SeSwA

TENNESSEE

SPOTLIGHT

Progressing Towards Stormwater Asset Management

May 16, 2024 / 11:00 a.m. – 12:00 p.m.(Eastern)

www.SESWA.org

Today's Presenters

Karen Ferency, PE
Water Resources Engineer
CDM Smith
ferencyks@cdmsmith.com

Randall Whitehead
Stormwater Engineering Manager
City of Knoxville
rwhitehead@knoxvilletn.gov

Dave Mason, PE, D.WRE, PMP
VP, Water Resources Engineer
CDM Smith
masond@cdmsmith.com

Progressing Towards Stormwater Asset Management

City of Knoxville, TN

SeSwA SPOTLIGHT

TENNESSEE

Webinar series bringing state-specific content to light.

Randall Whitehead

David Mason

Karen Ferency

May 16, 2024

CITY OF KNOXVILLE

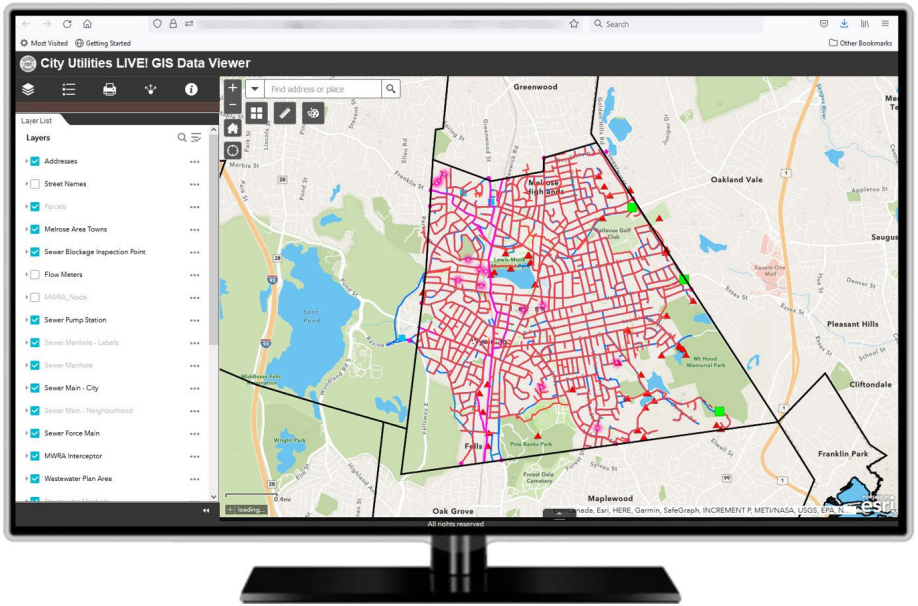
CDM Smith

Program History and Project Development

- Original inventory developed in early NPDES MS4 days
- GIS data updated periodically over time using as-built information
- Data lacked attribute or condition information
- ARP funds secured to modernize and update city-wide GIS database

The Rise of the Technology-Driven Organization

- Increasingly **Making Decisions** Based on Data
- Require **Instant Access** to Information, Regardless of Location
- **Leveraging Technology** in Every Facet of Their Organization
- Employing **Asset Management** Principals to Operate More Efficiently



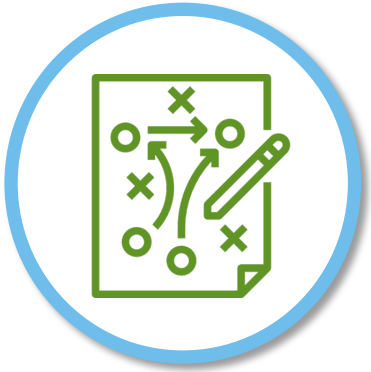
Employing Technology to Support Stormwater

- Stormwater Inventory & Assessment
- Stormwater Asset Management
- Stormwater Compliance
- Modeling & Resiliency
- Maintenance & Operations
- Stormwater Funding

Stormwater Inventory/Asset Management Development Process

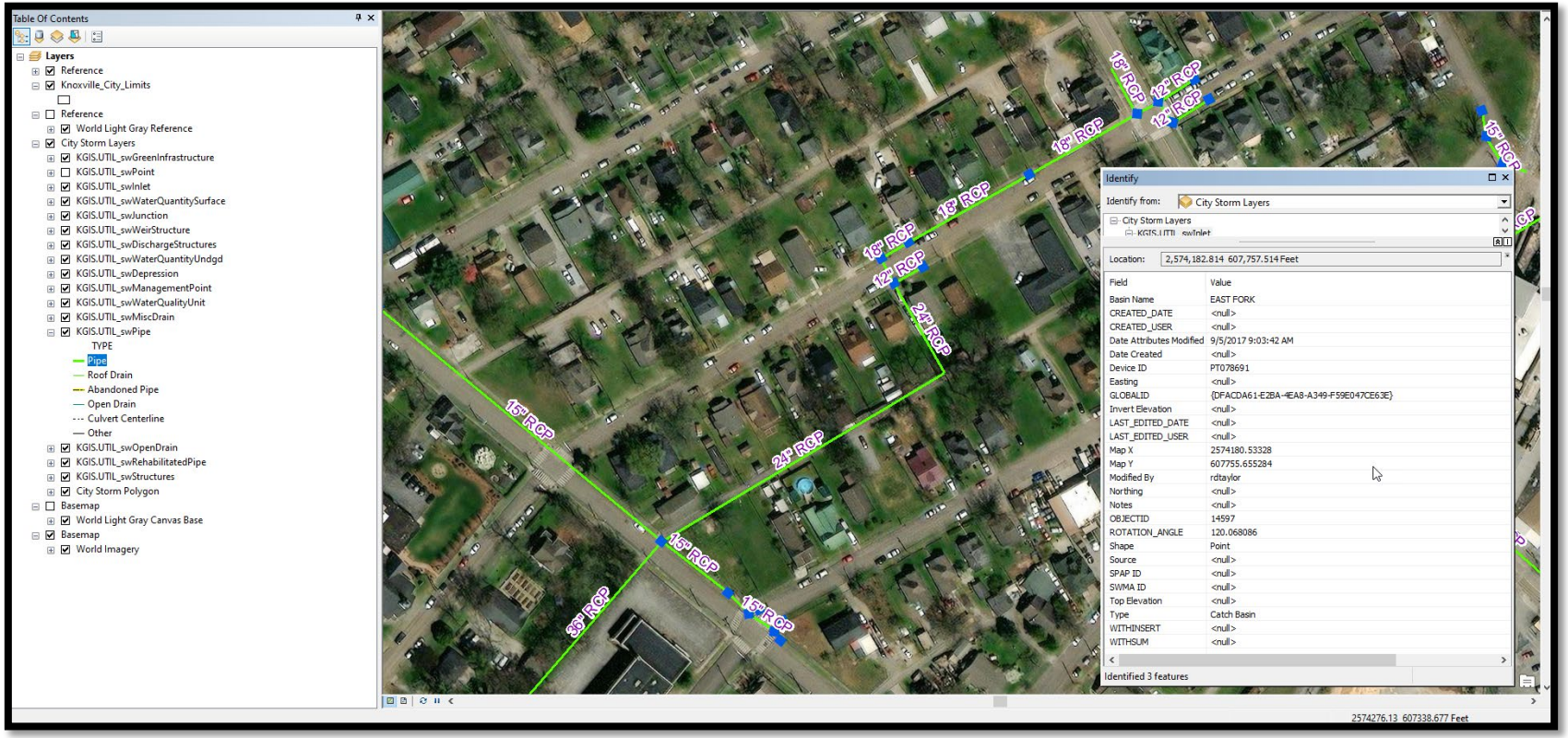
Plan

Develop



Implement

KGIS & City GIS Environment Overview



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Knoxville's Priority - Build an Accurate & Complete Inventory of the Stormwater System

Data Development to Accommodate Priorities:

NPDES Reporting, Modeling, & CMMS

Prioritization & Maintenance Plan

Risk Reduction

Capital Projects & PM Program

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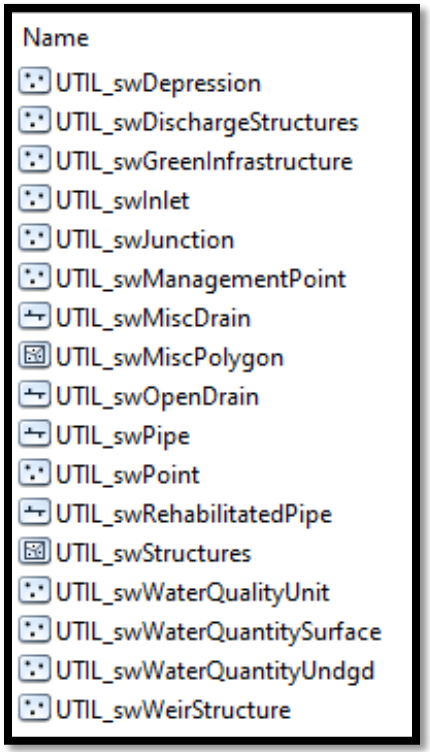
Geodatabase Design



- **Project Area** – The project area includes the entire City of Knoxville, minus the University of Tennessee campus. Mapping will only be completed within the City of Knoxville rights-of-way. Stormwater mapping will not be completed on private property.
- Features to be Mapped – Features to be mapped include manholes, catch basins, inlets, outfalls, culverts, headwalls, pipes, and other applicable "hard" stormwater system assets. Driveway culverts, streams, and roadside swales will be mapped using existing GIS data and aerial imagery only (for system connectivity).
- Coordinate System – All data will be delivered in Tennessee State Plane Coordinate system, Datum NAD 1983 (2011) in US Feet with a sub-foot horizontal accuracy and NAVD 88 (US Feet) vertical sub-foot accuracy.
- **Junctions & Manholes** – Horizontal survey will occur at center of structure. Attributes to be collected include rim, invert, and condition.
- **Inlets and Catch Basins** – Horizontal and vertical survey will occur at center of throat for curbs and center of grate for all other inlets. Attributes to be collected include rim, invert, and condition.
- **Culverts and Headwalls** – Horizontal and vertical survey will be collected at center of each barrel and structure dimensions will be recorded. Ground elevation, top elevation, and invert elevation will be collected for headwall and culvert. Structure material will be identified. Culverts 48-inches and larger are included in Task 3.
- **Outfalls** – Horizontal and vertical survey will occur at structure center. Attributes to be collected include rim, invert, condition, pipe size, and material. Any visible discharge will be documented with an estimate of time since the most recent rainfall event.
- **Pipes** – Pipe information will be captured as part of the field inventory process. Pipe locations, inverts, pipe size, condition, and material will be collected. Pipes will be snapped to structure location (inlet, junctions, outfall, culvert, etc.). Invert, material and diameter will be collected during structure survey. The process of integrating the pipes with the survey will occur in Task 4.
- **Condition Assessment** – A condition assessment, on a scale of 1 to 5 will be assigned to each feature inspected based on criteria established between the City of Knoxville and CDM Smith. Condition assessment will be completed visually. No confined entry will be completed.
- **Photos** – A photo will be collected for each feature inspected/mapped in the field.

Field Data Collection Environment

- ArcGIS Online or Portal
- CDM Smith or KGIS Environment
- Trimble R12 (“Inches” Accuracy)
- Real-Time Collection in AGOL
- Dashboards to Track Progress
- Execution & Quality Control Per Drainage Basin

Database Schema for Data Collection and Storage

- Updated KGIS schema
  - More aligned with ESRI Standard Utility Network
  - Spreadsheet with the new schema - feature classes and attribute fields

	A	B	C	D	E	F
1	**Name of Hosted Feature Layer:**	Survey_Catch_Basins		Data entry with Field Maps		
2				Desktop Entry for completion or QC		
3	**Asset Group:**	Catch Basin		Autopopulated Data		
4	**Asset Type:**	Standard or Drop-Inlet		GNSS data		
5						
6						
7	**Alias (Field Name)**	**Example Values**	**Domain Y|N**	**Code - Description**	**Scope Requirement**	**Data Source**
88	Source		Y	Survey GIS	N	Desktop Entry
89				Survey Conventional	N	Desktop Entry
90				Assumed	N	Desktop Entry
91				TDOT Reference	N	Desktop Entry
92				City Reference	N	Desktop Entry
93				County Reference	N	Desktop Entry
94				DEM	N	Desktop Entry
95				Aerial Imagery / Street View	N	Desktop Entry
96	CreationDate	2023-01-03 14:58	N		N	Autopopulate
97	Creator	gerrit.dolislager	N		N	Autopopulate
98	EditDate	2023-01-03 15:00	N		N	Autopopulate
99	Editor	gerrit.dolislager	N		N	Autopopulate
100	CreationDate		N		N	GNSS
101	Creator		N		N	GNSS
102	EditDate		N		N	GNSS
103	Editor		N		N	GNSS
104	Position source type	3	Y	0 - Unknown	N	GNSS
105				1 - User defined		
106				2 - Integrated (SystemP Location Provider		
107				3 - External GNSS Receiver		
108				4 - Network Location Provider		
109	Receiver Name	R12 6226F00278 Trimble	N		N	GNSS
110	Latitude	35.97419261	N		Y	GNSS
111	Longitude	-83.92161452	N		Y	GNSS
112	Average Horizontal Accuracy (m)		N		N	GNSS
113	Average Vertical Accuracy (m)		N		N	GNSS
114	Averaged Positions		N		N	GNSS
115	Horizontal Accuracy (m)	0.020966125	N		N	GNSS
116	Vertical Accuracy (m)	0.022565398	N		N	GNSS
117	Number of Satellites	12	N		N	GNSS
118	Altitude	255.8559097	N		N	GNSS

Baseline Condition Assessment

1. **New Condition** – Brand New Condition

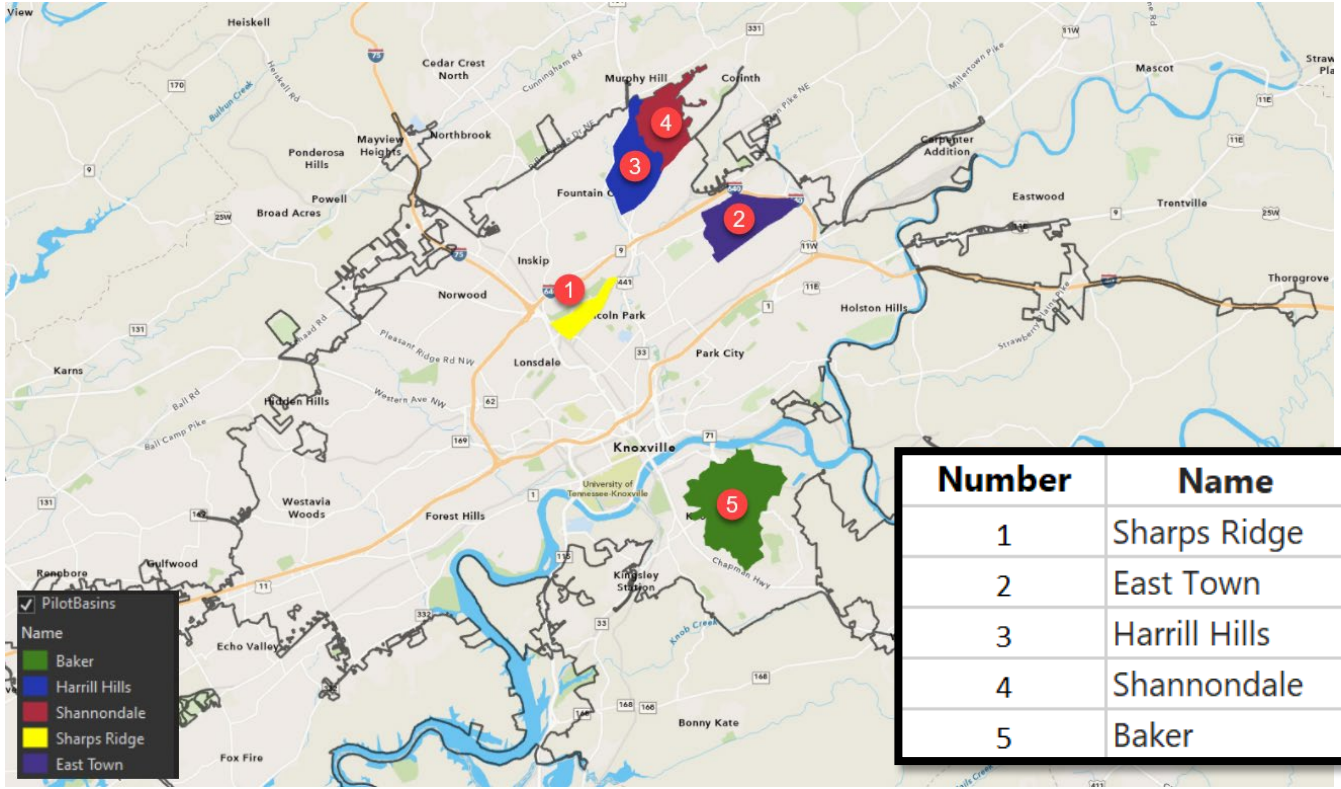
2. **Good Condition** – New Condition with Some Minor Signs of Aging

3. **Fair Condition** – Older Condition But Still Functioning Properly

4. **Poor Condition** – Failing Condition where Condition Affects the Function of the Asset

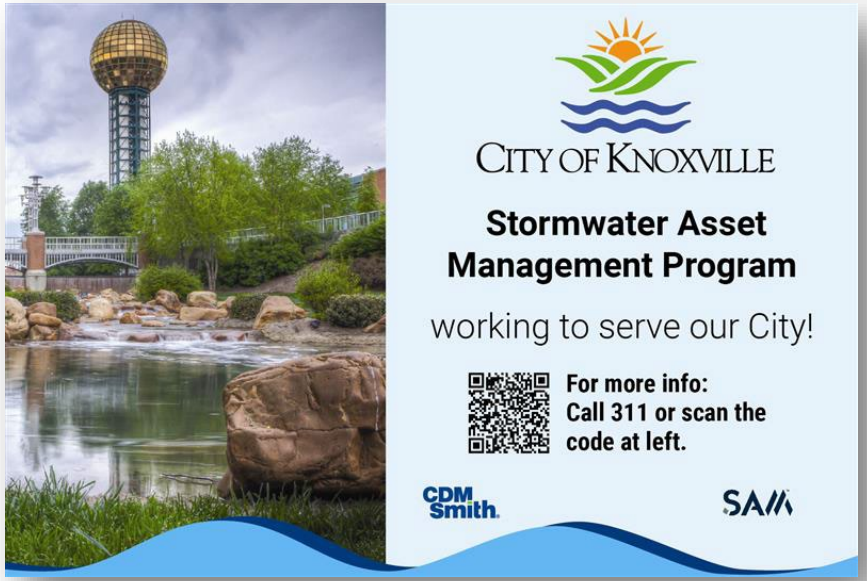
5. **Failing Condition** – Significant Structural Issues that Affect the Function of the Asset

Choosing a Pilot Area to Test Data Model



Number	Name	Acres	Inlets
1	Sharps Ridge	294	316
2	East Town	827	289
3	Harrill Hills	820	352
4	Shannondale	706	137
5	Baker	1662	767

Notification to the Public Re: Survey Teams



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INDYA KINCANNON, MAYOR

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City of Knoxville » Government » City Departments & Offices » Engineering » **Stormwater Engineering Division**

Stormwater Engineering Division

- Brochures and Links
- Floodplains
- Monitoring Stations
- NPDES Program
- Rainfall Data
- Request for Service (Stormwater Drainage)
- Sanitary Sewer Overflows (SSOs)
- Stormwater and Street Ordinance
- Total Maximum Daily Loads (TMDLs)
- KGIS Mapping

Engineering Director
Thomas V. Clabo, P.E.
tclabo@knoxvilletn.gov
(865) 215-2148

400 Main St., Suite 475
P.O. Box 1631
Knoxville, TN 37901

STORMWATER SURVEY CREWS

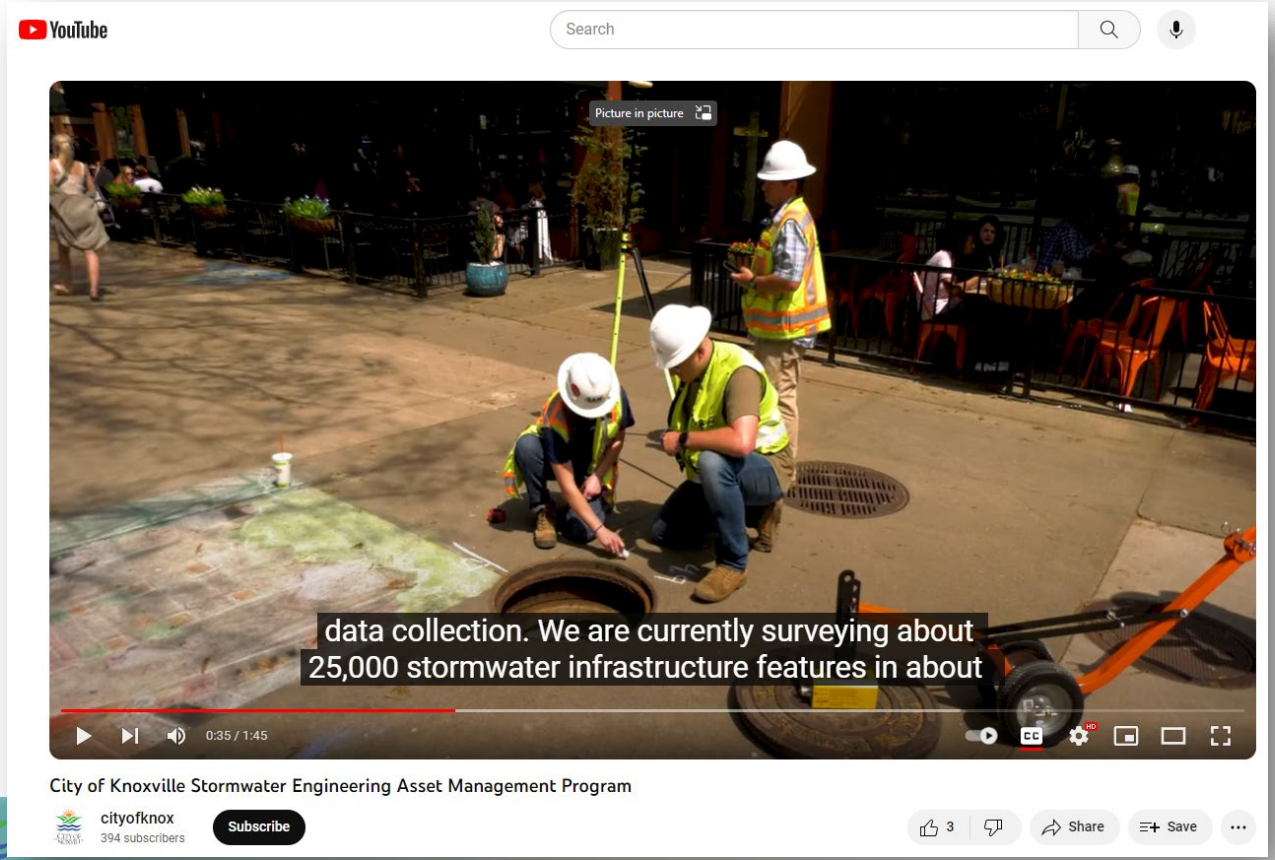
The City of Knoxville Engineering Department is conducting an assessment of stormwater infrastructure. Survey crews are working throughout the city, locating and collecting information on the City's stormwater assets, including culverts, manholes, catch basins and drain pipes. Surveyors may need to cross properties to get to a structure that is not located in or next to the street.

The information collected will be used to update the City's existing maps and plans and help City engineers identify and correct system deficiencies. Additionally, the program will help the City with regulatory compliance, routine maintenance, and planning for the future.

David B. McGinley, P.E.
Stormwater Chief
dmcginley@knoxvilletn.gov
865-215-2148 or 311

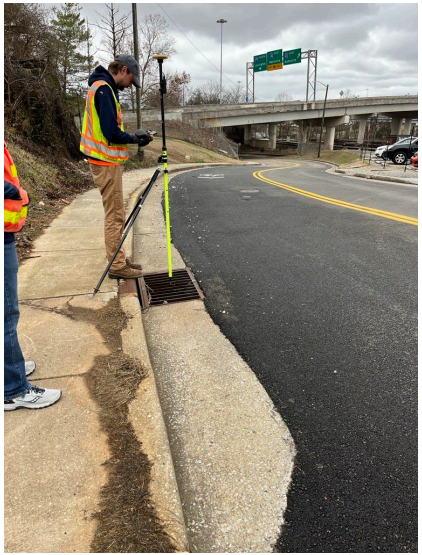
For direct requests for City Service:
Call 311 or (865) 215-4311 or send email to
311Office@KnoxvilleTN.gov.

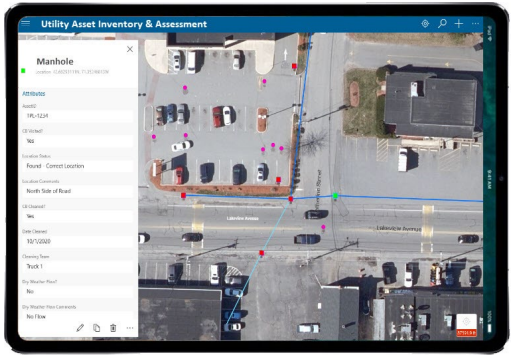
Additional Public Outreach Strategies to Consider



Stormwater Inventory Approach

- Develop field tools
- Leverage existing City GIS layers
- Integrate into Cloud services
- Accommodate QA/QC process
- Maintain visibility on progress with City staff



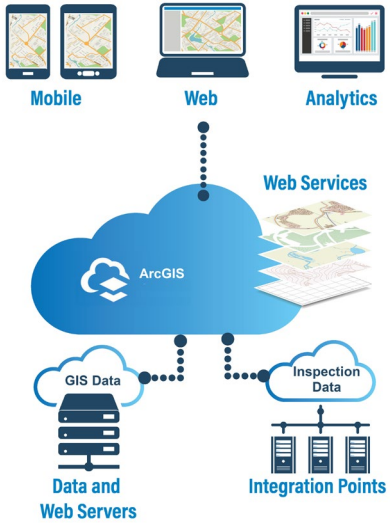


Configure Field Tools

High-Accuracy GPS

Mobile Devices

Imagery, LiDAR, Cameras

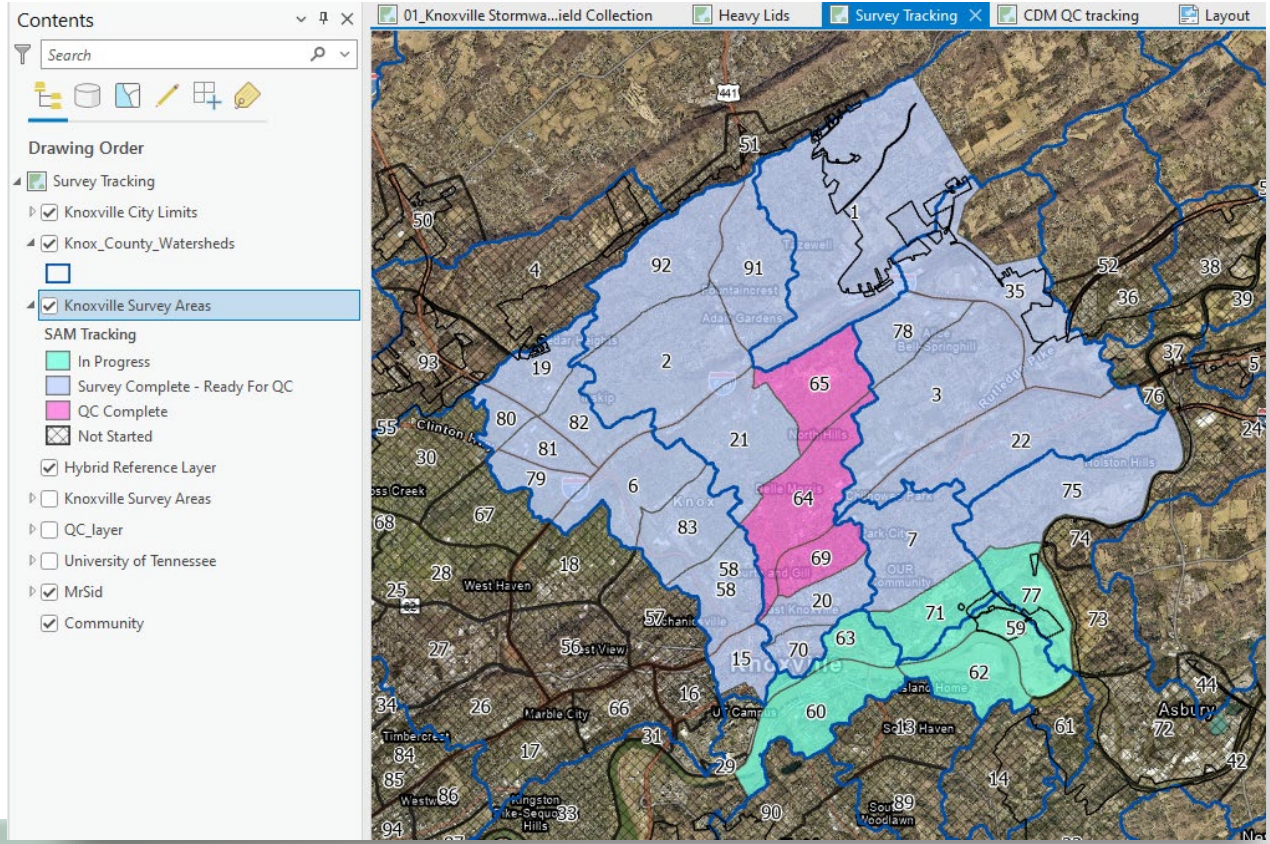


Develop Tools for Data Capture and Editing

- Desktop – ArcGIS Online
- Field – FieldMaps
- All hosted in the Cloud
- Allow for Editing in the Field or the Office

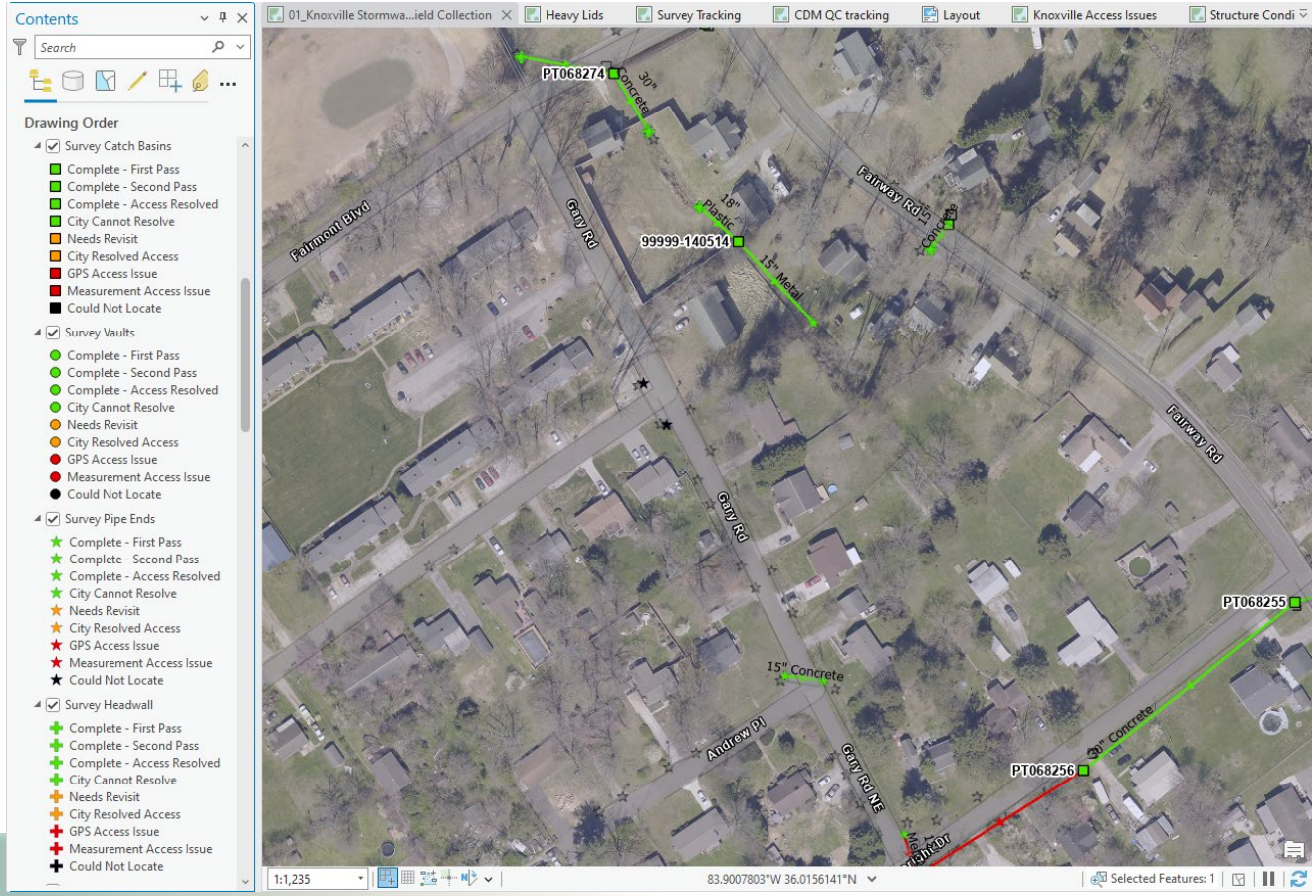
City Subdivided into “Survey Areas”

- Easier to manage survey crews
- Coordination with City
- Public notifications
- Organize QC



Establishing a Complete Network

- Desktop exercise
- Ditch/Channel Connectivity
- Digitizing with available GIS information
- Identifying easily attainable information



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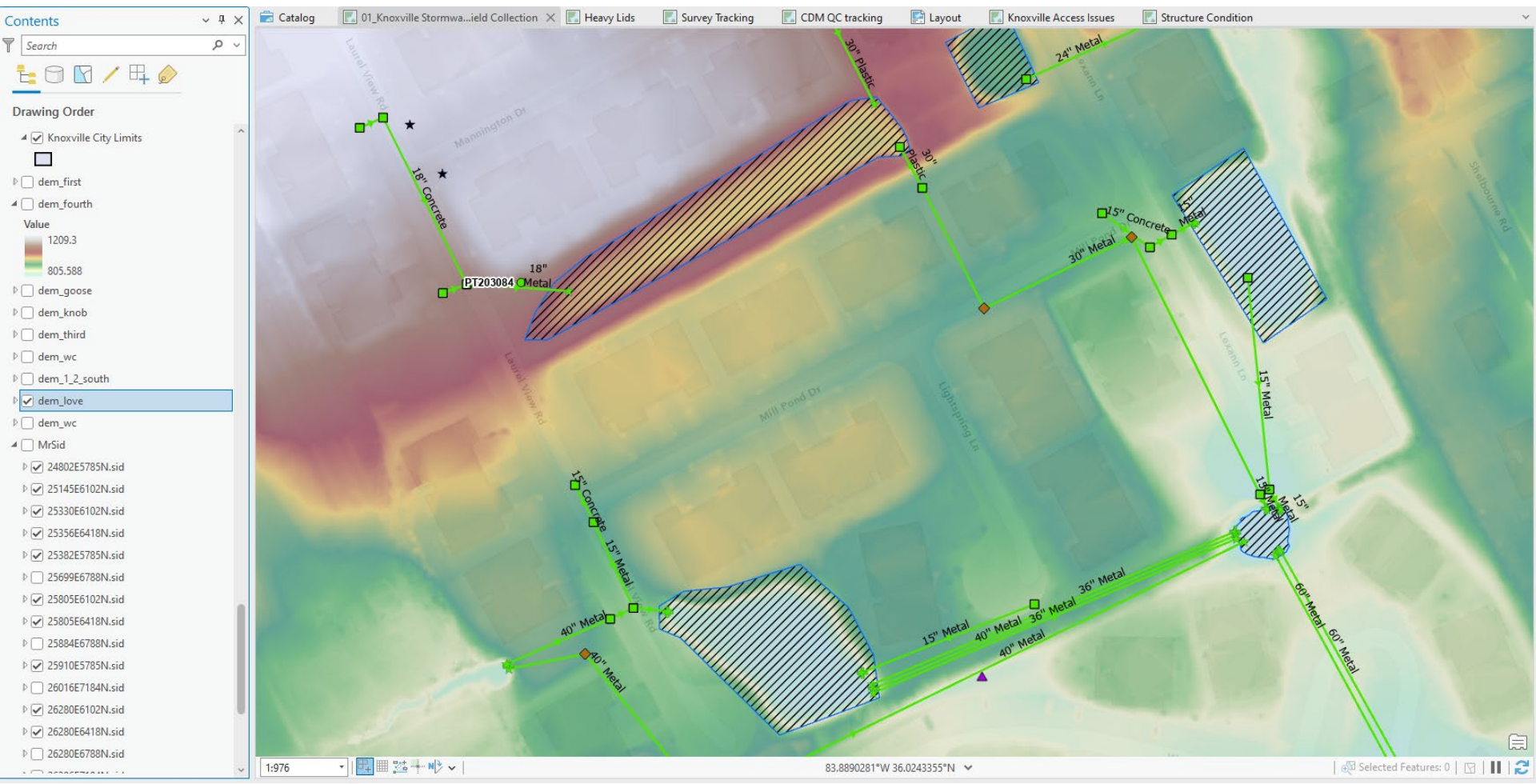

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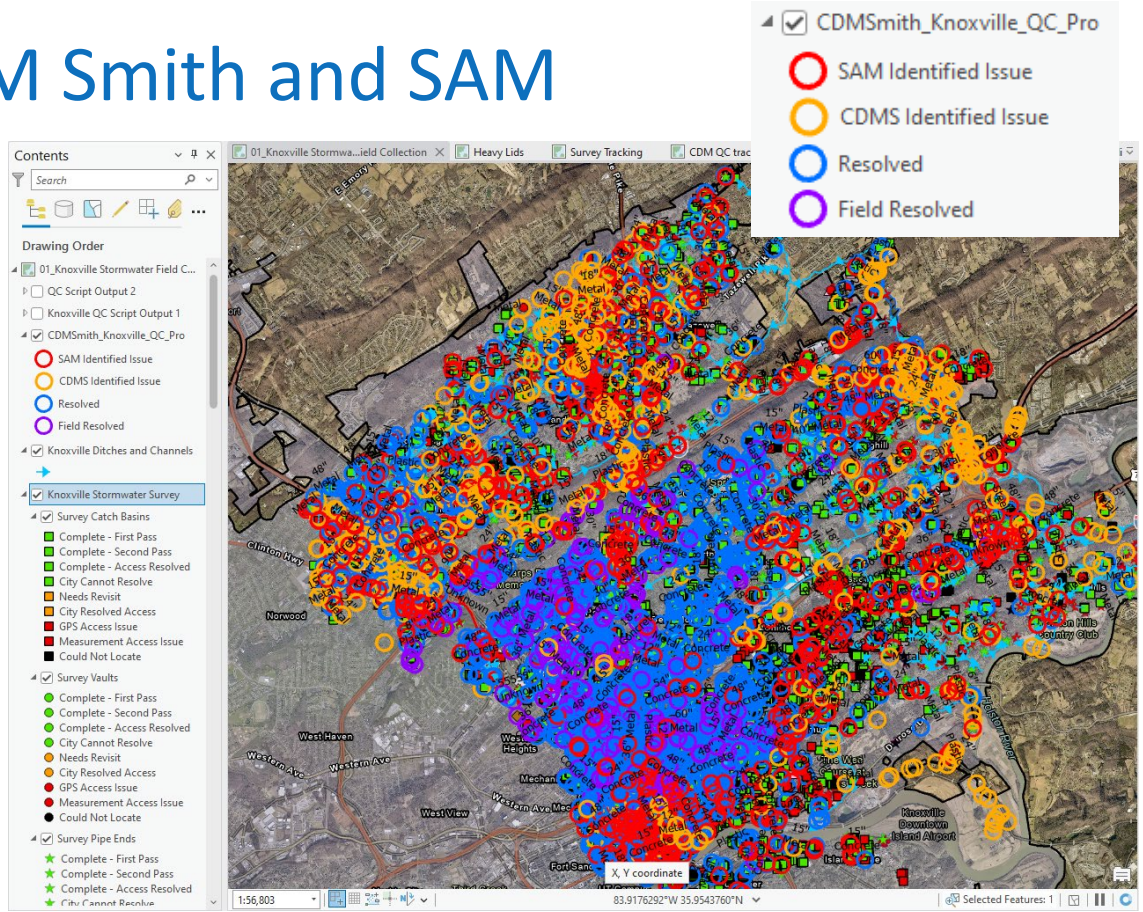
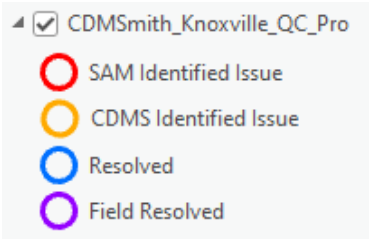
Quality Control – CDM Smith and SAM

- CDM Smith staff review each flow path
- Check that the information on the photos matches the database
- Use Google Street view for verification
- SAM has their own QC process



Quality Control – CDM Smith and SAM



Attributes | Geometry | Attachments (0)

CreationDate	4/4/2024 7:54:38.378 PM
Creator	feldmanhr_CDMSmith
EditDate	4/4/2024 7:55:02.772 PM
Editor	feldmanhr_CDMSmith
OBJECTID	6280
GlobalID	{91184AFF-093D-41F4-B2B2-56F9C2A48491}
Status	CDMS Identified Issue
Issue Description	CB needs to be surveyed
Issue Type	Missing Survey / Compared to GIS-DEM
Resolution Comment	<Null>
Feature Layer	Catch Basins
CreationDate	<Null>
Creator	<Null>
EditDate	<Null>
Editor	<Null>

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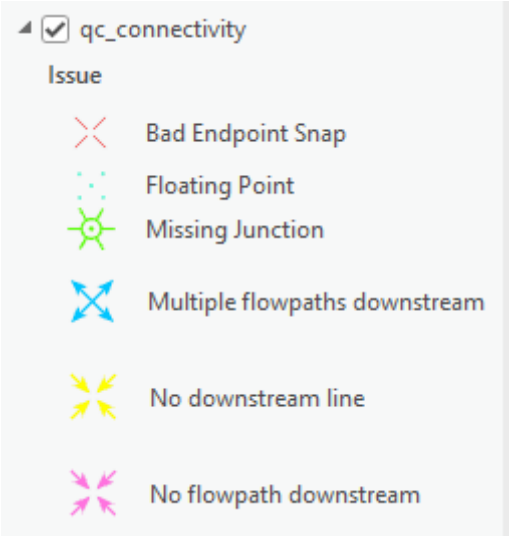
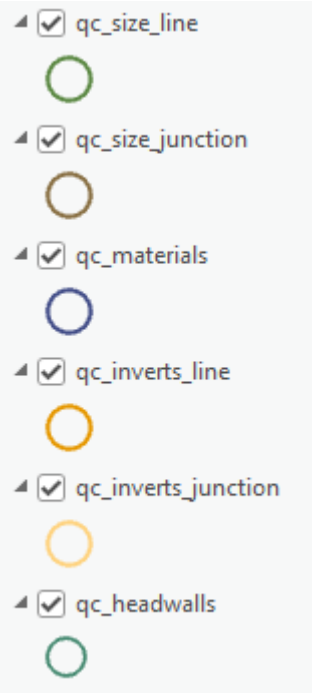
Scripting Uses to Quickly Identify Common Issues

- Multiple scripts run by the project teams
  - Identify pipe backflow
  - Tolerance accuracy issues
  - Inconsistent pipe size
  - Inconsistent material types
  - Connectivity
  - Missing pics
  - Tracing to outfalls
  - Status used properly





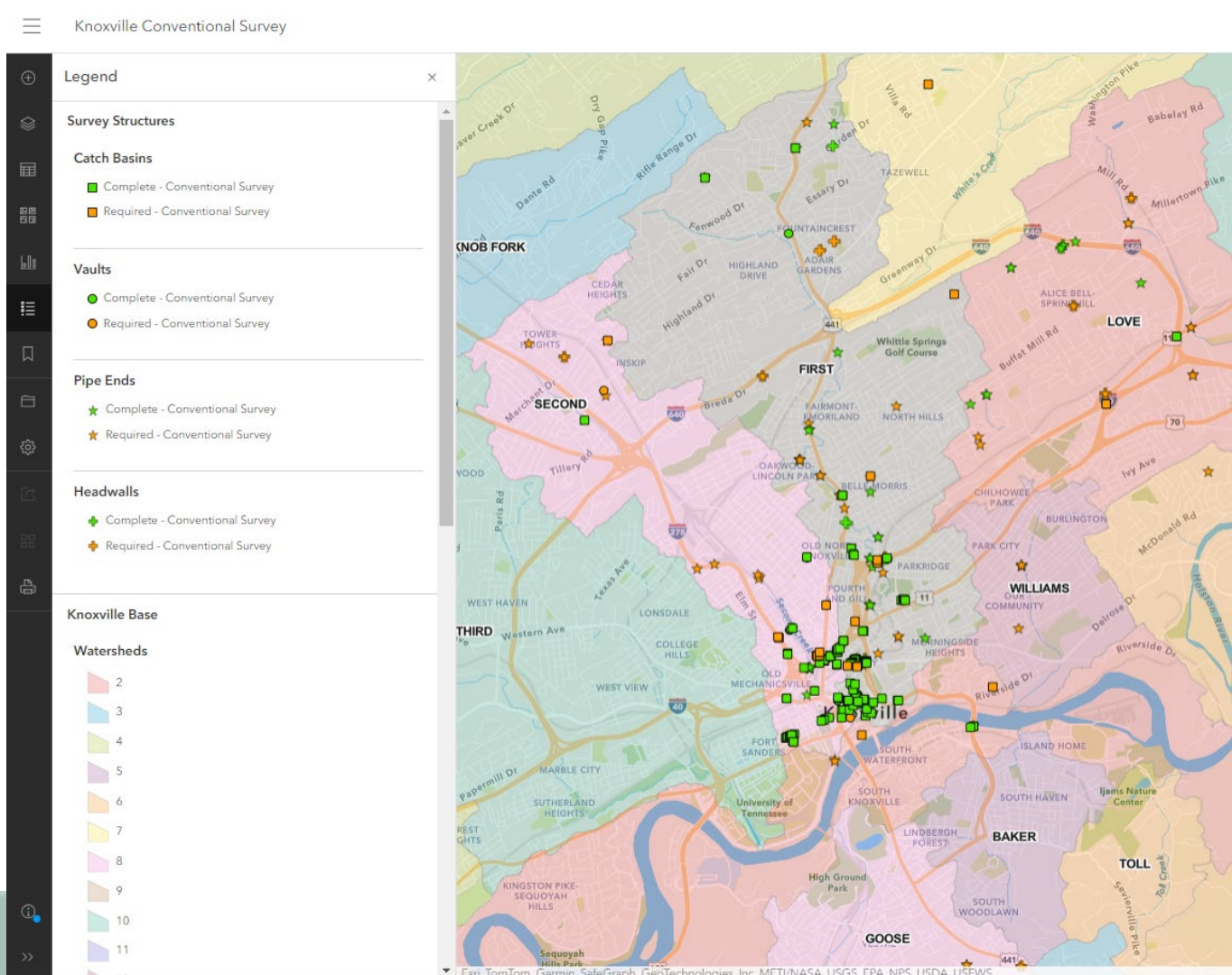
Coordinating on Structure Access Issues

- Conventional Survey
- Submerged
- Parked Car
- Clogged
- Sediment Bag
- Heavy Lid
- Bolted/Welded
- Heavy Traffic
- Vegetation





Conventional Survey



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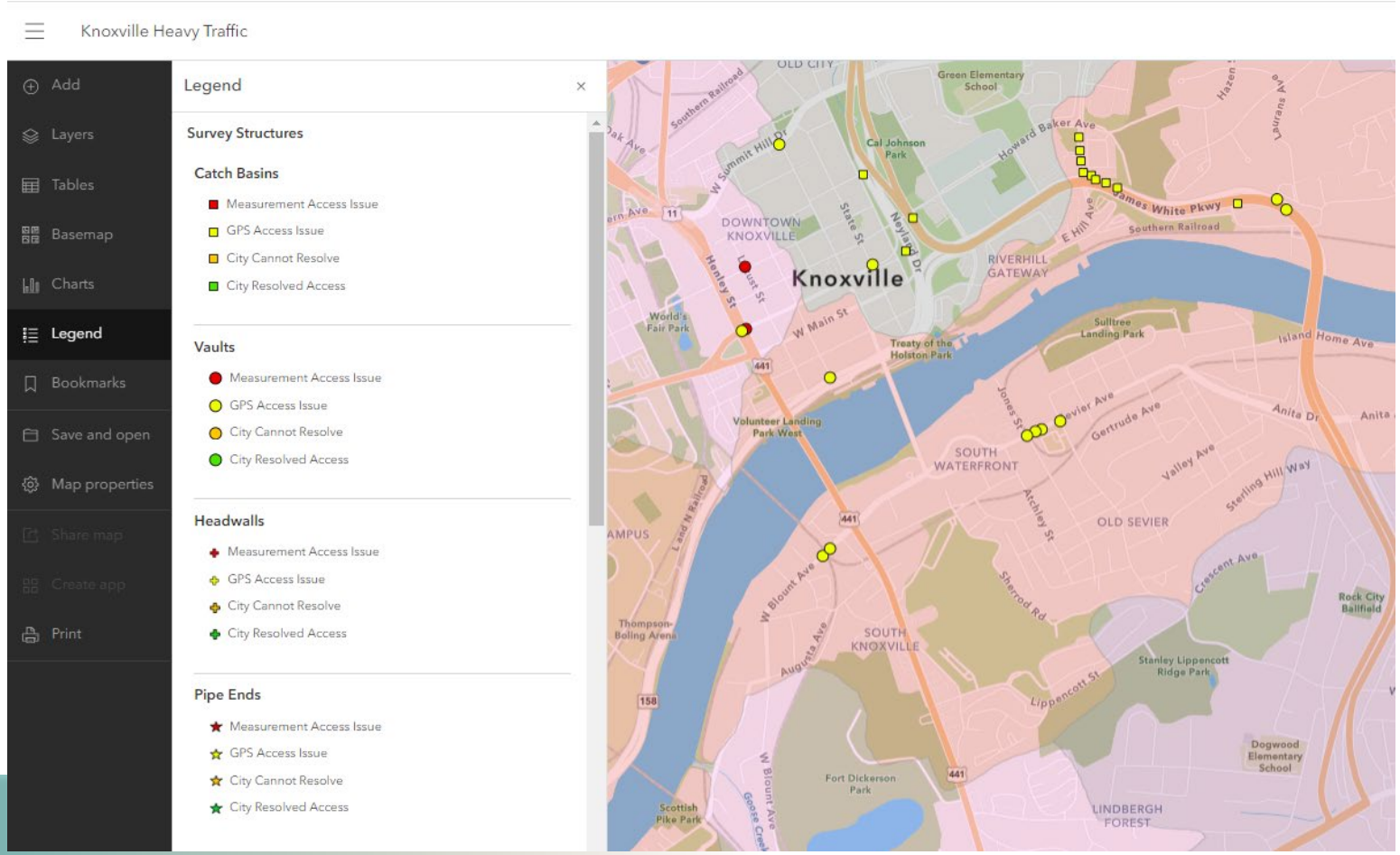
Traffic Control



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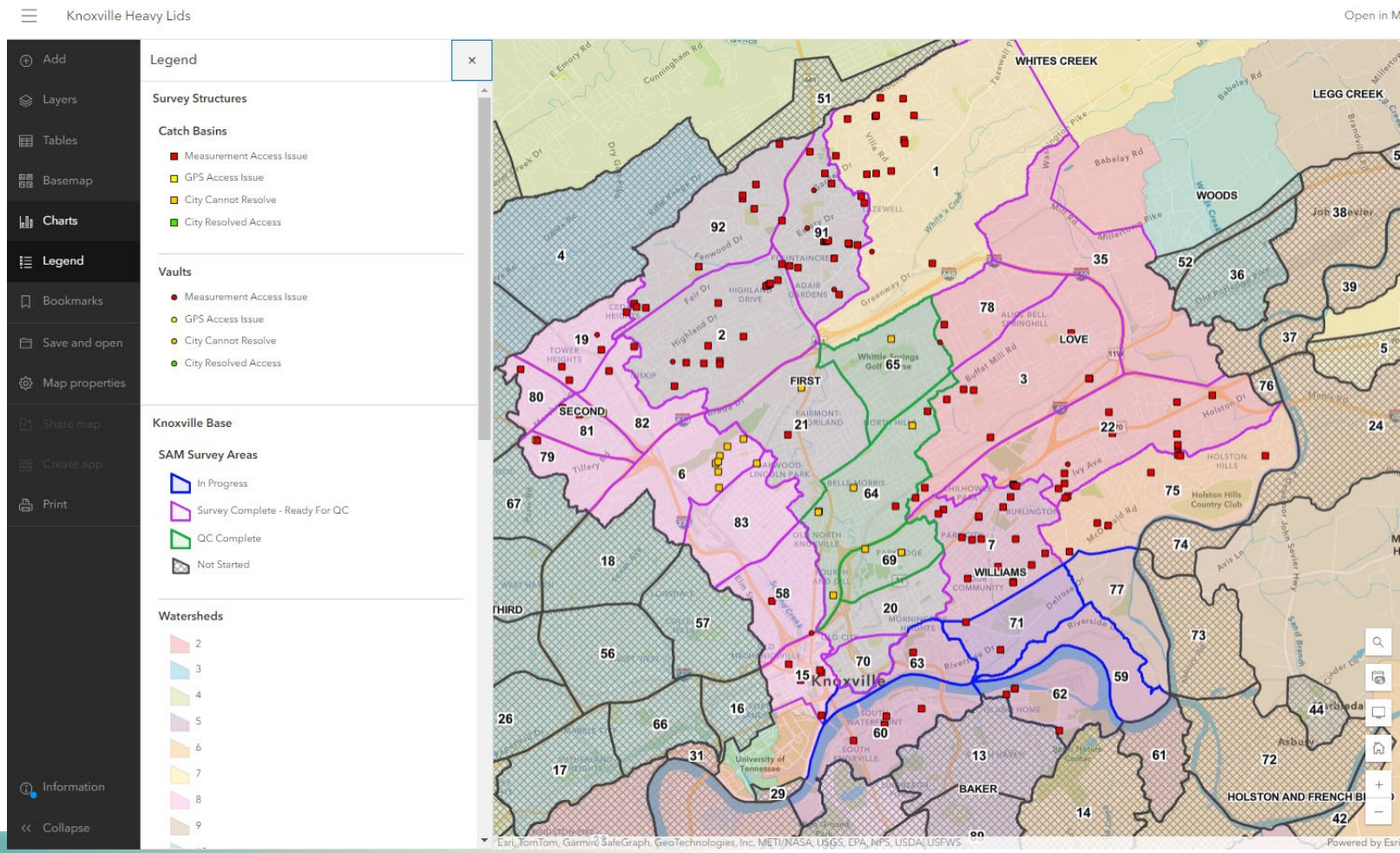
Heavy Lids



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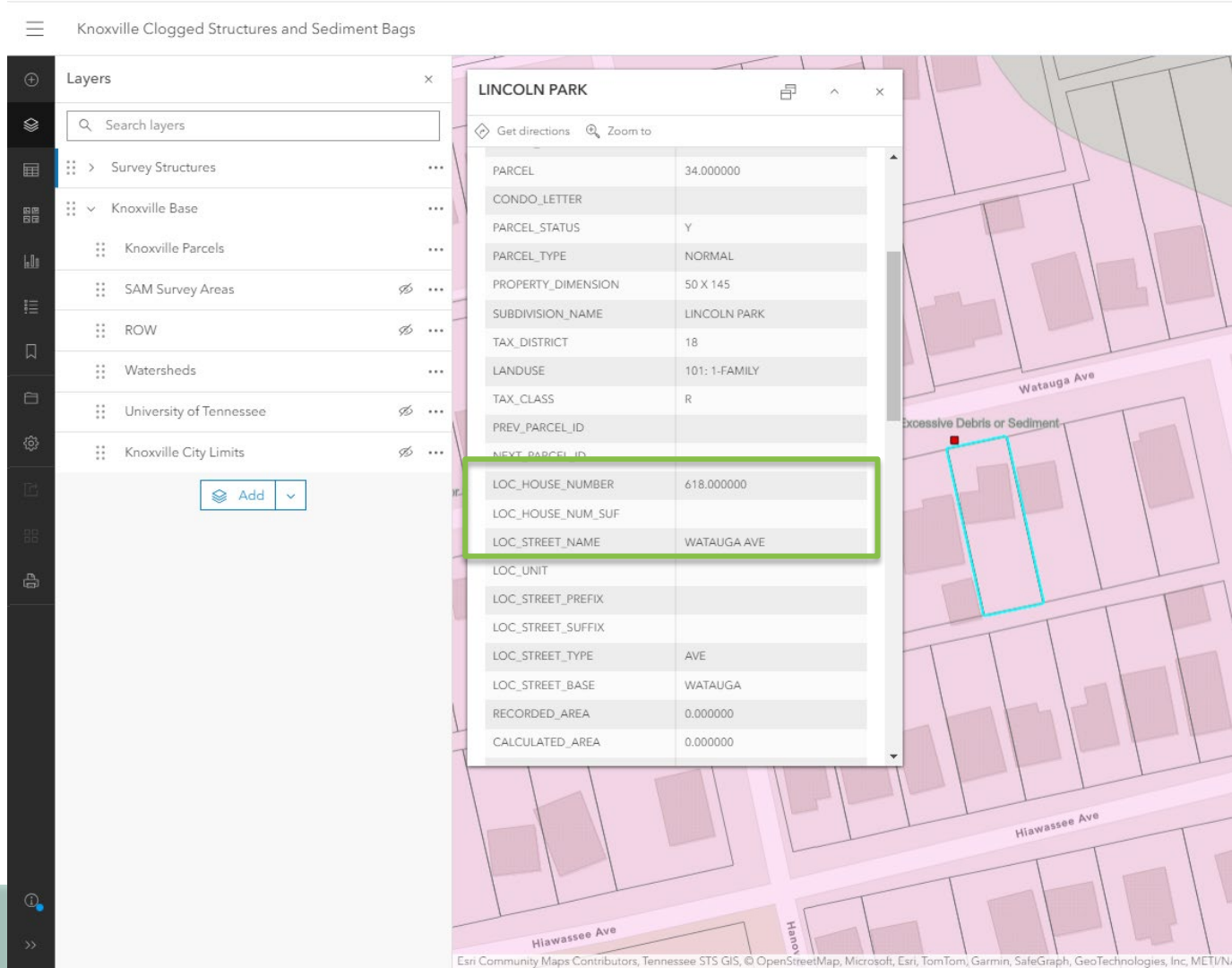
Clogged and Sediment Bags



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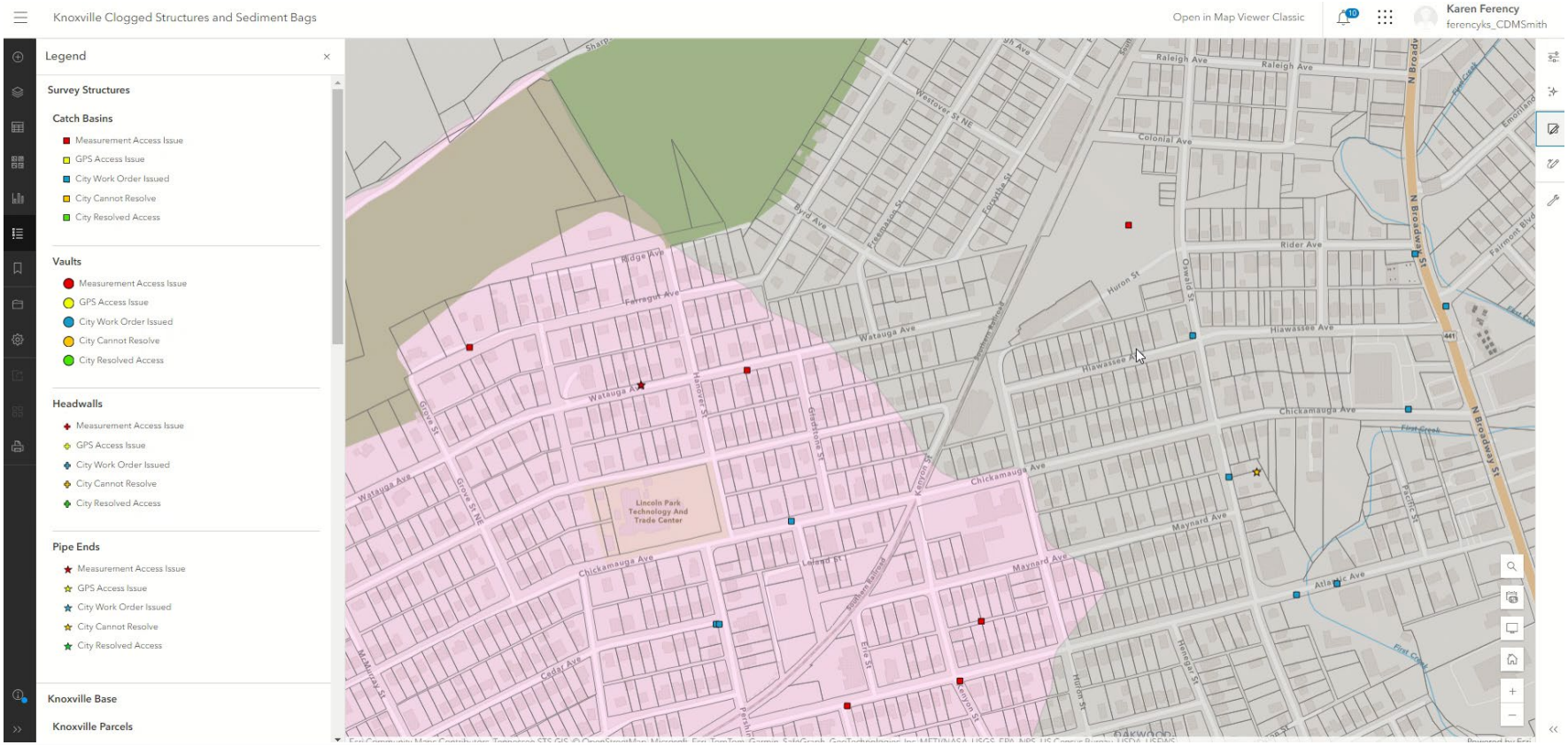
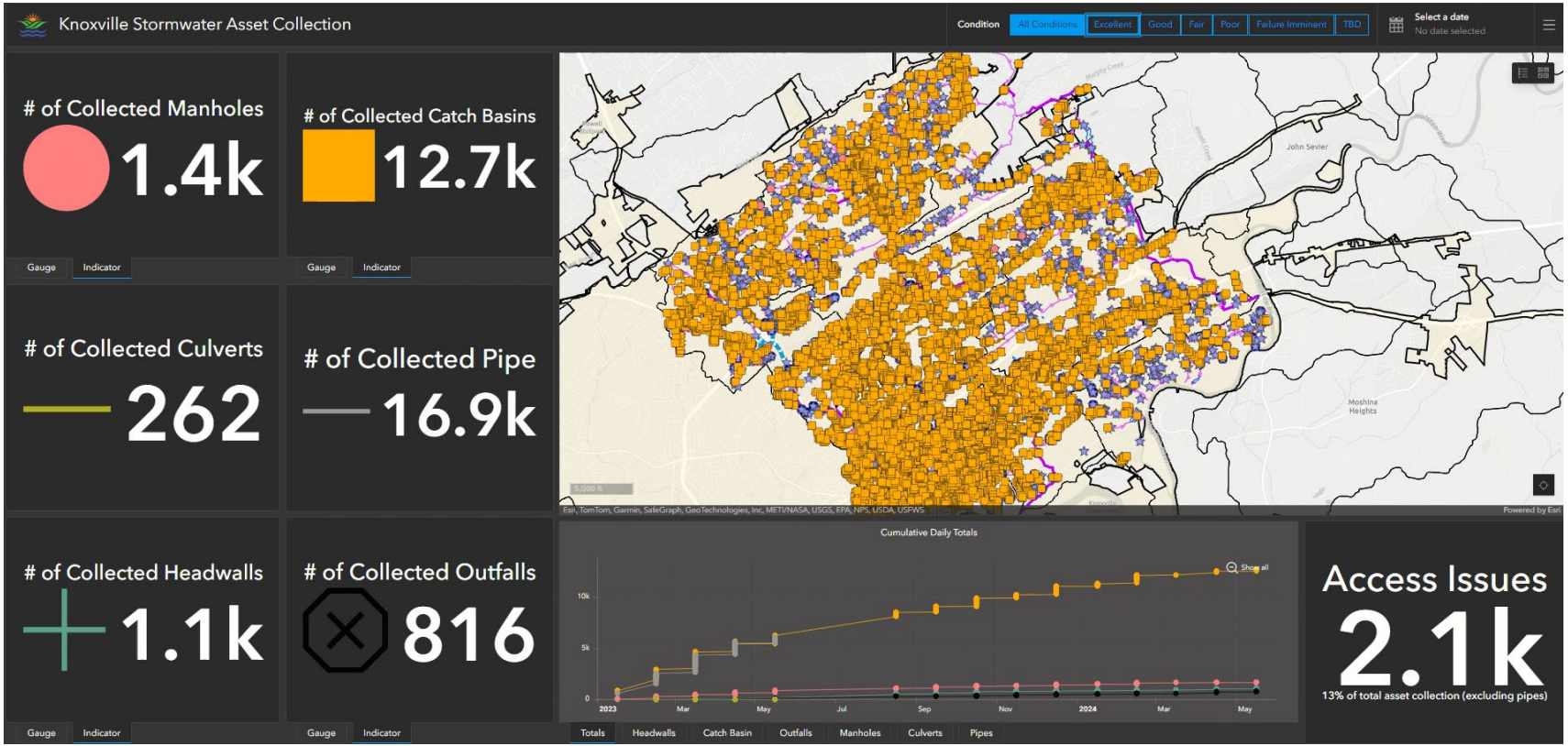
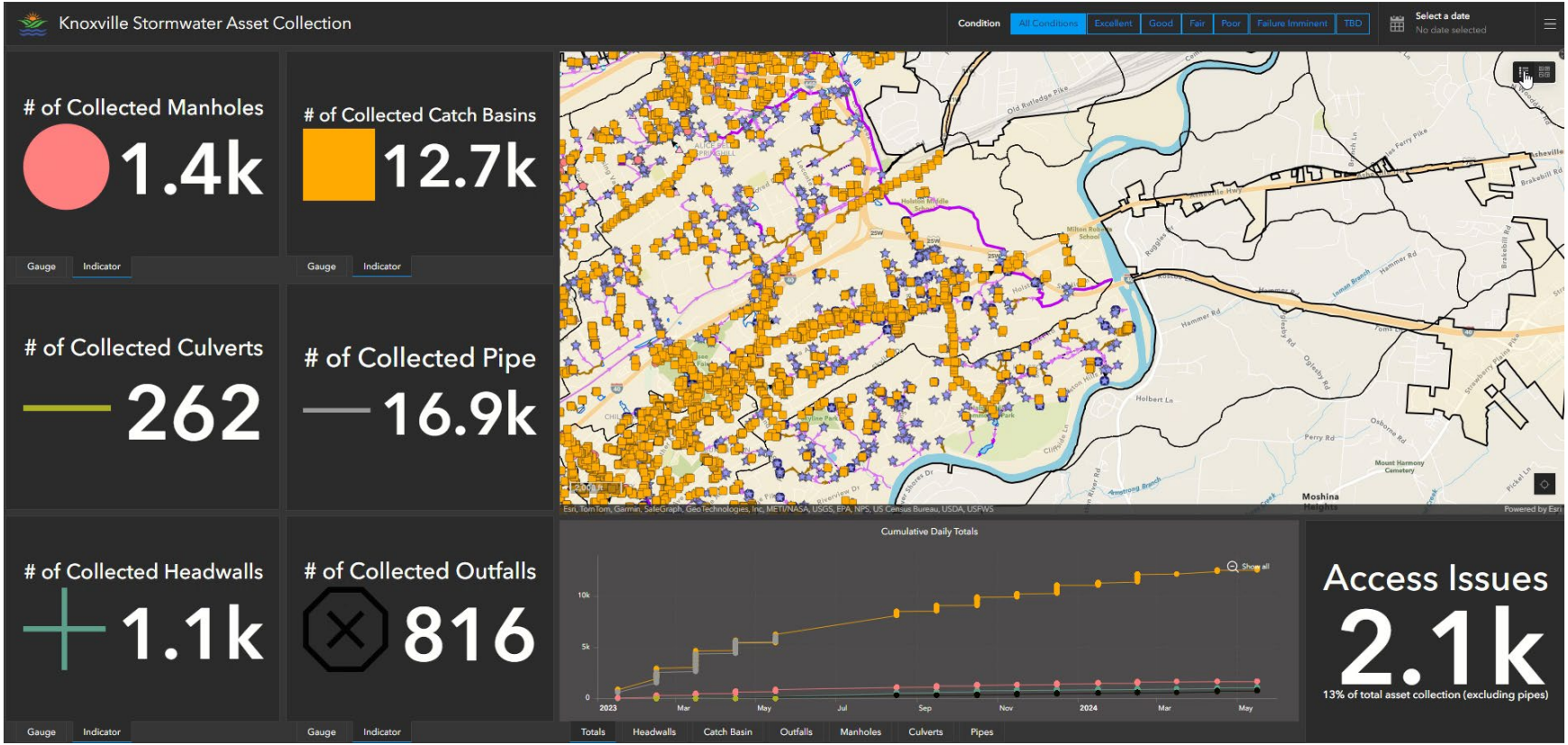
Clogged and Sediment Bags



Progress Dashboard

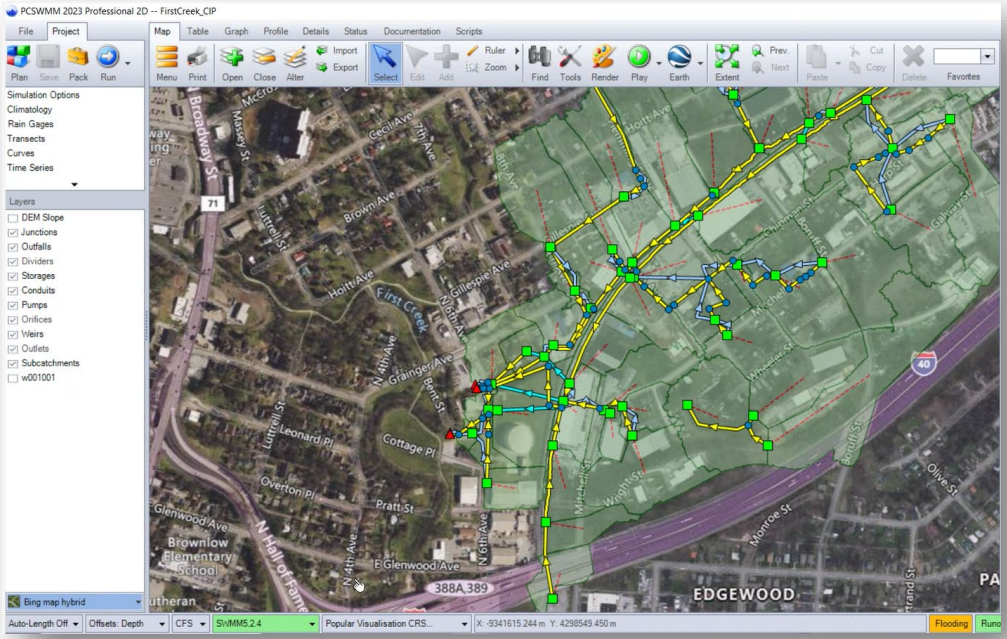


Progress Dashboard



Leveraging Data to Advance SW Program

- Building Flood Models Using GIS Data to Assess Areas of Frequent Flooding (5 locations)
- Developing a Pro-Active Maintenance Plan
  - Inspection Frequency
  - Call Response
  - Preventative vs Reactive Maintenance
  - Metrics and/or KPIs



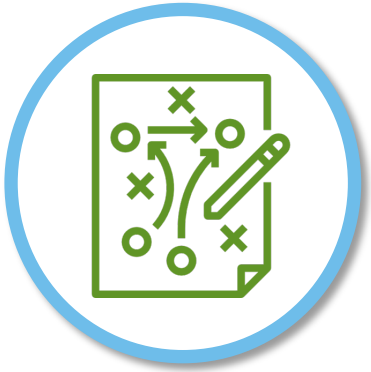
Summary Thoughts

- Data is Playing a Larger Role in Stormwater Management & an Accurate Asset Inventory is Critical
- Develop An Achievable Plan to Begin Your Asset Management Journey
- Work Closely with Your Field Teams to Establish Expectations
- Use Data to Advance Your Program

Discussion

Plan

Develop



Implement

- Contacts:
  - Randall Whitehead; rwhitehead@knoxvilletn.gov; 865-215-4137
  - Dave Mason; masond@cdmsmith.com; 615-340-6516
  - Karen Ferency; ferencyks@cdmsmith.com; 865-963-4314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