



# Sometimes the BOLDEST Impact Can be the QUIETEST.

*GREEN INFRASTRUCTURE GUARDIANSHIP:*

OPERATIONS & MAINTENANCE PROGRAM LESSONS LEARNED

*Ohio Stormwater Conference – March 11, 2018*



*A Partnership for Green  
Infrastructure Guardianship*





# AGENDA

INTRODUCTIONS

PROGRAM MANAGEMENT  
APPROACH

NEORS D PROGRAM DETAILS

LESSONS LEARNED:

- 1) Maintain Data
- 2) Maintain Intent
- 3) Appreciated Value
- 4) Cost Benefits
- 5) Co-Benefits







UNDERSTANDING  
NEIGHBORHOOD AESTHETICS



CREATIVE RETROFITS



# Program Management Approach

- LEAD: Green Infrastructure design and retrofit team
- 70% SBE/MBE/WBE
- Underserved workforce development - Parole/Ex-offender
- Aesthetic standards





# Northeast Ohio Regional Sewer District GI O&M Program Details





CREATIVE RETROFITS

## Program Metrics

- Property Management
  - Functionality Management
  - Security
  - Costs (T&M)
- Co-Benefits
  - Workforce Development
  - Aesthetics





5.....*CURRENT LOCATIONS*  
3 ..... *ADDITIONAL LOCATIONS*

**CURRENT LOCATIONS:**

10 ..... *SUBSITES BEING MAINTAINED*  
3 ..... *PERVIOUS PAVER AREAS*  
1 ..... *INFILTRATION BASIN*  
1 ..... *UNDERGROUND CHAMBER*  
2 ..... *DETENTION/BIORETENTION*  
7 ..... *WQ BIORETENTION*  
1 ..... *ROADSIDE RAINGARDEN*



## Project Site Locations

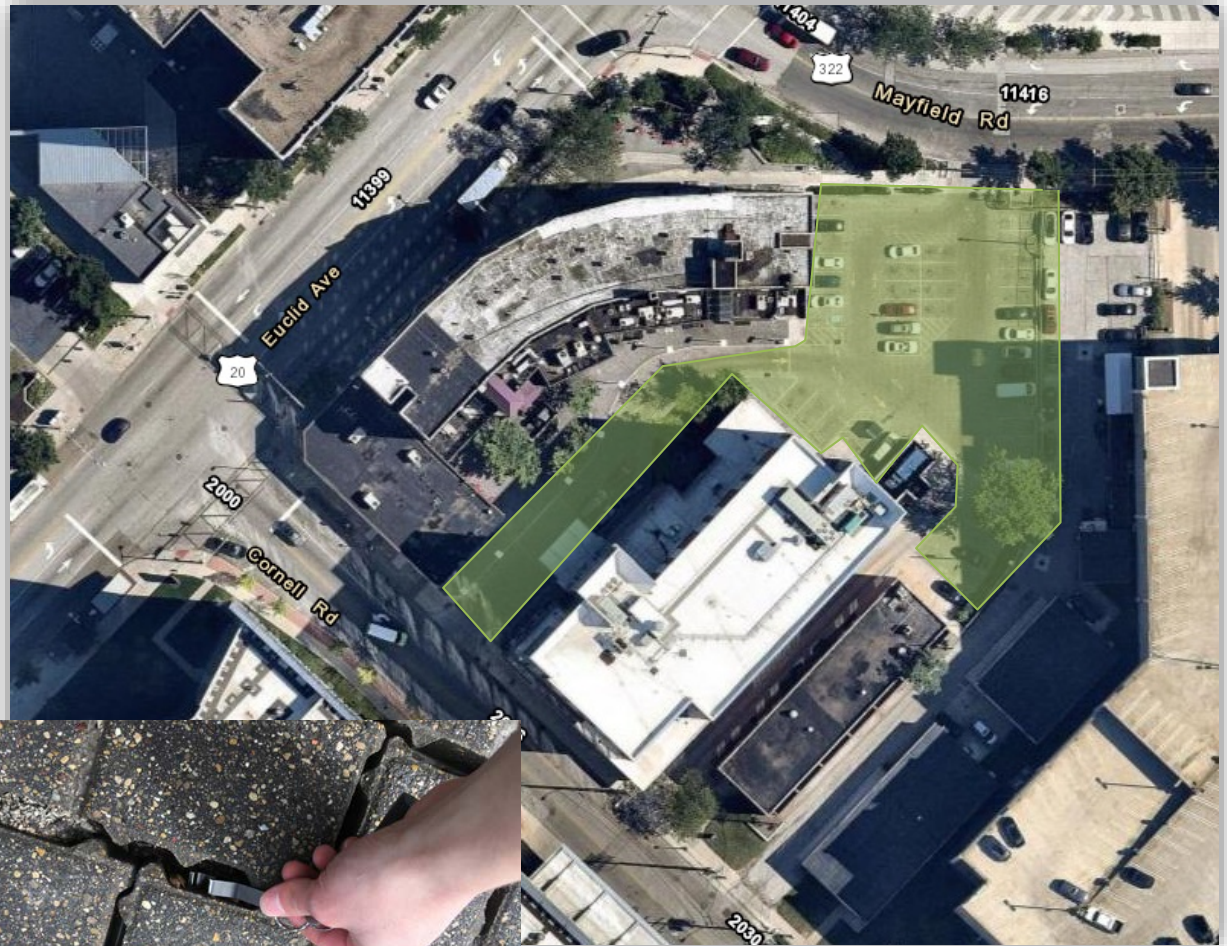




# UCI

- 1 PERVIOUS PAVER PARKING
- 1 UNDERGROUND  
CHAMBER
- 1 INTERPRETIVE SIGN
- CATCH BASIN
- INFILTRATION

- 1) Completed in 2014
- 2) Pavers were cleaned  
prior to contract





# SLAVIC VILLAGE

3 BIORETENTION AREAS

3 INTERPRETIVE SIGNS

PLANTING AREAS

LAWN

2 TRENCH DRAINS

ATTENUATION

- 1) Completed in 2014-2015
- 2) Had been maintained and replanted previously
- 3) Three locations



Northeast Ohio Regional  
**Sewer District**

*Protecting Your Health and Environment*





# FAIRHILL/MLK

- 2 BIORETENTION AREAS
  - 1 RIVERSIDE RESTORATION
  - 1 DIVERSION STRUCTURE
  - 1 PRETREATMENT DEVICE
  - 1 LARGE RETAINING WALL
  - 1 PERVIOUS PAVERS
  - 1 PLAZA
  - 1 INTERPRETIVE SIGN
  - 2 TRASH CANS
  - BENCHES
  - LIGHTS
- OFFLOADING

- 1) Completed in December 2016
- 2) Repairs already performed



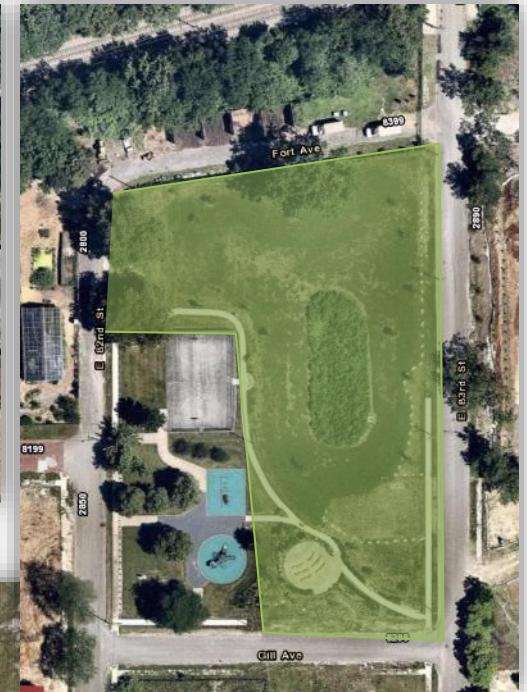


# URBAN AG

- 2 WQ BIORETENTION
- 2 BIORETENTION/DETENTION
- 1 PERVIOUS PAVERS
- AMPHITHEATER
- 3 INTERPRETIVE SIGNS
- PLANTING AREAS
- 2 PRETREATMENT DEVICES

## ATTENUATION/OFFLOADING

- 1) Completed in 2016
- 2) Four locations
- 3) Lawn being maintained by Non-Profit



A Partnership for Green  
Infrastructure Guardianship





# FLEET AVENUE

INFILTRATION BASIN  
FLOATING BIORETENTION  
ROADSIDE RAINGARDEN  
PERVIOUS PAVERS  
DIVERSION STRUCTURE  
PRETREATMENT STRUCTURE  
PLANTING AREAS  
LAWN  
KIOSK  
TRASH CAN  
BIKE RACKS  
BENCHES  
INTERPRETIVE SIGN  
ART PIECES  
CATCH BASINS  
INFILTRATION



1) Substantial completion July  
2017 – site not completed until  
August 2017





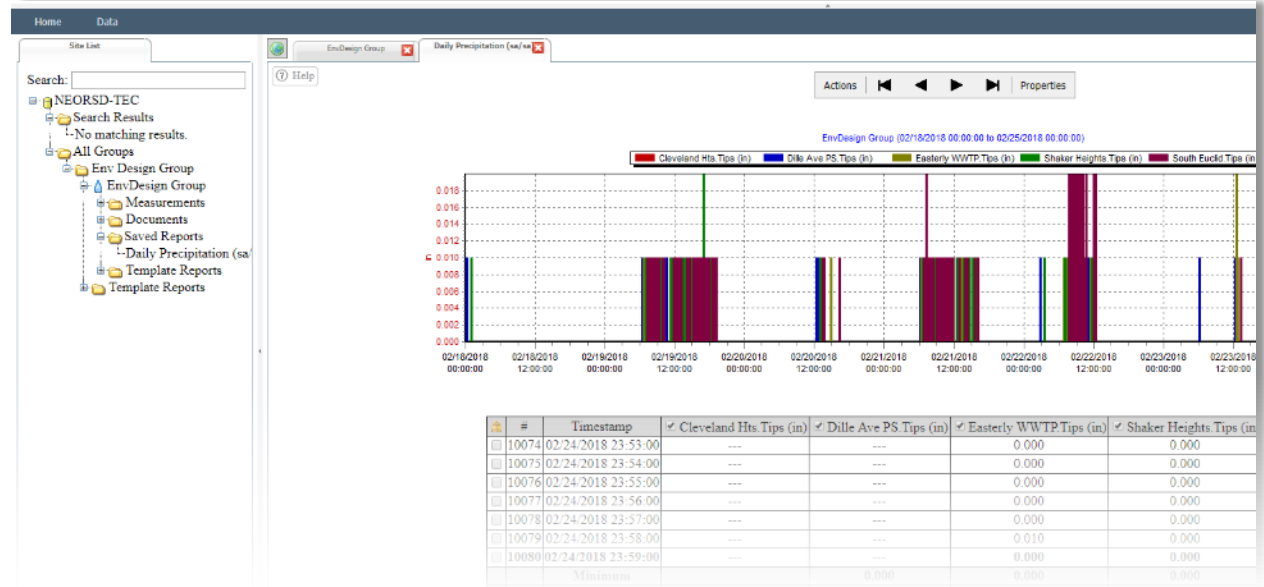
## Program Lessons Learned

- Manage the Data
- Maintain Intent
- Appreciated Value
- Cost Benefits
- Co-Benefits





# MANAGING THE DATA



## Program Specific Data

### Basic Scope Items:

- ☐ Assessments of Sites
- ☐ Weekly Inspection
- ☐ Weekly Maintenance, Trash Removal, and Lawn Mowing
- ☐ Inspection after Rain Events
- ☐ Cleaning of Pavers, Underground Chambers, Catch Bains – Gray Infrastructure
- ☐ Cleaning of Green Infrastructure
- ☐ Maintenance of Planting Areas
- ☐ Retrofits & Aesthetic Improvements



# FORMS

## CATCH BASIN INSPECTION CHECKLIST – Quarterly Log

Facility: UCI	Fleet	MLK/Fairhill	Urban Ag
Street:			
Date:	Time:	Weather Conditions:	Date of Last Inspection:
Inspector:		Title Firm:	
Rain in Last 24 Hours: <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, list amount and timing:			
Sketch of Maintenance Performed and Photos Attached (before and after maintenance): <input type="checkbox"/> Yes <input type="checkbox"/> No			

Catch Basin I.D.	Final Discharge to GI Element? Yes <input type="checkbox"/> No <input type="checkbox"/> If Yes, Discharge to GI Element Name:
Catch Basin Label: Street <input type="checkbox"/> Ground Inlet <input type="checkbox"/> Sign <input type="checkbox"/> None <input type="checkbox"/> Other:	Catch Basin Grate: Properly Aligned: Yes <input type="checkbox"/> No <input type="checkbox"/>
Catch Basin Condition: <input type="checkbox"/> Good <input type="checkbox"/> Poor <input type="checkbox"/> Crumbling <input type="checkbox"/> Fair	Required Maintenance: Problems (check all that apply): <input type="checkbox"/> Tree Work Required <input type="checkbox"/> Cannot Remove Cover <input type="checkbox"/> New Grate is Required <input type="checkbox"/> Ditch Work <input type="checkbox"/> Pipe is Blocked <input type="checkbox"/> Corrosion at Structure <input type="checkbox"/> Frame Maintenance is Required <input type="checkbox"/> Erosion Around Structure <input type="checkbox"/> Remove Accumulated Sediment <input type="checkbox"/> Remove Trash & Debris <input type="checkbox"/> Pipe Maintenance is Required <input type="checkbox"/> Need Cement Around Grate <input type="checkbox"/> Basin Undermined or bypassed Other: .
Sediment Buildup Depth in Catch basin: <input type="checkbox"/> 0-6 (in) <input type="checkbox"/> 6-12(in) <input type="checkbox"/> 12-18 (in) <input type="checkbox"/> 18-24 (in) <input type="checkbox"/> 24+ (in)	Description of Flow: Heavy <input type="checkbox"/> Moderate <input type="checkbox"/> Slight <input type="checkbox"/> Trickling <input type="checkbox"/>

\*If the outlet is submerged check yes and indicate approximate height of water above the outlet invert, height above invert (in). Yes ☐ No ☐

Flow	Observations:	Circle those present:
Standing Water (check one or both)	Color: <input type="checkbox"/> <input type="checkbox"/>	Oil Sheen <input type="checkbox"/>
Weather Conditions: Dry > 24 hours <input type="checkbox"/> Wet <input type="checkbox"/>	Sanitary Waste <input type="checkbox"/>	Bacterial Sludge <input type="checkbox"/>
Sample of Screenings Collected for Analysis? Yes <input type="checkbox"/> No <input type="checkbox"/>	Orange Staining <input type="checkbox"/>	Flotables <input type="checkbox"/>
Comments:	Excessive sediment <input type="checkbox"/>	Pet Waste <input type="checkbox"/>
	Other: <input type="checkbox"/>	Optical Enhance et <input type="checkbox"/>

## Post 1-inch Rain Inspection Report

NEORSD GI O&M – Environmental Design Group		
Date of Inspection		Start/End Time
Inspector's Name(s)		
Type of Inspection:	<input type="checkbox"/> During storm event <input type="checkbox"/> Post-storm event (40+ hours after 1-inch rain)	
Weather Information		
Was there a 1-inch storm prior to inspection provide: Storm Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):		
Weather at time of this inspection? <input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Rain <input type="checkbox"/> Sleet <input type="checkbox"/> Fog <input type="checkbox"/> Snow <input type="checkbox"/> Other: Temperature:		
Are there any discharges at the time of inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, describe:		

BMP Name	Dewatered?
	<input type="checkbox"/> Yes <input type="checkbox"/> No
UCI – Pervious Pavers	<input type="checkbox"/> Yes <input type="checkbox"/> No
Slavic Village – N. 75 <sup>th</sup>	<input type="checkbox"/> Yes <input type="checkbox"/> No
Slavic Village – S. 75 <sup>th</sup>	<input type="checkbox"/> Yes <input type="checkbox"/> No
Slavic Village – 78 <sup>th</sup>	<input type="checkbox"/> Yes <input type="checkbox"/> No
Fairhill/MLK-upper	<input type="checkbox"/> Yes <input type="checkbox"/> No
Fairhill/MLK-lower	<input type="checkbox"/> Yes <input type="checkbox"/> No
UrbanAg-East Bioretention	<input type="checkbox"/> Yes <input type="checkbox"/> No
UrbanAg-West Bioretention	<input type="checkbox"/> Yes <input type="checkbox"/> No
Urban Ag – East Gateway	<input type="checkbox"/> Yes <input type="checkbox"/> No
UrbanAg – West Gateway	<input type="checkbox"/> Yes <input type="checkbox"/> No
ETDPS-Bioretention 1	<input type="checkbox"/> Yes <input type="checkbox"/> No
ETDPS-Bioretention 2	<input type="checkbox"/> Yes <input type="checkbox"/> No
ETDPS-Bioretention 3	<input type="checkbox"/> Yes <input type="checkbox"/> No
Fleet Avenue-infiltration basin	<input type="checkbox"/> Yes <input type="checkbox"/> No
Fleet Avenue – roadside raingarden	<input type="checkbox"/> Yes <input type="checkbox"/> No

## Fleet Avenue Inspection and Maintenance Checklist – Weekly Log

Facility: Fleet Avenue	
Location/Address:	
Date:	Time: Weather Conditions: Title/Firm: Date of Last Inspection:
Inspector:	
Rain in Last 24 Hours: <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, list amount and timing:	
GI Type:	
Pretreatment:	
Sketch of Maintenance Performed and Photos Attached (before and after maintenance): <input type="checkbox"/> Yes <input type="checkbox"/> No	
Complete the form below by indicating the performance condition for each inspection item.	
Performance Condition Key:	
<input type="checkbox"/> Level 1: Good condition, no corrective action required.	
<input type="checkbox"/> Level 2: Fair condition, but still functional. Follow-up inspection in 6 months (or as corrective action dictates) is recommended.	
<input type="checkbox"/> Level 3: Poor condition, needing maintenance, repair and/or replacement – alert Property Manager immediately!	

Inspection Item	Comment	Condition (1, 2 or 3)
<b>1. GENERAL VISUAL ASSESSMENT OF EDUCATIONAL SIGN &amp; AMENITIES</b>		
Educational sign undamaged and clean?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Cracking or missing Pavers?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Solar lights missing or damaged?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Do the solar lights work (place something over solar panel to test)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Community sign board missing or damaged?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Seat wall crumbling, broken, damaged?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Any graffiti? If so where?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Black fence broken, missing panels?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Pavers in sidewalk broken or missing?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Pervious pavers in plaza missing or broken?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Concrete sidewalk on Fleet or W. 53 <sup>rd</sup> cracked, broken or heaving?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Trash can missing, broken or damaged?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>2. DEWATERING</b>		
Standing water is present in infiltration gravel area(s) after a 1" rain event in 40 hours.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Depth? <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Standing water is visible on the pervious paver plaza surface after a 1" rain event in 40 hours.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Depth? <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>3. PRETREATMENT DEVICE</b>		
Sediment & trash has accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Depth? <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Accumulation is near, at or over 50% sediment storage capacity?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>4. ROADSIDE RAINGARDEN INLET (CURB CUT AND PAVERS)</b>		
Concrete curb and/or paver swirl is cracked or broken?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>










# WEEKLY INTERNAL WORKSHEETS



Please refer to scope, property binders and property assessments for additional information and tasks. Communicate any and all changes, questions and comments to Environmental Design Group. Please try to perform work during work week hours of 7 am to 7 pm.

3:35 pm EDT  Print

DAY		DESCRIPTION	HIGH / LOW	PRECIP	WIND	HUMIDITY
TODAY OCT 27		Partly Cloudy	70°/44°	↓ 20%	SSW 13 mph	46%
SAT OCT 28		AM Rain	47°/41°	↓ 100%	SW 12 mph	73%
SUN OCT 29		AM Showers	49°/41°	↓ 60%	WNW 13 mph	70%
MON OCT 30		Cloudy	51°/40°	↓ 20%	WSW 19 mph	56%
TUE OCT 31		Mostly Sunny	48°/38°	↓ 0%	WSW 19 mph	56%
WED NOV 1		Showers	48°/44°	↓ 40%	S 11 mph	65%
THU NOV 2		AM Showers	58°/51°	↓ 60%	SSW 15 mph	78%
FRI NOV 3		PM Showers	59°/49°	↓ 50%	W 12 mph	63%
SAT NOV 4		Showers	56°/50°	↓ 40%	SE 8 mph	72%
SUN NOV 5		AM Showers	62°/54°	↓ 50%	SSE 11 mph	72%
MON NOV 6		Showers	62°/53°	↓ 60%	SSE 13 mph	72%
TUE NOV 7		Showers	59°/45°	↓ 60%	S 14 mph	84%
WED NOV 8		Showers	57°/42°	↓ 60%	SW 10 mph	65%
THU NOV 9		Showers	53°/44°	↓ 60%	SW 9 mph	62%
FRI NOV 10		AM Showers	55°/44°	↓ 40%	SSW 8 mph	66%



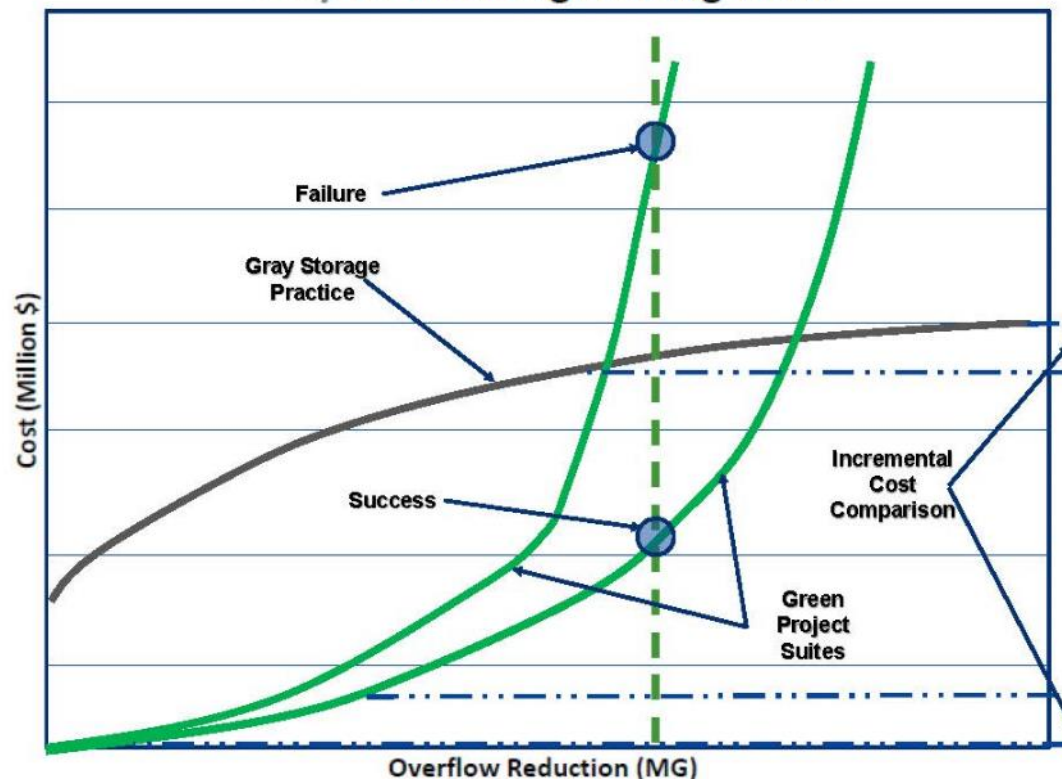
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Infrastructure Guardianship*



Green Infrastructure is like a child  
– with nurturing it grows,  
providing diverse benefits as it  
ages.

Gray infrastructure is like a car  
– it depreciates in value as soon as  
you leave the lot.

## Gray to Green Right Sizing Trend



Understanding the Cost Benefits – from  
cradle to grave (planning to preserving)

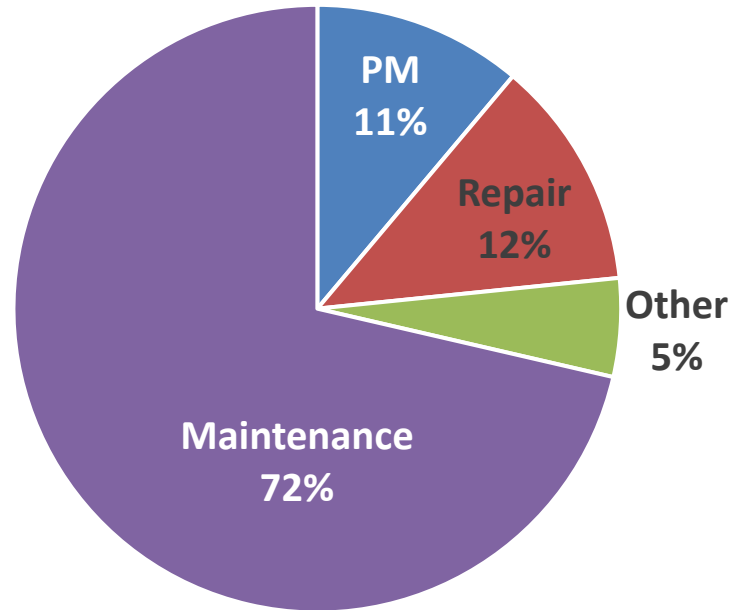




# CONTRACT ESTIMATES



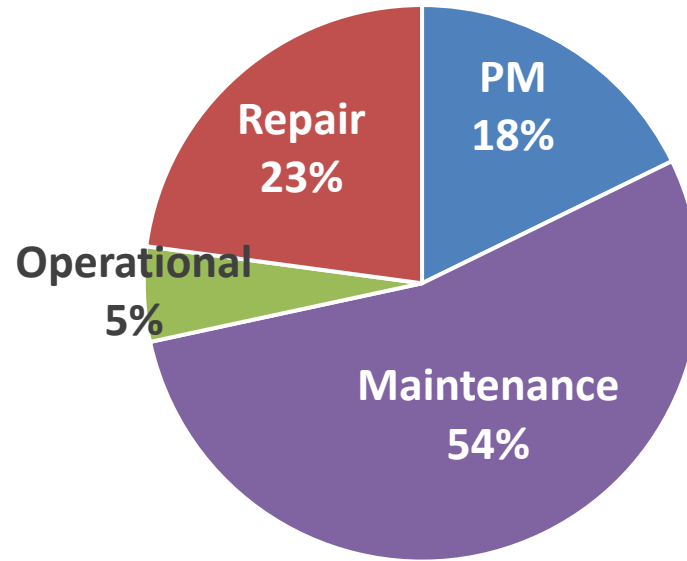
## CONTRACT BREAKDOWN



\$816,368 FOR 2 YEARS  
\$34,015 PER MONTH



# Contract Cost Breakdown



***65% Fee Remaining***  
***58% Time Remaining***

FIRST  
10 MONTHS

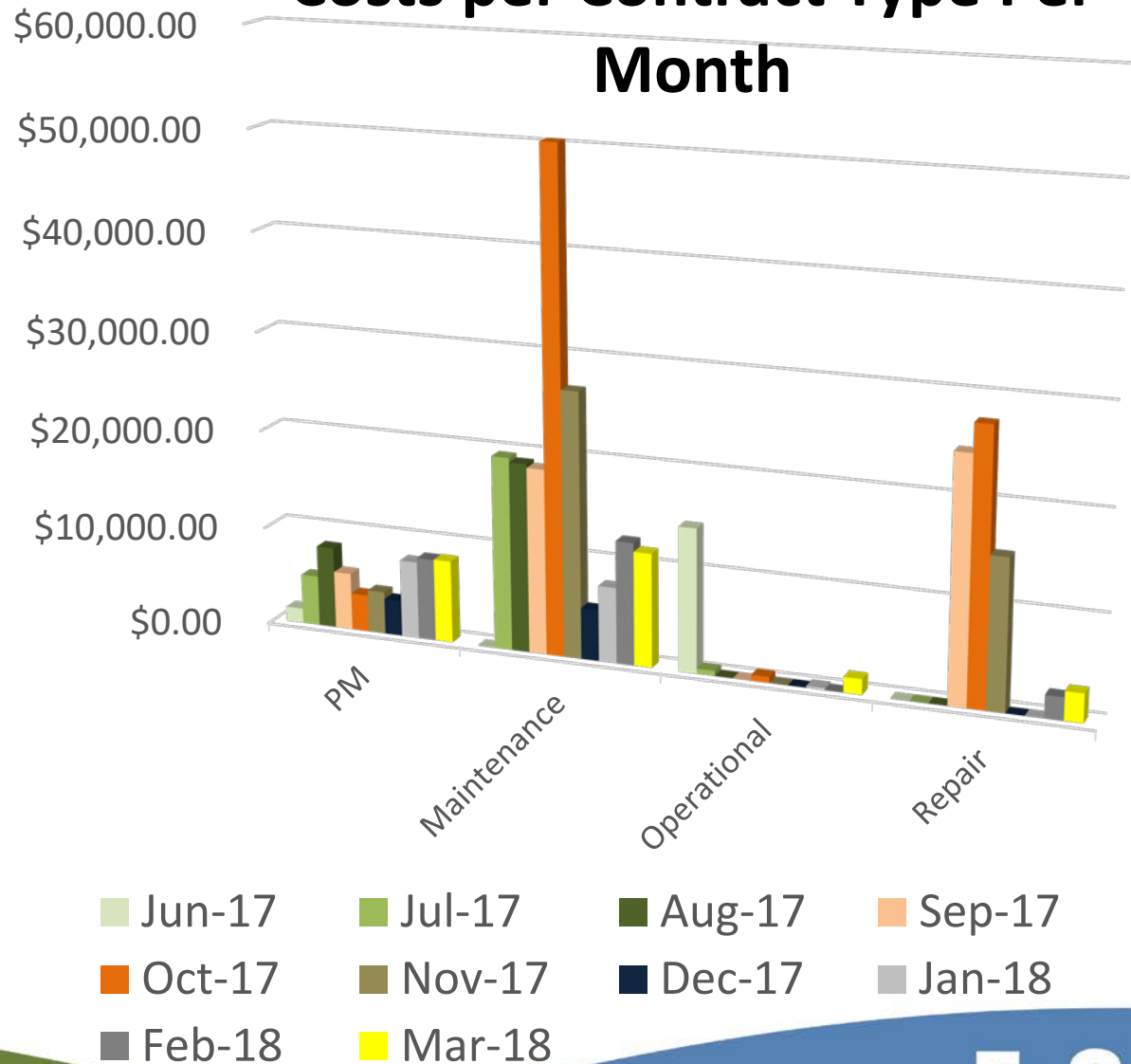




# FIRST 10 MONTHS



## Costs per Contract Type Per Month

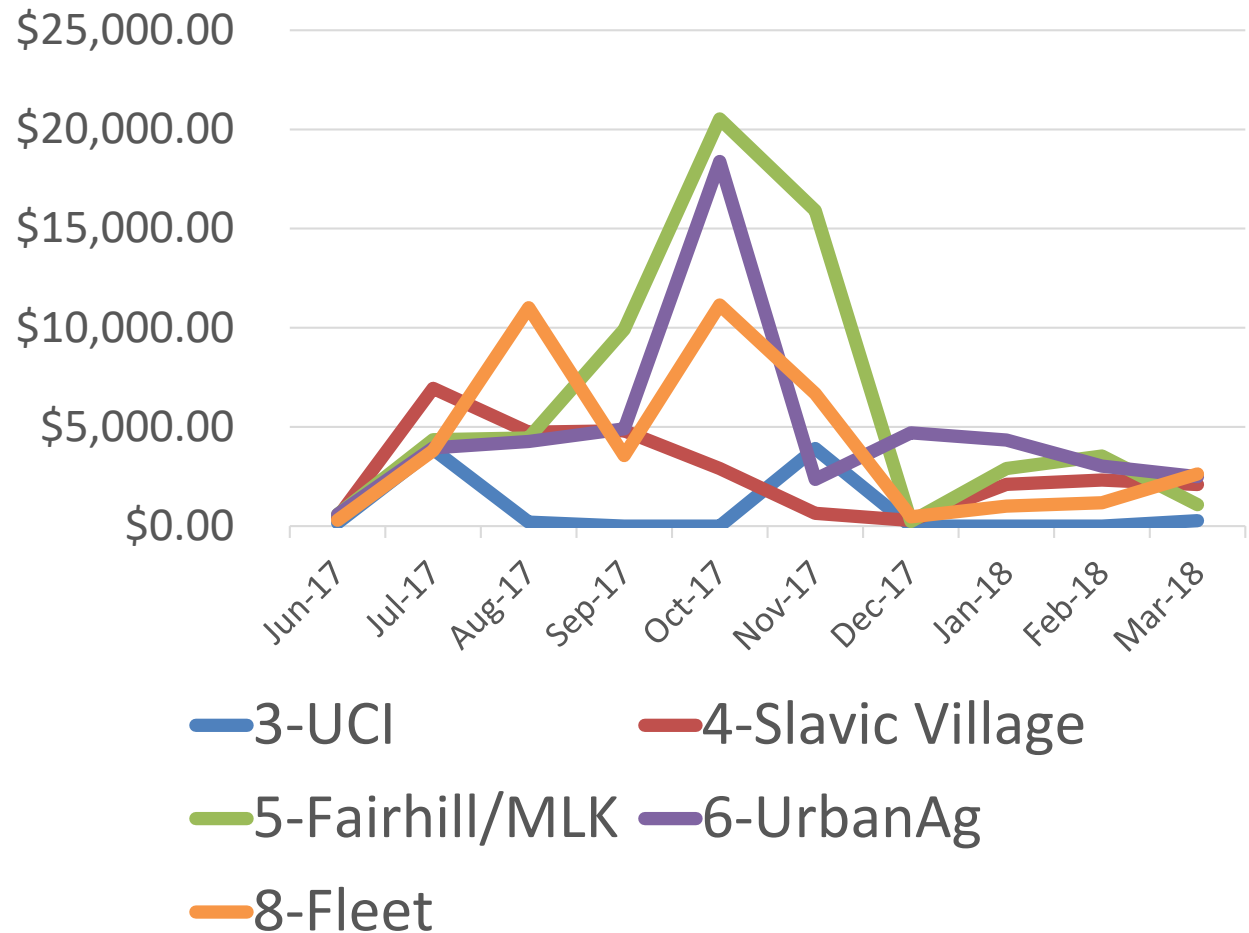




FIRST  
10 MONTHS



## Costs Per Month Per Site



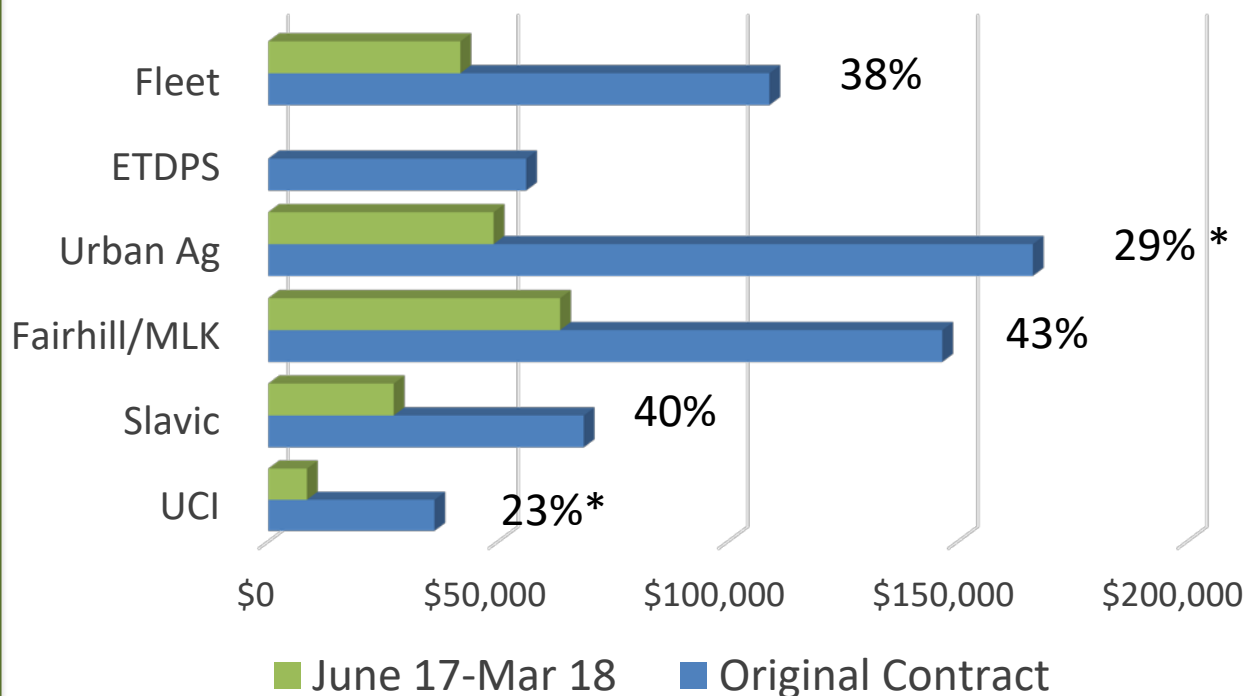


FIRST  
10 MONTHS

42% INTO  
CONTRACT  
DURATION



## Original Estimate Per Site to Current Costs



\* UCI - Non profit performs snow plowing

\* Urban Ag – Non profit performs mowing and trash removal

\*\* Costs include PM oversight costs



Current Data

Data Comparisons

SITE	H2O (MG)	CSO (MG)	Construction \$\$	O&M \$/month	O&M \$/MG H2O/Month
UCI	1.00	0.1	\$186,694	\$1,971	\$840*
Slavic	0.20	0.1	\$218,717	\$3,857	\$13,635
Fairhill/MLK	17.0	2.4	\$5,614,089	\$7,477	\$374
Urban Ag	7.00	1.6	\$6,460,815	\$6,030	\$700*
Fleet	4.70	0.5	\$1,997,989	\$5,308	\$889
Typ. Sewer Cleaning (USEPA)				\$2,823/mile/year	
Typ. Gray Basin (USEPA)				\$40,000/MG Capacity	

### Other Cost Breakdown

Program Management	\$5,650/month
Operational Support	\$1,752/month
Repair	\$72,764/to date

\* UCI - Non profit performs snow plowing

\* Urban Ag – Non profit performs mowing and trash removal

\*\* Costs include PM oversight costs





# RETROFITS



## 6-URBAN AG ZONE

*Aesthetic, educational and/or operational improvements*

### EAST BIORETENTION

09.07.2017  
Environmental  
Design Group  
the community impact people



#### **Curb Appeal:** Improvement of aesthetics from sidewalk on E 82ND

##### **Aesthetic Improvements**

Option A) Remove and reseed side slopes

\$18,000 to \$25,000 (kill off all weeds/clover, reseed as per plan)

Option B) Create three distinct zones of wildflower areas, mow rest, install educational signs (140 x 60)

\$7,500 to \$10,000 (work with NEORSR graphics staff for signs, remove three areas of seed, plant Karl Foerster or Big bluestem rows, reseed using seed mixes in plans)



Living infrastructure doesn't  
require more thought,  
just different thought



Maintain Sites To Their Useful Intent – Which May  
Be Different Than Maintaining To The Design



Living infrastructure doesn't  
require more thought,  
just different thought





Don't be a "NIMBY"  
(Not in my Back Yard)





Corresponding the Co-  
benefits



Provide appreciated value to rate  
payers/constituents





# WORKFORCE DEVELOPMENT

How to Create a Workforce

Metrics of Workforce Development

## Individual Taxpayers

If Taxable Income Is Between:	The Tax Due Is:
0 - \$9,525	10% of taxable income
\$9,526 - \$38,700	\$952.50 + 12% of the amount over \$9,525
\$38,701 - \$82,500	\$4,453.50 + 22% of the amount over \$38,700
\$82,501 - \$157,500	\$14,089.50 + 24% of the amount over \$82,500
\$157,501 - \$200,000	\$32,089.50 + 32% of the amount over \$157,500
\$200,001 - \$500,000	\$45,689.50 + 35% of the amount over \$200,000
\$500,001 +	\$150,689.50 + 37% of the amount over \$500,000

## FEDERAL TAX COMPARISON

### Gray

- 2 people @ \$83k/yr = \$28,178

### Green

- 3 people @\$90k/yr = \$47,668
  - 6 people @\$60k/yr = \$54,837
  - 8 people @ \$23k/yr = \$20,555
- \$123,061 annually







## Green Infrastructure Guardianship



Northeast Ohio Regional  
**Sewer District**  
Protecting Your Health and Environment

## SUMMARY LESSONS LEARNED

- Everything requires maintenance
- Get qualified maintenance
- Not all GI is created equal – consider the life cycle costs and co-benefits.





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