CITY OF VANCOUVER

Vancouver's Green Infrastructure Maintenance and Rehabilitation Pilot Programs

June 9, 2022

Presented by Julie McManus and Sheri DeBoer

We gratefully acknowledge that we live, work and play on the traditional, unceeded territories of the xʷməθkʷəy̓əm (Musqueam), Skwxwú7mesh Úxwumixw (Squamish Nation) and səlilwətaɬ (Tsleil-Waututh) Peoples.

Agenda

1. Rain City Strategy
2. Green Infrastructure in Vancouver
3. Rehabilitation Program
4. O&M Program
5. Next Steps


population growth
densification
extreme storms and floods
forest fires
sea level rise
urban heat island
drought spells
aging infrastructure
rethinking water management
SHOULD I BE WORRIED?
CITY OF VANCOUVER
GREENEST CITY

Rain City Strategy

9 transformative directions

3 action plans

A high level, 30-year plan that aims to manage rainwater through green rainwater infrastructure that

protects

restores

mimics

the natural water cycle

Image: Urban rainwater runoff
Photo Credit: Wendy de Hoog

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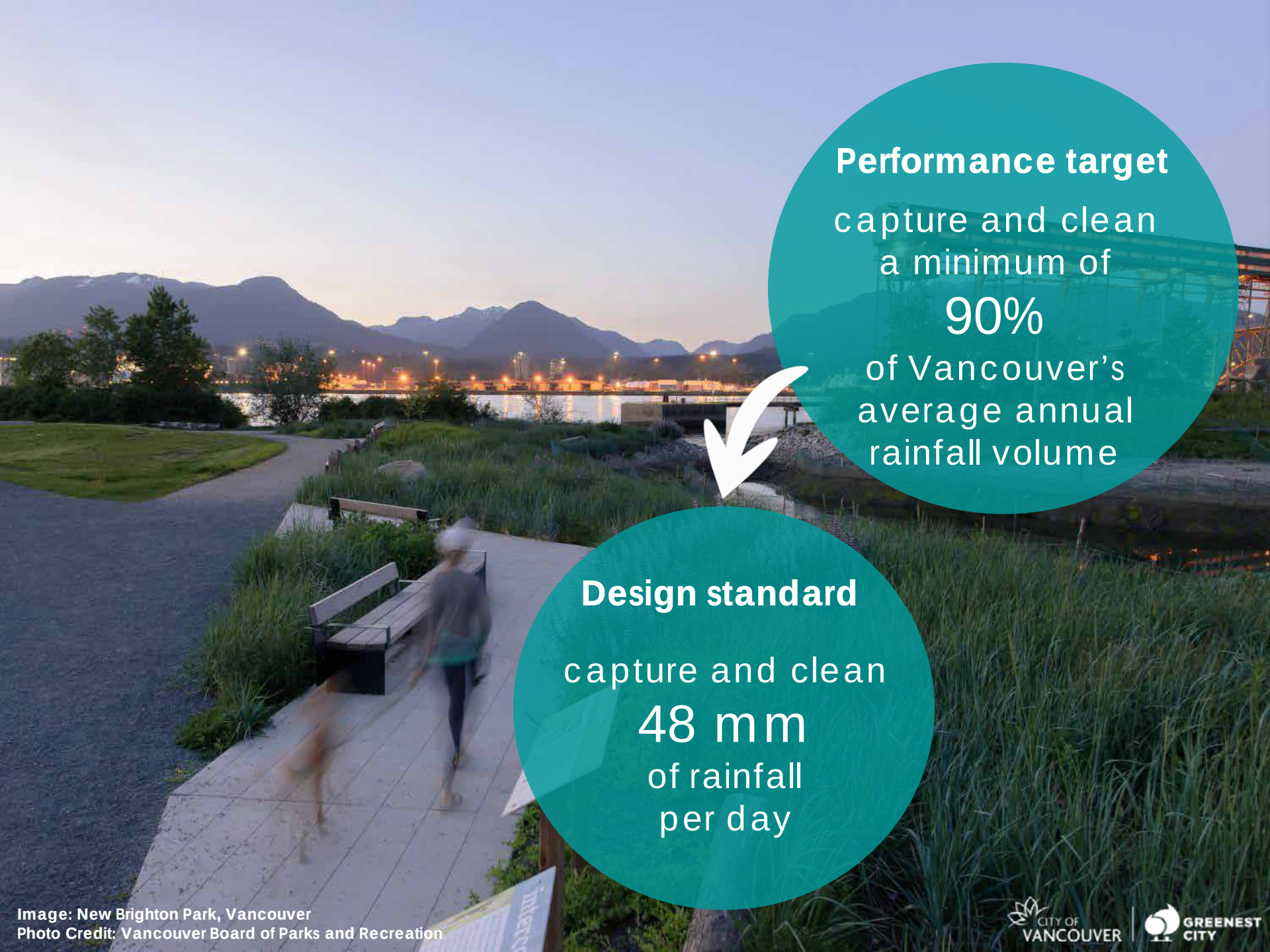
Objectives

reduce volume of rainwater entering the pipe system

reduce pollutants in urban rainwater runoff

Image: Green rainwater infrastructure project at Yukon & W 63rd
Photo Credit: Wendy de Hoog



Performance target

capture and clean
a minimum of
90%
of Vancouver's
average annual
rainfall volume

Design standard

capture and clean
48 mm
of rainfall
per day

Image: New Brighton Park, Vancouver
Photo Credit: Vancouver Board of Parks and Recreation

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Citywide green rainwater infrastructure implementation target

becomes business as usual through

renewal, redevelopment, retrofits

Image: Bioretention at E 1st Ave & Quebec St, Vancouver
Photo Credit: Kristen Hudson

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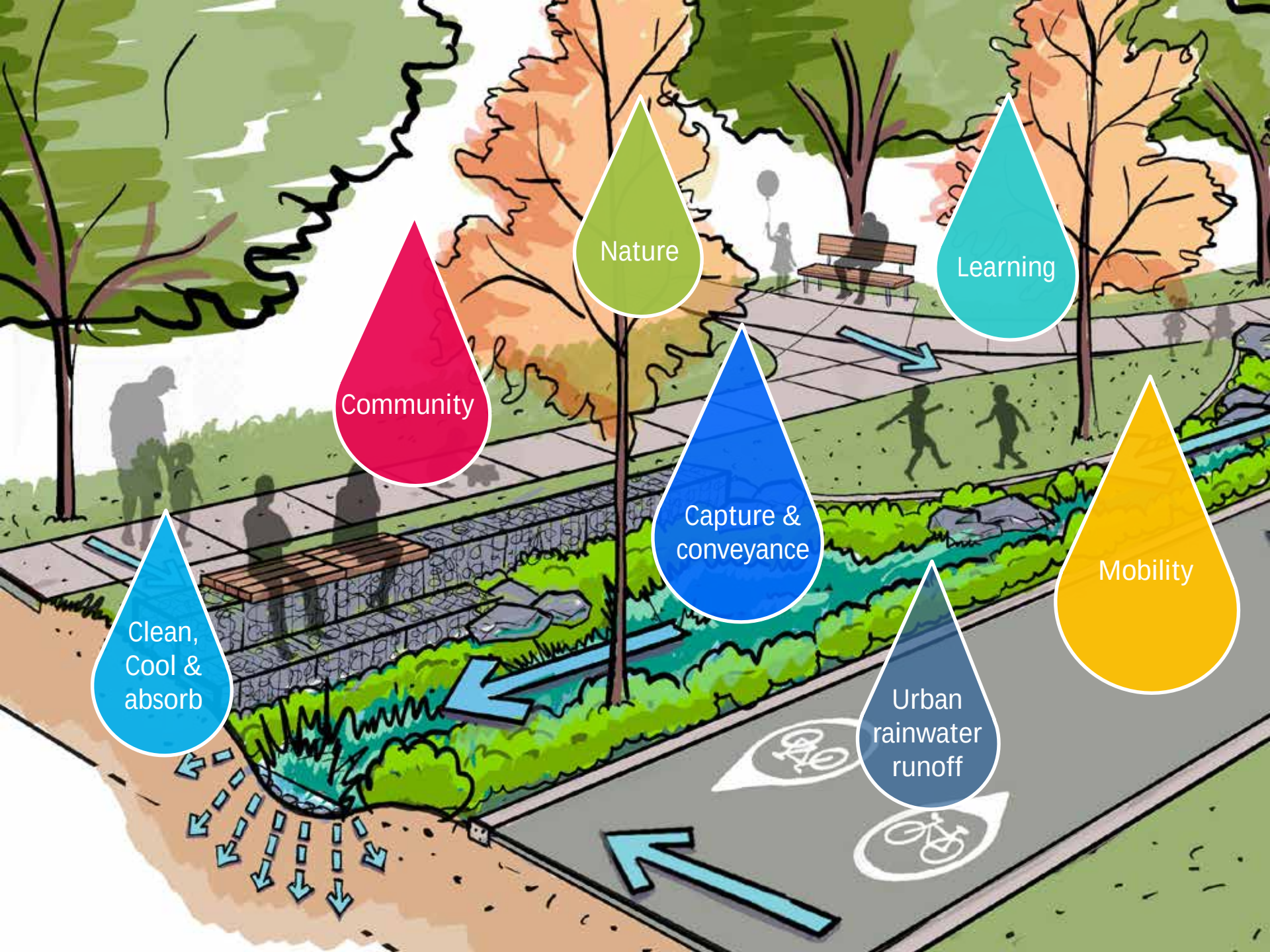
Nature
Learning
Community
Capture & conveyance
Mobility
Clean, Cool & absorb
Urban rainwater runoff

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Green Rainwater Infrastructure (GRI) Delivery in Vancouver

In our first 4 years, we will increase public realm GRI by 70%,

adding 132 new assets managing

8.6 ha of impervious area cleaning and diverting from pipes

108 million litres of run-off per year

Image: Quebec and 1st street, Vancouver
Photo Credit: Kristen Hudson

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309 GRI ASSETS IN VANCOUVER

163 bioretention

52 permeable pavement

26 rainwater tree trenches

68 sub-surface infiltration

2021 Highlights:

Projects deliver outcomes for drainage, climate action & community

Sunset Park

Construction Now Complete!

- **3** New trees
- **7.6 Thousand lbs** Carbon sequestration over 50 years
- **4.5 thousand m²** Impervious area managed
- **4 million litres** Urban rainwater runoff treated onsite annually

Richards St

Construction Now Complete!

- **8 blocks, two-way** All Ages and Abilities separated bike lane
- **100+** new trees
- **50,973 kg** carbon sequestration over 50 years
- **16 sensors installed** monitoring soil moisture levels
- **1.1 hectares** impervious area managed
- **15 million litres** urban rainwater runoff treated onsite annually
- **11 million litres** urban rainwater runoff diverted from sewers annually

Pine Street

Construction Now Complete!

- **2 blocks, two-way** All Ages and Abilities bike route
- **49 m² gardens** new pollinator habitat
- **250 thousand m²** impervious area managed
- **1.8 million litres** urban rainwater runoff treated onsite annually
- **895 thousand litres** urban rainwater runoff diverted from sewers annually

St George Rainway phase 1

Planning 2020-2021

- **4 blocks, two-way** All Ages and Abilities bike route
- **new trees** new trees
- **4 hectares** impervious area managed
- **24.6 million litres** urban rainwater runoff treated onsite annually
- **24.6 million litres** urban rainwater runoff diverted from sewers annually

CITY OF VANCOUVER

BUILDING A CITY WE LOVE

Streets and Public Spaces Action Plan

16
Implementation and enabling programs

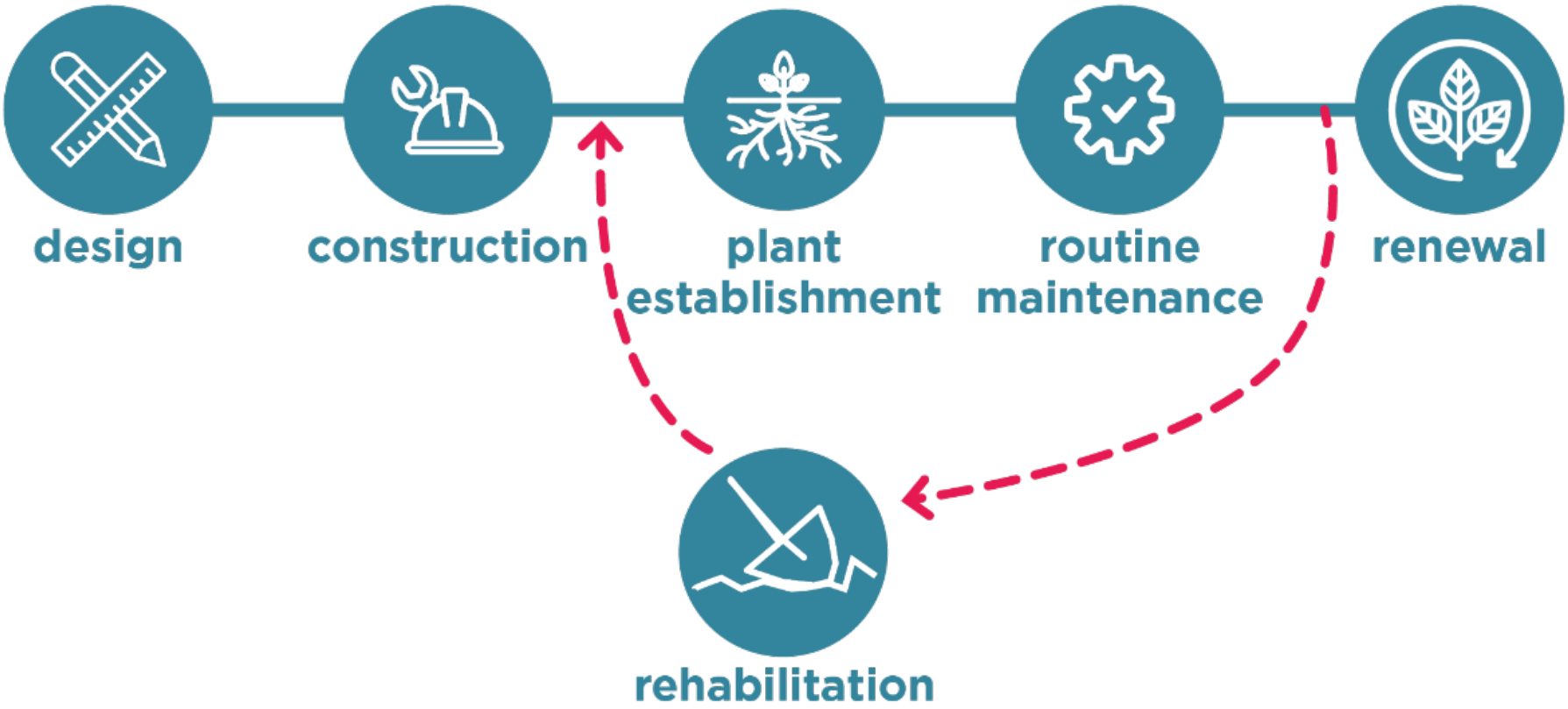
7
Streets and Public Spaces Adjacent to Schools Green Rainwater Infrastructure Retrofit Program

10
Streets and Public Spaces Adjacent to Schools GRI Retrofit Program

9
Green Rainwater Infrastructure Asset Management Program

15
Industry Capacity Building & Public Engagement

PROJECT LIFECYCLE




Efficient inlets


Bioretention
hide and
seek


With pre-installed tire plastic
Green Infrastructure Art Studios


Innovative solutions to poor road grading


Excess soil
storage

GI Bioretention Asset Background

- Many of the City's existing bioretention bulges were designed and installed prior to the formation of the GI Branch (2016) and without consistent maintenance.
- GI's Vegetated Assets assessed for level of service in 2017 & 2019; **48% are found to be under performing or Ineffective**
- Many lack infiltration function, have water by-pass and contain invasive weeds that must be managed.
- The underperforming assets require rehabilitation to bring them back provide adequate drainage and infiltration.

Design lacking in stormwater function

Short-circuiting to catch basin

Undersized inlet

Inlet clogging, requires re-design of pre-treatment

The need for ongoing maintenance

Improve water quality

Increase managed impermeable area

Reduce quantity of water entering pipe system

Climate resilience and adaptation

Other Service Outcomes

- **Upkeep to preserve drainage performance + community acceptance of condition**
- **Data and experience related to cost, levels of effort to inform future asset mgmt**
- **Ensure existing assets contribute to Rain City Strategy implementation target**

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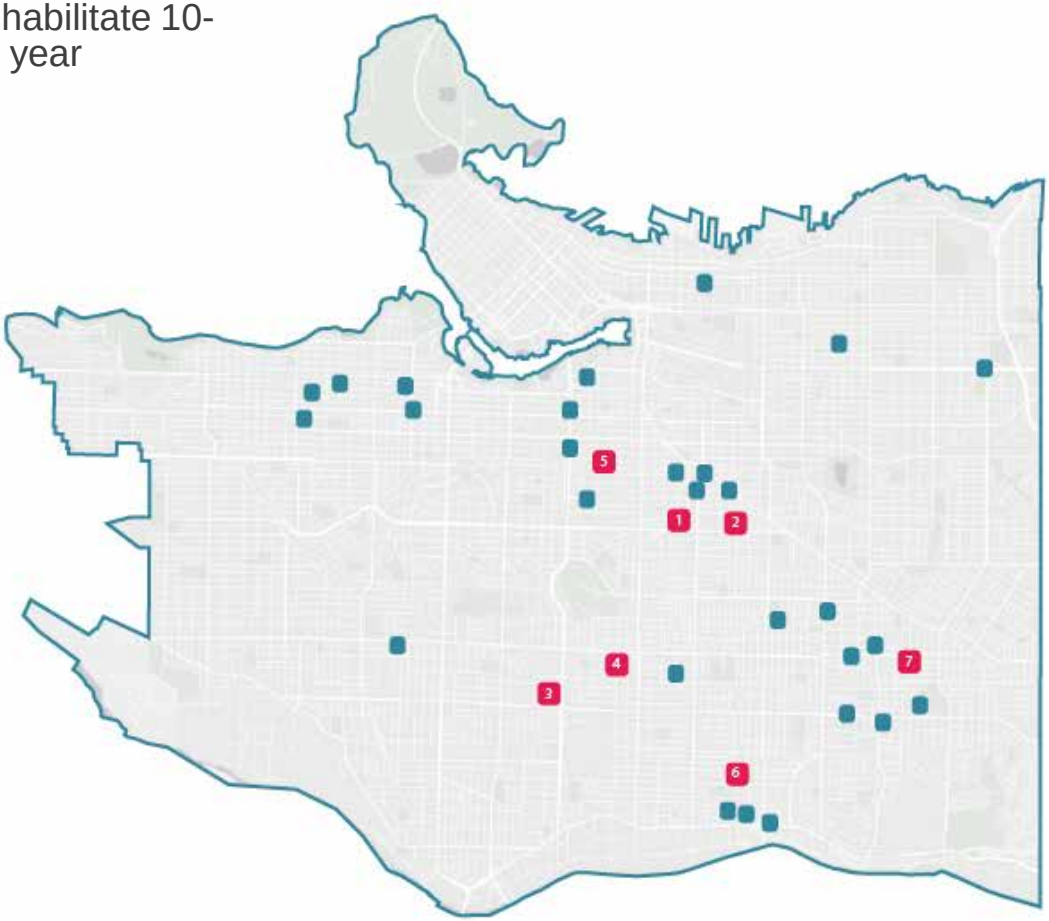
GI Bioretention Rehabilitation Program

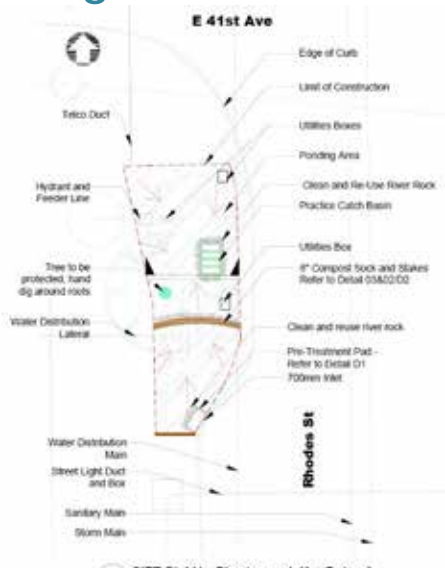
- The annual program aims to rehabilitate 10-15 underperforming assets per year

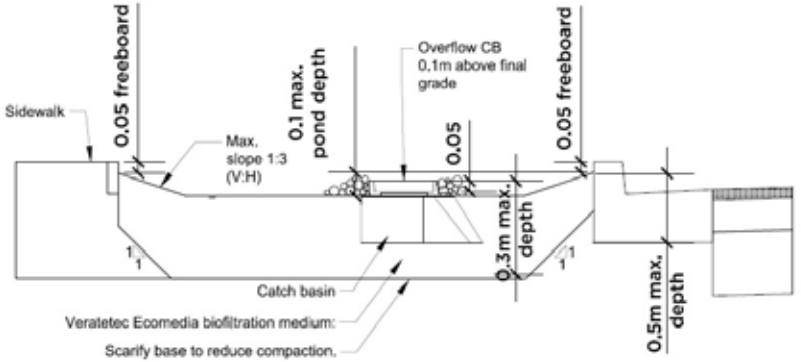


Example map of the assets requiring rehab and the 7 locations chosen for the 2021 Rehabilitation Program

GI Bioretention Rehabilitation Program

- The annual program aims to rehabilitate 10-15 underperforming assets per year;
- The assets are chosen based on performance, community need and strategic location;
- GI assets are rehabilitated using updated to current engineered design standards





PLANTING LIST				
CODE	QTY	BOTANICAL NAME	COMMON NAME	SIZE/SPECIFICATION
GRASSES				
Dc	34	Deschampsia cespitosa 'Goldtau'	Gold dew tufted hair grass	#1 pot @ 50cm o.c.
Jp	97	Juncus patens	California Gray Rush	#1 pot @ 35cm o.c.
PERENNIALS				
Cc	26	Crocosmia x crocosmiiflora 'Emily McKenzie'	Crocosmia Emily McKenzie	#1 pot @ 35cm o.c.
Lm	39	Liriope muscari	Lilyturf	#1 pot @ 35cm o.c.

BB
01
CROSS SECTION Rhodes and 41st Bulge 1
Scale: 1:20

GI Bioretention Rehabilitation Program

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- The assets are chosen based on performance, community need and strategic location;
- GRI assets are rehabilitated using updated engineered design standards and soil and plant designs that meet current standards
- Rehabilitation may involve regrading, adding soil and plants, and adding or replacing sediment pads.

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- Rehabilitation will Improve rainwater management performance, reduce maintenance needs, and improve water quality and climate resilience.

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- Rehabilitation will Improve rainwater management performance, reduce maintenance needs, and improve water quality and climate resilience.
- Rehabilitation may involve regrading, adding soil and plants, and adding or replacing sediment pads.
- The work is procured externally and includes two years of establishment maintenance including plant warranty.

2021 BIORETENTION REHABILITATION PROGRAM

2021 Before and After Example Locations

Manitoba & W 16th Ave

Simon Fraser Elementary School

Ross Rd &
E 59th Ave

Ross Park

Ross Rd &
E 57th Ave

Ontario & W 42nd Ave

Sir William Van Horne School

Public Engagement and Outreach

- Many Bioretention Sites from the rehab program were adjacent to schools

- Circulated an information sheet of the project and way to engage
- One School was keen on being involved
- Sir Charles Tupper Secondary School
  - Installed a monitoring well
  - Applied for a grant for equipment
  - Ongoing support with Environmental Science
  - Classroom weed removal

Tupper School Greenway

Public Engagement and Outreach

- Invasive Species Removal and Volunteers

- Petasite (Butterbur) at Sir Charles Tupper School
  - Not all was removed due to tree roots and utility conflicts
  - On top of monthly contractor maintenance visits, volunteers help manage

Public Engagement and Outreach

- Adjacent homeowners having concerns over bio retention flooding their basements
  - Engineered studies
  - Geotechnical investigation
  - Proper messaging

- Volunteers that Sponsor the Gardens
  - Give lots of notice
  - Allow for involvement and review

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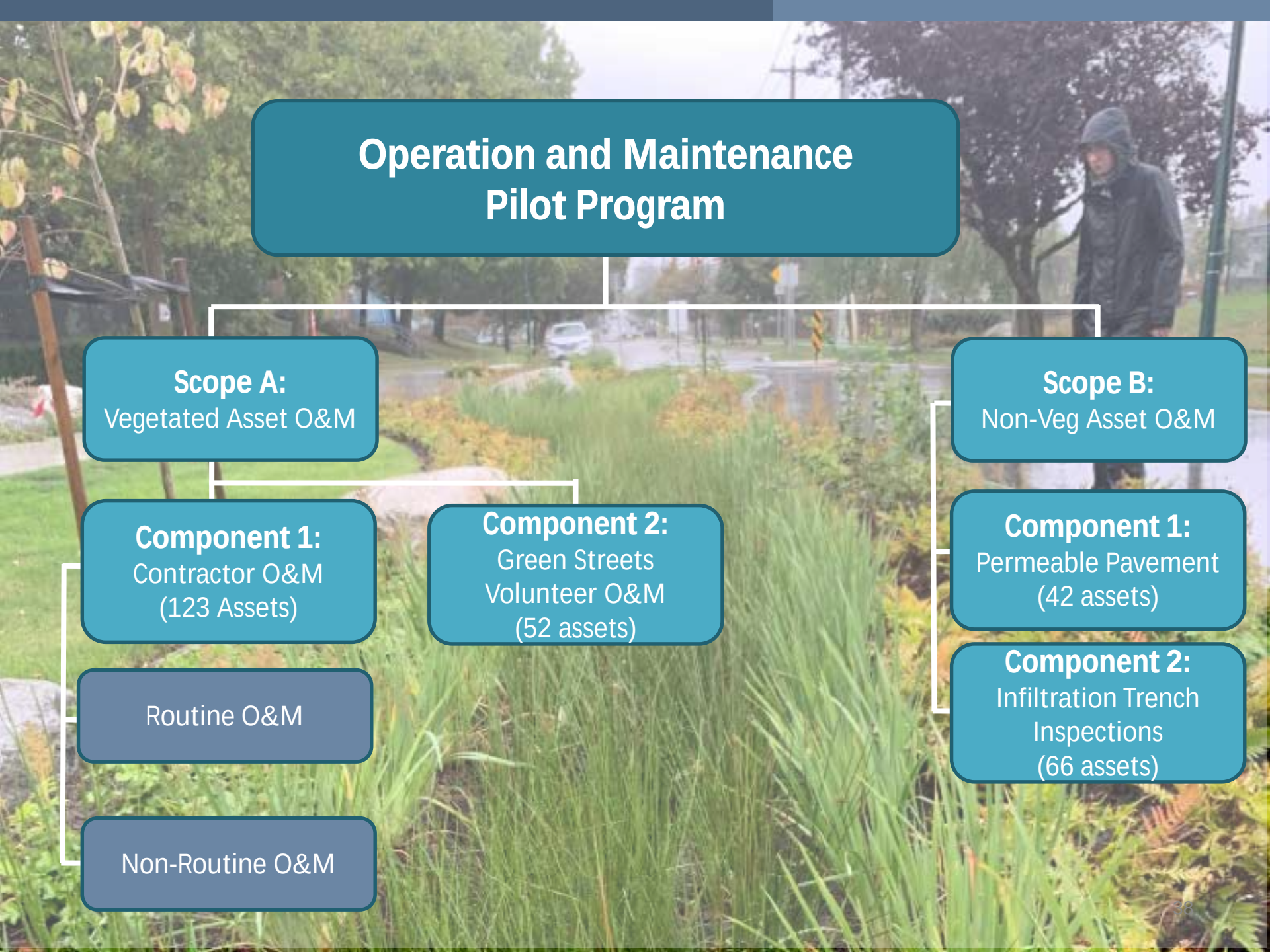
Bioretention Maintenance Triage

Water function first

Ecological benefits

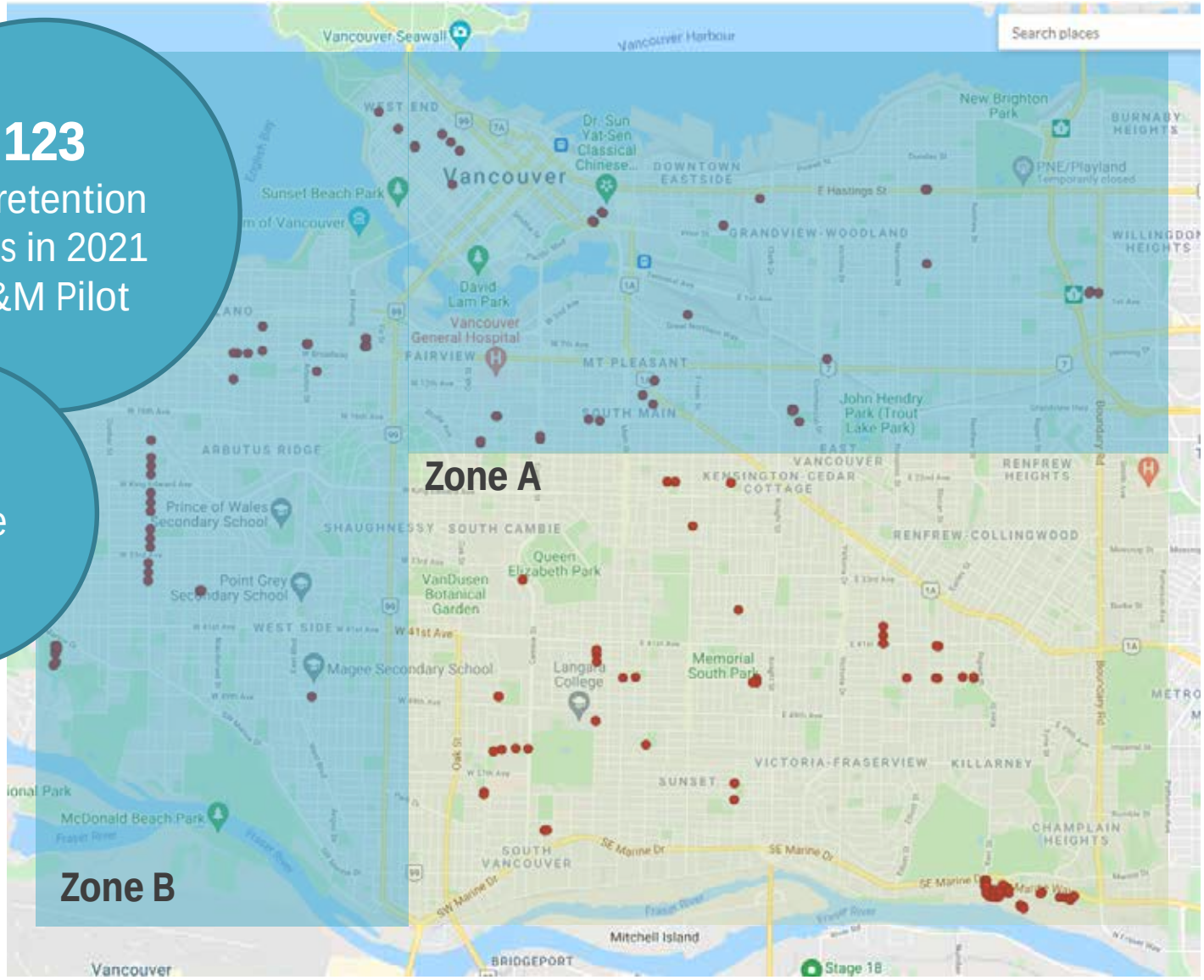
Aesthetics and Livability


Operation and Maintenance Pilot Program
Scope A: Vegetated Asset O&M
Component 1: Contractor O&M (123 Assets)
Routine O&M
Non-Routine O&M
Component 2: Green Streets Volunteer O&M (52 assets)
Scope B: Non-Veg Asset O&M
Component 1: Permeable Pavement (42 assets)
Component 2: Infiltration Trench Inspections (66 assets)

Vegetated O&M Pilot Program Overview

123
Bioretention Sites in 2021 O&M Pilot

2-3
Routine visits



Building Industry Capacity – Guidance Materials and Training

1. GRI 101
2. Types and components of bioretention
3. Routine and non-routine maintenance
4. Common maintenance issues
5. Materials matter
6. Sites with special considerations
7. Communication
8. Site visit

Inlet types

An opening that allows water to enter into the bioretention facility.

Image Source: City of Vancouver

COMMON MAINTENANCE ISSUES

EROSION

Erosion

- Occurs regularly at all bioretention sites, typically around the inlet.
- Erosion can be cause by too steep of grading, high inflow if water, lack of sediment / splash pad, or overdue maintenance.
- Erosion can prevent proper infiltration, damage planting, and create a location for debris / litter collection and build-up.

Maintenance Needed

- Re-grade to remove erosion lines / reduce slope and infill with new soil as needed
- Adjust sediment pad / river rock if available to help slow inflow of water
- If erosion is a serious concern, recommend sediment pad or river rock on site

PILOT PROGRAM HIGHLIGHTS

480

Routine Maintenance visits in 2021

- Sediment removal
- Vegetation maintenance
- Cleared inlets
- Inspection

94

Non-routine maintenance visits to improve condition

- Inlet improvements
- Mulching and river rock
- Planting
- Invasive species management

The grey area of non-routine maintenance

Routine Maintenance

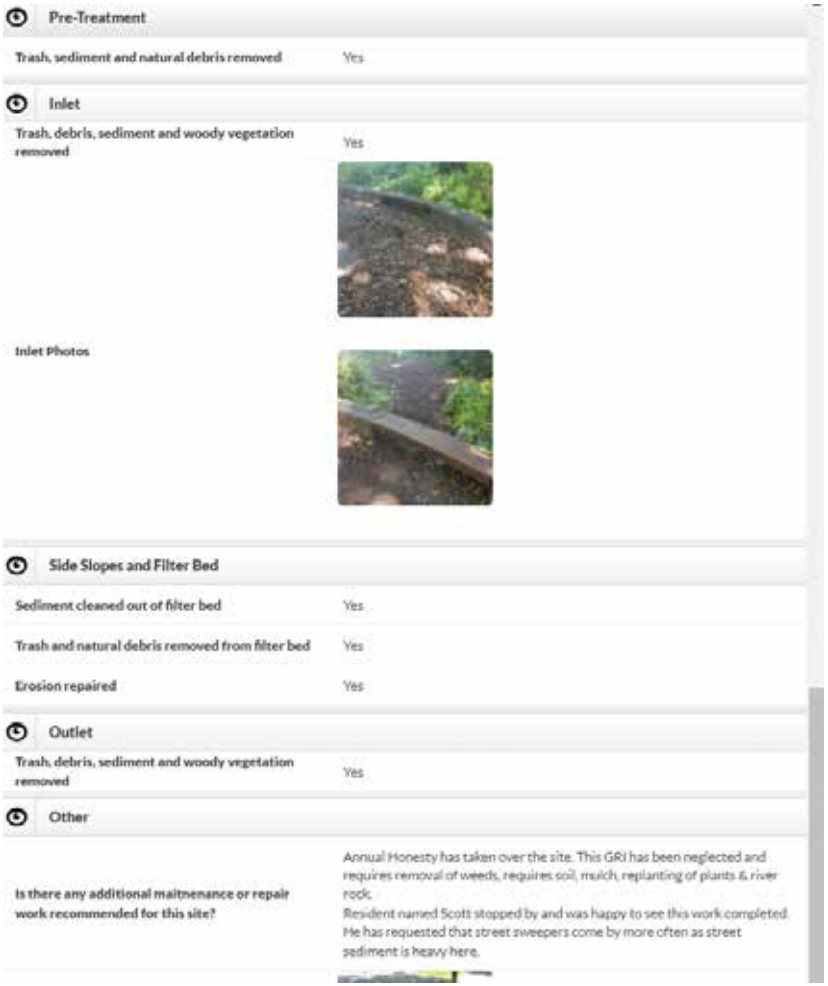
Non-Routine Maintenance


BEFORE
AFTER


BEFORE


AFTER

Contractor Accountability and Verification



Pre-Treatment

Trash, sediment and natural debris removed	Yes

Inlet

Trash, debris, sediment and woody vegetation removed	Yes
Inlet Photos	

Side Slopes and Filter Bed

Sediment cleaned out of filter bed	Yes
Trash and natural debris removed from filter bed	Yes
Erosion repaired	Yes

Outlet

Trash, debris, sediment and woody vegetation removed	Yes

Other

Is there any additional maitnenance or repair work recommended for this site?	Annual Honesty has taken over the site. This GRI has been neglected and requires removal of weeds, requires soil, mulch, replanting of plants & river rock. Resident named Scott stopped by and was happy to see this work completed. He has requested that street sweepers come by more often as street sediment is heavy here.

2021 Form

Inspection

Site photos

2022 Form

INSPECTION DATA COLLECTION

Informing asset management

$7.40
per sq. m
maintained

4 Min.
per sq. m
maintained

24%
Of sites in poor/very poor condition

42
Sites had additional maintenance needs or concerns

GREEN STREETS SPONSORED BIORETENTION

56 Eligible Sites

39 Currently Sponsored

Volunteer Resources and Appreciation

- Updates to Bioretention garden pamphlet
- Sunset park tour and plant giveaway

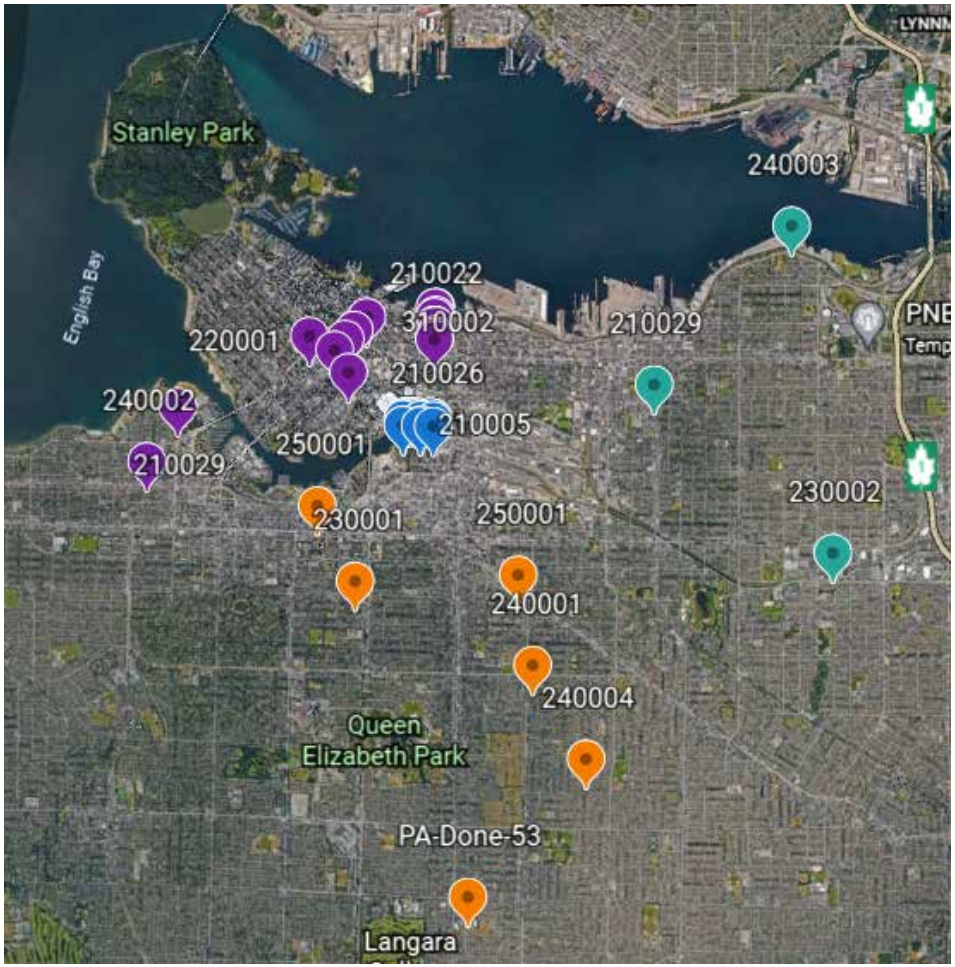
VOLUNTEER CHALLENGES AND OPPORTUNITIES

- Changing Volunteers
- Communicating with volunteers
- Various levels of care
- Understanding of bioretention

- Additional maintenance
- Sense of ownership and pride
- Education and training
- Community beautification

PERMEABLE PAVEMENT O&M

PERMEABLE PAVEMENT PRORGRAM BACKGROUND



PERMEABLE PAVEMENT PILOT OVERVIEW

11 Site Pilot

↓

Expanded to Olympic Village

↓

2nd Fall Routine Maintenance

Site	Pre-maintenance Infiltration	Post maintenance Infiltration
Nelson Street	> 100 mm/hr	1000 mm/hr
Expo Street	> 100 mm/hr	1200 mm/hr
Commercial Drive	> 100 mm/hr	120 mm/hr
Richards Street	> 100 mm/hr	1000-1200 mm/hr
Olympic Village	> 100 mm/hr	1200 mm/hr

Nelson between Cambie and Beatie

PERMEABLE PAVEMENT MAINTENANCE

1. Test infiltration

2. Clean pavement

3. Refill joint material

4. Retest infiltration

WORKFORCE DEVELOPMENT AND SOCIAL PROCUREMENT

"Having a job helps me keep a schedule and gives me something to wake up to," he said. "The supports Coast offers are important. I am employed in a positive environment, which helps me maintain my goals financially. It also helps me maintain a positive state of mind."

Fong tests the new power washer pressure tools with Lorcan Russell, the employment specialist at Coast Mental Health.

Members of Coast Mental Health's Street Clean Team

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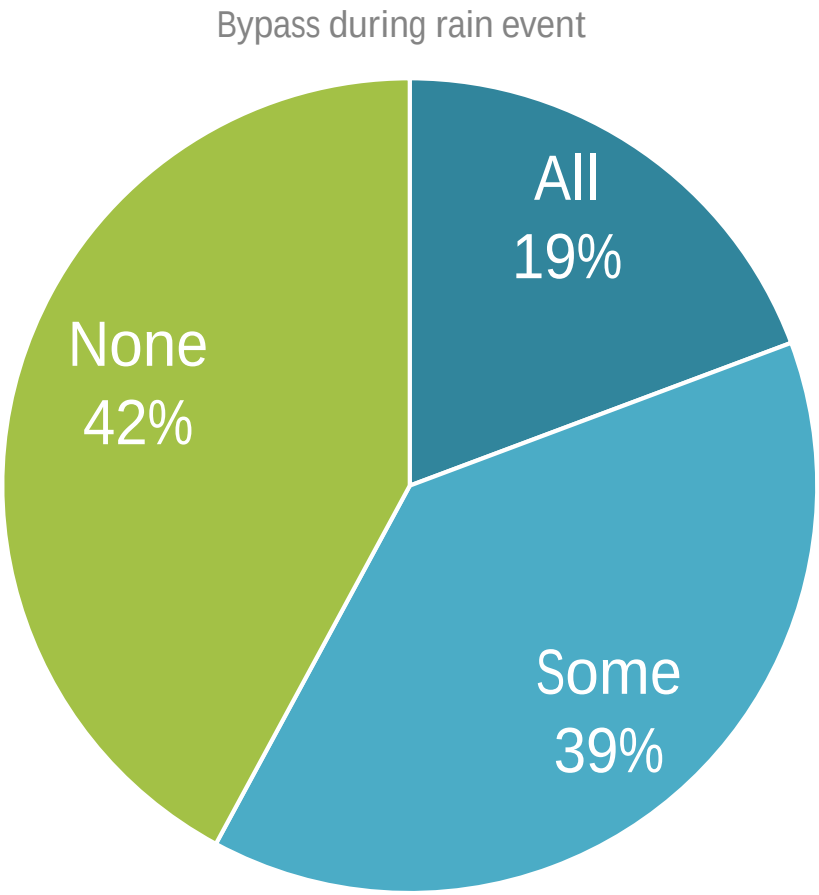
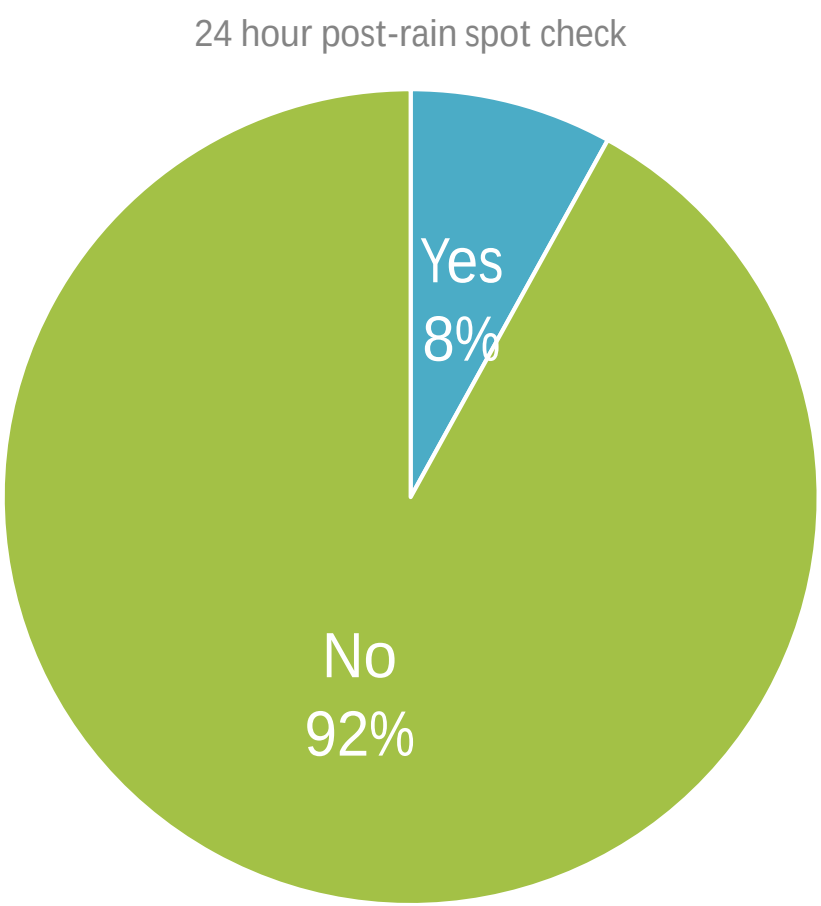
WET WEATHER INSPECTIONS





ADAPTIVE PROGRAM MANAGEMENT

1. Increase frequency of visits
2. Prioritize fall/winter maintenance
3. Reactive inlet maintenance for high intensity storms

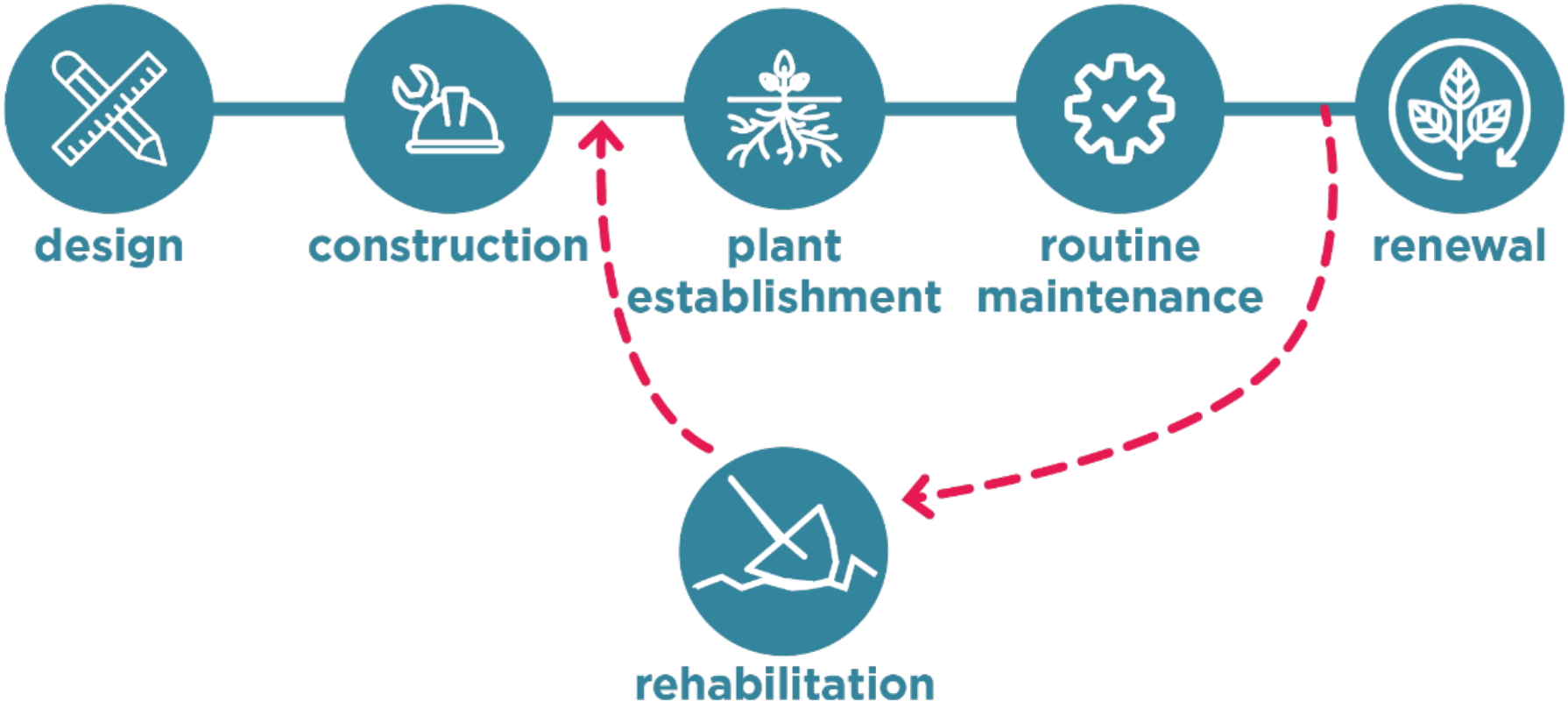
BIORETENTION CONDITION ASSESSMENTS

Improve and protect Vancouver's water quality

Increase Vancouver's resilience through sustainable water management

Enhance Vancouver's livability by improving natural and urban ecosystems

IMPROVING THE CYCLE



Have a Ha-Bee Day!

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