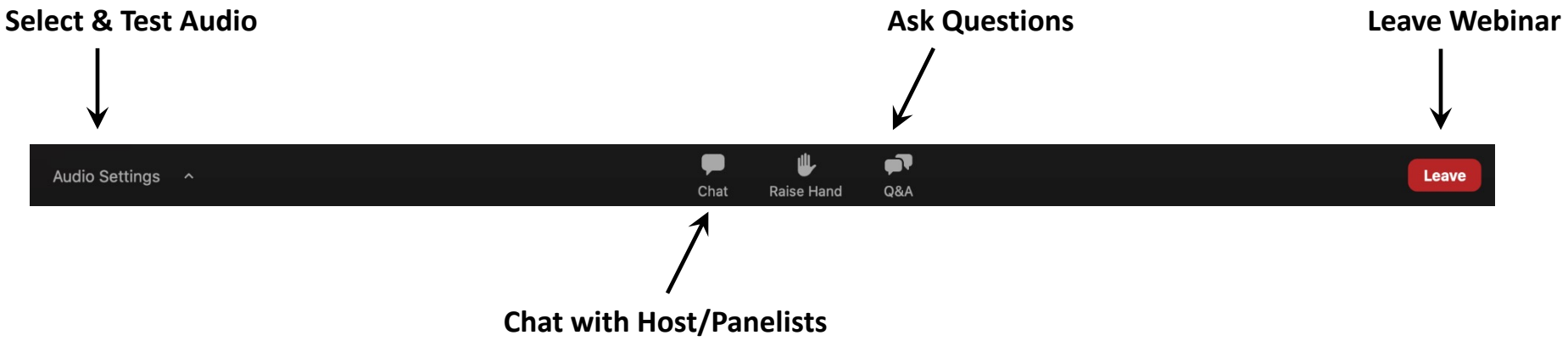
Digitizing Asset Management for Stormwater Infrastructure

STORMWATER UNIVERSITY

Attendee Control Panel



Can you hear me?

If you cannot hear me, please note this in the Chat or Q&A boxes.

Moderator

Ryan Graff
Continuing Education Manager
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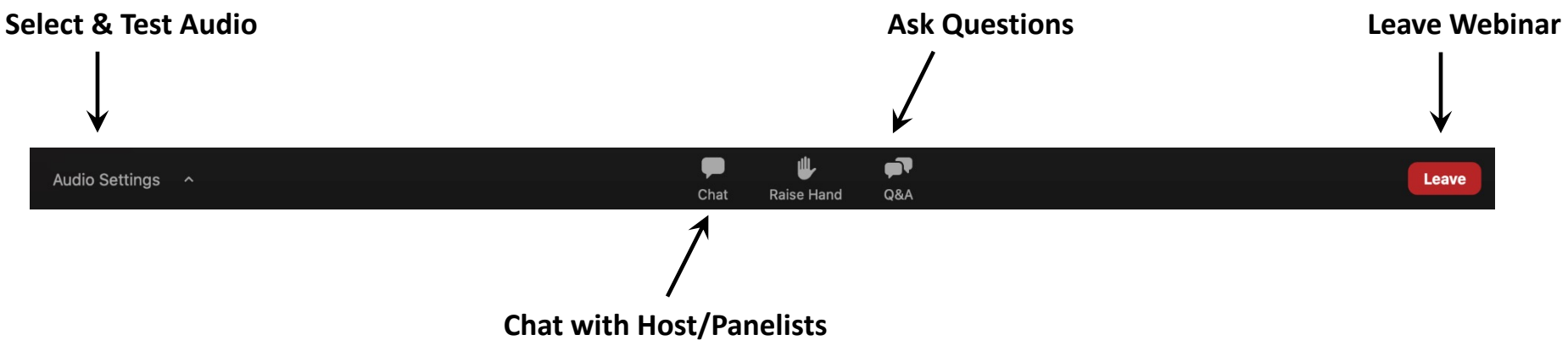
Attendee Control Panel

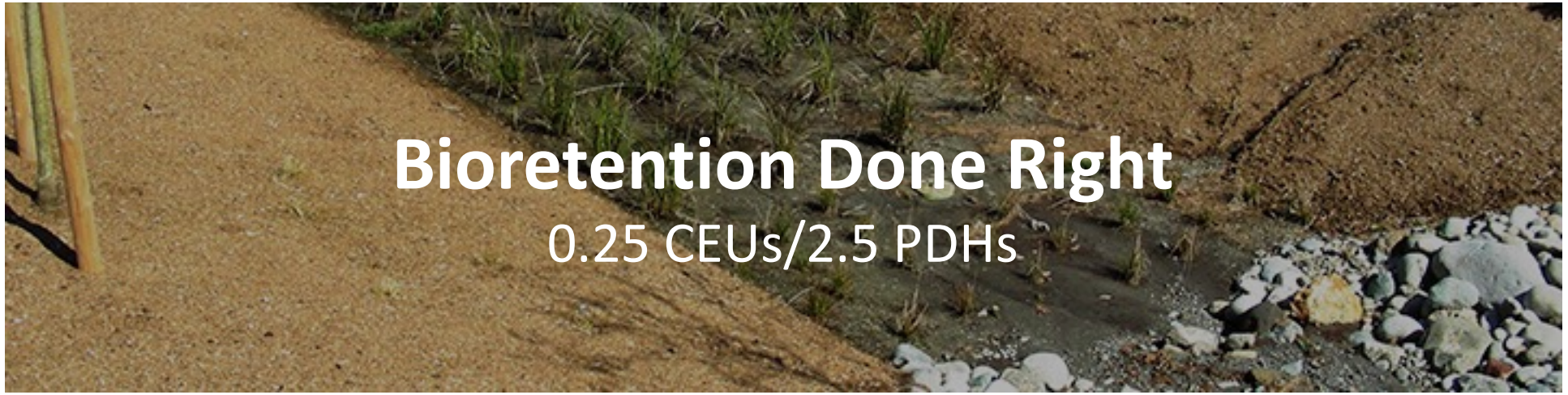


Best Practices

1. Utilize a high-speed connection.
2. Close all other windows and programs.
3. Turn off & put away cell phones.
4. Interact!

If we lose you…

1. Go to: **zoom.us/join**
2. Enter Webinar ID: **938 2756 0560** with Passcode: **12737**



Bioretention Done Right

0.25 CEUs/2.5 PDHs

Doug Beyerlein
Co-Founder, Clear Creek Solutions

This course will discuss how bioretention systems are designed, how different engineered soil media impact the movement of stormwater runoff through the engineered soil layers, and how this is typically modeled. Modeling assumptions, good and bad, will be identified along with their potential impact on bioretention facility sizing and effectiveness in providing water quality treatment.

Corryn Smith

Information Systems Administrator

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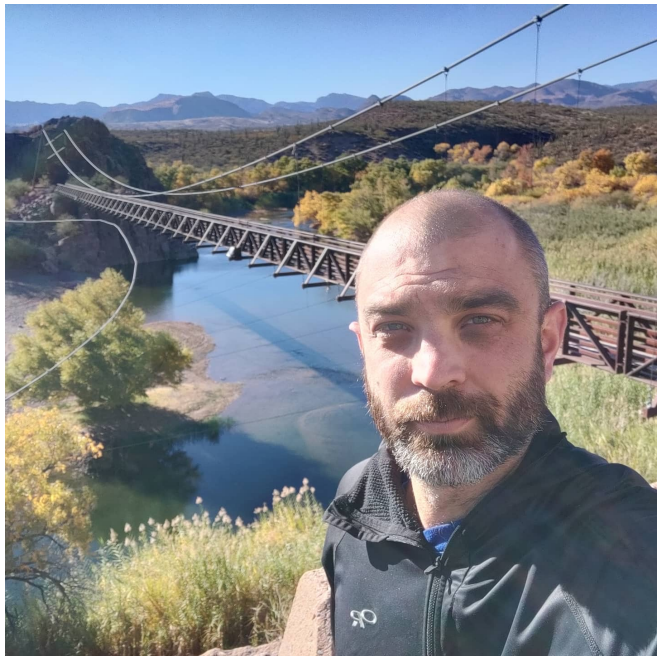

Ed Schenk

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City of Flagstaff Water Services

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Digitizing Asset Management for Stormwater Infrastructure

Outline:

- Revamping GIS for Stormwater Assets
    - What is GIS/geospatial technologies?
    - City of Flagstaff Case Study
- Implementing CMMS
    - Advantages to having a CMMS
    - Work Order, Inspection, and Service Request examples
- Displaying and Analyzing Data with Dashboards

Part 1
Revamping GIS for Stormwater Assets

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Revamping GIS for Stormwater Assets

Before jumping right into Asset Management, do you have an inventory of your assets?
Digitally?

Revamping GIS for Stormwater Assets

Spreadsheets can work for keeping an inventory for your assets.

But what about adding a spatial location to “where” your asset is situated?

Revamping GIS for Stormwater Assets

Geospatial Technologies:

- GIS – Geographic Information Systems
- Remote Sensing
- GPS/GNSS

Revamping GIS for Stormwater Assets

We use geospatial technologies daily

SMARTPHONES!

TRAILFORKS

Uber

Revamping GIS for Stormwater Assets

So why not add “where” to your Stormwater Assets??

What about accessing your stormwater infrastructure in the field –either on a smartphone, tablet, or laptop?

Put your Stormwater Infrastructure in GIS

Revamping GIS for Stormwater Assets – City of Flagstaff Case Study

Original Stormwater GIS Dataset created in 2007 as a graduate student capstone

Techniques used: External GPS and ArcMap Desktop Software

Revamping GIS for Stormwater Assets – City of Flagstaff Case Study

WaterServices.SDE.CatchBasins	SDE Feature Class
WaterServices.SDE.LID	SDE Feature Class
WaterServices.SDE.StormBasins	SDE Feature Class
WaterServices.SDE.StormChannels	SDE Feature Class
WaterServices.SDE.StormCulvertInlets	SDE Feature Class
WaterServices.SDE.StormCulvertOutlets	SDE Feature Class
WaterServices.SDE.StormCulverts	SDE Feature Class
WaterServices.SDE.StormLevees	SDE Feature Class
WaterServices.SDE.StormManholes	SDE Feature Class
WaterServices.SDE.StormOutfalls	SDE Feature Class
WaterServices.SDE.StormPipeInlets	SDE Feature Class
WaterServices.SDE.StormPipeOutlets	SDE Feature Class
WaterServices.SDE.StormPipes	SDE Feature Class
WaterServices.SDE.StormScuppers	SDE Feature Class

Revamping GIS for Stormwater Assets – City of Flagstaff Case Study

Stormwater Section hires temporary technicians to work on GIS dataset. No new infrastructure digitized in GIS after 2015 – lack of funding, needed technicians for other projects

SCADA IS team worked with Stormwater to create a new GIS database schema in Fall 2019

Revamping GIS for Stormwater Assets – City of Flagstaff Case Study

New database schema to help clean up redundant fields, null values, and what information is beneficial to the Stormwater team and GIS

Copy over legacy data into the new schema, then work on cleaning up the data

Revamping GIS for Stormwater Assets – City of Flagstaff Case Study

WaterServices.SDE.CatchBasin	SDE Feature Class
WaterServices.SDE.Channels	SDE Feature Class
WaterServices.SDE.Culvert	SDE Feature Class
WaterServices.SDE.Culvert_Outlet	SDE Feature Class
WaterServices.SDE.CulvertInlet	SDE Feature Class
WaterServices.SDE.Manhole	SDE Feature Class
WaterServices.SDE.OpenChannelMaintenance	SDE Feature Class
WaterServices.SDE.Pipe_Inlet	SDE Feature Class
WaterServices.SDE.Pipe_Outlet	SDE Feature Class
WaterServices.SDE.PipeFitting	SDE Feature Class
WaterServices.SDE.Scupper	SDE Feature Class
WaterServices.SDE.StormBasin	SDE Feature Class
WaterServices.SDE.StormPipe	SDE Feature Class

Revamping GIS for Stormwater Assets – City of Flagstaff Case Study

Catch Basin

- Facility ID
- Jurisdiction
- Custodian
- Type
- Grate Width
- Grate Length
- Curb Opening Length
- Grate, Invert, and Grate Invert Elevations
- Data Source
- Verified, and By Whom?
- Document Name
- Comments
- Subwatershed
- Picture Link

Revamping GIS for Stormwater Assets

Revamping GIS for Stormwater Assets – City of Flagstaff Case Study

Understanding our Closed Stormwater Infrastructure

Hired 2 field technicians to verify assets

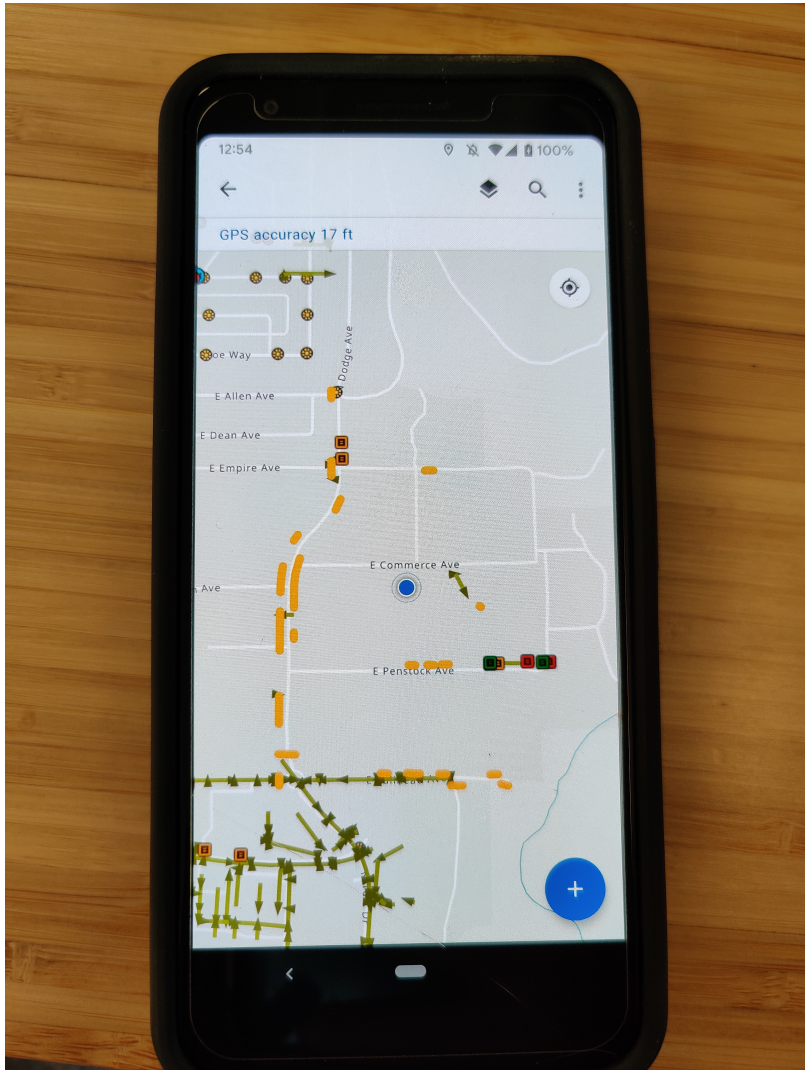
Revamping GIS for Stormwater Assets – City of Flagstaff Case Study

Instead of using a GPS and ArcMap Desktop, decided to use Smartphones with ESRI Collector App and BadElfGNSS and Arrow2 GNSS receivers

Benefits of Collector App:

- Map changes on the fly (add layers, change symbology, etc)
- Easy to use with touchscreen
- Don’t need to sync and post-process data
- Easy to move around
- Enhanced location when using external GNSS receiver

Revamping GIS for Stormwater Assets – City of Flagstaff Case Study



Revamping GIS for Stormwater Assets – City of Flagstaff Case Study

Added the Stormwater Dataset into ArcGIS Online and queried out the original field verifications (Verified Date > 2007)

Technicians would go to the asset and change drop-down for “Verified?” from “No” to “Yes” to clear the asset from the map. Would also update attribute information or location if incorrect in GIS

Technicians would walk/drive around new construction (since 2015) to add in GIS

Revamping GIS for Stormwater Assets – City of Flagstaff Case Study

Technicians were only collecting/verifying point features (no Culverts or Storm Pipes). This would help expediate the field process. Can “connect the dots” in the office.

Issues: Private vs Easement? Mislabeled Manhole lids. Few connectivity dead-zones. Clogged outlets reflecting wrong diameter size.

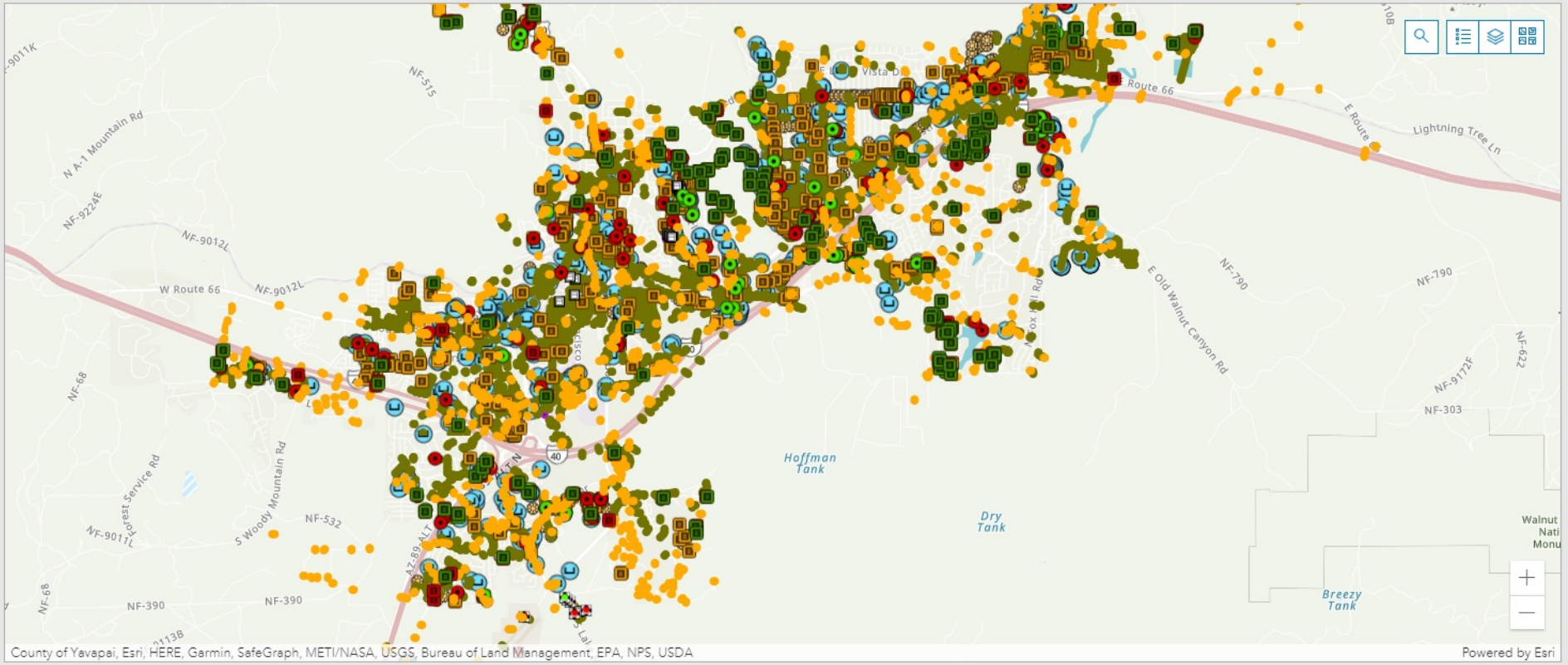
Stormwater Collector Status Dashboard

Select a date
11/12/2021 and before

Needs Verification
1
Culvert Outlets
Verified | To-Do | New

New
221
Culvert Inlets
Verified | To-Do | New

Total Verified
634
Pipe Outlets
Verified | To-Do | New



New
59
Pipe Inlets
Verified | To-Do | New

New
600
Catch Basin
Verified | To-Do | New

Needs Verification
7
Manhole
Verified | To-Do | New

Total Verified
372
Scupper
Verified | To-Do | New

Revamping GIS for Stormwater Assets – City of Flagstaff Case Study

Used a Select Spatial Location and Field Calculator to apply the appropriate subwatershed to each asset

By adding a subwatershed, you can bulk create Inspections and Work Orders in CMMS (coming soon in this talk!)

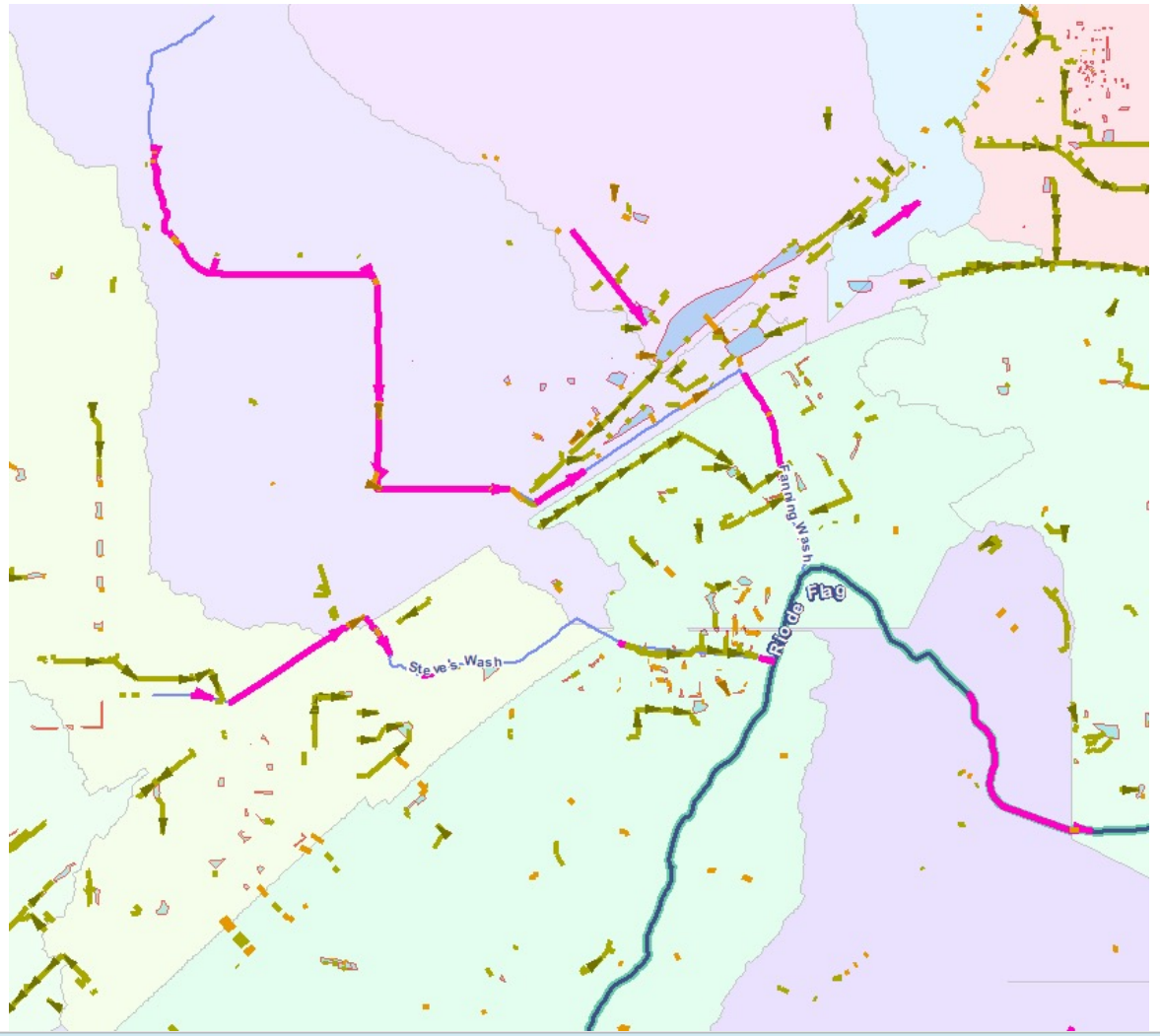
Also verified the FacilityID – no duplicates, and if this field was missing, populate one based on the next number in the sequence

Revamping GIS for Stormwater Assets – City of Flagstaff Case Study

FacilityID
CI10
CI106
CI107
CI108
CI109
CI110
CI111
CI113
CI124
CI128
CI132
CI134
CI135

FacilityID
CO100
CO101
CO102
CO103
CO104
CO105
CO107
CO108
CO109
CO110
CO111

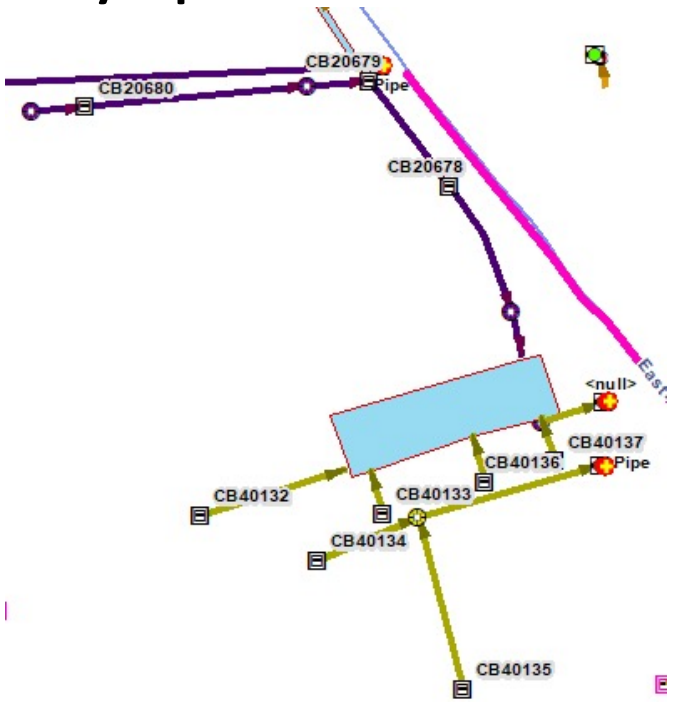
FacilityID
C77-79
C77-78
C77-77
C53-99
C53-98
C53-97
C53-96
C53-95
C53-94
C53-93
C53-92
C53-91



Revamping GIS for Stormwater Assets – City of Flagstaff Case Study

For Maintenance Purposes, we used display queries to create 2 datasets: City of Flagstaff
Stormwater and Private Stormwater

Based on Custodian field



Revamping GIS for Stormwater Assets – City of Flagstaff Case Study

Constantly updating our GIS – it's not perfect…yet

Culvert size verification for maintenance

Storm Pipe size/material verification for 3rd party modeling

Updating Custodian fields based on Drainage Easements

Part 2
Implementing CMMS

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Implementing CMMS

Computerized Maintenance Management System

“Sits” on top of GIS to collect information regarding Maintenance

Implementing CMMS

Inspection/Condition Scoring

- Form to complete to keep record how assets have changed over time
- Record for understanding the current condition (Damage? Needs Further Attention?)
- CMMS allows record keeping with Inspector, Date/Time, Observations, etc.

Work Order Management

- Create Work Orders based off of Inspection Forms (Condition Scoring)
- Different Work Order templates/types to describe the work being performed
- Closed Work Orders are stored in the database for quick history/query search

Implementing CMMS

Service Requests or Service Calls

Address based (not tied to a specific asset)

Crew will go to the address to see what's wrong, then create Work Order if needed

Implementing CMMS

Cityworks customers since 2005 (Wastewater Collections crew)

Implemented Cityworks for Water Distributions in 2018

Implemented Cityworks for Stormwater – both Closed System and Open Channel Maintenance in Summer 2020

Implementing CMMS

Most important factor when dealing with your assets in GIS and CMMS:

FACILITYID

Implementing CMMS

Once you have CMMS:

Determine which assets you want to have work performed on

What type of typical work will be performed on this asset?

Start creating Work Order templates to differentiate the various type of work

Implementing CMMS

Keep your Templates simple – know your audience

Make sure your specific enough for future data analysis

Clean, Repair, Replace

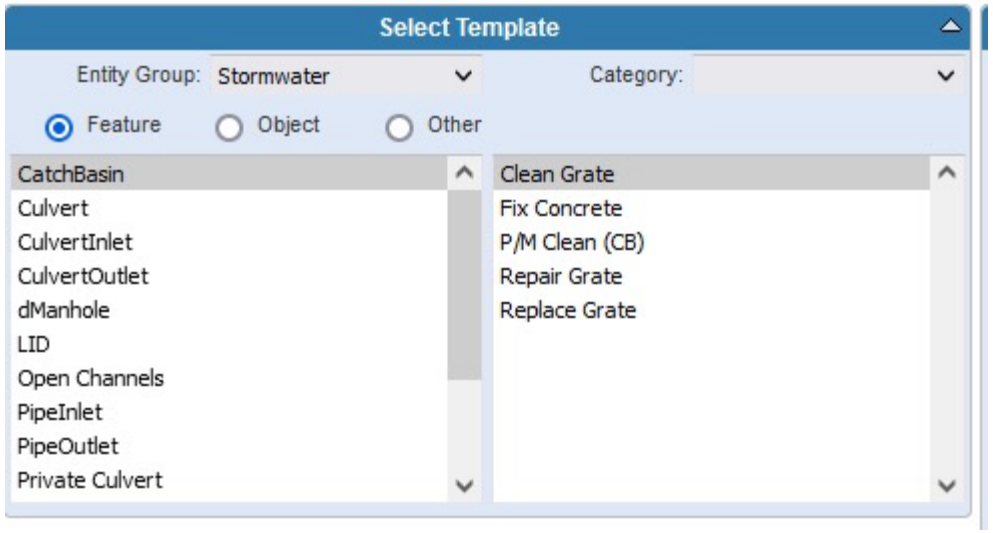
Implementing CMMS

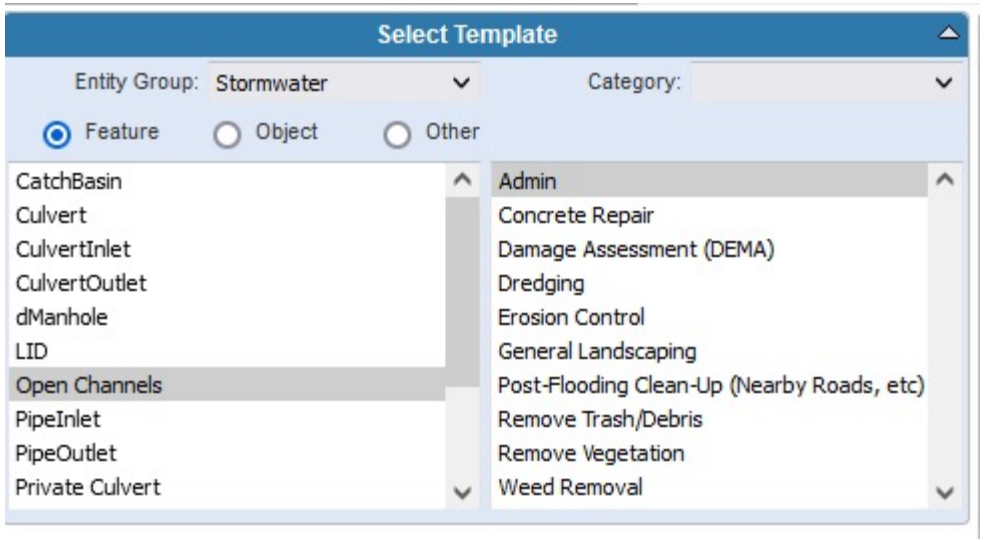
Make your CMMS as robust as possible

Library of equipment with hourly cost
Each employee's hourly and overtime rate recorded
List of Contractors with cost (if possible)

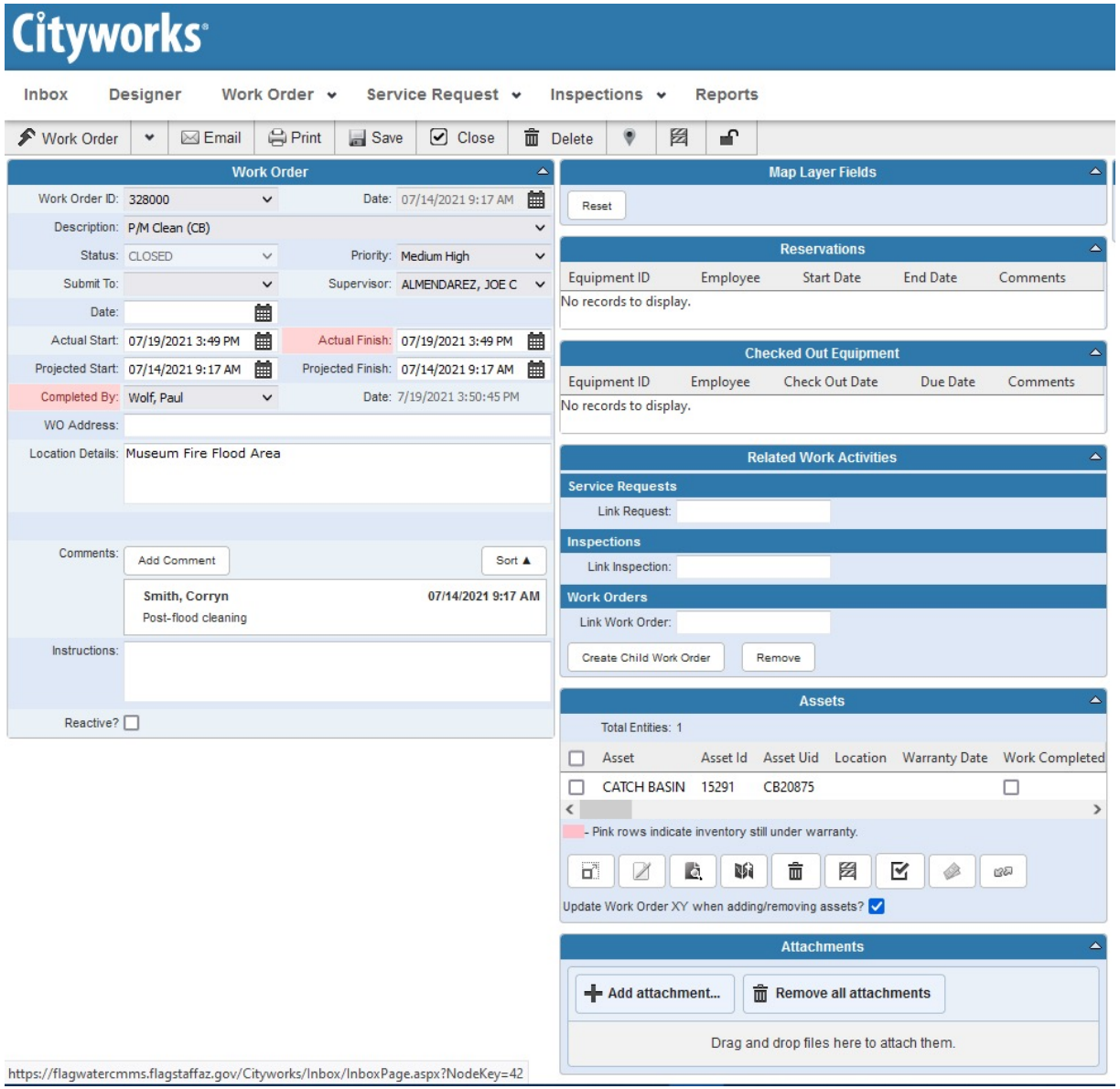
Then, encourage field crews to complete as much as possible

Implementing CMMS





Implementing CMMS



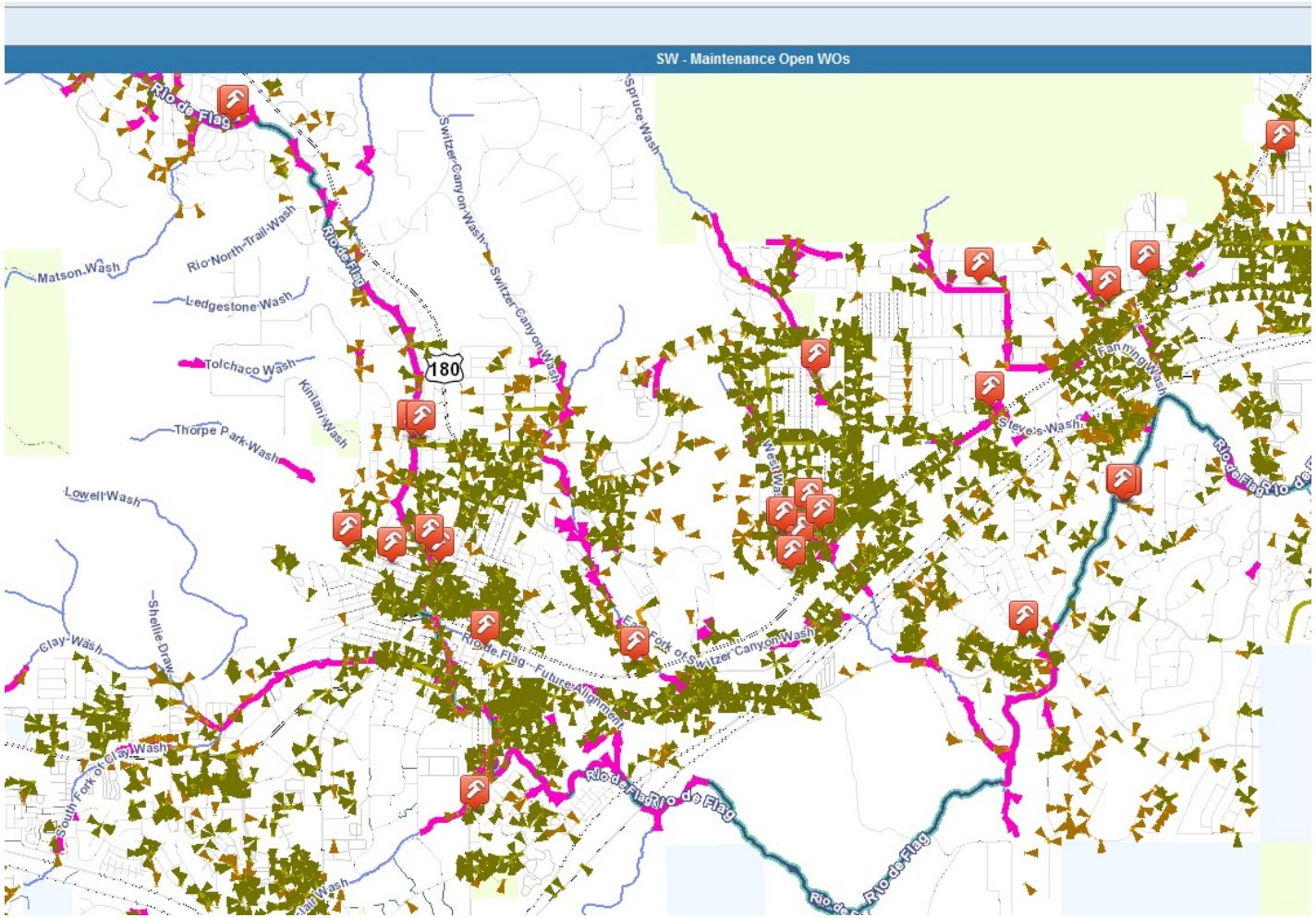
Implementing CMMS

Id	Name	Hours	Account	Start Date	Finish Date	Task	Id	Asset	Description	Labor Type	Trans Date	Regular
328000	Toback, J	0.33		07/19/2021 3:49 PM	07/19/2021 3:49 PM					0	07/19/2021 3:50 PM	9.3093
328000	Wolf, Paul	0.33		07/19/2021 3:49 PM	07/19/2021 3:49 PM					0	07/19/2021 3:50 PM	10.3521

Id	Equipment Id	Description	Units	Hours	Rate Type	Cost
328000	S4018	CAMEL/JET RODDER/VACUUMS4018	1	0.33	0	28.083

Implementing CMMS

Assigning Work Orders



Implementing CMMS

Inspection Forms – used primarily for annual inspection checklists/condition scoring

Currently use Inspection forms for Open Channel Maintenance

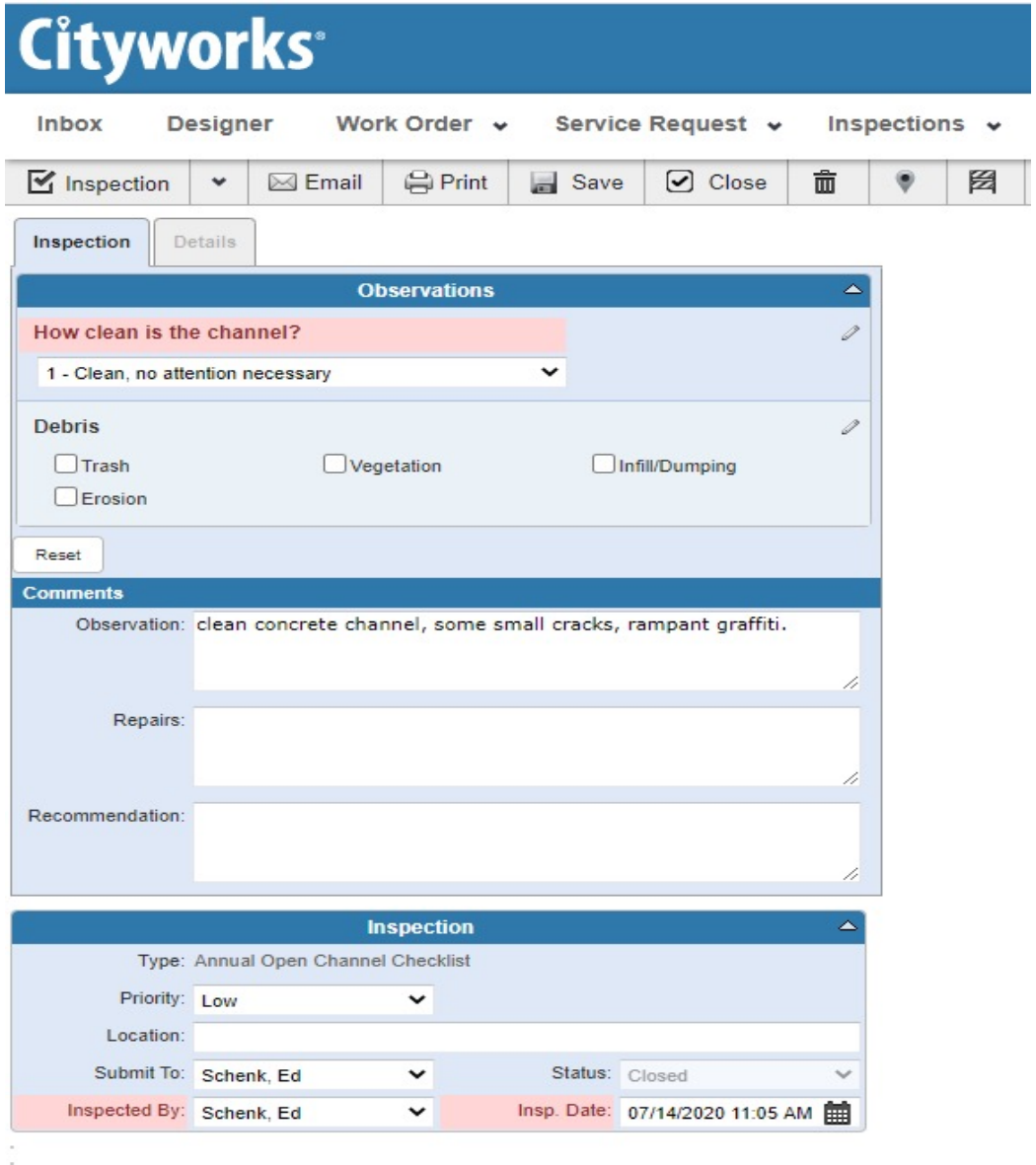
Implementing CMMS

Condition of the Channel helps determine the cleaning urgency

Debris type determines what type of Work needs to be preformed

Easy to customize

Inspector may enter in Observations, Repairs, and Recommendations



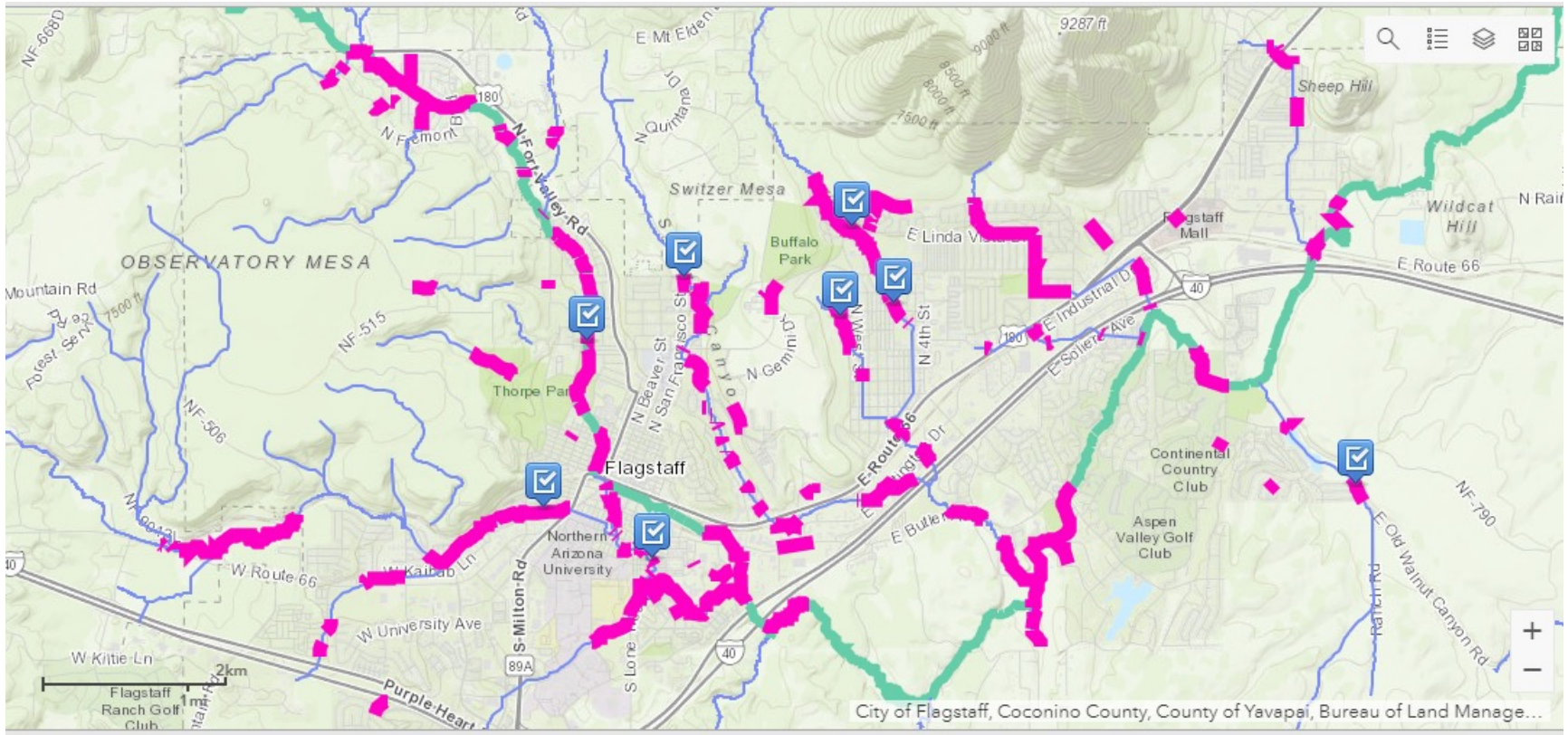
Implementing CMMS

Based off Condition Score, you can create appropriate Work Orders for crews

Query Out Inspections based on different attributes, such as Condition Score or Debris Type. Either in an excel spreadsheet or displayed on a map

Implementing CMMS

Closed Inspections with “Condition Score 2”



Implementing CMMS

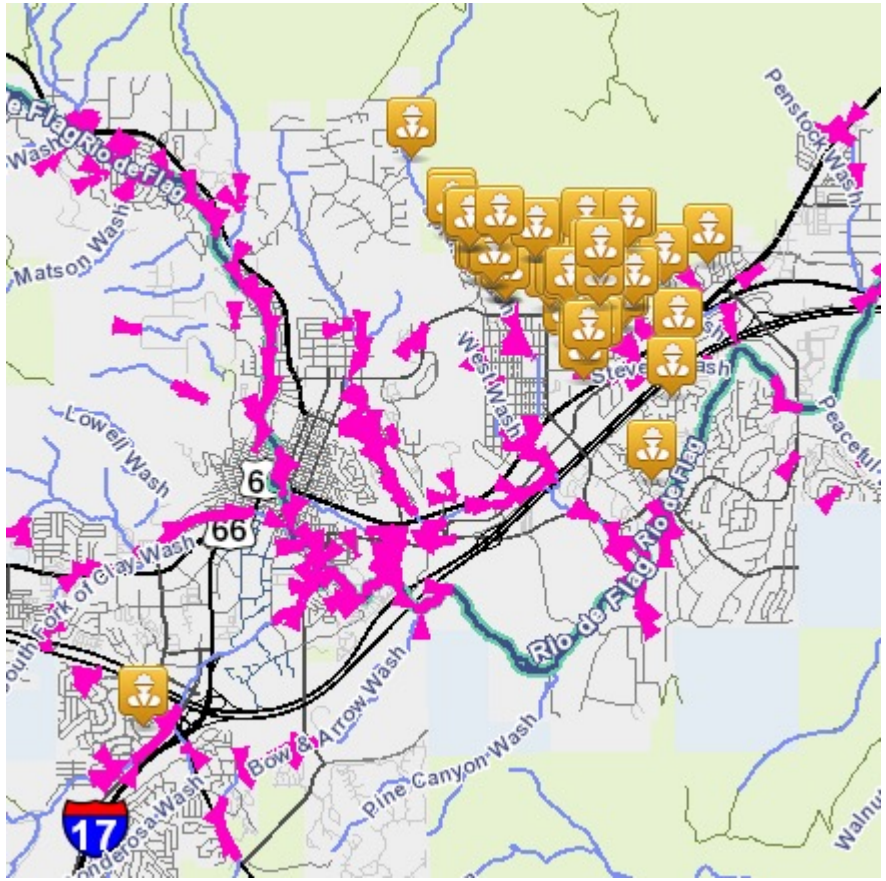
Service Requests – new for City of Flagstaff

Address based, not asset based

Crew can create appropriate Work Order after addressing the Service Call

Implementing CMMS

Service Requests – Coconino County Call Center (monsoon flooding)



Part 3
Displaying and Analyzing Data with Dashboards

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Displaying and Analyzing Data with Dashboards

With Cityworks, we use eURL tool to access the feature services for our saved search queries (either Work Orders, Inspections, or Service Requests)

Can also download the ShapeFile or CSV without the eURL tool to create maps using ArcGIS Desktop or QGIS

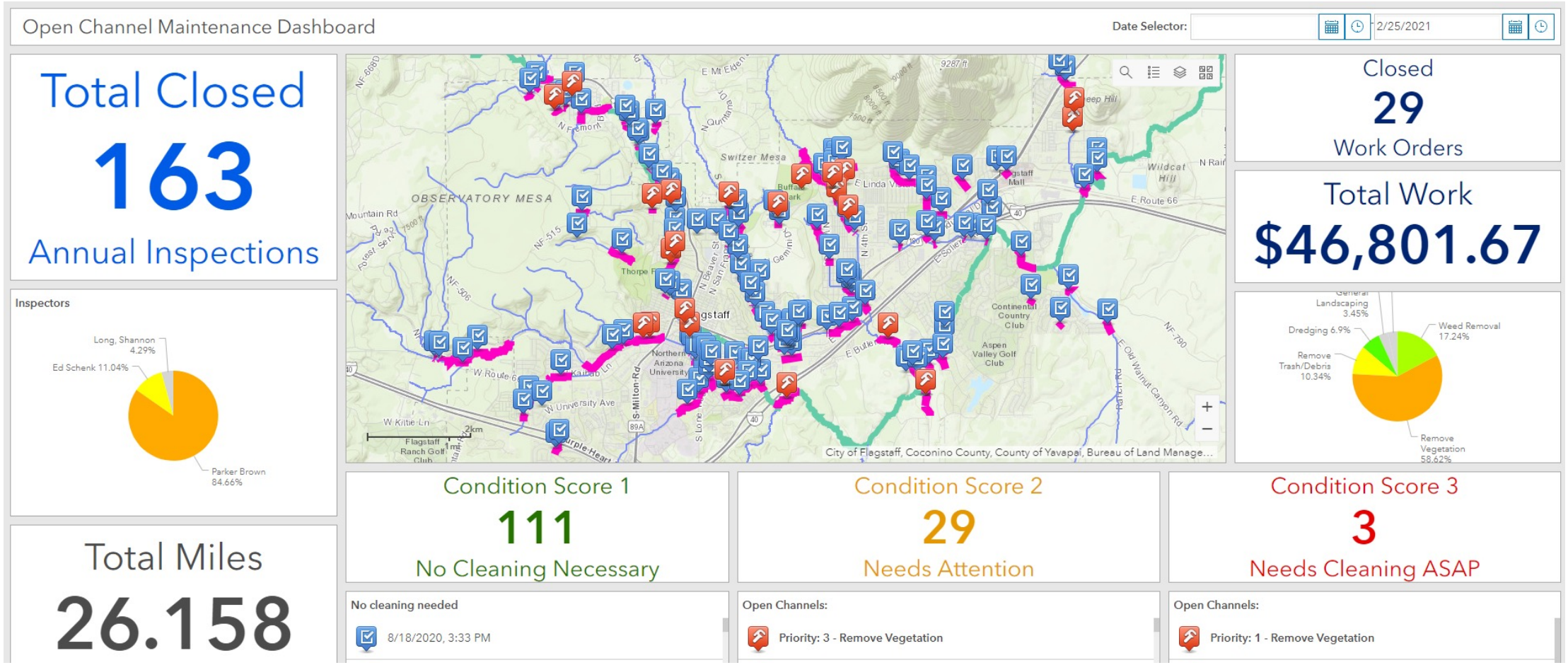
Displaying and Analyzing Data with Dashboards

Add your feature service in an ArcGIS Online Map with any additional layer you may want

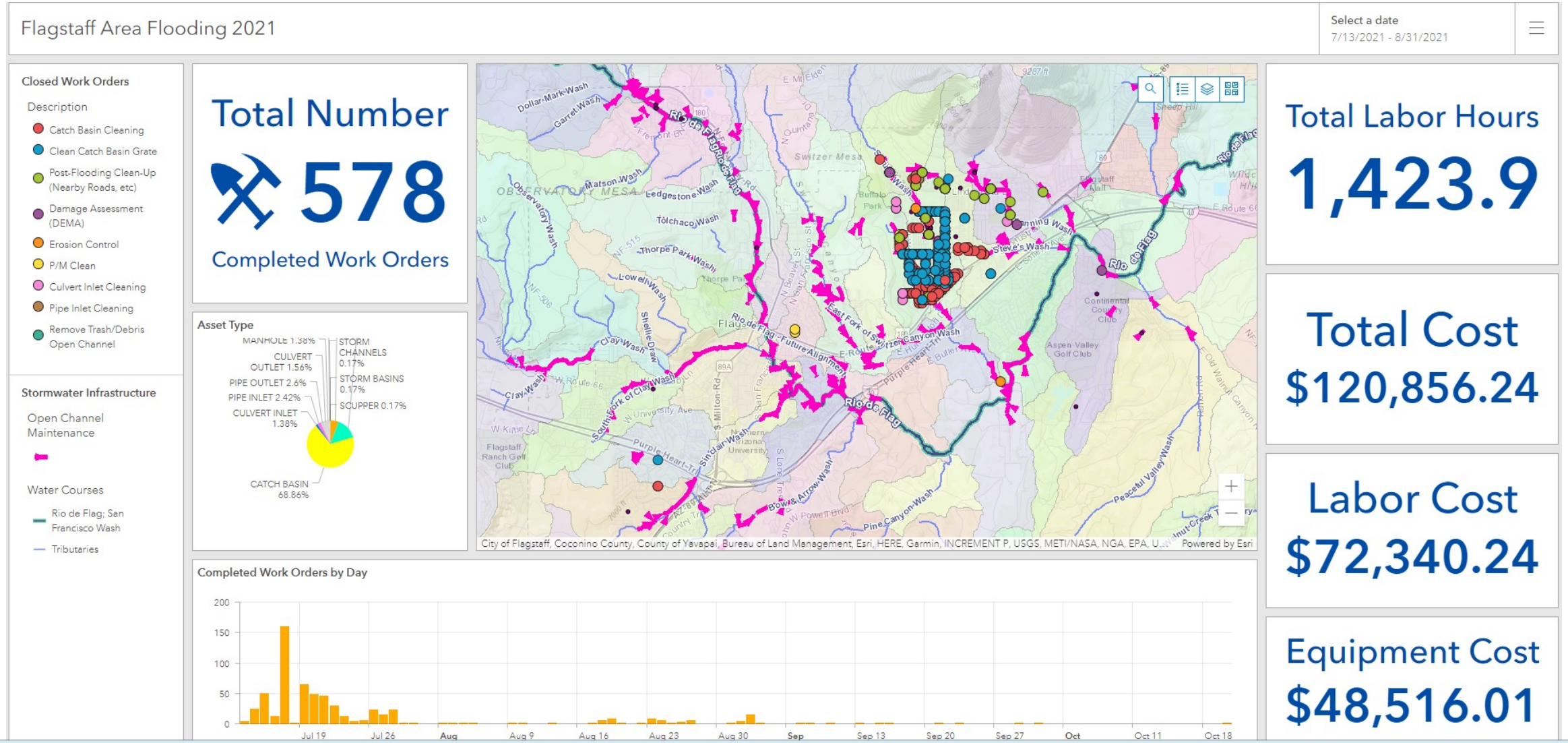
Create an ESRI Operational Dashboard to display the map and use additional functionality to display statistics of your data

Everything is dynamic! New Work Order, same map and dashboard

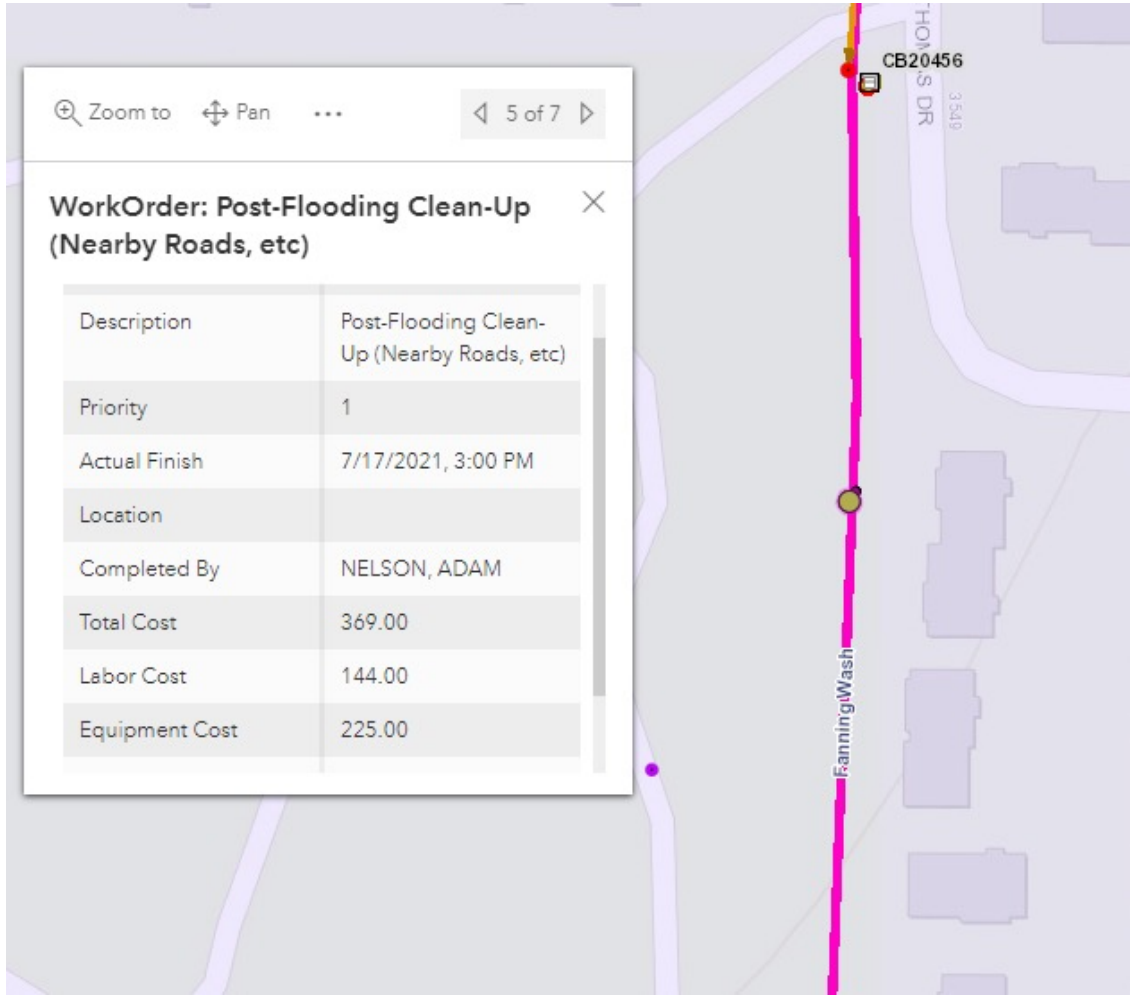
Displaying and Analyzing Data with Dashboards



Displaying and Analyzing Data with Dashboards



Displaying and Analyzing Data with Dashboards



Displaying and Analyzing Data with Dashboards

Don’t need a geography degree to read a map or dashboard

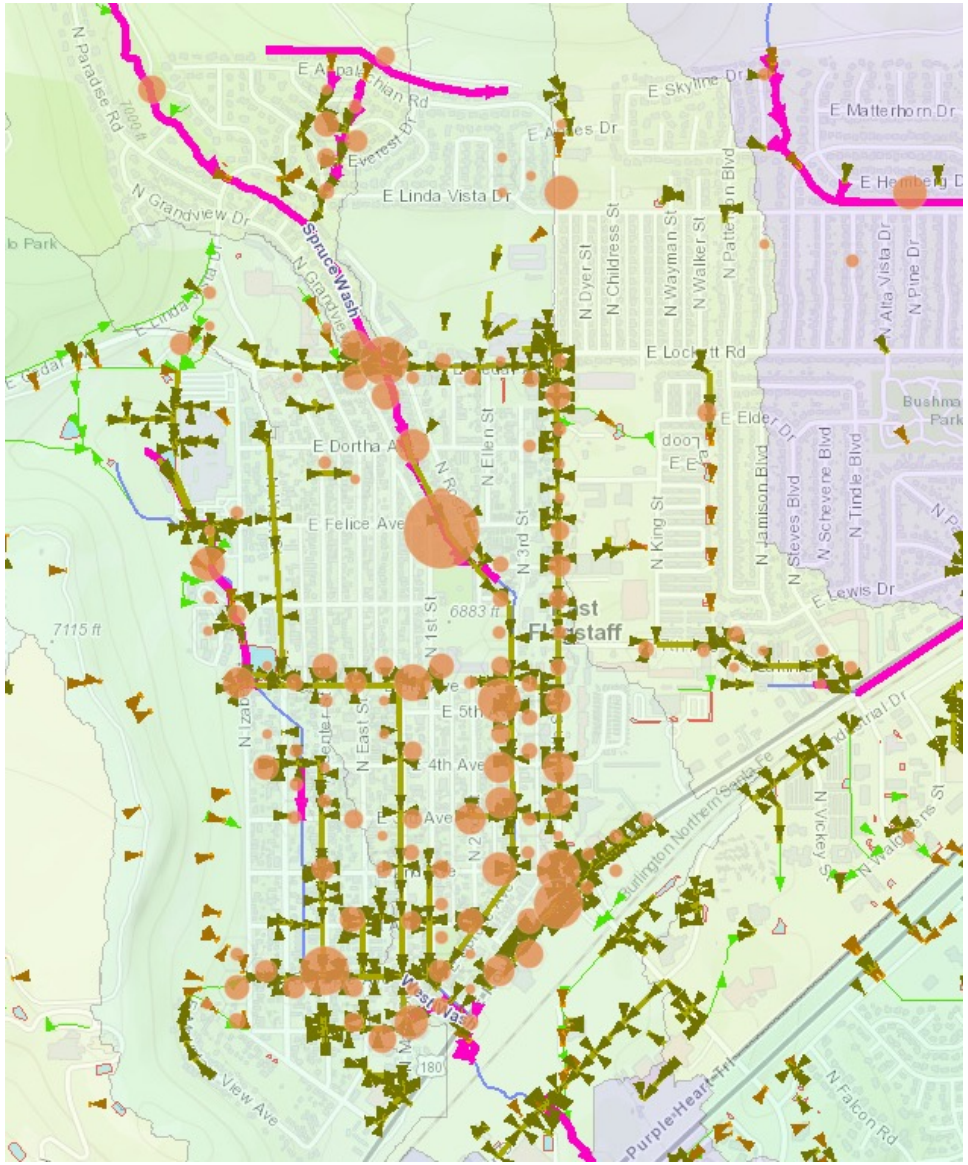
Quickly understand where work is being performed, what type of work, and how much each job costs

Find patterns or “hot spot” areas that are frequently cleaned after storm events

Displaying and Analyzing Data with Dashboards

Lots of closed Work Orders in the same area

Used density or hotspot tools in GIS to see where the concentration of points are occurring



Displaying and Analyzing Data with Dashboards

Dashboards are easy to share – interactive web link vs. PDF

Display at your workplace (break room, commons area, etc)

Easy to customize and update

Conclusion

- Are you still using Spreadsheets? If so, it's time to add Stormwater Infrastructure into your GIS
- Determine what attributes you want to know about each type of infrastructure (catch basin vs culvert vs pipe inlet)
- Add the infrastructure into GIS with field collection

Conclusion

- Once your assets are digital with a spatial element, it's time to select a CMMS
- Determine what type of Work Order Templates you want to create for your system. Add an Equipment Library. Make your CMMS robust by adding hourly and overtime wages for each active employee.
- Teach your field crews CMMS and encourage them to fill out as much information as possible

Conclusion

- Do you want to know Conditions of your assets? Is this something that could change annually? Then, create an Inspection Form for that asset
- Determine what information you want to collect.
- Keep the Condition Score simple, 1-3 or 1-5
- Use the Condition Score data to determine future Work Orders

Conclusion

- Do you want to record Service Calls to map out areas with frequent complaints? Use Service Requests.
- Record address of the Service Calls to spatially visualize calls
- Crews can create Work Orders for appropriate asset

Conclusion

- Create queries for Work Orders, Inspections, and Service Requests
- Display Open Work Orders, Inspections with a certain condition, or Service Requests during a certain timeframe
- Export data out as Excel or CSV
- Utilize the spatial component to understand what areas need attention
- Dashboards!

Conclusion

- Dashboard are easy to use, communicate, and share
- Dashboards dynamically update when Work Orders (or Inspections) are closed
- Use this information to find problems in your Stormwater Infrastructure. Where should we spend our money? Look at how much was spent cleaning in this location.

Conclusion

If you are trying to make the digital move:

- Find a GIS team
- Find someone with CMMS/Asset Management experience
- Need to be able to teach field crews
- What technology do you have?
- Software packages? Funds?

Your Feedback Is Important

Please send us your questions, comments, concerns, etc at support@stormwateruniv.com

Presentation PDF Available

Downloadable from the Chat area of the Zoom platform and the course page at stormwateruniv.com

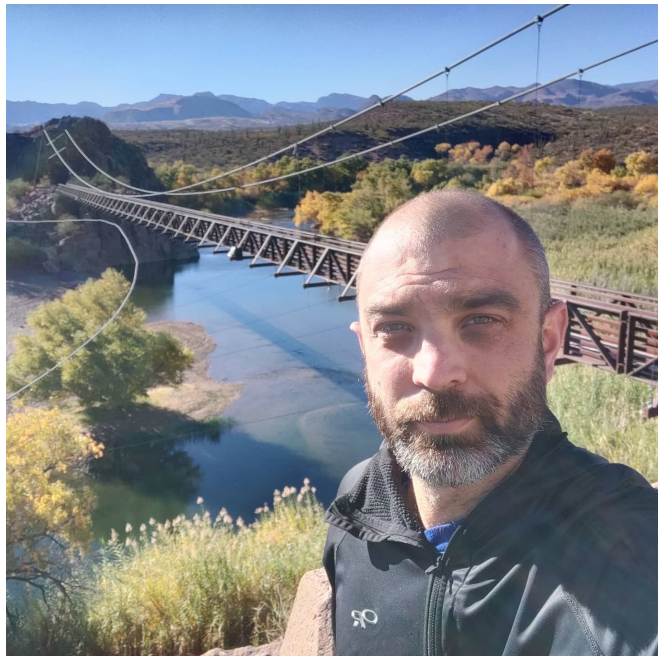
Recording Available

Within 48 hours on the course page at stormwateruniv.com

Certificates

Will receive email notification within 48 hours. Must have attended full session.

Questions?



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Job Site Management Series:

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0.3 CEUs/3 PDHs

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