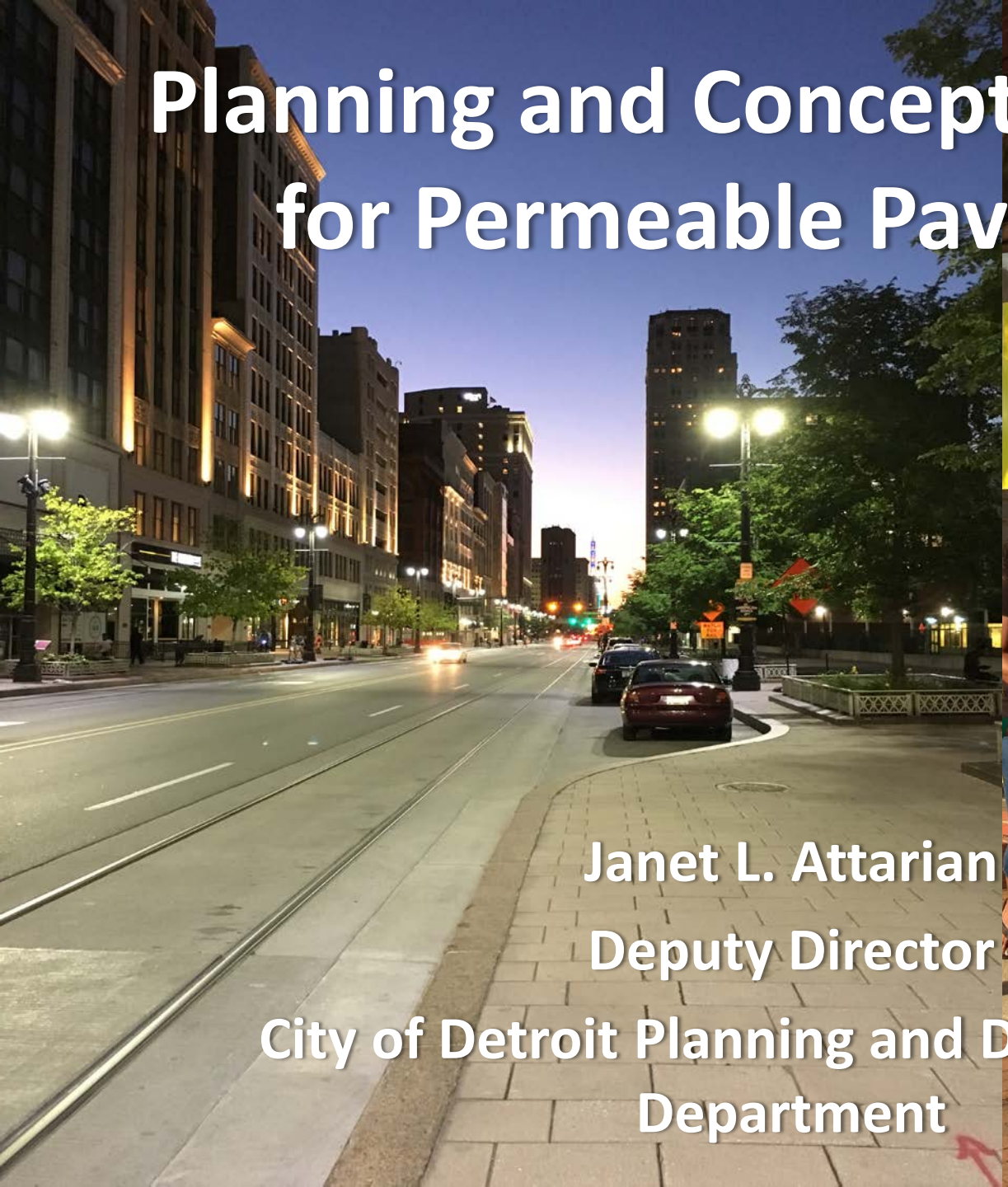
Planning and Conceptual Design for Permeable Pavements



Janet L. Attarian

Deputy Director

City of Detroit Planning and Development Department

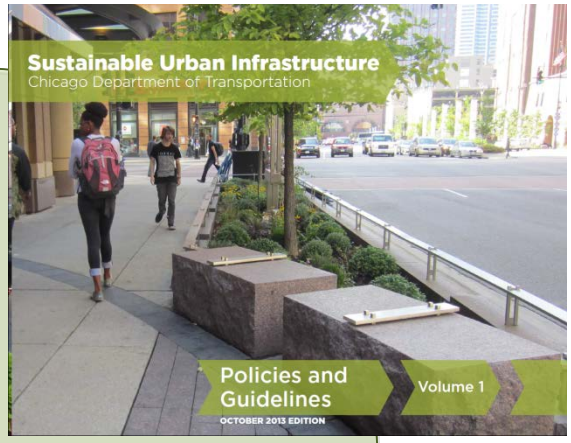
Getting to Sustainable Streets

Modal hierarchy & mode share

Ecological Services

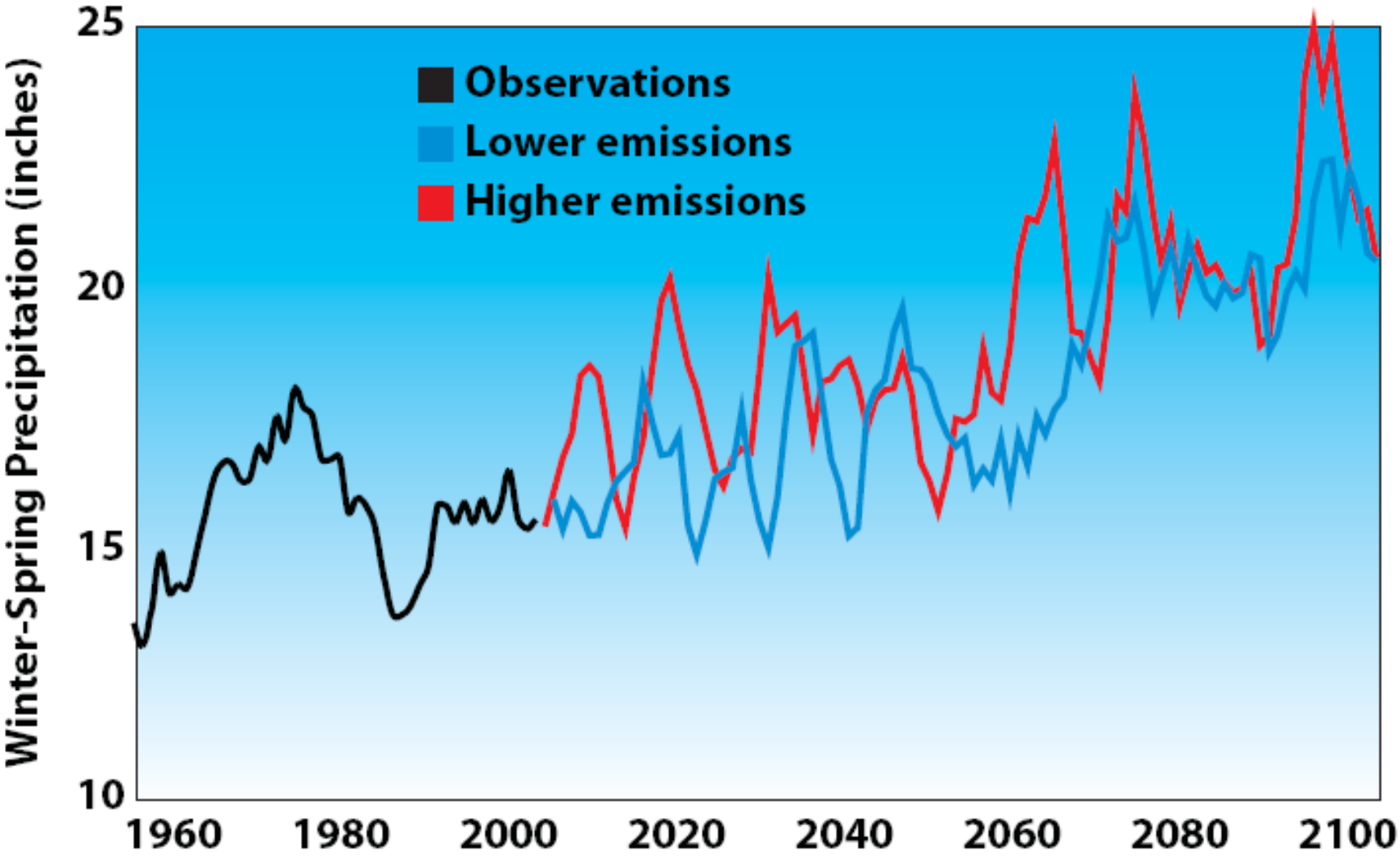
Sustainable Streets

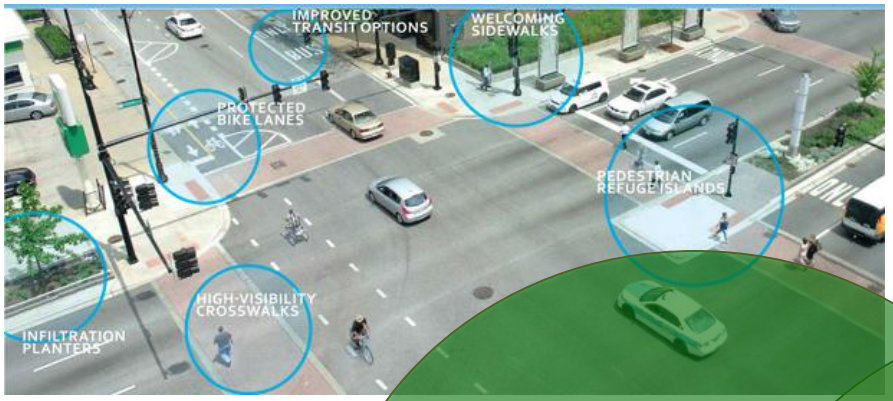
Placemaking



Data Driven - Environment

Fact: In a high-emissions scenario, 2040 springs could have 20% more precipitation events and summers could have 10% fewer





Access, mobility, Healthy lifestyles

Healthy communities, clean environment

Safe, Sustainable, Beautiful Streets

Beauty, Community, economic development

Outcomes

Chicago June 2013 – 25 year event

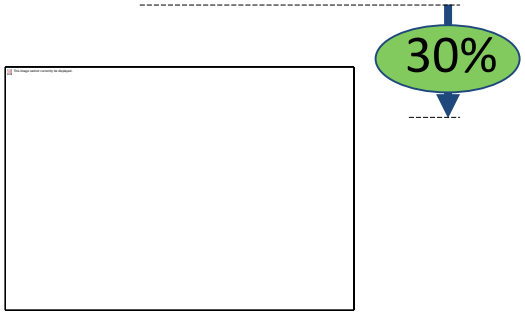
Typical Chicago Street

Pilsen Sustainable Street

Sustainable Streets are Cost Effective

Cost is 30% less than projected…

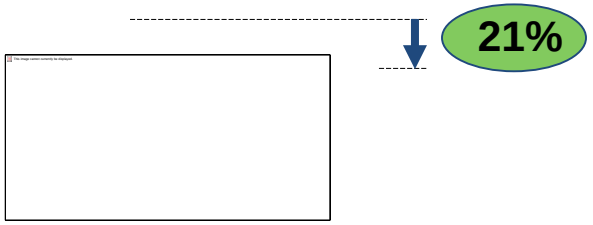
Cermak total project cost ($)



- Cermak projected cost
- Actual bid

… And is 20% less expensive than the average block in 2010

Average per block cost ($)

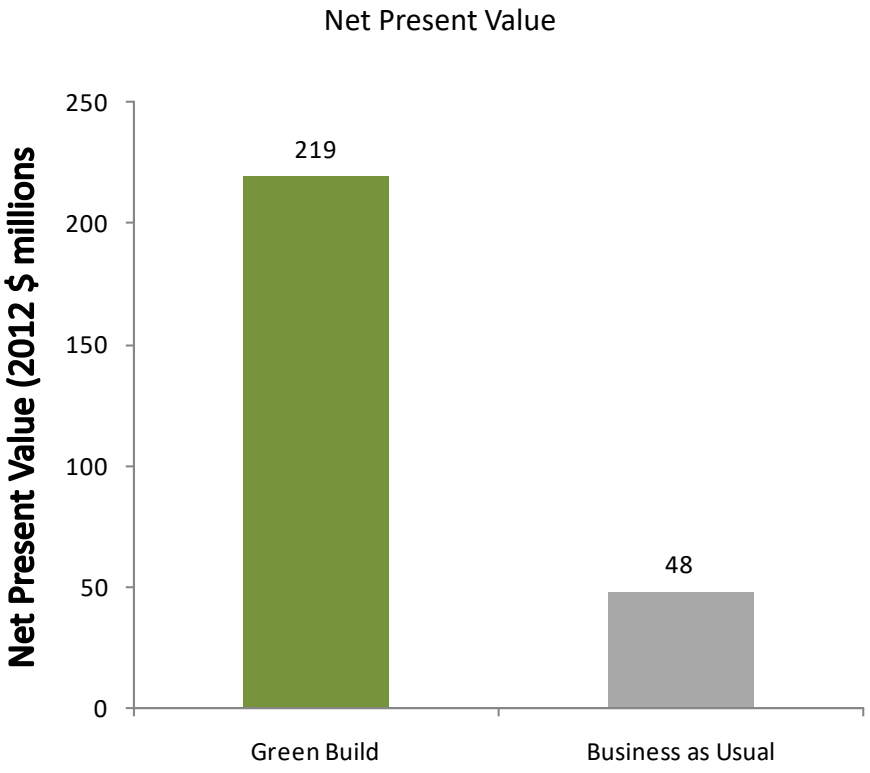


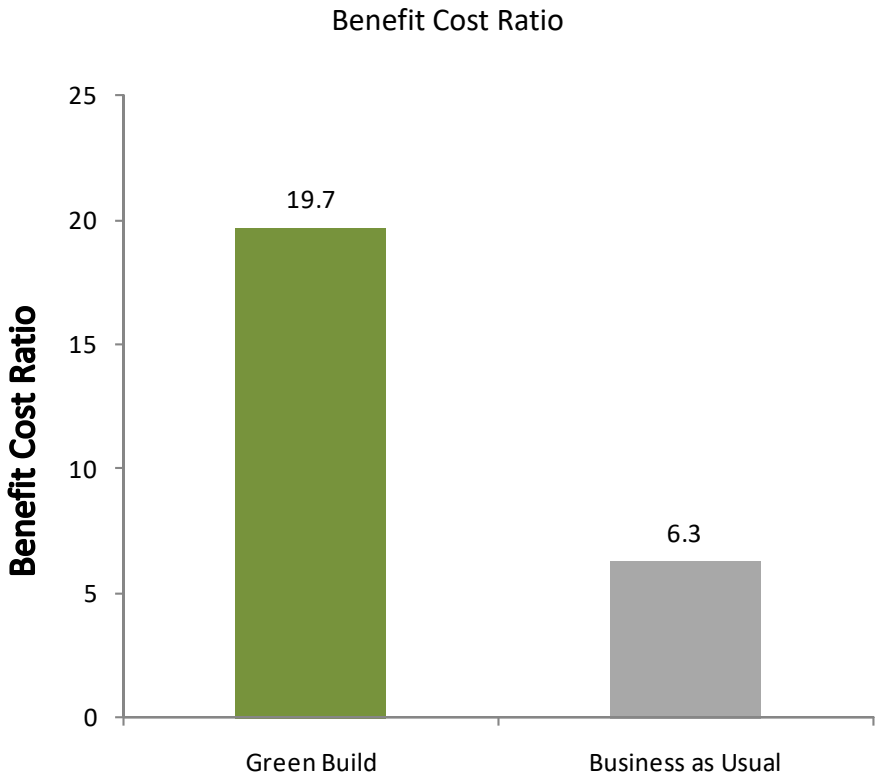
- Average construction cost per block in 2010
- Cermak cost per block

Preliminary Findings indicate a Benefit Cost Ratio of 19.7 for green build compared to only 6.3 for standard build.

Green and Business as Usual 30 Year Analysis Summary

- Green Build
  - Cost - $11.7 million (2012 $)
  - Benefits - $231.7 million (2012 $)
  - Net Present Value - $219.4 million (2012 $)
  - BCA - 19.7
- Business as Usual Build
  - Cost - $8.9 million (2012 $)
  - Benefits - $56.7 million (2012 $)
  - Net Present Value - $47.7 million (2012 $)
  - BCA - 6.3

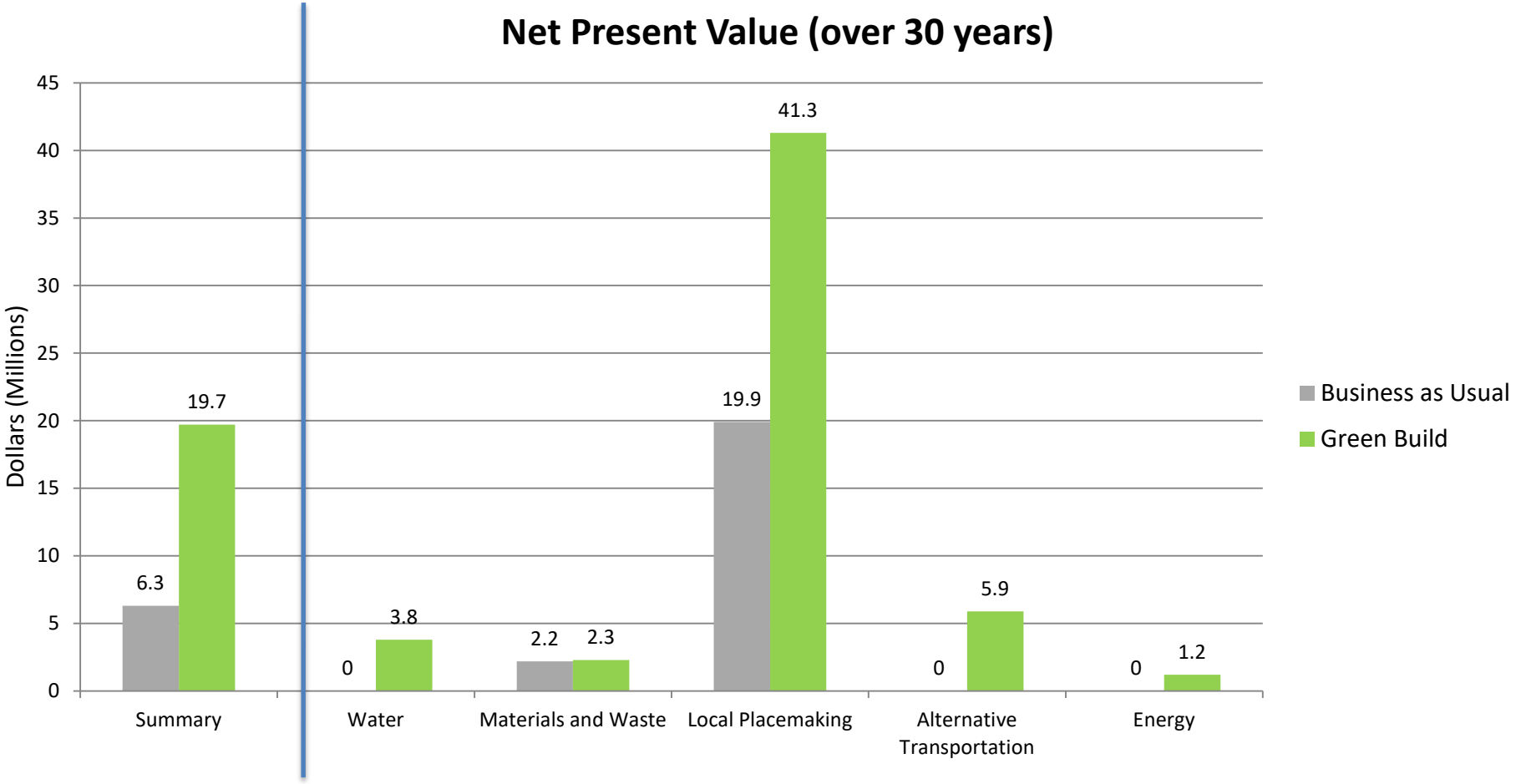


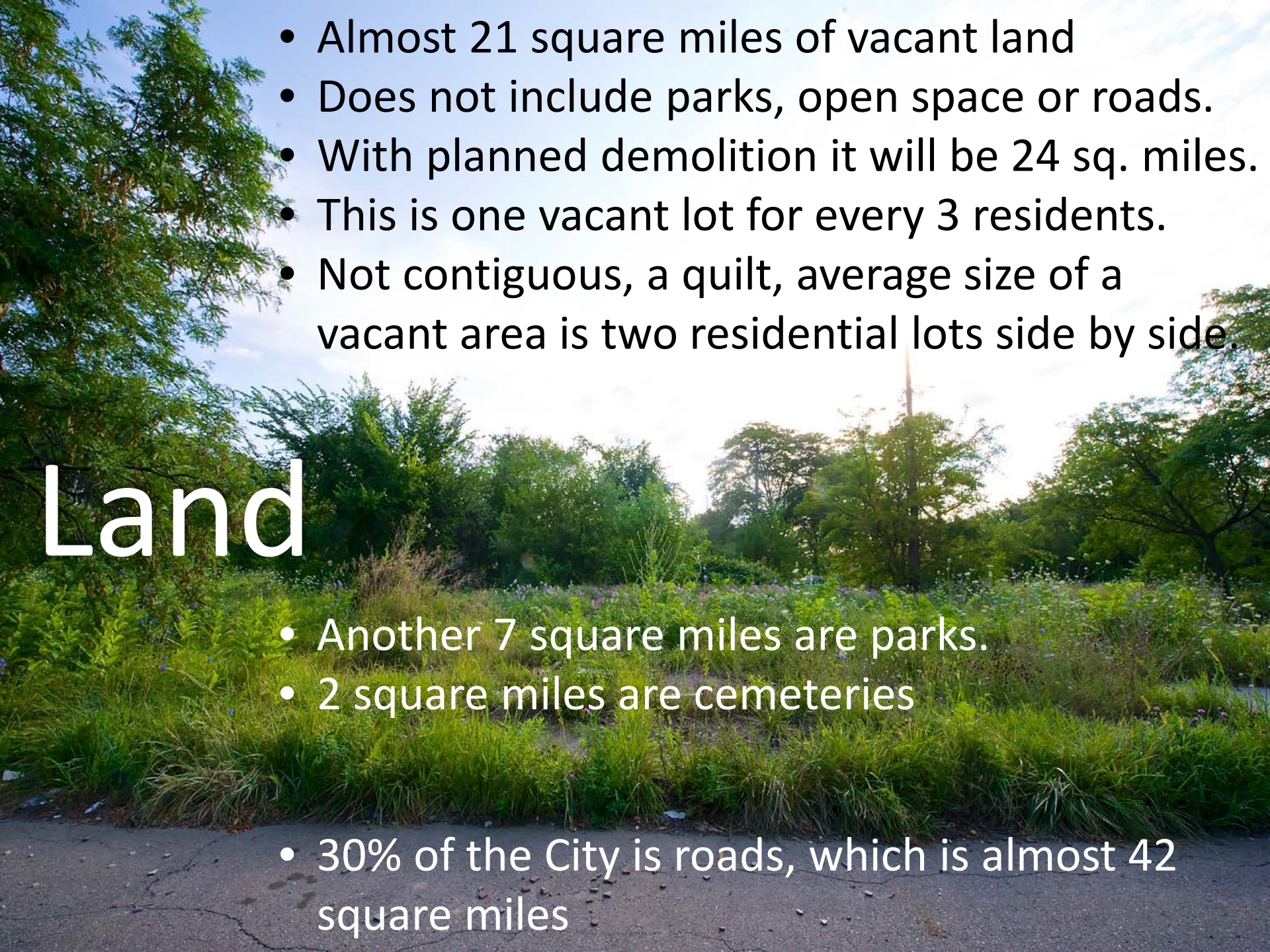


Why Complete Streets?

RETURN ON INVESTMENT:

Create a resilient transportation infrastructure, where each dollar invested reaps the most benefits and controls long term costs.





Land

- Almost 21 square miles of vacant land
- Does not include parks, open space or roads.
- With planned demolition it will be 24 sq. miles.
- This is one vacant lot for every 3 residents.
- Not contiguous, a quilt, average size of a vacant area is two residential lots side by side.

- Another 7 square miles are parks.
- 2 square miles are cemeteries

- 30% of the City is roads, which is almost 42 square miles

Water

DETROIT Water & Sewerage Department

Green More, Pay Less!

Are you a Detroit nonresidential property owner interested in knowing how you can receive a drainage charge credit?

The Detroit Water and Sewerage Department invites you to participate in a

NONRESIDENTIAL PROPERTY OWNER DRAINAGE CHARGE CREDIT WORKSHOP

Wednesday, November 9, 2016

SEMCOG (Woodward Room) • 1001 Woodward Avenue, Suite 1400

Storm water practices in Midtown Detroit's Green Alley. Photos courtesy of the Green Alley Project Partners.

Please RSVP for the drainage charge credit workshop that's best for your schedule.
Register by November 8. Space is limited to 85 per workshop.

Morning Session

9:00 am – 11:30 am

Go to http://whoozin.com/PRR-FNG-PREA to learn more and register.

Afternoon Session

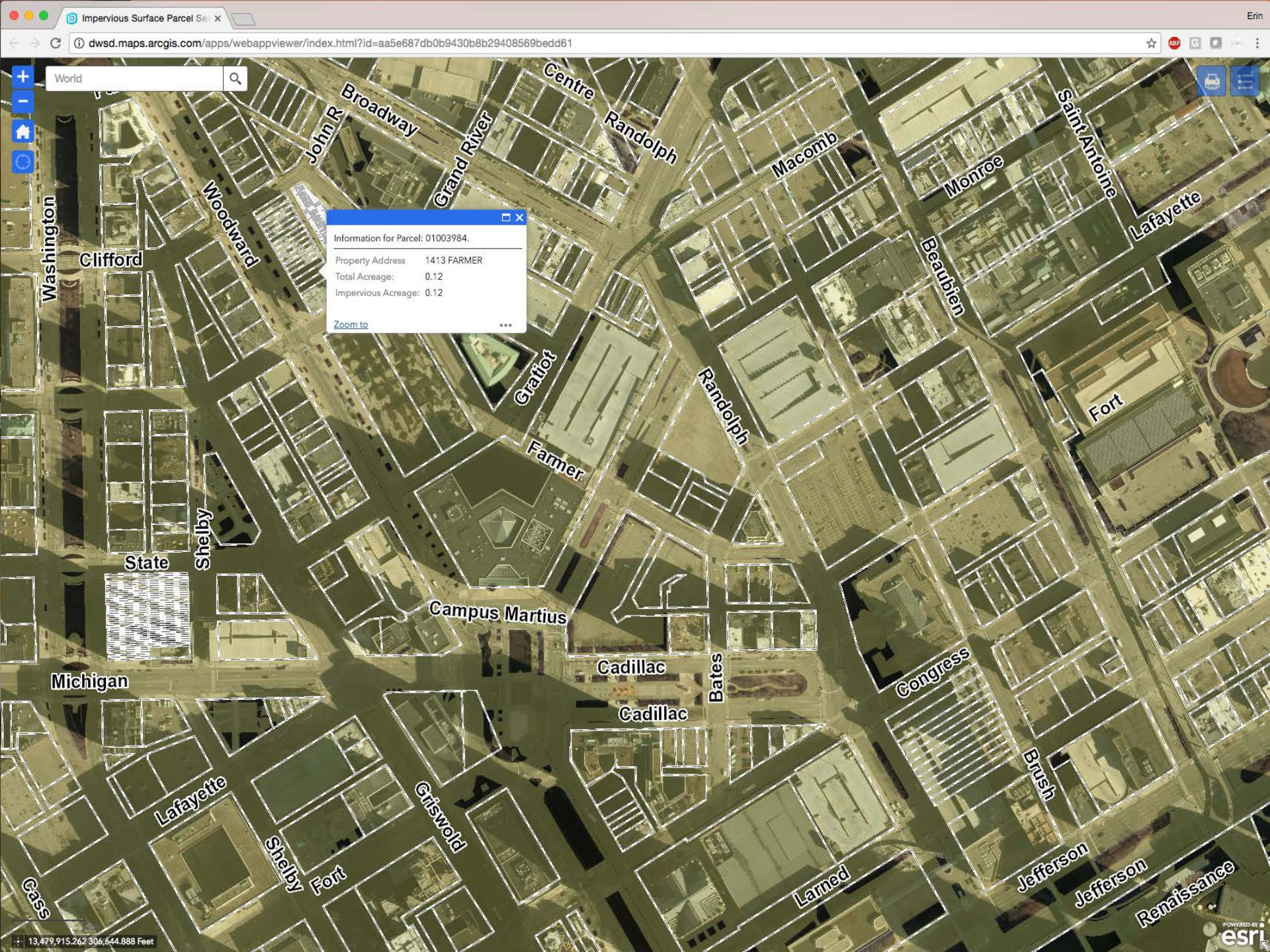
1:30 pm – 4:00 pm

Go to http://whoozin.com/NHA-MCU-A6MM to learn more and register.

DETROIT'S green space blue water

DWSD will continue to offer drainage charge credit workshops.
Visit www.detroitmi.gov/drainage for information on future workshops.

Questions? Email drainage@detroitmi.gov
or call 313-267-8000 and follow the prompts


Impervious Surface Parcel Se
Erin
dwsd.maps.arcgis.com/apps/webappviewer/index.html?id=aa5e687db0b9430b8b29408569bedd61
World
Information for Parcel: 01003984.
Property Address 1413 FARMER
Total Acreage: 0.12
Impervious Acreage: 0.12
Zoom to
Centre
Broadway
John R
Grand River
Randolph
Macomb
Monroe
Saint Antoine
Lafayette
Washington
Clifford
Woodward
Beaubien
Gratiot
Farmer
Randolph
Fort
State
Shelby
Campus Martius
Michigan
Cadillac
Bates
Cadillac
Congress
Brush
Lafayette
Griswold
Shelby
Fort
Cass
Larned
Jefferson
Jefferson
Renaissance
13,479,915.262 306,644.888 Feet
POWERED BY esri

6.4.2 Bioretention

Bioretention storm water practices include a number of different configurations that temporarily store runoff in an engineered system that will later infiltrate into the soil. The type of bioretention systems most commonly constructed include:

TABLE 4 - Bioretention Types and Application

Bioretention Type	Where Used	Comments
Rain garden	Homes and small buildings	Generally less than 1,000 square feet of impervious area, not engineered
Bioretention	Nonresidential sites	Installed in lawn areas to manage runoff from impervious areas, typically with engineered underdrain
Parking lots	Parking lots	Generally located in rights-of-way
Curb extension	Road rights of way or along private driveways	Structural walls, highly compact foot print
Planter boxes	Highly urban areas, sites without lawn	Structural walls, suspended pavement systems
Tree trenches	Highly urban areas, parking lots, sidewalks	Structural walls, suspended pavement systems

Other than rain gardens, bioretention systems are engineered storm water practices that include such elements as aggregate storage, filter layers, and special planting soils that are specifically designed to manage, treat and store storm water prior to infiltration into the soil.

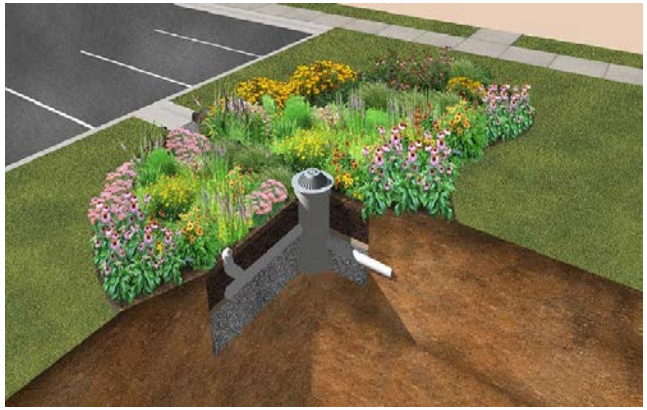


Figure 14: Bioretention Illustration

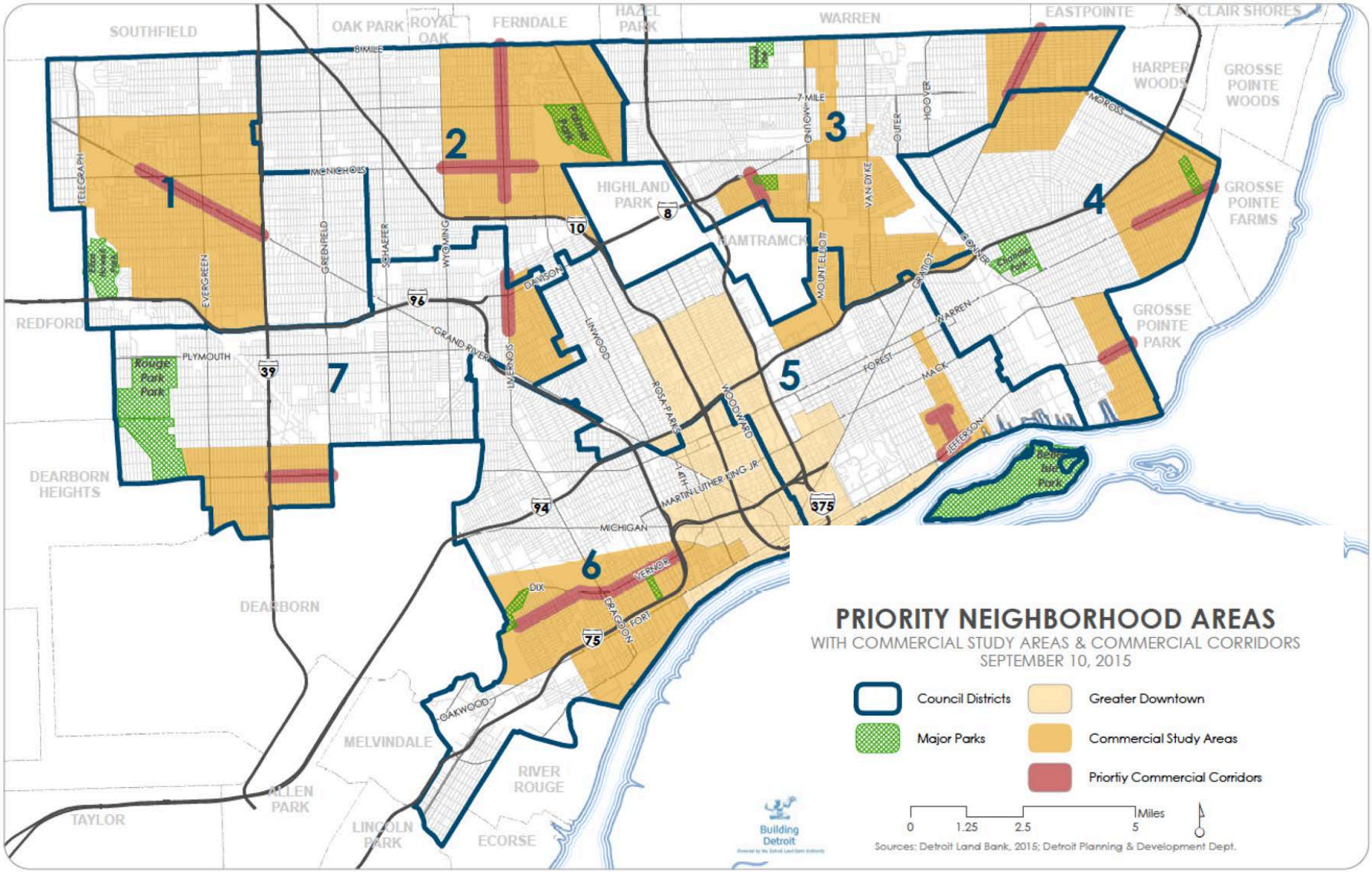
PERMEABLE PAVEMENT VOLUME CREDIT CALCULATION EXAMPLE

A commercial property is applying for a volume credit for permeable pavement. The site has the following characteristics:

- Drainage Area: 10,000 sf from parking lot plus 5,000 from roof runoff = 15,000 sf
- Total Impervious Area: 17,500 square feet
- Infiltration Rate: 0.1 in/hr
- Allowable Drain Time: 72 hr
- Permeable Pavement: > 25% of the parking lot (2,500 sf); Aggregate Storage Layer: 5,000 square feet of the parking lot. Therefore physical practice: 5,000 square feet.
- Aggregate (under the parking lot): 24 inches
- Usable Void Ratio in Aggregate: 35%
- Underdrain is located 12 inches off the bottom of the practice.

The calculation methodology selected is the *Equivalent Rainfall Method*.

Current Priority Neighborhoods



east riverfront framework plan

Creating a great and inclusive riverfront:
World-class public space (parks + streets)
Greenway connections to the neighborhoods
Accessible (transportation + parking)
Authentic, diverse and local retail

expanded parklands

EXISTING

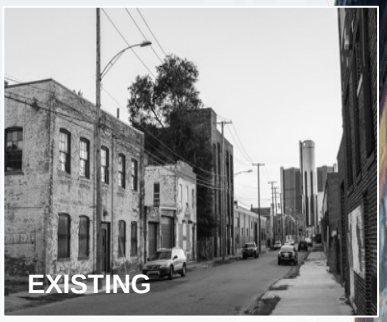
PROPOSED – AN EXPANDED MILLIKEN STATE PARK

Complete Streets

EXISTING

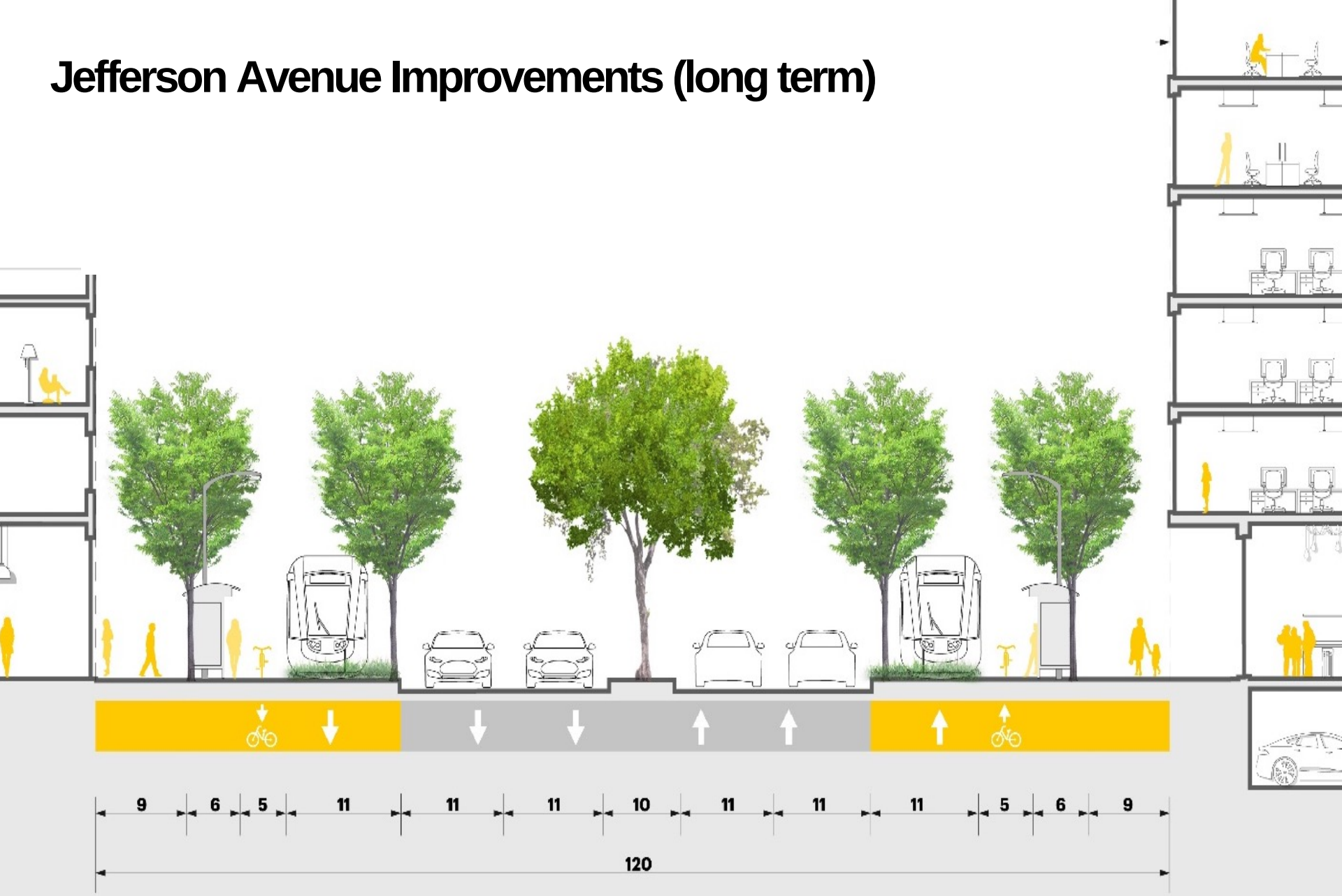
PROPOSED – CAMPAU GREENWAY

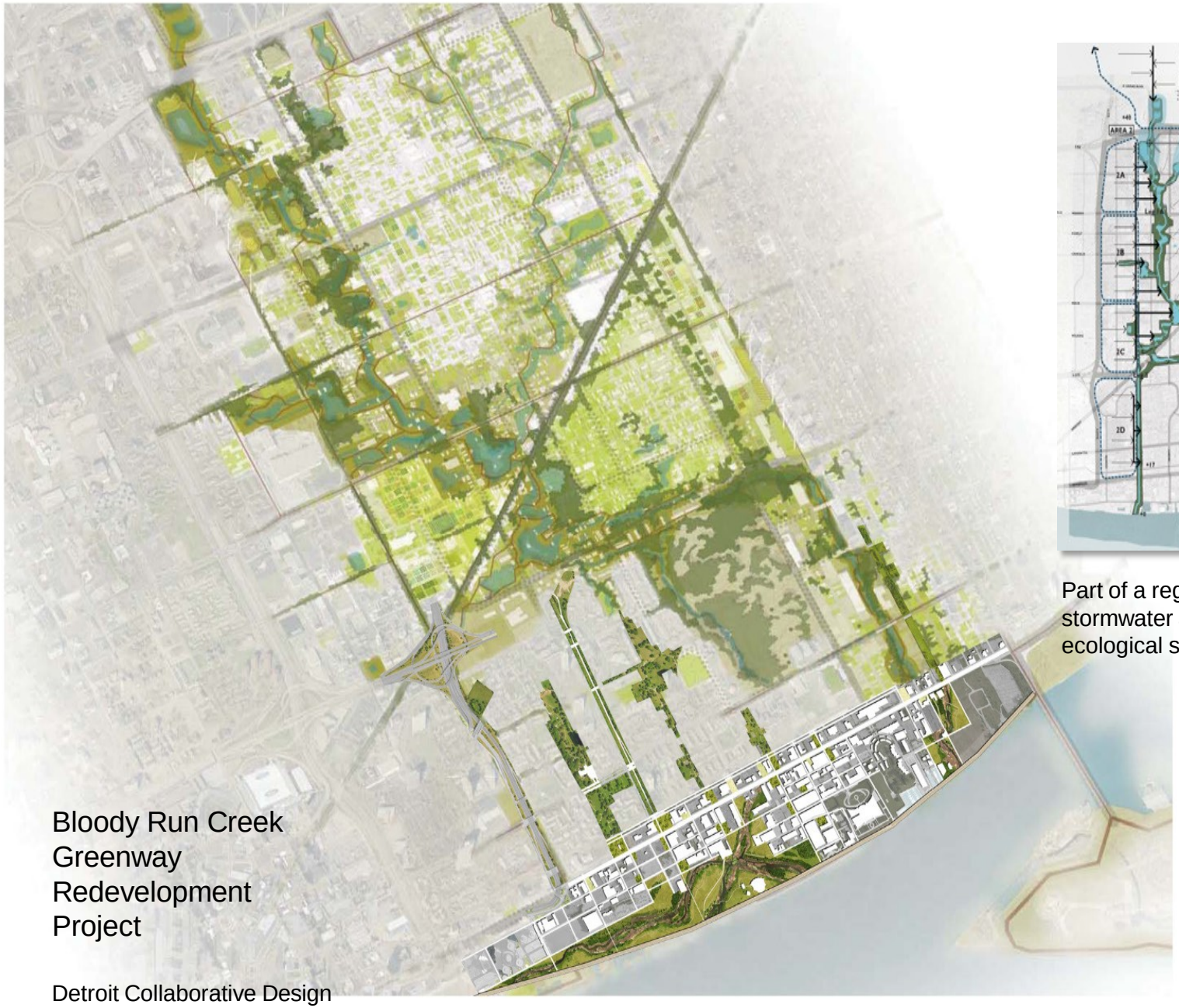
Complete Streets

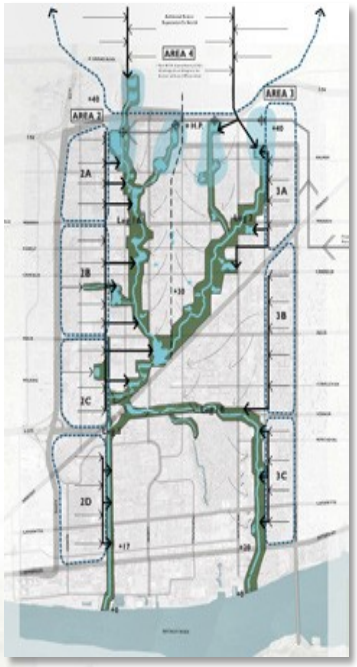


PROPOSED – FRANKLIN STREET ACTIVATION

Jefferson Avenue Improvements (long term)







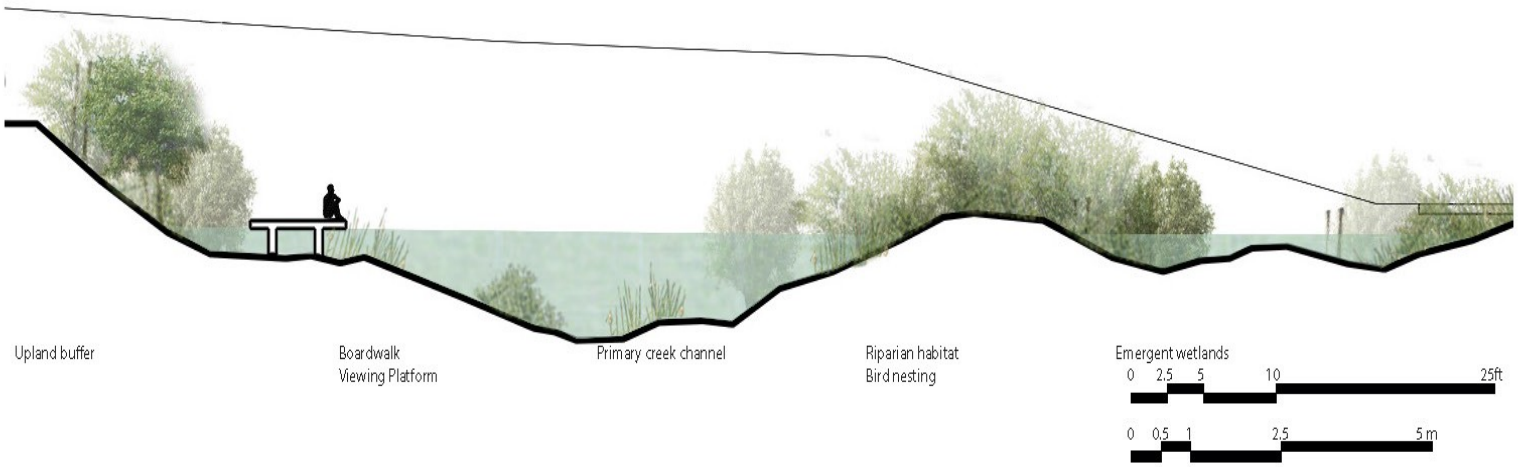
Part of a regional stormwater and ecological strategy

Bloody Run Creek Greenway Redevelopment Project

Detroit Collaborative Design Center, 2011

Expanded park system and Stormwater Control

introduce wetland habitat, connect people with water



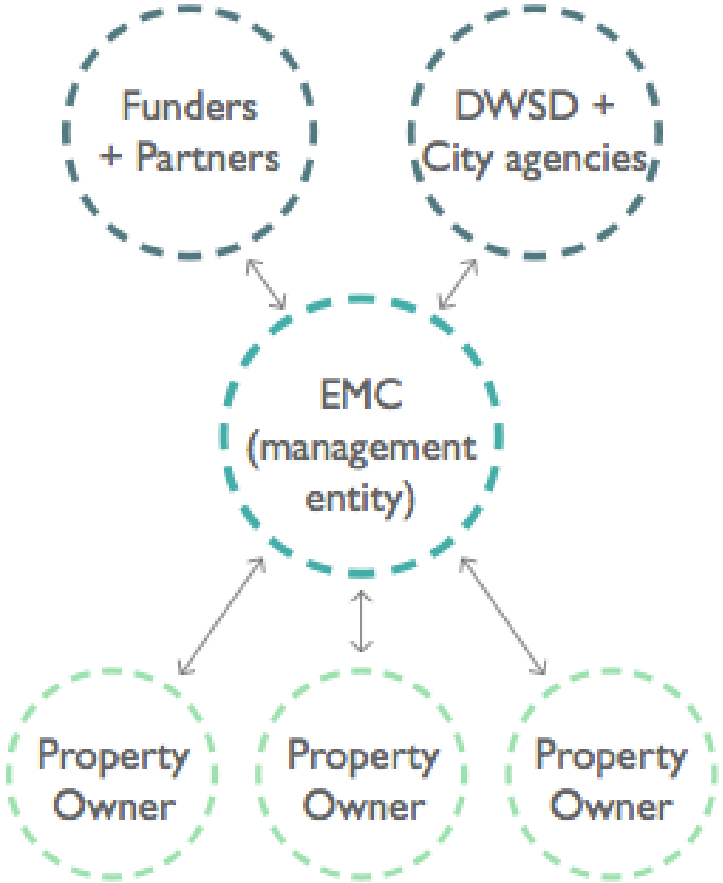
Stormwater Overlay District

CLEAN WATER, GOOD FOOD, GREAT PLACE

Eastern Market Green Stormwater Management Strategy

EASTERN MARKET

Why a districtwide green stormwater infrastructure and management strategy for the Eastern Market District?



ADVANTAGES

Model for sustainable redevelopment that reduces lifecycle costs and sets a standard for development

District support and a managing entity for GSI strategies is an added incentive for businesses

Beautification and identity of the district

DWSD benefits from an intermediary and cost/energy savings

More stormwater runoff collection and drainage charge savings will result from a districtwide approach to water management

TRIPLE BOTTOM LINE BENEFITS

Districtwide solutions
Set a precedent for a high-capacity nonprofits supporting district stormwater management facilities.

Detroit Water & Sewerage Department
Reduce long-term treatment and facility costs and showcase model green infrastructure practices.

Development Incentive
Utility management and reduced drainage charges for property owners.

Economic Development
Support economic development and create green jobs.

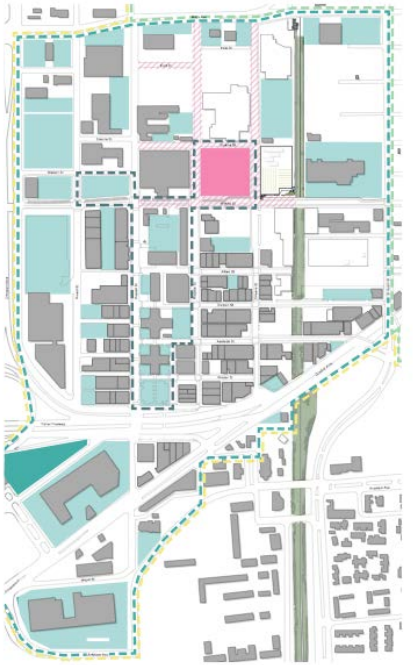
Property values
Green infrastructure improves the district's appearance and enhances the quality of life.

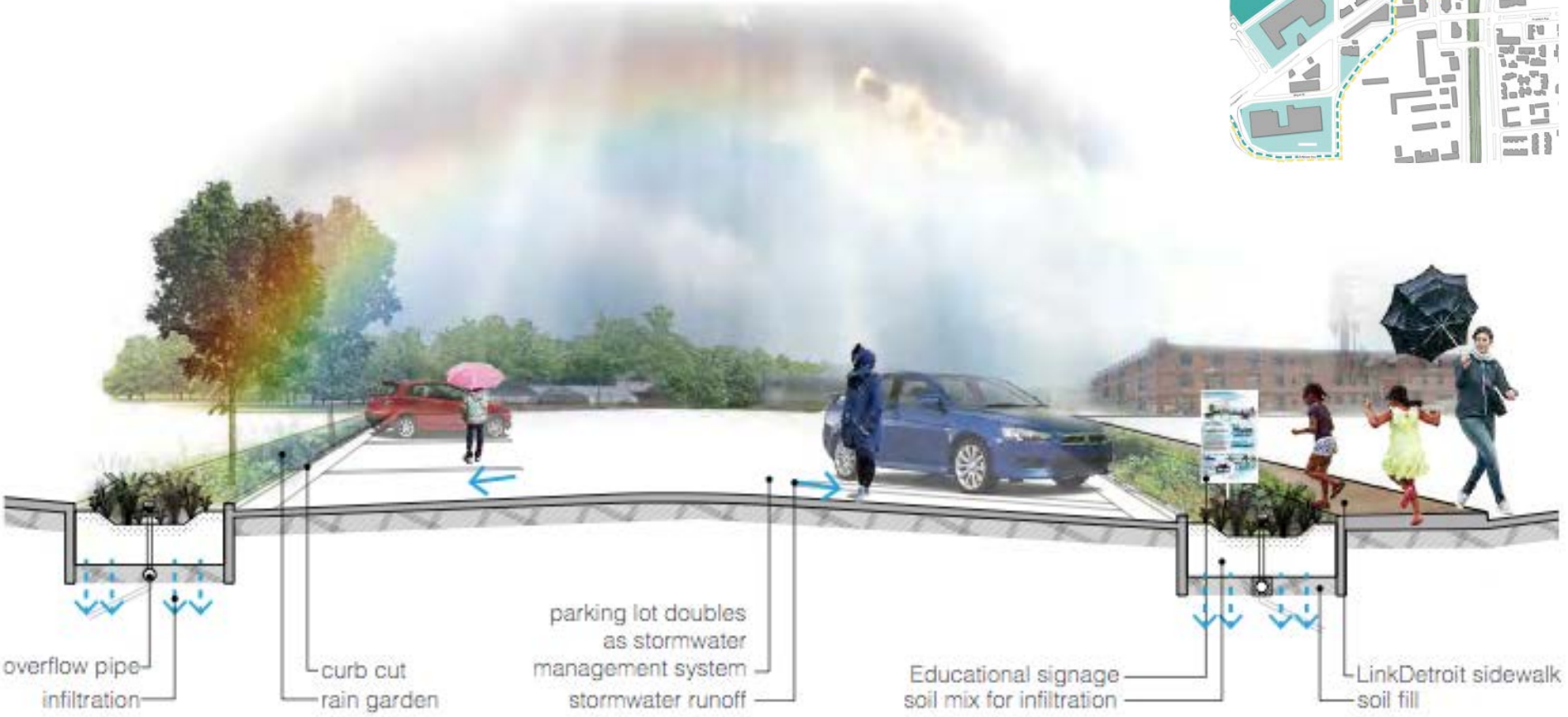
Placemaking & Public Education
High-performance green spaces intended for education and recreation.

Environment
Improved water quality for all.

Parking Lots

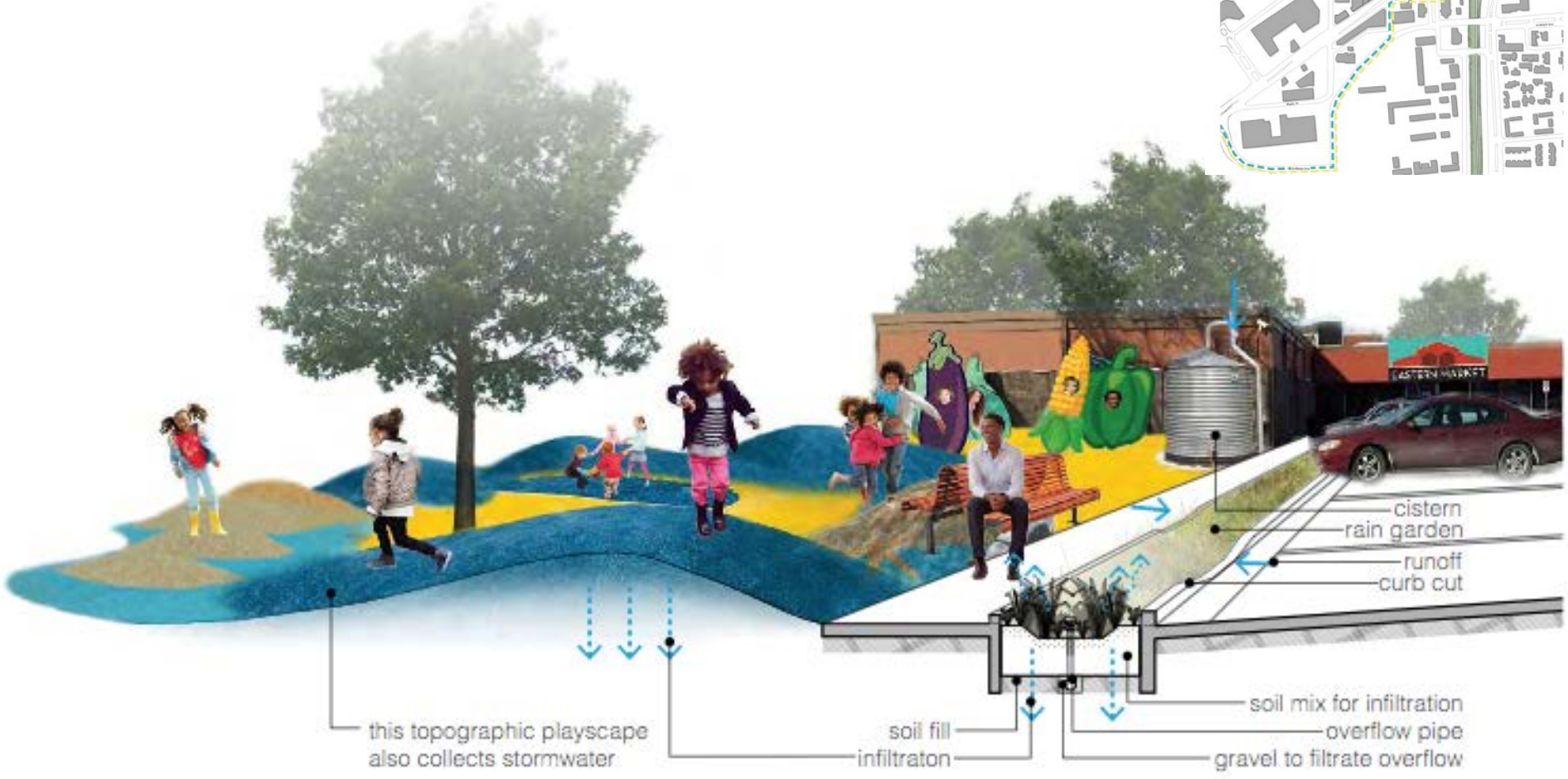
40 acres of parking lots in the existing district
$27,000 in reduced drainage charges per month combined





Small Existing Green Spaces

up to 27,000 gallons of runoff per storm
$1,000 annual drainage charge reduction for this site
$5,000 in additional annual savings for parking lot



Shed 4 and Parking Garage

2.2 acres or 60,000 gallons of water per storm
$7,000 in annual combined drainage charge savings

PRECEDENTS:

© Environmental Services, City of Portland Oregon

Sources: Clark Wilson, EPA; Banking on Green: A Look at How Green Infrastructure Can Save Municipalities Money and Provide Economic Benefits Community-wide

Rooftops

4 acres of rooftops in the public market core, $12,000 annual savings
72 acres in the existing district at $200,000 in annual savings

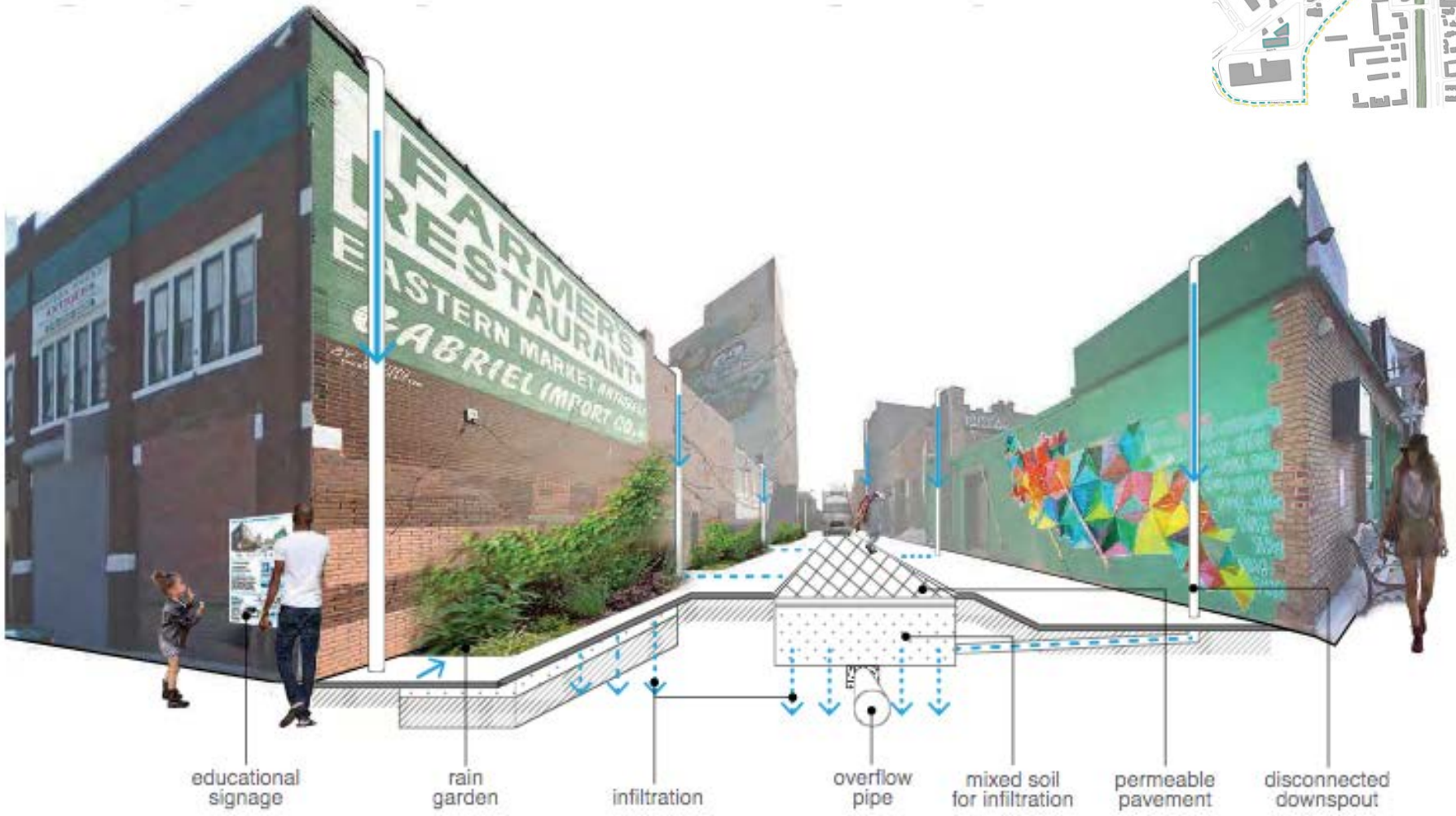
PRECEDENTS:

Sources: http://gbdmagazine.com/2014/26-super-sod/; http://www2.epa.gov/region8/green-roof-images

Alleys

14 acres of rooftop water could be collected in green alleys

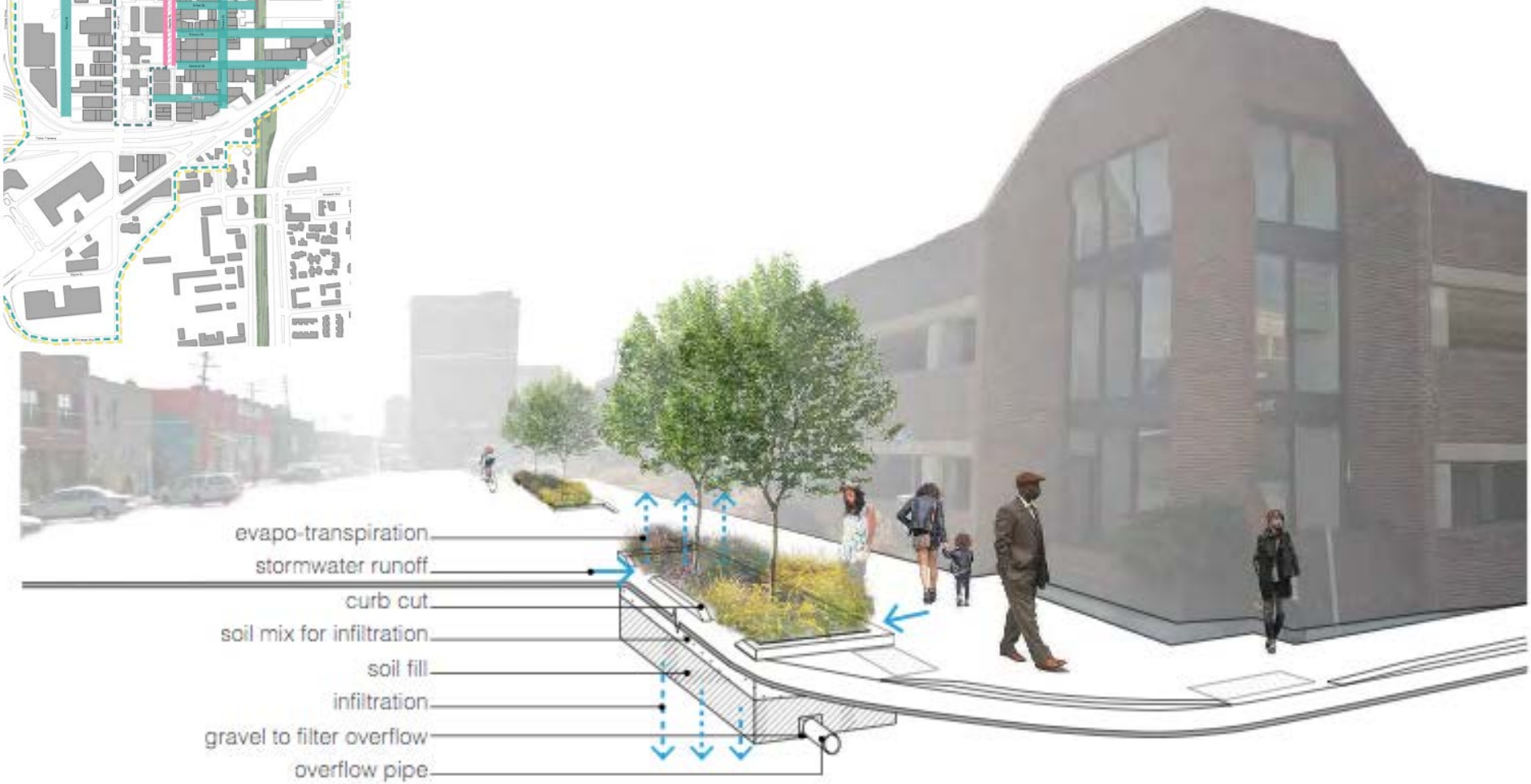
drainage charge savings of $50,000 annually



Public Rights of way

23.6 acres of public right of way could be green streetscapes

More than $70,000 in annual savings



Large Properties

40 acres
$120,000 in savings

Building Rehabilitation Projects

20.8 acres
$65,000 in savings

Continuous Vacant Properties

217 acres
$672,000 in savings

Next Steps

POLICY RECOMMENDATIONS

Take a district approach to stormwater runoff.

Create a drainage charge system that recognizes stormwater management on site.

Include the Eastern Market District in the 2017 CSO permit.

Revise the City of Detroit's design and construction standards.

Chicago Innovation: Green Alley Program

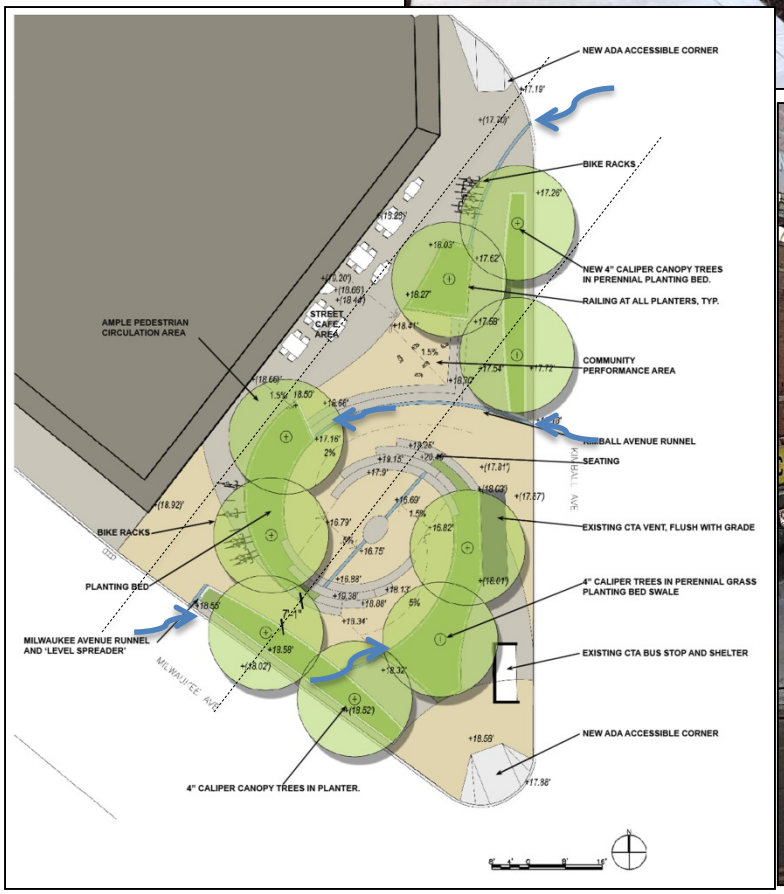
Development of Permeable Asphalt and Concrete:

- Best Practices
- Material Testing
- Trail Batches

The Ground Tire Rubber Solution:

- Approx 600 tires recycled per alley
- Solved cohesion problem

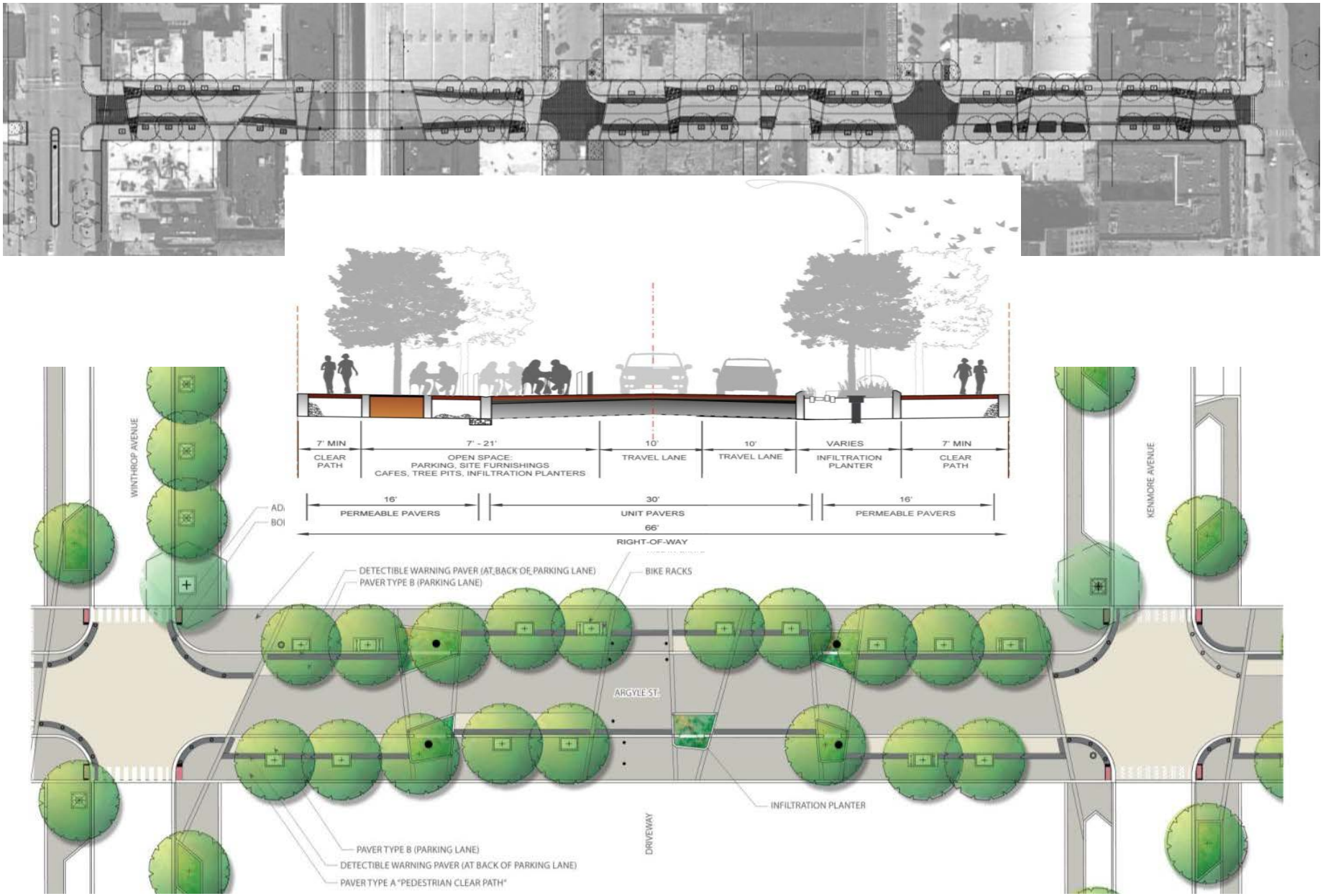
Woodard Plaza



Argyle Shared Street – Broadway to Sheridan

- CTA train station
- Asian market place
- Night market
- Community support
- Business support

Argyle Shared Street – Broadway to Sheridan



Argyle Shared Street

Argyle Shared Street

Argyle Shared Street

Argyle Shared Street

Sustainable Urban Infrastructure Guidelines and Policies (SUIG)

- Mission and Purpose: Create and maintain a city where all benefit from a high quality of life without depleting our natural resources.

- **Performance Metrics** to quantify benefits.

Allow for interaction and observation
Of both people and the natural world

COMMISSIONING

OBJECTIVES

Maintain the site year round to ensure environmental benefits
Identify and develop design tools to predict performance
Evaluate verify and document performance and update design tools

Process - Project Specific Guidance

- Project Delivery Notebook
- Compliance Committee
- Expandable

TABLE 1: WATER REQUIREMENT MATRIX

CDOT Project Type	W1a	W1b	W2	W3	W4	W5	W6	W7	W8	W9	W10
Signal											
Red Light Running Cameras											
Signage & Pavement Marking Improvements											
Lighting Projects											
Tree Planting		•	•				•	•	•	•	•
ADA Ramp Improvements							•	•			
Pedestrian Safety Infrastructure Improvements							•	•	•		
Arterial Resurfacing		•	•				•	•	•		
Bike Facility Projects (primarily striping)							•	•	•		
Bridge Repair (not replacement)							•	•			
Sidewalk and Miscellaneous Concrete Projects		•	•				•	•			
Vertical Clearance improvements		•	•		•	•	•	•	•		
Landscaped Median Improvements		•	•				•	•	•		•
Traffic Calming		•	•				•	•	•		
Transit Projects		•	•		•	•	•	•	•	•	•
City Funded Capital Projects		•	•				•	•	•	•	•
CREATE/Rail Projects		•	•		•	•	•	•	•	•	•
Alley Improvements	•		•	•	•	•	•	•			
Streetscape Projects	•		•	•	•	•	•	•	•	•	•
Federal Aid Capital Projects (highways)	•		•	•	•	•	•	•	•	•	•
WPA/Industrial Streets	•		•	•	•	•	•	•	•	•	•
Bike Stations		•	•		•	•	•	•	•	•	•
Development Funded								•	•		
Major Roadway Realignment	•		•	•	•	•	•	•	•	•	•
Major Roadway Reconstruction	•		•	•	•	•	•	•	•	•	•
Bridge Replacement	•		•	•	•	•	•	•	•	•	•
Riverwalk	•		•	•	•	•	•	•	•	•	•
Pedestrian Safety Zone		•	•				•	•			

CDOT COMPLETE STREETS & SUSTAINABILITY PROJECT DELIVERY Steps by Project Type

Select your project type here. This chart shows which steps are required (x), optional (o), or not required.

Project Type: Signage & pavement marking improvements

	1	**PROJECT SELECTION**
x	**1.1**	**Identify Project Initiation**
x	**1.2**	**Identify Project Budget**
	2	**SCOPING**
x	**2.1**	**Establish Project Goals & Requirements**
	2.2	**Research**
x	2.2.1	Examine Crash Report Summaries
x	2.2.2	Examine Relevant Planned/Programmed Roadway Projects
	2.2.3	Examine Neighborhood and Modal Plans
	2.2.4	Examine Notable Developments Within or Near Project Area
	2.2.5	Review Prior Transportation & Traffic Studies
	2.2.6	Examine Existing Sustainability Data Sets
	2.2.7	Summarize Prior Public Engagement
x	2.2.8	Update Budget
	2.3	**Site Visits**
x	2.3.1	Initial Observation
x	2.3.2	Observation checklist
	2.3.3	Building Form and Function
x	2.3.4	Roadway Form and Function
	2.3.5	Typical Sections
x	2.3.6	Intersection and Mid-block Crossing Worksheets
	2.4	**Mapping and Analysis**
o	2.4.1	Generate and Analyze Typology Maps
	2.4.2	Generate and Analyze Activity Maps
	2.4.3	Generate and Analyze Volume Maps
x	2.4.4	Generate and Analyze Crash Maps
x	2.4.5	Identify Preliminary Sustainability Strategies
x	2.4.6	Create Outreach Plan
x	**2.5**	**Modal Deficiencies & Hierarchy**
x	**2.6**	**Revisit Project Goals and Envionmental Requirements; Formalize Strategies**
	3	**DESIGN**
	3.1	**Create Design Alternatives**
x	3.1.1	Summarize Project Information from Scoping
x	3.1.2	Cross Section Development
	3.1.3	Perform Sustainability Calculations
x	3.1.4	Identify Sustainable Features
x	3.1.5	Initial Public Engagement
	3.2	**Schematic Design**
o	3.2.1	Analyze Crashes and Design for Safer Streets
x	3.2.2	Apply Street and Intersection Designs and Policies
x	3.2.3	Create Geometric Layout
x	3.2.4	Conduct Signal Timing Analysis
o	3.2.5	Conduct Traffic Impact Studies
	3.2.6	Review Intersection Design
x	3.2.7	Verify sustainable requirements or request variance
	3.3	**Obtain Feedback and Approvals**
x	3.3.1	Engage Internal Partners
x	3.3.2	Engage External Agencies
	3.3.3	Engage Public Stakeholders
	3.4	**Design Impact Evaluation**
o	3.4.1	Calculate Projected MMLOS
	3.4.2	Conduct Stormwater Modeling
	3.4.3	Perform Sustainability Valuation
x	**3.5**	**Prepare Prefered Alternative**
x	**3.6**	**Record Design Outputs**

Project Delivery Process and Tracking

- Project Delivery Summary Sheet - Notebook
  - Project “snap shot” for CDOT management
  - Tracks chain of ownership as project develops
  - Construction RE will receive from design PM along w/ documentation
  - Hand back to PM for Maintenance & Commissioning

CDOT COMPLETE STREETS & SUSTAINABILITY PROJECT DELIVERY: SUMMARY

Project Name		Consultants		Source of Funds 1	$0.00	0	Project Scope (160 or fewer characters):
Project Number		Consultants		Source of Funds 2	$0.00	0	
Chief Project Manager		Roadway Jurisdiction		Source of Funds 3	$0.00	0	
CDOT Project Type	(select one)			Project Budget	$0.00		

Stages 1-3: Planning and Design		Stage 4: Construction		Stage 5: Measurement		Stage 6: Maintenance	
Project Manager		Project Manager		Project Manager		Project Manager	
Consultant(s)		Consultant(s)		Consultant(s)		Consultant(s)	

Instructions for Summary: Please refer to Steps by Project Type to see which steps below, from planning through maintenance, need to be completed for your project type. Then fill out the Notebook Stages 1-6 workbooks throughout project delivery. The "Summary" questions will automatically populate here. Check your work and provide the requested explanations on lines 8 and 9 on this page for management review. Project Managers are responsible for seeing projects through all stages.

1: Project Selection	2: Scoping						3: Design							
Goal: Identify, promote projects that advance Complete Streets	Goal: Address all needs identified during scoping						Goal: Address all needs identified during scoping							
Steps 1.1-1.2	Steps 2.1 to 2.5						Steps 3.1 to 3.5 (Substeps formatted 3.X.X)							
1	2.1	2.2	2.2	2.3	2.4	2.5	3.1	3.1	3.2	3.2.3	3.2.4	3.2.5	3.3	3.4
Does this project rank as a High Impact Improvement with the Community Development and Pavement Condition Index ratings?	Established project goals & sustainability requirements	Conducted research: crash analysis, neighborhood and modal plans, roadway projects, developments, transportation studies, soil maps, sewer sensitivity map, urban heat island map, public engagement	Evaluated synergies, coordinated with CDOT PMO to avoid inefficiencies; partnered with community and property owners to maximize co-benefits & long-term maintenance	Completed & documented site visits, typology, segment and intersection worksheets or drawings, as required by project type	Completed mapping, preliminary sustainability strategies, and outreach plan?	Does this project follow Ped-Transit-Bike-Auto hierarchy?	Created draft alternatives: Developed cross sections, including sustainable strategies, ranked alternatives and labeled prefered cross section in Sharepoint?	Analyzed research, performed sustainability calculations, created monitoring or performance plan, and engaged the public, as required by project type?	Schematic Design: Analyzed research, performed sustainability calculations, created performance plan and engaged public	Geometric Layout, intersection design, signal timing, and traffic impact studies. Is project requesting exception to design values?	Geometric Layout. Is project following complete streets traffic control device policies?	Does this project meet applicable sustainability requirements?	Obtained feedback and approvals (external and internal)	Evaluated impacts: MMLOS, stormwater modeling, and sustainability valuation.
(select one)	0	(select one)	(select one)	(select one)	(select one)	(select one)	(select one)	(select one)	(select one)	(select one)	(select one)	(select one)	(select one)	(select one)
If no, please briefly explain below (160 or fewer characers):	If no, please briefly explain below (160 or fewer characters):	If no, please briefly explain below (160 or fewer characters):	If no, please briefly explain below (160 or fewer characters):	If no, please briefly explain below (160 or fewer characters):	If no, please briefly explain below (160 or fewer characters):	If variance requested, received Compliance Committee approval? Enter date.	If cross section was reviewed by Compliance Committee during a spot-check, enter date of review here.	If no, please briefly explain below (160 or fewer characters):	If no, please briefly explain below (160 or fewer characters):	If variance requested, received Compliance Committee approval? Enter date.	If variance requested, received Compliance Committee approval? Enter date.	If variance requested, received Compliance Committee approval? Enter date.	If no, please briefly explain below (160 or fewer characters):	If no, please briefly explain below (160 or fewer characters):
						0				0	0	0		

Access, mobility, Healthy lifestyles

Healthy communities, clean environment

Safe, Sustainable, Beautiful neighborhoods

Beauty, Community, economic development

Outcomes

THANK YOU.

My email address: attarianj @ d e t r o I t m i . g o v