Hydrologic/Hydraulic Monitoring & Assessment of Iowa's Highway Infrastructure

FHWA Flooding and Traffic Management Webinar

March 6, 2014

IOWA DOT

Iowa's Advantages for Monitoring & Assessing Infrastructure

- Statewide Lidar – Completed in 2010
- BridgeWatch – Since 2006
- Infrastructure Data Base – On-Going

IOWA DOT

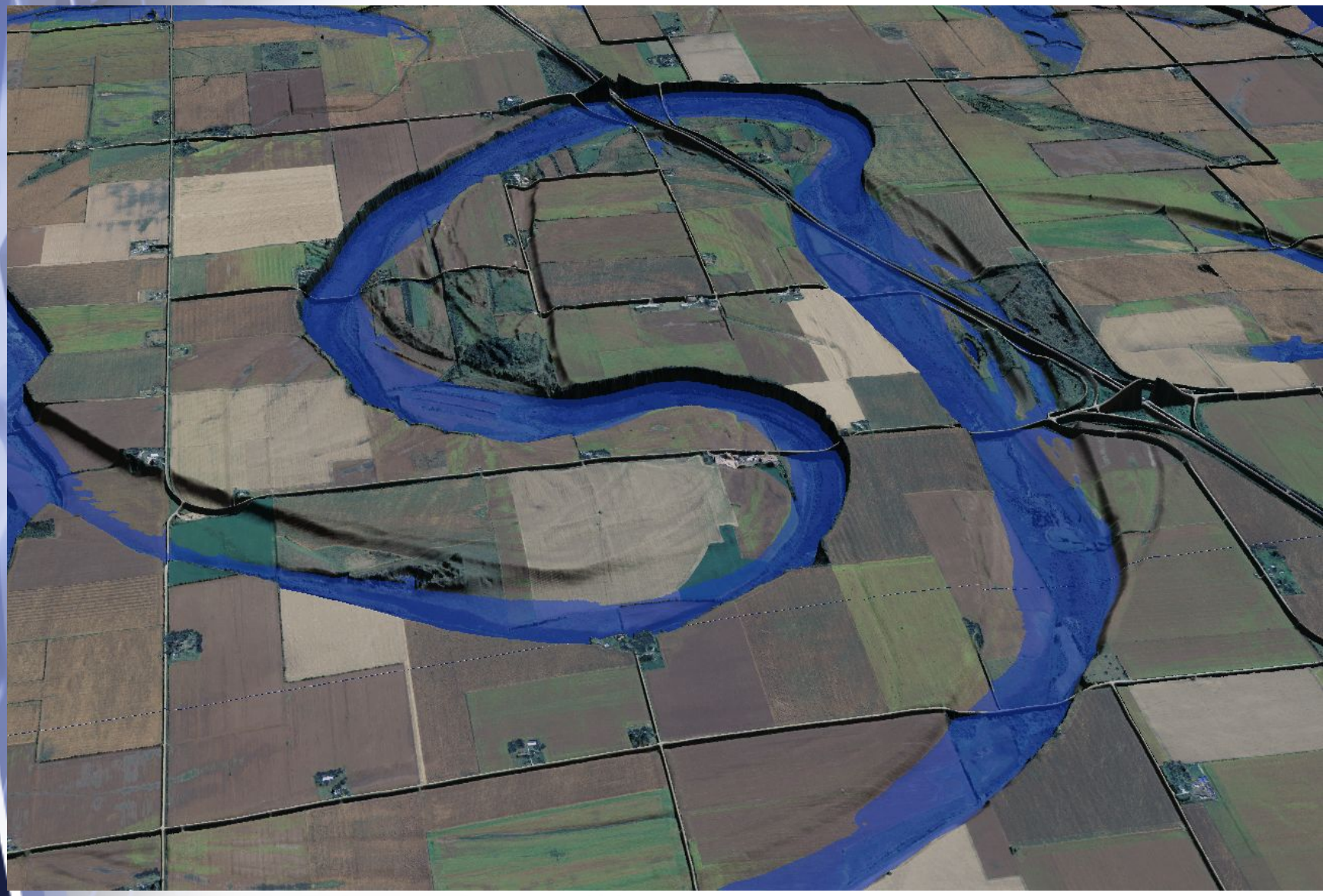
Using LiDAR for Mitigating 2011 Missouri River Flood

Missouri River Basin

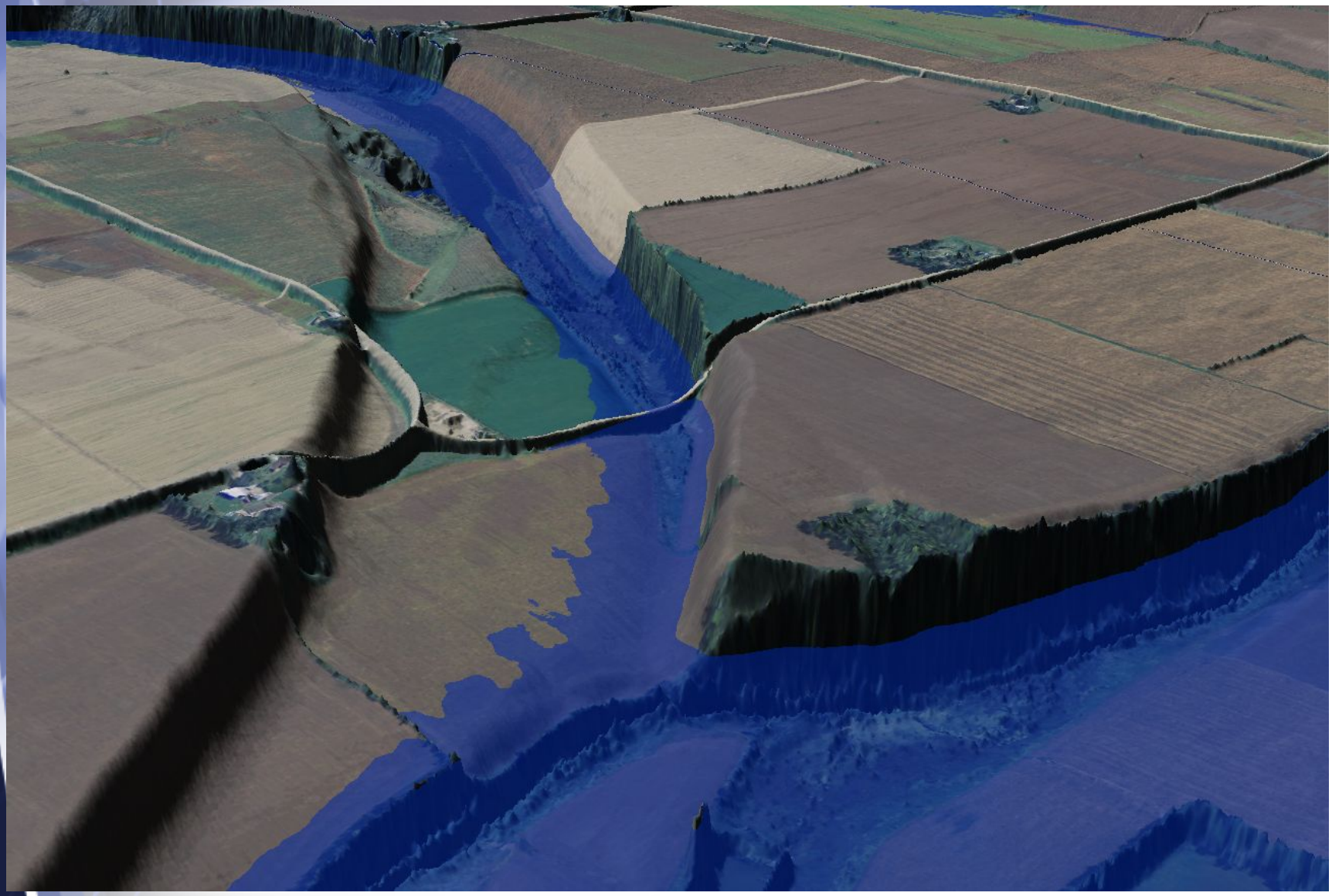
Iowa Department of Transportation

2011 Missouri River Flood

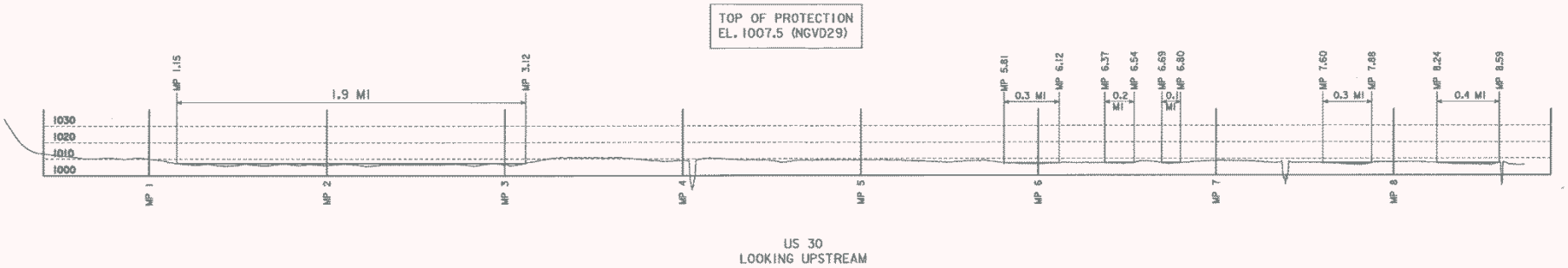
LiDAR View

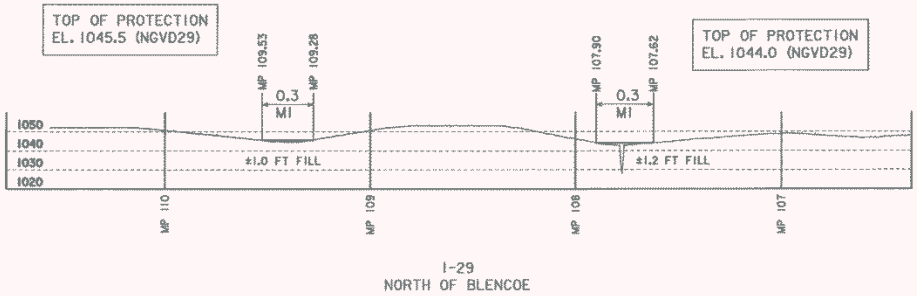


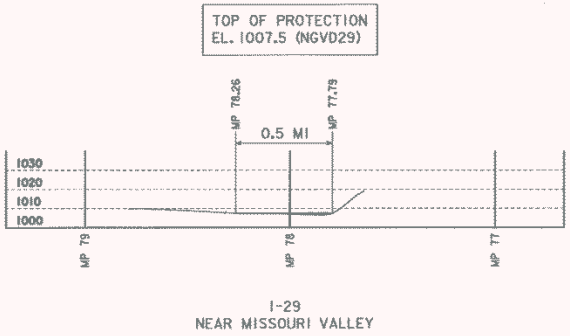
Exaggerated LiDAR View



Identifying I-29 & U.S. 30 Mitigation Sites using LiDAR Data



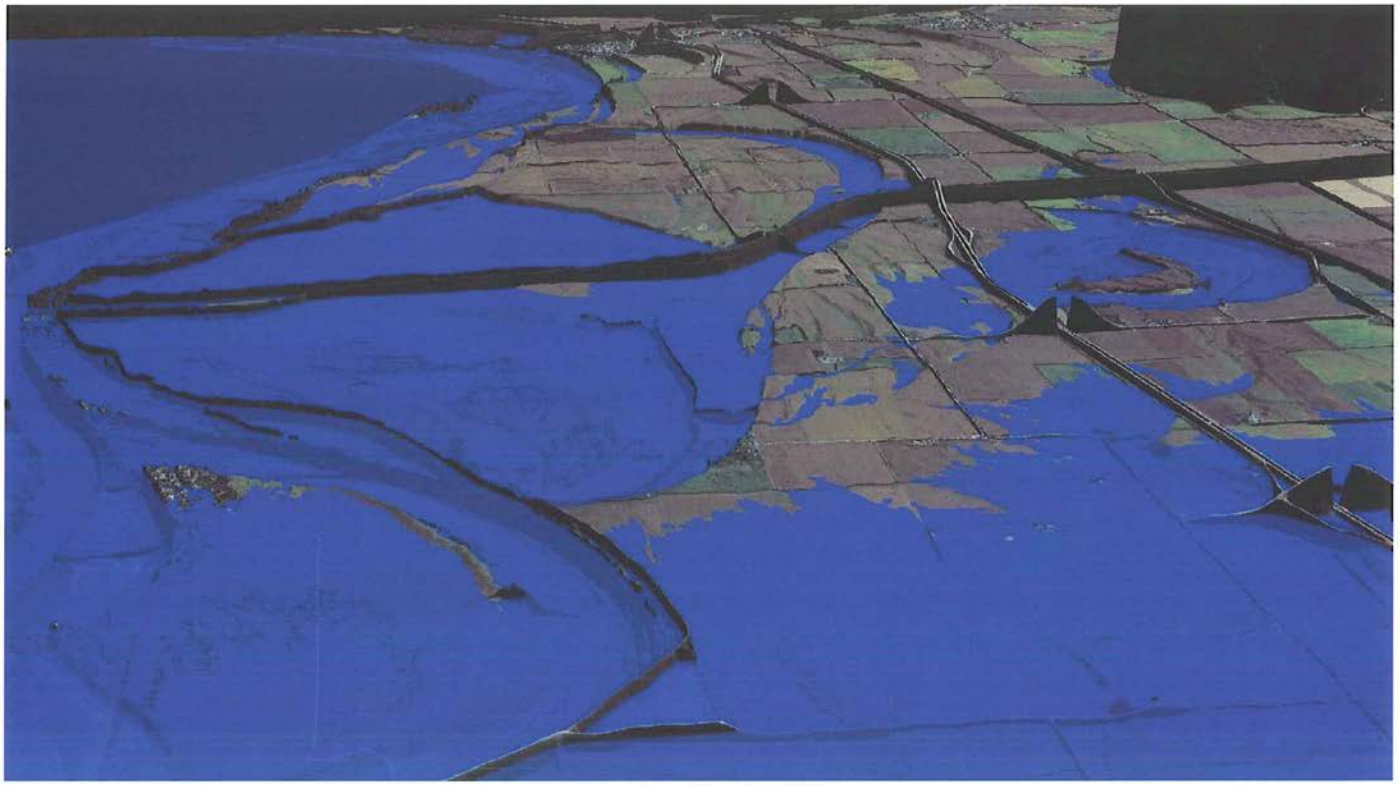




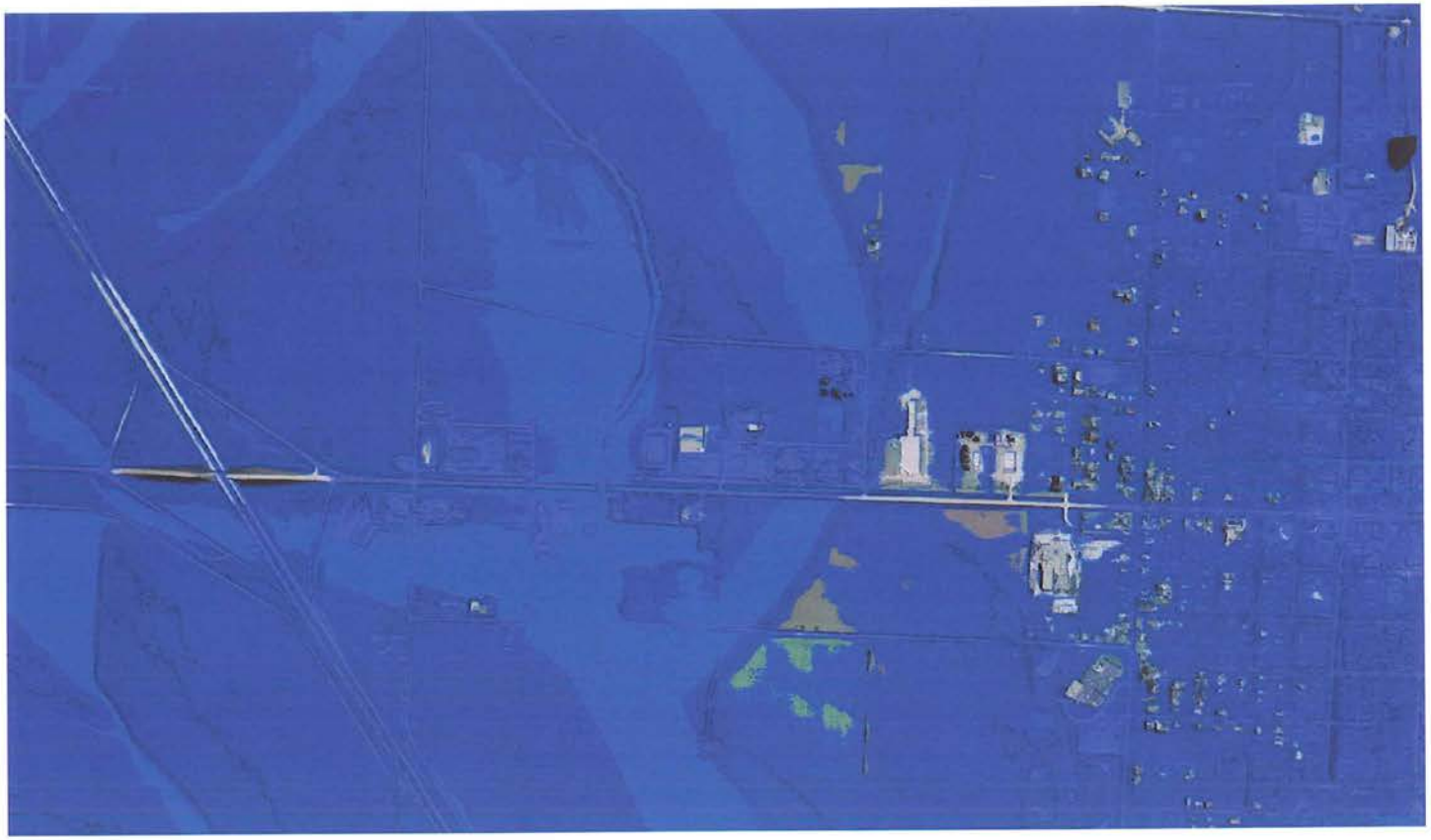
LiDAR determined that I-29 in Monona County could be inundated by flood waters. Trap Bags were installed along I-29 near MP 105.5 and 107.7

Trap Bag installation completed along SB I-29 in Monona County

Soldier River Levee Breach – Upstream of U.S. 30



Onawa Garage – Monona County



Summary

- Statewide LiDAR Information was invaluable for:
  - Flood Impact Forecasting and Assessment of Mitigation Sites
    - 3 Interstate Locations w/Trap Bags
    - 1 Interstate Location w/Asphalt Overlay
    - Interstate Interchange w/Flood Protection/Pumping
    - 1 U.S. Highway w/Trap Bags

Summary

- Statewide LiDAR Information was invaluable for:
  - Appropriate Allocation of Resources
  - Proactive Decisions Based on Accurate Information
  - Providing Information to Management for Road Closure/Detour Information

Other LiDAR Uses for DOT's

- Identify/Design Wetland Mitigation Sites
- Identify/Design Borrow Sites
- Concept/Alternative's Design
- Drainage Complaints/Issues
- 2-D Hydraulic Analysis
- Forecasting/Mitigating Highway Impacts From 2011 Missouri River Flood
- Many Others!!!

BridgeWatch

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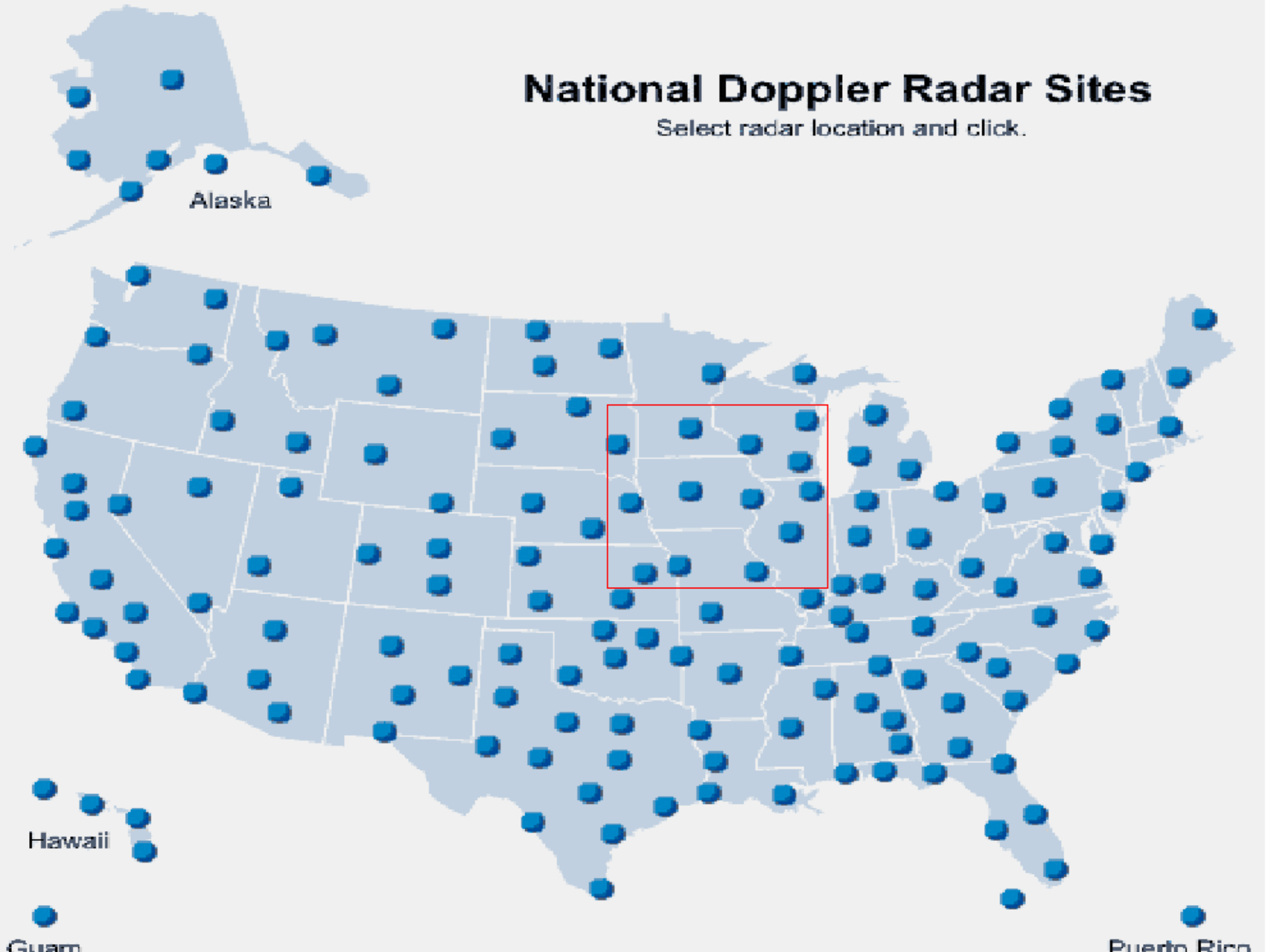
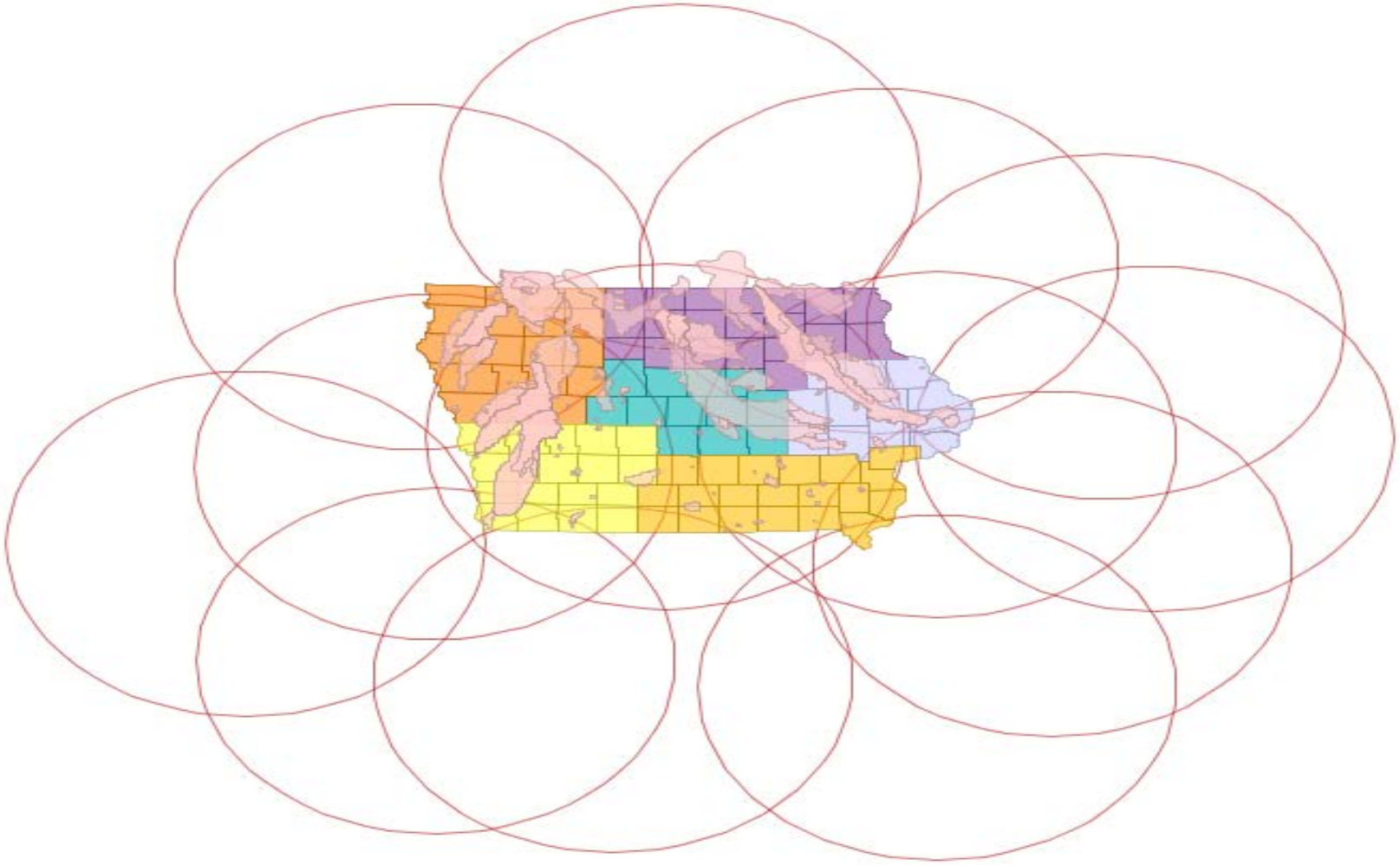
National Doppler Radar Sites

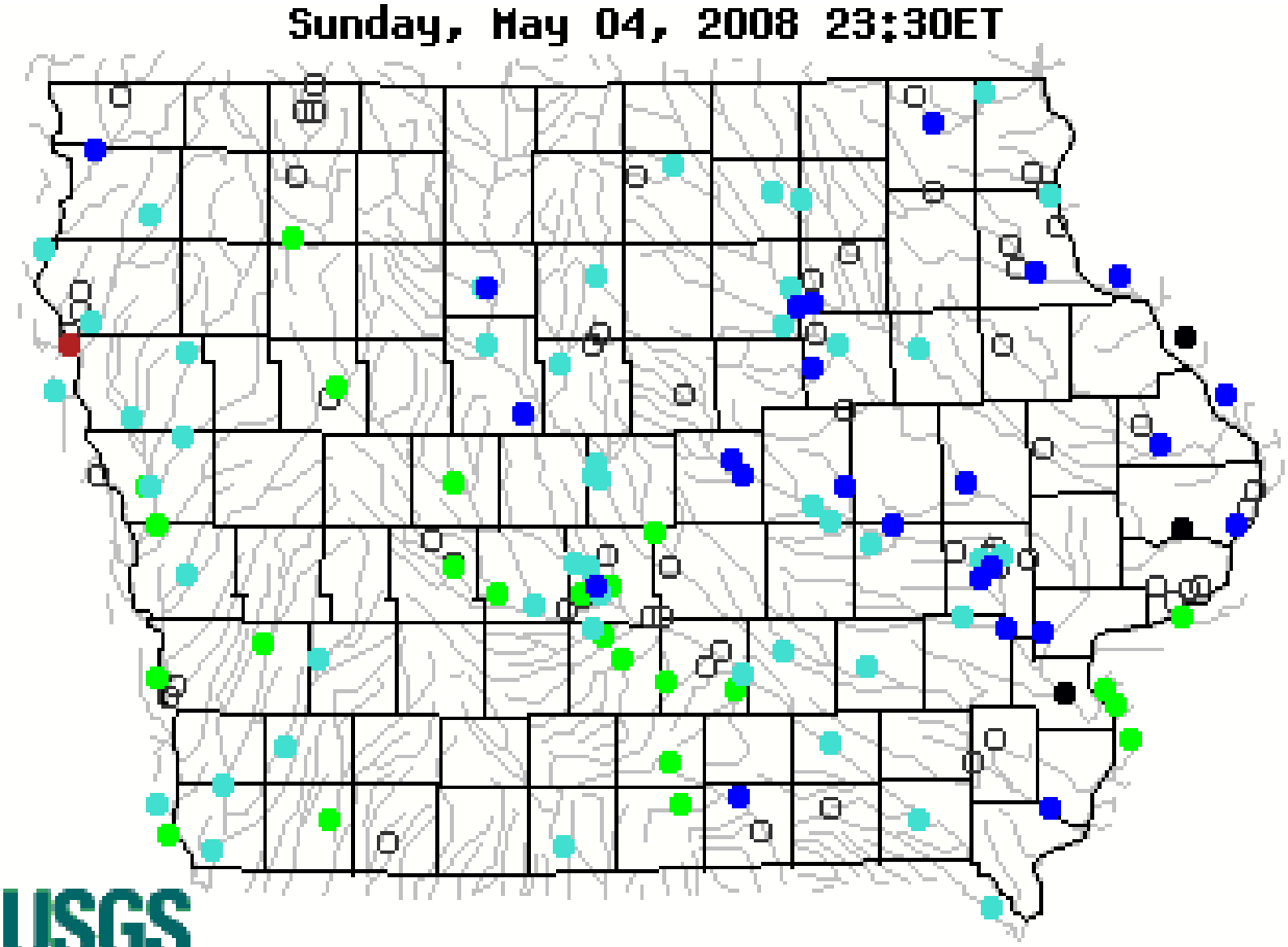
Select radar location and click.



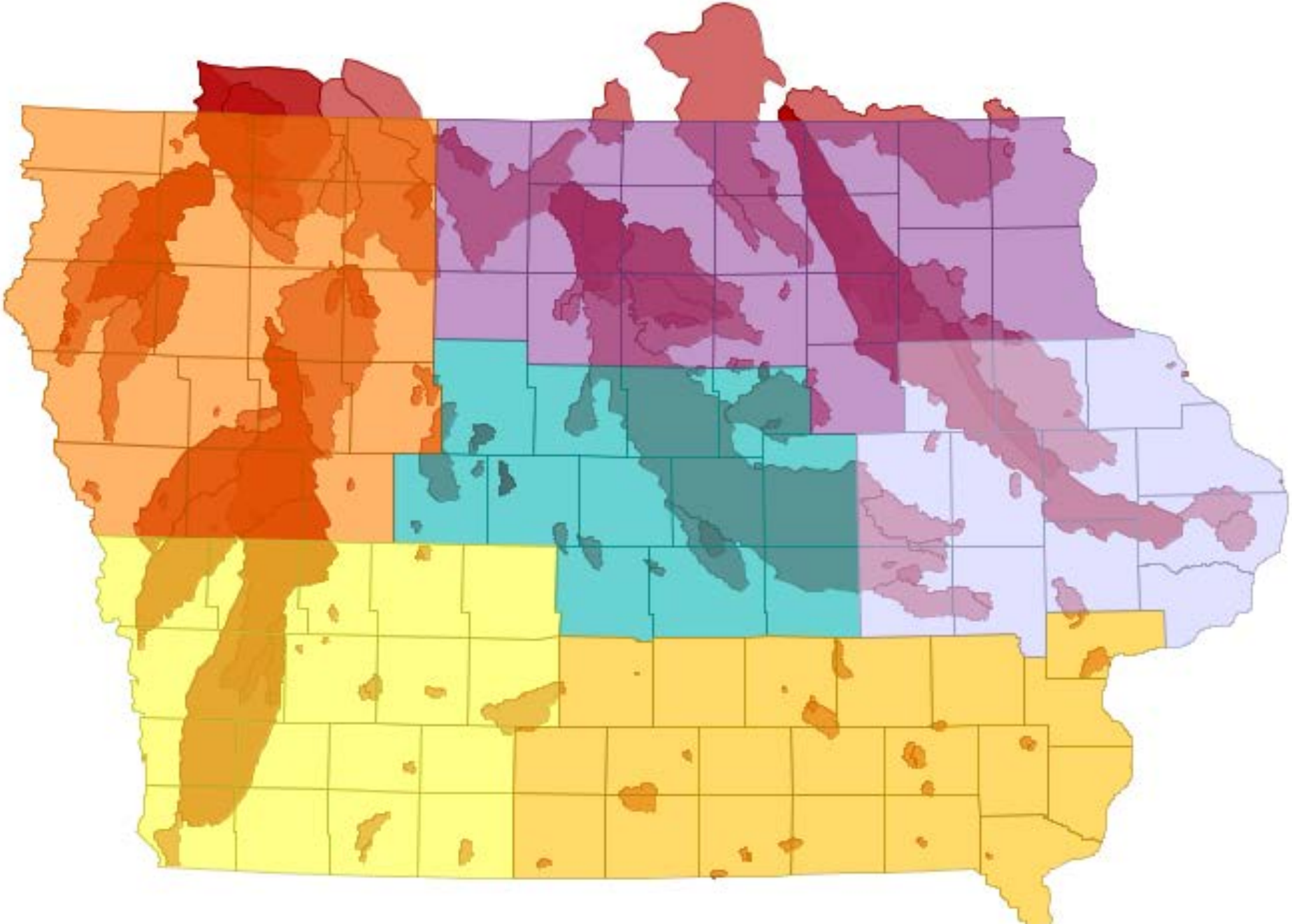
NWS Doppler Radar Stations



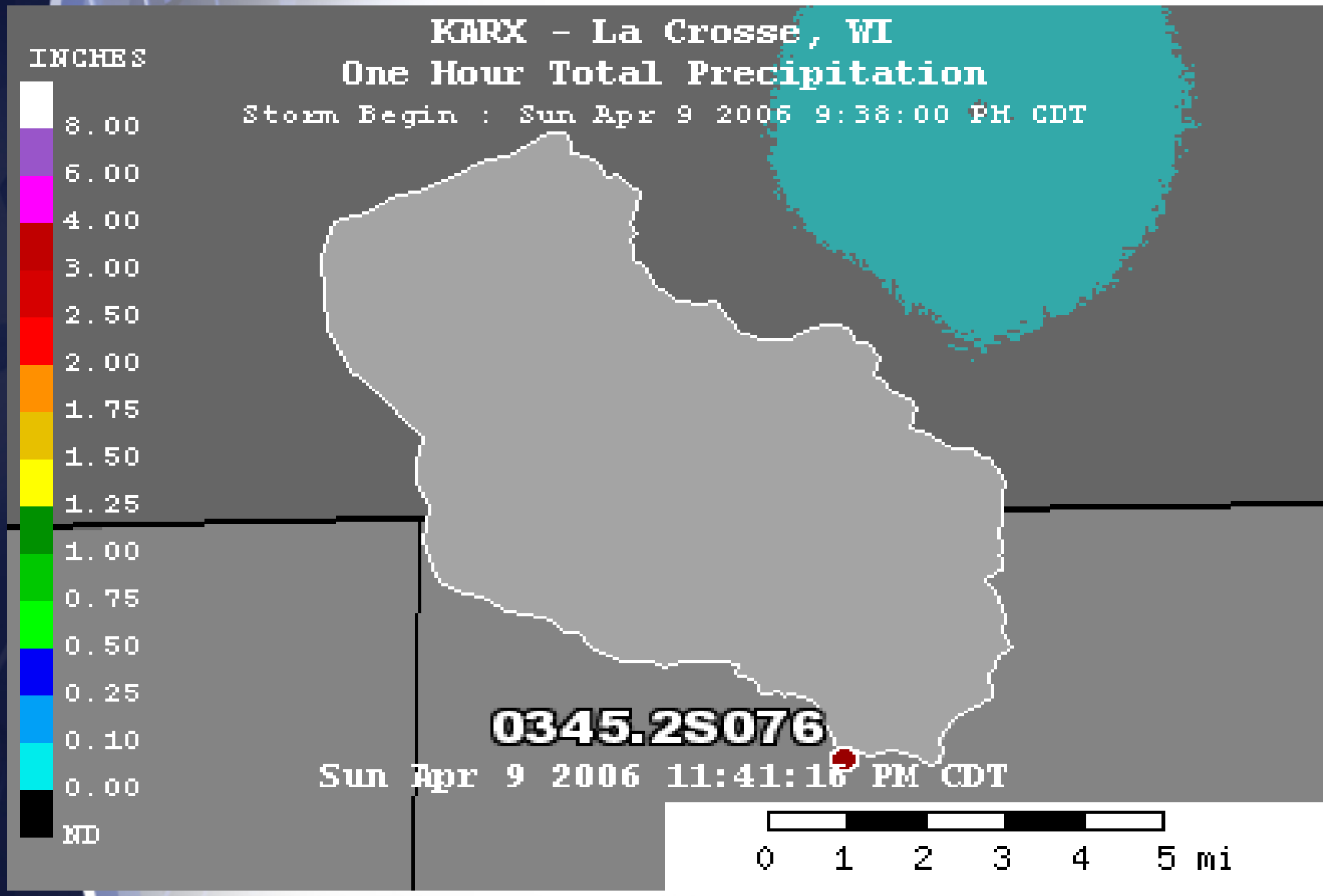
Iowa has 148 USGS Stream Gauge Sites



Drainage Basins Scour Critical Bridges



Rainfall vs. Basin



http://scourwatch.usengineeringsolutions.com/iadot/main/welcome.html

ScourWatch | Iowa Department of Transportation

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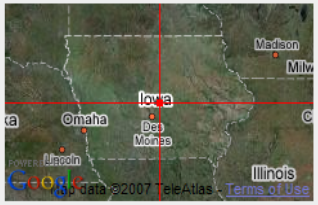
ScourWatch



4:37:33 PM Central 5/17/2007

Current View & History

Iowa	GO
Select District / Region #	GO
Select County	GO
Select Town	GO
Select Bridge	GO

Select a NEXRAD Station & Product Type

Select Station | None | GO

Select a Gage or HUC

Select HUC	GO
Select Gage	GO

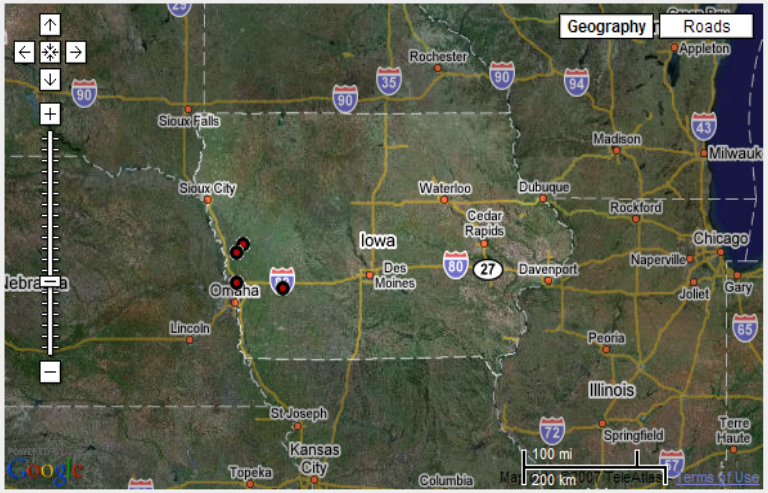
Search

Bridge | GO

Bridge Watch List

- 1528.2S083 in Cass County
- 4372.6S029 in Harrison County
- 6746.7S183 in Monona County
- 6756.2S183 in Monona County

Update



General | Gages | Pictures | Notes | Report | Alerts | Directions | POA

NEXRAD Alerts | USGS Alerts | Device Alerts | Simulated Alerts

Bridge 1528.2S083 zoom to bridge

Terminate All

#	ID:	Bridge:	Year peak:	Exceedance:	Duration:	Time:	Terminated:	Display:
1	KOAX	1528.2S083	10 year	3 inches	3 hour	5/6/07 5:20 AM	Terminate	Display

http://scourwatch.usengineeringsolutions.com/iadot/main/welcome.html

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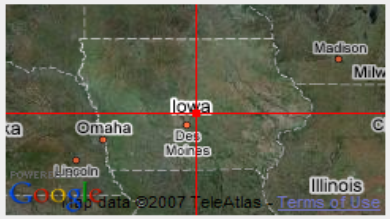
ScourWatch



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Current View & History

Iowa	GO
Select District / Region #	GO
Select County	GO
Select Town	GO
Select Bridge	GO

Select a NEXRAD Station & Product Type

Select Station	None	GO

Select a Gage or HUC

Select HUC	GO
Select Gage	GO

Search

	Bridge	GO

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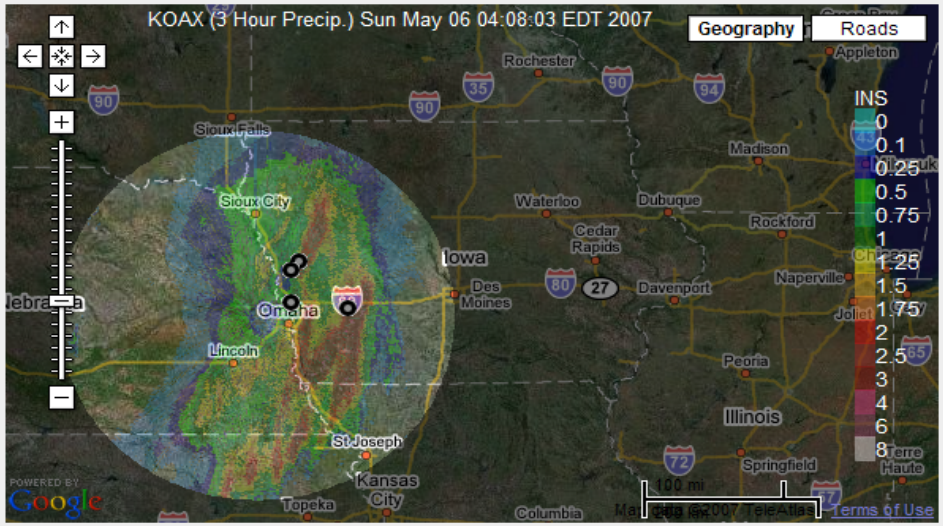

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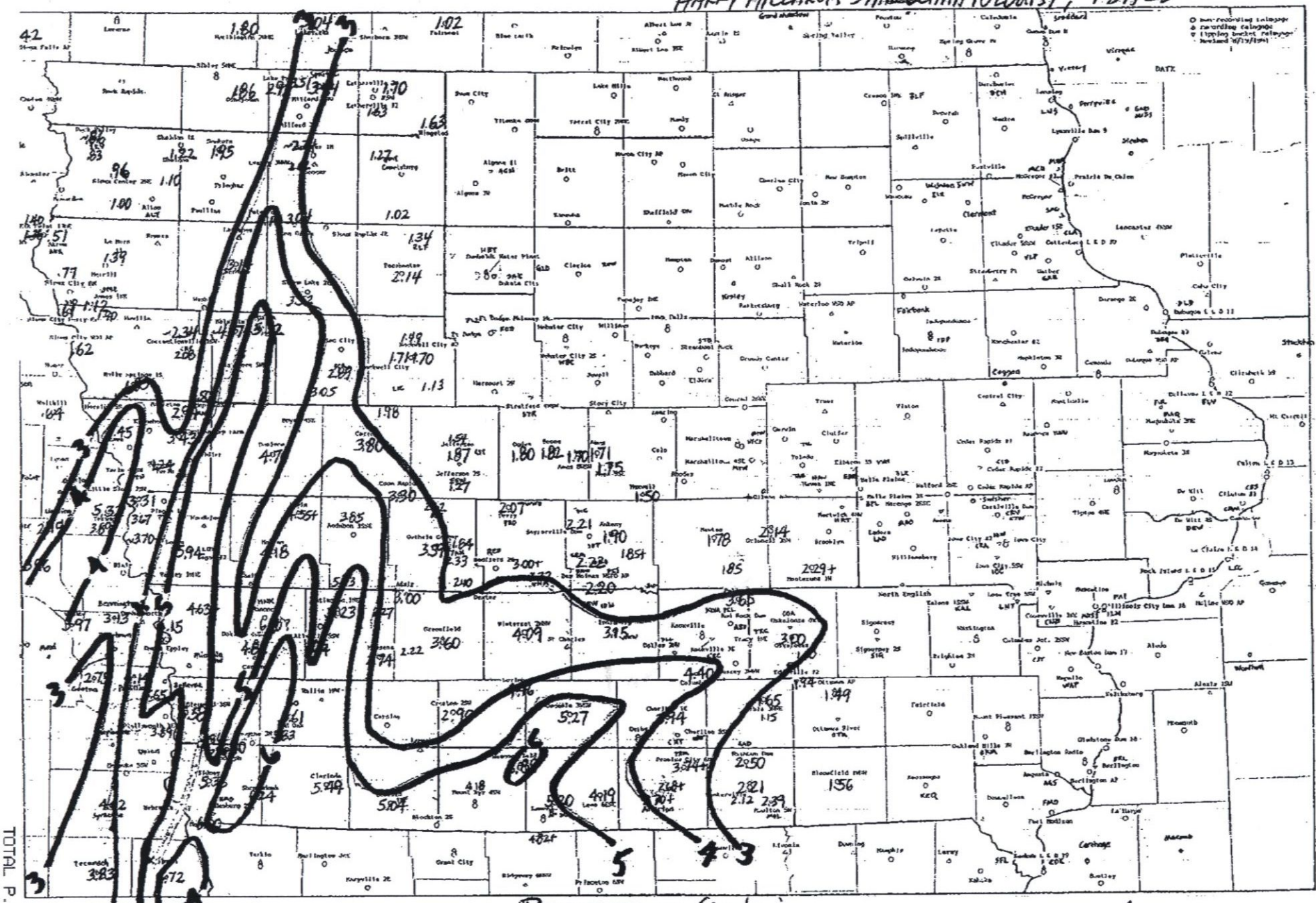
HARRY HILLAKER, STATE CLIMATOLOGIST, IDALS



PRECIPITATION (inches)

48 HOURS ENDING 7 AM CDT, MAY 7, 2007

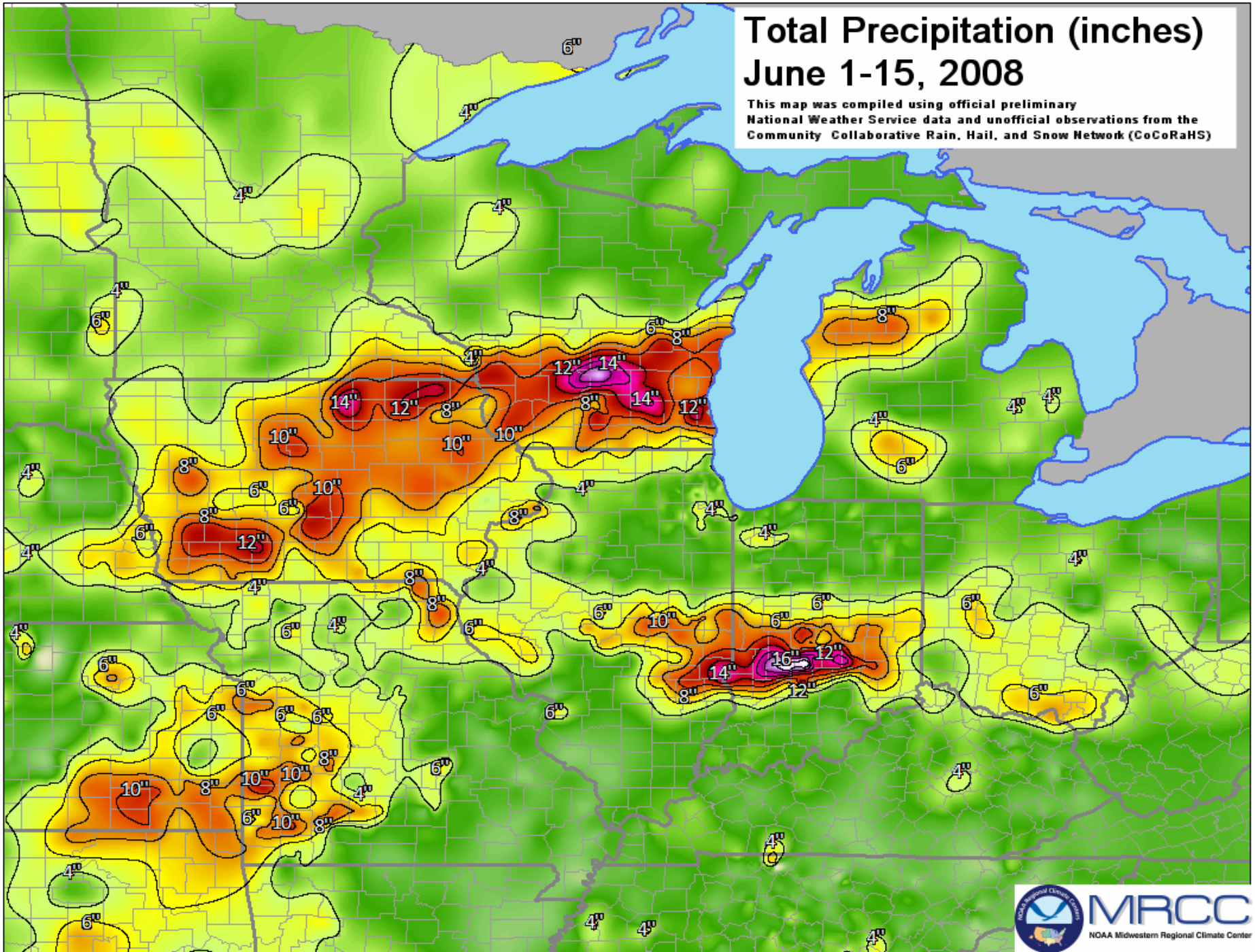
Benefits of BridgeWatch®

Monitoring Scour Critical Bridges

- Allocates Resources Where Needed
- Proactive in Implementing POA's
- Reliable - Eliminates Human Element
- Adaptable – Modify Structure Status
- 24/7/365 Monitoring of bridge/highway population
- Pay-Back w/2 Flood Events/YR

Iowa's Infrastructure Data Base Due to 2008 Floods

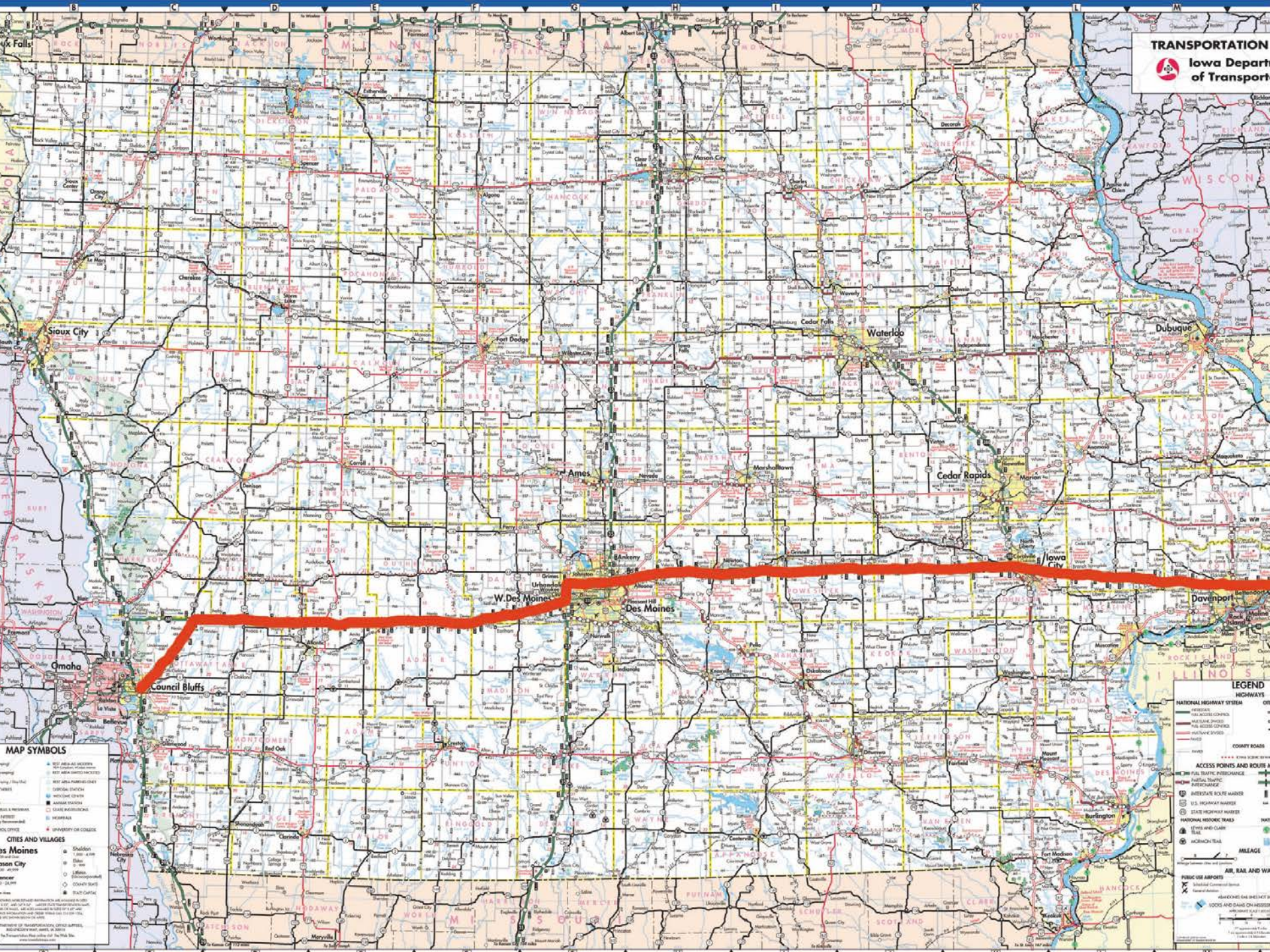
- Need to Monitor, Assess and Proactively Warn for Impacts to Iowa's Highway System due to Flooding
- Develop Rating Curve, Low Road and Beam Elevations for Most Vulnerable Assets
- Establish Thresholds for Gages or Rainfall Events for Each Asset (Low Road & Bridge Beam)


Total Precipitation (inches)
June 1-15, 2008
This map was compiled using official preliminary
National Weather Service data and unofficial observations from the
Community Collaborative Rain, Hail, and Snow Network (CoCoRaHS)
MRCC
NOAA Midwestern Regional Climate Center

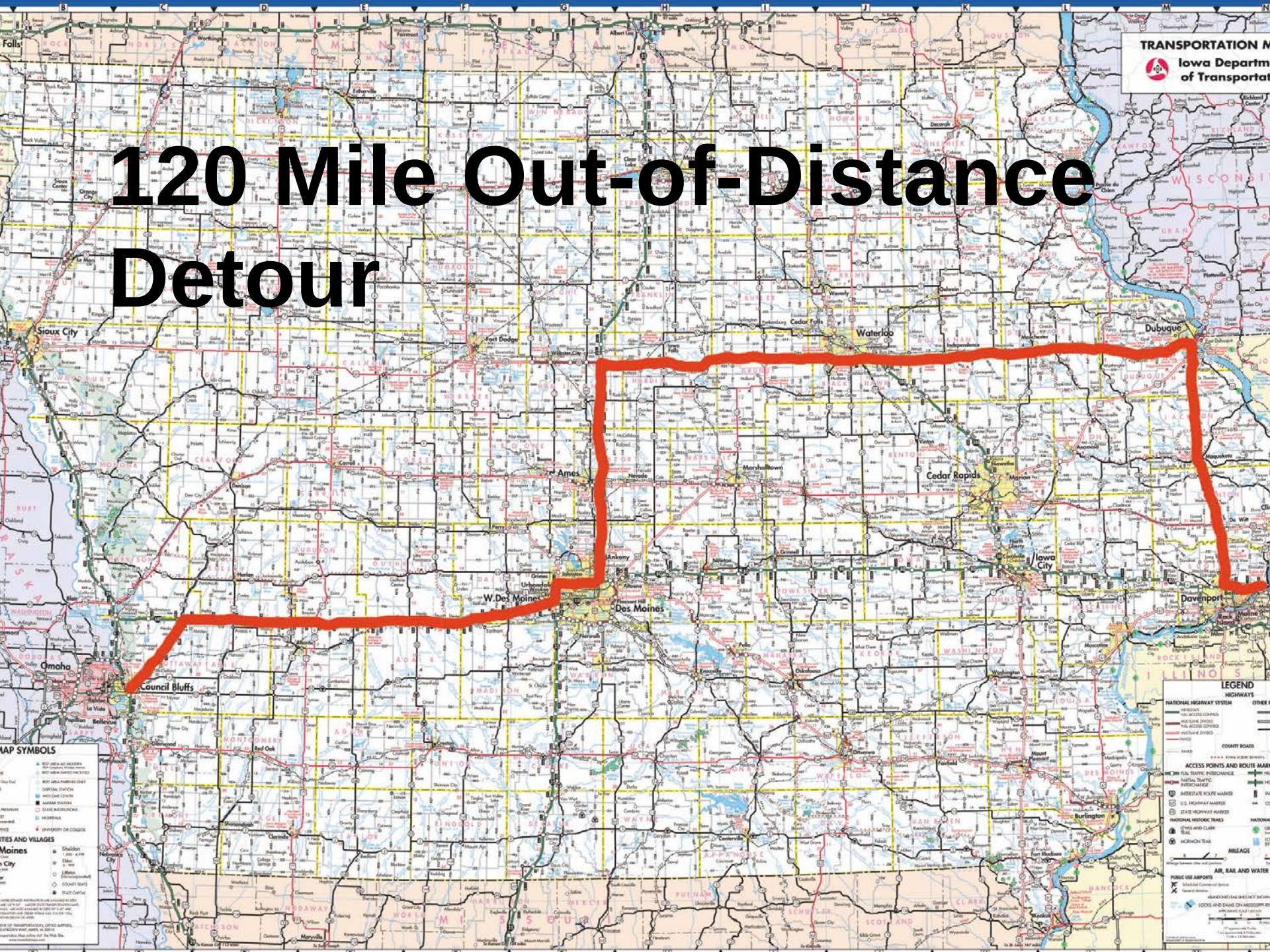
Normal Precipitation – June 1 to June 15
2.3 Inches

- 11 Counties – Over 5 Times Norm. – 12” to 13”
- 30 Counties – Over 4 Times Norm. – 10” to 12”
- 18 Counties – 3.5 Times Normal - 8” to 10”
- 26 Counties – 3 Times Normal - 6” to 8”
- 14 Counties - 2 Times Normal - 4.4” to 5.9”

- NO COUNTY HAD NORMAL PRECIPITATION!!


TRANSPORTATION
Iowa Depart
of Transport
Sioux City
Fort Dodge
Mason City
Waterloo
Cedar Falls
Dubuque
Ames
Marshalltown
Cedar Rapids
Iowa City
Davenport
W.Des Moines
Des Moines
Omaha
Council Bluffs
Burlington
MAP SYMBOLS
CITIES AND VILLAGES
LEGEND
HIGHWAYS
NATIONAL HIGHWAY SYSTEM
ACCESS POINTS AND ROUTE
MILEAGE
AIR, RAIL AND WA

120 Mile Out-of-Distance Detour



U.S. 30 – Iowa River

U.S. 30 – U.S. Rock Dike

U.S. 30 – Upstream Side (4” Above Road)

Recording H.W. Marks

Infrastructure Database Summary

- Utilize Past Flooding Information to Create Database of Critical Infrastructure
- Analyze LiDAR Information to Develop Correlation w/Rainfall Events or Gage Readings
- Integrate Infrastructure Database into BridgeWatch to Provide Real-Time Monitoring and Automated Alerts to Protect the Traveling Public From Highway Overtopping

QUESTIONS?

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Iowa DOT
515-239-1487
david.claman@dot.iowa.gov