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Columbia Engineering

GIS Tools for Asset Management
Modeling

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Presenters



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GIS Tools and Asset Management Modeling

Overview

Introduction

Asset Management

Overview

GIS Tools for Inventory &

Inspection

System Analysis

CIP Tool



Challenges Facing SW Managers

- Changing demographics and urbanization
- Impacts of severe weather
- Meeting public's expectations for transparency and community engagement
- Funding
- Integration of new technologies and data management systems
- Adapting to changing regulations and policies



Asset Management

A strategic framework focused on **managing risk** while providing the **desired level of service** at the **lowest life cycle cost**.

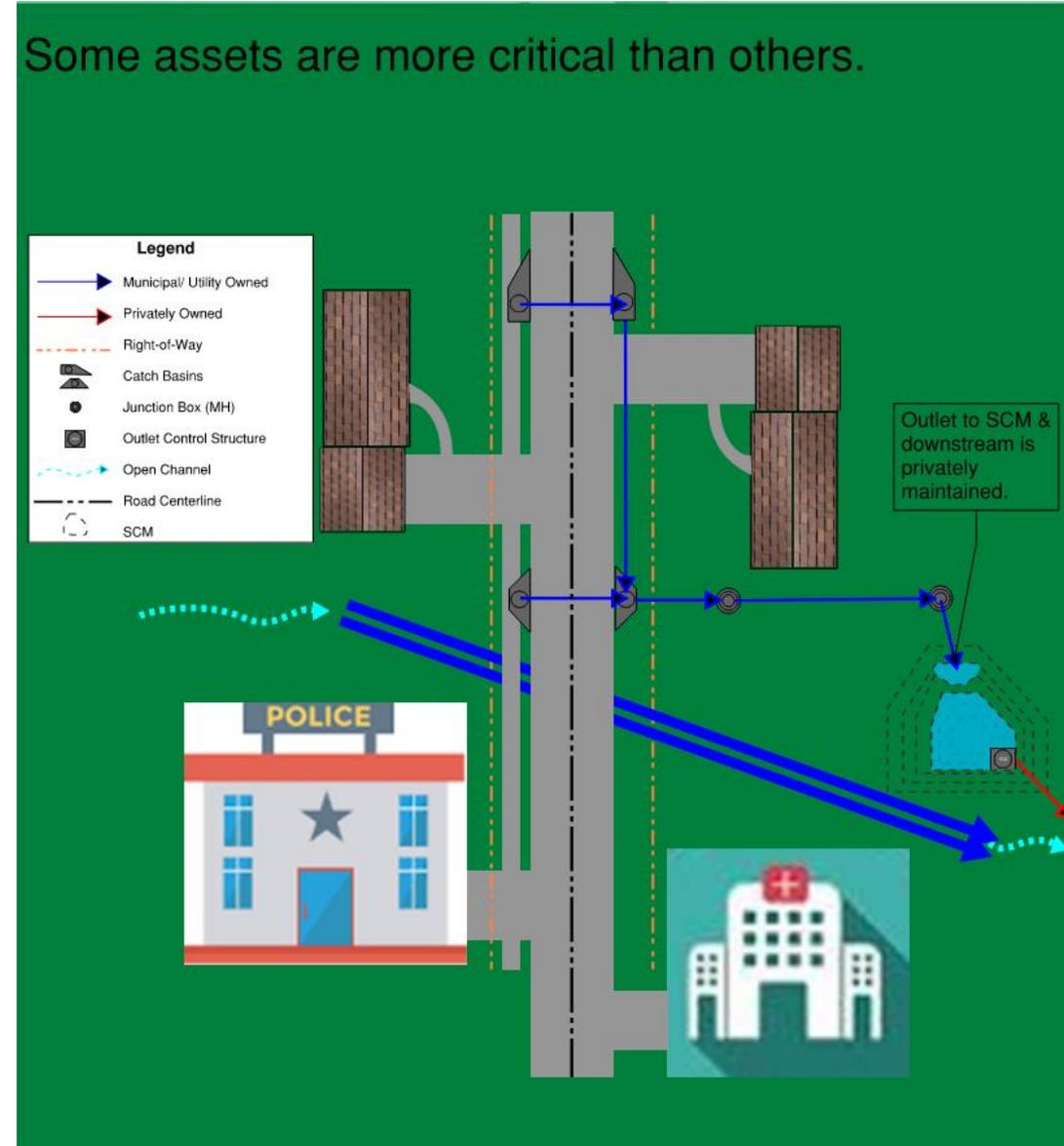


Asset Management Process

1. Determine Desired Level of Service
2. Develop an Inventory
3. Prioritize
4. Develop Asset Management Plan (AMP)
5. Implementation
6. Review & Update AMP as Required

Stormwater Asset Management

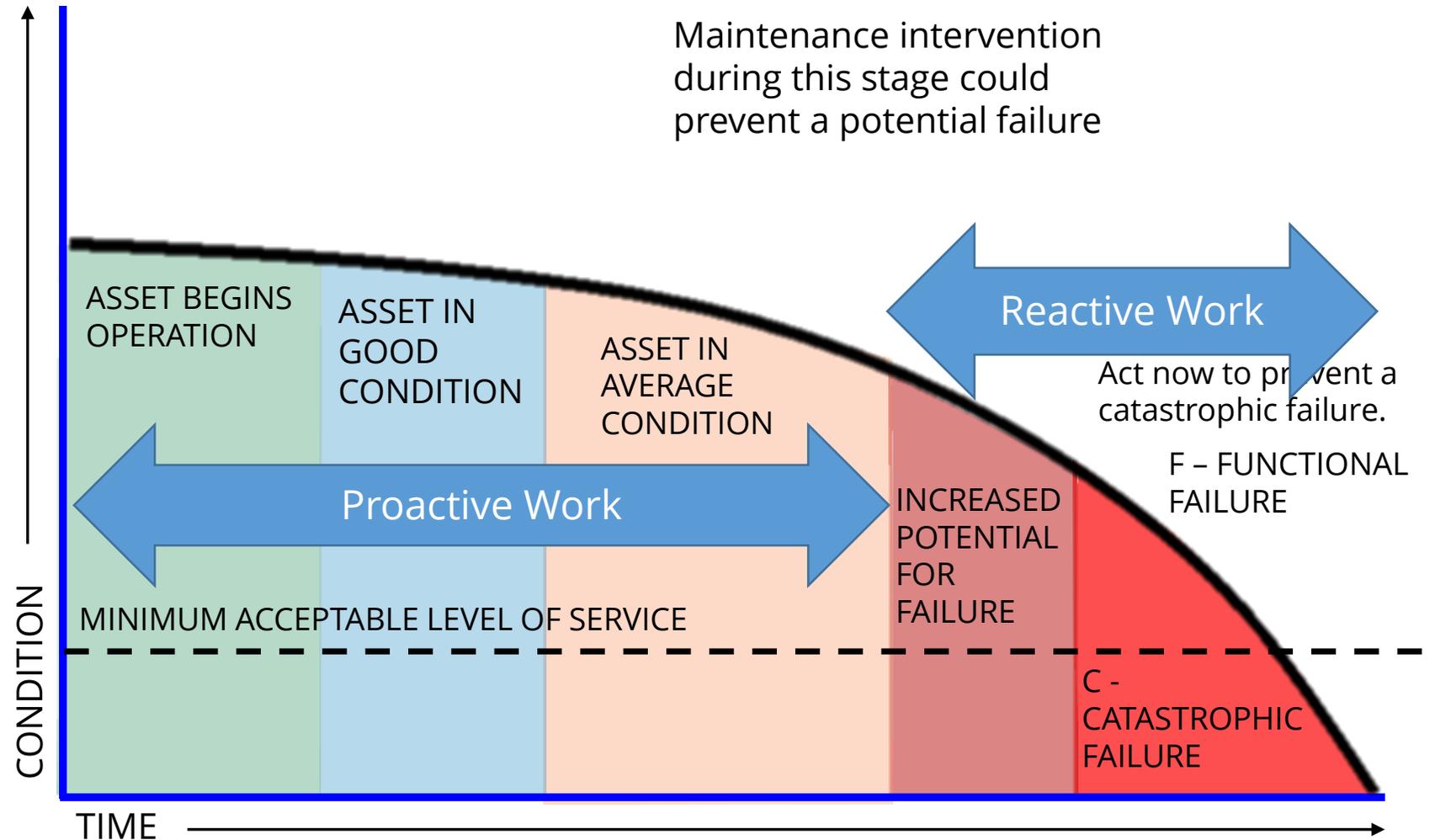
- What are our assets?
 - Extent of service
 - Include Natural Assets
 - Green Stormwater Infrastructure
- What is our desired level of service?
 - Do different parts of the system have different LOS requirements?
 - Emergency/Evacuation route
 - Proximity to other critical infrastructure/ service



Stormwater Asset Management

4 Failure Modes

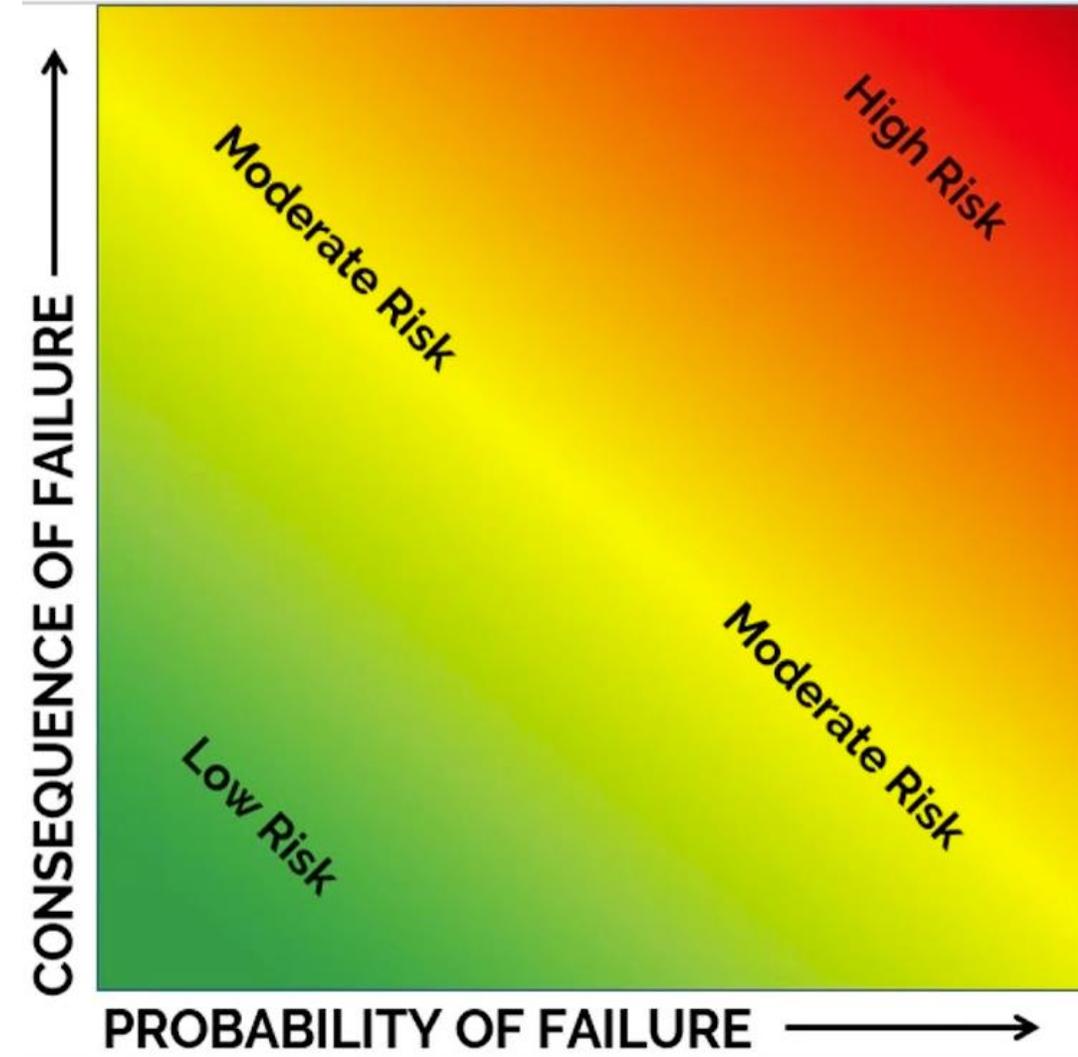
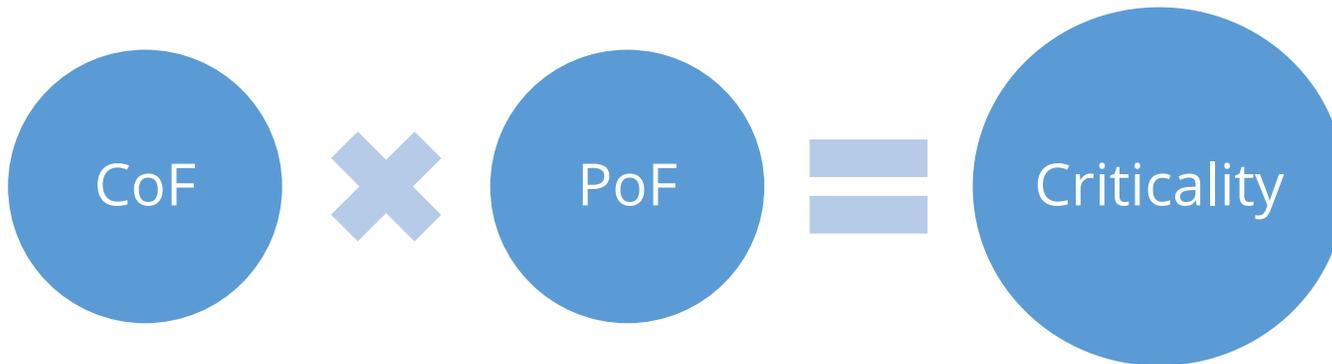
- Capacity
- Level of service
- Financial Inefficiency
- Mortality



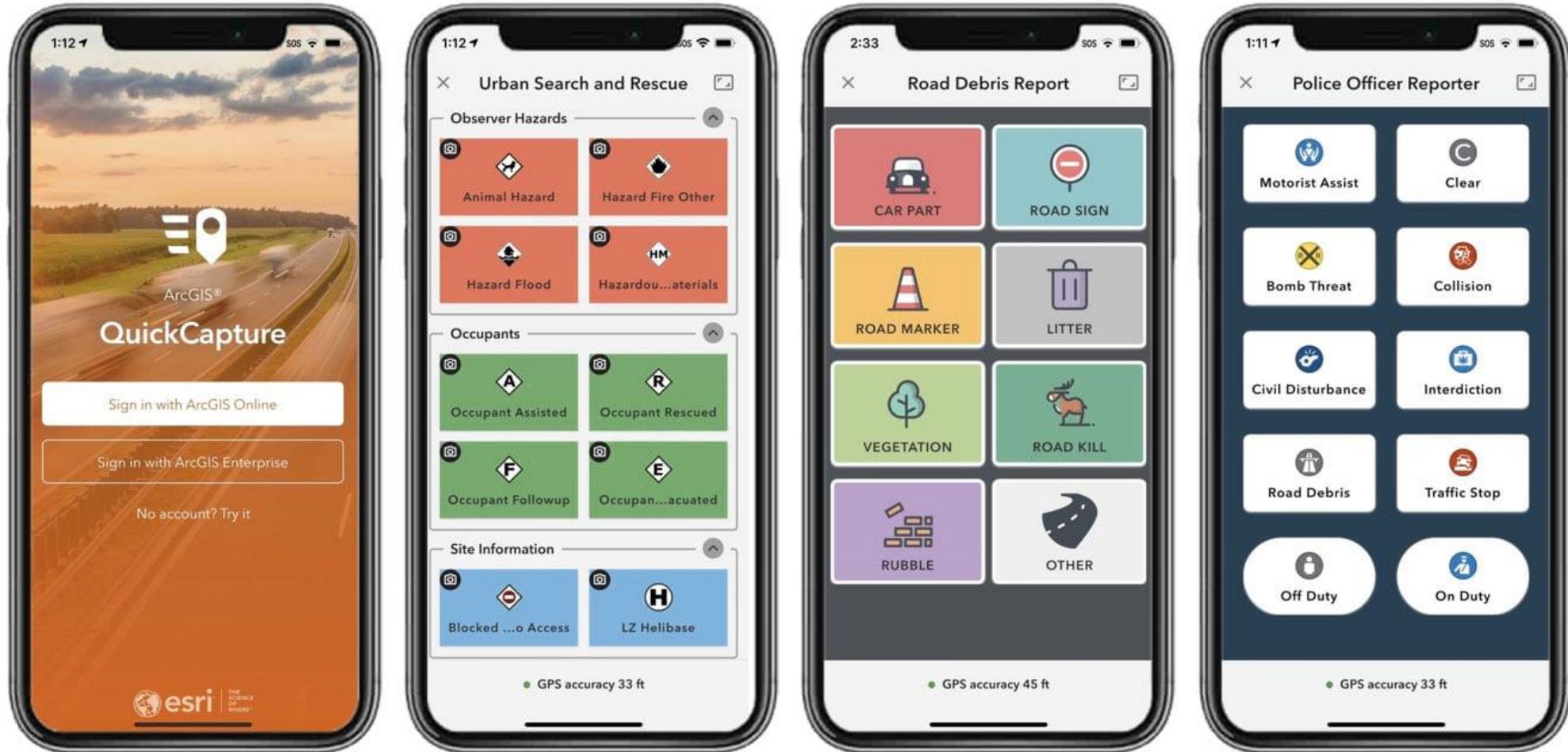
Stormwater Asset Management

Business Risk Exposure Analysis

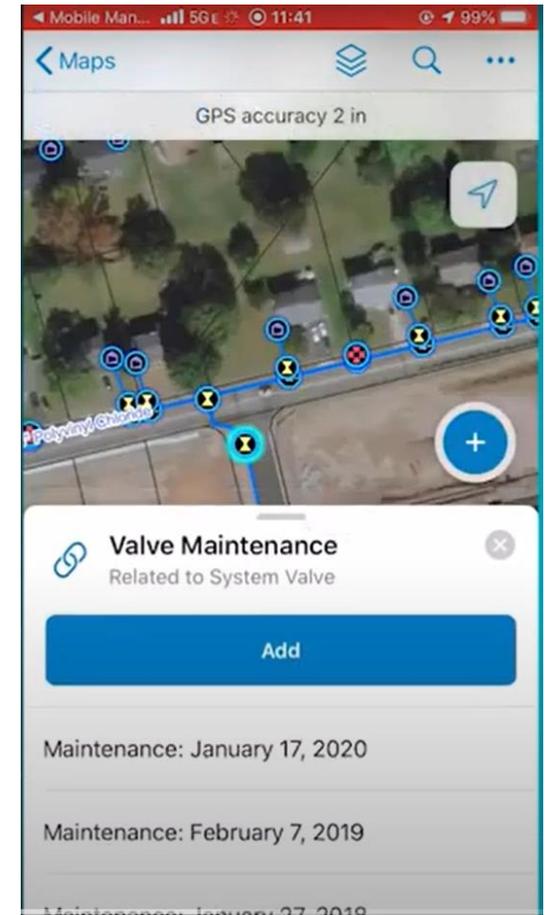
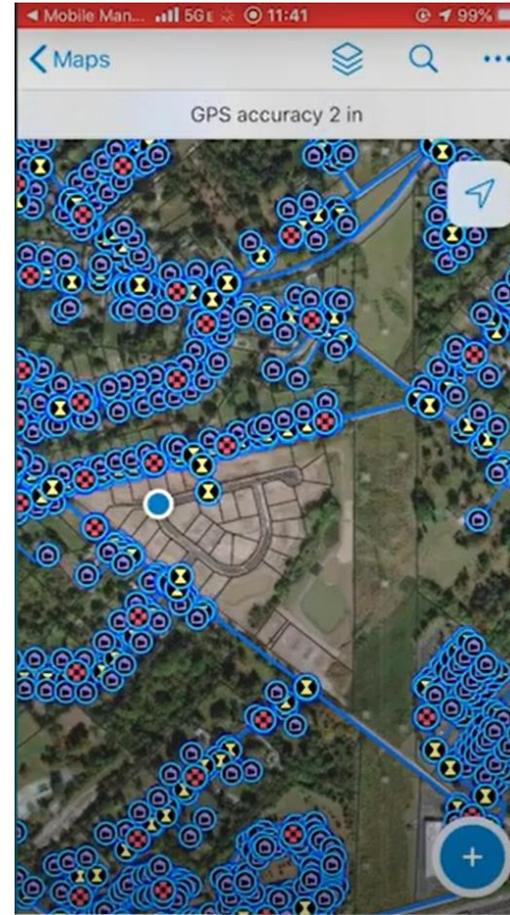
- Used to prioritize capital improvement and maintenance operations
- Consequence of failure (CoF)
- Probability of failure (PoF)



GIS Tools for Inventory and Assessment



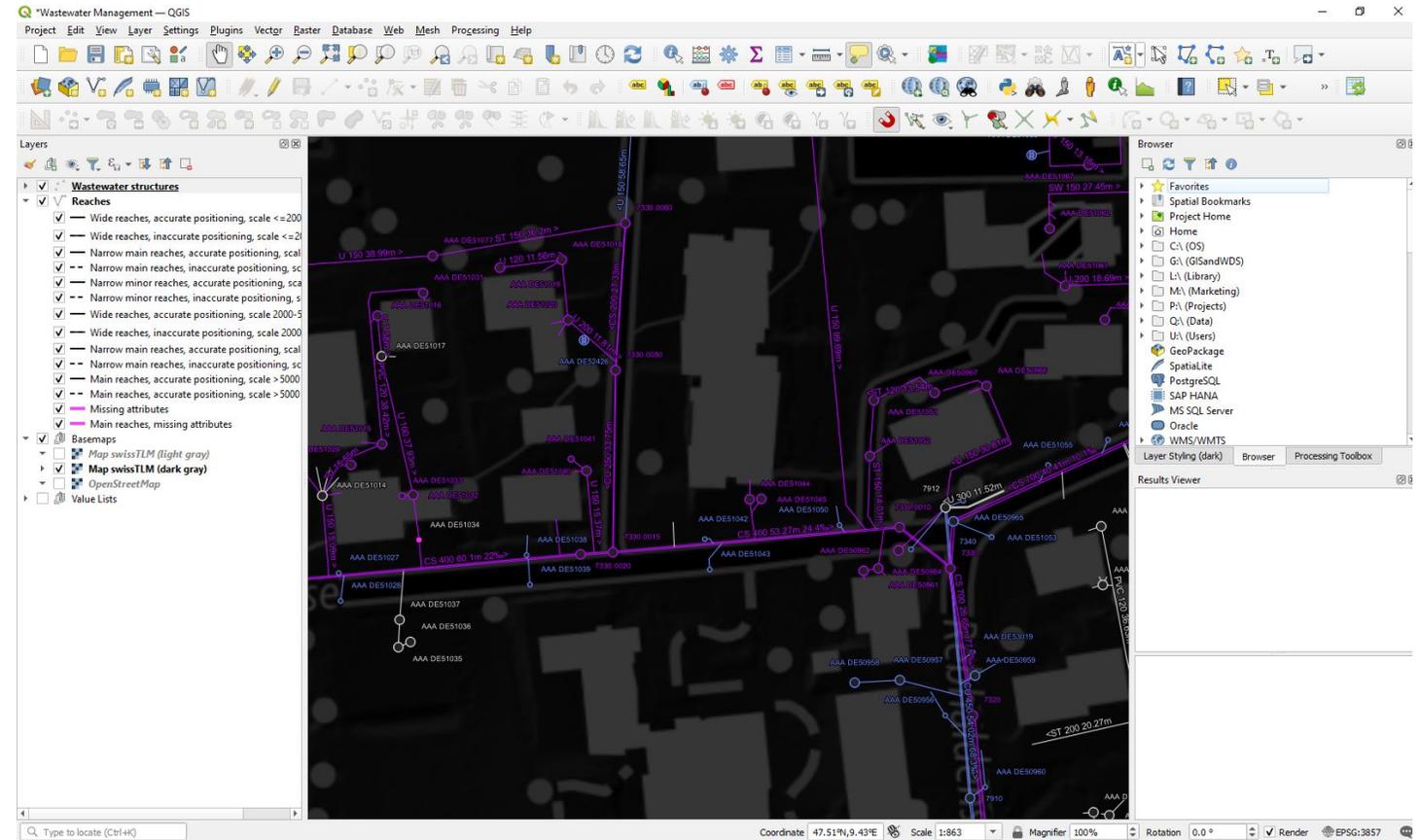
GIS Tools for Inventory and Assessment



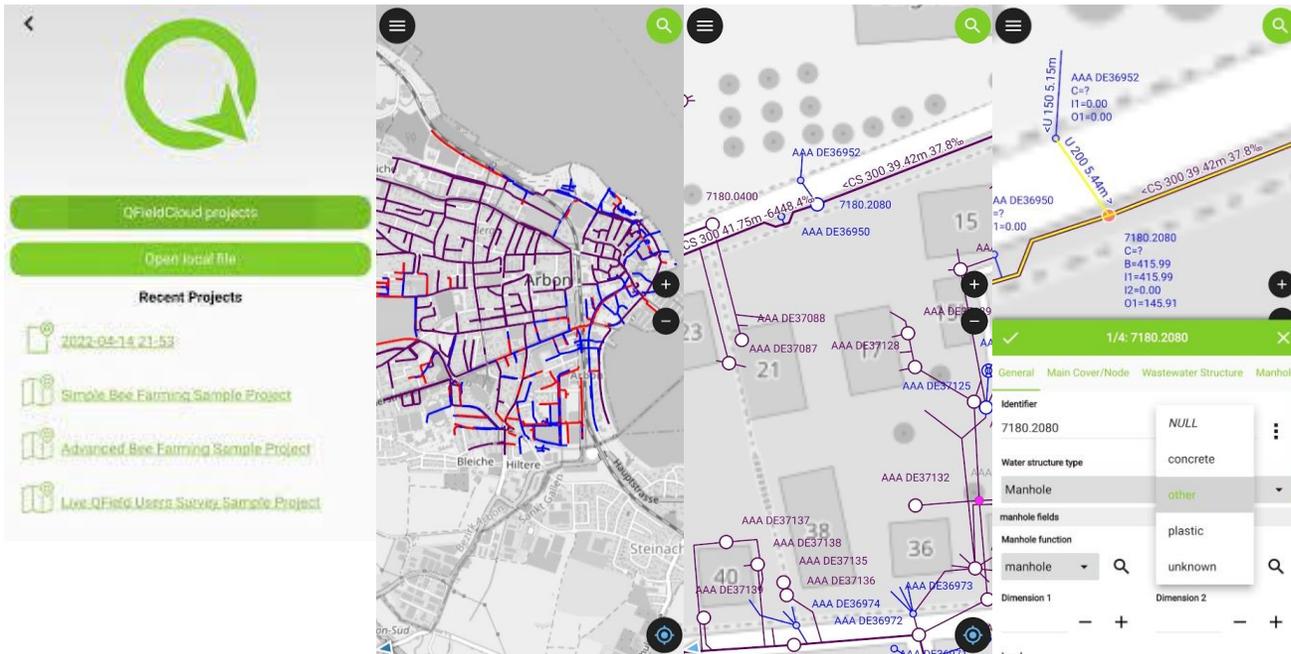
GIS Tools for Inventory and Assessment

QGIS

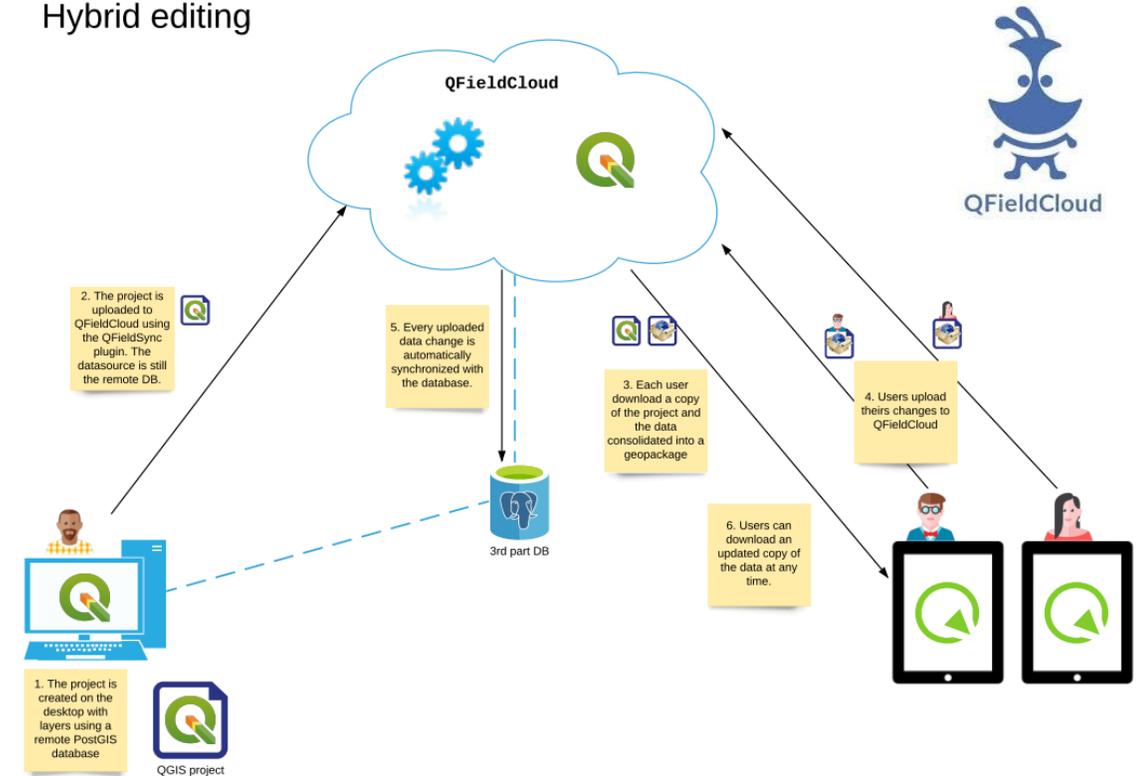
- Free and Open Source
- Complete GIS Solution
- Desktop, Web, Mobile



GIS Tools for Inventory and Assessment



Hybrid editing



GIS Tools for Inventory and Assessment

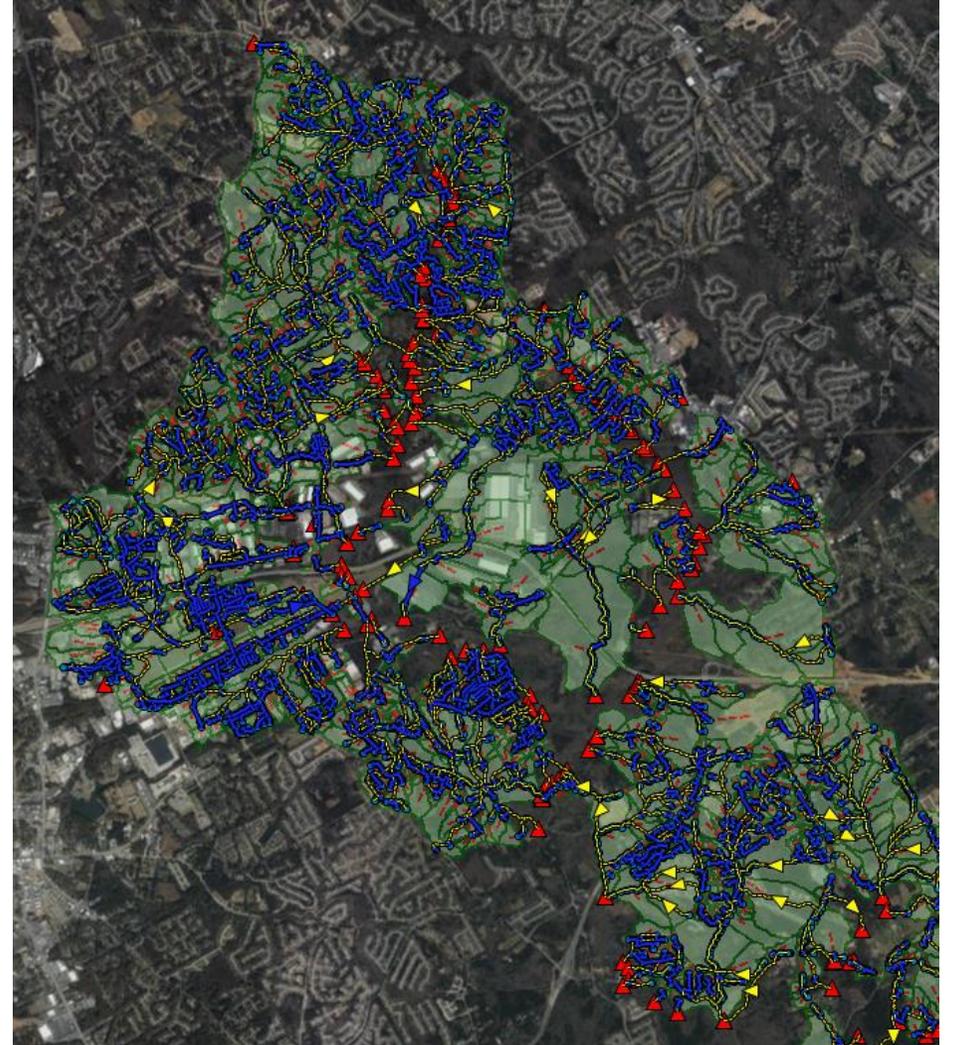
Trimble Catalyst DA2

- High Accuracy
- Flexible subscription
- Works with Field Maps & Qfield
- Easy setup



What is System Analysis

- Level of Service Estimator
- Conceptual Designer
- Planning Tool
- Cost Estimator
- Master Model
- **DECISION MAKING TOOL**

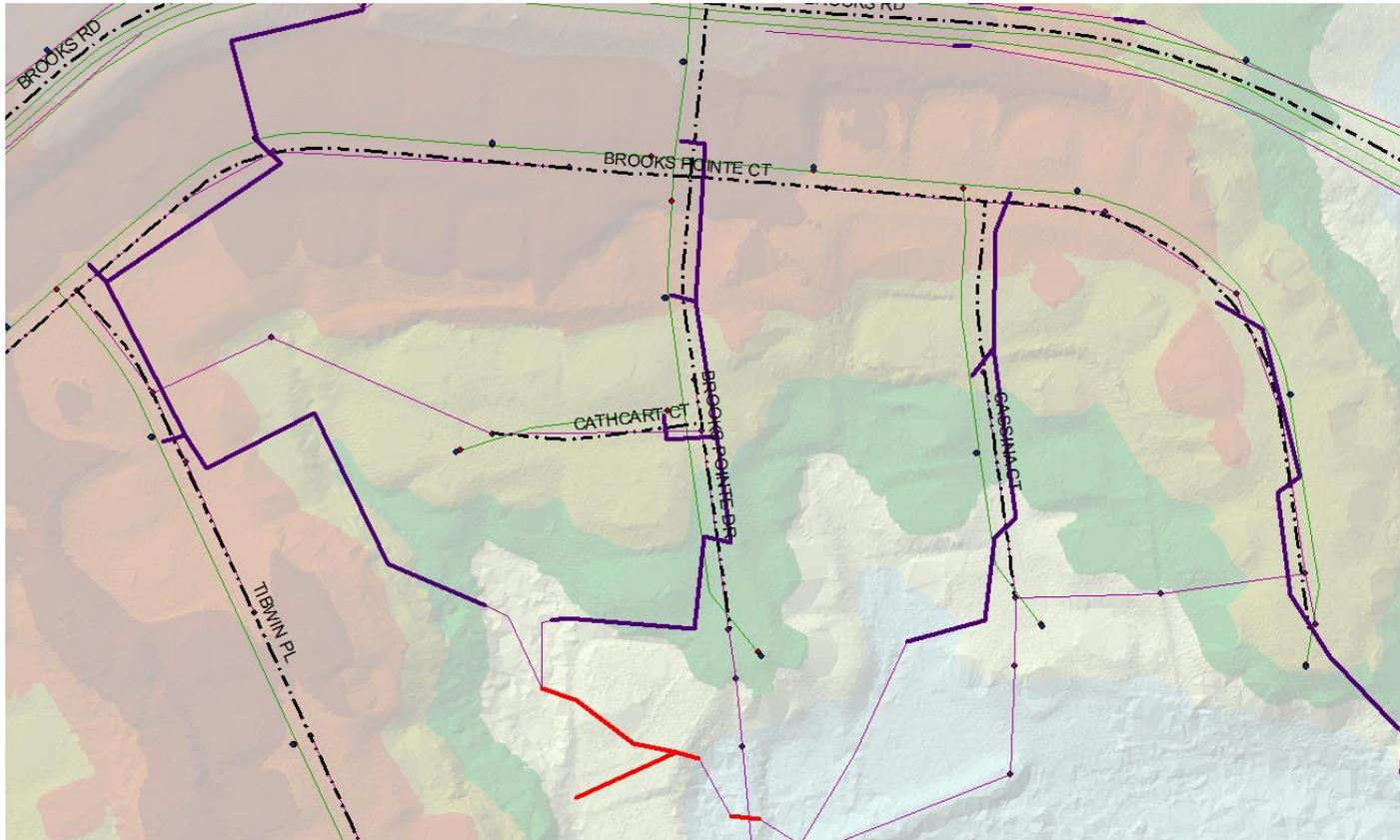


How We Get There

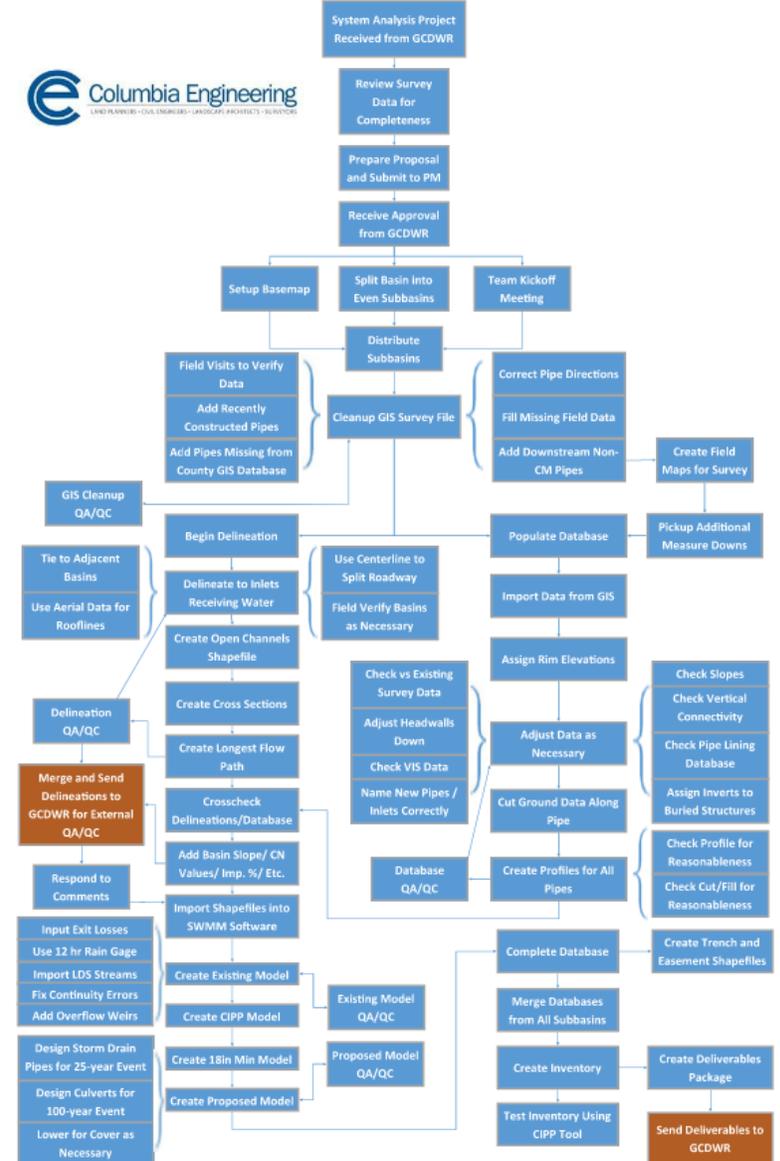
- Establish Our System
- Evaluate Existing Data
- Develop Workflow
- Gather Additional Data
- GIS and Delineation
- Model
- Create Deliverables



Data Evaluation and Workflow



SYSTEM ANALYSIS PROJECT WORKFLOW



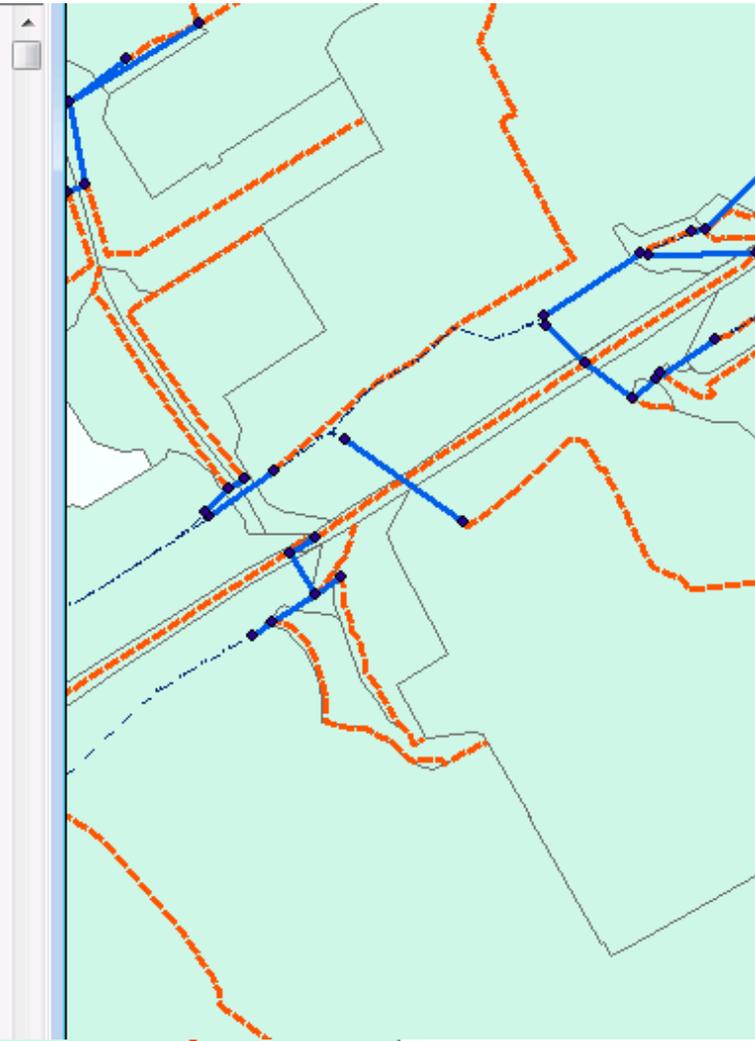
Fieldwork

Attributes of ClosedConduit_Inventory

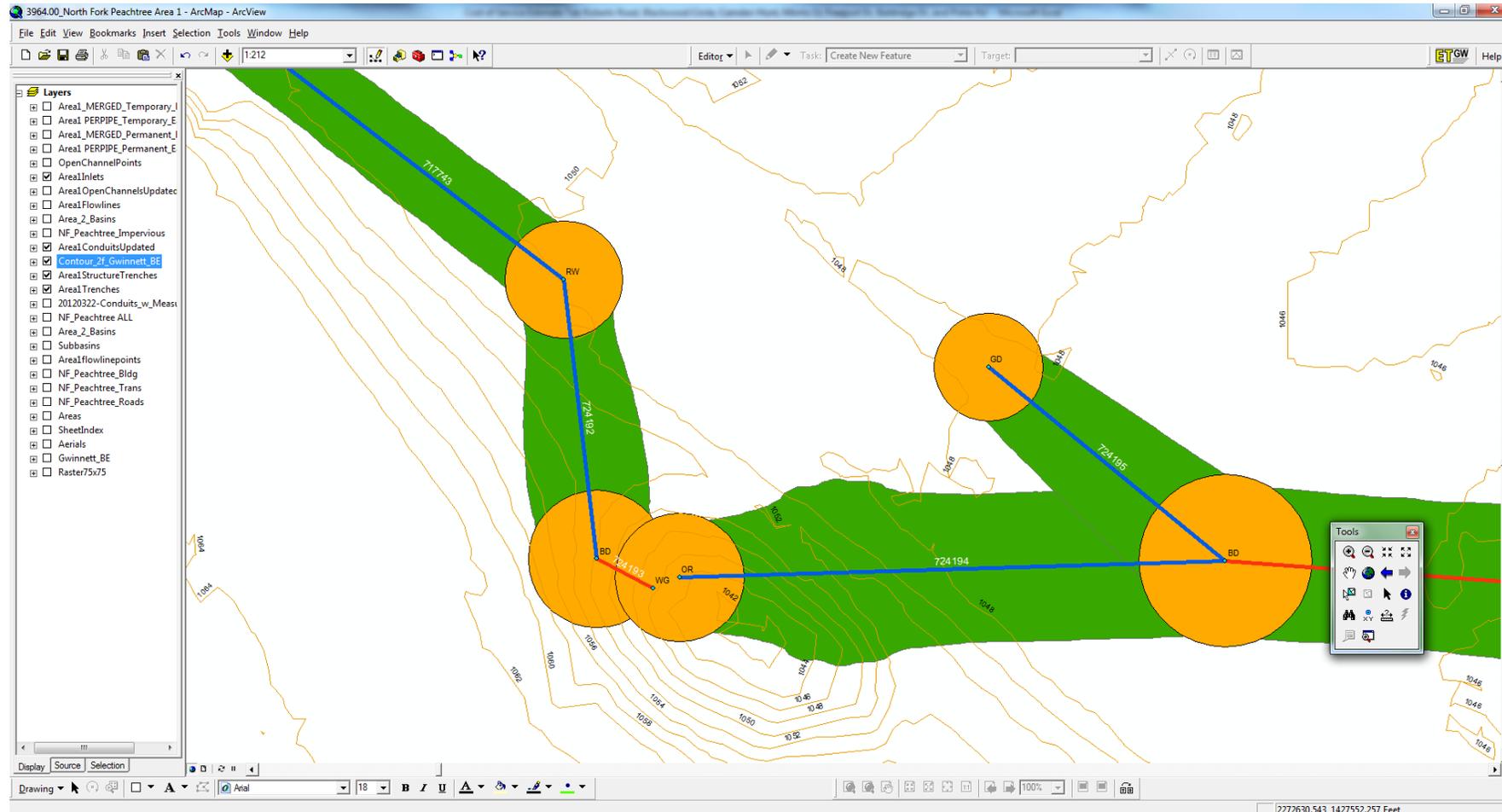
FID	Shape *	FacilityID	StreetName	County_MAI	Cond_Shape	Material	Span	Rise	US_NODE	DS_NODE	US_INV_ELV	DS_INV_ELV	Roughness
878	Polyline	500300	RESEARCH DRIVE	Y	RO	CO	3	3	701641	5000071	1007.399548	1007.830493	0.024
890	Polyline	500301	HOLCOMB BRIDGE ROAD	Y	RO	CI	1	1	716376	716375	1034.534912	1034.5354	0.013
521	Polyline	500302	PACIFIC DRIVE	Y	RO	CO	2	2	717278	717272	985.430212	984.70736	0.024
520	Polyline	500303	PACIFIC DRIVE	Y	RO	CO	5	5	717261	717358	983.10653	980.94746	0.024
519	Polyline	500304	PACIFIC DRIVE	Y	RO	CO	5	5	717355	717261	994.764135	983.10653	0.024
518	Polyline	500305	ATLANTIC BOULEVARD	Y	RO	CO	1.5	1.5	717291	717356	991.660119	991.483422	0.024
517	Polyline	500306	PEACHTREE INDUSTRIAL BOULEVARD	Y	RO	CO	2.5	2.5	701241	701243	1057.064526	1054.420483	0.024
516	Polyline	500307	HOLCOMB BRIDGE	Y	RO	RC	1.5	1.5	5000016	5000015	943.215209	943.088891	0.013
869	Polyline	500308	SATURN COURT	N	RO	CO	3	3	701661	5000066	1014.244921	1009.505297	0.024
870	Polyline	500309	SATURN COURT	N	RO	RC	2.5	2.5	5000066	701533	1009.505297	1005.902185	0.013
871	Polyline	500310	SATURN COURT	Y	RO	RC	2.5	2.5	701223	701659	1032.18811	1027.792211	0.013
872	Polyline	500311	ATLANTIC BOULEVARD	Y	RO	RC	1.5	1.5	5000067	717269	980.236267	971.446398	0.013
873	Polyline	500312	BUSINESS PARK DRIVE	N	RO	CO	1.5	1.5	5000068	694955	1056.137182	1054.139995	0.024
874	Polyline	500313	HOLCOMB BRIDGE	Y	RO	CO	1	1	719628	5000069	954.54309	950.045605	0.024
875	Polyline	500314	HOLCOMB BRIDGE	Y	RO	RC	1.5	1.5	5000069	5000014	948.245605	948.051266	0.013
876	Polyline	500315	HOLCOMB BRIDGE	Y	RO	RC	2	2	5000015	5000070	942.938891	941.02362	0.013
877	Polyline	500316	RESEARCH DRIVE	Y	RO	CO	3	3	5000071	701642	1007.830493	1007.615865	0.024
880	Polyline	500317	PACIFIC DRIVE	Y	RO	CO	2	2	5000072	725099	1008.735961	1008.341687	0.024
888	Polyline	500318	PEACHTREE INDUSTRIAL BOULEVARD	N	RO	CO	3	3	5000078	5000079	1022.886912	1014.800292	0.024
887	Polyline	500319	PEACHTREE INDUSTRIAL BOULEVARD	N	RO	CO	3	3	5000077	5000078	1025.561595	1022.886912	0.024
886	Polyline	500320	PEACHTREE INDUSTRIAL BOULEVARD	N	RO	CO	3	3	5000076	5000077	1031.969067	1025.561595	0.024
885	Polyline	500321	PEACHTREE INDUSTRIAL BOULEVARD	N	RO	CO	3	3	5000075	5000076	1033.730053	1031.969067	0.024
884	Polyline	500322	PEACHTREE INDUSTRIAL BOULEVARD	N	RO	CO	3	3	5000074	5000075	1036.012866	1033.780053	0.024
883	Polyline	500323	PEACHTREE INDUSTRIAL BOULEVARD	N	RO	CO	3	3	694655	5000074	1040.689501	1036.062866	0.024
892	Polyline	500324	SOUTH PEACHTREE STREET	Y	RO	RC	1.5	1.5	725144	725064	1080.152099	1067.960327	0.013
889	Polyline	500325	WEST PEACHTREE STREET	Y	RO	CO	1.5	1.5	716445	5000092	1021.570361	1019.79541	0.024
891	Polyline	500326	HOLCOMB BRIDGE ROAD	Y	RO	CO	1.2	1.2	5000093	5000094	1035.800433	1034.380126	0.024
893	Polyline	500327	SOUTH PEACHTREE STREET	Y	RO	RC	1.5	1.5	5000095	5000096	1092.695068	1092.482788	0.013
894	Polyline	500328	MEDLOCK BRIDGE ROAD	Y	RO	RC	1.5	1.5	5000097	5000098	1099.139648	1097.672119	0.013
895	Polyline	500329	MEDLOCK BRIDGE ROAD	Y	RO	RC	1.5	1.5	5000098	5000099	1097.672119	1097.363831	0.013
896	Polyline	500330	MEDLOCK BRIDGE ROAD	Y	RO	RC	1.5	1.5	5000099	5000100	1097.361831	1088.90625	0.013
897	Polyline	500331	MEDLOCK BRIDGE ROAD	Y	RO	RC	1.5	1.5	5000101	5000102	1091.795654	1089.864941	0.013
898	Polyline	500332	MEDLOCK BRIDGE ROAD	Y	RO	RC	1.5	1.5	5000102	5000103	1089.764941	1088.682373	0.013
899	Polyline	500333	MEDLOCK BRIDGE ROAD	Y	RO	RC	1.5	1.5	5000103	5000104	1088.682373	1085.169042	0.013
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901	Polyline	500335	MEDLOCK BRIDGE ROAD	Y	RO	CO	1.5	1.5	5000105	5000106	1084.186865	1079.470703	0.024
903	Polyline	500336	PEACHTREE INDUSTRIAL BOULEVARD	N	RO	CO	3	3	704457	704362	1017.276806	1010.600903	0.024
904	Polyline	500337	PEACHTREE INDUSTRIAL BOULEVARD	N	RO	CO	3	3	704362	704458	1010.400903	997.404528	0.024
905	Polyline	500338	PEACHTREE CORNERS EAST	N	RO	RC	4	4	704458	5000107	989.154528	988.226391	0.013

GIS and Delineation

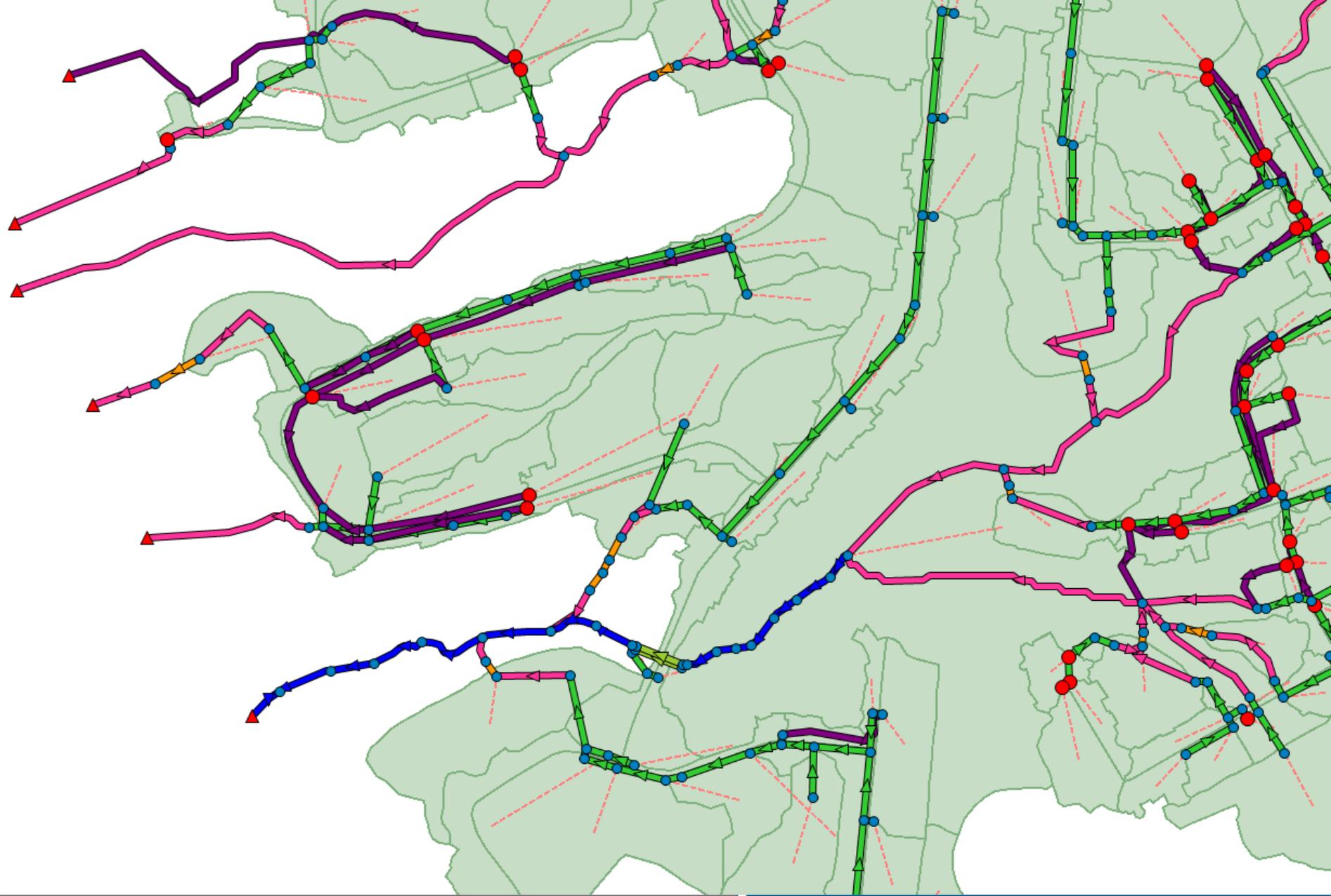
FID	Shape	Area_AC	ImpAreaPer	CN_VALUE	SUB_ID	DR_NODE_ID	EQ_WIDTH	SLOPE
0	Polygon	0.835	53.89	80.68	SUB-706471	706471	83.75	4.797
1	Polygon	4.781	42.31	75.72	SUB-718596	718596	155.62	4.83
2	Polygon	0.066	81.82	91.46	SUB-734348	734348	19.63	3.087
3	Polygon	3.801	71.8	89.9	SUB-734284	734284	372.8	1.774
4	Polygon	0.988	56.98	82.12	SUB-734402	734402	65.27	0.846
5	Polygon	9.822	73.21	89.6	SUB-717361	717361	511.62	1.435
6	Polygon	13.238	71.52	83.82	SUB-734285	734285	494.98	1.452
7	Polygon	1.661	65.8	85.23	SUB-728162	728162	204.51	3.63
8	Polygon	0.551	50.27	79.81	SUB-716996	716996	41.65	5.246
9	Polygon	0.175	54.86	81.35	SUB-733764	733764	51.62	4.591
10	Polygon	7.004	47.93	78.74	SUB-733836	733836	227.29	5.156
11	Polygon	0.561	96.08	95.57	SUB-733758	733758	56.96	1.26
12	Polygon	0.441	89.34	92.44	SUB-733761	733761	61.8	2.964
13	Polygon	5.082	58.99	82.45	SUB-734334	734334	181	1.444
14	Polygon	1.36	91.32	95.02	SUB-734405	734405	101.65	0.364
15	Polygon	1.689	75.49	90.37	SUB-734305	734305	217.2	0.576
16	Polygon	0.711	98.17	97.38	SUB-734438	734438	97.96	8.576
17	Polygon	0.161	59.63	82.98	SUB-734354	734354	29.59	3.09
18	Polygon	2.252	61.23	86.42	SUB-734346	734346	213.75	2.07
19	Polygon	0.299	60.54	83.29	SUB-734350	734350	46.75	1.998
20	Polygon	1.691	58.19	80.83	SUB-5000082	5000082	92.25	1.987
21	Polygon	1.014	74.95	87.52	SUB-715353	715353	240.03	7.101
22	Polygon	0.52	72.5	87.31	SUB-715354	715354	162.25	9.948
23	Polygon	2.33	67.51	87.17	SUB-717001	717001	197.56	3.555
24	Polygon	2.516	48.53	79.23	SUB-716991	716991	199.53	0.138
25	Polygon	1.526	11.86	66.38	SUB-716992	716992	165.66	7.751
26	Polygon	0.276	63.41	83.81	SUB-716993	716993	79.49	8.761
27	Polygon	0.245	62.86	83.07	SUB-716994	716994	111.01	1.207
28	Polygon	3.791	67.74	85.27	SUB-716990	716990	171.94	0.978
29	Polygon	0.074	93.24	95.57	SUB-733769	733769	24.06	1.976
30	Polygon	0.382	89.79	94.13	SUB-733745	733745	53.22	1.828
31	Polygon	2.254	85.31	92.56	SUB-716986	716986	154.15	2.325



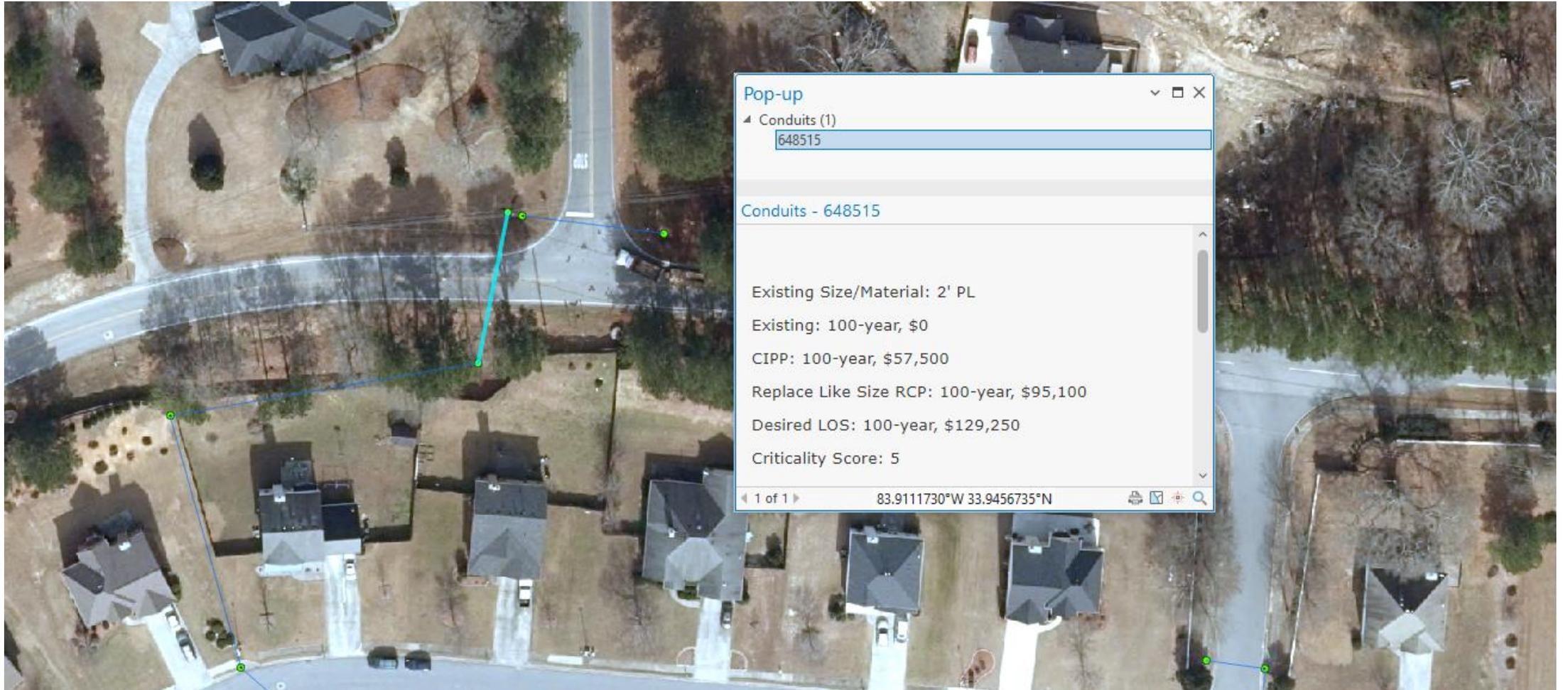
GIS and Delineation



Modeling



Deliverable



Deliverable

CIP Tool - Scenario Cost Estimates

Repair/Replace Scenario Costs

Repair: Line Pipe (CIPP)

Replace: Same Size HDPE

Replace: Same Size RCP/RCB

Replace: Upsize HDPE

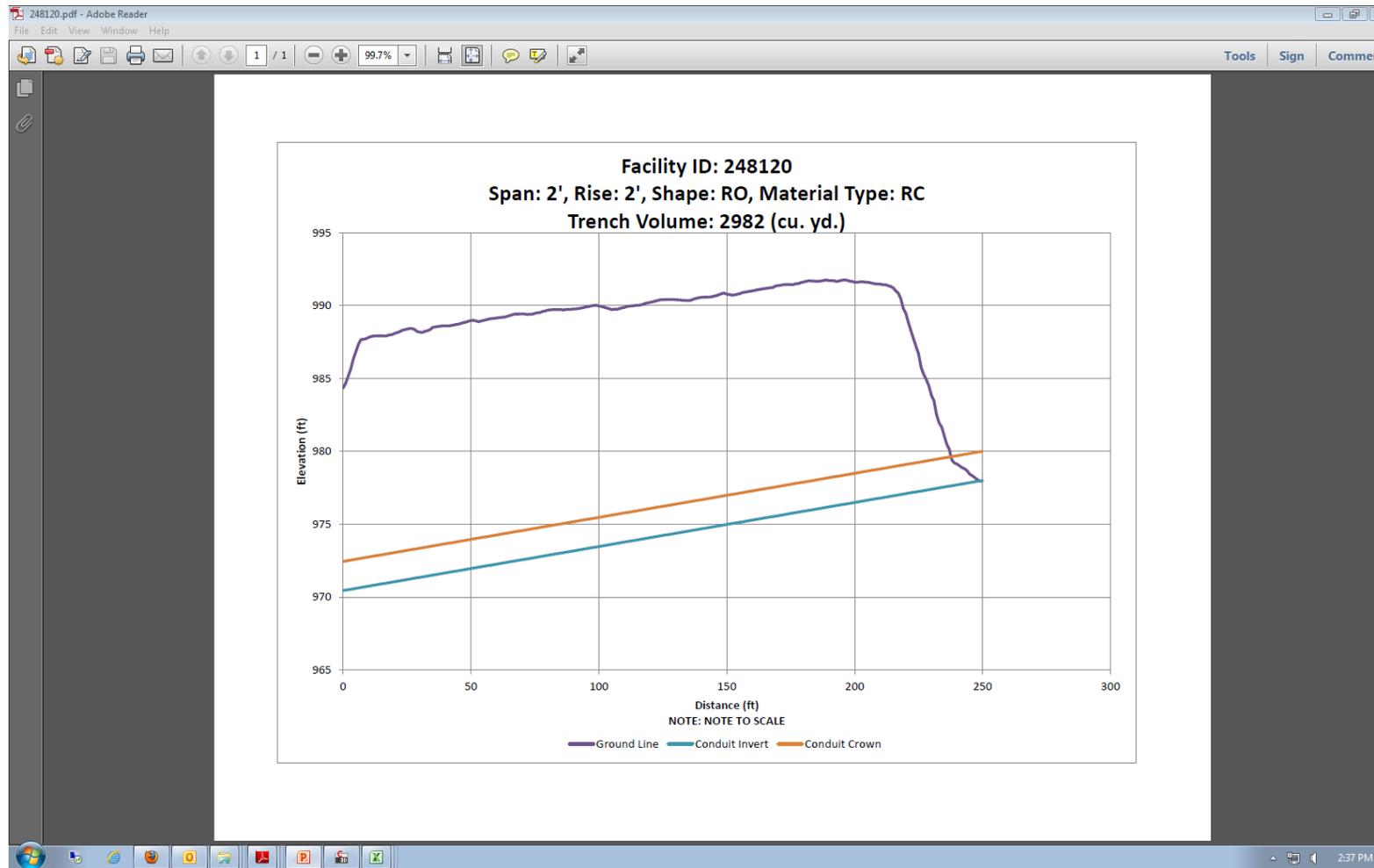
Replace: Upsize RCP/RCB

Type	Facility	Level of Service	Description	Quantit	Unit	Unit Cc	Total Cost
Replacement by Same Size RCP							
Conduit	750473	25	18" RCP PIPE	32	L.F.	\$70.0	\$2,215.5
			REMOVE EXISTING PIPE, ALL TYPES AND SI	32	L.F.	\$5.0	\$158.2
			STREET CUT	53	S.Y.	\$55.0	\$2,924.9
			SIDEWALK	0	S.Y.	\$60.0	\$26.4
			SODDING COMPLETE	12	S.Y.	\$10.0	\$115.6
			ADDITIONAL EXCAVATION	72	C.Y.	\$20.0	\$1,444.8
			FENCE REMOVAL AND REPLACEMENT, CO	0	L.F.	\$25.0	\$11.0
			SILT FENCE TYPE C, COMPLETE	63	L.F.	\$5.0	\$316.5
			DEPTH TO TOP OF PIPE (< 8.1')	32	L.F.	\$0.0	\$0.0
Conduit	750474	100	18" RCP PIPE	311	L.F.	\$70.0	\$21,763.0
			REMOVE EXISTING PIPE, ALL TYPES AND SI	311	L.F.	\$5.0	\$1,554.5
			STREET CUT	208	S.Y.	\$55.0	\$11,458.2
			SIDEWALK	8	S.Y.	\$60.0	\$468.0
			SODDING COMPLETE	350	S.Y.	\$10.0	\$3,503.6
			ADDITIONAL EXCAVATION	606	C.Y.	\$20.0	\$12,127.6
			FENCE REMOVAL AND REPLACEMENT, CO	8	L.F.	\$25.0	\$195.0
			SILT FENCE TYPE C, COMPLETE	622	L.F.	\$5.0	\$3,109.0
			DEPTH TO TOP OF PIPE (< 8.1')	311	L.F.	\$0.0	\$0.0
Conduit	750481	100	42" RCP PIPE	63	L.F.	\$175.0	\$10,956.8
			REMOVE EXISTING PIPE, ALL TYPES AND SI	63	L.F.	\$5.0	\$313.1
			STREET CUT	133	S.Y.	\$55.0	\$7,335.9
			SODDING COMPLETE	42	S.Y.	\$10.0	\$421.9
			ADDITIONAL EXCAVATION	240	C.Y.	\$20.0	\$4,798.0
			SILT FENCE TYPE C, COMPLETE	125	L.F.	\$5.0	\$626.1
			DEPTH TO TOP OF PIPE (< 8.1')	63	L.F.	\$0.0	\$0.0
Conduit	750501	100	36" RCP PIPE	122	L.F.	\$180.0	\$21,898.8
			REMOVE EXISTING PIPE, ALL TYPES AND SI	122	L.F.	\$5.0	\$608.3
			STREET CUT	247	S.Y.	\$55.0	\$13,576.8
			SODDING COMPLETE	196	S.Y.	\$10.0	\$1,964.7
			ADDITIONAL EXCAVATION	936	C.Y.	\$20.0	\$18,728.8
			SILT FENCE TYPE C, COMPLETE	243	L.F.	\$5.0	\$1,216.6
			DEPTH TO TOP OF PIPE (8.1' - 12.0')	122	L.F.	\$25.0	\$3,041.5
Conduit	750502	100	36" RCP PIPE	17	L.F.	\$180.0	\$3,106.8
			REMOVE EXISTING PIPE, ALL TYPES AND SI	17	L.F.	\$5.0	\$86.3
			SODDING COMPLETE	33	S.Y.	\$10.0	\$330.4
			ADDITIONAL EXCAVATION	6	C.Y.	\$20.0	\$110.1
			SILT FENCE TYPE C, COMPLETE	35	L.F.	\$5.0	\$172.6
			DEPTH TO TOP OF PIPE (< 8.1')	17	L.F.	\$0.0	\$0.0
Conduit	750479	100	18" RCP PIPE	91	L.F.	\$70.0	\$6,373.5
			REMOVE EXISTING PIPE, ALL TYPES AND SI	91	L.F.	\$5.0	\$455.3
			STREET CUT	112	S.Y.	\$55.0	\$6,151.7
			SODDING COMPLETE	30	S.Y.	\$10.0	\$300.6
			ADDITIONAL EXCAVATION	95	C.Y.	\$20.0	\$1,891.4
			SILT FENCE TYPE C, COMPLETE	182	L.F.	\$5.0	\$910.5
			DEPTH TO TOP OF PIPE (< 8.1')	91	L.F.	\$0.0	\$0.0
Conduit	750477	100	18" RCP PIPE	51	L.F.	\$70.0	\$3,595.9
			REMOVE EXISTING PIPE, ALL TYPES AND SI	51	L.F.	\$5.0	\$256.8
			STREET CUT	62	S.Y.	\$55.0	\$3,423.2
			SODDING COMPLETE	8	S.Y.	\$10.0	\$77.0
			ADDITIONAL EXCAVATION	8	C.Y.	\$20.0	\$163.8
			SILT FENCE TYPE C, COMPLETE	103	L.F.	\$5.0	\$513.7
			DEPTH TO TOP OF PIPE (< 8.1')	51	L.F.	\$0.0	\$0.0
Conduit	750475	50	18" RCP PIPE	165	L.F.	\$70.0	\$11,545.8
			REMOVE EXISTING PIPE, ALL TYPES AND SI	165	L.F.	\$5.0	\$824.7
			STREET CUT	260	S.Y.	\$55.0	\$14,306.0
			SODDING COMPLETE	64	S.Y.	\$10.0	\$643.9

Cost (Pivot Table)

Costs

Deliverable



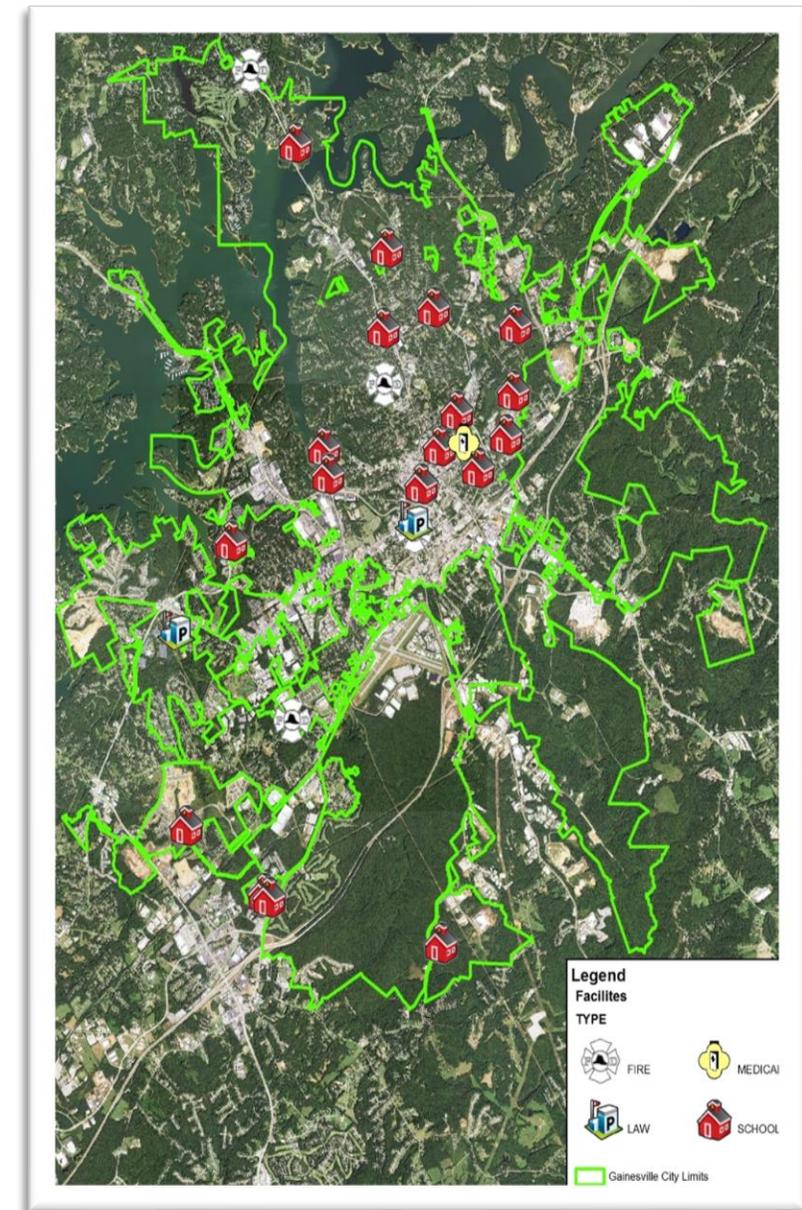
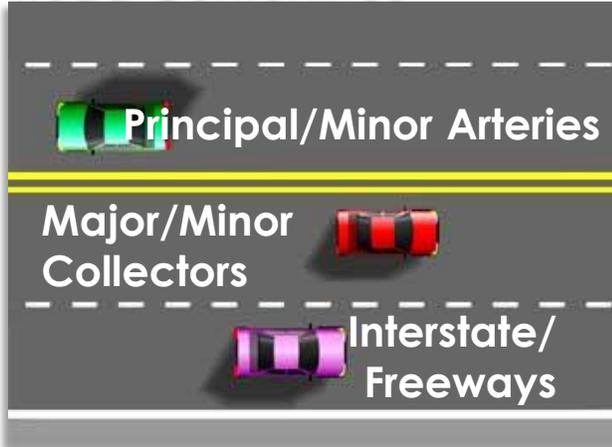
Capital Improvement Planning

Facilities GIS Data

- Police
- Fire
- Medical
- Schools
 - Preschool
 - Public Schools
 - Private School
 - College



Road Centerlines





THANK YOU

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