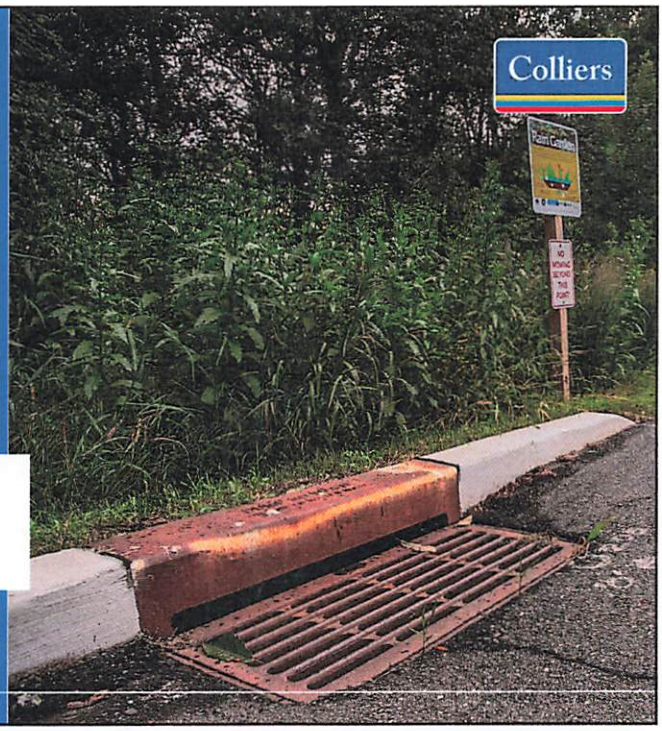
GIS for Stormwater Management



Presented to: New Jersey Water Association
Presented by: Megan Turi

esri Partner Network Silver

Accelerating success.

1

Background

GIS for Stormwater Management

Part 1	Part 2	Part 3	Part 4	Part 5
Project Background GIS Overview	**Getting Started** Hardware and Software Requirements	**Data Collection Process** GPS and GNSS Overview	**Mobile Inspections** ArcGIS Survey123	**Data Review and Analysis** Dashboards and Work Order Management

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Part 1:

PROJECT BACKGROUND

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Background

Geographic Information Systems (GIS)

- Mapped data layers that are displayed in a known coordinate system that contain characteristics of the mapped objects
- Data can be queried and analyzed, displaying results thematically or in database format

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Background

Why Implement GIS?

- Provide staff and customers with tools for effective collaboration, analysis & data sharing
- Comply with MS4 permit requirements
- Improve asset performance, existing workflows, and delivery of service
- Realize cost savings
- Start small with a specific map/app or implement an enterprise level GIS...
- Whichever approach you choose... GIS is scalable to meet your organizational needs

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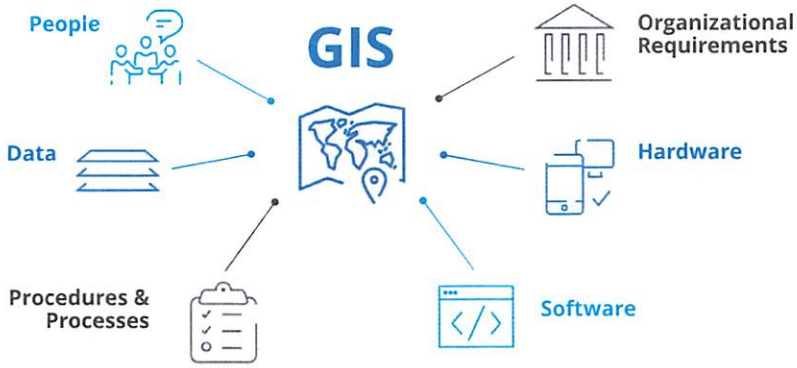
Getting Started

Components of GIS



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Background
City of Rahway, NJ

- 22 miles southwest of New York City
- 30,000 residents
- First settled in the 1660s
- Four square miles; mostly urban & dense suburban
- Rahway River splits the City into three areas
- US Route 1/9 and NJ Route 27 run through the city

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Background
Project Background

- The City's Division of Engineering and Department of Public Works were using paper and scanned documents in the field and office.
- The City began implementing Esri's Enterprise GIS in 2020 to assist with COVID-19 response.
- Mapping the sanitary sewer & stormwater system using GIS will allow the City to migrate to digital workflows

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Background
Project Requirements

- Map the sanitary sewer and stormwater system using GIS
- Utilize high accuracy GNSS to map surface features in the field
- Incorporate additional data from legacy maps and documents
- Import final data to the City's new Enterprise GIS
- Publish web maps & apps for internal use at the City

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Step 2:

GETTING STARTED

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Getting Started

Software Applications

Eos Tools Pro

ArcGIS Field Maps

ArcGIS Online

ArcGIS Workforce

ArcGIS Tracker

ArcGIS Dashboards

ArcGIS Survey123

ArcGIS Web AppBuilder

ArcGIS Pro

NYSNet (NYS Spatial Reference Network)
CORS/Real Time GPS Network

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Getting Started

ArcGIS Online

- Cloud-based GIS platform
  - Create maps & layers
  - Share content
  - Perform analysis
- Organizational Account
  - Share content with members of an organization
  - Link to other AGO organizational accounts

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Getting Started

Hardware & Equipment

- Supported on iOS, Android, Windows devices
- Offline capabilities
- Receiver, antenna, rod

Eos Arrow Gold

TruPulse Laser 200x

Mobile Device

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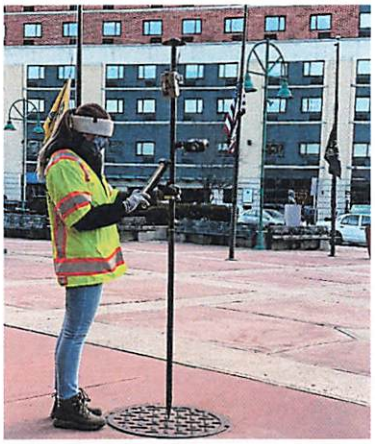
Getting Started

GPS/GNSS Equipment



- Handheld Data Collector
  - Allows end-user to control the receiver and collect data
  - Mobile device such as a tablet or smart phone
- Receiver (antenna)
  - Receives information from GNSS satellites
  - Pairs with mobile device via Bluetooth
- Rod/Pole
  - Hardware that holds the mobile device and receiver together

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Getting Started

Positional Accuracy

- Recreational Grade – Bought in retail stores; accuracy can range between 20-100 ft
- Mapping Grade – Accuracy varies per model, can range from 0.5 – 15 ft; These are most often used by GIS users
- Survey Grade – Accurate to within a millimeter or centimeter; typically used by professional land surveyors

- The vertical accuracy is usually 2-3 times the horizontal
- Cost rises with accuracy
- Post-process or real time corrections

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Getting Started

Real Time Kinematic Navigation (RTK)

- RTK improves accuracy in real time
- Improves navigation accuracy when relocating an asset
- It's an additional service that eliminates post-processing of data in the office

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Step 3:

FIELD DATA COLLECTION

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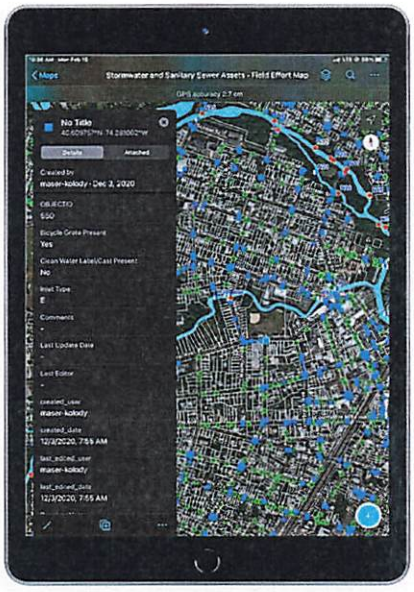

Process
Setup & Configure

1 **Create GIS data models**
Based on Esri data models

2 **Create & publish web maps**
To be used in Field Maps and dashboards

3 **Enable ArcGIS Tracker**
Capture where our field crews have been

4 **Configure hardware**
Eos Arrow Gold, Apple iPads, TruPulse 200x, RTK network

5 **Plan field work approach**
Where to start? How to collect data?

6 **Prepare project status dashboard**
Identify key metrics to be tracked

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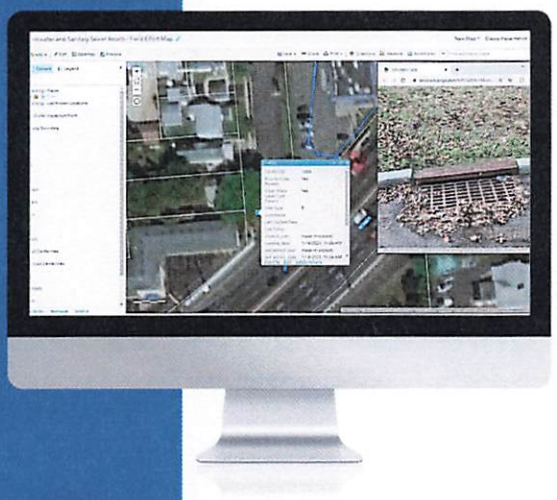

Process

Creating Web Maps

- Create GIS data model
  - Attributes
  - Domain Values
  - GNSS Metadata
- Map Design
- Link Documents/Photos

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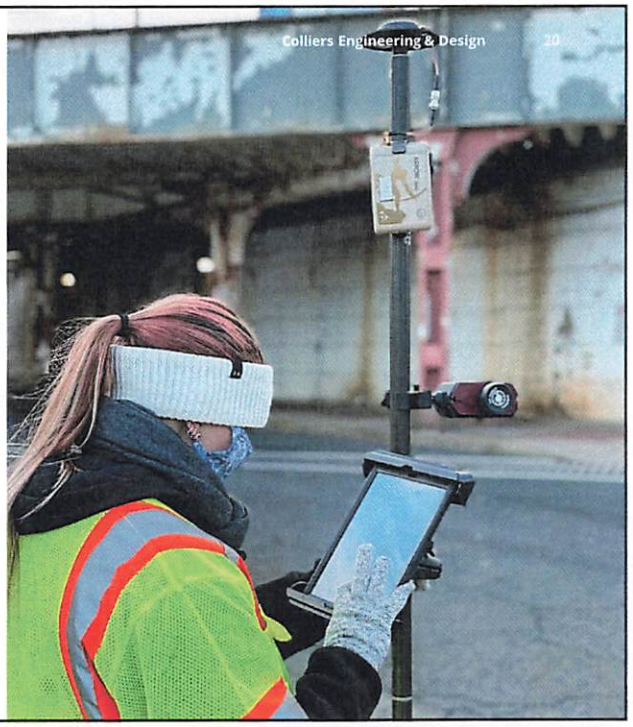
Process
Field Data Collection

- Stormwater System
  - Manholes
  - Catch Basin Inlets
  - Outfalls
  - Gravity Mains
  - Detention Basins
  - Swales



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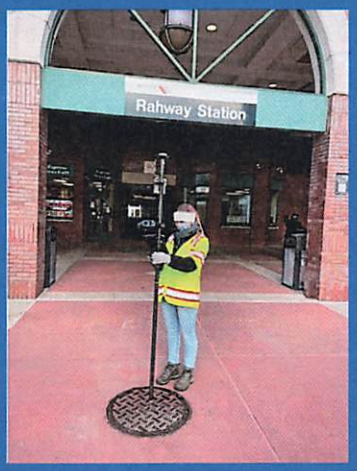
Process

Field Data Collection



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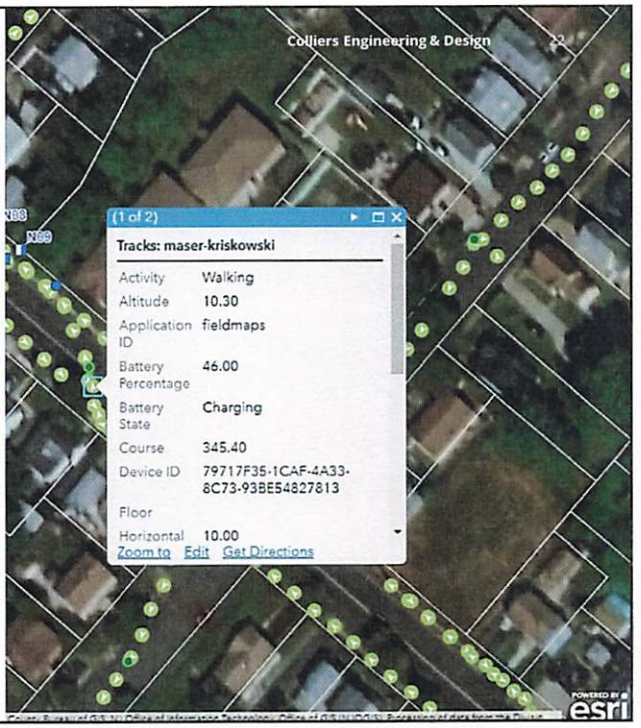
Process

ArcGIS Tracker

- Automatically capture tracks of where you have been
- Locate crews in real time
- Tracks allowed our field crew & office staff to "see" where we had been



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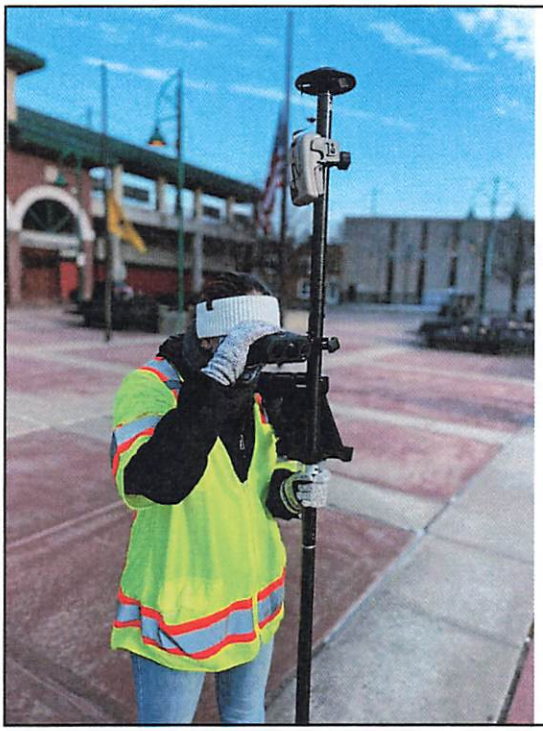

Technology
TruPulse Laser Rangefinder

- Two major highways run through Rahway
- US Route 1/9 is a major highway with 8+ lanes of traffic
- Laser rangefinder allowed us to collect highly accurate locations SAFELY

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Step 4:

MOBILE INSPECTIONS

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Mobile Inspections
ArcGIS Survey123

- Simple and intuitive web-based forms
- Replace paper inspection forms
- Online and offline mobile access
- Create a digital record of inspections and maintenance

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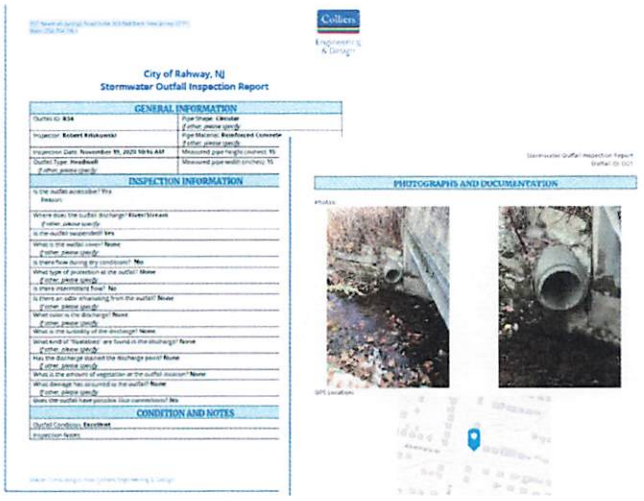
Mobile Inspections
ArcGIS Survey123

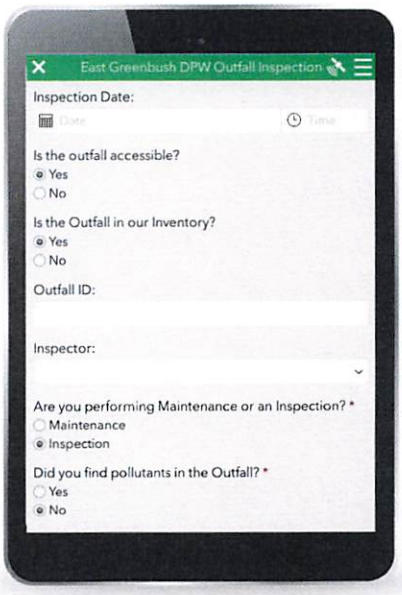

City of Rahway, NJ
Stormwater Outfall Inspection Report

GENERAL INFORMATION

INSPECTION INFORMATION

CONDITION AND NOTES

PHOTOGRAPHS AND DOCUMENTATION



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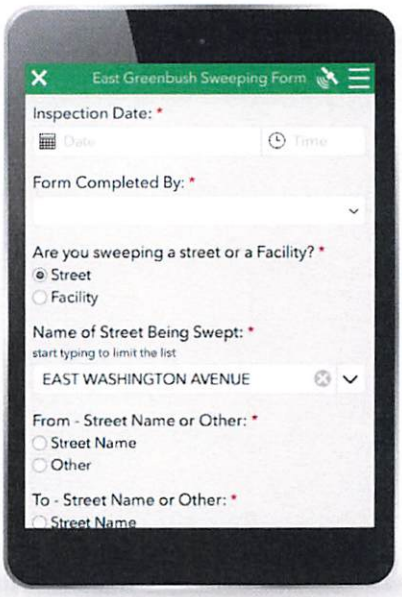
Mobile Inspections
ArcGIS Survey123

- Manholes
- Catch Basins
- Construction Site Stormwater Compliance
- Detention/Retention Basins
- Street Sweeping



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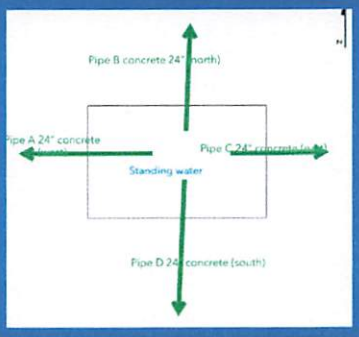
Mobile Inspections
ArcGIS Survey123

Map and Attribute View

Data Analytics



Sketches and Photos

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Step 5:

DATA REVIEW & ANALYSIS

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Data Review & Analysis
Project Status Dashboard

- Built with ArcGIS Dashboards
- Allowed our project manager and the client to monitor progress of the field data collection in real-time
- Interactive map view with graphs and metrics

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Sanitary Manholes Collected:
2,186
Storm Inlets Collected:
1,709
Storm Culverts Collected:
9
Storm Gravity Mains Collected:
1,412
Storm Outfalls Collected:
91
Total Storm Outfalls in System: 160
Storm Manholes Collected:
621
Outfall Inspections Completed:
100
Storm Basins Collected:
0

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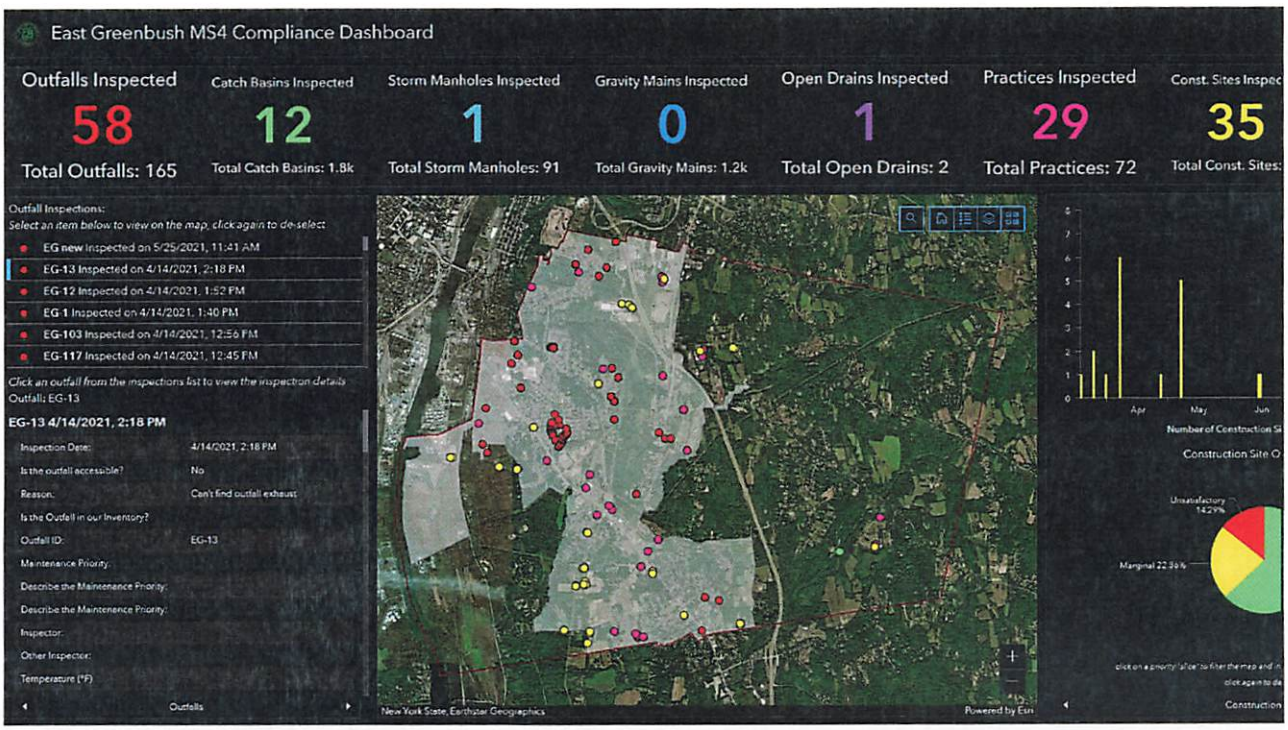
East Greenbush MS4 Compliance Dashboard
Outfalls Inspected
58
Total Outfalls: 165
Catch Basins Inspected
12
Total Catch Basins: 1.8k
Storm Manholes Inspected
1
Total Storm Manholes: 91
Gravity Mains Inspected
0
Total Gravity Mains: 1.2k
Open Drains Inspected
1
Total Open Drains: 2
Practices Inspected
29
Total Practices: 72
Const. Sites Inspec
35
Total Const. Sites:
Outfall Inspections:
Select an item below to view on the map, click again to de-select
EG new Inspected on 5/25/2021, 11:41 AM
EG-13 Inspected on 4/14/2021, 2:18 PM
EG-12 Inspected on 4/14/2021, 1:52 PM
EG-1 Inspected on 4/14/2021, 1:40 PM
EG-103 Inspected on 4/14/2021, 12:56 PM
EG-117 Inspected on 4/14/2021, 12:45 PM
Click an outfall from the inspections list to view the inspection details
Outfall: EG-13
EG-13 4/14/2021, 2:18 PM
Inspection Date: 4/14/2021, 2:18 PM
Is the outfall accessible? No
Reason: Can't find outfall exhaust
Is the Outfall in our Inventory?
Outfall ID: EG-13
Maintenance Priority:
Describe the Maintenance Priority:
Describe the Maintenance Priority:
Inspector:
Other Inspector:
Temperature (°F)
Outfalls
New York State, Earthstar Geographics
Powered by Esri
Apr
May
Jun
Construction Site O
Unsatisfactory 14.29%
Marginal 22.39%
Construction

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Data Review and Analysis

ArcGIS Workforce

- Mobile GIS solution for better coordination of the workforce in the field
- Real-time connection between field workers & office staff
- Integrate with ArcGIS software & mobile applications

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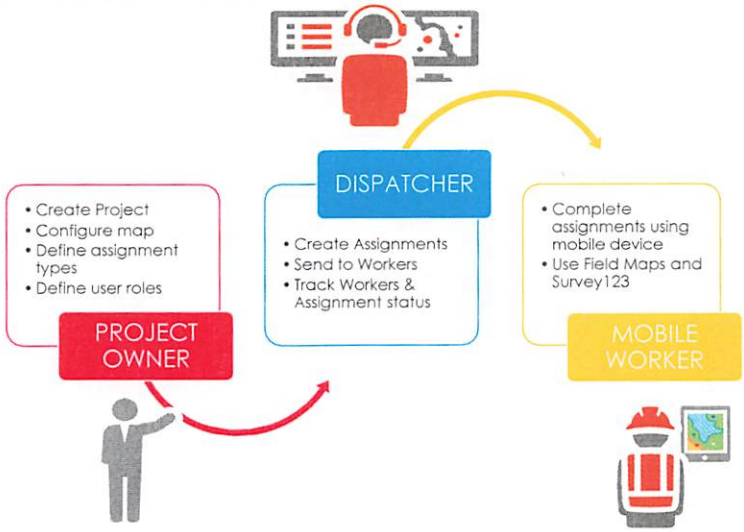
Data Review and Analysis

ArcGIS Workforce



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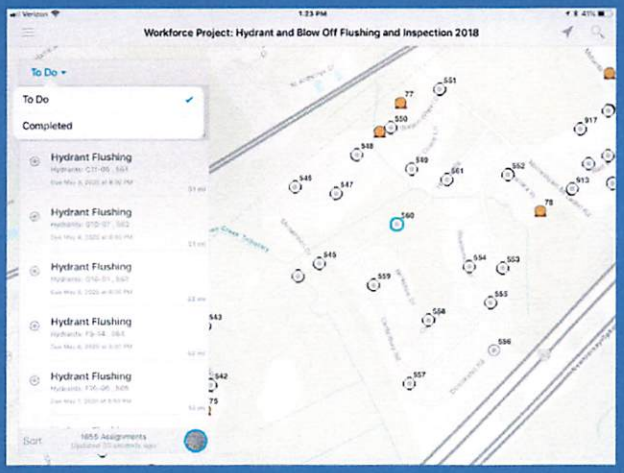
Data Review and Analysis

ArcGIS Workforce



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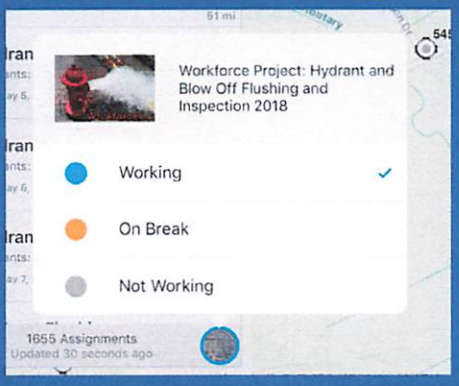
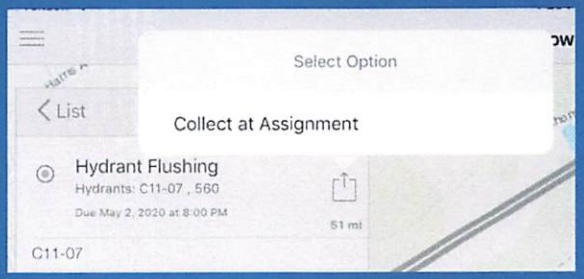
Data Review and Analysis

ArcGIS Workforce





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186
hours of data collection

4,585
assets collected in the field

95%
of data accurate within 6"

Conclusion

Final Results: Asset Location

Accuracy	# of Assets	Percentage
< 1"	2,947	66%
1" – 6"	1,287	29%
6" – 12"	100	2%
12" – 24"	77	< 2%
> 24"	43	< 1%
No Data	131	-

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Key Takeaways

- **Locate assets** with high-accuracy GNSS technology
- Connect the field and office with **real-time access** to data
- Improve record-keeping and track **maintenance history**
- **Comply** with MS4 permit requirements

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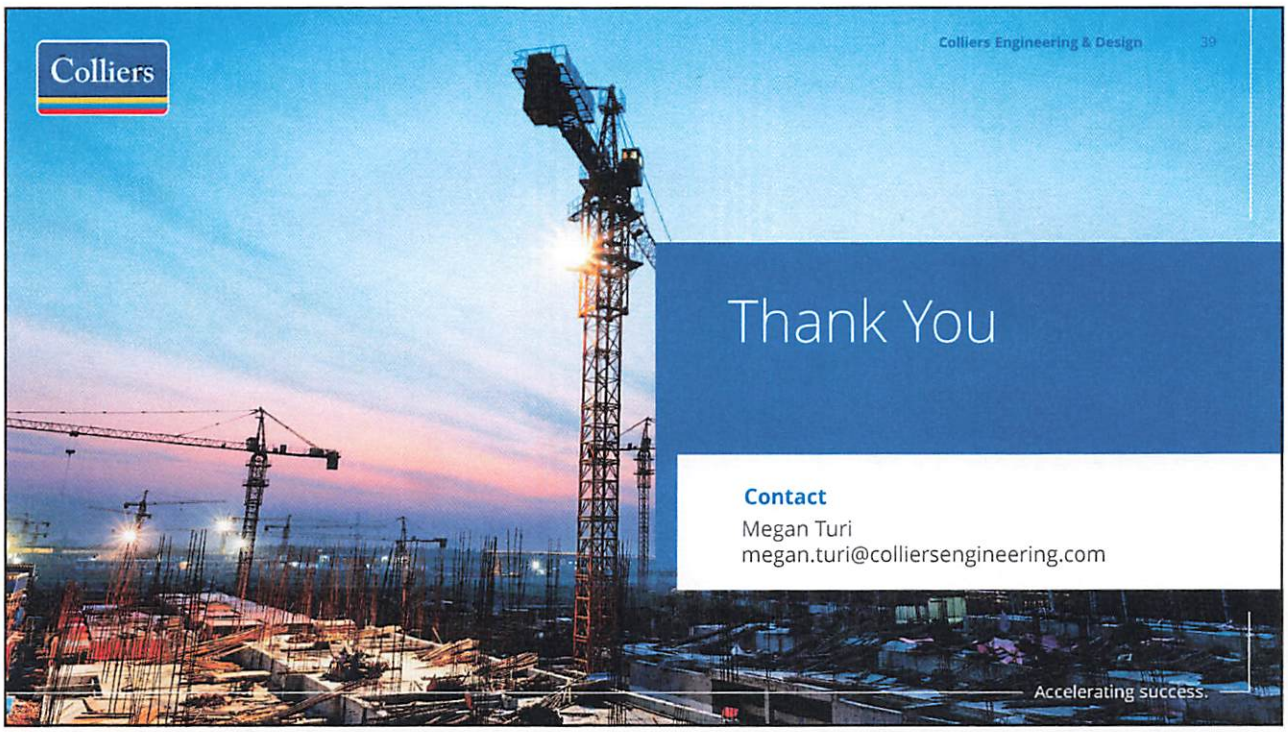
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Thank You
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