DRainscape to Create Green Cities

www.greenskinslab.sala.ubc.ca

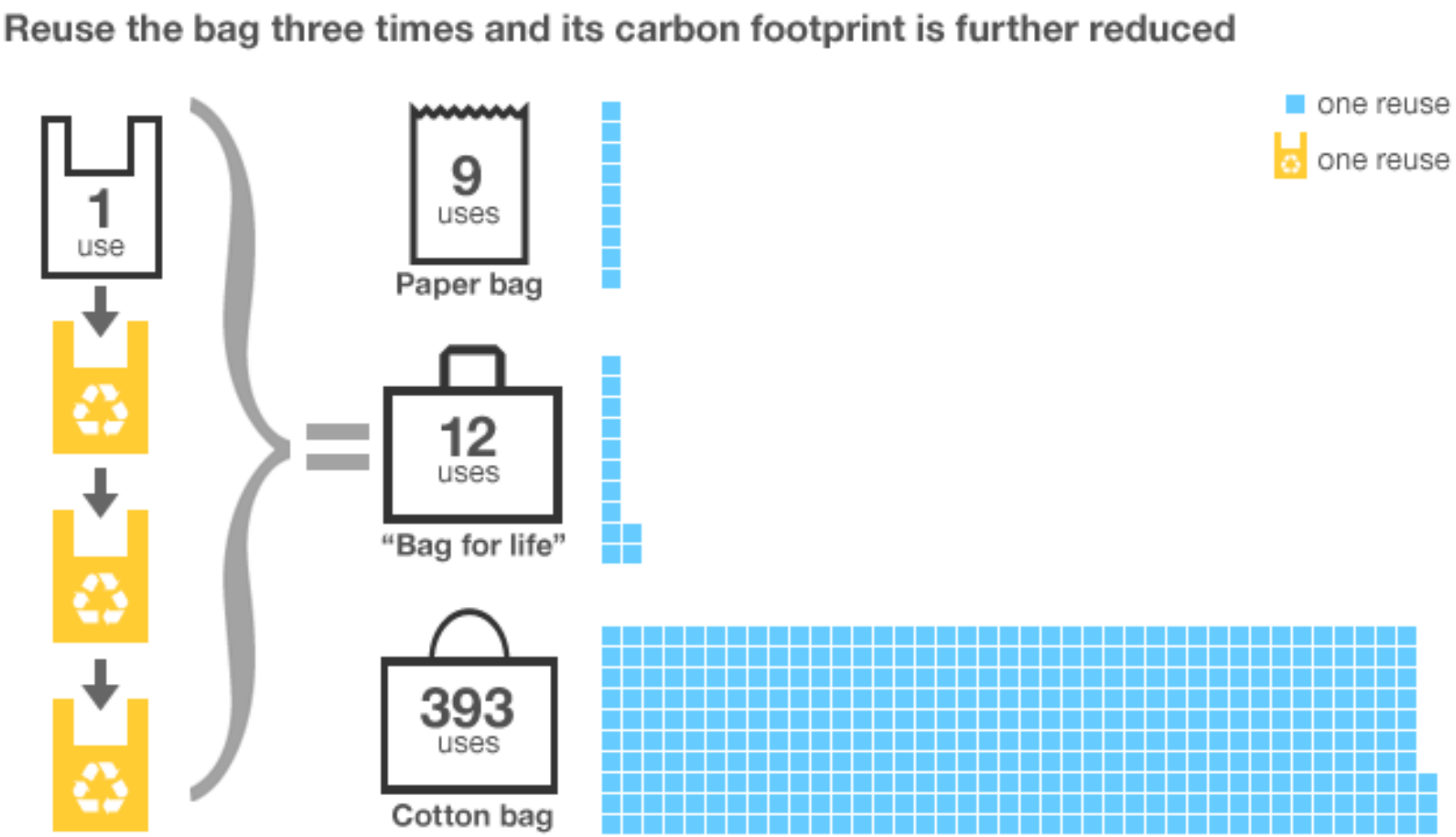

GO BACK. WE FUCKED UP EVERYTHING.

Where Should Sustainability Measures Start?

In Your Own Household

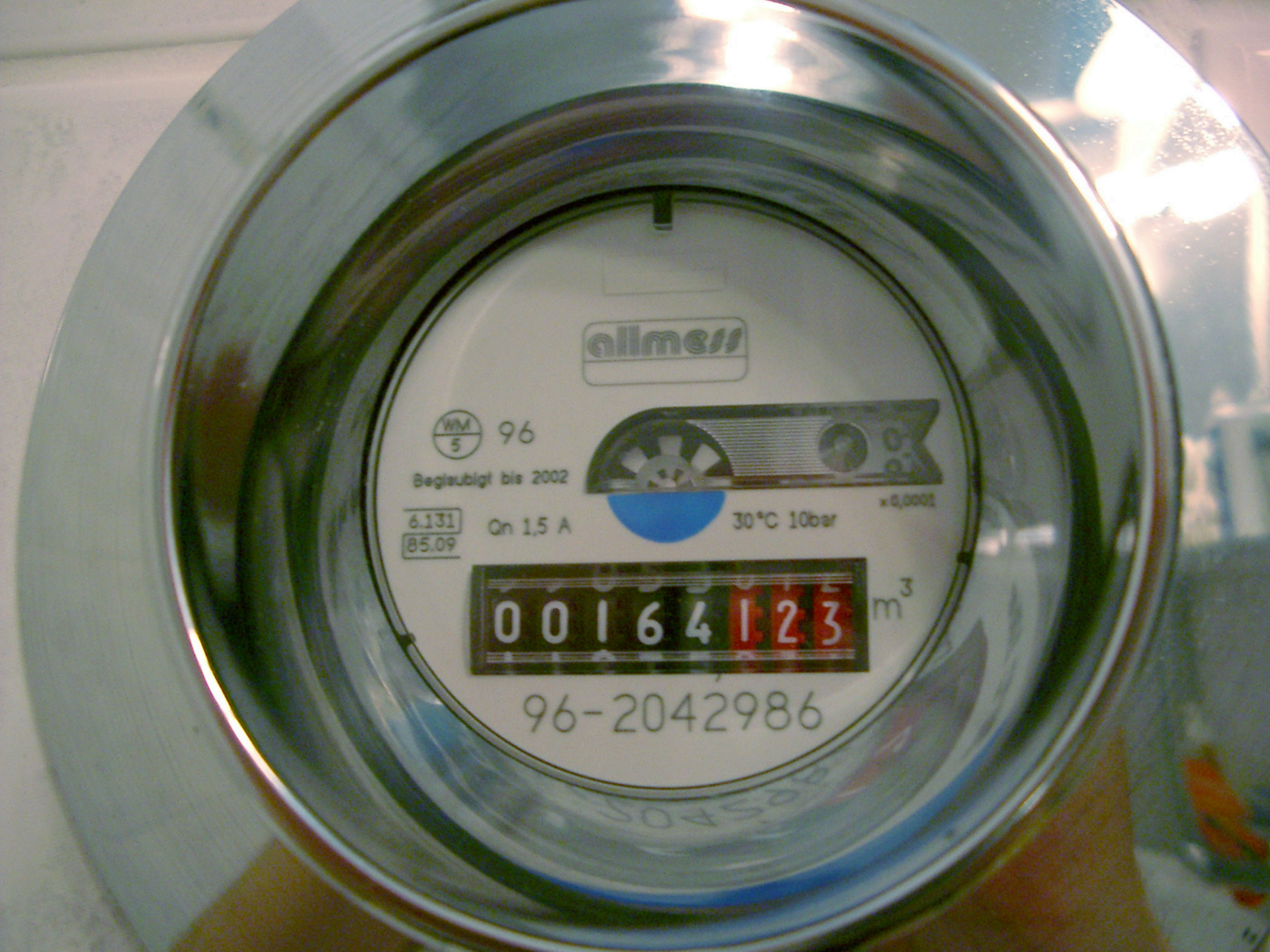
Planning/Design

Understanding
Life Cycle Analysis
When
“Making Design Decisions”



Marchant, J. 2006, "Life Cycle Assessment of Supermarket Carrier Bags: a Review of the Bags available in 2006," Illegal & Waste

Brownlee, A., Li, C., Lo, M., University of British Columbia, 2013
"Assessment: Aspenware Biodegradable Cutlery"
UBC Social Ecological Economic Development Studies (SEEDS) Student Report Life Cycle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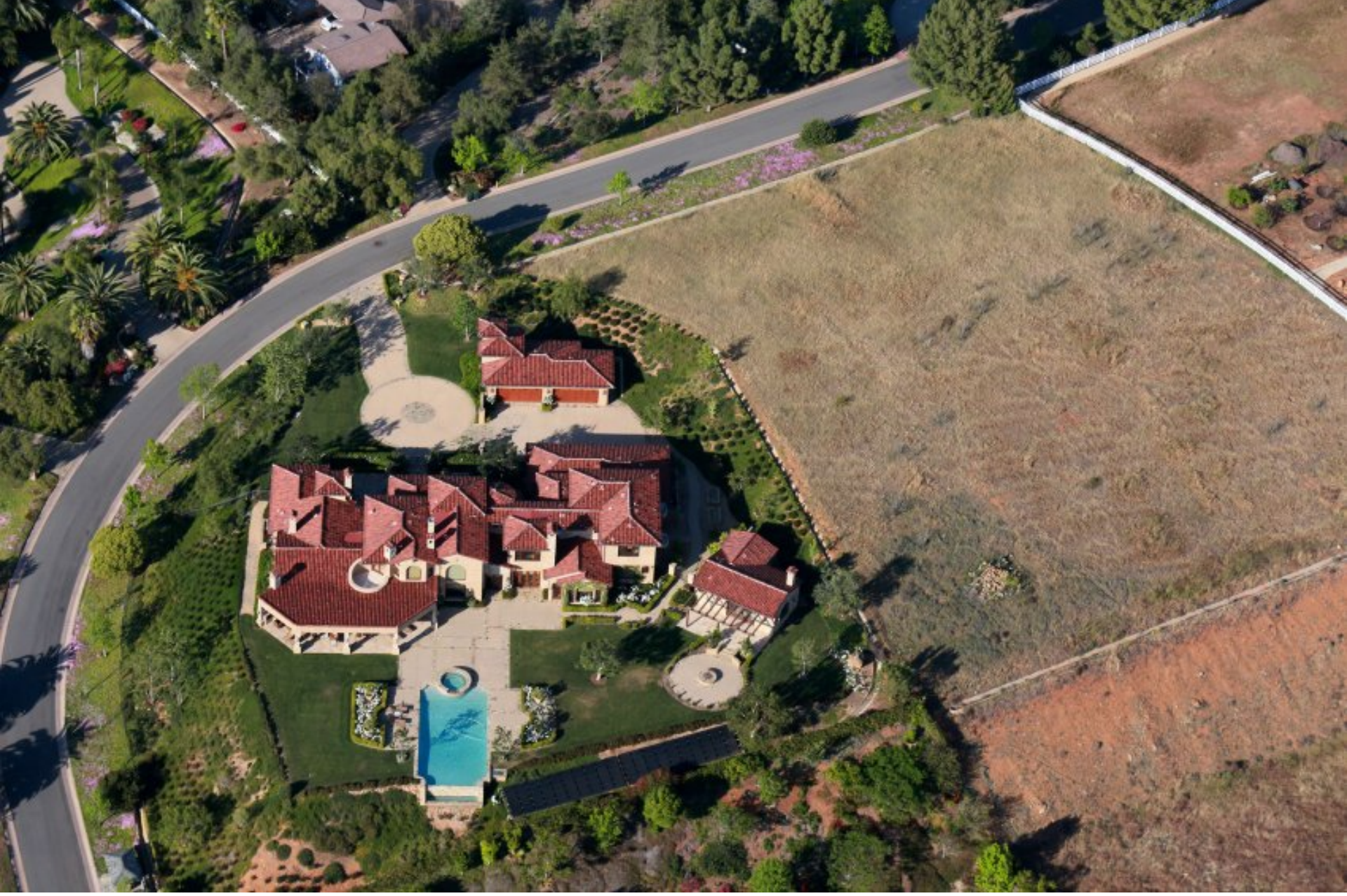
Hoover Dam, USA

Empty Water Reservoirs

Spraying Lawn in CA



Irrigated Property in CA

Irrigated Property in CA

Bosco Verticale, Milan, Italy

Energieberg former Landfill Site, Georgswerder, Hamburg, Germany

Garden Bridge, Thomas Heatherwick Architects, London, England

Verde 1, Luciano Pia Architects, Turin, Italy

Tokyo District 2045

Sky Mile Tower, Urban Design Concept, Kohn Pedersen Fox Associates (KPF) und Leslie E. Roberson Associates (Lera) Architects, Tokyo, Japan

Sky Mile Tower, Urban Design Concept, Kohn Pedersen Fox Associates (KPF) und
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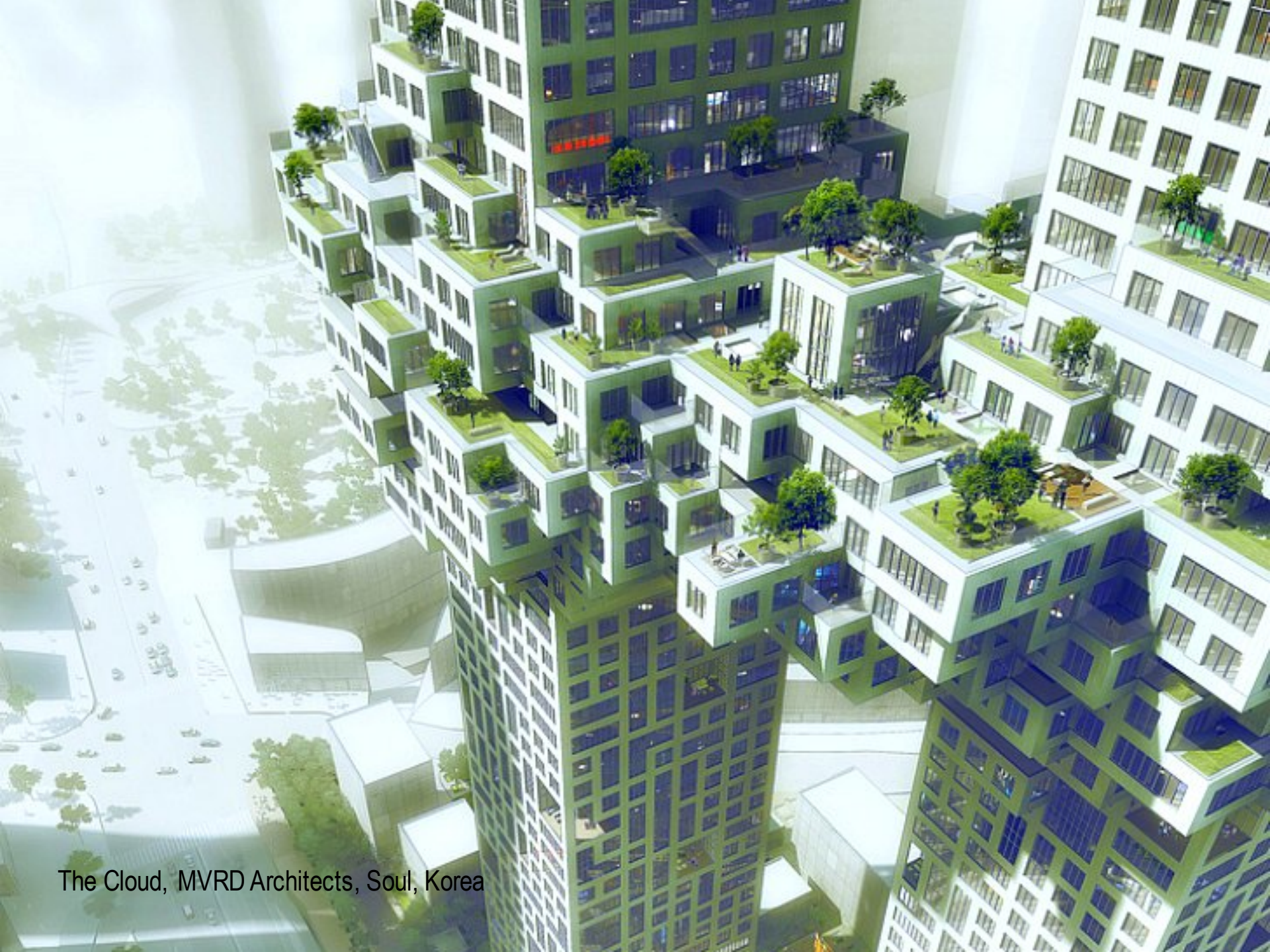
Sky Mile Tower, Urban Design Concept, Kohn Pedersen Fox Associates (KPF) und Leslie E. Roberson Associates (Lera) Architects, Tokyo, Japan


Green Loop, New York, USA

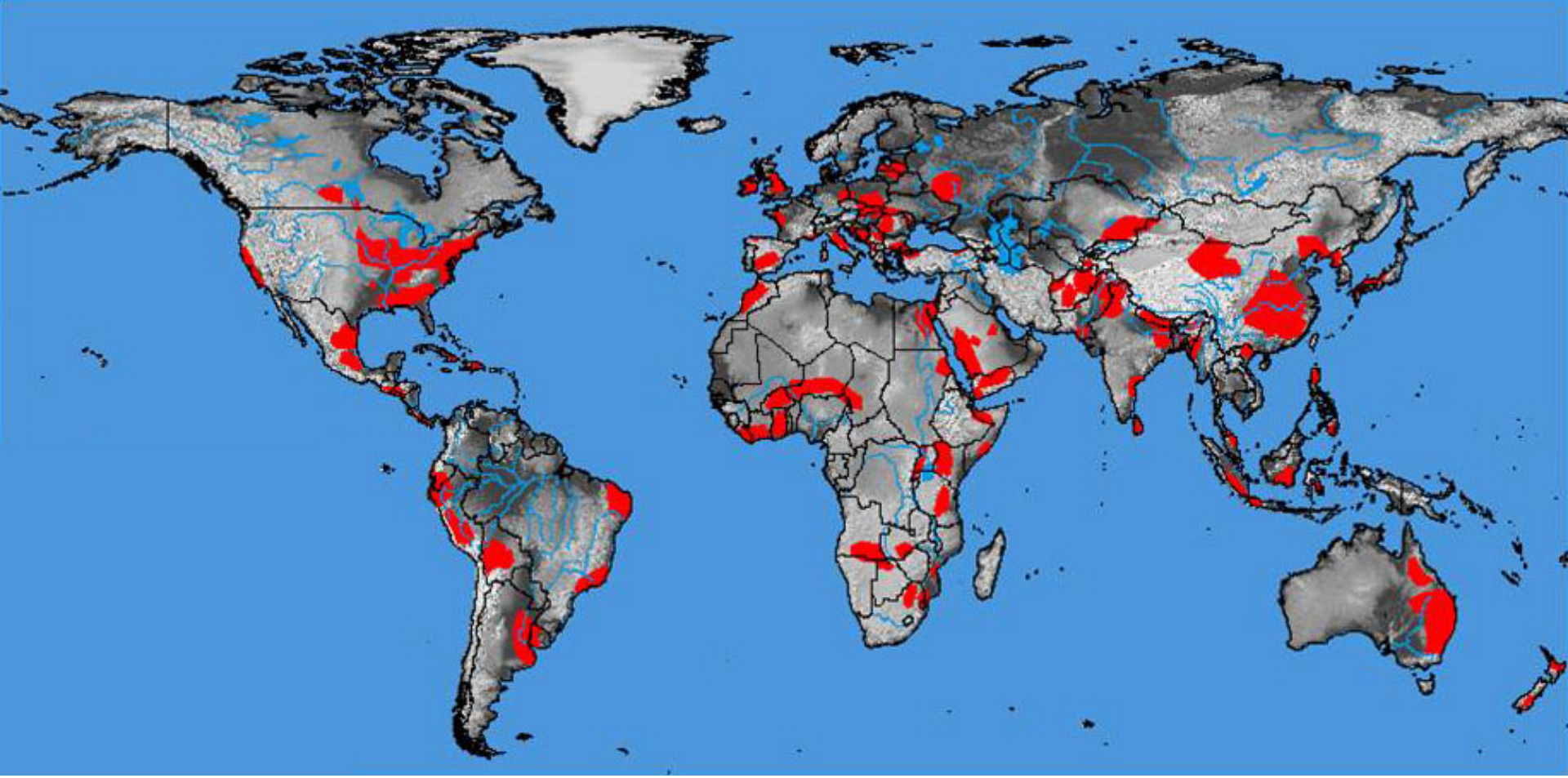


The Cloud, MVRD Architects, Soul, Korea

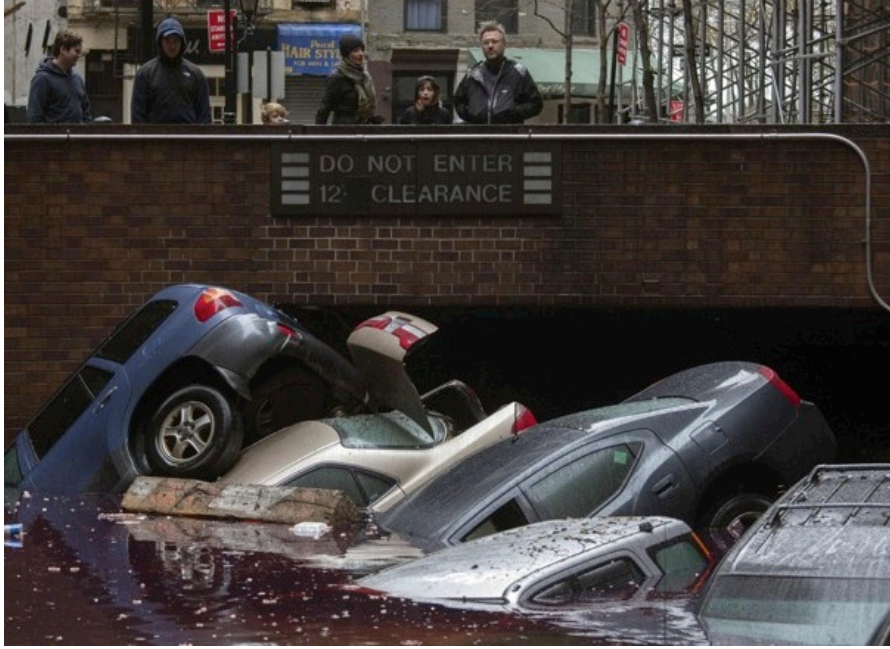

Van Dusen Garden Entrance Building, Vancouver



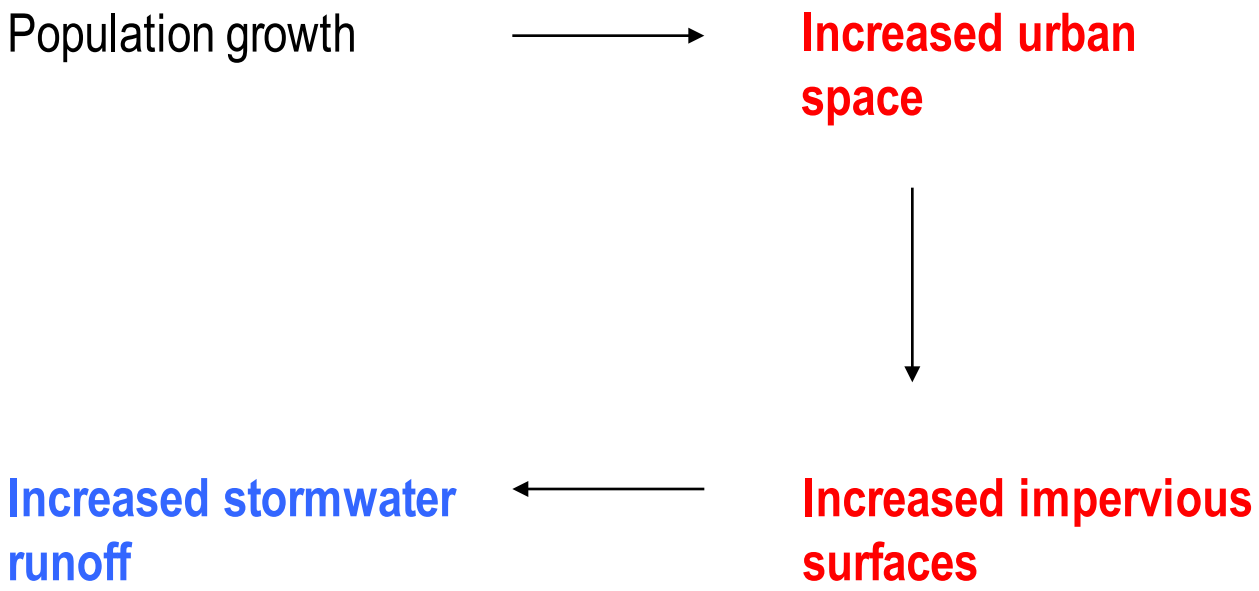
Stormwater



Flood Event World Map 2010



Sandy New York 2012


Population growth
Increased urban space
Increased impervious surfaces
Increased stormwater runoff

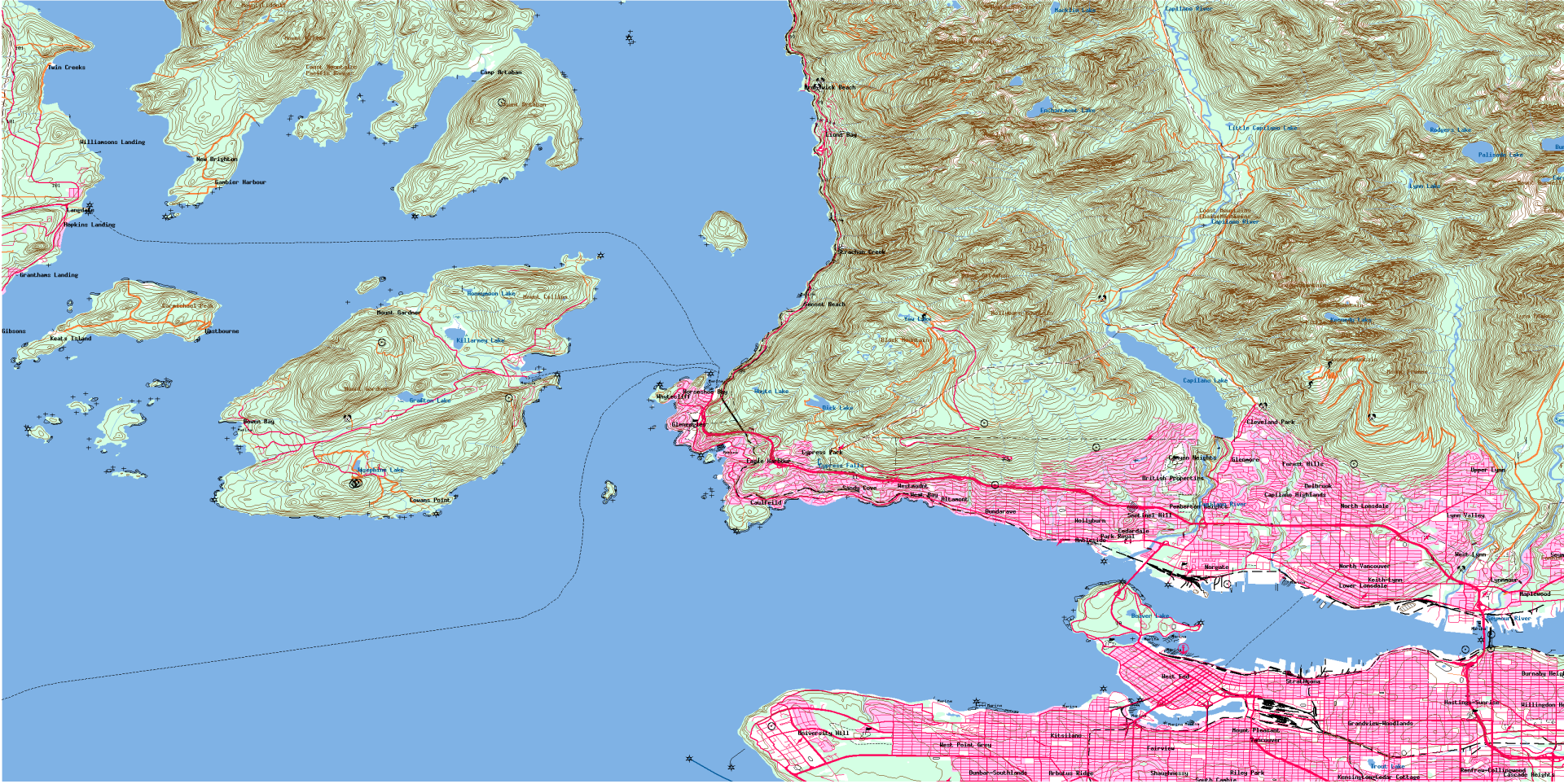
Stormwater Problems are Largely a Car Problem

2/3 impervious coverage comes from habit of driving:

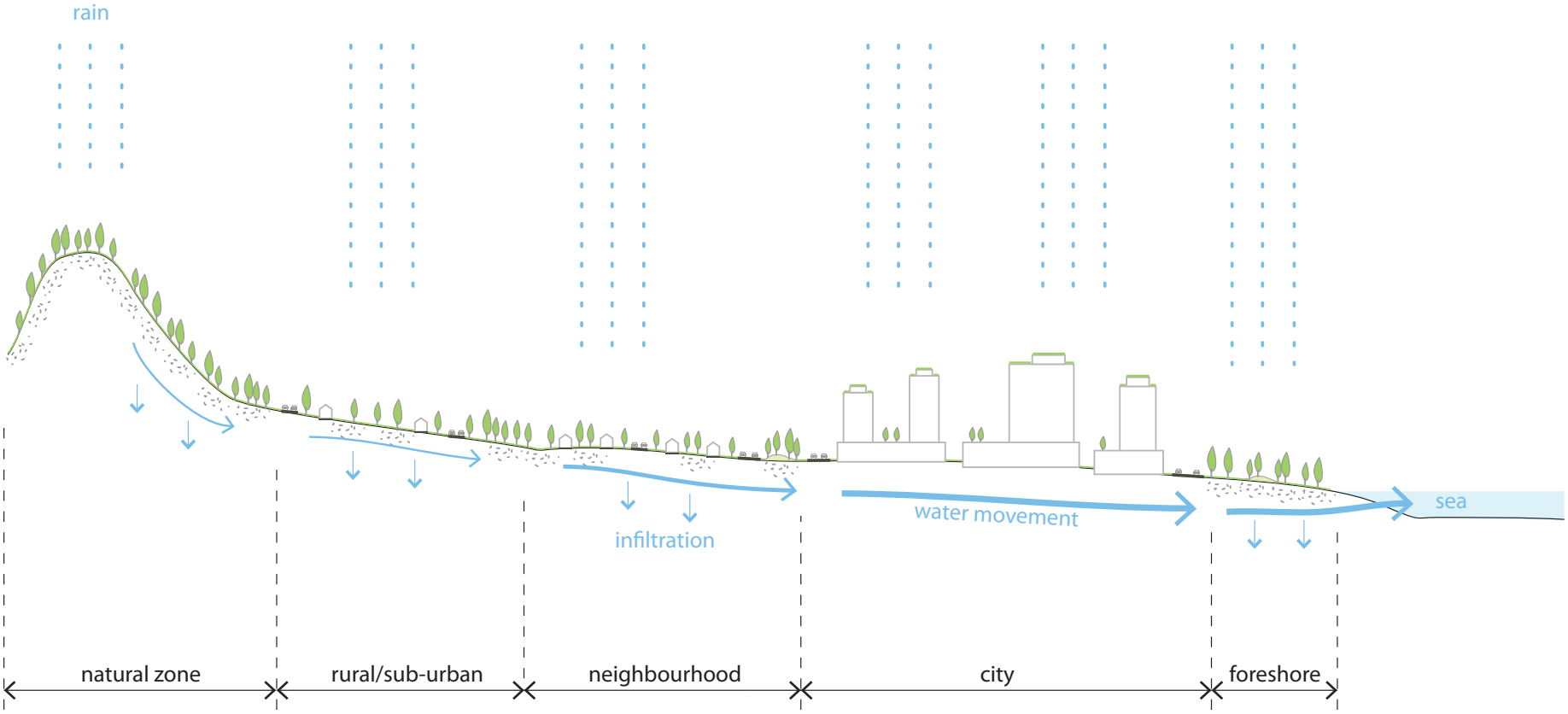
- Parking Lots
- Driveways
- Roads
- Highways

(T. Schueler, Centre for Watershed Protection, US)

Increased Stormwater Runoff

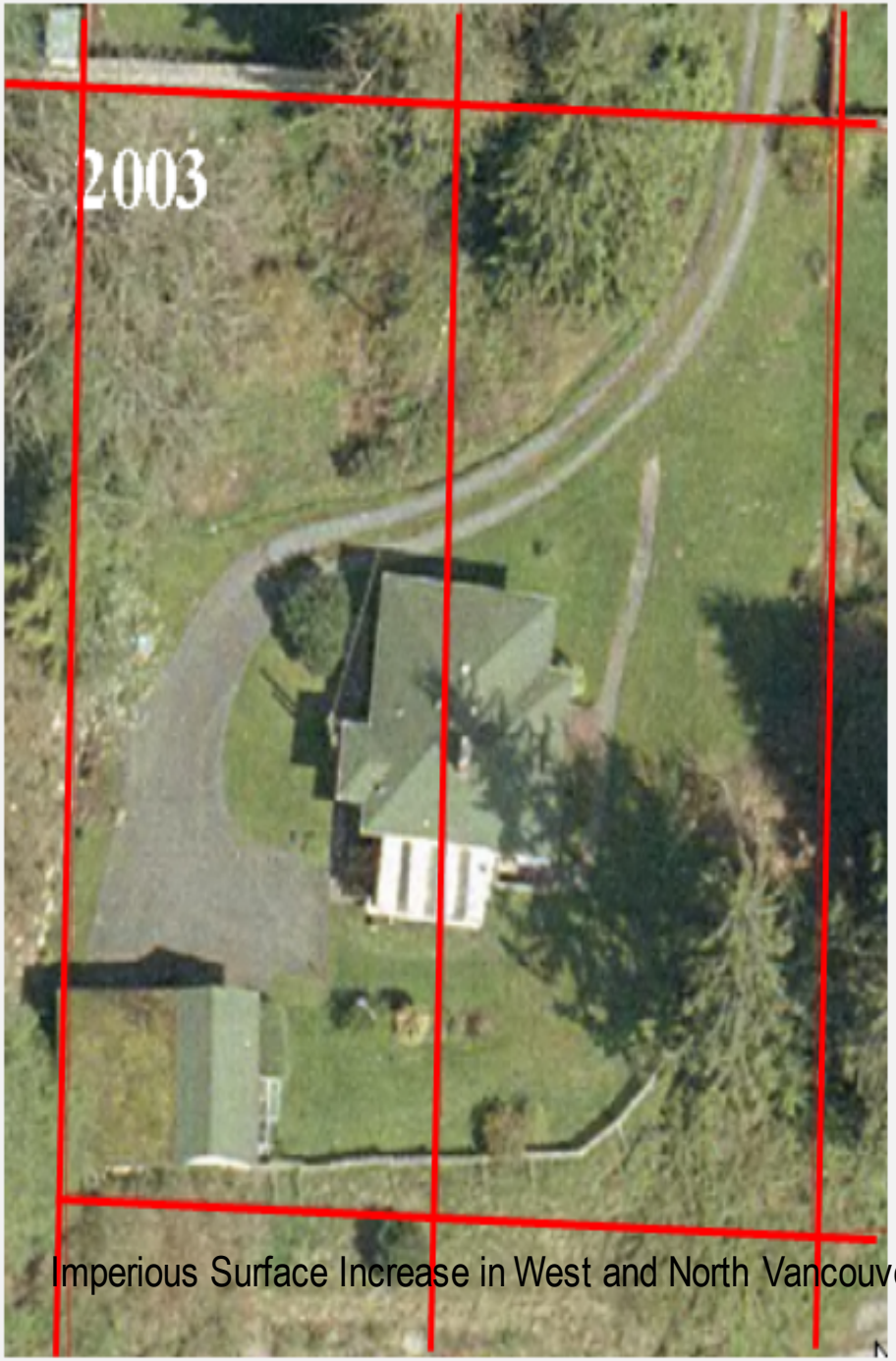


West and North Vancouver

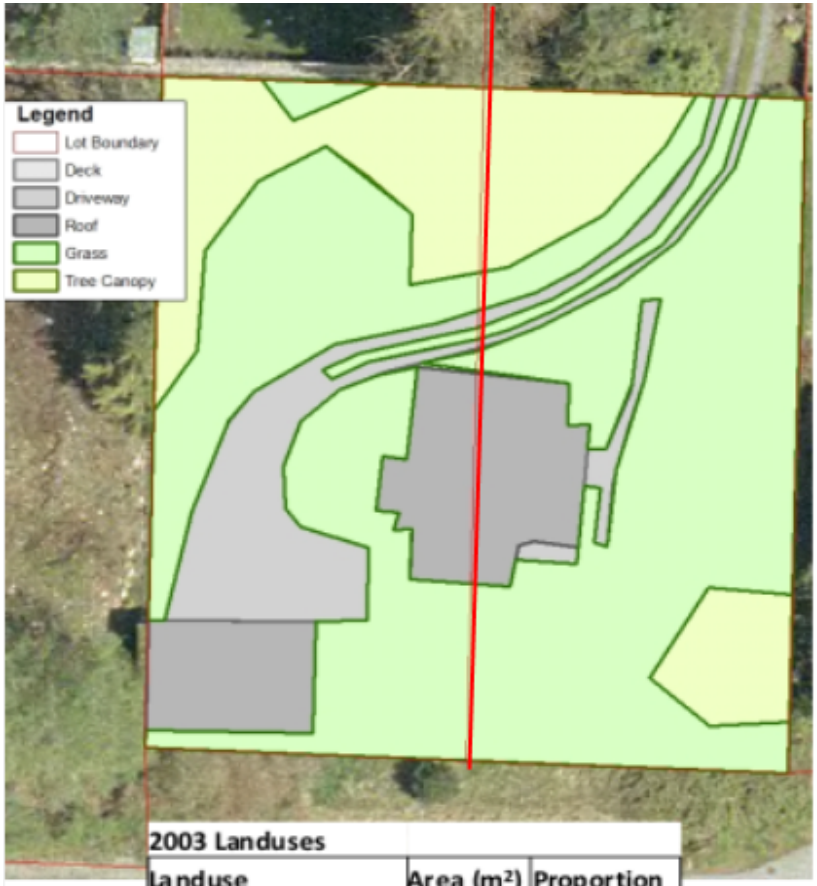


Rainwater Drainage Movement in West and North Vancouver

Neighbourhood until 1990



Imperious Surface Increase in West and North Vancouver, Image Prof. Dr. HansPeter Schreier



2003 Landuses

Landuse	Area (m^2)	Proportion
Driveway	186	11%
Roof	207	12%
Grass	961	57%
Tree Canopy	339	20%
Impervious	393	**23%**
Pervious	1300	**77%**

2003 Imperviousness 23%

2009 Landuses

Landuse	Area (m^2)	Proportion
Driveway	373	22%
Roof	463	27%
Deck	74	4%
Grass	723	43%
Tree Canopy	65	4%
Impervious	910	**54%**
Pervious	788	**46%**

2009 Imperviousness 54%

Imperious Surface Increase in West and North Vancouver, Image Prof. Dr. HansPeter Schreier

2014

North Vancouver MacKay Creek,
http://geo2.scholarsportal.info/ ESRI Base map 2014

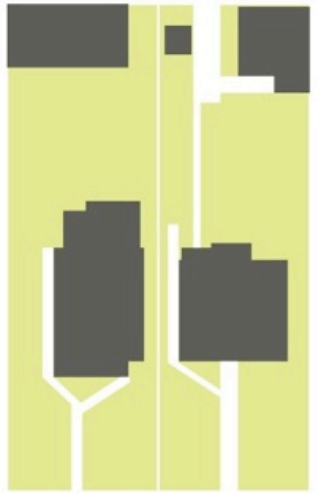
2015

North Vancouver MacKay Creek,
Google Earth, 2015

Drawing by Anezka Gocova 2015

2014

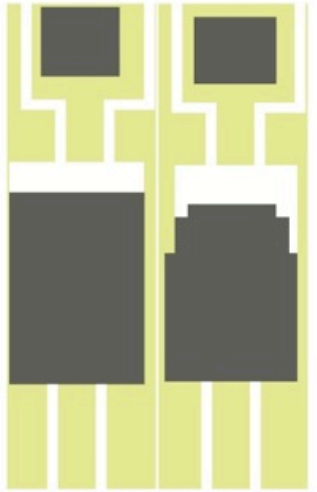
North Vancouver Block,
http://geo2.scholarsportal.info/ ESRI Base map 2014



Redeveloped from single family housing into duplex

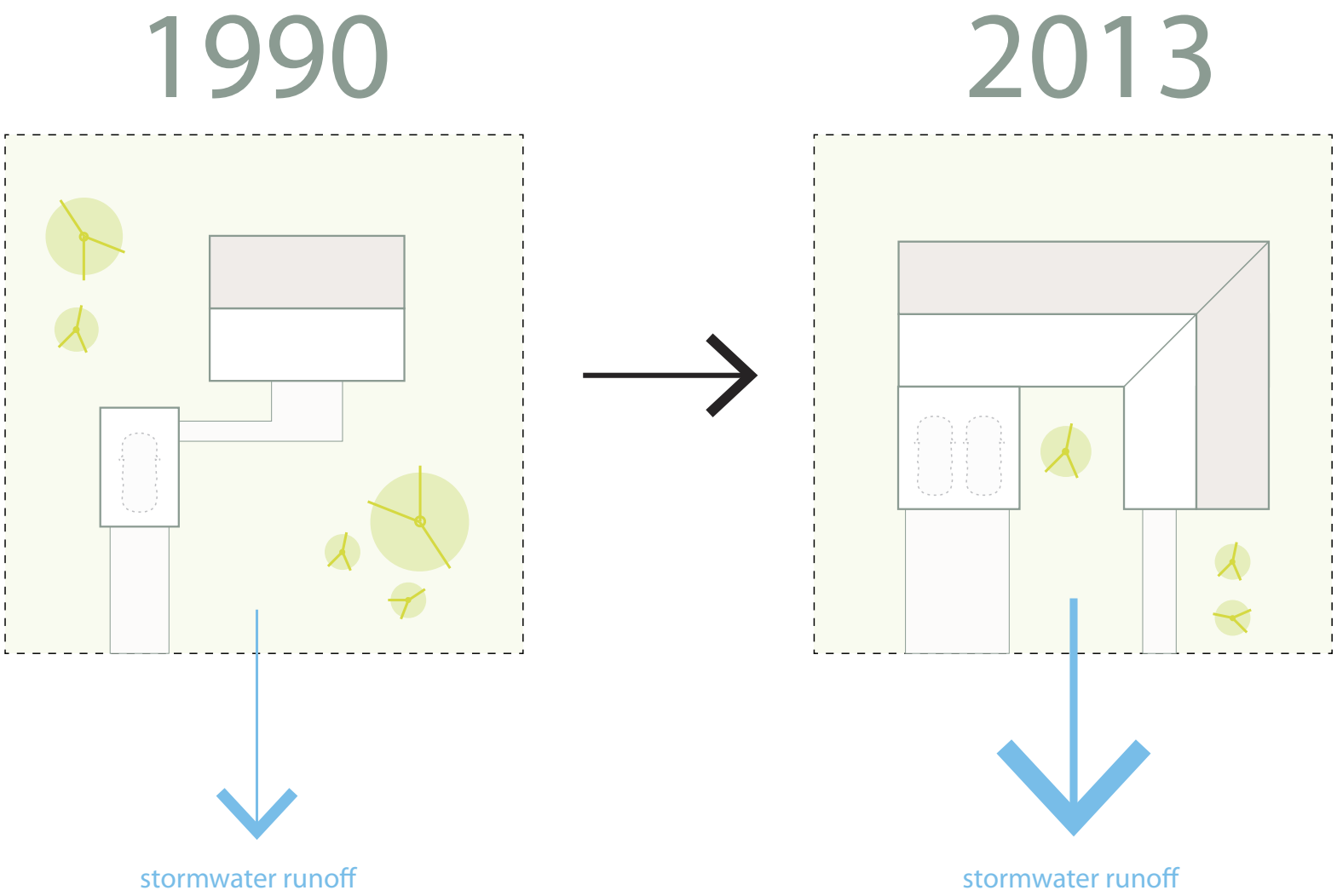
2015

North Vancouver Block,
Google Earth, 2015



Drawing by Anezka Gocova 2015

Neighbourhood in 2013


1990
2013
stormwater runoff
stormwater runoff

City North Vancouver

Neighbourhood and City – Where and how can LID be applied to manange stormwater?

Building Boom creates Massive Stormwater Runoff at Neigbourhood and City Scale

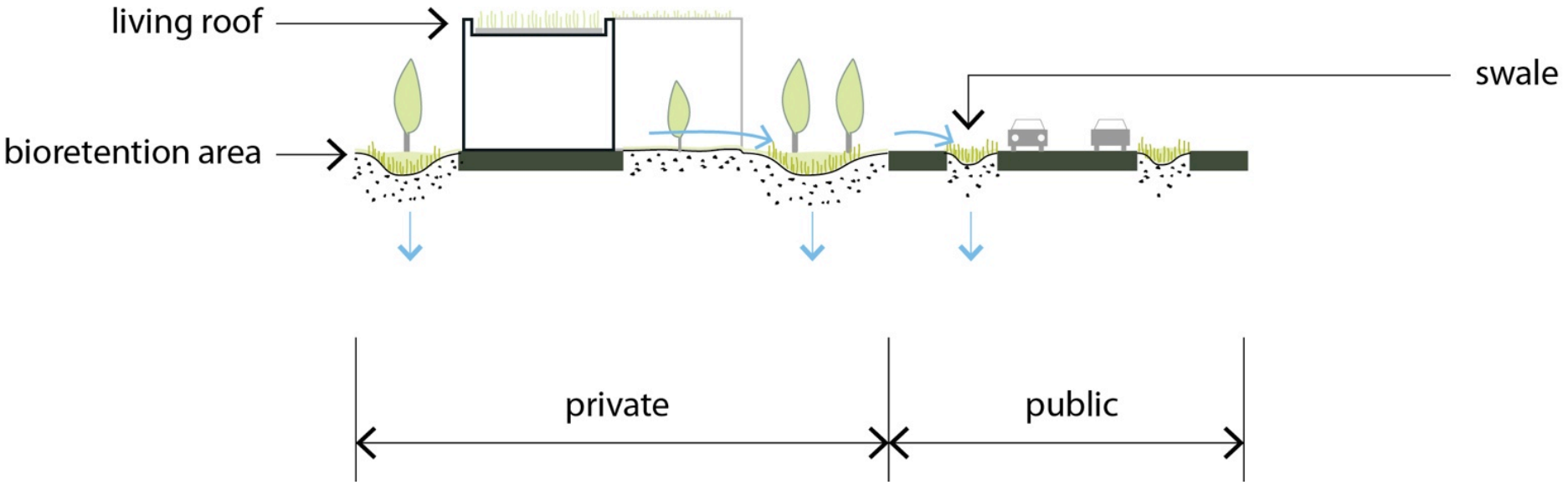
- What are the Options…..?

- Public Initiatives i.e. Increase of Sewage System means increase in taxes

- Private and Public Initiatives – Share the Cost 50/50% - i.e. Low Impact Development (LID) on private and public land i.e. living roofs, bio retention areas (private) and stormwater retention facilities (public)

Public Initiatives - Enlarge Sewage System - INCREASES TAXES

NO!



Stormwater Management (LID) on Private + Public Land in Neighbourhoods

Cost Sharing **50 / 50%**

LID

The goal of LID is to emulate the stormwater function that a site had in its natural state, before it was touched by humans. LID techniques include:

- Living Roofs and Walls
- Bio-Retention Areas
- Permeable Paving
- Swales
- Water Retention Basins
- Rainwater Harvesting and Storage

Stormwater Management Solutions



living roofs, bio retention areas, swales, cistern, permeable paving (50% Private Land)



Swales, stormwater retention facilities (50% Public Land)

Retain small Rain **< 20mm**
Collect and Infiltrate

Living Roofs
Green Walls
Bio-retenion
Trees
Swales
Permeable surfaces

Retention and Delay of medium
Rain **20 – 40mm**

Bio-Retention Areas
Swales
Detention Areas Retention
Ponds

Safe Diversion of Large
Rain **> 40mm**
Avoid Flooding

Open Creeks
Rivers
Planned flooding of:
Swales and Roads during
extreme precipitation

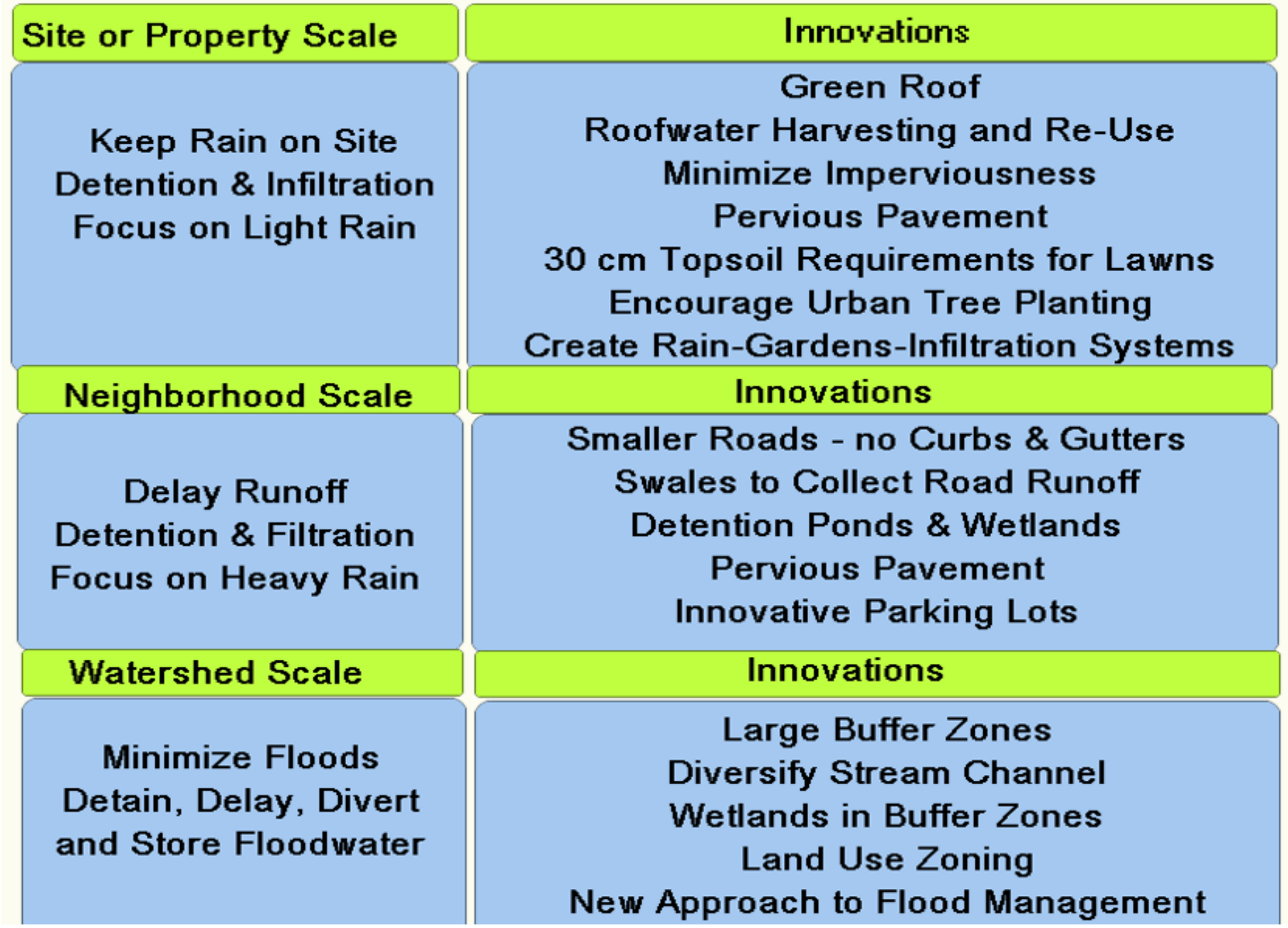
Drawing by Odegard 2015

Three-Step Stormwater Strategy from Norway, Lindholm et al. 2008

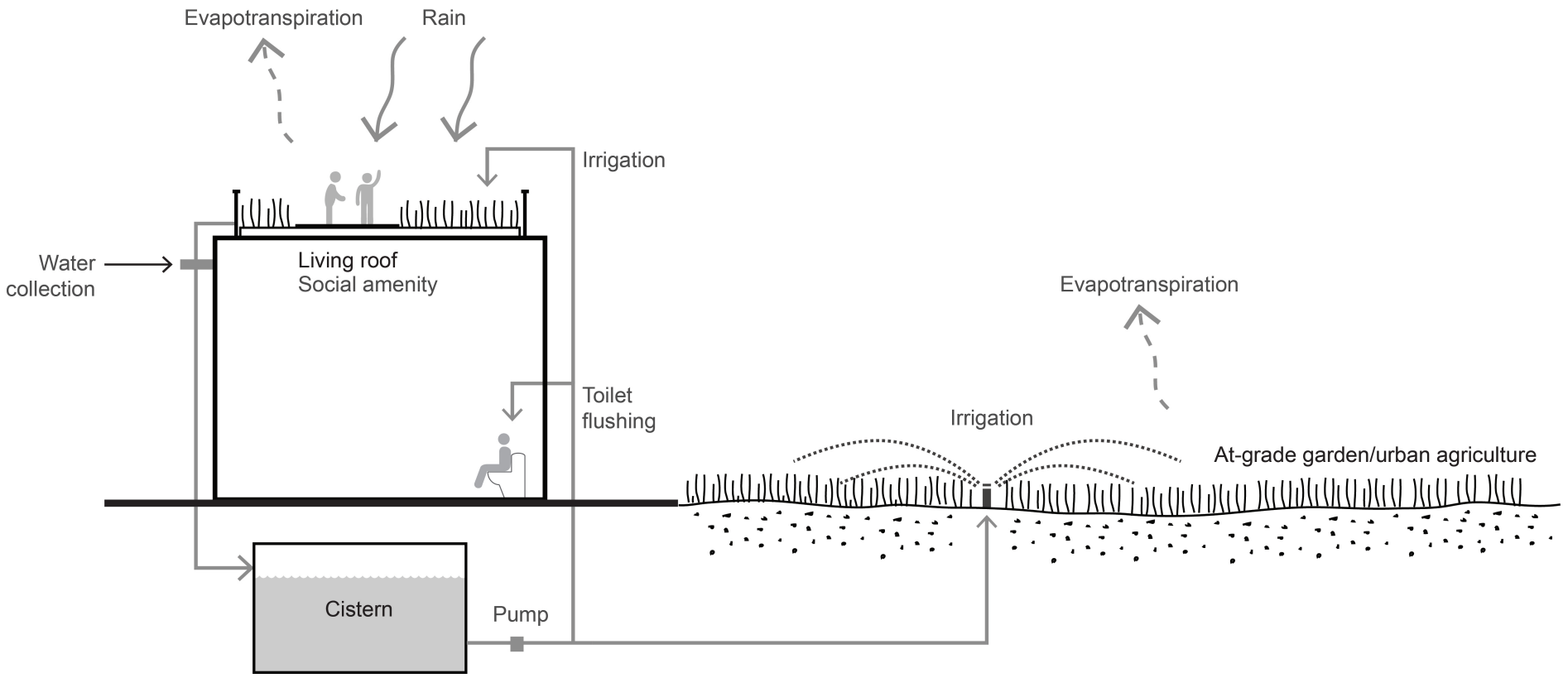
Urban Stormwater Management

SCALE	TRADITIONAL APPROACH	INNOVATIVE APPROACH
Site (Property)	Drain & Remove (Piping)	Retain Rain on Site
Neighbourhood (Subdivision)	Drain & Remove (Piping)	Store & Delay Runoff
Watershed	Store Runoff (dams) Channalize Flow Protective Structures	Delay & Reduce Floods, Large Buffer Zones & BMP's

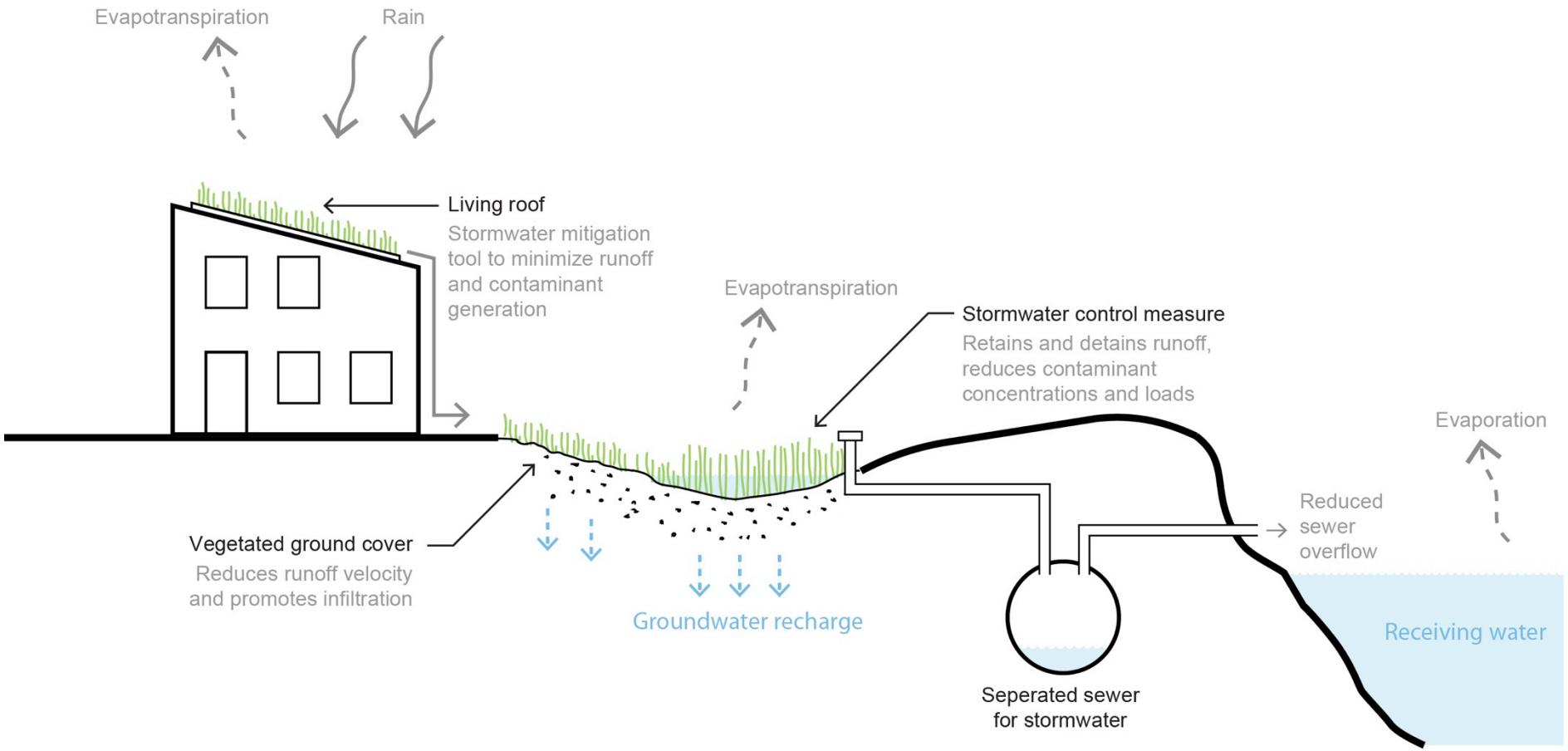
Stormwater Strategy in West and North Vancouver, Image Prof. Dr. HansPeter Schreier



Stormwater Strategy in West and North Vancouver, Image Prof. Dr. HansPeter Schreier



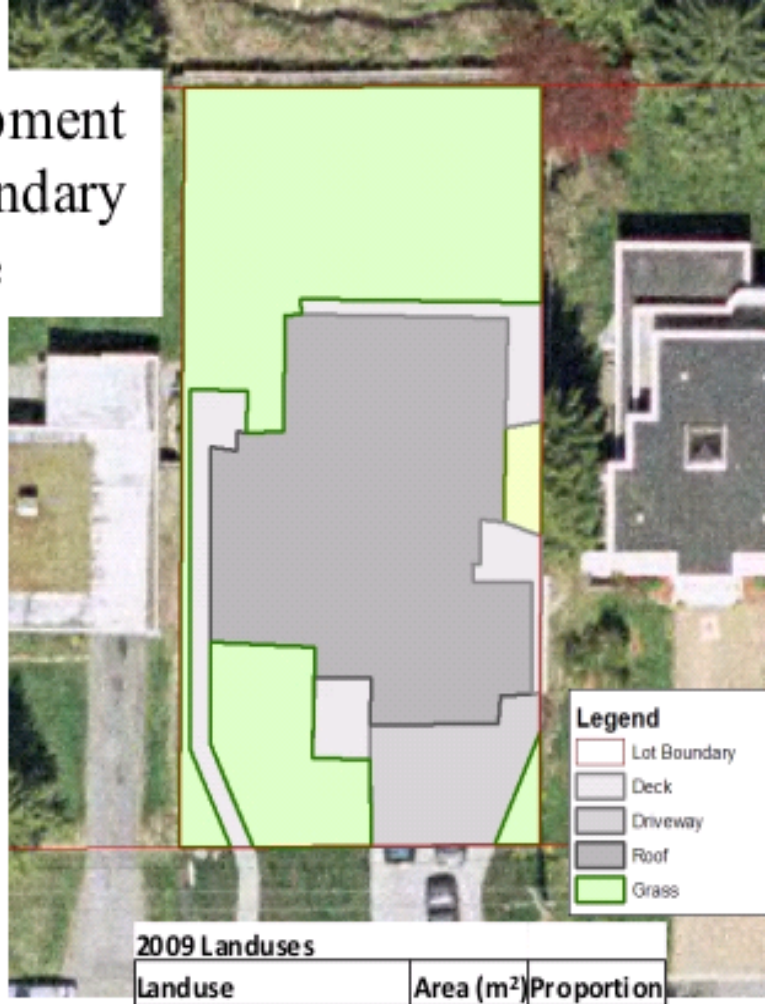
Living Roof as Water Recycling Tool ?



LID Treatment Train

Imperious Surface Increase in West and North Vancouver, Image Prof. Dr. HansPeter Schreier

Redevelopment with Secondary Suite



2007 Landuses

Landuse	Area (m^2)	Proportion
Driveway	47	6%
Roof	270	35%
Grass	420	54%
Tree Canopy	44	6%
Impervious	317	41%
Pervious	464	59%

2007 Imperviousness 41%

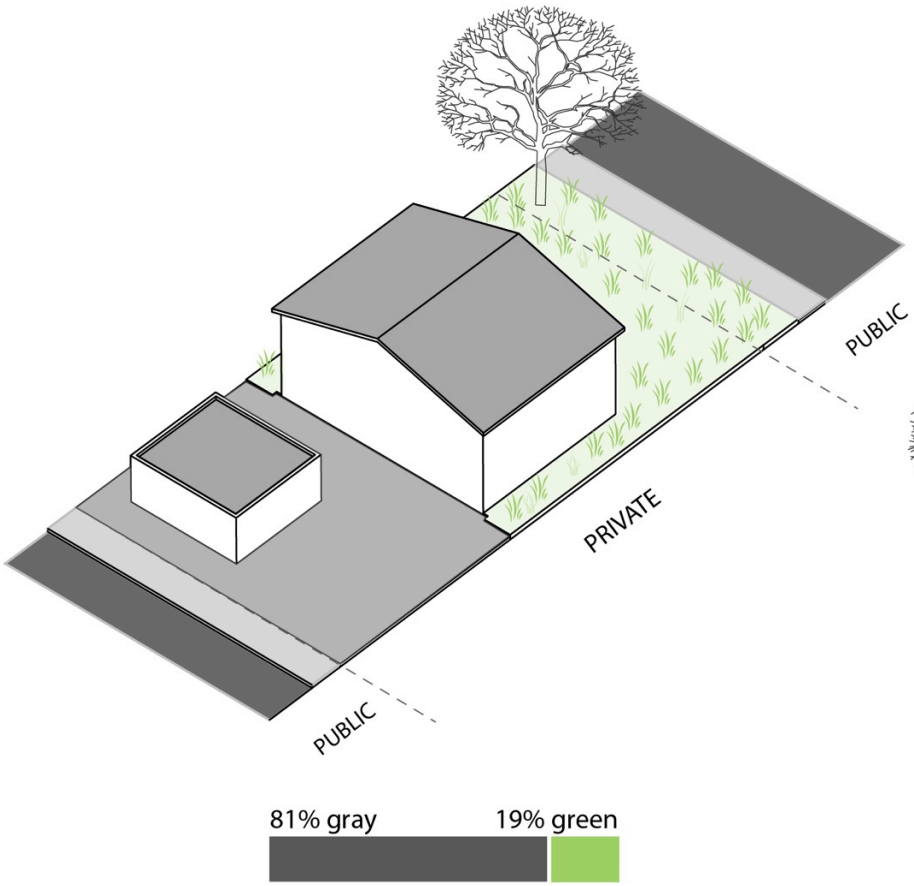
2009 Landuses

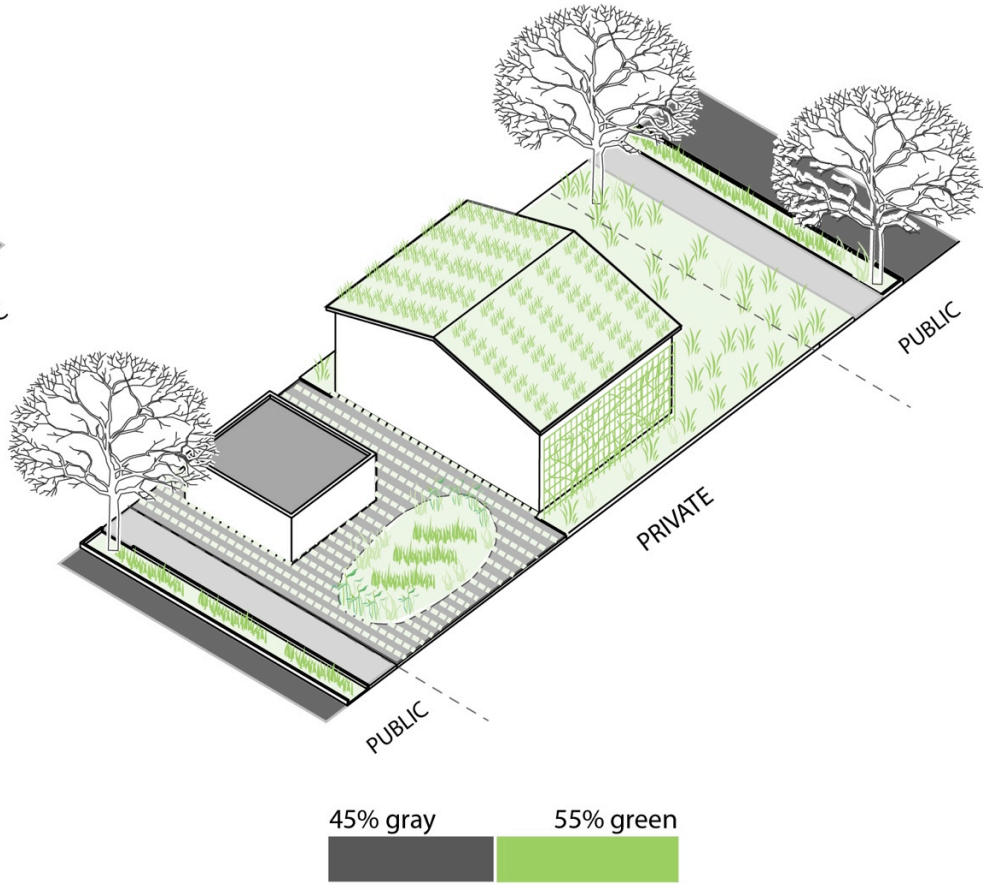
Landuse	Area (m^2)	Proportion
Driveway	55	7%
Roof	291	37%
Deck	80	10%
Grass	344	44%
Tree Canopy	11	1%
Impervious	426	55%
Pervious	355	45%

2009 Imperviousness 55%

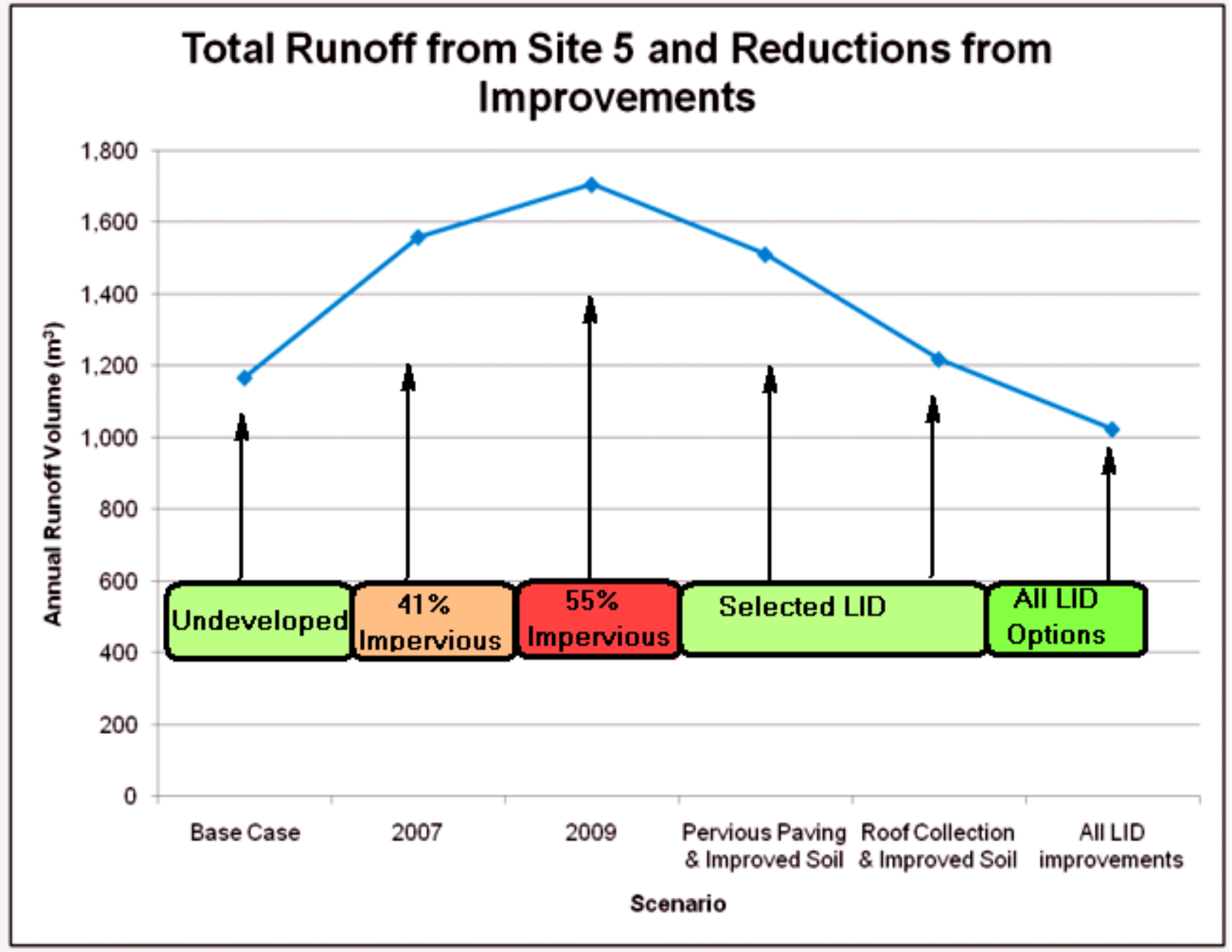
Imperious Surface Increase in West and North Vancouver, Image Prof. Dr. HansPeter Schreier

Typical North American Neigbourhood Situation, Example Calgary



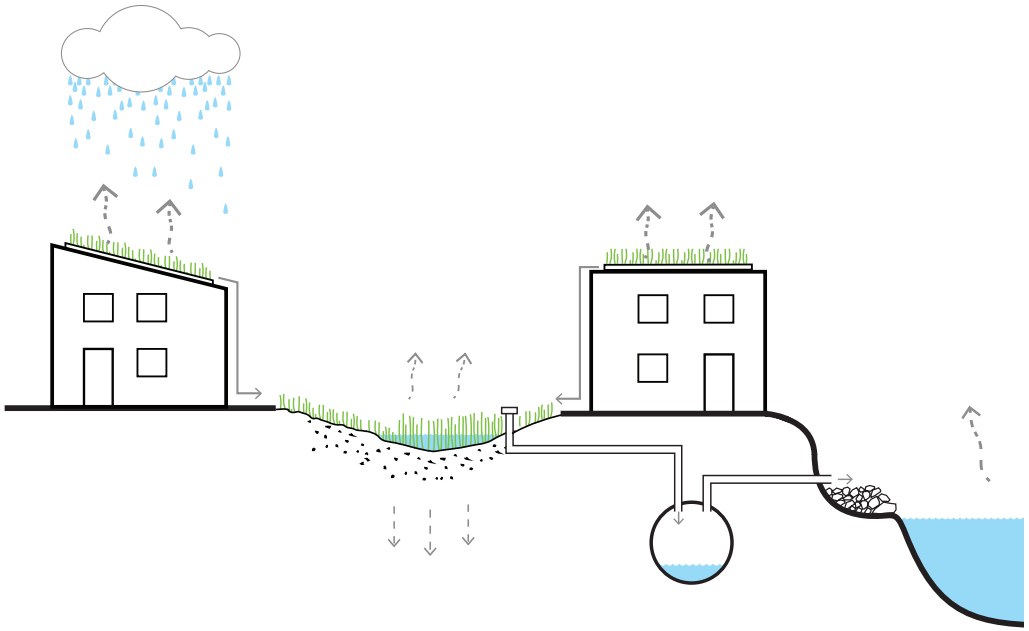


LID Private and Public Initiative



LID Impact on Run Off in West and North Vancouver, Image Prof. Dr. HansPeter Schreier

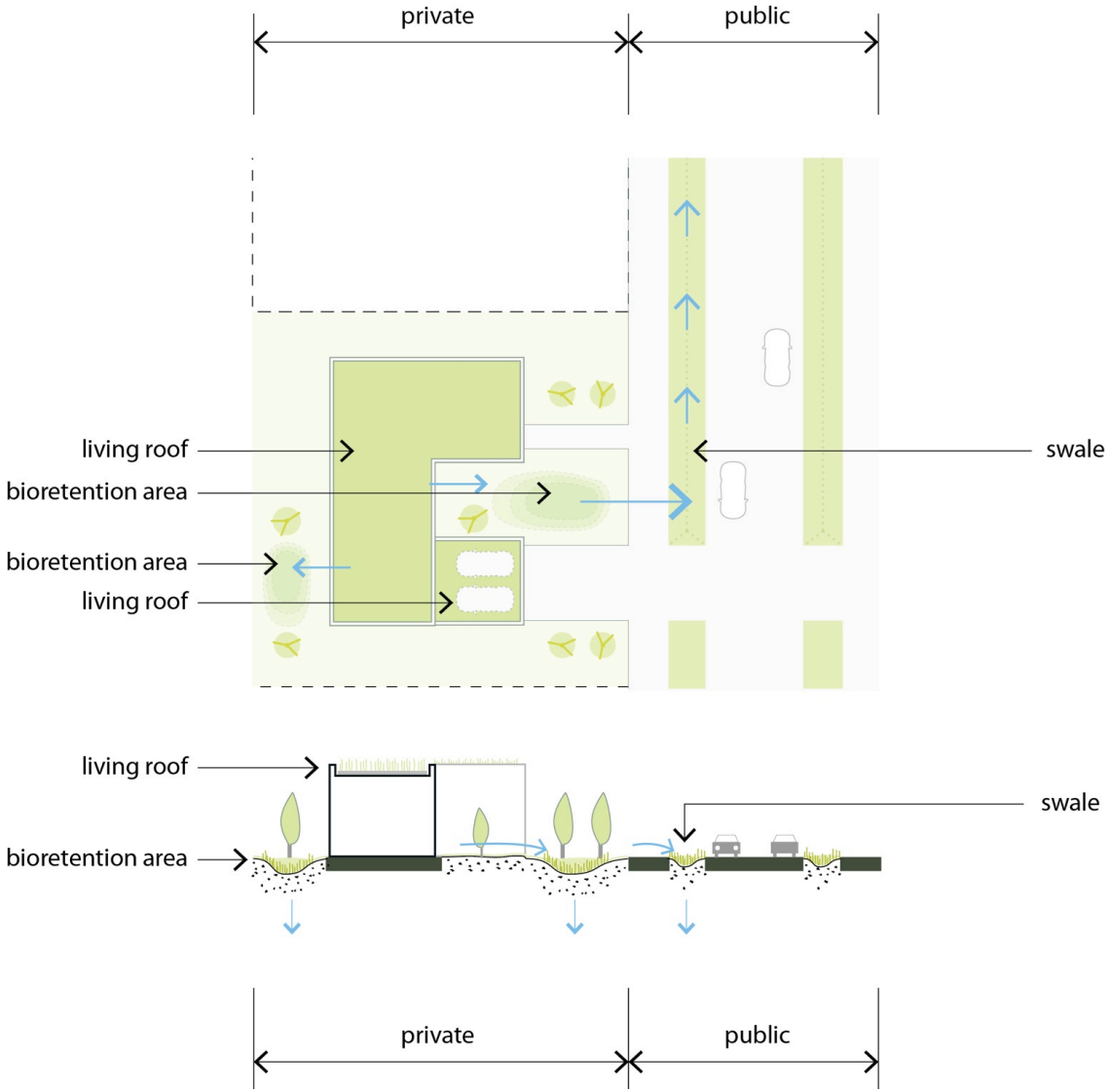
Daniel Roehr and
Elizabeth Fassman-Beck



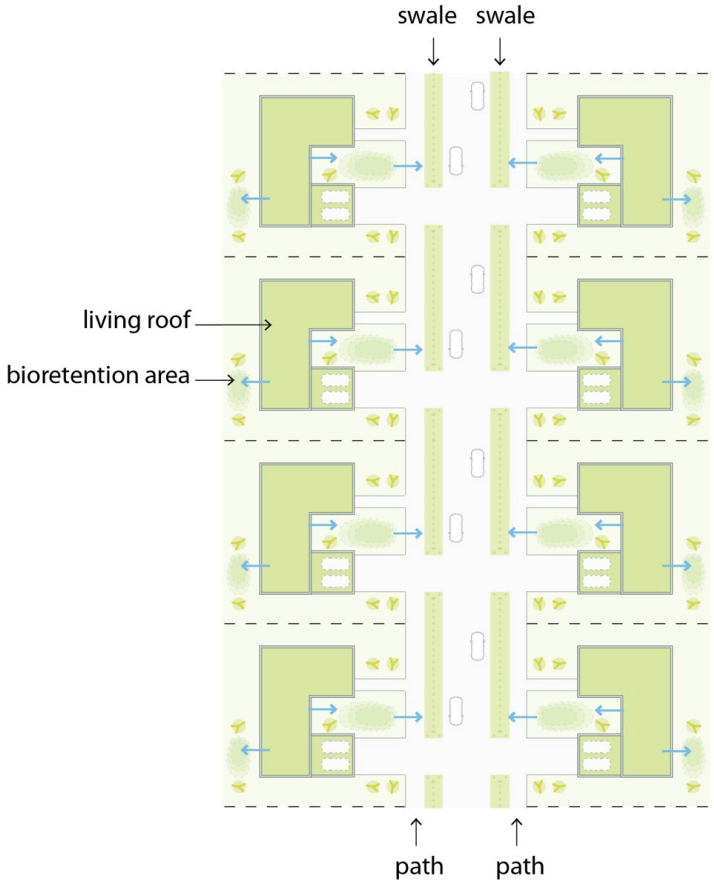
Living Roofs

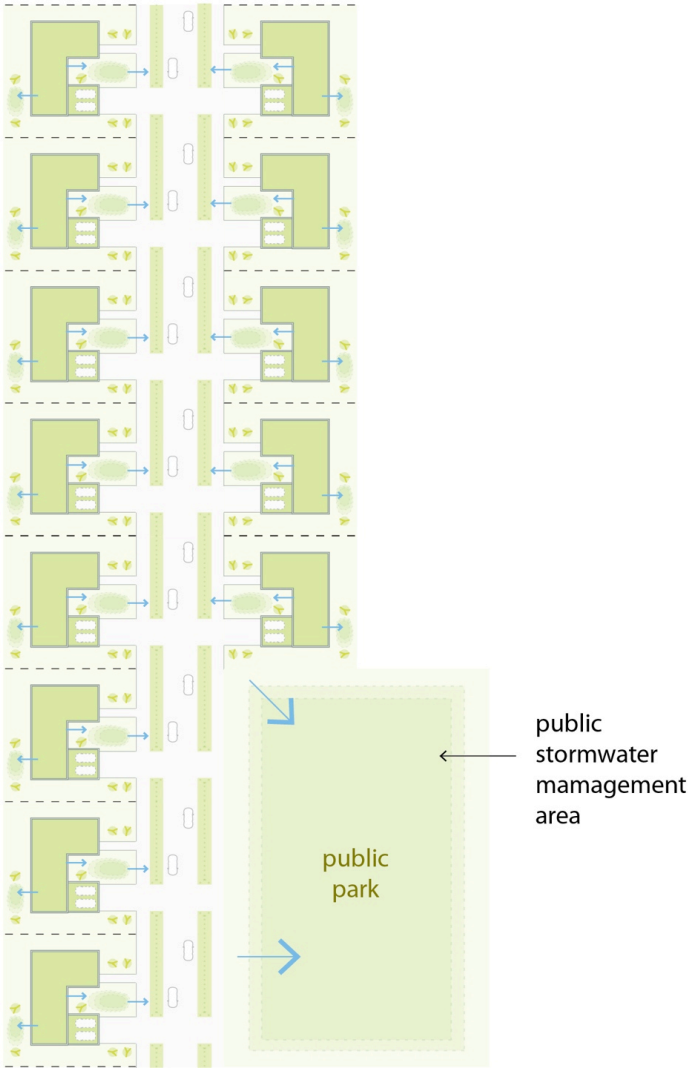
In Integrated Urban Water Systems

ROUTLEDGE



LID Private and Public Initiative





LID Systems on Public Land in Neighbourhoods

Living Roofs and Bio-Retention Areas

Swales

LID Systems on Public Land in Neighbourhoods


Swales, Vancouver


Swales, Vancouver

Swales, Van Dusen Garden, Vancouver

Swales, Van Dusen Garden, Vancouver

Rain Gardens – Bio Retention Area

Rain Gardens – Bio Retention Area

Portland, OR, South Waterfront

Portland, OR, Elisabeth Caruthers Park

LID Systems on Public Land in Neighbourhoods

Rain Gardens – Bio Retention Area

Portland, OR, Elisabeth Caruthers Park

LID Systems on Public Land in Neighbourhoods

Rain Gardens – Bio Retention Area

Portland, OR, Elisabeth Caruthers Park

Rain Gardens – Bio Retention Area

Portland, OR, South Waterfront

Portland, OR

LID Systems on Public Land in Neighbourhoods

Rain Gardens – Bio Retention Area

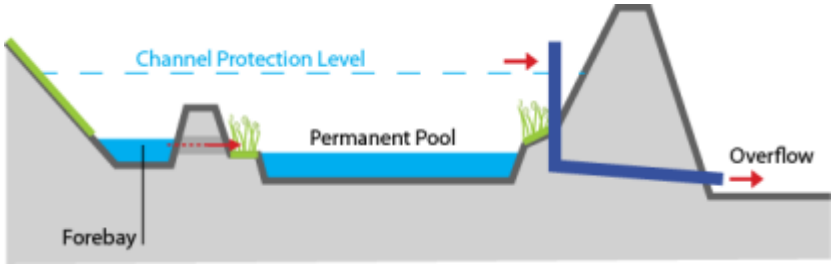
Portland, OR, Headwaters at Tryon Creek

LID Systems on Public Land in Neighbourhoods

Water Retention Basin in Neigbourhoods

A retention basin or pond is used to manage stormwater runoff. It is essentially an artificial lake with or without vegetation, and includes a permanent pool of water.

- water quality improvement
- flood protection
- groundwater recharge



LID Systems on Public Land in Neighbourhoods

Jenefeld, Hamburg, Germany

LID Systems on Public Land in Neighbourhoods

QiaoyuanPark, Tianjin, China

LID Systems on Public Land in Neighbourhoods

QiaoyuanPark, Tianjin, China

QiaoyuanPark, Tianjin, China

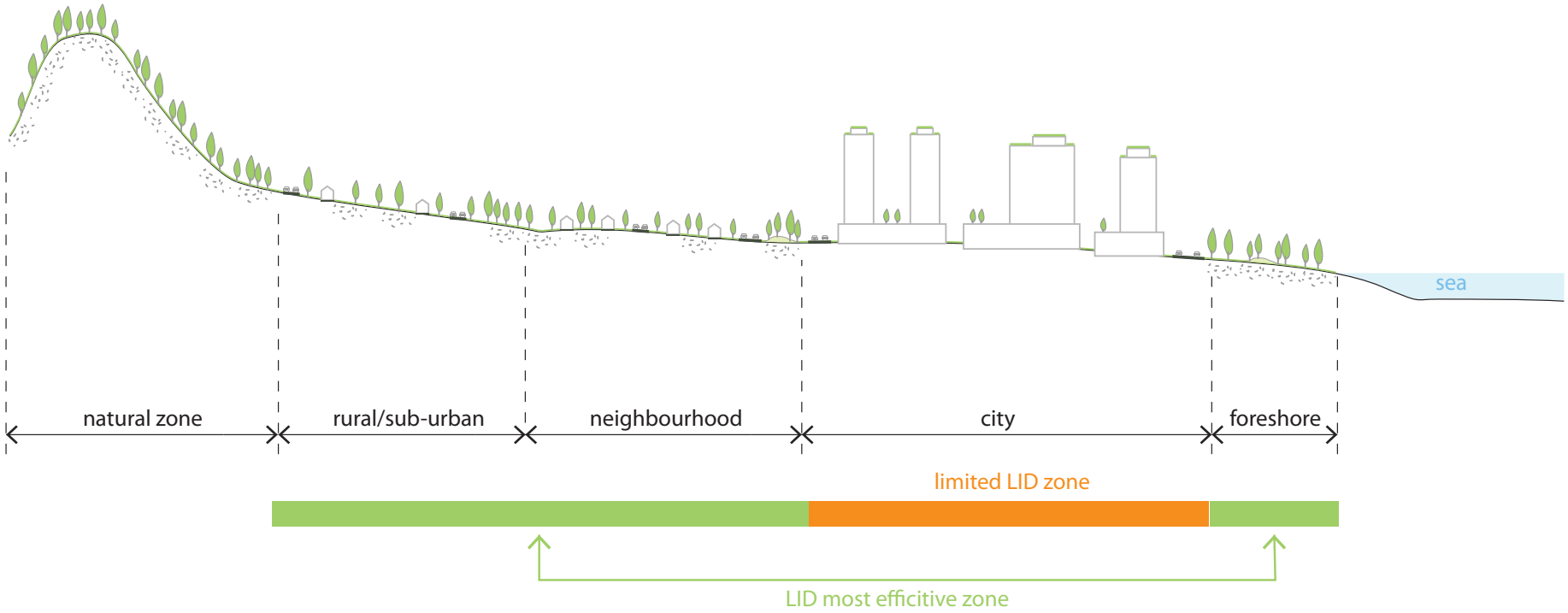
LID Systems on Public Land in Neighbourhoods

Main Stormwater Mitigation

Private Land in Neighbourhood Areas

Backup for Worst Case Scenarios

Public Land in Neighbourhood and Foreshore Areas



Dense City Areas Not Effective for Stormwater Mitigation

Living Roofs most Effective

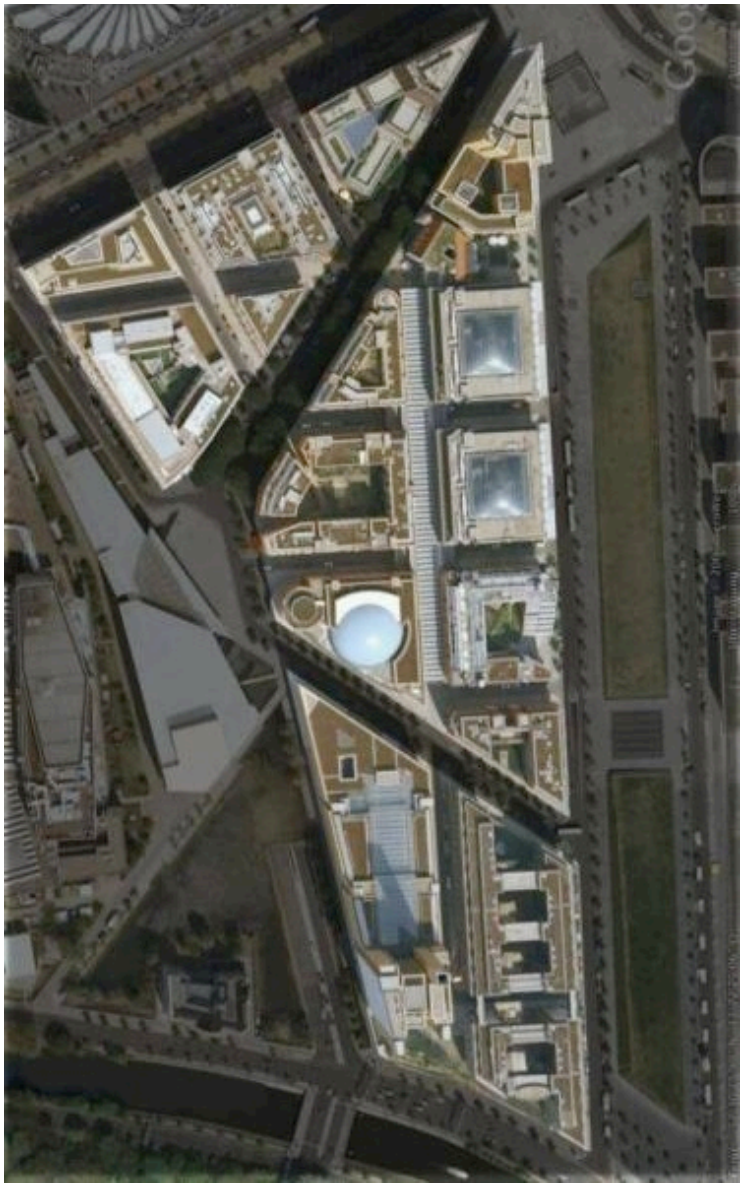
LID Systems in the City

Living Roofs most Effective

Increasing Vegetation in Urban Areas i.e. Down Town Vancouver Simulation

Living Roofs

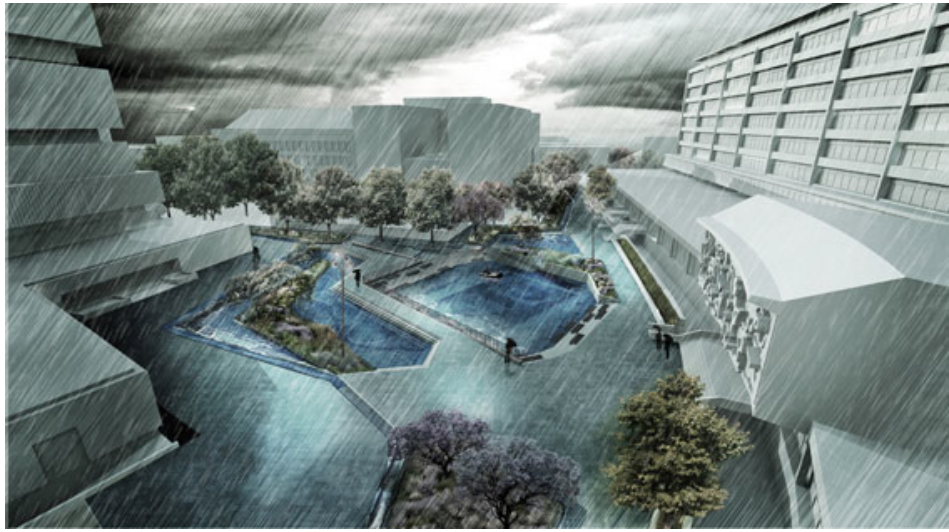
Adlershof, Berlin, City Block Scale



Potsdamer Platz, Berlin, City Block Scale

Public Plaza as Stormwater Retention Basin

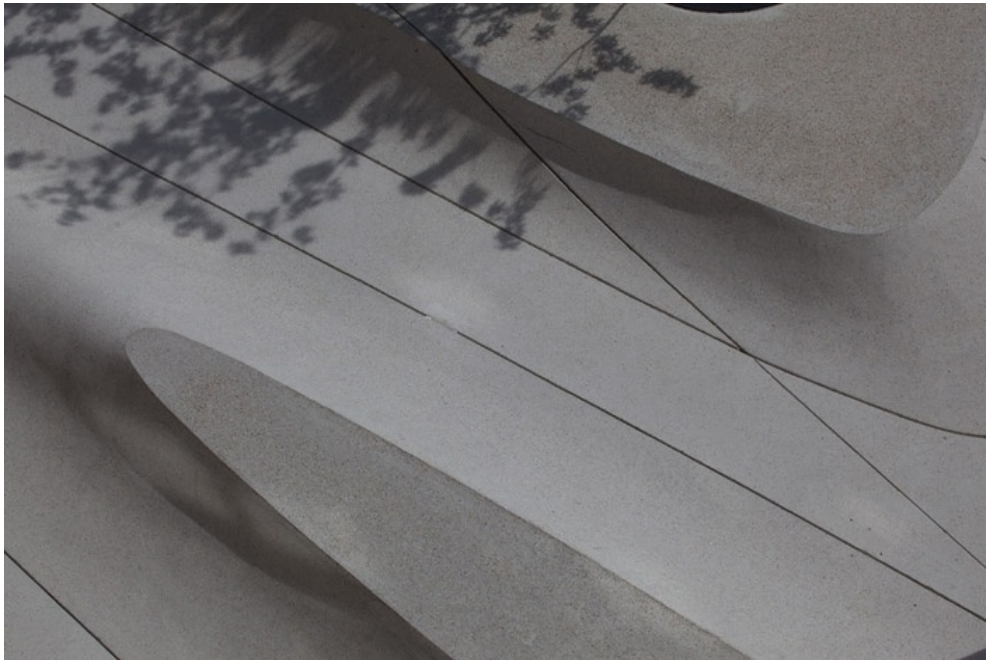
De Urbanisten, Holland, The Wondrous Water Square, 2010



Public Plaza with Stormwater Facility

Landhausplatz, Innsbruck, Austria

Landhausplatz, Innsbruck, Austria



LID Systems in the City

Rain Gardens – Bio Retention Area

Downtown Los Angeles, CA

LID Systems in the City

Rain Gardens – Bio Retention Area

Seattle, WA

LID Systems in Norway and Sweden

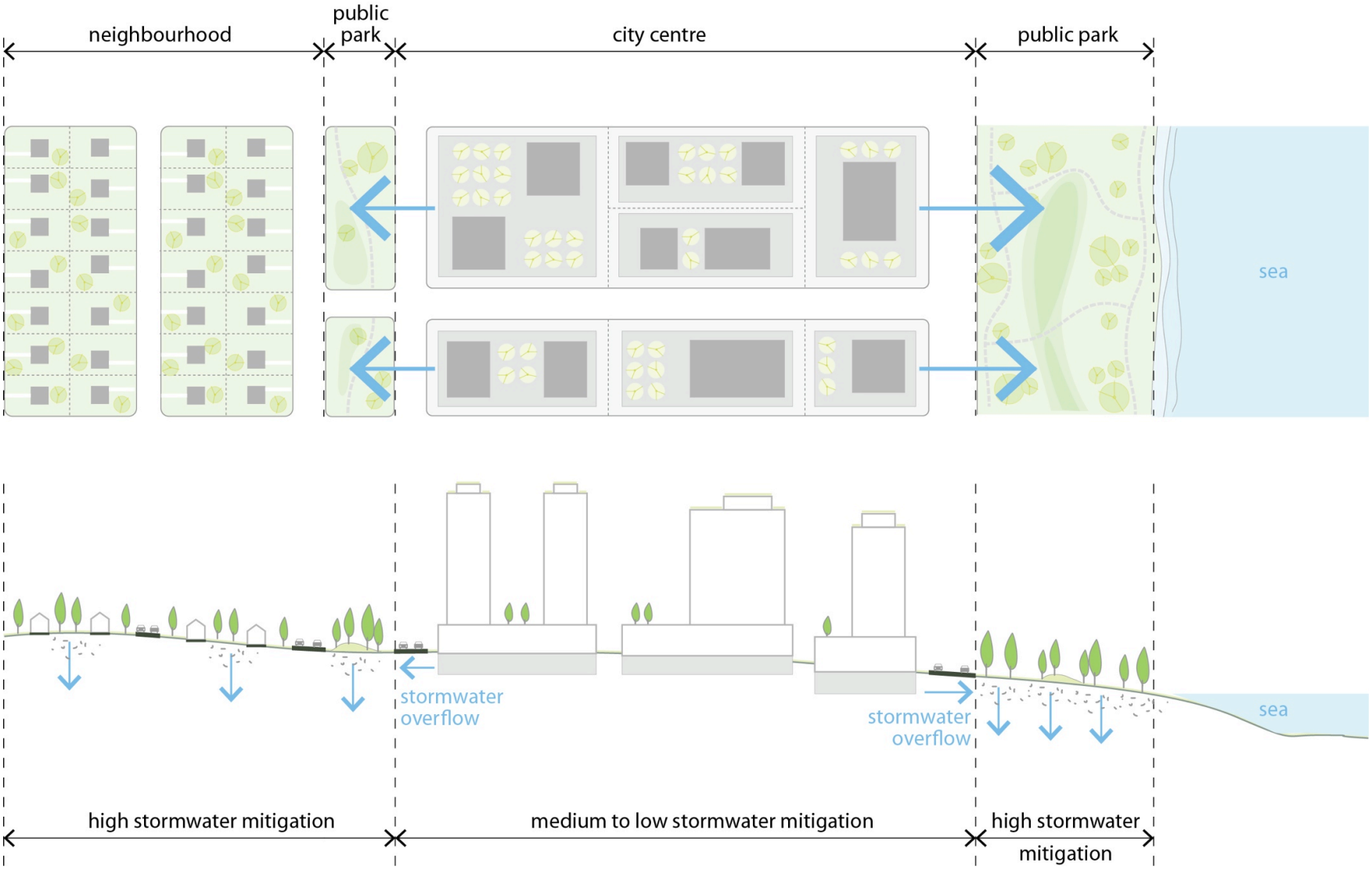
LID Systems in Norway and Sweden

LID Systems in Norway and Sweden

Amenity Space, LID - Final Stormwater Infiltration, Cleansing and Control before Entering Sea

Foreshore

LID is most Effective – Neigbourhood and Foreshore



LID Systems at the Foreshore

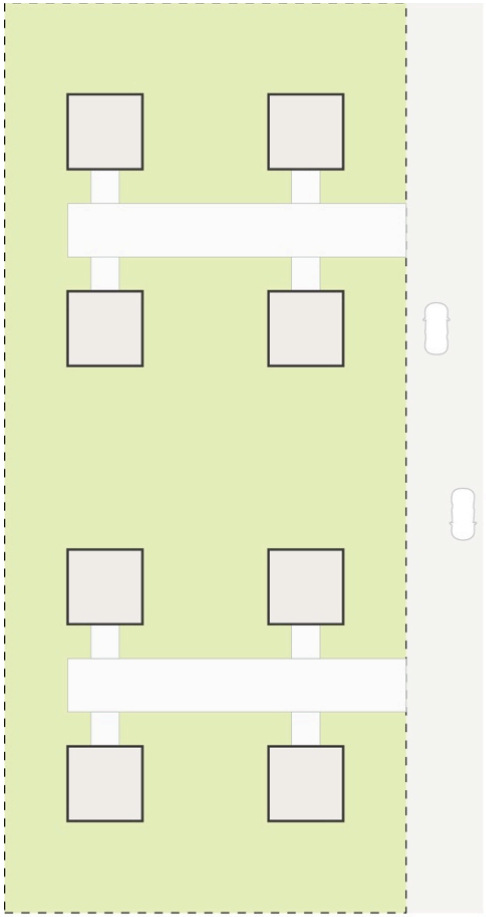
LID Systems at the Foreshore in Cities
New design Seattle's Elliott Bay Seawall including habitat for young salmon and a glass-floored promenade to allow light into the ocean (James Corner Field Operations)

New York, Manhatten

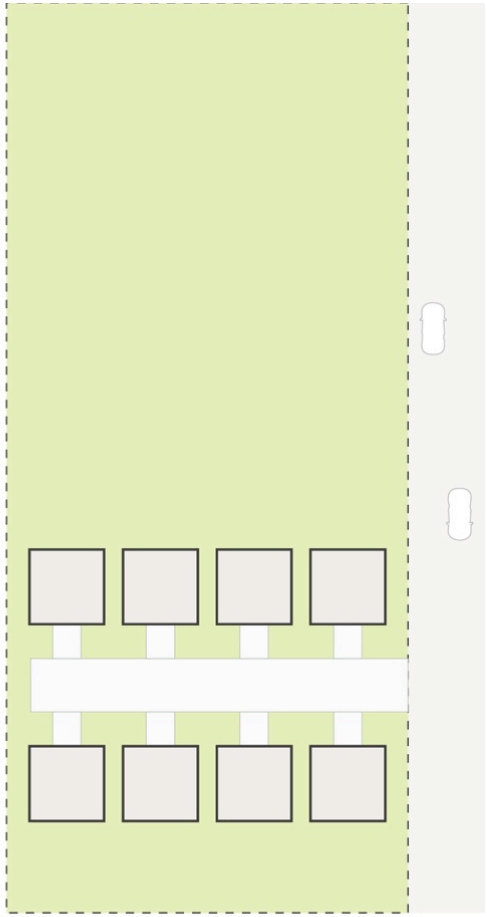
Vancouver, Kitsilano

Compact City – Green City
Both Are Needed!

Compact Development disturbs less Land and Accommodates more Development and Preserves Land



low density



high density

Solutions

It's a Planning Policy Issue

Cooperation between:

- Architects, Landscape Architects, Urban Designers, Planners and Engineers
- Municipalities
- Acceptance and Enforcement by Public

Urban Sprawl Hurts Water Sheds – Has to be Avoided!

Administration/Planning Problem:

- Recognize Density as BPM (Best Management Practice)
- Allow Off-Site Mitigation, preferably in the Neigbourhood, Foreshore

Solutions

Green Stormwater Solutions must be allocated by Context in Order to meet the Functional Requirements of well Functioning Urban Design:

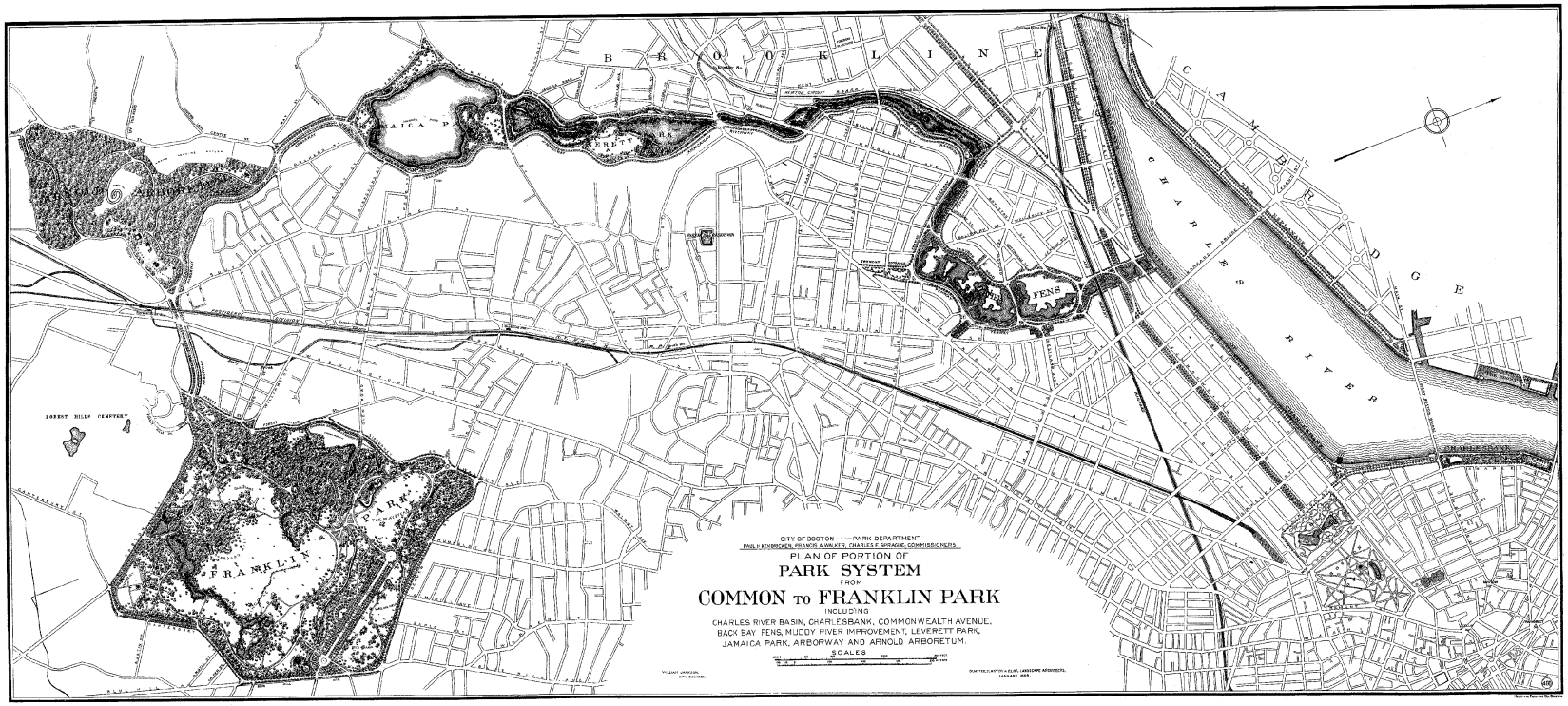
- Pedestrian Orientated Frontages
- Walkability
- Viable Retail
- Active Civic Spaces (such as Squares and Plaza)
- Closed Proximity to Mixed Use/Daily Activities

The following Strategies are Recommended:

- Encourage density and recognize the per-capita benefits of density
- Support stormwater solutions that are shared between different sites and landowners
- Develop public and private partnerships to retrofit existing urban areas with shared stormwater solutions
- Better understand the best strategies for various urban patterns
- Help administrators/planners adopt the larger view of what is best for the watershed

Laurence Aurbach (2010)

Design Quality Needs to be Recognized, Refer to Historic Models i.e. Frederik Law Olmstead's Boston's Emerald Necklace.



Conclusion

Stormwater is not a Green Chore but a Celebration of Natural and Man-Made in Combination:

Both are Ingredients of an Uniquely “Human Habitat of Towns and Cities”

(Aurbach, L. 2010)

Conclusion

University of British Columbia

School of Architecture + Landscape Architecture
THE UNIVERSITY OF BRITISH COLUMBIA

www.greenskinslab.sala.ubc.ca