
A Journey of GIS Data Integration into an Asset Management System

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Who am I?

- My name is Eliud Flores Saenz.
- GIS Analyst with the City of Pullman for the past couple of years.
- Bachelor degree in Geography and a Minor in GIS.

How it began

- The GIS program at the City of Pullman started in 2021.
- Spearheaded by Public Works and Community Development Departments.
- Primary Objective to transition from CAD maps to dedicated geospatial features.
- As well to map tax parcels.

Asset Management

The system the City contracted was Open Gov's Cartegraph Asset Management.

City Works was too expensive, and Tyler Munis was not agreeable.

Development was split into two phases.

- Phase 1:
 - Sewer, Wastewater Treatment Plant, and Water Services.
- Phase 2:
 - Stormwater, Parks and Recreation, Facilities, Streets.
- Our GIS team saw an opportunity to expand our data stewardship to centralize all data into our Portal GIS service across departments.
- The hard part was to prepare our GIS system to accommodate and capture new data.

The Starting Data Situation

What we have

- Water, Sewer, and Stormwater Utility Network.
- A Planimetric dataset from a contracted flight flown in 2023.
- A Road Layer.
- Park, Trails, and Paths

What we needed

- Wastewater Treatment Plant
 - Where does Sewer ends and Wastewater begins?
- Floor Plans of Facilities owned and maintained by the City.
- Bridges, Paint Markings, Guardrails.
- Trees, Landscape Areas, Water Features.

What is the Definition of an Asset

HISTORICAL ORGANIZATIONAL DEFINITION

- Locally, an asset was defined as a physical location, or place. A sewer main could be defined as the direct line between manholes.
- The old-IDs represented this line of thought.
 - A sewer line was defined by the IDs of the manholes at each end.

GIS BEST PRACTICE

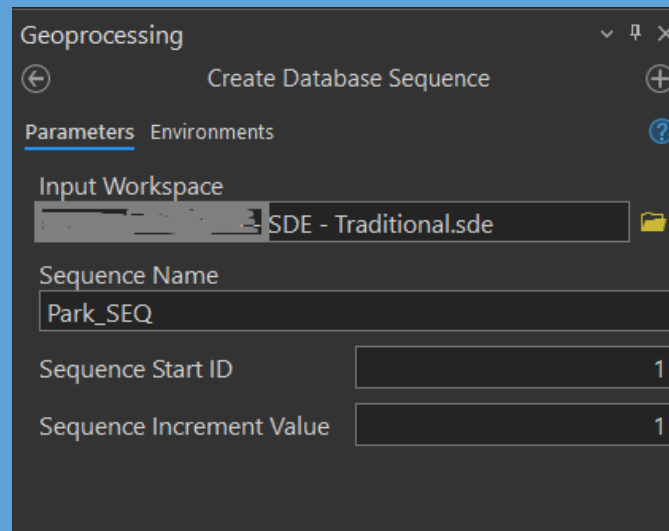
- Our goal was to represent what's on the ground as accurate as possible.
- A portion of a water main being replaced would create two assets.

What we needed to change

- Each utility had their own asset IDs that was not standardized.
- Some IDs were being used as attributes.
- Utility lines had no IDs at all.
- A massive amount of asset collecting/creation.

Creating a Database Sequence

- Using the Create Database Sequence Tool, we create a database sequence to keep track of IDs across the whole database.
- Using an attribute rule, we can call it every time a feature is created.
- Ensures lack of duplicated numbers across all datasets.



Geoprocessing

Create Database Sequence

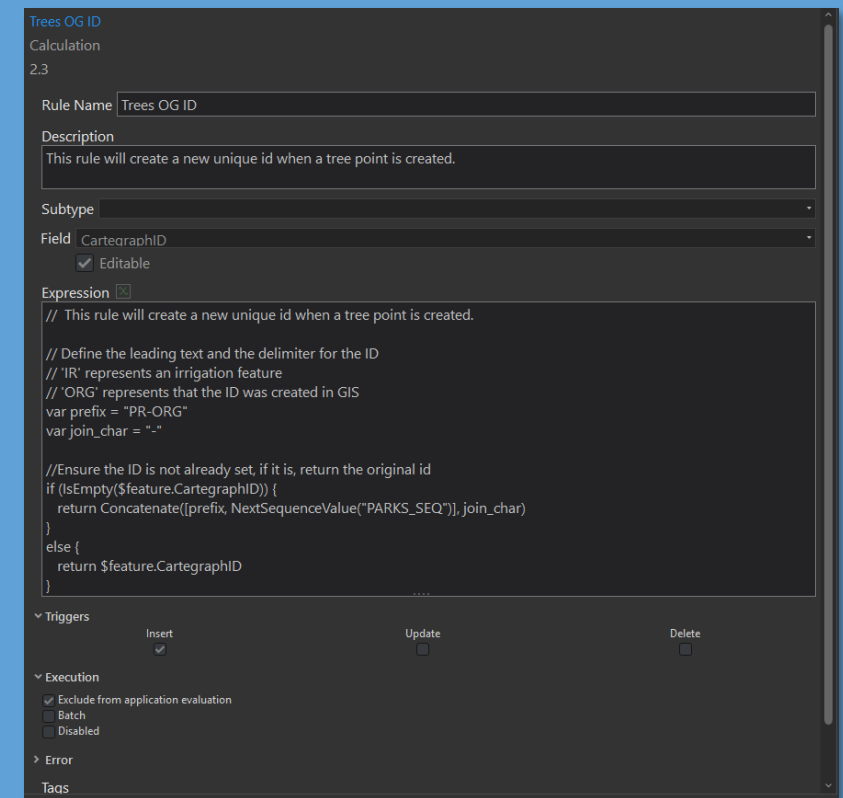
Parameters Environments

Input Workspace
SDE - Traditional.sde

Sequence Name
Park_SEQ

Sequence Start ID 1

Sequence Increment Value 1



Trees OG ID

Calculation

2.3

Rule Name Trees OG ID

Description
This rule will create a new unique id when a tree point is created.

Subtype

Field CarteagraphID

Editable

Expression

```
// This rule will create a new unique id when a tree point is created.  
  
// Define the leading text and the delimiter for the ID  
// 'IR' represents an irrigation feature  
// 'ORG' represents that the ID was created in GIS  
var prefix = "PR-ORG"  
var join_char = "-"  
  
//Ensure the ID is not already set, if it is, return the original id  
if (IsEmpty($feature.CarteagraphID)) {  
    return Concatenate([prefix, NextSequenceValue("PARKS_SEQ")], join_char)  
}  
else {  
    return $feature.CarteagraphID  
}
```

Triggers

Insert Update Delete

Execution

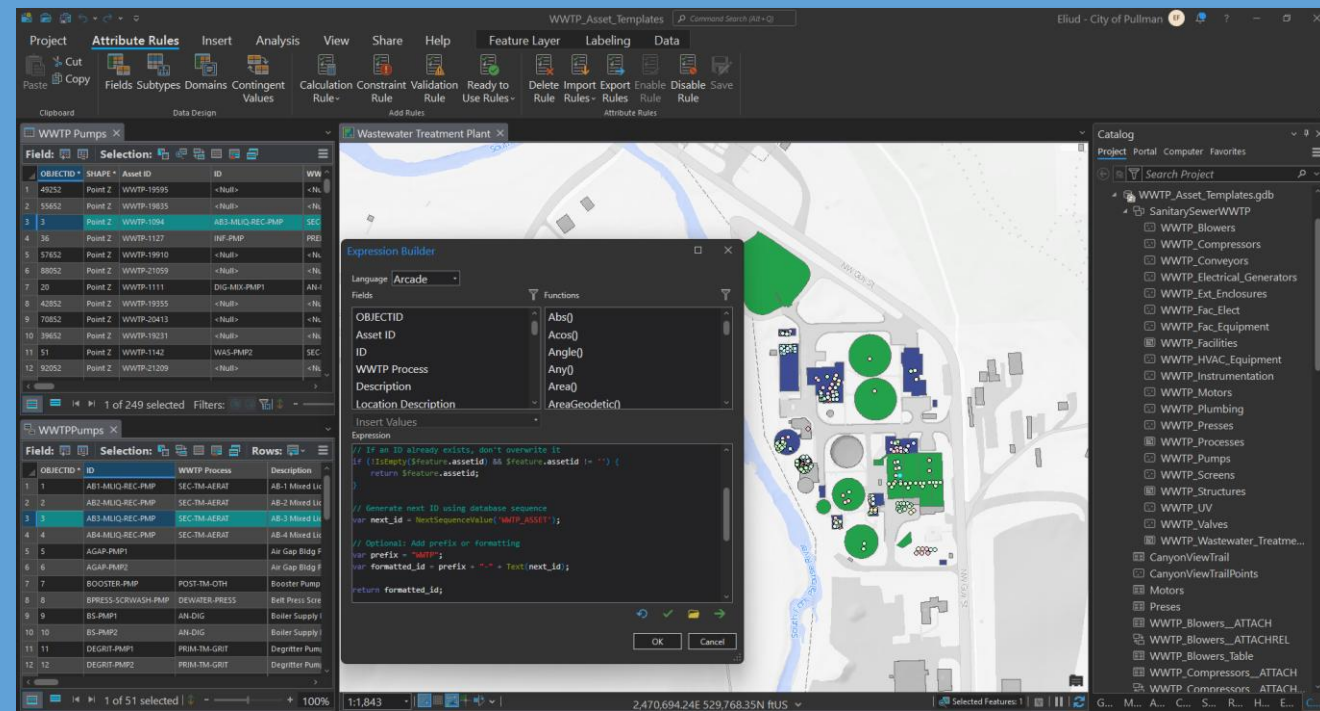
Exclude from application evaluation
 Batch
 Disabled

Error

Tags

Phase 1: Wastewater Treatment Plant

- Had to decide early if we were going to model this as a portion of the sewer utility network.
- Acquired data templates/schema from Cartegraph and created a non-spatial table.
- Appended entries from old asset management system. ID created based on attribute rule using a database sequence.
- Using the 'continue' edit tool. It's possible to assign geometry to non-spatial features.
- They are placed where we think they are, but it's expected users to move them to where they should be.



Phase 1: Wastewater Treatment Plant (cont.)

- Field matching them one by one.
- Running on nightly sync.
- Created specific domains for easier exact matching.
- Easiest scenario due to building dataset from the ground up to match Cartegraph's "out of the box" data templates.
- Enabled attachments to capture field data input to feed back into GIS.

The screenshot shows the configuration page for 'Association: WWTP Pumps'. The page includes a 'Data Source' section with the following settings:

- Server Name: Pullman GIS Server
- Feature Service: PublicUtilities/Cartegraph_Asset_Management_Wastewater_Treatment_Plant
- Feature Class Layer: WWTP Pumps
- Cartegraph Recordset: WWTP Pumps
- Integration Type: Two-Way
- Geometric or Utility Network:
- Synchronize Attachments:
- Pull GIS for Changes: (Set the polling interval with the GISPollingInterval system setting)
- Inactive:

A yellow warning banner states: 'Cartegraph SOE not enabled. Manual synchronization required after ArcMap or ArcGIS Pro edits for two-way integrations.'

The 'Field Associations' section contains a table with the following columns: Geodatabase Attribute, Domain/Subtype, Cartegraph Field, and Cartegraph Library.

Geodatabase Attribute	Domain/Subtype	Cartegraph Field	Cartegraph Library
Activation Type		Activation Type	Pump Activation Types
Address Number		Address Number	
Asset ID		ID	
Average Flow (gpm)			
Baseline Meter		Baseline Meter	
Casing Type		Casing Type	Pump Casing Types
City		City	Cities
Consequence of Failure			
County		County	Counties
Description		Pump Description	
EstLife	WastewaterTreatmentPlant_Est_Life		
ID			
Installed		Installed	
Jurisdiction		Jurisdiction	Jurisdictions
Location Description		Location Description	
Manufacturer	WastewaterTreatmentPlant_Pump_Manufacturer	Manufacturer	Pump Manufacturers
Model		Model	Pump Models
Motor Type		Motor Type	Pump Motor Types
Notes		Notes	
Off Elevation (ft)		Off Elevation	

Phase 1: Water Services

- The current GIS data was based on historic CAD files and as-builts.
- Meter information was semi-reliable thanks to copper/lead surveys conducted using Survey 123.
- Had to manually do data cleanup when cross referenced to the old Asset Management.
- Documented source of data using the note fields and field calculation in ArcGIS Pro with delimiters.

Phase 1: Sanitary Sewer

- The maintenance crew relied on old asset ID's as label guides.
- Cartegraph Asset Management wouldn't display public maps in their application, but had no problem displaying organization-shared ones.
- Utility Maps suffered from authentication issues when displaying.

Solution?

- Create a private webmap composed of our public utility map layers. Somehow that worked!
- We are currently implementing directional symbology to slowly phase out the old ID labels.

Successes

- When our maps are used to schedule tasks and work orders. Mistakes or errors in geometry are obvious.
- There was a case of a older line that got replaced that still showed in use. Never documented as replaced.
- We added ourselves to the workflow by creating a specific task within the Asset Management system to request map changes where geometry changes require desktop privileges. (Utility Network).

Phase 2: Parks and Recreation

- We started with little data to start the process.
- We used our planimetric vector dataset to digitize some of the required assets. Playgrounds, structures, benches.
- With an incomplete dataset, I manually digitized Trees and other assets that were easily observed through recent imagery in a couple of Parks.
- Mostly to show what a fully documented Park would look like.



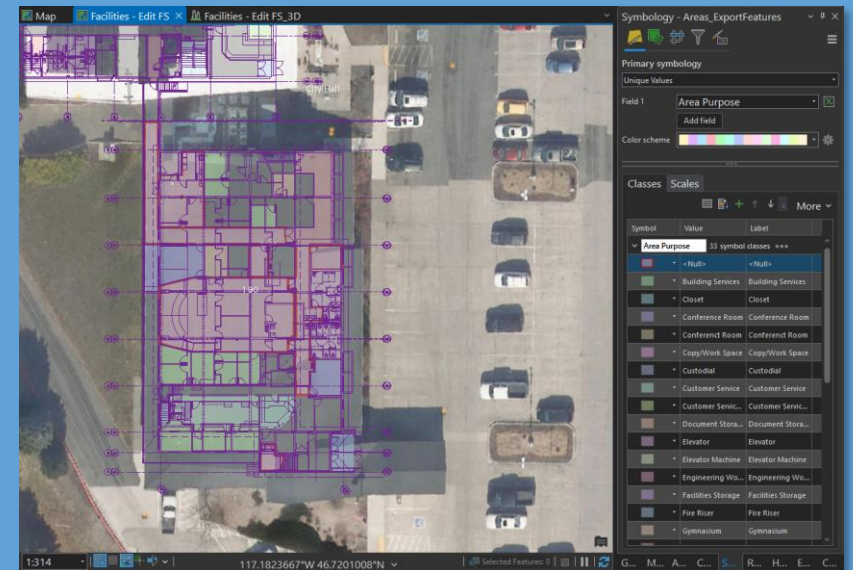
Phase 2: Facilities

Like with Parks, there was little digitized data.

Our Planimetric Data gave building outlines, but higher detail was requested.

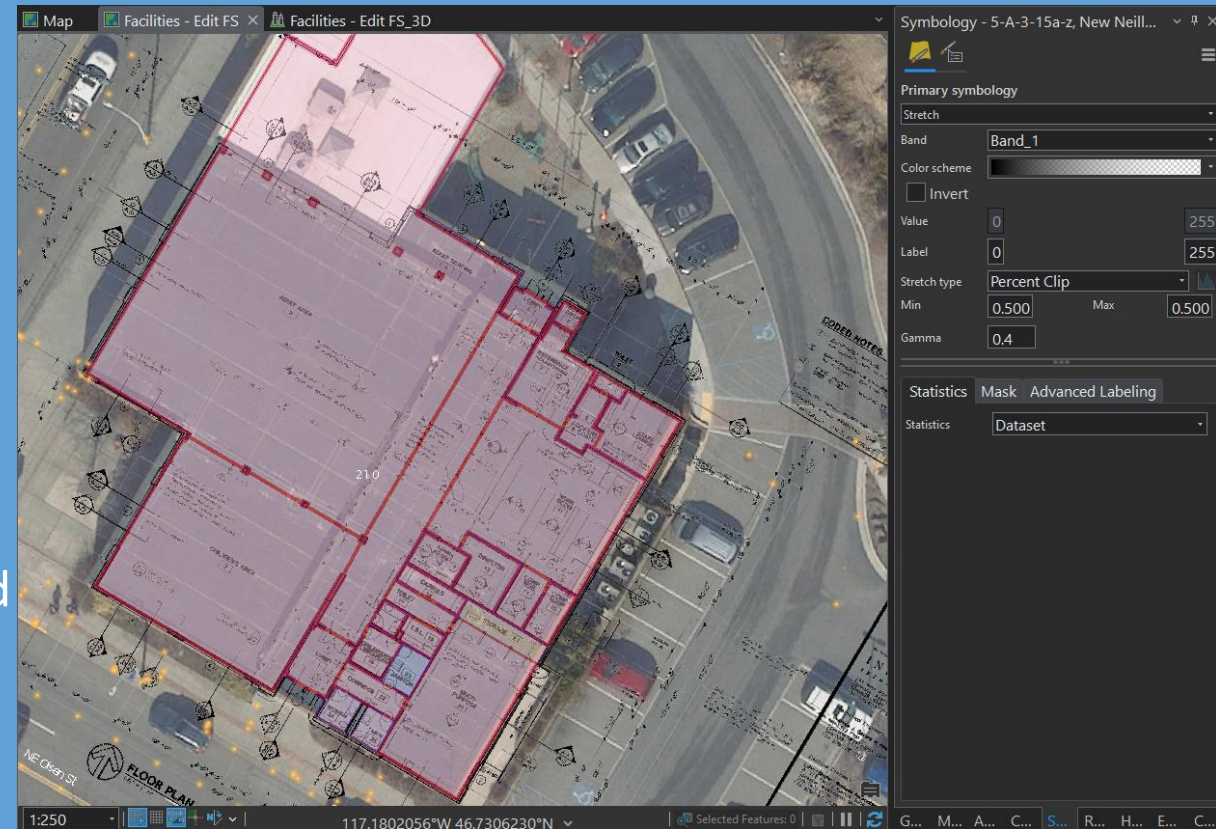
In some lucky cases. PDFs of construction plans had vector data saved on them that could be retrieved with open source programs like inkscape and saved as CAD files.

These could be geo-referenced and digitized to feed into our room and facility floor asset layer.



Phase 2: Facilities (Cont.)

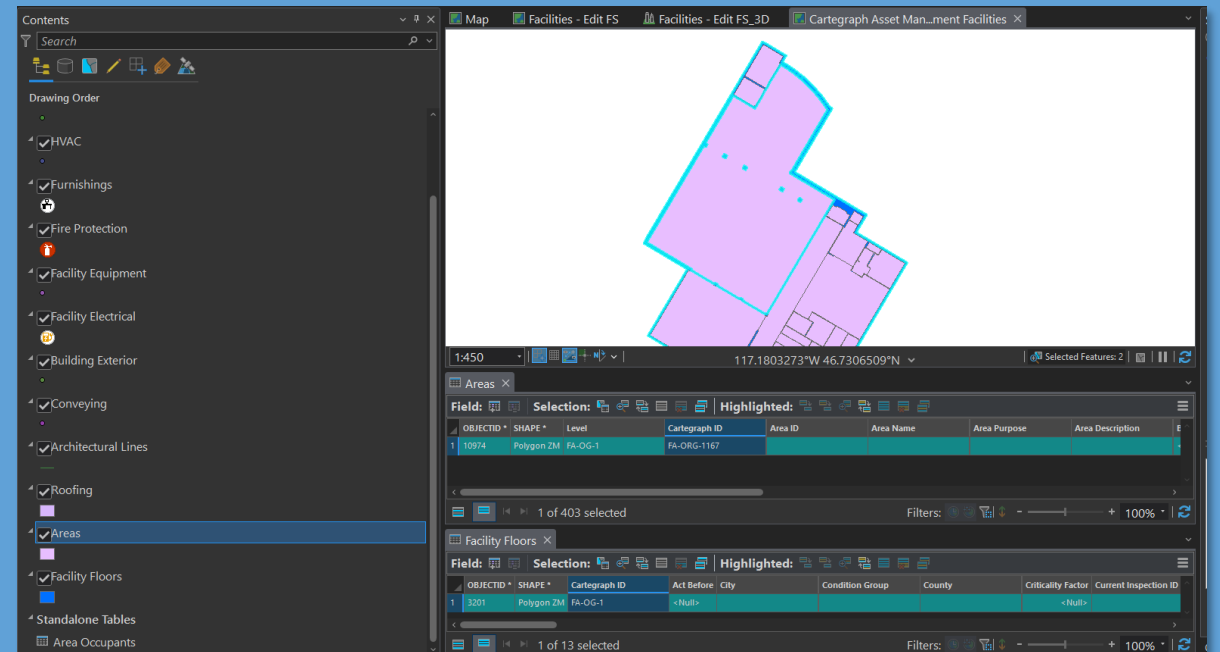
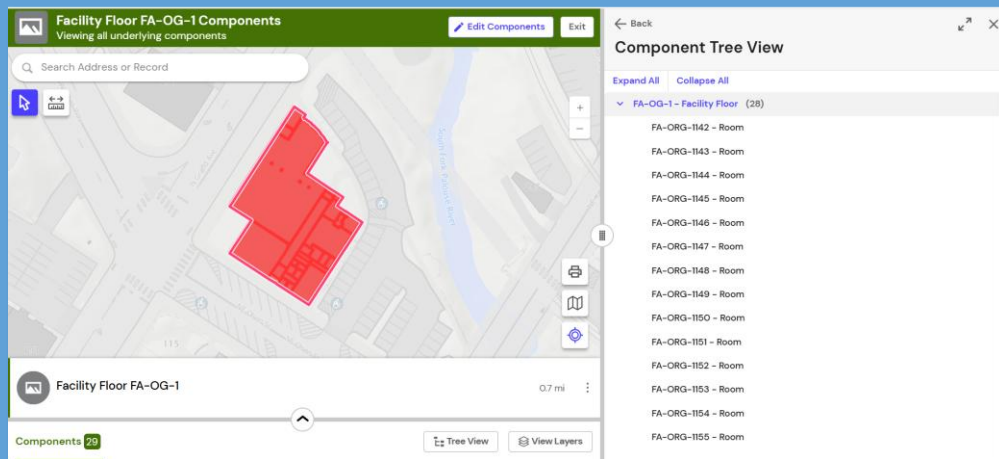
- Unfortunately, many of our archived building plans are old scans. Which don't have vectorized data saved onto them.
- Currently georeferencing construction plans and digitizing lines by hand.
- Prioritizing facilities of constant use or high importance. City Hall, Fire Stations, Library, etc.
- Time consuming, but needs to be done.
- Work in Progress.
- After integration is done. Will add z values based on construction documents.



Phase 2: Facilities (Cont.)

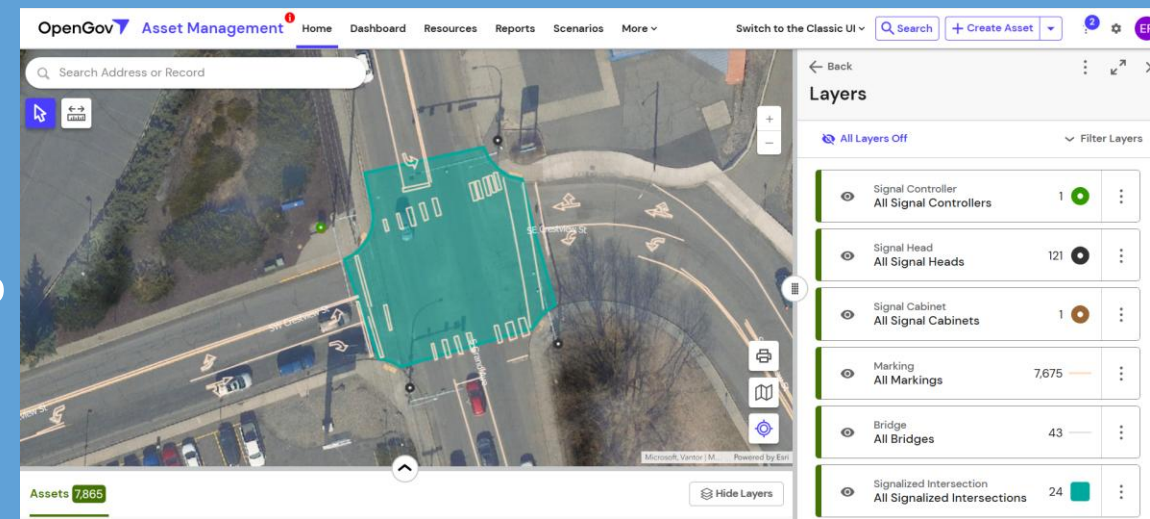
Parent/Child relationships – How we hard coded them in GIS.

Containers in Open Gov.



Streets & Signalized Intersections

- We have a robust road layer with historical data Stantec's Road Matrix pavement management system.
- Planimetric Data shows us all bridges, paint markings, and pavement areas such as parking lots.
- Currently filtering out city-maintained assets.
- Using bridge inspection reports to build out bridge data.
- Using polygon Intersection I had previously built to create a city basemap to act as a parent for individual assets within such as street signals.
- Question of where do Trails and Paths live?



Current Challenges

Domain Mismatch

- Utility Network GIS Features have specific subtypes that have domains applied to them across the board.
- This meant that something like a material type field is used among all features in each subtype.
 - Ex. A water main would use the same 'material' domain as a water meter, water valve, or pump.

The problem:

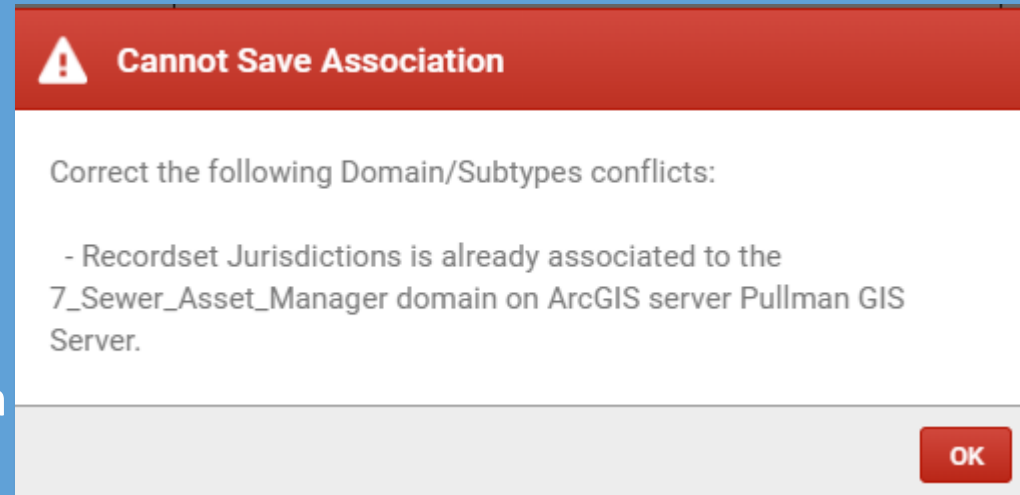
- Cartegraph has a 1 to 1 relationship on it's GIS integration when it came to field matching.
 - Won't allow the same domain to apply to more than 1 Asset Type.

Solution (for now and currently in implementation.)

- Make a separate Cartegraph field and make a attribute rule to update the original Utility Network field.

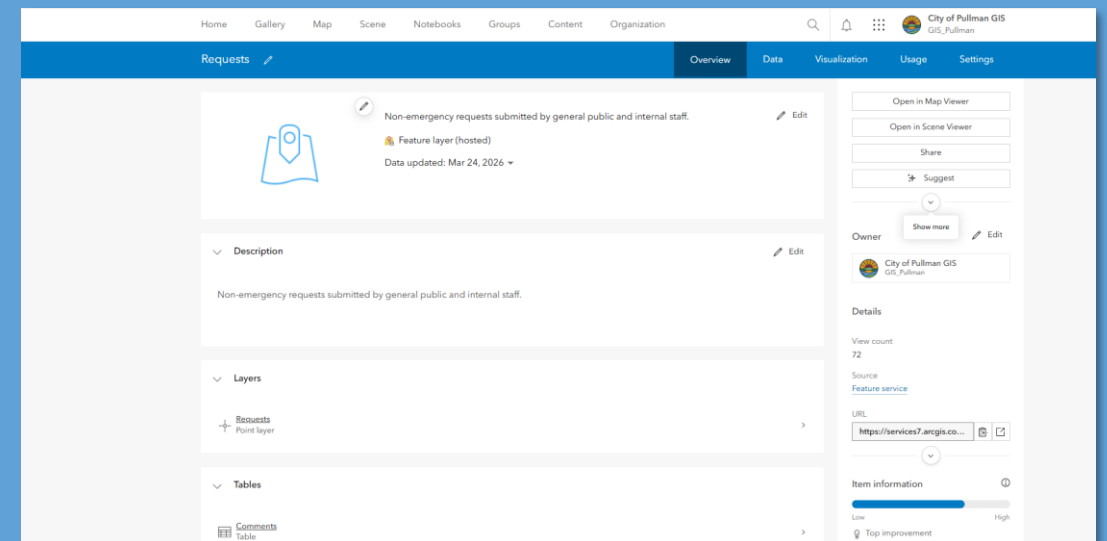
Current Challenges (Cont.)

- It is also restricted from the opposite side.
- A recordset from their end can only be associated to a single domain.
- If it's already in use, it also throws out an error.
- Solution again, is to associate with a new costume field that we can play around with attribute rules to modify our default fields.
- Not elegant, but it *should work*.



311 Implementation

- Currently in talks to acquire a 311 system.
- There is already a ESRI Citizen Reporter Solution
- Possible Way Forward:
 - Integrate the Request Feature layer to that solution to feed the Request layer in Cartegraph.
 - In theory this will sync both layers.
 - Shouldn't incur extra cost.



Foreseen Issues

- Minor domain mismatch. Replacing Esri integer based domains with text ones.
 - Or replace them for ease of use.
- Esri Solution is clunky to operate out of the box.
- Needs time to customize.
- Needs Organizational Buy-in.
- Lots of responsibility to maintain on current GIS team.

The screenshot shows the 'Creating Association' page in the Asset Management system. The page is divided into two main sections: 'Data Source' and 'Field Associations'.

Data Source Configuration:

- Server Name: Pullman ArcGIS Online Server
- Feature Service: Requests_98d0e97390b942f4b978f6d4...
- Feature Class Layer: Requests
- Cartograph Recordset: Requests
- Integration Type: Two-Way (click icon to change)
- Synchronize Attachments:
- Poll GIS for Changes: (Set the polling interval with the GISPollingInterval system setting)
- Inactive:

Field Associations Table:

Geodatabase Attribute	Domain/Subtype	Cartograph Field	Cartograph Library
Assigned To			
Details			
Email			
First Name			
Last Name			
Location			
Notes			
Phone Number			
Request Category	reqcategory		
Request ID		Request ID	X
Request Type	reqtype	Issue	X Request Issues

Extra Credit

- During the course of this project. Some longstanding issues came up that had fun solutions.
- It turns out that we were running out of space to store CCTV footage of utility line inspections.
- Footage was captured and stored in close to RAW format.
- City Engineers needed a time-sensitive project link to access project files on a case-by-case basis.

Extra Credit (Cont.)

- Asked for a copy of some videos and took them home and re-encoded them.
- Found the Open Source program called Handbreak that allowed me to re-encode them in H.264 MP4.

Reduced the file size from 608 megabytes to 32 using modern encoding standards while preserving resolution and reducing framerate from 60 to 30 frames per second.

- Made a secondary example adjusting only the framerate setting to keep the original 59.6 fps. Still saw a reduction from 765 megabytes to 66!
- This is small enough to add as an attachment!

Name	Date	Type	Size	Len
Mh1-10-60-010Mh_7B8427d8-Fa3d-4E40-A056-Ac4eab54569f4f3ecb71-E067-4E04-84C1-4563164380C4	4/7/2026 6:04 PM	MP4 File	32,769 ...	00
MH1-10-60-010MH_7b8427d8-fa3d-4e40-a056-ac4eab54569f4f3ecb71-e067-4e04-84c1-4563164380c4	4/7/2026 2:22 PM	AVI File	608,356...	00
South East Cb-10-60-010Mh_77E49c64-C5a0-4D1c-A81b-54938Fa8775de062db49-242F-49Cd-A2a0-A6fdeaff514f	4/8/2026 1:13 AM	MP4 File	66,151 ...	00
SOUTH EAST CB-10-60-010MH_77e49c64-c5a0-4d1c-a81b-54938fa8775de062db49-242f-49cd-a2a0-a6fdeaff514f	4/7/2026 2:22 PM	AVI File	765,005...	00

Extra Credit (Cont.)

- Developed an Arcade Expression to display latest attached video.
- Attachments are not retrievable in arcade for map image layers.
- Have to call upon the feature layer and match them by GIDs.
- From there I push entries of the ID field into an array.
- Make a comparison to find largest ID value.
- Build attachment URL from there.

```
// -----  
// PORTAL CONNECTION  
// -----  
var portal = Portal("https://gis.pullman-wa.gov/portal/");  
  
// -----  
// FEATURE SET (RELATED TABLE)  
// -----  
var relatedFeatureSet = FeatureSetByPortalItem(  
  portal,  
  "76f68f2e9e094e4583a270028f29b30a", // Portal item ID  
  415004, // Layer / table ID  
  ["GlobalID"], // Only fetch needed field  
  false  
);  
  
// -----  
// FIND RELATED FEATURE  
// -----  
// GlobalID must be created as a string  
var relatedFeature = First(  
  Filter(  
    relatedFeatureSet,  
    "GlobalID = '" + $feature.GlobalID + "'"  
  )  
);  
  
// -----  
// ATTACHMENTS FILTER  
// -----  
// Only video/mp4 attachments  
var videoAttachments = Attachments(relatedFeature, {  
  types: ["video/mp4"]  
});  
  
// -----  
// -----  
// RETURN HTML VIDEO OUTPUT  
// -----  
if (Count(videoAttachments) == 0) {  
  return {  
    type: 'text',  
    text: 'No video available'  
  };  
}
```

```
// -----  
if (Count(videoAttachments) == 0) {  
  return {  
    type: 'text',  
    text: 'No video available'  
  };  
}  
  
// -----  
// EXTRACT ATTACHMENT IDS  
// -----  
var attachmentIds = [];  
  
for (var a in videoAttachments) {  
  Push(attachmentIds, videoAttachments[a].id);  
}  
  
// -----  
// GET LAST ATTACHMENT ID  
// -----  
// Forms an array of attachment IDs. Finding the largest numeric value.  
// Converts values to Number.  
var maxId = -Infinity; // starting at lowest possible value  
  
for (var i in attachmentIds) { // Looping through all the IDs.  
  var val = Number(attachmentIds[i]); // converting to number for comparison  
  
  if (val > maxId) { //If the value is greater than the max id variable, the value becomes the new max id variable.  
    maxId = val;  
  }  
}  
  
var latestAttachmentID = maxId; // the maxId becomes the latest attachment.  
  
// -----  
// BUILD ATTACHMENT URL  
// -----  
var attachmentUrl = "https://gis.pullman-wa.gov/arcgis/rest/services/PublicUtilities/CoP_Stormwater_UTILITY_Map/MapServer/415004/" +  
  relatedFeature.OBJECTID +  
  "/attachments/" +  
  latestAttachmentID;  
  
// -----  
// RETURN HTML VIDEO OUTPUT  
// -----  
return {  
  type: "text",  
  text:  
    '<video controls preload="none" width="100%">' +  
    '<source src="' + attachmentUrl + '" type="video/mp4">' +  
    '</video>'  
};
```

Extra Credit (Cont.)

Final Webmap can be accessed in Cartograph!

Some issues with it loading faster within our network vs the field.

Should work fine for a extra layer of context for assigning tasks/work.

The screenshot displays the OpenGov Asset Management web application. The top navigation bar includes 'OpenGov Asset Management', 'Home', 'Dashboard', 'Resources', 'Reports', 'Scenarios', and 'More'. A search bar and a '+ Create Asset' button are also present. The main interface is divided into several sections:

- Map View:** A central map showing a street layout with a green line representing an asset. A video player is overlaid on the map, showing a close-up of a pipe. The video player has a progress bar at 0:00 / 1:03.
- Asset Details Panel:** On the right side, a panel titled 'SW-ORG-18678 Storm Pipe' is visible. It includes tabs for 'Details', 'Attachments 2', 'Inspections 0', and 'Tasks 0'. Below these are fields for 'Location' (Street and City) and 'Location Description'.
- Asset Summary:** Below the map, there is a summary for 'Storm Pipe SW-ORG-18678' with a distance of '0.9 mi'. It also shows 'Tasks 6' and 'Assets 6,923'.
- Map Controls:** At the bottom, there are controls for 'Show Selected', 'Assets of 0 Total Records', 'Map Filter Off', 'All Assets', 'Sort', and 'Actions'.
- Table:** A table is partially visible at the bottom, with columns for 'ID', 'AssetType', 'Street', 'Estimated OCI', and 'Proximi...'. The table has a green header row.

Hopeful End Results

- Centralization of all spatial asset data into current GIS Portal.
- Encourage inter-departmental communication on assets with shared ownership/responsibilities.
- Massive influx of data for GIS analysis in the coming years.
 - With creation of initiative GIS products to observe and analyze asset use through time.