Clarkson UNIVERSITY

defy convention

Wallace H. Coulter School of Engineering

DAVIDSON & ASSOCIATES CONSULTING, LLC

GIS Resources for Highway and Asset Management

19 October 2017

NY GeoCON

Your Panelists

Charles Davidson, CEO, Davidson and Associates Consulting, LLC and Clarkson University

Erik Backus, PE, LEED AP BD+C
Director, Construction Engineering Management Program, Clarkson University

Bill Olsen, GIS Coordinator, Clarkson University

Agenda

- Asset Management – Why is it Important?
- GIS and Municipal Asset Management Services
- What are your (highway) assets worth?
- Highway Asset Management
  - Cazenovia Signage
  - Sherburne Assets
- ArcGIS Collector
- Project Examples
  - Culvert Analysis and Removal
  - Snow Removal
- Clarkson U – GIS and C3G
  - Watertown ADA Ramp Inventory
  - Internship Pairing with Local Municipalities
- Conclusion/Questions

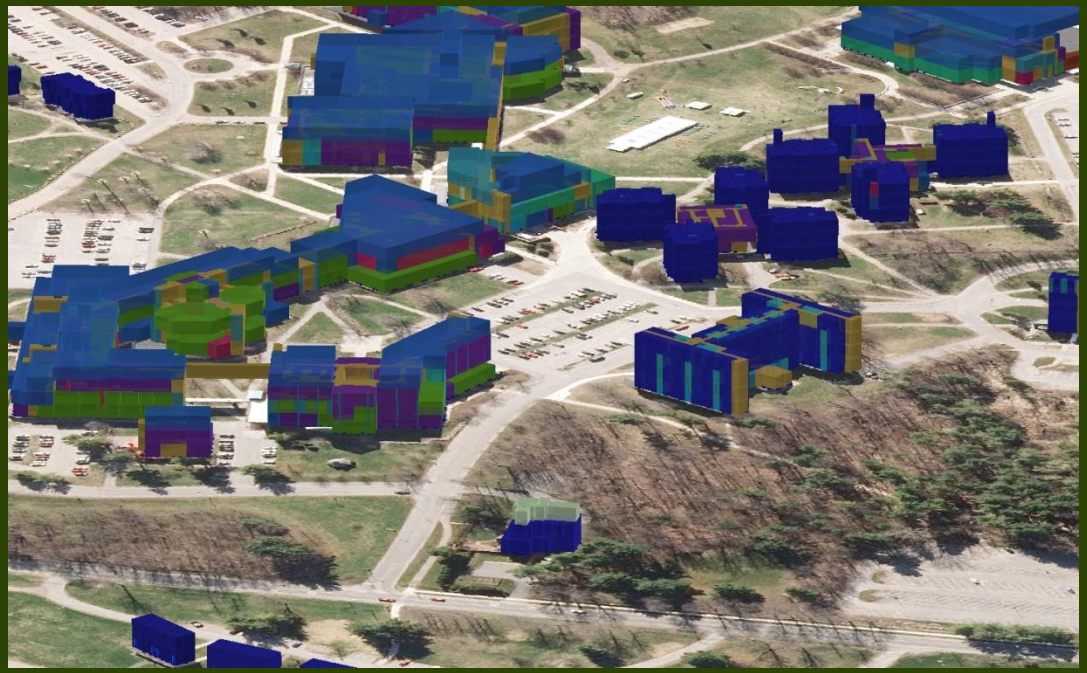
Why Asset Manage?

- Infrastructure/Facilities Assets require investment
  - Buying/owning assets requires a decision to place resources in them over and against another financial investment (e.g. banking $$$)
- Infrastructure/Facilities Assets have value
  - These assets effect real property values and can be sold/recapped over their lifetime; lack of care for them decreases their long-term value
- Infrastructure/Facilities Assets support the economy/business enterprise
  - Absent these assets, the core enterprise could not happen or would be severely hindered. With them operating at peak efficiency, they empower the enterprise to take on new opportunities

RESULT: Take care of the assets you have!! Asset Management

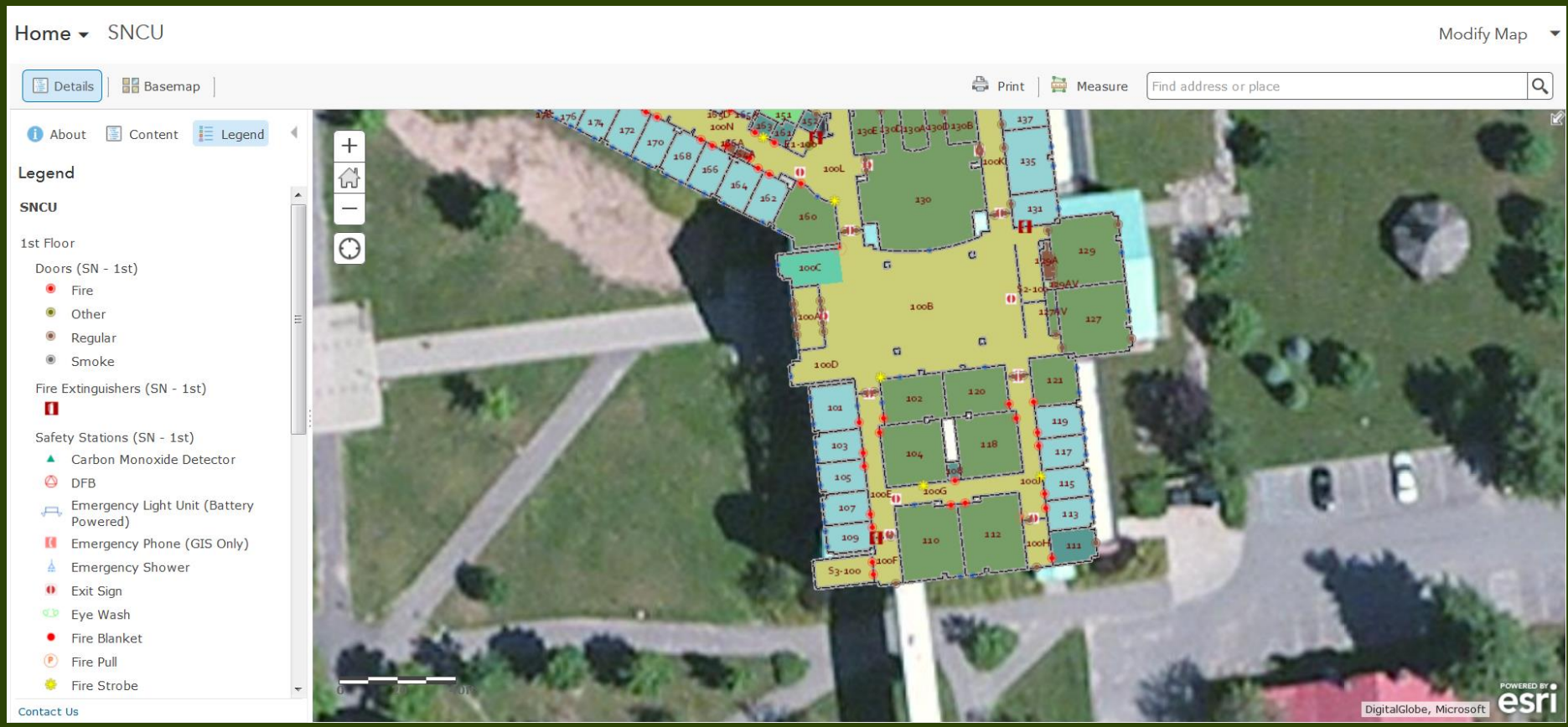
GIS and Municipal Assets

- Some popular GIS services for municipalities/districts
  - Building and Utility Infrastructure Management
  - Asset Management and Inventory
  - Road Network Analysis and Routing
  - Hydrologic Modeling
  - Visibility Analysis



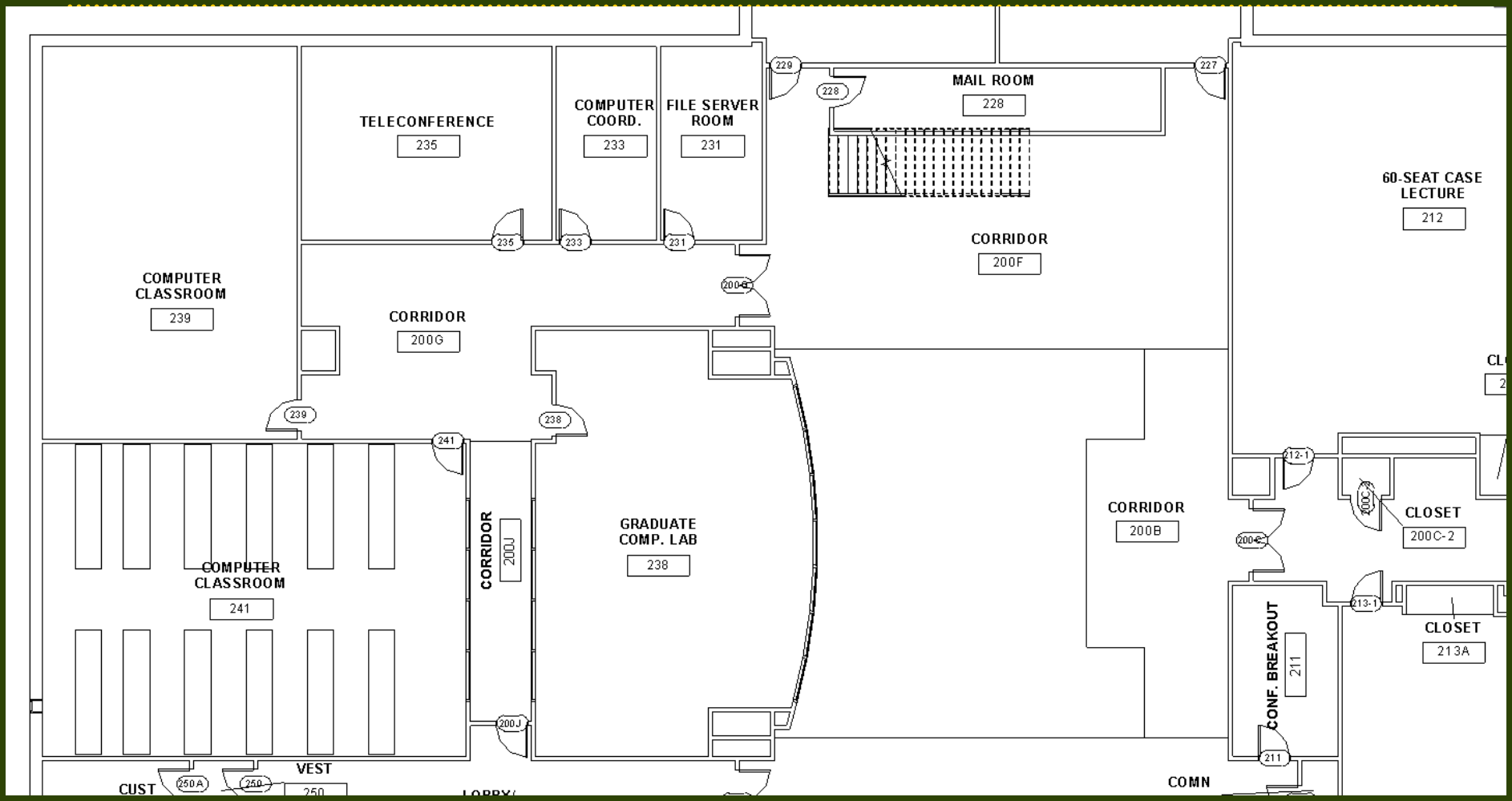
Clarkson University Facilities

- Goals: Provide utility and mechanical equipment access to workers
  Provide building floor plans and campus maps to public



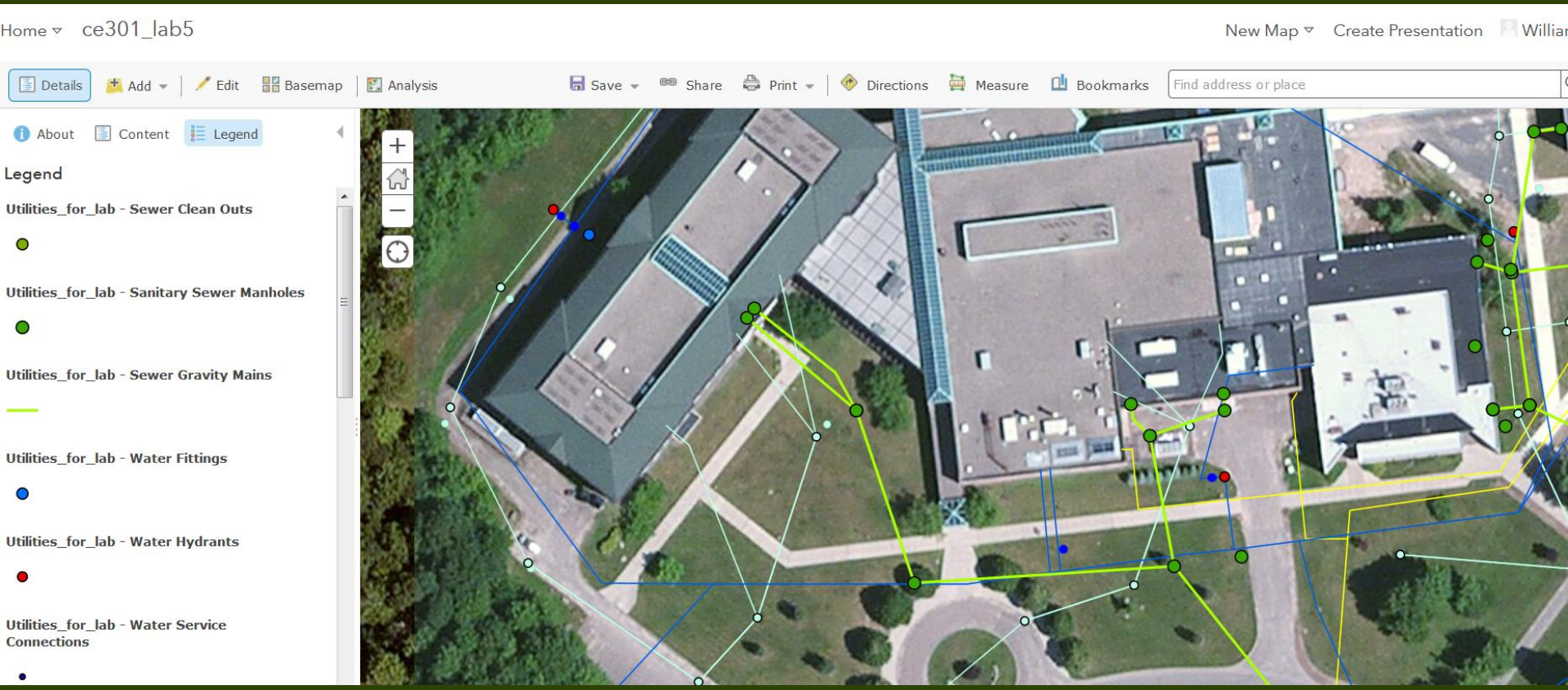
CU Web Map Viewer

2nd Floor Snell, Modeled by CE408 Students



- Students used tape measures, laser distance measure and scanned PDFs

Utility Inventory



What are Your (Highway) Assets Worth?

- Some Common Values*:
  - 17 signs/mile
  - 30-900 lane miles of roads
  - 10-20 culverts/mile
  - $75-$100k per inch/mile

Town of Sherburne Key Stats			
Feature	Sherburne Owns	Avg. Unit Cost:	Total Value
Pavement Lane Miles	128	$100,000	$12.8 M
Signs	288	$150	$43,200
Culverts	348	$2500	$865,660

- Example: Town of Sherburne

  Residents:

  Town (4k people) + Village (1k people) = Tax Base (5k people)

  Town Highway Department:

  Annual Budget = $1.2 Million

  Staff: 1 Superintendent, 5 full time (1 per 1000 residents)

*courtesy of the NYS Local Roads Program at Cornell

Value Analysis

				2016		2017		Differential	
	Condition	*Multiplier*	*Avg. Value*	*#*	*Lump Sum Value*	*#*	*Lump Sum Value*	*#*	Lump Sum Value
Signage	Excellent	1	$150.00	70	$10,500.00	110	$16,500.00	40	$6,000.00
	Good	0.75	$112.50	100	$11,250.00	79	$8,887.50	-21	-$2,362.50
	Fair	0.5	$75.00	92	$6,900.00	71	$5,325.00	-21	-$1,575.00
Sherburne average est. replace cost = $150	Replace	0.25	$37.50	35	$1,312.50	28	$1,050.00	-7	-$262.50
	Sub Total			**297**	**$29,962.50**	**288**	**$31,762.50**	**-9**	**$1,800.00**
Culverts	Excellent	1	$2,000.00	48	$151,880.00	58	$178,280.00	10	$26,400.00
	Good	0.75	$1,500.00	78	$154,567.50	79	$158,677.50	1	$4,110.00
	Fair	0.5	$1,000.00	118	$136,050.00	112	$129,905.00	-6	-$6,145.00
Sherburne average est. replace cost = $2500	Replace	0.25	$500.00	102	$55,750.00	99	$54,000.00	-3	-$1,750.00
	Sub Total			**346**	**$498,247.50**	**348**	**$520,862.50**	**2**	**$22,615.00**
	Total				**$528,210.00**		**$552,625.00**		**$24,415.00**

Note: Culvert **VALUES** are based on length and diameter and **NOT THE AVERAGE REPLACE COST**. The culvert average replace cost, above, is based on the cost of **REPLACING ALL** culverts with D = 5ft or less . Signage is based on an average value of $150 per sign

Culvert Cost Analysis

Purchasing Length:

1. Rounded up to nearest 10 feet
(ex. Culvert of 42' = 50 ' purchasing lengt

Unit cost based on diameter:

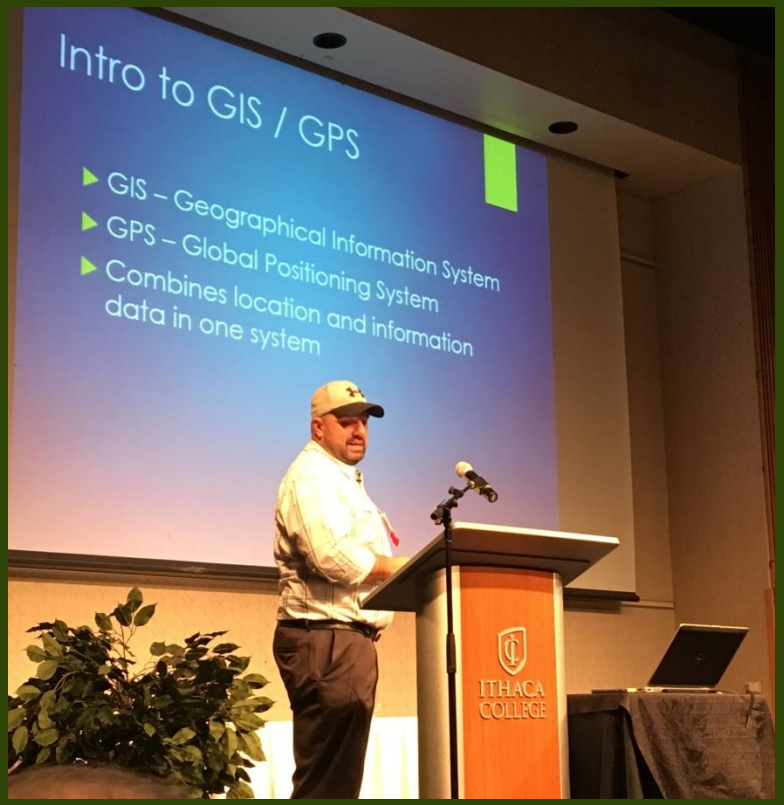
D = 2ft or < 2ft is estimated at $50/ft
Add $25/ft to cost for increasing diameter
(ex. For D = 4 ft, Unit Cost = $100/ft)

Current Value

Current value = multiplier X replace cost
(Multiplier is based on condition)

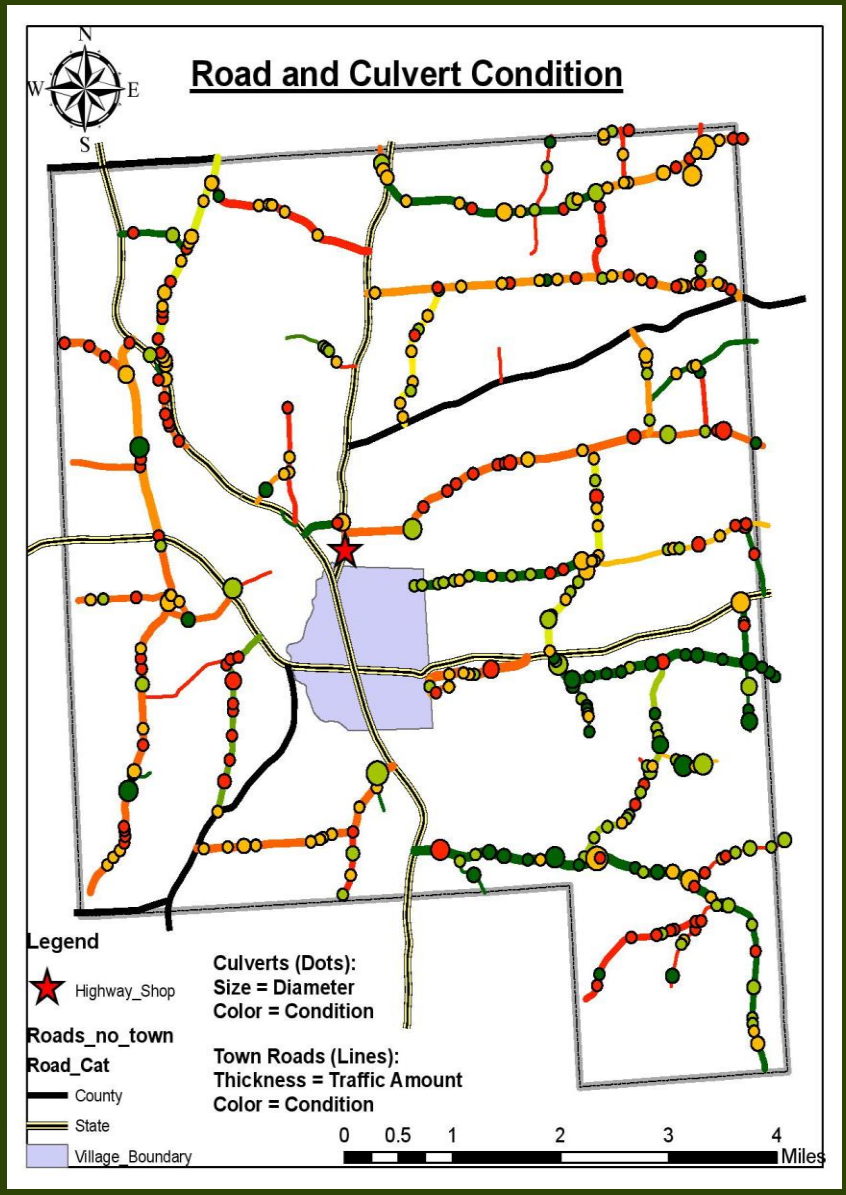
Sherburne GIS Projects

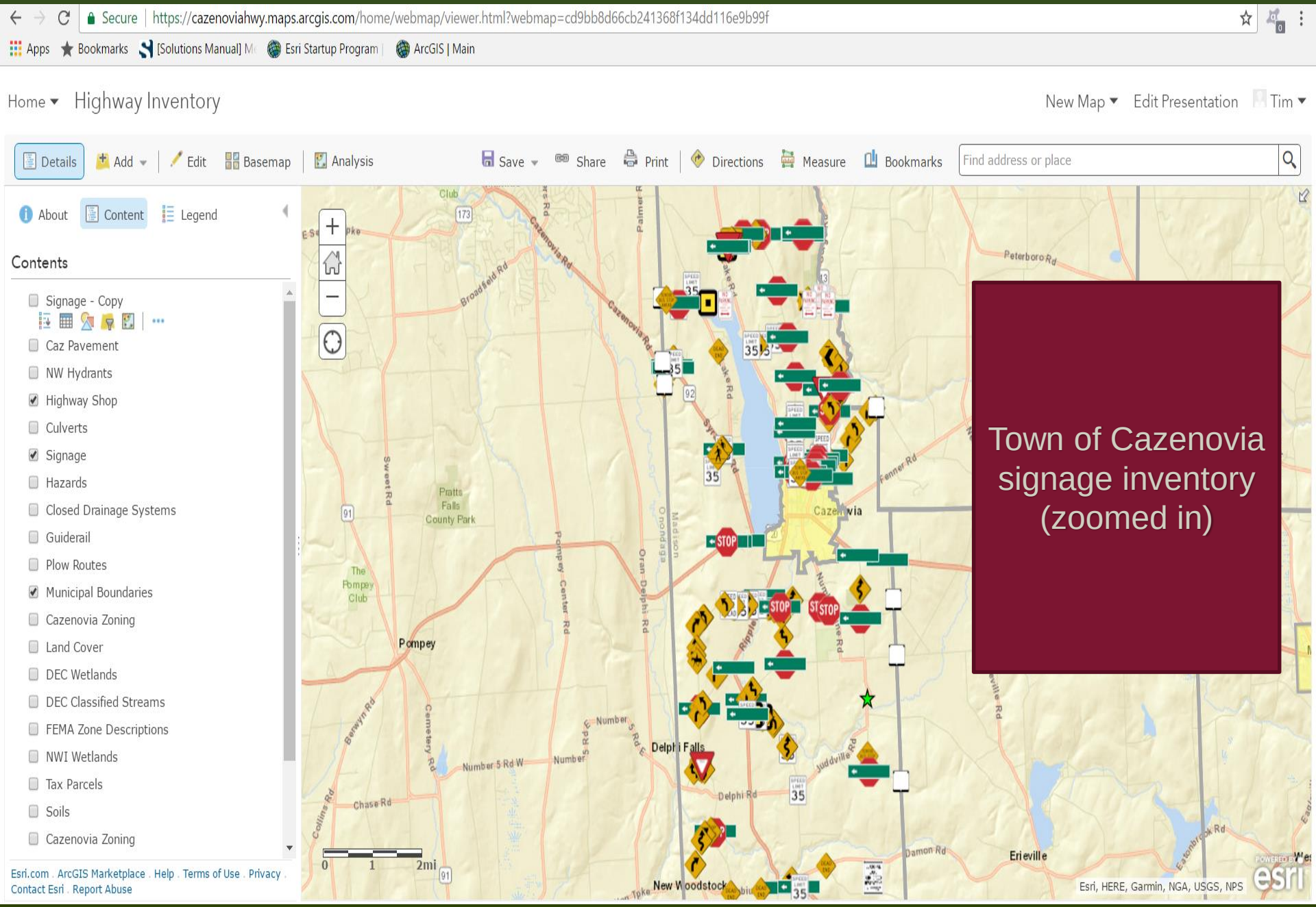
- Asset Management
- Vehicle Routing
- Culvert Sizing and Removal
- Roadway Sign Distances and Speeds
- Flood Zones
- Tax Parcels



Asset Management

- Access and update data through Collector and ArcGIS online
- Collect signs, culverts, shut off valves, fire hydrants, street lights, etc.
- Create fields for condition, height, ID number, material, flow rates, etc.
- Quickly sort, count, and organize information

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Esri Startup Program
ArcGIS | Main
Home
Highway Inventory
New Map
Edit Presentation
Tim
Details
Add
Edit
Basemap
Analysis
Save
Share
Print
Directions
Measure
Bookmarks
Find address or place
About
Content
Legend
Contents
Signage - Copy
Caz Pavement
NW Hydrants
Highway Shop
Culverts
Signage
Hazards
Closed Drainage Systems
Guiderail
Plow Routes
Municipal Boundaries
Cazenovia Zoning
Land Cover
DEC Wetlands
DEC Classified Streams
FEMA Zone Descriptions
NWI Wetlands
Tax Parcels
Soils
Cazenovia Zoning
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Contact Esri . Report Abuse
Town of Cazenovia signage inventory (zoomed in)
Pompey
Delphi Falls
New Woodstock
Erieville
Cazenovia
Peterboro Rd
Broadfield Rd
Cazenovia Rd
Lake Rd
Fenner Rd
Sweet Rd
Pratts Falls County Park
Pompey Center Rd
Madison Onondaga Delphi Rd
Number 5 Rd W
Number 5 Rd E
Chase Rd
Delphi Rd
Juddville Rd
Damon Rd
Eaton Brook Rd
Collins Rd
Benwyn Rd
Cemetery Rd
The Pompey Club
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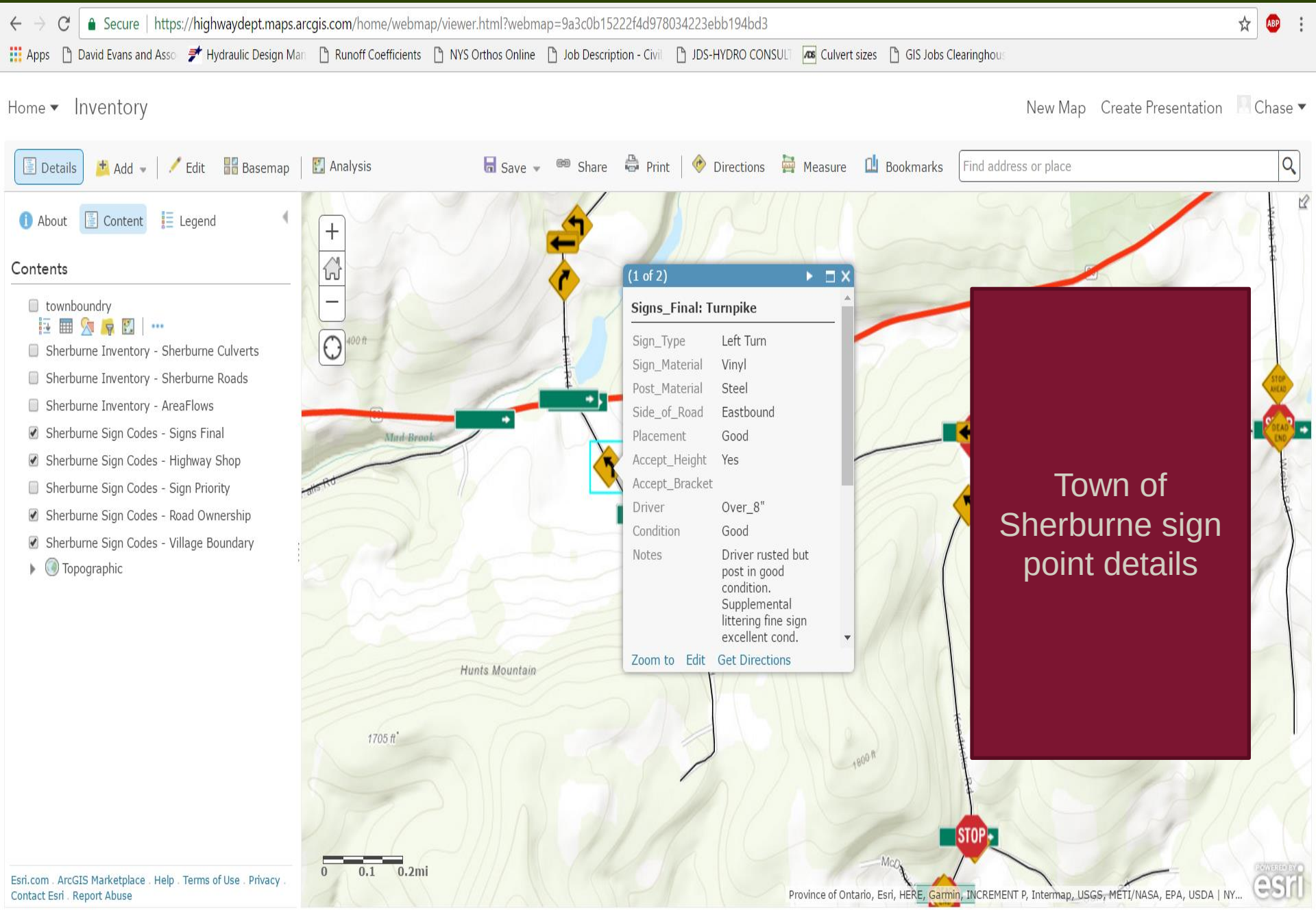
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Apps
David Evans and Asso
Hydraulic Design Mar
Runoff Coefficients
NYS Orthos Online
Job Description - Civil
JDS-HYDRO CONSULT
Culvert sizes
GIS Jobs Clearinghous
Home
Inventory
New Map
Create Presentation
Chase
Details
Add
Edit
Basemap
Analysis
Save
Share
Print
Directions
Measure
Bookmarks
Find address or place
About
Content
Legend
Contents
townboundry
Sherburne Inventory - Sherburne Culverts
Sherburne Inventory - Sherburne Roads
Sherburne Inventory - AreaFlows
Sherburne Sign Codes - Signs Final
Sherburne Sign Codes - Highway Shop
Sherburne Sign Codes - Sign Priority
Sherburne Sign Codes - Road Ownership
Sherburne Sign Codes - Village Boundary
Topographic
(1 of 2)
Signs_Final: Turnpike
Sign_Type Left Turn
Sign_Material Vinyl
Post_Material Steel
Side_of_Road Eastbound
Placement Good
Accept_Height Yes
Accept_Bracket
Driver Over_8"
Condition Good
Notes Driver rusted but post in good condition. Supplemental littering fine sign excellent cond.
Zoom to
Edit
Get Directions
Mud Brook
Hunts Mountain
1705 ft
1800 ft
STOP
STOP AHEAD
DEAD END
0
0.1
0.2mi
Province of Ontario, Esri, HERE, Garmin, INCREMENT P, Intermap, USGS, METI/NASA, EPA, USDA | NY...
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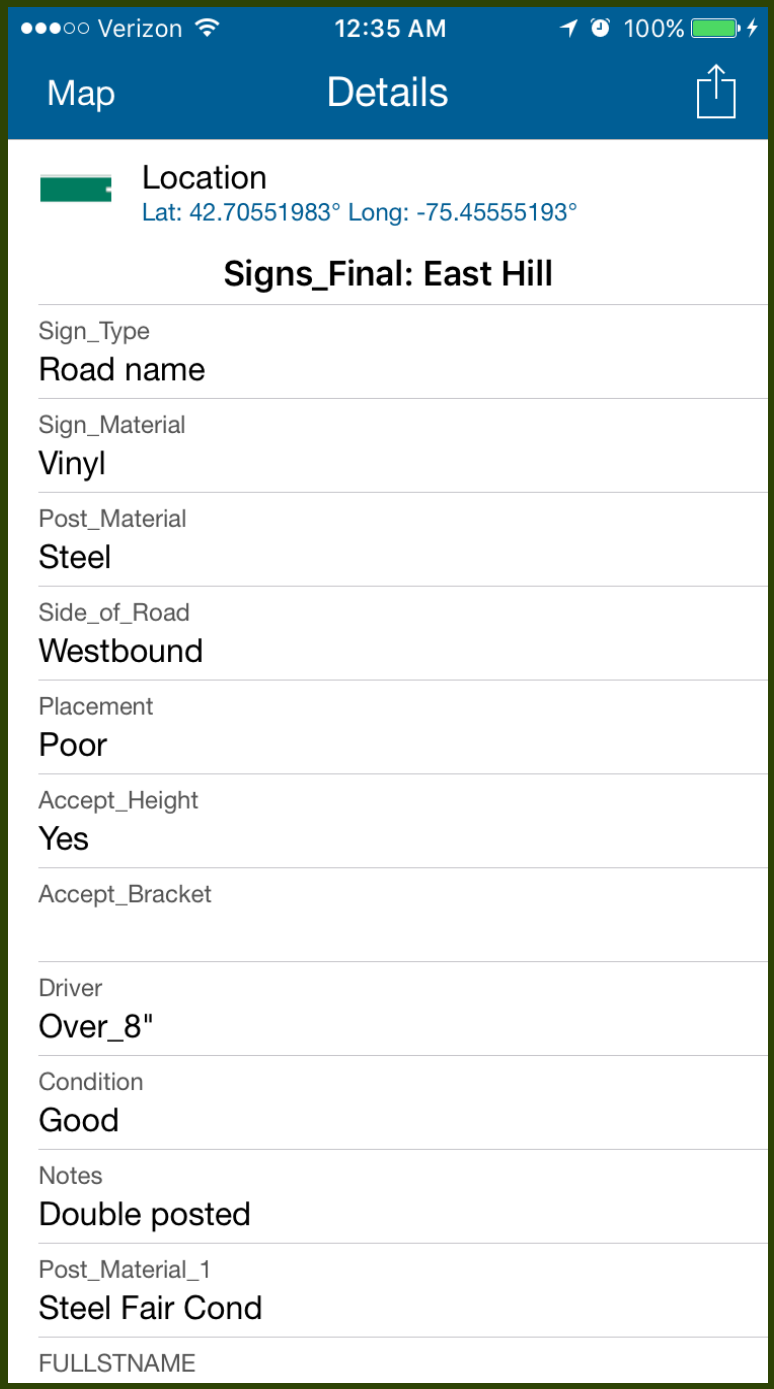
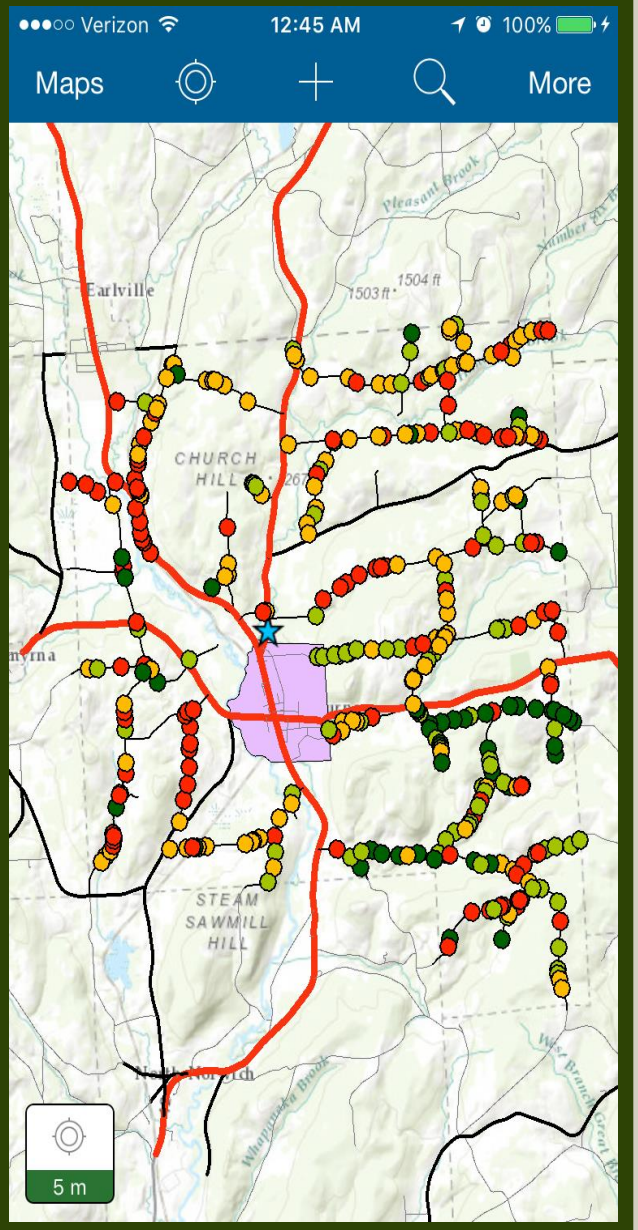
Contact Esri . Report Abuse
Town of Sherburne sign point details



Collector: Accessing Attributes and Attached Photos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Earlville
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1504 ft
CHURCH HILL
STEAM SAWMILL HILL
5 m

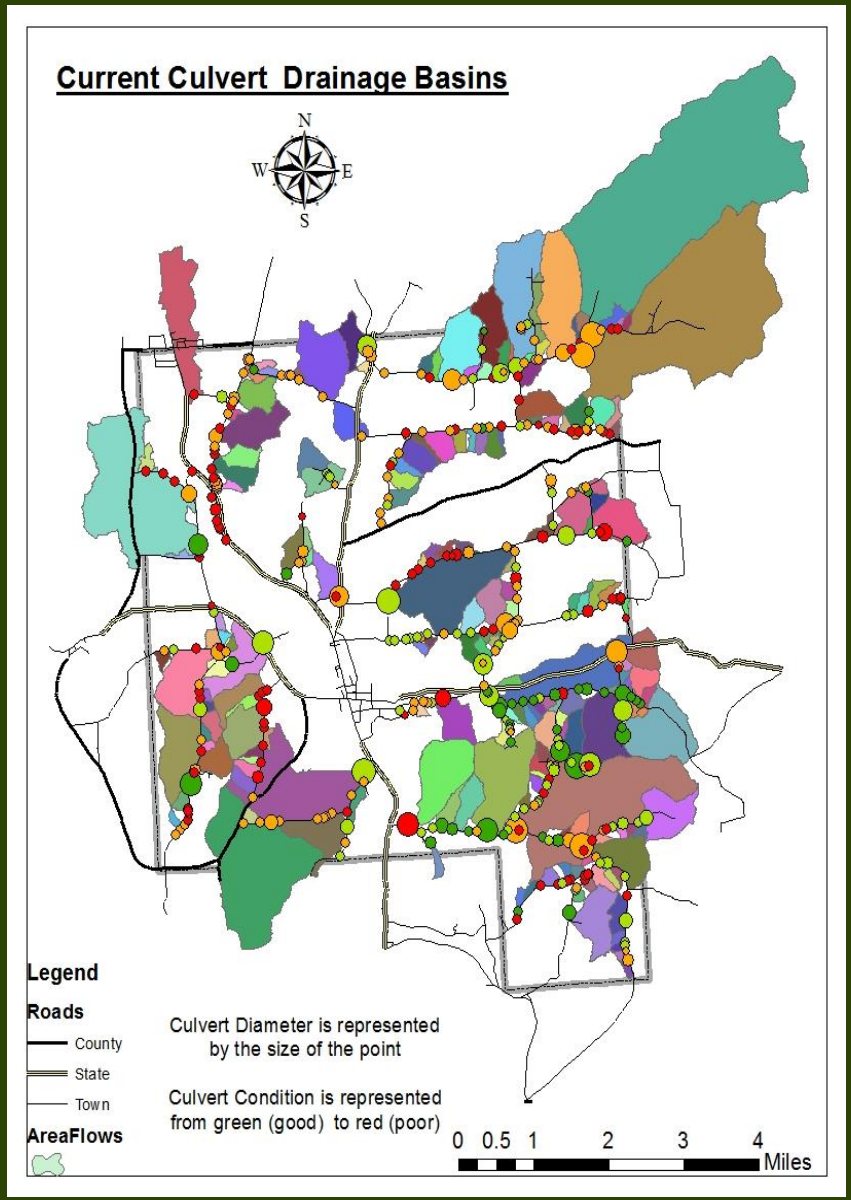

Verizon
12:45 AM
100%
Maps
More
5 m

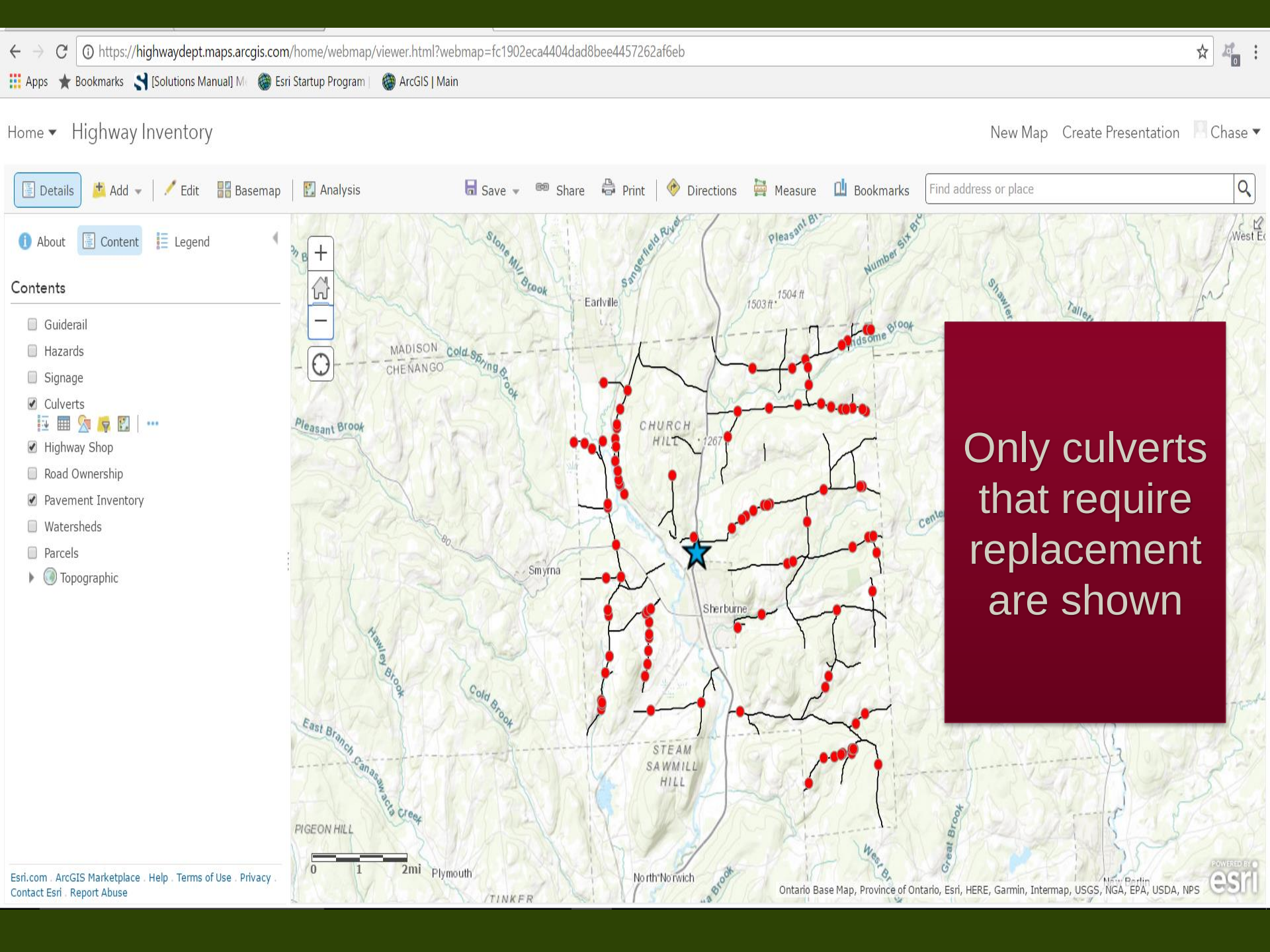

Verizon
12:52 AM
100%
Maps
More
465 m
5 m
Sherburne_Culverts: Plastic
Plastic

Culvert Sizing and Removal

Remove unnecessary culverts and size remaining culverts using GIS

- Used rational method for flow rate calculation
  - **Land-cover**
  - **Elevation**
  - **SSURGO Soils – Hydrologic Group**
- Export all variables into excel to solve for flow-rate using Macro
- Associate flow rate to culvert size
- Link excel data to attribute table

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Highway Inventory
New Map
Create Presentation
Chase
Details
Add
Edit
Basemap
Analysis
Save
Share
Print
Directions
Measure
Bookmarks
Find address or place
About
Content
Legend
Contents
Guiderail
Hazards
Signage
Culverts
Highway Shop
Road Ownership
Pavement Inventory
Watersheds
Parcels
Topographic
Only culverts that require replacement are shown
Earlville
MADISON
CHENANGO
Cold Spring Brook
Pleasant Brook
CHURCH HILL
Smyrna
Sherburne
Hawley Brook
Cold Brook
East Branch Canasawacta Creek
STEAM SAWMILL HILL
PIGEON HILL
North Norwich
Plymouth
0
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Vehicle Routing

Annual Budget:

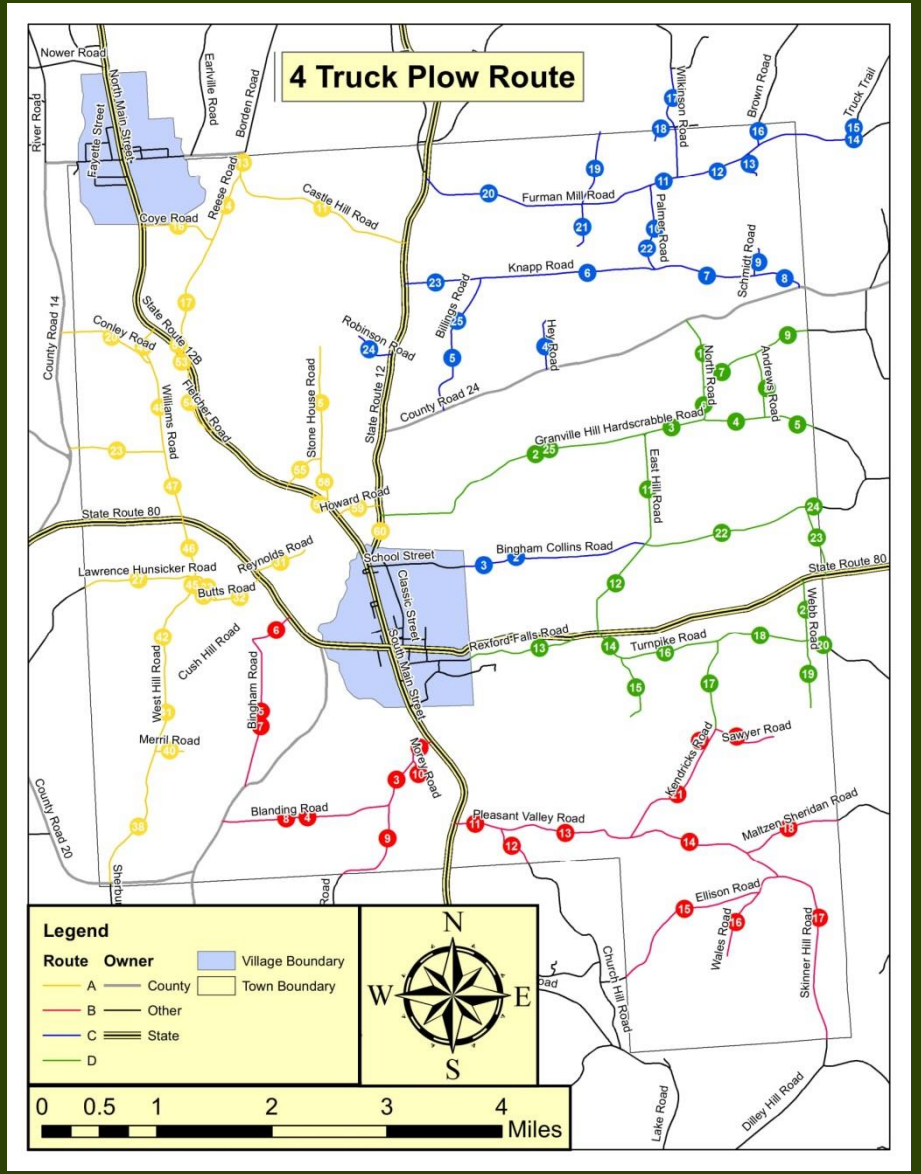
Fuel for snow removal: $60k

Maintenance: $80k

Utilized network analyst - vehicle routing problem

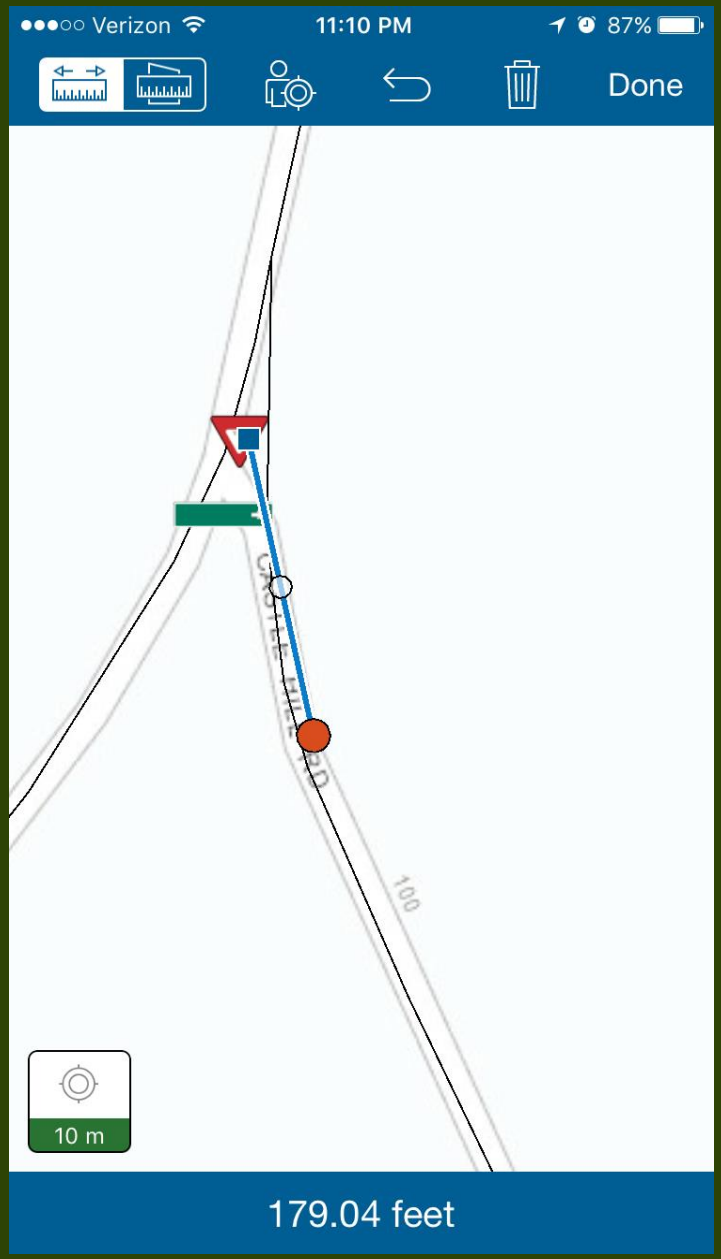
- Right turns are preferred
- Must plow both sides
- Other constraints

Cut **7 miles** per trip for both 4 truck plow and 3 truck sanding routes



Roadway Sign Distance and Speed

Increase standardization and safety while reducing liability

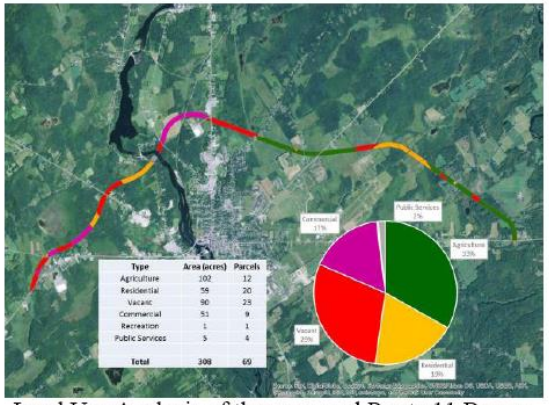


Clarkson University: C3G and GIS

Clarkson UNIVERSITY defy convention

Clarkson CEM Consulting Group (C3G) & GIS Support

- Student Run/Faculty Managed Service Provider
- Clarkson CEM Program can offer clients:
  - As-Built Documentation
  - **GIS Services**
  - Project Scoping and Conceptual Development
  - Community, Urban, and Transportation Planning
  - Rough Order of Magnitude and Parametric Cost Estimating
  - Periodic Maintenance Planning, Building Investigations
  - Construction/Facilities Education Services
  - Land Use Planning and Sustainable Stewardship
- Example Projects:
  - **Potsdam/Canton Route 11 Bypass Geographic Information System (GIS) and Land-Use Study**
  - **Clarkson University Buildings Mapping, GIS Implementation and Facility Management Interoperability**
  - **City of Watertown, ADA Ramp Inventory**

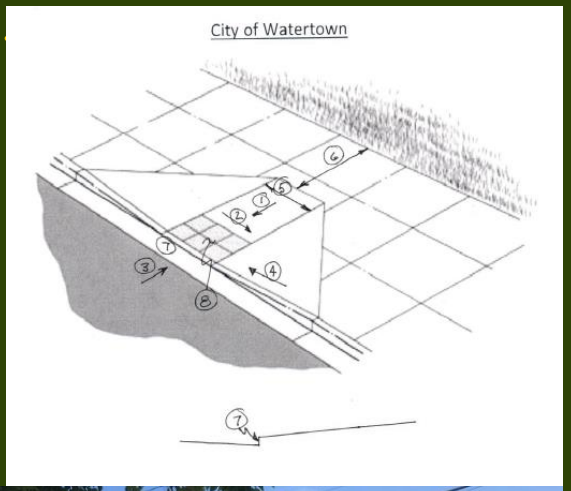


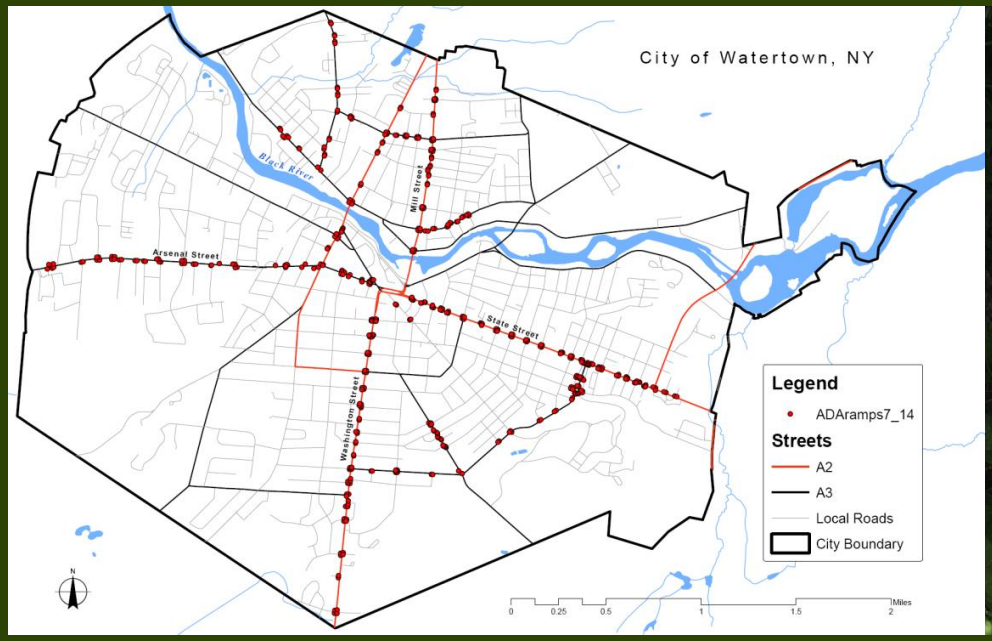
Land Use Analysis of the proposed Route 11 Bypass of Potsdam NY


Potsdam, NY Complete Streets planning imagery for improved bike infrastructure on Market Street

Watertown, NY ADA Ramp Inventory

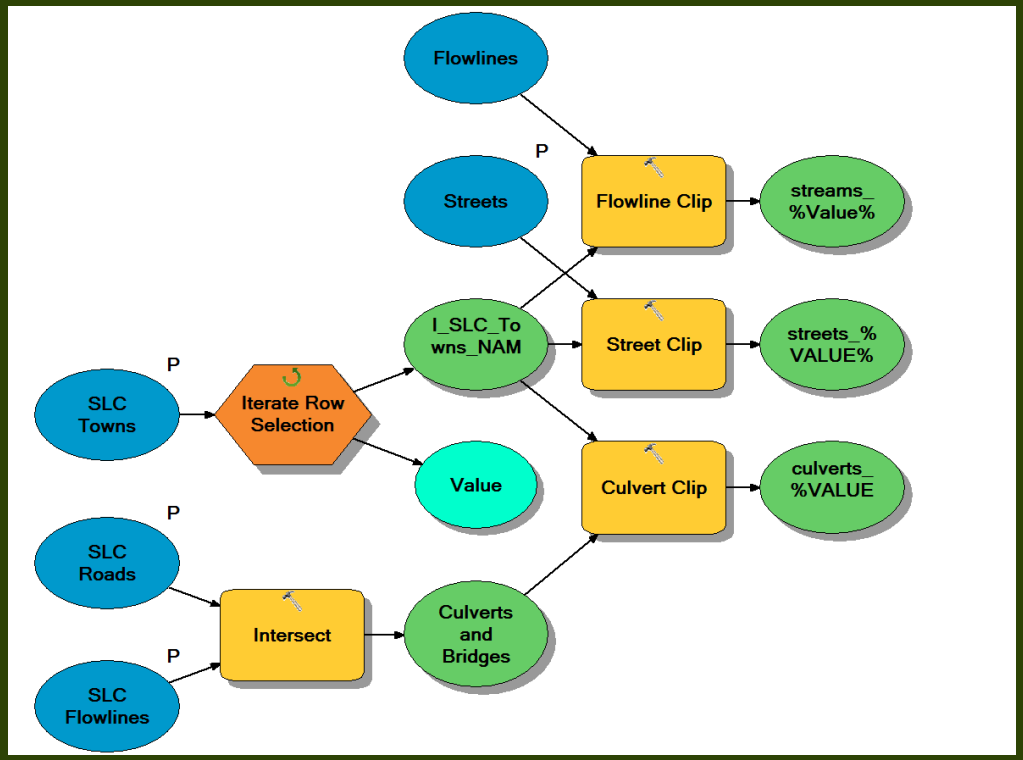
- Inventoried over 1200 sidewalk curb ramps
- 5 Student Interns, over 6 weeks of work
- Clarkson Faculty QC of work, Watertown limited QA
- Very satisfied customer





C3G Intern Program

- Goals:
  - Pair up able students with local government to accomplish asset inventory for low costs
  - Automate repetitive GeoProcessing tasks and produce models that can be re-used



Conclusion

- **Organize and sort your data**
- **See and analyze your own data**
- **The possibilities are endless**

- Contact Info:

Erik Backus – Director CEM, 315-268-6522, ebackus@clarkson.edu

Bill Olsen – GIS Coordinator, 315-268-3878, wbolsen@clarkson.edu

Charles Davidson – CEO, Davidson Associates, 315-506-8590, cdavidson@dac-btb.com

Internship Pairing with Local Municipalities

- Town of Sherburne
  - Plow Routes
  - Culvert and Signage Inventory
- Town of Sullivan
  - Signage Inventory
- Town/Village of Malone (Pending)
- City of Ogdensburg

- **Your Town!**
  - Students at Clarkson's CE301 GIS Class are being asked to inquire about Town/Municipality GIS