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GIS APPLICATIONS FOR WATER/WASTEWATER OPERATIONS: MAKING DATA WORK FOR YOU

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GIS ANALYST

OUR SERVICES

YOUR VISION. MADE REAL.

FACILITIES & BUILDING ENGINEERING | TRANSPORTATION | ENERGY | CIVIL | RETAIL DESIGN

OUR OFFICES

New York Ohio Pennsylvania West Virginia

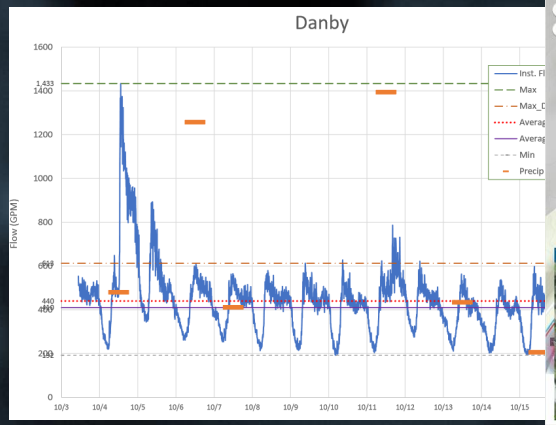
CHALLENGE FOR UTILITIES

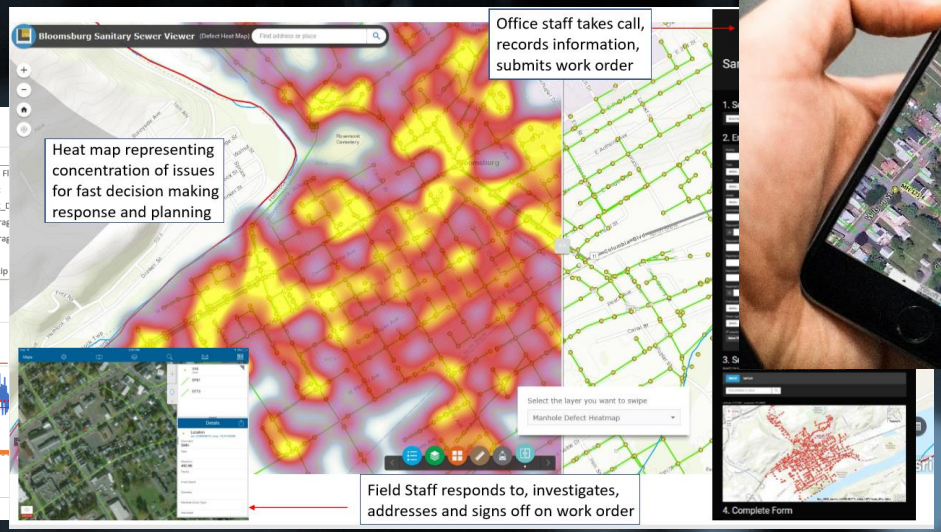
- Underground
- Aging infrastructure
- Hard to assess and access
- Planning, maintaining, capital costs
- Leveraging technology
- Knowledge Retention
- Technology adoption of older staff
- Analysis

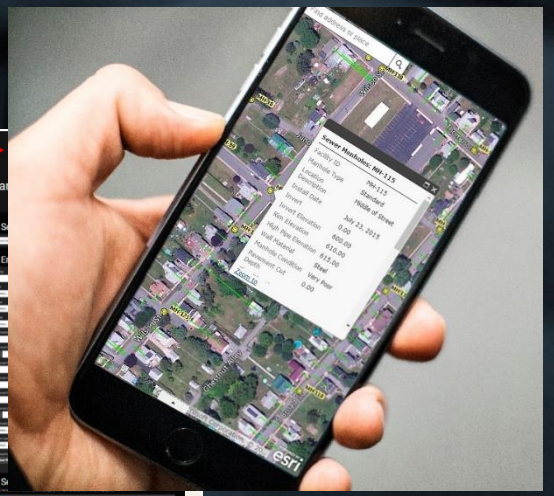
Fiscal years ending December 31	2009	2008	2007	2006	2005	To
e	1,721	2,115	1,829	1,889	1,534	
From Operations (a)	3,413	3,977	3,492	3,189	2,706	
l Expenditures, excl Equipment:						
nce of way (rails, ties, surfacing)	1,605	1,561	1,359	1,226	1,053	
al	107	168	141	152	136	
	110	133	105	121	108	
intenance Cap-Ex	1,822	1,862	1,605	1,499	1,297	
Information Services	83	83	75	65	64	
Termianl and line expansion	86	230	568	450	389	
Total Cash Capital Expenditures (b)	1,991	2,175	2,248	2,014	1,750	
Depreciation	1,537	1,397	1,293	1,176	1,111	6,514
Free Cash Flow (a) - (b)	1,422	1,802	1,244	1,175	956	6,599

GIS AS A SOLUTION FOR THESE CHALLENGES

- GIS gives you a way to visualize the data
- Push it out to mobile devices
- Put it in the hands of field staff, decision makers, the public
- Leveraging a platform that can tie other systems together
- Focused tasks on easy to use applications







ADDITIONAL BENEFITS GIS OFFERS

- Office to field and Field to office workflows
- GIS enables you to make more informed and faster data driven decisions.
- Faster and Easy document retrieval
- Preserves metadata (How the data was collected, accuracy, dates, etc.)
- Accessibility of your data
- All of this makes for improved communication.

GIS give you a way to **tell your story** to your constituents using a combination of maps, data and images.

MAPPING YOUR SYSTEM

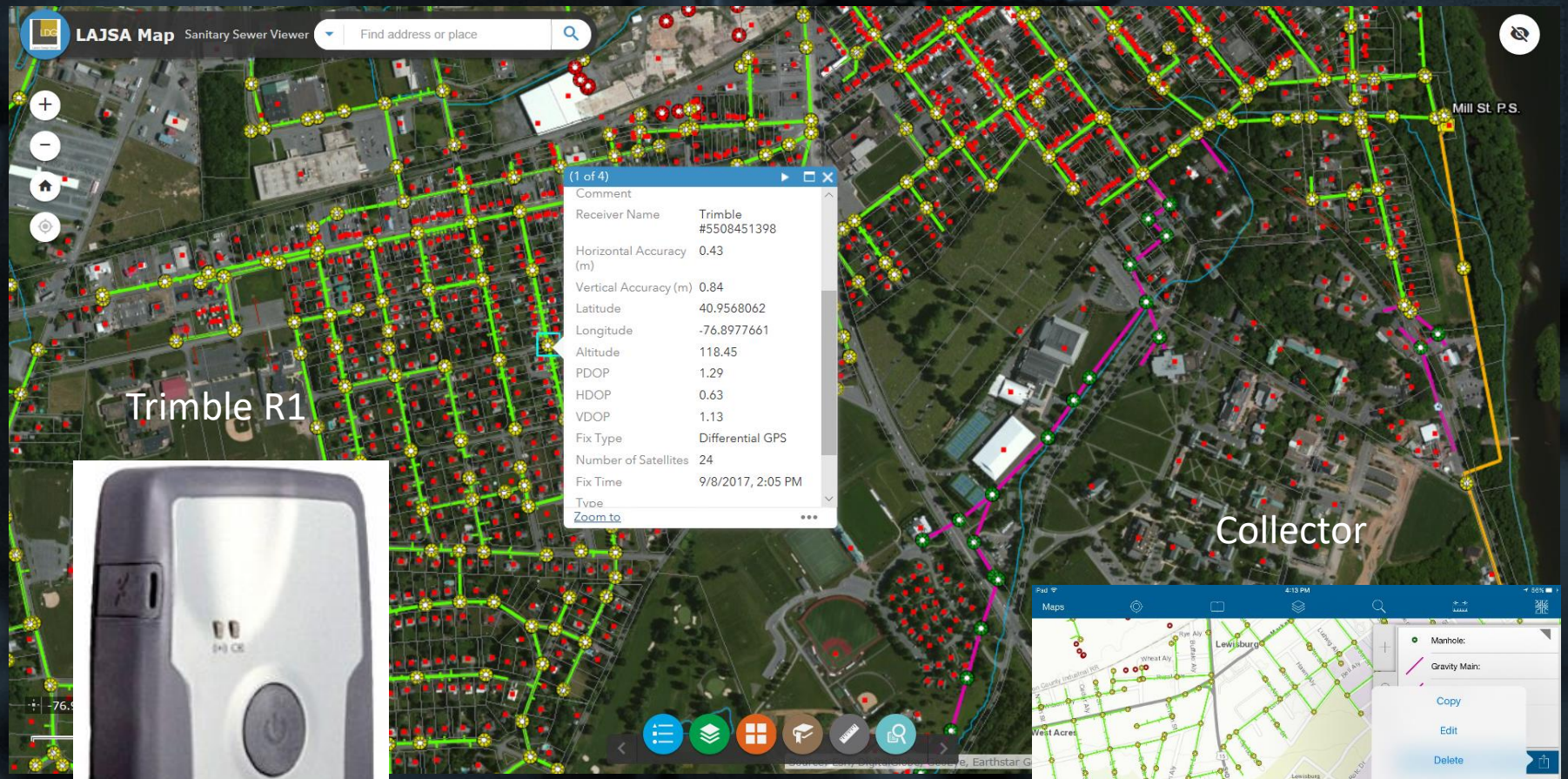
OFFICE TO FIELD
FIELD TO OFFICE
WORK FLOWS
MAKING TASKS MORE EFFICIENT

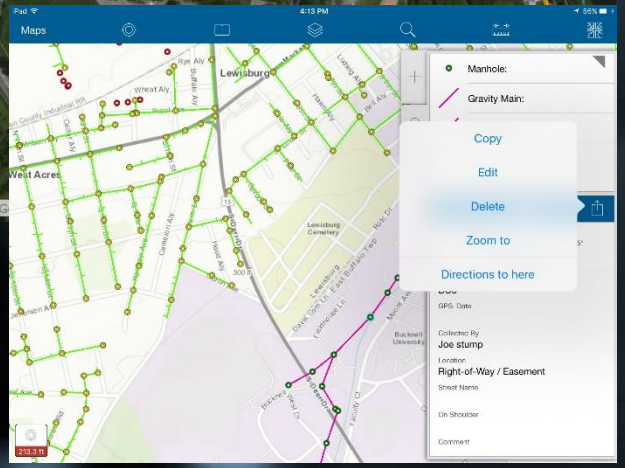
- Never been easier or cheaper to map your entire system with highly accurate data
- Taking advantage of Collector and high accuracy Bluetooth GPS
- Capture surface representation of the system, snap pictures

GIS enables you to make more informed and faster data driven decisions

FOCUSED APPLICATIONS

LEWISBURG (L.A.J.S.A)





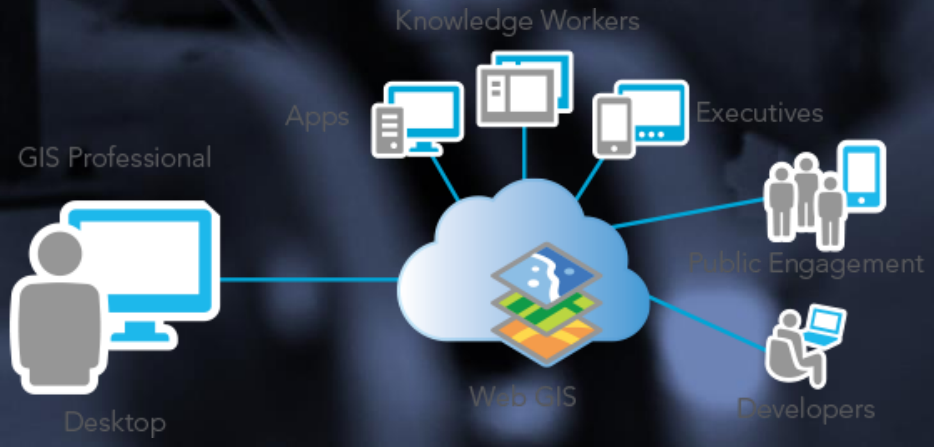
Sub Meter Accuracy

AFTER IT IS MAPPED - NOW WHAT?

- Now that you have good data
- Now that you spent the money, the time and the effort to map your system
- What do you do with all of this data?
- How do you take advantage of it?
- What's the benefit?

MAKING YOUR DATA WORK FOR YOU

- Collect once and reuse
- Make information accessible to field staff (Mobile apps / ArcGIS Online)
- Stream line communication (Story maps and Dashboards)
- Enhance office to field and field to office work flows (using ArcGIS online, survey 123 and Collector)
- Record information and take photo to reference condition
- Attach documents and drawing to features making them easy to return and accessible from anywhere
- Analysis (capacity analysis / planning / maintenance / capital expenditures)



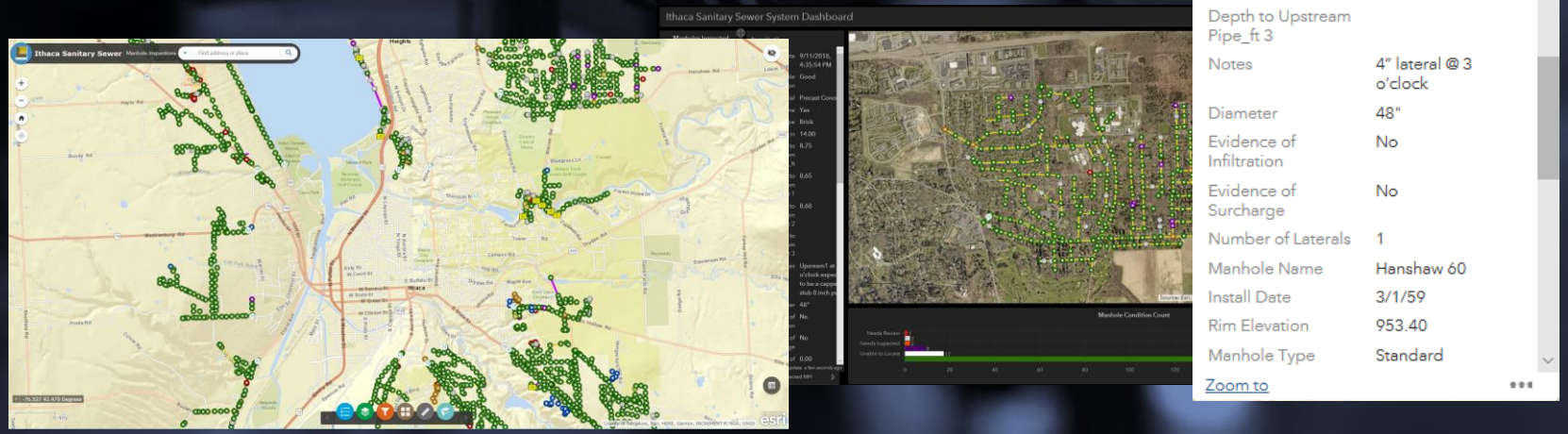
EXAMPLE TOWN OF ITHACA:

Goals of Project

1. Manhole Inspections
2. Improve Town Mapping
3. Assess current system capacity
4. Assess Future system capacity
5. Identify Areas where there are capacity problems
6. Recommend corrective actions to address current and prepare for future needs

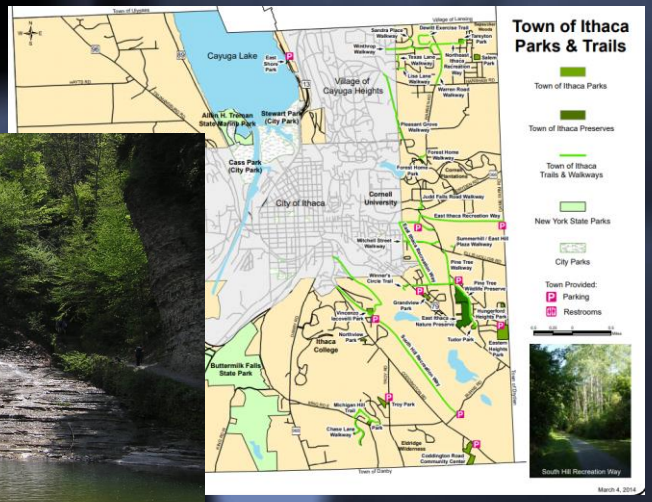
What is needed to meet project goals

1. Water usage data
2. Flow meters
3. Parcels / comprehensive plan and build out scenarios
4. Inspections (materials, diameter, condition, inverts to pipes, evidence of surcharging etc….)
5. Existing GIS data from Town of Ithaca
6. Survey data to capture X,Y,Z accuracy requirement to a 1/10 of a foot
7. Inflow and Infiltration numbers

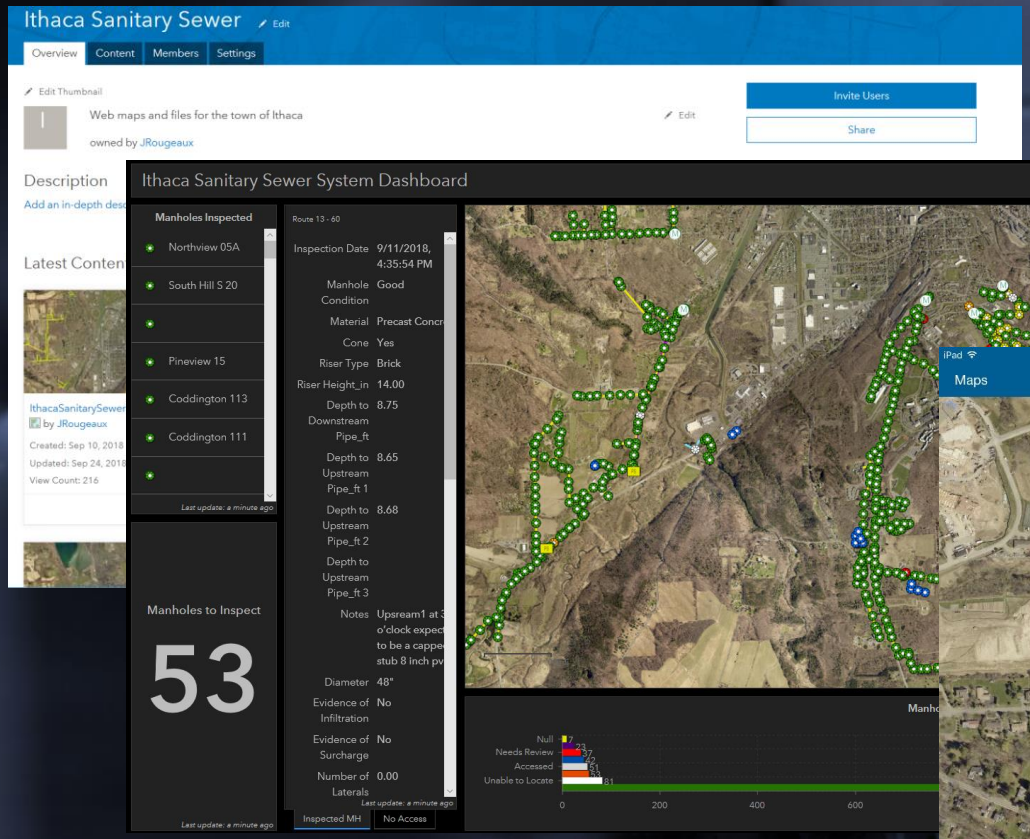


Looked at a few options and found that building the solution using GIS software would work best for this project
Used enterprise ArcGIS server / SQL database

- Very involved client (Ithaca liked to be very hands on throughout the project)
- Looked at modeling software, but prices versus our project budget was an issue
- It was easy to share information through ArcGIS Online
- Enhanced communication (client knew where our field crews were)
- set up dashboards, and web apps for clients to access info, monitor, and track collection progress
- Shared feature services through AGOL with the client to address issues and write back



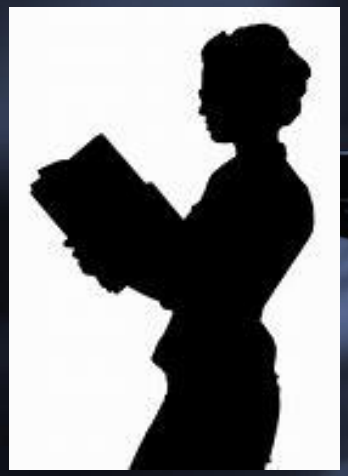
Dynamic Workflows
Enhanced Communication



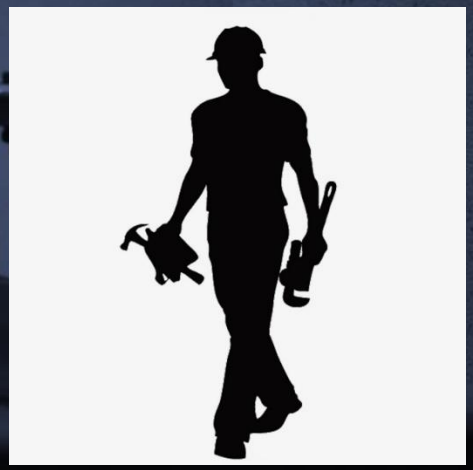
1. Publish maps out to Portal and ArcGIS Online
2. Inspections (locate manholes)
3. Flag issues / unable to access
4. Town staff uses apps to address issues, locate missing, and gains access to manholes
5. Survey staff uses Explorer to locate manholes

FIELD WORK FLOW

GIS Professional



Town Worker

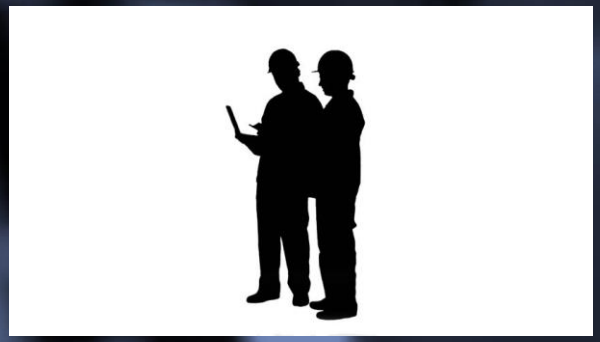


Web GIS

Mobile GIS

Survey Crew

Inspections



PROCESSING AND BUILDING OUT DATA

Survey pick up RIM elevation = z value to 1/10 ft accuracy

We measured invert looking for depth of Upstream and Downstream

Move existing data (inspection data) to survey data. Split pipes at manholes

Automation Collected data used throughout the entire process

- Inverts used in slope
- Type used for roughness
- Diameter used for capacity
- Length used in slope and capacity

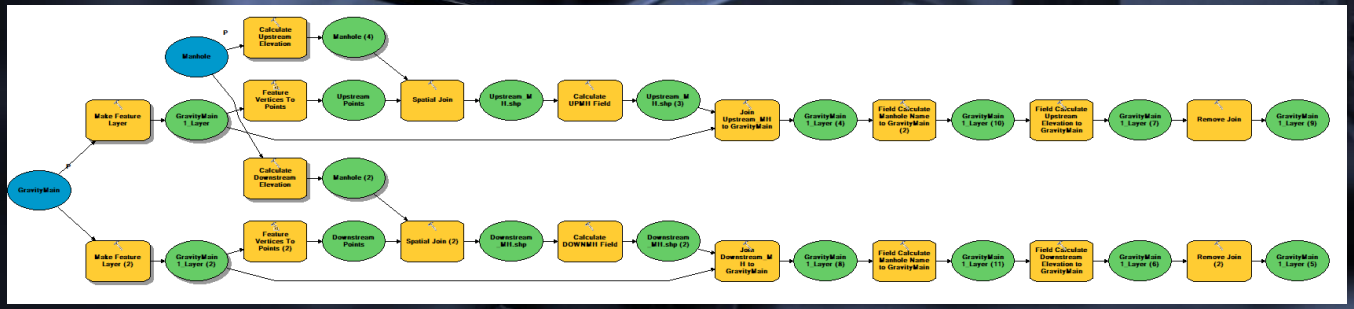
Preparing the data

Manning's Equation:

$$Q = \frac{1}{n} \times (D)^2 \times \left(\frac{D}{4}\right)^{\frac{2}{3}} \times \left(\frac{USI - DSI}{L}\right)^{\frac{1}{2}} \times 523.82$$

Push Manhole information over to gravity mains

Automation



Slope

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Capacity

Manning's Roughness Coefficients	
Asbestos Cement	0.011
Cast Iron	0.014
Clay Tile	0.013
Ductile Iron	0.013
Polyvinyl Chloride	0.010
Steel	0.012
Vitrified Clay	0.015
Concrete	0.015

GEOMETRIC NETWORK

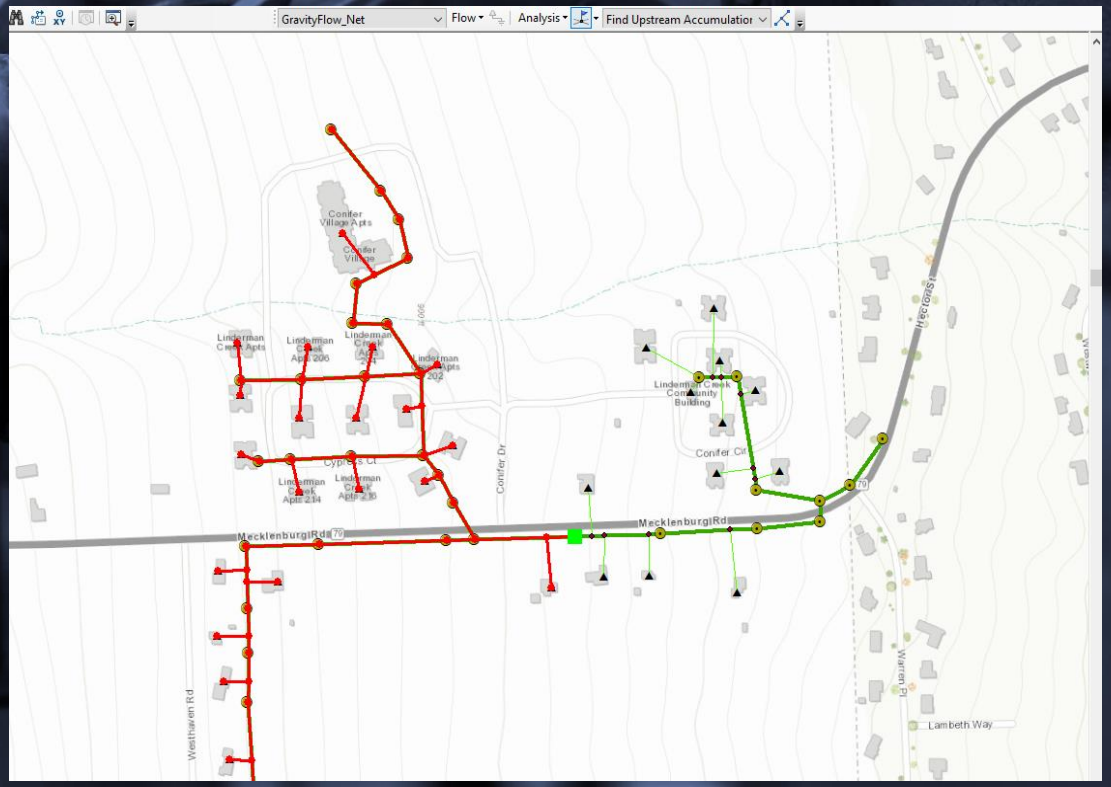
Populate service connection with a peak discharge number GPM

Build out Geometric network

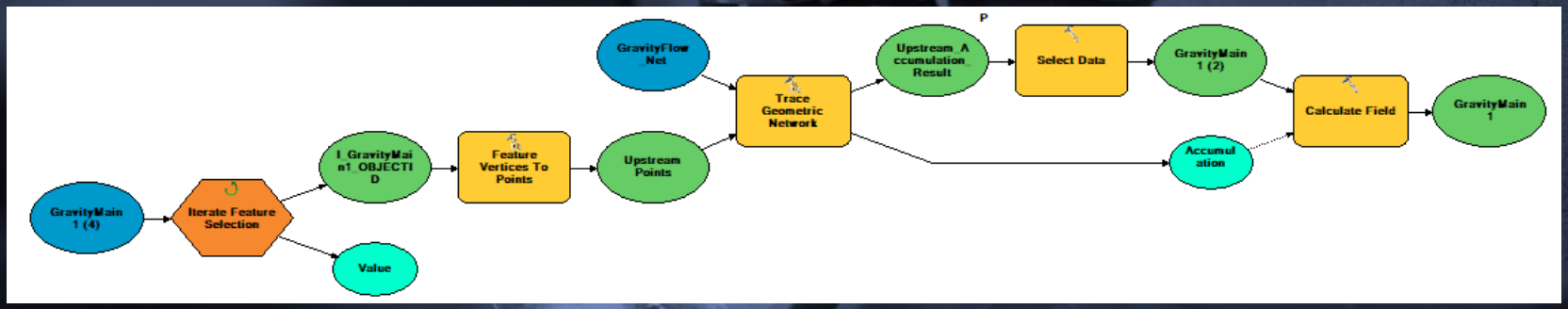
Upstream traces and accumulations to determine what the peak flow would be on that given pipe section.

Run this on existing data to determine the current flow vs. the capacity.

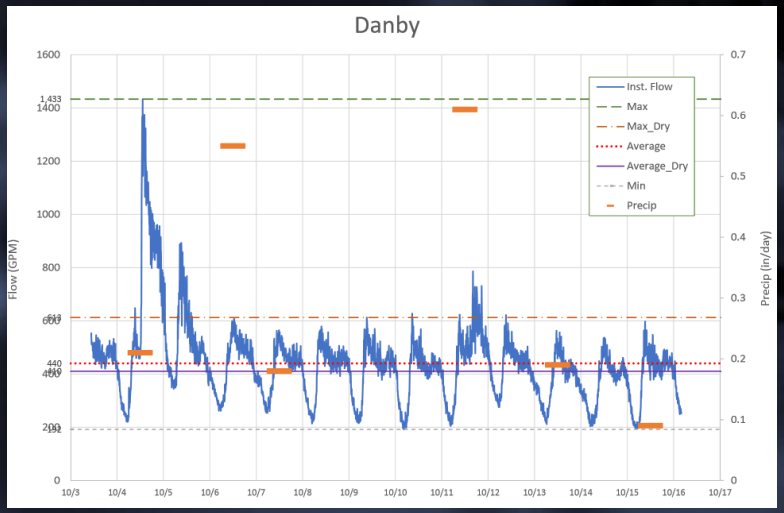
Drop a point at the end of a line, connect the lateral, and populate what a new subdivision would contribute. This would return the future flows vs. the capacity.

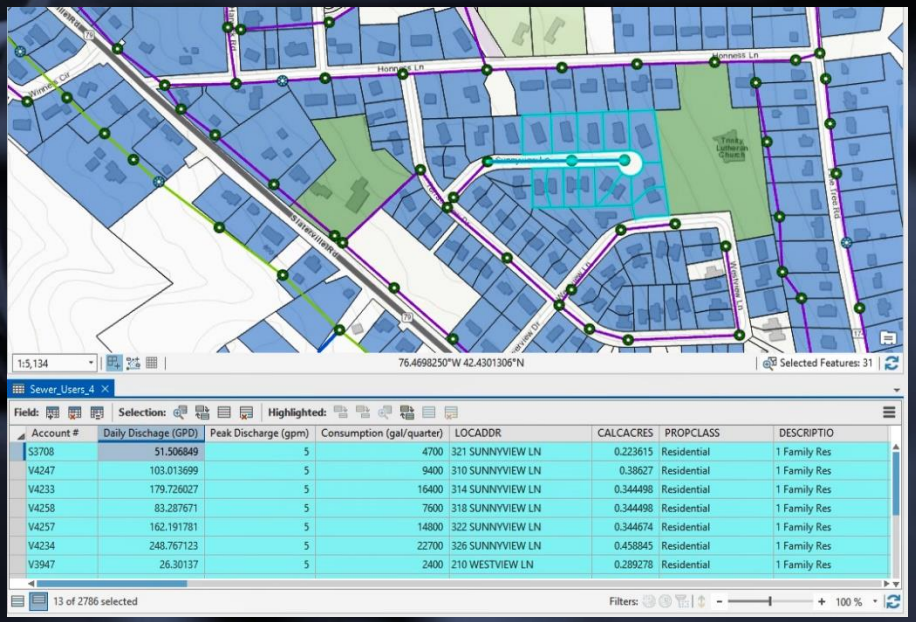


FLOW DURING PEAK DISCHARGE AUTOMATE



Unique Inflow and infiltration number GPM / Per foot of Pipe based upon flow meter data and some other information

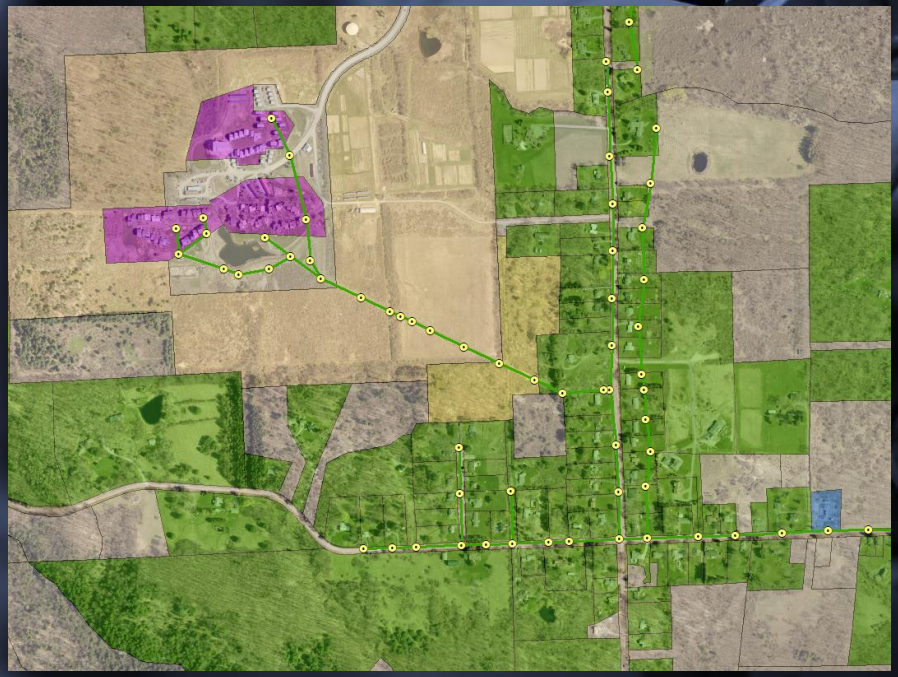




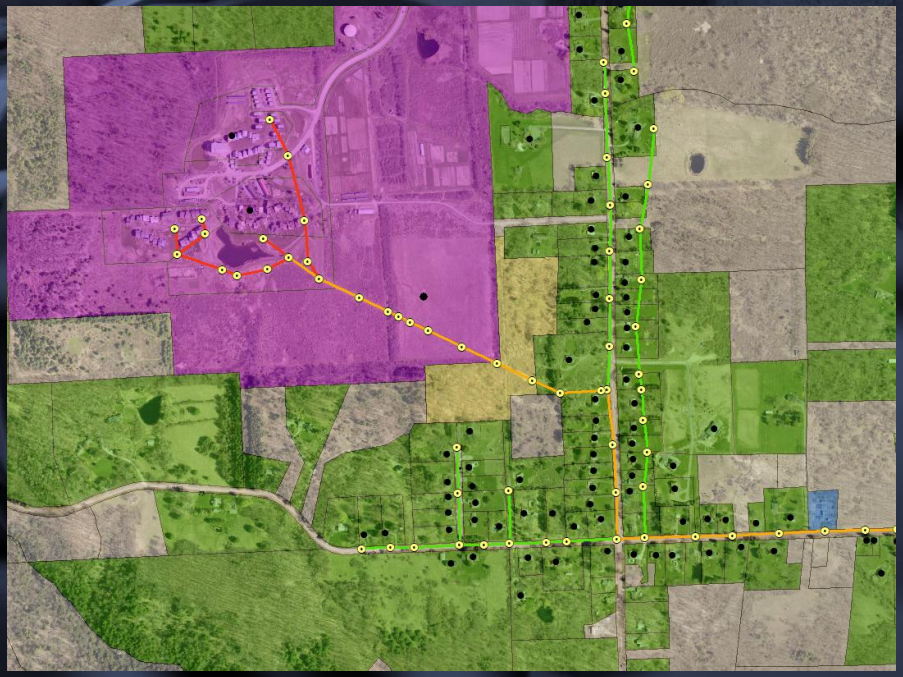
Water usage data tied to parcel / structure data

ANALYSIS RESULTS

Current



Future



ROI

- Benefit of collecting data that gets fed into the GIS model … a seamless flow of data
- Explore different build out scenarios
- Help planners understand the complexity and the capacity of underground networks
- See key areas that will act as a bottle neck and plan for capital expenses
- Helps everyone make more informed data driven decisions

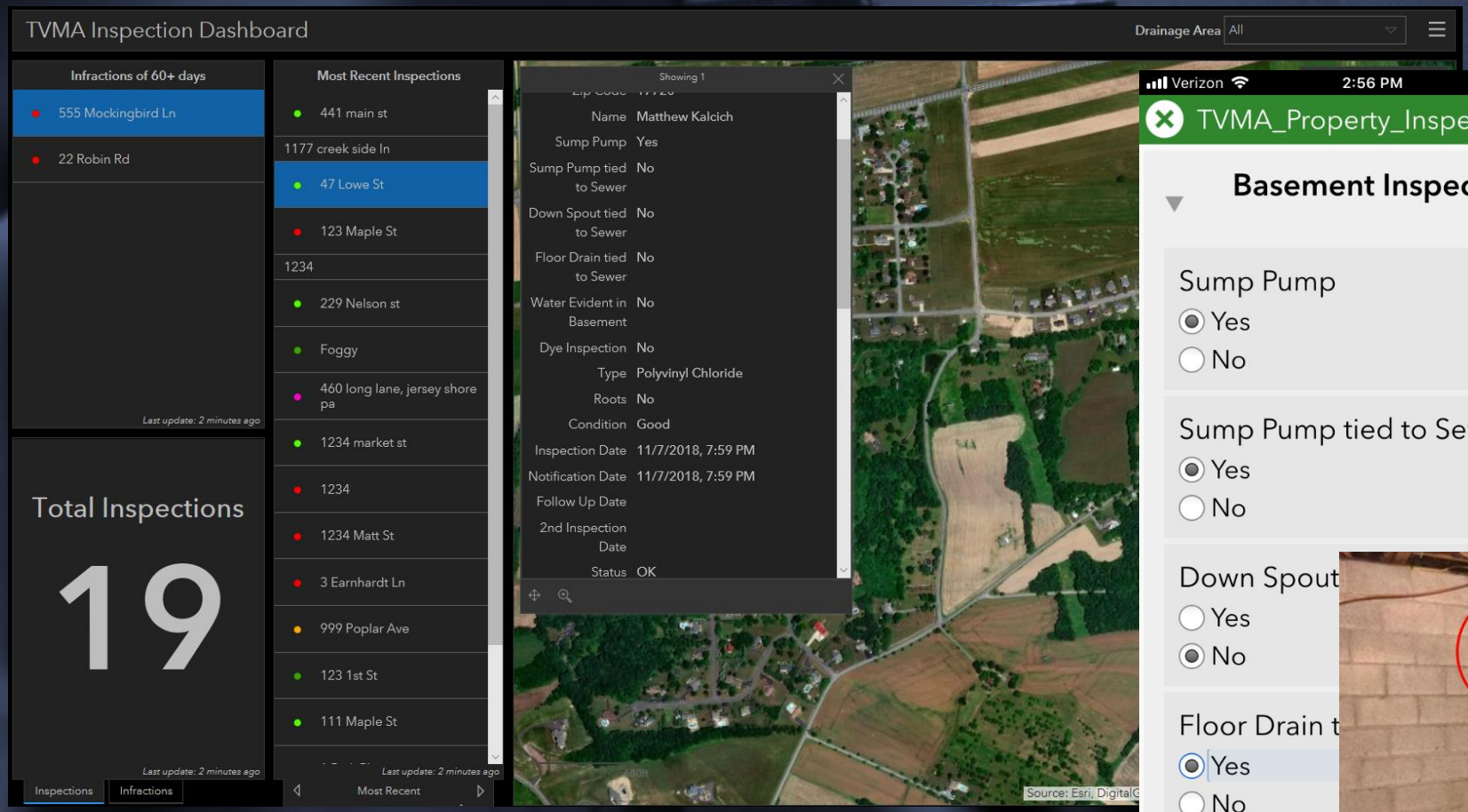
EXAMPLE TVMA

(SURVEY 123 APPLICATIONS)

THE PROBLEM

- The problem is there is a lot of illegal connections on this part of the sewer system during a moderate rain event the pump station reaches capacity, causing a lot of wear and tear extra maintenance costs, and overflow issues

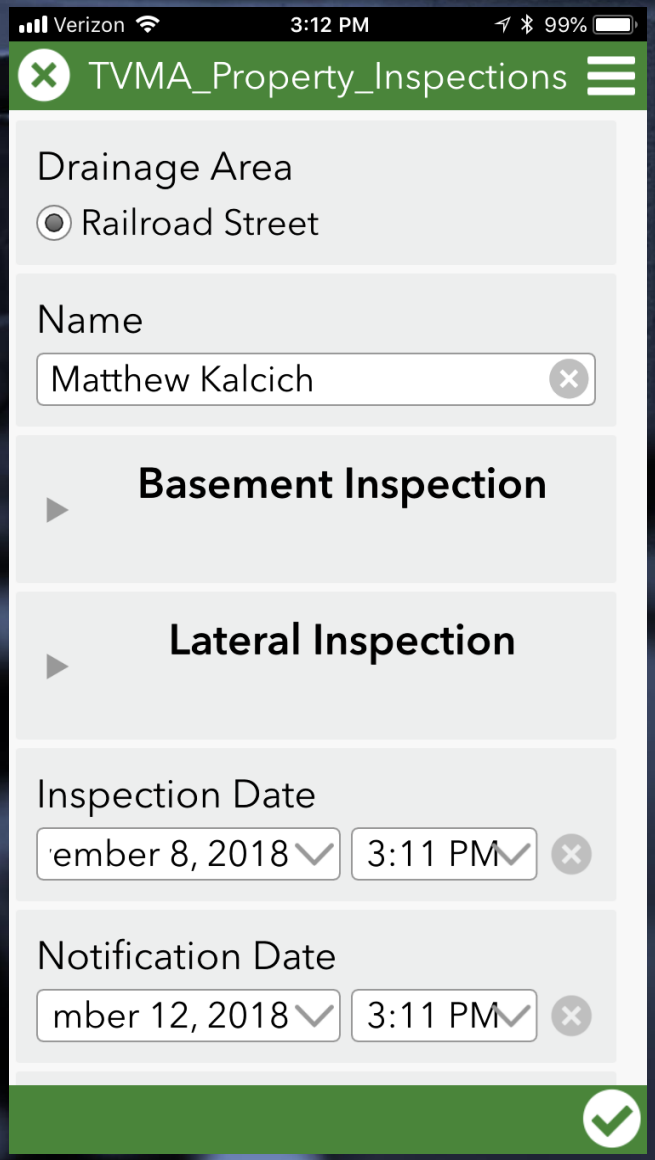
THE SOLUTION



- Solution use GIS to notify property owners of inspection
- Use Survey 123 to quickly assess basement and laterals
- Use Operations Dashboards to manage the project, track infractions, progress, and to be notified when an action needs to be followed up on.

THE PROCESS

- Start from existing GIS data
- Define questions
- Set up Survey 123 forms
- perform basement and lateral inspections with Survey 123 app
- ArcGIS Online
- Operations dashboards where manager can access data, get prompted on an action, and reference the infractions



RETURN OF INVESTMENT

The authority did this very project with paper 10 years ago

- When folks got around to it they inspected a property (no structure)
- No action or follow up was taken on any of the infractions
- All of the paper documents have since been lost
- Hundreds of manhours and tens of thousands of dollars was wasted.
- Pumps got worse and had to be repaired
- Quick inspections, less disruptive to property owner
- Take detailed photo of an infraction
- These applications will save time in the field, organize data, track progress, and remind staff when an action needs to be taken on an infraction.

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QUESTIONS