

Water Balance Model

A Technical Application



Today

BACKGROUND

- Why?

WBM DETAILS

- What
- User
- Needs

Water Balance Model

WHY THE WATER BALANCE MODEL

- Creation of watershed objectives
- Quickly establish the predevelopment base line
- Quickly test alternative LID techniques
- Measure the performance of future development scenarios
- Establish the easiest and best ways to achieve the most desirable vision of the future

GUIDEBOOK OBJECTIVE

- Adaptive Management
- Change as needed

DFO Guidelines (2004)

Hydrologic Design

- “Pre-development rates of runoff from developed and undeveloped sites will be modelled with continuous simulation”
- “Single event models are acceptable for preliminary sizing of BMP’s and conveyance systemsif multiple event scenarios are modelled”

My interpretation of the Guideline objectives:

protect fish and fish habitat from the impacts of stormwater runoff

OR

It’s all about the stream

Concentration Upon The Site

LOST OUR FOCUS ON THE STREAM, HABITAT AND FISH

- As an industry we have managed to concentrate on rainfall and site infiltration to the exclusion of the stream

WHAT FACTORS ARE IMPORTANT TO STREAMS?

- Rates of flow
- Duration of flow
- Minimum flow
- In the stream (morphology)
 - Erosion and sediment build-up
- Water quality

NEED TO REFOCUS THE PROCESS

“RAINwater management is about protecting streams, not how much volume you can infiltrate”

Corino Salomi, Area Manager
Department of Fisheries & Oceans

at the Beyond the Guidebook Seminar
November 2007



Water Balance Model User

TARGET USER

- Engineers, Planners, Biologists, Developers, Homeowners

MUST BE EASY TO USE AND INCLUDES:

- Climate data
- Zoning information of Partner Municipalities
- Standardized output for review

MUST BE EASY TO ACCESS AND BE INEXPENSIVE

Water Balance Model - Focus

Three measures of impact and mitigation effectiveness

- Discharge Volume **FREE ACCESS**
- Discharge Duration **FREE ACCESS**
- Potential Steam Erosion **SUBSCRIPTION COST**
- Can easily add water quality in future releases

Typical Projects

Three levels of project



- Site
- Development – with or without a stream
- Watershed – with a stream

Free Access for Site and Development without a stream.

Subscription Access for inclusion of a stream, private climate data input

Partner Access for municipal zoning information or new climate data with general user access

Startup the WBM

WATER Balance MODEL Powered By **QUALHYMO**

Canada Homepage

(Click on the Map to Access the Model and Homepage for each Province)

This *public domain* tool promotes **rainwater management** and **green development practices**

The vision for the Water Balance Model powered by QUALHYMO... is that it will help communities create neighbourhoods that integrate both good planning and innovative engineering designs, for overall objectives of greater sustainability, such as:

- minimal environmental impacts
- enhanced social values
- economic stability, and
- recreational opportunities

The Pan-Canadian Hydrology Modelling Tool

Model These Projects

1. Sites
2. Developments
3. Watersheds

Enter all of your scenario parameters through a point and click interface. Simulate and compare pre-development, base cases and multiple scenarios with hourly timestep weather data. Onsite and off-site storage facilities available!

Graphed Results
Volume Summary
Exceedance Summary
Stream Erosion

About the Model
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Start-up screen

- Click on Province
- Log in
- Run Model

Typical Scenarios

PREDEVELOPMENT

- Establish base line for all other scenarios

POST DEVELOPMENT

- Establish the worst case

MITIGATION WORKS

- Try different mitigation works and sizing
- Establish best system
 - Performance
 - Then check the cost for local conditions and contractors

Soil Calculator in WBM

http://interface.waterbalance.ca/main.html?date=Tue Apr 14 13:01:19 2009&loc=BC - Windows Internet Explorer

http://interface.waterbalance.ca/main.html?date=Tue%20Apr%2014%2013%01:19%202009&loc=BC

File Edit View Favorites Tools Help

Water Balance Model - ... http://interface.wate... x

Home Feeds (J) Print

Step 1 Configure Drainage Area

These values are calculated from the Surface Conditions in one Drainage Area(s). The values will update as Surface Conditions are added and removed. You have the option of overriding them as well by clicking on the Use Custom Surface Values checkbox and entering your own.

Define a New Surface Condition

Required Parameters:

Surface Condition Name: Scope: **User-Defined**

Permeability: **Pervious** Depression Storage: mm

Rational Coefficient: ratio Retardance Roughness: ratio

Selected Properties:

Soil Type: Clay Loam (Sand: 31%, Clay: 34%)

Organics % by Weight: 0 2 4 6 8

Gravel % by Weight: 0 10 20 30 40 50

Compaction: Loose Normal Dense Hard Severe

Click on the Soil Triangle to select a Soil Type

Calculated Results:

Maximum Water Content: 50.12 % Field Capacity: 36.1 % Wilting Point: 21.81 %

Save New Surface Condition **Cancel**

Design Source Controls - Surface Enhancements

Design Source Controls - With Storage

Apply Source Controls

Configure Stream

Project Cowichan Sample Set (Cowichan Valley, 100 hectares) Scenario Pre - Forest - Test Case ID 9991803_9991804

User Guide 1. Getting Started 2. Background Science

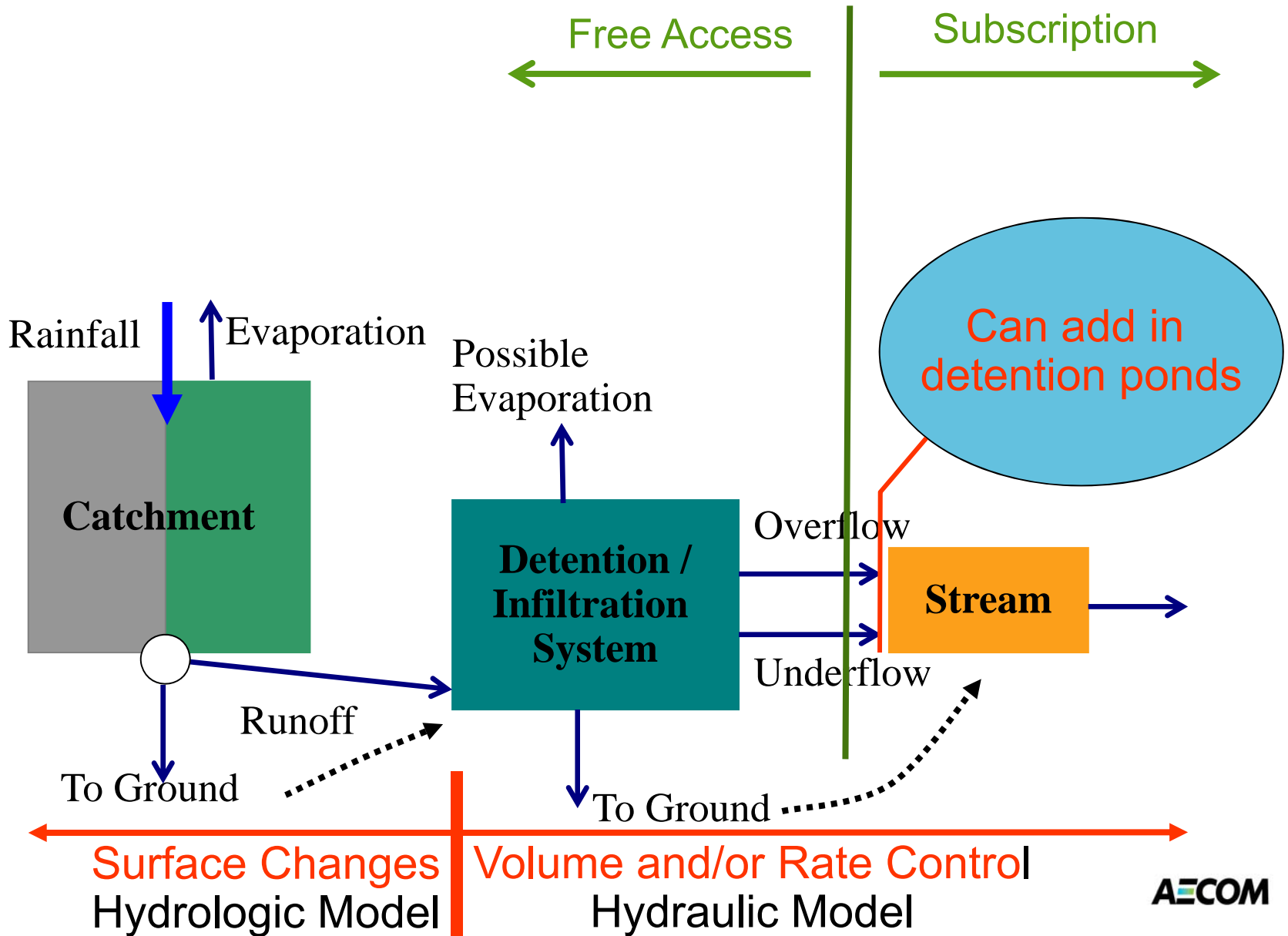
Open Project Browser

Log Out

Done Internet 100%

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Water Balance Model




DRAINAGE AREA (Project or Site)

http://interface.waterbalance.ca/main.html?date=Thu Oct 28 11:58:55 2010&loc=BC - Internet Explorer, optimized for Bing and MSN

http://interface.waterbalance.ca/main.html?date=Thu Oct 28 11:58:55 2010&loc=BC

Configure Drainage Area

Step 1 Configure Drainage Area



The Drainage Area that the user wishes to model can be as small as a single lot or site, it can encompass a larger development, or it can represent a watershed.

Whereas the original Water Balance Model comprised a series of screens that represented layers of data entry, the data inputs are now consolidated on a single screen so that you can "build" your project in modules and always see exactly where you are in the process.

specified above the soil.

Native Soil Types

Sandy Loam

Area acres
 %
 Depth mm

[Edit](#) [Delete](#)

[Add Land Use](#)

Native Soil Type descriptions for this Drainage Area are complete.

Land Uses

Global - Park

Area acres
 %

[Edit](#) [Delete](#)

[Add Land Use](#)

Land Use descriptions for this Native Soil Type are complete.

Surface Conditions

Forest

Area acres
 %
 Depth mm

[Edit](#) [Delete](#)

Surface Condition descriptions for this Land Use are complete.

[Add Surface Condition](#)

[Define New Land Use](#) [Define New Surface Condition](#) [Save](#) [Check Results](#)

Design Source Controls - Surface Enhancements
 Design Source Controls - With Storage
 Apply Source Controls

Project Burnaby Mtn (Burnaby, 2 acres) Scenario pre - forest ID 9996018_9996019 [Open Project Browser](#)

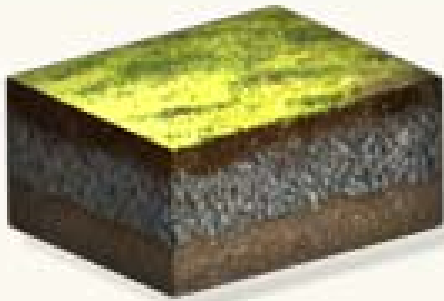
User Guide 1. Getting Started 2. Background Science [Log Out](#)

Done Internet 100% 12:00 PM

Surface Changes

- Model Impacts and Mitigation
- Mitigation with Absorbent Landscapes
 - Tree cover density
 - Increased top soil depth
 - Porous pavement
 - Green Roof – Typical
 - Some infiltration swales – without storage
- **HYDROLOGIC MODEL**

Surface Change Types



Absorbent Landscaping



Pervious Paving



Infiltration Swale - Without Underdrain



Rain Garden - Without Underdrain



Box Planter - Without Underdrain



Infiltration Trench

Replaces the area to which they are applied

Volume Reduction Systems

- Capture surface runoff and STORE it
- Infiltration for volume reduction
 - Rain gardens
 - Infiltration swales with storage
 - Surface or subsurface storage
 - Infiltration ponds
 - Underground galleries
- HYDRAULIC MODEL

Volume Reduction Types



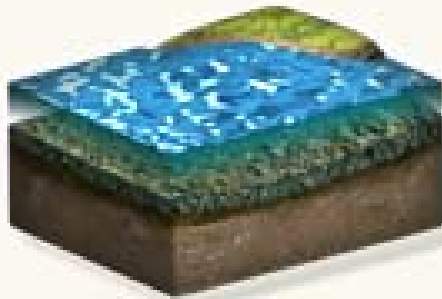
Infiltration Swale - With Underdrain



Green Roof - With Underdrain



Rain Garden - With Underdrain



Infiltration Pond



Box Planter - With Underdrain



Underground Source Control

Surface types have evaporation, underground systems do not.

Surface types replace the area to which they are applied

APPLY Source Controls

http://interface.waterbalance.ca/main.html?date=Thu Oct 28 11:58:55 2010&loc=BC - Internet Explorer, optimized for Bing and MSN

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Configure Drainage Area

Design Source Controls - Surface Enhancements

Design Source Controls - With Storage

Apply Source Controls


Treatment Areas connected to that specific Source Control design.

Step 4

Apply Source Controls


Text coming soon.

Drainage Area: Modelled Area




Native Soil Types

Sandy Loam




Land Uses

Global - Park



Surface Conditions

Forest



Source Controls and Treatment Areas

Area	100	%
5	%	
0.1	acres	

Area	100	%
0.1	acres	
Depth	500	mm

Source Controls on Forest

Click **Size Source Control** to place and size the one shown in the drop down menu.

Available Source Controls

Top soil

Size Source Control

Connected Treatment Areas

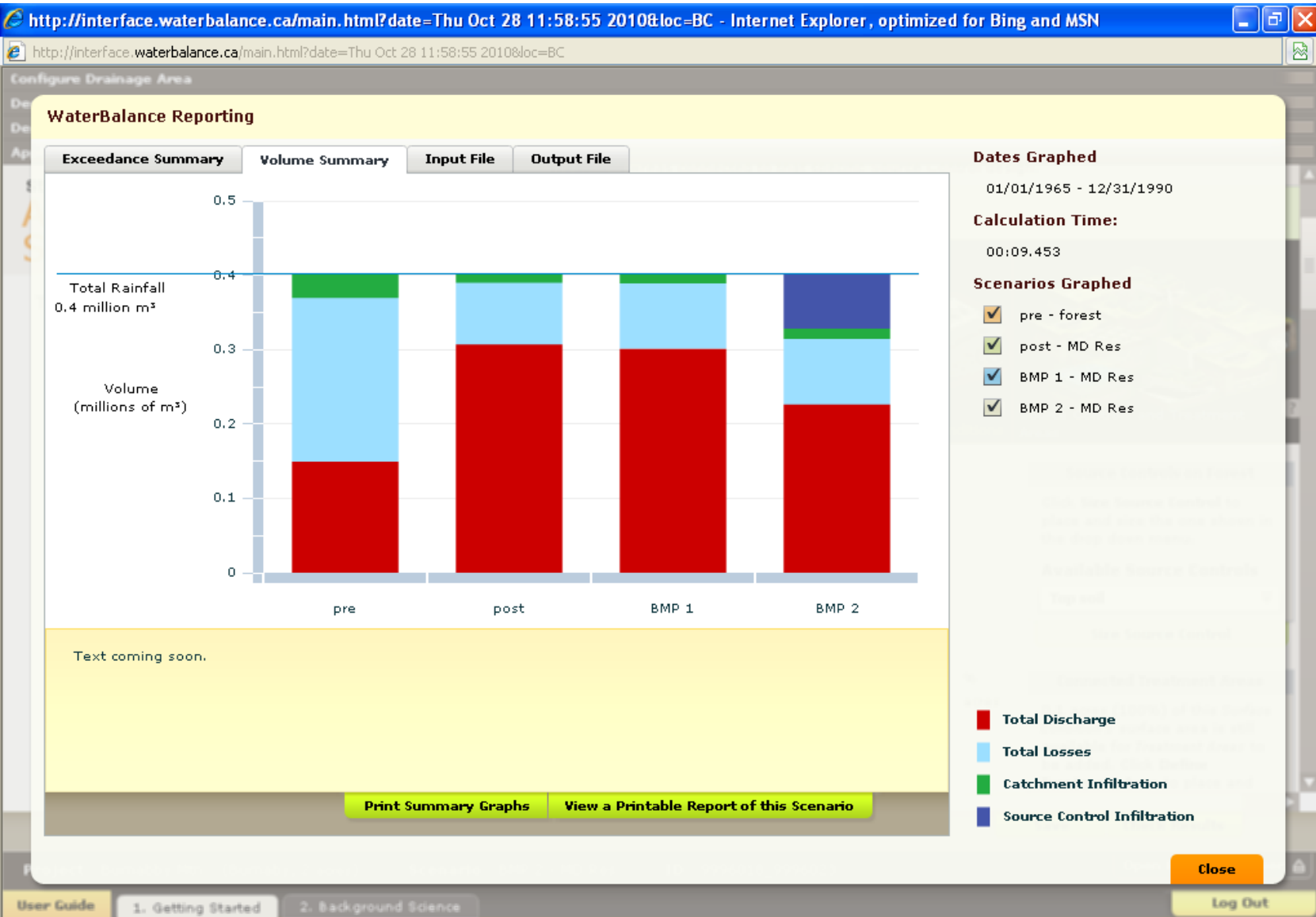
0.1 acres (100%) of this *Surface Condition's* surface area is still available for *Treatment Areas* to be added. Click **Define Treatment Area** to place and

Save
Check Results

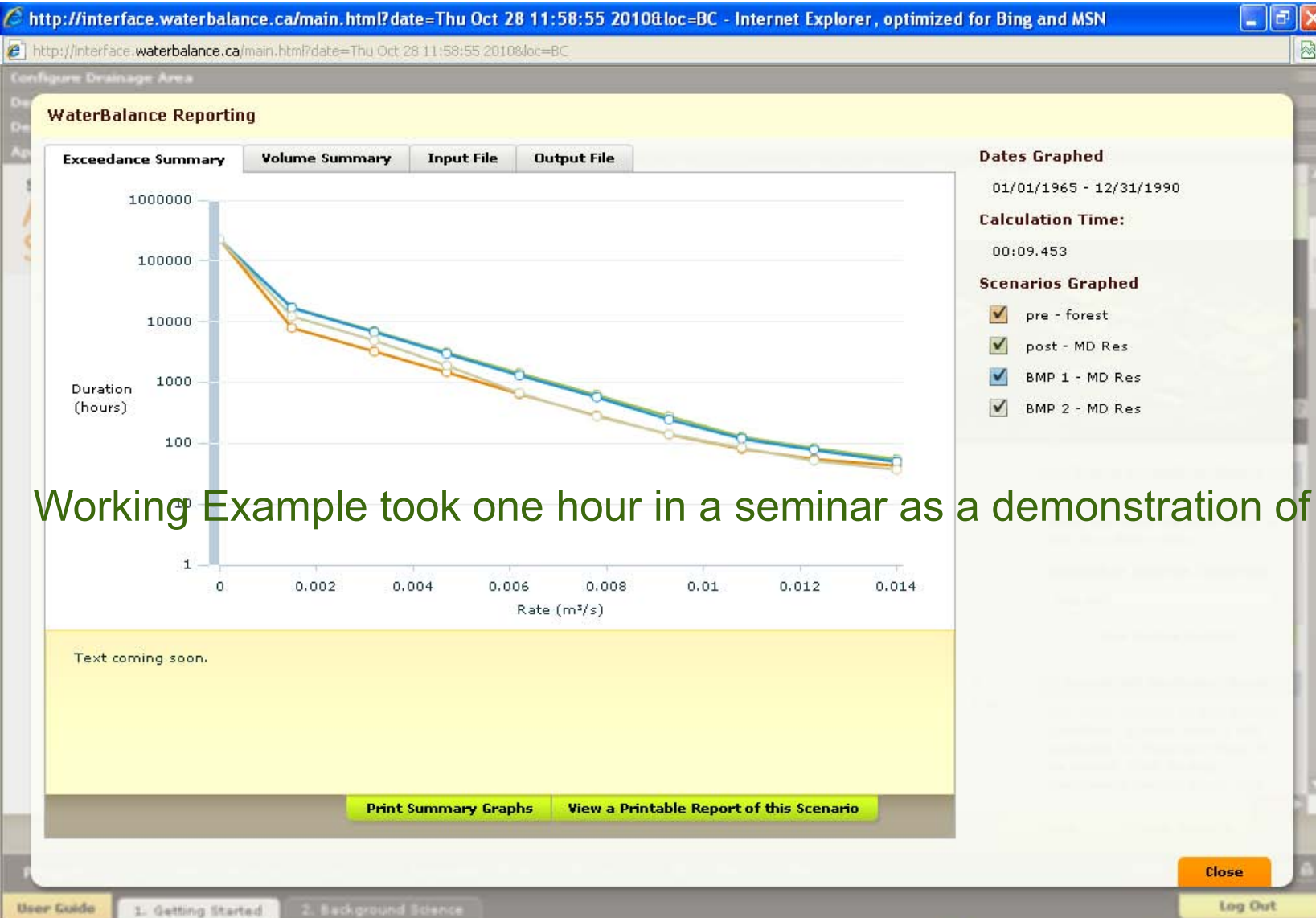
Project: Burnabby Mtn (Burnaby, 2 acres) Scenario: BMP 2 - MD Res ID: 9996018_9996023 Open Project Browser

User Guide 1. Getting Started 2. Background Science Log Out

RESULTS - Volumes



RESULTS - Exceedance



Working Example took one hour in a seminar as a demonstration of the WBM.

RESULTS - Text



Report for
BMP 2
Burnabby Mtn

Report Details

Project

Site Name	Burnabby Mtn
Site Description	demo
Site Location	Burnaby
Site Type	Development
Site Size	2 acres
Stream Present	No
Climate Data File	Surrey Kwantlen Park
Climate Start & End Dates	01/01/1965 to 12/31/1990

Scenario

Scenario Name	BMP 2
Scenario Description	MD Res

Timestamps

Report Generated	Thu, 28 Oct 2010 12:13:46 -0700
Processed by QUALHYMO	Thu, 28 Oct 2010 12:11:16 -0700

Drainage Area Configuration

Drainage Areas

Drainage Areas	Native Soil Types	Land Uses	Surface Conditions	Source Controls
Modelled Area Area 2 acres	Sandy Loam Area 2 acres	Global - Park Area 0.1 acres	Forest Area 0.1	

For each scenario

1. All information input by user

- Project and Scenario
- Soils, any Enhancements

2. Results information

- Volume Summary
- Exceedance values

3. Easy to review in one standard format

4. Copy and paste into Word or other file format

Enhancements in Progress

- Potable water reuse
- Natural Stream cross section assessment
- Tree Canopy Module
- Climate Change Module

Numerous items on wish list awaiting user demand and funding

- WBM Light
- Statistical Module
- On-Line Training
- *fill in the blank*

Conclusions – Water Balance Model

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1. Simple and Easy to use
2. FREE to inexpensive
3. Quick to run
4. Meets the need for comparing results and values
5. Can establish base case, then compare scenarios to target
6. Establishes component design sizing and operation
7. Standardized output for easy review
8. Fills a need

Water Balance Model

A Technical Application

