OWEA 2019

ARCADIS Design & Consultancy for natural and built assets

# KEYS TO AN EFFECTIVE GI OPERATIONS AND MAINTENANCE PROGRAM

June 27th 2019

**Bill Landshof, PE**
Principal Water Engineer

**Kurt Kinney, PE**
Staff Water Engineer

# Four Elements for Success

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# Four Elements for Success

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# Workforce: Key Players

Routine Maintenance Worker

Skilled Inspectors

Program Manager

Data Management Specialist

Subject Matter Experts (Plant, Tree, Engineering)

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# Workforce – Importance of Experts

Plant Expert Address planting issues and plant health concerns

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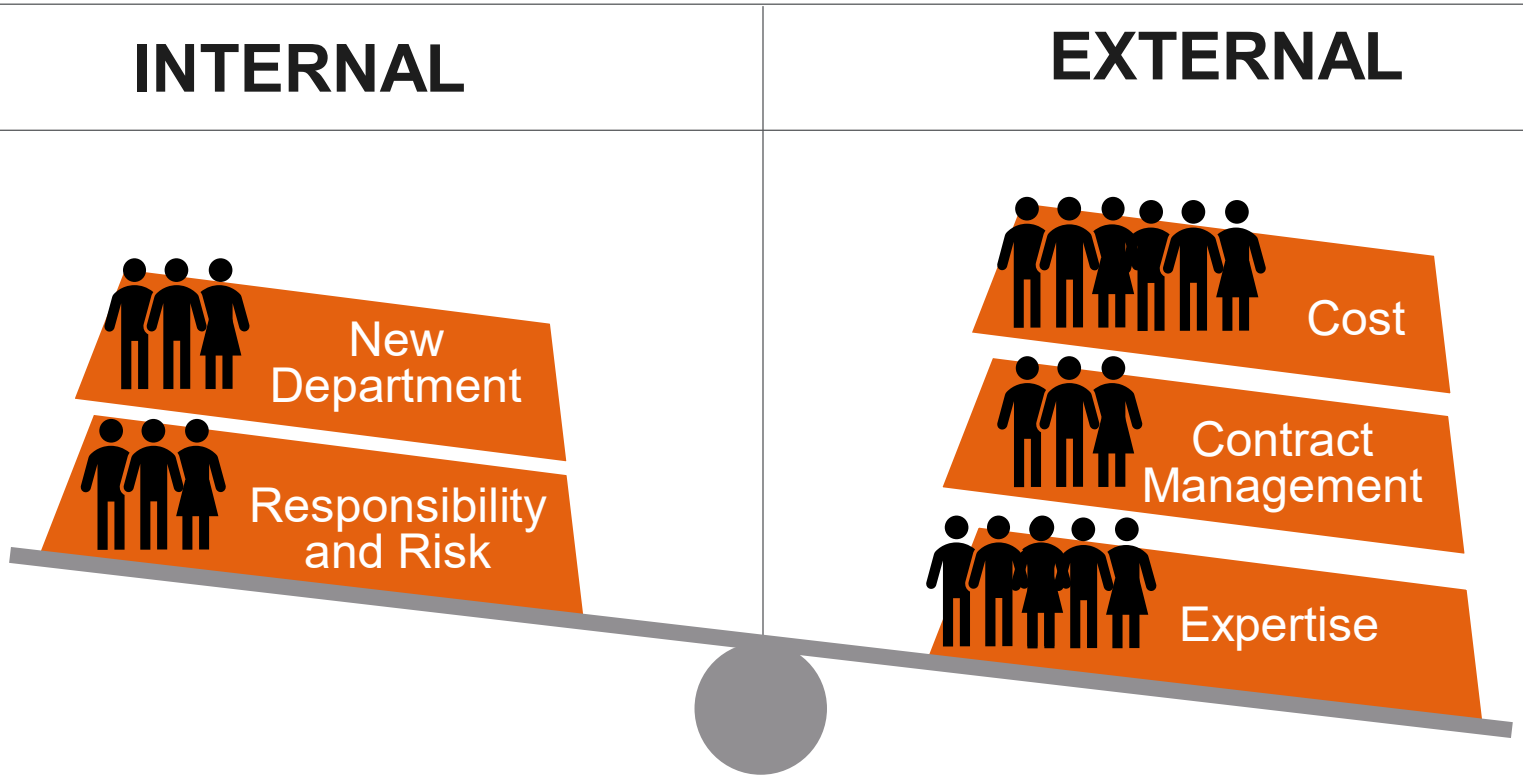
# Workforce – Balancing Resources

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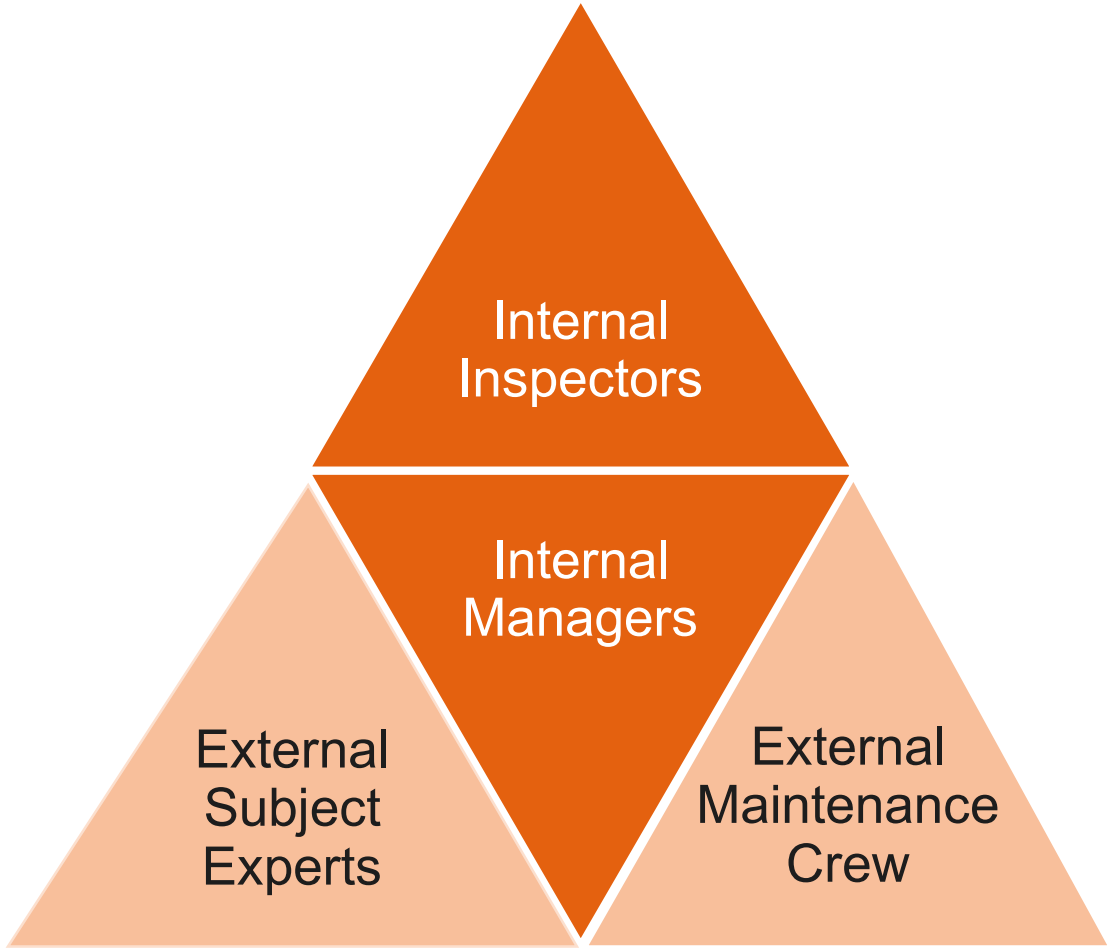
# Workforce – Balanced Recommendation

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# Recommended Inspection Types

**Standard Maintenance Inspections:**

- Mowing
- Trash removal
- Plant replacement
- Mulching

**Quality-Related Inspections:**

- Effectiveness
- Structural repair
- Regulating overflow
- Asset integrity
- Resident concern

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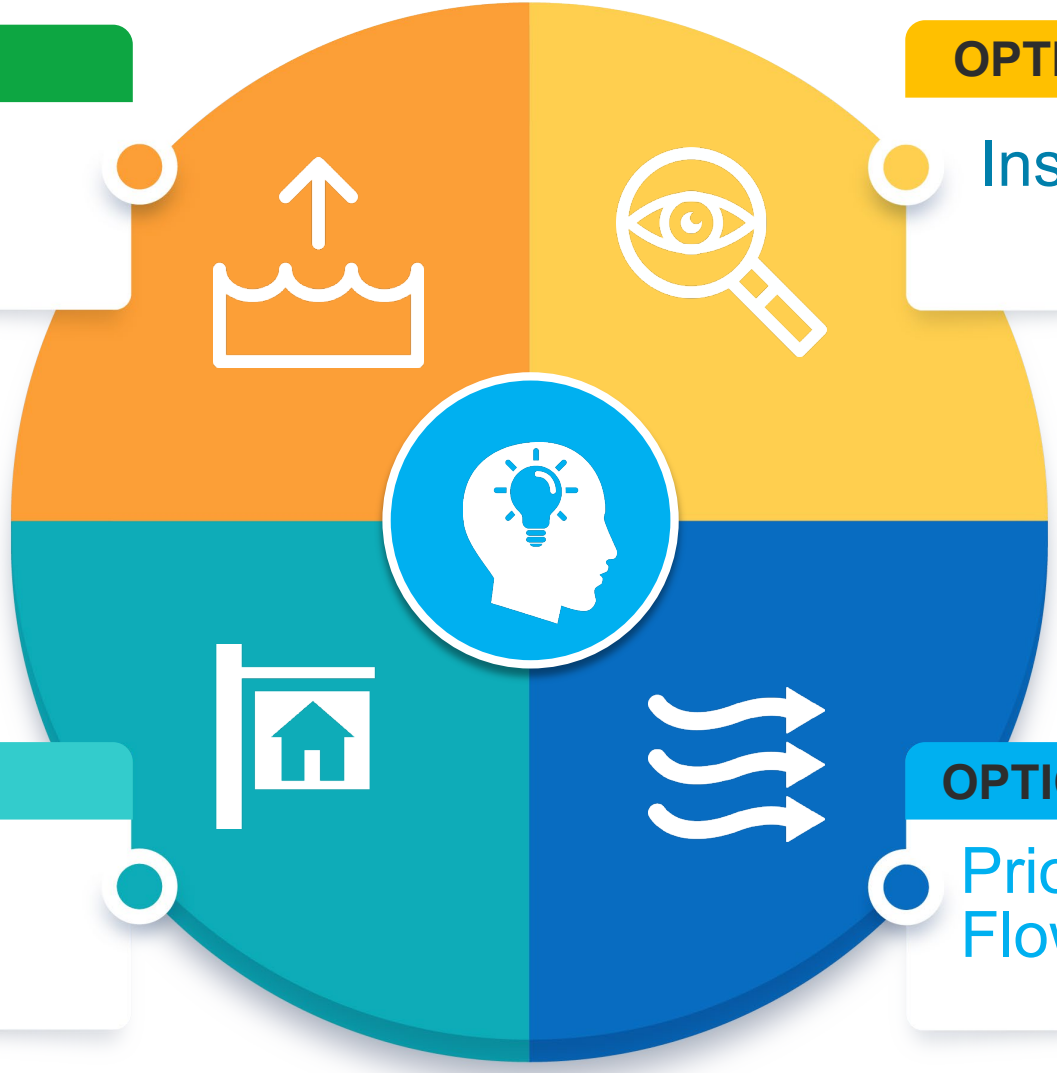
# Quality Inspection Frequency Options

**OPTION 4**

Only Inspect After Major Storm Events

**OPTION 1**

Inspect Monthly



**OPTION 3**

Potential for the Largest Failure or Resident Impact

**OPTION 2**

Prioritize Based on Flow & Slope

# Maintenance Inspection Guidelines

## Seattle Public Utilities Green Stormwater Operations and Maintenance Manual Erosion

| Service Level A (Excellent Effort) | Service Level B (Good Effort) | Service Level C (Moderate Effort) | Service D (Poor Effort) |
|---|---|---|---|
| No erosion or bare spots | Some erosion and bare spots (0-5%) | Substantial erosion and bare spots (5-10%) | Completely eroded and bare spots(More than 10%) |
| | | | |

**A Picture is Worth a Thousand Words**

# Maintenance Inspection Guidelines

## Seattle Public Utilities Green Stormwater Operations and Maintenance Manual Erosion

| Service Level B (Good Effort) | Service Level C (Moderate Effort) | Service Level D (Low Effort) |
|---|---|---|
| water infiltrates well, pavers are up to 10% clogged or minimal ponding is observed | water infiltrates well, pavers are between 10-40% clogged and minimal ponding is observed | water does not infiltrate well, pavers are more than 40% clogged |
| | | |

**A Picture is Worth a Thousand Words**

# Transform to a Digital Platform

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- Microsoft Excel
- Collector for ArcGIS by ESRI
- Survey 123 for ArcGIS by ESRI
- ArcGIS Desktop
- SQL Server Reporting Services

- Fulcrum
- SQL Sync
- SQL Server Reporting Services

Create a Software Workflow

# Data Collection Tools

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# Data Collection Tools – Tablet Inspection

# Tablet Inspections Deliver One-Touch Reporting

BLUE PRINT COLUMBUS
Clean streams. Strong neighborhoods.

ARCADIS

**City BMP ID:** 0000G0130
**Inspector Names:** S.Weagraff,R.Finy
**Lead Inspector:** S.Weagraff
**Inspection Date/Time:** 5/7/2018/08:12
**CIP No.:** 650870-100005
**BMP Type/No.:** Rain Garden / RG No. 1 - 400 Canyon Dr. S.

**Project Area:** Blueprint Clintonville 1 - Cooke / Glenmont
**Owner Name:** City of Columbus
**Design Firm:** Brown and Caldwell
**Latitude:** 40.046242
**Longitude:** -83.008591

| Inspection Items | Present? (Yes/No) | Maintenance Needed? (Yes/No) | Inspection Frequency | Comments |
|---|---|---|---|---|
| ***Bioretention Facilities*** | | | | |
| 1. Permanent Structures | | | | 1a. Debris is present in catch basin.<br>1i. Bare spots are evident in turf along rain garden. |
| a. Overflow structure/Catch basin | Yes | Yes | M | |
| b.Inlet/Inlet Structure/Curb cut/Curb plate/Grates | No | No | M | |
| c. Basin walls | No | No | M | |
| d. Outlet Control (i.e. ball valve, Agridrain, etc.) | Yes | No | M | |
| e. Inflow pipe headwall | No | No | M | |
| f. Splash pads | No | No | M | |
| g. Delineators | No | No | M | |
| h. Downspouts | No | No | M | |
| i. Condition of side slopes | Yes | Yes | M | |
| j. Cleanout | Yes | No | M | |
| 2. Debris Removal | | | | |
| a. Debris in bioretention and contributing areas? | No | No | M | |
| b. Leaf and tree debris | No | No | M | |
| c. Sediment deposition (depth and percent coverage) | No | No | M | |
| d. Trash | No | No | M | |
| 3. Vegetation | | | | 3c. It appears that the Kims Knee High and Asclepias Tuberosa have not broken dormancy and will be recounted during a future inspection. All other plants are correct according to planting plans.<br>3d. Bare spots are evident in turf along rain garden.<br>3e. Weeds are present in rain garden. |
| a. Dead or diseased plants | No | No | M | |
| b. Prune perennials (Spring/Fall) | Yes | No | SA | |
| c. Plant composition according to approved plans | Yes | No | M | |
| d. Turf | Yes | Yes | M | |
| e. Weeds | Yes | Yes | M | |
| f. Vegetation sufficiently watered? | Yes | No | M | |
| g. Trees and shrubs? | No | No | M | |
| 4. Erosion | | | | |
| a. Mulch erosion | No | No | A | |
| b. Biosoil erosion | No | No | M | |
| c. Stone erosion | No | No | M | |
| 5. Function | | | | 5d. There are bare areas where no vegetation is planted or where plants have not broken dormancy. |
| a. Sediment depth greater than 20% of swale design depth | No | No | M | |
| b. Filter bed is blocked or filled inappropriately | No | No | A | |
| c. Vandalism | No | No | M | |
| d. Sufficient plant coverage | No | Yes | M | |
| 6. Temporary Erosion Controls | | | | |
| a. Straw wattles/straw bales/straw matting/silt fence | | | M and S | |
| b. Inlet protection | | | M and S | |
| c. Sediment issues | | | M and S | |
| d. Erosion issues | | | M and S | |
| e. Standing water | | | and S | |
| f. Side slopes | | | nd S | |
| g. Unhealthy plants? | | | | |
| h. Temporary seeding and mulching | | | S | |

Inspection Frequency Key A = Annual, SA = Semi-annual, M = Monthly, S = A

Summary
1. Inspector's Remarks: None

2. Previous maintenance not completed: None

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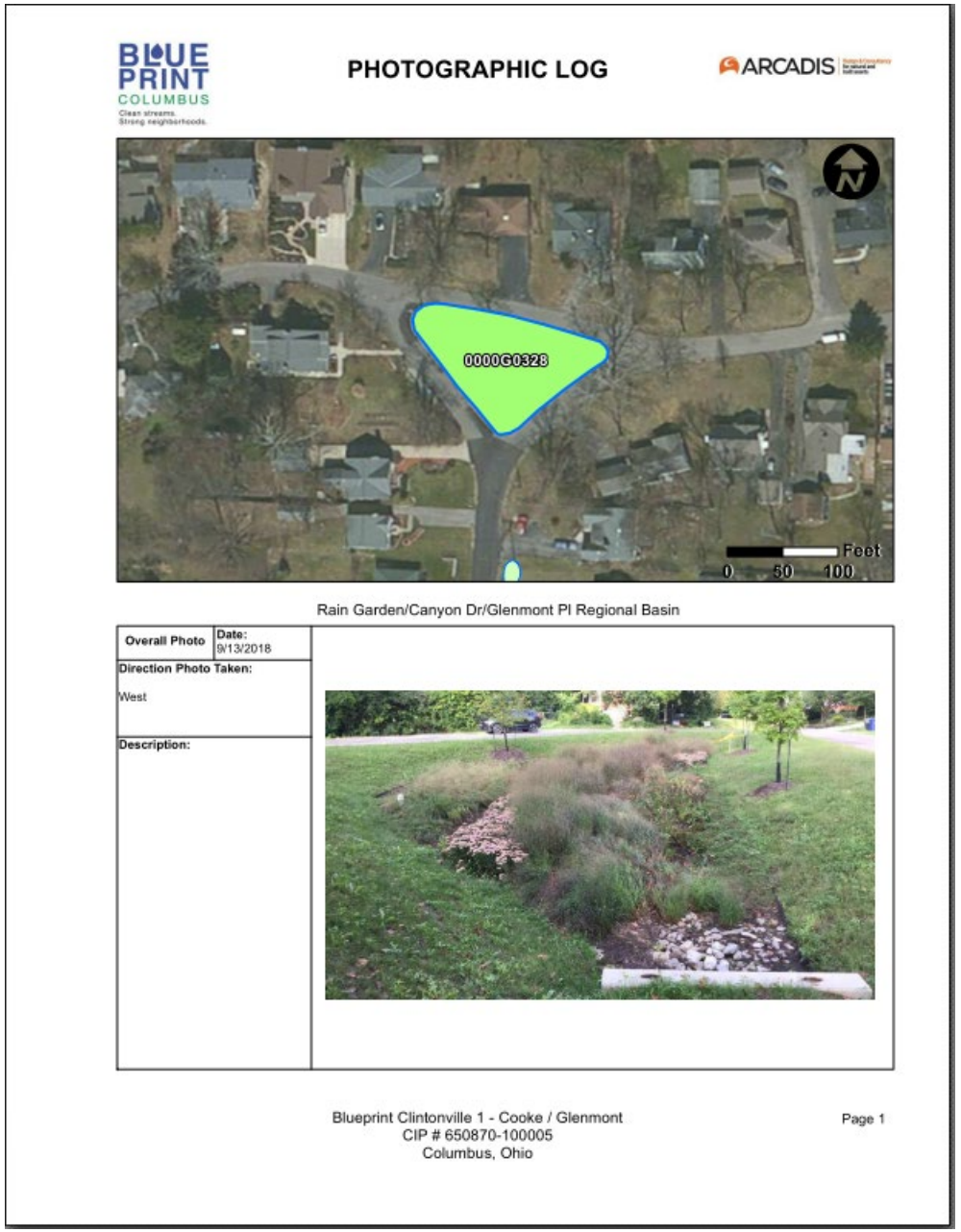
# One Touch Reporting



BLUE PRINT COLUMBUS
Clean streams. Strong neighborhoods.

**PHOTOGRAPHIC LOG**

ARCADIS




Rain Garden/Canyon Dr/Glenmont Pl Regional Basin

| Overall Photo | Date: 9/13/2018 |
|---|---|
| Direction Photo Taken: West | |
| Description: | |



Blueprint Clintonville 1 - Cooke / Glenmont
CIP # 650870-100005
Columbus, Ohio

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# One Touch Reporting

BLUE PRINT COLUMBUS
Clean streams. Strong neighborhoods.

**PHOTOGRAPHIC LOG**

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| Photo No. | Date: |
|---|---|
| 01 | 9/13/2018 |

**Direction Photo Taken:**
North

**Description:**
Overall photo facing north.

| Photo No. | Date: |
|---|---|
| 02 | 9/13/2018 |

**Direction Photo Taken:**
North

**Description:**
Missing butterfly weed in southwestern area of basin.

Blueprint Clintonville 1 - Cooke / Glenmont
CIP # 650870-100005
Columbus, Ohio

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# Maintenance Inspection Summary

**MAINTENANCE INSPECTION SUMMARY SHEET**

| Project Name | No. of BMPs Inspected this Month | No. of BMPs With Maintenance Items | No. of BMPs With Maintenance Items for 2+ months |
|---|---|---|---|
| Blenheim / Glencoe | 0 | 0 | 0 |
| Cooke / Glenmont | 16 | 16 | 5 |
| Morse / Dominion | 0 | 0 | 0 |
| Overbrook / Chatham | 0 | 0 | 0 |
| Schreyer / Springs | 20 | 17 | 0 |
| Weisheimer / Indian Springs | 0 | 0 | 0 |

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# Maintenance Inspection Summary

**MAINTENANCE INSPECTION SUMMARY SHEET**

**Cooke / Glenmont**

| Recurring for 2+ Mo | BMP Name | BMP ID | Issues at BMP | Comments |
|---|---|---|---|---|
| | Rain Garden | 0000G0130 | 1a | 1a. Debris found in catch basin, needs removal. |
| X | Rain Garden | 0000G0130 | 2b | 2b. Sycamore seeds present in rain garden. |
| X | Rain Garden | 0000G0130 | 3d | 3c. Vegetation is actively growing. Species count will occur after all plants breaks dormancy.<br>3d. Bare spots evident in turf along rain garden. |
| X | Rain Garden | 0000G0130 | 4a | 4a. Mulch erosion along outer perimeter of rain garden on west end. |
| | Rain Garden | 0000G0324 | 3e | 3c. Vegetation is growing and will be re-evaluated when all plants break dormancy.<br>3e. Grass is present along the edging of the basin inside the basin and needs to be weeded. |
| | Rain Garden | 0000G0324 | 4a | 4a. Mulch has eroded away at the inlet locations for the downspout redirections. |
| | Rain Garden | 0000G0328 | 1e | 1e. Sediment removal is needed downstream of inflow pipe headwall. |

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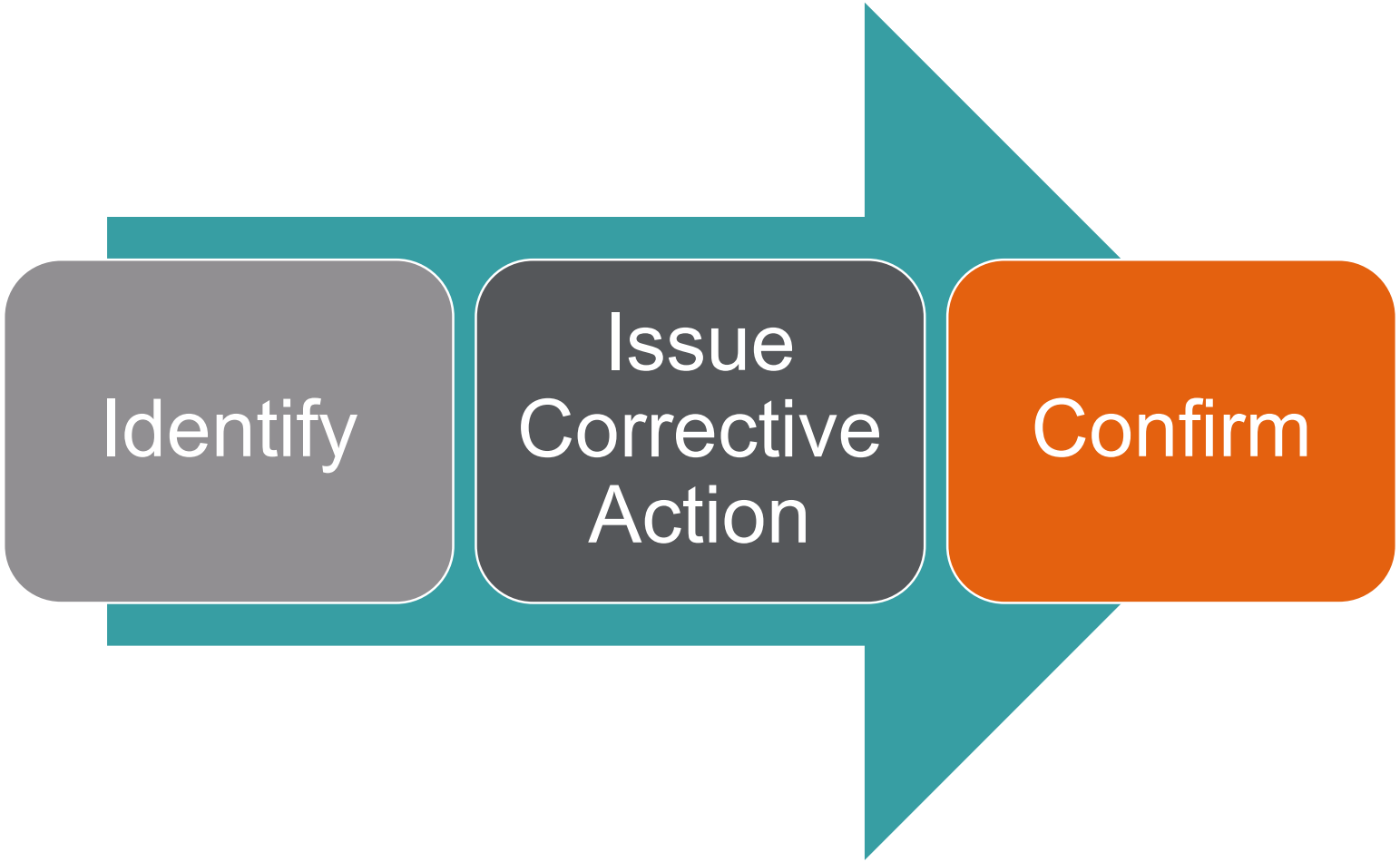
# Corrective Action - Process

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# Corrective Action – Issue

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# Corrective Action – Three Methods

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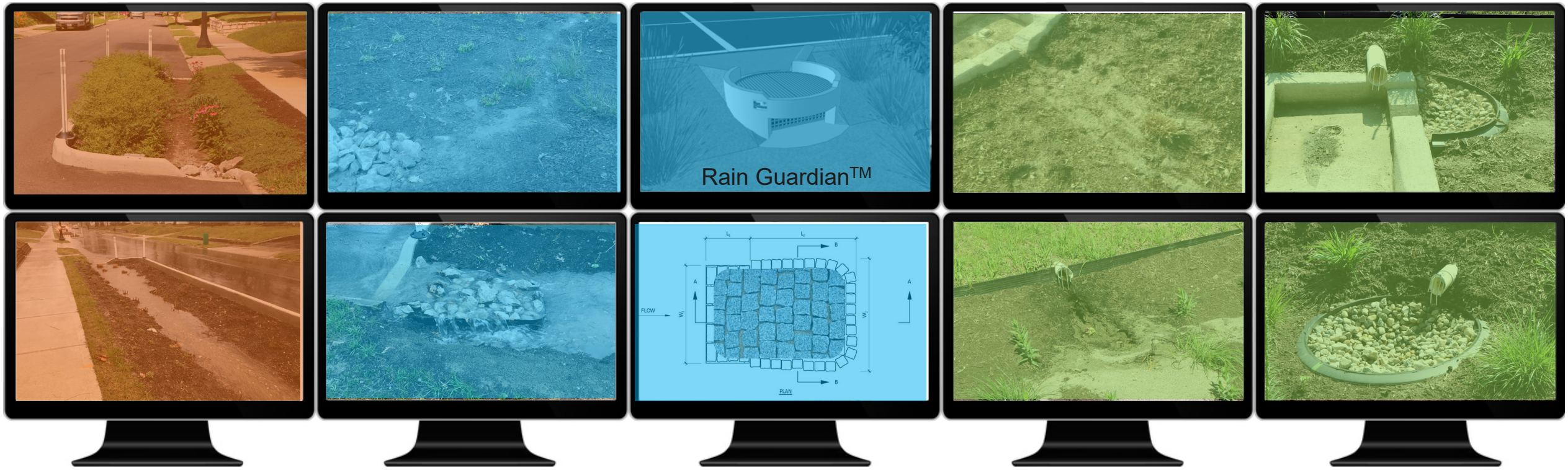
# Typical Corrective Action Issues

Velocity | Inlet Before | Inlet After | Erosion Before | Erosion After

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# Data Management System

## Generate work order from inspection data

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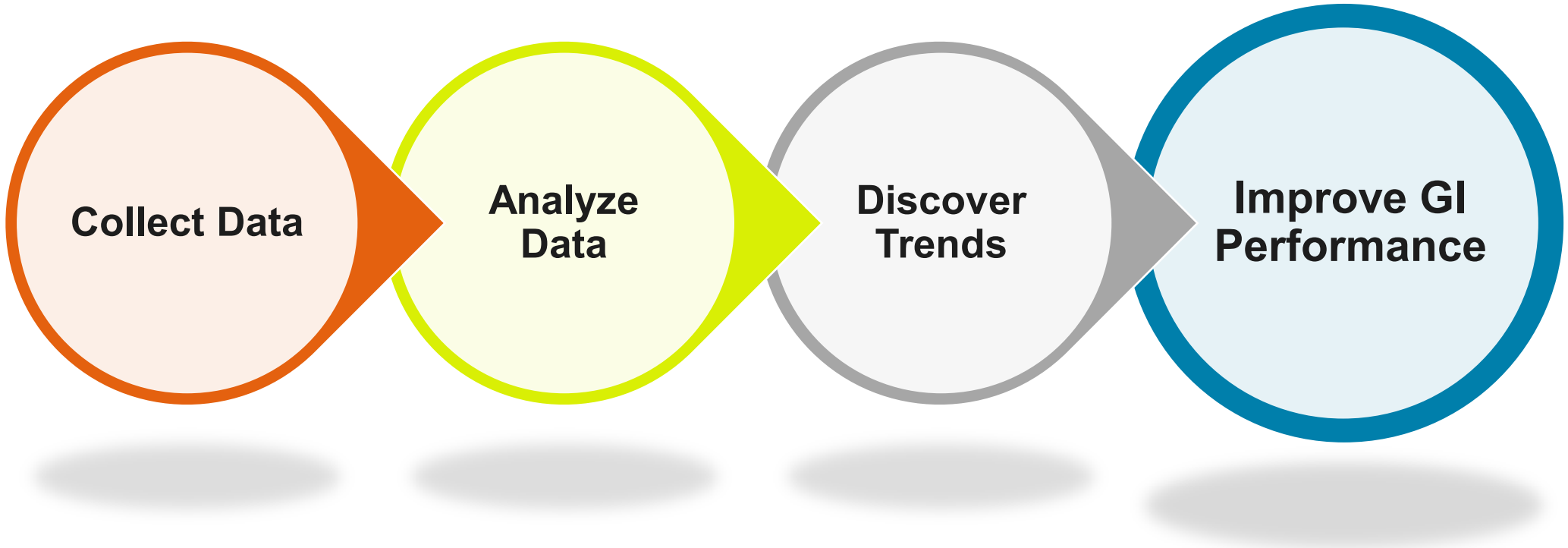
# Data Analytics

## Analyze Maintenance Data for Trends

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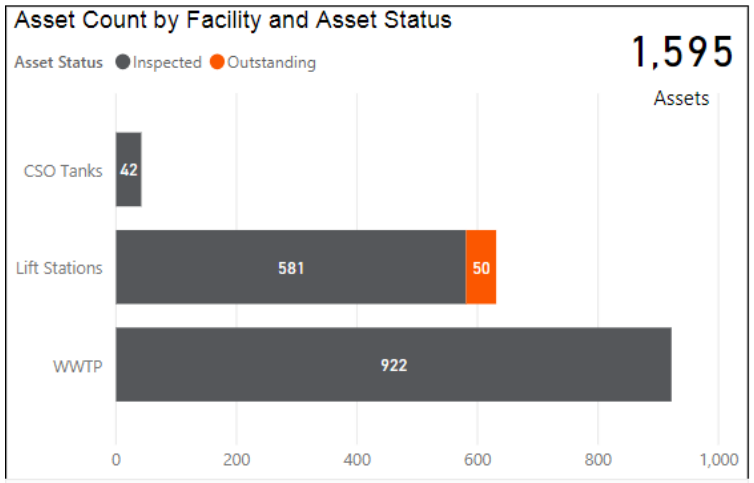
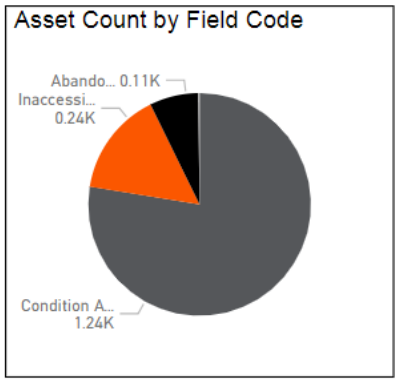
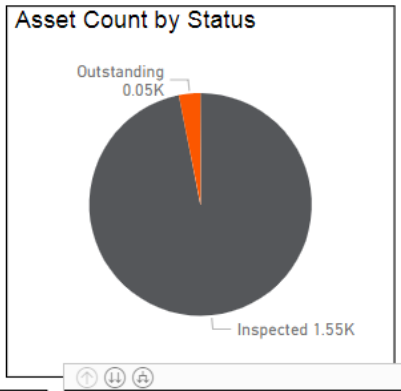
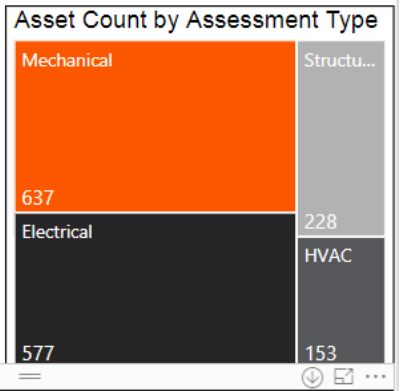
# Data Analytics

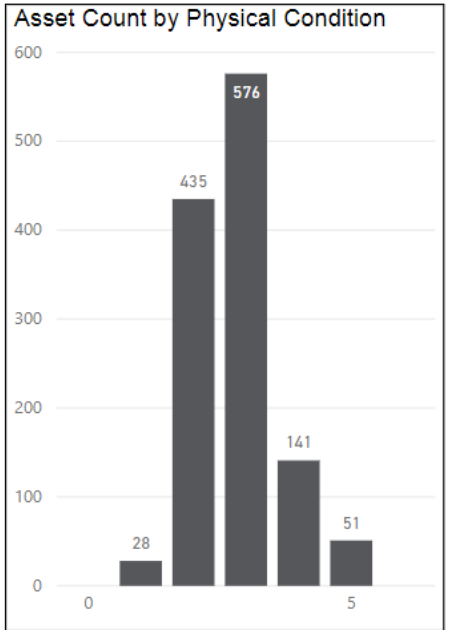


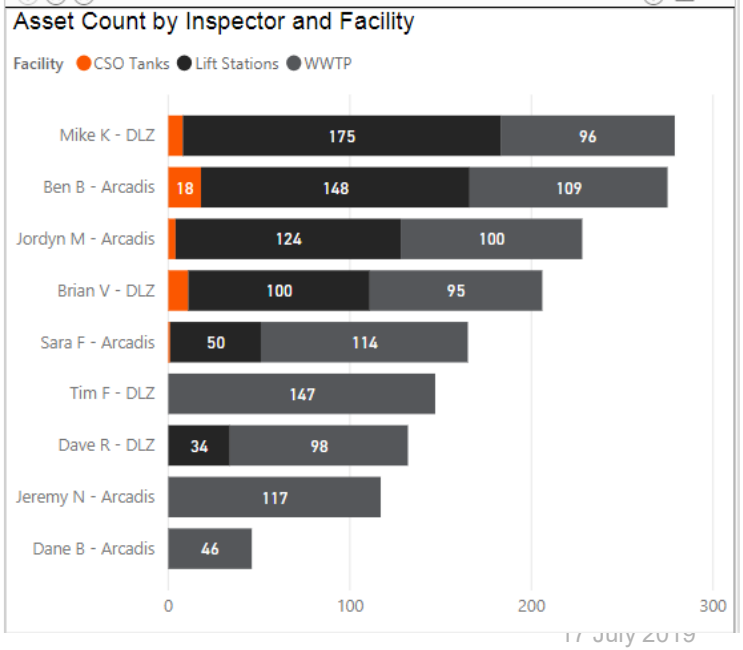




| Facility | Area | Process | Asset | Max C... | Photos |
|---|---|---|---|---|---|
| WWTP | Disinfection | Facility Support | Alarm Annunciator Panel 2 | | |
| WWTP | Plant Wide | Old Chlorine Building | Chlorine Building Roof | | |
| Lift Stations | Cottage Ct | Pumping | Level Transducer | | |
| Lift Stations | High Dive Park | Pumping | Level Transducer 2 | | |
| WWTP | Primary Clarifiers | Facility Support | Primary Building Roof | | |
| WWTP | Digestion | Digestion | West Digester 3 Cover | | |
| CSO Tanks | New Jackson | Storage | Wetwell | | |
| WWTP | Final Clarifiers | Secondary Settling | Float Switch 2 | | |
| WWTP | Aeration Tanks | Aeration | Gate 4A, Aeration Tank 4 (Abandoned) | | |
| WWTP | Plant Wide | Westside South Storage Building | Unit Heater 1, Westside South | | |

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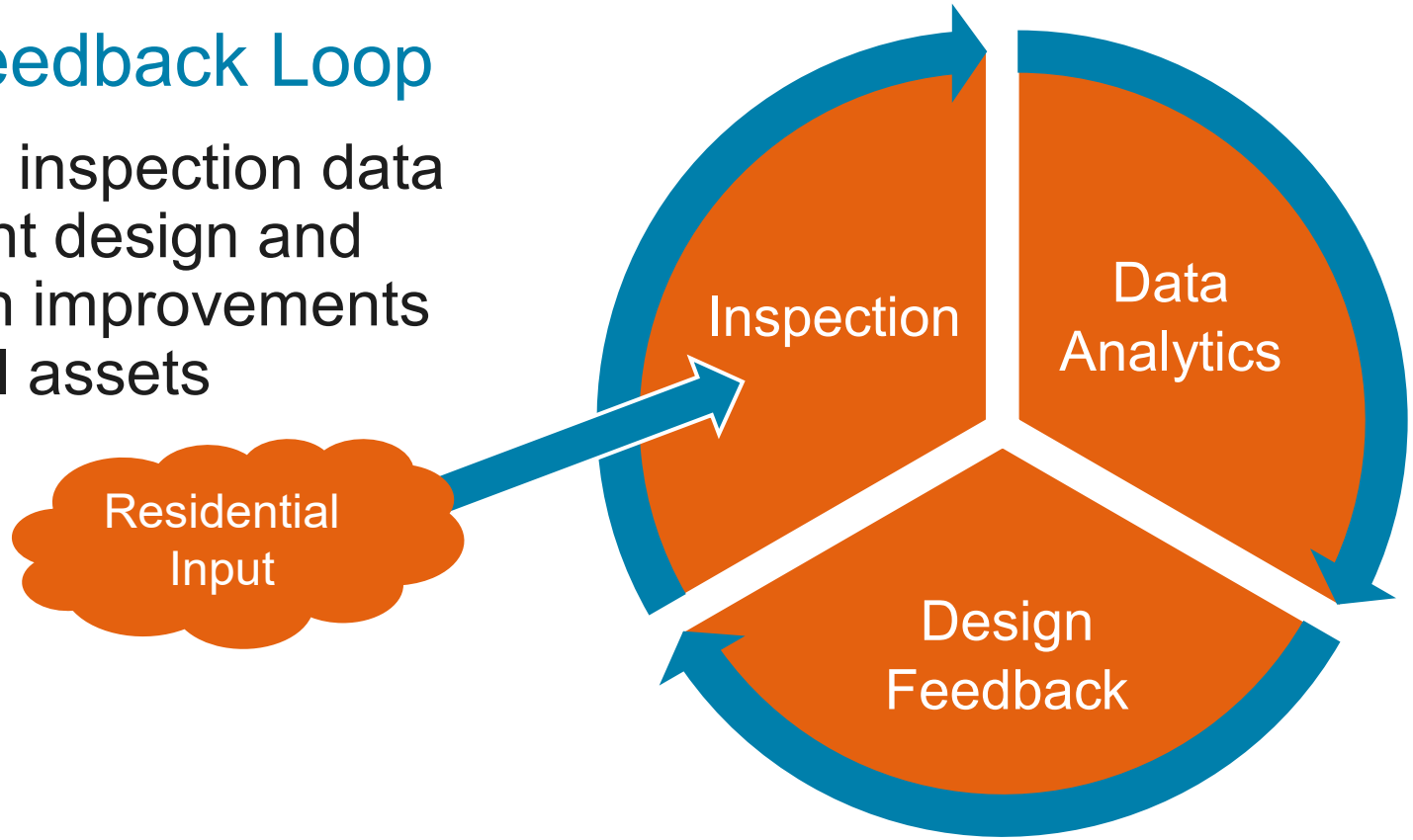
# Leveraging Best Practices

## Design Feedback Loop

Utilizing the inspection data to implement design and construction improvements for future GI assets

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# Residential Input

Phone Application
Utilizing resident feedback
as a real-time indicator

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# Feedback Changes

BEFORE

AFTER

# Feedback Design Change

# Beautiful Raingardens

# Questions?

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