2017 Summer Meeting

ASCE ALABAMA SECTION

AMERICAN PUBLIC WORKS ASSOCIATION APWA

GIS Analytics for Engineering and Public Works

July 18, 2017

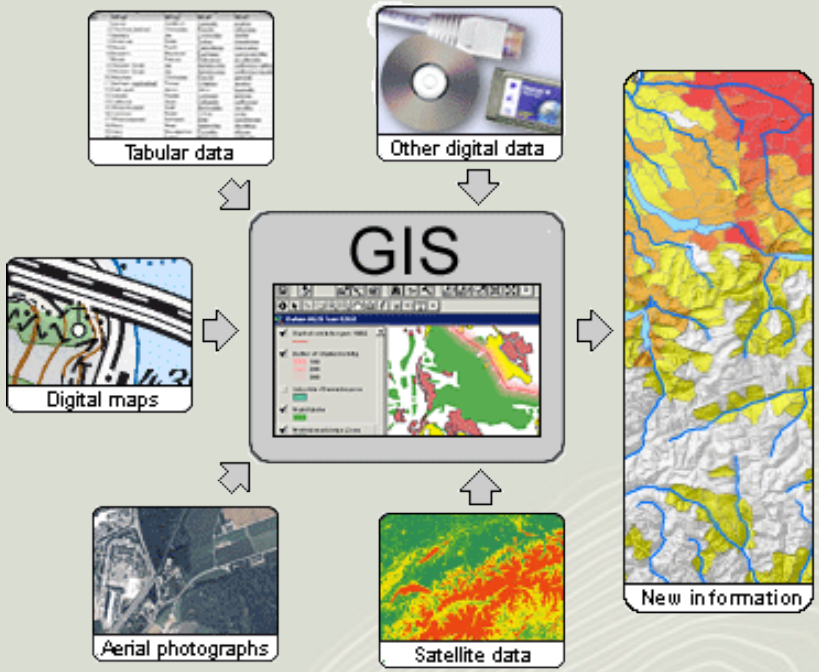
Daniel R. Mellott, GISP

SAIN associates

ENGINEERING BETTER PARTNERSHIPS

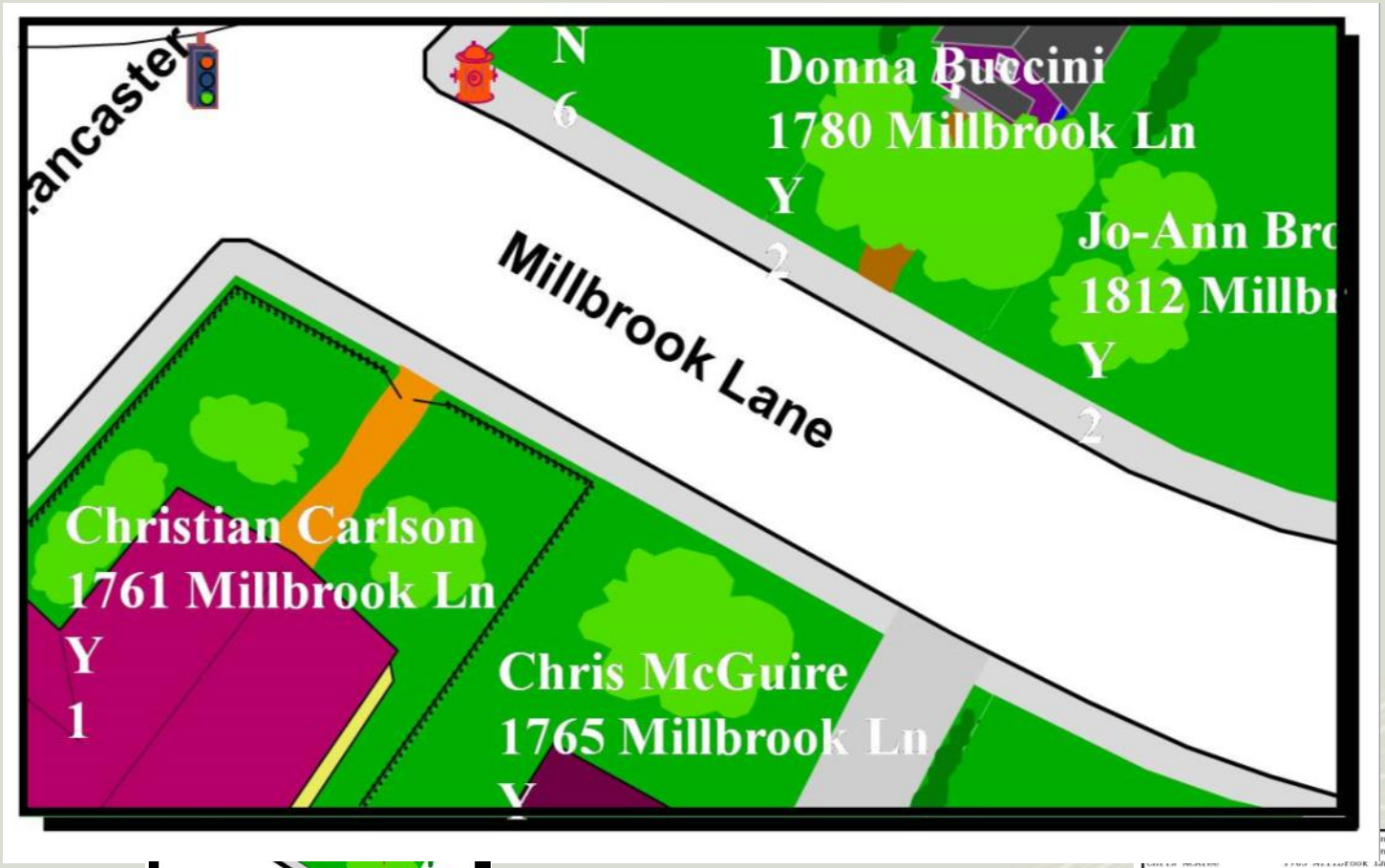
GIS Overview

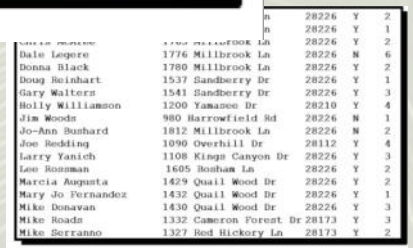
- **Geographic Information System (GIS)**
  - **A set of tools used to gather, transform, analyze, and produce information related to the surface of the Earth**
  - **Computer software that maps and analyzes geographic data**



SAIN associates

GIS Overview





	28226	Y	2
	28226	Y	1
	28226	Y	2
Dale Legere	1776 Millbrook Ln	28226	N	6
Donna Black	1780 Millbrook Ln	28226	Y	2
Doug Reinhart	1537 Sandberry Dr	28226	Y	1
Gary Walters	1541 Sandberry Dr	28226	Y	3
Holly Williamson	1200 Yamacee Dr	28210	Y	4
Jim Woods	980 Harrowfield Rd	28226	N	1
Jo-Ann Bushard	1812 Millbrook Ln	28226	N	2
Joe Bedding	1090 Overhill Dr	28112	Y	4
Larry Yanich	1108 Kings Canyon Dr	28226	Y	3
Lee Rossman	1605 Bonham Ln	28226	Y	2
Marcia Augusta	1429 Quail Wood Dr	28226	Y	2
Mary Jo Fernandez	1432 Quail Wood Dr	28226	Y	1
Mike Donavan	1430 Quail Wood Dr	28226	Y	3
Mike Roads	1332 Cameron Forest Dr	28173	Y	3
Mike Serranno	1327 Red Hickory Ln	28173	Y	2

SAIN associates

GIS versus CAD

- **CAD – Computer Aided Drafting**
  - Typically used for designing a product or infrastructure in 2d and 3d diagrams (displays things that are going to be created)
    - Microstation
    - AutoCAD
- **GIS – Geographic Information System**
  - Typically used to develop a relationship between data (information) and a geographic object (displays the world as it is)
    - ArcGIS (by ESRI)
    - GeoMedia (Microstation-based)
    - AutoCAD Map (AutoCAD-based)
    - MapInfo

SAIN associates

Industries Using GIS Solutions

- Electric/Gas Utilities
- Business/Marketing
- Telecommunications
- Transportation Logistics
- Petroleum & Mining
- Pipeline
- Water & Wastewater
- Health Care
- Federal Government
- National Agencies
- Environmental Mgmt.
- Local Government
- Public Sector
- Retail
- Military/Intelligence
- Computer Aided Dispatch
- Mapping
- Land Use Planning
- Real Estate & Cadastral
- Site Location
- Agriculture
- Forestry
- Land Use Planning
- Risk Management

SAIN associates

Case 1: Horizontal Curve Study

SAIN associates

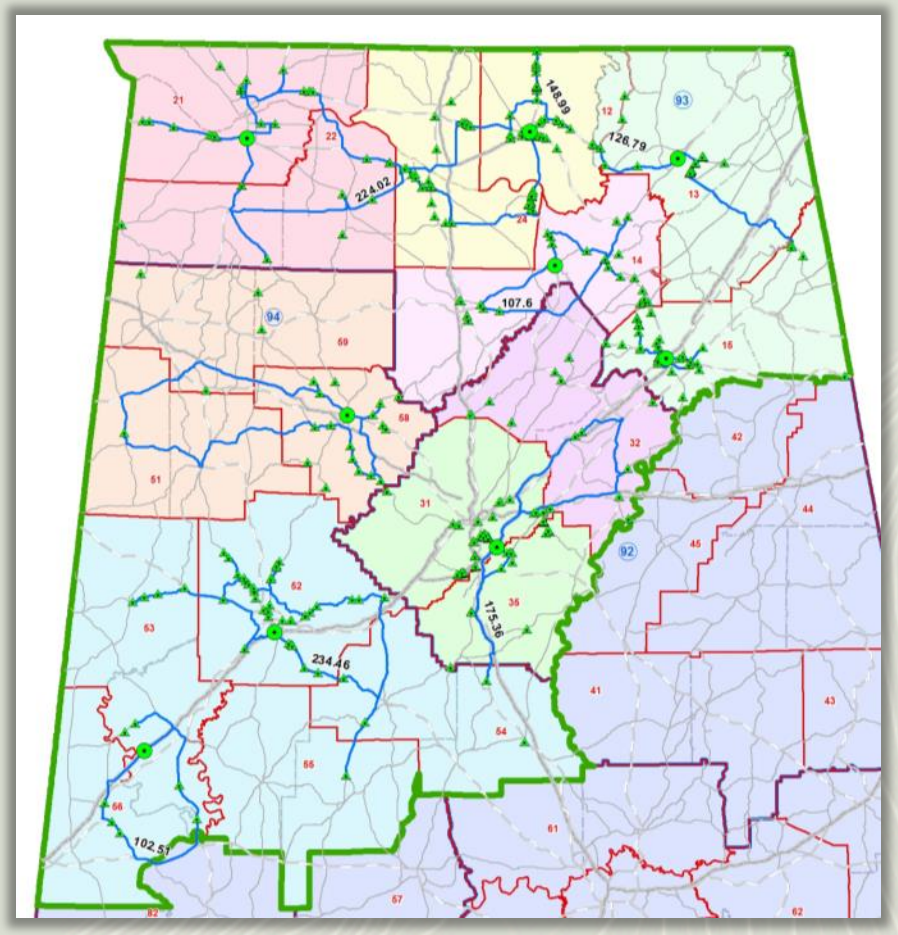
Case 1: Horizontal Curve Study

- **Project Description**
  - Field review horizontal alignment on 4,356 miles of state roads and perform Road Safety Assessment at 368 sites
- **Problem Summary**
  - Project scoping and estimating
  - Large number of sites to inspect
  - Sites are located in DOT log miles
  - Sites dispersed all over north Alabama
  - Multiple survey teams

SAIN associates

Pre-Project Planning

- **Define project areas**
- **Convert road segments to start points**
- **Identify regional “Depots”**
- **Estimate project mileage**



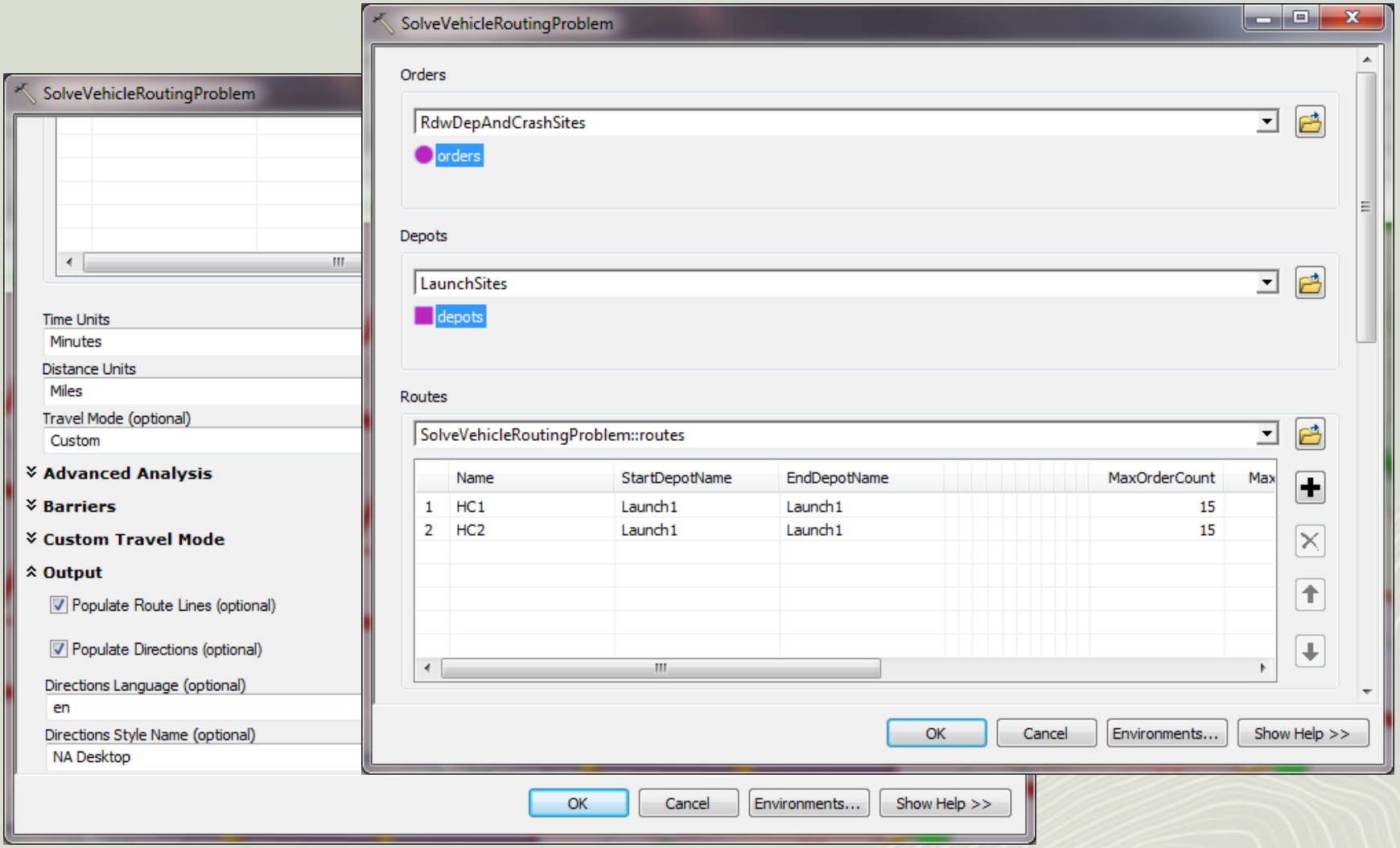
SAIN associates

Data Collection Planning

- **Estimate the number of sites that can be collected per day**
  - **Horizontal Curve Collection Sites – Up to 15 per day**
  - **Road Safety Assessment Collection Sites – Average 6 per day**
- **Use "VehicleRoutingProblem" tool to optimize routes for Horizontal Curve and Road Safety Assessment data collection**

SAIN associates

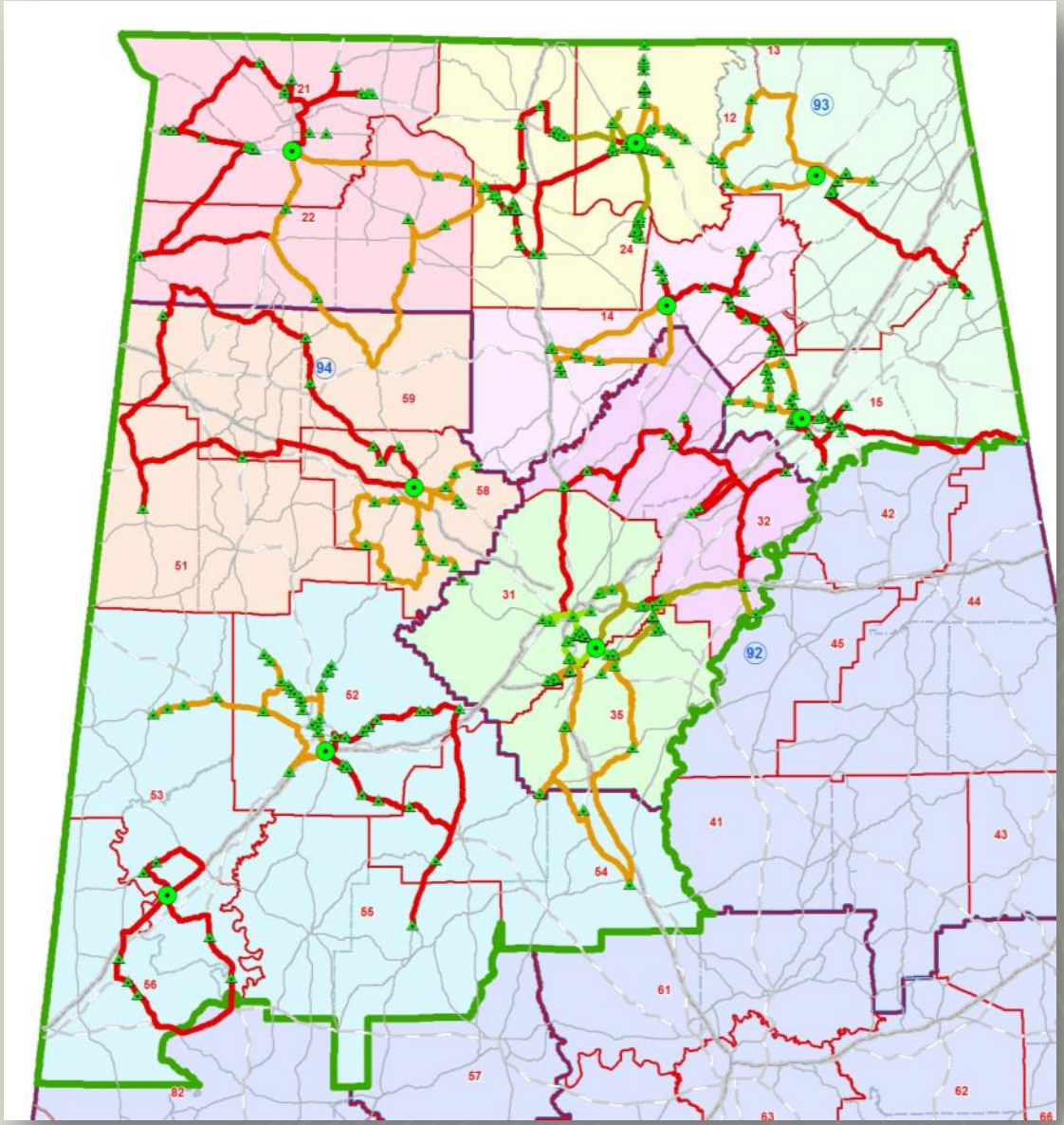
Data Collection Planning



SAIN associates

Data Collection Planning

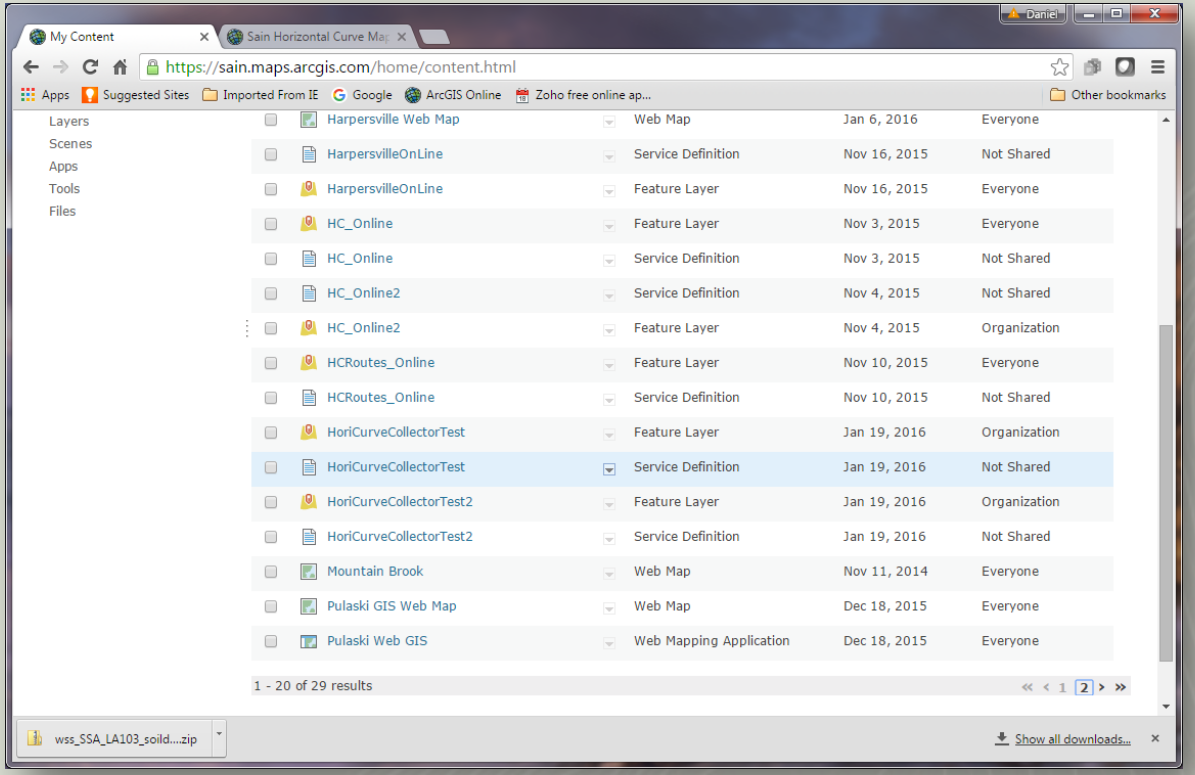
Horizontal Curve Site Routes



SAIN associates

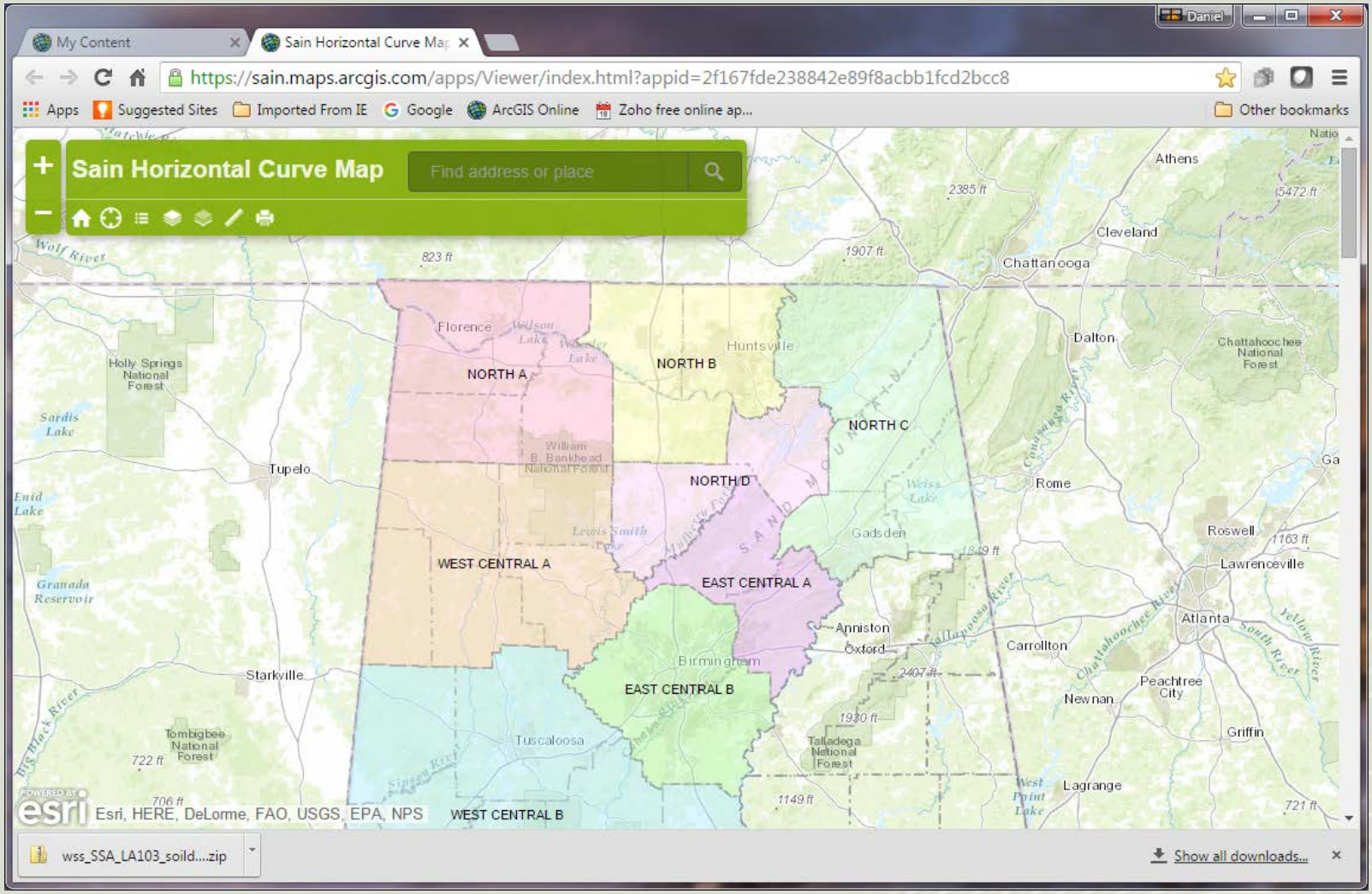
Site Location

- **Upload data to ArcGIS Online**
- **Setup a Web Mapping Application**
- **Provide instructions to Engineers**



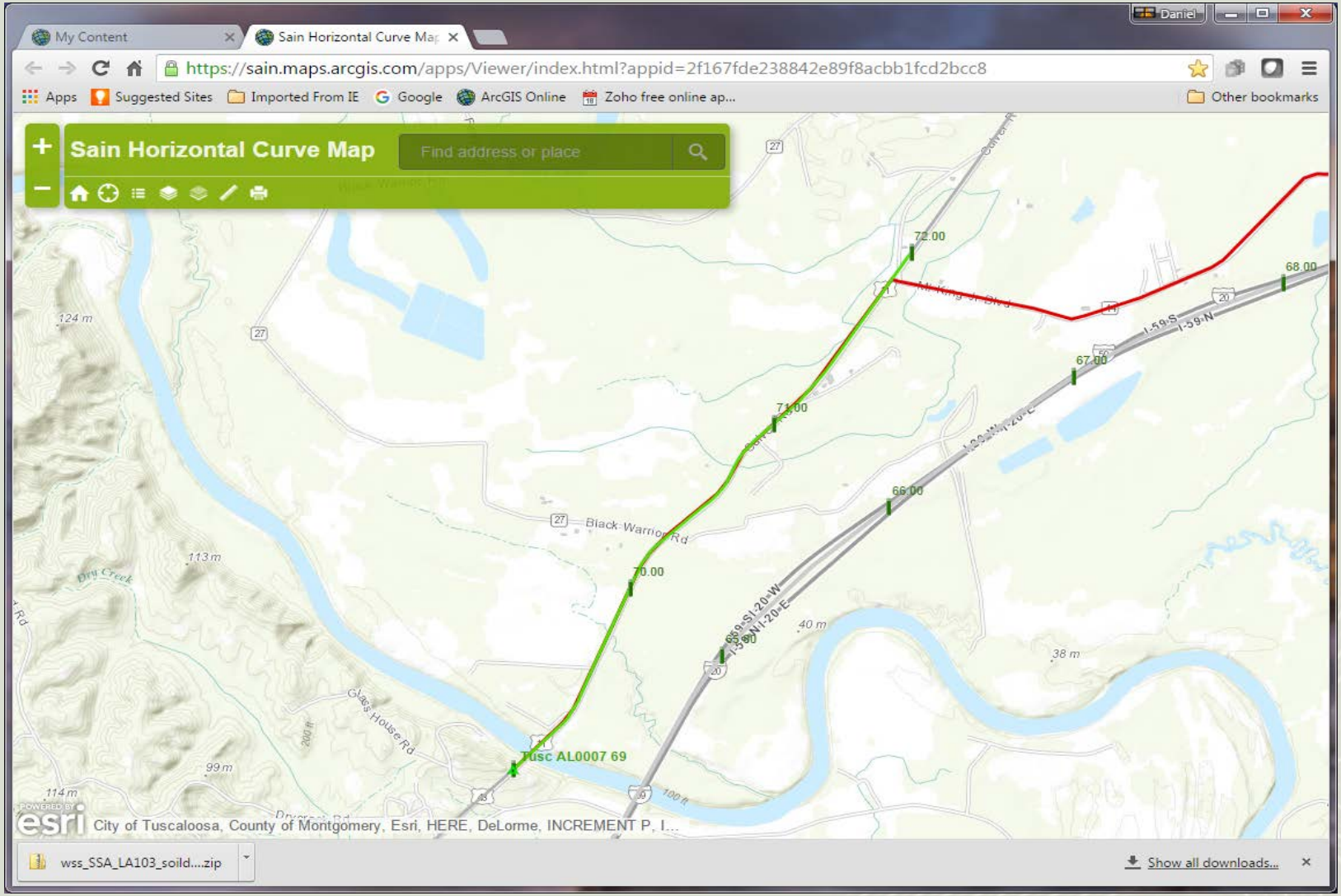
SAIN associates

Site Location



SAIN associates

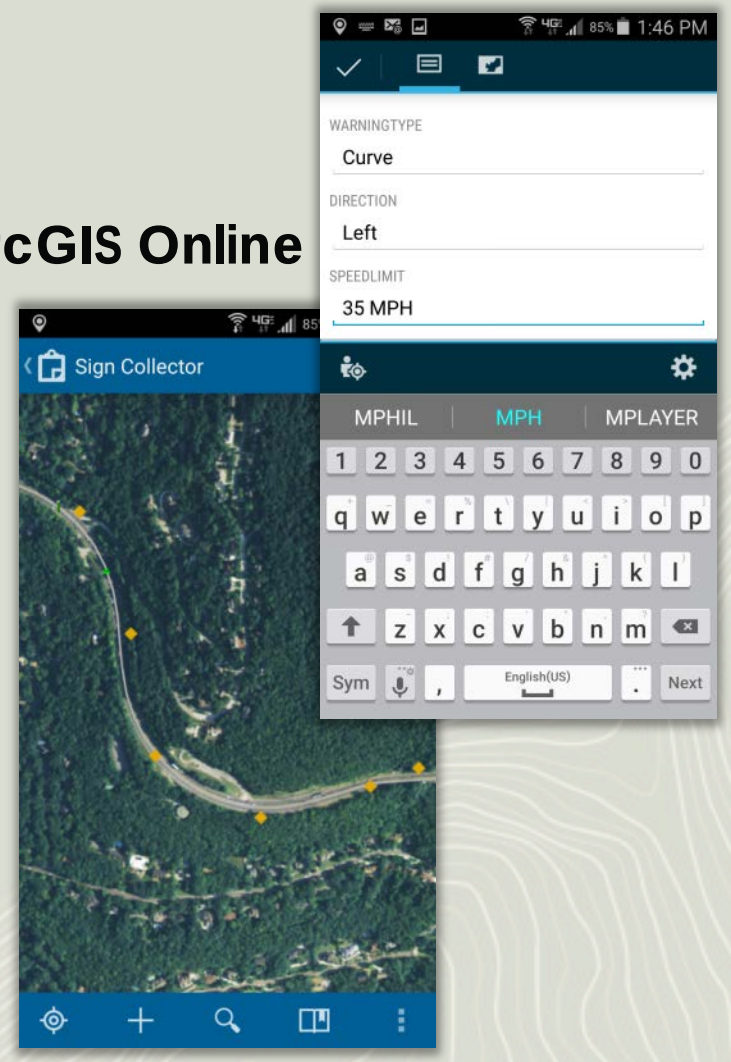
Site Location



SAIN associates

Sign Data Collection

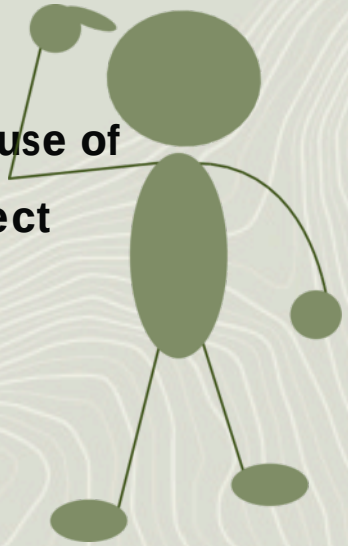
- Setup File GDB for signs to be collected
  - Define Fields
  - Define Domains
- Publish editable Feature Layer to ArcGIS Online
- Setup Web Map
- Provide instructions to Engineers



SAIN associates

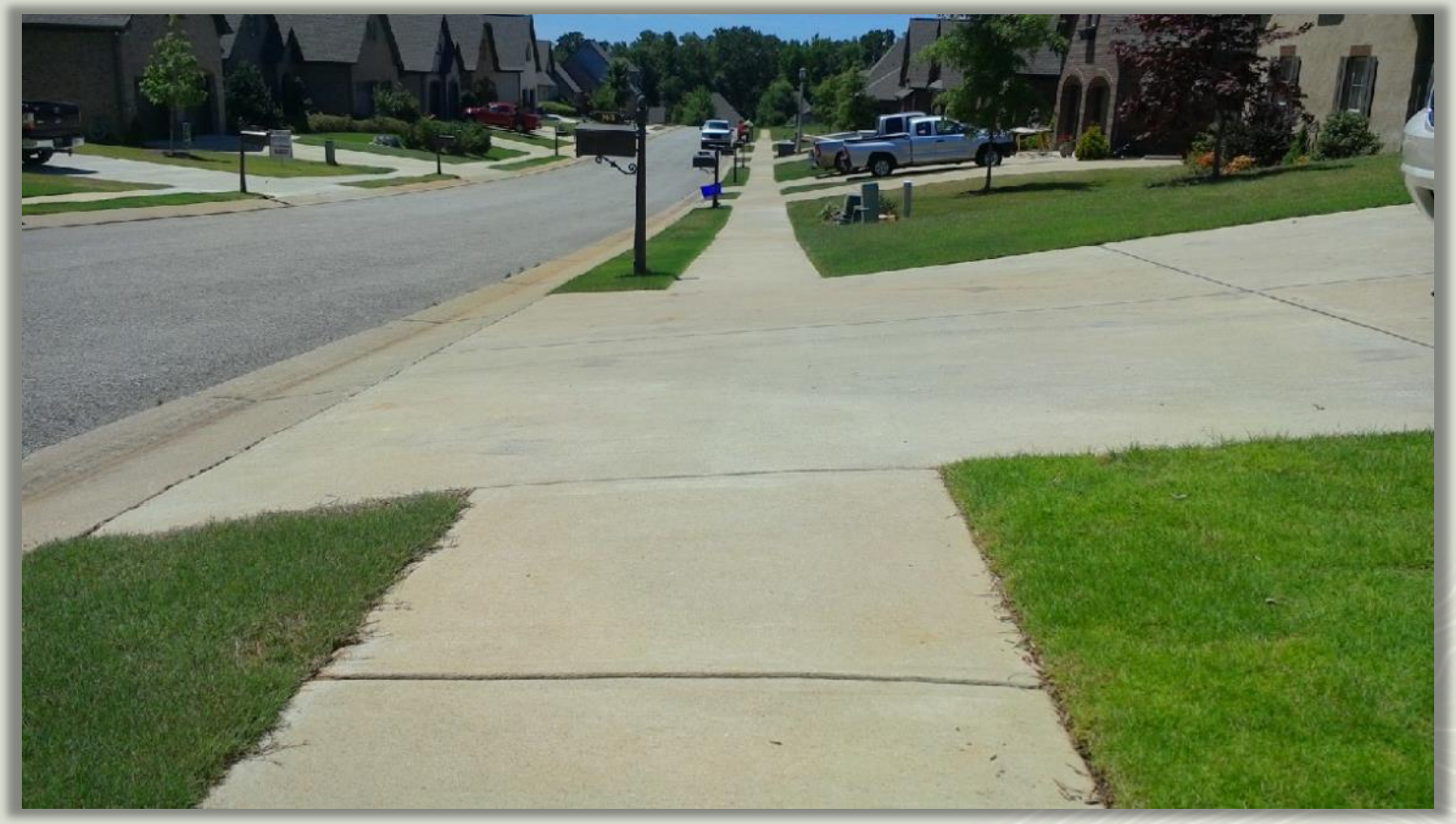
Case 1: Horizontal Curve Study

- **Lessons Learned**
  - **GIS was helpful in developing a more accurate scope of work and estimate**
  - **GIS was more effective in planning Horizontal Curve site surveys than Road Safety Assessment site surveys**
  - **The GIS Web Map Application assisted Engineers with verifying they were in the correct location for collecting site surveys because the sites were defined by log miles instead of physical features**
  - **Using the ArcCollector app tended to be less effective because of the vehicle speed at which the Engineers were trying to collect information**



SAIN associates

Case 2: ADA Transition Plan



SAIN associates

Case 2: ADA Transition Plan

- **Project Description**
  - Collect pedestrian facilities data to develop a plan to ensure facilities are Americans with Disabilities Act (ADA) compliant
- **Problem Summary**
  - Field data collection of pedestrian facilities
  - Evaluate facilities for ADA compliance
  - Develop plan to upgrade pedestrian facilities
  - Publish results for public review

SAIN associates

Collect Pedestrian Facility Data

- **Course of Action**
  - **Develop database model for data collection**
    - Sidewalks
    - Crosswalks
    - Curb Ramps
    - Pedestrian Signals
    - On Street Parking
  - **Upload Geo-database model to ArcGIS Online for data collection**
  - **Use ArcCollector to gather field data**
    - Feature locations
    - Photos linked to pedestrian features

SAIN associates

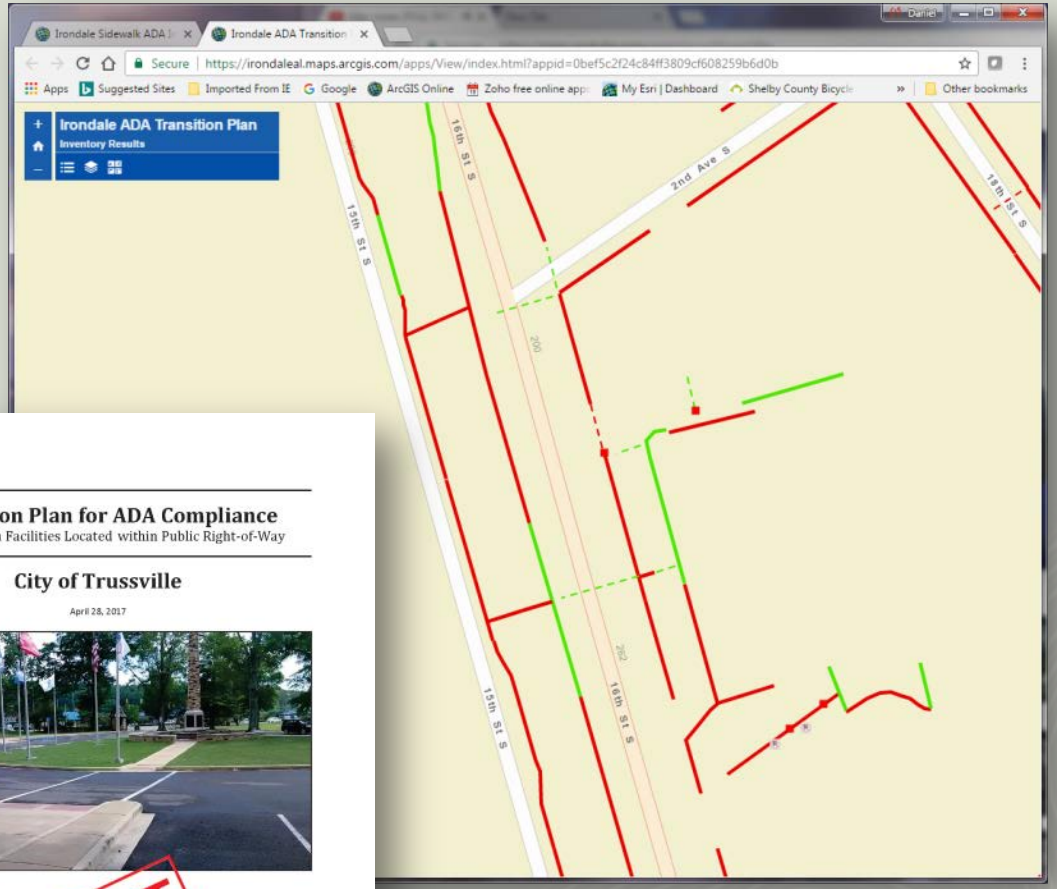
Process Facility Data

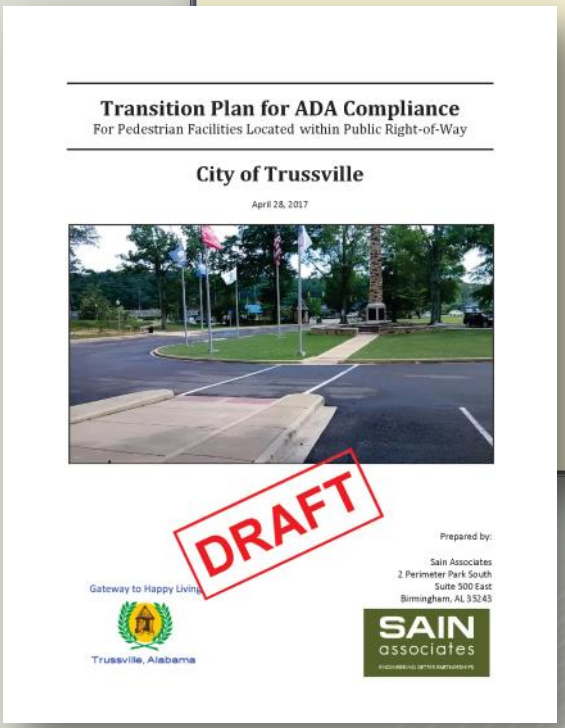
- **Course of Action**
  - **Download Pedestrian data from ArcGIS Online**
  - **Analyze data to develop severity rating**

SAIN associates

Produce Transition Plan Report

- **Course of Action**
  - **Develop Transition Plan**
  - **Publish mapping results with ArcGIS Online for public review**

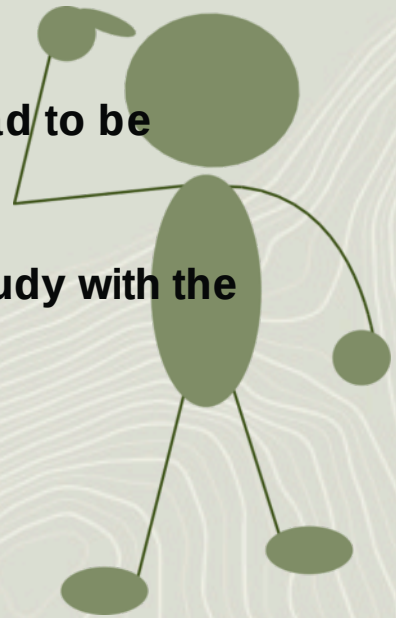




SAIN associates

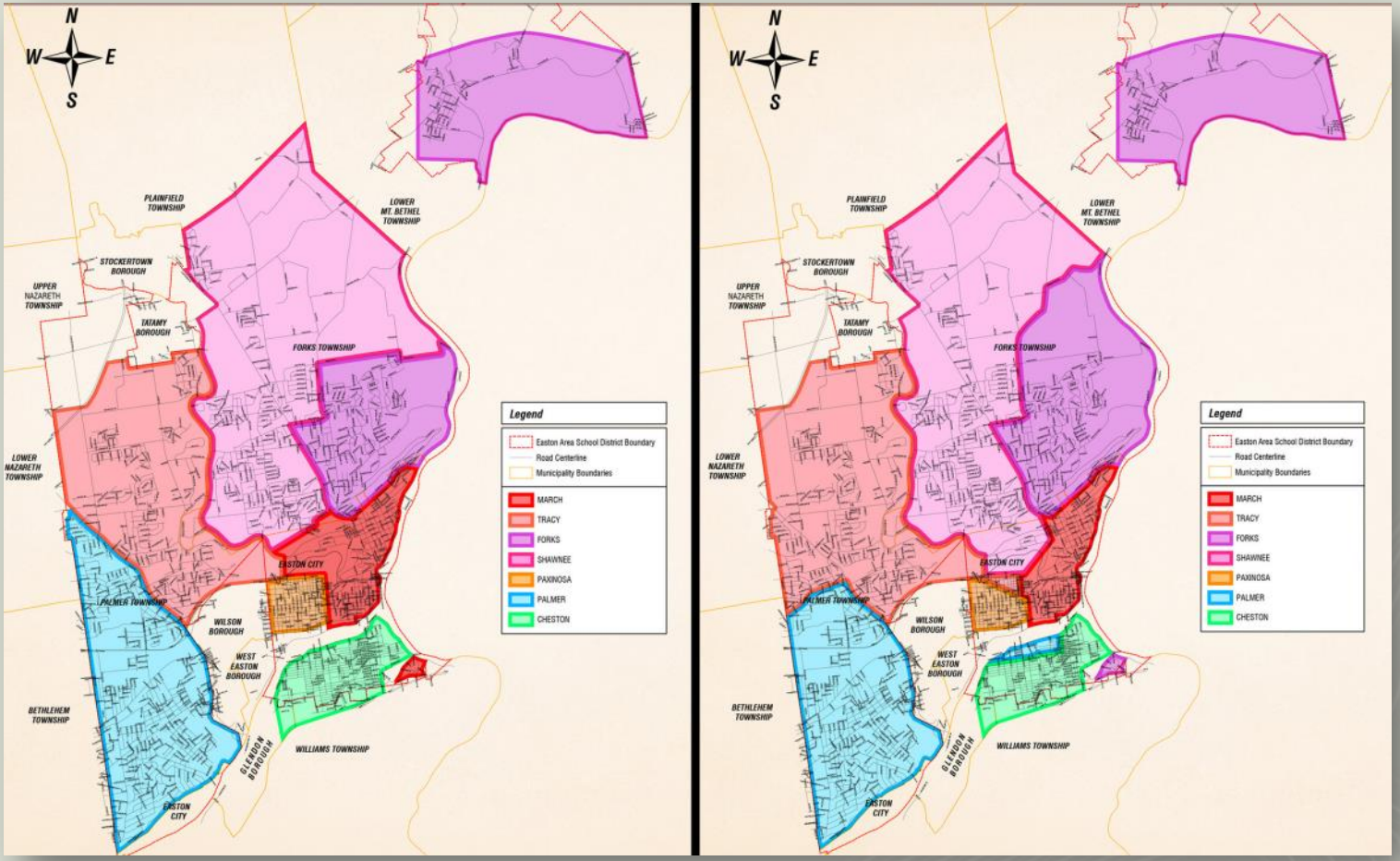
Case 2: ADA Transition Plan

- **Lessons Learned**
  - **A standard Geodatabase model could be used across multiple projects**
  - **Using ArcCollector for data collection saved time by …**
    - **Inputting data one time; in the field**
    - **Using GIS for compiling data**
    - **Allowing input data to transition directly to report maps**
  - **Using ArcCollector improved quality because it only had to be input once; directly in the field**
  - **ArcGIS Online made it easy to share the results of the study with the public**



SAIN associates

Case 3: School Redistricting



N
W
E
S
PLAINFIELD TOWNSHIP
LOWER MT. BETHEL TOWNSHIP
STOCKERTOWN BOROUGH
UPPER NAZARETH TOWNSHIP
TATAMY BOROUGH
FORKS TOWNSHIP
LOWER NAZARETH TOWNSHIP
EASTON CITY
PALMER TOWNSHIP
WILSON BOROUGH
WEST EASTON BOROUGH
BETHLEHEM TOWNSHIP
GLENDON BOROUGH
WILLIAMS TOWNSHIP
EASTON CITY
Legend
Easton Area School District Boundary
Road Centerline
Municipality Boundaries
MARCH
TRACY
FORKS
SHAWNEE
PAXINOSA
PALMER
CHESTON

SAIN associates

Case 3: School Redistricting

- **Project Description**
  - Use GIS mapping to help substantiate the equitable redistribution of students, based on race, affected by a school redistricting plan
- **Problem Summary**
  - Develop the existing and proposed school district boundaries
  - Determine the location of all students based on address and determine in which existing and proposed school district they reside
  - Determine the volume of students, by race and school, that will be required to change schools due to the proposed redistricting

SAIN associates

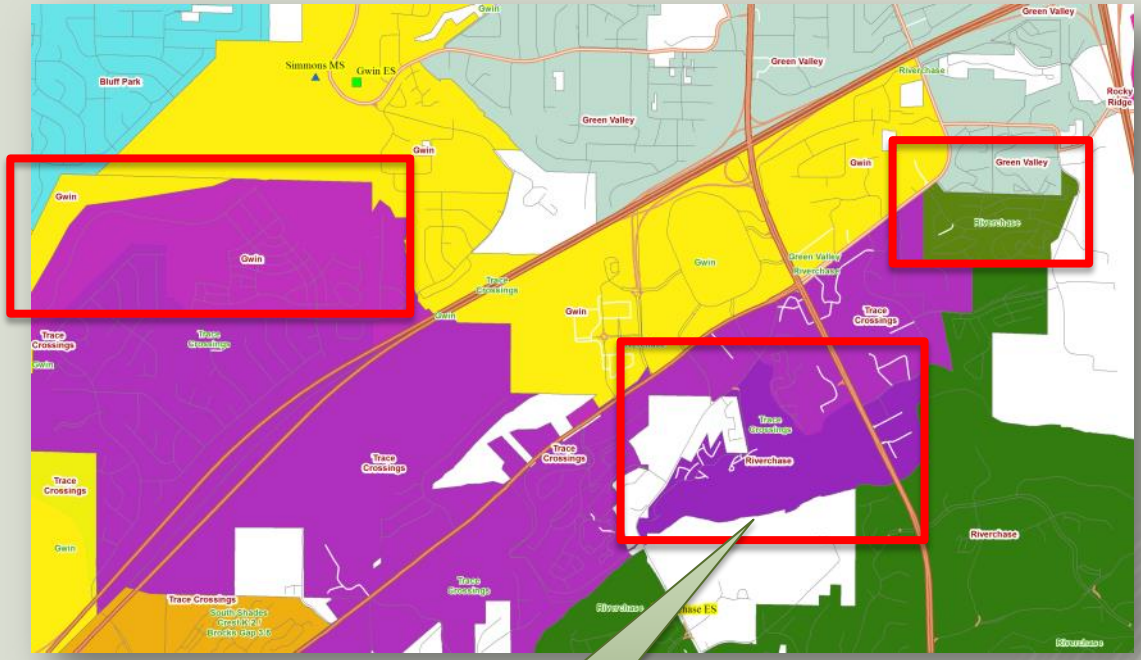
Background

- Client was an attorney working on behalf of the school district
- Student information was provided in a tabular format by the school district, along with existing and proposed school district boundaries
- Address points and other base map data was provided by the local city government
- The information was highly sensitive

SAIN associates

Collect GIS Data from Various Sources

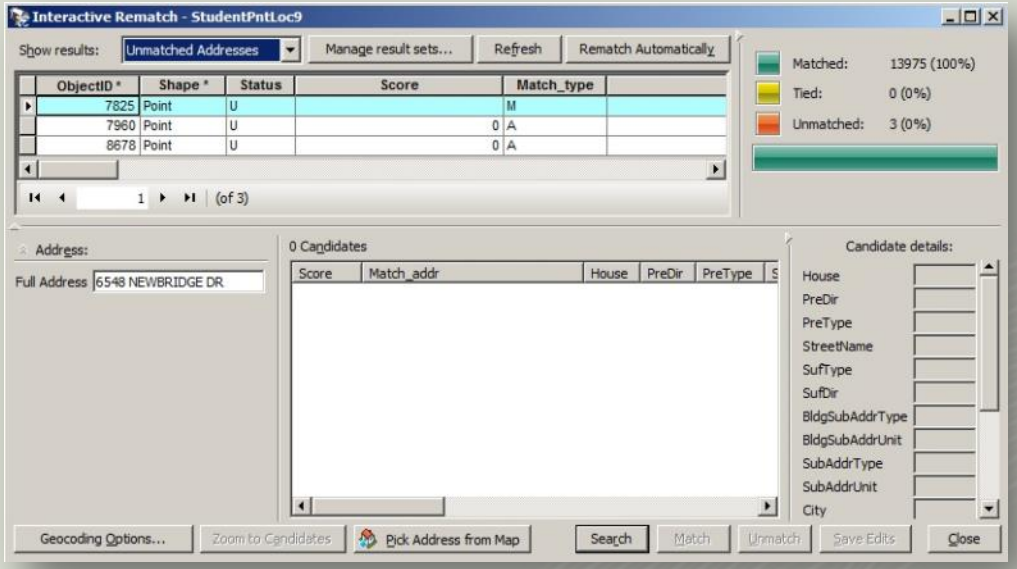
- **School District**
  - Existing Districts
  - Proposed Districts
  - School Locations
  - Student Information
- **Local Government**
  - City Boundary
  - Address Points
  - Road Centerlines



SAIN associates

Geocode Student Locations

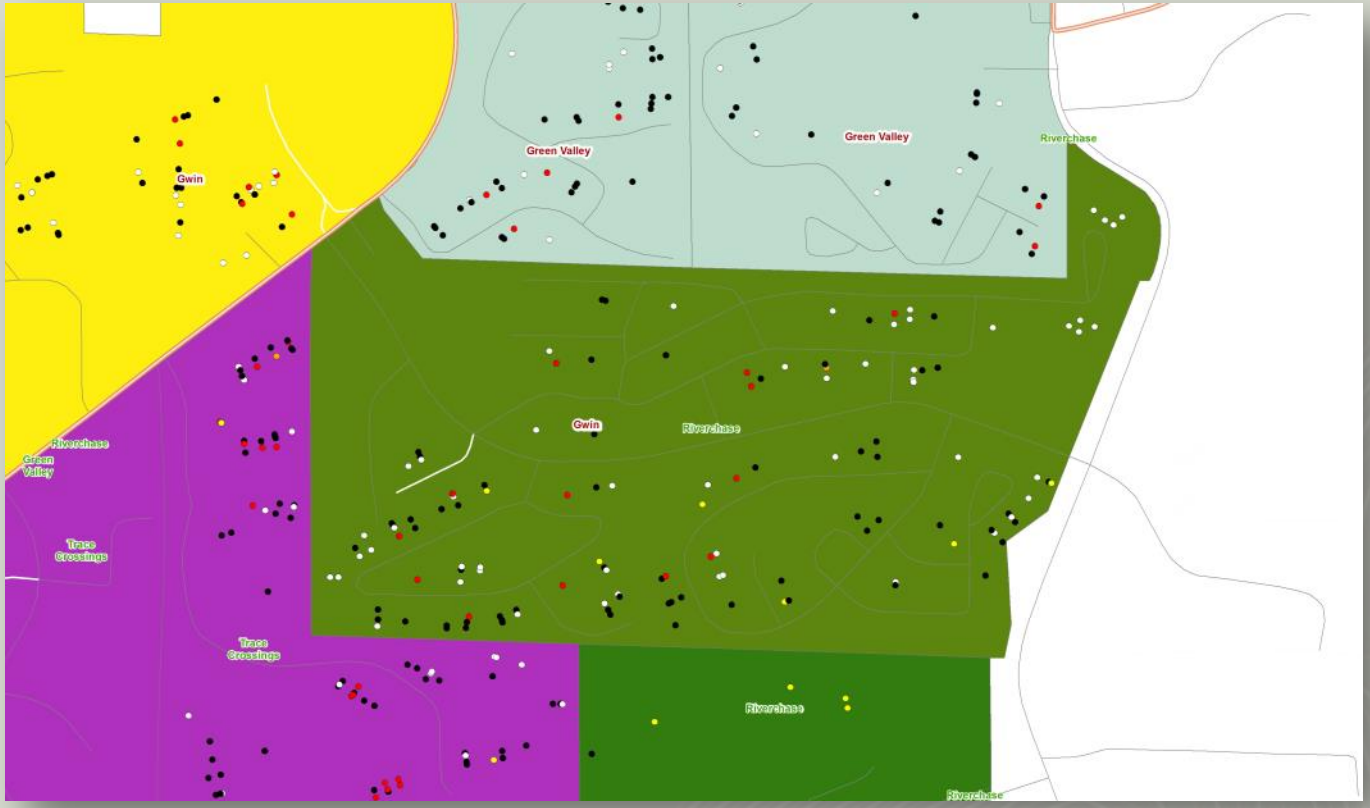
- **Setup a Geocoding Service using the address points**
- **Geocode addresses from the student database**
  - **Initial pass match rate was about 95%**
- **Manually locate all unmatched address records**
  - **Approximately 400 records**
  - **Most unmatched records related to apartment addresses**



SAIN associates

Analyze Student Data by Location

- **Develop list of students to be affected by the redistricting**
- **Summarize student counts by school district and race**



SAIN associates

Case 3: School Redistricting

- **Lessons Learned**
  - **It is important to have both accurate address base map data and source reference addresses when geocoding locations**
  - **GIS analytics is perfect for overlaying multiple feature layers and showing the spatial changes that occur**
  - **GIS allows users to perform complex calculations using many different parameters in a geospatial context**

SAIN associates

Case 4: Access Management Plan

PREPARED FOR

ALDOT Southeast Region
100 Capital Commerce Boulevard
Suite 210, Building B
Montgomery, AL 36117

This is a preliminary document. Not to be used for construction, bidding, recordation, conveyance, sales, or as the basis for the issuance of a permit.

Jeff Stephenson, P.E.
AL License #25129

PREPARED BY

SAIN associates

Sain Associates
Two Perimeter Park South, Suite 500 East
Birmingham, AL 35243

SAIN associates

Case 4: Access Management Plan

- **Project Description**
  - **Develop an Access Management Plan to alleviate traffic congestion issues**
- **Problem Summary**
  - **Need to collect existing conditions**
  - **Perform field survey**
  - **Produce concept maps showing plan recommendations**

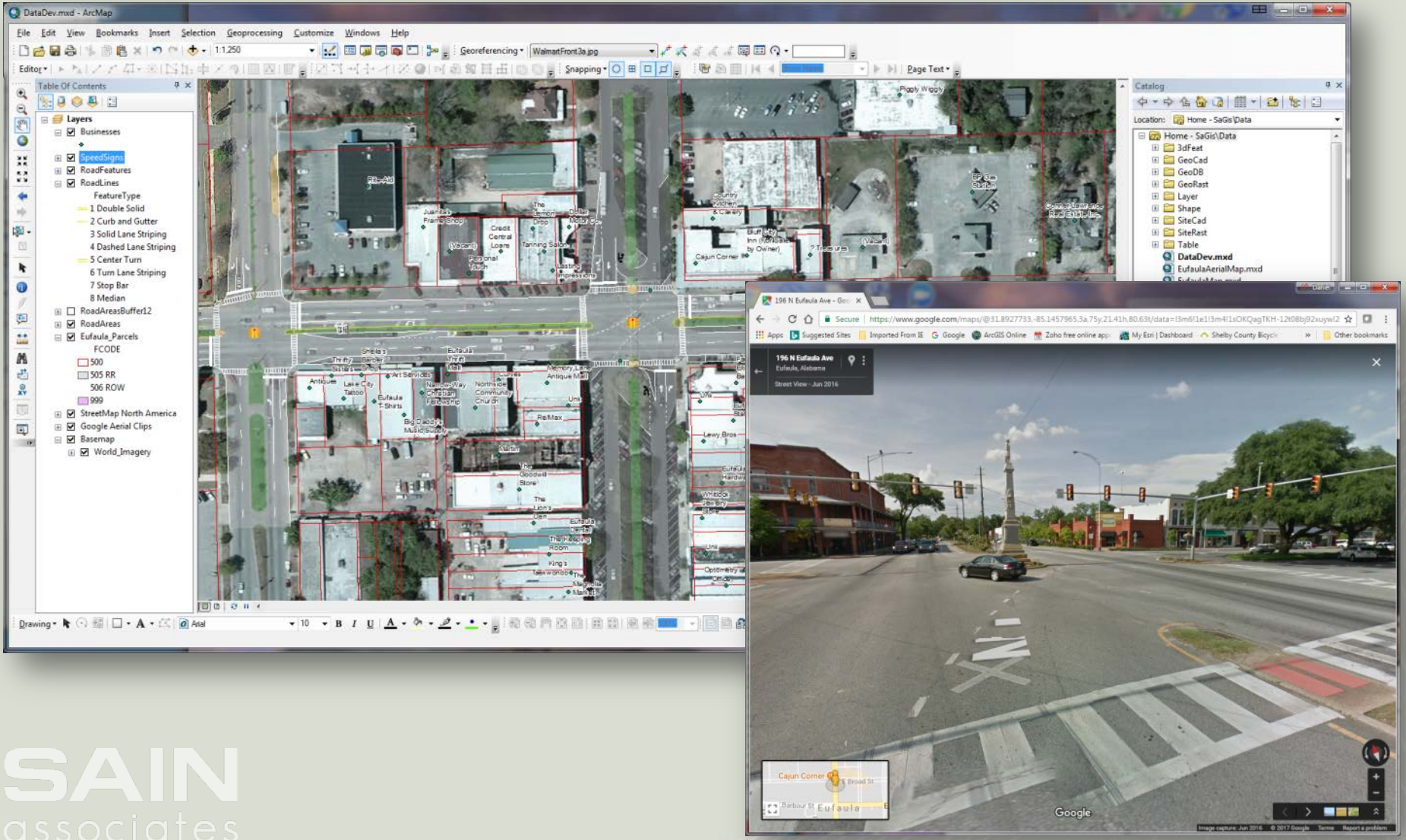
SAIN associates

Develop Existing Conditions Data

- **Course of Action**
  - Use aerial photography base map
  - Clip and geo-reference aerial updates from various sources
  - Develop road features
    - Paved areas (roads, driveways parking areas)
    - Road striping and markings
    - Speed limit signs
    - Business locations
  - Obtain parcel data from local government
  - Use Google StreetView to verify information

SAIN associates

Develop Existing Conditions Data



SAIN associates

Perform Field Survey

- **Course of Action**
  - **Use Map Book created by GIS**
  - **Verify business locations and names**
  - **Verify driveway and median locations**
  - **Verify speed limits**
  - **Mark up map book and return to office for updates**

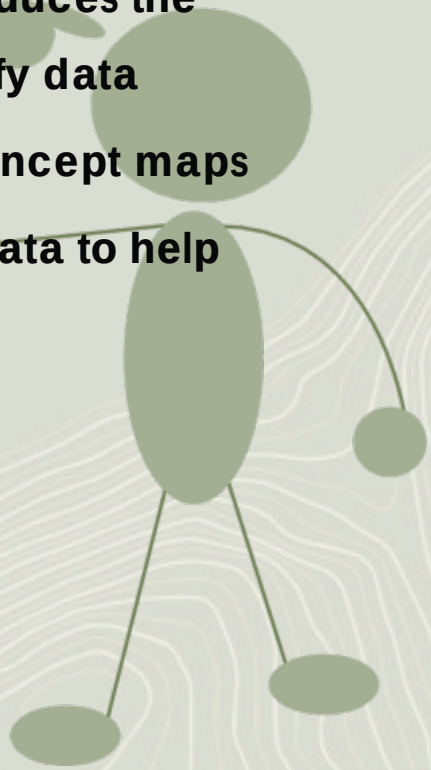
SAIN associates

Develop Concept Plans

SAIN associates

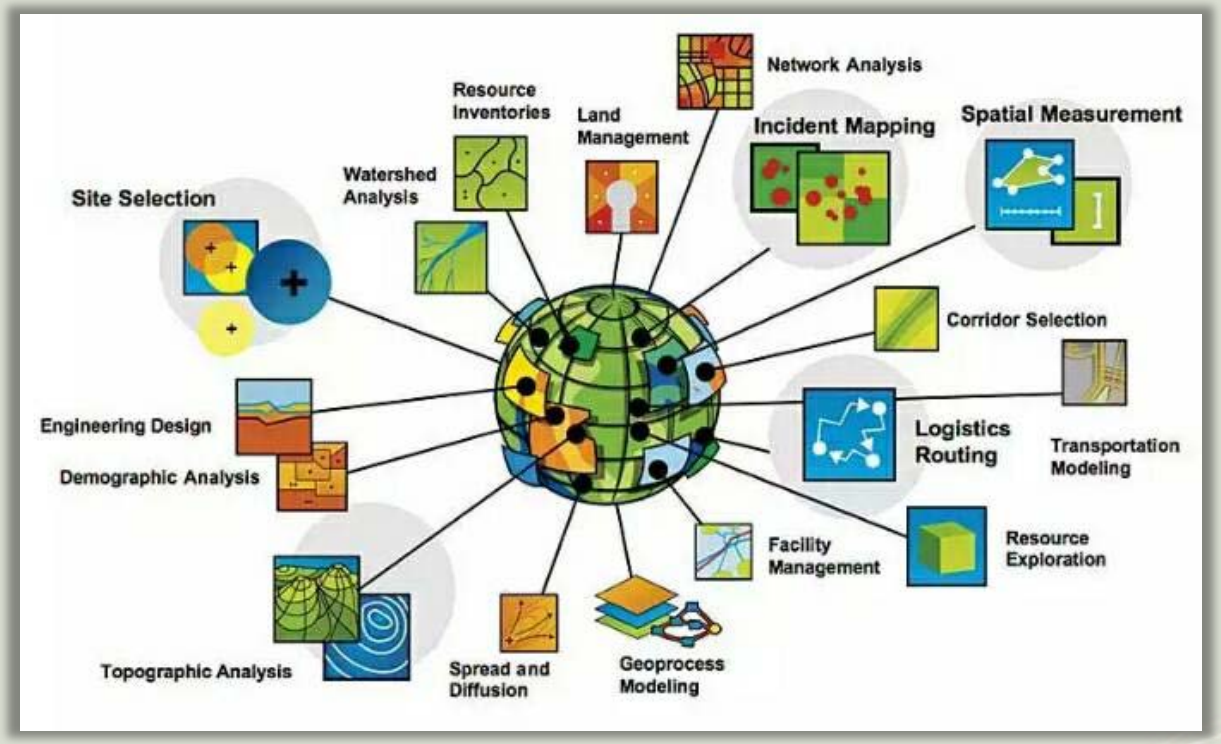
Case 4: Access Management Plan

- **Lessons Learned**
  - GIS allows us to develop existing condition information before making a trip to the field
  - Using the GIS to develop existing conditions greatly reduces the amount of time required in the field to collect and verify data
  - GIS helps produce more accurate and high quality concept maps
  - Volume data can be extracted directly from the GIS data to help produce more accurate cost estimates



SAIN associates

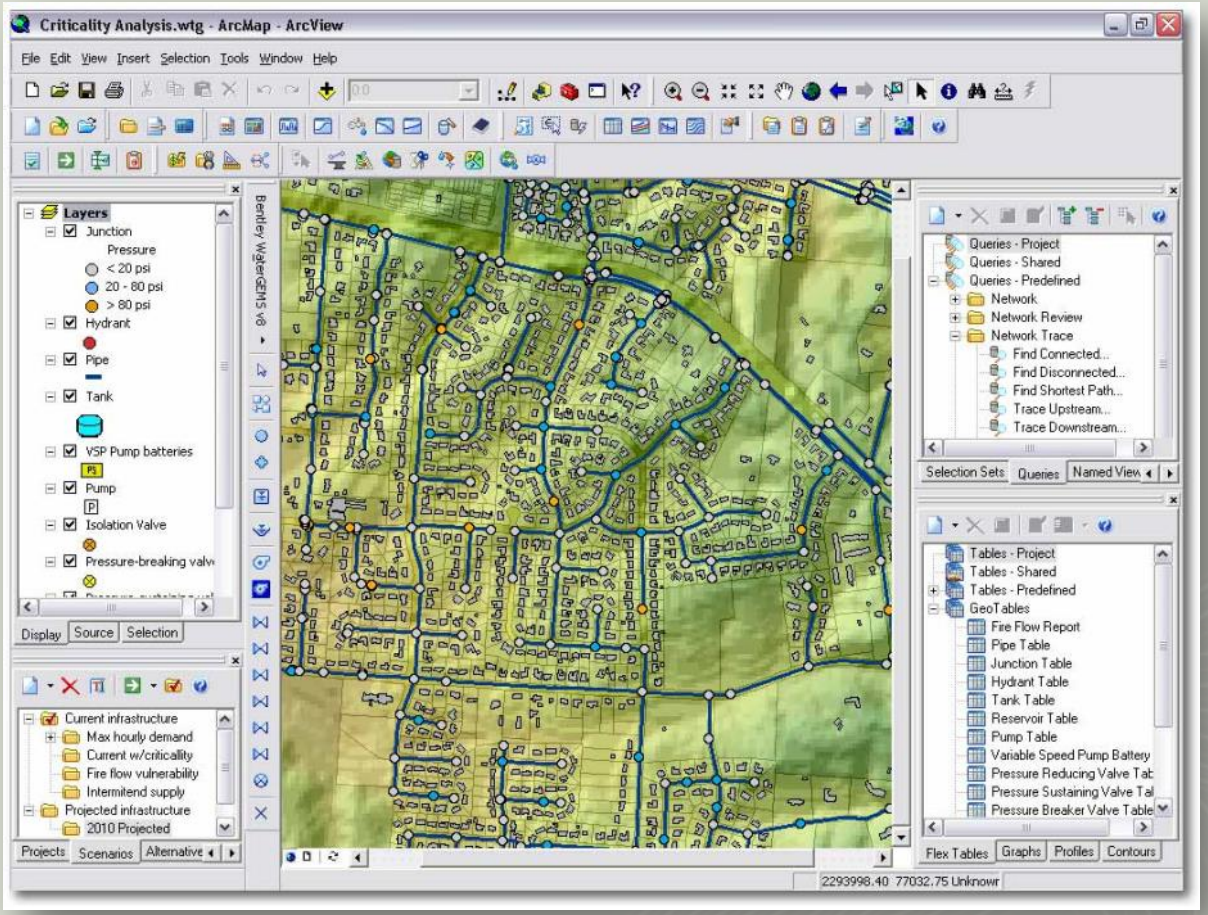
Other Possible GIS Uses



SAIN associates

Other Possible GIS Uses

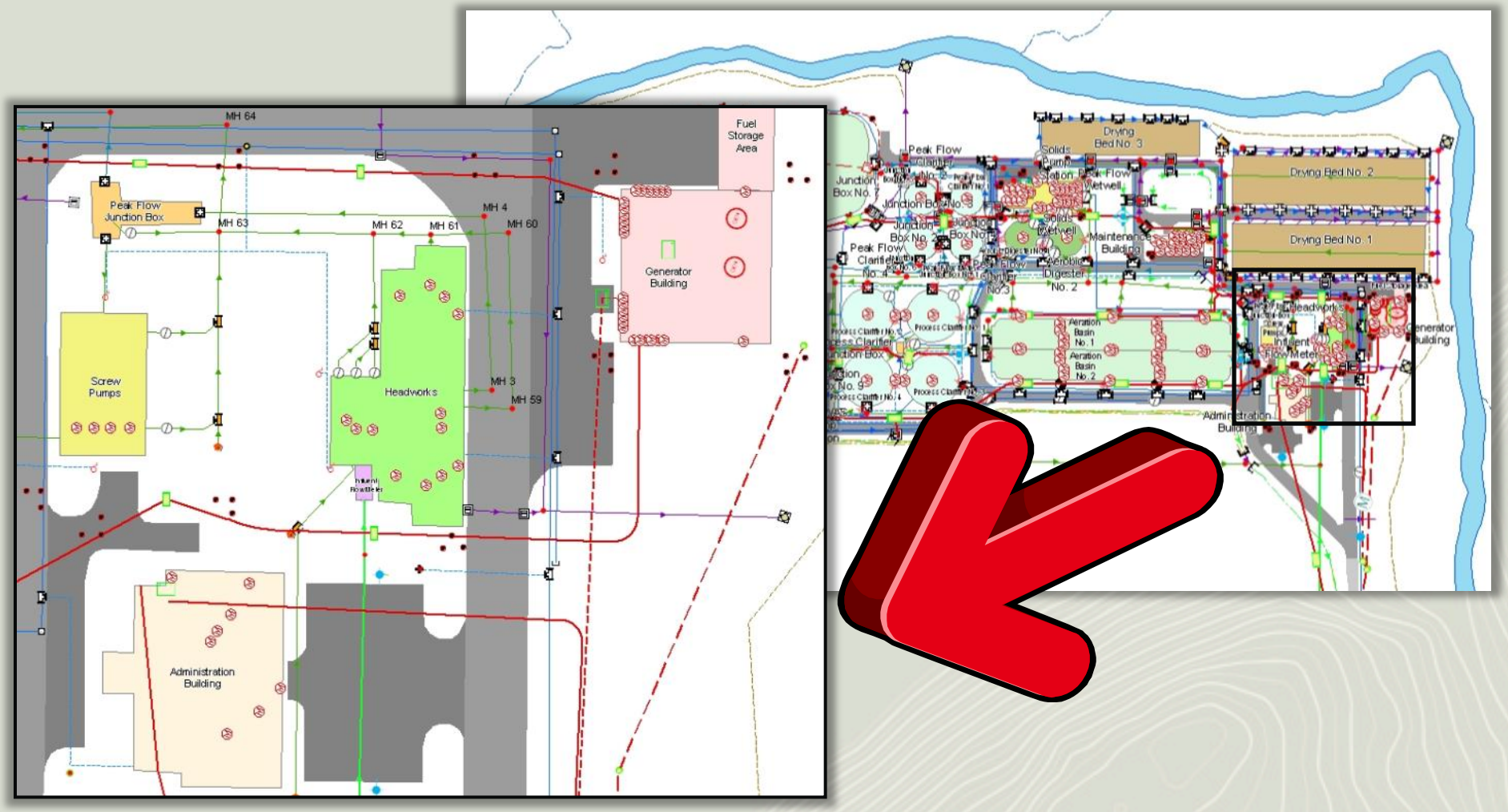
- Utility Infrastructure Modeling



SAIN associates

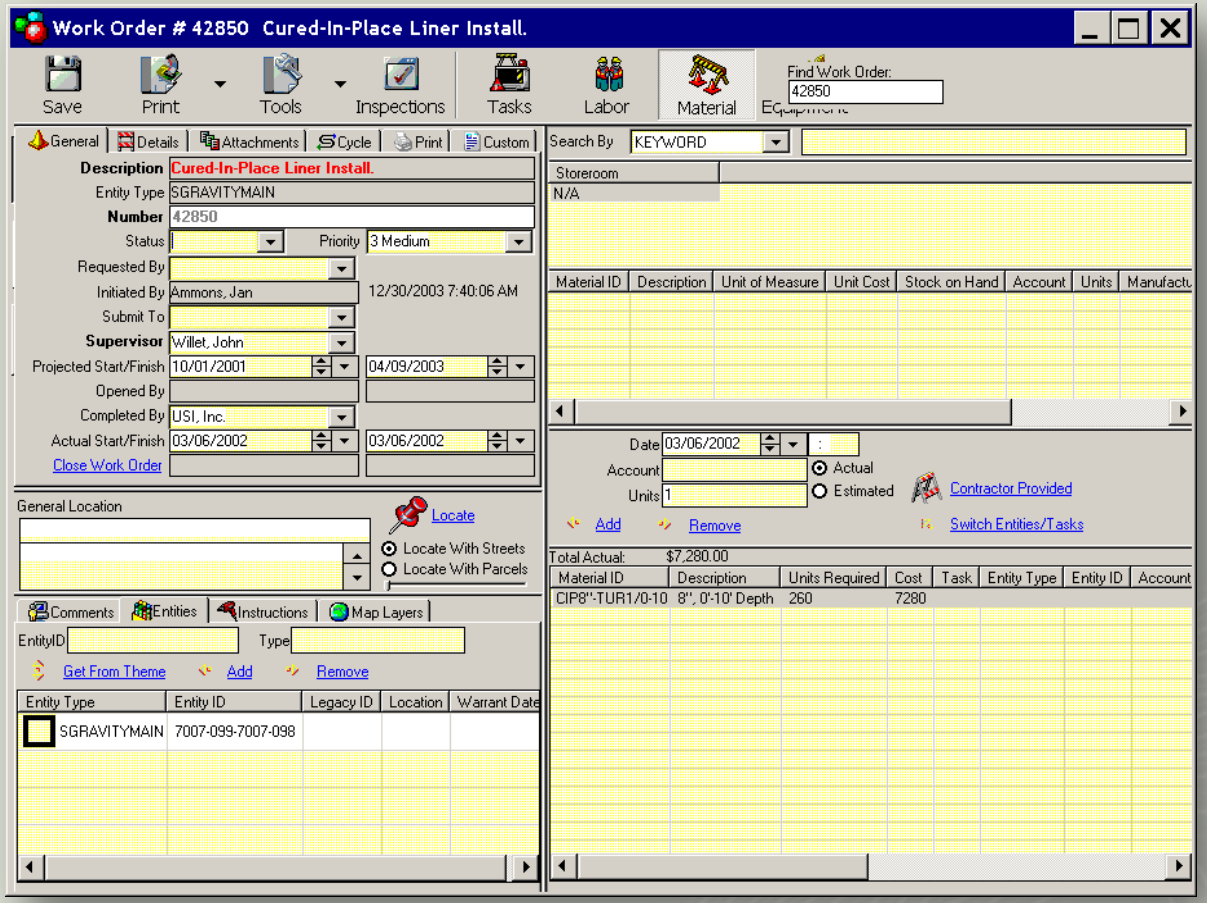
Other Possible GIS Uses

- Asset Management



Other Possible GIS Uses

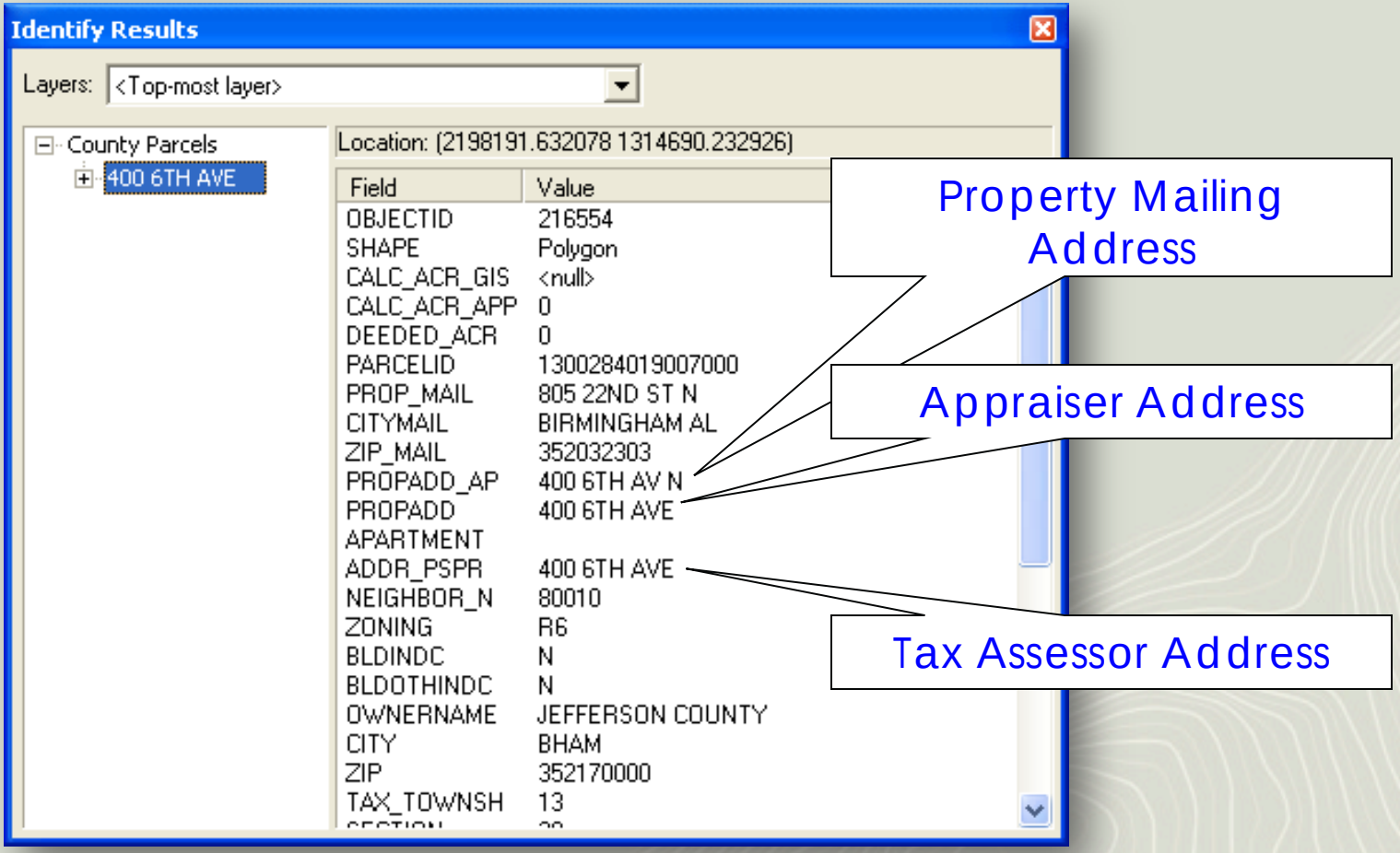
- Work Order Management



SAIN associates

Other Possible GIS Uses

- Address Management



SAIN associates

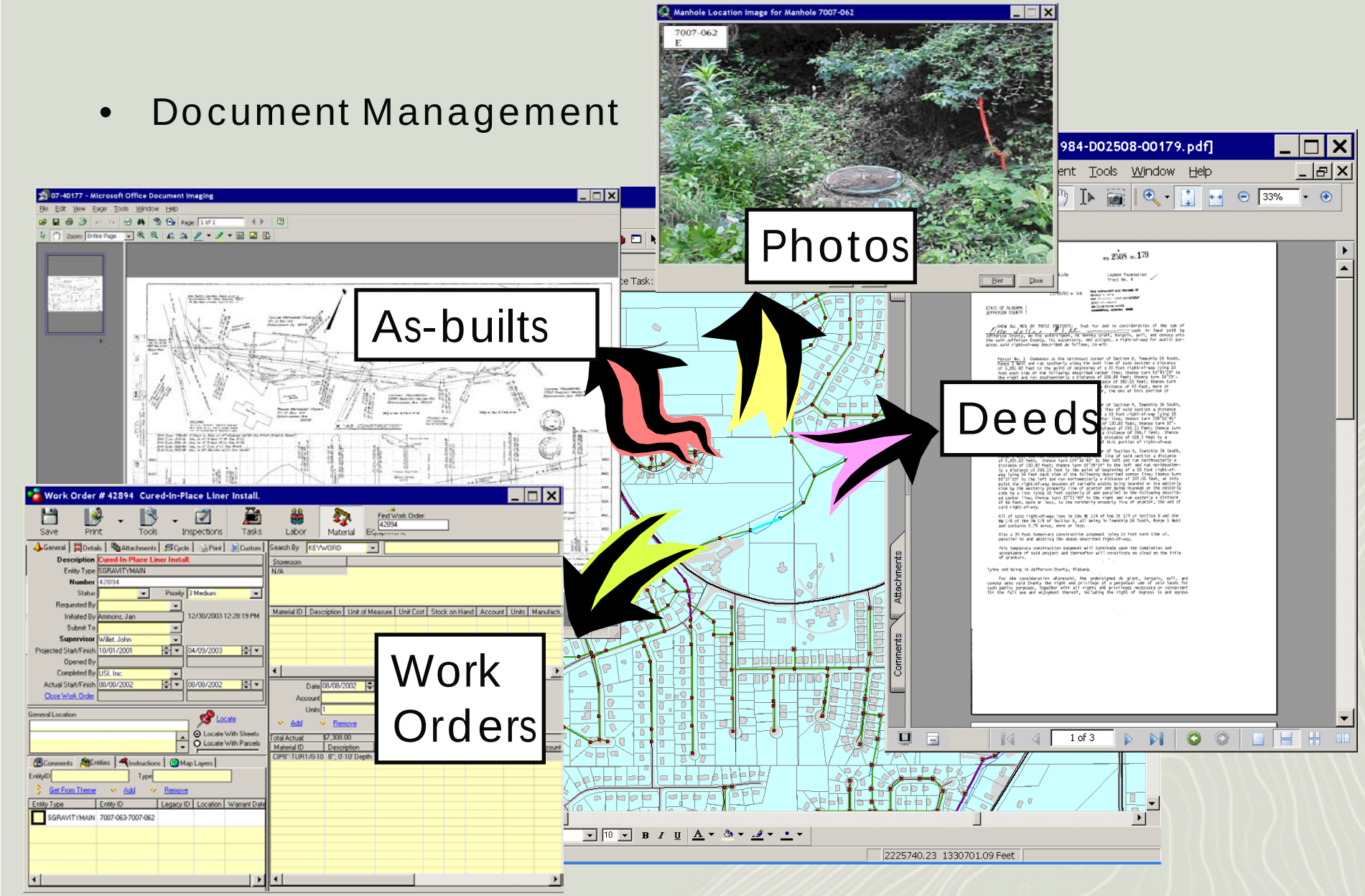
Other Possible GIS Uses

- Cemetery Management

SAIN associates

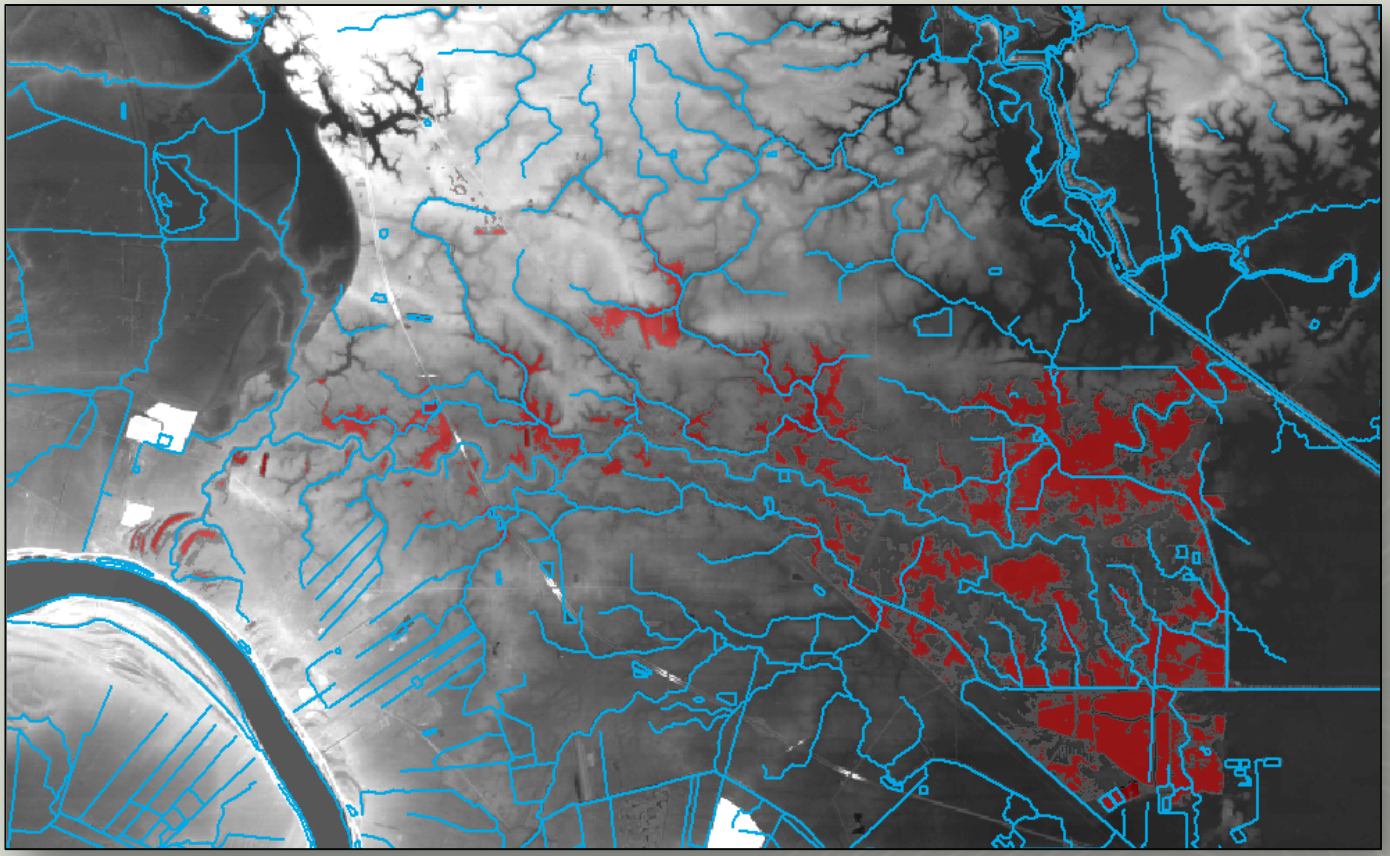
Other Possible GIS Uses

- Document Management



Other Possible GIS Uses

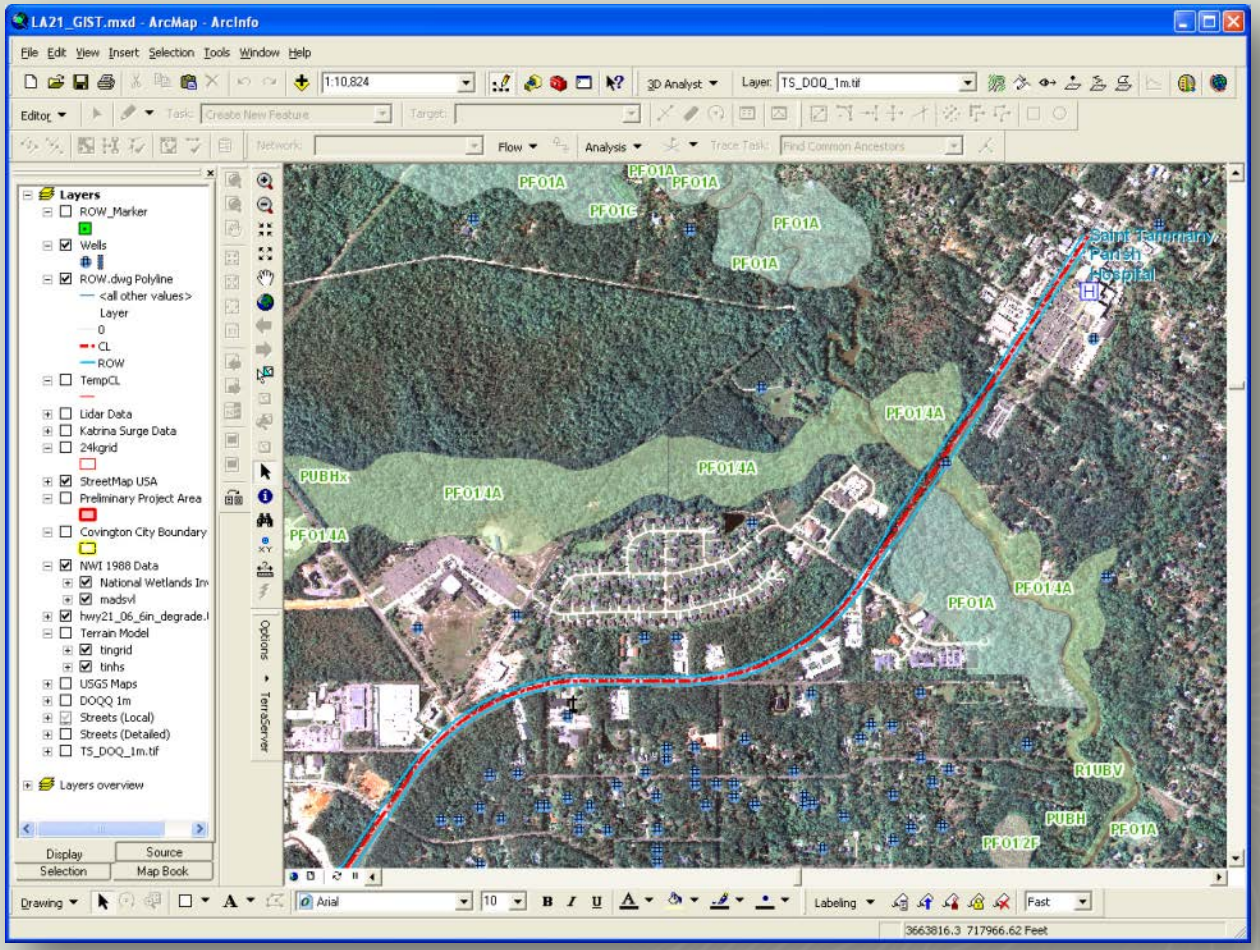
- Flood Mitigation



SAIN associates

Other Possible GIS Uses

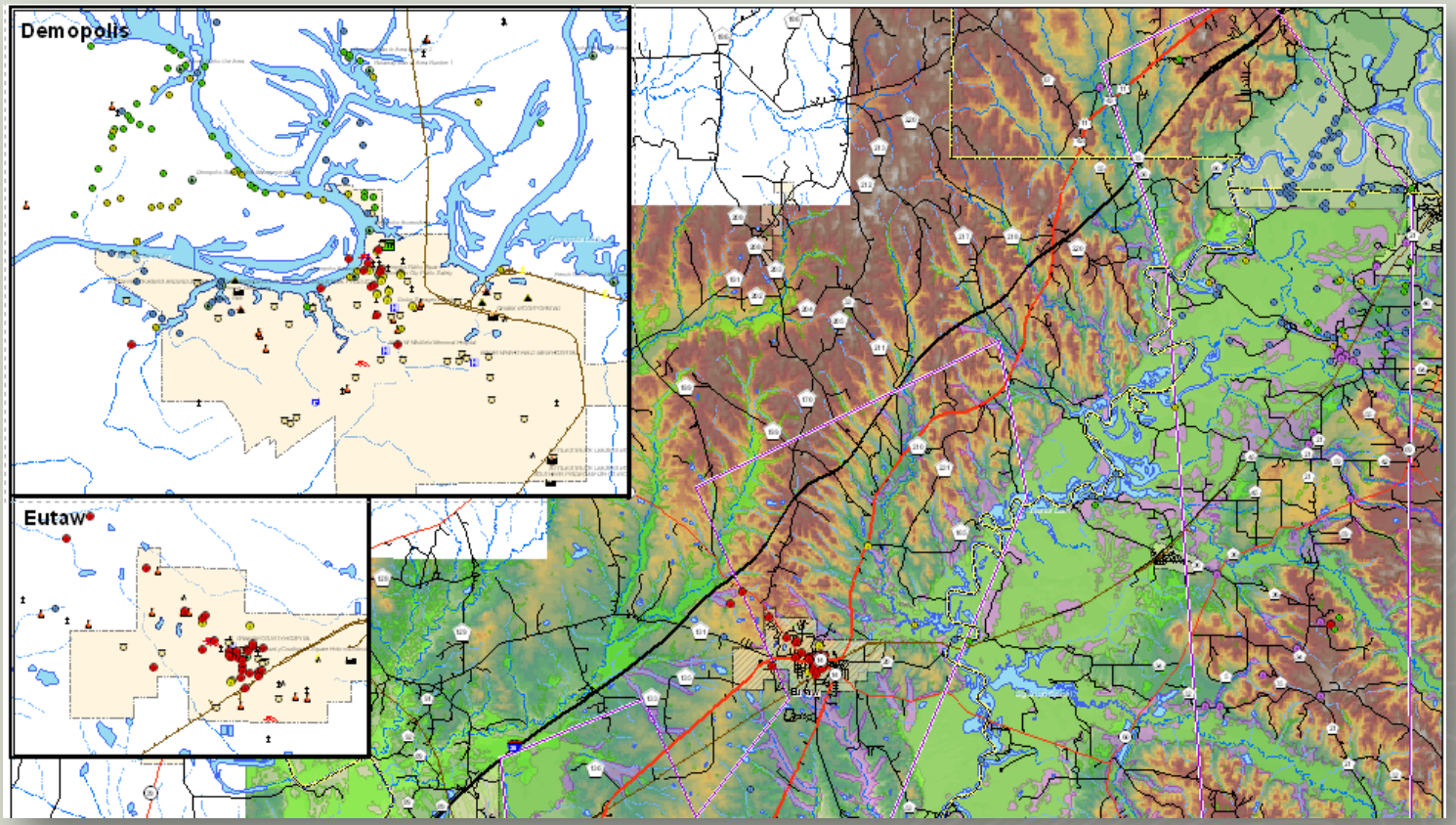
- Environmental Assessments



SAIN associates

Other Possible GIS Uses

- Corridor Studies



SAIN associates

Other Possible GIS Uses

- Site Planning

SAIN associates

Let Sain Associates join you in a personal and proactive partnership centered on longevity, innovation, and value-creation beyond the project.

SAIN associates

ENGINEERING BETTER PARTNERSHIPS

Daniel Mellott, GISP
E-mail: dmellott@sain.com
Direct: (205) 263-2131
Mobile: (205) 790-5752

TRUSTWORTHY | EXPERIENCED | FOREHANDED | COLLABORATIVE