Planning for Green Infrastructure

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City of Vancouver

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Photo Credit: Todd Diemer on Unsplash

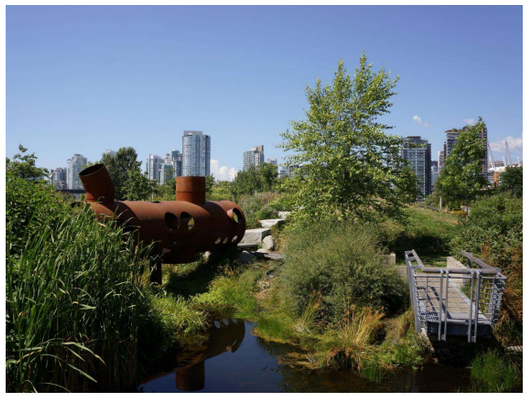
CITY OF VANCOUVER | GREENEST CITY

Green Infrastructure 101

Green Rainwater Infrastructure, Blue-Green Systems, Nature-Based Solutions, Sustainable Urban Drainage Systems…

Project: VanDussen Botanical Garden Visitor Centre, Vancouver
Photo Credit: Connect Landscape Architecture

What is Green Infrastructure



Green Infrastructure

Uses vegetation, soils and other engineered systems to mimic natural processes required to manage water and create resilient and healthier urban Environments


Rain garden


Non porous asphalt
Porous asphalt


Tree soil cells

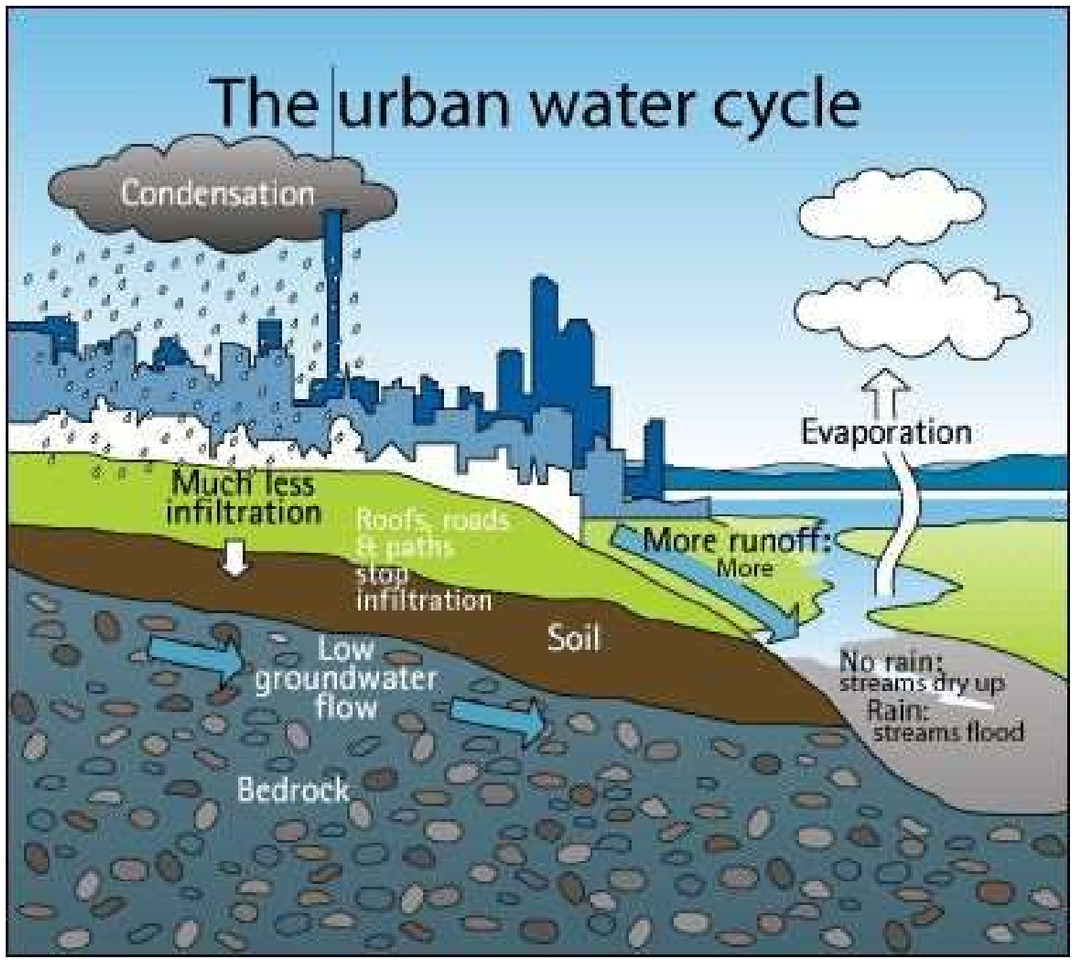

Absorbent landscape

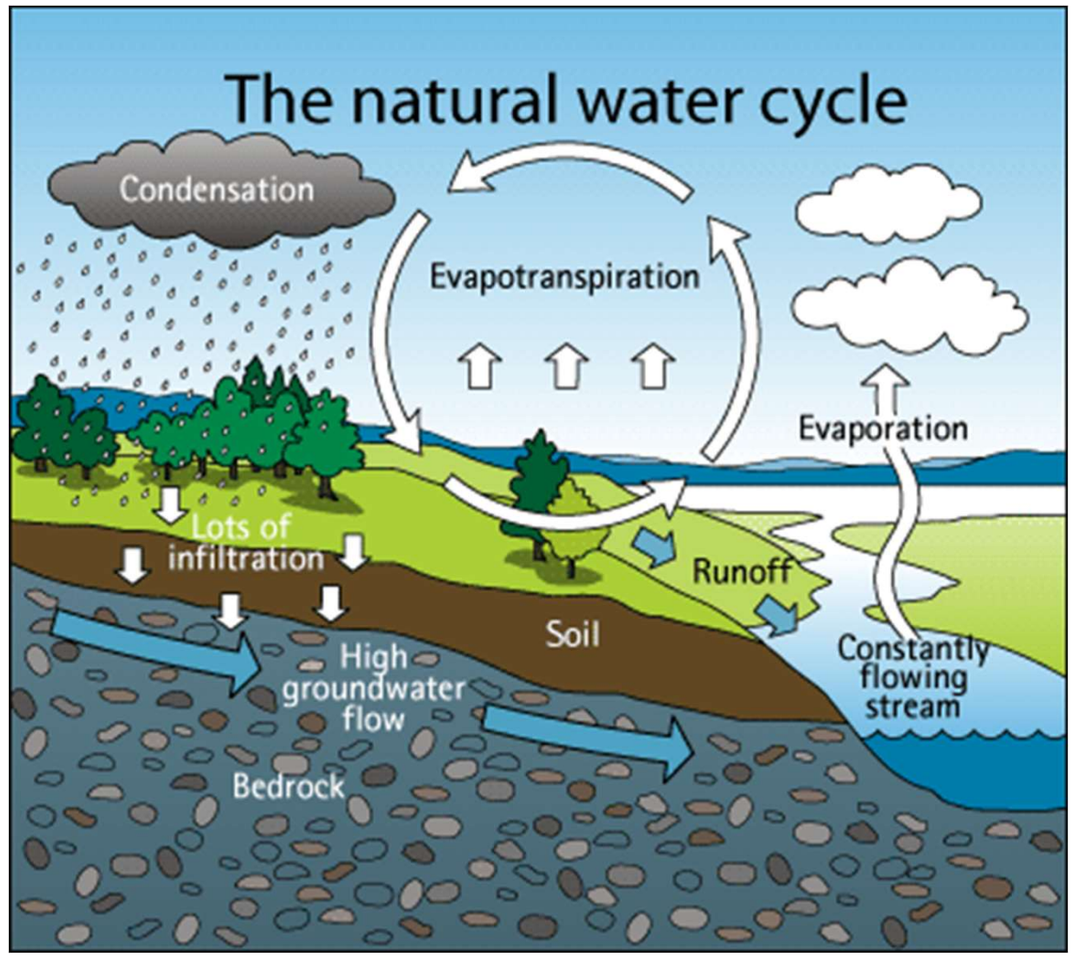

Green roof

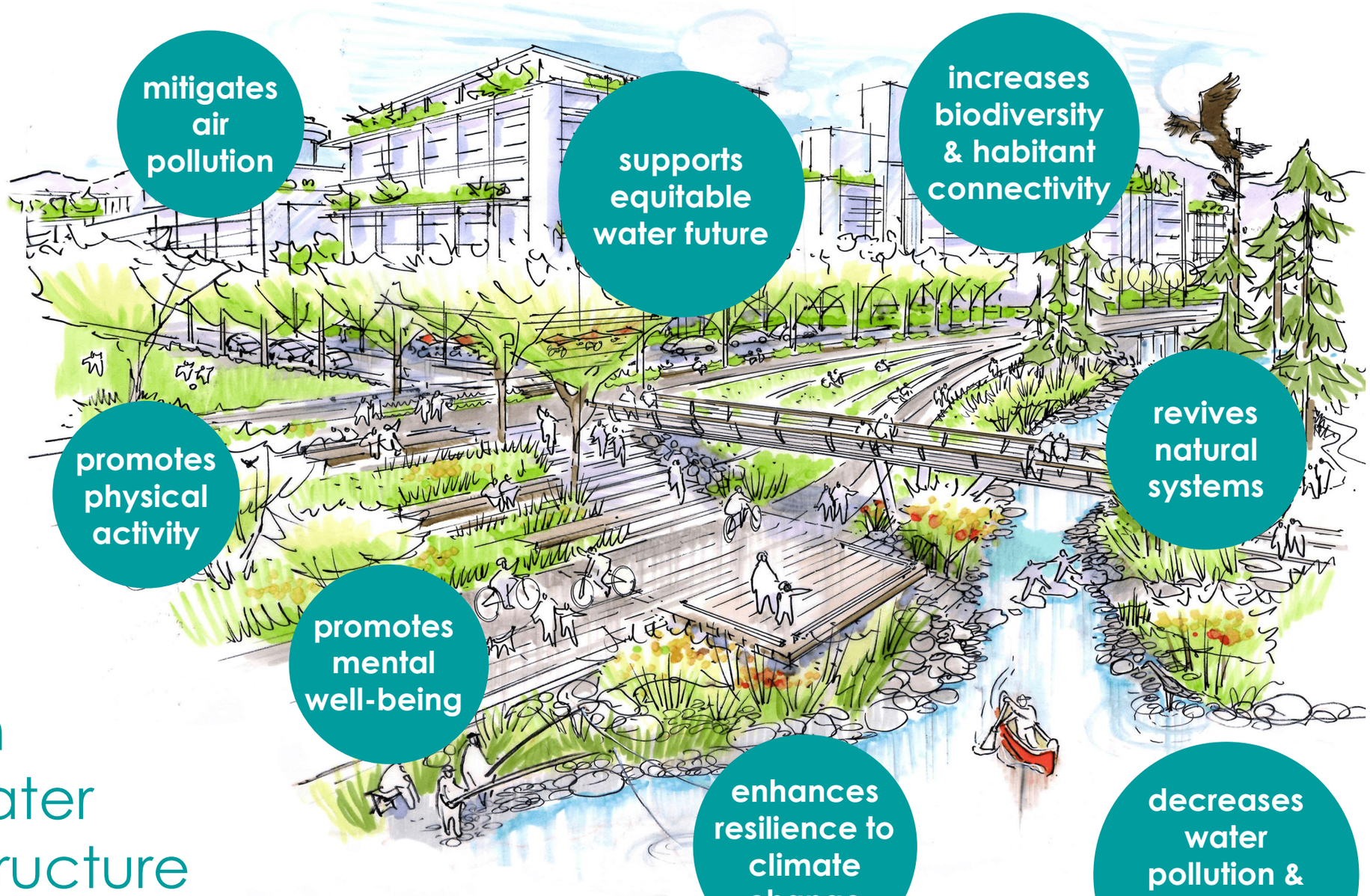

Rainwater harvesting


Detention tank

GI Hydrology







Green rainwater infrastructure provides multiple benefits

Image: Columbia St & W 10th Ave, Vancouver
Photo Credit: Robert Pennings

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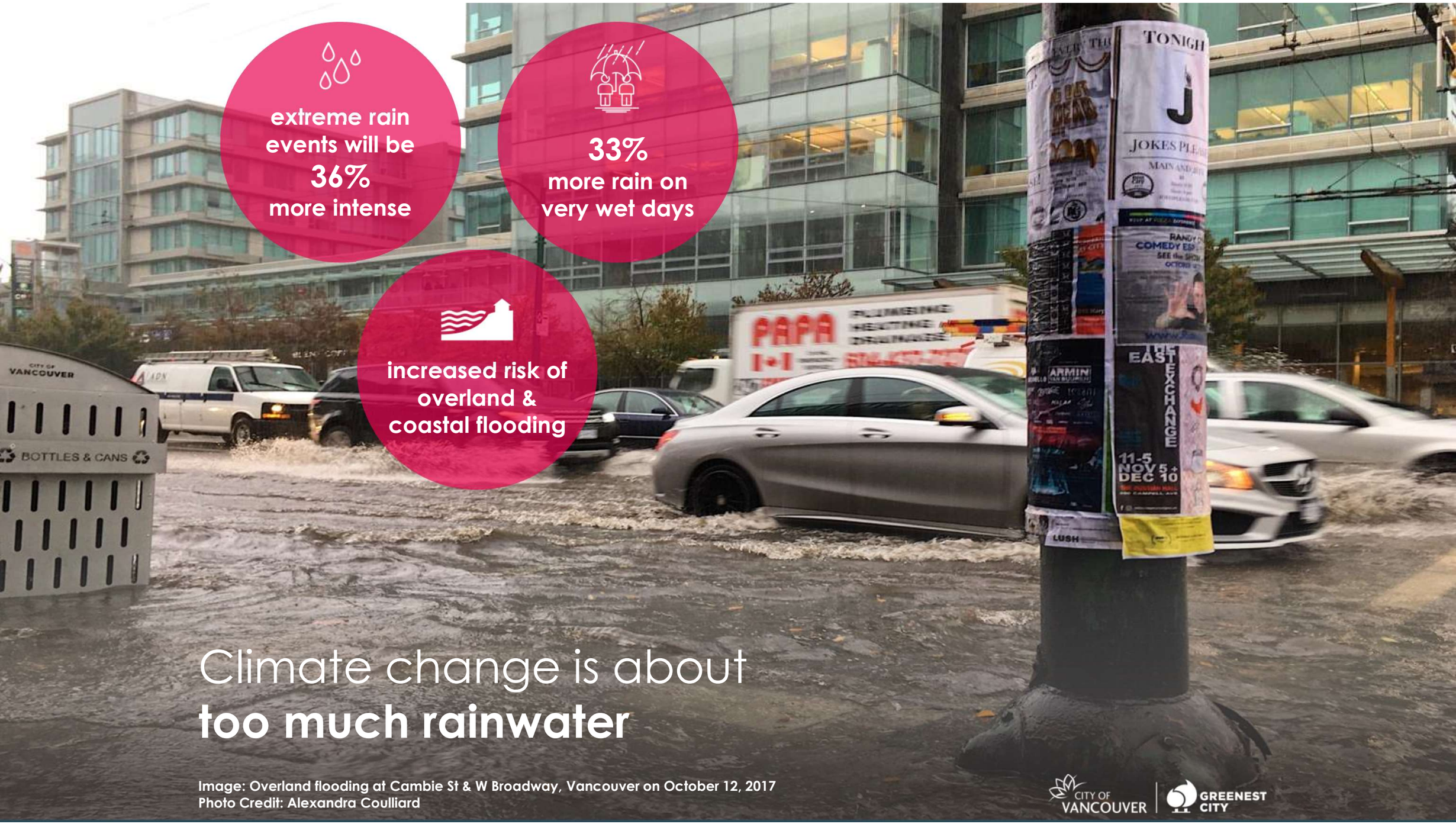

Image: Overland flooding at Cambie St & W Broadway, Vancouver on October 12, 2017
Photo Credit: Alexandra Coulliard

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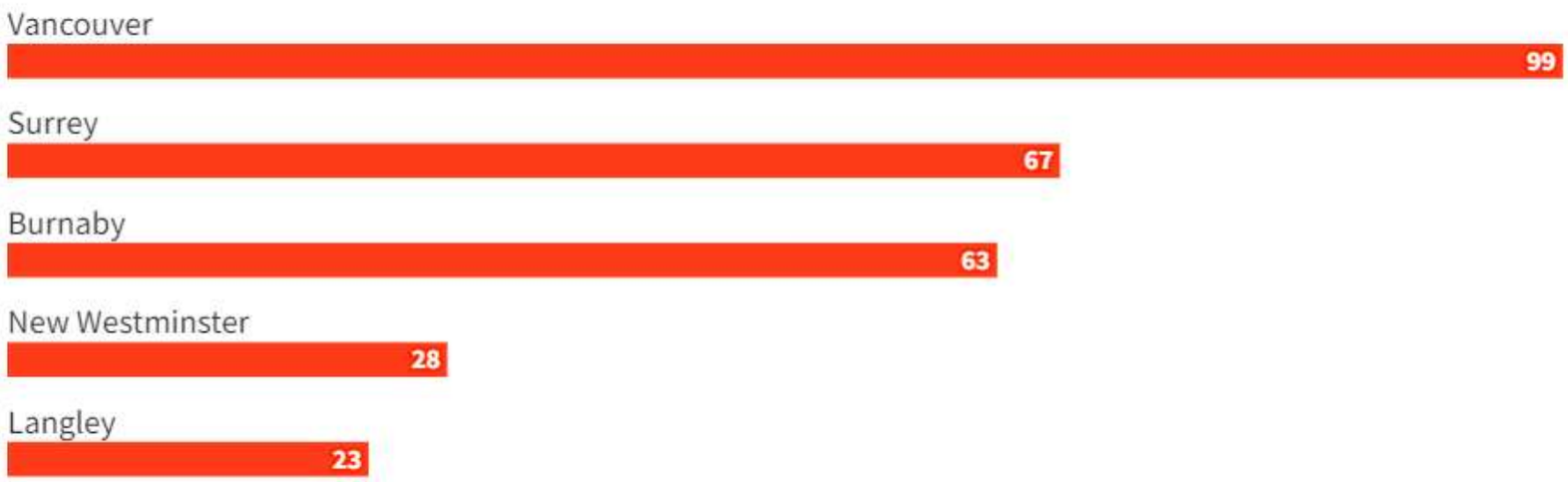
VANCOUVER SUN

Nearly 600 people died due to record-setting B.C. heat wave this summer

Cheryl Chan
Nov 01, 2021 • November 1, 2021

B.C. Heat Wave Deaths

June 25 - July 1

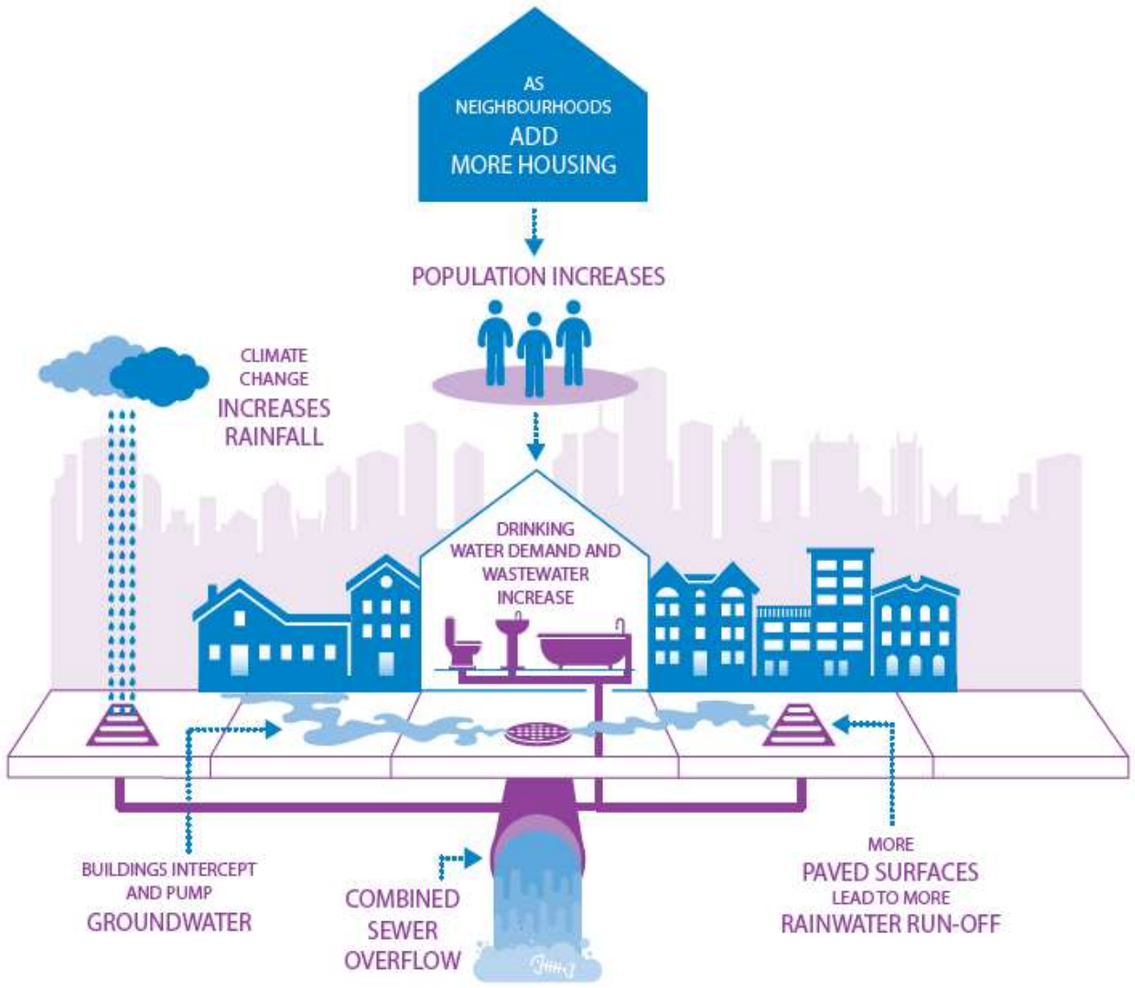


Cli
too

wildfires

Image: Summer drought
Photo Credit: City of Vancouver

Growth & Utilities Servicing



Water quality is impacted by

combined sewer overflows (CSOs)

over **33 billion** litres of combined sewage was discharged in 2018

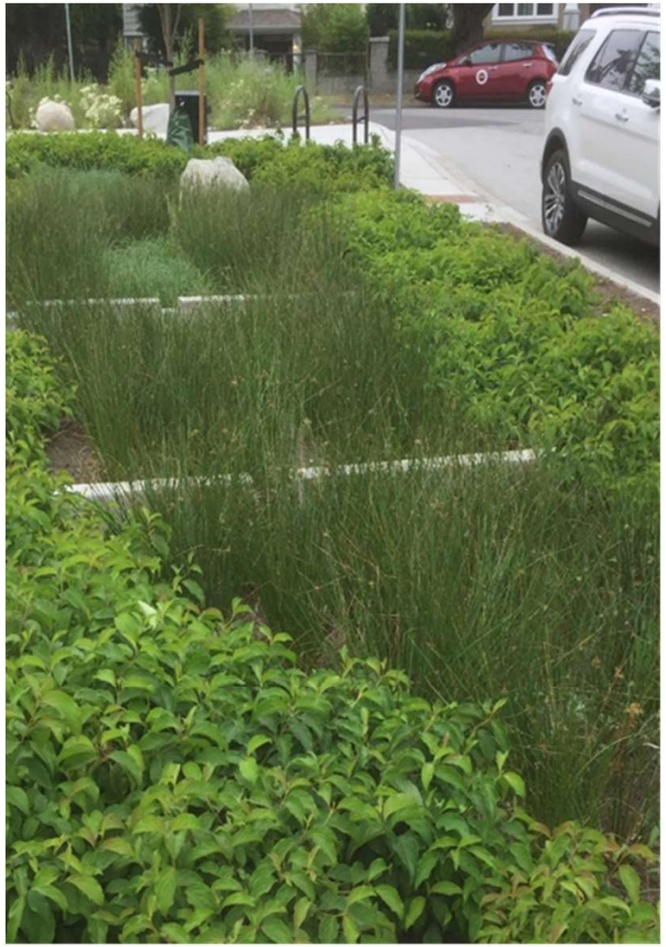
ongoing efforts to mitigate combined sewer overflows since the 1970's

Image: Outfall at Clark Drive, Vancouver
Photo Credit: Bruce Todd

stormwater pollutants

pollutants
litter
tire debris
copper & zinc
oils & gasoline
animal waste
fertilizer
micro-plastics
sediment

332 GRI Assets in Vancouver



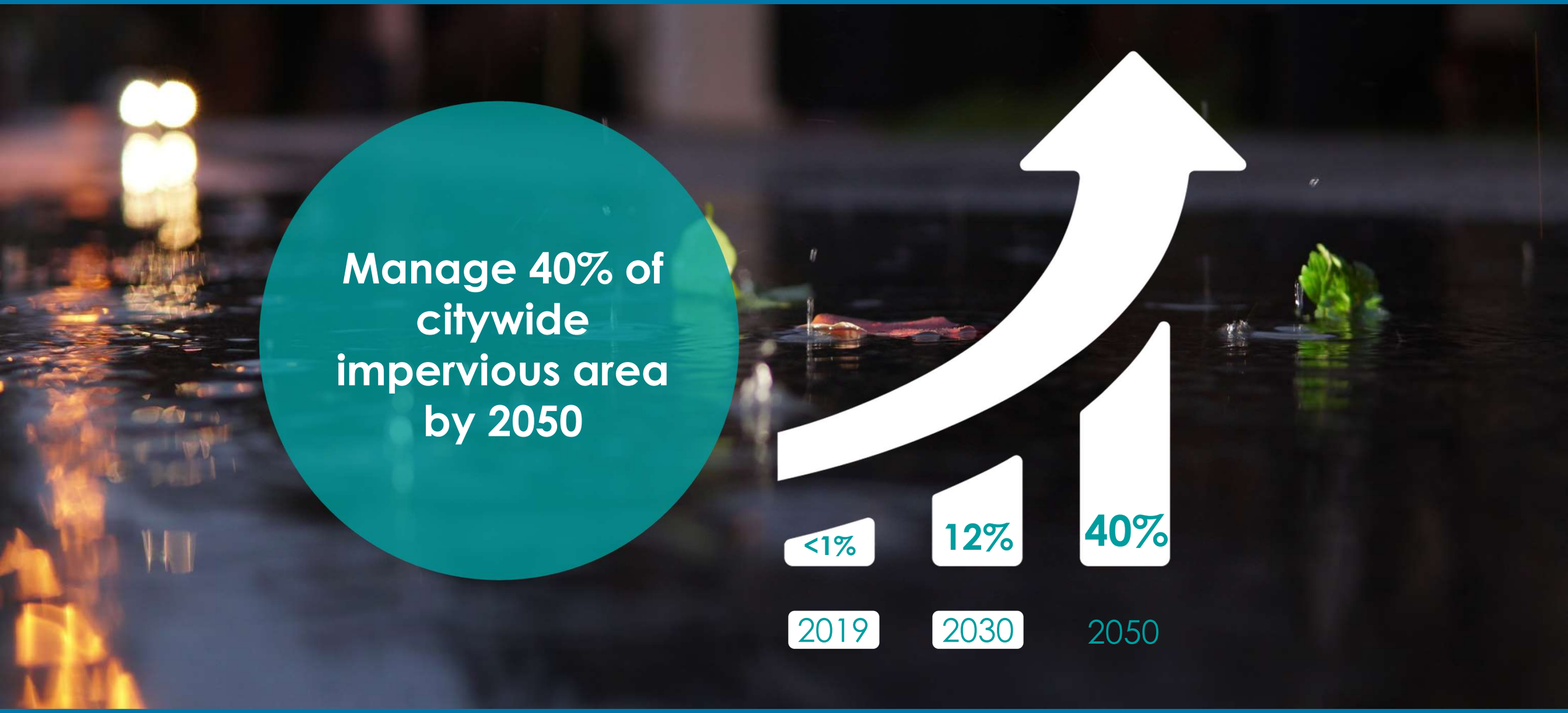
169 bioretention (54%)

51 permeable pavement (16%)

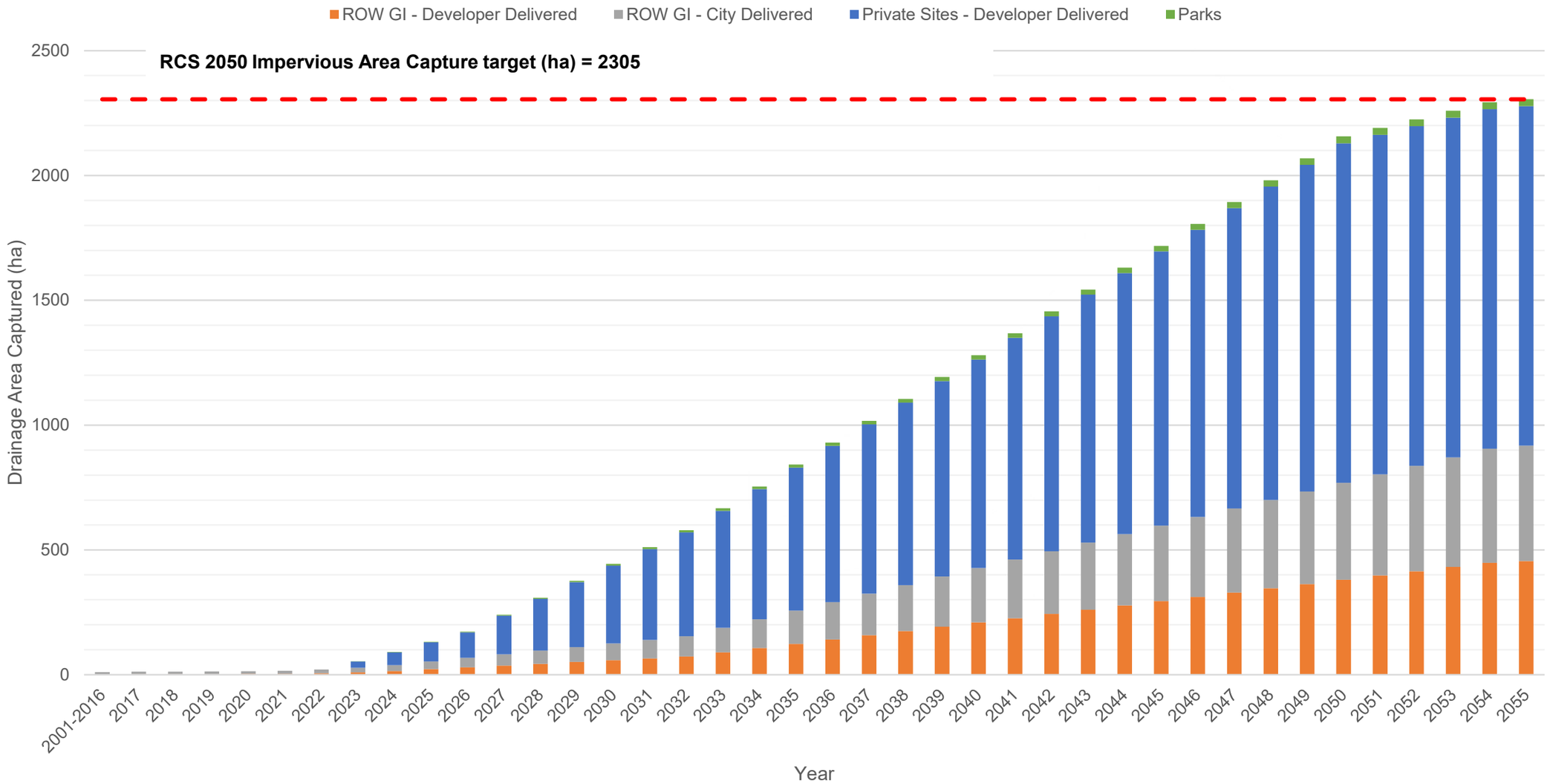
26 Rainwater tree trenches (8%)

69 sub-surface infiltration (22%)

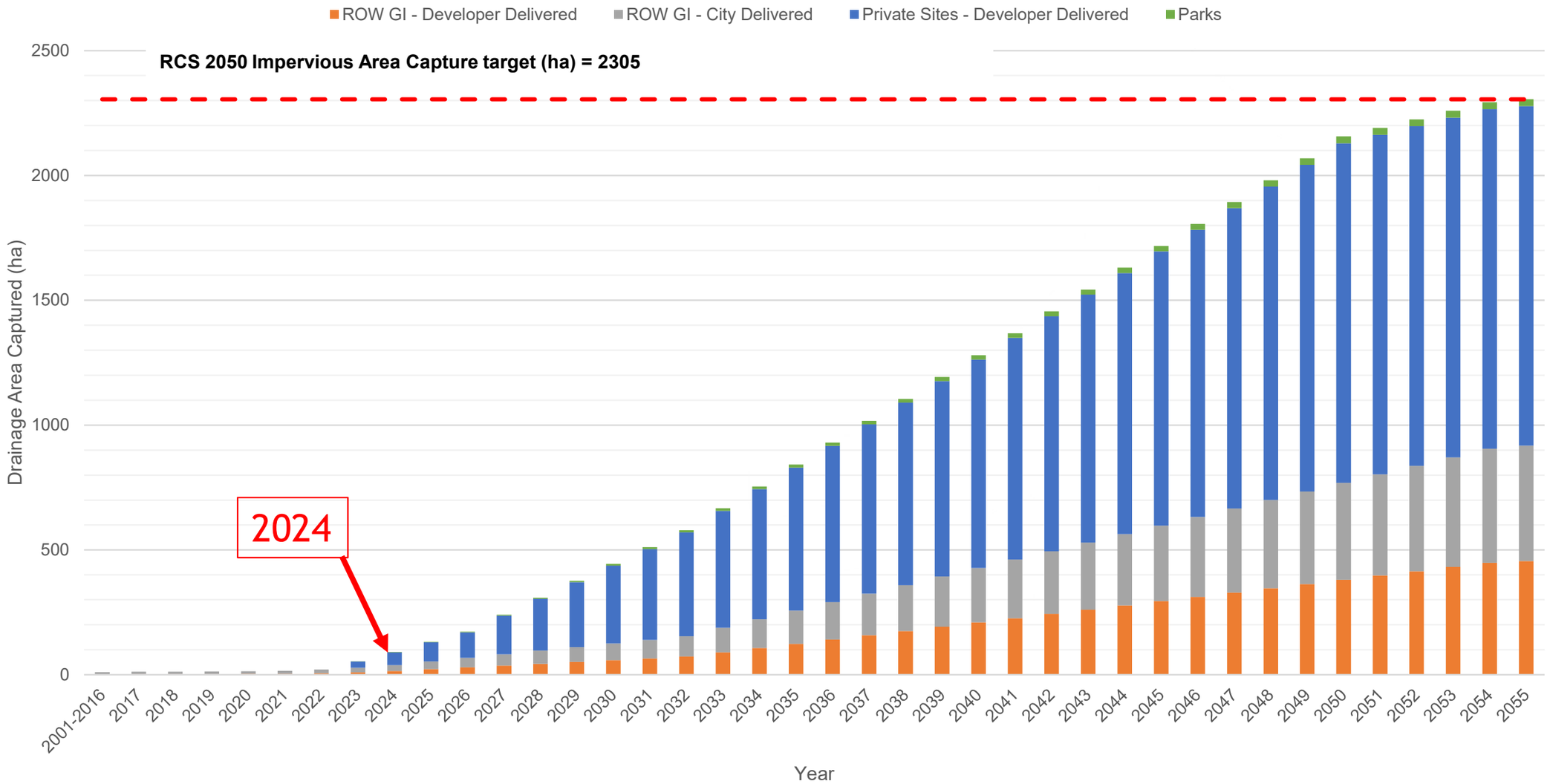
City of Vancouver - Rain City Strategy Targets



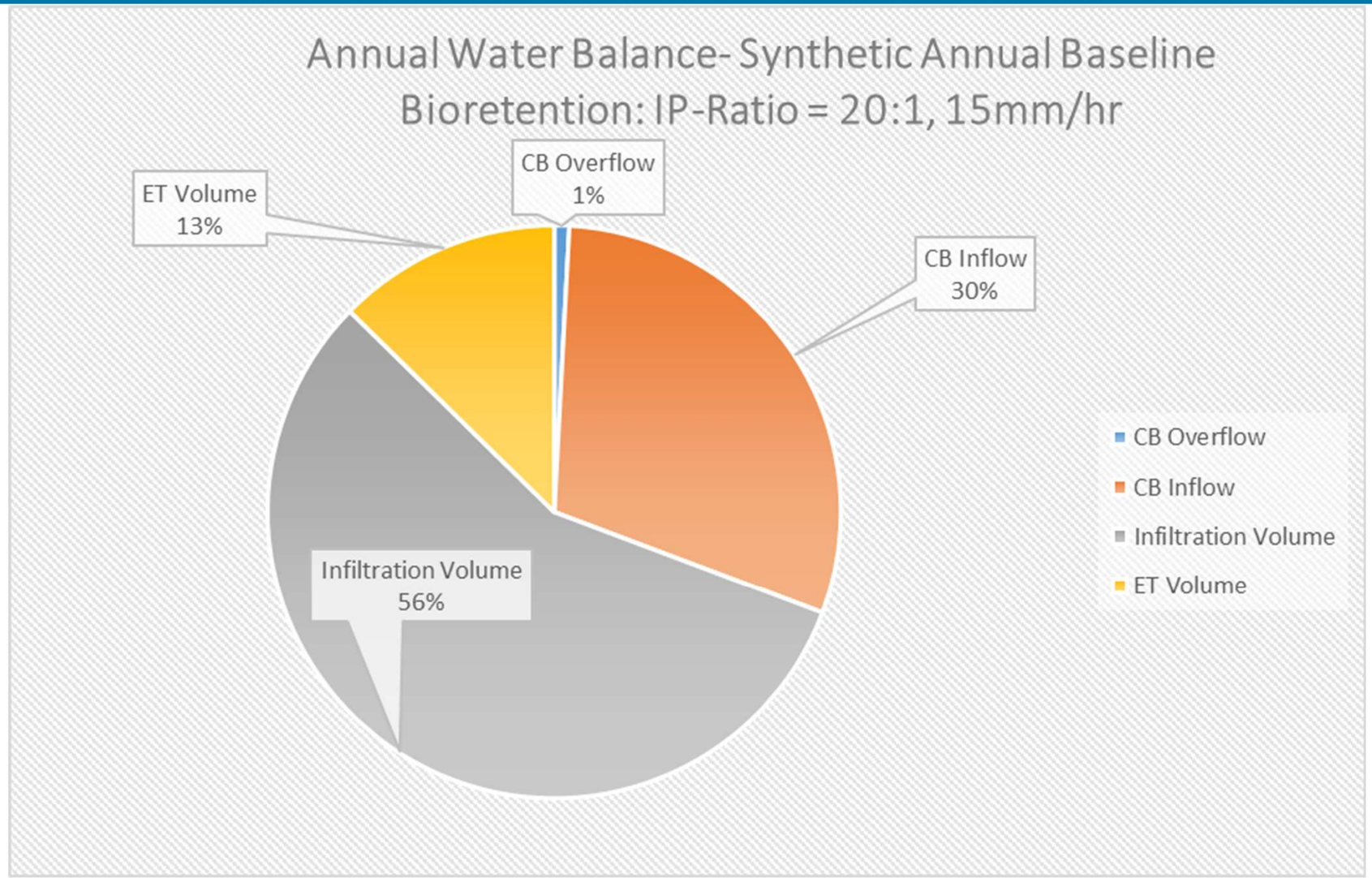
City of Vancouver – Implementation Projections



City of Vancouver – Implementation Projections

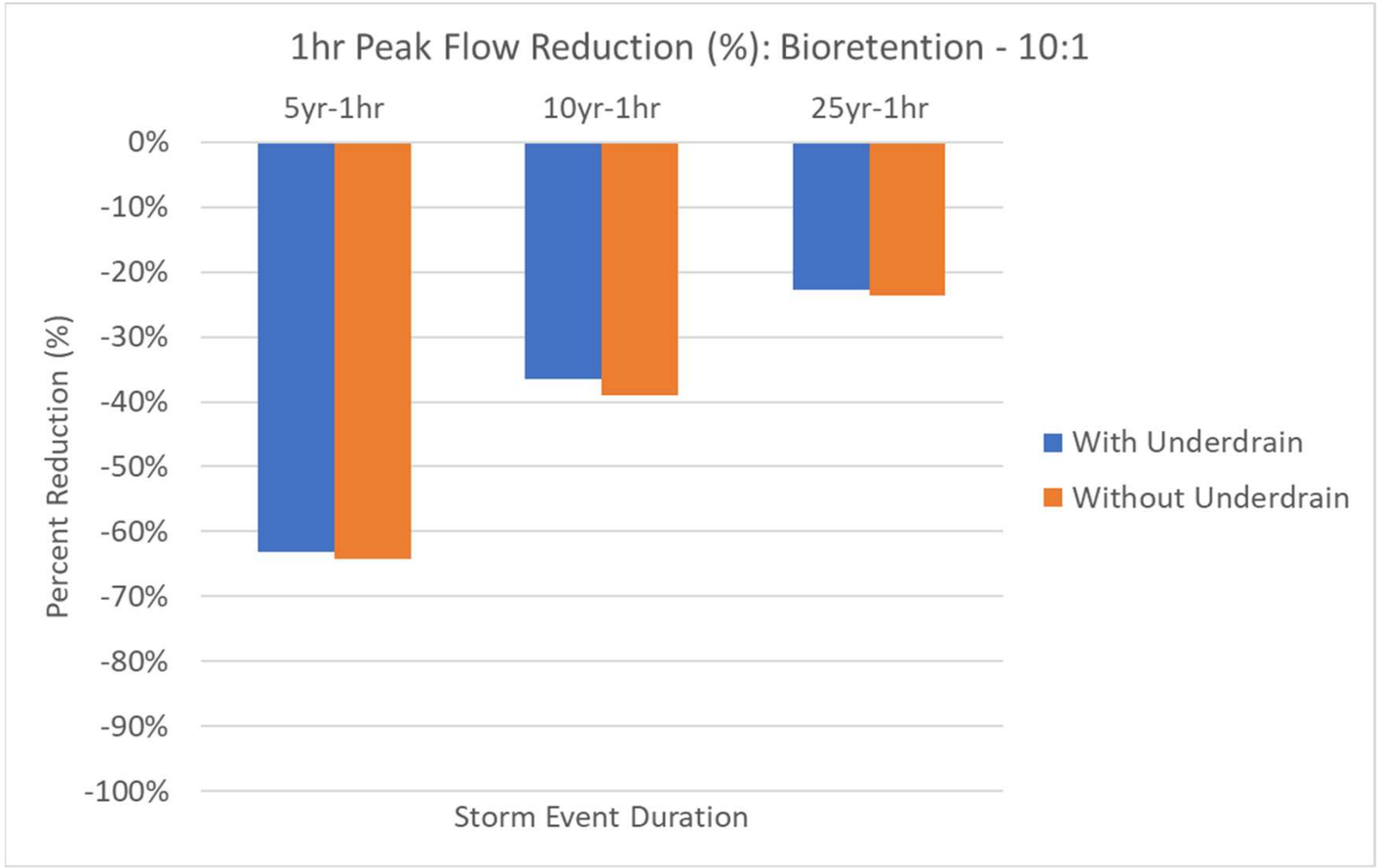


GI Performance Analysis



Annual Water Balance

GI Performance Analysis



Moderate 2100 GCM
Manages % increase
from 10yr-1hr projection (37%)

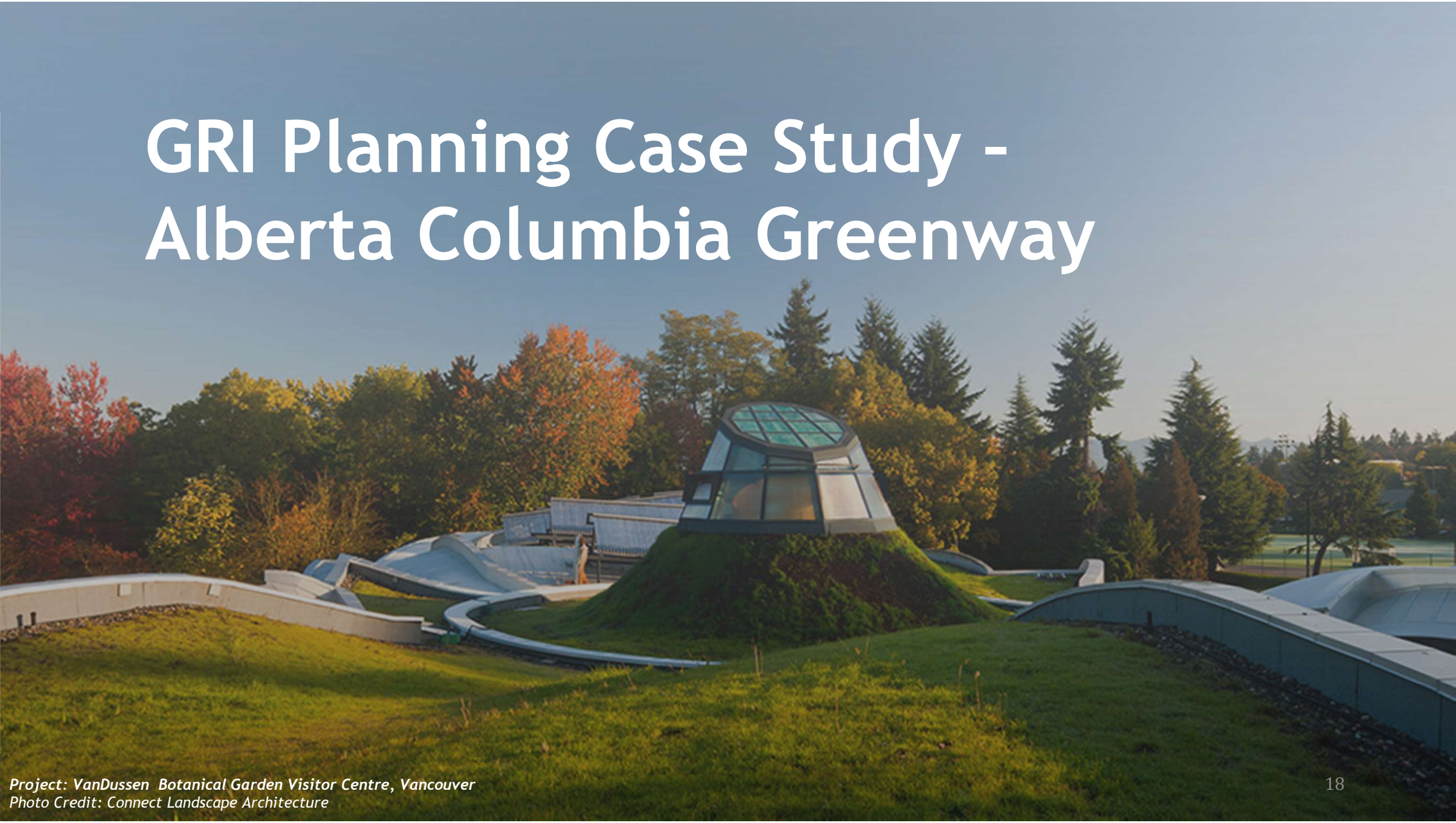
High 2100 GCM
Does not manage % increase
from 10yr-1yr projection (67%)

We can't plan for everything

Significant impact on current need for CSO reduction!

Sewer Design Storm Impacts

GRI Planning Case Study – Alberta Columbia Greenway



Project: VanDussen Botanical Garden Visitor Centre, Vancouver
Photo Credit: Connect Landscape Architecture

Alberta Columbia Greenway Planning

Site Overview

- 9 Blocks along Alberta Street & 1 City Park
- Single Family Residential
- Large Contributing Drainage Area
- Wide Right of Way
- Low Traffic
- Adjacent Park Spaces
- Sewers are under capacity but not in need of replacement
- High Infiltration Rates

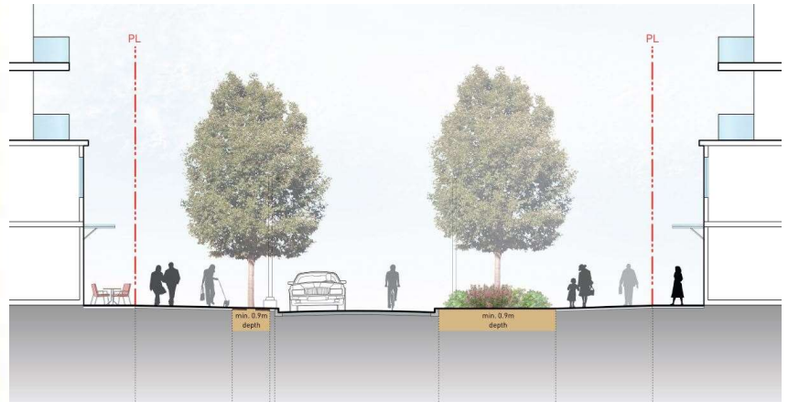
Alberta Columbia Greenway Planning

Alberta Street Block Highlights

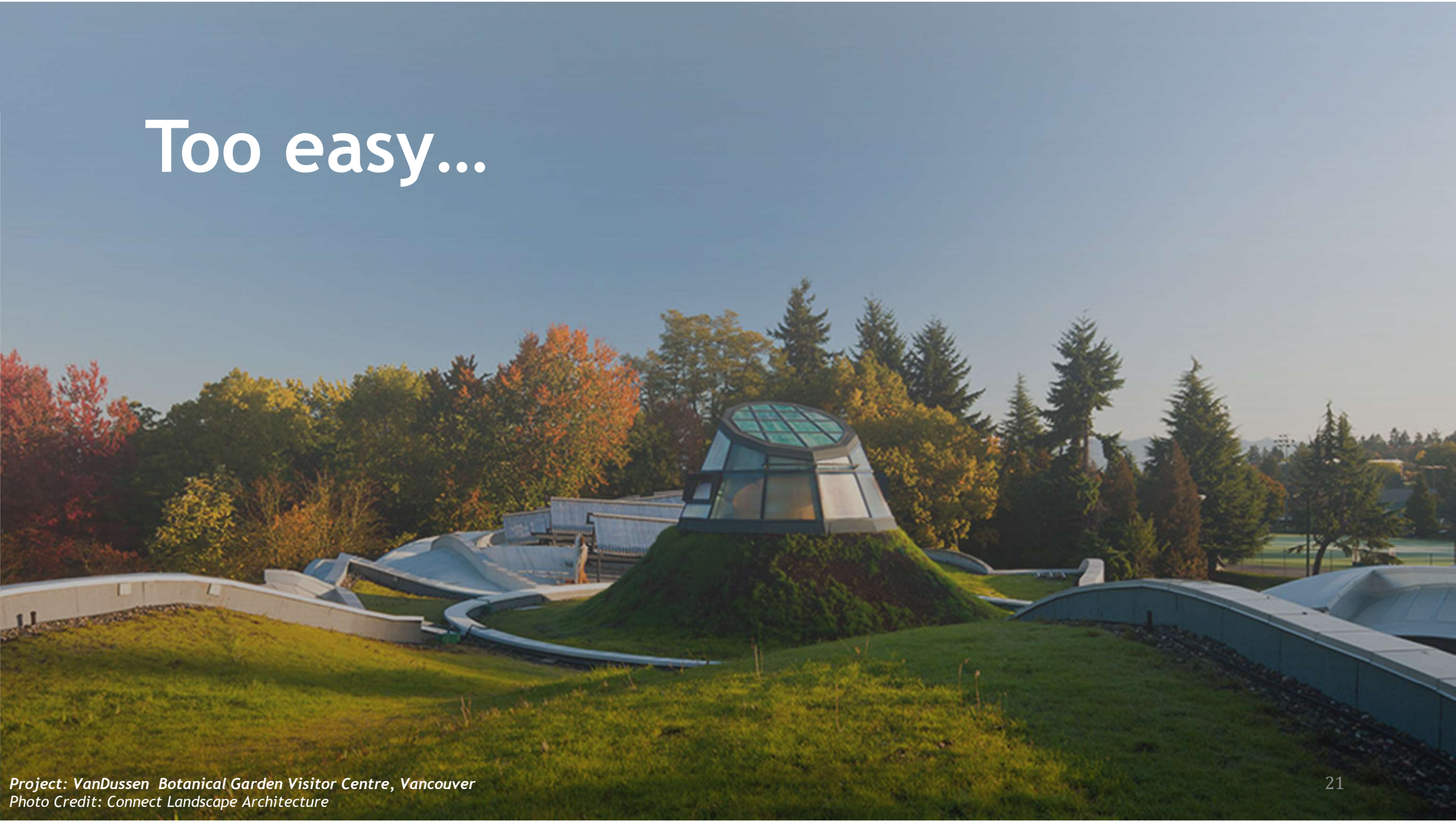
1. Retention of Existing Trees
2. Rain Gardens
3. Planted Boulevard incorporating pollinator species
4. Meadow Boulevard incorporating wildflowers
5. Sod
6. Continuous sidewalks
7. Pedestrian Nodes incorporating a variety of seating types and passive play elements
8. Mid-block seating
9. Enhanced paving pattern per Cambie Corridor Plan
10. Raised intersections / bike lanes
11. Incorporation of additional trees where feasible
12. Basalt seating elements

Car Free Block

One Way Traffic



Too easy…



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Planning for Green Infrastructure

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Planning for Green Infrastructure

Policy Initiatives

1. Identify policy barriers (foundation and utility setbacks, ROW ponding, boulevard widths)
2. Use examples and templates for implementation expectations
3. Allocate space (surface and sub-surface)
4. Standardize Development and Rezoning Conditions

Technical Resources

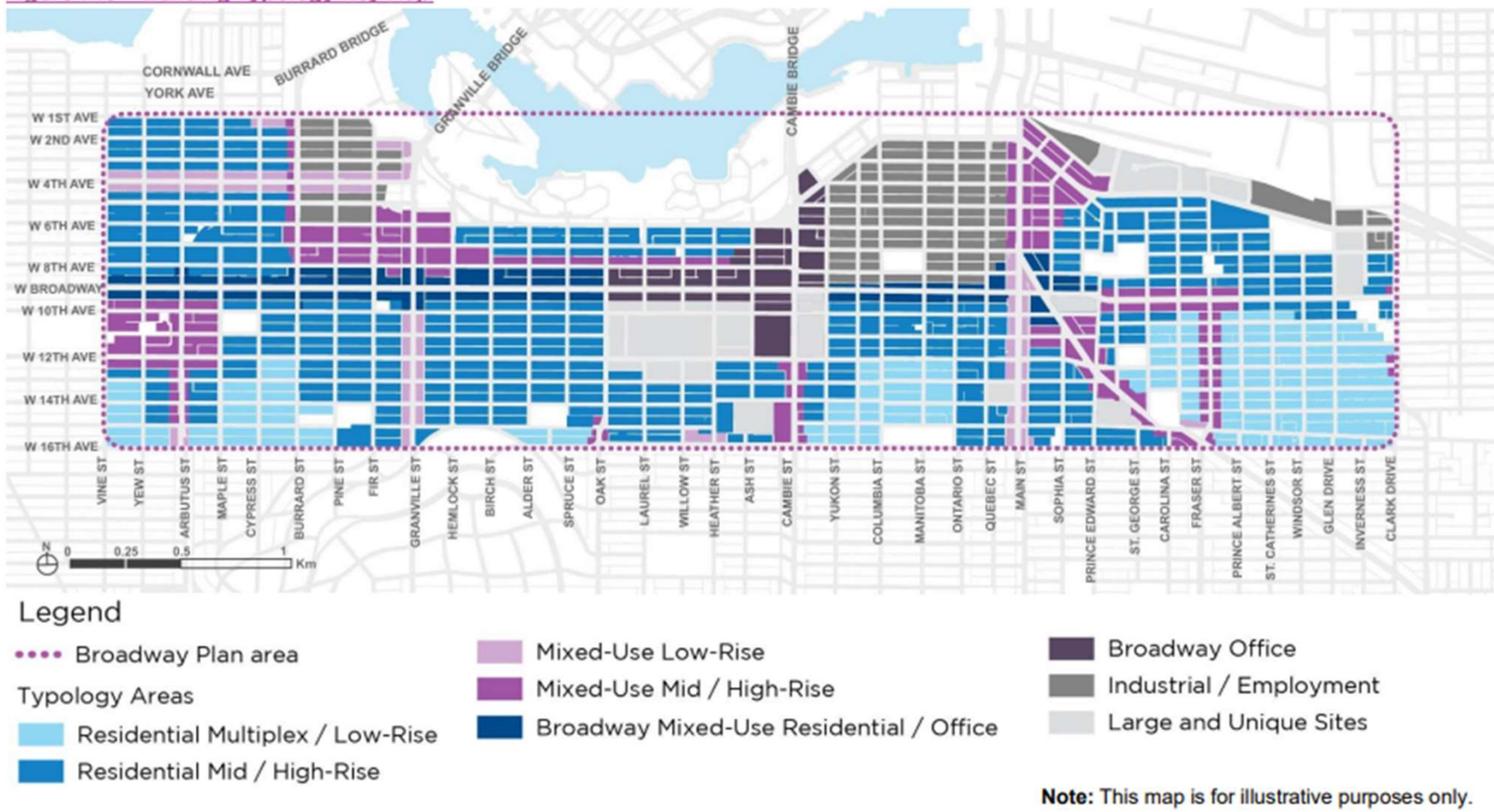
1. Standard Engineering Drawings
2. Construction Specifications
3. Design Guidance
4. Utility Protection Standards
5. Achievable Performance Criteria
6. Maintenance Expectations

Where is it feasible? Citywide Planning

Green Infrastructure Considerations

- Clear sidewalk zones
- Bike lanes
- Front boulevard and street trees
- Back boulevard and patio space
- Bus priority lanes
- Street maintenance

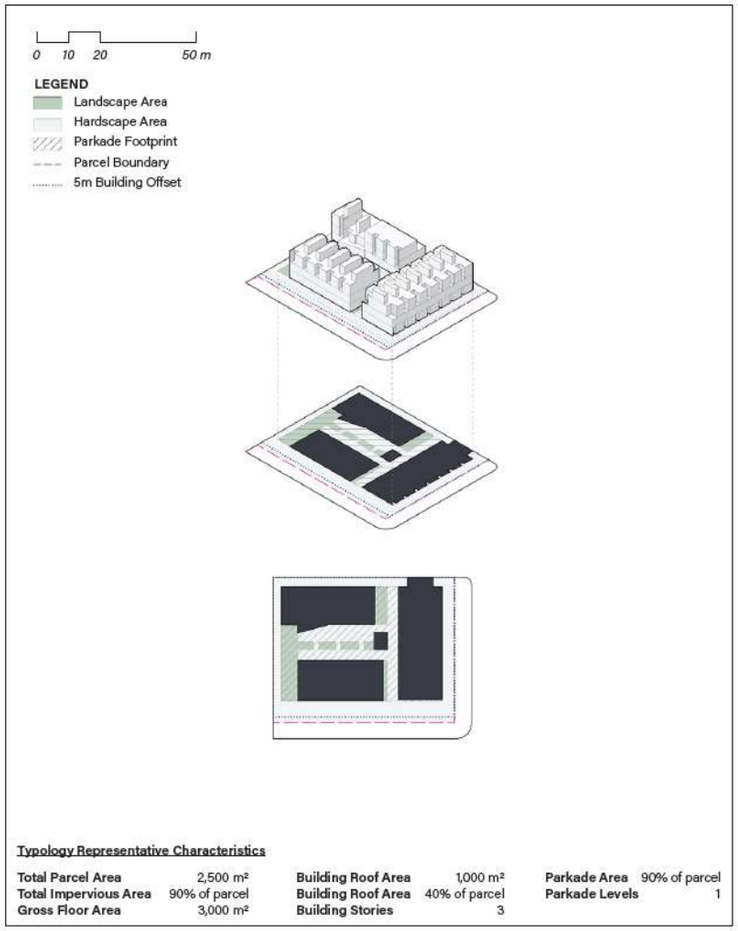
Figure 11.8 - Building Typology Key Map



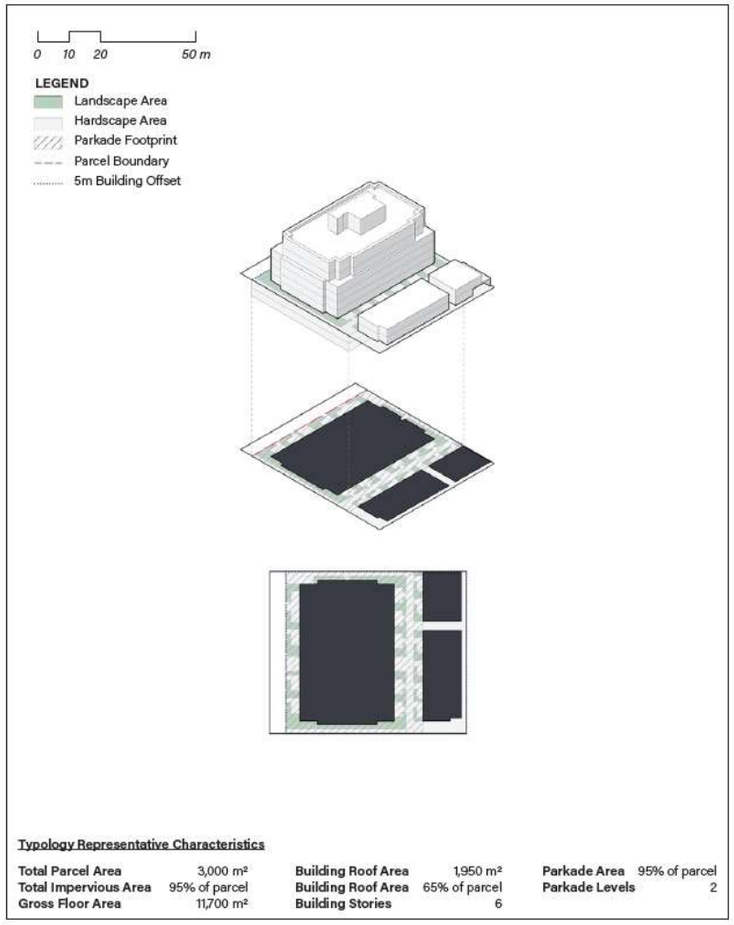
Note: This map is for illustrative purposes only.

From City of Vancouver - Healthy Waters Plan Options Catalogue

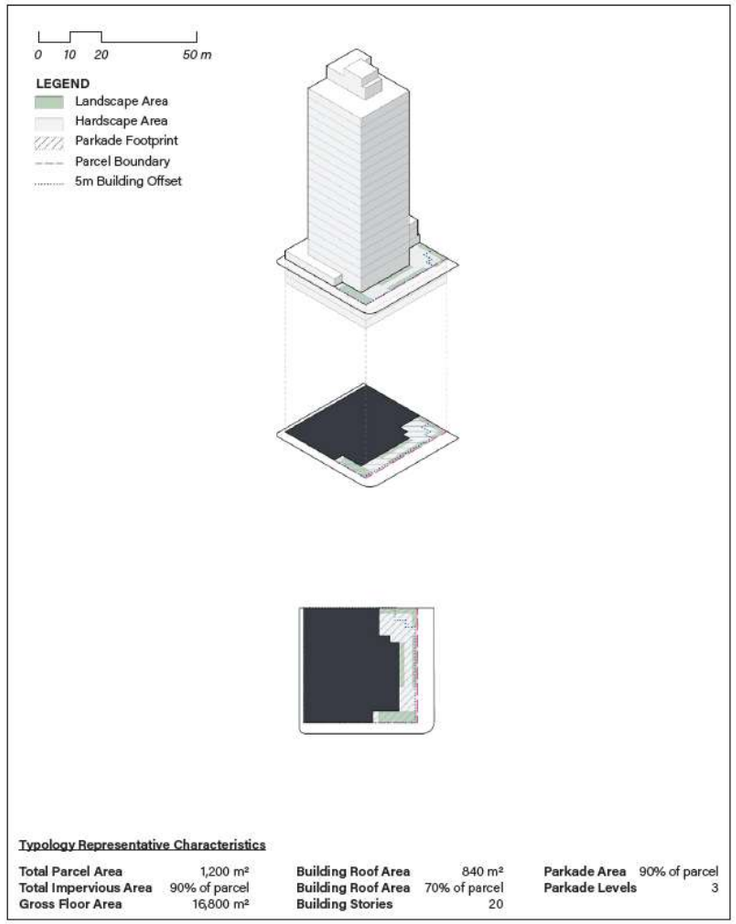
Where is it feasible? Building Typologies



LOW-RISE RESIDENTIAL & MIXED-USE



MID-RISE RESIDENTIAL & MIXED-USE (VERSION A)



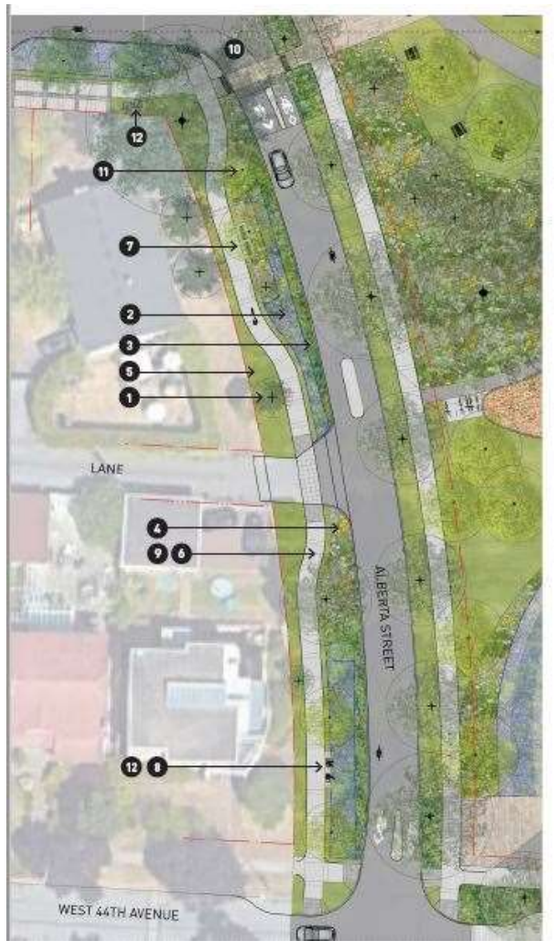
HIGH-RISE RESIDENTIAL & MIXED-USE

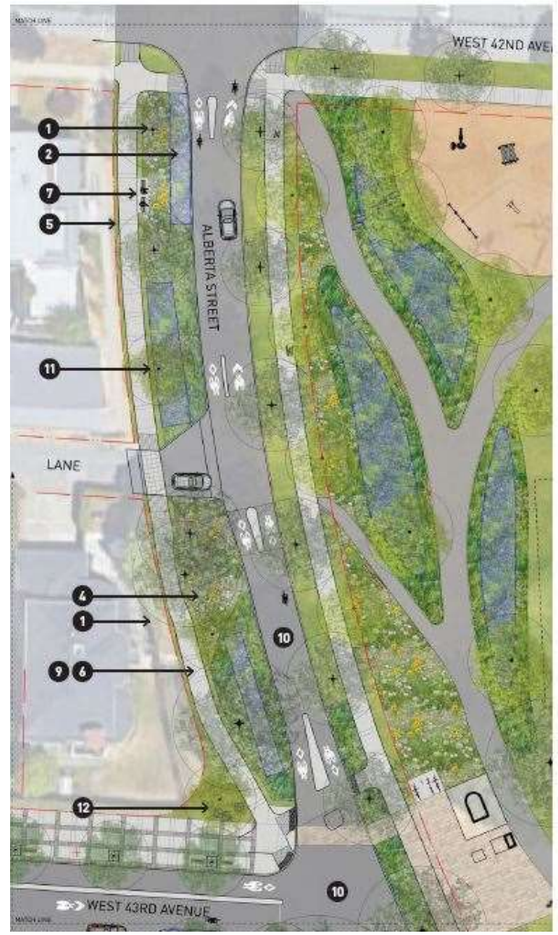
From City of Vancouver – Pathways Study

Where is it feasible? Public Lands

Rights of way

Public Parks





Assess Policy Changes

MN0

48mm MID-RISE GI Feasibility – Current Policy Conditions

Percent of Total Surface Type Runoff Volume Managed by Tool in Isolation

Infiltration Scenario	Surface Type	Existing Area (m2)	Rainwater harvesting	Permeable pavement	Bioretention	Subsurface infiltration	Rainwater harvesting	Permeable pavement	Bioretention	Subsurface infiltration	Rainwater harvesting	Permeable pavement	Bioretention	Subsurface infiltration	Rainwater harvesting	Permeable pavement	Bioretention	Subsurface infiltration	Rainwater harvesting	Permeable pavement	Bioretention	Subsurface infiltration
No Infiltration	Impervious - Roof	1,950	30%	0%	0%	0%	40%	0%	0%	0%	59%	0%	0%	0%	100%	0%	1%	0%	NA	NA	NA	NA
	Impervious - Ground	900	64%	0%	0%	0%	64%	0%	0%	0%	64%	0%	0%	0%	64%	0%	0%	0%	64%	0%	0%	0%
	Pervious	150			5%	0%			5%	0%			5%	0%			5%	0%			5%	0%
	All Surface Types Tributary to GRI		**20%**	**0%**	**0%**	**0%**	**24%**	**0%**	**0%**	**0%**	**31%**	**0%**	**0%**	**0%**	**42%**	**0%**	**0%**	**0%**	**64%**	**0%**	**0%**	**0%**
	Compliant Pathway Available?		**No**				**No**				**No**				**No**				**No**			
Low Infiltration	Impervious - Roof	1,950	30%	0%	12%	10%	40%	0%	15%	13%	59%	0%	23%	20%	100%	0%	46%	40%	NA	NA	NA	NA
	Impervious - Ground	900	64%	0%	25%	22%	64%	0%	25%	22%	64%	0%	25%	22%	64%	0%	25%	22%	64%	0%	25%	22%
	Pervious	150			100%	100%			100%	100%			100%	100%			100%	100%			100%	100%
	All Surface Types Tributary to GRI		**20%**	**0%**	**8%**	**7%**	**24%**	**0%**	**9%**	**8%**	**31%**	**0%**	**12%**	**10%**	**42%**	**0%**	**16%**	**14%**	**64%**	**0%**	**24%**	**21%**
	Compliant Pathway Available?		**No**				**No**				**No**				**No**				**No**			
Moderate Infiltration	Impervious - Roof	1,950	30%	0%	21%	14%	40%	0%	28%	18%	59%	0%	42%	27%	100%	0%	83%	55%	NA	NA	NA	NA
	Impervious - Ground	900	64%	0%	45%	30%	64%	0%	45%	30%	64%	0%	45%	30%	64%	0%	45%	30%	64%	0%	45%	30%
	Pervious	150			100%	100%			100%	100%			100%	100%			100%	100%			100%	100%
	All Surface Types Tributary to GRI		**20%**	**0%**	**14%**	**9%**	**24%**	**0%**	**17%**	**11%**	**31%**	**0%**	**21%**	**14%**	**42%**	**0%**	**29%**	**19%**	**64%**	**0%**	**43%**	**29%**
	Compliant Pathway Available?		**No**				**No**				**No**				**No**				**Yes**			
High Infiltration	Impervious - Roof	1,950	30%	0%	39%	21%	40%	0%	52%	28%	59%	0%	78%	42%	100%	0%	100%	84%	NA	NA	NA	NA
	Impervious - Ground	900	64%	0%	80%	46%	64%	0%	80%	46%	64%	0%	80%	46%	64%	0%	80%	46%	64%	0%	80%	45%
	Pervious	150			100%	NA			100%	NA			100%	NA			100%	NA			100%	NA
	All Surface Types Tributary to GRI		**20%**	**0%**	**27%**	**14%**	**24%**	**0%**	**32%**	**17%**	**31%**	**0%**	**40%**	**22%**	**42%**	**0%**	**53%**	**30%**	**64%**	**0%**	**78%**	**45%**
	Compliant Pathway Available?		**No**				**No**				**No**				**No**				**Yes**			
			0% Managed with Resilient Roof				***25% Managed with Resilient Roof***				***50% Managed with Resilient Roof***				***75% Managed with Resilient Roof***				***100% Managed with Resilient Roof***			

From City of Vancouver – Pathways Study

Slide 27

MN0 The contrast between these slides is important to show impact of policy changes
Mead-Fox, Nick, 2023-12-01T21:54:00.503

Assess Policy Changes
48mm MID-RISE – Modified Setback and Reduced Parkage

Percent of Total Surface Type Runoff Volume Managed by Tool in Isolation

Infiltration Scenario	Surface Type	Existing Area (m2)	Rainwater harvesting	Permeable pavement	Bioretention	Subsurface infiltration	Rainwater harvesting	Permeable pavement	Bioretention	Subsurface infiltration	Rainwater harvesting	Permeable pavement	Bioretention	Subsurface infiltration	Rainwater harvesting	Permeable pavement	Bioretention	Subsurface infiltration	Rainwater harvesting	Permeable pavement	Bioretention	Subsurface infiltration
No Infiltration	Impervious - Roof	1,950	30%	0%	0%	0%	40%	0%	1%	0%	59%	0%	1%	0%	100%	0%	2%	0%	NA	NA	NA	NA
	Impervious - Ground	900	64%	0%	1%	0%	64%	0%	1%	0%	64%	0%	1%	0%	64%	0%	1%	0%	64%	0%	1%	0%
	Pervious	150			9%	0%			9%	0%			9%	0%			9%	0%			9%	0%
	All Surface Types Tributary to GRI		**20%**	**0%**	**0%**	**0%**	**24%**	**0%**	**0%**	**0%**	**31%**	**0%**	**0%**	**0%**	**42%**	**0%**	**1%**	**0%**	**64%**	**0%**	**1%**	**0%**
	Compliant Pathway Available?		**No**				**No**				**No**				**No**				**No**			
Low Infiltration	Impervious - Roof	1,950	30%	100%	34%	100%	40%	100%	45%	100%	59%	100%	68%	100%	100%	100%	100%	100%	NA	NA	NA	NA
	Impervious - Ground	900	64%	100%	73%	100%	64%	100%	73%	100%	64%	100%	73%	100%	64%	100%	73%	100%	64%	100%	73%	100%
	Pervious	150			100%	100%			100%	100%			100%	100%			100%	100%			100%	100%
	All Surface Types Tributary to GRI		**20%**	**100%**	**22%**	**100%**	**24%**	**100%**	**27%**	**100%**	**31%**	**100%**	**34%**	**100%**	**42%**	**100%**	**45%**	**100%**	**64%**	**100%**	**67%**	**100%**
	Compliant Pathway Available?		**Yes**				**Yes**				**Yes**				**Yes**				**Yes**			
Moderate Infiltration	Impervious - Roof	1,950	30%	100%	61%	100%	40%	100%	81%	100%	59%	100%	100%	100%	100%	100%	100%	100%	NA	NA	NA	NA
	Impervious - Ground	900	64%	100%	100%	100%	64%	100%	100%	100%	64%	100%	100%	100%	64%	100%	100%	100%	64%	100%	100%	100%
	Pervious	150			100%	100%			100%	100%			100%	100%			100%	100%			100%	100%
	All Surface Types Tributary to GRI		**20%**	**100%**	**40%**	**100%**	**24%**	**100%**	**48%**	**100%**	**31%**	**100%**	**60%**	**100%**	**42%**	**100%**	**80%**	**100%**	**64%**	**100%**	**100%**	**100%**
	Compliant Pathway Available?		**Yes**				**Yes**				**Yes**				**Yes**				**Yes**			
High Infiltration	Impervious - Roof	1,950	30%	100%	100%	100%	40%	100%	100%	100%	59%	100%	100%	100%	100%	100%	100%	100%	NA	NA	NA	NA
	Impervious - Ground	900	64%	100%	100%	100%	64%	100%	100%	100%	64%	100%	100%	100%	64%	100%	100%	100%	64%	100%	100%	100%
	Pervious	150			100%	NA			100%	NA			100%	NA			100%	NA			100%	NA
	All Surface Types Tributary to GRI		**20%**	**100%**	**73%**	**100%**	**24%**	**100%**	**85%**	**100%**	**31%**	**100%**	**98%**	**100%**	**42%**	**100%**	**100%**	**100%**	**64%**	**100%**	**100%**	**100%**
	Compliant Pathway Available?		**Yes**				**Yes**				**Yes**				**Yes**				**Yes**			
			0% Managed with Resilient Roof				***25% Managed with Resilient Roof***				***50% Managed with Resilient Roof***				***75% Managed with Resilient Roof***				***100% Managed with Resilient Roof***			

From City of Vancouver – Pathways Study

Major Takeaways

GI can help accommodate densification

- Infrastructure benefits - Stormwater servicing, heat reduction
- Community Benefits - Green space, walkability

Expand ROWs wherever possible (utility conflicts, GI, trees, flood prevention)

- Aim for wider boulevards and sidewalks
- Helps address utility conflicts, space for GI+trees, walkability, flooding

Formalize development and rezoning GI conditions

- Road improvements AND on-site GI
- Provide support with technical engineering standards and maintenance documents.

Major Takeaways

Increase property line setbacks to foundations and parkades

- Creates opportunities for private and public GI

GI cannot go everywhere

- Require GI where it is environmentally and technically feasible
- Create alternative compliance options for where it isn’t

Thank You

Project: VanDussen Botanical Garden Visitor Centre, Vancouver
Photo Credit: Connect Landscape Architecture