

Rising Above the Floods: Resilience for Iowa's Transportation Infrastructure

ACEC-IA


Presenters:
Andy McCoy (HDR)
Austin Yates (Iowa DOT)




HDR | IOWA | DOT

September 24, 2024

INTRODUCTIONS



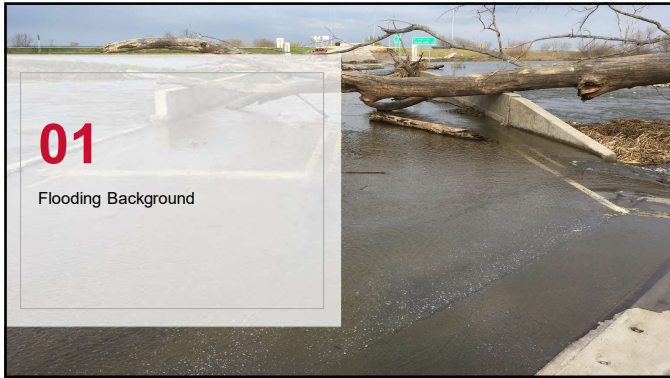
Andy McCoy
HDR



Austin Yates
Iowa DOT

Agenda

- 01** Flooding Background
- 02** Iowa DOT Impacts
- 03** Evaluating Resiliency
- 04** Implemented Resiliency Measures
- 05** Take-Aways

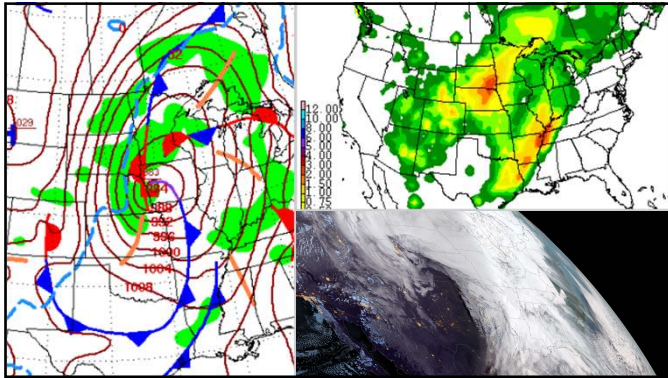


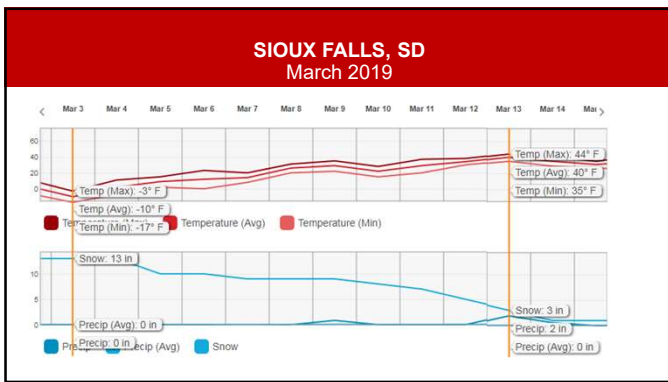


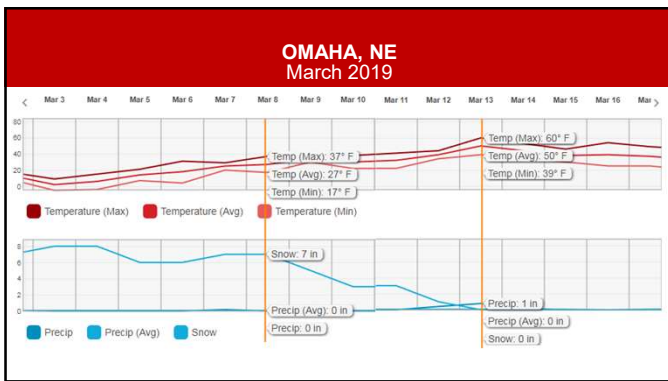


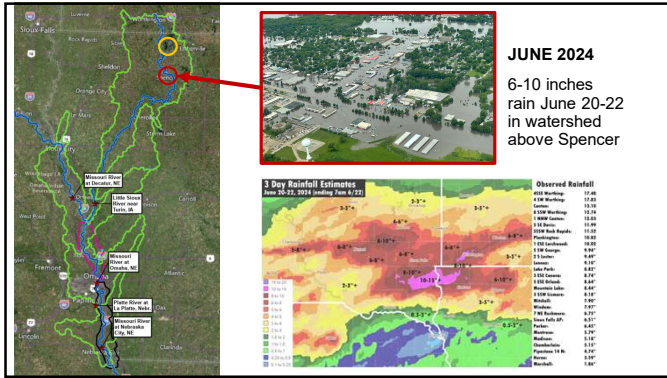
Slide 6

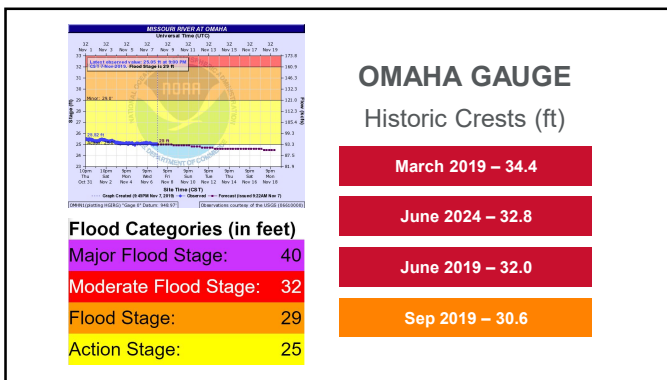
OJO Austin to drop in updated graphic
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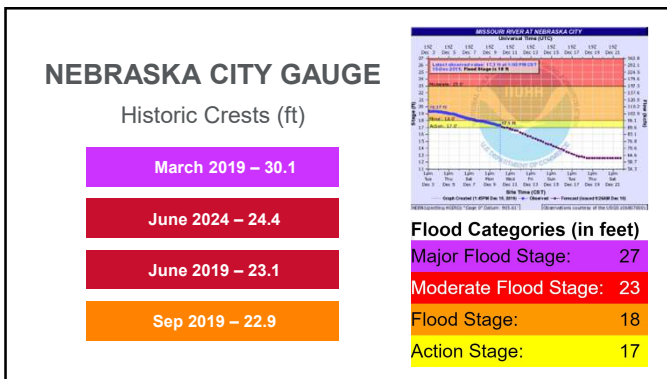


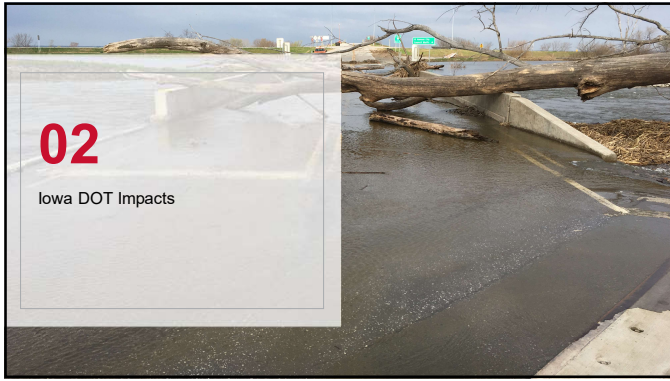










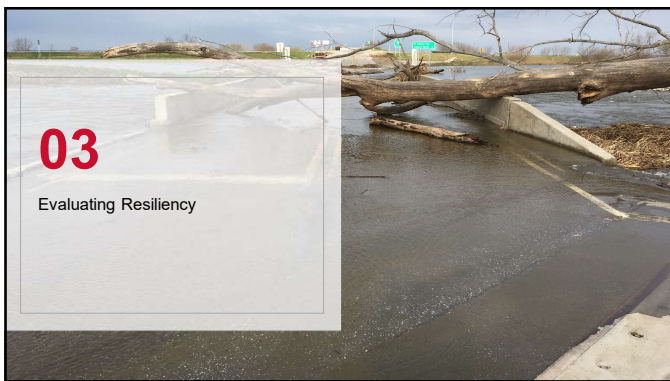






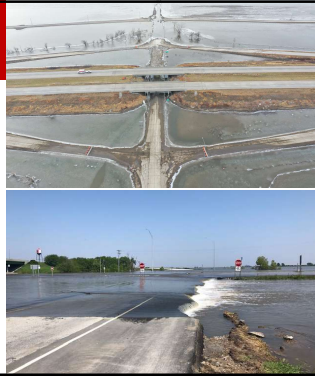






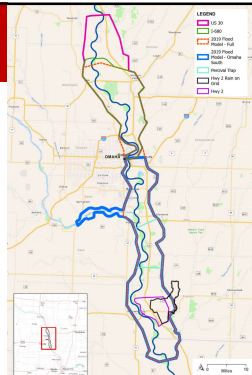
EVALUATING RESILIENCY From Operations to Mitigation

- Iowa DOT focused on resiliency for future floods
- Protect DOT assets and provide public benefits
- Leverage 2D hydraulic flood model to evaluate mitigation options
- Test hypothetical breaches against mitigation measures
- Provide operational support during flood events



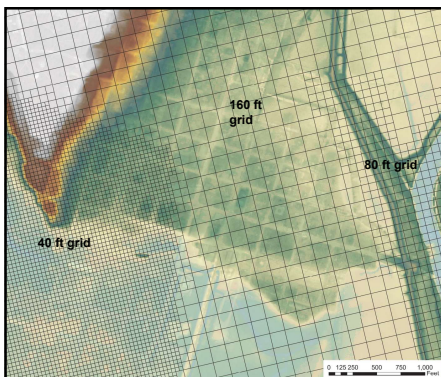
MISSOURI RIVER HYDRAULIC MODELS

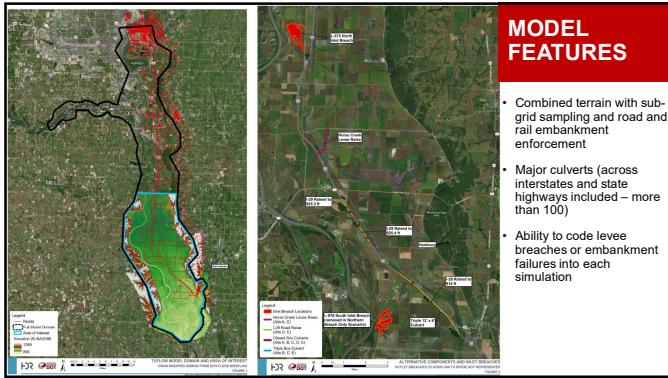
- TUFLOW models
 - Work spanning 2019-2024
 - 2019 peak 190k cfs
- 645,200 cells in US 30 model (North of Omaha)
 - 52 river miles
 - 6.5 hours US 30 model (600 real life hours)
- 776,500 cells in Missouri River Model Omaha to Hamburg
 - 75 river miles
 - 3 hours Big Model (Omaha to Hamburg) (600 real life hours)

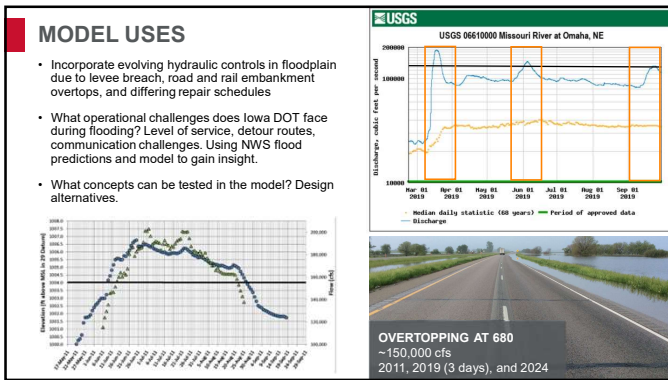


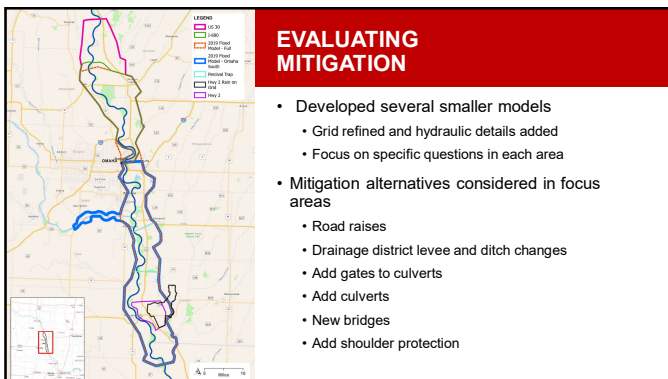
QUADTREE CELLS

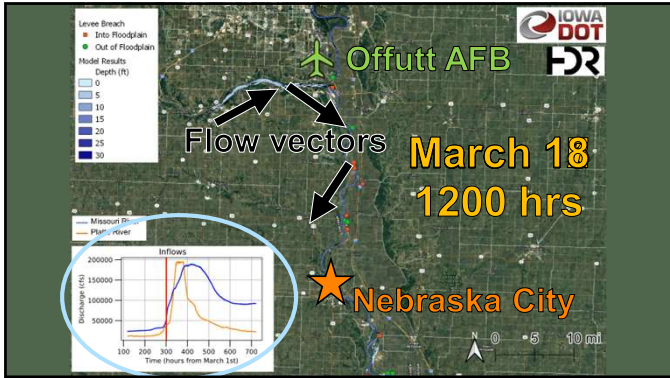
- Sub-grid sampling captures underlying terrain
- Resolution between 40 ft and 160 ft cells
- About 1.1 M wet cells
- March 2019 30-day hydrograph simulation runs in about **3 hours**

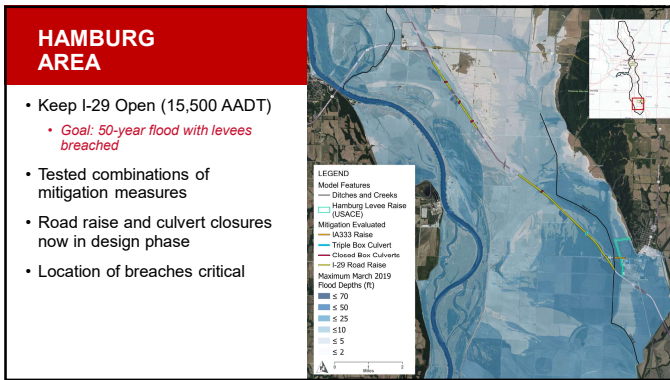


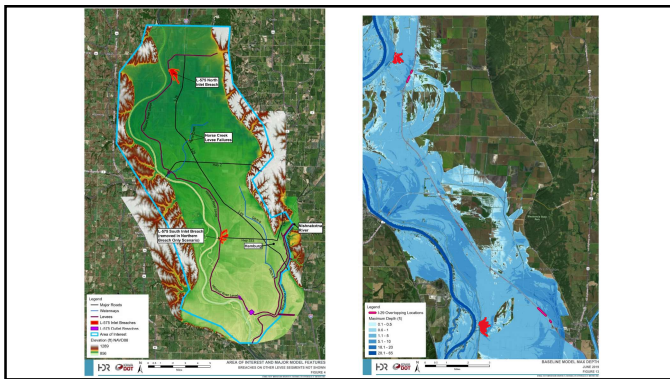












ASSESSING ALTERNATIVES

Alternative A
Raise and strengthen the southeast side of the Horse Creek Levee upstream of IA2 and provide closure structures that prevent flow from west to east for the four box culverts greater than four feet wide along I-29 between IA2 and Hamburg.

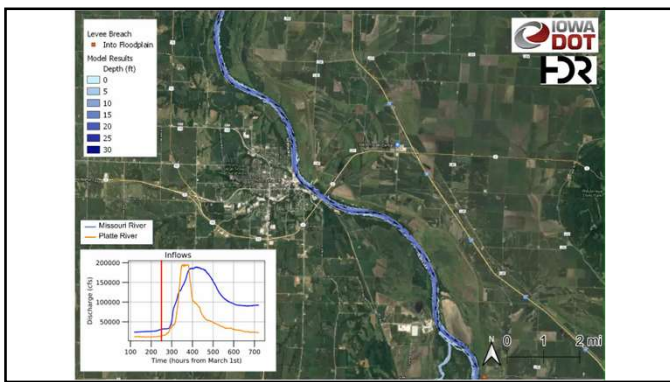
Alternative B
Provide closure structures that prevent flow from west to east for the four box culverts greater than four feet wide along I-29 between IA2 and Hamburg and install a new trible box culvert (12' x 6') near where I-29 overtopped in June 2019.

Alternative C
Provide closure structures that prevent flow from west to east for the four box culverts greater than four feet wide along I-29 between IA2 and Hamburg, install a new trible box culvert (12' x 6') near where I-29 overtopped in June 2019, and raise the Horse Creek Levee.

Alternative D
Provide closure structures that prevent flow from west than four feet wide along I-29 between IA2 and Hamburg to prevent overtopping.

Alternative E
Provide closure structures that prevent flow from west than four feet wide along I-29 between IA2 and Hamburg (12' x 6') near where I-29 overtopped in June 2019, an leet to prevent overtopping.

Event	Features	Road Elevation (ft)	Baselevel (ft)	Alt B WSE (ft)	Alt B Road Elevation (ft)	Alt D WSE (ft)	Alt E WSE (ft)
June 2019 Event	Hwy 335 East of State	908.9	913.1	914.3	908.9	913.8	913.3
	I-29 Near Hamburg WSE	912.0	912.2	912.3	914.0	911.0	912.1
	I-29 Overtop (I-29BR-SS) WSE	923.3	924.7	924.2	925.2	924.7	924.7
50-year North Branch Only	I-29 Overtop 2 (I-29-SS) WSE	923.4	923.7	923.9	924.4	923.9	923.3
	Hwy 335 East of State	906.9	911.4	914.4	906.9	910.8	910.5
	I-29 Near Hamburg WSE	912.0	911.4	911.9	914.9	911.8	912.3
	I-29 Overtop 1 (I-29BR-SS) WSE	923.3	923.4	922.7	925.3	922.7	922.7
	I-29 Overtop 2 (I-29-SS) WSE	923.4	922.4	922.6	924.4	922.4	922.4
100-year North Branch Only	Hwy 335 East of State	906.9	920.8	921.2	906.9	916.2	916.0
	I-29 Near Hamburg WSE	912.0	912.8	911.5	914.0	912.3	911.1
	I-29 Overtop 1 (I-29BR-SS) WSE	923.3	924.2	924.3	925.3	924.2	924.2
	I-29 Overtop 2 (I-29-SS) WSE	923.4	923.0	924.0	924.4	922.1	924.1
50-year North Branch	Hwy 335 East of State	906.9	912.2	914.4	906.9	910.2	911.6
	I-29 Near Hamburg WSE	912.0	912.8	914.0	914.0	913.0	912.3
	I-29 Overtop 1 (I-29BR-SS) WSE	923.3	923.8	923.7	925.3	922.7	922.7
	I-29 Overtop 2 (I-29-SS) WSE	923.4	922.4	922.6	924.4	922.4	922.4
100-year North Branch	Hwy 335 East of State	906.9	916.3	916.3	906.9	916.3	916.3
	I-29 Near Hamburg WSE	912.0	916.3	916.4	914.0	916.3	916.4
	I-29 Overtop 1 (I-29BR-SS) WSE	923.3	924.8	924.9	926.3	924.8	924.8
	I-29 Overtop 2 (I-29-SS) WSE	923.4	923.0	924.0	924.4	924.0	924.0



IA-2 Conveyance and Local Protection

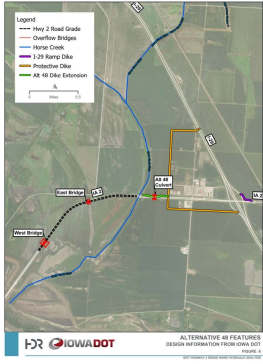
- Combinations of road embankment raises, culverts, protective berms, and bridges
- Breach flows get trapped west of I-29 (15,500 AADT)
- Proposed bridges allow conveyance from upstream breaches
- Berms and box culvert protect businesses near IA-2 (9,000 AADT)

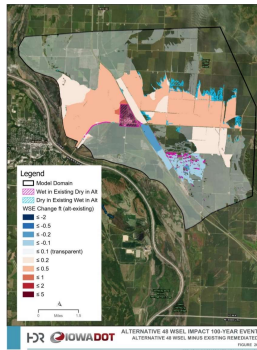
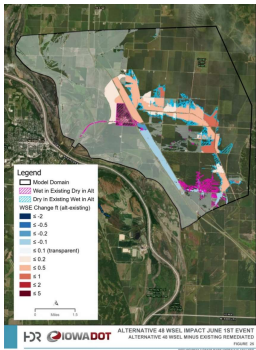


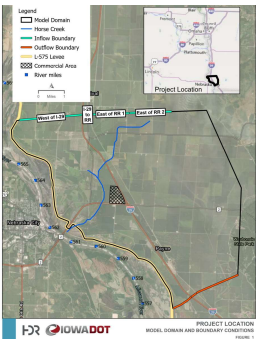
OJO Combine with the following slide under the header: Assessing Alternatives

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ALT. 48 – IA 2
Grade Raise, Two
Overflow Bridges,
Overflow Culvert +
Protective Dike





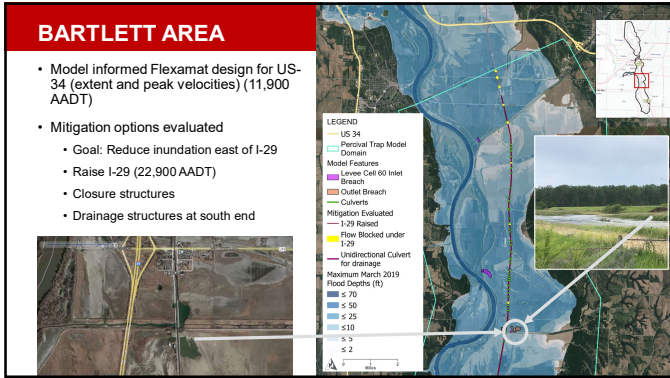


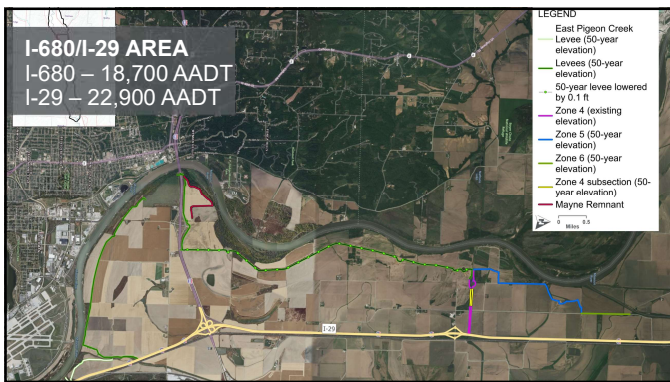
JUNE 1 EVENT
 Table 10 WSEL Horse Creek June 1st Event

	WSEL West of I-29 Horse Creek ft NAVD83	West WSEL Difference ft	WSEL East of I- 29 Horse Creek ft NAVD83	East WSEL Difference ft
Existing	925.6	N/A	926.1	N/A
Remediated	925.6	0.0	926.1	0.0
AR 12	925.6	0.0	926.1	0.0
AR 32	926.0	0.4	926.2	0.1
AR 42	925.9	0.4	926.2	0.1
AR 48	925.5	-0.1	926.1	0.0
AR 48	925.7	0.1	926.1	0.0
AR 52	925.5	-0.1	926.1	0.0

100-YEAR EVENT
 Table 11 WSEL Horse Creek 100-Year Event

	WSEL West of I-29 Horse Creek ft NAVD83	West WSEL Difference ft	WSEL East of I- 29 Horse Creek ft NAVD83	East WSEL Difference ft
Existing	926.0	N/A	926.6	N/A
Remediated	926.0	0.0	926.6	0.0
AR 12	926.0	0.0	926.6	0.0
AR 32	926.5	0.5	926.7	0.1
AR 32	926.5	0.5	926.7	0.1
AR 42	926.2	0.2	926.6	0.0
AR 48	926.3	0.4	926.7	0.1
AR 48	926.3	0.4	926.6	0.0





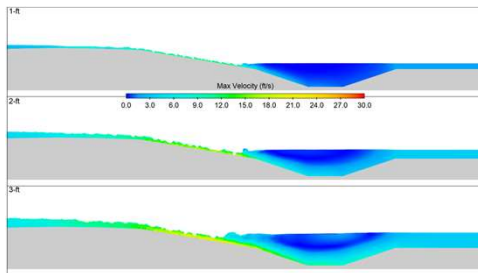


2019 ROADWAY DAMAGE

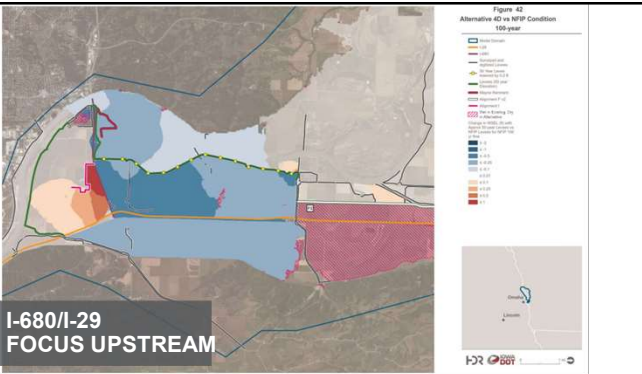


Seven horizontal lines for notes.

MAX VELOCITY LOCATIONS
1 to 3 ft overtop



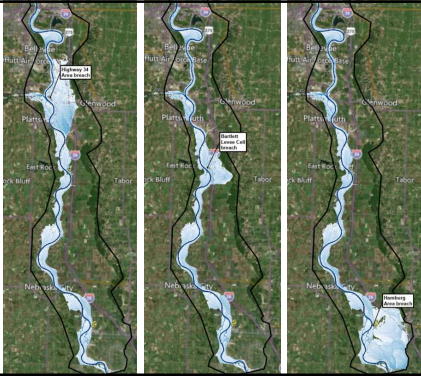
Seven horizontal lines for notes.



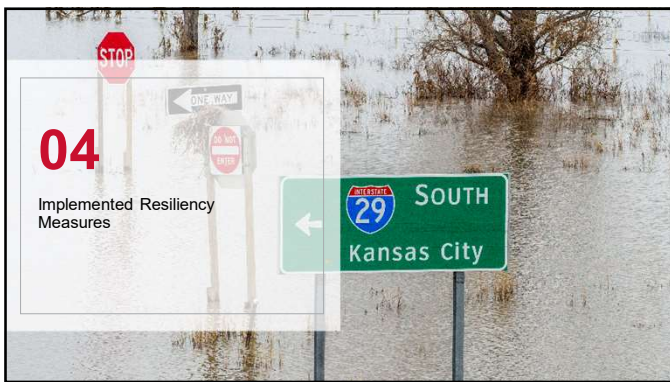
Seven horizontal lines for notes.

2024 HYPOTHETICAL I-29 IMPACTS SOUTH OF OMAHA

- DOT interest in breach inundation for levee cells
- Estimation necessary for breach timing and depth
- Hydrograph construction
 - NOAA forecast (213 kcfs)
 - USACE forecast (170 kcfs)
 - Falling limb shape estimation

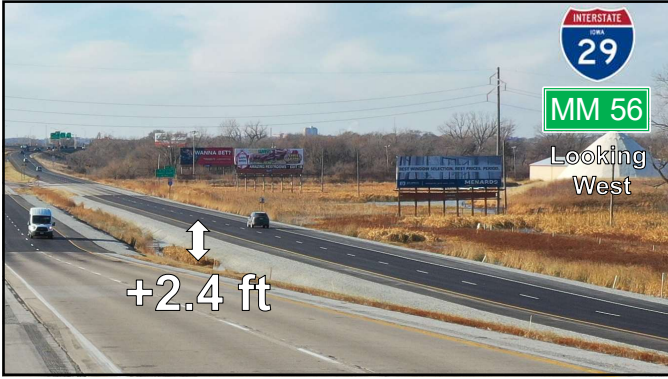


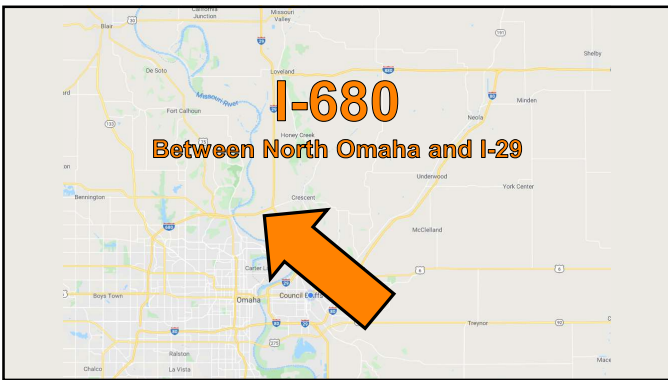
04
Implemented Resiliency Measures



Blackbird Marsh
Between Exit 55 and Exit 56



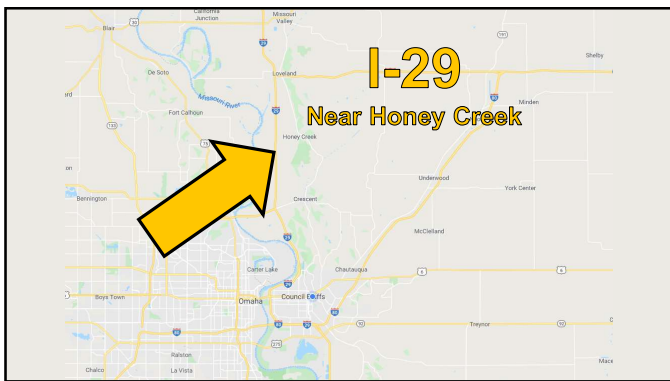


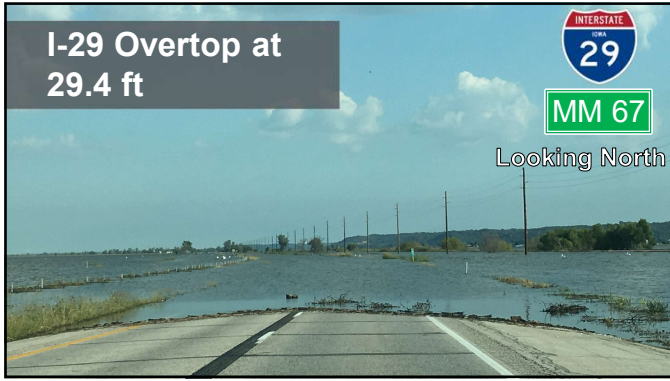








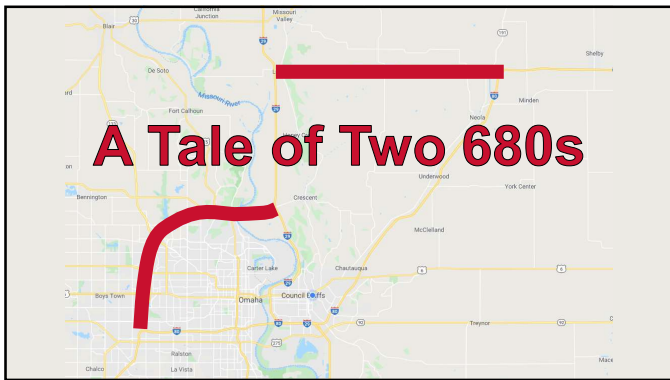




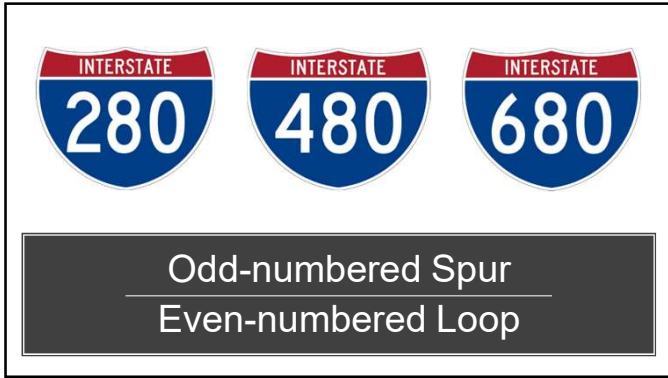








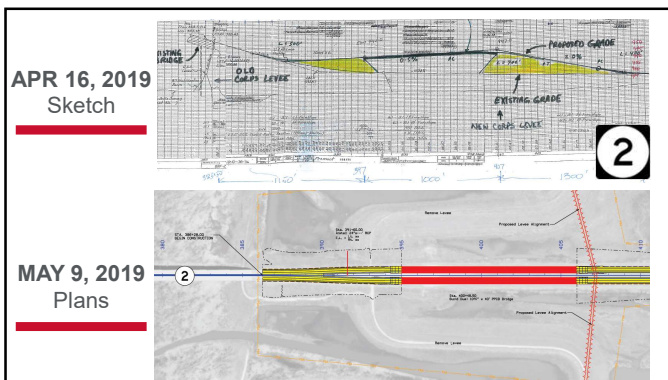






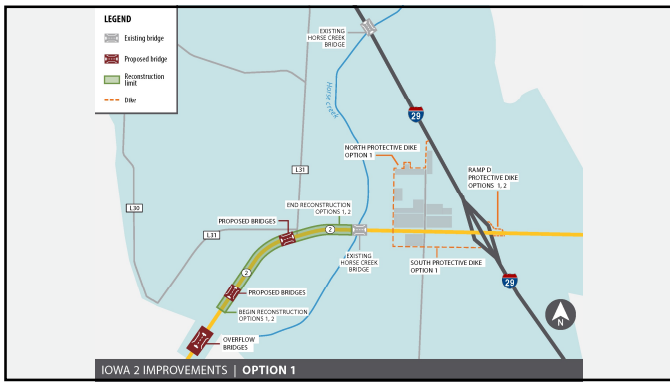














Take-Aways

- Floodplain drainage and connectivity extremely complex and important – use the hydraulic modeling right tool
- Large scale model allows for experimentation, holistic understanding of floodplain and connectivity (breaches, embankment failures)
- Leveraging analytical tools to work through the possible combinations of protective measures and alternatives to maintain and preserve mobility
- Nothing is flood proof, we invest in resiliency