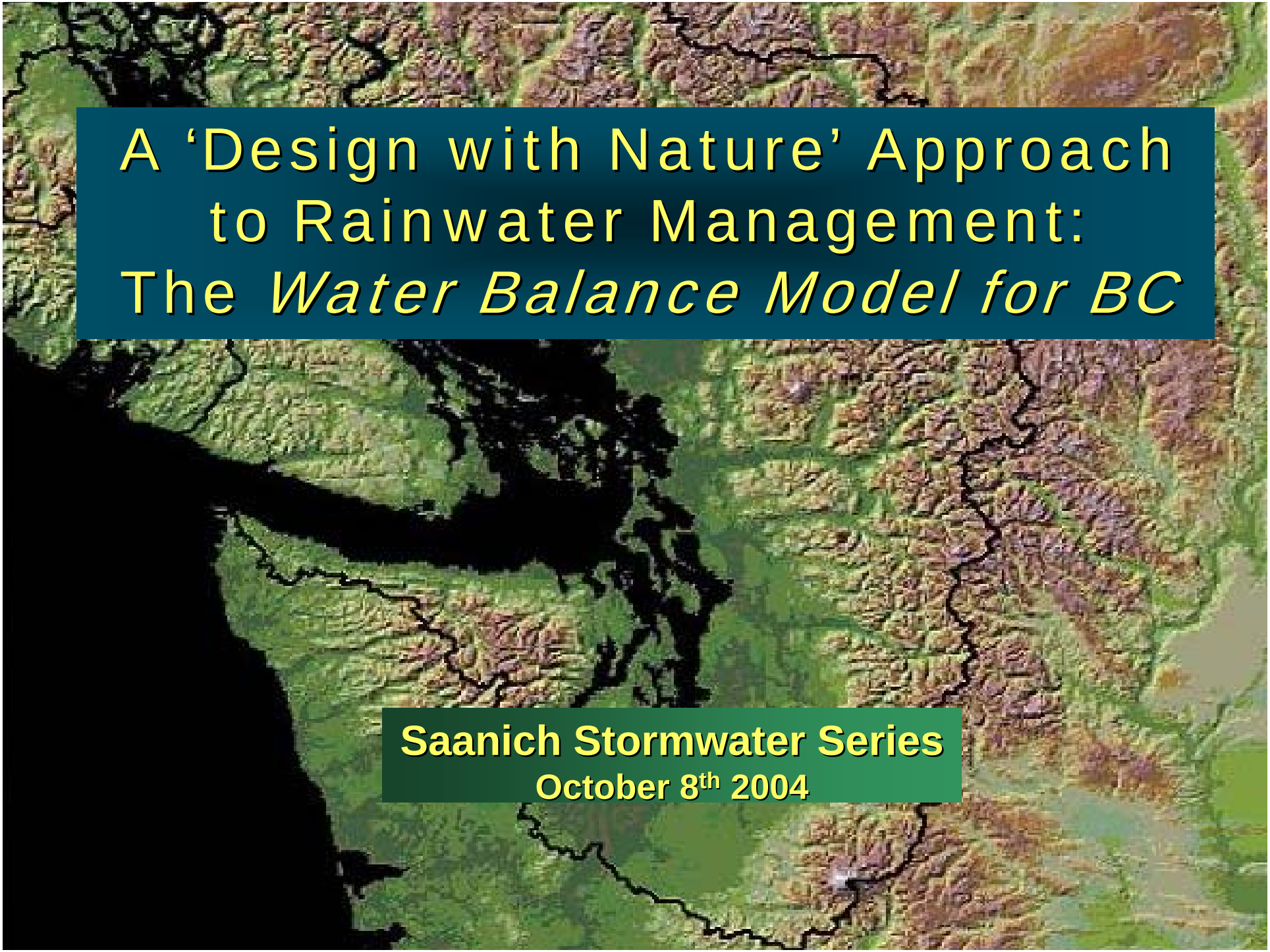


A 'Design with Nature' Approach to Rainwater Management: The *Water Balance Model for BC*

Saanich Stormwater Series

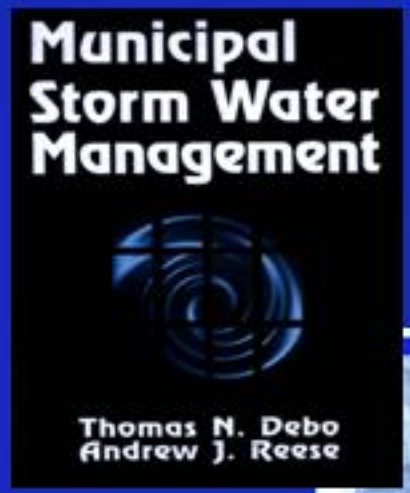
October 8th 2004

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

Presentation Road Map

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

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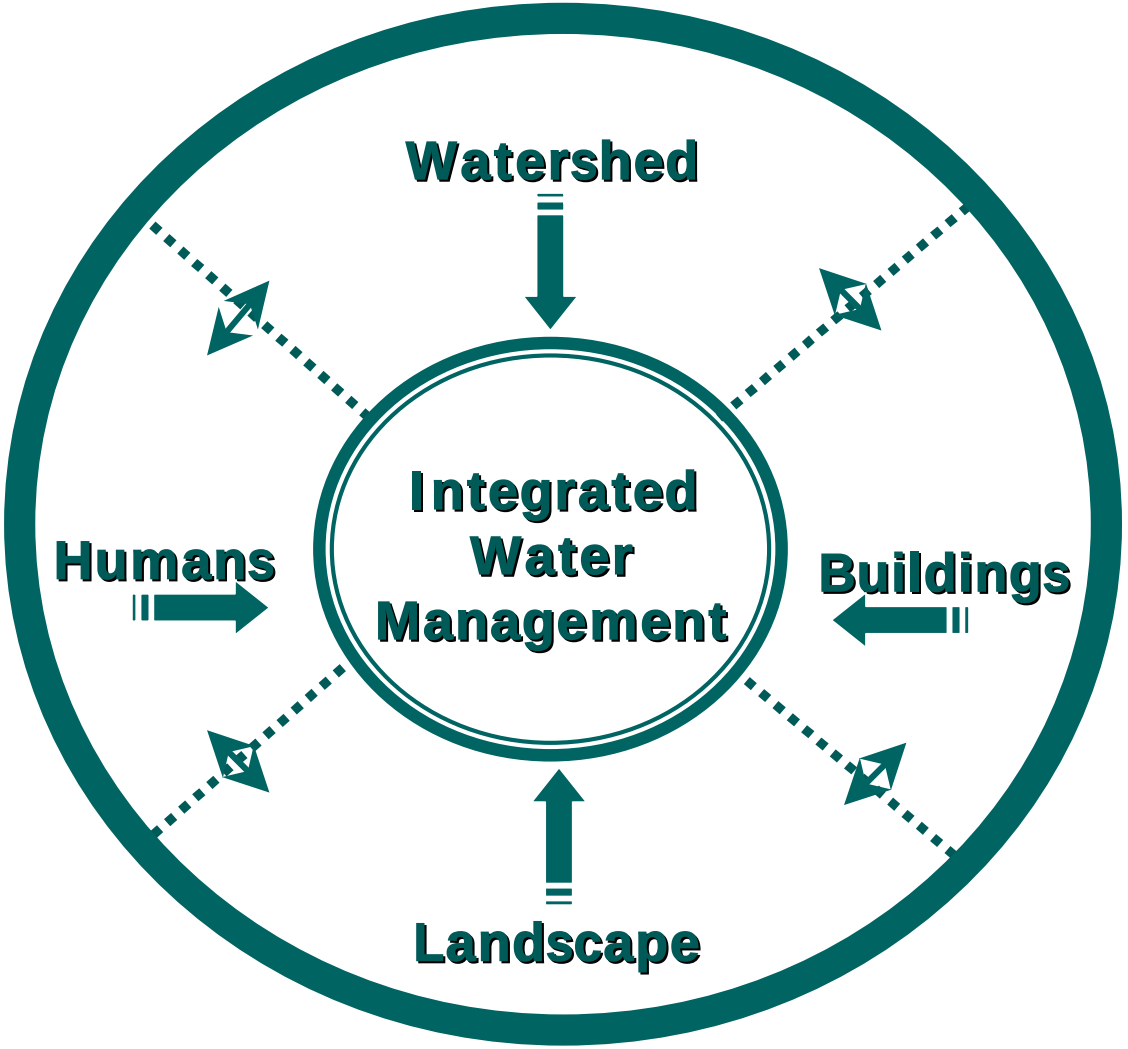
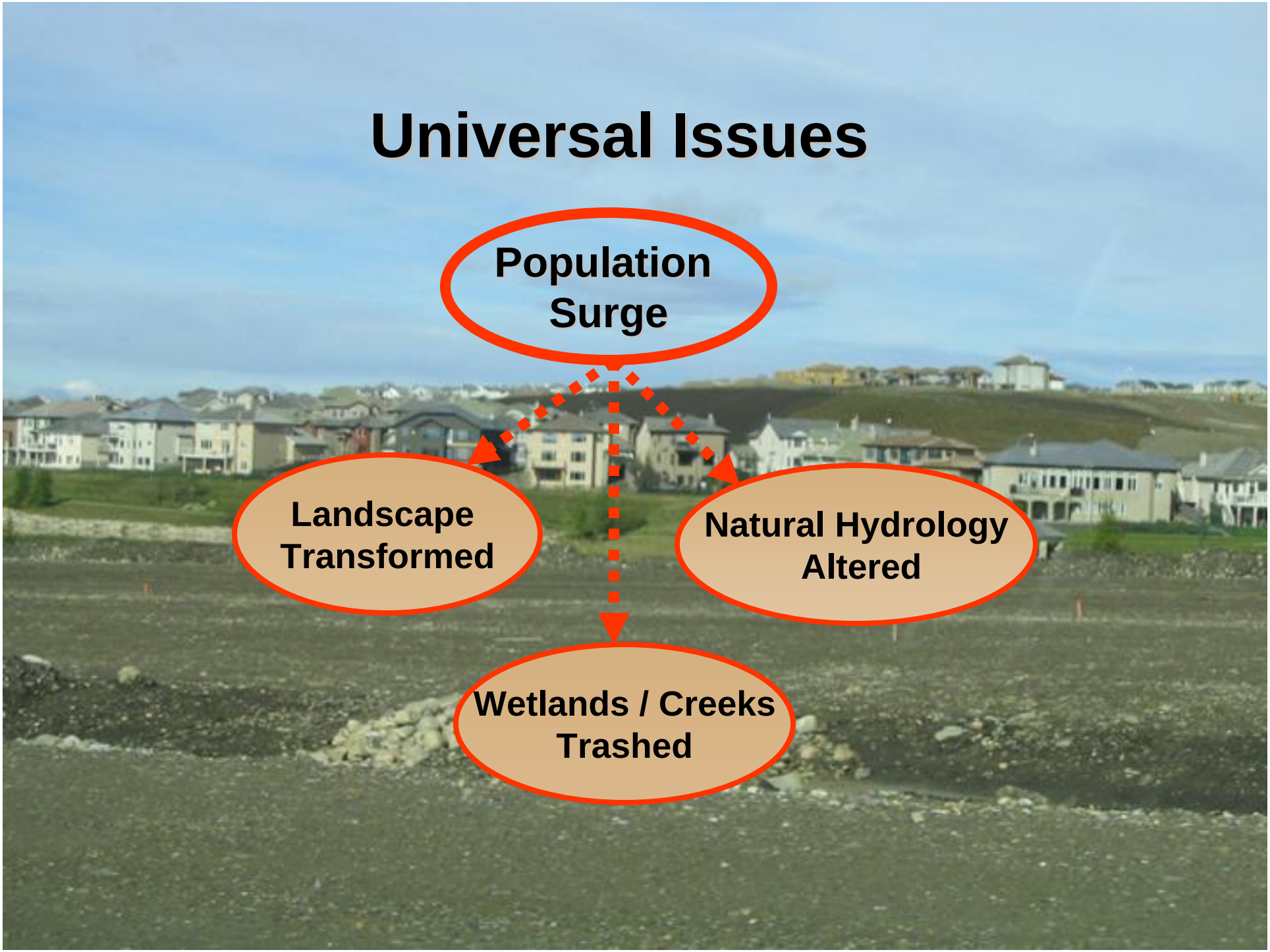
Continuum of Water Use – Everything is Connected!



Universal Issues



WATER Balance MODEL FOR BRITISH COLUMBIA

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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

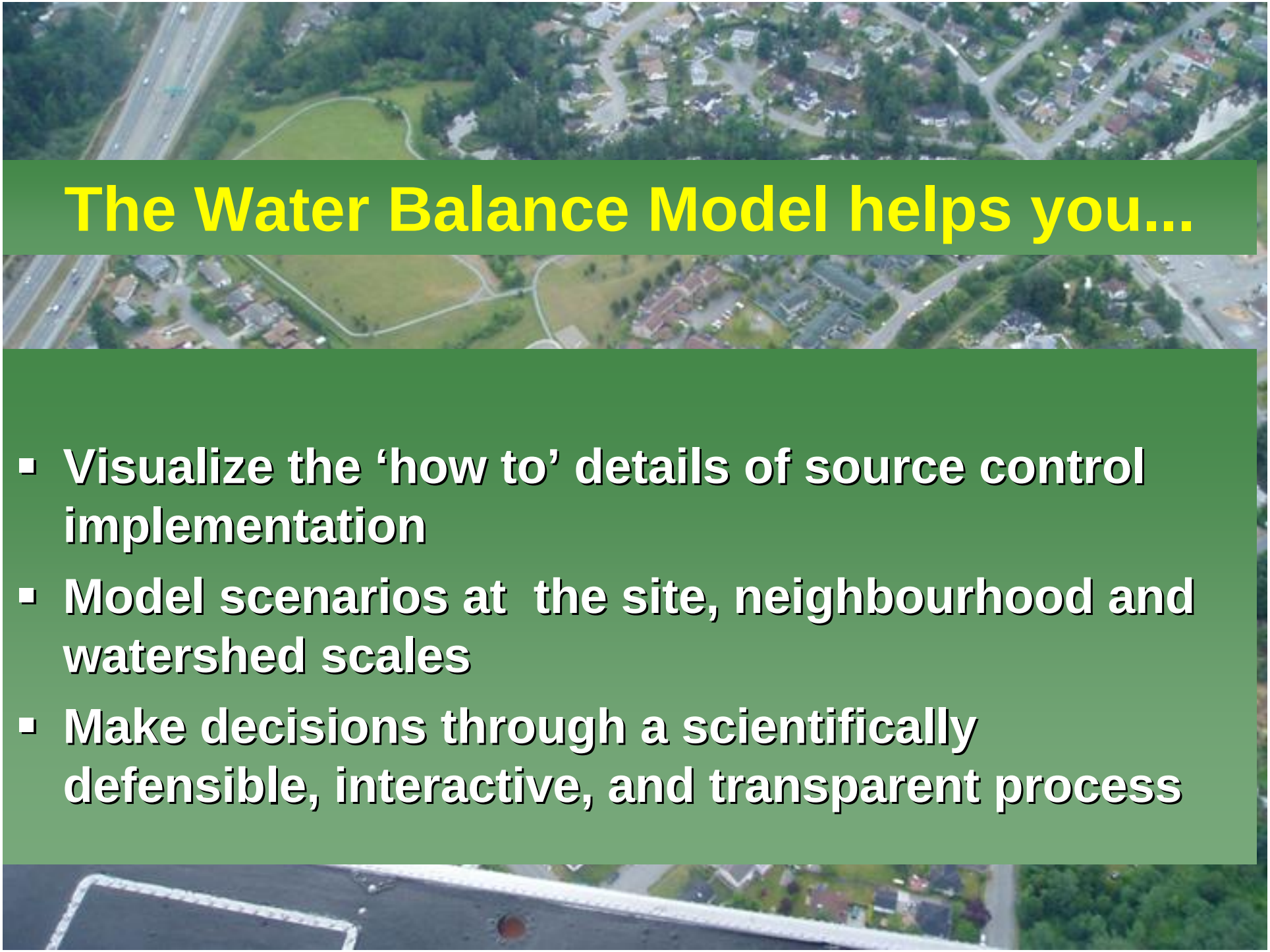
A GUIDEBOOK FOR BRITISH COLUMBIA

Stormwater Planning

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

BRITISH COLUMBIA Ministry of Water, Land and Air Protection

http://wlapwww.gov.bc.ca/epd/epdpa/mpp/stormwater/stormwater.html



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 Balance MODEL FOR BRITISH COLUMBIA

Inter-Governmental Partnership:
Key Partnerships

Real Estate Foundation of BC

Urban Development Institute

BC Water and Waste Association

UDI

THE REAL ESTATE FOUNDATION OF BRITISH COLUMBIA

BCWWA


WATER
Balance
MODEL
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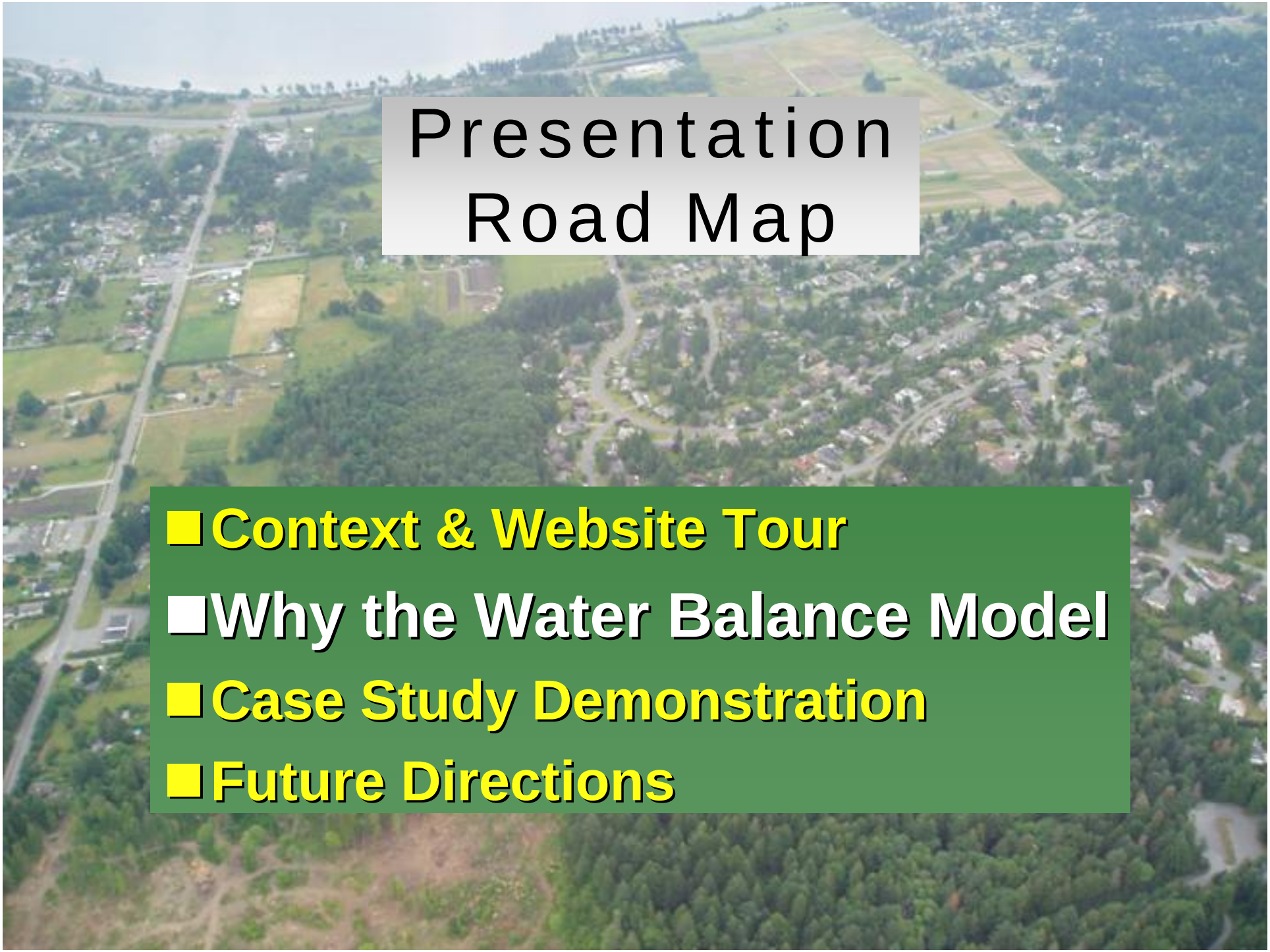
WATER
Balance
MODEL
FOR BRITISH COLUMBIA
Partners • About • Home
Access Model • Resources • Background
IGP Proceeding with Training Workshops
The Water Balance Model promotes a watershed-based approach that manages the natural environment and the built environment as integrated components of the same 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 Scenerios
Describe Native Soils
Add Land Use Information
Describe Surface Types
• Public Domain
• Web-based
• Interactive
• Decision Support
www.waterbalance.ca


Presentation
Road Map
Context & Website Tour
Why the Water Balance Model
Case Study Demonstration
Future Directions

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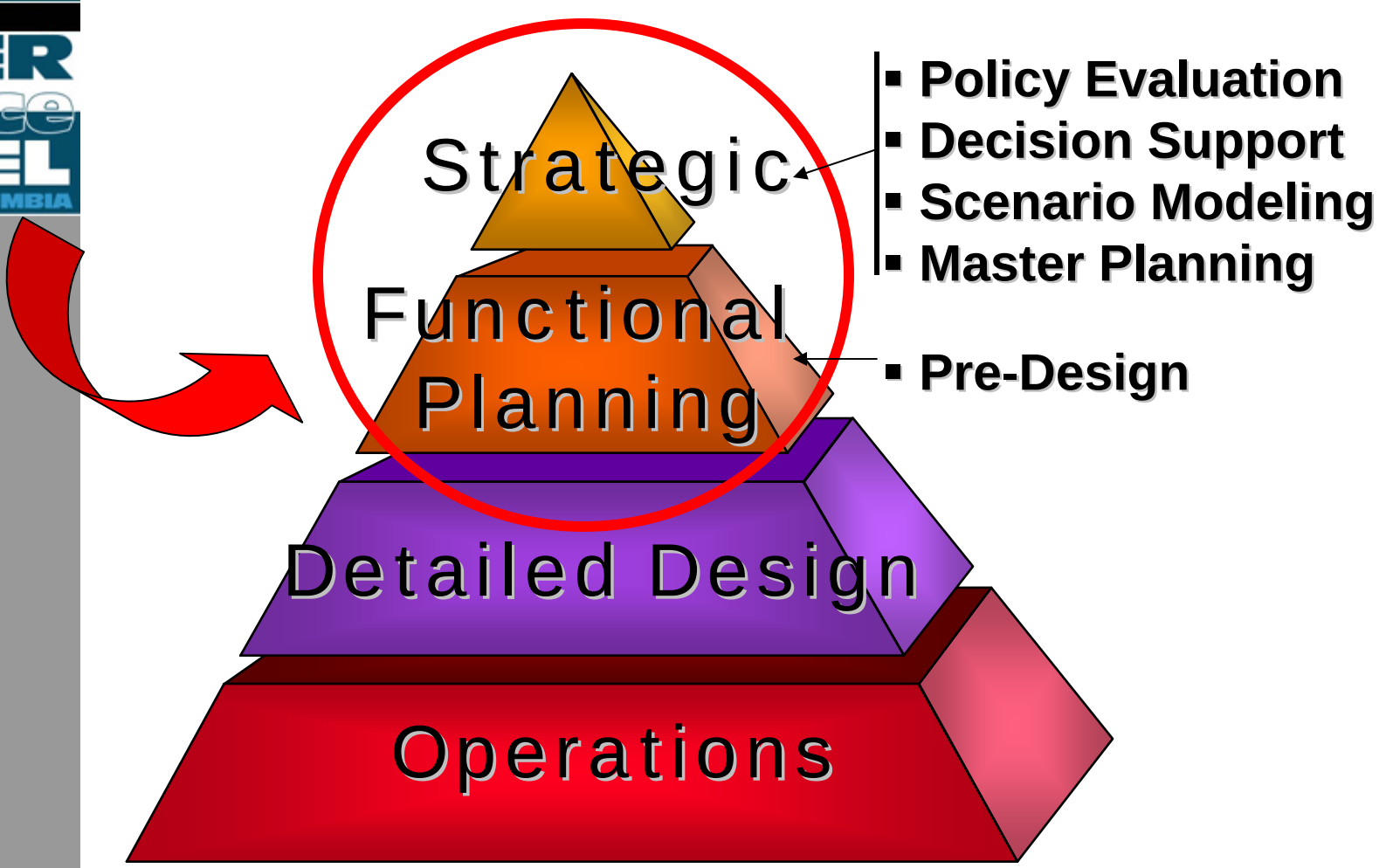
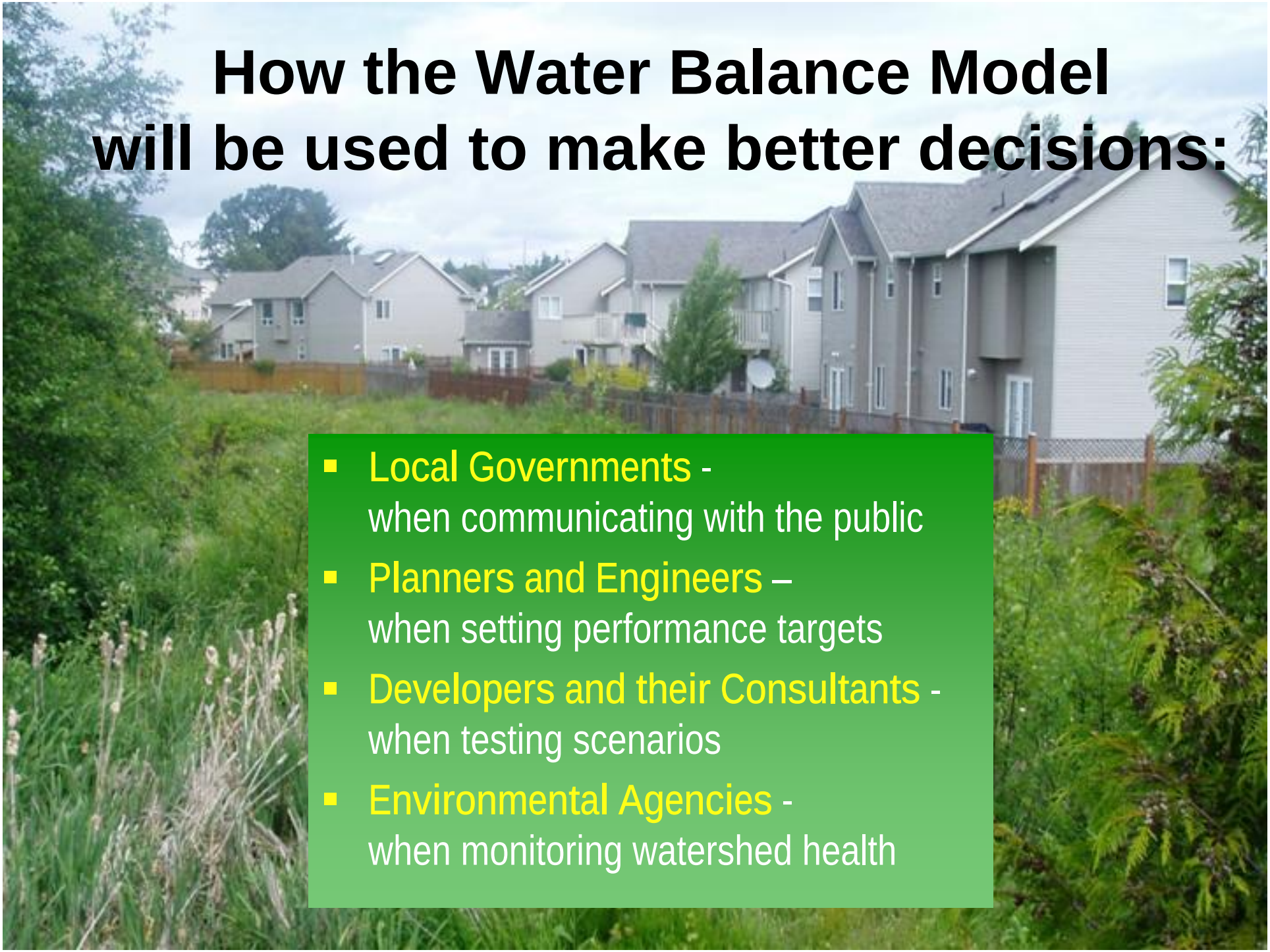
Start with an understanding of the 'Modeling Hierarchy'



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

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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

Stormwater

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.

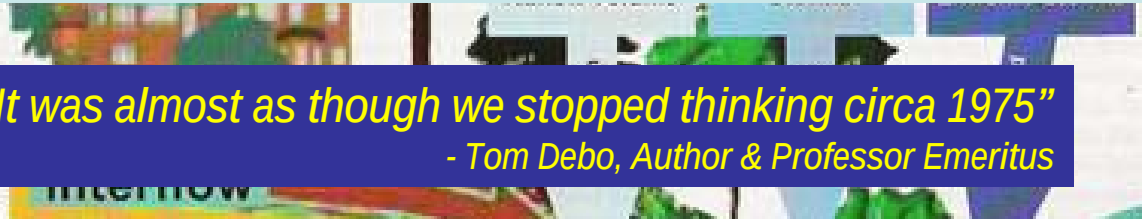
Linsley fought a difficult war to replace the established procedures that had been used for many years, and that continue to be used in most

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'

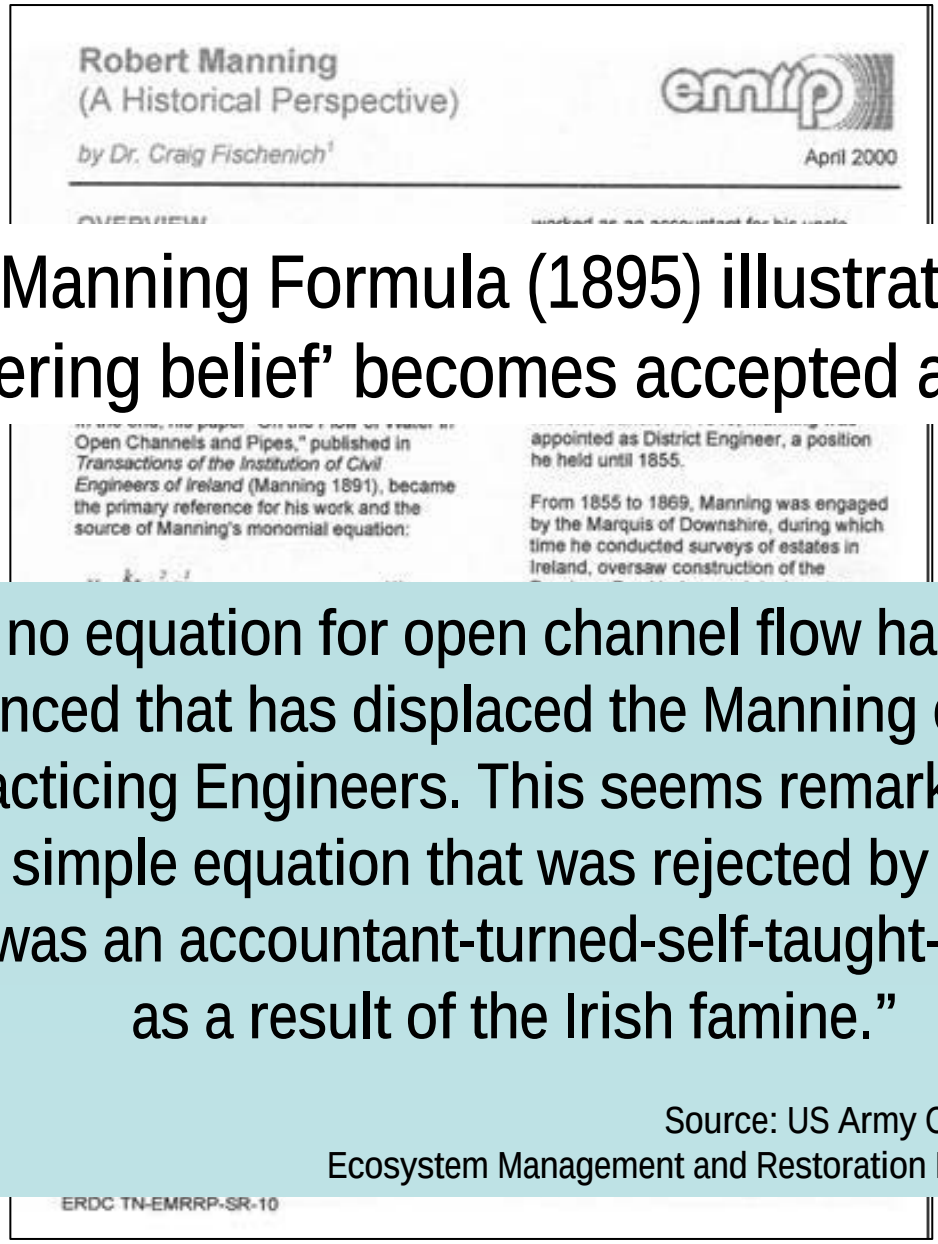
as a consulting engineer, Linsley pioneered the development of continuous hydrologic simulat as the foundation for water balance management. He rece worldwide recognition for his vision and his contributions to the



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

WATER Balance MODEL FOR BRITISH COLUMBIA

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



Robert Manning
(A Historical Perspective)

by Dr. Craig Fischenich[1]

April 2000

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:

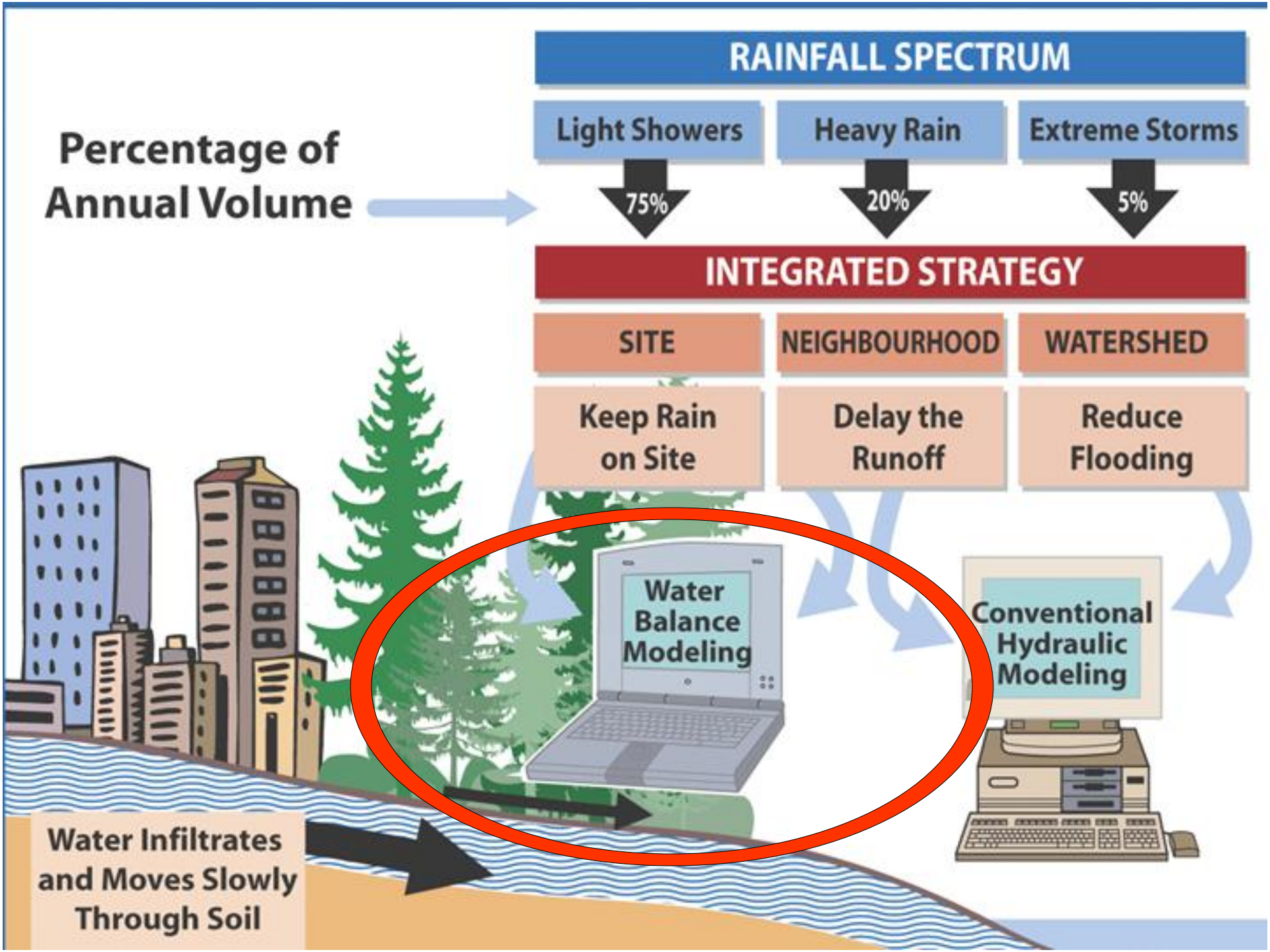
appointed as District Engineer, a position he held until 1855.

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

ERDC TN-EMRRP-SR-10

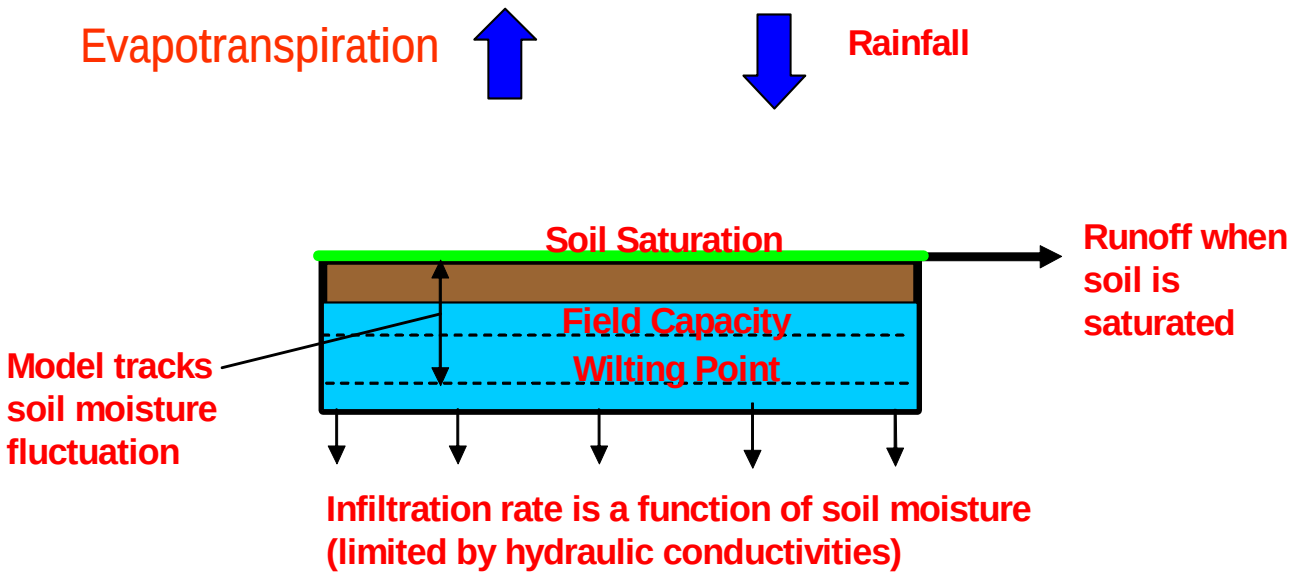
“…no equation for open channel flow has been advanced that has displaced the Manning equation for practicing Engineers. This seems remarkable for a rather simple equation that was rejected by its author who was an accountant-turned-self-taught-engineer as a result of the Irish famine.”

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


RAINFALL SPECTRUM
Light Showers
Heavy Rain
Extreme Storms
Percentage of Annual Volume
75%
20%
5%
INTEGRATED STRATEGY
SITE
NEIGHBOURHOOD
WATERSHED
Keep Rain on Site
Delay the Runoff
Reduce Flooding
Water Balance Modeling
Conventional Hydraulic Modeling
Water Infiltrates and Moves Slowly Through Soil

WATER Balance MODEL FOR BRITISH COLUMBIA

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'

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

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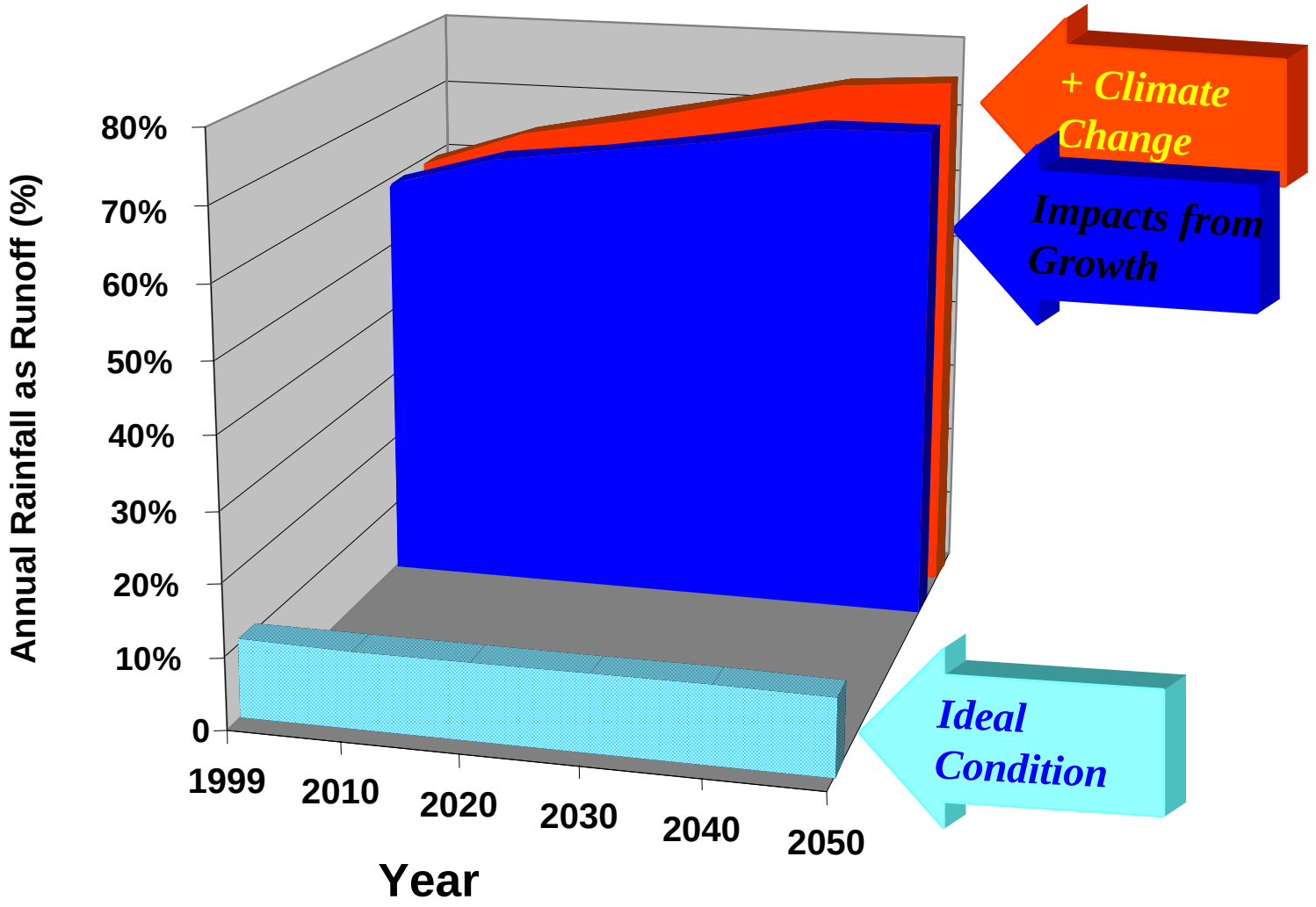
The Big Picture: Current Trends



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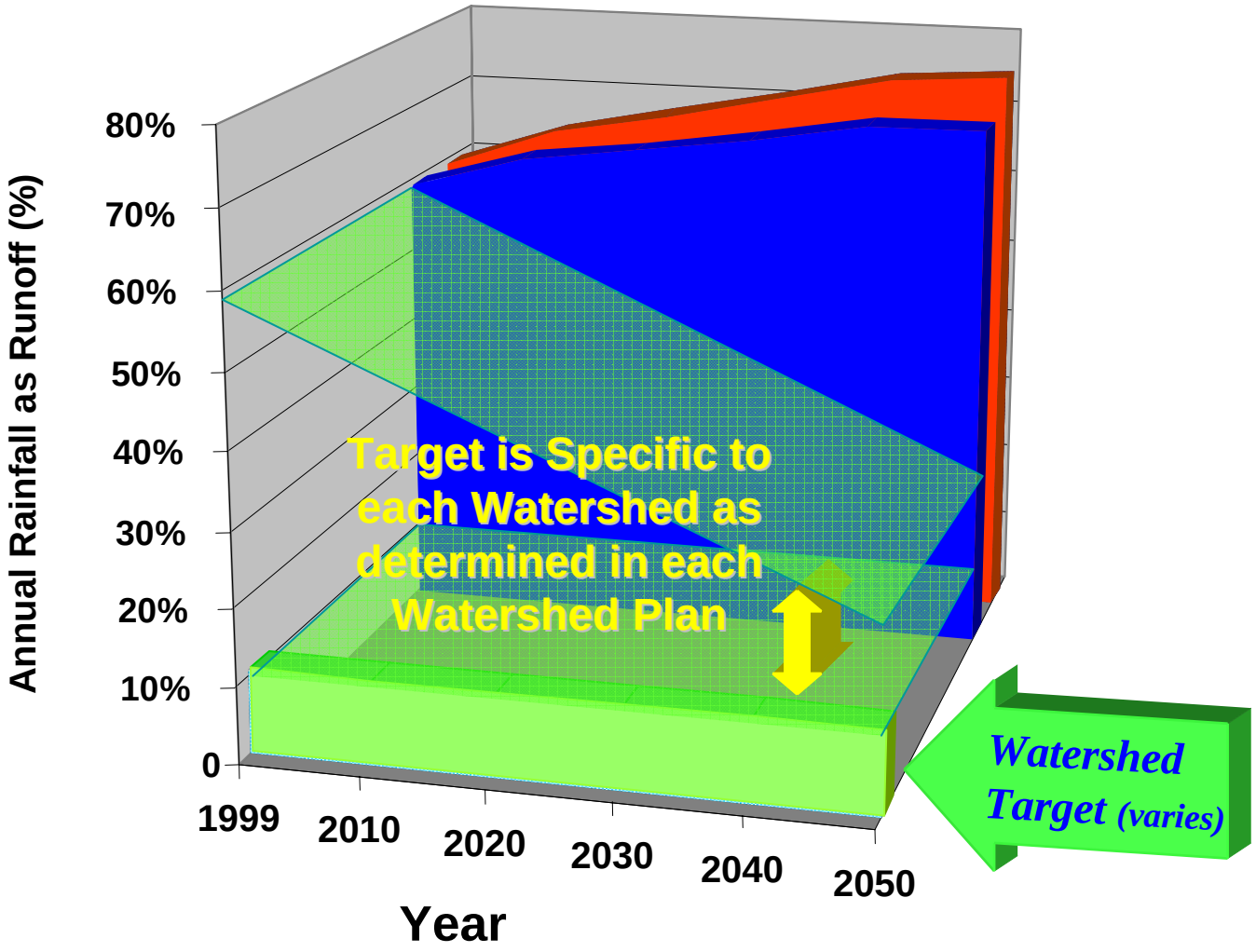
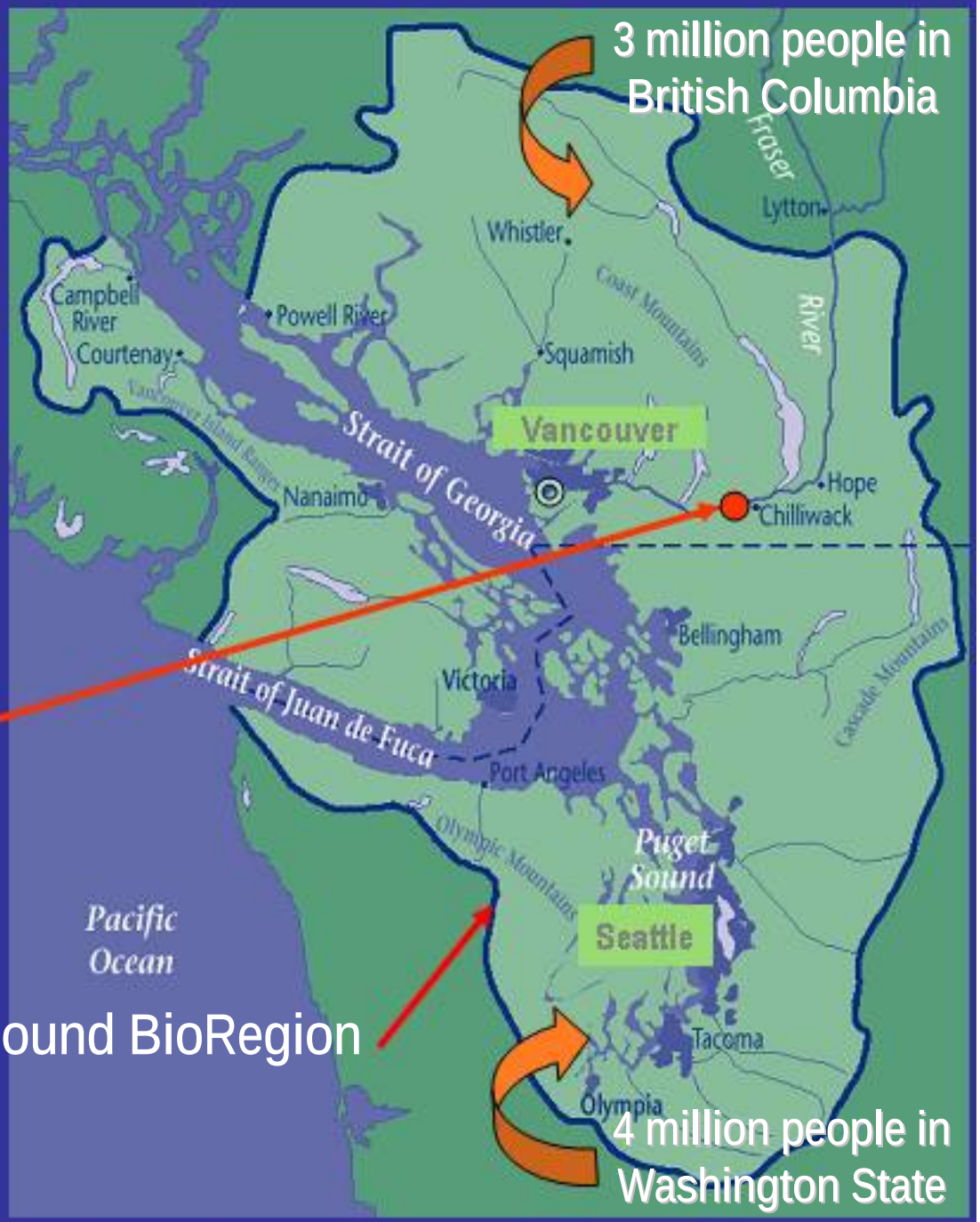
The Big Picture: Watershed Targets



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



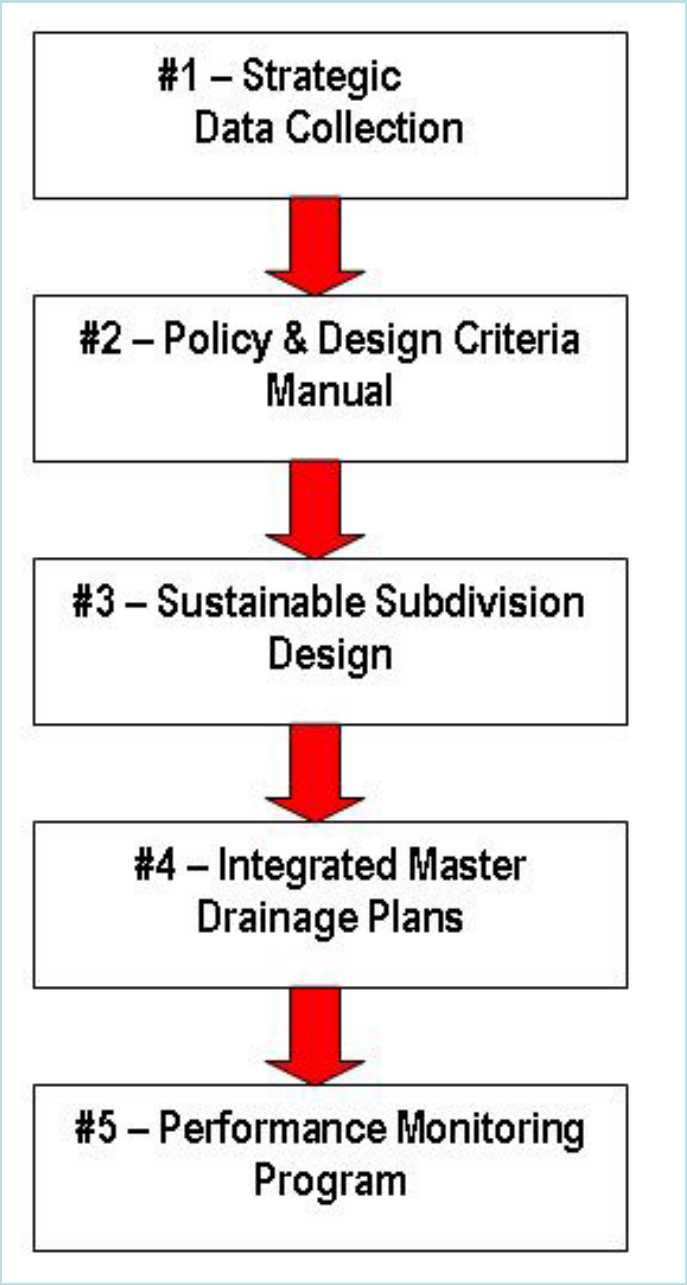
Georgia Basin / Puget Sound BioRegion

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

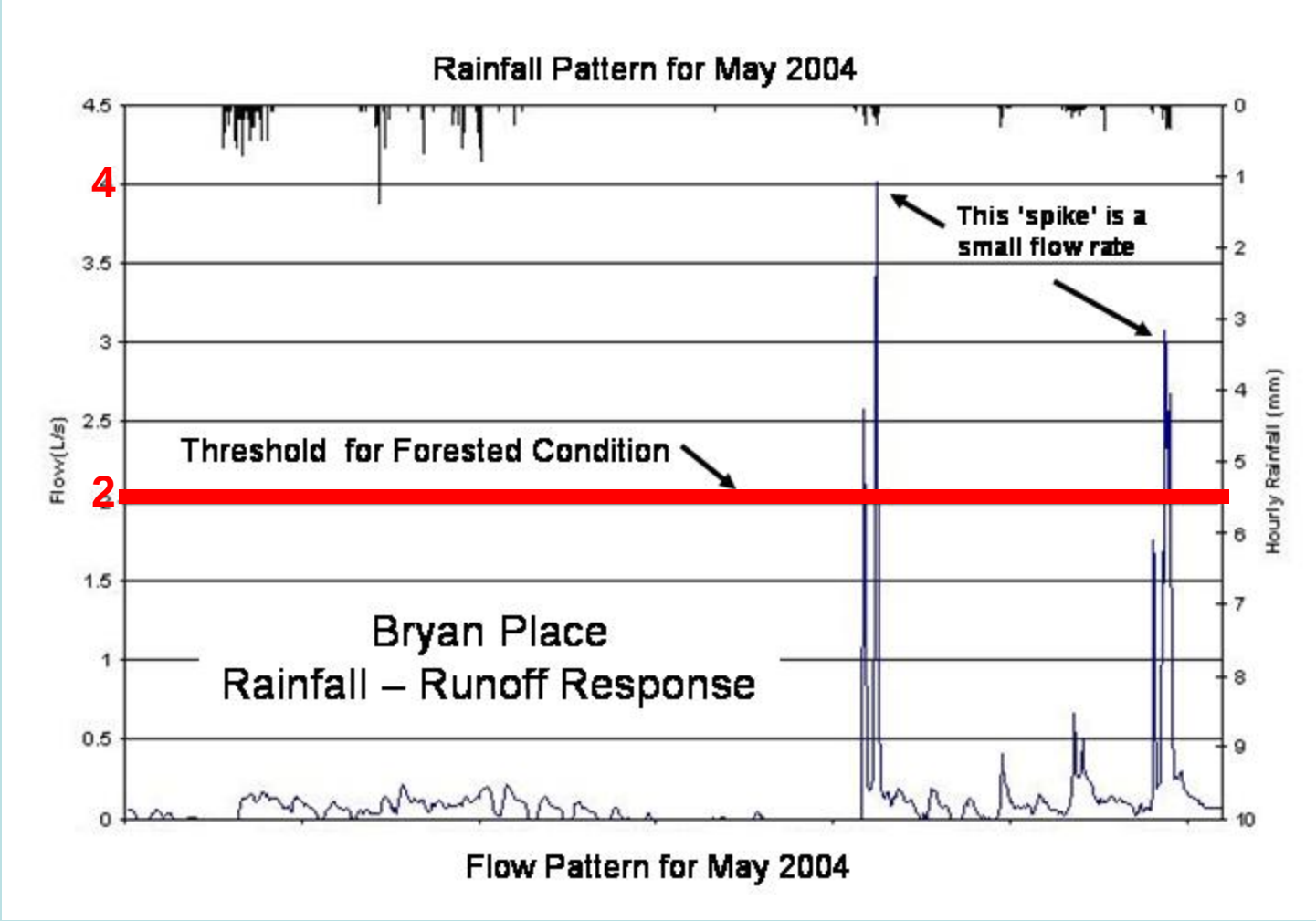

The Design Objective is to
Infiltrate the First 30mm of Rainfall
lage at Sardis Park
11. 2. 2002

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"

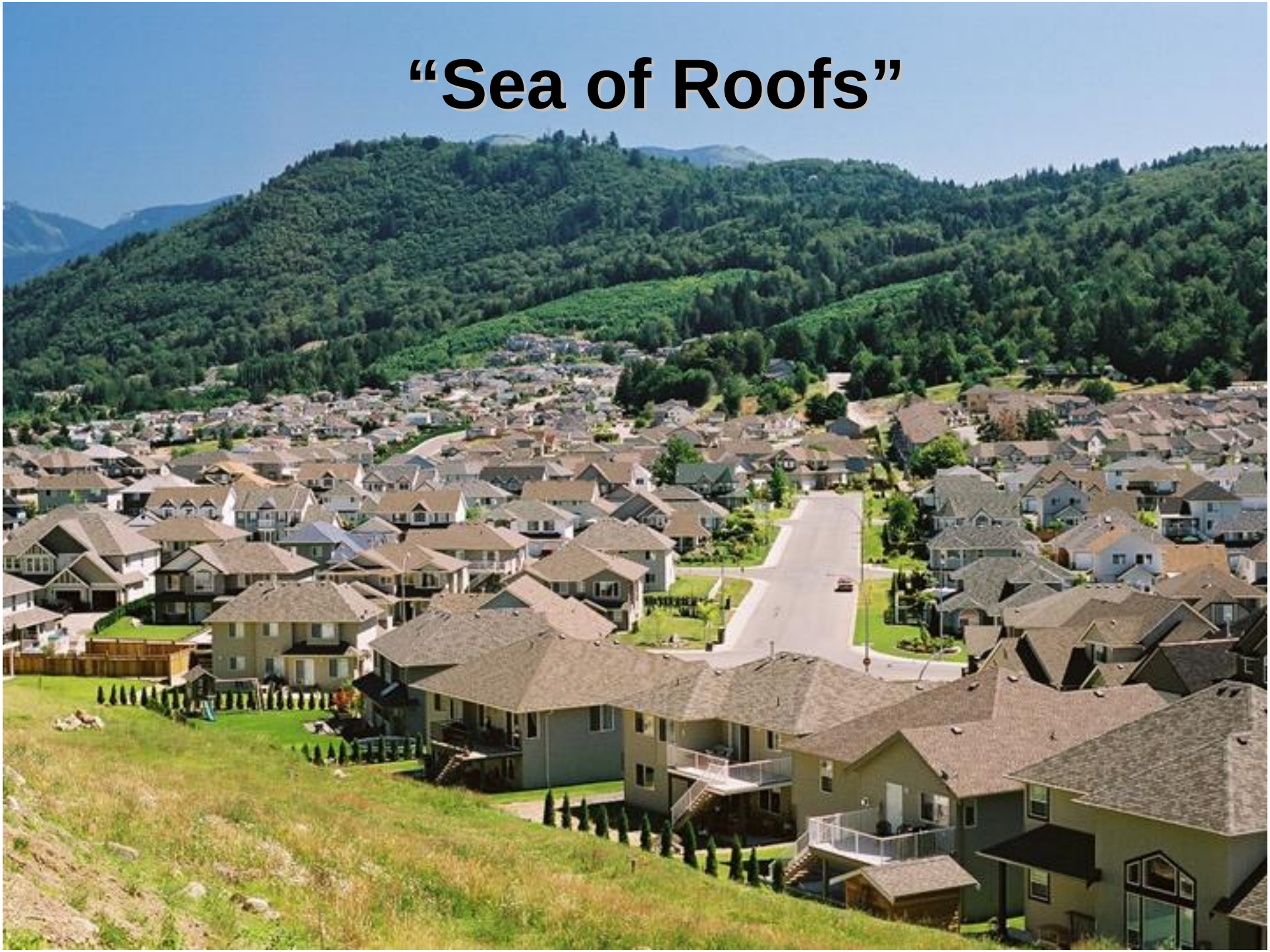
“A High Degree of ‘Runoff Control’ is Being Achieved in Both Subdivisions”

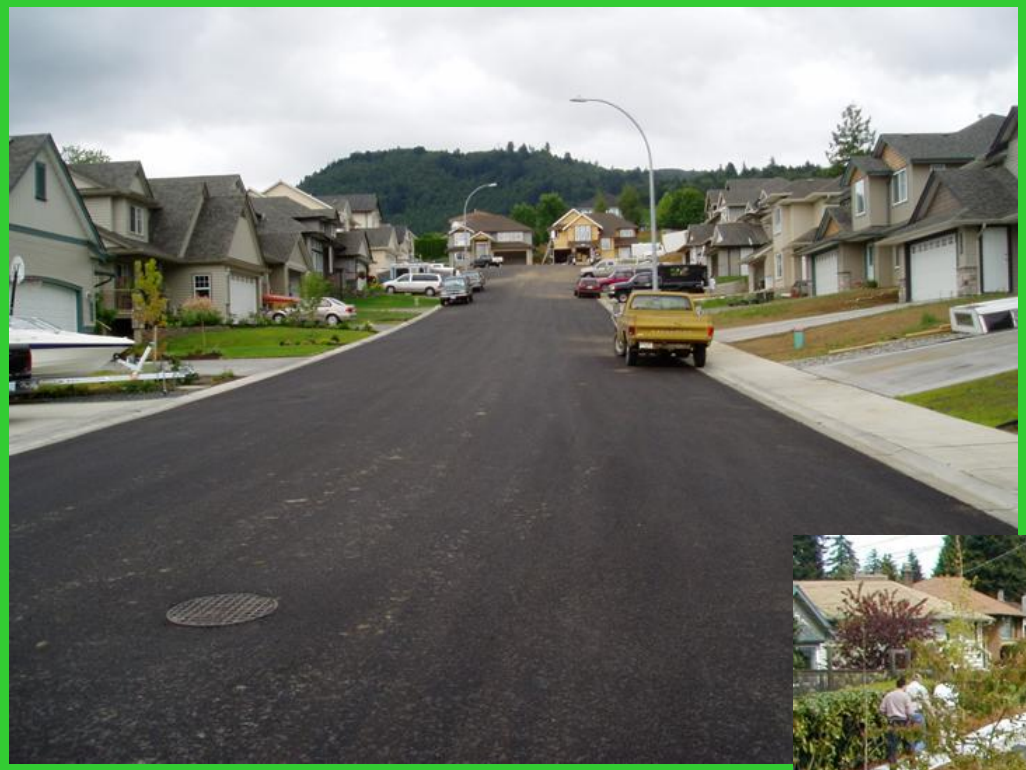


Lessons Learned?

- 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?

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

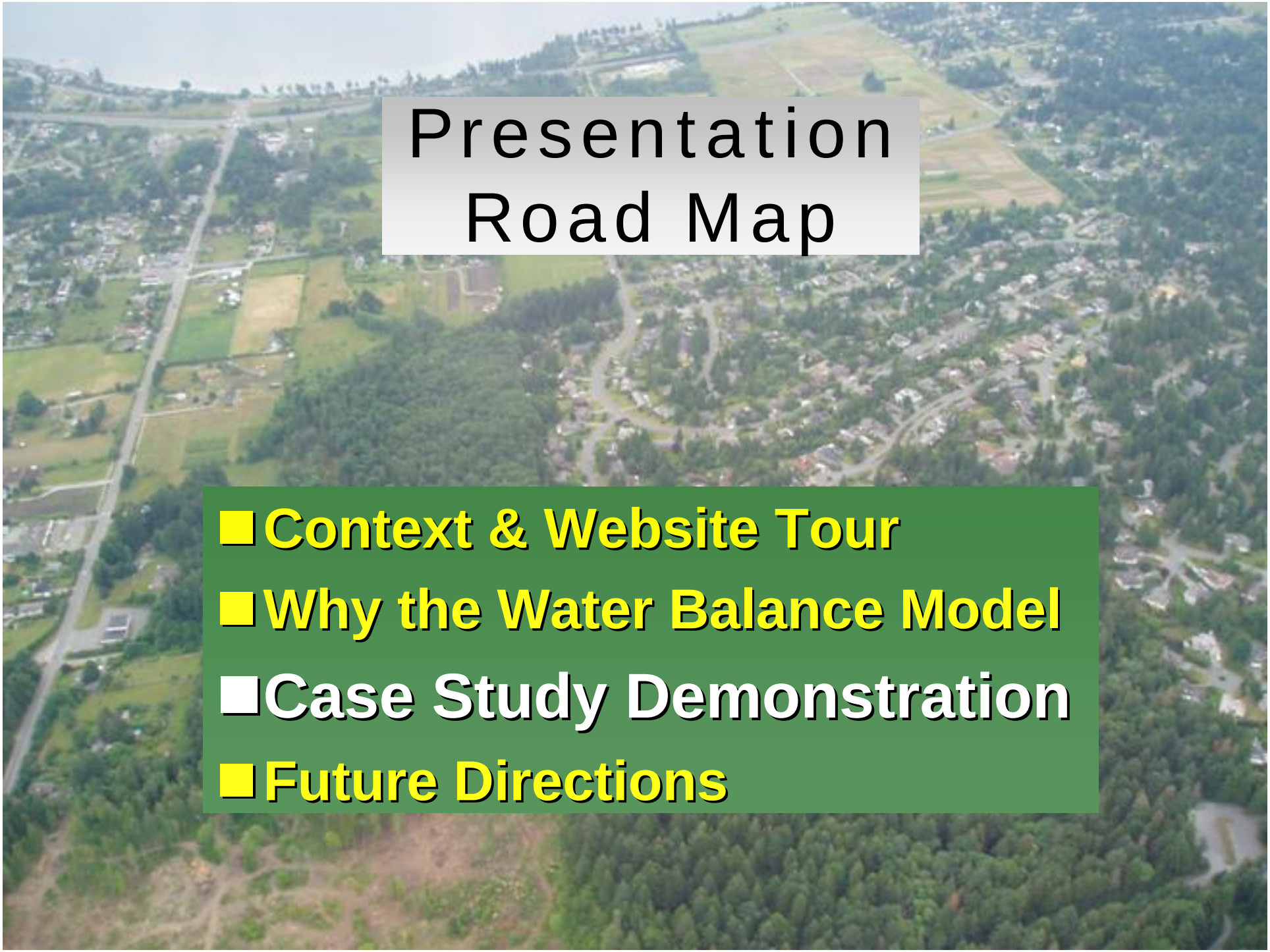
Replica Miner's Cottage
in Retirement Village

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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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		INTEGRATED:
Drainage Systems	→	Ecosystems
Reactive (Solve Problems)	→	Proactive (Prevent Problems)
Engineer-Driven	→	Interdisciplinary Team-Driven
Protect Property	→	Protect Property *and* Habitat
Pipe and Convey	→	Mimic Natural Processes
Unilateral Decisions	→	Consensus-Based Decisions
Local Government Ownership	→	Partnerships with Others
Extreme Storm Focus	→	Rainwater Integrated with Land Use
Peak Flow Thinking!	→	Volume-Based Thinking!

And in conclusion…
‘Designing with Nature’ means:

- **Create Greener Communities**
- **Achieve Higher Levels of Wetlands / Stream Protection**