

Extreme Weather and Infrastructure Resilience

Iowa DOT- MPO/RPA Quarterly Meeting 6/23/21

BI-STATE REGIONAL COMMISSION

FHWA PILOT PROJECT

GENA MCCULLOUGH, ASST. EXECUTIVE/
PLANNING DIRECTOR

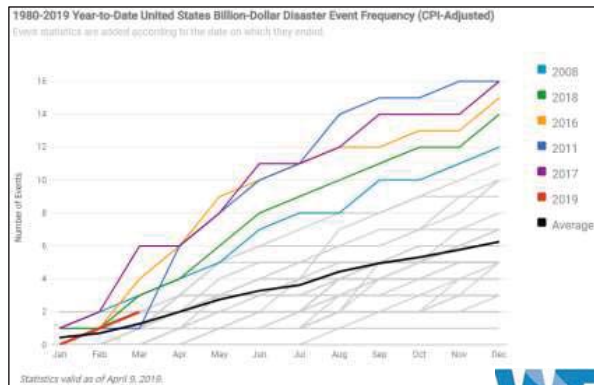


U.S. Department of Transportation
Federal Highway Administration



FHWA Resilience and Durability to Extreme Weather Pilot Program

2018 Resilience Pilots

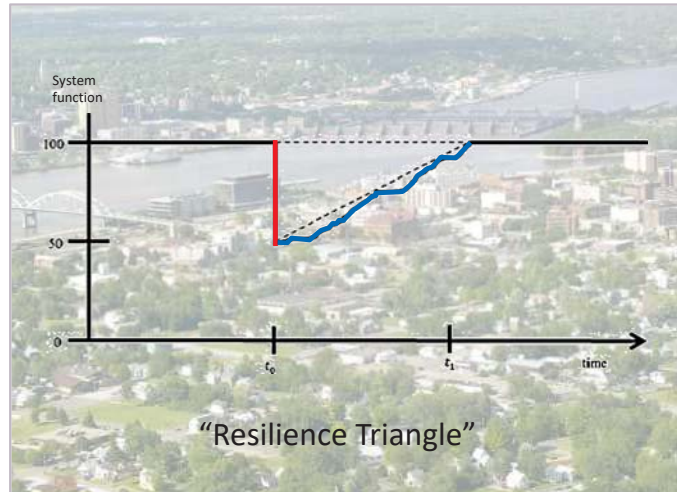


Source: National Weather Service

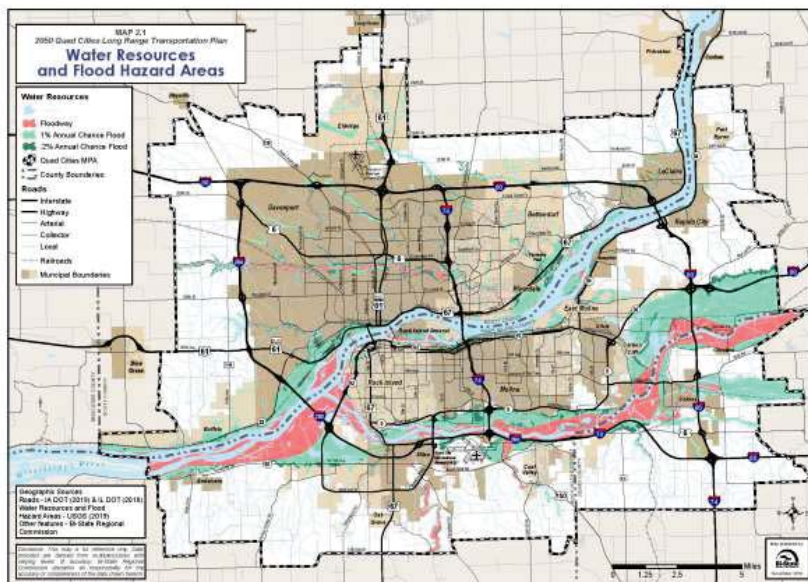


Purpose of the Grant

- Conduct vulnerability assessment
- Determine strategies to mitigate impacts



Quad Cities, Iowa/Illinois



5 Mississippi River Bridges +
Rock River Crossings

4 Interstates, 5 U.S. Highways,
10 State Highways

3 Railroads – Class I & II

24 Barge Terminals

2 Locks/Dams

3 Public Transit Systems
+ Multiple On-Demand Private
Providers & Taxis Services

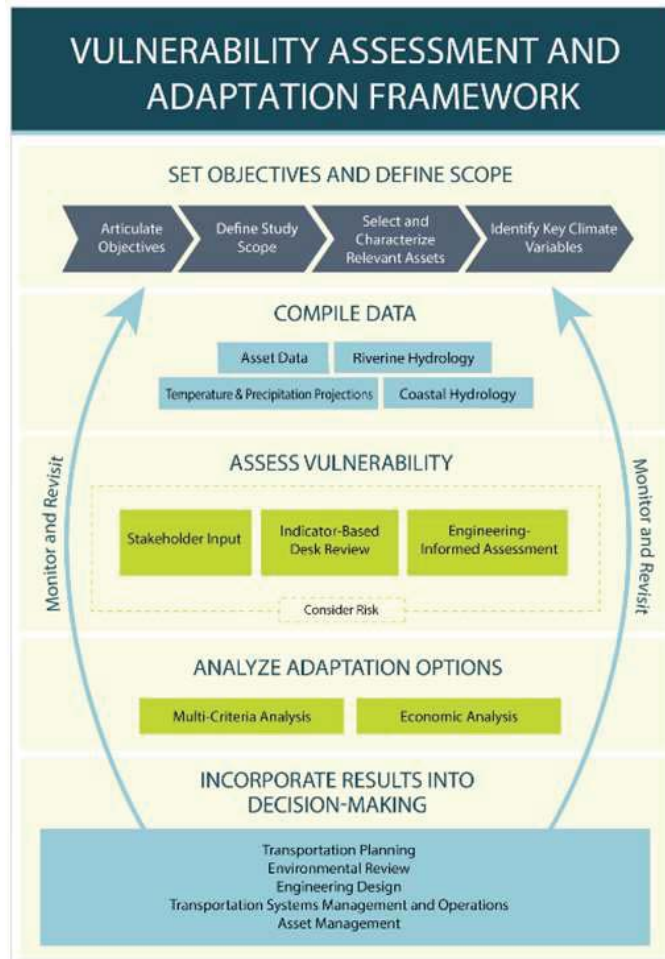
2 Airports

2 National Trails



Project framework

- Develop an Advisory Committee
- Secure data
- Access vulnerability and adaptation options
- Determine priorities and opportunities to incorporate adaptation
- Integrate assessment



Stakeholders



Environmental/Other

- NOAA-NWS, State Climatologists
- Corps of Engineers, NRCS, DNR/IEPA
- Industry, Health Depts., Universities



Transportation

- FHWA, State DOTs, County & City Engineers/Planners, EMAs
- Transit, Railroads, Airports, Trails Interests

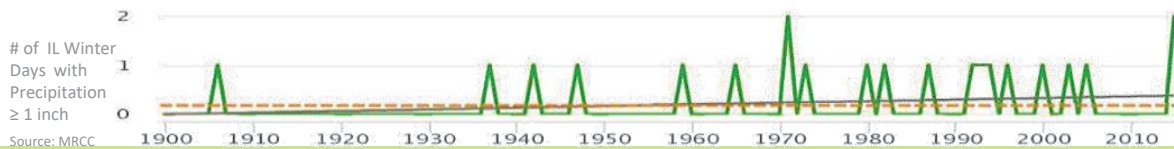


Policy and Adaptation

- Planning Advisory Group
- Transportation Technical and Policy Committees

Summary of data trends

- FEMA Flood Risk Report
 - CMIP Climate Data Processing Tool
 - National Climatic Data Center
 - FHWA, IL DOT, IA DOT
 - Midwest Regional Climate Center
 - US Geological Survey
 - National Weather Service
- Increased variability
 - Floods, tornadoes, storms
 - Increased precipitation
 - Frequency
 - Volume
 - Increased disruptions for transportation networks
 - Impacts CAN be reduced through adaptive actions

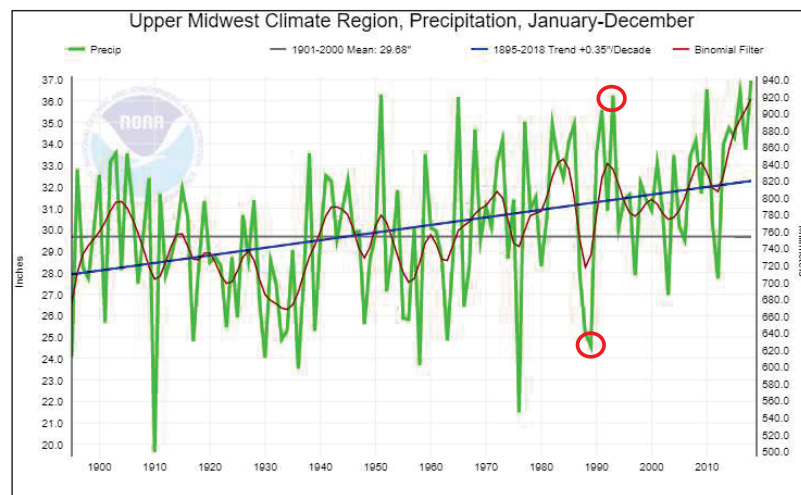


Variability vs. Trend and Extremes

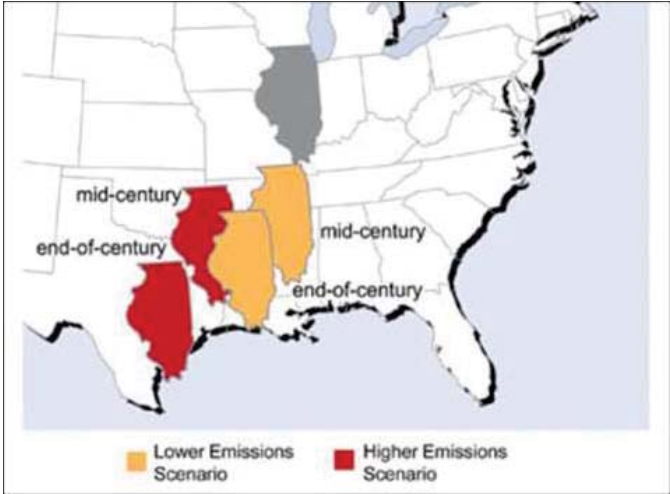
Trend

Variability

Extremes



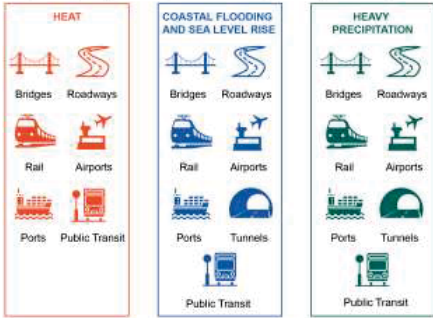
Future Climate



Hazards today and in the future

- Heat
- Flood, river and flash
- Drought
 - Wildfires (rare)
- Winter Storms
- Severe weather
 - Tornadoes, hail, damaging wind
- Hurricanes? Coastal Flooding?

Climate Change and Notable Vulnerabilities of Transportation Assets



National Performance Goals at Risk



These are confounded with an increase in social vulnerability.

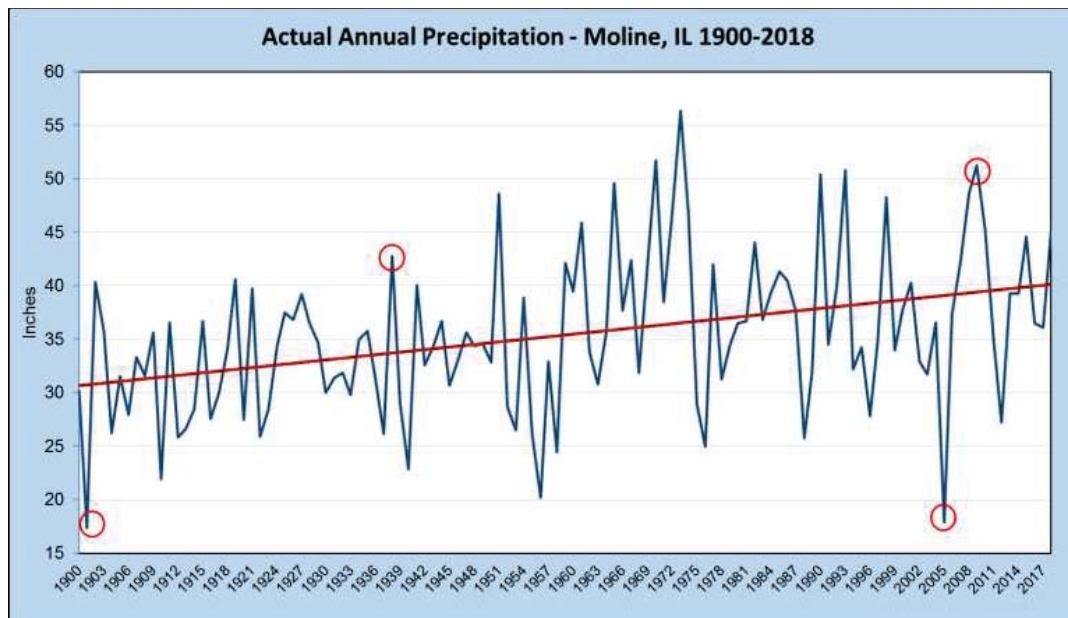


Extreme weather in the Quad Cities

- River flooding
- Flash flooding
- Combined storms
 - Hail
 - Lightning/thunder
 - High winds
- Severe winter storm
- Extreme heat
- Tornadoes



Local Trends 1900-2018



Learning to Live With The River – 1993, 2008, 2019



Record Crests

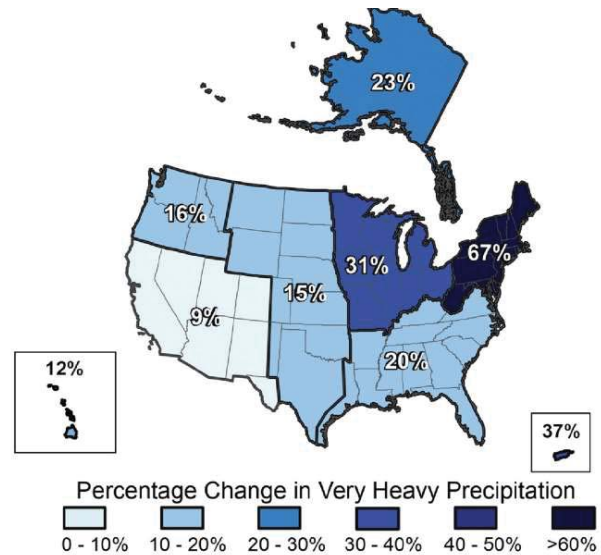
22.70 ft on 5/2/2019 1st
22.63 ft on 7/09/1993 2nd

Records for Consecutive Days above Flood Stage

96 days: 2019 – 3/15 to 6/18
43 days: 2011 – 3/29 to 5/10

Data sharing

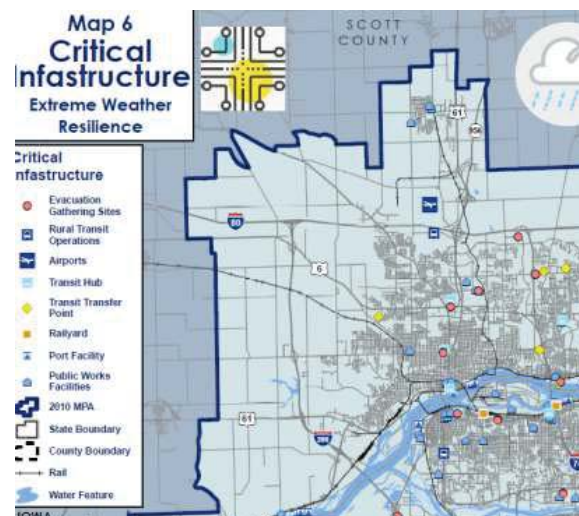
- City inundation data?
- Storm surge backup on the Mississippi?
- Late season floods?
- Straight line winds?
- Main routes that have underground power lines?
- Extreme heat?
- Other?



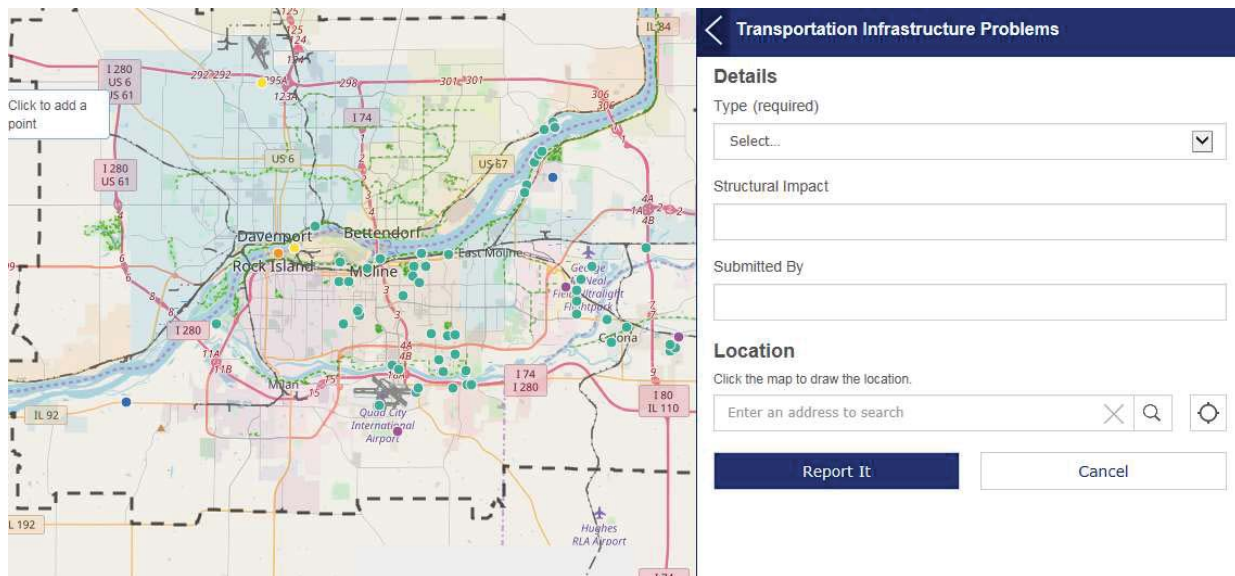
Source: Climate Change Impacts in Iowa: Report to the Governor and Assembly, 2010

Critical Infrastructure & Facilities

- Evacuation gathering sites
- Public works facilities
- Transit hubs
- Transit transfer points
- Rural transit operations
- Airports
- Port facilities
- Railyard



Stakeholder Survey & Interviews



Stakeholder Workshop

- Vulnerability assessment
- Adaptation options



Vulnerability assessment = what critical facilities/infrastructure are more vulnerable to disruptions or likely to be impacted by extreme weather, now and in the future.

Defining Criticality Criteria

Stakeholder & Transportation Technical Committee Input

Criticality assessment
 = involves identifying the most critical elements of the transportation system for analysis, using quantitative and qualitative data.

- High use areas/routes
- Land use/destinations of importance
 - i.e. RI Arsenal, densely populated areas
- Mississippi River crossings
- Medical/emergency routes
 - i.e. hospital access
- Redundancy throughout network
- Economic vitality
 - i.e. access to large employers

Data Input for Weighted Sum Overlay Analysis

Bridges (AADT)

Manual Classification	
< 1,000	1
1,001 – 10,000	2
10,001 – 25,000	3
25,001 – 40,000	4
> 40,000	5
Pedestrian access bridge	1

IL Roadways (AADT)

Natural Breaks Classification	
500 - 4,250	1
4,251 – 9,400	2
9,401 – 17,900	3
17,901 – 32,600	4
32,601 – 69,700	5

IA Roadways (AADT)

Natural Breaks Classification	
500 - 3,520	1
3,521 – 8,900	2
8,901 – 17,100	3
17,101 – 30,000	4
30,001 – 72,000	5

Access to Critical Facilities

All access road segments 5

Access to Major Employers

All access road segments 1

Bettendorf Transit (Ridership)

Natural Breaks Classification of Avg. Weekday Ridership	
0 – 76	1
77 - 95	2
96 - 111	3

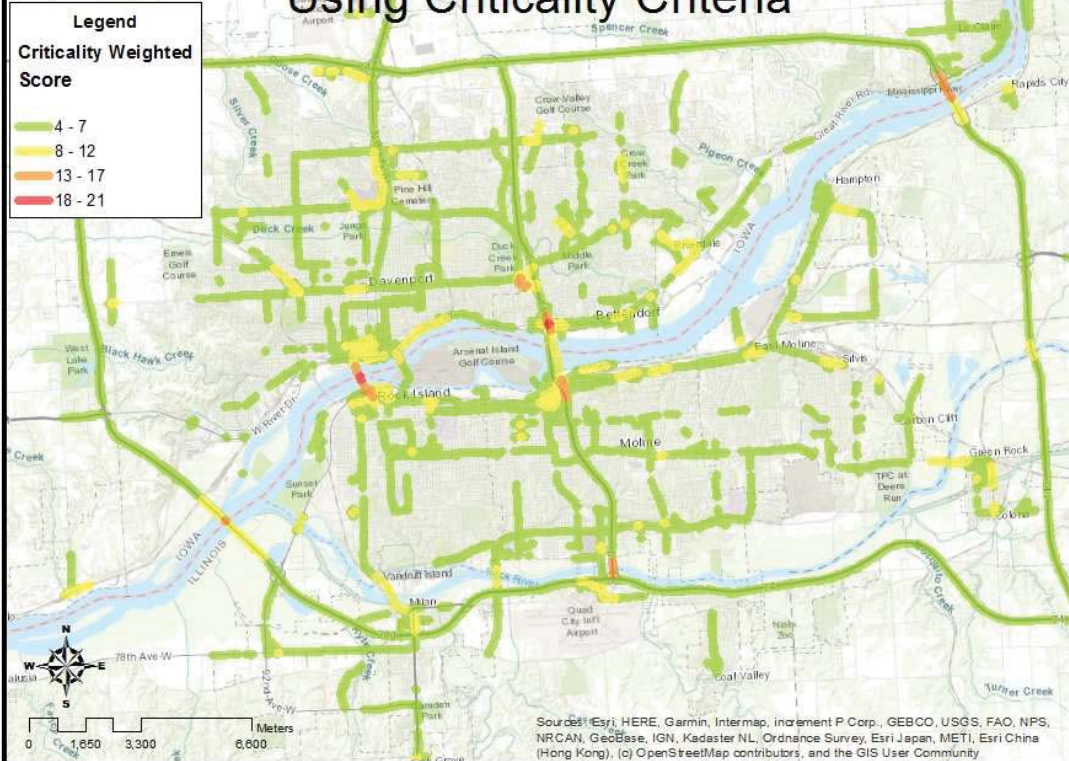
Davenport Transit (Ridership)

Natural Breaks Classification of Avg. Weekday Ridership	
0 – 110	1
111 - 186	2
187 - 302	3

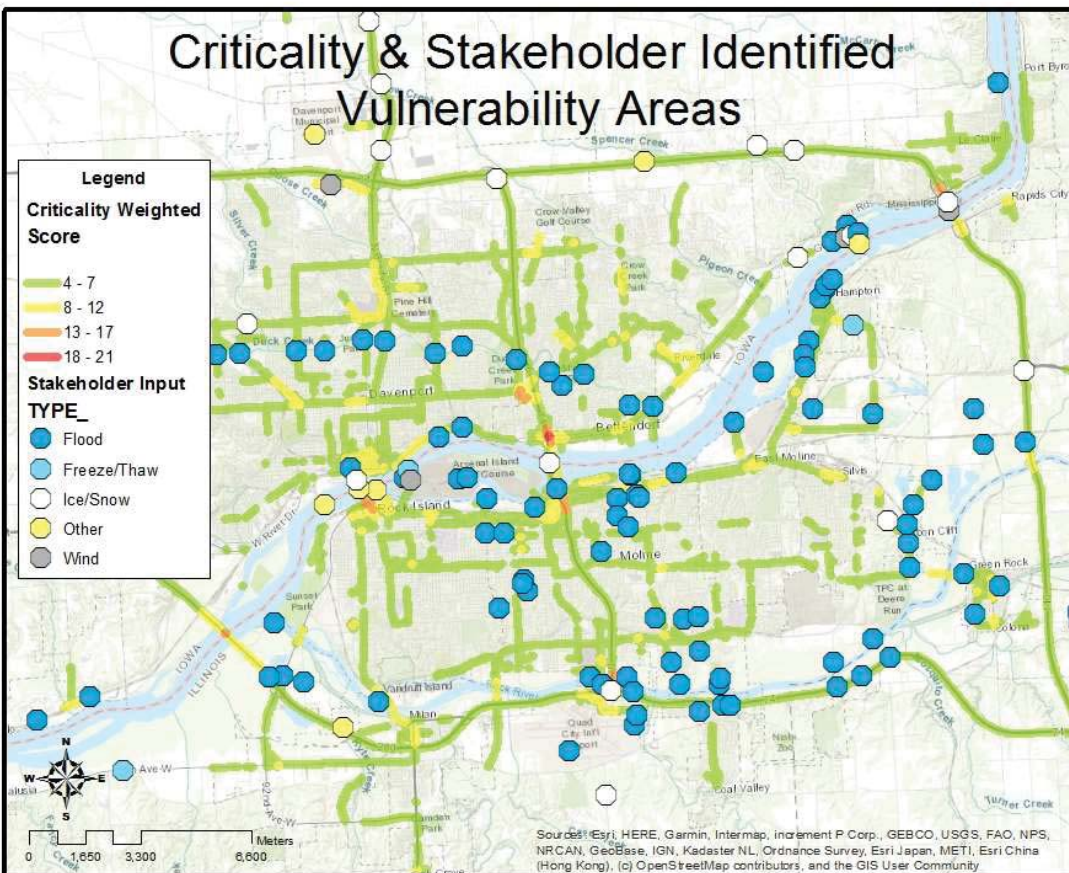
MetroLink Transit (Ridership)

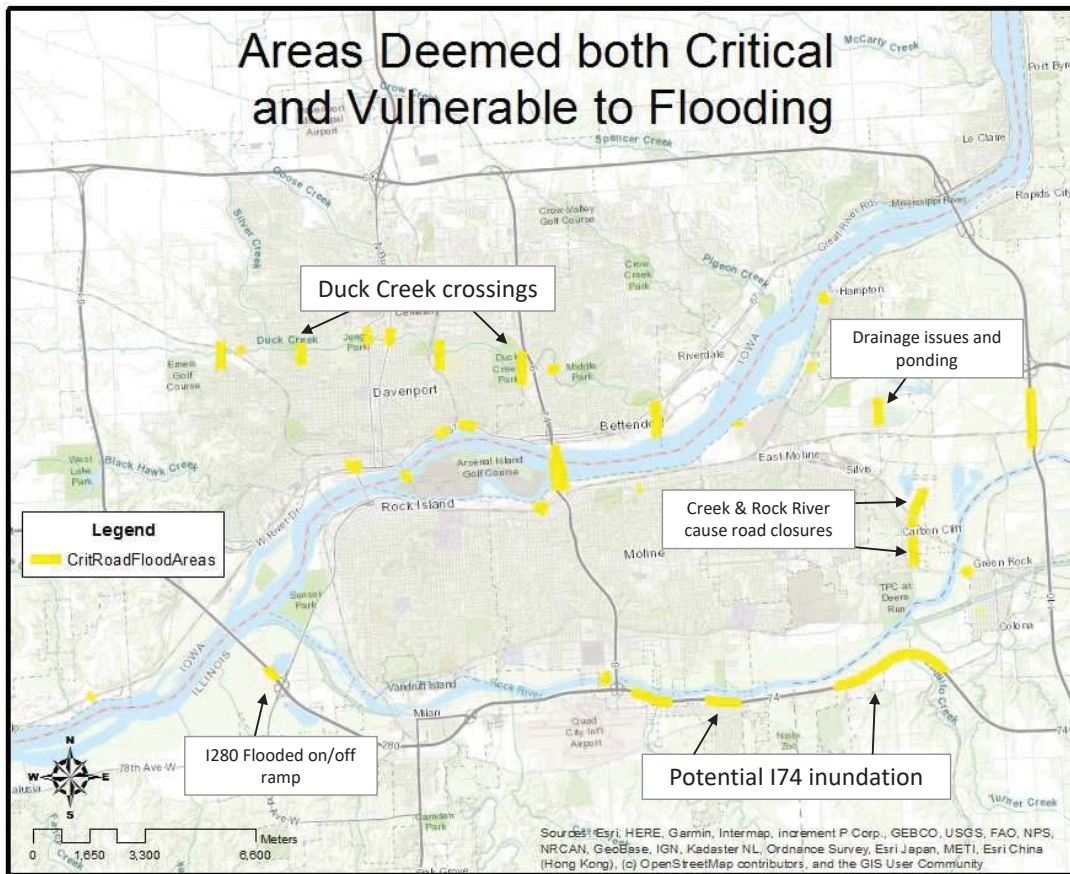
Natural Breaks Classification of Avg. Weekday Ridership	
0 – 634	1
635 – 1,545	2
1,546 – 2,518	3

Result of Weighted Multi-criterion Analysis Using Criticality Criteria



Criticality & Stakeholder Identified Vulnerability Areas





Focus for Adaptation Options Prioritization

- Most at-risk
 - Corridors
 - Hot spots
- Already Planned Projects
- Asset by State or Jurisdiction
- Combination

Priority Segments for Adaptation Options Review



Review Priorities by Potential Solutions

Advisory

Intelligent Transportation System (ITS)

Motorist alerts

Communication & Outreach Plan

Road side active warning systems

Control

Variable speed limits

Vehicle restrictions

Route restrictions

Road-surface treatments

Treatment

Green infrastructure

Levee construction (traditional and living)

Culvert sizing

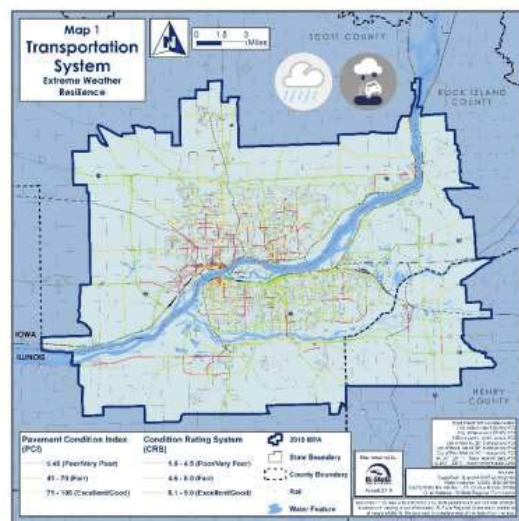
Road/bridge elevation

(Asam et. al., FHWA, 2015)

25

Other *Policies and Procedures*

- Climate and emissions policies
- Emergency Management
- Mitigation Measures
- Disinvestment
- Solutions with co-benefits
- Environmental Justice and Equity



Criteria for Adaptation Options Review

1.	Effectiveness of responding to climate stressors across a range of extreme weather scenarios?	High effectiveness	Low effectiveness
2.	Are the capital/life-cycle costs high?	High costs	Low costs
3.	Are there environmental impacts that may occur?	High impacts	Low impacts
4.	Are there permitting constraints to consider?	High constraints	Low constraints
5.	Will the option be publicly accepted?	High acceptance	Low acceptance
6.	Are there environmental justice impacts to consider?	High impacts	Low impacts
7.	Will the adaptation impact the vulnerability and increase resilience?	High impact	Low impact
8.	Is it a feasible option?	High feasibility	Low feasibility

27

Incorporating into Transportation Planning Process

L RTP Extreme Weather Resilience Objective

- Developed objective for L RTP – policy statement
- Discussed Critical and Vulnerable Areas
- Examined resilience review for planned projects

TIP Resilience Discussion & Project Selection

- Recognize resilience in TIP – use environmental maps to highlight vulnerabilities
- Incorporate resilience similar to EJ review as additional input prior to decisions

Technical Asst. Resilience in Project Development Process

- Write grants for priority resilience projects
- Work with local jurisdictions during project development process to incorporate adaptation options into project development

28

Lessons Learned

Priorities and Opportunities for Adaptation

+

Integrate Results & Recommendations

Lessons Learned – Peer Exchange

- Growing Staff Capacity in Climate
- Data Integration
- Valuing Resilience
- Proactive Collaboration
- Mainstreaming Resilience
- Resilience Informed Planning

Questions?

GENA MCCULLOUGH

GMCCULLOUGH@BISTATEONLINE.ORG

