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Sewer System Asset Data Collection with ESRI Mobile Apps

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Historical Sewers

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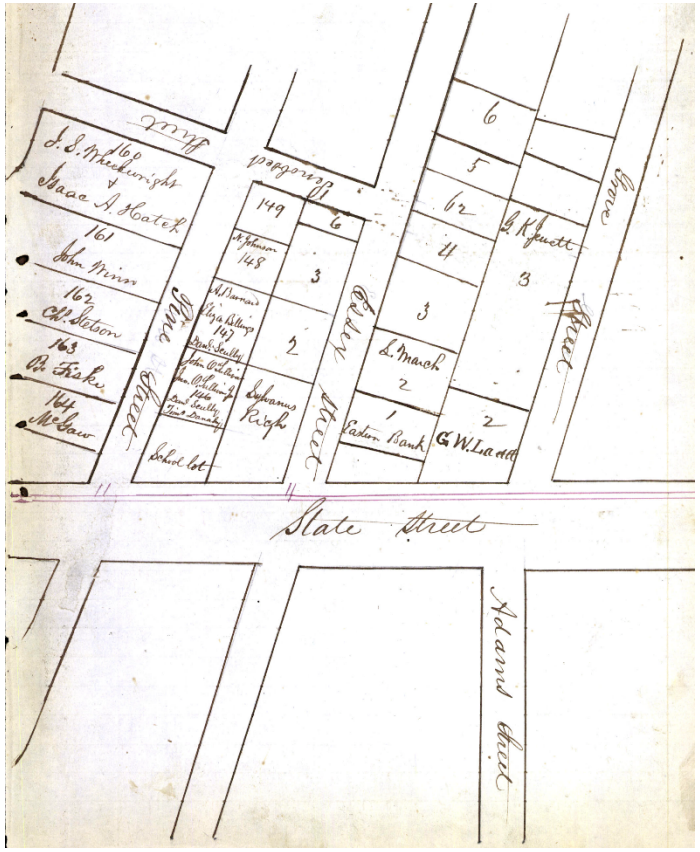

1850

Historical Sewers

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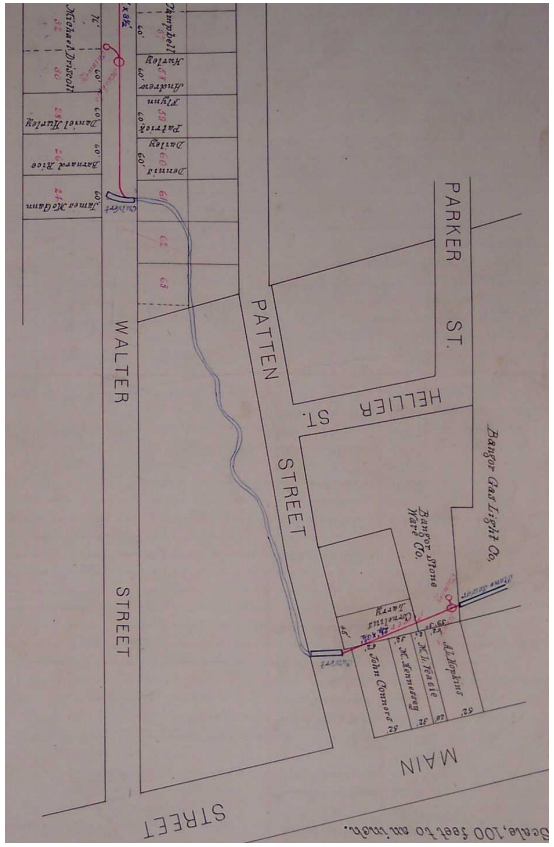
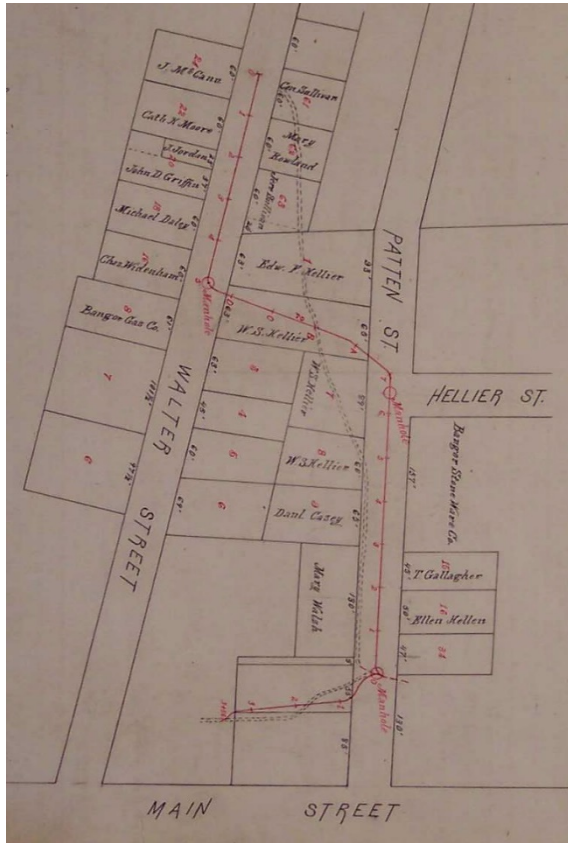


1883



1886

today

Sewer Statistics

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146 miles of pipe

3,300 manholes

30% combined (by length)

31 subsections

8 CSO outfalls

3 CSO storage facilities

Age (yrs)	Miles	%
0 – 25	29	20
26 – 50	51	34
50 – 75	31	21
75 – 100	7	5
> 100	21	15
unknown	7	5
TOTAL	**146**	

Sewer Statistics

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53 miles of PVC (36%)

34 miles of VCP (23%)

9 miles of brick pipe

350 feet of stone sewer

Progress

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WWTP built in 1968 with 9 miles of interceptors

1987	2017
22 CSO locations	9 CSO locations
58% combined system	32% combined system

Consent Decrees in 1987 and 1991 for plant upgrades and CSO abatement
Consent Decree in 2015 for CSO abatement

2015 Consent Decree

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Annual Requirements for Collection System:

CCTV 10% of system

Flush 10% of system

Inspect 10% of the manholes

Stone Age To The Digital Age

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Paper maps and plans dating back to 1850

2010/2011 - GIS built from plans

- 3 years to build out
- Many assumptions were made

Stormwater and Sewer as layers in GIS

Collection Process History

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Paper inspection forms until 2016

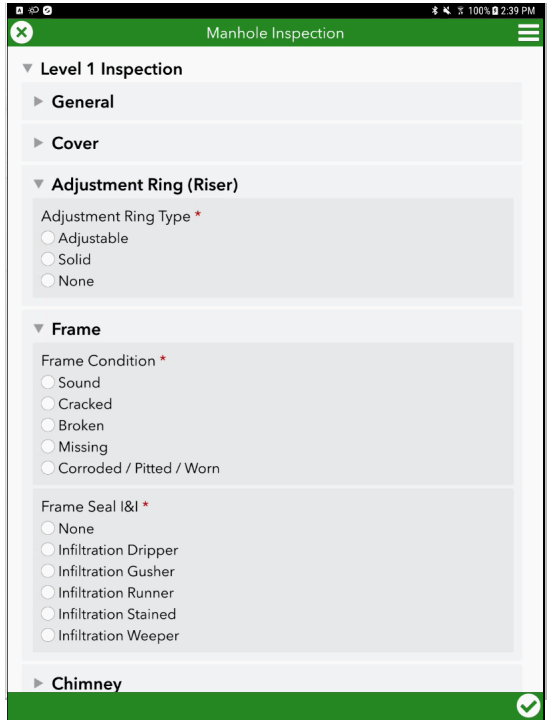
- Hard to analyze
- Prone to errors
- Inefficient

GoFormz 2016

- First digital process
- Still was not easy to integrate into GIS

ESRI mobile apps 2017 to present

- Results can be directly linked to GIS and analyzed
- Effective and efficient



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Considerations

Easy to use

Improve safety

Low cost

Integrated with GIS

Improves data collection

Easily analyzable

ESRI Apps

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ESRI Explorer

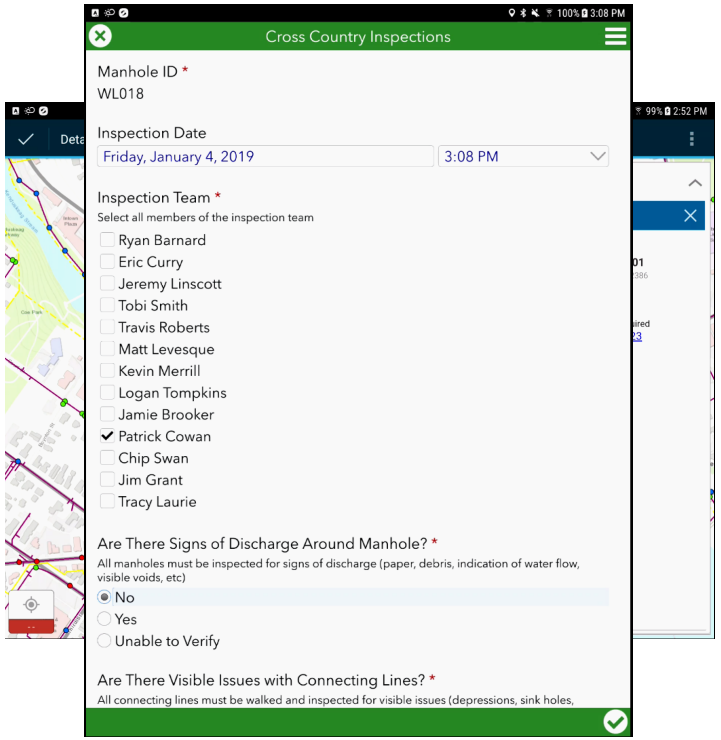
- Maps without editing capabilities (view only)
- Connected to ArcGIS Server

ESRI Collector

- Maps with editing capabilities
- Connected to ArcGIS Server

ESRI Survey123

- Used to capture data in a form
- Connected to the cloud and/or a portal



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Sewer Apps Developed

Manhole Inspections

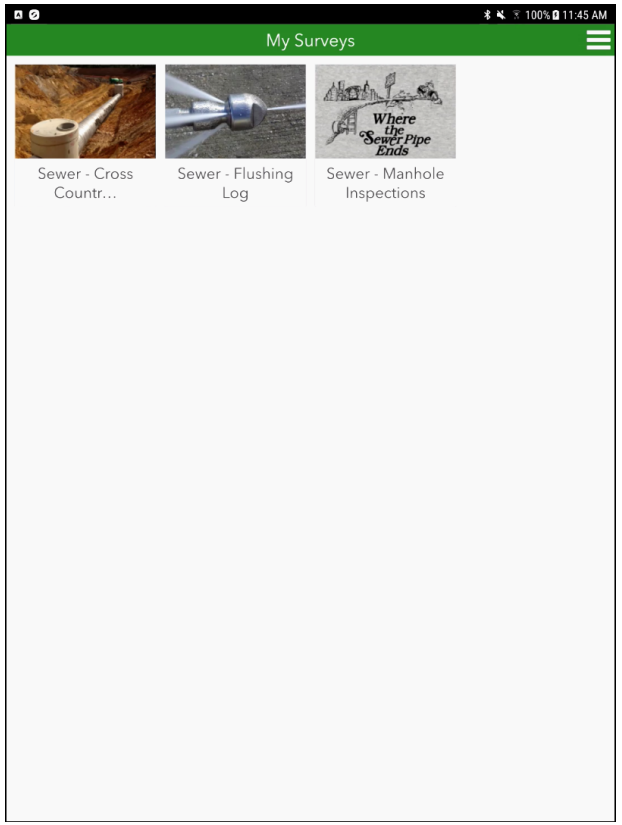
- Very important
- Hybrid of NASSCO manhole inspection

Cross Country Inspections

- Done 3 times a year
- On-the-fly status for field crews
- Identify issues

Flushing Logs

- Track flushing in a digital format



Using Technology

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Tablets

- Samsung Galaxy Tab S2 tablets with Hotspots
- Samsung Galaxy Tab Active2 tablets with modems

GoPro Cameras

- GoPro Hero 6 cameras
- Handlebar mount and painter's pole

Software

- ESRI mobile apps on tablets
- Enterprise geodatabase hosted via ArcGIS Server

Manhole Inspection - Levels

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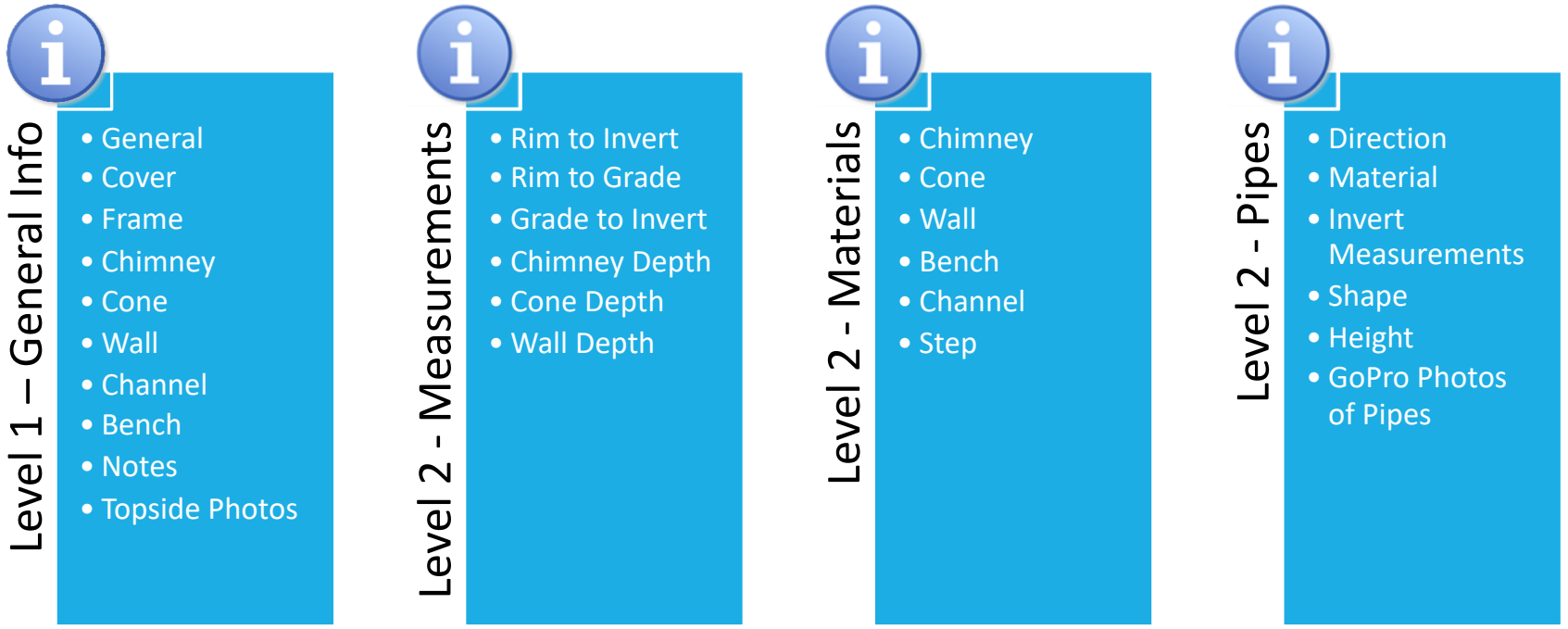
- Level 1
  - Newer than 40 years old and/or a pre-cast structure
- Level 2
  - Older than 40 years old and/or not a pre-cast structure



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Manhole Inspections - GoPro Camera Pipe Photos

Inexpensive

Waterproof

Light attachment

Picture is worth a thousand words

Remotely controlled via the tablets

Grade rods for pipe measurements

Historic documentation

Safer! Limits confined space entries

Manhole Inspections – Workflow

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Done with every CCTV inspection

GoPro Images
- Images taken of connecting pipes
- Upload to tablet

Collector
- Used to select manhole for inspection and launch Survey123

Survey123
- Used to collect the inspection information
- Downloaded GoPro photos are directly attached to the inspection

Cloud
- All data is saved in “the cloud”

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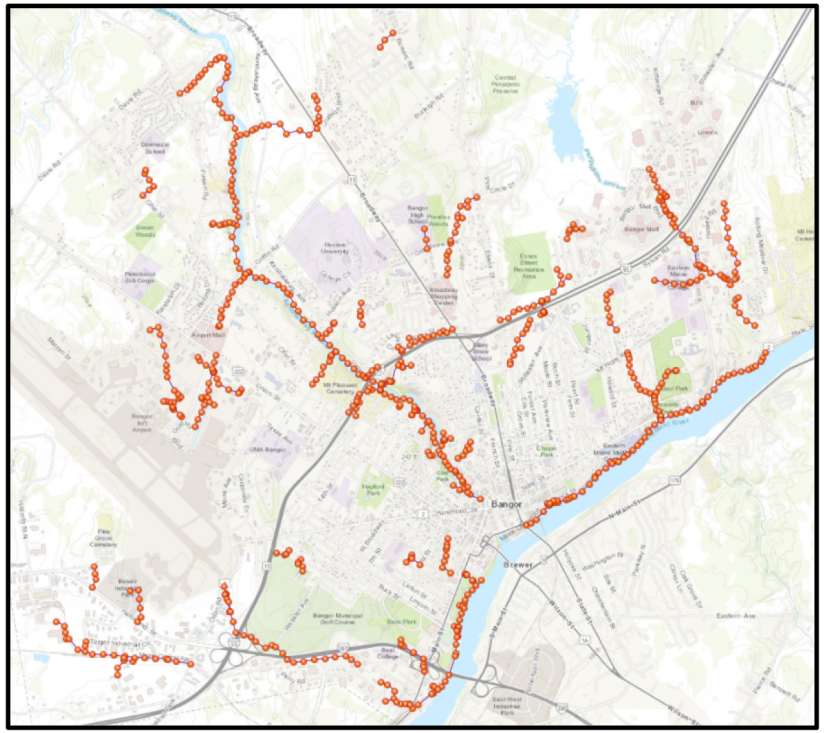
Cross Country Inspections

Done 3x a year (spring, summer, fall)

Need to check approximately 621 manholes and 673 pipe segments (10.9 miles) for signs of overflows or issues

Previously had limited documentation on inspections

Summer of 2018 – moved to digital format



Cross Country Inspections - Workflow

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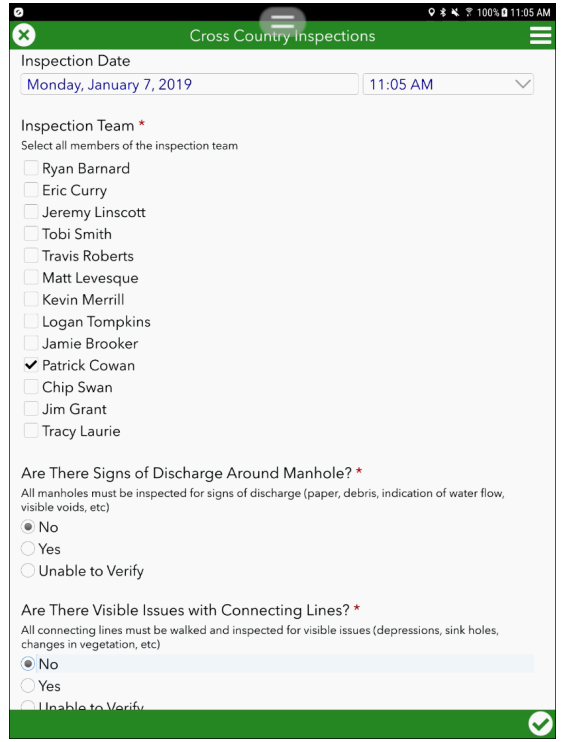
Collector map used for identification and to launch a survey in Survey123

Survey123 used to capture information about inspection

- Survey Team
- Problems noted (if present)
- Photos

Flagging refresh and easement maintenance needed tracking

- Allows to build backlog of off season work to be done



Building Forms in Survey123

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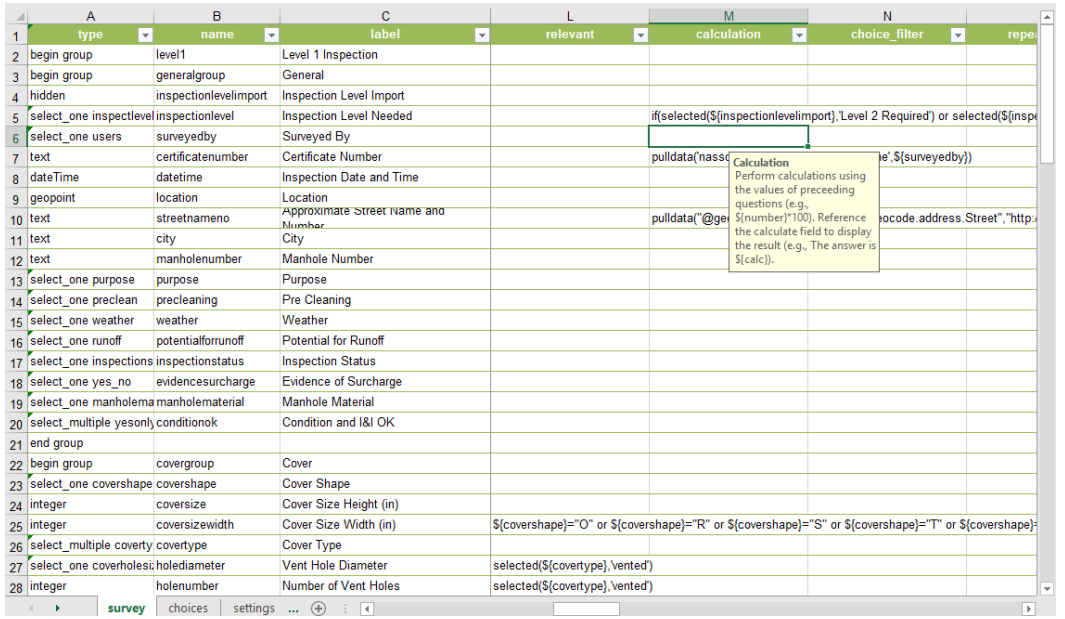
Can be built two ways

- Online form builder
- Excel spreadsheets
  - Provides more functionality and flexibility

Either format is very simple to use and build

Changes can be rolled out in a matter of minutes

Build logic into questions



	A	B	C	L	M	N
1	type	name	label	relevant	calculation	choice_filter
2	begin group	level1	Level 1 Inspection			
3	begin group	generalgroup	General			
4	hidden	inspectionlevelimport	Inspection Level Import			
5	select_one inspectlevel	inspectionlevel	Inspection Level Needed		if(selected(${inspectionlevelimport},'Level 2 Required') or selected(${insp	
6	select_one users	surveyedby	Surveyed By			
7	text	certificatenumber	Certificate Number		pulldata('nass	e',${surveyedby})
8	dateTime	datetime	Inspection Date and Time			
9	geopoint	location	Location			
10	text	streetnameno	Approximate Street Name and Number		pulldata("@ge	ocode.address.Street","http:
11	text	city	City			
12	text	manholenumber	Manhole Number			
13	select_one purpose	purpose	Purpose			
14	select_one preclean	precleaning	Pre Cleaning			
15	select_one weather	weather	Weather			
16	select_one runoff	potentialforrunoff	Potential for Runoff			
17	select_one inspections	inspectionstatus	Inspection Status			
18	select_one yes_no	evidencesurcharge	Evidence of Surcharge			
19	select_one manholema	manholematerial	Manhole Material			
20	select_multiple yesonly	conditionok	Condition and I&I OK			
21	end group					
22	begin group	covergroup	Cover			
23	select_one covershape	covershape	Cover Shape			
24	integer	coversize	Cover Size Height (in)			
25	integer	coversizewidth	Cover Size Width (in)	${covershape}="O" or ${covershape}="R" or ${covershape}="S" or ${covershape}="T" or ${covershape}=		
26	select_multiple coverty	covertype	Cover Type			
27	select_one coverholesi	holediameter	Vent Hole Diameter	selected(${covertype},'vented')		
28	integer	holenumber	Number of Vent Holes	selected(${covertype},'vented')		

Calculation
Perform calculations using the values of preceeding questions (e.g., ${number}*100). Reference the calculate field to display the result (e.g., The answer is ${calc}).

survey | choices | settings

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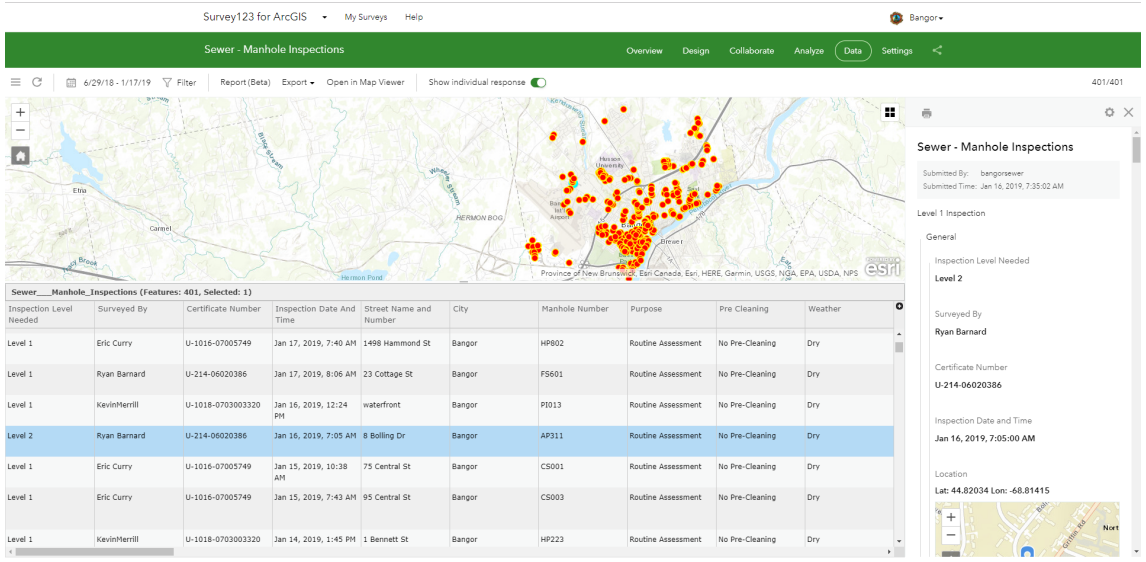
Survey123 Web Interface

Data can be accessed through a web interface

- User friendly design
- Custom reports
- Quickly viewable results

Survey data stored in hosted feature dataset

- Can be loaded into the GIS
- Easy to analyze
- Design QC and update routines



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The Future

Migrate results from ArcGIS Online to self hosted ArcGIS Portal

Automate more QC steps

Transition more processes away from paper and towards digital

Updating GIS with results from surveys

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Any Questions?

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