City of Norman

Flood Warning System Overview

City Council Community Planning and Transportation Committee Meeting

October 26, 2023 – 4:00pm

Project No. 2122-63

MESHEK & ASSOCIATES, LLC

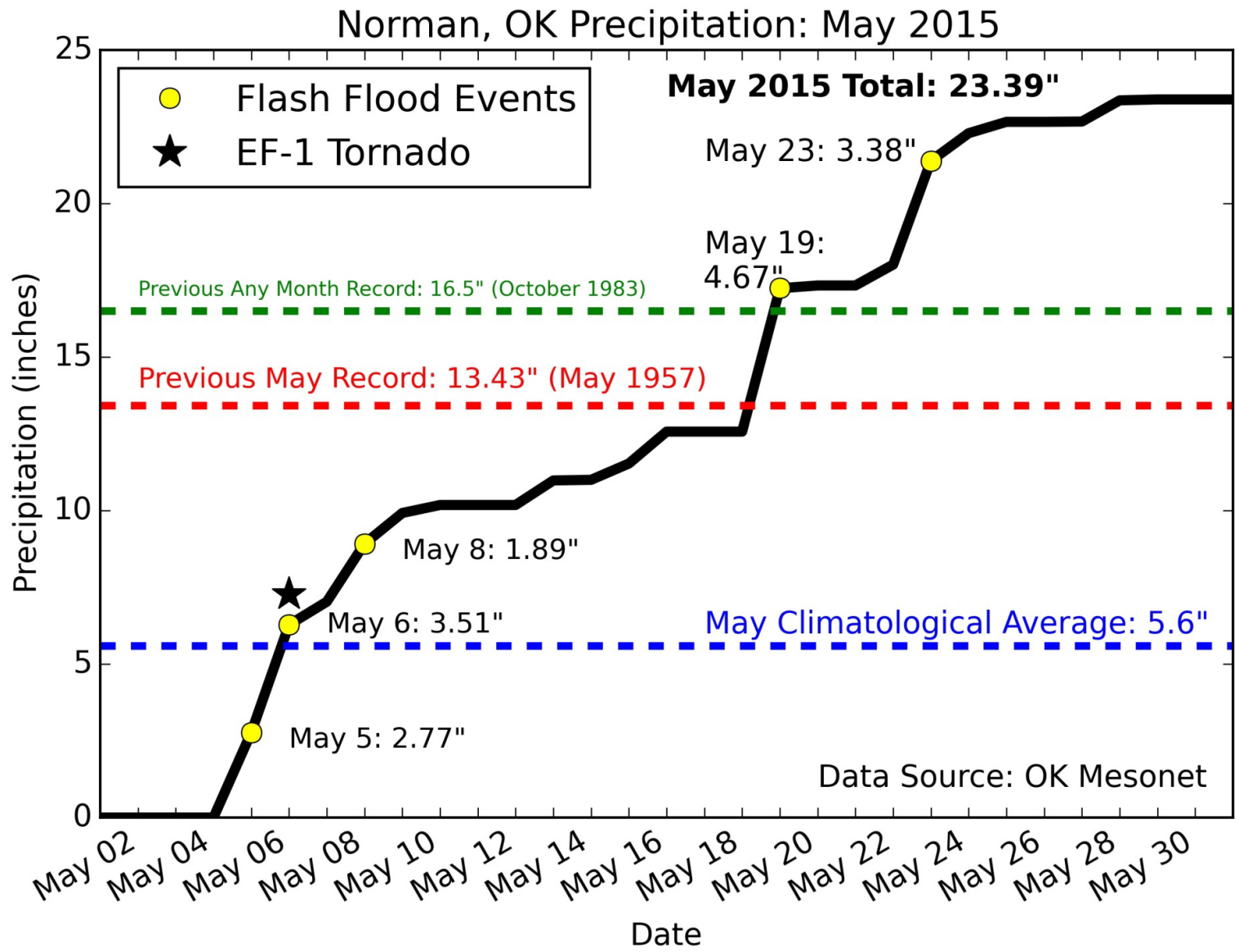
ESP 35
1986 | 2021

Why Does Norman Need a Flood Warning System?

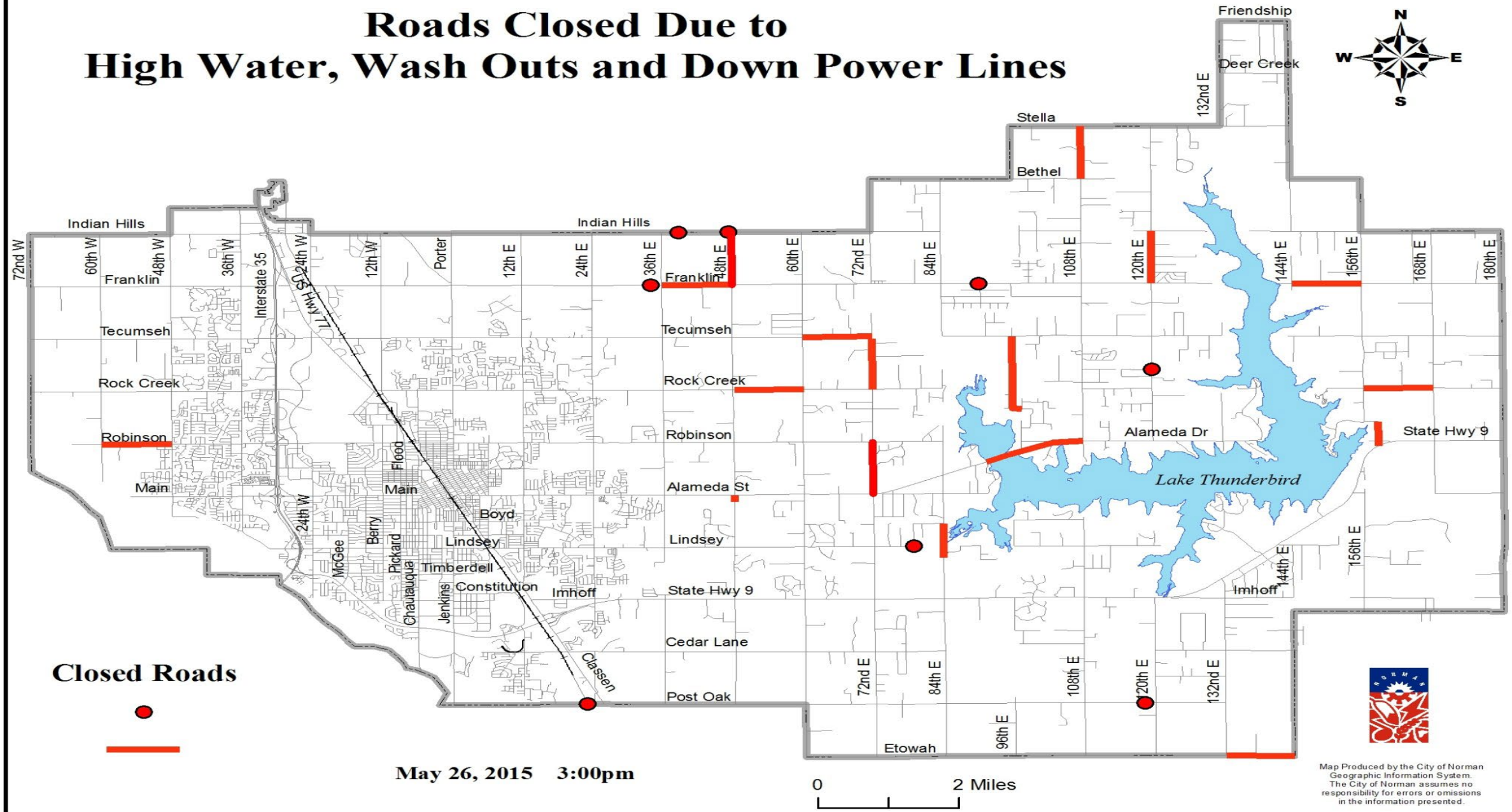
May 2015 Flood – Rock Creek Rd and 72nd Ave NW

May 2015 Flood – 72nd Ave NE between Robinson and Alameda

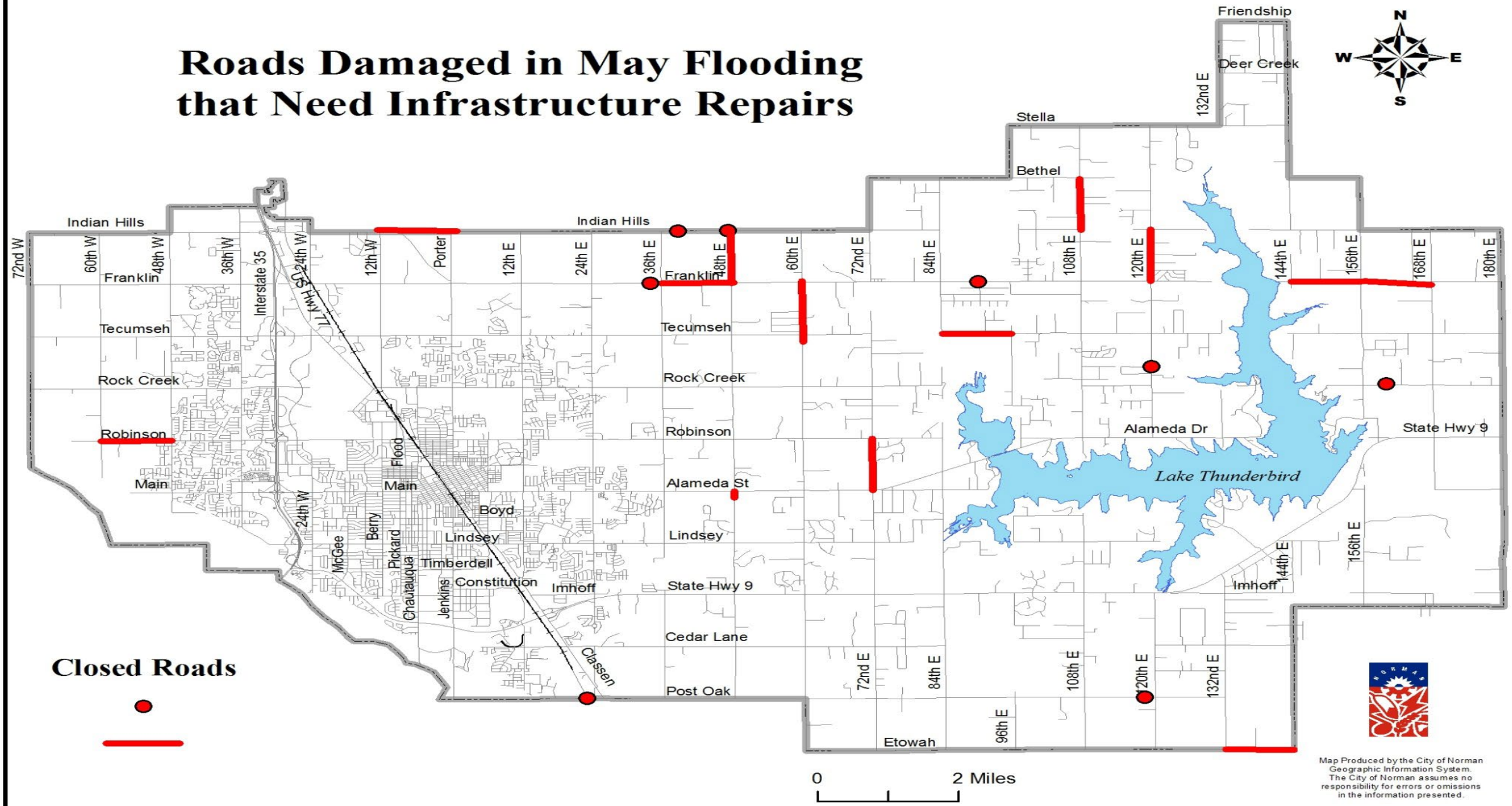
May 2015 Flood – Andrews Park Pavilion


Norman, OK Precipitation: May 2015
Flash Flood Events
EF-1 Tornado
May 2015 Total: 23.39"
May 23: 3.38"
May 19:
4.67"
Previous Any Month Record: 16.5" (October 1983)
Previous May Record: 13.43" (May 1957)
May 8: 1.89"
May 6: 3.51"
May Climatological Average: 5.6"
May 5: 2.77"
Data Source: OK Mesonet
Precipitation (inches)
0
5
10
15
20
25
May 02
May 04
May 06
May 08
May 10
May 12
May 14
May 16
May 18
May 20
May 22
May 24
May 26
May 28
May 30
Date

Roads Closed Due to High Water, Wash Outs and Down Power Lines



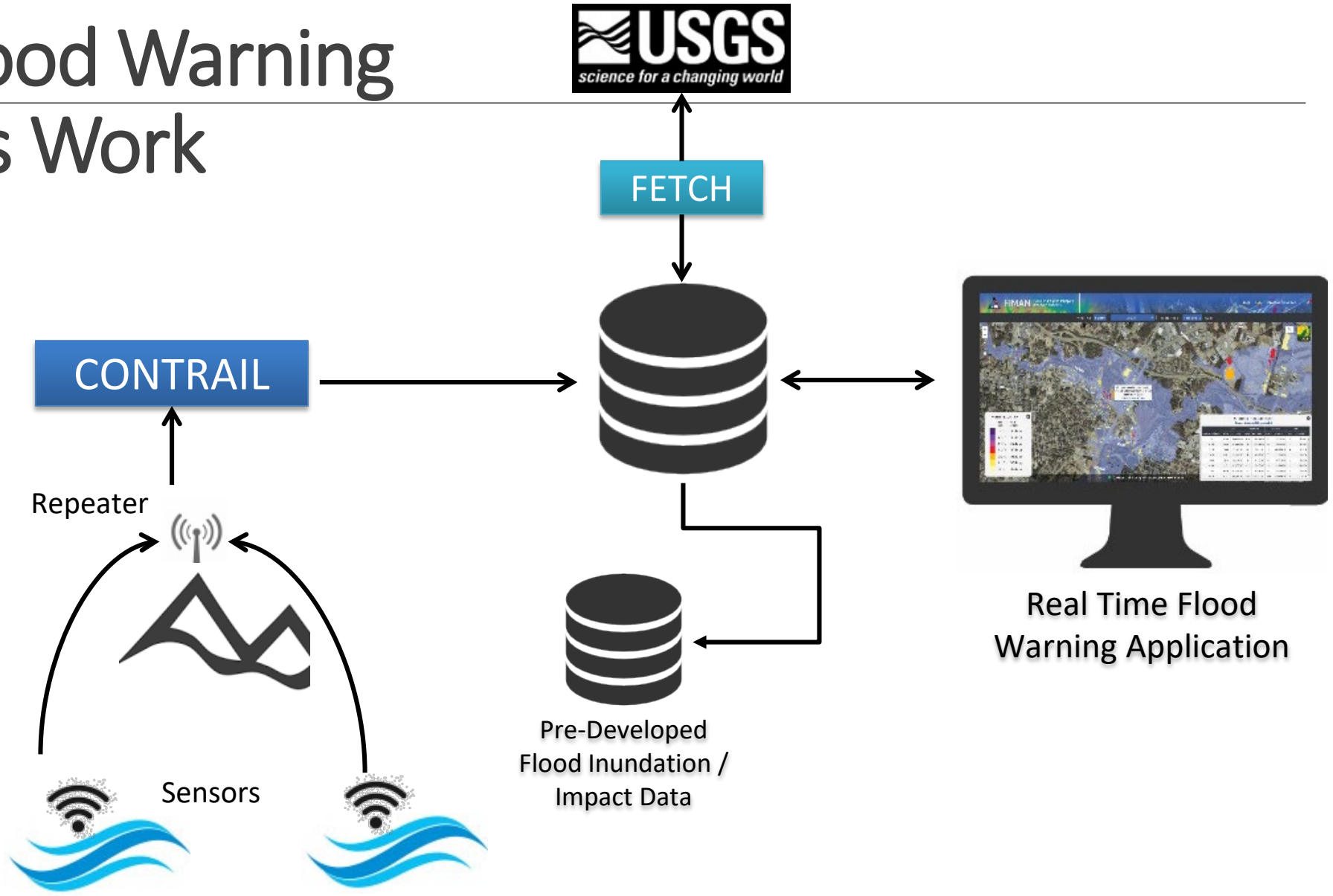
Roads Damaged in May Flooding that Need Infrastructure Repairs



Flood Warning System Scoping and Implementation Milestones

- November 2020 – City applies for FEMA Building Resilient Infrastructure & Communities (BRIC) Grant for scoping project for flood warning system
- February 2022 – City receives notification of award of BRIC grant
- March 8, 2022 – Council accepts grant contract K-2122-103 with ODEMHS
  - $100,000 grant
  - 25% City cost share
- September 13, 2022 – Meshek/ESP awarded contract K-2223-19 for scoping project
- July 2023 – Meshek/ESP delivered final scoping report
- September 26, 2023 – Council approves Resolution R-2324-65, authorizing CM or his designee to submit grant applications for Flood Warning implementation in the amount of $313,000
- October 2023 – Application submitted for US DOT SMART grant
- December 2023 – deadline for BRIC grant application

How Flood Warning Systems Work



What Are Inundation Libraries?

“Library” of flood inundation mapping near gaging stations

+ Gaging Stations

+ Telemetry

+ Pre-made inundation libraries

+ Web tool to efficiently communicate

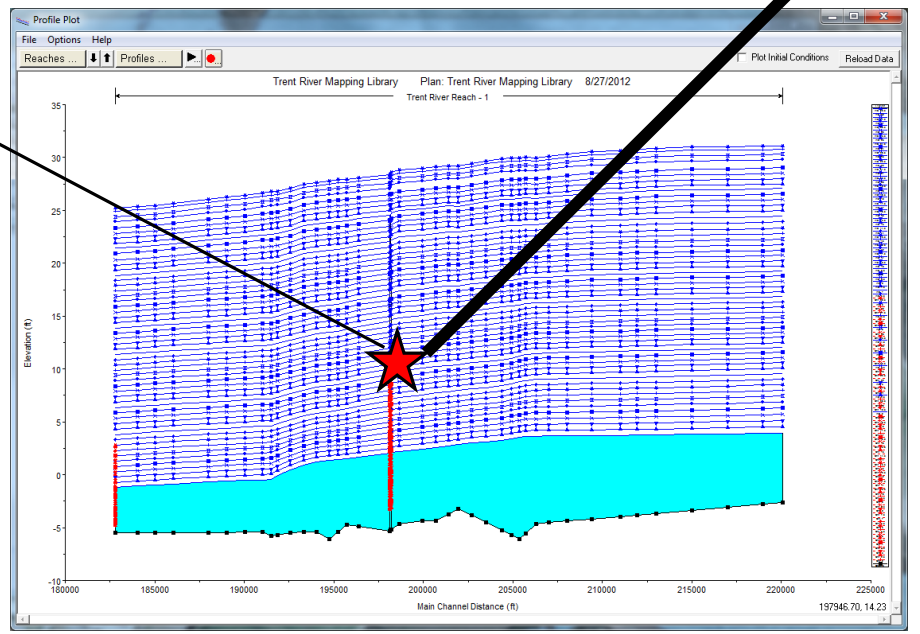
Real-time flood mapping solution

How do you make one?

1. Start with Hydraulic Model for Stream /River
2. Perform Iterative Modeling for all “Stage Targets”

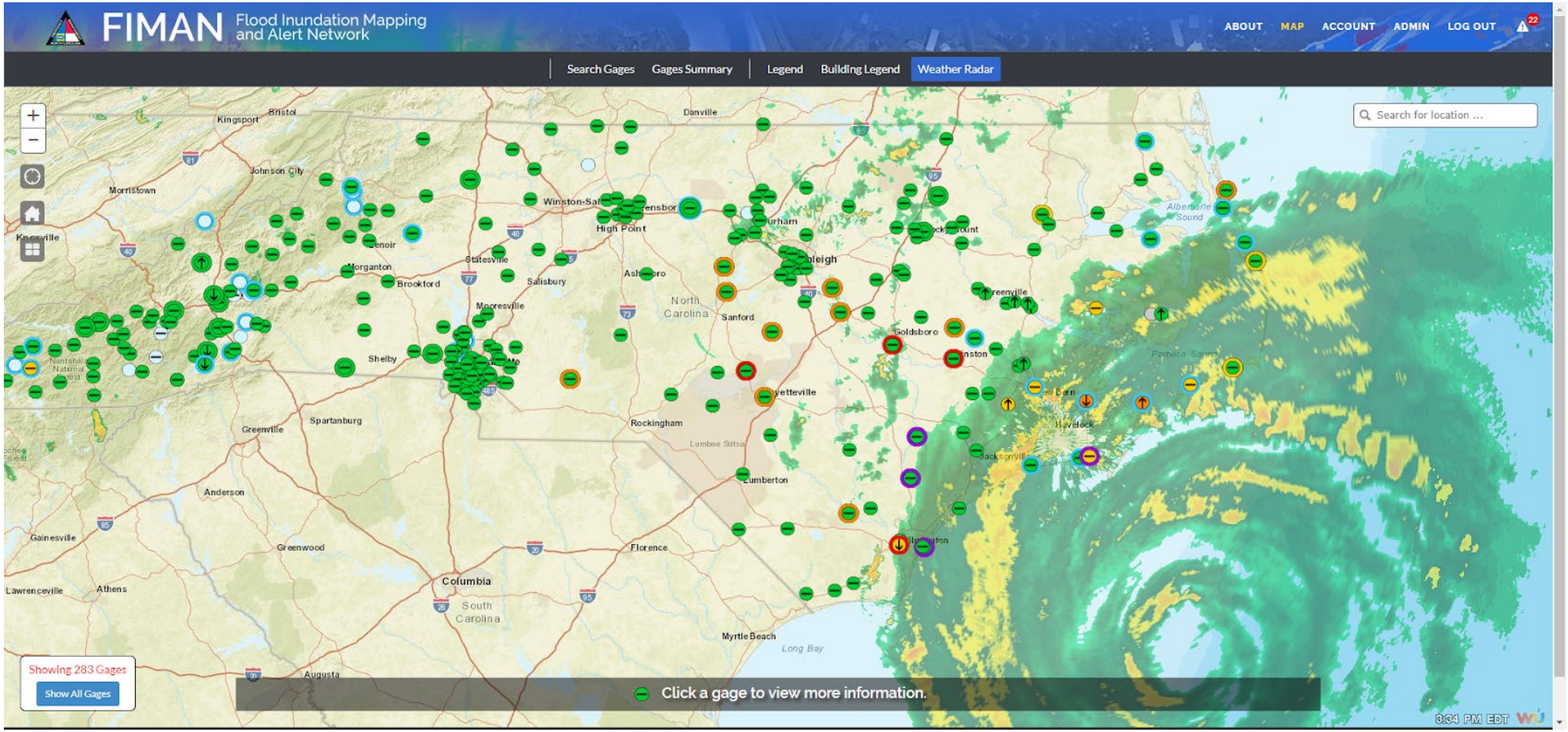
“Stage” target in each model.

This is station location

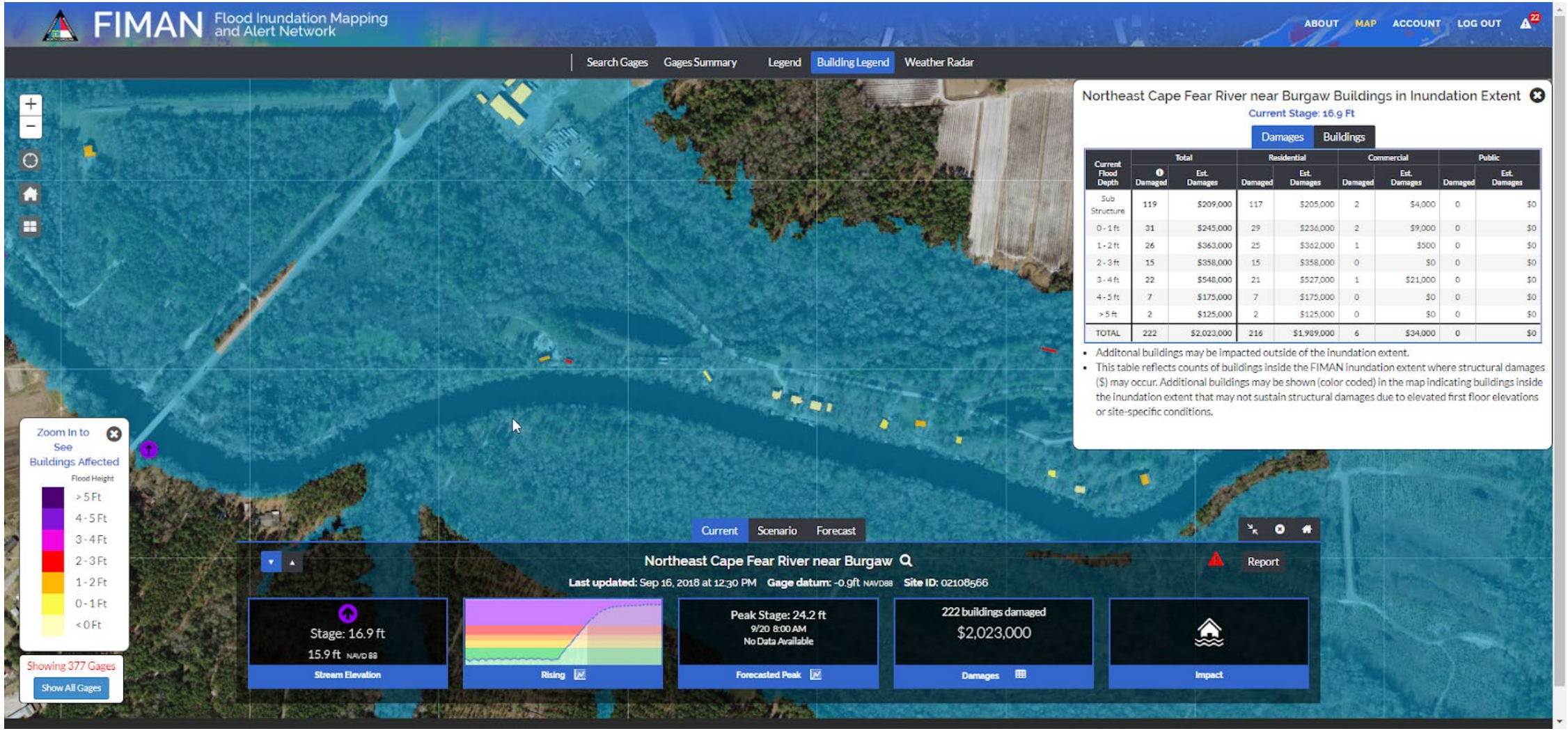


Reach	River Sta	Profile	W.S. Elev (ft)	Q Total (cfs)
Reach - 1	198164.3BR D	7.5	7.50	1435.0
Reach - 1	198164.3BR D	8	8.00	1563.0
Reach - 1	198164.3BR D	8.5	8.50	1698.0
Reach - 1	198164.3BR D	9	9.00	1838.0
Reach - 1	198164.3BR D	9.5	9.50	1980.0
Reach - 1	198164.3BR D	10	10.00	2130.0
Reach - 1	198164.3BR D	10.5	10.50	2285.0
Reach - 1	198164.3BR D	11	11.00	2450.0
Reach - 1	198164.3BR D	11.5	11.50	2625.0
Reach - 1	198164.3BR D	12	12.00	2805.0
Reach - 1	198164.3BR D	12.5	12.50	2995.0
Reach - 1	198164.3BR D	13	13.00	3195.0
Reach - 1	198164.3BR D	13.5	13.50	3395.0
Reach - 1	198164.3BR D	14	14.00	3615.0
Reach - 1	198164.3BR D	14.5	14.50	3842.0
Reach - 1	198164.3BR D	15	15.00	4080.0
Reach - 1	198164.3BR D	15.5	15.50	4330.0
Reach - 1	198164.3BR D	16	16.00	4595.0
Reach - 1	198164.3BR D	16.5	16.50	4875.0
Reach - 1	198164.3BR D	17	17.00	5160.0
Reach - 1	198164.3BR D	17.5	17.50	5460.0
Reach - 1	198164.3BR D	18	18.00	5775.0
Reach - 1	198164.3BR D	18.5	18.50	6105.0
Reach - 1	198164.3BR D	19	19.00	6450.0
Reach - 1	198164.3BR D	19.5	19.50	6815.0
Reach - 1	198164.3BR D	20	20.00	7230.0
Reach - 1	198164.3BR D	20.5	20.50	7660.0
Reach - 1	198164.3BR D	21	21.00	8075.0
Reach - 1	198164.3BR D	21.5	21.50	8590.0
Reach - 1	198164.3BR D	22	22.00	9140.0
Reach - 1	198164.3BR D	22.5	22.50	9715.0
Reach - 1	198164.3BR D	23	23.00	10300.0
Reach - 1	198164.3BR D	23.5	23.50	10920.0
Reach - 1	198164.3BR D	24	24.00	11500.0
Reach - 1	198164.3BR D	24.5	24.50	12190.0
Reach - 1	198164.3BR D	25	25.00	12830.0
Reach - 1	198164.3BR D	25.5	25.50	13550.0
Reach - 1	198164.3BR D	26	26.00	14270.0
Reach - 1	198164.3BR D	26.5	26.50	15040.0
Reach - 1	198164.3BR D	27	27.00	16005.0

Example Flood Warning System: NC FIMAN



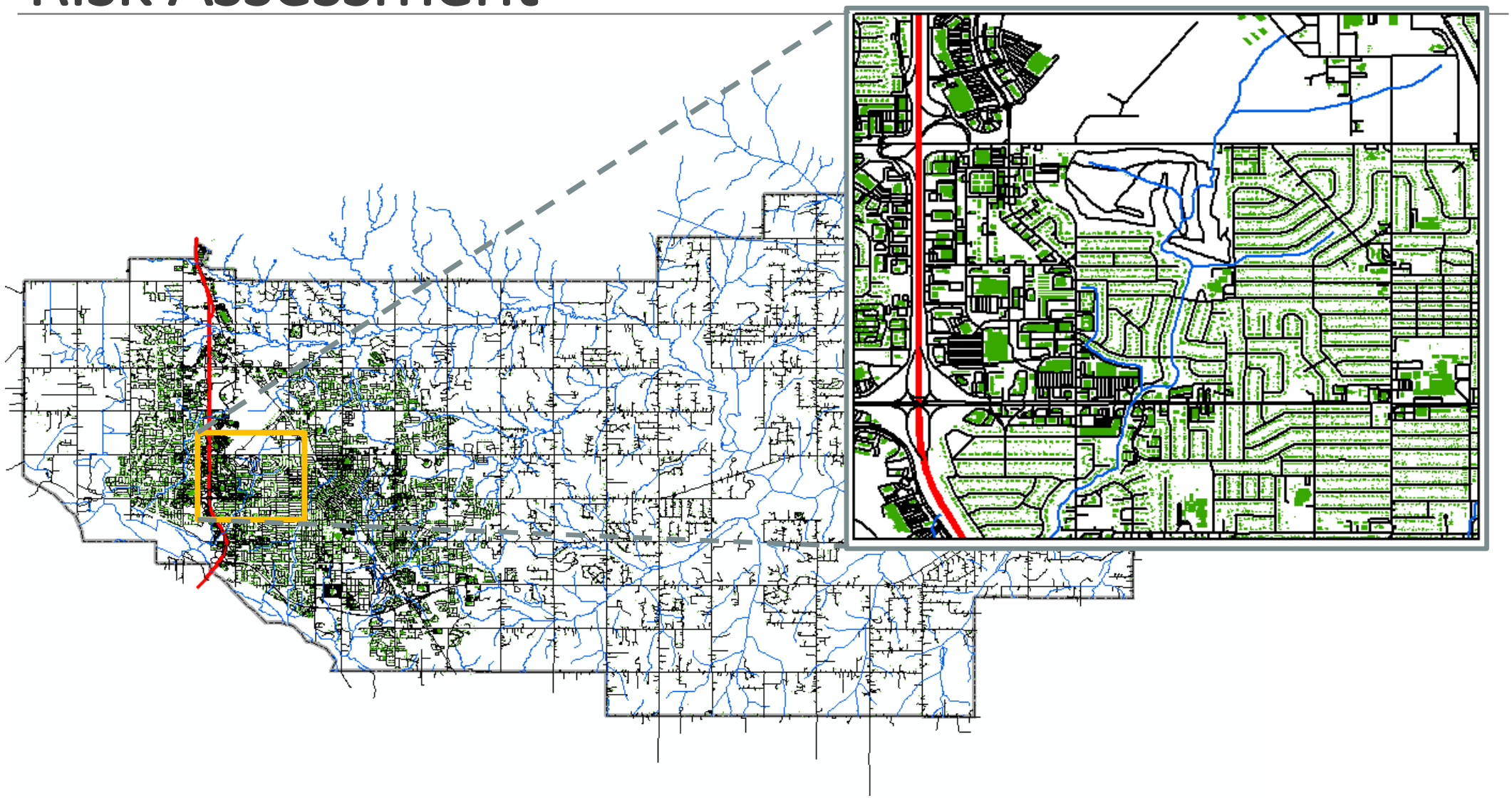
Example Flood Warning System: NC FIMAN



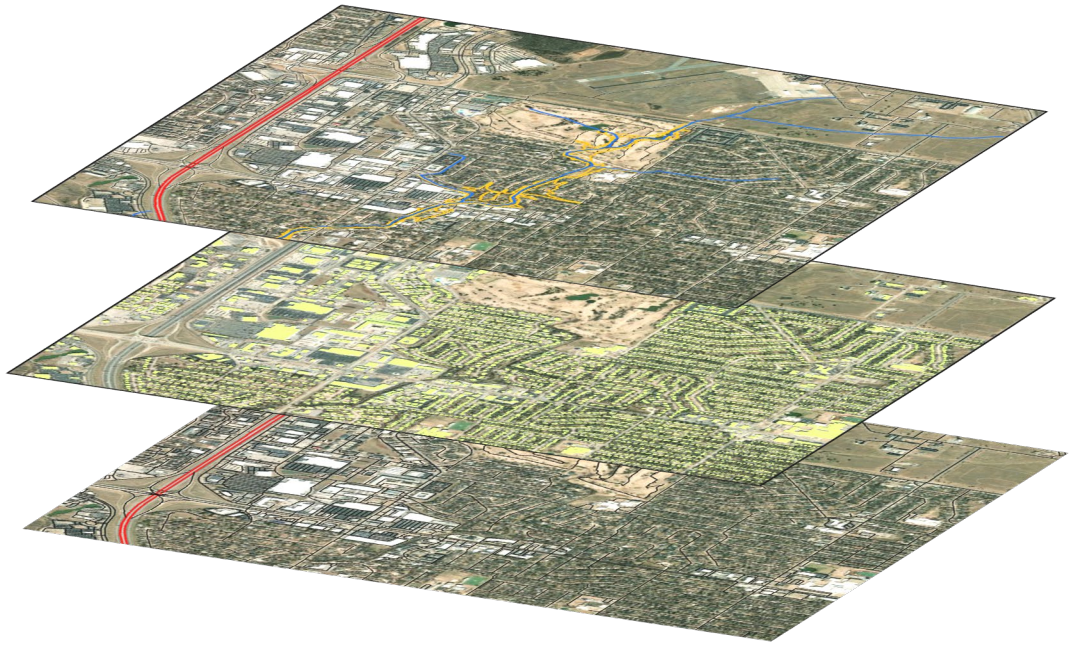
Norman Flood Warning: Phase 1

- October 2022: Meshek Awarded Contract for Flood Warning System Project Scoping
  - Phase 1 Flood Warning System:
    - Task 1: Develop Assessment Standards
    - Task 2: Document Current Emergency Management Standard
    - Task 3: Assess Traffic and Development Information
    - Task 4: Development of Flood Warning System Requirements & Location Priority
    - Task 5: Report and Implementation Plan
- July 2023: Phase 1 Deliverables Submitted Final
- Fall 2023: Phase 2 Scope Development

Risk Assessment



Hazards and Vulnerabilities



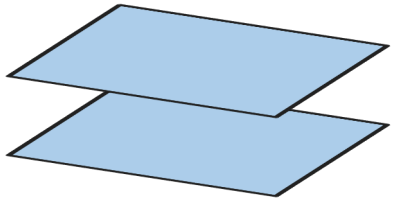
Risk - Flooding

Vulnerability - Buildings

Vulnerability - Roads

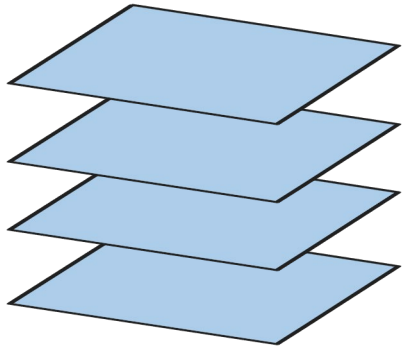
Hazards and Vulnerabilities

Hazards



- Flashflood Likelihood
- Flood depths

Vulnerabilities



- Buildings affected
- Critical Facilities
- Type of Road
- Road Redundancy

Repeat for each stream/location

Geospatial Analysis

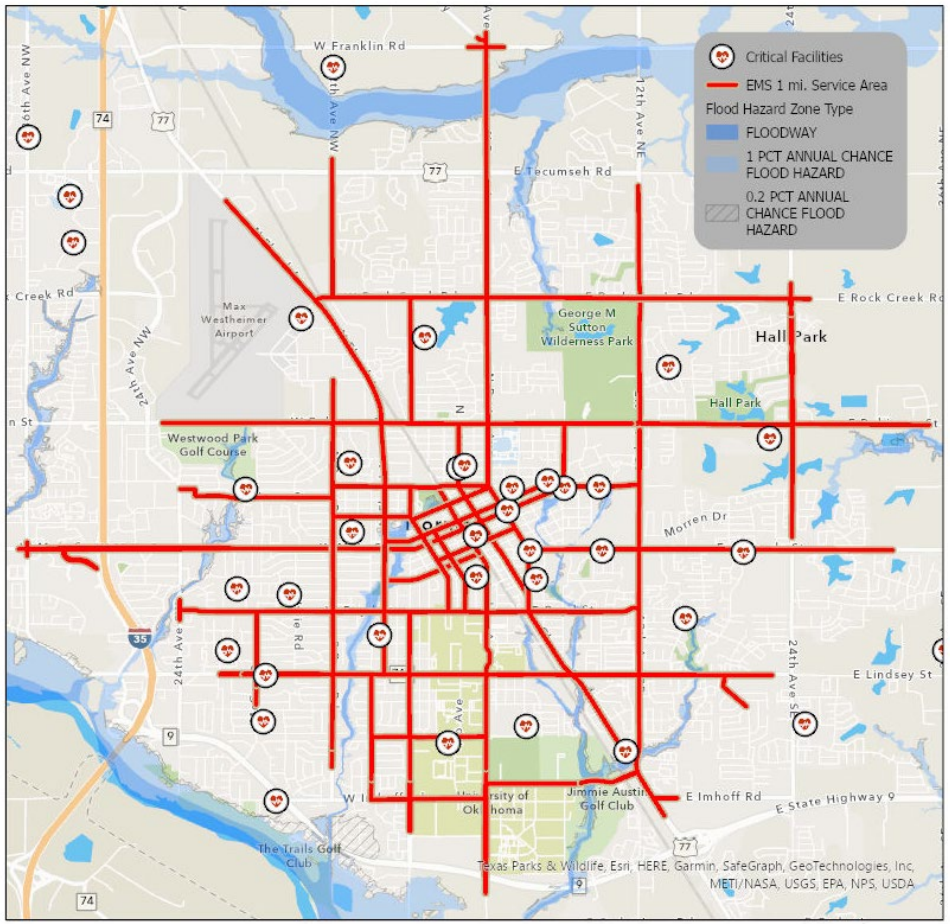


Figure 1. Network Connectivity for Critical Facilities

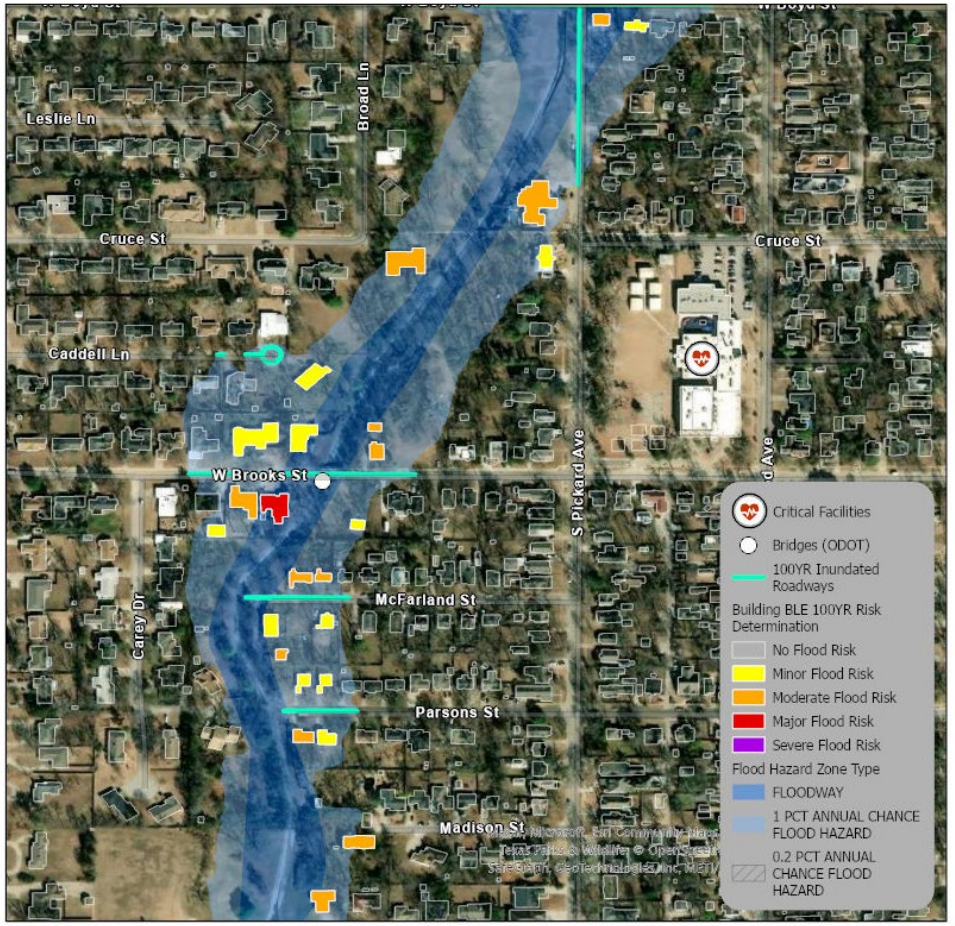


Figure 2. At Risk Buildings

Imhoff Creek

I1: Culvert on W. Main St.

Figure 1. Culvert over Imhoff Creek at location I1.

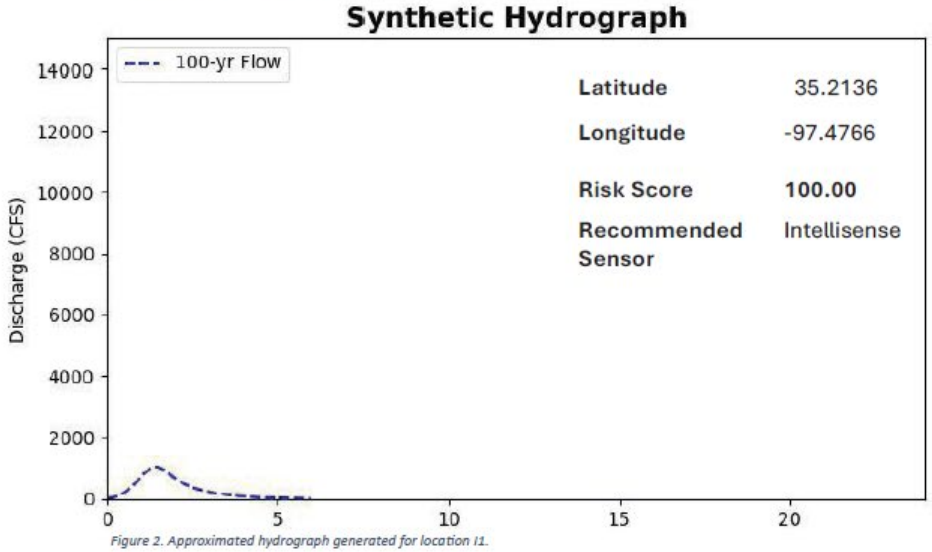
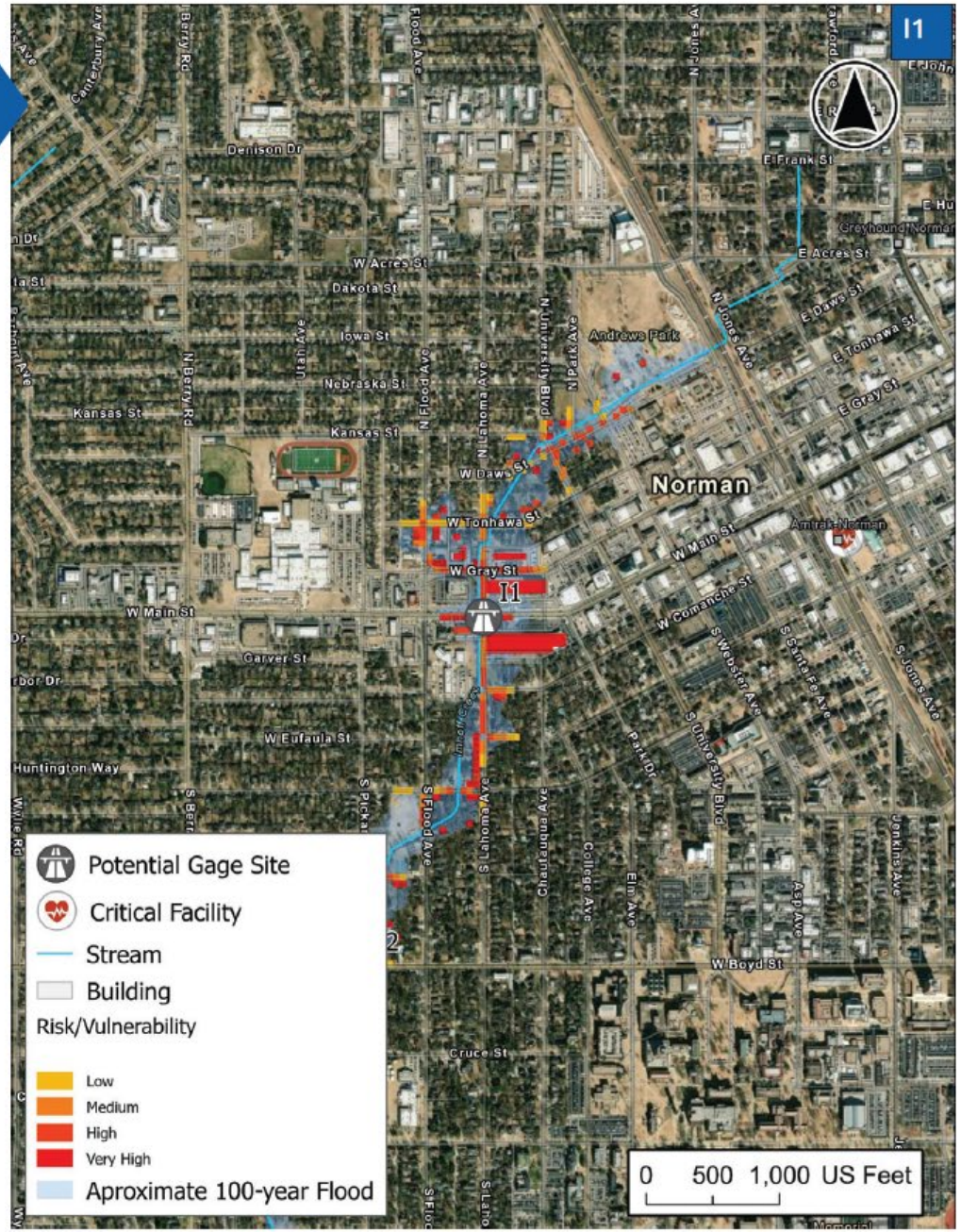


Figure 2. Approximated hydrograph generated for location I1.



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Ten Mile Flat

BG1: Culvert on 60th Ave NW.

Figure 1. Culvert over Boggy Creek at location BG1.

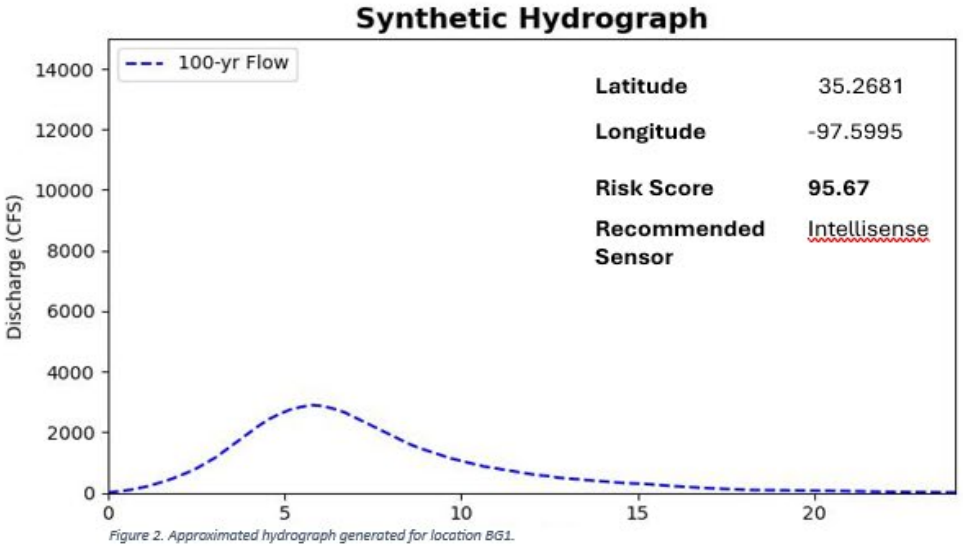
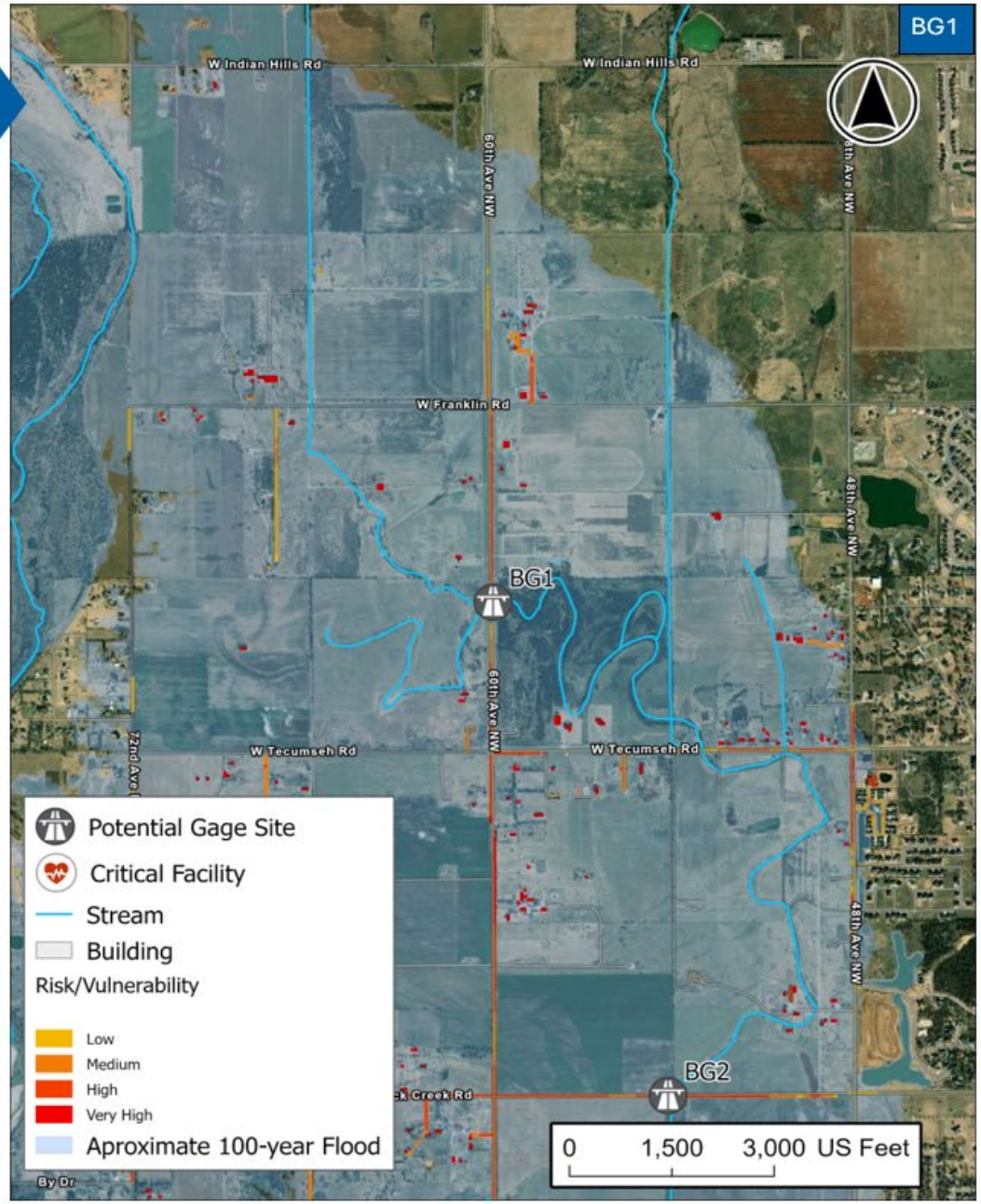
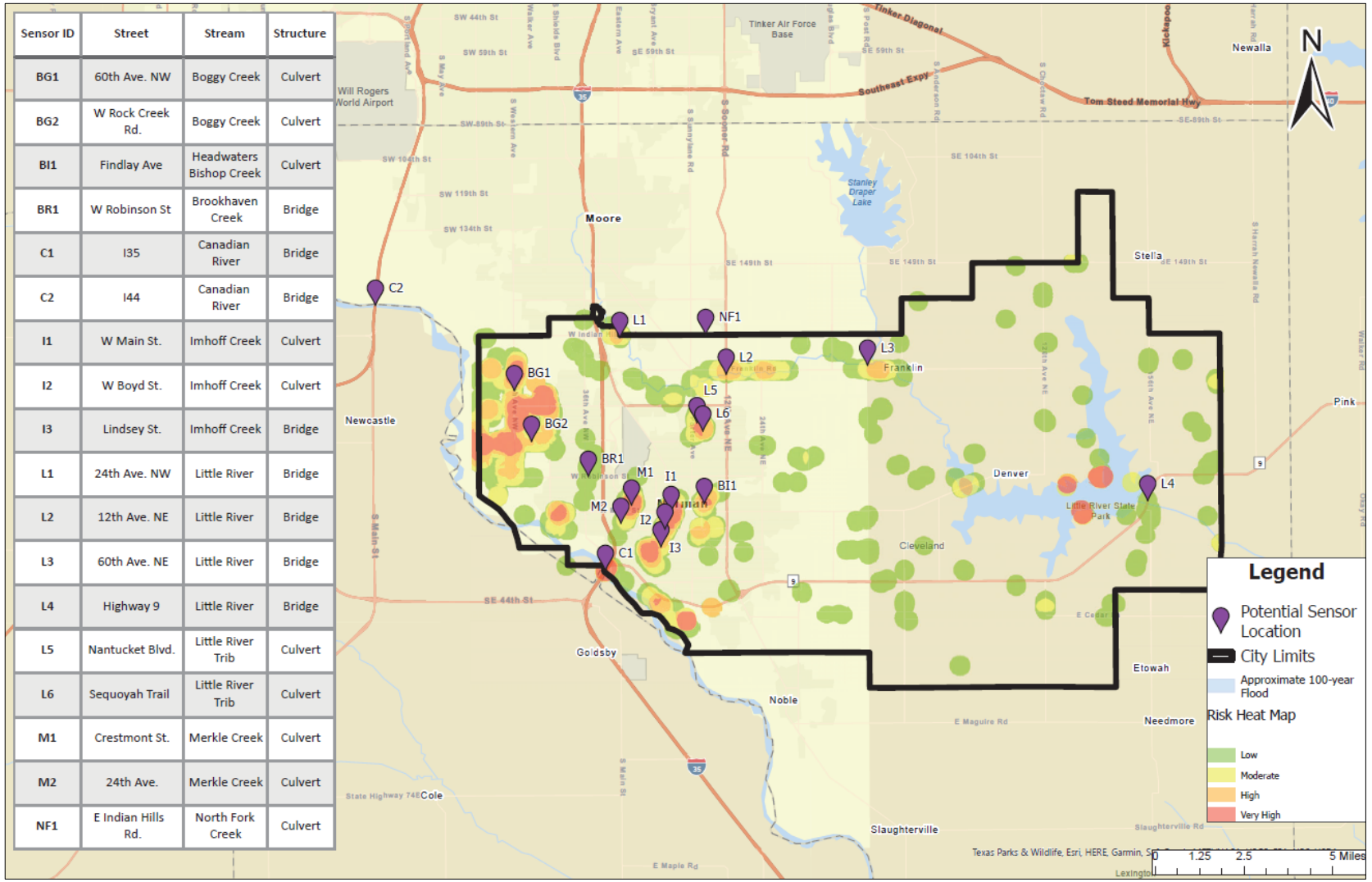


Figure 2. Approximated hydrograph generated for location BG1.



Sensor Location Prioritization

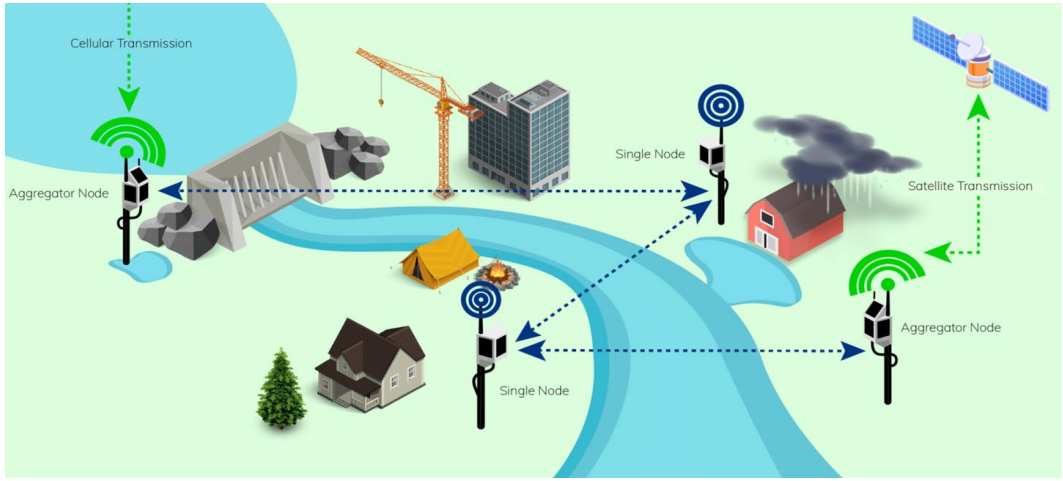
Sensor ID	Street	Stream	Structure
BG1	60th Ave. NW	Boggy Creek	Culvert
BG2	W Rock Creek Rd.	Boggy Creek	Culvert
BI1	Findlay Ave	Headwaters Bishop Creek	Culvert
BR1	W Robinson St	Brookhaven Creek	Bridge
C1	I35	Canadian River	Bridge
C2	I44	Canadian River	Bridge
I1	W Main St.	Imhoff Creek	Culvert
I2	W Boyd St.	Imhoff Creek	Culvert
I3	Lindsey St.	Imhoff Creek	Bridge
L1	24th Ave. NW	Little River	Bridge
L2	12th Ave. NE	Little River	Bridge
L3	60th Ave. NE	Little River	Bridge
L4	Highway 9	Little River	Bridge
L5	Nantucket Blvd.	Little River Trib	Culvert
L6	Sequoyah Trail	Little River Trib	Culvert
M1	Crestmont St.	Merkle Creek	Culvert
M2	24th Ave.	Merkle Creek	Culvert
NF1	E Indian Hills Rd.	North Fork Creek	Culvert



Sensor Type Recommendation

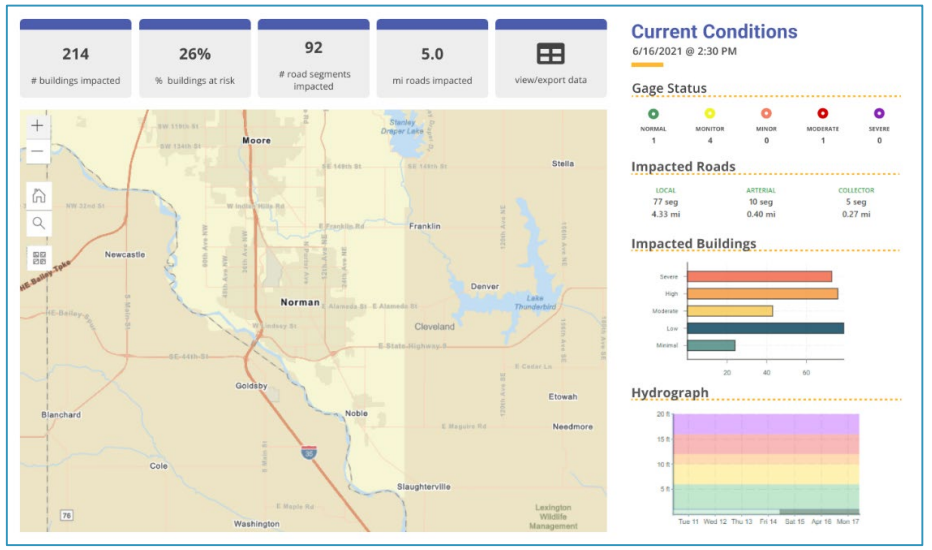
IntelliSense

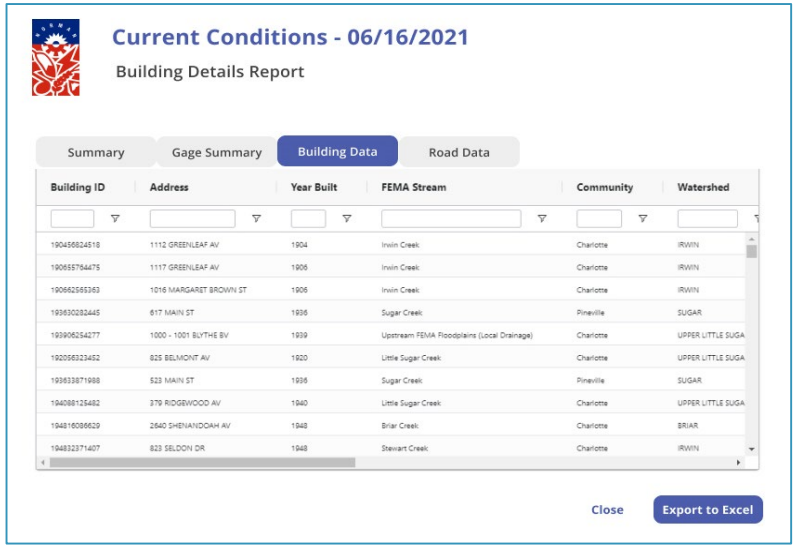
- ✓Unit cost is $4k +/- per unit (vs $25 - $30k)
- ✓Rain sensors and optional cameras
- ✓Integrated Solar power. Can operate 7-10 days without charge.
- ✓Rugged and Lockable
- ✓Automatically Detects Flash Floods
- ✓Uses a cloud-based operating system / IoT



Phase 2 Overview
Flood Warning Application

- Site Users: Public, Stakeholders, Emergency Managers
- Sensors: Recommended Low Costs Intellisense AWARE Flood Warning Sensors
- Real Time Stream Stage and Water Elevations – 25 locations Citywide
- Enterprise Flood Warning Database Development
- Perform Inundation Library Development. Modeling + Inundation Mapping + Impact Assessment
- Real Time and Scenario Based Mapping and Impact Analysis
  - Floodplain Extent
  - Buildings Impacted
  - Roadways Impacted





Additional Benefits of Flood Warning Systems

- Efficient Post Event Damage Assessments
- Benefit Cost Analysis Calculations
- FEMA Grant Applications
- Hazard Mitigation Planning and Exercises
- Emergency Response
- Community Rating System (CRS)

Next Steps

- Secure federal grant for Flood Warning System Implementation
- City Council considers contract amendment with Meshek & Associates for Phase II of Flood Warning System
- Coordinate Flood Warning System with Traffic Management Center (TMC)
- Final Implementation of Flood Warning System 2025

Questions / Discussion

Thank you