Pedaling Towards Innovation & High-Accuracy GIS

A case study on the development of the Cave Creek Utilities GIS

Presented by:
Phil Ponce, P.E. (EMS, Vice President, AGIC Board Member)
phil@emsol.com

Technical support by:
Nikolas Smilovsky, PhD, GISP (Bad Elf, GIS Solutions Director, ASU Faculty)
nik@bad-elf.com

Agenda

Factoids

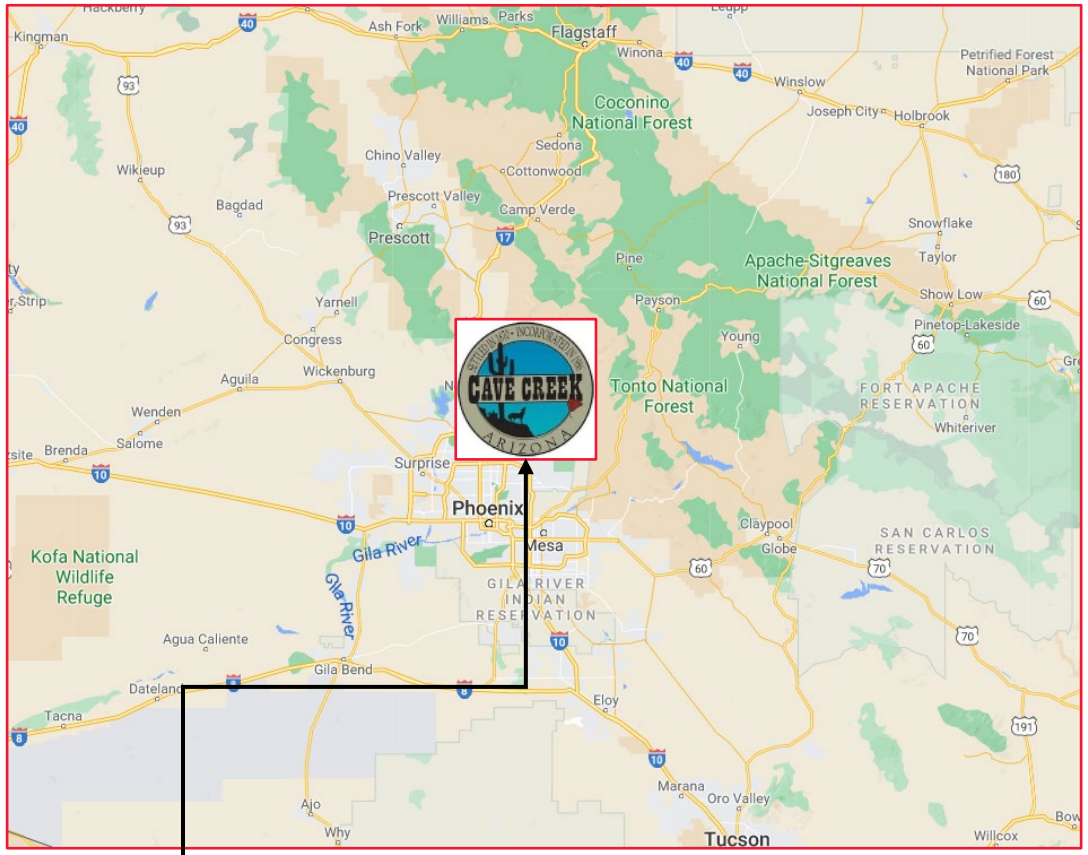
The geospatial problem

A High-accuracy custom GIS solution

Analysis and results

Prophetic declarations & questions

Factoids



Cave Creek, Arizona

Cave Creek was originally settled in 1870. It is approximately 30 square miles, located north of Phoenix. Cave Creek Water is a water and sewer utility system servicing approximately 1600 households.

EMS was founded in 1995 focusing on the development of engineering accurate digital mapping.

A leading GIS company in the state with emphasis on wet utilities database development and custom software deployment.

GIS project started in 2019. Our goal - to build an accurate GIS that is functional, scalable and cost efficient.

Bad Elf & custom GIS deployed 2020.

Our Challenges

The Town has had various data sources over the years including:

- **Engineering As-Builts**
- **Previous Engineering Water and Sewer Modeling**
- **Field Mark-ups**
- **Various "Schematic" GIS drawings**
- **Traditionally high-cost associated with field data collection**

Town of Cave Creek employee Shawn Kreuzwiesner expressed that *"we're working with a system that is over fifty years old, not built to a municipal standard, and poorly documented."*

Our Solution

- Create the GIS from the ground up using engineering as-builts against the accurate land base.
- Follow behind with field data validation through observations and GPS measurements.
- Leverage the newest GIS mapping and collaboration technology
    - ESRI ArcMap and ArcGIS Pro
    - ArcGIS Online via AZGEO
    - ESRI FieldMaps for ArcGIS
    - High Accuracy GNSS Technology – Bad Elf Flex
    - Custom 360 degree Imagery & Object Viewer

One Reality is all that Matters

Control: GDACS set the stage for the Maricopa County Landbase (‘90s).

Parcel Base: Maricopa County parcels georeferenced to GDACS.

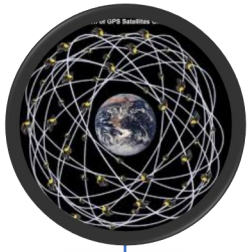
Aerial Base: Maricopa County Aerials fit to GDACS.

Maricopa county has established the reality.

Bad Elf

Bad Elf Flex fits that reality!

Methodology



COLLECT

Bad Elf

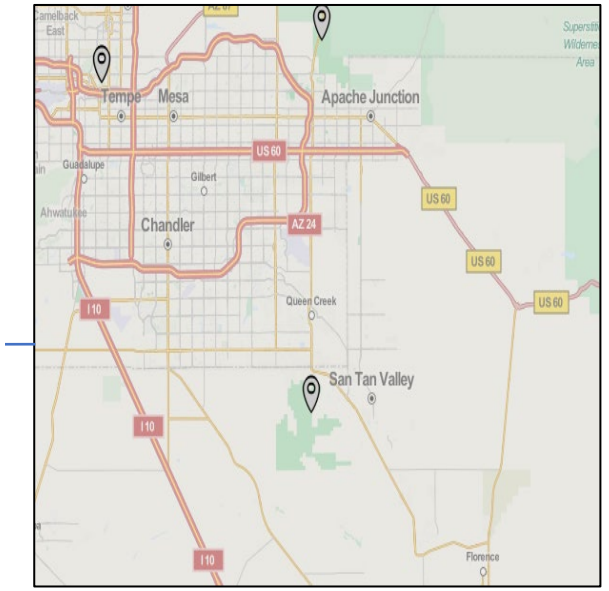
Bluetooth

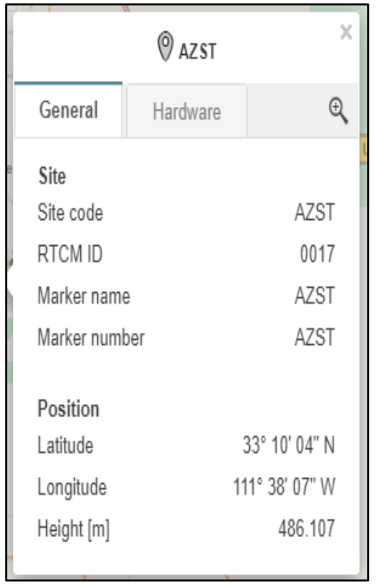
Bad Elf Software

RTK Corrected Position

ESRI Collector

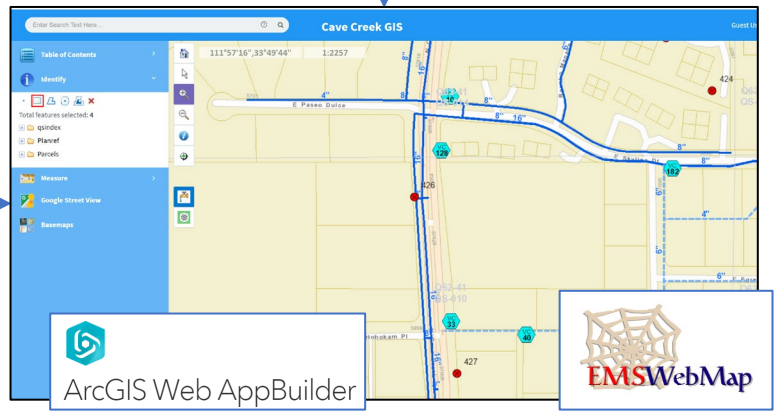
AZCORS (ADOT) GPS Correction Service





AZGeo Data Hub

DEPLOY

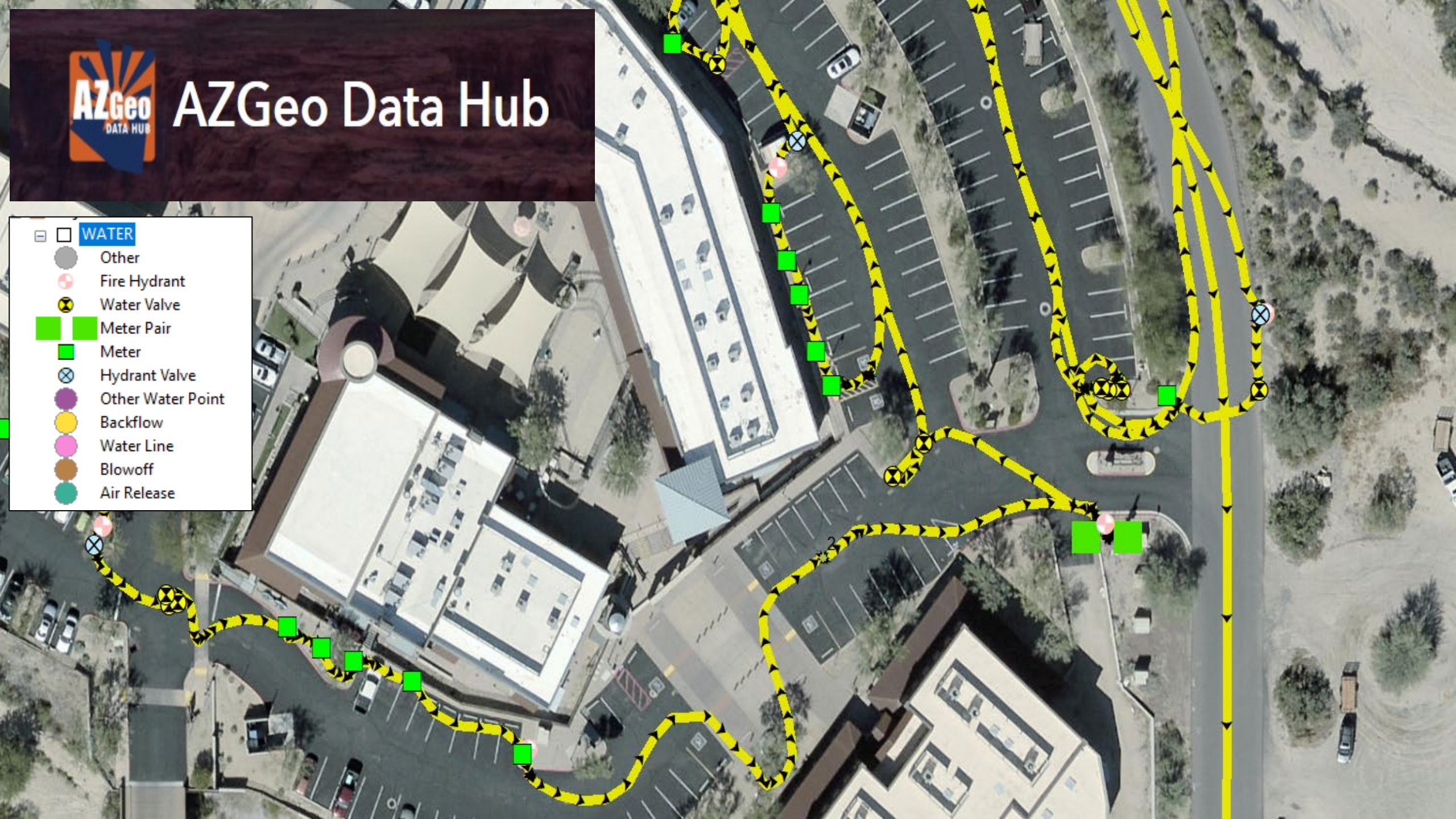


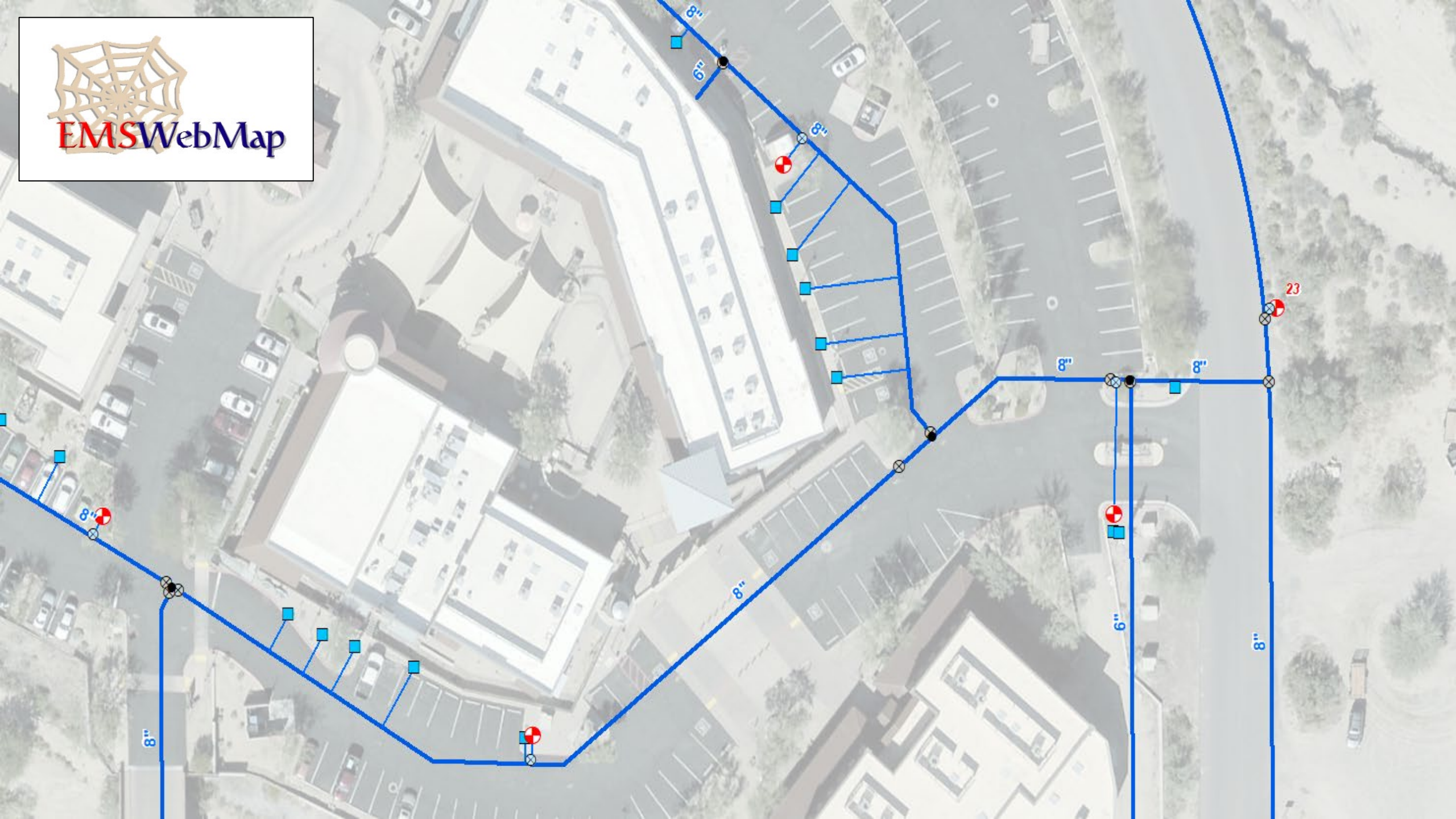
EDIT

Cave Creek GIS

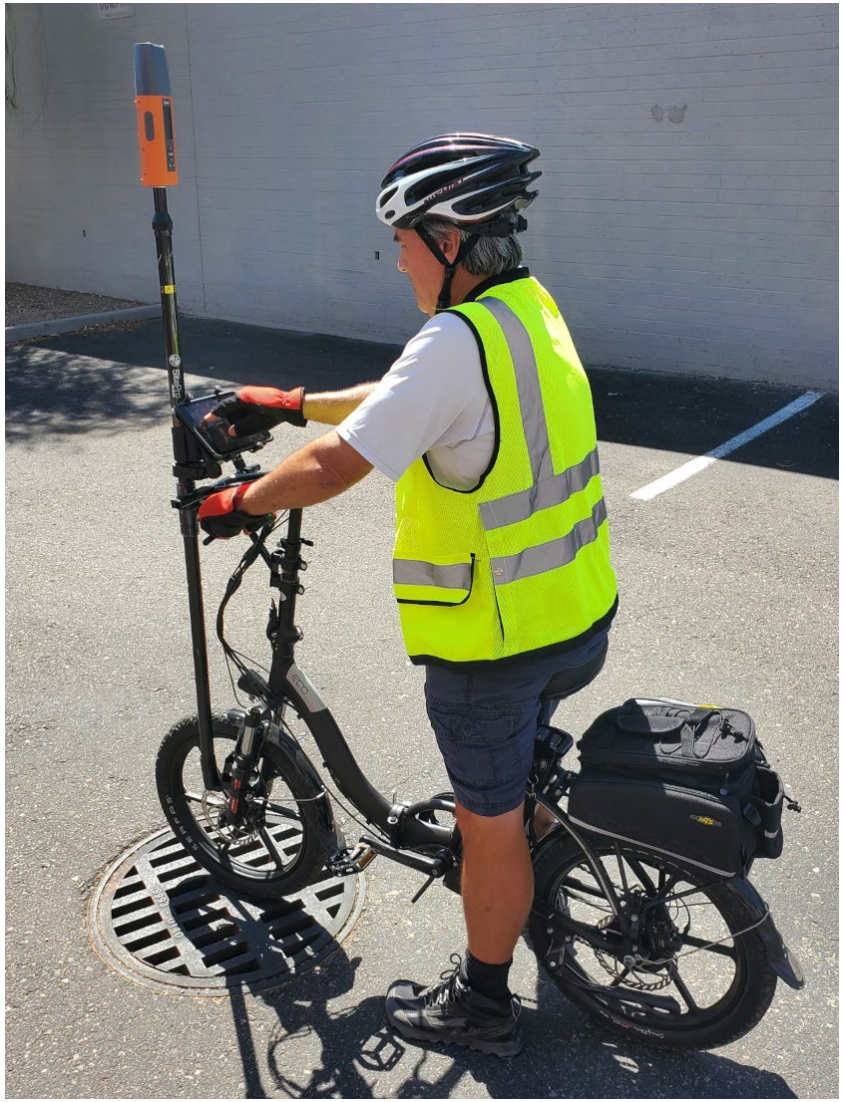
Engineering Mapping Solutions

esri ArcGIS


AZGeo Data Hub
WATER
Other
Fire Hydrant
Water Valve
Meter Pair
Meter
Hydrant Valve
Other Water Point
Backflow
Water Line
Blowoff
Air Release


EMSWebMap
8"
6"
8"
8"
8"
8"
8"
6"
8"
8"
23

A high-accuracy custom GIS solution



DATE	Field Hours	Points collected	Points/Hour	CL Miles covered	Bike Traveled	Ratio	CL Miles/hour
8/29/2020	1.5	72	48	4.5			3.0
8/31/2020	2.5	135	54	3.9			1.6
9/3/2020	1.2	80	67	2.5	4.7	1.9	2.1
9/5/2020	1	50	50	3	6.0	2.0	3.0
9/7/2020	1	148	148	3.5	4.4	1.3	3.5
9/8/2020	1	149	149	3.8	5.7	1.5	3.8
9/9/2020	0.8	74	93	2	2.1	1.1	2.5
9/11/2020	0.7	75	107	3	3.0	1.0	4.3
9/12/2020	1.3	51	39	5.2	9.4	1.8	4.0
9/13/2020	1	73	73	3.8	6.9	1.8	3.8
9/14/2020	1.3	100	77	4	9.0	2.3	3
9/15/2020	1.3	132	102	1.7	5.5	3	1
9/19/2020	1.75	195	111	3.3	7.2	2	2
9/20/2020	1.1	195	177	1.7			2
9/21/2020	1	166	166	2.3			2
9/24/2020	1.25	123	98	2.7			2.2
9/25/2020	0.97	108	112	2.1	5.3		2.2
9/26/2020	1.42	155	109	2.1	7.6		1.5
9/27/2020	1.07	142	133	2.3	4.1		2.2
9/28/2020	0.98	173	176	3.8	8.5		3.8
10/1/2020	0.75	52	69	2.7	4.0		3.7
10/2/2020	1.67	137	82	4.8	10.7		2.9
10/3/2020	1.75	156	89	5.9	11.9		3.4
10/4/2020	1.33	203	152	2.7	5.9		2.0
10/5/2020	0.93	190	204	3.8	7.5		4.1
10/6/2020	2.00	201	101	3.7	8.5		1.9
10/7/2020	1.50	91	61	4.8	9.8		3.2
10/11/2020	1.13	130	115	2.5	6.2		2.2
10/12/2020	1.50	102	68	0.9	2.4		0.6

A high-accuracy custom GIS solution

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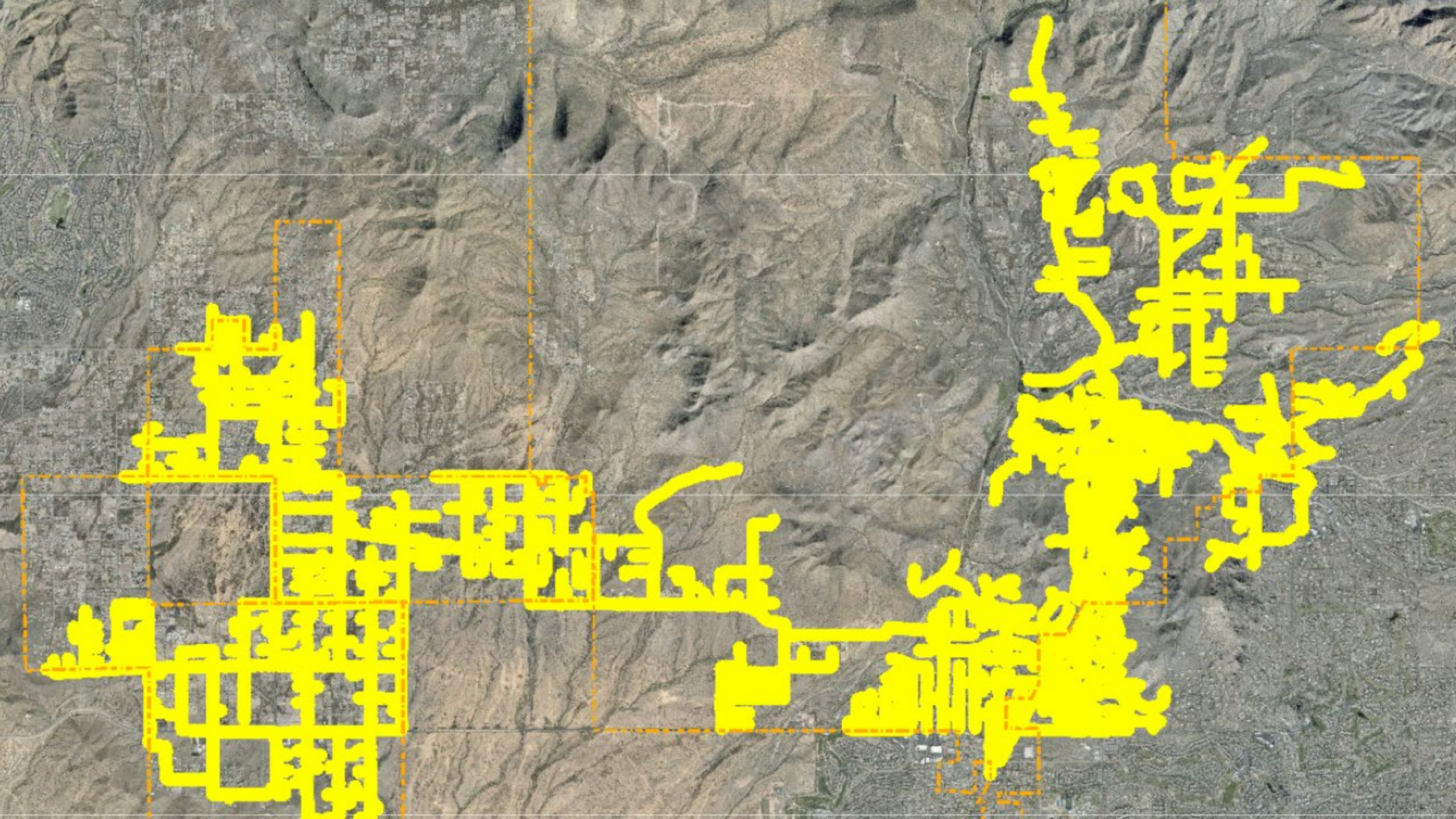
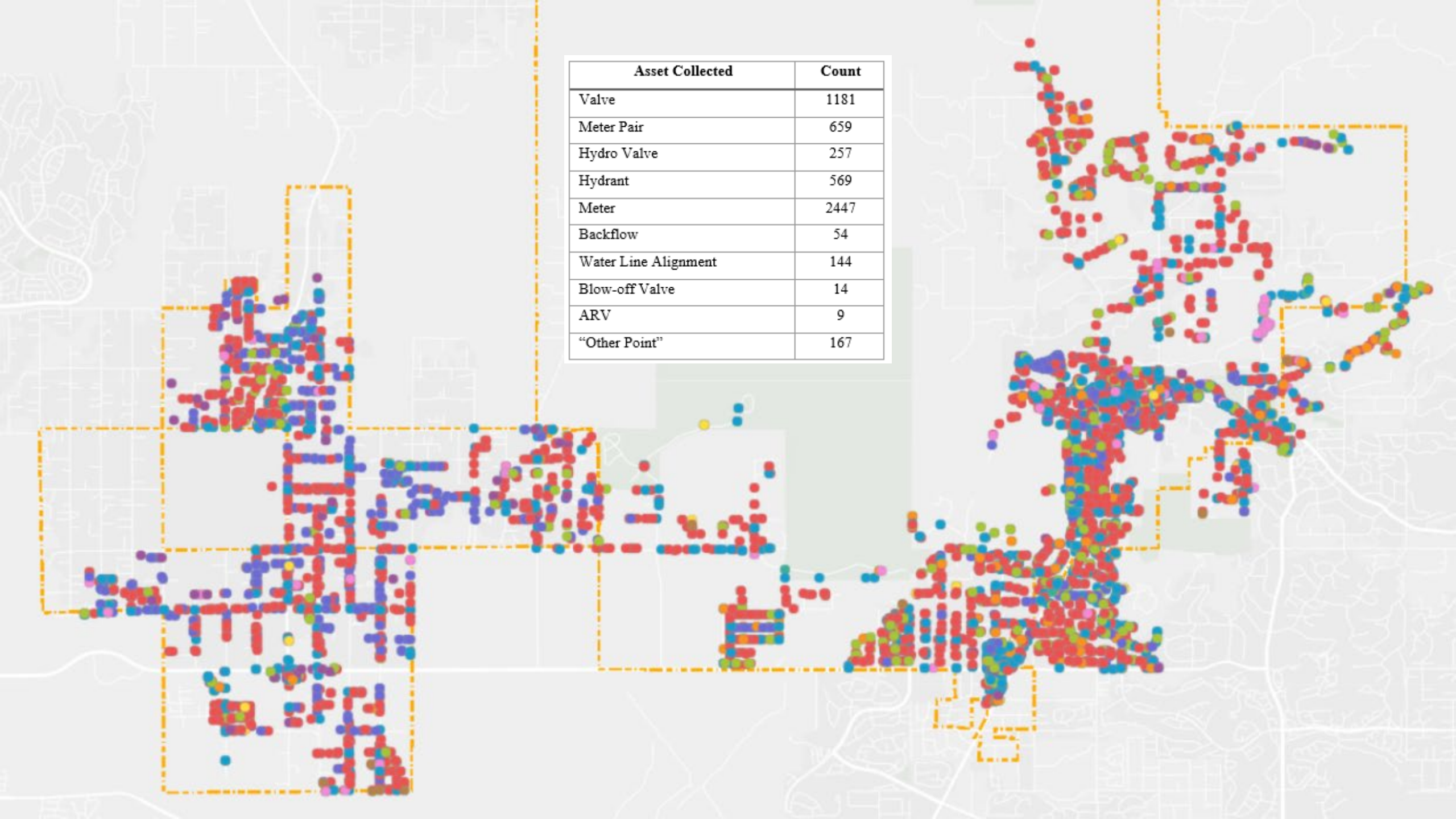
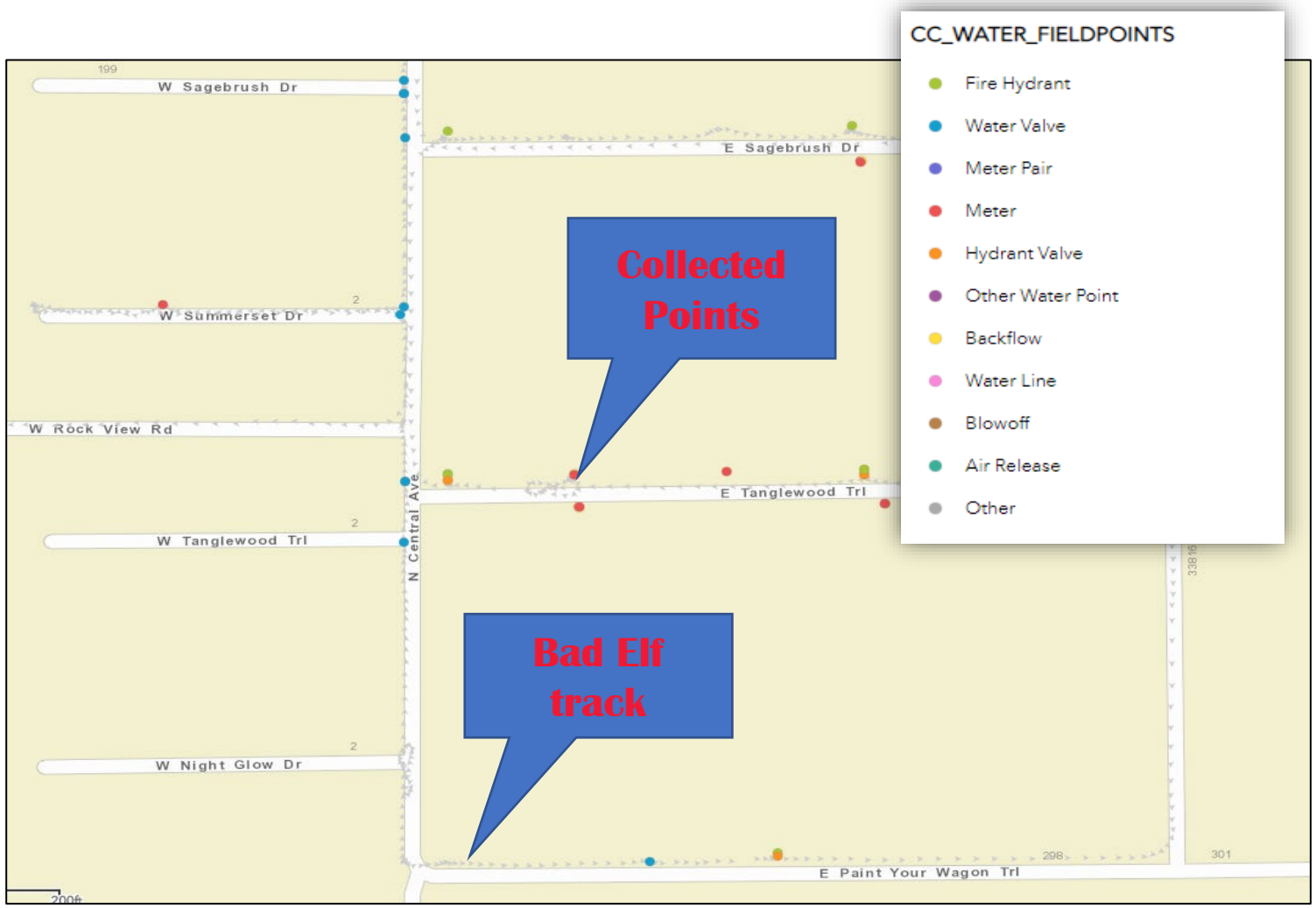
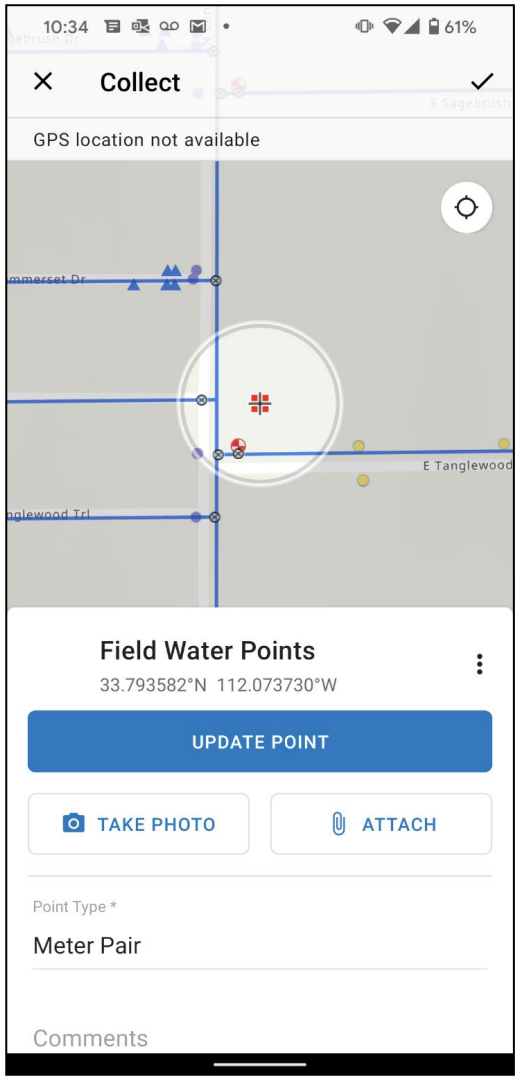




Asset Collected	Count
Valve	1181
Meter Pair	659
Hydro Valve	257
Hydrant	569
Meter	2447
Backflow	54
Water Line Alignment	144
Blow-off Valve	14
ARV	9
“Other Point”	167

A high-accuracy custom GIS solution





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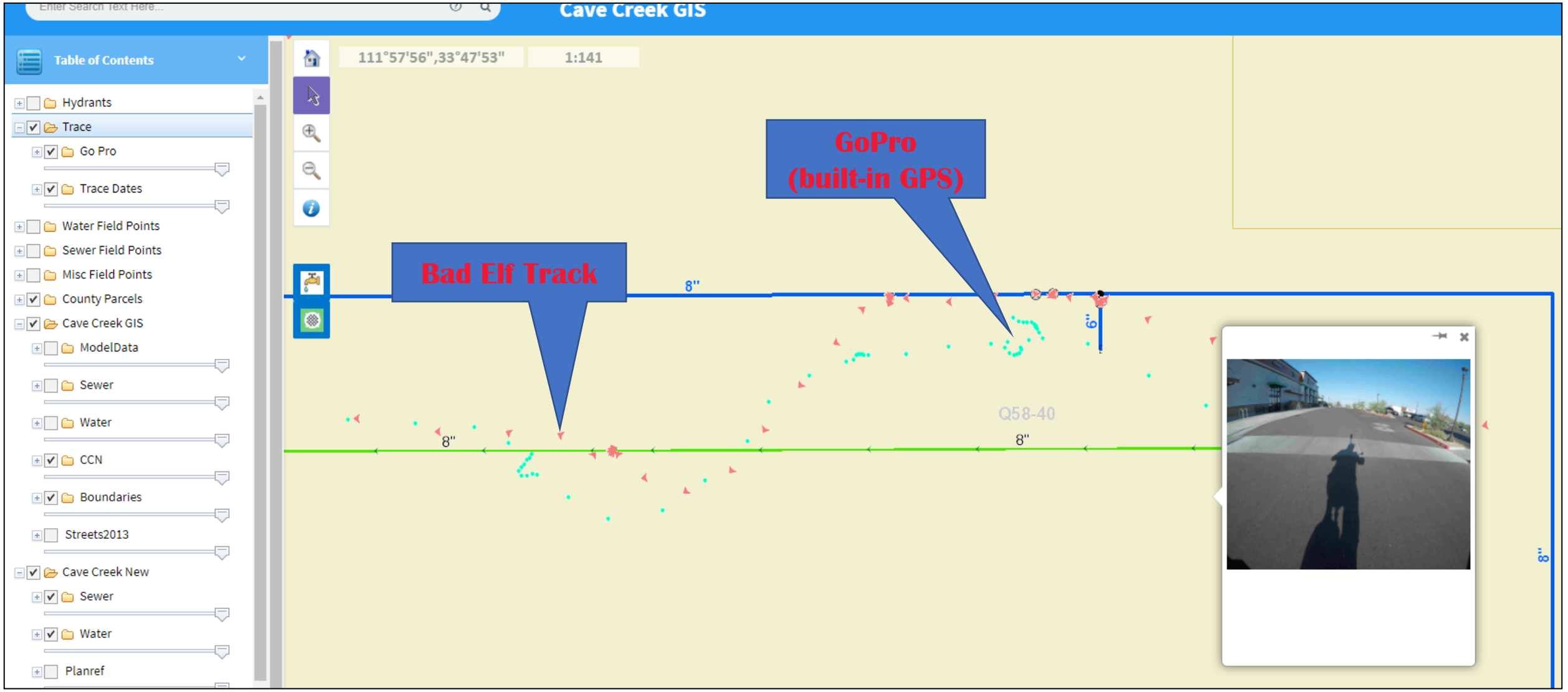

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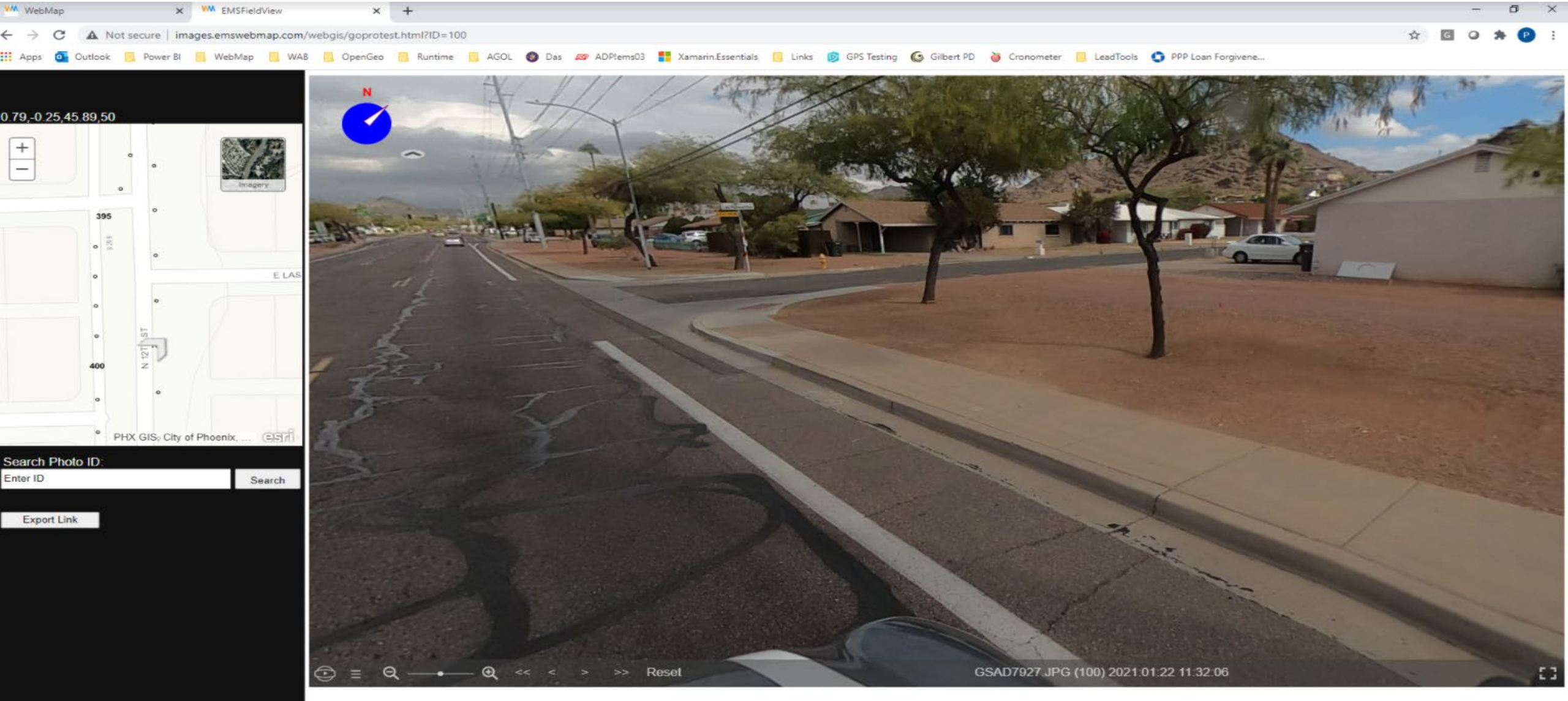

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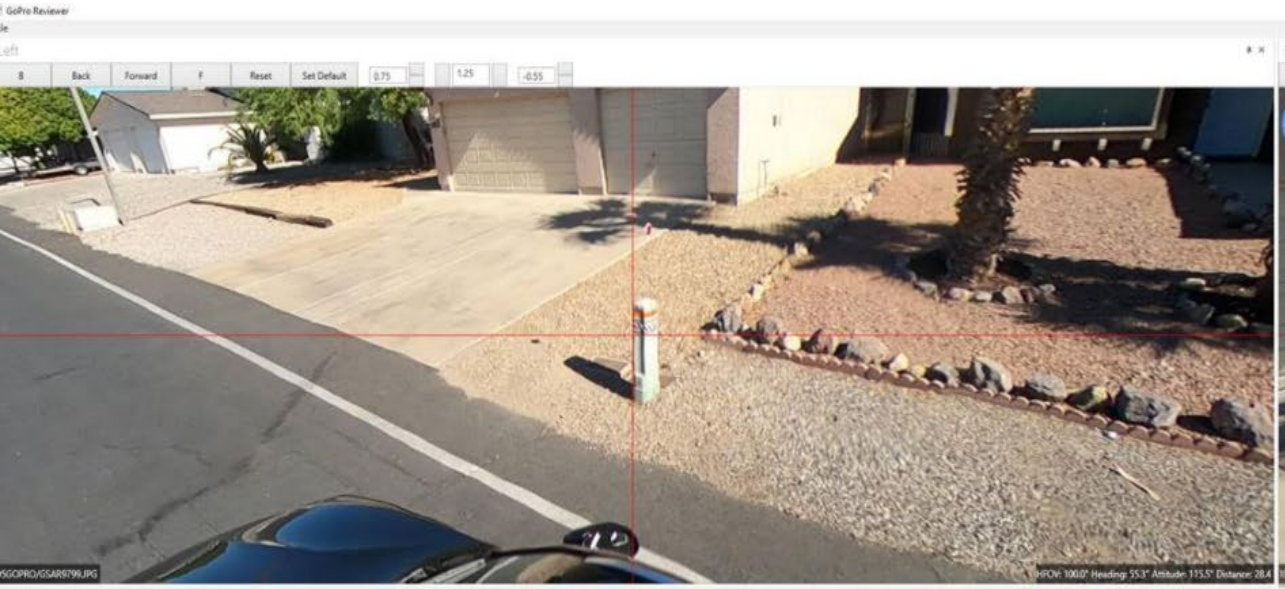

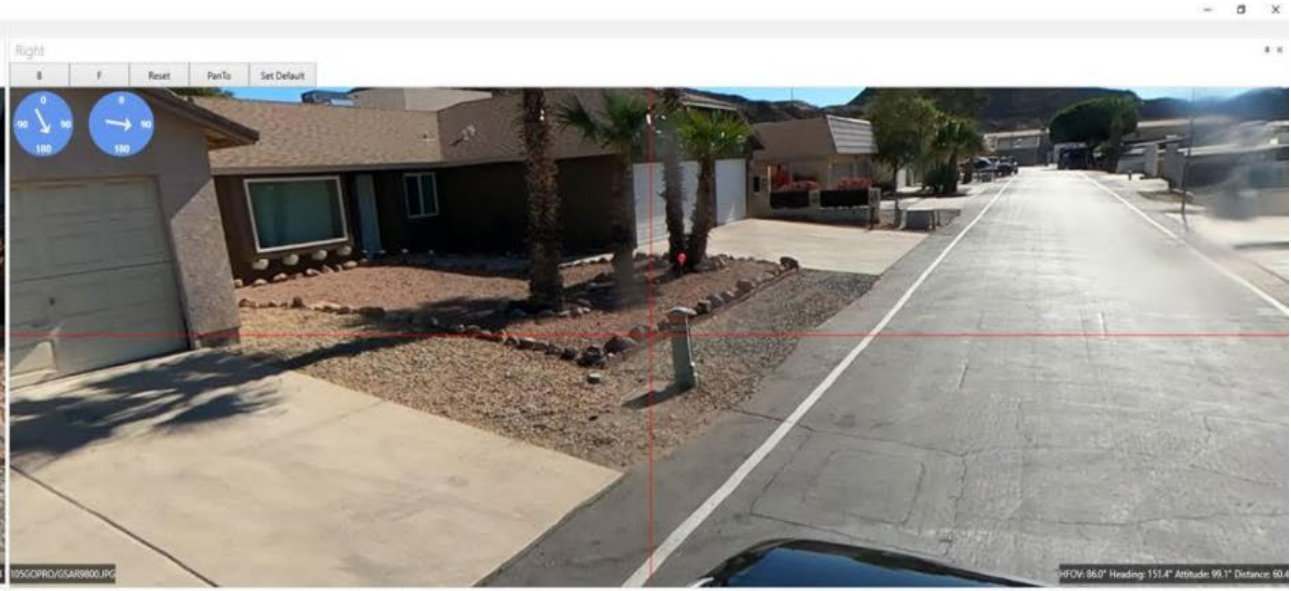

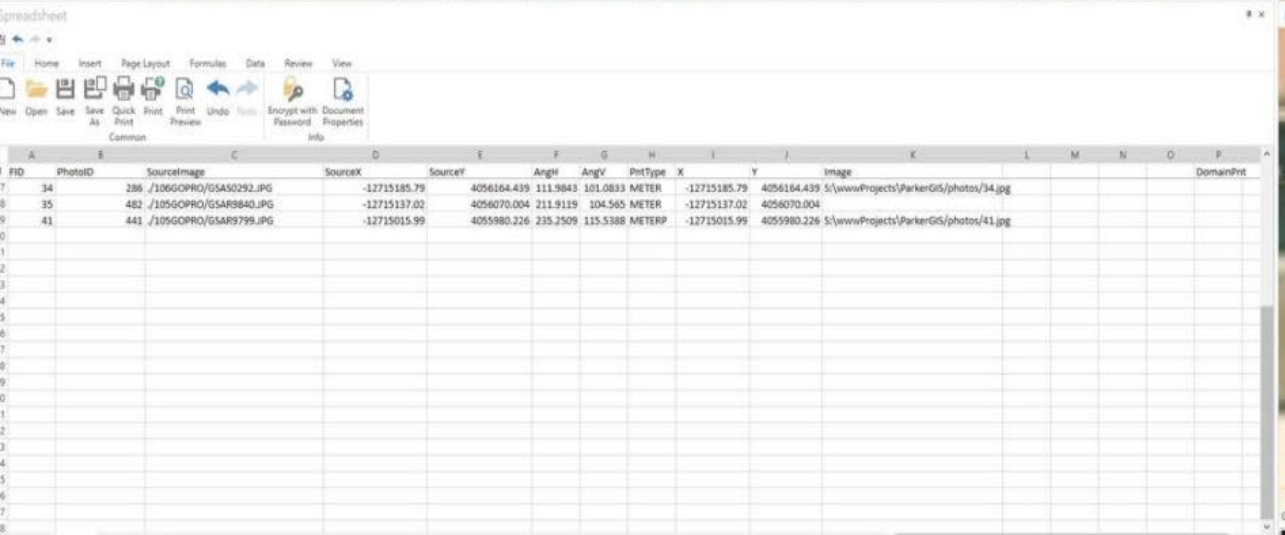

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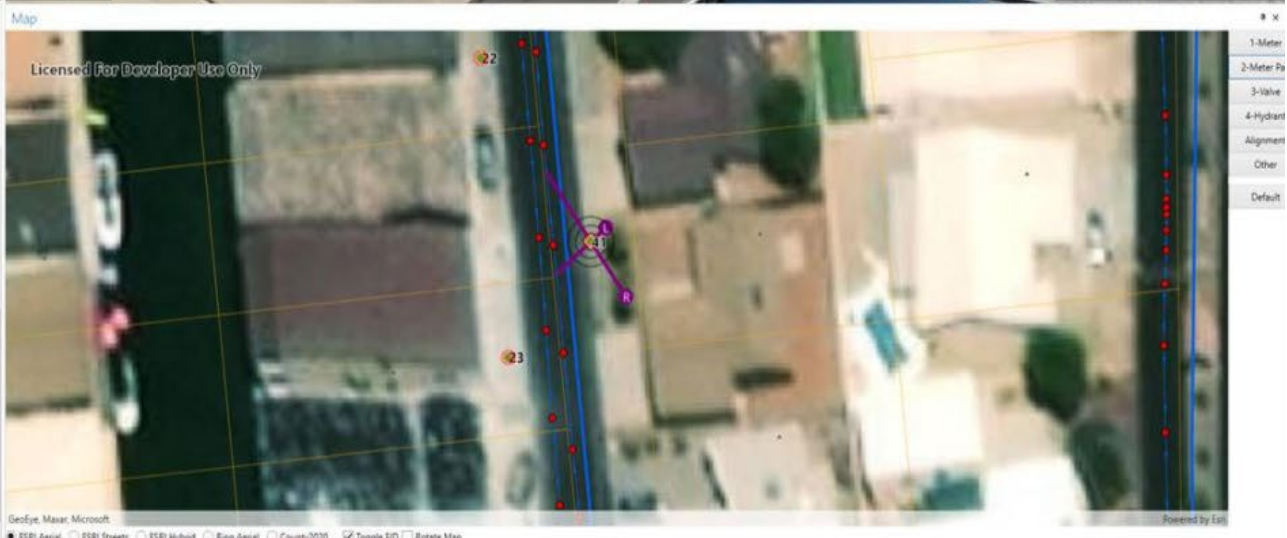
41	441	./105GOPRO/GSAR9799.JPG	-12715015.99	4055980.226	235.2509	115.5388	METERP	-12715015.99	4055980.226	S:\wwwProjects\ParkerGIS/photos/41.jpg	



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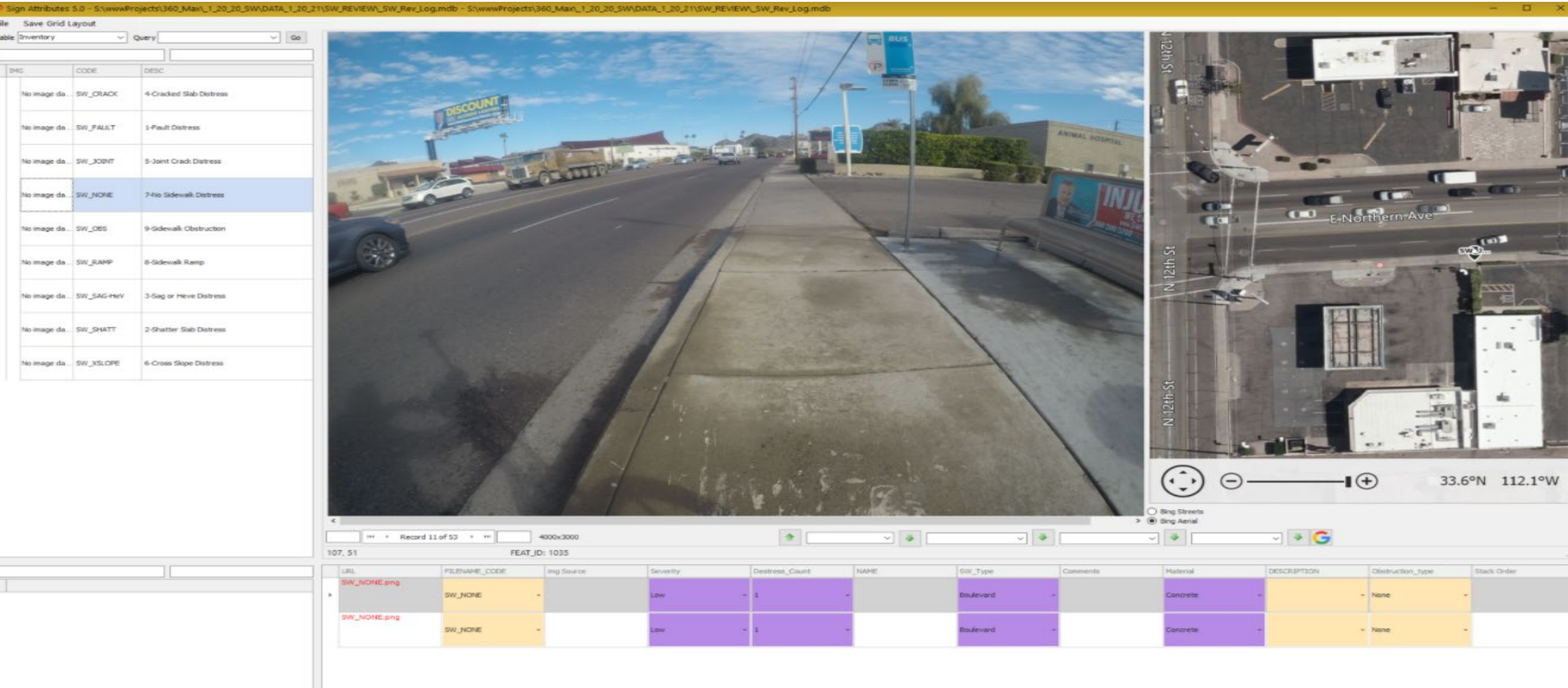
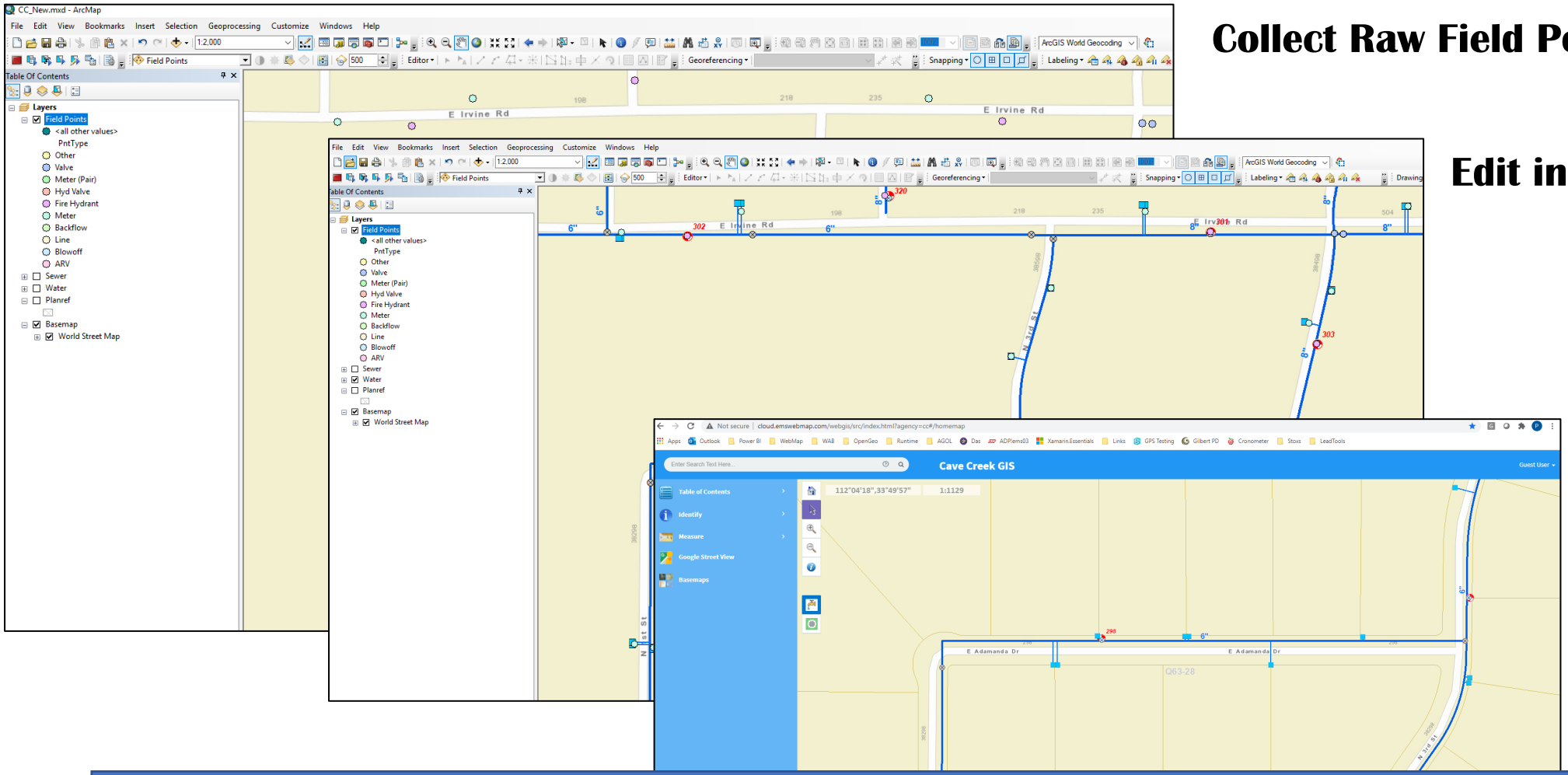


In Summary

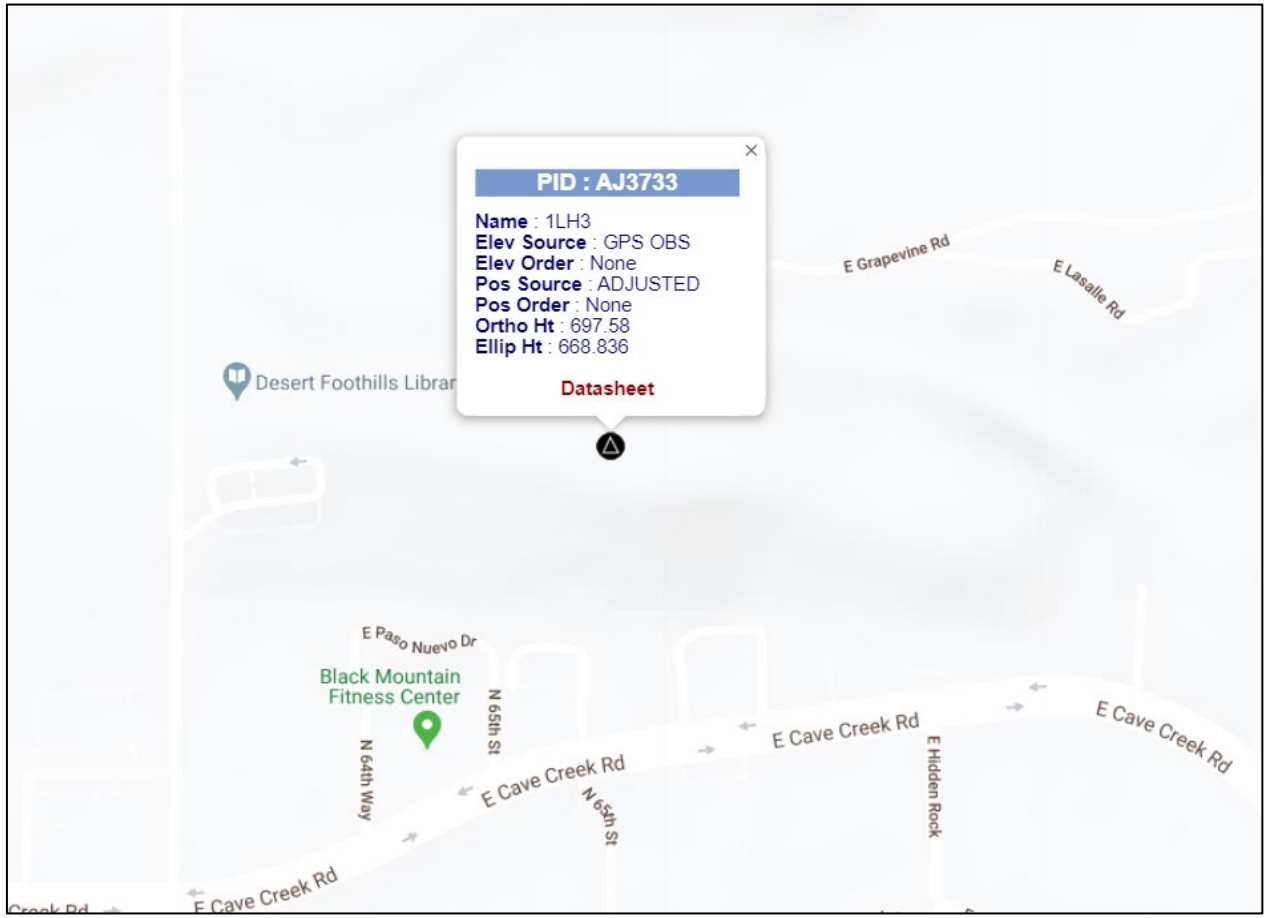


Collect Raw Field Points

Edit in Esri Ecosystem

Deployment in EMS WebMap
(ESRI Javascript custom viewer)

A better GIS by leveraging the "best in breed software" and GNSS technology!



USGS Datasheet

```
AJ3733                          *CURRENT SURVEY CONTROL
AJ3733  ______________________________________________________________________
 AJ3733* NAD 83(2011) POSITION- 33 50 05.23728(N) 111 56 24.32073(W)   ADJUSTED
 AJ3733* NAD 83(2011) ELLIP HT-   668.836 (meters)        (06/27/12)   ADJUSTED
 AJ3733* NAD 83(2011) EPOCH    -  2010.00
 AJ3733* NAVD 88 ORTHO HEIGHT -   697.58  (meters)     2288.6   (feet) GPS OBS
 AJ3733  ______________________________________________________________________

 AJ3733  NAVD 88 orthometric height was determined with geoid model    GEOID09
 AJ3733  GEOID HEIGHT    -        -28.740 (meters)                     GEOID09
 AJ3733  GEOID HEIGHT    -        -28.688 (meters)                     GEOID18
 AJ3733  NAD 83(2011) X  - -1,981,784.780 (meters)                     COMP
 AJ3733  NAD 83(2011) Y  - -4,919,894.664 (meters)                     COMP
 AJ3733  NAD 83(2011) Z  -  3,531,611.733 (meters)                     COMP
 AJ3733  LAPLACE CORR    -          3.38  (seconds)                    DEFLEC18
```

Bad Elf Observations

0.025	33.834788	-111.940089	667.17	1.1	0.5	0.9	RTKFixed
0.022	33.834788	-111.940089	667.16	1.1	0.5	0.9	RTKFixed
0.026	33.834788	-111.940089	667.159	1.1	0.5	0.9	RTKFixed

Analysis & Results

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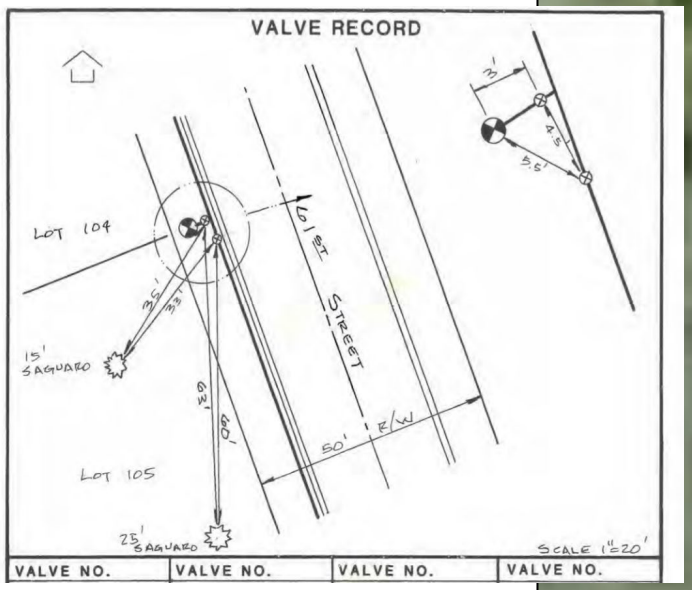
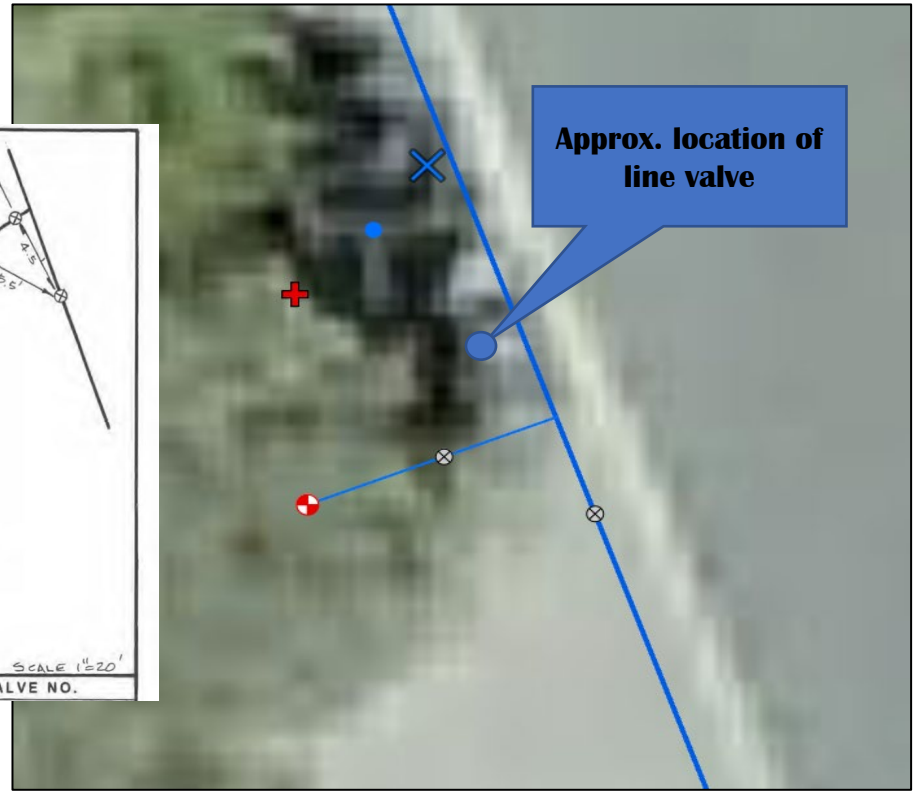
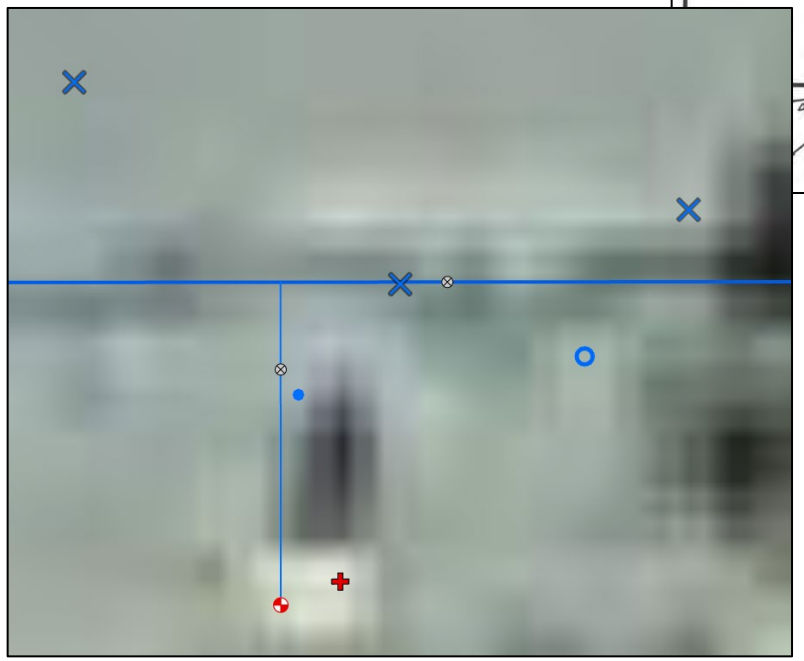
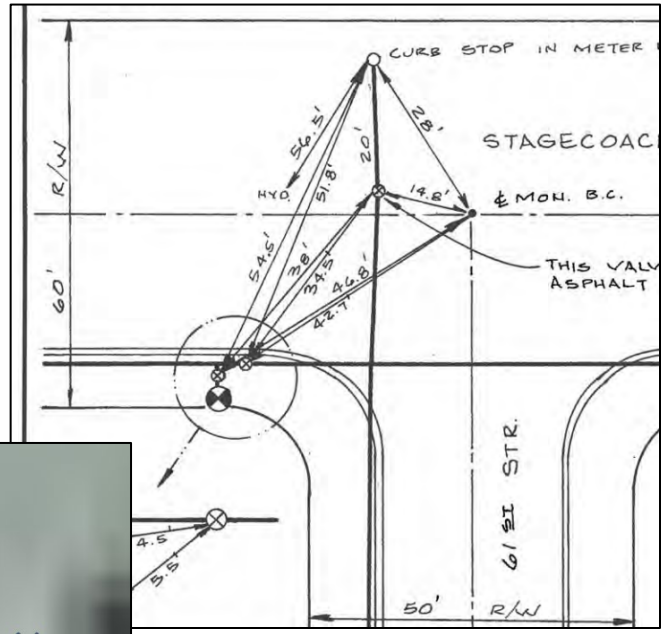




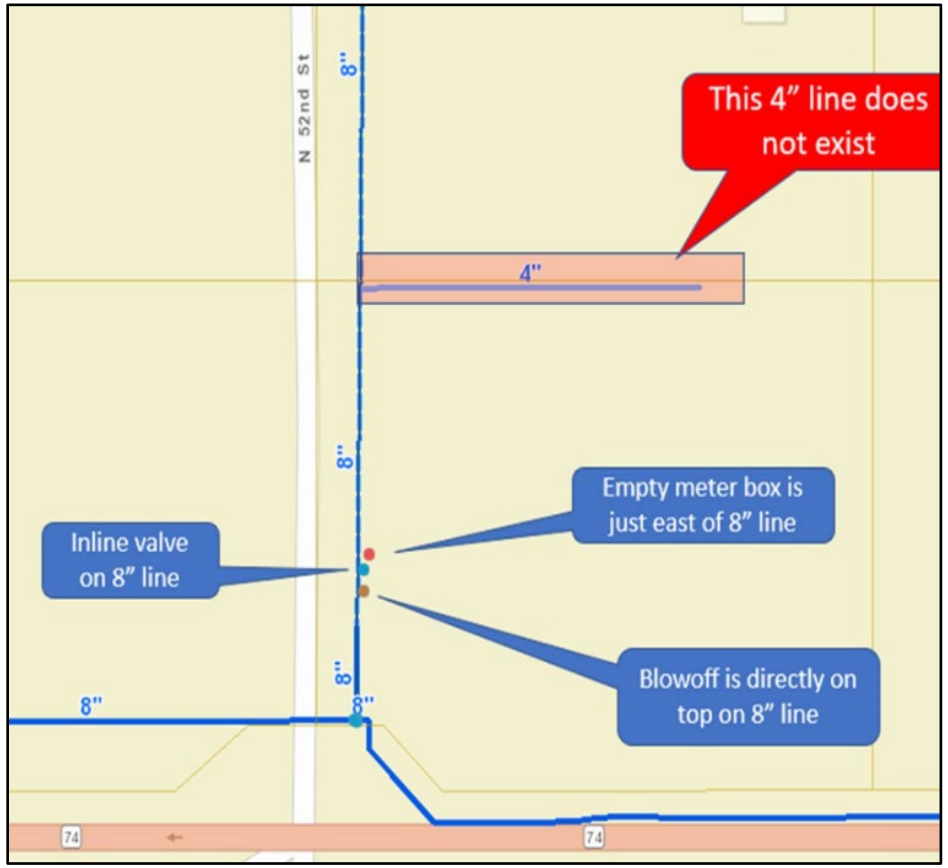
ValveCard Number	PLANID	Comments	# Valves on VC	GIS Valve Count	Survey Valve Count	GIS Match Valve Card?	Survey Match Valve Card?	Survey and GIS in Sync?	Valves seen on GS
21	60-42	http://www.emsol.com/googlestreetview/?posX=33.81	2	1	1	no	no	no	1 hydrant valve

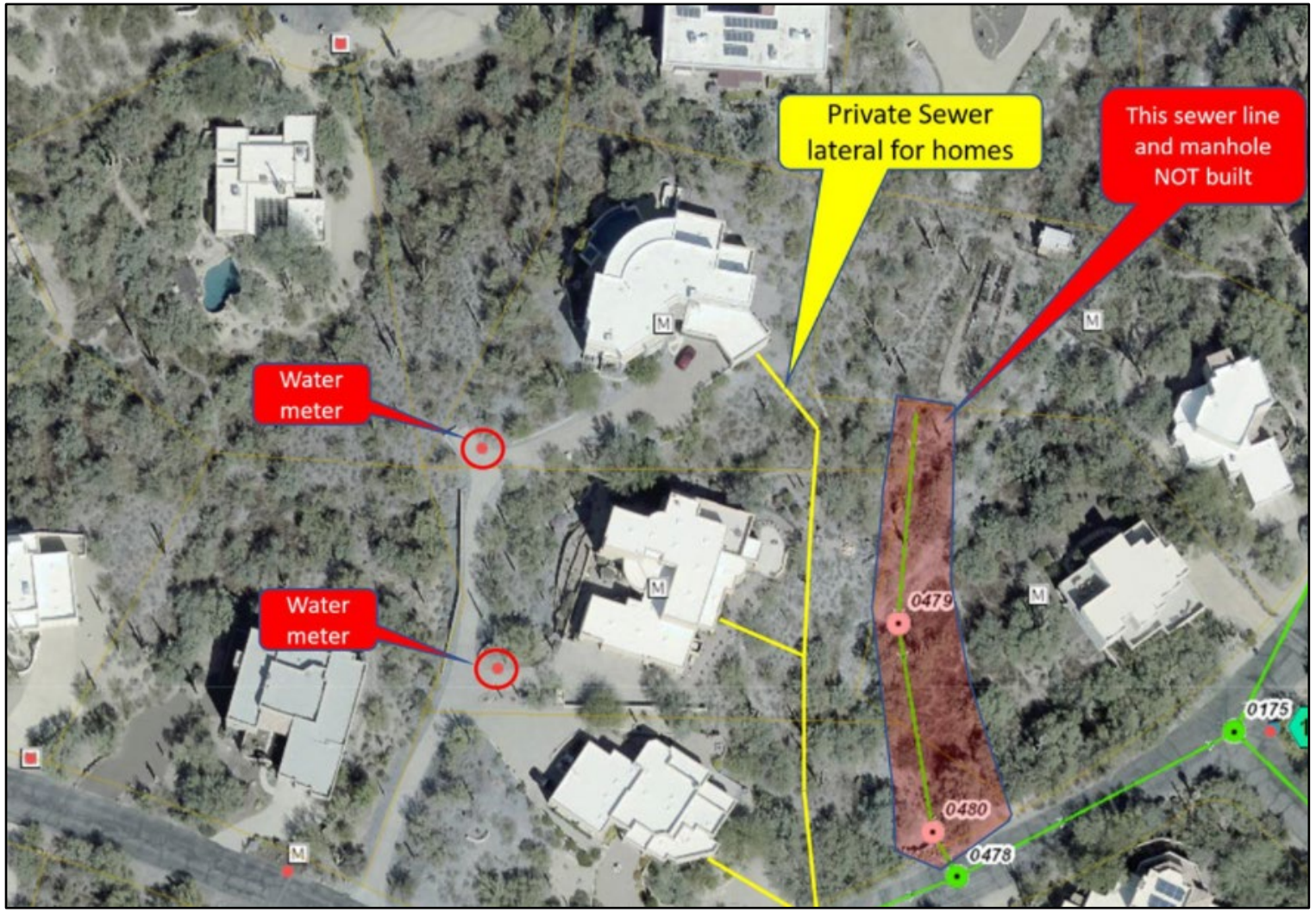
Analysis & Results





Analysis & Results





Analysis & Results

"Cost. Traditional market research exemplifies that a traditional registered surveyor would charge between $80 and a $100 dollars per field-collected point. Using this math, The Town of Cave Creek estimated that they would have to spend about $350,000.00 to complete this project! However, with *EMS's* innovative geospatial solution, the project cost dropped to just over $15,000.00."

The Geoholics

MY NAME IS

_____

AND I AM A GEOHOLIC!

Episode 065 - https://thegeoholics.com/

Prophetic Declarations & Questions

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phil@emsol.com

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