

What Happens When Floods Collide?

An Update on Missouri River Levees

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2020 Sediment and Erosion Control Seminar

February 6, 2020



With information from:



Presentation Outline



Missouri River Levee History



Plans for Levee
Improvements begin
in 2010

Notice to Proceed
for Construction
was set for March
18, 2019



Missouri and Platte River Flooding



USACE Levee Repairs

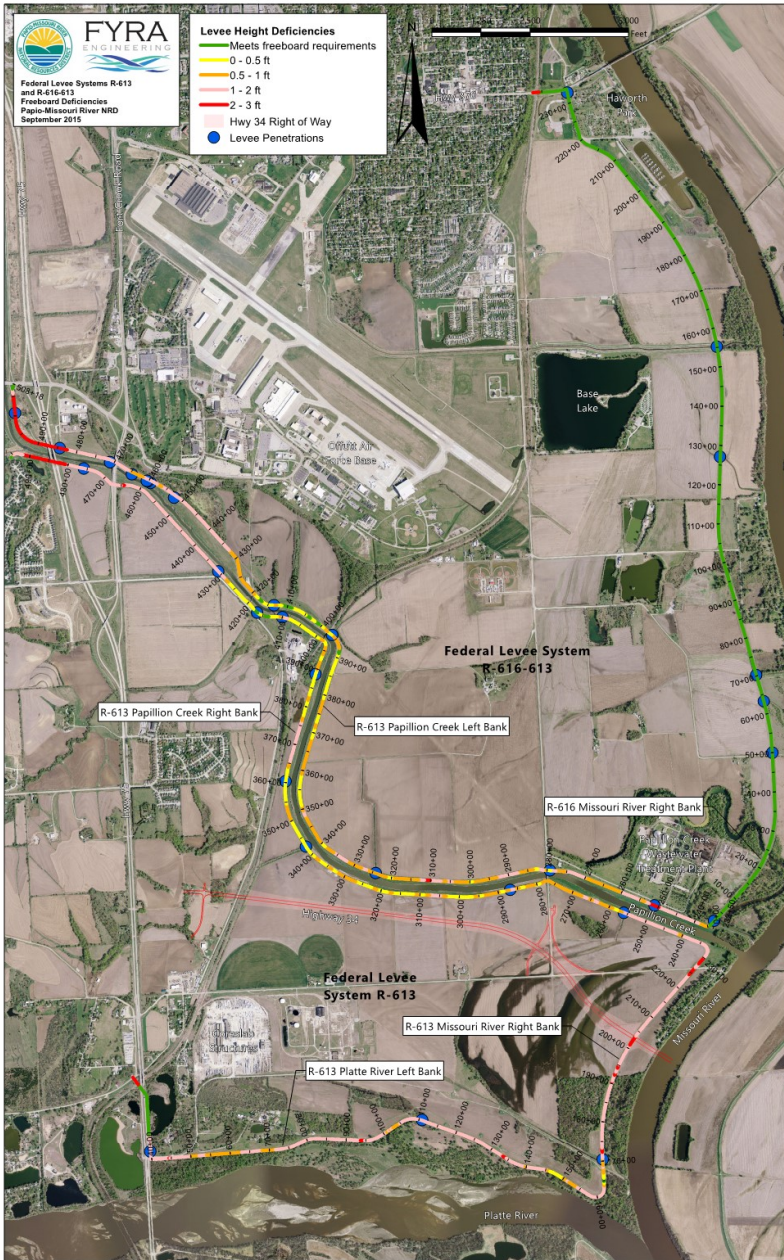


Progress of Levee Improvements

Levee History

- R-613 along the Platte, Missouri and both sides of Papillion Creek was constructed in 1975
 - No Levees on the Iowa side
 - Papio and Platte tie backs only built for Missouri River flood elevations
- Iowa's L-611-614 and Nebraska's R-616 constructed in 1985
 - Designed flood elevations above R-613 as-built elevations

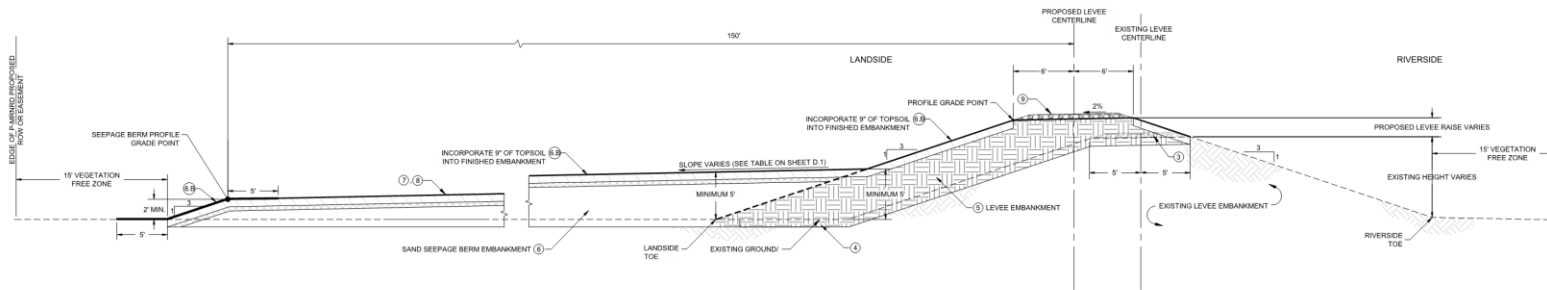




Proposed Levee Improvements

- Raises of up to 3 feet required – No raise on R-616 along Missouri River
- Sand Seepage Berms – 150 to 200 ft wide (limited width and location to save cost)
- Most levee penetrations will be lined and grouted in place
- Short floodwall required on N levee east of Ft. Crook
- Permanent closure structure across BNSF under Hwy 370

Proposed Levee – w/ and w/out Sand Seepage Berm



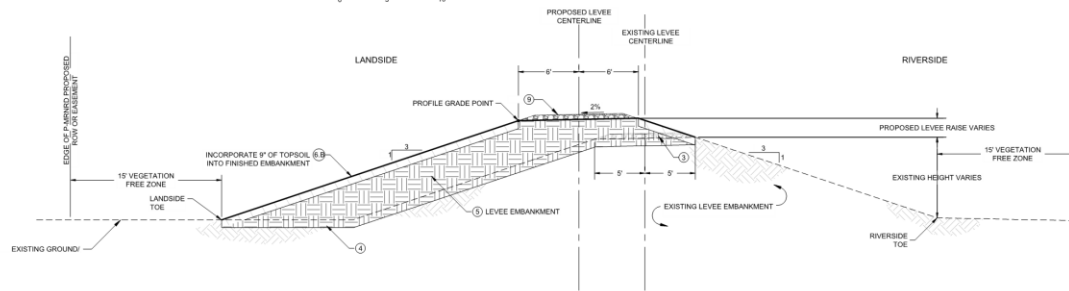
NOTE: CONTRACTOR SHOULD CONSIDER THE DEPTH OF THE SOIL AND TOPSOIL ZONE ON TOP OF THE AGGREGATE EMBANKMENT IN THE SEEPAGE BERM WHEN SELECTING THE EQUIPMENT TYPE TO PLACE, SPREAD, AND COMPACT THE SOIL AND TOPSOIL. IT SHOULD NOT BE NECESSARY TO SEGREGATE THE BORROWED SOIL FROM THE BENCH STRIPPINGS FROM THE TOPSOIL REMOVED FROM THE SEEPAGE BERM FOOTPRINT SINCE BOTH MATERIALS WILL SERVE AS SUITABLE TOPSOIL MATERIALS.

LEVEE EMBANKMENT CONSTRUCTION SEQUENCING

- ① ALL EARTHWORK TO BE CONDUCTED IN ACCORDANCE WITH PROJECT SPECIFICATIONS.
- ② P-MINNO HAS PROVIDED TWO STOCKPILES. ONE IS REFERRED TO AS EARTHEN STOCKPILE AND THE OTHER IS REFERRED TO AS TOPSOIL STOCKPILE.
- ③ STRIP AND STOCKPILE ALL EXISTING AGGREGATE SURFACING FROM TOP OF LEVEE/ACCESS ROAD EMBANKMENT OR REMOVE EXISTING 6" CONCRETE TRAIL.
- ④ STRIP AND STOCKPILE TOPSOIL (9") FROM ALL LEVEE EMBANKMENT AND SEEPAGE BERM AREAS TO RECEIVE FILL.
- ⑤ PLACE EARTHEN LEVEE EMBANKMENT ON STRIPPED. EXISTING LEVEE EMBANKMENT BORROW FOR THIS FILL TO COME FROM STRIPPED BENCH MATERIAL.
- ⑥ PLACE SAND SEEPAGE BERM EMBANKMENT.
- ⑦ PLACE STRIPPED TOPSOIL OVER LEVEE EMBANKMENT AREAS.
- ⑧ PLACE ALL REMAINING STRIPPED BENCH MATERIAL EVENLY OVER SEEPAGE BERM SAND EMBANKMENT AREAS. CALCULATIONS INDICATE THAT APPROXIMATELY 427,000 CUBIC YARDS IS AVAILABLE FROM BENCH STRIPPING AND THAT APPROXIMATELY 327,000 CY WILL BE UTILIZED FOR LEVEE EMBANKMENT. THE REMAINING 100,000 CY SHALL BE APPLIED EVENLY OVER THE PROPOSED SEEPAGE BERMS. THIS EQUATES TO 6" OF SOIL DEPTH TO BE PLACED ON TOP OF THE BERM BEFORE THE 9" OF TOPSOIL STRIPPING (NOTE 4) IS PLACED.
- ⑨ PLACE ALL REMAINING STRIPPED TOPSOIL AND NND TOPSOIL STOCKPILE OVER SEEPAGE BERM SAND EMBANKMENT AREAS.
- ⑩ PLACE EROSION CONTROL BLANKET.
- ⑪ PLACE 6" CRUSHED ROCK SURFACING OR 6" CONCRETE ON TOP OF RAISED LEVEE.
- ⑫ PLACE TEMPORARY COVER CROP AND MULCH IN ACCORDANCE WITH PROJECT SPECIFICATIONS AND SWPPP PLAN ON ALL DISTURBED SURFACES.

LEVEE CROSS SECTION - STA 284+20 TO 369+08

1
D.3



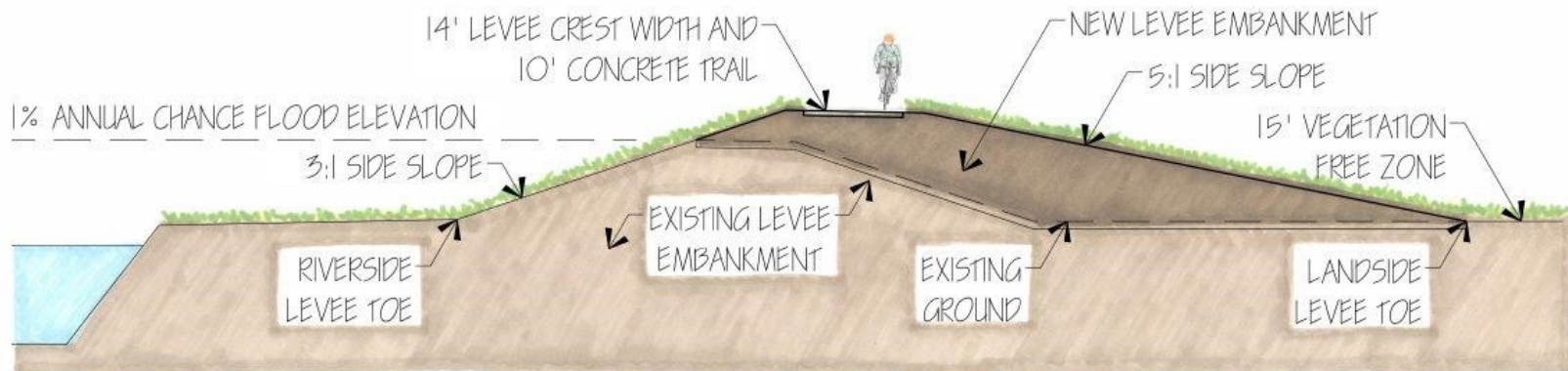
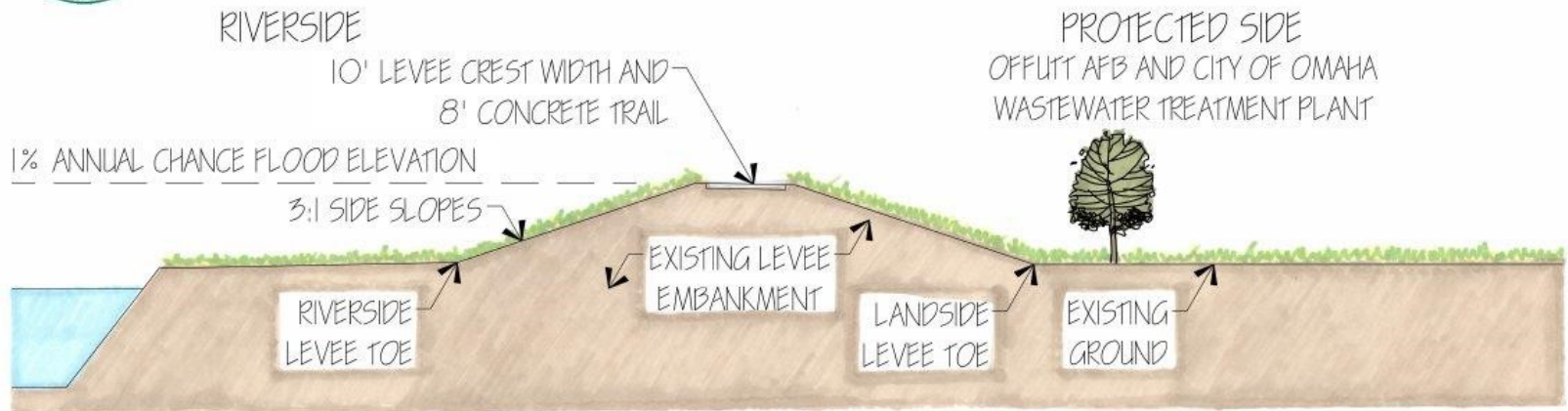
LEVEE CROSS SECTIONS -
STA 369+08 TO 431+80 AND STA 464+05 TO 487+00

2
D.3

Proposed Levee – Along WWTP

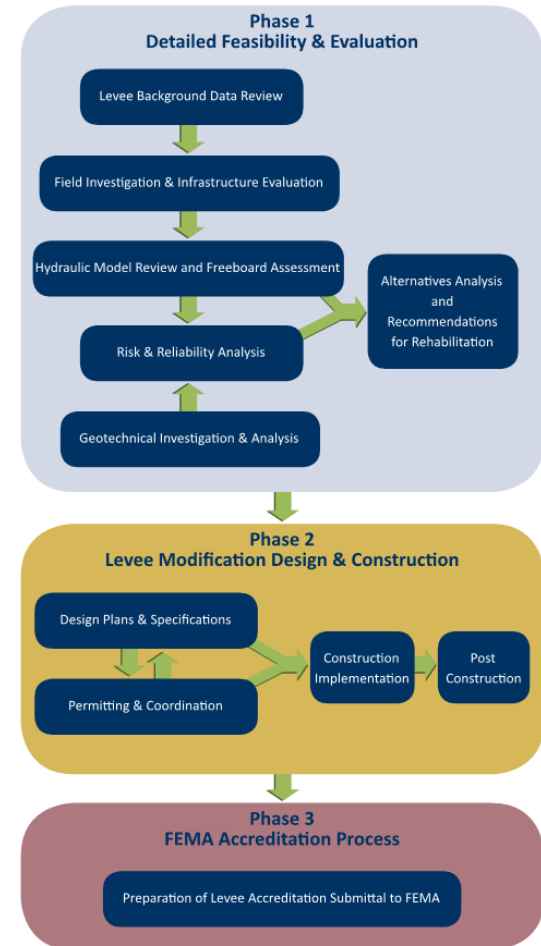


MODIFICATIONS TO FEDERAL LEVEE SYSTEMS R-616-613 AND R-613 - SARPY COUNTY, NE



What Took So..... Long?

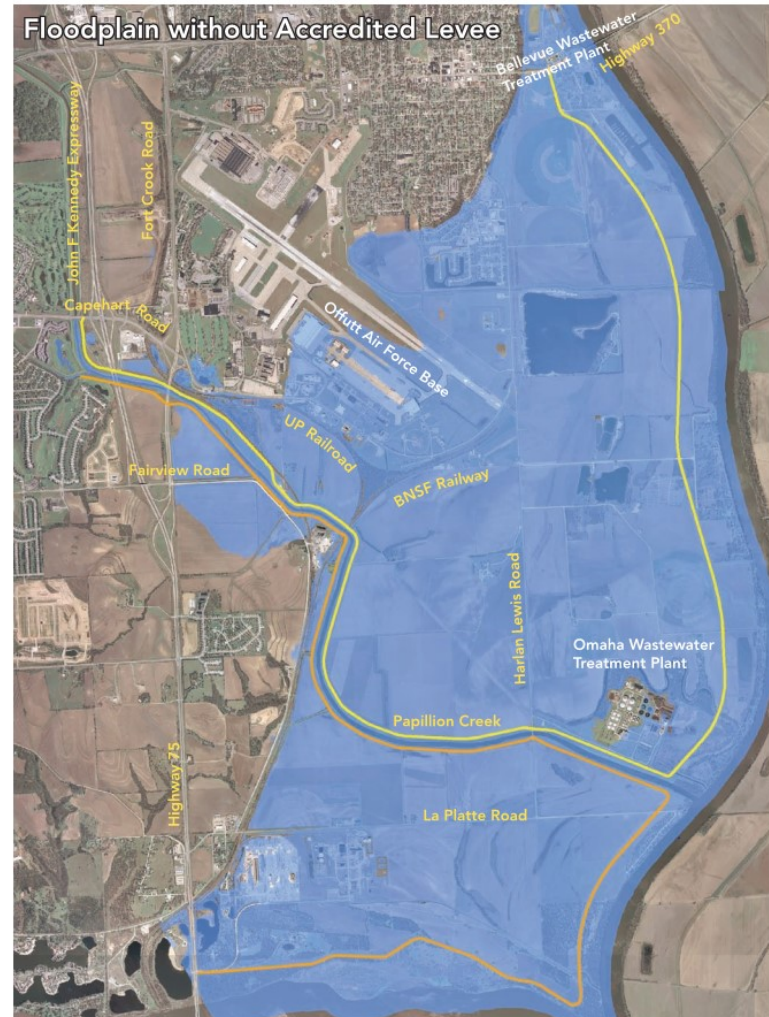
- Numerous Issues and Hurdles – looking back from potentially starting construction on March 18, 2019
 - Land Rights – couldn't start until design was approved
 - Still coordinating UPRR, BNSF, and utilities
 - USACE 408 Review and Approval – Approved May 2019, Submitted 60% plans in May 2013
 - Pre-project feasibility began Jan. 2010



Anticipated Flood Risk w/out Levees

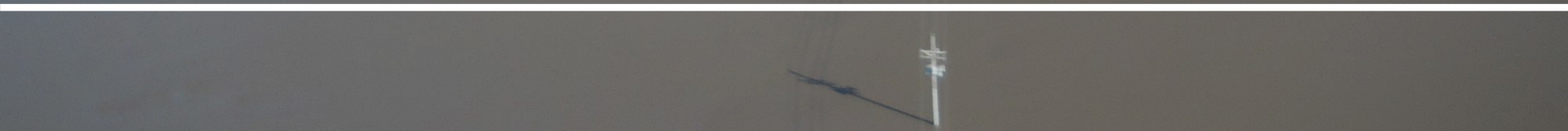
Missouri River R-613 and R-616 Levee Accreditation Project Professional Services

Figure 2: Potential Floodplain Areas



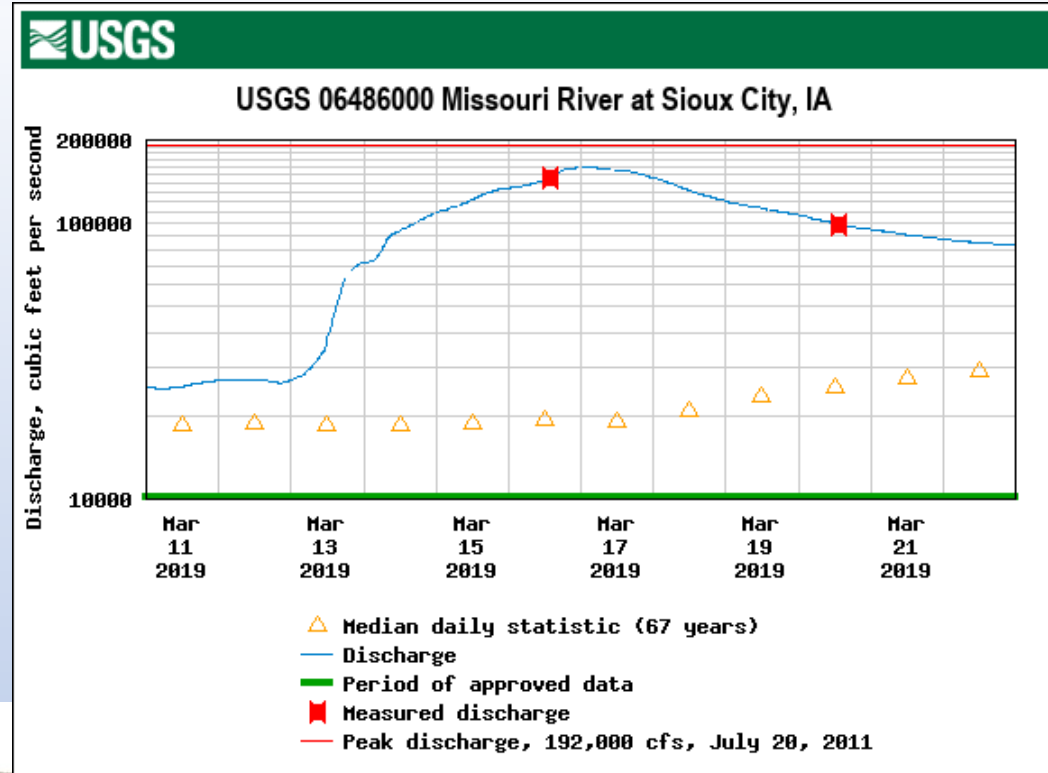


What Happens When Floods Collide?



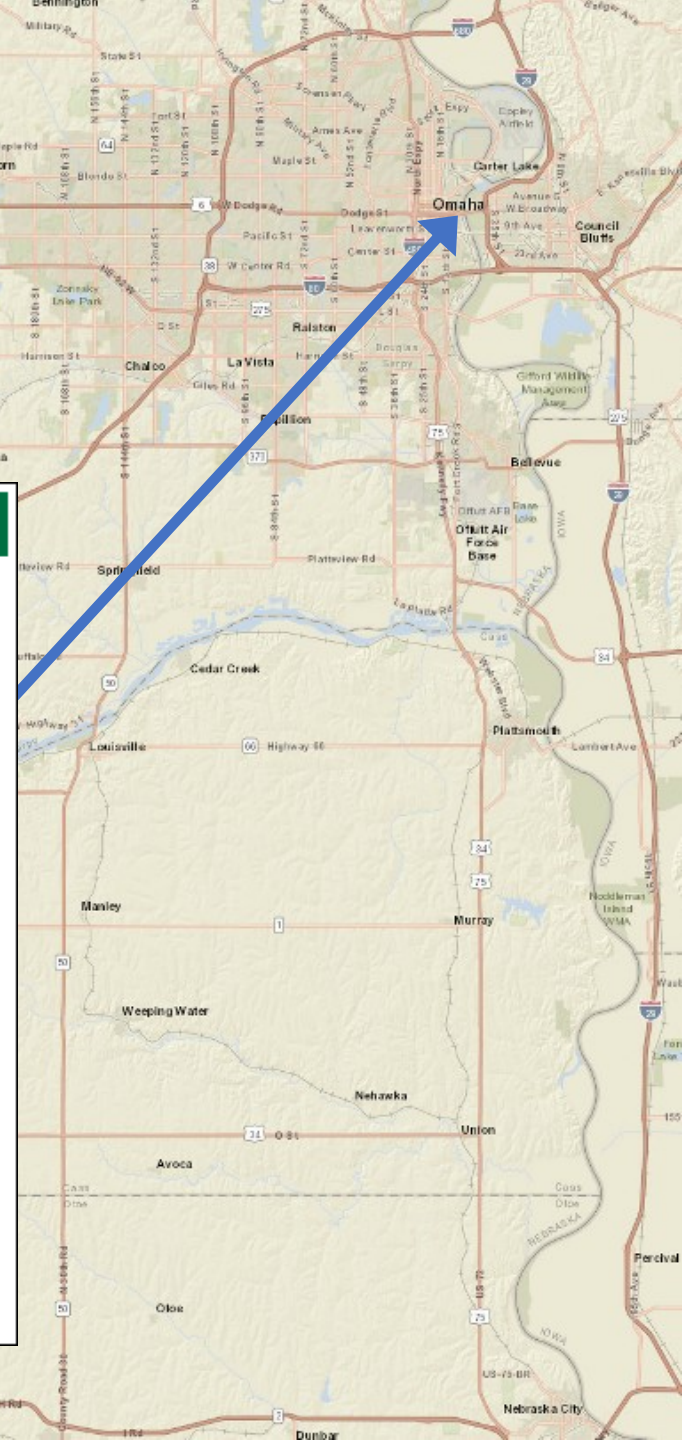
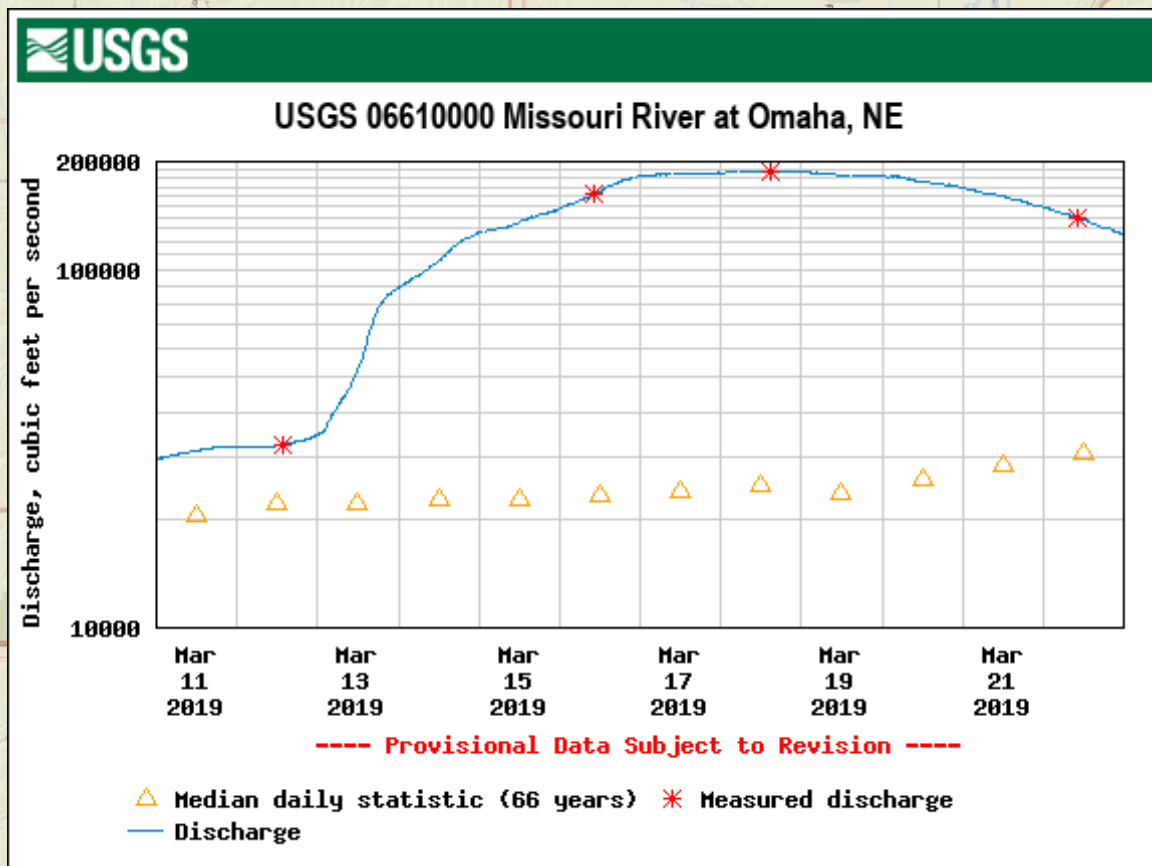
Missouri River

- Spencer Dam Breach reached Gavins Point Dam on March 13th
- Gavins Point outflow nearly 100,000 cfs on March 15th



Missouri River: Train 1

- 100+ Year Event
- 180,000+ cfs March 16th 9:00 pm

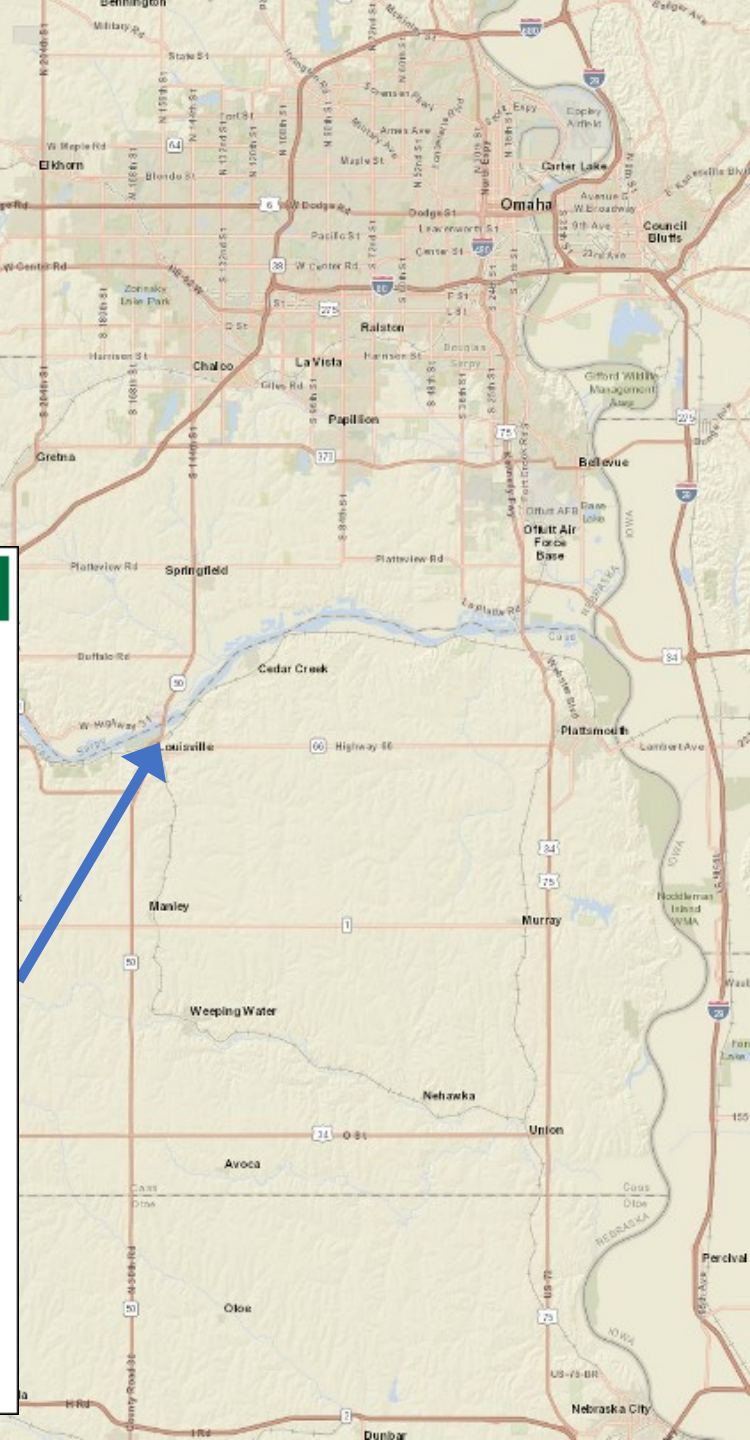
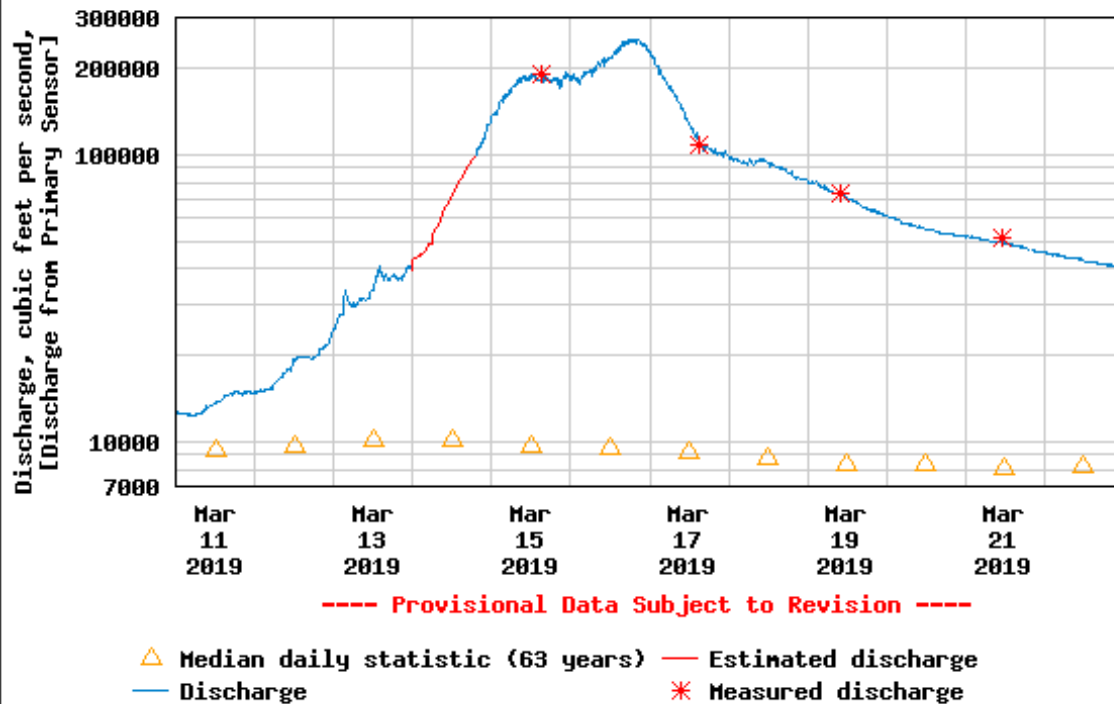


Platte River: Train 2

- Elkhorn + Loup + Platte
- 252,000 cfs March 16th 8:45 pm
- 250 to 300-yr flood flows



USGS 06805500 Platte River at Louisville, Nebr.



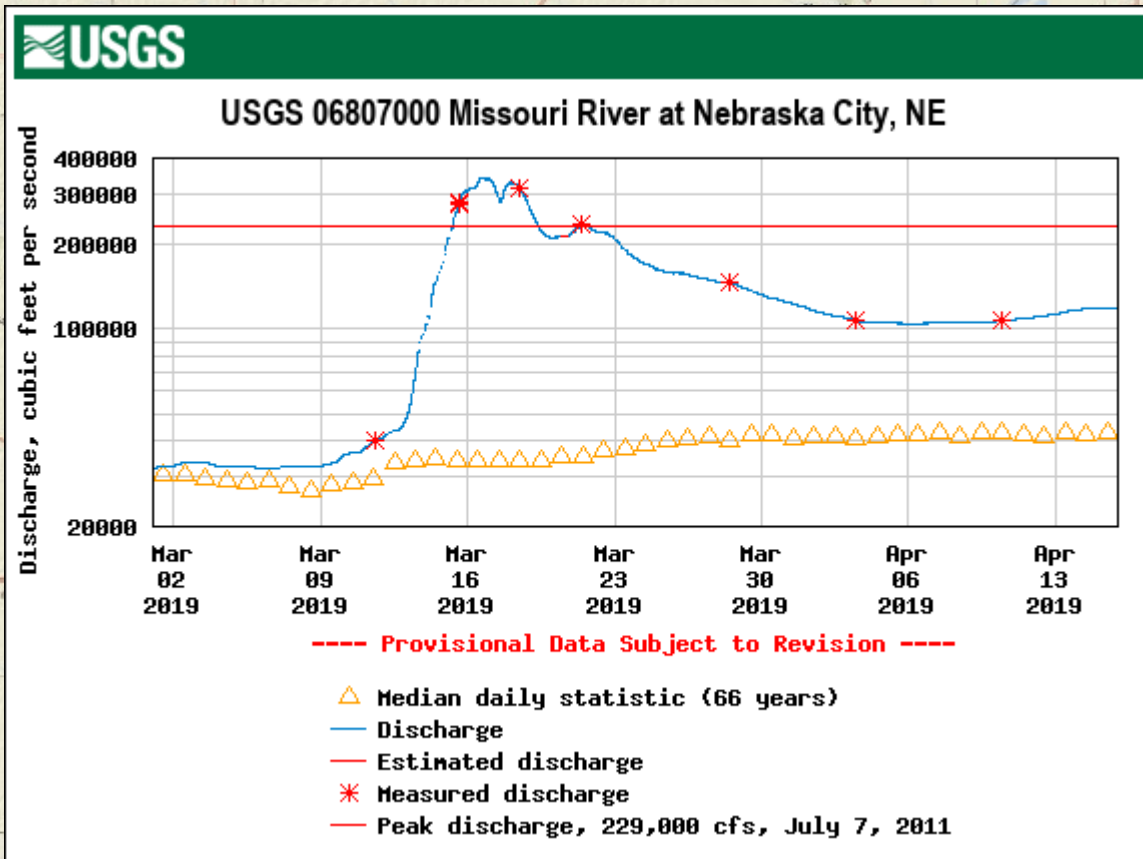
Platte River: Train 2

- Elkhorn + Loup + Platte
- 252,000 cfs March 16th 8:45 pm
- 250 to 300-yr flood flows
- New Flood Frequency Analysis matches downstream levee design

PROVISIONAL ANALYSES – DO NOT CITE					
Recurrence interval (yrs)		50	100	200	500
Annual Exceedance Probability (%)		2	1	0.5	0.2
Platte River at Louisville, Nebr. (06805500)	2018	151,000	176,000	203,000	240,000
	2019	169,000	202,000	238,000	290,000

Train 1 + 2 = Missouri + Platte River

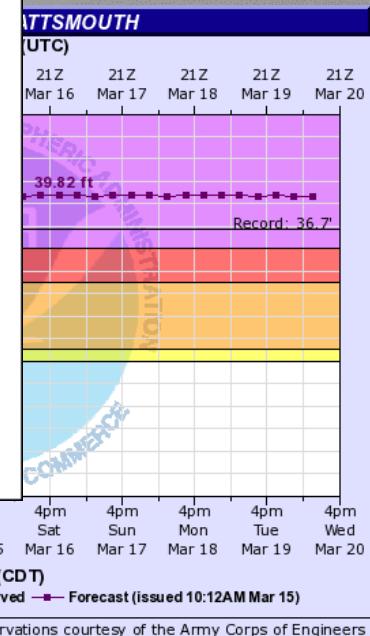
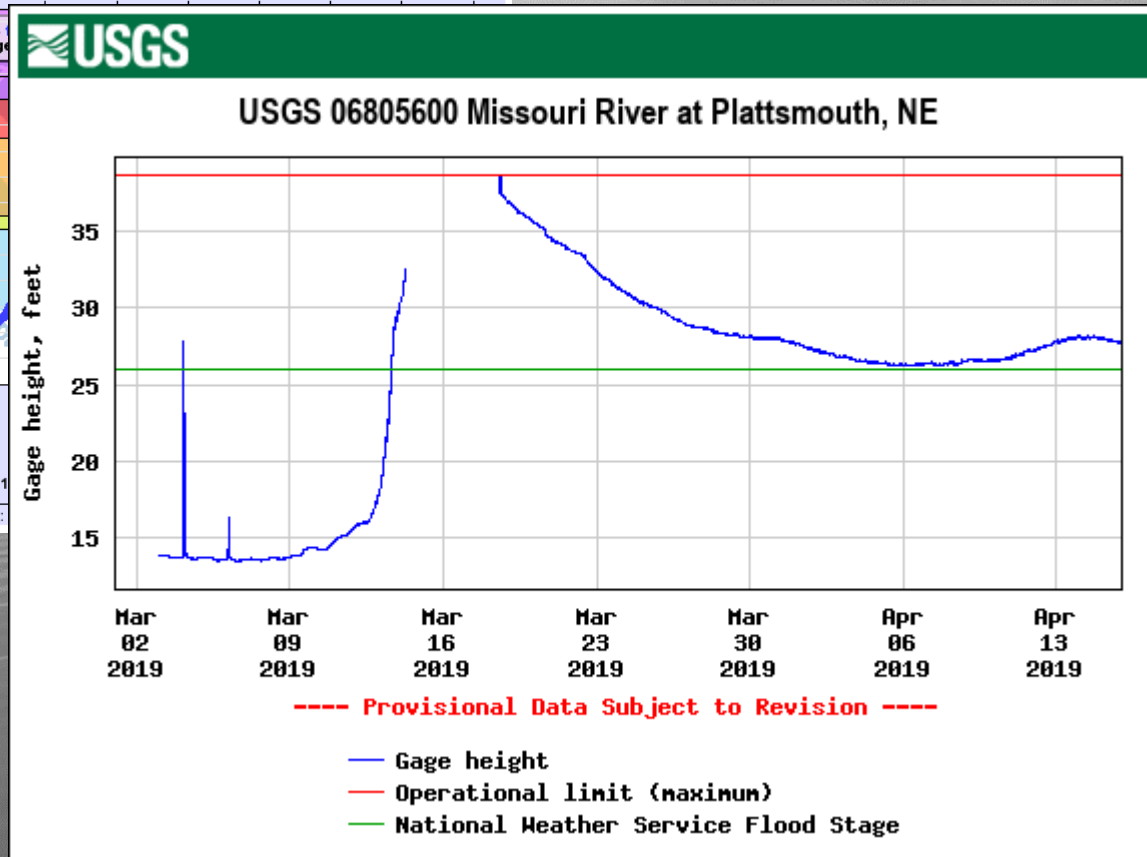
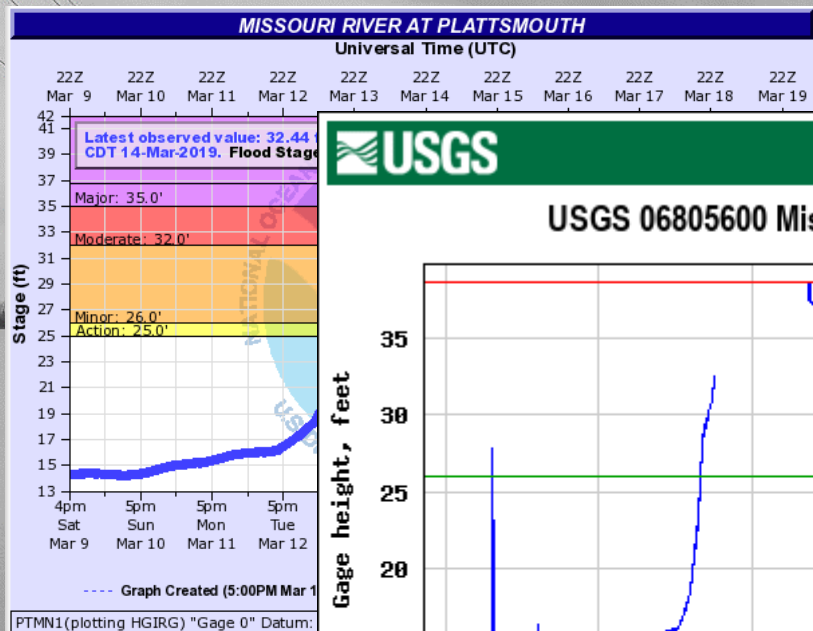
- 252,000 + 180,000 /= 342,000 cfs March 16th 7:15pm
- Major levee breaches lowered total peak flow
- 750 to 1,000 year event?



R-613 and R-616 Levees



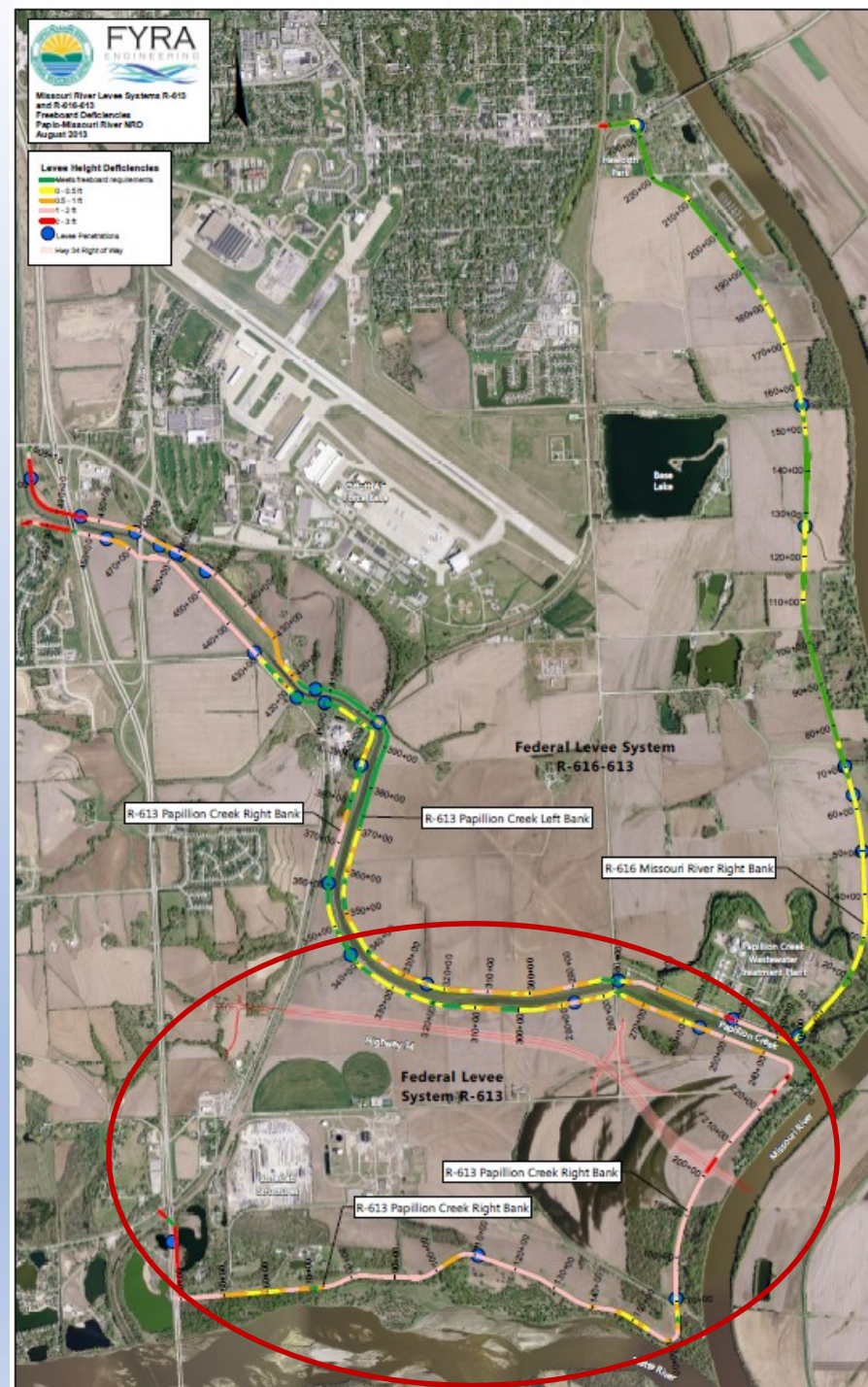
Couldn't provide warning, because this was unprecedented



16 Hours

8 Hours

- Overtopping –R-613 along Papio, Missouri, and Platte
- Small Breach at La Platte Rd crossing



Levee Overtopping at WWTP (R-613-616 System)



R-613 Levee Breach at La Platte Rd.



R-613 Levee Breach at La Platte Rd.





Levee Breach Repaired by NRD

- Completed by NRD prior to USACE Repairs
- Plans approved by USACE
- Repair work completed by April 5th

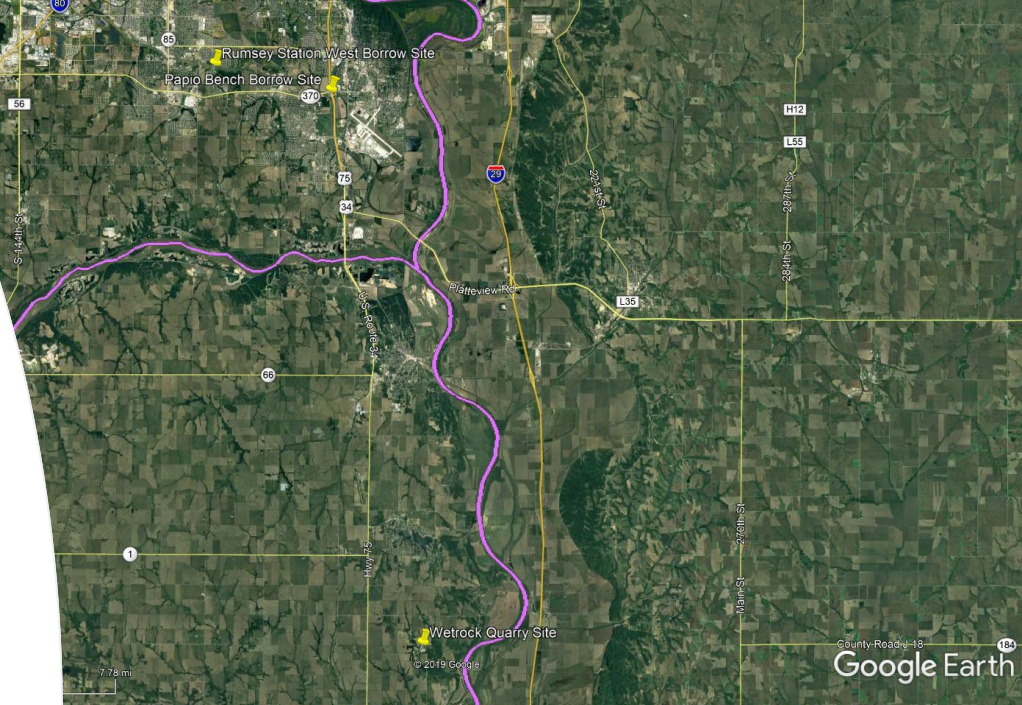


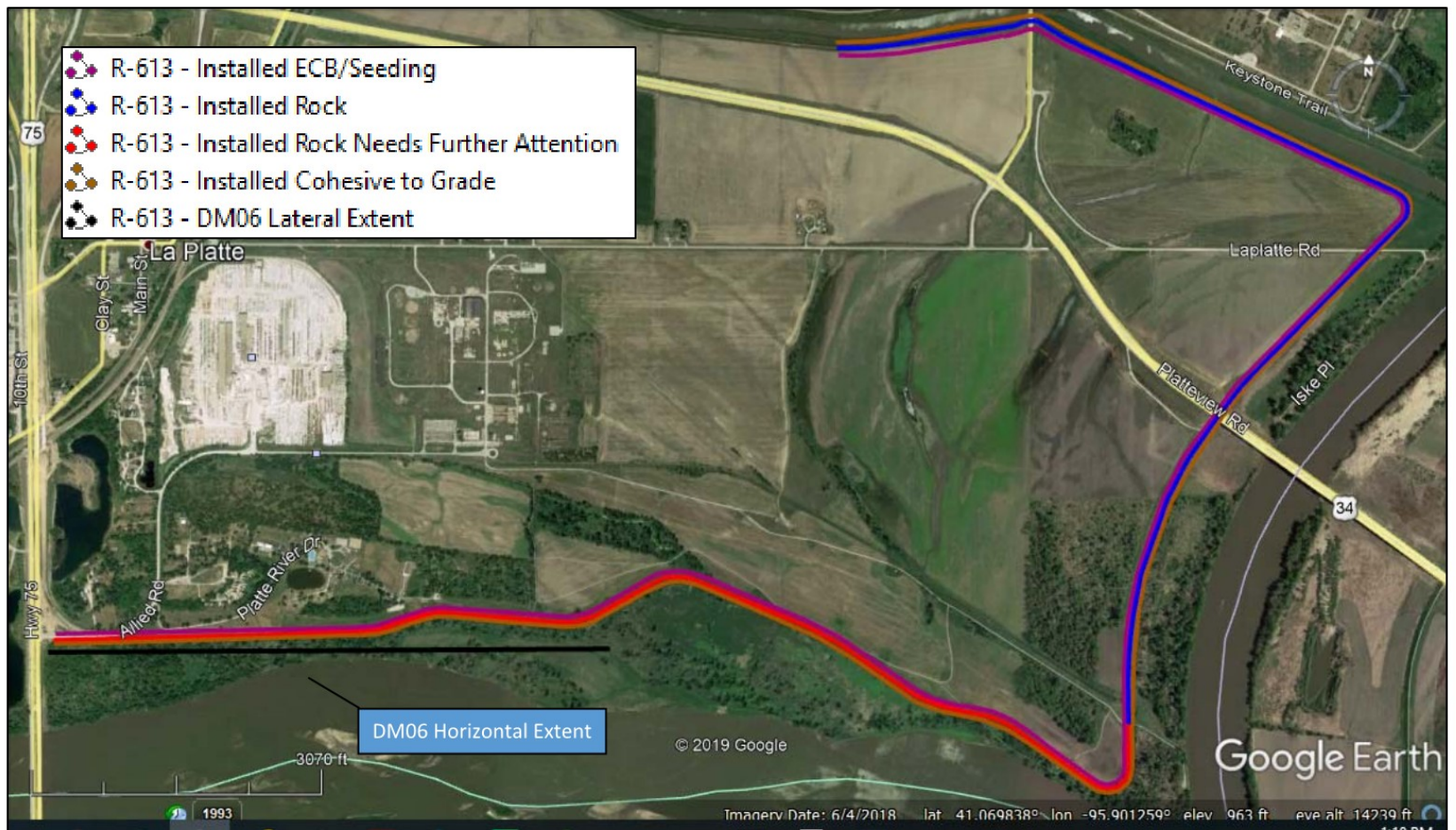
USACE Levee Repairs

Rebuild at or above pre-existing levee height

USACE Levee Repairs

- 3 Borrow Sites
 - Rumsey Station West Wetland Mitigation Area
 - Papio Creek Bench – S of Hwy 370
 - Wetrock Quarry – E of Murray, NE





R-613 Status Map as of 2/3/20

R-616 and R-613 Repaired by USACE Contractor, pending final rock placement and relief wells

NRD Levee Improvements

- Actually began work in Aug 2019
 - Began on Papio RB and working downstream
 - Now placing sand seepage berms
 - Pipe penetration rehabs before water rises again!
- Final completion is still June 2021 (but hasn't been adjusted following the flood)

R-616 Approximate Changes in Expected Annual Damages							
Index Location	Station	Scenario	LTR (50 yr)	Expected AEP from LTR (50 year)	Change in AEP	LSAC Event Damages	Change in EAD
RB - 616 - Missouri	RM 597.63	NoPrj	0.1169	0.0025	0.000045	\$ 98,400,000	\$ 4,500
		W/Prj	0.1189	0.0025			
LB - 613 - Papio	RAS 3000	NoPrj	0.5578	0.0162	-0.013162	\$ 98,400,000	\$ (1,295,100)
		W/Prj	0.1406	0.0030			
R-616 - Combined ¹		NoPrj	0.6095	0.0186	-0.013084	\$ 98,400,000	\$ (1,287,400)
		W/Prj	0.2428	0.0055			

R-613 Approximate Changes in Expected Annual Damages							
Index Location	Station	Scenario	LTR (50 yr)	Expected AEP from LTR (50 year)	Change in AEP	LSAC Event Damages	Change in EAD
RB - 613 - Missouri	RM 596.47	NoPrj	0.2985	0.0071	-0.004373	\$ 19,400,000	\$ (84,800)
		W/Prj	0.1261	0.0027			
RB - 613 - Papio	RAS 3000	NoPrj	0.5578	0.0162	-0.013162	\$ 19,400,000	\$ (255,300)
		W/Prj	0.1406	0.0030			
LB - 613 - Platte	RAS 13581	NoPrj	0.0734	0.0015	-0.001465	\$ 19,400,000	\$ (28,400)
		W/Prj	0.0029	0.0001			
R-613 Combined ²		NoPrj	0.7126	0.0246	-0.018859	\$ 19,400,000	\$ (365,900)
		W/Prj	0.2511	0.0058			

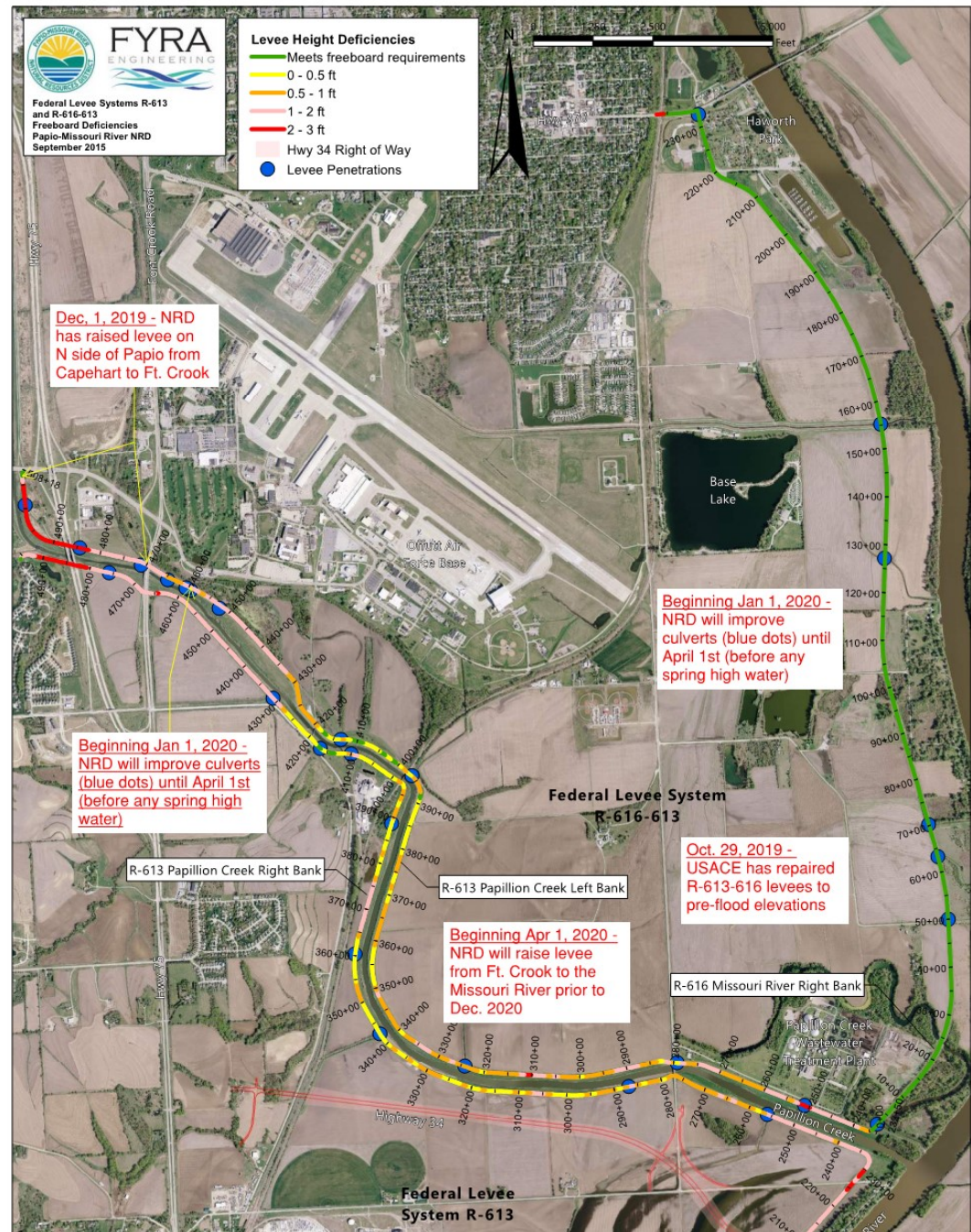
L-611-614 Approximate Changes in Expected Annual Damages							
Index Location	Station	Scenario	LTR (50 yr)	Expected AEP from LTR (50 year)	Change in AEP	LSAC Event Damages	Change in EAD
LB - 611/614	RM 596.87	NoPrj	0.1373	0.0029	0.0000347	\$ 46,100,000	\$ 1,600
		W/Prj	0.1388	0.0030			

1 - Combined Prob = LTR(MR) + LTR(Papio) - LTR(MR)*LTR(Papio)

2 - Combined Prob = LTR(MR) + LTR(Papio) + LTR(PR) - LTR(MR)*LTR(Papio) - LTR(MR)*LTR(PR) - LTR(PR)*LTR(Papio) + LTR(PR)*LTR(MR)*LTR(Papio)

Levee Improvement ~Schedule

- Winter work
 - Place sand seepage berms
 - Culvert Improvements before high water in spring
- Begin full levee raises in spring
- Work to finalize RR closure plans



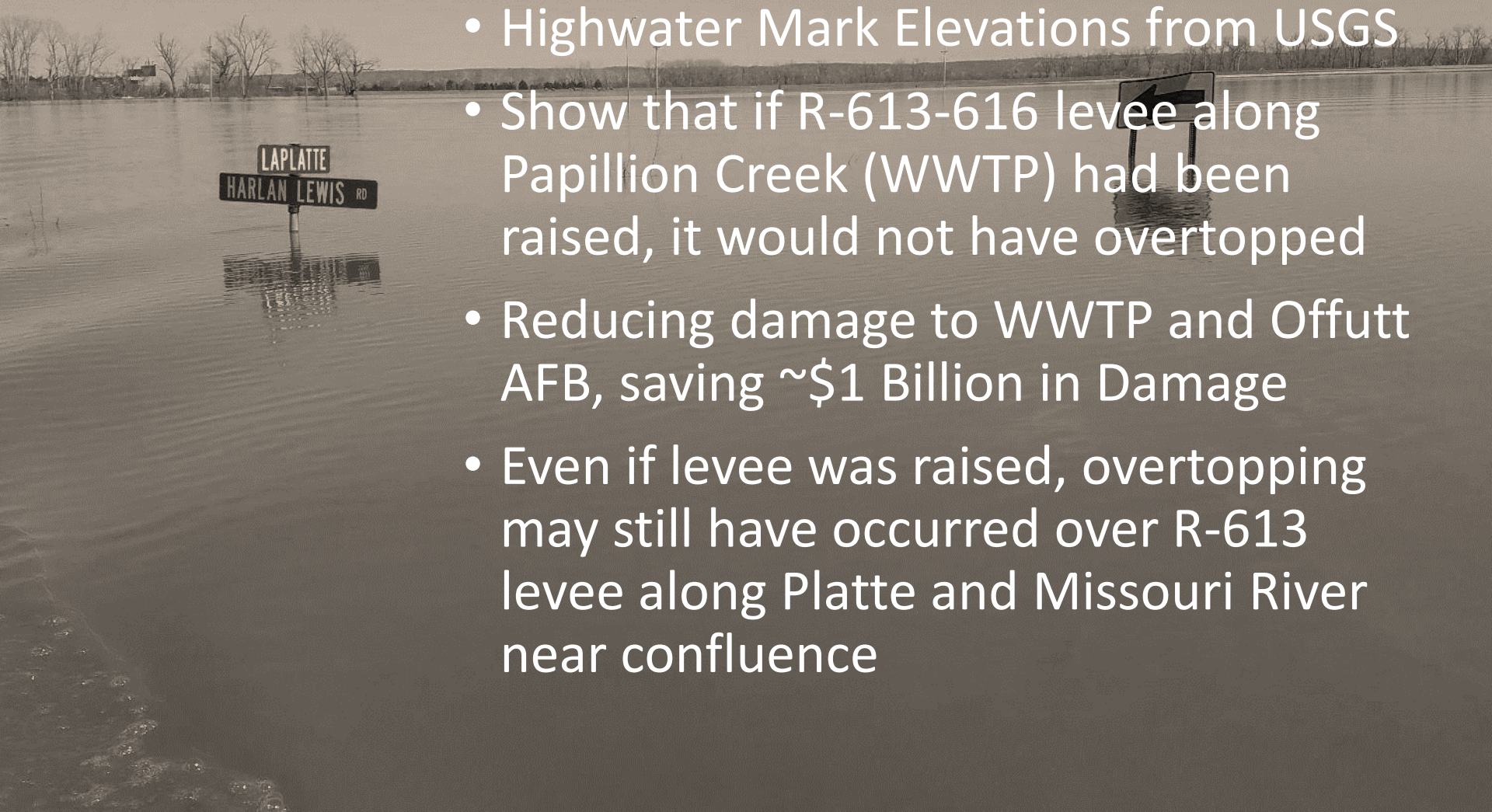


Levee
Raise

Sand Berm
Placement



NRD Levee Improvements vs. March 2019 Flood



- Highwater Mark Elevations from USGS
- Show that if R-613-616 levee along Papillion Creek (WWTP) had been raised, it would not have overtopped
- Reducing damage to WWTP and Offutt AFB, saving ~\$1 Billion in Damage
- Even if levee was raised, overtopping may still have occurred over R-613 levee along Platte and Missouri River near confluence

Questions???

Levee Presentation Webmap