NGWOS Urban Hydrology: Building Future Resilience

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Source: https://www.cnn.com/2023/01/10/weather/gallery/california-weather-flooding/index.html

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‘We weren’t prepared’: Redwood City grapples with the aftermath of devastating winter storms

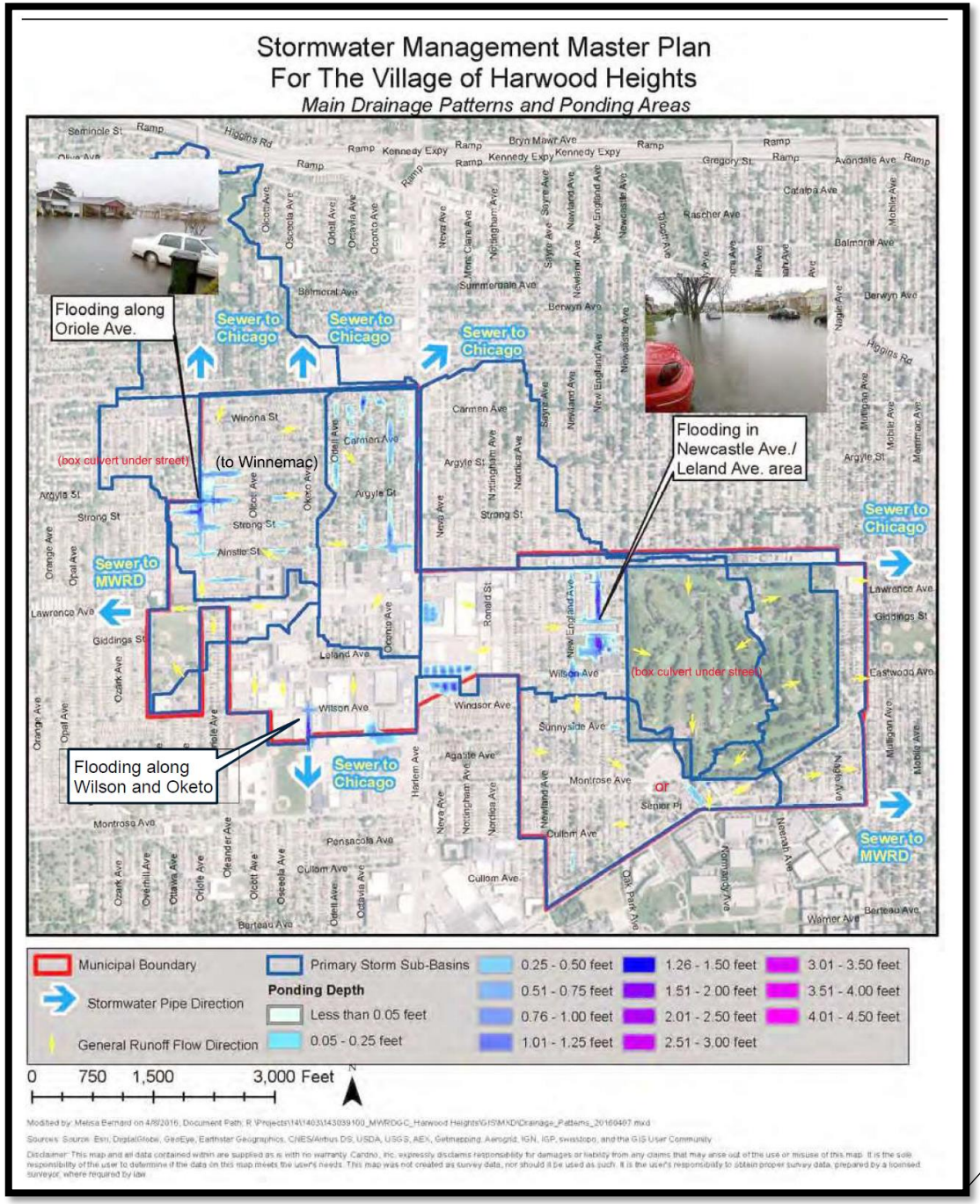
Residents and officials said more needs to be done to prepare for weather events made increasingly severe by climate change

Leah Worthington
Jan 12, 2023 10:19 AM

Source: RWCPulse.com

Source: WEAU news

Source: Ryan Soderlin/Omaha World-Herald via AP



Harwood Heights, IL

(population = ~8,500)

Concept

- Pilot ***low-cost***, ***low-power***, autonomous sensor network in urban areas prone to flooding
- Provide real-time data dashboard for end users
- Automatically send alerts to critical response teams when thresholds breached

Source: Gary Hershorn/Reuters

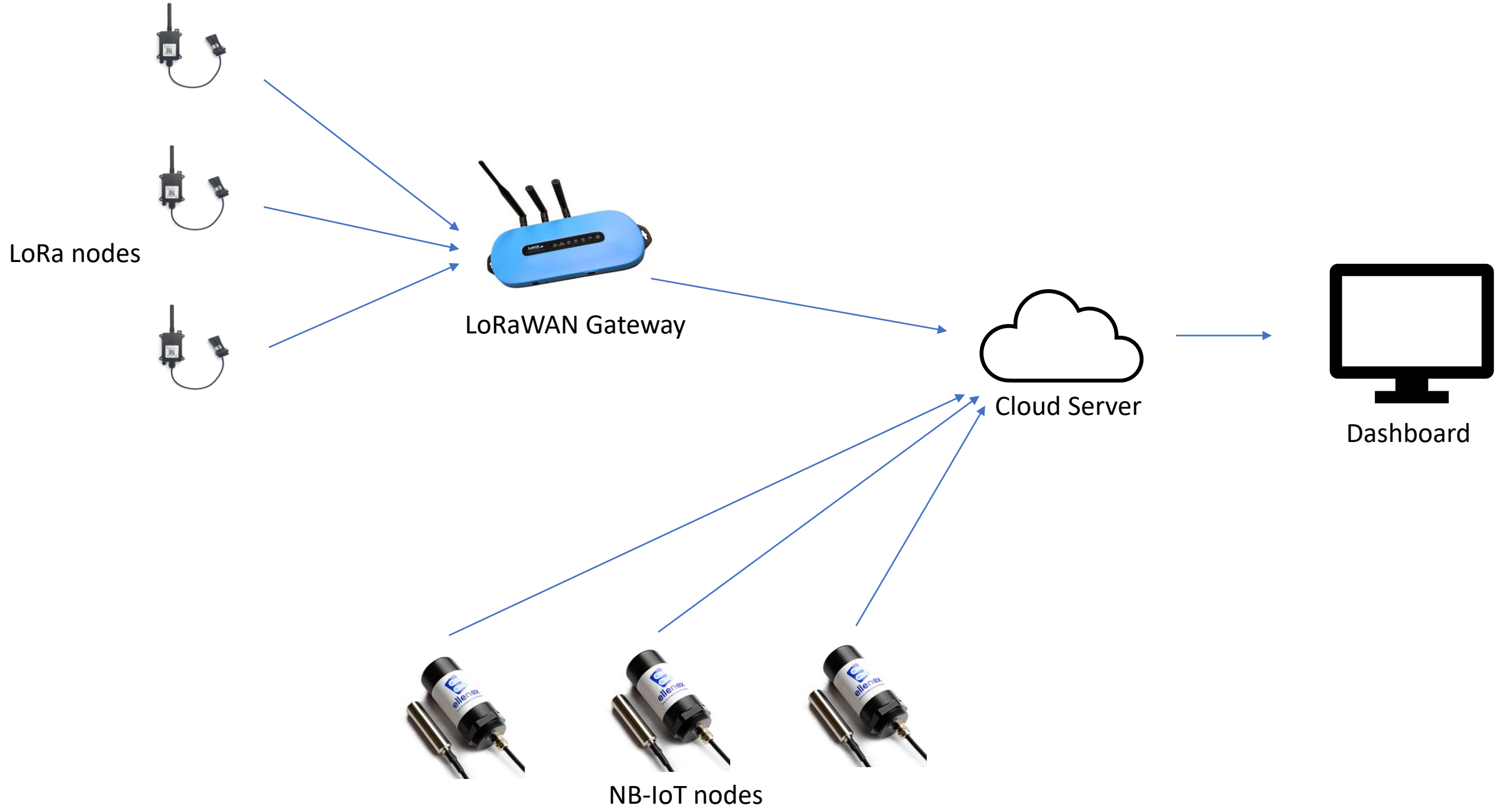
All photos: USGS

LoRaWAN

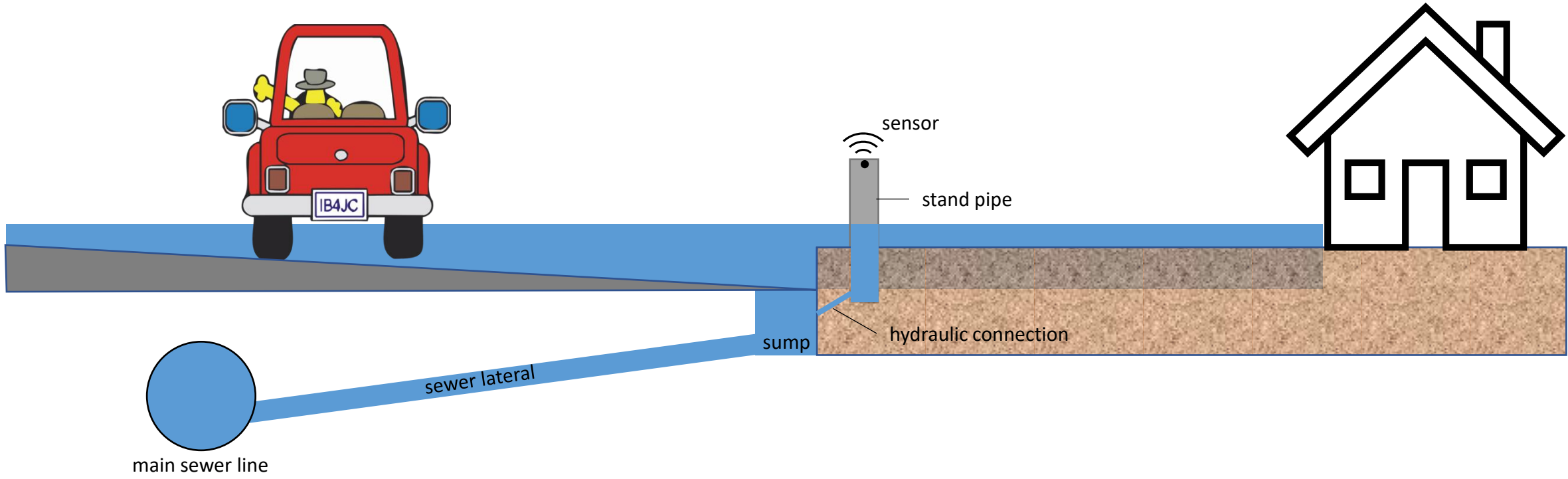
- ***Low-cost***, long-range wide area network
- Many-to-one

NB-IoT

- Narrow band Internet of Things (LTE-M, CAT-M1)
- One-to-one


LoRa nodes
LoRaWAN Gateway
Cloud Server
Dashboard
NB-IoT nodes

Conceptual Diagram




0.9 x 1.3 m HERO
0.3 m pipe

Ultrasonic
$70

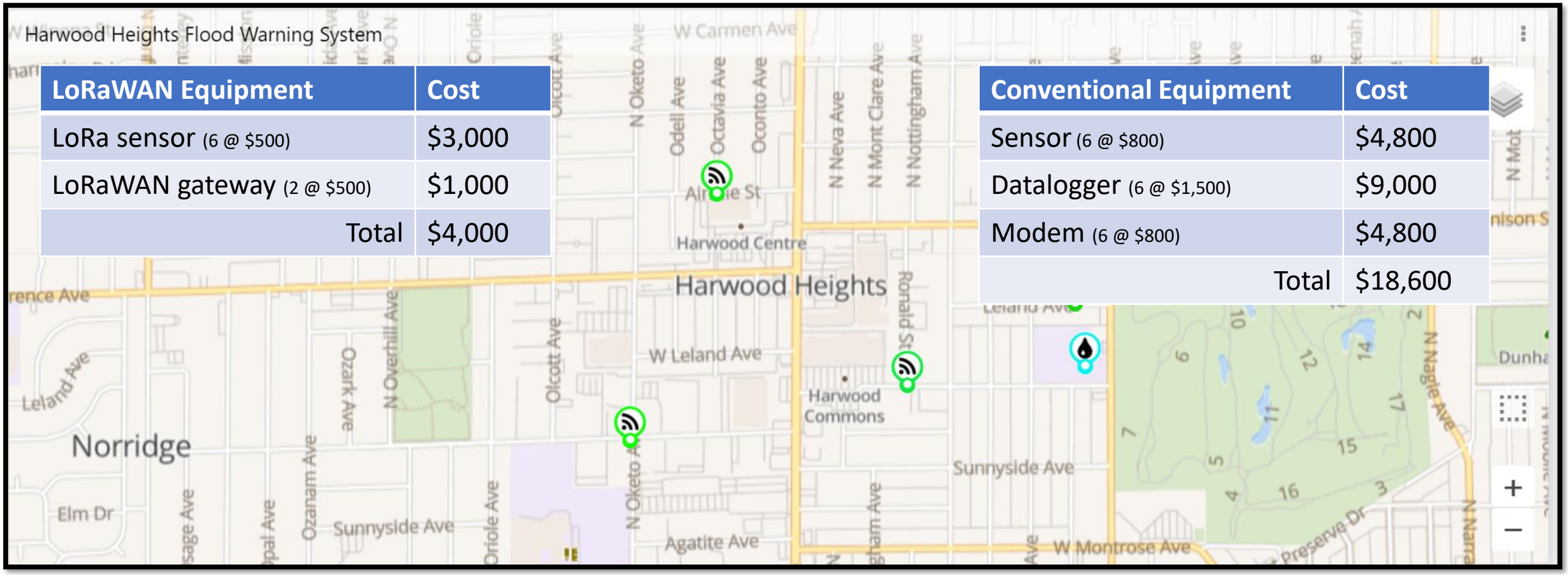
Mechanical float
$125

float

Submersible pressure transducer
$ 500

All photos: USGS

Equipment cost to monitor 6 different locations



LoRaWAN Equipment	Cost
LoRa sensor (6 @ $500)	$3,000
LoRaWAN gateway (2 @ $500)	$1,000
Total	$4,000

Conventional Equipment	Cost
Sensor (6 @ $800)	$4,800
Datalogger (6 @ $1,500)	$9,000
Modem (6 @ $800)	$4,800
Total	$18,600

Source: ESRI ArcMap 10.8.1

Real-time Dashboard and Alert System

Rapid identification of hazardous areas

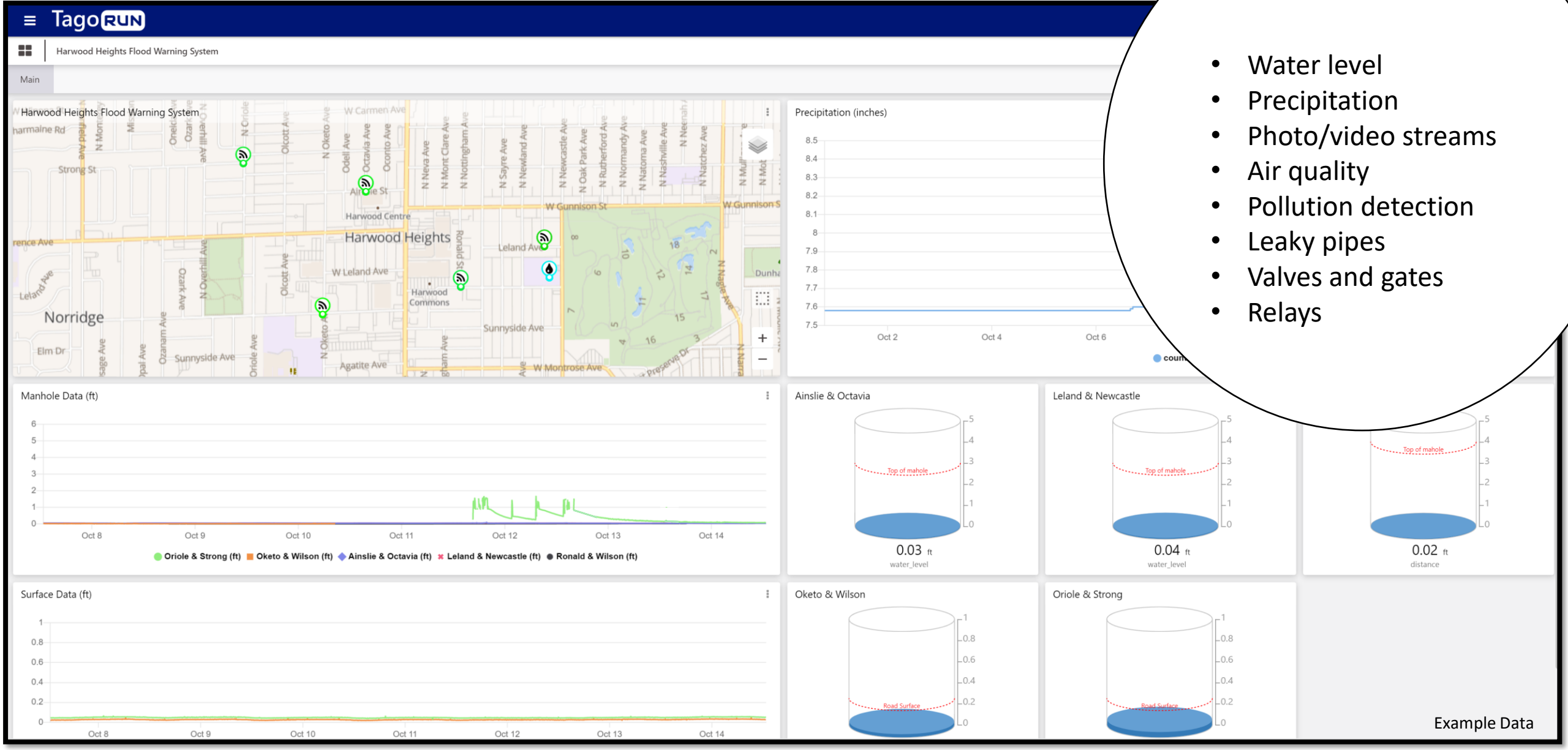
- Graphical tools for quick visual assessment
- Data updated every 5 minutes (user defined)

Automated alerts

- Sent to specific people or teams (e.g. fire, police)
- Trigger other actions/analyses based on sensor data (e.g. signs)

Data logging capabilities

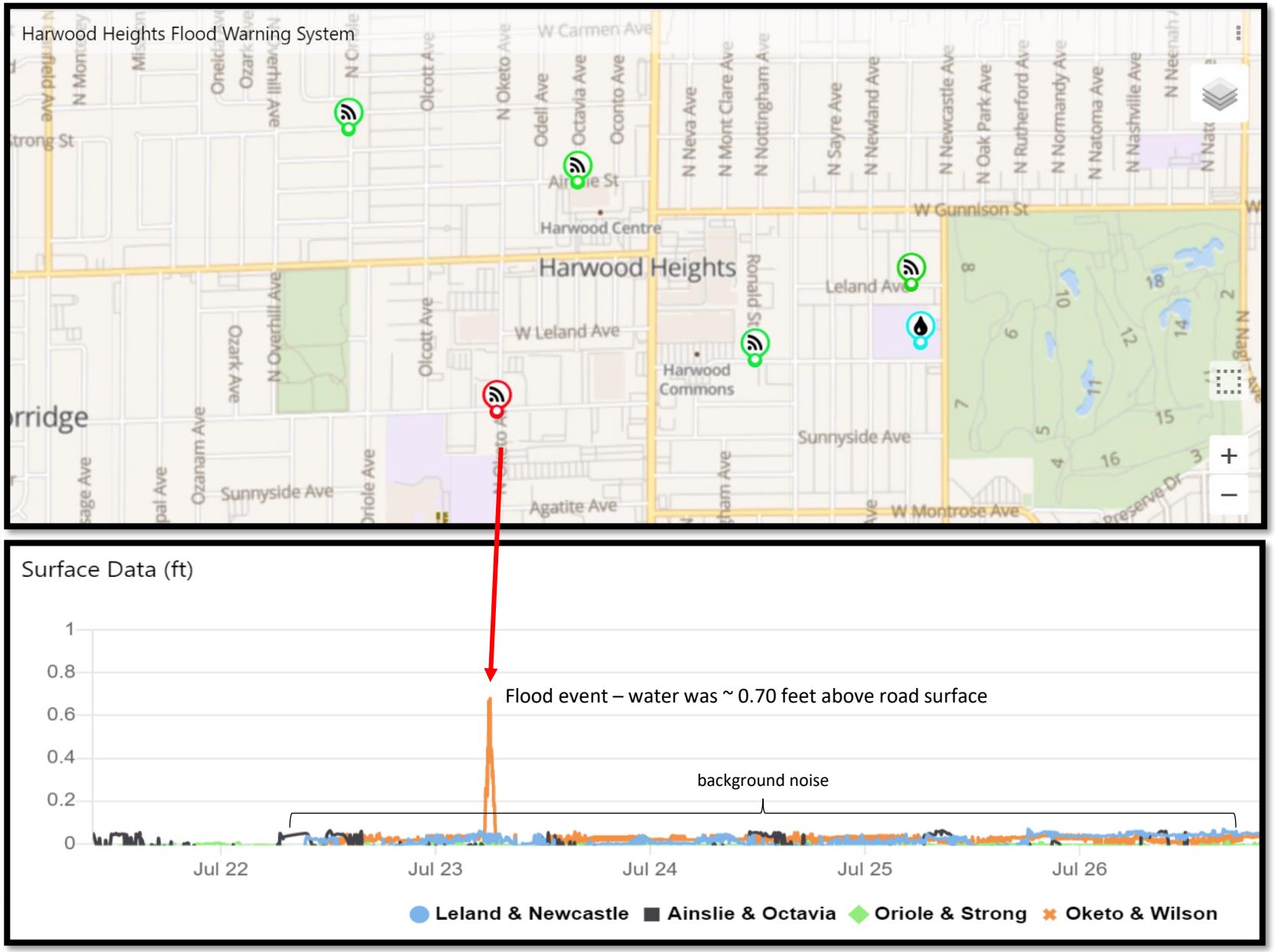
- Export data to files
- Integrate with external websites/databases



- Water level
- Precipitation
- Photo/video streams
- Air quality
- Pollution detection
- Leaky pipes
- Valves and gates
- Relays

Dashboard visually presents real-time data in various graphical displays

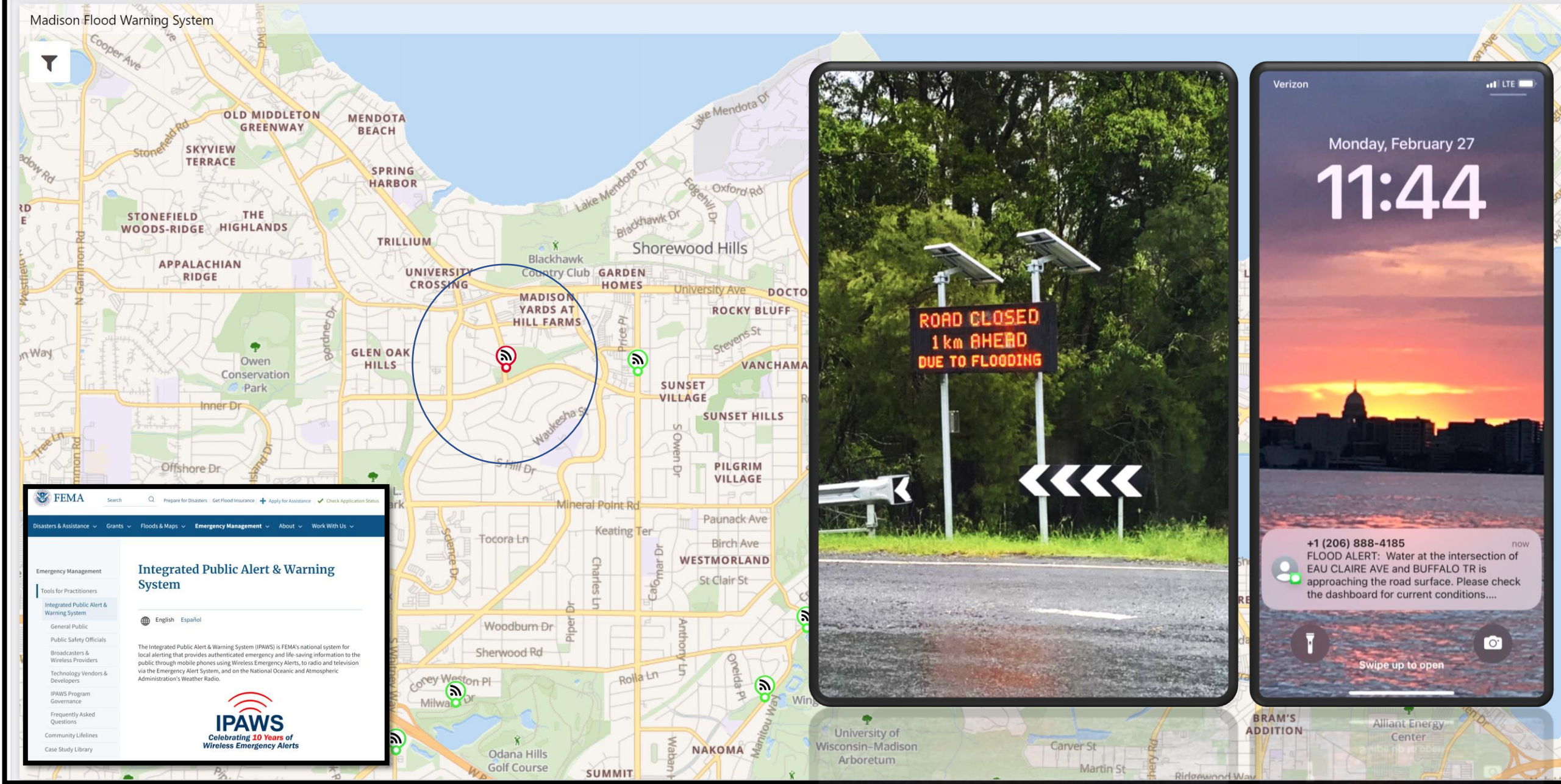

Historical Data
0.4 ft above road surface
0.4133808
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.2755872
Debris line from recent flood
08/07 03:00 am
08/07 09:00 am
08/07 03:00 pm
08/07 09:00 pm
08/08 03:00 am
08/08 09:00 am
08/08 03:00 pm
08/08 09:00 pm
Eau Claire & Buffalo
Rose Pl.
Shorewood Blvd
Midvale & Vernon



Example Data

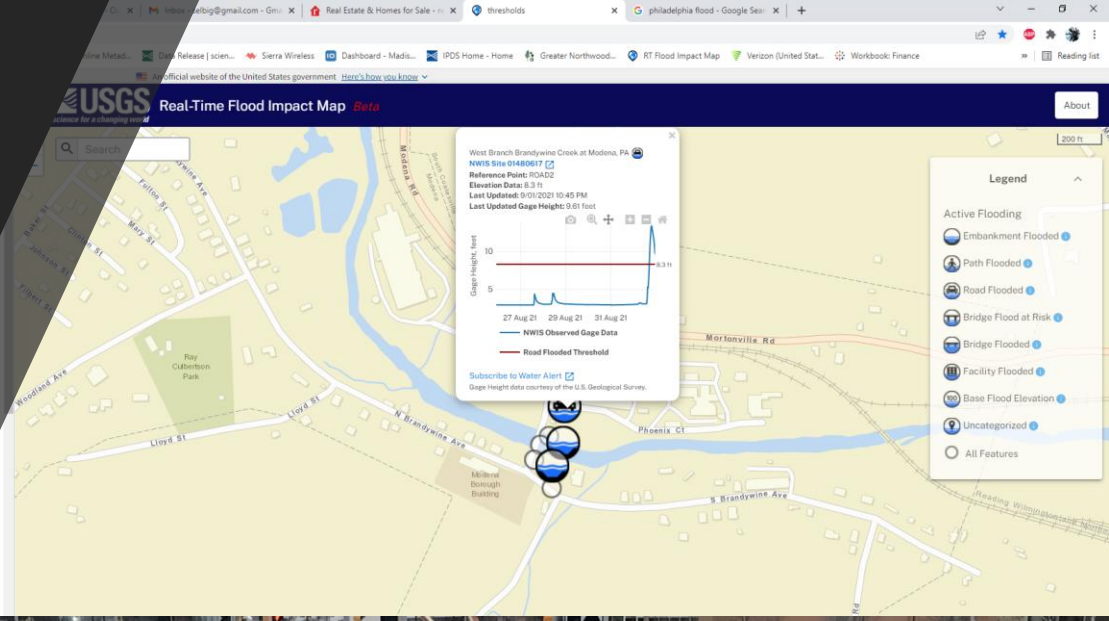
Madison Flood Warning System

Map View | Pipe Data | Surface Data | History | Battery Levels



Future Smart City Integration

- Integrate cameras for visual confirmation
- Integrate with other USGS web mapping services
- Incorporate edge analytics for autonomous flood prevention (gates, valves, etc.)
- Public alerts – warn vehicles based on proximity to flooded area



Source: USGS

Intel Corporation

Isle Utilities

INTERA

EPIC Consulting

NGWOS

City of Madison

Collaborative Partners

U.S. Army Corps of Engineers

National Weather Service

Metropolitan Water Reclamation District

Illinois Department of Natural Resources

Village of Harwood Heights