



JOINT CITY/COUNTY MEETING

# Museum Post-Wildfire Flooding

August 23, 2021





# Introduction



- Introductory comments by Museum Flood Co-Incident Commanders:
- Lucinda Andreani, Coconino County Flood Control District Administrator and Deputy County Manager
- Andy Bertelsen, City of Flagstaff Public Works Director

***Secure Flood Insurance No Matter  
Where You Live in the County!!!***



# Agenda



- Museum Flood Events, Impacts, Response & Costs
  - Joint Emergency Response
  - Operational Response
  - Assessment and Recovery
  - Financial Impact
  - Long-Term Mitigation Strategies
  - Support Services
- Greater Flagstaff Area Flood Events
  - East Flagstaff
  - University Heights
  - Forest Hills
  - Rio de Flag

# Museum Flood Area

- **2019 & 2020 Museum Flood mitigation efforts**
- **2021 Museum Flood Events, Impacts, Response & Costs**





# Museum Flood Area Mitigation 2019 - 2021



Apr 17, 2020 at 12:20:25 PM





# 2019 & 2020 Mitigation



## Flood Analysis

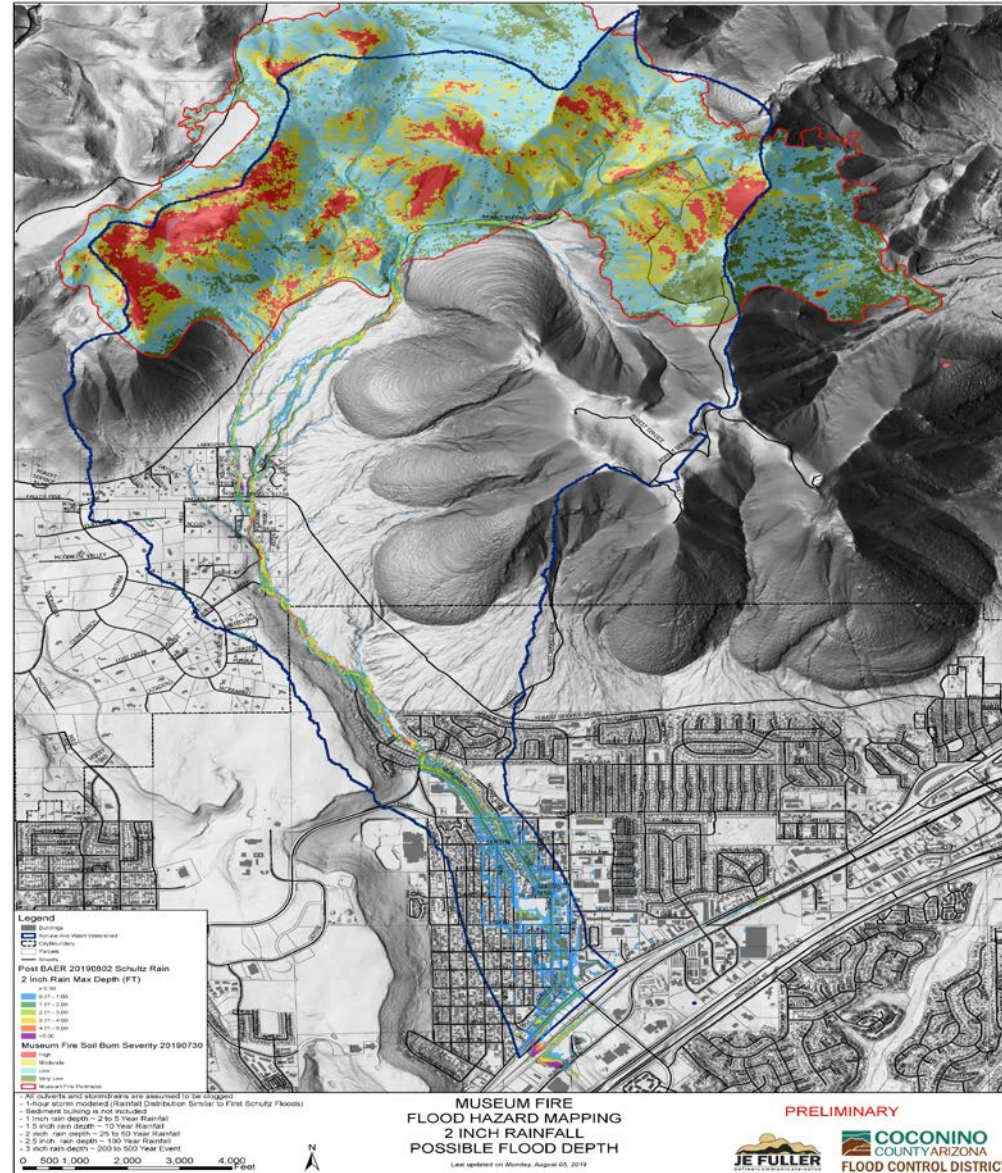
- JE Fuller Hydrology & Geomorphology conducted flood hazard modeling
- Used 2" storm given data from Schultz flood area & results showed severe and repetitive flooding
- Anticipated impacts to over 400 homes and 35 businesses
- Coconino County Flood Control District (District) immediately developed a flood mitigation plan based on the analysis and deployed concrete barriers and sandbags to the flood area
- Actual flooding events have largely reflected the modeling



# 2019 & 2020 Mitigation



## Flood Analysis





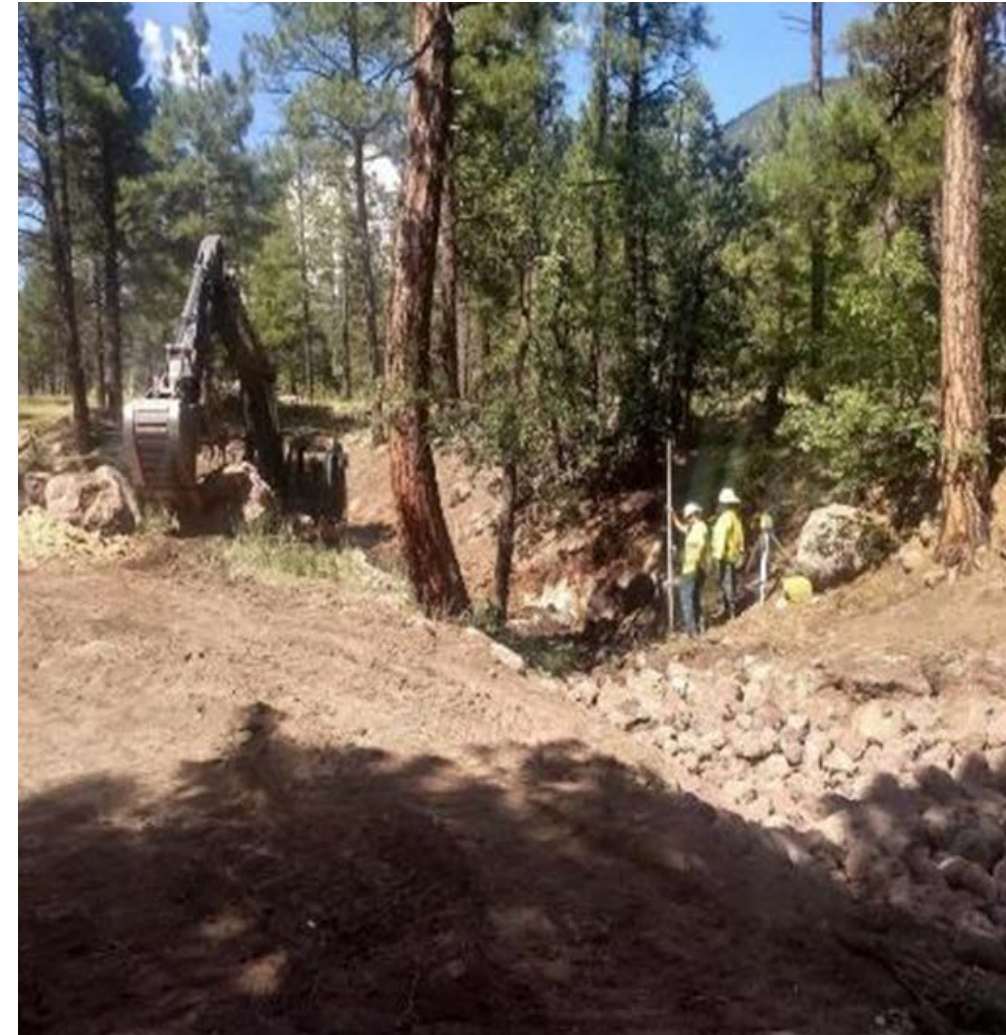


# 2019 & 2020 Mitigation



## District's Initial Projects

- FCD constructed rock weirs on an alluvial fan on forest above Mt. Elden Estates to stabilize the fan, which has captured over 6' of sediment & debris to date
- FCD constructed flood mitigation through the Mt. Elden Estates area to mitigate impacts to 20 homes at very high risk for home destruction
- Established flood monitoring & alert system







# 2019 & 2020 Mitigation

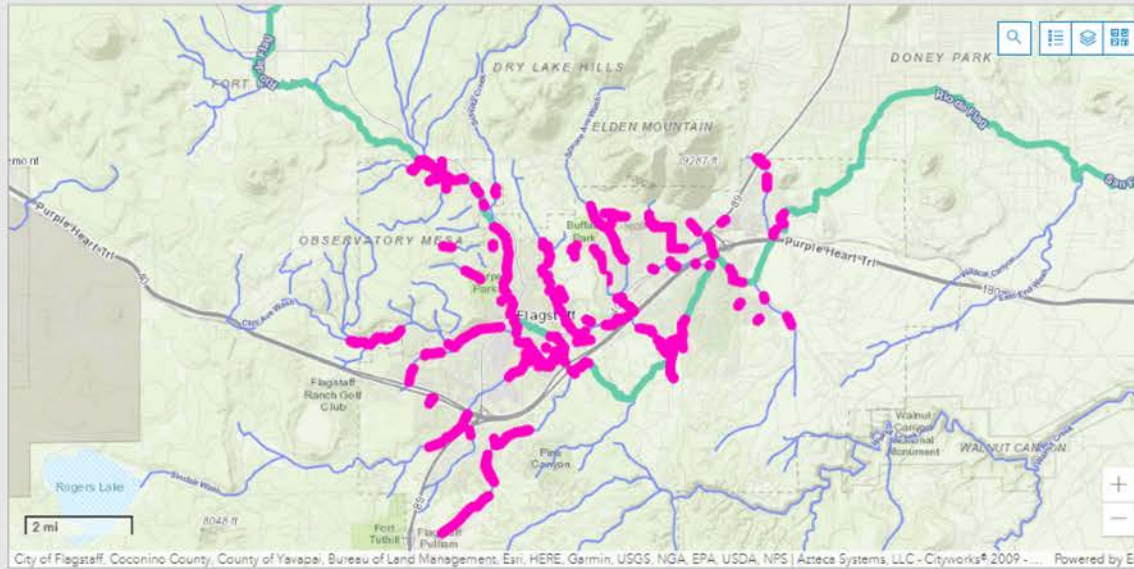


## City's Open Channel Maintenance

Open Channel Maintenance Dashboard

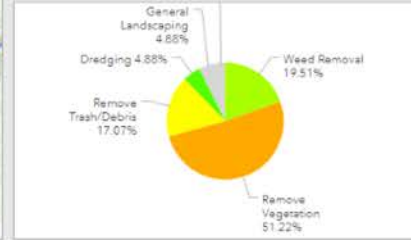
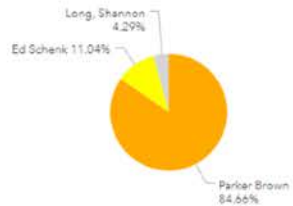
Date Selector:  
7/1/2020 - 6/30/2021

Total Closed  
**163**  
Annual Inspections



Closed  
**41**  
Work Orders  
Total Work  
**\$118,575.91**

Inspectors



Total Miles  
**26.158**

Open Channel for FEMA CRS

Condition Score 1

**111**

No Cleaning Necessary

No cleaning needed

- 8/18/2020, 3:33 PM
- 8/18/2020, 1:56 PM

Condition Score 2

**29**

Needs Attention

Open Channels:

- Priority: 3 - Remove Vegetation
- Priority: 3 - Remove Vegetation

Condition Score 3

**3**

Needs Cleaning ASAP

Open Channels:

- Priority: 1 - Remove Vegetation
- Priority: 1 - Remove Trash/Debris



# 2019 & 2020 Mitigation



## City's Underground Stormwater Maintenance

- Purchase of combo truck in December 2019 for better service of underground infrastructure.
- The Wastewater Collection crews were able to complete 1,501 Work Orders from July 1, 2020 – June 30, 2021. These Work Orders consisted of cleaning catch basins, storm pipes, culverts, trash racks on culvert and pipe inlets, and more.
- More focus on stormwater collection system to reduce risk of exposure to wastewater collection staff to COVID-19.
- Focus was on Sunnyside, Grandview, Paradise.

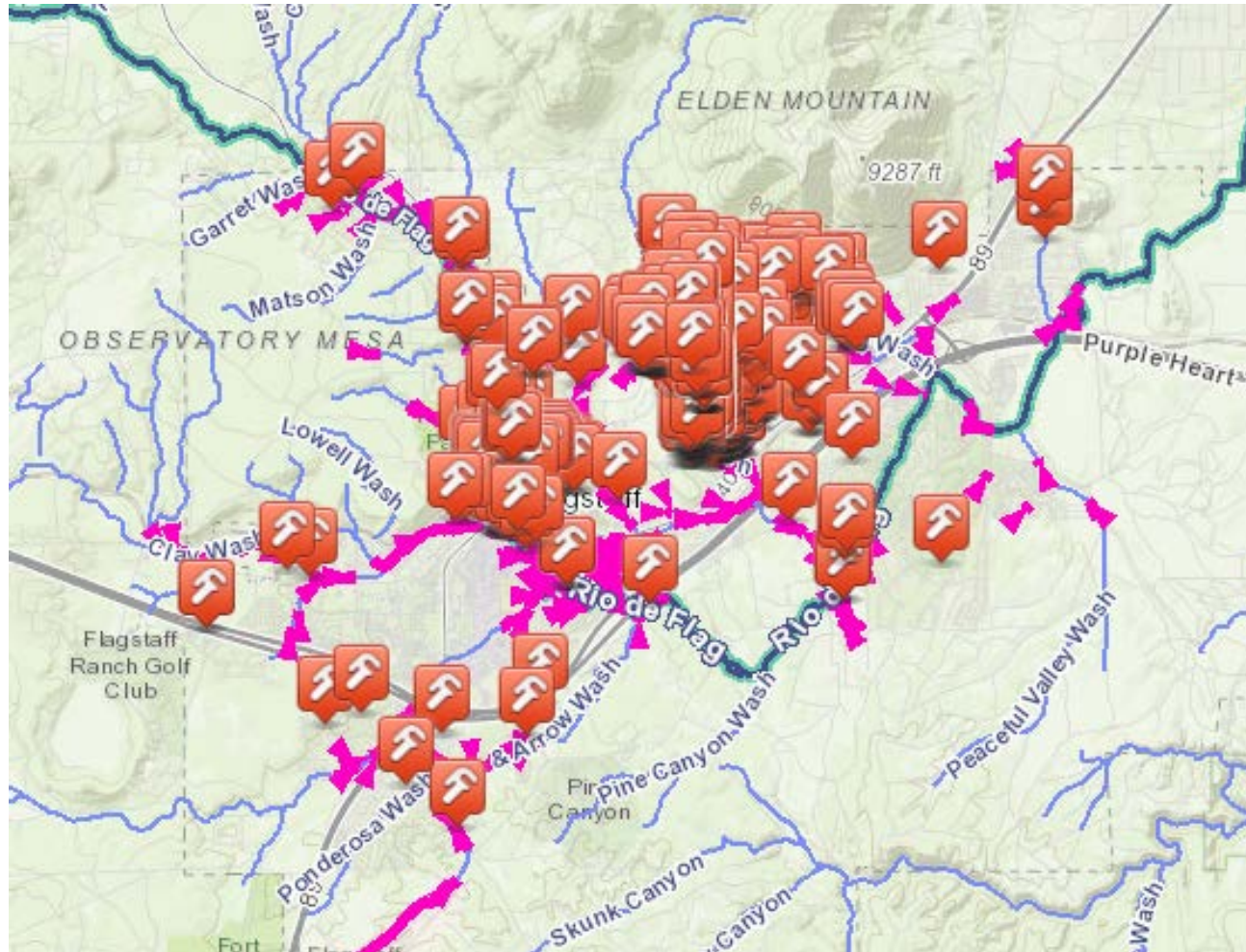




# 2019 & 2020 Mitigation



## City's Underground Stormwater Maintenance





# 2019 & 2020 Mitigation



## Spruce Avenue Channel Improvements

- Cedar to Dortha
- Improve channel from a narrow-grassed channel to concrete lined trapezoidal channel (design in progress).
- Re-design Dortha Inlet and Dortha Avenue street crossing to determine feasibility of greater flows and reduction of clogging.





# 2019 & 2020 Mitigation



## Cross-Vein Weirs

City of Flagstaff installed seven cross-vein weirs with 4-foot keystone members to protect existing water main and natural gas pipeline, and to reduce erosion thus sediment into the neighborhoods







# 2019 & 2020 Mitigation



## Channel Dredging

- Summer 2020
- Spruce Wash channel dredging and re-configuration at Cedar Avenue







# 2019 & 2020 Mitigation



## Culvert Upsizing

- Summer 2020
- City added second culvert at Linda Vista
- The additional culvert had to be sized to match the downstream channel and culvert at Cedar Avenue so downstream impacts were avoided







# 2019 & 2020 Mitigation



## Debris Bollards

- City installed new debris bollards
- Located at Linda Vista and Dortha culvert locations







# Museum Flood Area Mitigation - 2021



- Shore-up of mitigation took place again during spring 2021
- Sandbags delivered to neighborhoods and held meetings in the streets throughout the Museum Flood Area
- Over 600,000 sandbags in the Museum Flood Area & 6,600 feet of barrier at start of monsoon

# 2021 Museum Flood Events, Impacts, Response, Costs, Mitigation & Support





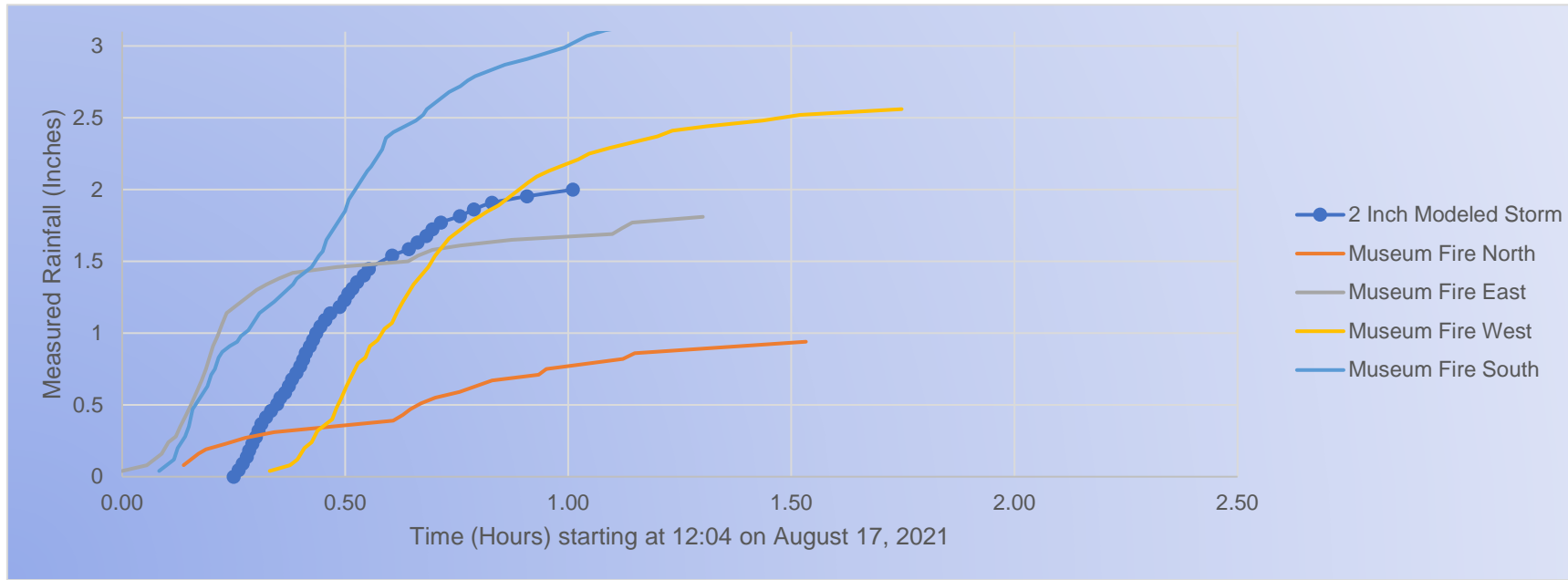


# Museum Post-Wildfire Flooding

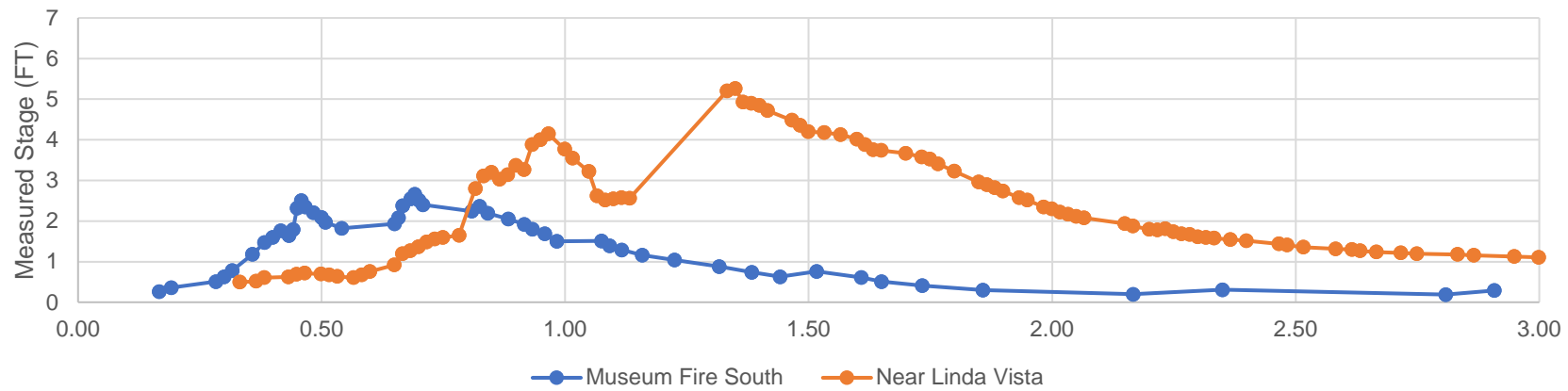


- Flooding events began on July 13, 2021
- Experienced 6 rainfall events that resulted in Emergency Notifications
- Most significant rainfall occurred on August 17<sup>th</sup>
- 3.07" of rainfall in 1-hour; 1.14" in 15 minutes (at two gauges)
- Equivalent to 200+ year rainfall event, 0.5% probability





Stages along Spruce Ave Wash during 8.17.2021 Event

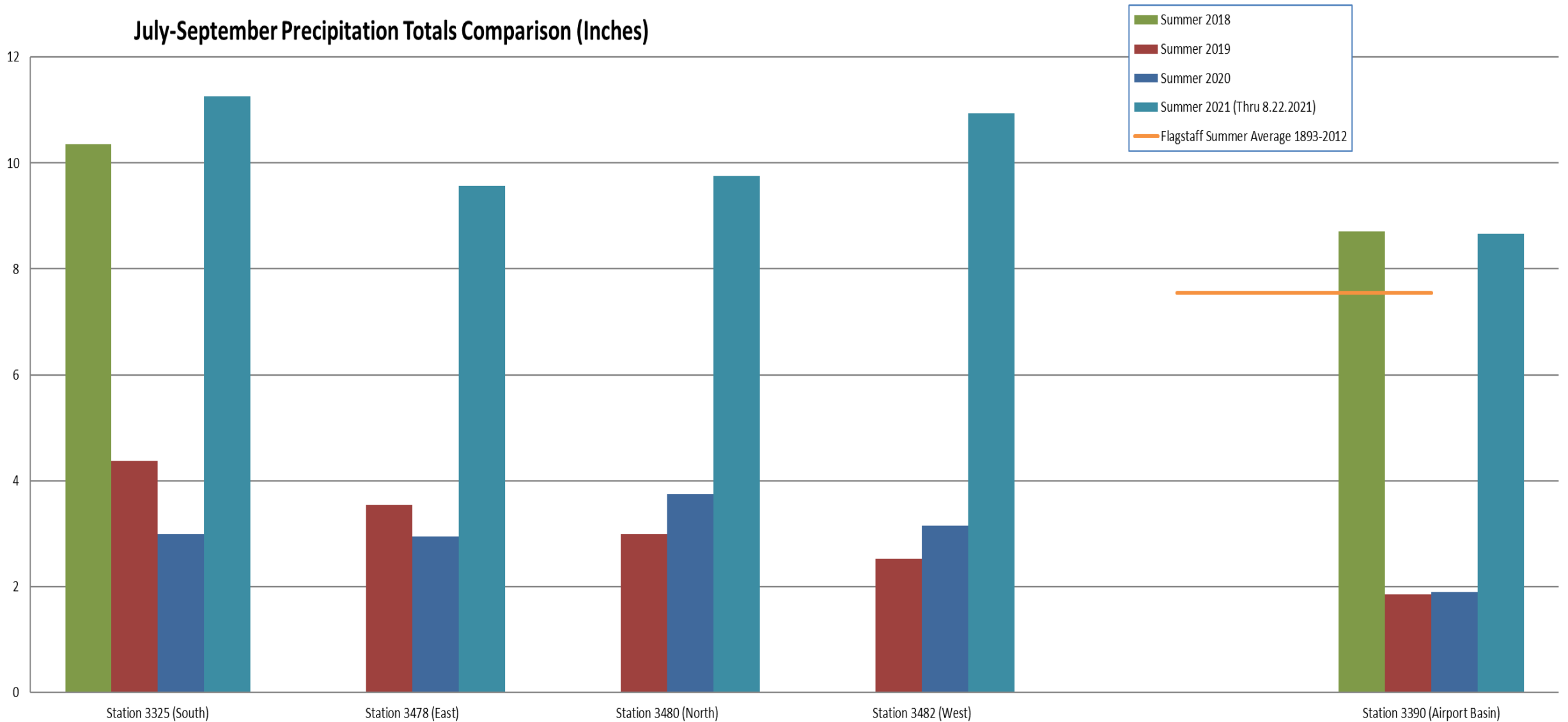


# August 17, 2021, Flood Event Hydrograph & Stream Gauge Data



# Museum Burn Scar Rainfall

## July-September Precipitation Totals Comparison (Inches)



*The East, North, and West rain stations were installed in the Museum Fire burn scar in late July 2019*



# Museum Private Property Impacts

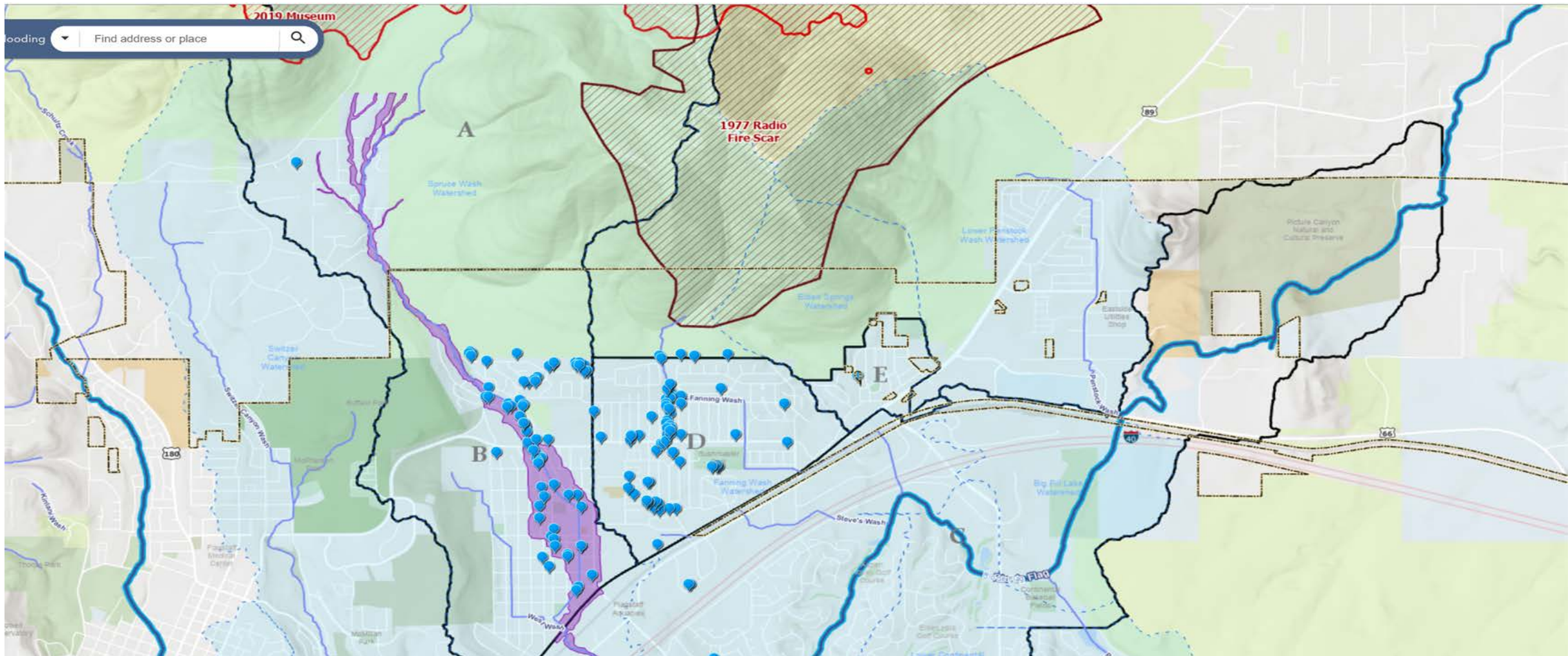


## Museum Flood Area

**46 interior private property assessments with a total damage estimate of \$1,013,900**



# Museum Flood Specific Area (in Purple)





# Museum Public Infrastructure Impacts



- **Pre-August 17<sup>th</sup> Storm Damage**
  - 19 sites
  - \$1.3 million
  
- **August 17<sup>th</sup> Storm Damage**
  - 33 sites
  - Approximately \$1 million



# Joint Emergency Response

- Flood Alert System
- Incident Management Team
- Emergency Operations Center
- Declaration of Emergency





# Flood Alert System



- National Weather Service participated in Emergency Operations Center providing critical updates
- Flash Flood Warnings were issued by the National Weather Service
- Each week a Flood Director is assigned to monitor radar, watch rain gauges and cameras for potential flooding, communicate with the NWS and to request the Emergency Manager to issue alerts
- Field Observers report flooding characteristics and impacts to infrastructure to Flood Director





# IMT & EOC



The **Incident Management Team (IMT)** plans and executes daily & future operations to meet response needs – “Boots on the Ground”

**The Emergency Operations Center** manages support services for the IMT, including:

- Logistics support (the “Amazon” for the IMT)
- Call Center
- Tracks public infrastructure impacted by flooding
- Conducts private property damage assessments for residents and businesses with flood damage
- Public & Media communications by the Joint Information Center
- Tracks all costs associated with response



# Declaration of Emergency



- City and County declared a state of emergency on July 15, 2021
- Governor declared a state emergency on July 16, 2021
- Declarations provide an opportunity for the City, Flood Control District and the County to pursue reimbursement for up to 75% of flood response costs deemed eligible by the Arizona Department of Emergency Management
- No funds have been received and generally reimbursements take two to three years
- Unlikely to exceed thresholds for Individual Assistance or Public Assistance Funds





# Operational Response





# Operational Response



- Joint City/County Public Works Response
- Water Services Response
- Engineering Response
- Joint Information Center & Call Center
- Volunteer & Corps Efforts
- Partner Recognition





# Joint Public Works Response



- Flood waters laden with silt, rock and forest debris
- Over 8,000 tons of sediment & debris transported to Cinder Lake Landfill
- Currently 700,000 total sandbags and 7,600 lineal feet of barrier installed in Museum Flood area
- All roads were cleaned swiftly and made passable
- Sweeping was extensive and provided 24 hours a day for 3 weeks and will continue for weeks
- ADOT and private contractors were utilized to support the effort, in addition to City and County Public Works crews.



# Water Services Response



- Water Distribution and Wastewater Collection crews assisted in flooding response
- Inspected system for any clearing needs
- Cleared stormwater drains and pipes of debris
- Worked on keeping culverts clear of debris
- Opened up outlets to support water flowing out of culverts





# Water Services Response



## Orders

### Description

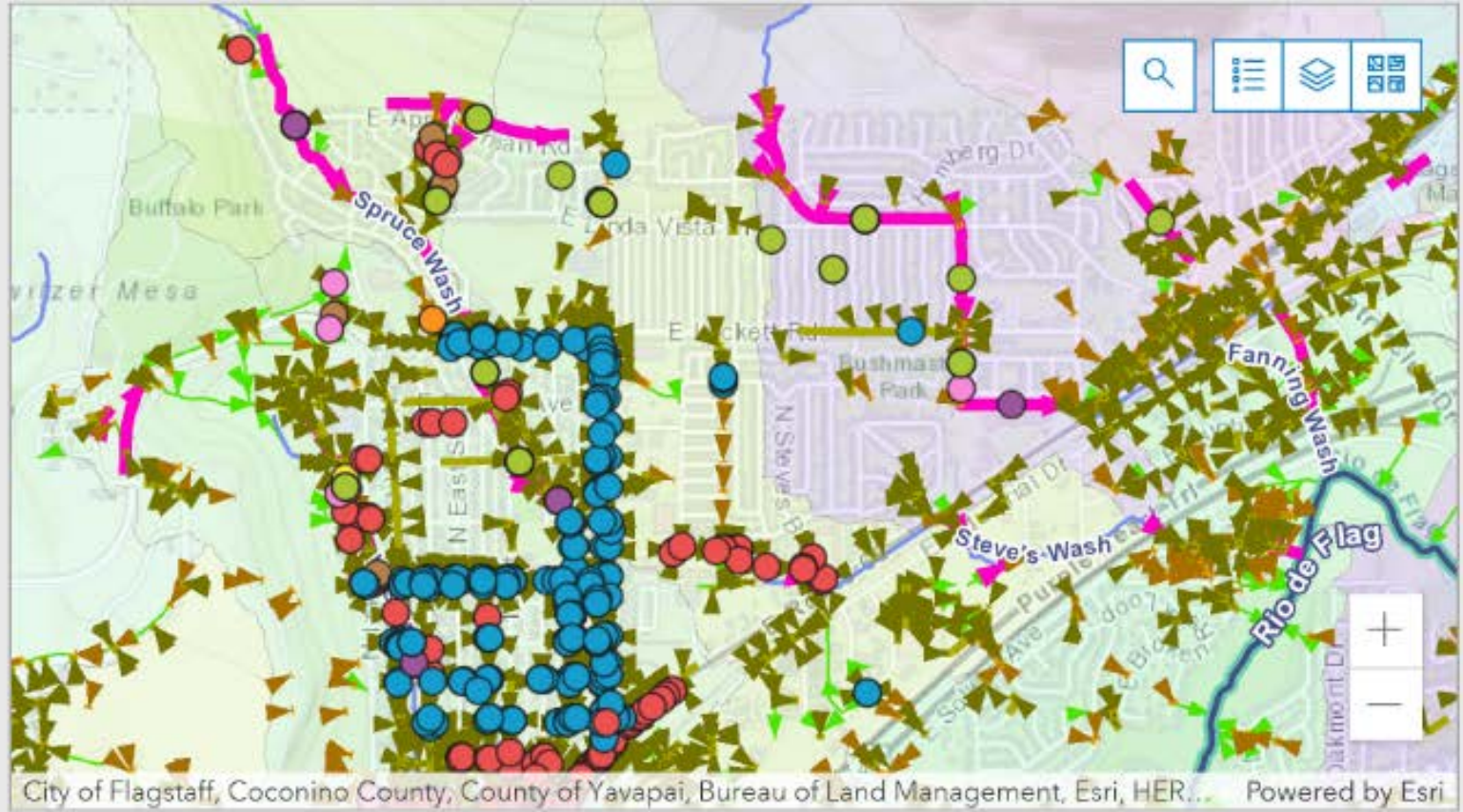
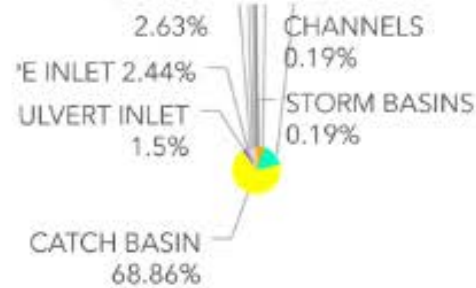
- Catch Basin Cleaning
- Clean Catch Basin Grate
- Post-Flooding Clean-Up (Nearby Road etc)
- Damage Assessment (DEMA)
- Erosion Control
- P/M Clean
- Culvert Inlet Cleaning
- Pipe Inlet Cleaning
- Remove Trash/Debris
- Open Channel

## Total Number

# 533

### Completed Work Orders

## Asset Type



## Completed Work Orders by Day





# Engineering Response



- Conduct site assessments to assist property owners with identifying appropriate mitigation strategies
- Evaluate impacts to infrastructure and overall mitigation measures and determine repairs and improvements
- Partnered with JE Fuller using online tools for modeling and potential outcomes of mitigation strategies
- City & County GIS supported the efforts

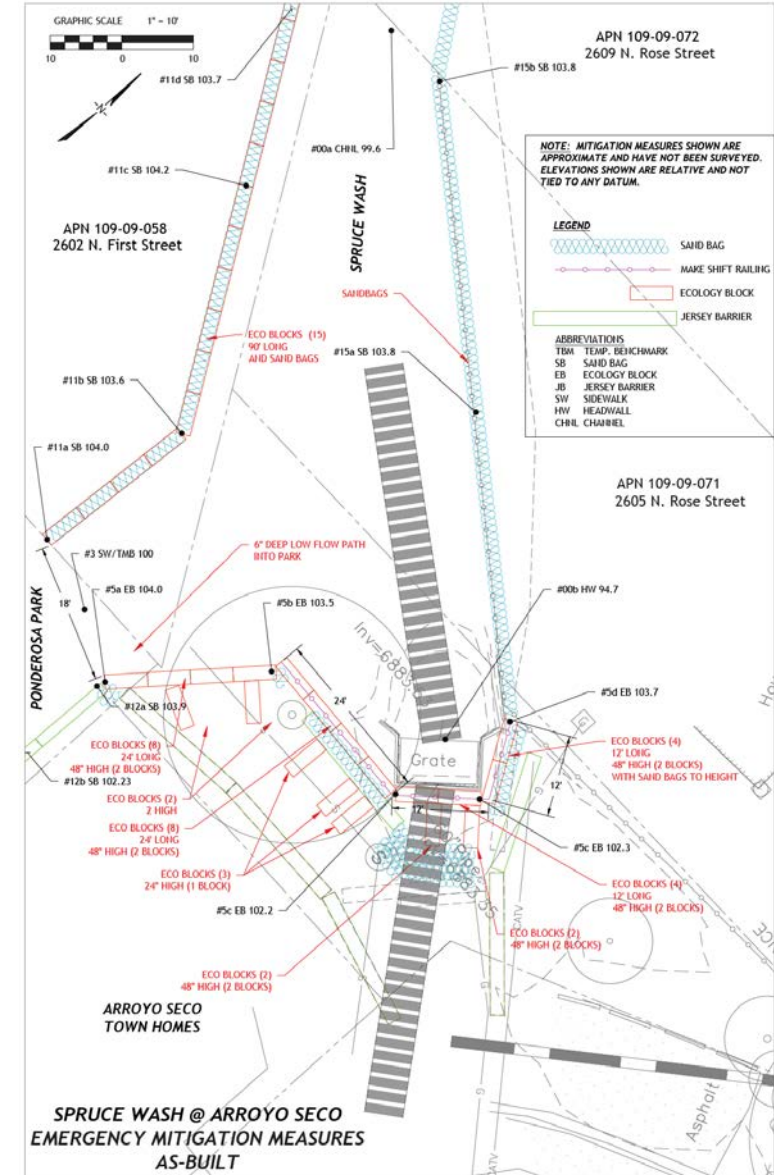




# Arroyo Seco Example



## Improved Mitigation





# Joint Information Center



- A Joint Information Center (JIC) was stood up inside the Emergency Operations Center
- Includes staffing from both City and County
- Call Center produces emergency communications to the media during flood events and provides a variety of communications to the Museum Flood Area
- Call Center has received 704 calls to-date
- Call Center staff using Salesforce to track calls, damage and resident & business needs



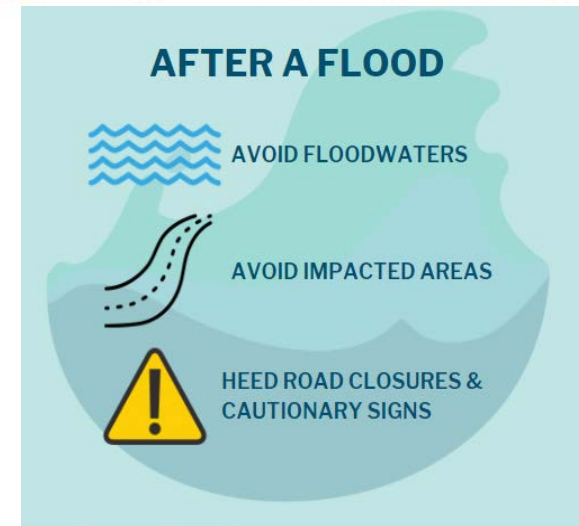


# Joint Information Center



## Planned Communications

- Flood communication letter sent to all residents in the post-wildfire flood risk area
- Creating nightly emails to residents and media (during high activity periods), and safety messages on social media
- Routine updates via email to the Museum Flood Area residents, social media, websites and media advisories



[coconino.az.gov/museumfire/floodarea](http://coconino.az.gov/museumfire/floodarea)





# Joint Communication Center



## Community Meetings

- Before the monsoon season started there was a series of “Meet In the Street” community meetings
- An outdoor meeting was held with Mount Elden Estates residents to review the emergency project plan funded by the FCD & NRCS
- Any additional meetings will be virtual due to flood risk & COVID-19







# Volunteer & Corps Efforts

- 717 volunteers to date through United Way of Northern Arizona
- Over 60 sandbag placements for elderly and/or disabled
- Crews from Arizona Conservation Corp, American Conservation Experience, Team Rubicon and others helped place & build a stock sandbags
- 75,000 sandbags deployed in four days after July 13 flood event & 20,000 deployed after Aug. 17<sup>th</sup> flood event





# Many Partners...

AZWARN

National Guard

Tiffany Construction

Eagle Mountain Construction

Joe Dirt Excavating

C&E Paving and Grading

Fastenal

Badger Daylighting

United Pumping Services

JE Fuller Hydrology

Peak Engineering

Natural Channel Design

CivilTech Engineering

Mark Lamer

SWI Engineering

Turner Engineering

Woodson Engineering

\* List may not be all inclusive





# And Many Other Partners...

United Way of Northern Arizona  
Arizona Conservation Corps  
American Conservation Experience  
Team Rubicon  
Flagstaff Wildland Fire  
C&S Sweeping  
Hubbard Merrell Engineering

Arizona National Guard  
Kinney Construction Services  
Quail Construction LLC.  
First Class Sanitation

\* List may not be all inclusive



# And More Partners...

Performance Staffing

United Methodist (shower trailer)

Bandoleros66

Jimmy John's

Jitter's Lunchbox

Toasted Owl

La Fonda

ATL Wings

Chick-fil-A

Firehouse Subs

Texas Roadhouse

Cracker Barrel

Sam's Club

\* List may not be all inclusive



# Museum Flood Financial Impacts

## Museum Flood Total Mitigation & Response Costs to Date:

- Coconino County Flood Control District has invested over \$3.4 million since July 20, 2019
- City's response costs are \$1.8 million since July 13, 2021

**Grand Total: \$5.2 million**



# Museum Flood Long-Term Mitigation Strategies

- Engineering Summit
- NRCS Exigency
- Regional Detention at Killip Elementary School







# Engineering Summit



- Bring together experts in post-wildfire flood mitigation in an Engineering Summit
- Goal to further identify potential, conceptual long-term mitigation measures
- Very fortunate to have significant local expertise
- Summit Report to County Flood Control District and City Leadership will be conducted through a virtual meeting Report session will be streamed for public viewing
- Friday, August 27th from 12:00 - 1:00pm
- Link will be made available and will be on the Museum Flood webpage



# NRCS Exigency



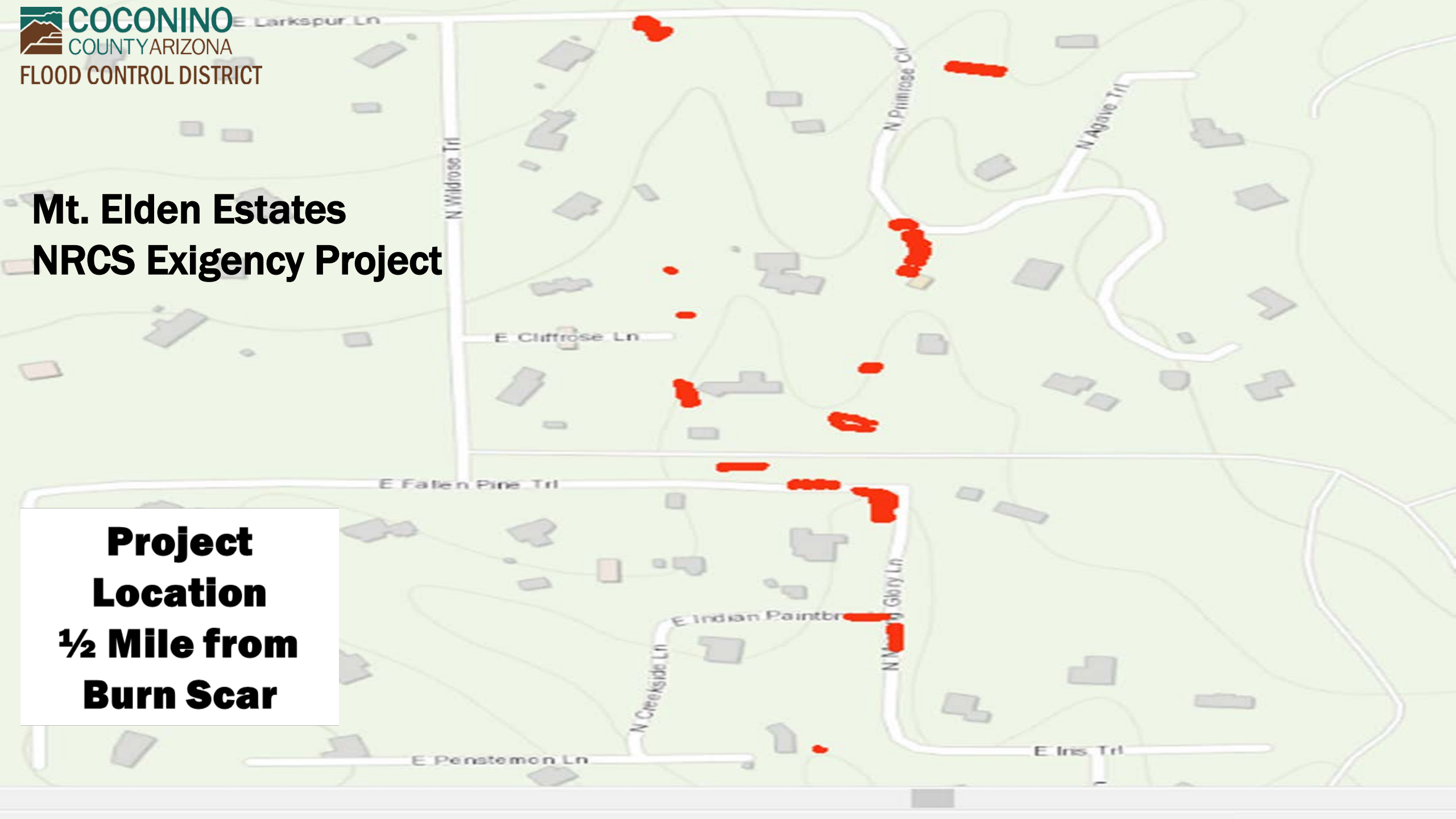
- The main goal of the project is to stabilize stream channels which will decrease erosion
- Erosion is destroying private property, roads and threatens to destruct homes
- Erosion also sources sediment, which is then transported downstream and negatively impacts downstream infrastructure and homes





# Mt. Elden Estates NRCS Exigency Project

**Project  
Location  
1/2 Mile from  
Burn Scar**

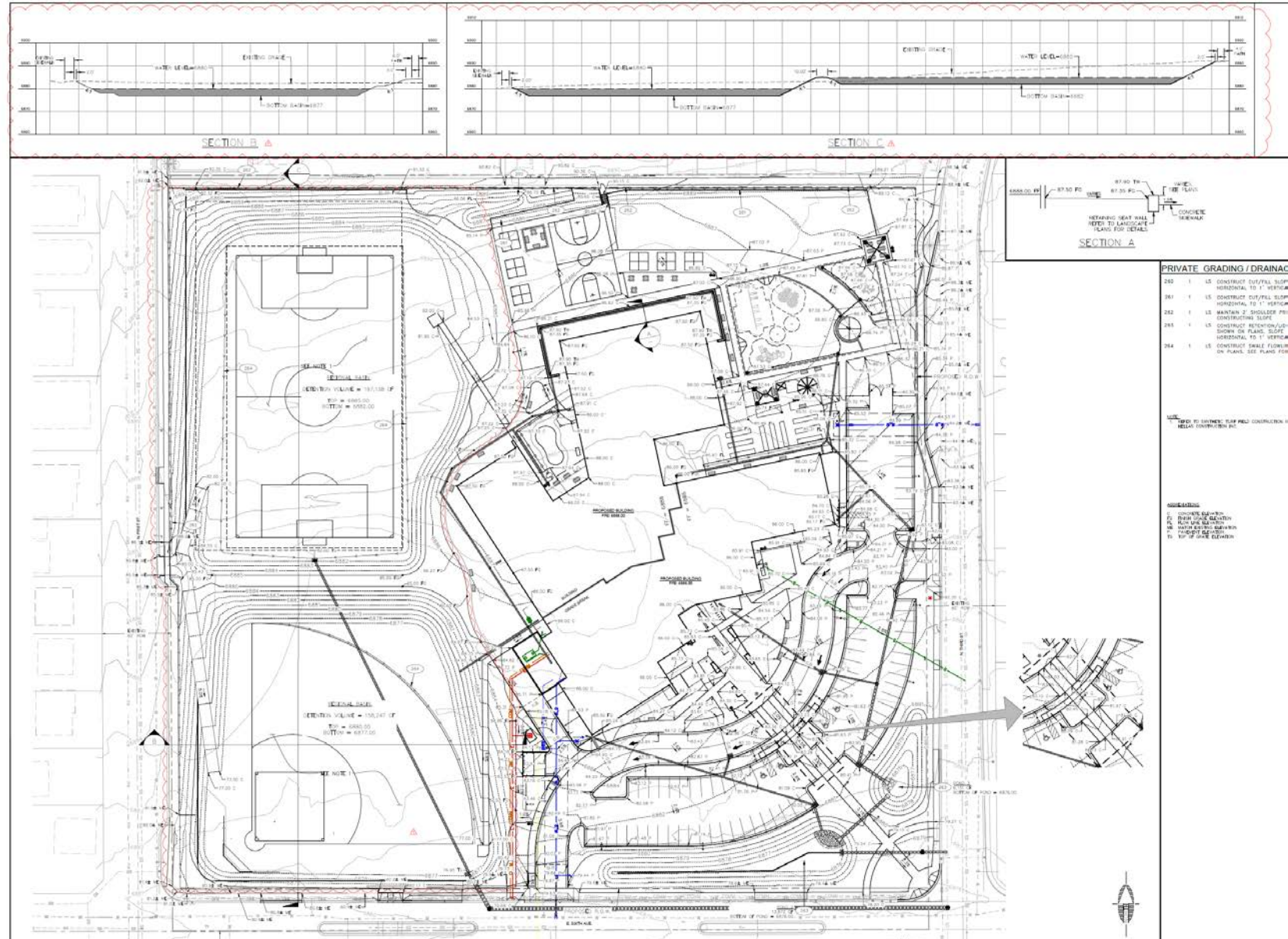




# Detention at Killip Elementary



## Regional Detention at Killip Elementary School







# Legislative Advocacy



- The District and City are working closely with our Congressional Delegation to identify and seek out potential federal funding
- Rep. O'Halleran and Senators Kelly and Sinema have pledged strong support for our efforts
- Key challenge is securing re-funding of the Emergency Watershed Protection Program and to extend the use of those funds to National Forest lands
- Infrastructure bill in Congress, if passed may be a potential source of funding, but likely very competitive process

# Support Services

- **Virtual Assistance Center**
- **Home repair assistance program for low-income homeowners**







# Virtual Assistance Center



- Website for citizens and businesses to receive information and services to meet their needs
- Current services are accessed through the Call Center
  - Property Assessment
  - Food
  - Rental Assistance
  - Shelter Needs
  - Mental Health Assistance



# Home Repair for Low Income Homeowners



- United Way of Northern Arizona and the Arizona Community Foundation are collecting donations
- \$24,114 has been collected to date
- Monies collected will be used to help low-income residents with interior damage due to flooding

## **Please donate by going to:**

- UWNA webpage: <https://nazunitedway.org/crisis-response/>
- ACF Webpage: <https://www.azfoundation.org/Giving/Flagstaff-Flash-Flood-Disaster-Relief-Fund>

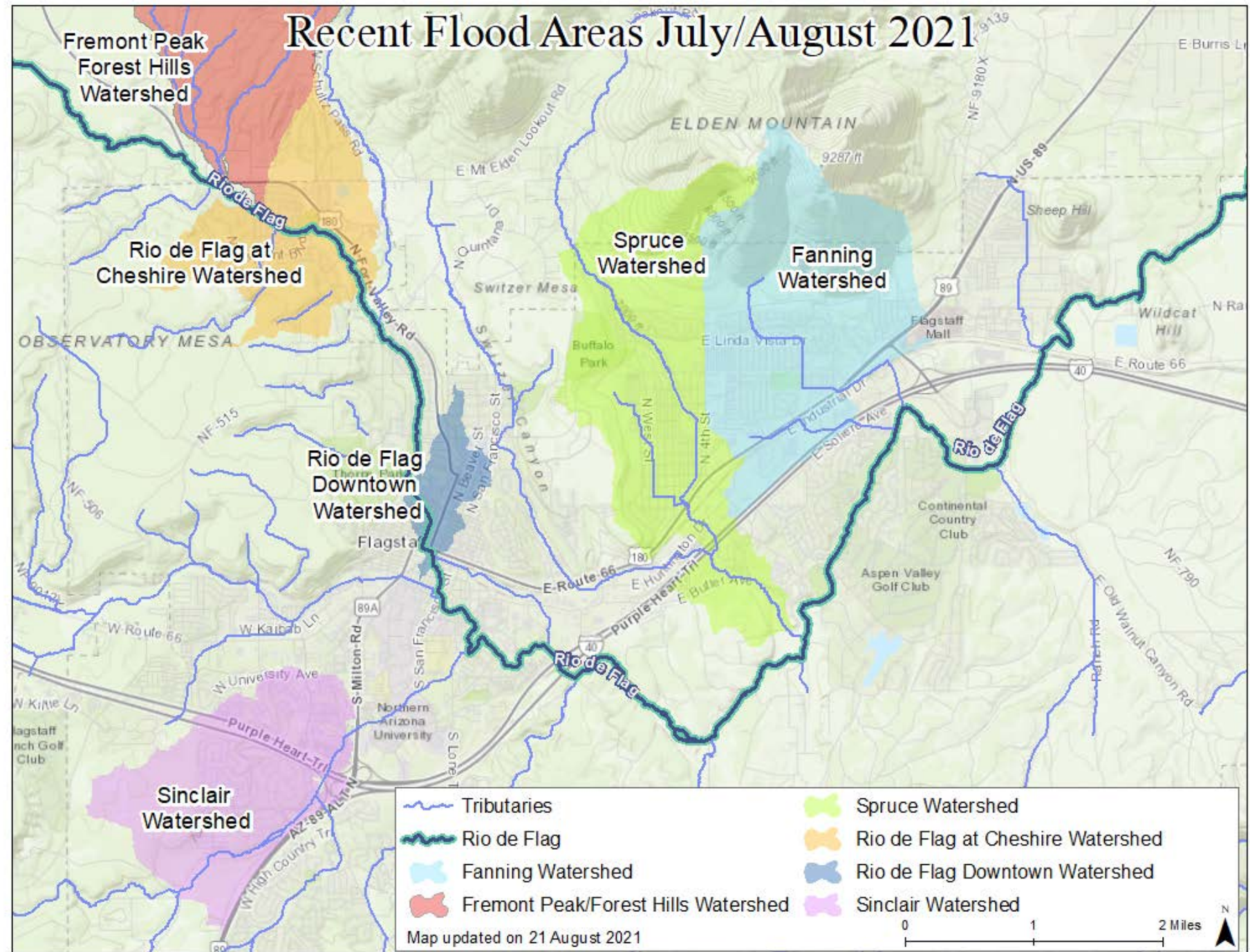


# Greater Flagstaff Area Flood Events

- 100-year rainfall event in East Flagstaff
- 50-year rainfall event in University Heights
- 300+ year rainfall event impacted the Forest Hills area and Rio de Flag



# Map of Watersheds







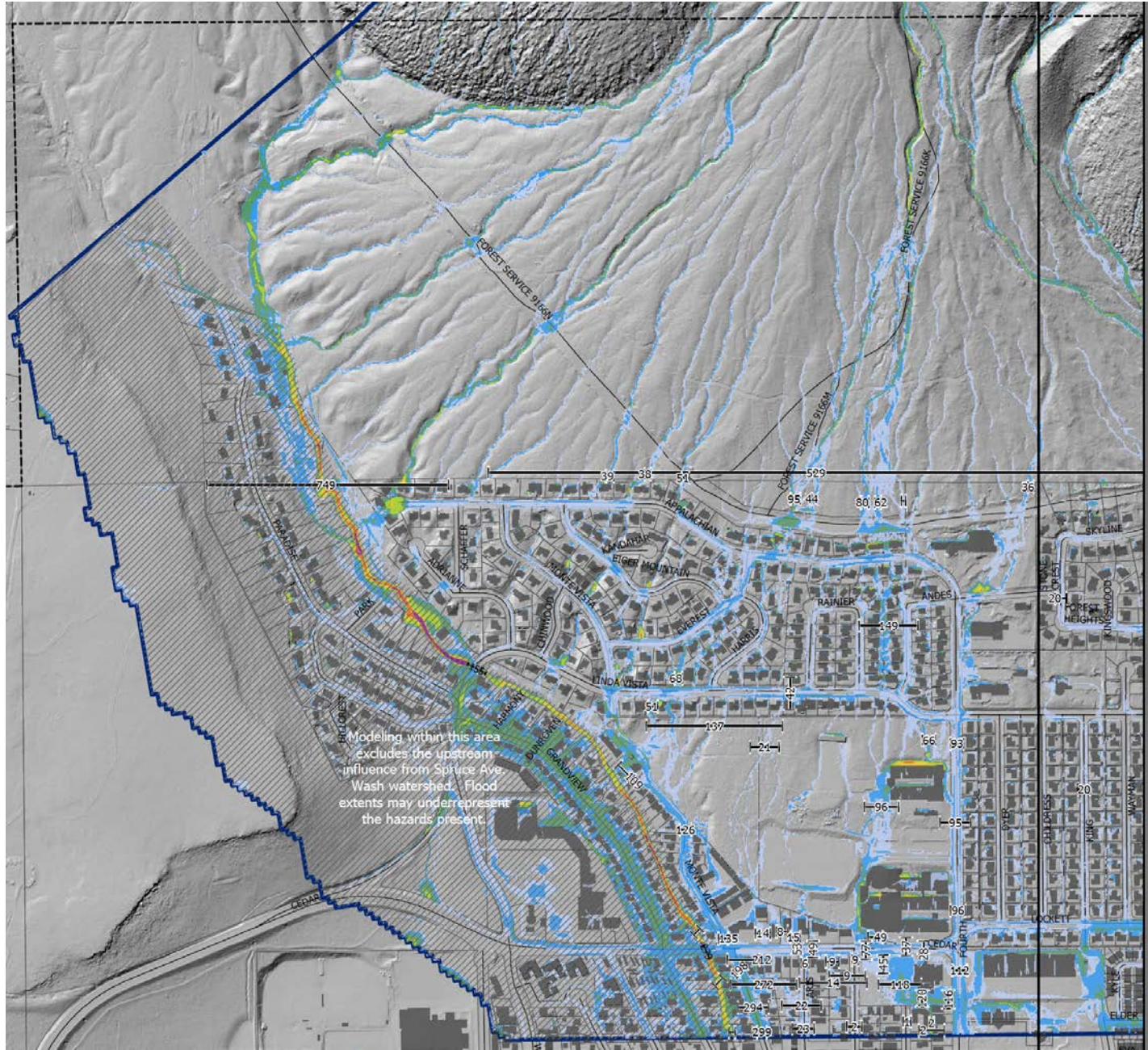
# 100-yr Event in East Flagstaff



- July 14th, 2.56" in one hour at the Fanning Wash gauge, a 100-year event or a 1% probability
- Very intense storm, 1.8" fell in 15 minutes = 200- year storm with 0.5%
- Substantial flooding along Fanning Wash, Shadow Mountain and Mobile Haven due to Mount Elden runoff
- Area was identified in 2007 Northeast Area Master Drainage Study as a flood concern
- Fanning Wash was partially upsized in the last decade but only near Thomas School and Siler Homes
- Headwaters of the watershed are now severely incised (higher flood threat)



# East Flagstaff Flood Event



**TEAM FLAGSTAFF**  
WE MAKE THE CITY BETTER



# Damage Along Fanning Wash







# Engineering Response

- Engineering response to East Flagstaff
- Several site visits at affected properties including meetings with Kinder Morgan (natural gas pipeline)
- A new FLO-2D model of both the event and a 100-year storm
- Ground truthing of the model including storm damage and highwater marks
- Very complex situation given the City's stormwater system does not now extend to this area
- Extremely costly to develop system to address large events given the watershed dynamics on Mt. Elden









# Engineering Response



City is working with AZGS to determine new flood risk based on new channel character







# 50-yr Event in University Heights



- July 24th event, 3 inches of rain in 1 hour at the Sinclair Wash gauge near University Heights South (~ 50-year rainfall event equals a 2% chance )
- Localized flooding along minor drainage conveyances and ditches
- Damage to public infrastructure is minimal but maintenance was required immediately after the rain
- Future neighborhood stormwater spot improvements need to be assessed



Ancestral Land crew cleaning detention basin near DeMiguel Elementary School



# 300+yr Event in Forest Hills



- Weather radar shows very large and intense thunderstorm over the drainage that flows through the Forest Hills area
- Likely in excess of a 300-year rainfall event which has a 0.33% chance of happening in any given year
- Two homes in the Forest Hills area and one home in Cheshire experienced interior flooding
- This rainfall event combined with localized rainfall in the City also produced flooding along the Rio de Flag
- Storm produced flooding and run-off for at least 24 hours





# Rio de Flag



- Rio de Flag gauges showed 2-3" rain in 1 hour, greater than 100-year rainfall event or a 1% probability
- One home damaged in Cheshire
- Impacts to downtown Flagstaff



# Private Property Impacts

## Outside of the Museum Flood Area

- 106 private property assessments with a total damage estimate up to August 17<sup>th</sup> event of \$1,207,300
- 8 interior private property residential damage assessments with a total damage estimate of \$1,600,500
- As of August 17<sup>th</sup> - 8 exterior residential and commercial property assessments with a total damage estimate of \$28,000

**Private Property Damage Grand Total: \$2,835,800**





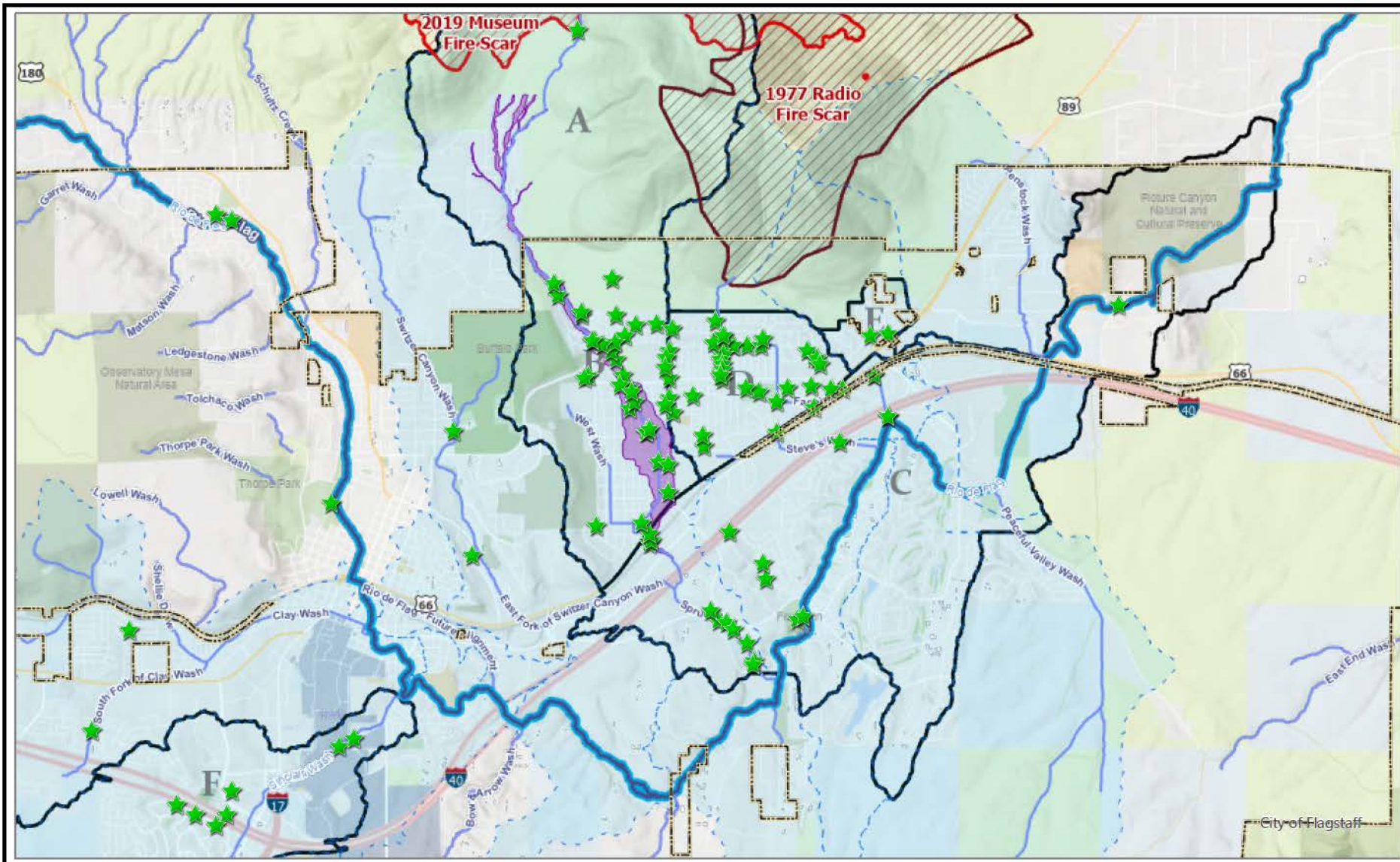
# Public Infrastructure Impacts

## Outside of the Museum Flood Area (within City limits)

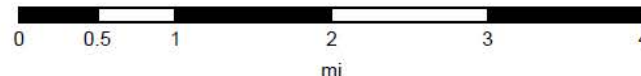
- 117 sites
- \$4.5 million

# PUBLIC INFRASTRUCTURE ASSESSMENT & RECOVERY GIS MAP

- Inspector
- Date/Time
- Damage Categories per DEMA
- Description and Impact of Damage
- Cost Estimate
- Photo(s)



## 2021 Monsoon Flood Damage Assessment



City of Flagstaff maps and data are updated on a regular basis from data obtained from various sources. The City of Flagstaff endeavors to provide accurate information, but accuracy is not guaranteed. You are strongly encouraged to obtain any information you need for a business or legal transaction from a surveyor, engineer, title company, or other licensed professional as appropriate. Information is provided subject to the express condition that you knowingly waive any and all claims for damages against the City of Flagstaff relating to use of this information.





# Comments & Questions from Council and Board





# Public Member Questions



**PLEASE EMAIL US AT**  
**[museumfloodinfo@coconino.az.gov](mailto:museumfloodinfo@coconino.az.gov)**

