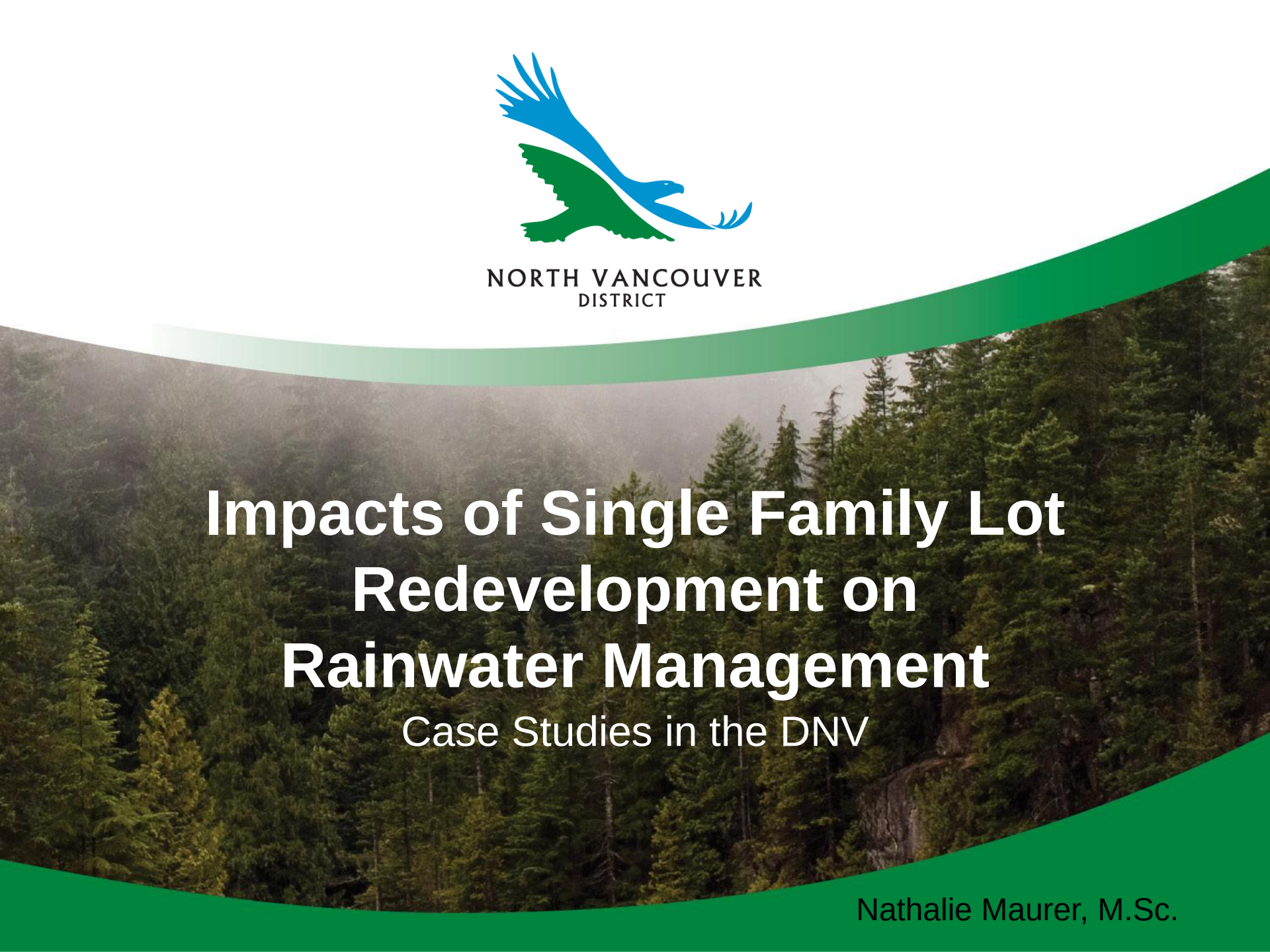

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Impacts of Single Family Lot Redevelopment on Rainwater Management

Case Studies in the DNV

Nathalie Maurer, M.Sc.

Purpose

- Demonstrate the impacts of single family redevelopment on water supply/demand and rainwater management
- Use of multi-year aerial photos to digitize land uses from years 1992-2009
- Use of the Waterbalance model to assess the impacts of land changes on rainwater management
- Use of the Waterbalance model to develop alternative development options to reduce runoff at the property scale

WATER Balance MODEL Powered By QUALHYMO

Returning Users

Username

Password

Log In!

Forgotten Your Password? Help

Is this your first visit to the model?

You will have to register in order to create model scenarios. There is only one option during our public beta testing period:

1. Register a (free) "trial" account. As a trial account registrant you are free to access all model features, however your account and any scenarios you've created **will be deleted 7 days** from the *time you register*.

Following the end of the beta period, scenarios created by subscribers or members of subscribing groups will remain in the database permanently.

Create a New Account

www.waterbalance.ca

We are incorporating all the lessons we have learned to date…

The 'new Water Balance Model' integrates the Site with the Watershed and the Stream…

CANADA

Urban Tree Canopy and Soil

- Trees, vegetation and soil function together in natural rainwater management.
- Study of urban trees* indicate certain trees can intercept up to 90% of the rain from storm events
- Studies indicate that urban lawns with 30 cm of quality top soil can improve infiltration, minimize irrigation requirements, reduce runoff volume and reduce pesticide use
- Majority of north shore lawns have less than 10cm of top soil over densely compacted glacial till

*Asadian, Y. Weiler M. 2009


Healthy Soil


Hard Pan

Low-Impact Design (LID)

Facilities and landscapes aimed at capturing rainfall and reducing runoff. Consist of augmented or enhanced surface conditions (trees, vegetation and soil).

Influencing variables include:

- Vegetation and ground cover
- Imperviousness
- Increased top soil depth
- Soil porosity or moisture holding capacity
- Surface infiltration rates
- Surface roughness

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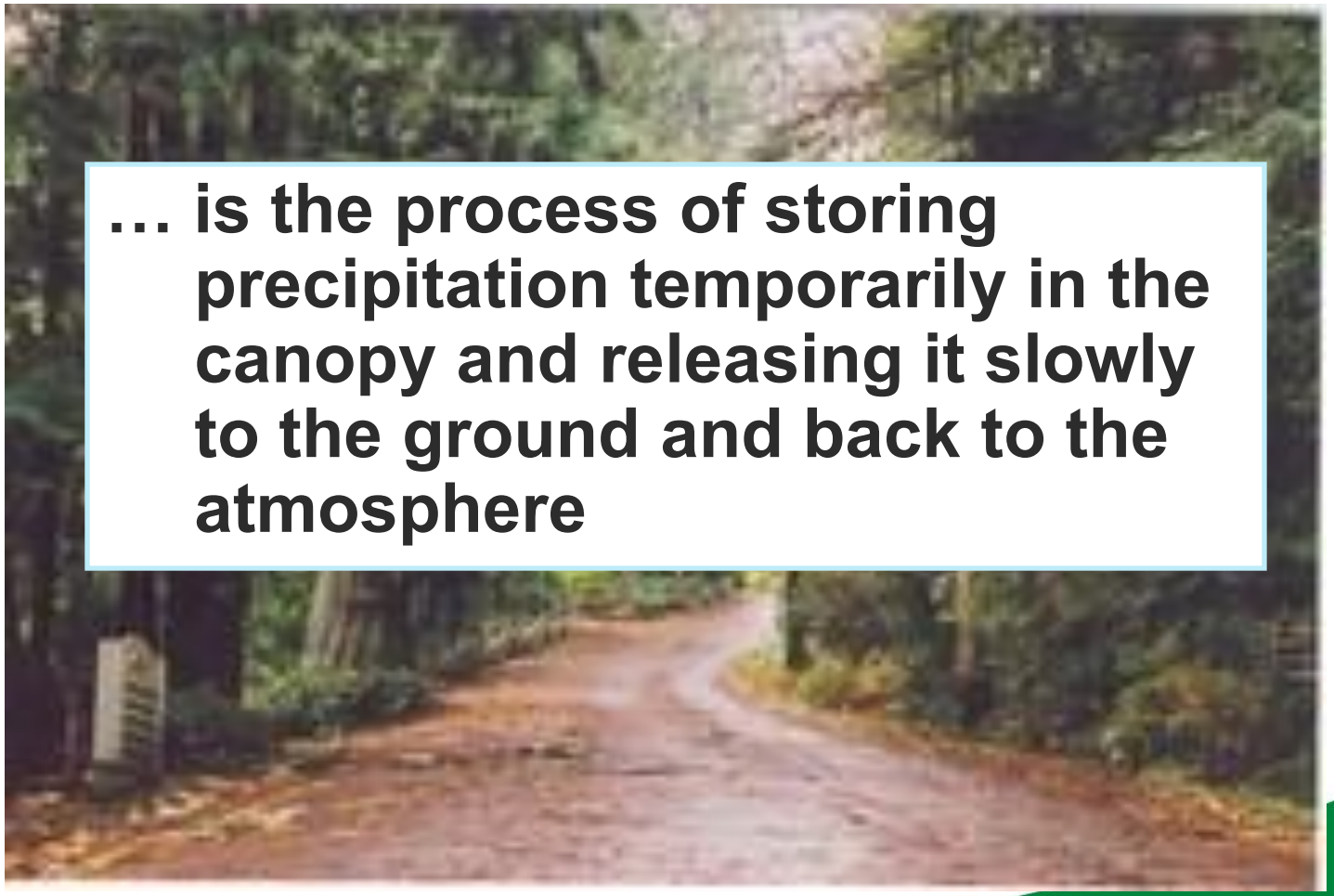
Tree Canopy Reduction

UBC Tree Canopy Interception Research Project:

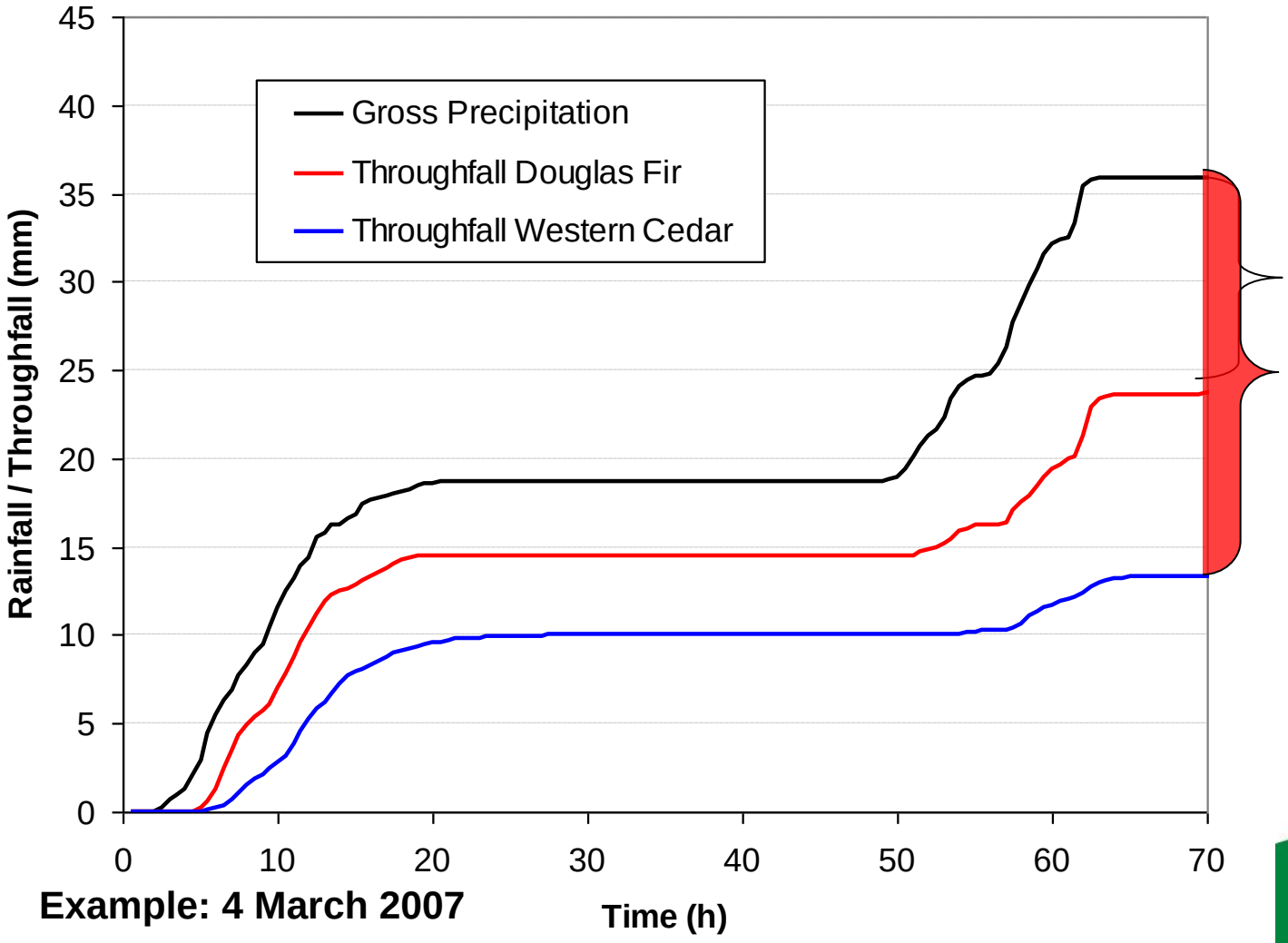
Bringing Rainwater Management Science into the Community

Tree canopy interception …



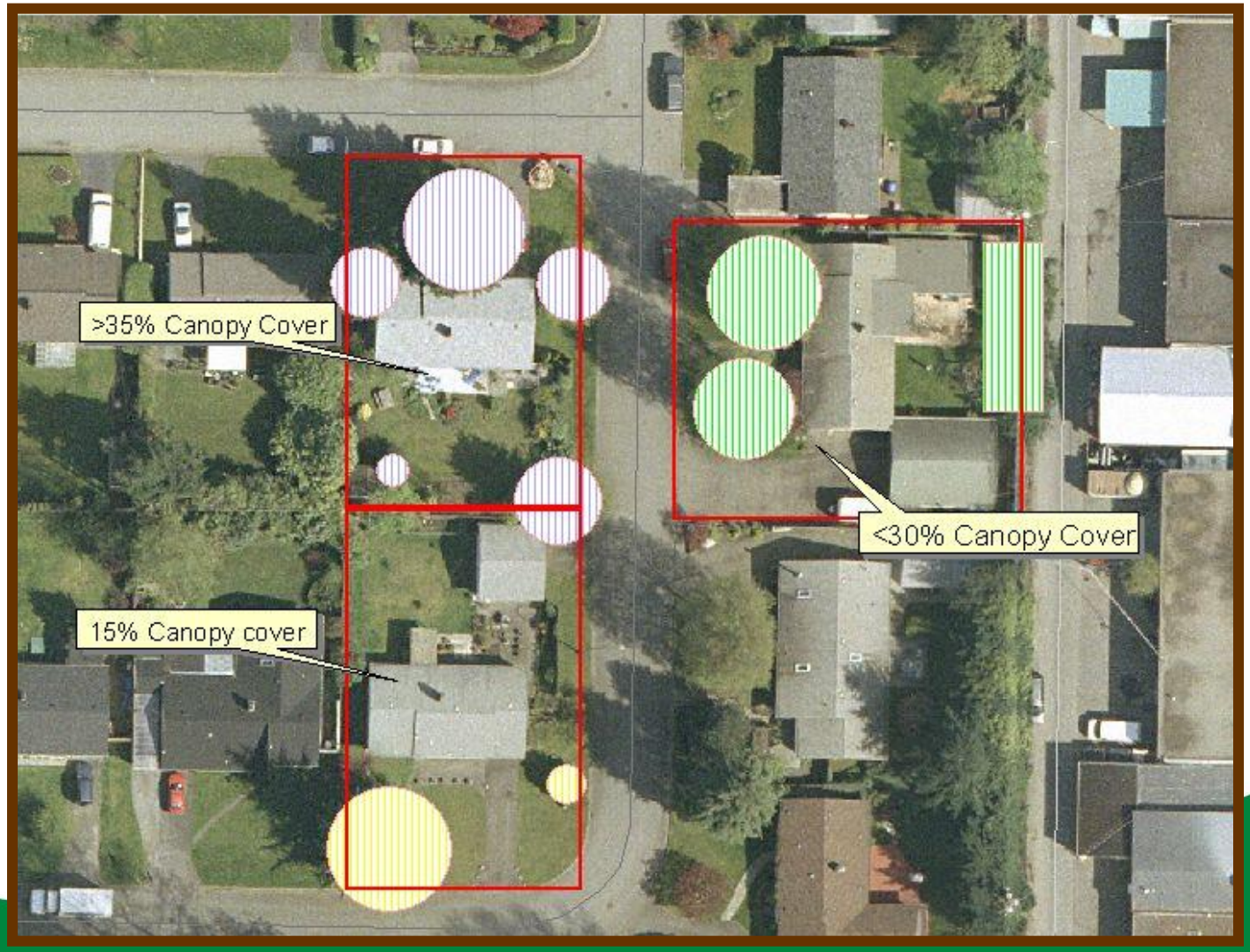
… is the process of storing precipitation temporarily in the canopy and releasing it slowly to the ground and back to the atmosphere

Results



Example: 4 March 2007

Urban Forest *"Planning"*



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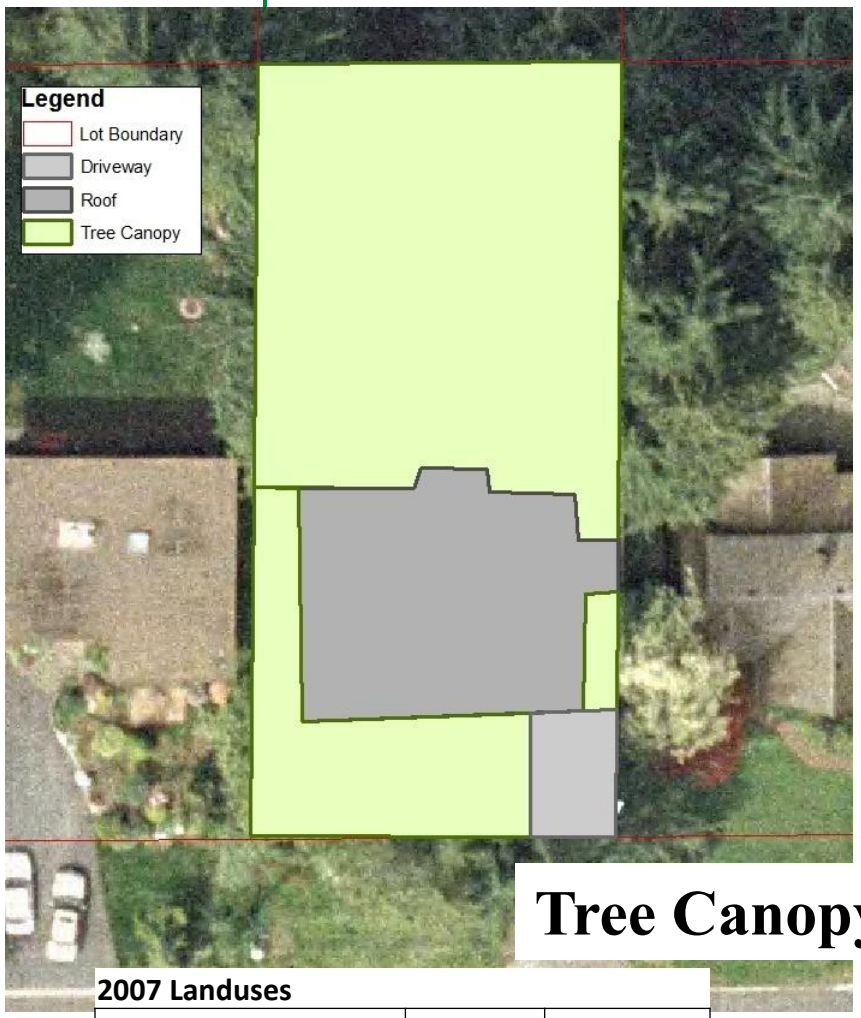
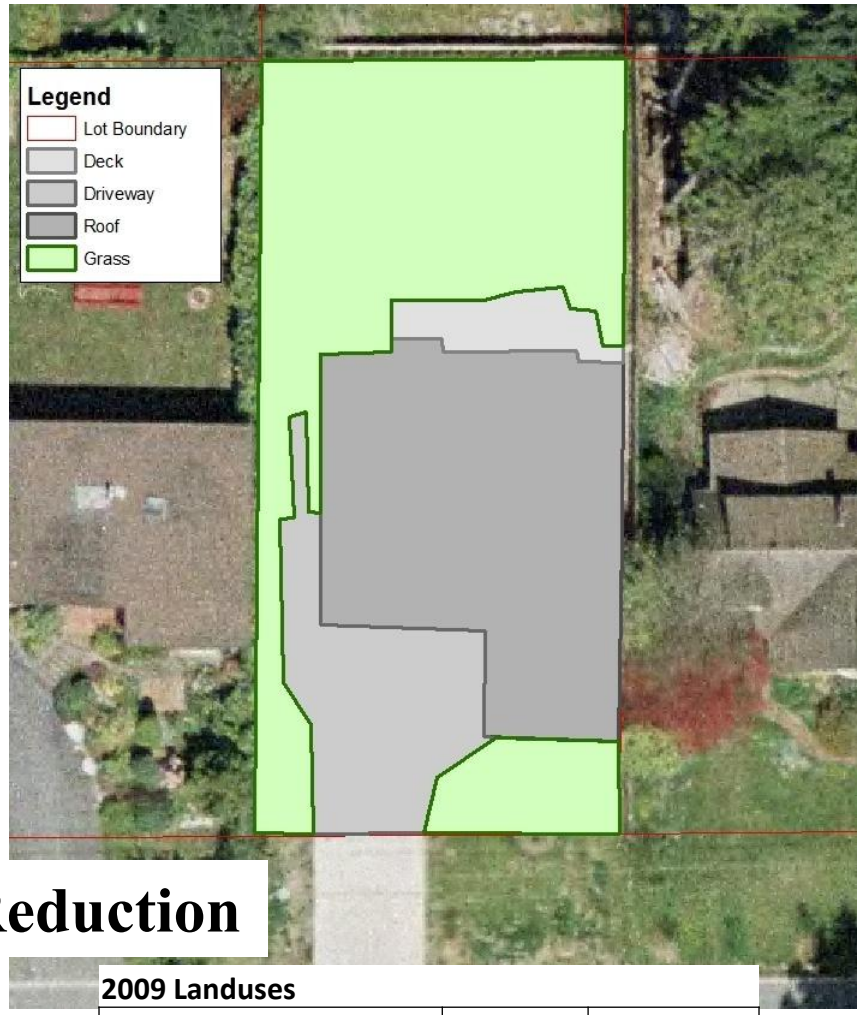
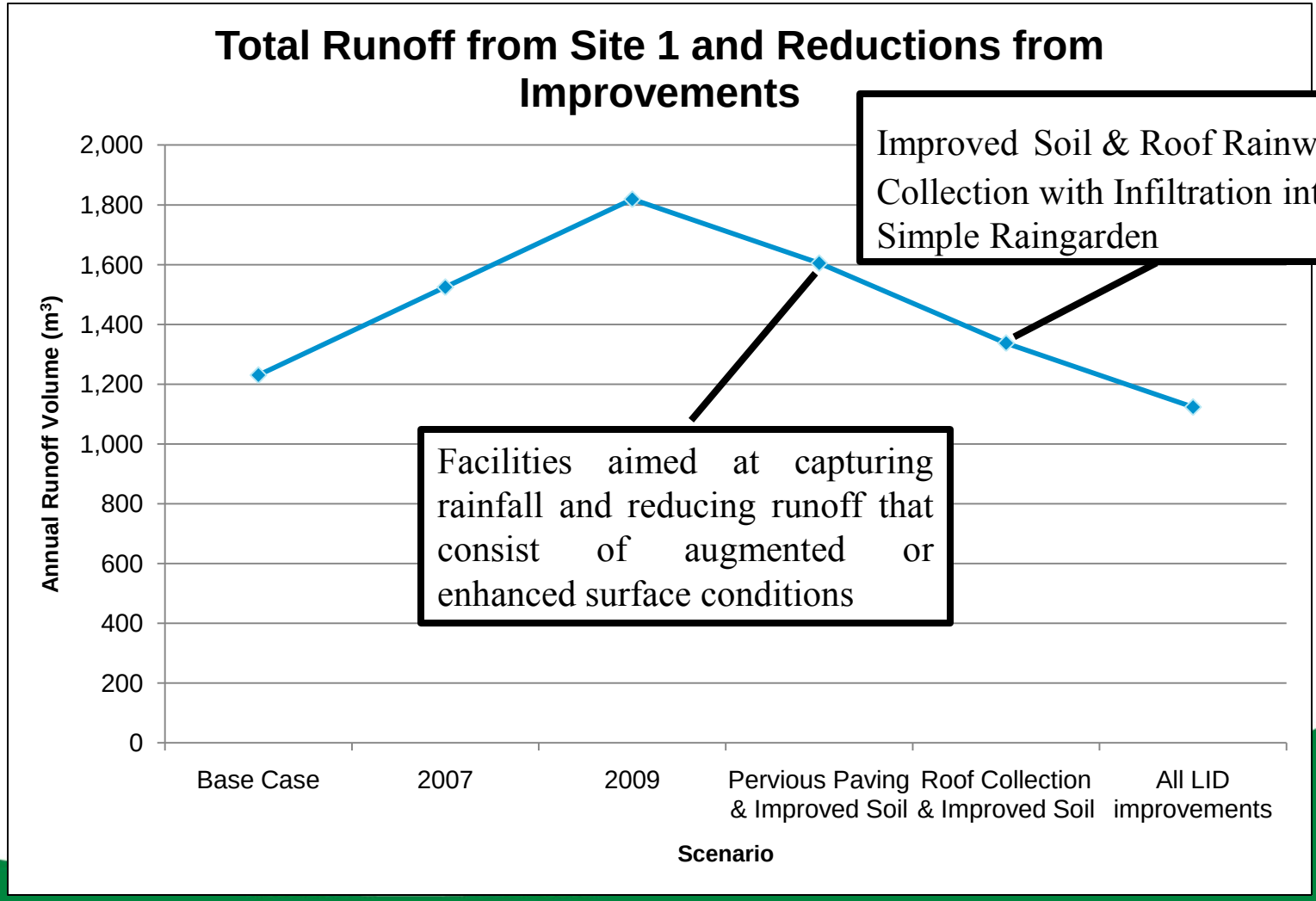




Tree Canopy Reduction

2007 Landuses		
Landuse	**Area (m²)**	**Proportion**
Driveway	33	4%
Roof	204	24%
Tree Canopy	622	72%
Impervious	236	**28%**
Pervious	622	**72%**

2009 Landuses		
Landuse	**Area (m²)**	**Proportion**
Driveway	121	14%
Roof	298	35%
Deck	33	? 4%
Grass	402	? 47%
Impervious	452	**53%**
Pervious	402	**47%**


Total Runoff from Site 1 and Reductions from Improvements
Annual Runoff Volume (m³)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Base Case
2007
2009
Pervious Paving & Improved Soil
Roof Collection & Improved Soil
All LID improvements
Scenario
Improved Soil & Roof Rainwater Collection with Infiltration into Simple Raingarden
Facilities aimed at capturing rainfall and reducing runoff that consist of augmented or enhanced surface conditions

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Increased Site Imperviousness

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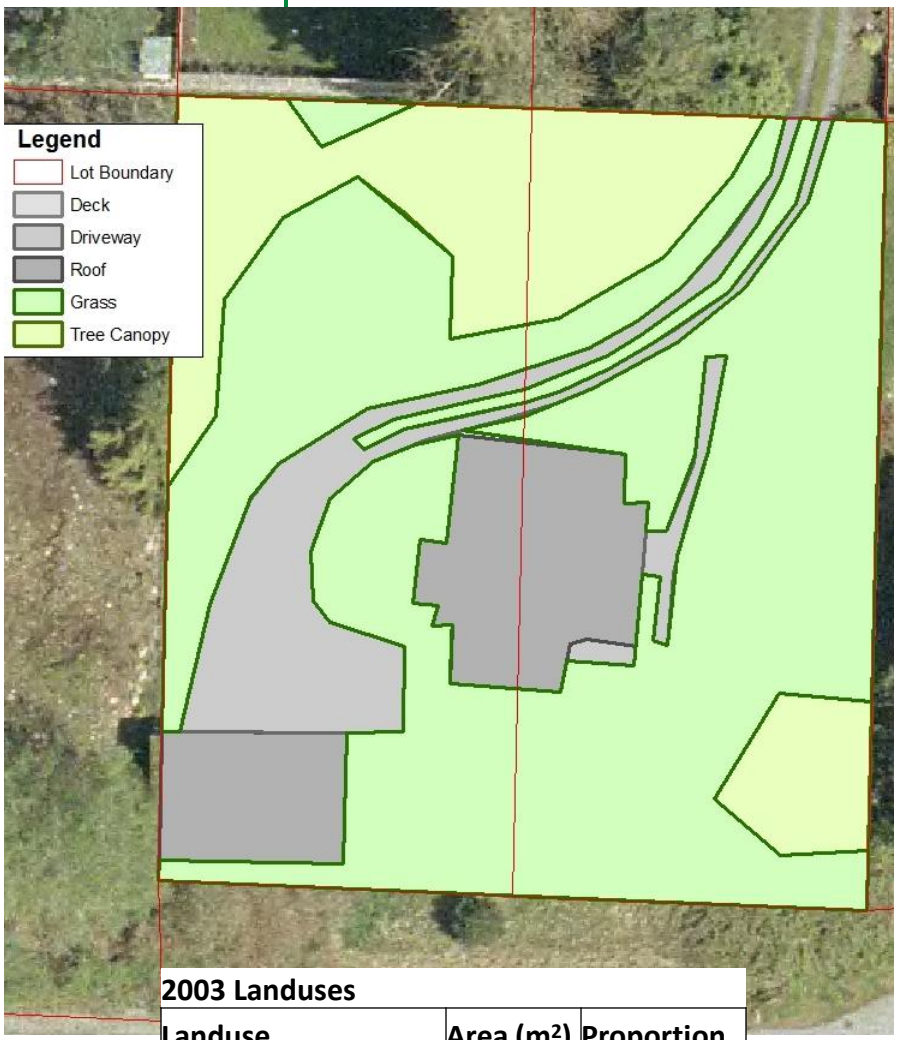
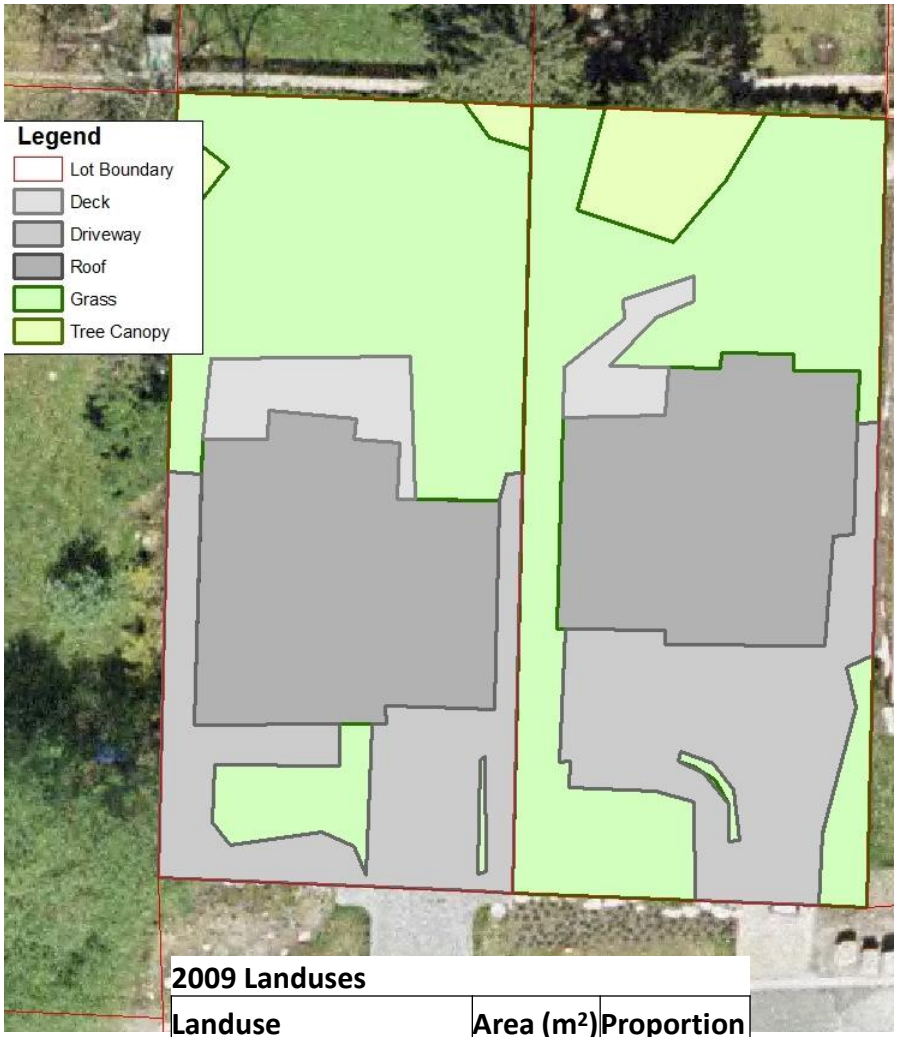


2003 Landuses

Landuse	Area (m²)	Proportion
Driveway	186	11%
Roof	207	12%
Grass	961	57%
Tree Canopy	339	20%
Impervious	393	**23%**
Pervious	1300	**77%**



2009 Landuses

Landuse	Area (m²)	Proportion
Driveway	373	22%
Roof	463	27%
Deck	74	4%
Grass	723	43%
Tree Canopy	65	4%
Impervious	910	**54%**
Pervious	788	**46%**

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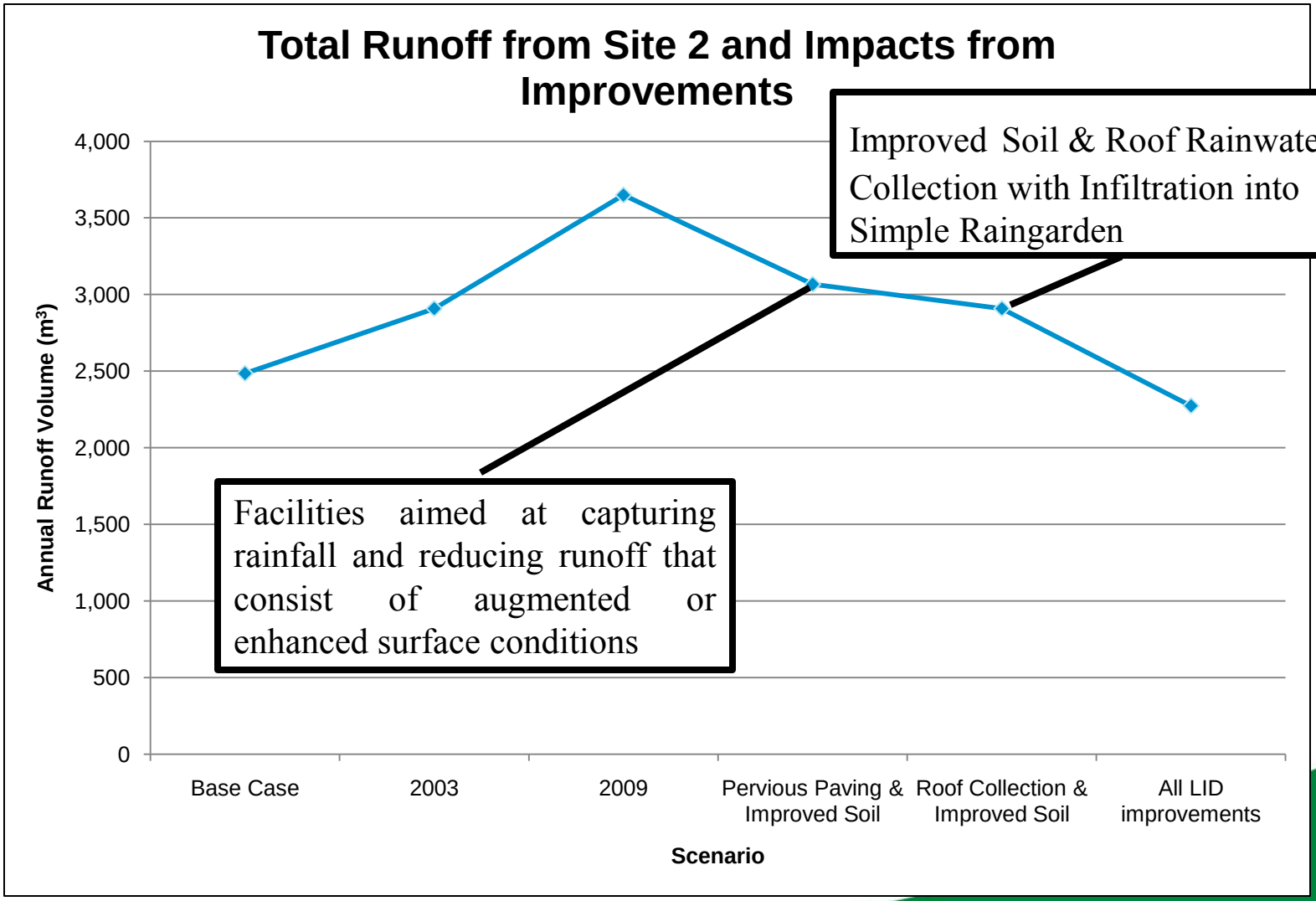

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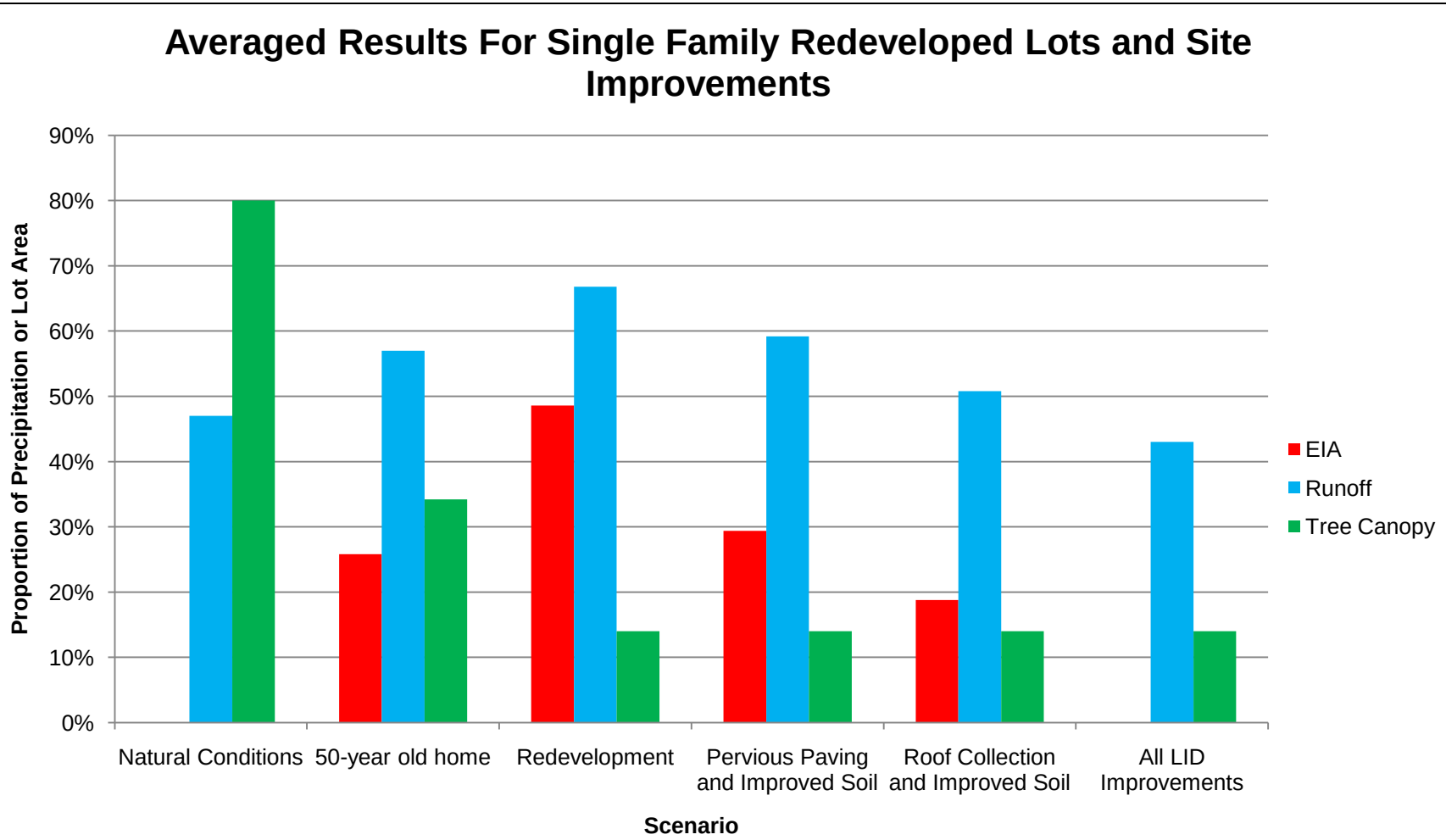

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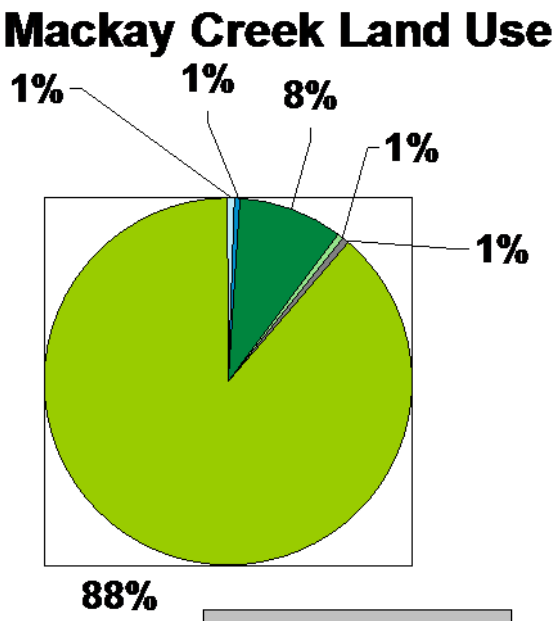
Watershed Scale

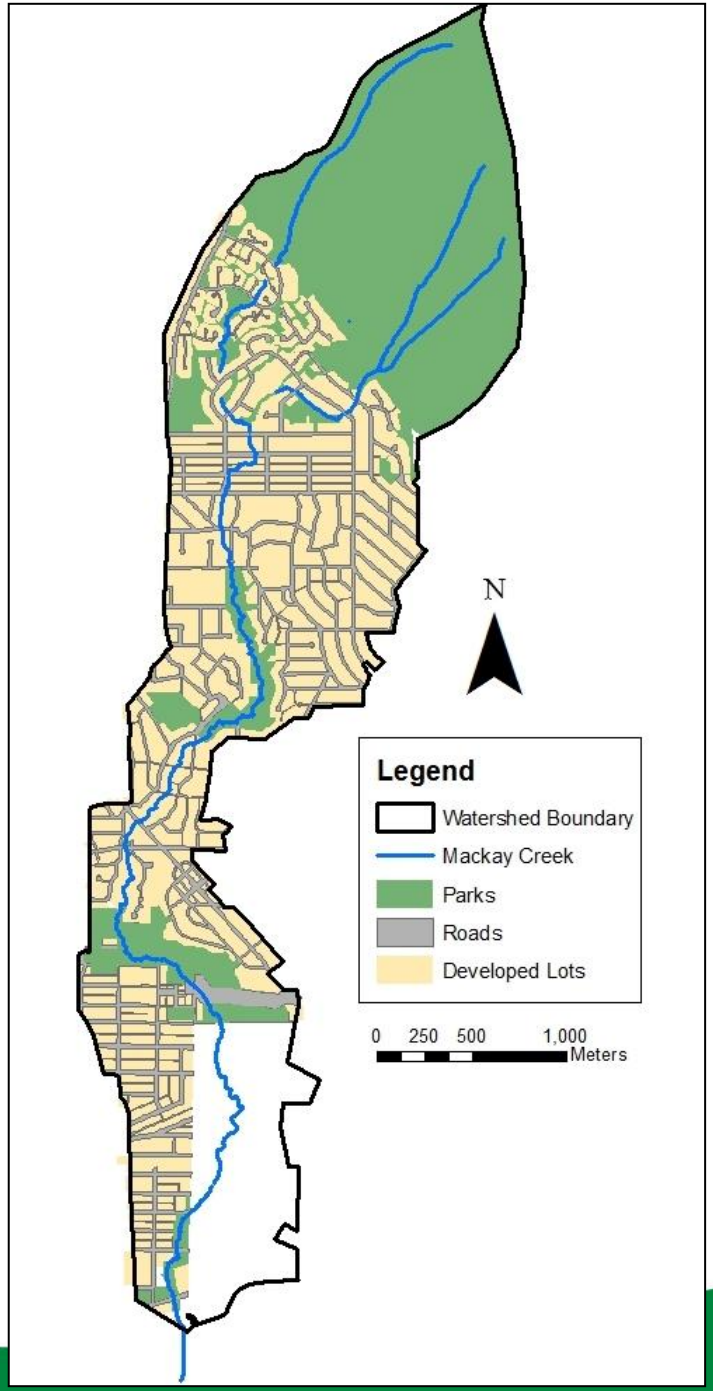
Development Trends

2009 Issued New Construction Permits

- Avg. Square footage 2,758 ft^2
- Avg. Basement 1,435 ft^2
- New construction value $27,500,00 (2009)
- New construction value $47,7190,00 (2008)

Mackay Creek





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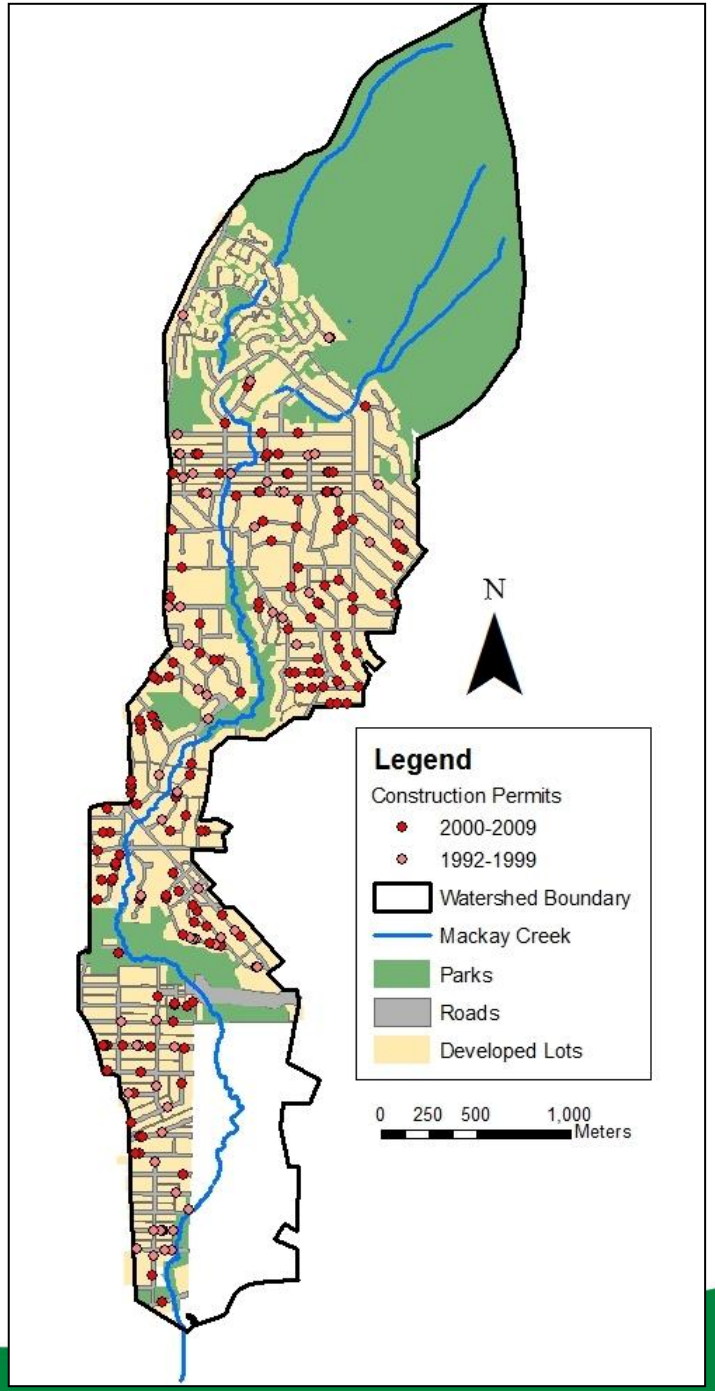
Mackay Creek



Mackay Creek Construction Permits

77	1992-1999
150	2000-2009
2884	Single Family Lots

5% of SF lots were redeveloped in 10 years

In 20 years...

10% of the existing lots could be redeveloped

Resulting in:

- 25% increase of effective impervious area (EIA) on each of these lots
- 10% increase of runoff per redeveloped lot
- 300 Redeveloped lots, average 700 m^2 in size
- 52,500 m^2 increase in EIA
- Approximately 105,000 m^3 in additional annual runoff for Mackay Creek watershed

However...

- Improving top soil depth to 400 mm
- Collecting the roof runoff off on site in a simple raingarden

Results in:

- 10% less EIA per lot than *existing*
- 5% less runoff per lot than *existing*
- 42,000 m^3 *decrease* in annual runoff in Mackay Creek watershed

With the same development FSR

Simple Raingarden

What's Next?

- In such a fast growing region can we make a difference?
- Should we even try?
- What will it take to changes our ways?
  - Soft selling, education based methods?
  - New tough laws?
  - Local environmental disaster (what kinds)?
  - All of the above

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Acknowledgements:
Nathalie Maurer, M.Sc.
Dr. Hans Schreier, UBC RMES