POCKETS OF RESILIENCE:
SMALL-SCALE CITIZEN DRIVEN LID PERFORMANCE
IN THE URBAN LANDSCAPE

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in partnership with
Green Venture Hamilton
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ACKNOWLEDGEMENTS

A special thanks to Liz Enriquez and Jessica Gale, who provided the impetus for this research. We have worked together on nine projects in the past five years, depaving, installing rain gardens and planting up 1187 m^2 of both public and private space. Each one of these projects has been informed, planted and maintained by community members. The latest of these projects, Laidlaw Memorial Church at 155 Ottawa Street N in Hamilton Ontario is the subject of this study.

A thank you to Ginkgo Sustainability for providing the technical equipment to measure changes in soil temperature, humidity and moisture.

To the congregation of Laidlaw Memorial United Church, a special debt of gratitude for your generosity and kindness. The Reverend Douglas Moore provided boundless enthusiasm for the project, keeping a watchful eye on the gardens and providing a warm welcome to all members of the surrounding community. And a special thanks to James for watering the plants through the hot, dry summer days of 2025.

All of the above are grateful to the Landscape Architecture Canada Foundation for supporting this project.

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ABSTRACT

Opportunities for creating green space, particularly spaces with potential to contribute meaningfully to the ecological health of the community, can be challenging in the urban landscape. Through the leadership of Green Venture, nine small urban sites in the industrial sector of Hamilton, Ontario have been transformed through the use of rain gardens, native plantings and permeable paving. (Figure 1) The property at 155 Ottawa Street N (Laidlaw Memorial United Church), a location central to many community activities, presented an opportunity to install multiple Low Impat Development (LID) strategies within a small site. Each one of the practices: rain gardens, rain barrels, permeable pavement, extensive native plantings, was installed at low cost with minimal site disturbance. This study aims to evaluate the effectiveness of these installations in their second season.

Onsite observations and photo documentation were employed to gauge factors of stormwater management and plant health. A relatively new technology was used to measure soil conditions. During the Living Cities Conference in 2024, Green venture staff and Gingko Sustainability began a conversation about a new product, SoilLiNQ™, and how it is used to provide live updates of soil conditions for green roofs and other agricultural businesses. Green Venture posed the idea of using these sensors for data collection on rain gardens, comparing soil conditions to that of gardens without bioretention by measuring factors of humidity, soil temperature and soil moisture. This data may aid in determining the overall efficacy of rain gardens and inform how rain gardens could increase overall soil health.

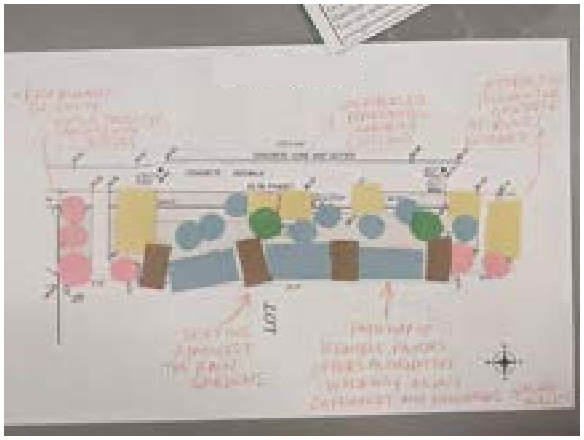
Figure 1 Nine small scale LID installations within a span of 3.6 km

PROJECT DETAILS

The site of Laidlaw Memorial United Church at 155 Ottawa N provided an opportunity to engage with a community already attuned to reducing its environmental impact. Out of the necessity to reduce costs attendent on an ageing building, congregants have worked together to maintain facilities and reduce energy costs. A grant for solar panels provided the means for a new roof. Disconnecting six downspouts from the city sewers helped to reduce flooding around the building. (*Figure 2*).

Figure 2 Stormwater discharge

As a first step, a design charrette was scheduled for March 28, 2024. More than 30 members of the congregation and surrounding community took part. A concept plan had been prepared in advance, but participants were encouraged to make modifications both to layout and plantings. (*Images 1,2.)*



Images 1, 2 Community Design Charrette

From the accumulated input, a final design was prepared by the landscape architect.

Four distinct areas were demarcated in the landscape, each aiding in stormwater management:

- Site1 south of the building incorporating rain barrel, permeable paving and plantings
- Site 2 south of the building replacing asphalt with a rain garden
- Site 3 south of the building replacing asphalt with primarily native plantings
- Site 4 north of the building along Cannon Street, replacing turf with plantings and slowing the exit of stormwater water from downspouts
- Site 5 west of the building. Strip of waste land in alley planted with native grasses and perennials.

Images of ‘Existing’ conditions and ‘New Installation’ conditions on planting day are shown on pages 5-13.

Preliminary work; removing asphalt, adding soil and compost, was performed by a local landscape company one week before scheduled planting. Due to lack of secure storage facilities, all plant material was delivered early on planting day, June 22, 2024, and laid out on site before volunteer planters arrived. Being relatively late in the spring planting season, a number of substitutions were made for native plant materials, and some plant material was not sent as no appropriate alternates were found. As a result many last minute modifications were made to the plant layout, however all plants were installed within a few hours by a team of 73 volunteers. These included community members, a team from a local steel company, volunteers with Green Communities Canada and local landscapers. Plants were well watered in, and due to good amount of precipitation through July and August 2024, most survived the season.

Volunteers from church and community performed maintenance, keeping weed growth in check. One challenge with native plantings; most people do not recognize the various species and some are mistakenly removed. Unfortunately, some native plants added to the sites were lost due to this challenge.

On April 25, 2025 a Spring Celebration was co-hosted by a Laidlaw neighbour, Hamilton Regional Indian Centre. Gail Whitlow and Michele Dent led the participants through a tobacco offering to the gardens while sharing their knowledge and perspectives on environmental stewardship and the significance of water. After a short break featuring local indigenous dishes, participants toured the gardens, learning about the rain garden, permeable paving, rain barrels and native plants.

Image 3 Spring Celebration

Image 4 Spring Celebration

Image 5 Spring Celebration Pathway Garden

Image 6 Spring Celebration Rain Barrel overflow

Site 1: Pathway Garden 105m^2

a) Existing conditions:

- Full sun
- Concrete pathway of 45cm square patio stones
- Existing turf
- Mature *Acer platanoides*
- Two downspouts (#7&#8) connected to storm sewers
- One downspout (#6) draining to turf
- Native soil texture is sandy loam (62% sand, 26% silt, 13% clay)
- Steps up to accessibility ramp
- No ground level walkway from street into building

Image 7 Fence at entrance, Mature Acer platanoides

Image 8 Existing walkway and turf

b) New Installation:

- Turf and small area of asphalt ($6m^2$) replaced by new plant beds; high percentage of native plants used.
- Small concrete pathway removed and replaced with permeable walkway. Walkway is composed of limestone screenings sealed with a binder which allows water to flow through.
- Downspout #5 disconnected and connected to the Rain Grid Cistern with a 500 litre (132gal) capacity
- Rain barrel overflow is directed into new plant bed.
- Chain link fences removed
- Steps to accessibility ramp removed
- Native soil texture is sandy loam (62% sand, 26% silt, 13% clay) with good permeability. It was amended with top dressing of compost to replace organic matter lost through removal of turf.

Image 9 Permeable walkway, new plantings

Image 10 Multi-generational planting crews

Image 11 Permeable walkway
Downspout not yet connected to rain barrel

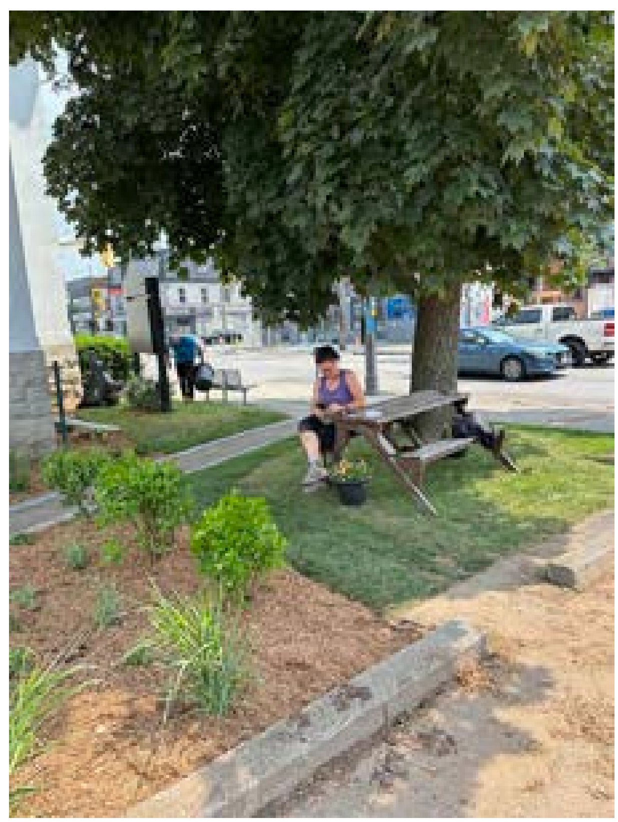


Image 12 Fence removed, Acer platanoides provides deep shade

Site 2: Rain Garden 22.6m²

a) Existing conditions
- Existing asphalt
- Concrete shed on asphalt
- Downspout draining to parking lot and adjoining alley
- Low to no permeability

Image 13 Existing location of shed on asphalt

Image 14 Downspout draining to asphalt

Image 15 Asphalt along building facade

b) New Installation:

- Concrete shed was relocated to Site 4
- 22.6m^2 of asphalt and all associated granular material was removed to a depth of approximately 60cm
- The excavation was filled with triple mix consisting of equal parts top soil, loam and compost sourced from a local soil supply company
- No further excavation was required for the rain garden, however the surface was graded from edge of asphalt to centre of bed allowing for 150mm of ponding
- Downspout was redirected to the centre of the bed, with rainwater exiting onto a boulder before entering the soil
- Plantings consist of native species and some cultivars of native species, all tolerant of occasional flooding

Image 16 Rain garden installed, downspout not yet redirected

Site 3: Shade Garden 13.3m^2

a) Existing conditions

- Partial shade(6-8 hours)
- Asphalt surface
- Shaded to the south by mature evergreens

Image 17 Existing asphalt surface

b) New Installation:

- Concrete shed was relocated along back fence line
- 13.3m^2 of asphalt and all associated granular material removed to a depth of approximately 60cm
- The excavation was filled with triple mix consisting of equal parts top soil, loam and compost sourced from a local soil supply company
- No downspout leads into the garden bed
- There is some runoff from the parking lot
- Plantings consist primarily of native species

Image 18 Relocated shed

Image 19 Native tree, small evergreens, perennials, ferns and groundcover

Site 4: Woodland Garden 172.5m^2

a) Existing conditions:

- Partial to full shade
- Turf grass in poor to fair condition
- Three disconnected downspouts draining on to turf
- Hamilton Street Railway bus stop and shelter
- Mature *Gleditsia triacanthos* var. *inermis*

Image 20 Three disconnected downspouts draining to turf

b) New installation:

- Replaced 73.4m^2 of turf with plant beds
- Turf was removed and the soil modified with 100mm top dressing of compost
- Granular material was installed at mouths of downspouts to slow flow of water
- Native and non-native plantings were installed to infiltrate stormwater, provide pollinator habitat and create four seasons of beauty.
- Seating boulders were added to plant beds to create a shaded resting place by the bus stop.

Image 21 New plantings, water slowed at downspout termination

Site 5: Alley Garden 13.3m²

a) Existing conditions
- Partial shade (4 hrs.)
- Mixture of soil and gravel

Image 22 Alley concept plan

b) New Installation
- No soil remediation.
- Plants have been chosen to thrive in existing conditions (Rainer& West 2015) (Beck 2013)
- Intensive planting of native plant plugs

PLANT LIST
20 *Agastache foeniculum* PL50
15 *Allium cernuum* PL32
25 *Aster laevis* PL50
25 *Aster novae-angliae* PL50
40 *Coreopsis lanceolata* PL50
25 *Echinacea purpurea* PL50
40 *Carex pensylvanica*
15 *Panicum virgatum* 1gal
10 *Sporobolus heterolepis* 1gal

Image 23 Planting Day May 11, 2024

Image 24 August 13, 2025

Image 25 October 2, 2025

METHODOLOGY

1. Soil monitering Ginkgo SoiLiNQ™

Three sensors and a gateway (a router used to connect to Ginkgo Sustainability servers) were used for this part of the project. The gateway was located inside the building, roughly 15-20m from the sensors. The sensors were located in three distinct locations (*Figure 3*) in the gardens:

- Site 1 - full sun between shrubs, adjacent to a downspout outlet that often overflows onto the permeable pathway
- Site 2 - full sun in the outer edge of the rain garden depression, near native grasses
- Site 3 - partial shade under a shrub with no excess water directed into the garden

The sensors were all set up under plants to ensure minimal disturbance to the sensors over the data collection period. The sensors were placed July 10, 2025 and collected data until October 27, 2025. Data was collected in 6 hour intervals where the sensors would capture the temperature, moisture levels, soil resistance, soil capacitance, ambient temperature around the sensor box, soil humidity and ambient air humidity.

The sensors consisted of a probe attached to a box that contained the hardware for the equipment (*Image 26*). The sensor tongs were roughly 4 inches in length and were completely inserted into the soil and covered. We experienced one of the sensors (shade garden) dislodge from its original spot once but otherwise the sensors remained untouched for the duration of the data collection period.

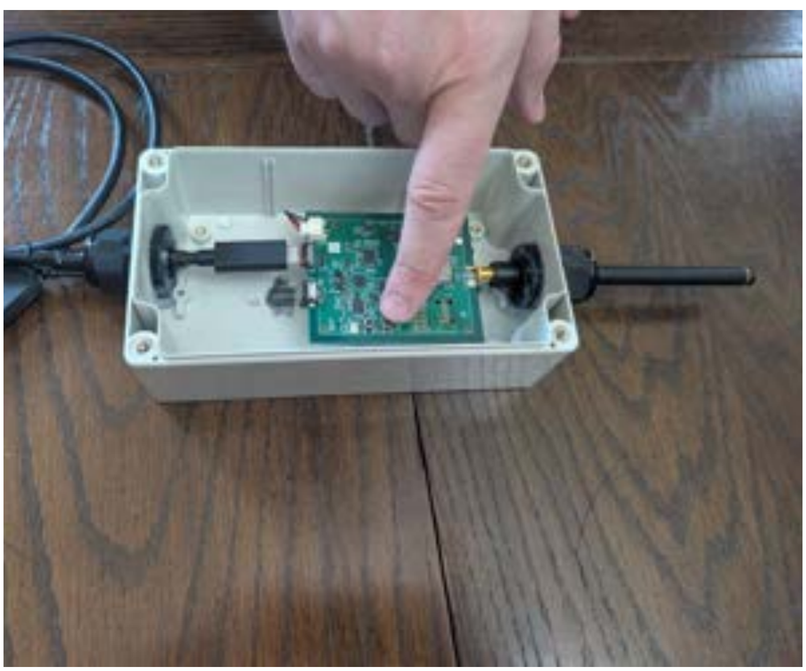
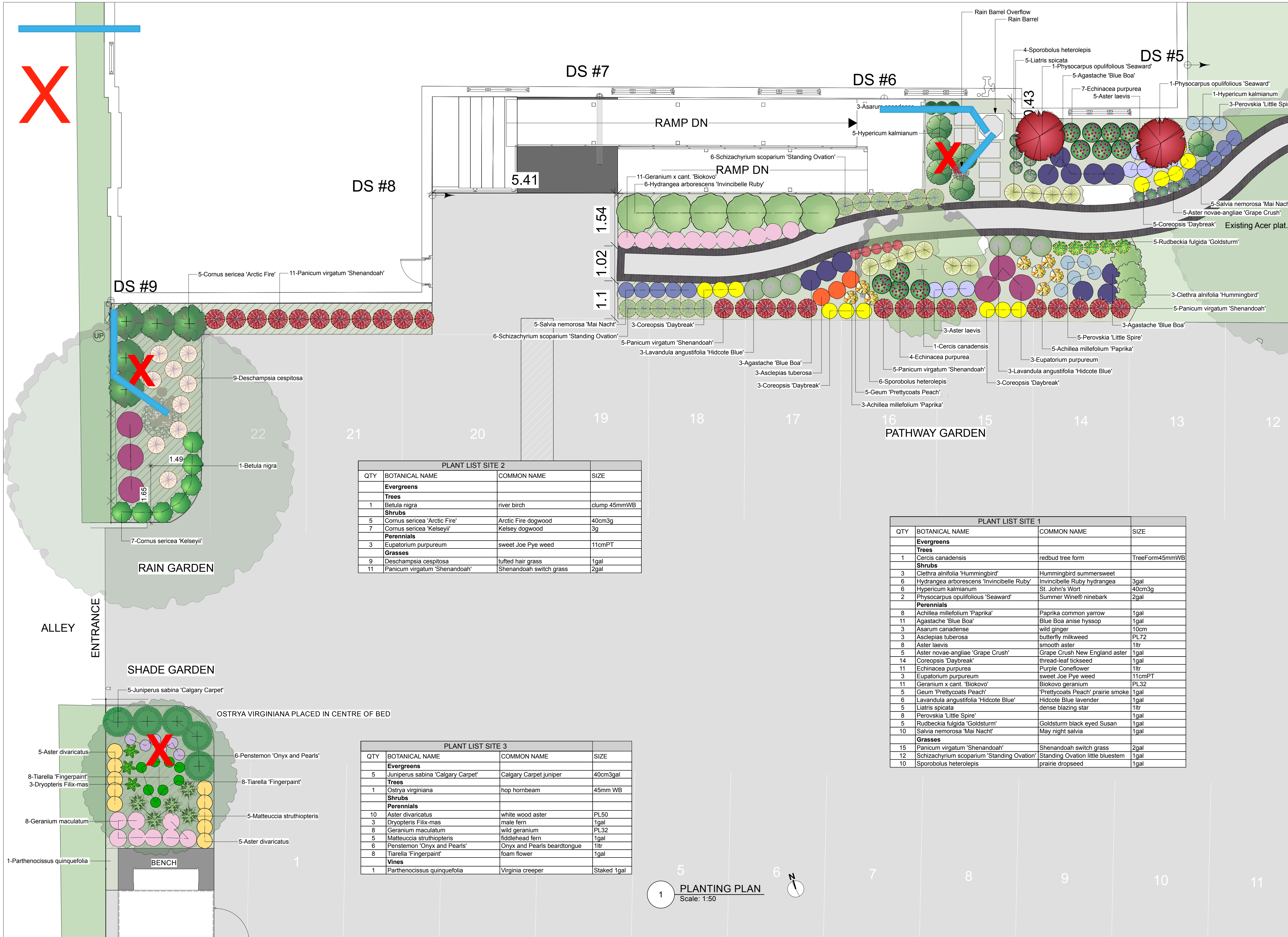


Image 26 SoiLiNQ™ sensors

Redirected downspout

SoiLiNQ™ Sensor



PLANT LIST SITE 2			
QTY	BOTANICAL NAME	COMMON NAME	SIZE
	Evergreens		
	Trees		
1	Betula nigra	river birch	clump 45mmWB
	Shrubs		
5	Cornus sericea 'Arctic Fire'	Arctic Fire dogwood	40cm3g
7	Cornus sericea 'Kelseyii'	Kelsey dogwood	3g
	Perennials		
3	Eupatorium purpureum	sweet Joe Pye weed	11cmPT
	Grasses		
9	Deschampsia cespitosa	tufted hair grass	1gal
11	Panicum virgatum 'Shenandoah'	Shenandoah switch grass	2gal

PLANT LIST SITE 1			
QTY	BOTANICAL NAME	COMMON NAME	SIZE
	Evergreens		
	Trees		
1	Cercis canadensis	redbud tree form	TreeForm45mmWB
	Shrubs		
3	Clethra alnifolia 'Hummingbird'	Hummingbird summersweet	
6	Hydrangea arborescens 'Invincibelle Ruby'	Invincibelle Ruby hydrangea	3gal
6	Hypericum kalmianum	St. John's Wort	40cm3g
2	Physocarpus opulifolious 'Seaward'	Summer Wine® ninebark	2gal
	Perennials		
8	Achillea millefolium 'Paprika'	Paprika common yarrow	1gal
11	Agastache 'Blue Boa'	Blue Boa anise hyssop	1gal
3	Asarum canadense	wild ginger	10cm
3	Asclepias tuberosa	butterfly milkweed	PL72
8	Aster laevis	smooth aster	1ltr
5	Aster novae-angliae 'Grape Crush'	Grape Crush New England aster	1gal
14	Coreopsis 'Daybreak'	thread-leaf tickseed	1gal
11	Echinacea purpurea	Purple Coneflower	1ltr
3	Eupatorium purpureum	sweet Joe Pye weed	11cmPT
11	Geranium x cant. 'Biokovo'	Biokovo geranium	PL32
5	Geum 'Prettycoats Peach'	'Prettycoats Peach' prairie smoke	1gal
6	Lavandula angustifolia 'Hidcote Blue'	Hidcote Blue lavender	1gal
5	Liatris spicata	dense blazing star	1ltr
8	Perovskia 'Little Spire'		1gal
5	Rudbeckia fulgida 'Goldsturm'	Goldsturm black eyed Susan	1gal
10	Salvia nemorosa 'Mai Nacht'	May night salvia	1gal
	Grasses		
15	Panicum virgatum 'Shenandoah'	Shenandoah switch grass	2gal
12	Schizachyrium scoparium 'Standing Ovation'	Standing Ovation little bluestem	1gal
10	Sporobolus heterolepis	prairie dropseed	1gal

PLANT LIST SITE 3			
QTY	BOTANICAL NAME	COMMON NAME	SIZE
	Evergreens		
5	Juniperus sabina 'Calgary Carpet'	Calgary Carpet juniper	40cm3gal
	Trees		
1	Ostrya virginiana	hop hornbeam	45mm WB
	Shrubs		
	Perennials		
10	Aster divaricatus	white wood aster	PL50
3	Dryopteris Filix-mas	male fern	1gal
8	Geranium maculatum	wild geranium	PL32
5	Matteuccia struthiopteris	fiddlehead fern	1gal
6	Penstemon 'Onyx and Pearls'	Onyx and Pearls beardtongue	1ltr
8	Tiarella 'Fingerpaint'	foam flower	1gal
	Vines		
1	Parthenocissus quinquefolia	Virginia creeper	Staked 1gal

Figure 3 Layout

2. Stormwater Infiltration:

In an effort to provide as much infiltration on site as possible, surfaces not required for another specific function were remediated to increase permeability. Out of a total site area of 1700m^2, 213.4m^2 were converted from turf or asphalt into plant beds (191.3m^2) or permeable paving (22.1m^2).

Site 1 Rain barrel capacity was sized at 500 litres. Overflow was directed into the surrounding planting bed.

Site 2 Rain garden was oversized to exceed runoff requirements from the downspout, draining 70m^2 of roof area in a garden area of 22.6m^2. The receiving area is 32% of the contributing area. (STEP n.d. Bioretention) No underdrain was used.

Stormware infiltration was monitered visually through two methods:

- daily assessment on site by church staff
- live feed from security cameras placed around the perimeter of the building

3. Soil Health:

Soil samples were obtained on April 27, 2025 and December 16, 2025 from two locations on site:

- Site 4 undisturbed turf
- Site 2 Rain Garden

Samples were sent to A & L Laboritories in London, Ontario to determine changes over the growing season in soil nutrients, organic matter and fertility.

4. Plant Health:

Visual assessment of plant health was conducted on a bi-monthly basis, with photo documentation for the purposes of this study on May 26, August 13 and October 2, 2025
Plant vigour was graded as:

Good:

- Increase in height and spread since initial planting in June 2024
- Active growth throughout the 2025 season
- Good flowering and seed set as applicable to species
- Healthy foliage throughout growing season

Fair:

- Growth variable throughout the season.
- Evidence of disease (mildew, leaf spot, die back)
- Set backs due to lack of water and/or proximity to established trees

Poor:

- Severely compromised growth.
- No evidence of new roots or shoots,
- Small or non-existent flowers or seeds
- Dead

Plant health for the purposes of this study is documented for those gardens monitered with SoiLiNQ™ sensors; Sites 1-3 comprising Pathway Garden, Rain Garden, Shade Garden.

OBSERVATIONS AND RESULTS

1. Soil Monitor SoiLiNQ™ Data Analysis

Data collected from the three sensors was collected and collated. A comparison of soil moisture, soil temperature and soil humidity was graphed out in the following figures.
Additional information as to surrounding atmospheric conditions is added for context.

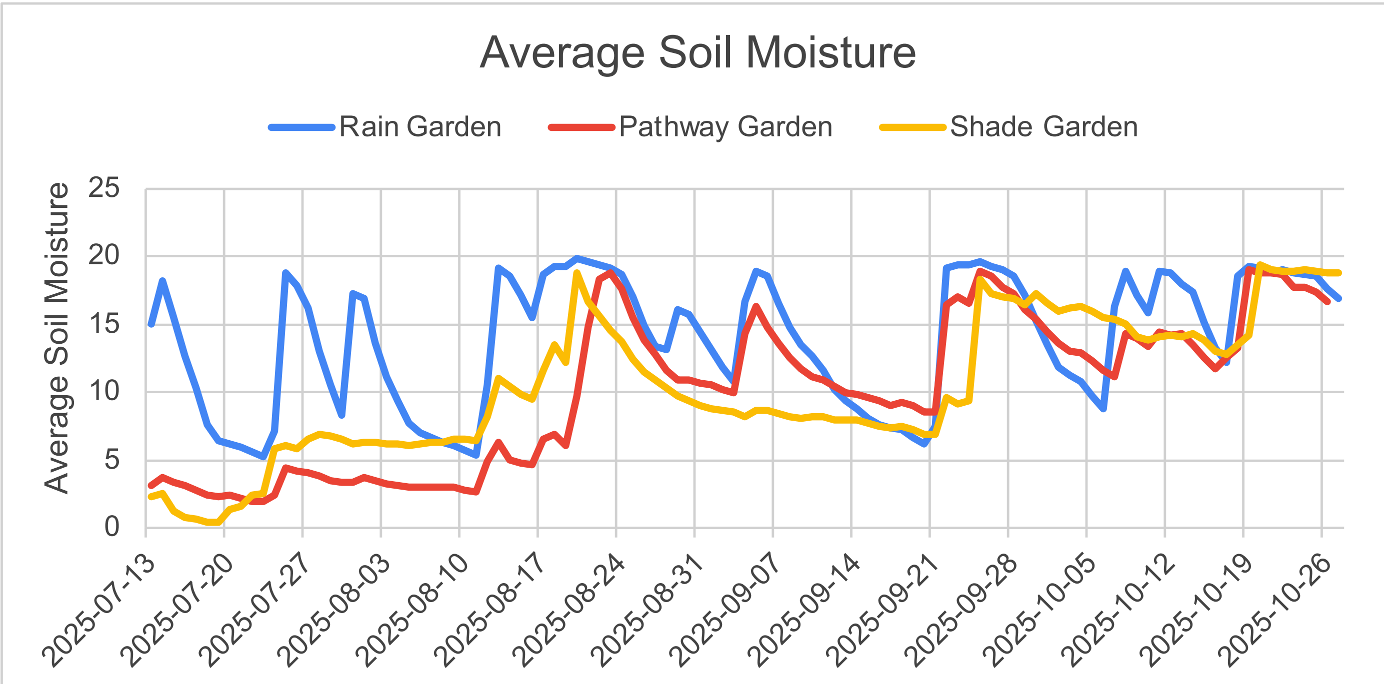


Figure 4 Average Soil Moisture Comparison

Hamilton Monthly Precipitation 2025:

July	36.9 mm
August	39.7 mm
September	56 mm
October	61.6 mm

FINDINGS:
The Rain Garden's design effectively retains water at a high level following precipitation events, quickly dropping to low levels during dry periods. This finding correlates with that of other research in Ontario, most recently from a Credit Valley Conservation project (Credit Valley 2024). Overall the soil in the Rain Garden maintains the highest level of soil moisture, providing the means to support healthy plant growth throughout a very dry summer. The Shade Garden provides fairly consistent moisture retention, while the Pathway Garden shows the lowest levels of retention during the dry periods of July and August, 2025.

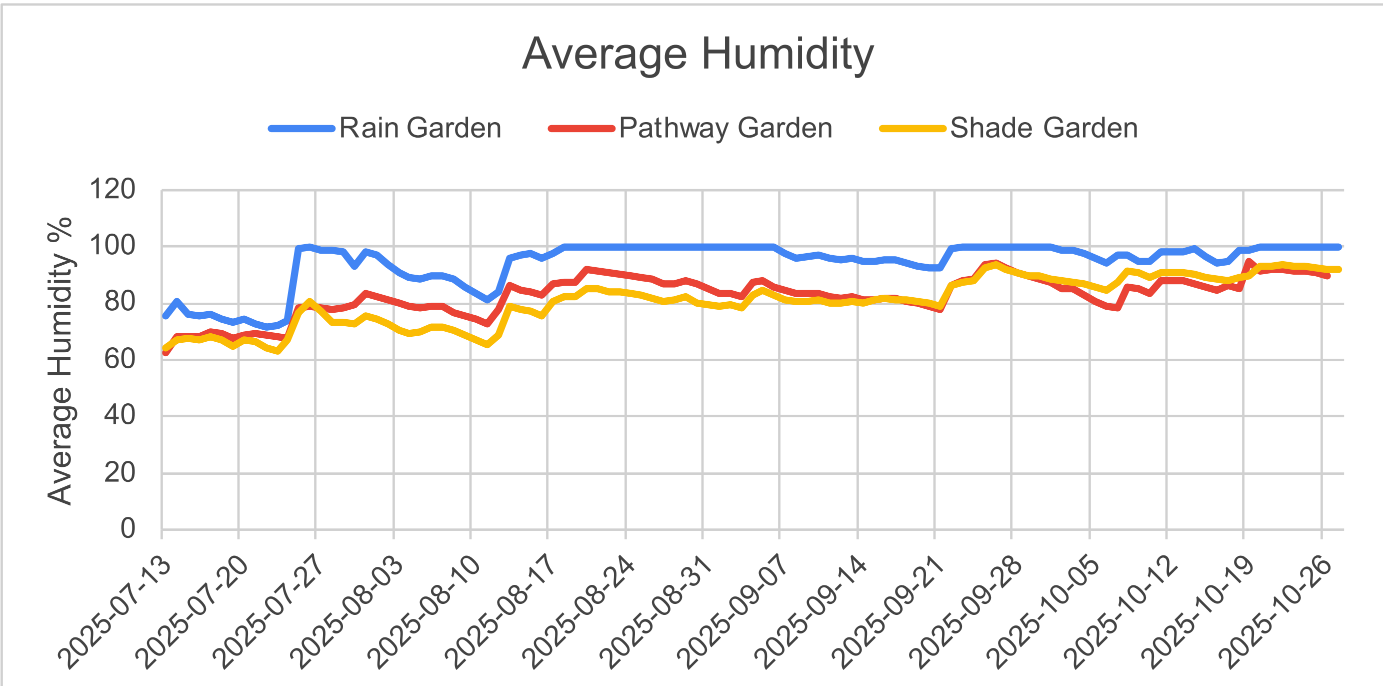


Figure 5 Average Humidity Comparison

Hamilton Ambient Relative Humidity, 2025:

July:	Max. 100%	Min. 28%	Mean 74%
August:	Max 100%	Min. 32%	Mean 74%
September:	Max. 100%	Min. 30%	Mean 73%
October:	Max. 99%	Min. 36%	Mean 75%

FINDINGS:

The Rain Garden maintained consistently higher relative humidity compared to the Shade Garden, driven by its higher soil moisture content and active evapotranspiration. While the Shade Garden benefits from canopy cover, it cannot match the humidity-generation capacity of a moisture-retentive bioretention system. This performance difference reinforces the Rain Garden’s role as a microclimate stabilizer and moisture reservoir within the site.

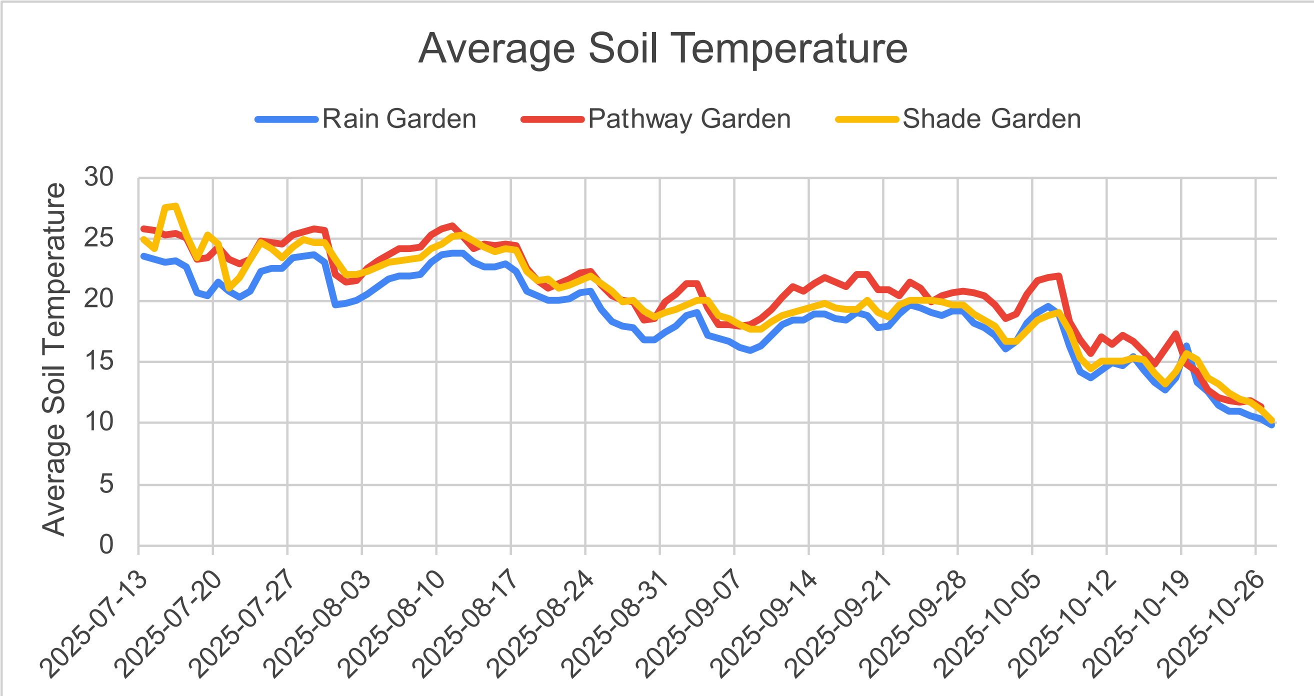


Figure 6 Average Soil Temperature Comparison

FINDINGS:
The comparative analysis shows a clear performance hierarchy across the three garden zones. The Rain Garden consistently maintained the lowest soil temperatures, reflecting higher moisture retention. The Shade Garden provided moderate cooling. The Pathway Garden generally had higher soil temperatures than the Shade Garden, being in full sun throughout daylight hours.
The high ambient temperatures combined with lower than normal precipitation raised soil temperatures particularly during July when air temperatures exceeded 30°C for 10 days. This created challenging conditions for plants with relatively shallow roots *(see Image 37).*

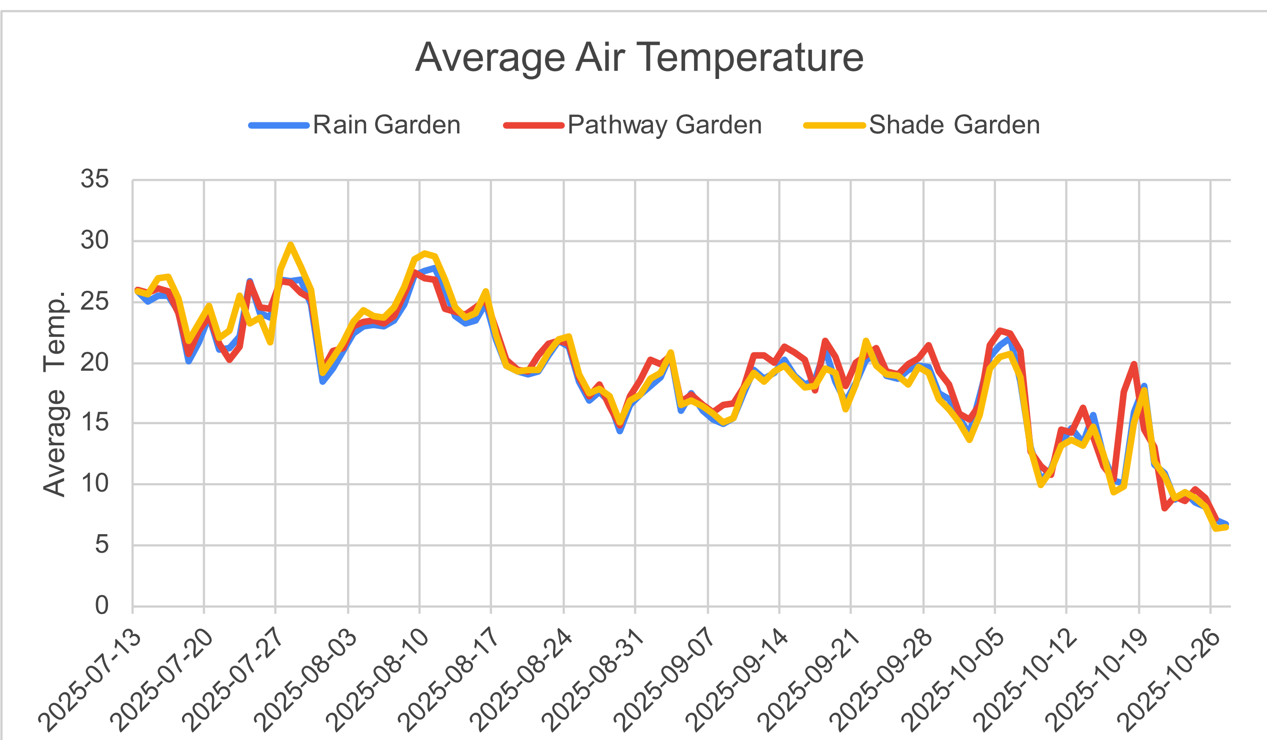


Figure 6 Average Air Temperature Comparison No significant variation between gardens

2. Stormwater Infiltration

March 5, 2025 Temp. 3⁰C
Precipitation: Light Rain
Royal Botanical Gardens 20.1mm
Hamilton Munro Airport 23.1mm

March 6, 2025 Temp. -3⁰C
Precipitation: Light Snow

Image 27 Permeable Pathway March 5, 9:05am
Water pooling in lowest area

Image 28 Permeable Pathway March 6, 10:10am
Water drained completely

Image 29 Rain Garden March 5, 9:05am
Water collecting at lowest point

Image 30 Rain Garden March 6, 10:10am
Water completely infiltrated within 24 hours

October 30, 2025 Temp. 8^0C
Precipitation:
Royal Botanical Gardens 11.9mm
Hamilton Munro Airport 18.7mm
Photo Documentation Hik-Connect Security Camera

Image 31 Permeable Pathway October 31, 10:42am
Slight pooling at lowest point

Image 32 Rain Garden October 30, 11:20am
No overflow, rainwater from downspout appears to be totally infiltrated

FINDINGS:
Bioswales/Rain Gardens should infiltrate fully within 24 hours of the cessation of a storm event. (STEP, n.d. Bioretention). The Rain Garden infiltrated stormwater fully even in the shoulder seasons when ground was already carrying high levels of moisture. (Images 30, 32)

3. Soil Health

Soil samples were gathered and submitted for testing on two dates; April 24, 2025 and December 18, 2025. Samples were sent to A & L Laboratories Inc. in London, Ontario.

Two samples were submitted on each occassion, one collected from an undisturbed area of turf in Site 4, and the second from the rain garden, Site 2. At the time of the April submission, the rain garden had been functioning for ten months.

The soil tests were extensive, to the extent of those normally conducted for farm crops, and they provided some insights into the fertility and biological activity of the rain garden as compared to those soils already on site.

Results shown are those parameters specified by Sustainable Technologies Evaluation Program (STEP), a resource for Low Impact Development specifically geared towards southern Ontario.

Soil Structure:

		April 2025	December 2025
Turf :	Sandy Loam	Sand 62% Silt 26% Clay 13%	Sand 59% Silt 24% Clay 17%
Rain :	Sandy Loam	Sand 63% Silt 23% Clay 14%	Sand 65% Silt 20% Clay 15%

Recommended texture for Bioretention (STEP, n.d Testing): Sandy Loam

- 70-88% sand sized particles
- 12-30% silt and clay sized particles
- < 20% clay particles

While the amount of sand in the rain garden is slightly slightly lower than recommended, the garden still shows good infiltration. Some research suggests working with existing soils rather than modifying with a higher percentage of sand is effective for infiltration, as long as the size (area and volume) of installation and infiltration rates are adequate. (Maxwell 2016)

Soil pH:

	April 2025	December 2025
Turf :	7.4	7.7
Rain :	7.6	8

Recommended pH for bioretention (STEP, n.d Testing): 6-7.8
Rain garden should be monitered in future to prevent further increase in pH, As the pH increases, some essential nutrients may become unavailable to certain plants.

Cationic Exchange Capacity (CEC):

	April 2025	December 2025
Turf :	10.1 meq/100g	18.2 meq/100g
Rain :	17.6 meq/100g	16 meq/100g

Recommended CEC for Bioretention (STEP, n.d. Testing): > 10 meq/ 100g
All soils showed good Cationic Echange Capacity indicating good retention of positively charged elements thus allowing them to be used by plant material. Without this retention positively charged elements such as metals may enter stormwater runoff . (STEP, 2018).

Organic Matter:

	April 2025	December 2025
Turf :	4.5%	5.5%
Rain :	6.1%	6%

Recommended Percentage of Organic Matter for Bioretention (STEP, n.d Testing): 3-10%
Organic matter is adequate and will likely increase with the decay of plant material each year.

Phosphorus

	April 2025	December 2025
Turf :	46 ppm	127 ppm
Rain :	117 ppm	143 ppm

Recommended Levels of Phosphorus for Bioretention (STEP, n.d Testing): 12-40 ppm
Levels of phosphorus are very high and may affect plant health, similar to constraints caused by elevated pH.
Further study should be done as to the cause of these levels as the site is located next to industrial lands, and a means of remediation found.

Soluble Salts:

	April 2025	December 2025
Turf :	0.5 mS/cm	0.5 mS/cm
Rain :	0.6 mS/cm	0.3 mS/cm

Recommended Levels of Soluble Salts for Bioretention (STEP, n.d Testing): < 2 mS/cm
Levels are well below maximum limit.

FINDINGS:
Soil in the rain garden appears to be healthy and functioning well, but an area of concern remains with the high pH, very high level of phosphorus and very high levels (not shown in this document) of calcium, zinc, manganese, iron and copper. As per above, it would be worthwhile to expand this study to determine the possible effects of air pollution on soils this close to industry.

4. Plant Health

Site 1: Pathway Garden

May 26, 2025

Image 33 Most vegetation thriving;
poor growth near Acer platanoides

Image 34 Near rain barrel overflow;
Hypericum kalmianum is thriving

Image 35 Panicum virgatum good early growth;
Salvia ready to bloom

Image 36 Losses near Acer platanoides;
many plants did not recover over the summer months.
Native grasses that thrived further away from Acer
maintained strong growth but reached only 50% of
mature height in this area.

August 13, 2025

Image 37 Hydrangeas and some geranium under stress from heat and lack of precipitation

Image 38 Schizachyrium thriving next to hydrangea; poor plant growth under Acer; only Rudbeckia remains strong.

Image 39 Strong growth next to rain barrel overflow

Image 40 Native grasses and Asclepius tuberosa all thriving south side of path

October 2, 2025

Image 41 Echinacea and grasses setting seed

Image 42 Asters full of blooms

Image 43 Schizachyrium strong; some hydrangeas recovering
A newly disconnected downspout #7 was directed to this area
in late fall and should strengthen plant growth in 2026.

Image 44 Asclepius setting seed.

PLANT LIST SITE 1					
QTY	BOTANICAL NAME	COMMON NAME	CONDITION May 26	CONDITION August 13	CONDITION October 2
	Trees				
1	*Cercis canadensis*	redbud tree form	Fair	Poor	Poor
	Shrubs				
3	*Clethra alnifolia* 'Hummingbird'	Hummingbird summersweet	Dead	Dead	Dead
6	*Hydrangea arborescens* 'Invincibelle Ruby'	Invincibelle Ruby hydrangea	5/6 Good	Poor	Poor
6	*Hypericum kalmianum*	St. John's Wort	Good	Good	Good
2	*Physocarpus opulifolious* 'Seaward'	Summer Wine® ninebark	Good	Good	Good
	Perennials				
8	*Achillea millefolium* 'Paprika'	Paprika common yarrow	Good	Good	Fair
11	*Agastache* 'Blue Boa'	Blue Boa anise hyssop	Good-Fair location dependent	Good-Poor location dependent	Good-Poor location dependent
3	*Asarum canadense*	wild ginger	Good	Good	Good
3	*Asclepias tuberosa*	butterfly milkweed	Good	Good	Good
8	*Aster laevis*	smooth aster	Good	Good	Good
5	*Aster novae-angliae* 'Grape Crush'	Grape Crush New England aster	Good	Good	Good
14	*Coreopsis* 'Daybreak' substitution for *Coreopsis lanceolata*	thread-leaf tickseed	Good	Good-Fair location dependent	Good-Fair location dependent
11	*Echinacea purpurea*	Purple Coneflower	Good	Good	Good
3	*Eupatorium purpureum*	sweet Joe Pye weed	Good	Fair	Poor
11	*Geranium* x cant. 'Biokovo' substitution for *Geranium maculatum*	Biokovo geranium	Good	Fair	Fair
5	*Geum* 'Prettycoats Peach' substitution for *Geum triflorum*	'Prettycoats Peach' prairie smoke	Good	Fair	Poor
6	*Lavandula angustifolia* 'Hidcote Blue'	Hidcote Blue lavender	Good	Fair	2/3 specimens dead
5	*Liatris spicata*	dense blazing star	Good	Good	Good
8	*Perovskia* 'Little Spire'	Little Spire Russian sage	Good	Good	Good
5	*Rudbeckia fulgida* 'Goldsturm'	Goldsturm black eyed Susan	Good	Good	Good
10	*Salvia nemorosa* 'Mai Nacht'	May night salvia	Good	Good	Good
	Grasses				
15	*Panicum virgatum* 'Shenandoah'	Shenandoah switch grass	Good	Good	Good
12	*Schizachyrium scoparium* 'Standing Ovation'	Standing Ovation little bluestem	Good	Good	Good
10	*Sporobolus heterolepis*	prairie dropseed	Good	Good	Good

Figure 7 Plant List and Conditions Site 1

FINDINGS:

Out of the three gardens, plant health was most variable in this site.

Plantings near the downspout overflow showed healthy rates of growth throughout the season.

Native grasses thrived despite low rates of precipitation, struggling to maintain growth only near the *Acer platanoide*s. This invasive tree out competes most other plants for water and nutrients, but in this location it provides some much needed shade. In future, this area of the garden bed may be reclaimed for increased seating.

The hydrangea suffered both from heat and lack of water. This was a poor design decision, evidenced by the contrasting vigorous health of drought tolerant grasses in the same bed. The hydrangeas were chosen to provide an attractive flowering shrub at the entrance to the walkway. Even though the shrubs were watered by hand, the surface tension of the soil and thick layer of bark mulch prevented water from infiltrating the soil deeply enough to reach the root zone. As of October, 2025 another downspout (DS #7) was disconnected from the storm drains and directed into the garden. This may provide enough water in future to allow these flowering shrubs to thrive.

Site 2 Rain Garden

May 26, 2025

Image 45 All plants displaying good health

Image 46 Deschampsia cespitosa thriving

August 13, 2025

Image 47 Strong growth, healthy foliage on Betula nigra; Deschampsia multiplying

Image 48 Healthy foliage on Cornus sp.; Eupatorium blooming

October 2, 2025

Image 49 All plants continue to thrive

Image 50 Panicum virgatum provides strong linear element, infiltrates rainwater, no adverse effects from salt used on parking lot.

November 13, 2025

Image 51 Foliage on tree and shrubs maintained into November, 2025

Site 3 Shade Garden

May 26, 2025

Image 52 All plants displaying good health

Image 53 Geranium maculatum provide important source for pollinators in spring

Image 54 Ferns and ground covers show solid growth

August 13, 2025

Image 55 Pennstemon finished flowering; ferns and geraniums showing stress from drought.

Image 56 Ostrya virginiana-some yellowing of leaves, good fruit set.

October 2, 2025

Image 57 Aster divaricatus in full bloom

Image 58 Ferns and ground covers recovering from drought

PLANT LIST SITE 2					
QTY	BOTANICAL NAME	COMMON NAME	CONDITION May 26	CONDITION August 13	CONDITION October 2
	Trees				
1	*Betula nigra*	river birch	Good	Good	Good
	Shrubs				
5	*Cornus sericea* ‘Arctic Fire’	Arctic Fire dogwood	Good	Good	Good
7	*Cornus sericea* ‘Kelseyii’-substitution for *Aronia mel*. ‘Low Scape Mound’	Kelsey dogwood	Good	Good	Good
	Perennials				
3	*Eupatorium purpureum*	sweet Joe Pye weed	Good	Good	Good
	Grasses				
9	*Deschampsia cespitosa*	tufted hair grass	Good	Good-multiplying	Good
11	*Panicum virgatum* ‘Shenandoah’	Shenandoah switch grass	Good	Good	Good

Figure 8 Plant List and Conditions Site 2

FINDINGS:

Plants in the rain garden thrived throughout the growing season. Particularly satisfying was the growth and vigour of *Deschampsia cespitosa*. This grass has been used in previous LID installations with less success for two reasons:

- Without fairly consistent supply of moisture they do not thrive.
- When the grass turns a golden colour early in the season means that gardeners performing maintenance perceive it to be dead, and pull it out.

The *Betula nigra* displays good health with increased growth and healthy foliage. As it matures and spreads, it will serve to the reduce surface temperatures both in the garden and on the surrounding asphalt.

PLANT LIST SITE 3					
QTY	BOTANICAL NAME	COMMON NAME	CONDITION May 26	CONDITION August 13	CONDITION October 2
	Evergreens				
5	*Juniperus sabina* ‘Calgary Carpet’	Calgary Carpet juniper	Good	Good	Good
	Trees				
1	*Ostrya virginiana*	hop hornbeam	Good	Good	Good-some leaf edge browning
	Perennials		Good	Good	Good
6	*Asarum canadense*-substitution for *Tiarella cordifolia*	wild ginger	Fair	Fair	Fair
10	*Aster divaricatus*	white wood aster	Good	Good	Good
3	*Dryopteris Filix-mas*	male fern	Good	Fair	Fair
8	*Geranium maculatum*	wild geranium	Good	Good	Good
5	*Matteuccia struthiopteris*	fiddlehead fern	Good	Good-multiplying	Good
6	*Penstemon* ‘Onyx and Pearls’-substitution for *Penstemon digitalis*	Onyx and Pearls beardtongue	Good	Good	Good
	Vines				
1	*Parthenocissus quinquefolia*	Virginia creeper	Fair	Fair	Stem broken at base

Figure 9 Plant List and Conditions Site 3

FINDINGS:

Growth in the shade garden was fairly consistent throughout. *Juniperus* was a large enough presence to prevent cars driving over the corner of the garden.

Some plantings right next to a parking spot suffered from pedestrian traffic as people exited and entered cars.

Ferns and *asarum canadense* all suffered some setback during July and early August, but appeared to recover when temperatures lowered and precipitation increased.

Aster divaricatus may become invasive in this garden but is easily removed as needed.

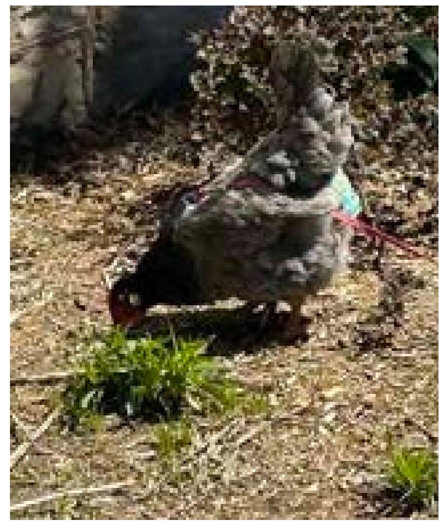
CONCLUSIONS

Evidence of a resilient community after 2 seasons of growth; June 22, 2024-October 27, 2025:

- Out of a total site area of $1700m^2$, $213.4m^2$ were converted from turf or asphalt into plant beds ($191.3m^2$) or permeable paving ($22.1m^2$).

- Downspouts carrying stormwater runoff were redirected and now provide irrigation for the gardens

- Extensive plantings add biodiversity to an area of Hamilton lacking in green space.
  Total number of plant species used on site: 54
  Total number of plants used on site: 754
  Plant losses: 40-50 plants, mainly shrubs



PLANT TYPE	NO. OF SPECIES	NO. OF PLANTS
Evergreens	3	13
Trees	3	3
Shrubs	8	59
Perennials	34	509
Grasses	6	170

Figure 10 Total Plant Quantities

- A high percentage of native plants utilized on site provide habitat for a wide variety of pollinators (and other community members)

- The majority of plants appear to be thriving in spite of a hot and dry summer.

- Plant losses appear to stem from two factors: poor choice of plant material for a specific location and competition from tree roots. One must always plan for drought tolerant plants given climate change.

- The LID strategies are functioning as intended:

  - Rain garden functions well, detaining water during storms and inflitrating within 24 hours. An area of concern remains high levels of phosphorus and an increase in pH.
  - Rain barrel provides a good volume of storage with overflow providing nearby plants with irrigation.
  - Though there is overflow from plant beds to the low lying area of the pathway, water pools for a short period of time then infiltrates quickly. The example shown in the document (page 20) shows infiltration during winter months. Drainage was also documented in April showing water infiltrating within an hour.

- The entire grounds of the church act as a gathering space for the community, providing a welcome to all. Gardens are maintained by volunteers, weeding and watering when needed. Green Venture offers events on site, educating the public on the benefits of rain gardens, rain barrels, permeable pavement and native plants.

CONCLUSIONS AND LESSONS LEARNED

Given the collected data from this project, undergirded with similar installations in the same area of Hamilton, a number of key factors emerge regarding the efficacy of Small-Scale, Citizen Driven LID installations as pockets of resilience.

1. Community engagement is critical, not only for the planning and installation, but for maintenance of the gardens. It is not difficult to get volunteers to show up to plant. Weeding is quite another matter.

2. Invite the community in through the design. Getting rid of fences, even though there is no gate prohibiting entrance, encourages members of the community to enter the space. Pathways are always welcoming, especially to children. In the Laidlaw garden they were observed on many occassions exiting cars in the parking lot, running to the end of the pathway, then walking the length of the garden to enter the church.

3. Try to accomodate the plant desires of the host community. If they want hydrangeas, lilacs and lavender, try to fit these gardenesque plants into the design where they will be seen. There are many ways of adding native plant material such as colourful perennials, grasses, ground cover, or by filling a space that is otherwise seen as waste space; in this instance the strip of of soil along the alley (Site 5 Alley Garden)

4. Educate at every stage of the project. “This tree is used because it will thrive in a rain garden. This native grass has long roots, will be drought tolerant and will hold the soil. This perennial is a host plant for this pollinator.” There is not great familiarty with native plants and it is our duty to provide much needed information.

5. Find every opportunity to improve stormwater management and increase biodiversity on every site, no matter how small. In this project, parking spots could not be sacrificed, however those along the south border of the parking lot were wider than necessary. Parking lines were redrawn and enough space carved out to create the shade garden.

6. Don’t obsess over plant placement. People love to plant. On this project there were 74 volunteers not including Green Venture staff and though plants are placed ahead of time, it is impossible to control placement, planting depth etc. It is important to plant trees correctly, but after that the designer cannot exercise a high level of control without frustrating volunteers.

7. Make friends with the people caring for the gardens. Visit often and offer gentle advice and encouragement. For them, it is a labour of love.

8. Keep going, planning and planting small spaces as close together as possible. There is not always space for a lot of trees or a dazzling design, but there is great power in small gestures repeated over and over. Create links between many small patches and suddenly habitat has been created on a much larger scale. The ultimate goal with these small gardens installed thus far in Hamilton (Figure 1) is to create a horizontal swath of green space all across the lower city, providing places for water to infiltrate, increasing biodiversity and above all creating beauty for the residents of these communities.

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