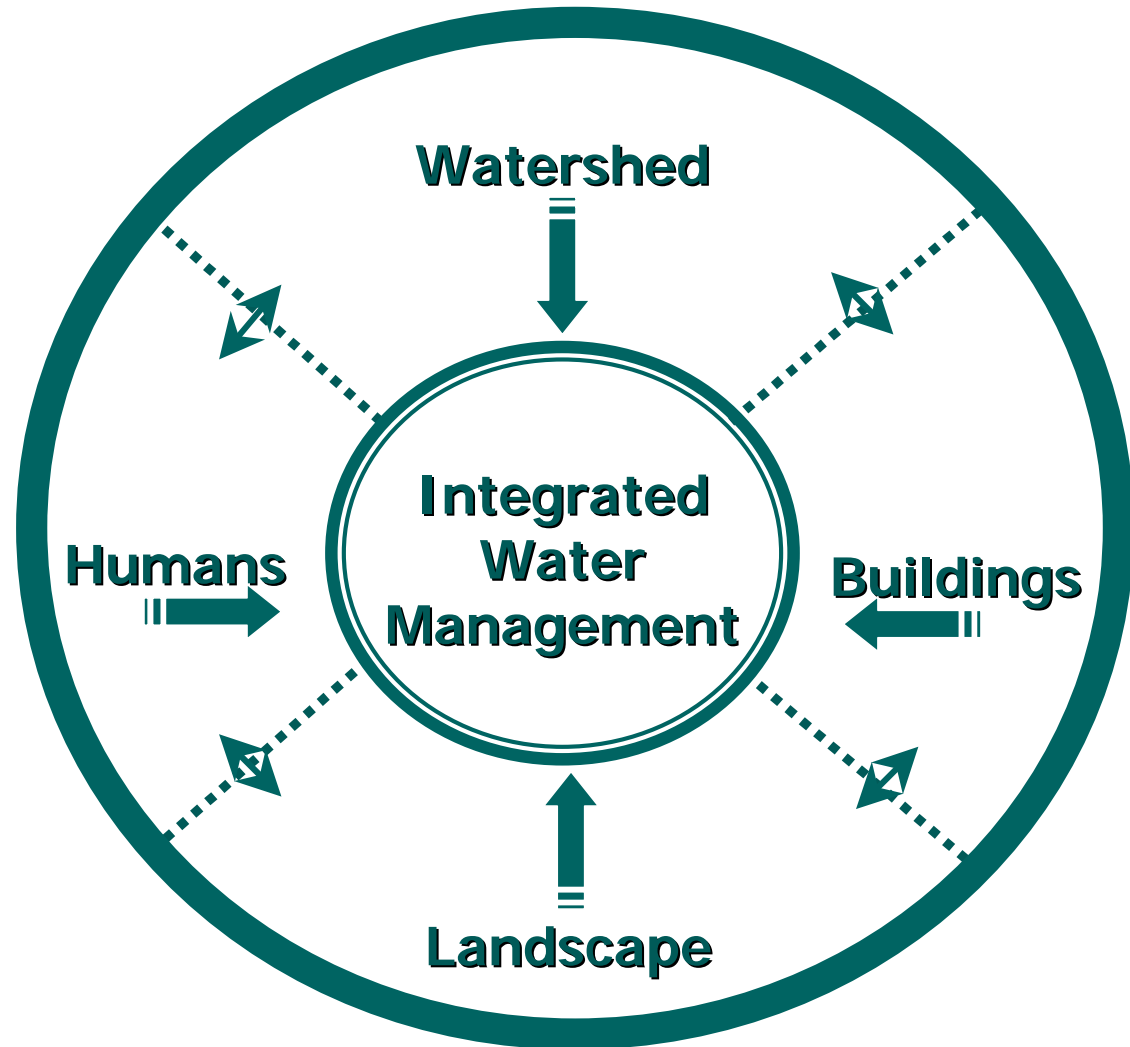
Presentation Road Map

- **Context & Website Tour** (Laura Maclean)
- **Why the Water Balance Model** (Kim Stephens)
- **Case Study Demonstration** (Doug Backhouse)
- **Future Directions** (Laura Maclean)



WATER
Balance
MODEL
FOR BRITISH COLUMBIA

Continuum of Water Use – Everything is Connected!



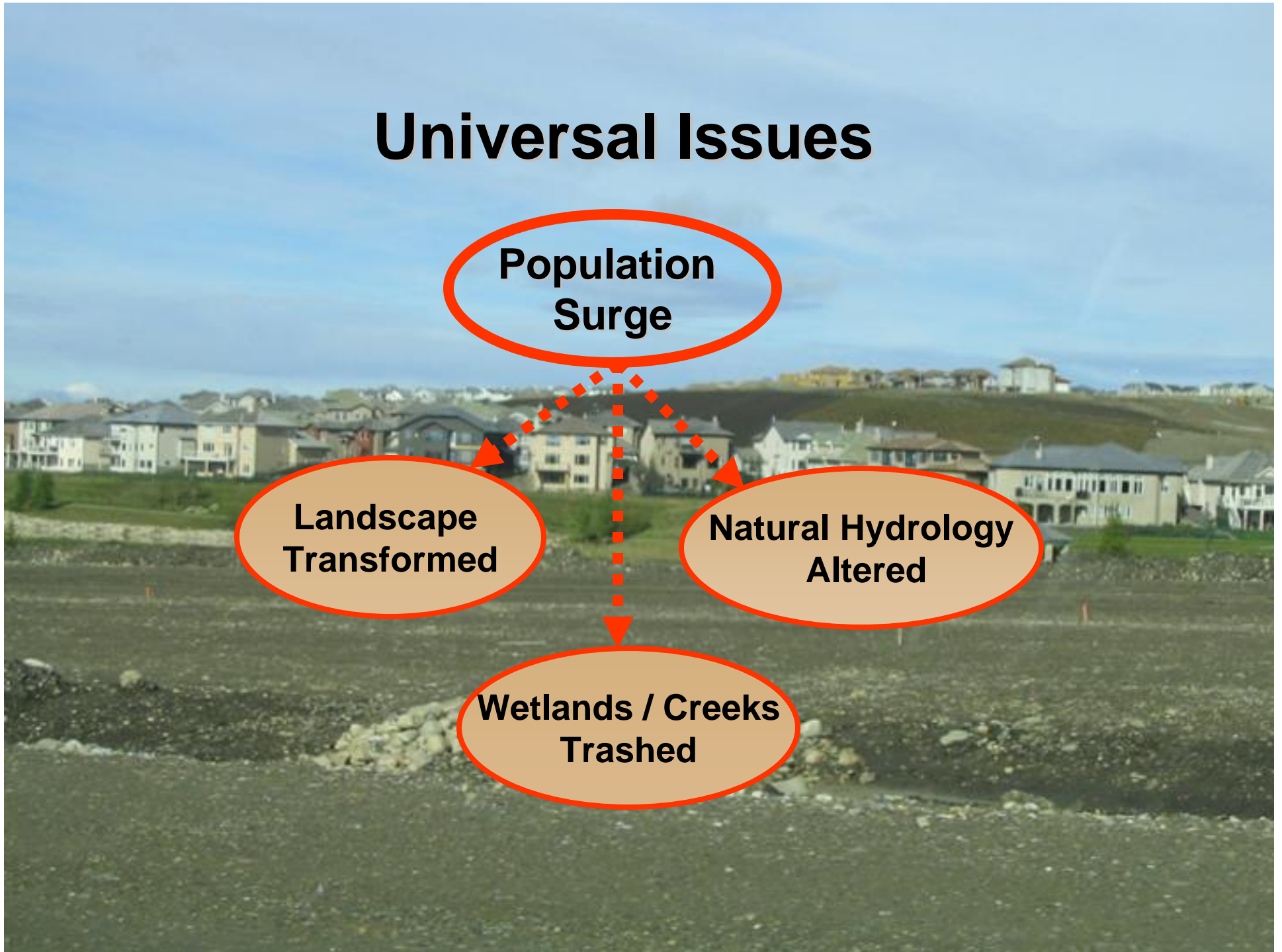
Universal Issues

Population Surge

Landscape Transformed

Natural Hydrology Altered

Wetlands / Creeks Trashed





WATER
Balance
MODEL
FOR BRITISH COLUMBIA

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*



WATER
Balance
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FOR BRITISH COLUMBIA

Inter-Governmental Partnership: Mission

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




A GUIDEBOOK FOR BRITISH COLUMBIA

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**
- 



WATER
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FOR BRITISH COLUMBIA

Inter-Governmental Partnership: Key Partnerships

Real Estate Foundation of BC

Urban Development Institute

BC Water and Waste Association





WATER Balance MODEL FOR BRITISH COLUMBIA

The Water Balance Model promotes a watershed-based approach that manages the natural environment and the built environment as integrated components of the same watershed.

Learn why the Water Balance Model is an important resource

See how the Water Balance Model can be applied.

View recent presentations

To Learn More About Using the Model View these Tutorials:

- Create a Project
- Develop Scenarios
- Describe Native Soils
- Add Land Use Information
- Describe Surface Types



WATER Balance MODEL FOR BRITISH COLUMBIA

Partners • About • Home

Access Model • Resources • Background



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IGP Proceeding with Training Workshops

The mission is to landowners to rainwater volu conditions.

The goal is th development

To accomplish based support Outreach and and training s

OCEP was lau event provide with the Uyar development

- Public Domain
- Web-based
- Interactive
- Decision Support

verments and ance targets for soil and climate

i for land

build broad- : via an resentations lore

alties. This collaborating he land



Richi posit Model

trates the Balance

www.waterbalance.ca

An aerial photograph of a suburban neighborhood with a road map overlay. The map shows a network of roads in white and yellow, with a prominent road running vertically on the left side. The background shows a mix of green fields, trees, and residential buildings.

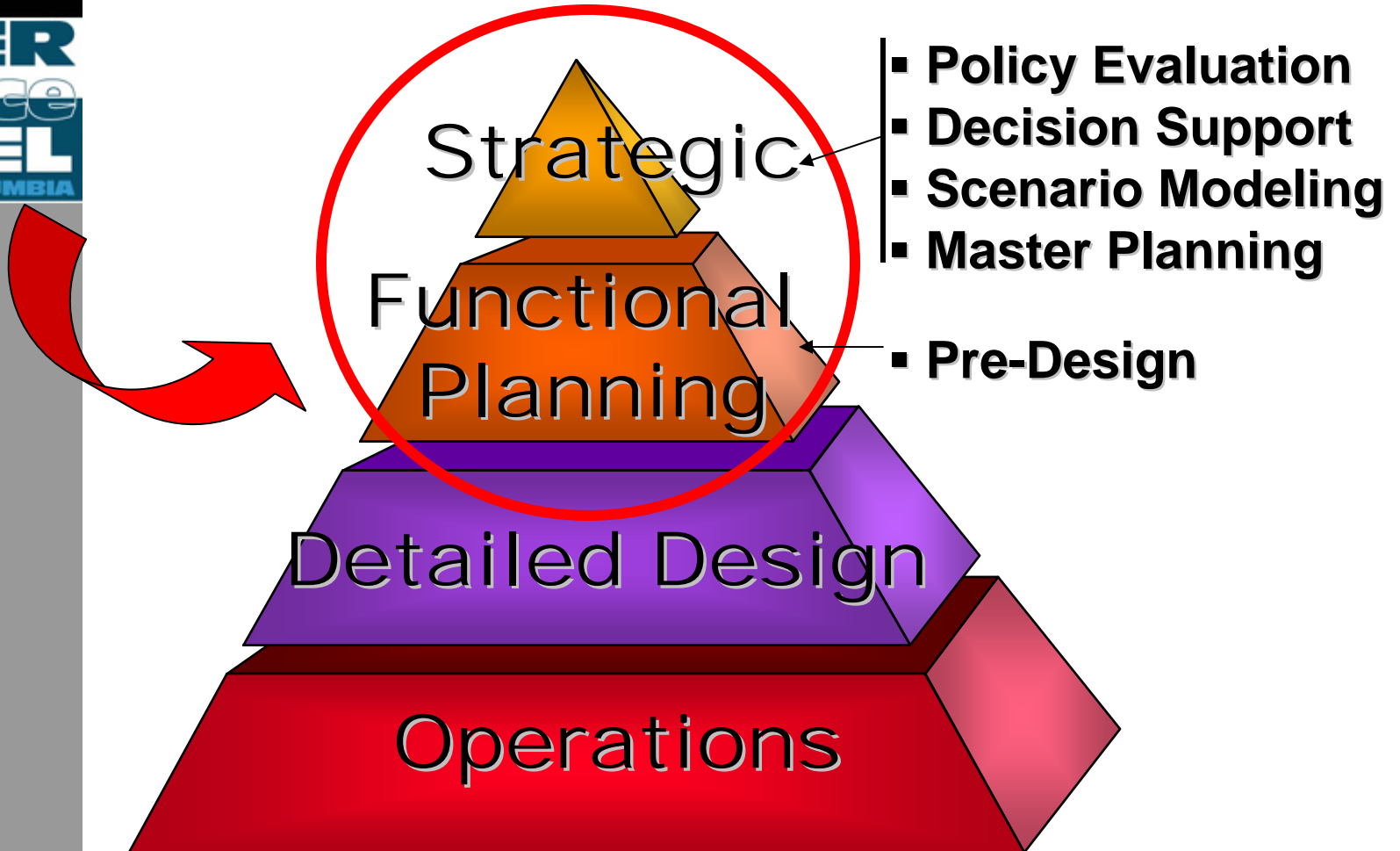
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WATER
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MODEL
FOR BRITISH COLUMBIA

Start with an understanding of the 'Modeling Hierarchy'



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



WATER
Balance
MODEL
FOR BRITISH COLUMBIA

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

Re-inventing urban hydrology – going back to basics to develop new tools

by Kim A. Stephens, KSA Consultants Ltd.
Thomas N. Debo, PhD,
Georgia Institute of Technology

- to represent the hydrologic cycle.
- Linsley fought a difficult war to replace the established procedures that had been used for many years, and that continue to be used in most

Somewhat ironically, the “hydrology engine” for HSPF and other contemporary models (such as the Stormwater Management Model – SWMM) is based on 1930s and 1940s science. As reported by Linsley in

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’

as a consulting engineer, Linsley pioneered the development of continuous hydrologic simulation as the foundation for water balance management. He received worldwide recognition for his vision and his contributions to the

“It was almost as though we stopped thinking circa 1975”
- Tom Debo, Author & Professor Emeritus

Hydrologic
Pathway



WATER Balance MODEL FOR BRITISH COLUMBIA

Robert Manning
(A Historical Perspective)
by Dr. Craig Fischenich¹

emip

April 2000

The Manning Formula (1895) illustrates how 'engineering belief' becomes accepted as 'science'

Open Channels and Pipes," published in *Transactions of the Institution of Civil Engineers of Ireland* (Manning 1891), became the primary reference for his work and the source of Manning's monomial equation:

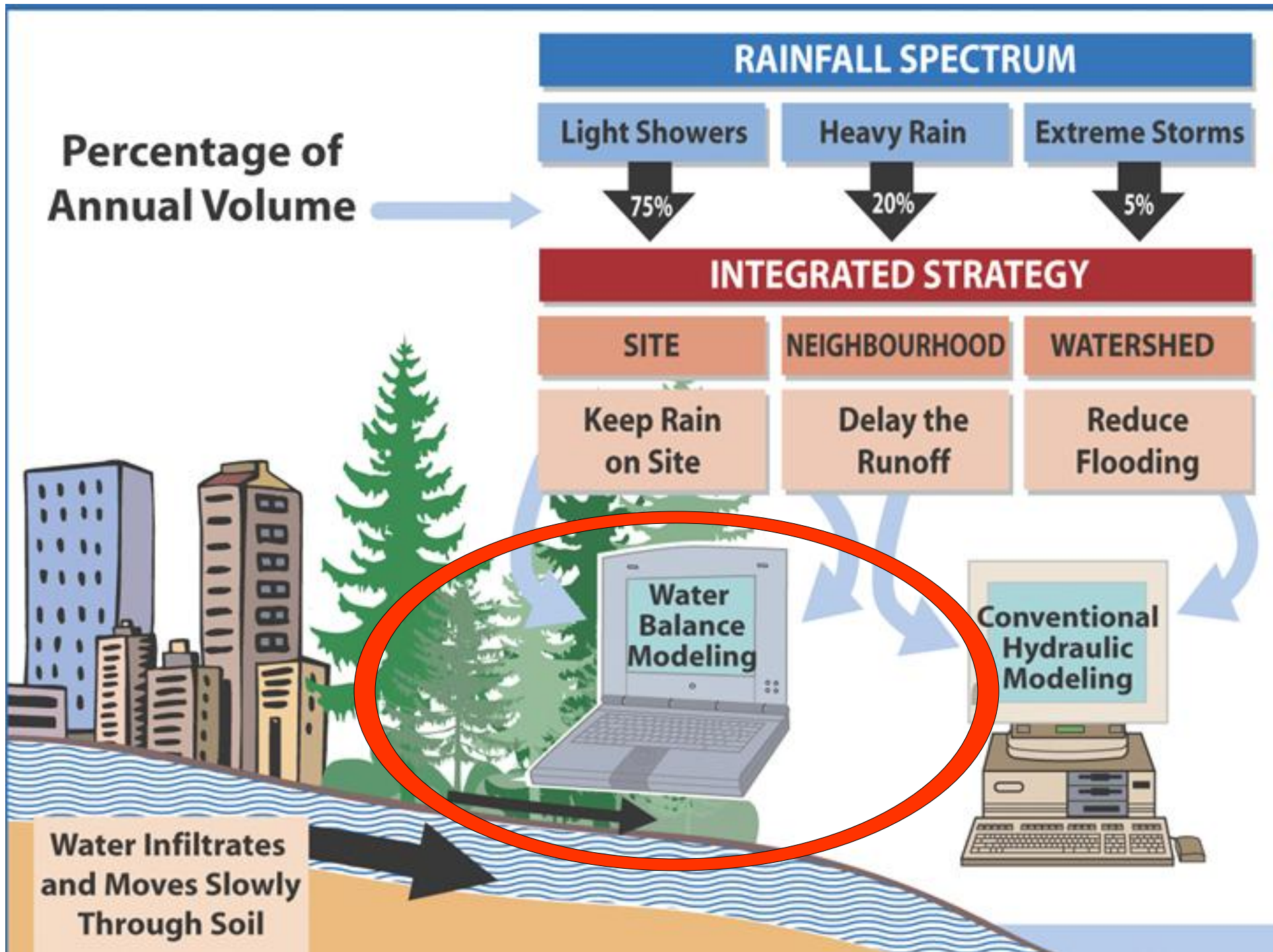
appointed as District Engineer, a position he held until 1855.

From 1855 to 1869, Manning was engaged by the Marquis of Downshire, during which time he conducted surveys of estates in Ireland, oversaw construction of the

"...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

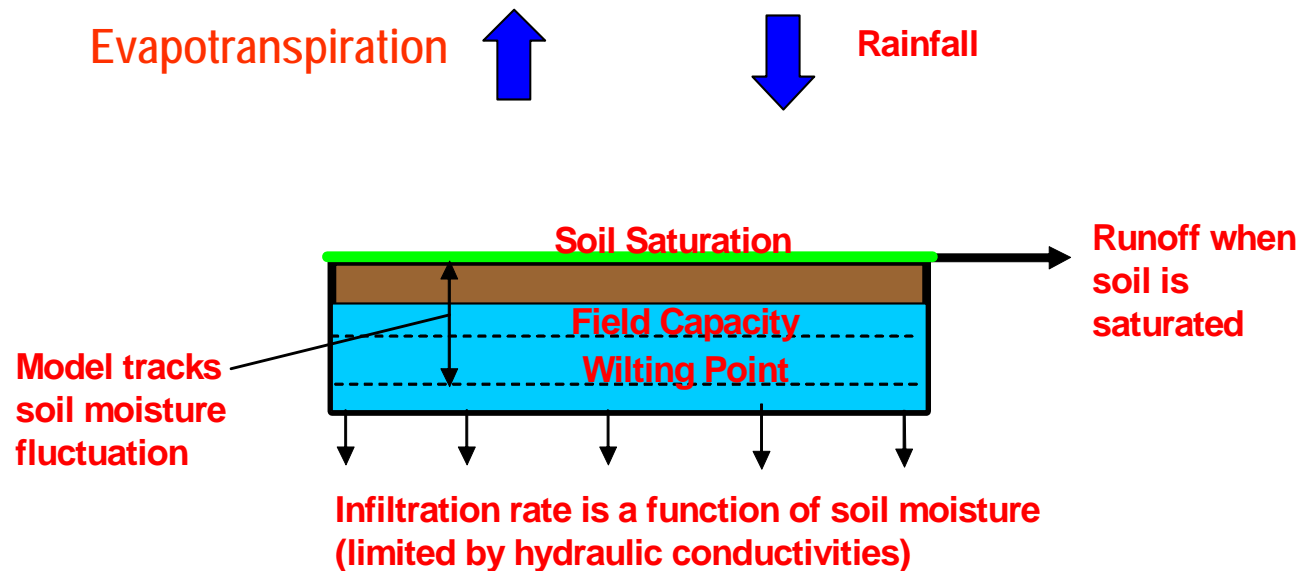
ERDC TN-EMRRP-SR-10






WATER
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The hydrology engine is built around a continuous Soil Moisture Simulation



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'

A world map with a light blue background and yellow landmasses. Red stars are placed on the maps of North America, Australia, and South America. Small portrait photos of individuals are overlaid on the map: three in North America, two in Australia, and one in South America. A central text box and two side-by-side list boxes are overlaid on the map.

Our *Expert Panel* comprised individuals who are pioneering source-control applications and/or research

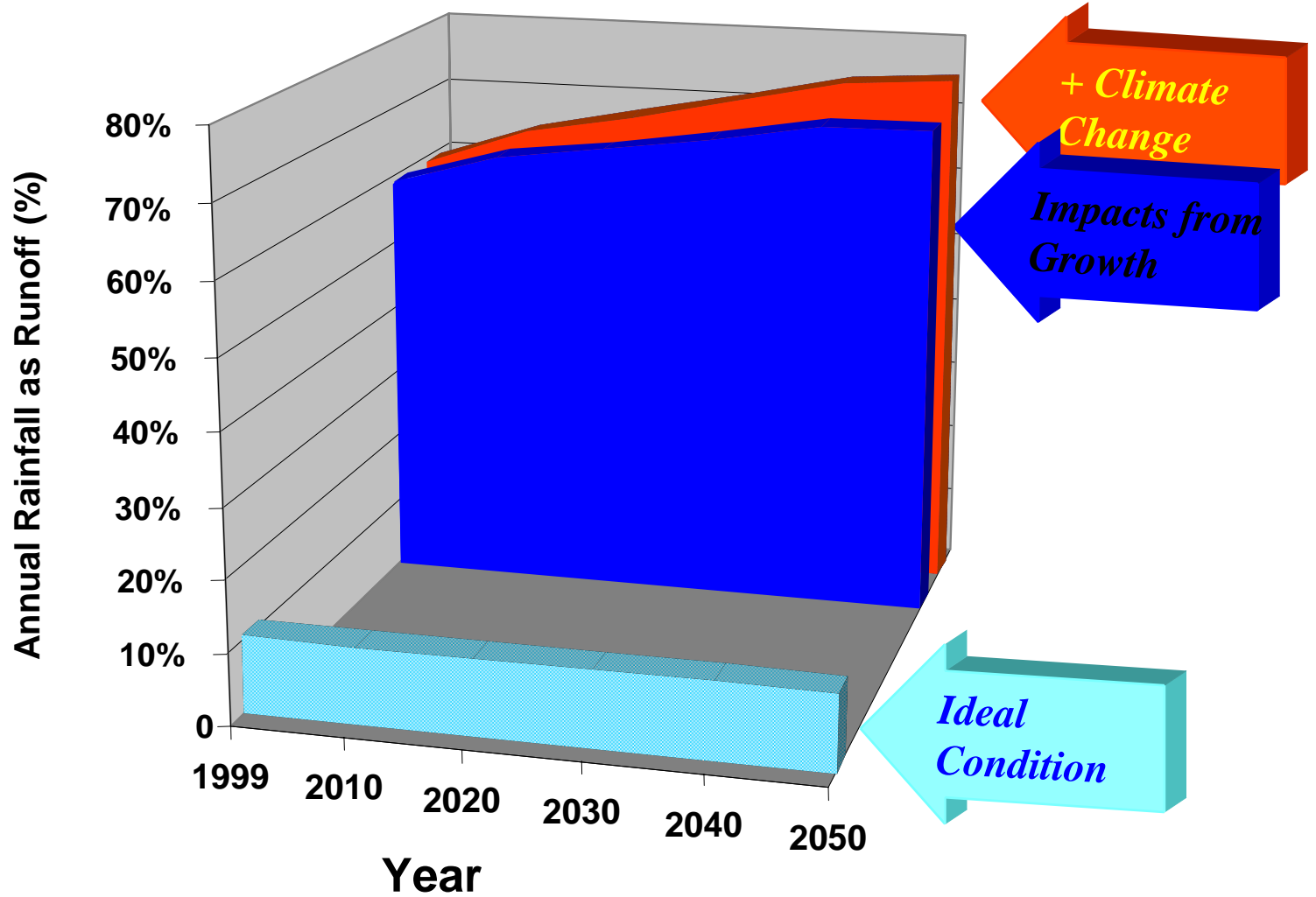
- John Argue
- Peter Coombes
- Dan Medina
- Charlie Miller
- Patrick Condon
- Bill Derry
- David Reid

- Infiltration Technology
- Stormwater Re-Use
- Low Impact Development
- Green Roof Technology
- Urban Site Design
- Best Management Practices
- Landscape Architecture



WATER Balance MODEL FOR BRITISH COLUMBIA

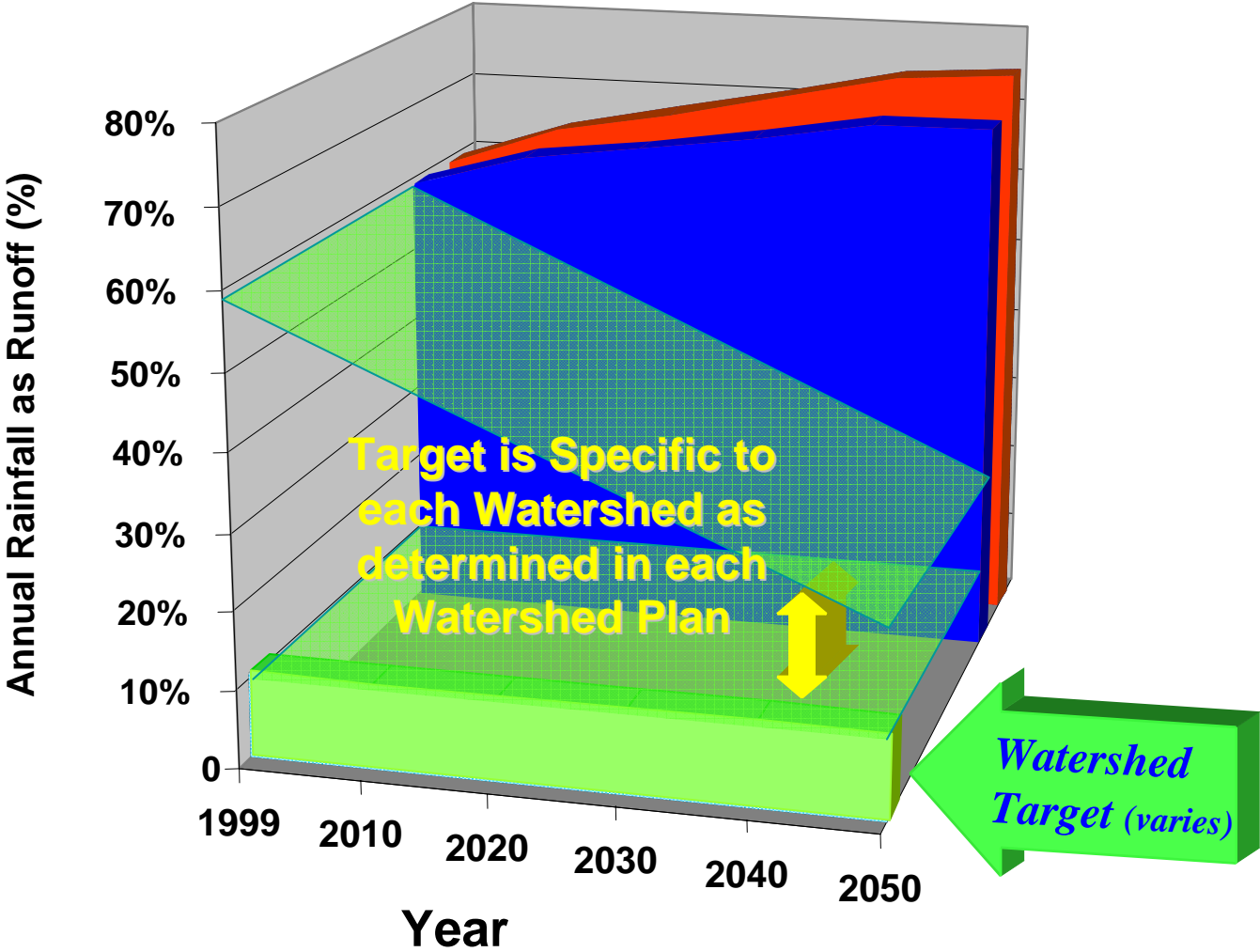
The Big Picture: Current Trends



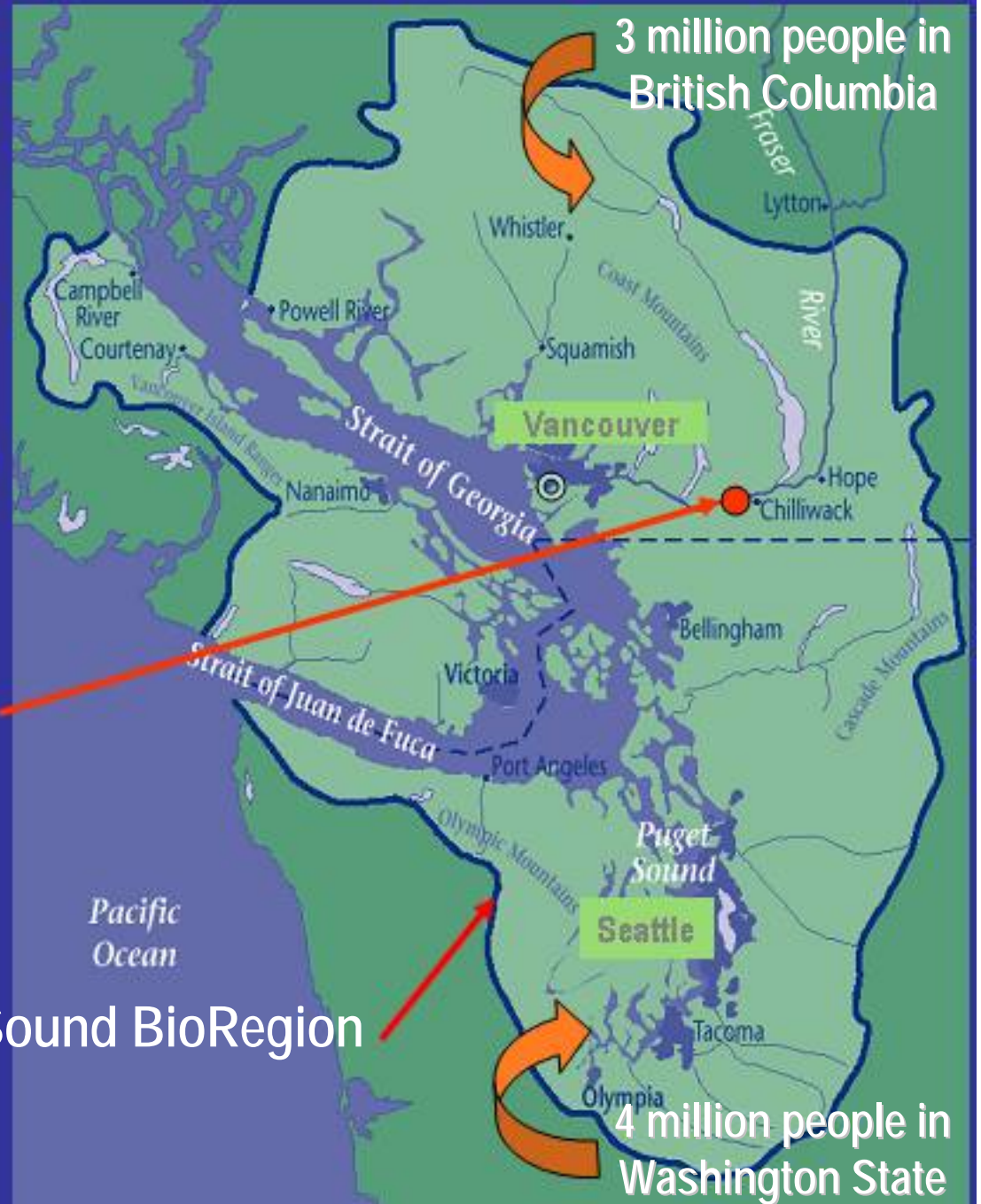


WATER Balance MODEL FOR BRITISH COLUMBIA

The Big Picture: Watershed Targets



3 million people in
British Columbia



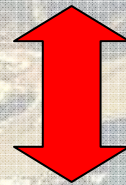
Chilliwack is a community of
70,000 in the Fraser Valley

Georgia Basin / Puget Sound BioRegion

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

#1 – Strategic
Data Collection



#2 – Policy & Design Criteria
Manual



#3 – Sustainable Subdivision
Design



#4 – Integrated Master
Drainage Plans



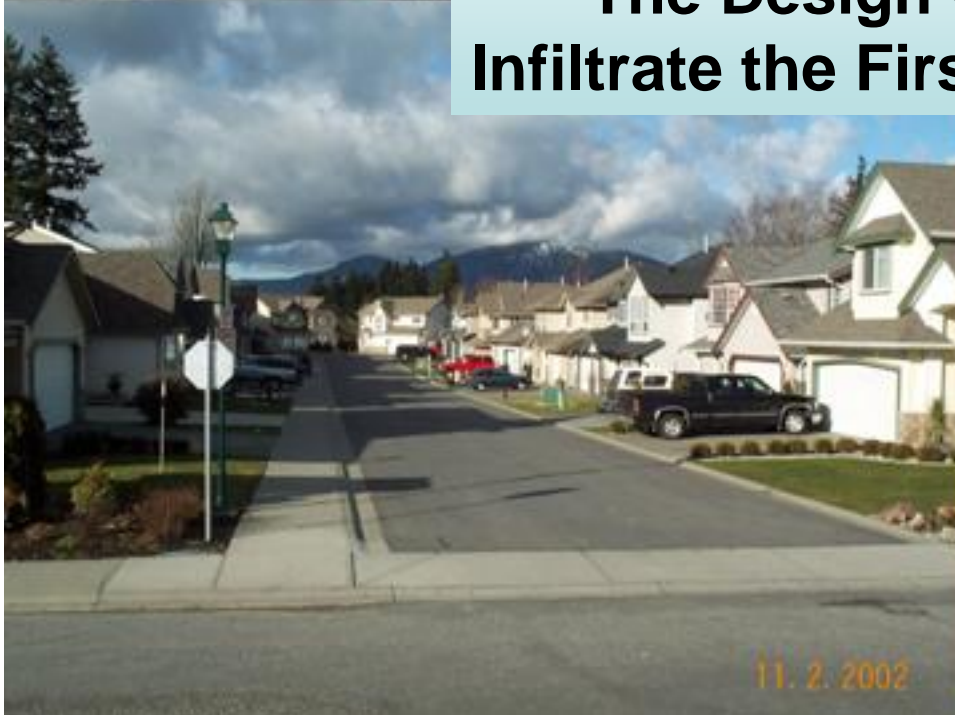
#5 – Performance Monitoring
Program

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

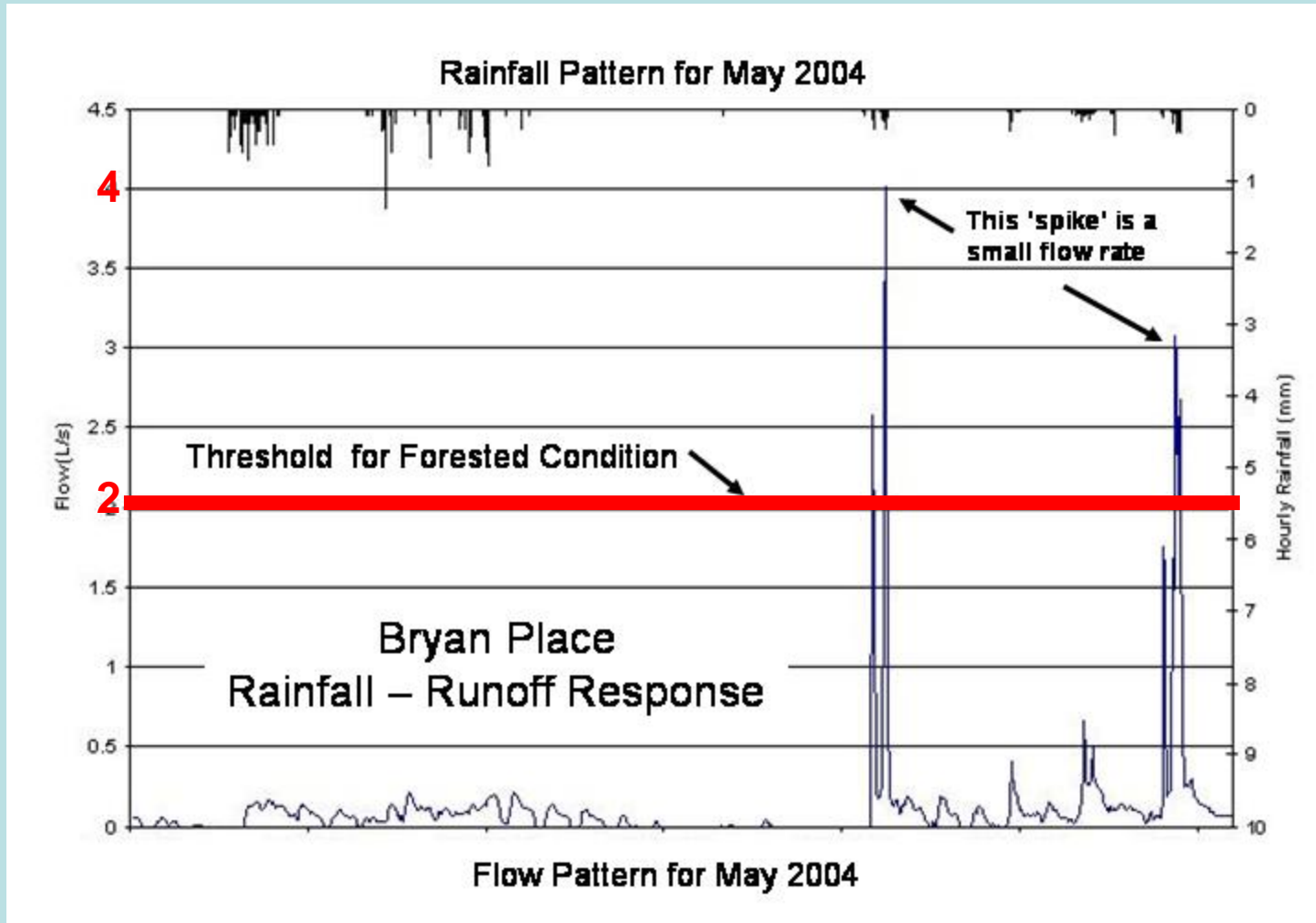
Land Use Little area is needed for source control infiltration. The galleries can be installed under landscape or asphalt parking.	Percentage of Land Needed for Infiltration	
	Deep Infiltration Systems	Shallow Infiltration Systems
Commercial / Industrial	2.5%	6.7%
Institutional	2.2%	5.3%
Residential – Low Density	1.4%	3.1%
Residential – Medium/High Density	2.3%	6.3%

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

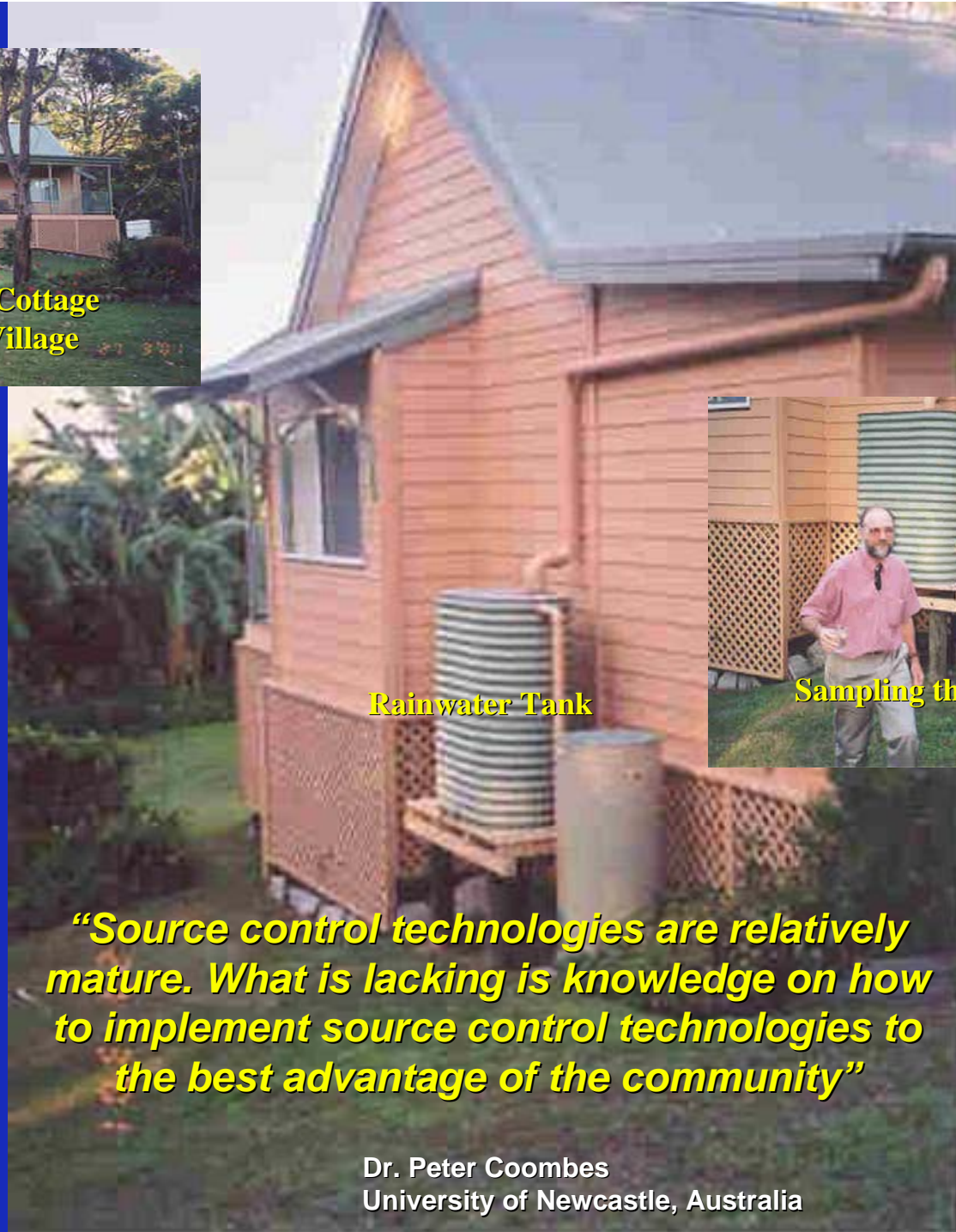
- 'Break the connection'
- Encourage 'rain gardens'

Water Balance Model Perspectives

- **Planners:** Tool for Better Use of Space
- **Engineers:** Tool for Infiltration Pre-Design
- **Landscape Architects:** Tool for Green Solutions



**Replica Miner's Cottage
in Retirement Village**



Rainwater Tank



Sampling the Rainwater


“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**



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HOSTED WEBSITES

- Habitat Conservation Trust Fund
- The Leading Edge Conference

Events

- SER 2004: Restoration on the Edge
- 6th Canadian Urban Forest Conference
- North America Lake Management Society 2004
- Conference: Lakes - Habitat for Fish, Habitat for People

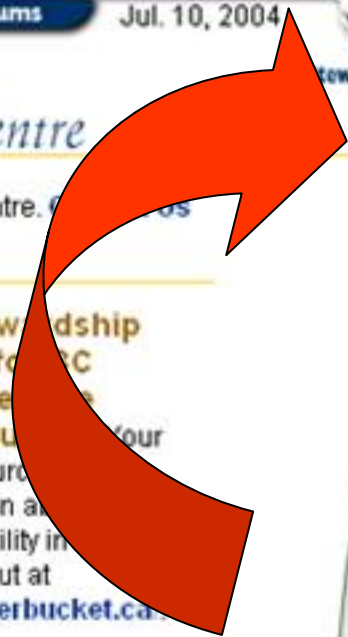
News

- News Magazines
 - Eco-bytes
 - Envirozine
 - Grist
 - Science and Environment Bulletin
- News Releases
 - Ministry of Water Land and Air Protection
 - Ministry of Agriculture, Food and Fisheries
 - Ministry of Energy and Mines
 - Ministry of Forests
 - Ministry of

Click Here to find out more about the BC Stewardship Centre. If you have questions about this site.



The Stewardship Centre for BC welcomes you to our Water Bucket, your online source for information and sustainability information. Check it out at www.waterbucket.ca



Stewardship Spotlights

Click here to add your web resources to the Stewardship Library.

Stewardship Series



Stream Stewardship: A Guide for Planners & Managers
This document introduces a process to accommodate urban and rural stream users, conserve the fish resource, and those of future generations.

The Water Balance Model is 'Going National'... and the layout will be similar to the Stewardship Canada website

Guidebook Coastal Shore Stewardship Guide

Stream Bugs as Bioindicators: Guide to Macroinvertebrate Monitoring and Identification

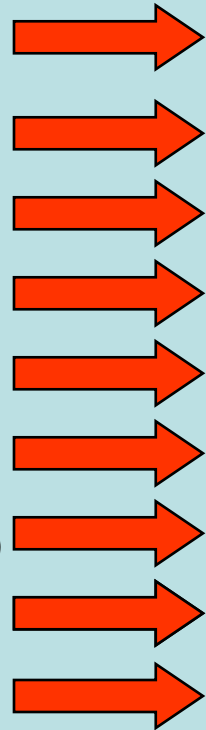
A photograph of a suburban neighborhood viewed from an elevated position. In the foreground, a large brick chimney stands on a white porch. The middle ground is filled with houses, many of which have pink cherry blossom trees in bloom. The background shows a clear blue sky with scattered white clouds. The text "The Water Balance Model is about a way of thinking" is overlaid in yellow at the bottom of the image.

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**