

Distribution System Mapping and GIS: Lessons Learned

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ASSOCIATE VICE CHANCELLOR

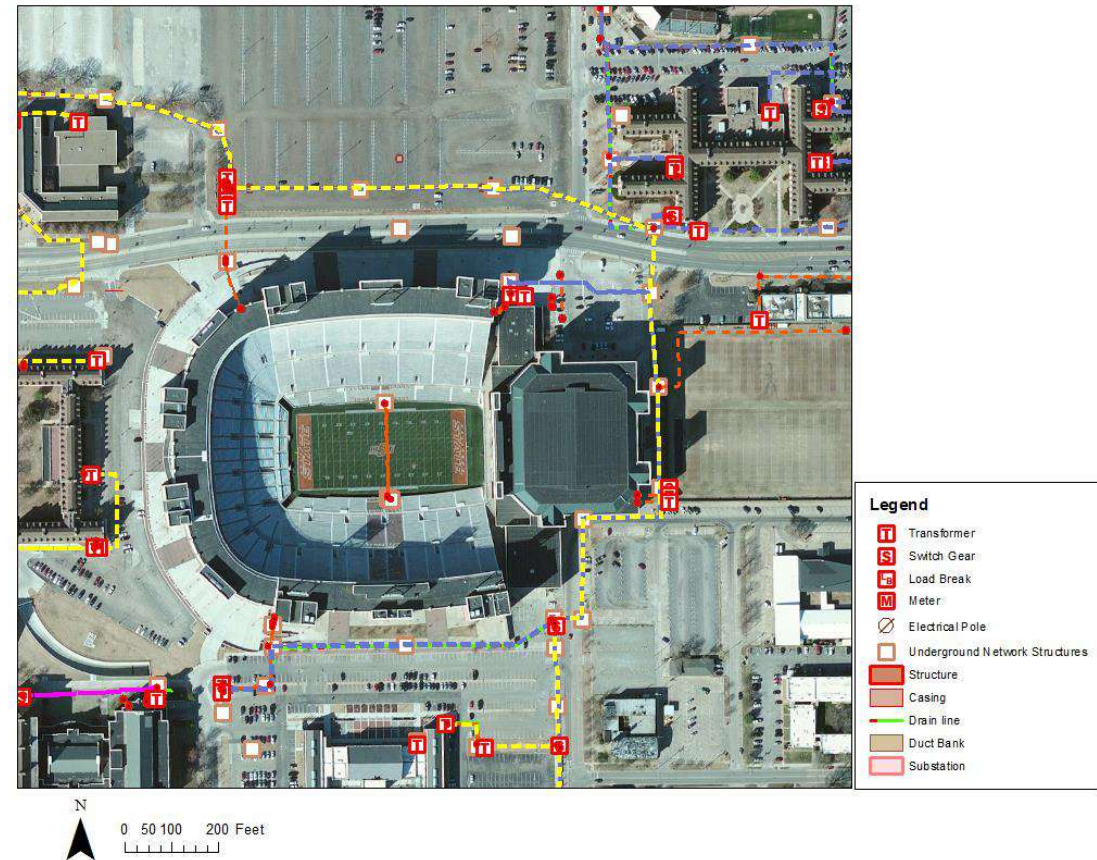


UNIVERSITY *of*
DENVER

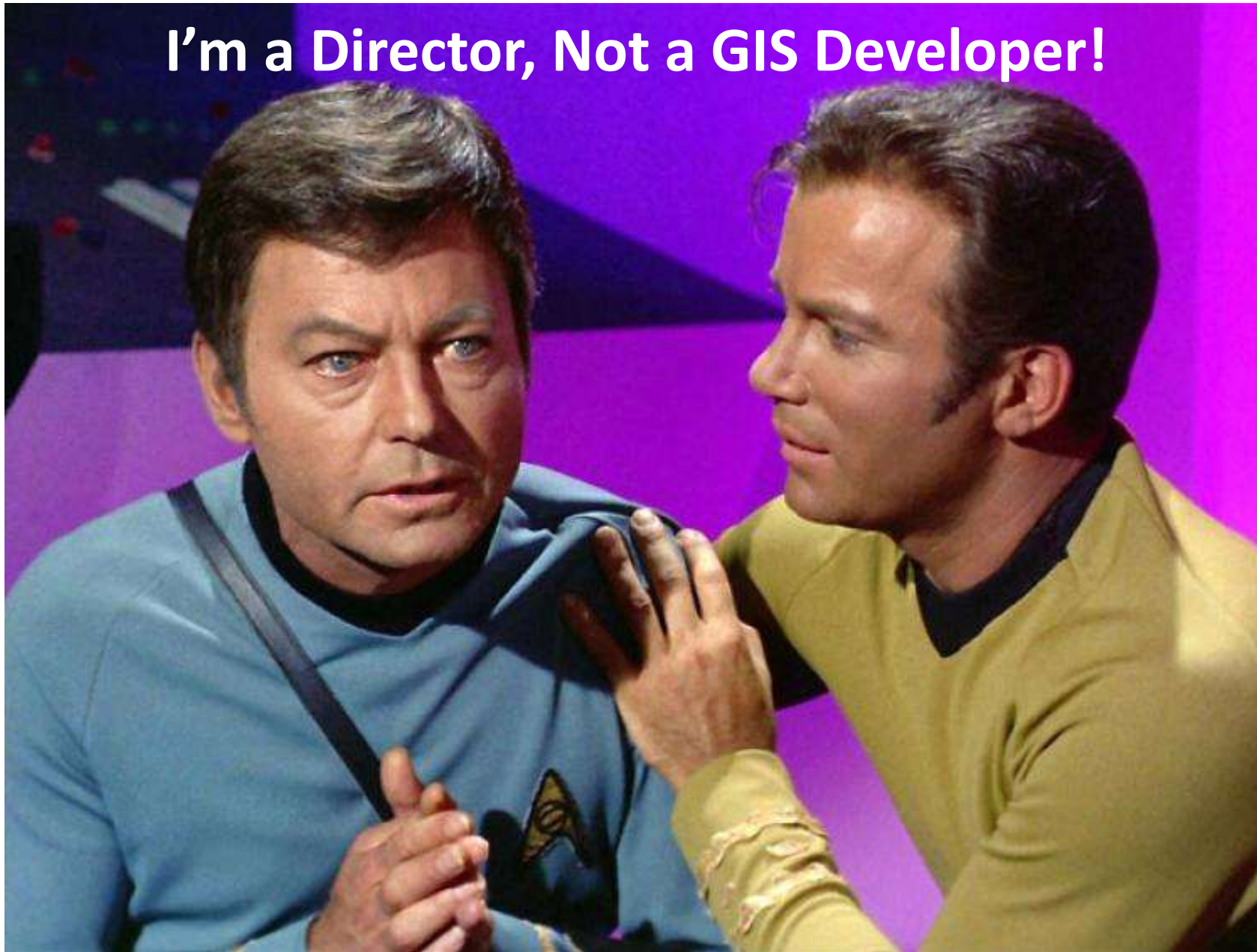
FACILITIES MANAGEMENT & PLANNING

Overview:

- Motivation
- Approach
- Implementation
- Benefits
- Lessons Learned

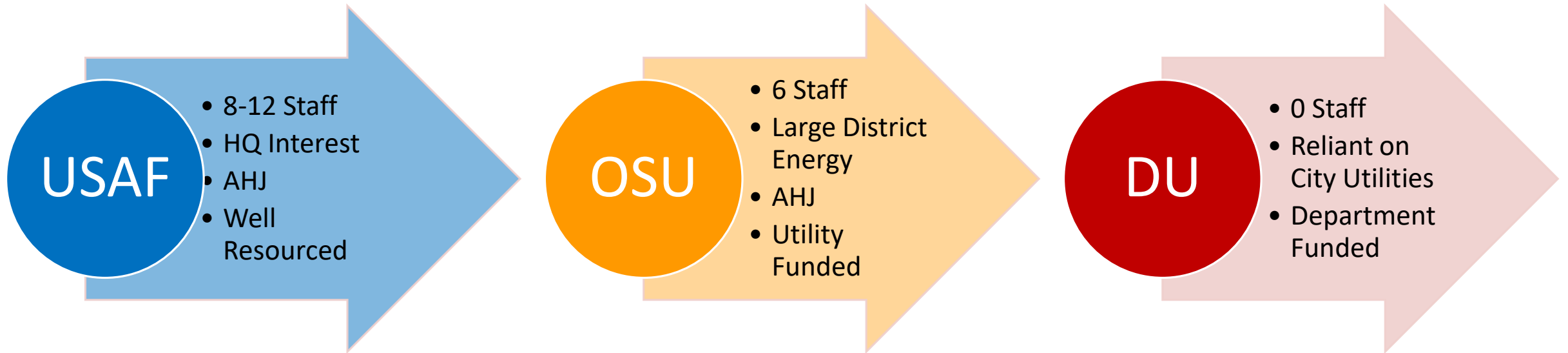


I'm a Director, Not a GIS Developer!



Motivation:

➤ My Background: Organizations with varying capacities and capabilities



Motivation:

- Advocate for Resources: Why Spend the Money?
- Retiring of key personnel possess the institutional knowledge
 - Know where all the skeletons are buried...or valves at least
- Increasing need for real time/multi-layered information for decision making and planning
- Increasing need to share/coordinate with partner city/county/state/utility organizations

Critical Infrastructure Management for:
Federal, State, City, County, Campus Owners!

Approach: OSU GIS System

Utility Master Plan

Identify Location of
New Central Plant

Account for Future
campus growth

Understand system
costs of location
decision

System Models

Steam (KYPipe)

Chilled Water (KYPipe)

Electrical (SKM)

GIS

Capitalized on
development of system
models to gather
location, data, and
validation of system
information

Approach: OSU GIS System

- Information was stored in the ESRI Geodatabase format, with the database structure based on the ArcGIS Local Government Data Model.
- Hired additional resources using Campus Master Plan consultants
- Managing Expectations: setting goals for the team
 - Use of best practices and industry standards
 - Avoid “paralysis by analysis”
 - Never going to get it done if we try to get it perfect
 - Want a reliable Chevy, not a Pinto or a Cadillac

Implementation:

GIS Data Entry

- Converting Existing AutoCAD Files
- Populating GIS Fields within the AutoCAD layers
- Entered information gleaned from text labels within CAD files

Geometric Network

- Constructed in GIS ensuring point features snap to vertices of line features
- Allows for tracing of the network and isolation of breaks

MetaData

- Developed for each GIS feature class
- Provides information about the use of the GIS datasets
- Used Federal Geographic Data Committee (FGDC) Content Standard for Digital Geospatial Metadata (CSDGM) standards



Pan



Zoom In



Zoom Out



Initial View



Previous Extent



Next Extent



Bookmarks

Navigation

Layers



I want to...

Filter Layers...



Filter

Layer Catalog

☒ Chilled Water



☒ Domestic Water



☒ Electrical Distribution



☒ Natural Gas (CAD)



☒ Sanitary Sewer



☒ Steam & Condensate



☒ Storm Drain (CAD)



☒ IT Telecom (CAD)



☐ Map Change & Markup

☒ Unidentified Utility Line



☐ Utilities Grid



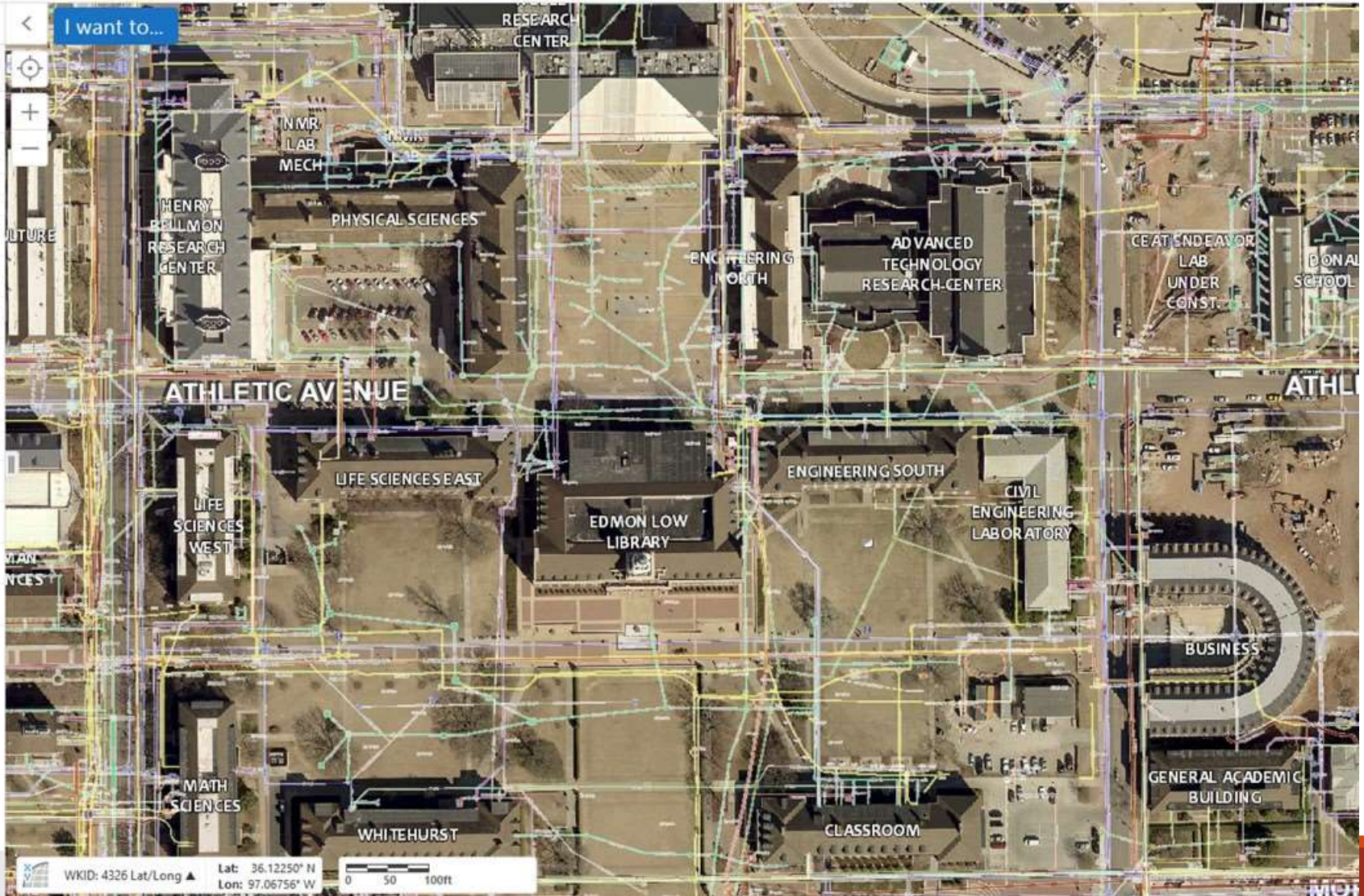
☒ Base Map



Layers



Projects



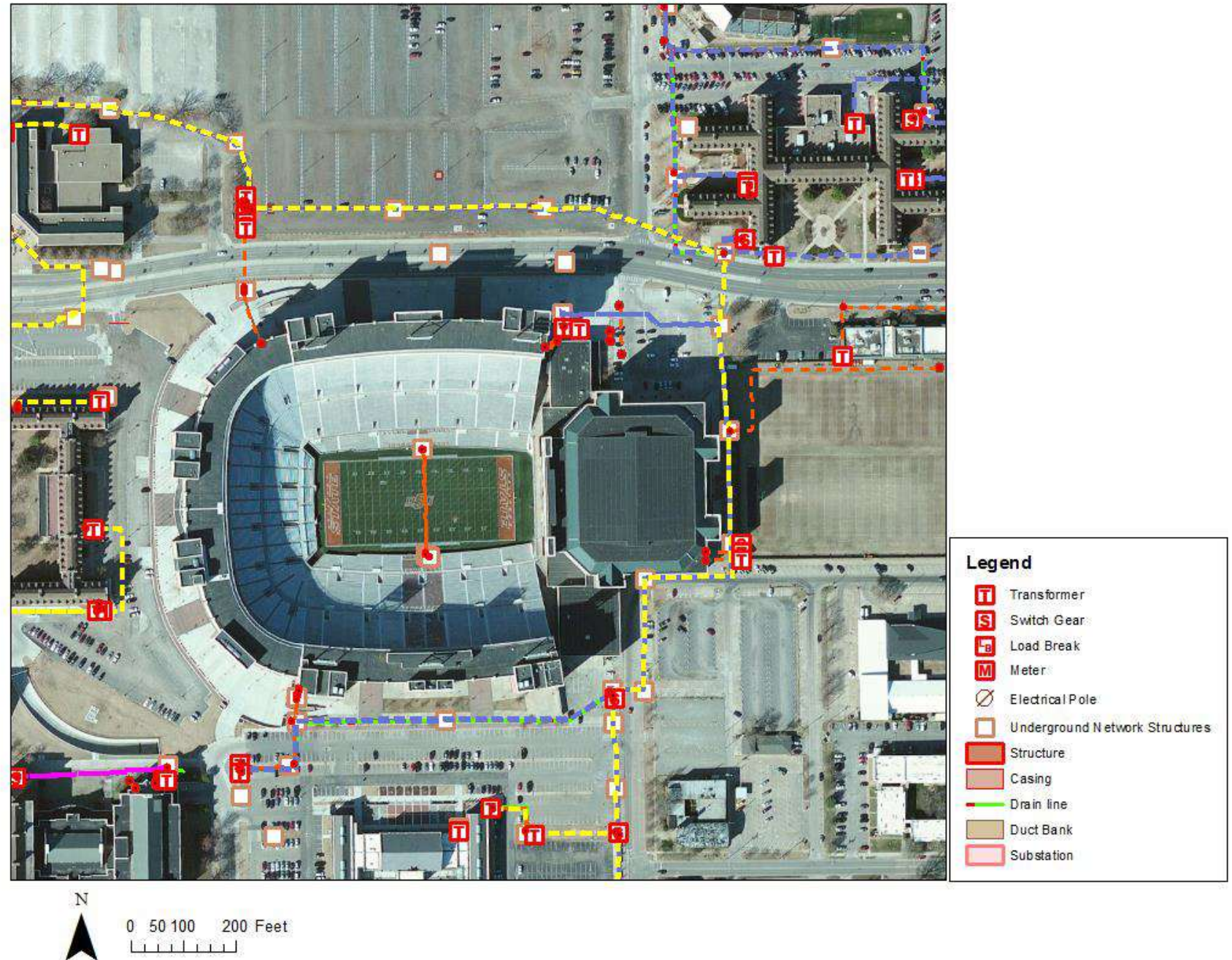
WKID: 4326 Lat/Long



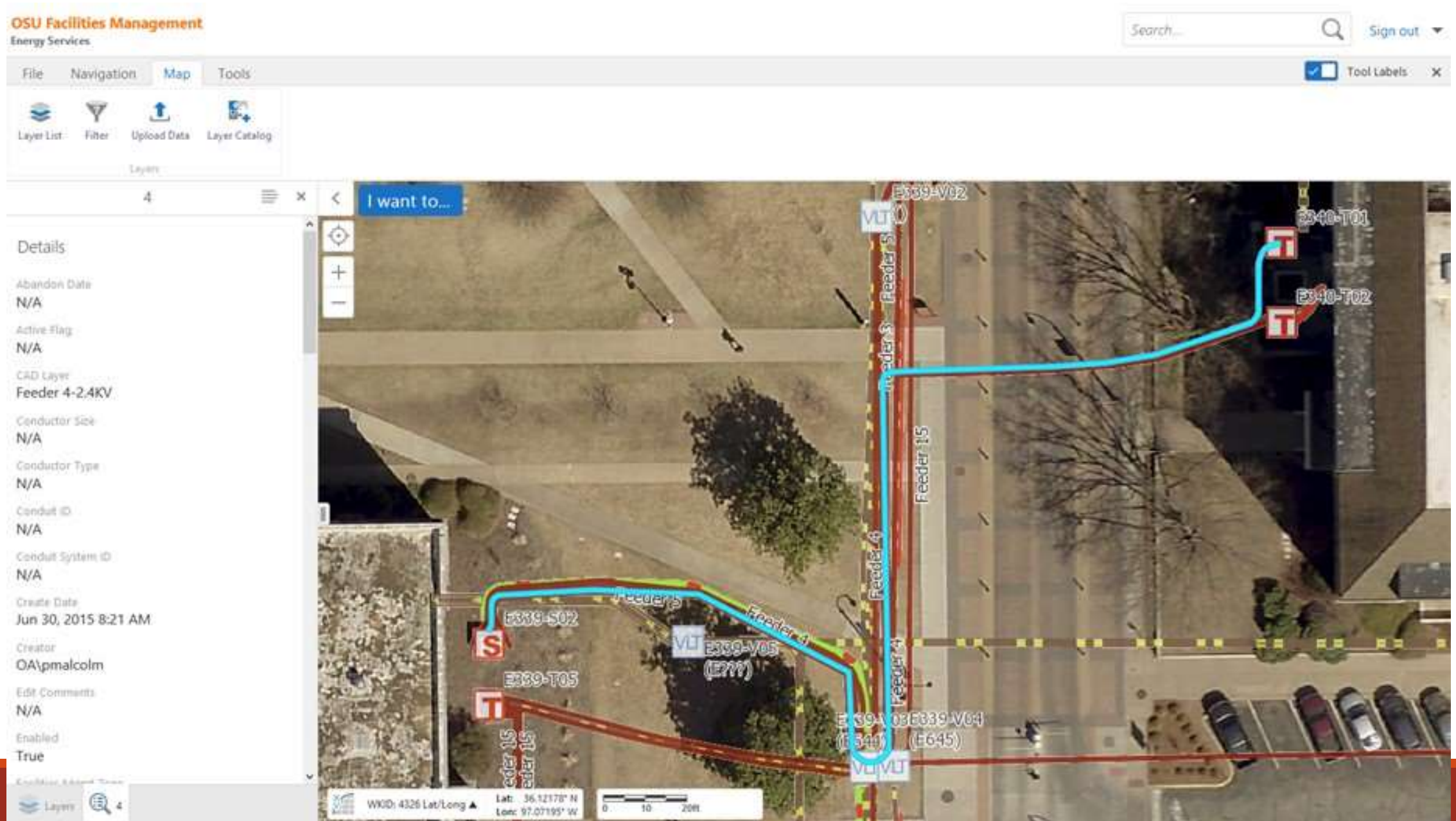
Lat: 36.12250° N
Lon: 97.06756° W

0 50 100ft

Electrical Distribution



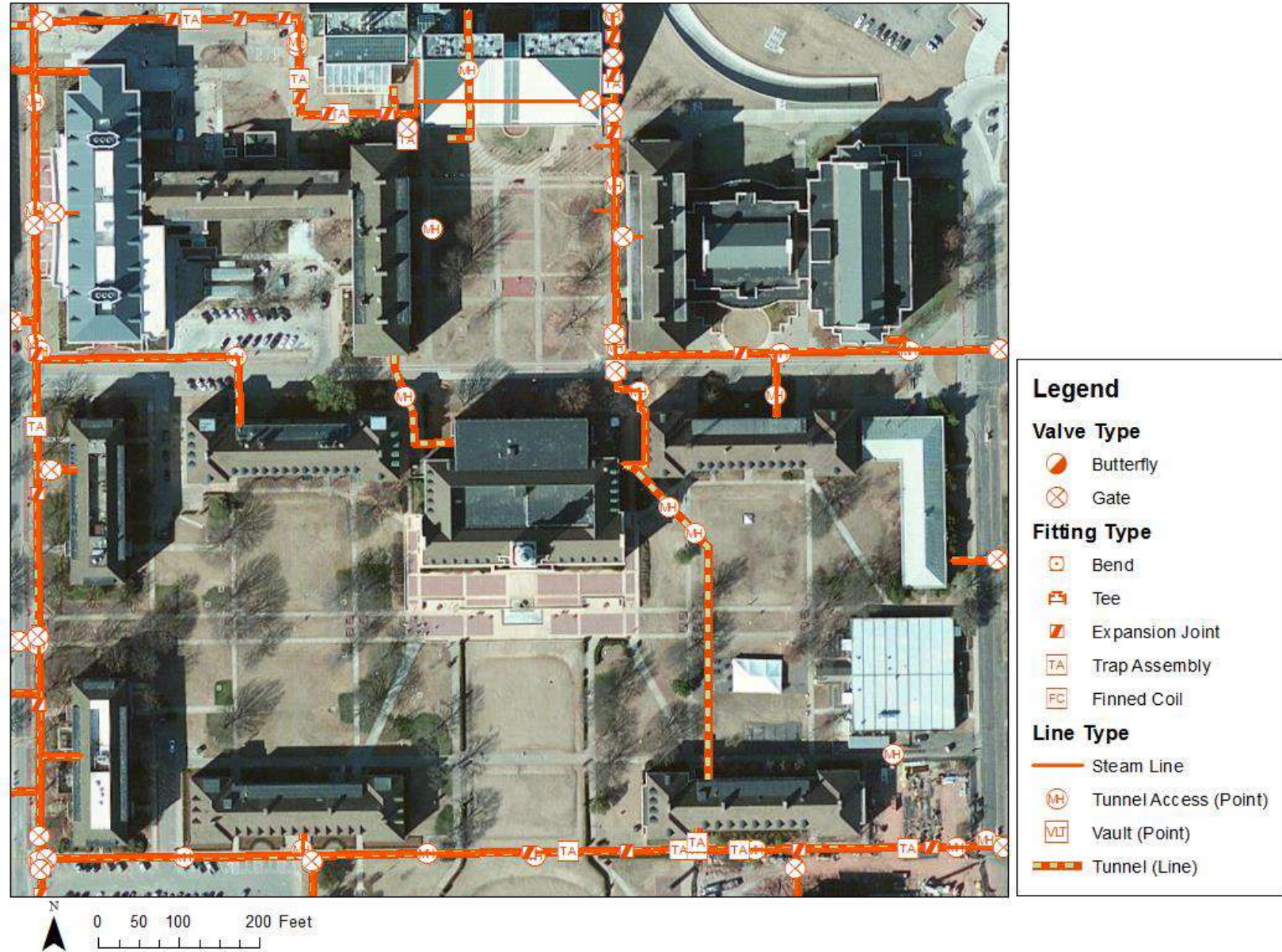
Electrical distribution



Electrical Distribution Challenges

- Water, Chilled Water, Sewer Systems well suited for AutoCAD to GIS transfer...not Electrical
- Duct Banks use multiple ducts and frequently have multiple feeders per duct
- Electricity acting “like water in a pipe” doesn’t translate well in the digitized GIS representation
 - Transformers don’t directly connect feeders and can be High to Secondary voltages
 - A trace along a primary lines shows the line passing through the transformer, which it doesn’t
 - Somewhat more complex situations with transformers and switches as well
 - Only connected features at the end of lines or in-line with single electrical line
- Determining the meaning of each layer in a CAD file and digitizing it properly in GIS

Steam Distribution



File

Navigation

Map

Tools



Tool Labels



Layer List



Filter



Upload Data



Layer Catalog

Layers

S35



I want to...



Details

OBJECTID

157

Shape

N/A

Creator

OA\pmalcolm

Create Date

Sep 16, 2015 4:03 AM

Last Editor

OA\pmalcolm

Last Edit Date

Feb 9, 2016 4:35 AM

Edit Comments

N/A

CAD Layer

C-STEM-TUNL-EHS-SECT

Location Description

N/A

Facilities Mgmt Zone

N/A

Utilities Grid

339

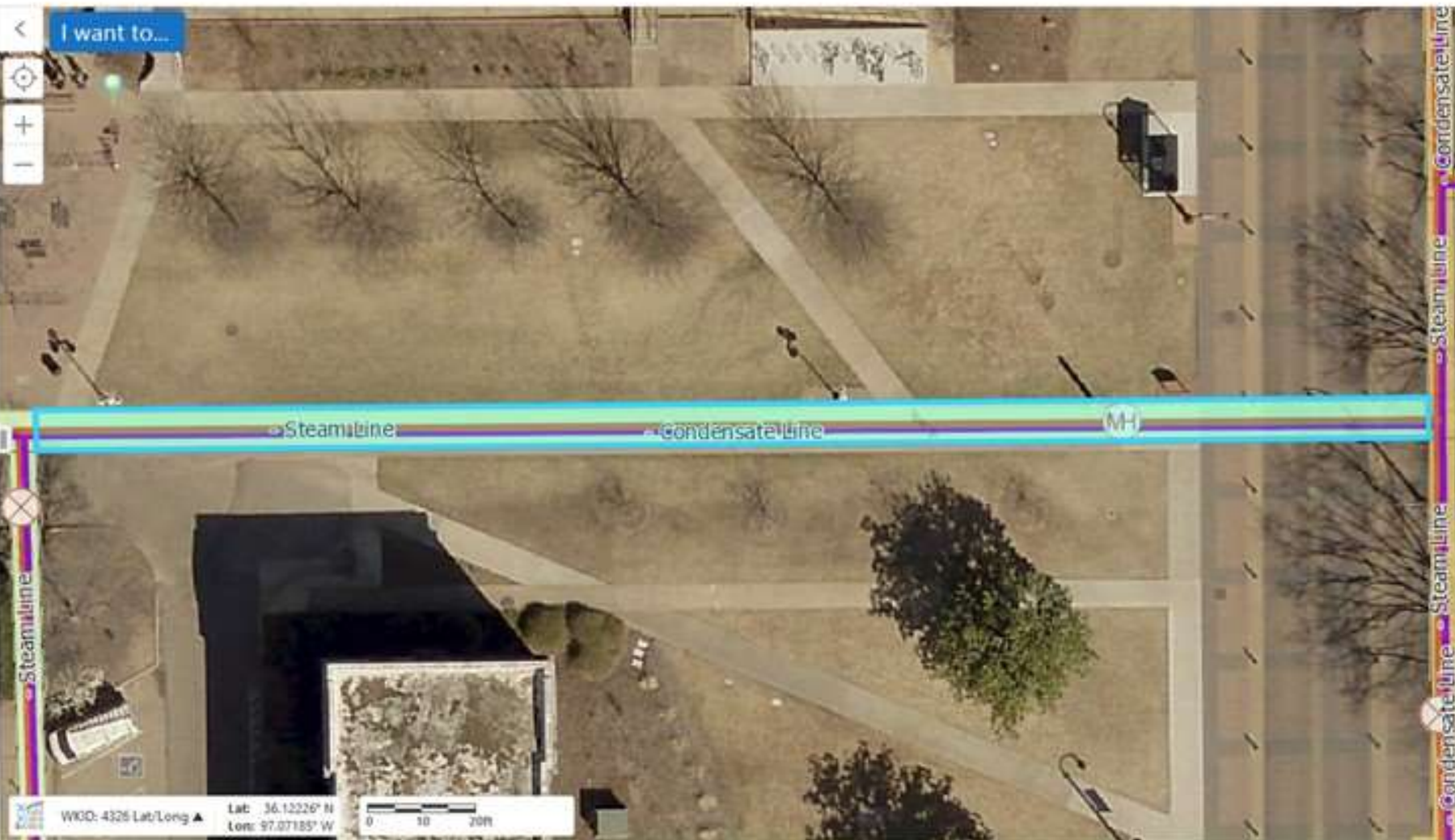
Point/Line/Stand/Level/Creation



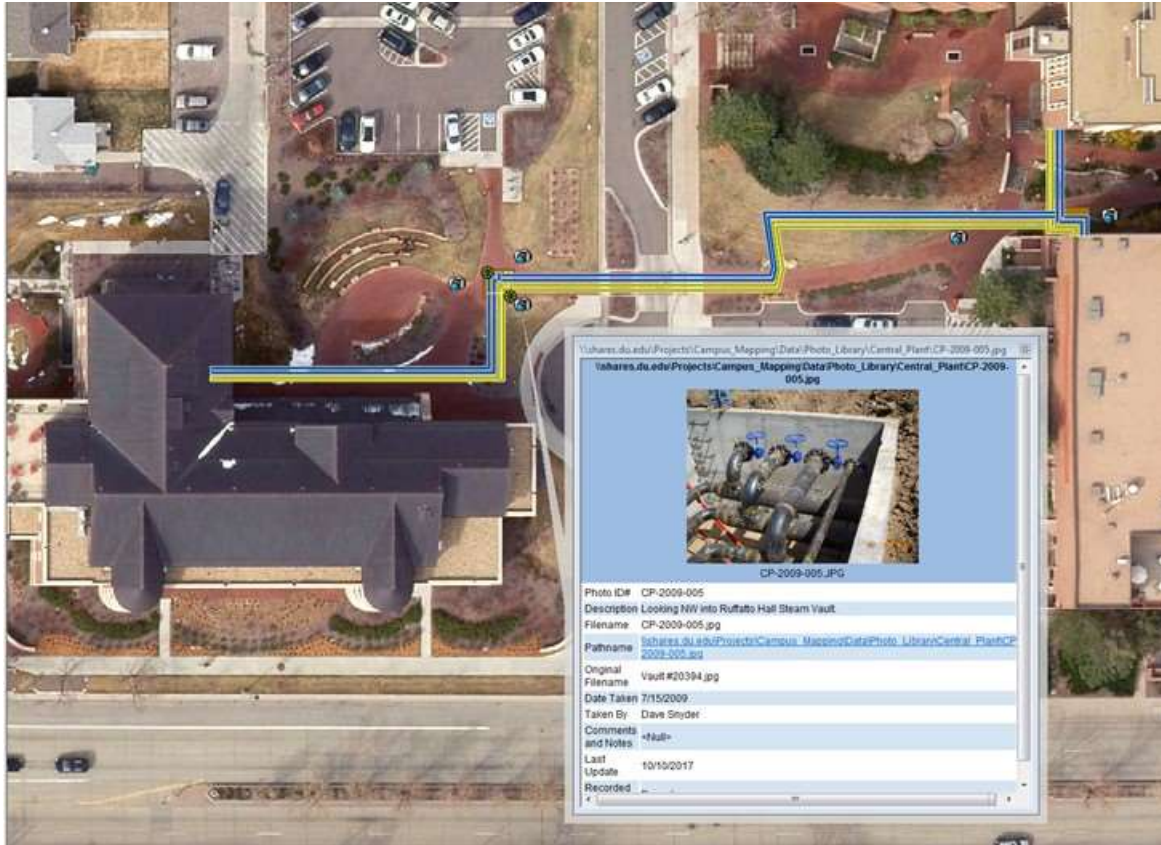
Layers



S35



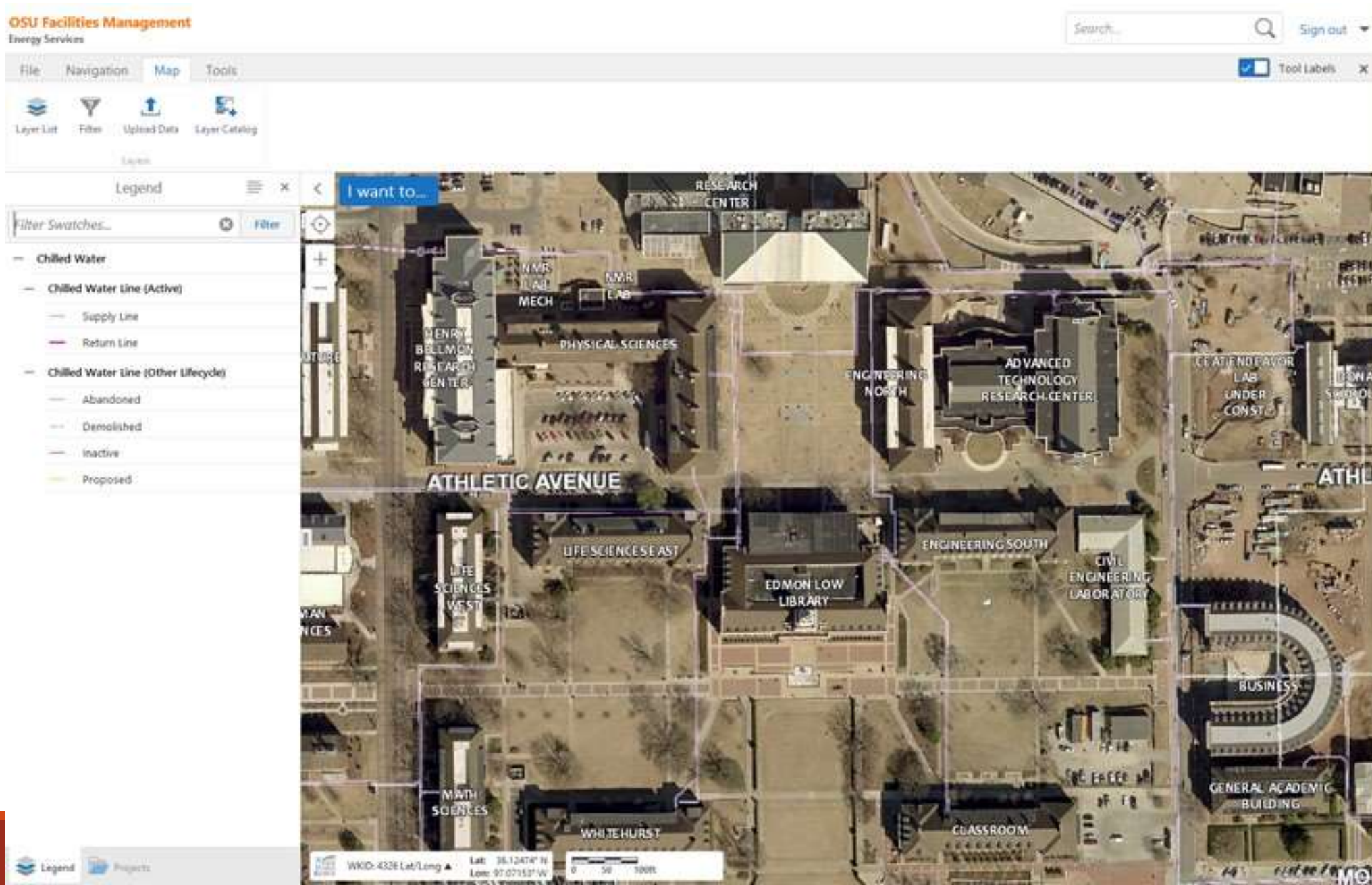
Steam Tunnel: DU



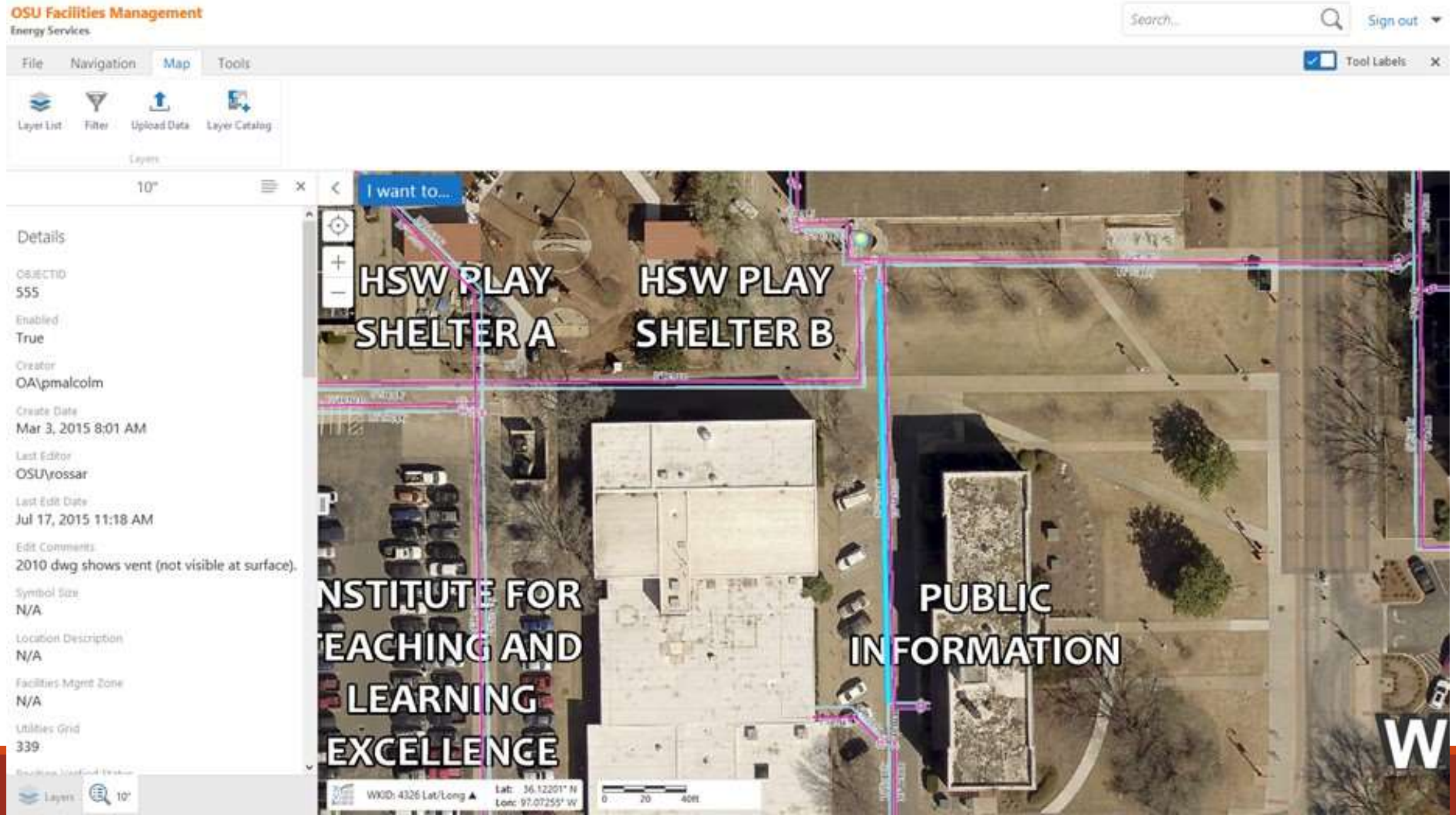
Steam System Challenges

- Visualization of Steam Tunnels and the contents within vs. accuracy in the field
- Consolidating Information from multiple sources with varying degrees of special accuracy and attribute information
 - Current and Past AutoCAD Map
 - KYPipe model
 - Field verification
- At the time implementation, a bug was discovered in the Attribute Assistant that was corrected in a future release

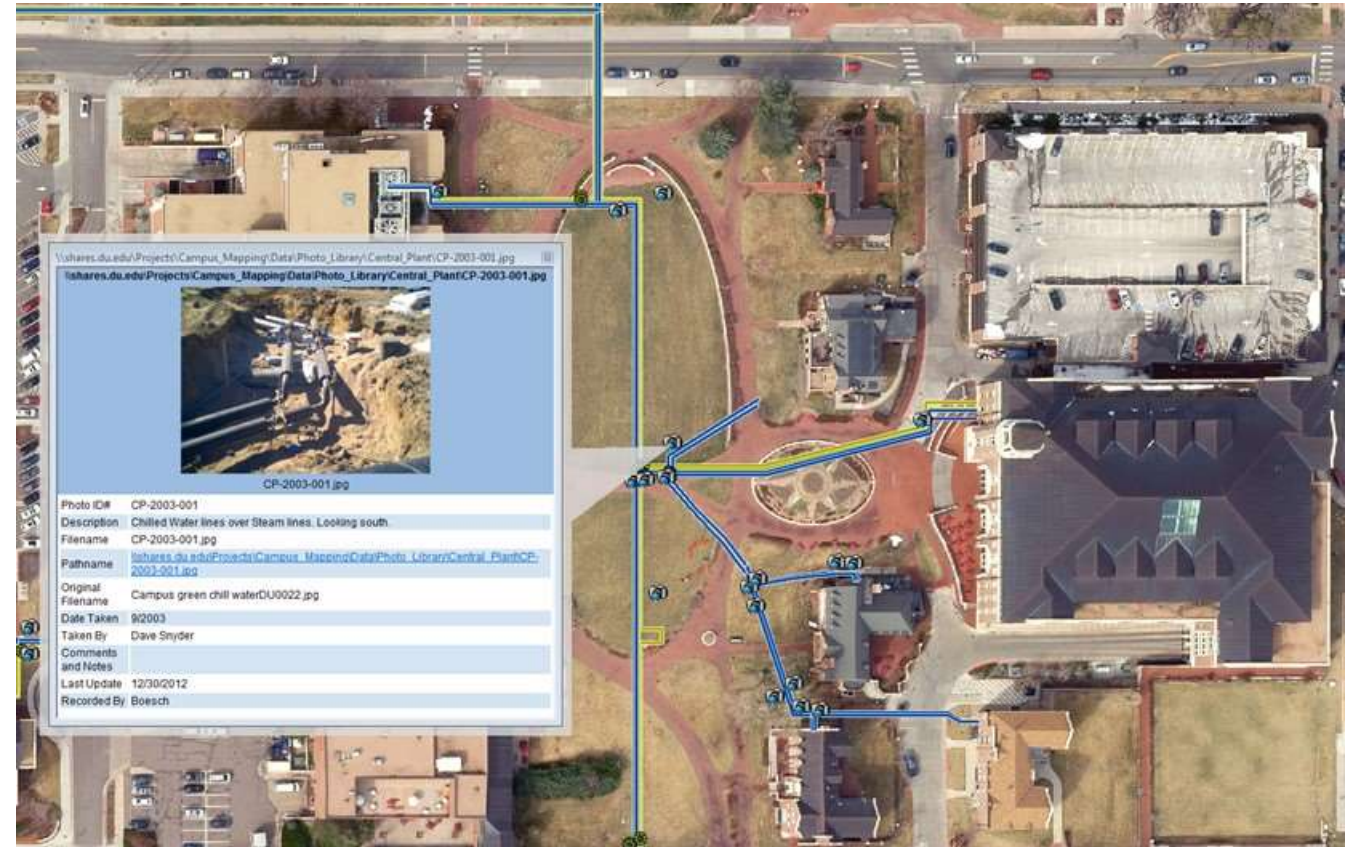
Chilled Water Distribution: OSU



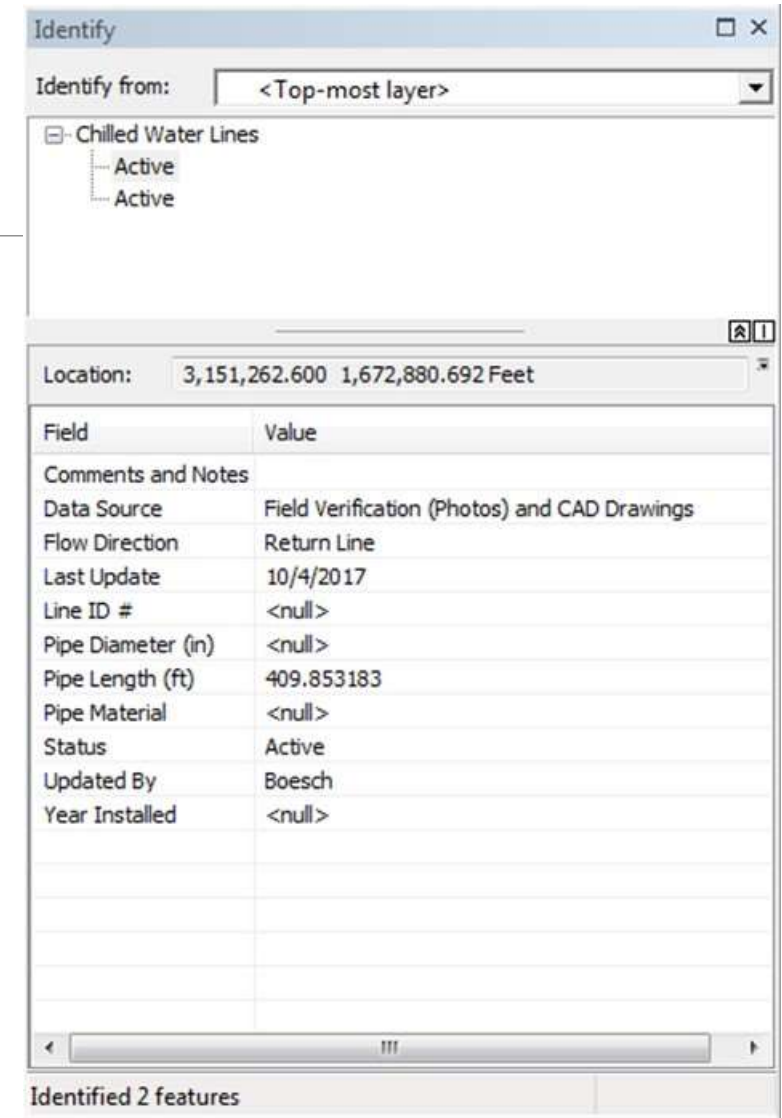
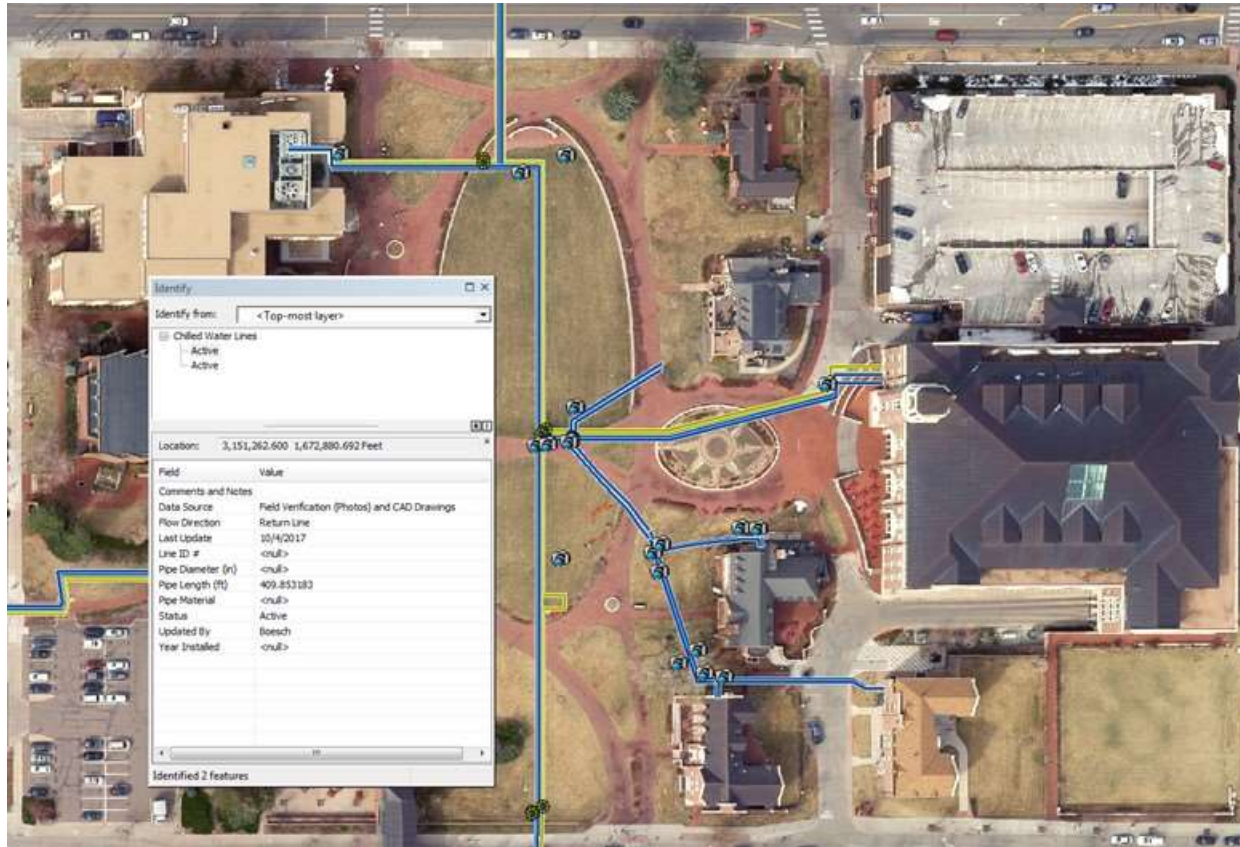
Chilled Water: OSU



Chilled Water Distribution: DU



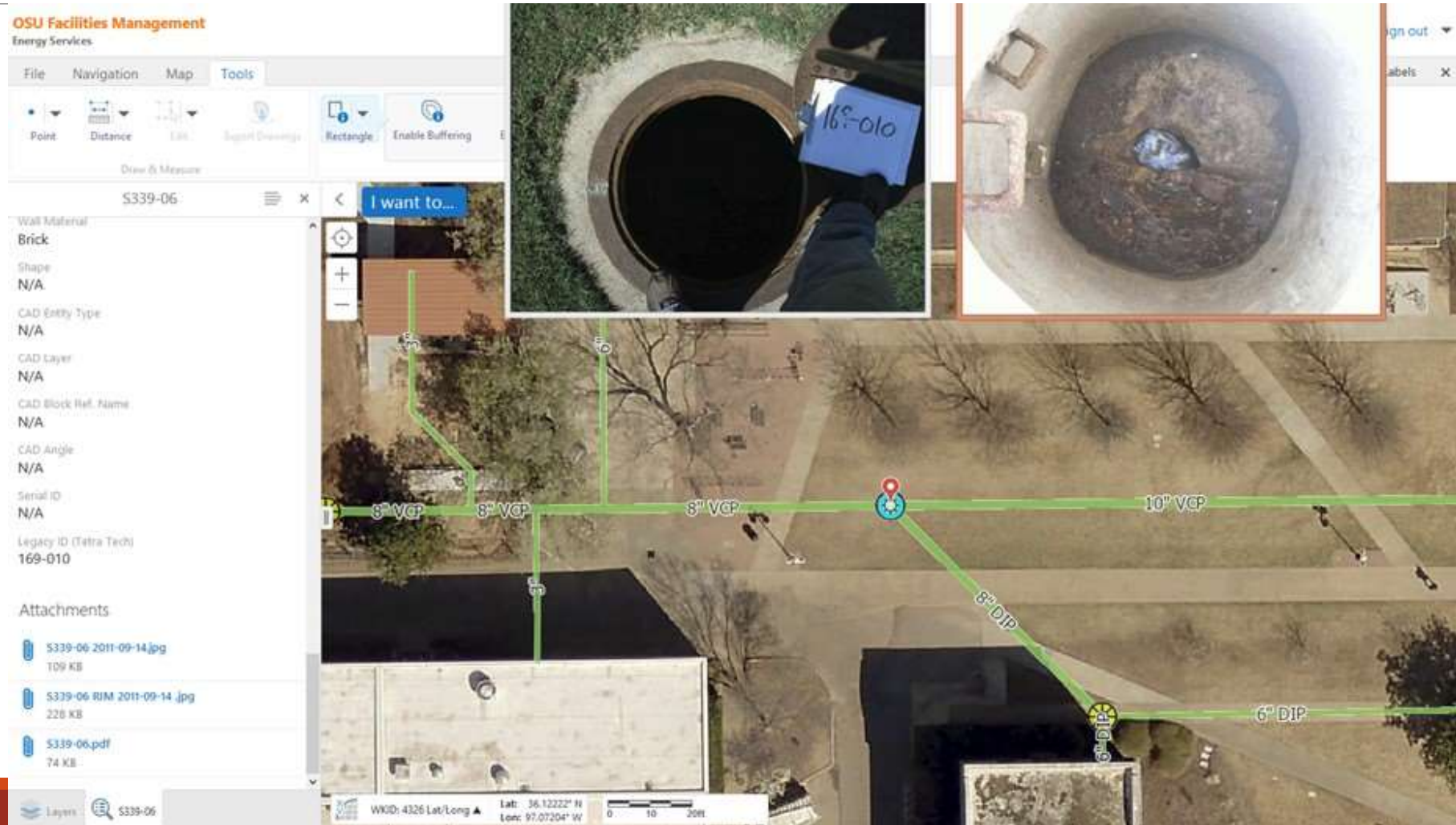
Chilled Water: DU



Chilled Water System Challenges

- Importing of features created as “blocks” in AutCAD drawings with the insertion point not correctly set to (0,0,0)
- If insertion point not assigned when the object is brought into GIS, it doesn’t know where to put it and has no spatial reference in GIS
- In some instances, the block had been rotated and must be corrected, typically using algorithm
- Finding and cleaning up these block features was a tremendous effort to complete the correct closed hydraulic system

Sanitary Sewer/Manhole details



Map Change Request note details

OSU Facilities Management
Energy Services

Search... [Sign out](#)

File Navigation Map Tools

Point Distance Edit Export Drawings Draw & Measure

Rectangle Enable Buffering Enable Add Results Enable Subtract Results Identifiable Layers Query Plot Coordinates Create New Feature Coordinates Edit

Identify & Query

Other I want to...

Details

OBJECTID
11617

Creator
Joe Gaskins

Create Date
Nov 10, 2017 12:00 AM

Last Editor
N/A

Last Edit Date
N/A

Edit Comments
valves not right

System or Utility
Chilled Water

What is the issue?
Other

Notes or comments
N/A

Status
Open

Map view showing pipe network with labels: 6" Supply, 6" Return, 8" Supply, 8" Return, 10" Supply, 10" Return, 14" Return, 14" Supply.

WKID: 4326 Lat/Long Lat: 36.12242° N Long: 97.07238° W 0 10 20ft

Apps Page with QR Codes for Mobiles



Technical Lessons Learned

- Chose SQL server enterprise database as foundation, struggled with permissions and security to allow for updating and editing
- Start with desktop ArcGIS system in place and make sure it was robust before trying to launch into new Mobile software and work out bugs
- Challenges with bringing in CAD maps
 - Most likely CAD maps were made and built upon long ago
 - CAD maps made were created without GIS in mind
 - AUTCAD DWG, into ESRI GIS, all these small features that didn't make sense, duplicate features, all lot of point features were in block, blocks do not work with GIS well when one feature is off
 - Block in AutoCAD, create it in 0,0,0 coordinate for insertion. So if insertion point not assigned when the object is brought into GIS it doesn't know where to put it and has no spatial reference in GIS

Lessons Learned

- Require vendors or firms bidding on a project or product prove they meet the specifications or requirements during the bidding or purchasing process. Don't let that onus fall back on your organization--it costs time and labor that should be used in more effective ways.
- It is a challenge to produce good results in a timely manner without substantial resources. Expectations can exceed the reality of the work, knowledge, and expertise required.
- Cannot overstate the importance of the proper design of the GIS database and proper preparation of the data that will be placed within it.
- Real success will only be accomplished if the core workgroup has the ability and desire to maintain the vision and make decisions (move forward) without the input of others when others do not respond to requests for input.

Leadership Lessons Learned

- Active collection of attribute and detailed survey information created powerful tool
- Incorporation of GIS data with work and asset management system improved operations
- Technology moves fast, don't rush to purchase software and hardware
- Not a fast or easy process: 12-18 months MINIMUM
- Maintaining it is a monster
- Necessary to bring additional resources to in house resources
- Get Buy-In from your operations staff!

“What is GIS???”

“Why can't I just get a paper print?”

“This valve is in the Wrong Place!”

“I don't trust this map!”

