

2019 Mississippi River Flood

Joey Windham, P.E., D. WRE

Chief, Watershed Division
Regional Business Directorate
Mississippi Valley Division
11 DEC 2019



US Army Corps
of Engineers®

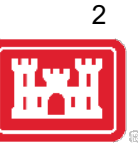


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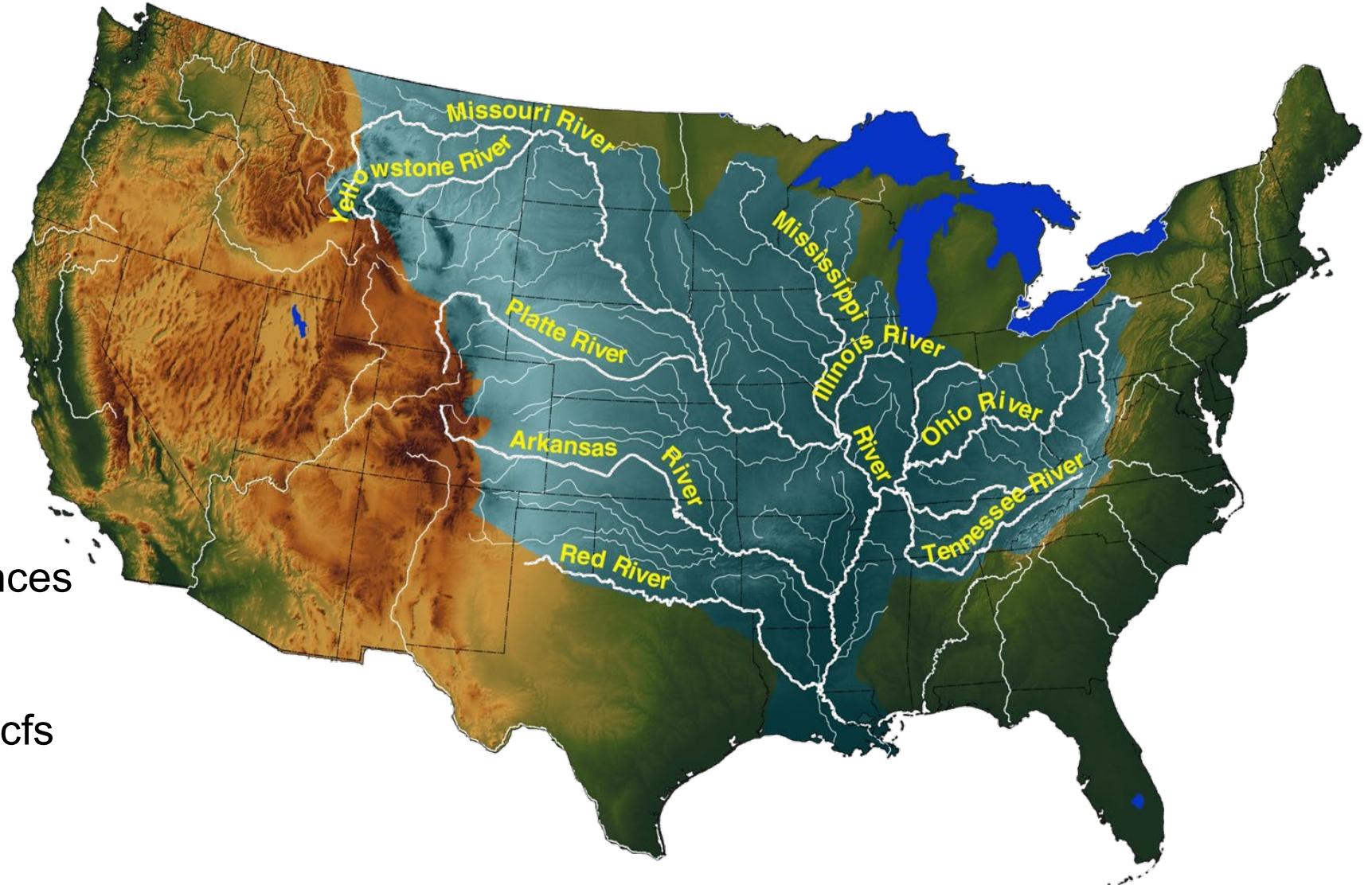




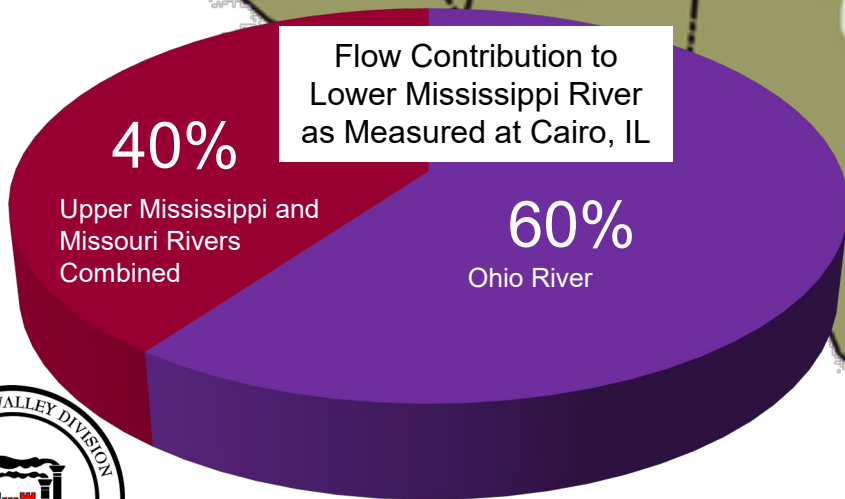
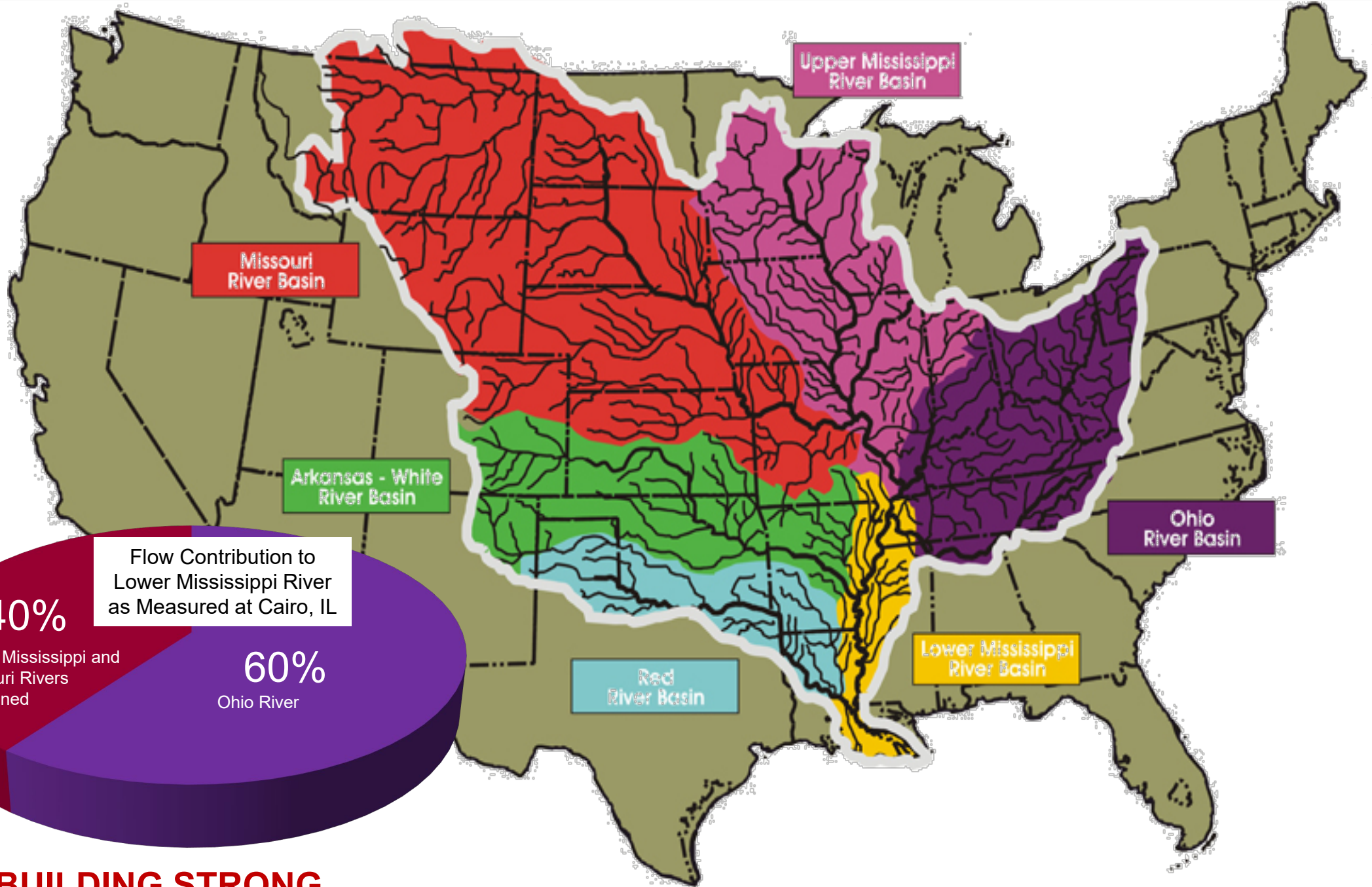
Mississippi River Watershed



- 1,250,000 square miles
- 41% of the U.S.
- 31 states, 2 Canadian provinces
- 4 Corps Divisions
- Average flow = 640,000 cfs
- 2011 peak flow = 2.3 million cfs

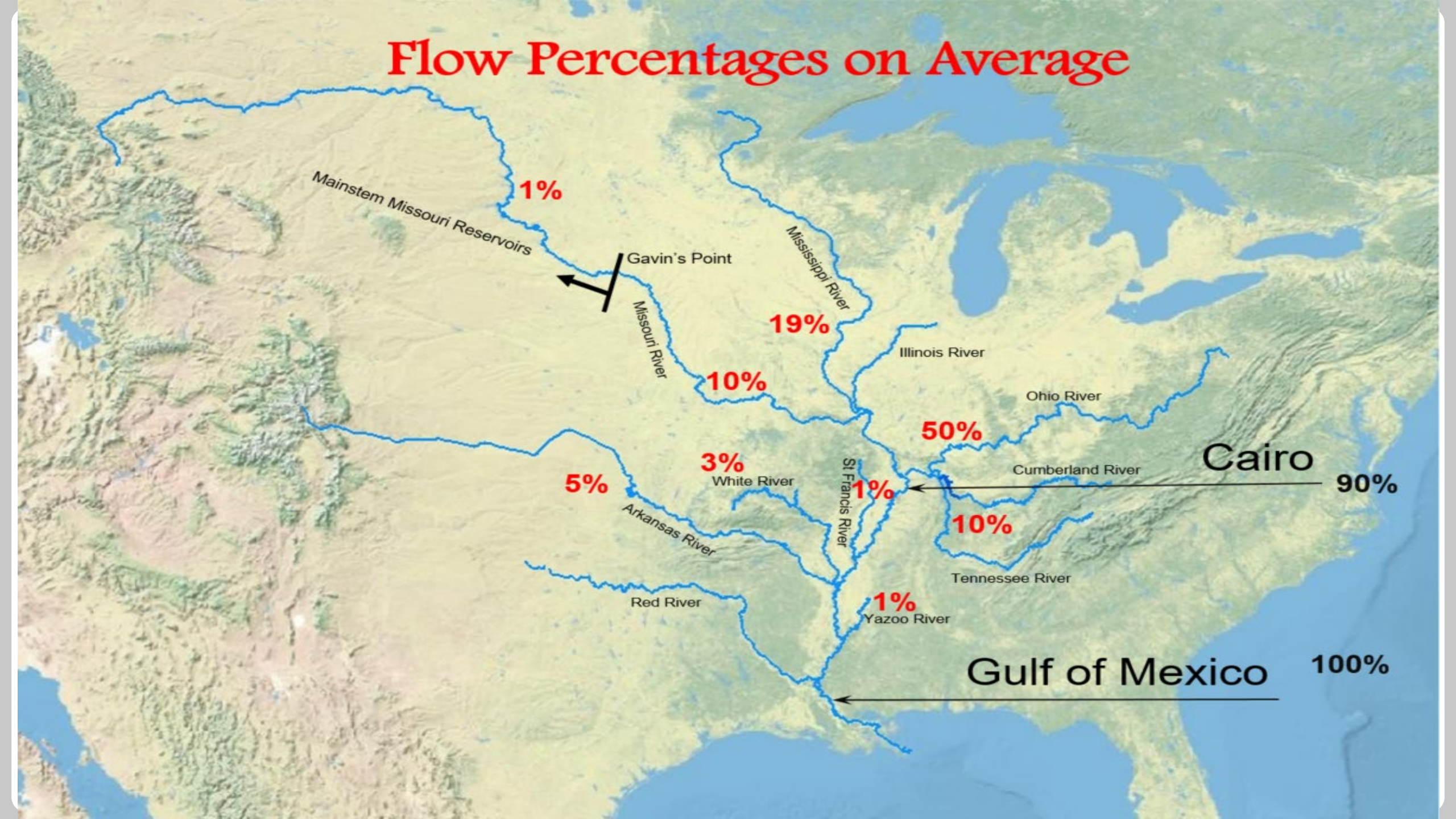


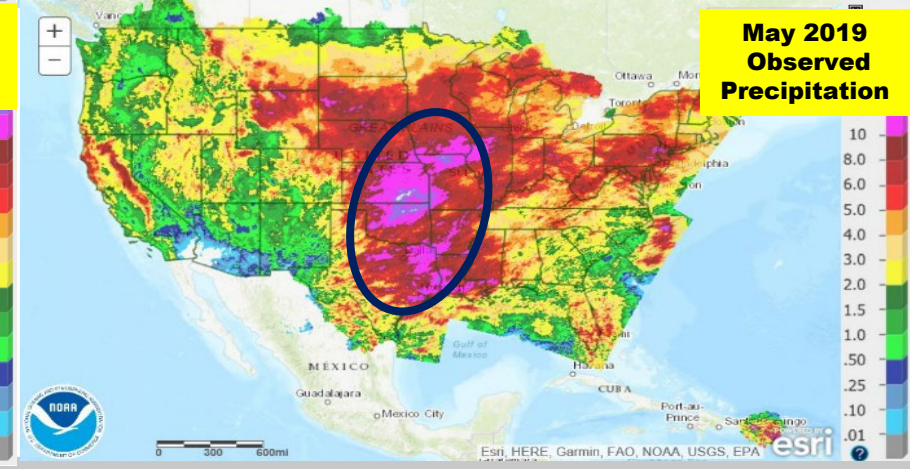
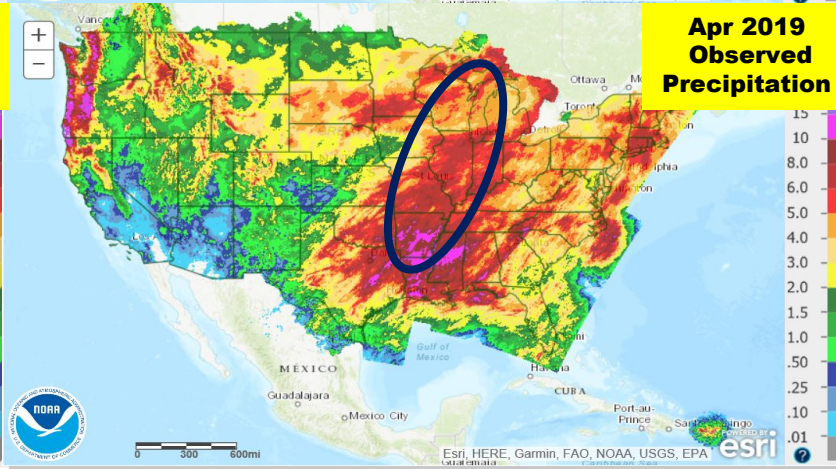
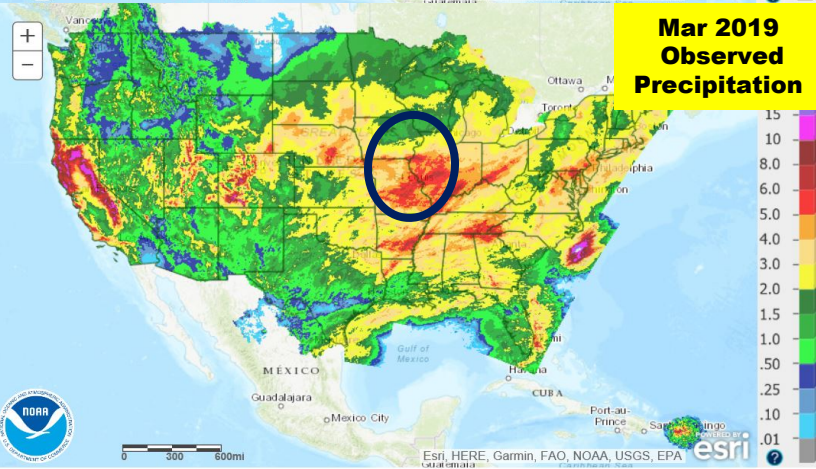
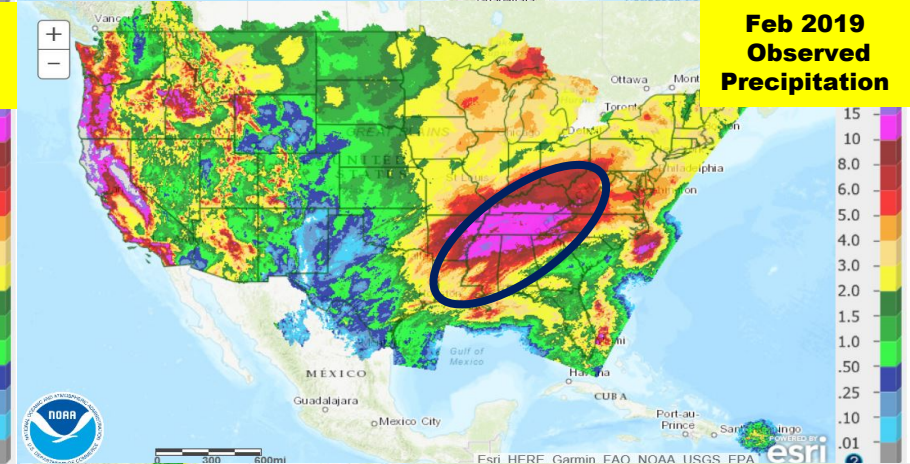
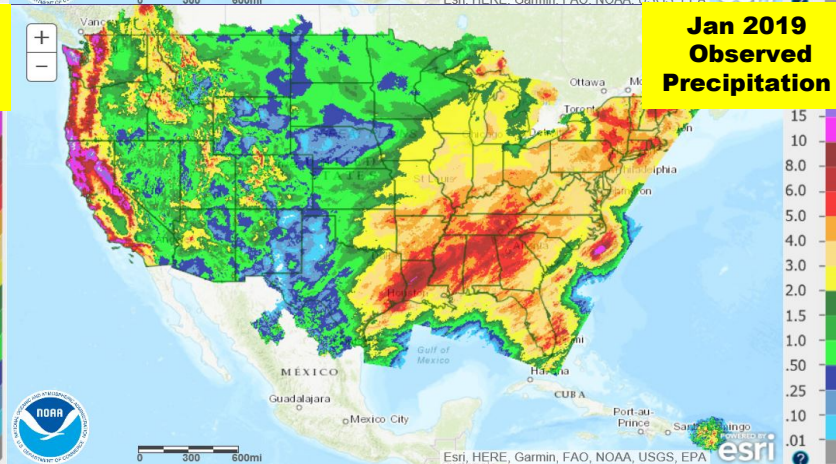
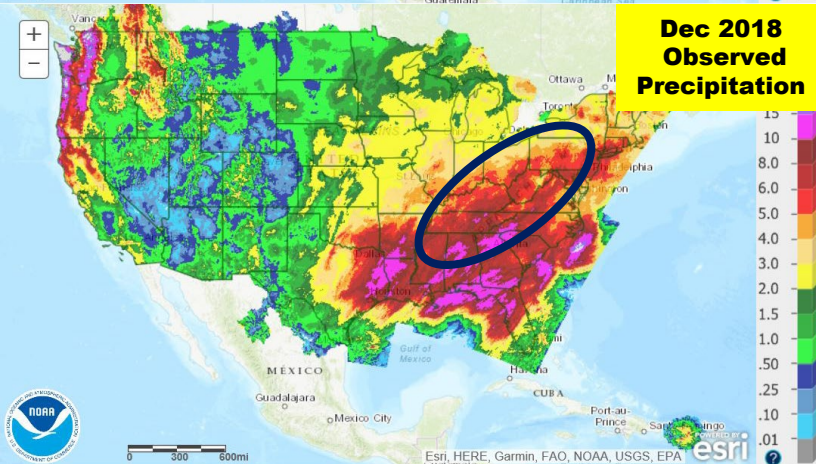
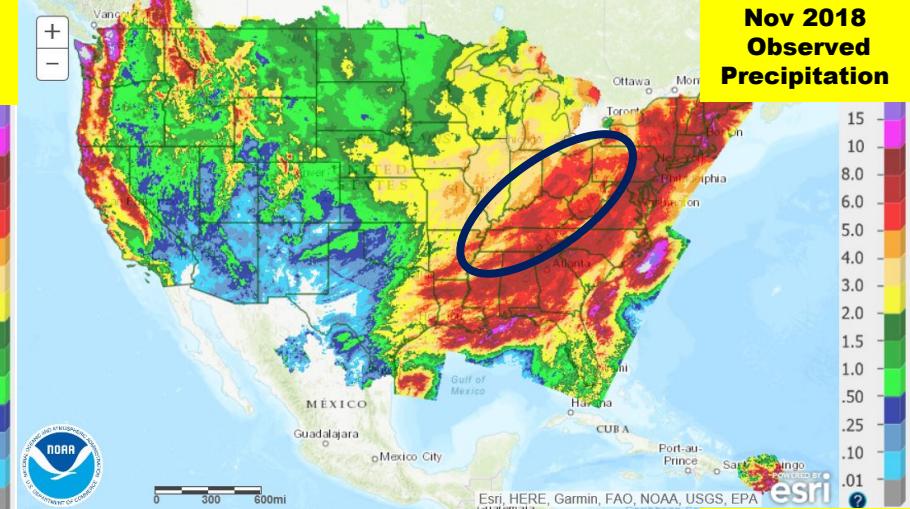
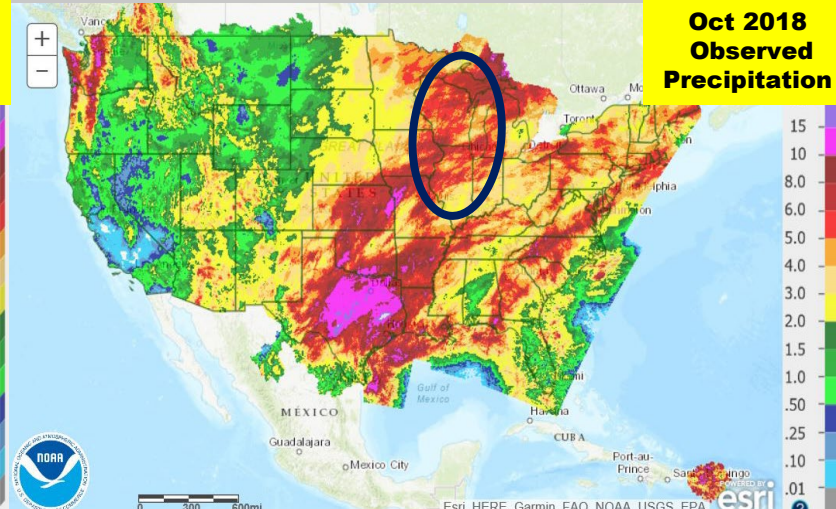
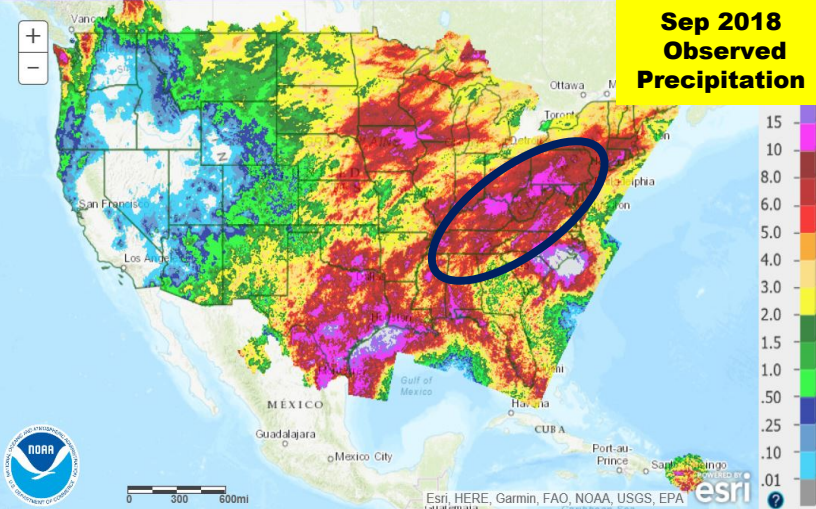
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Flow Percentages on Average





Departure From Normal Water Year To June



Basemap

Reset View



Inches

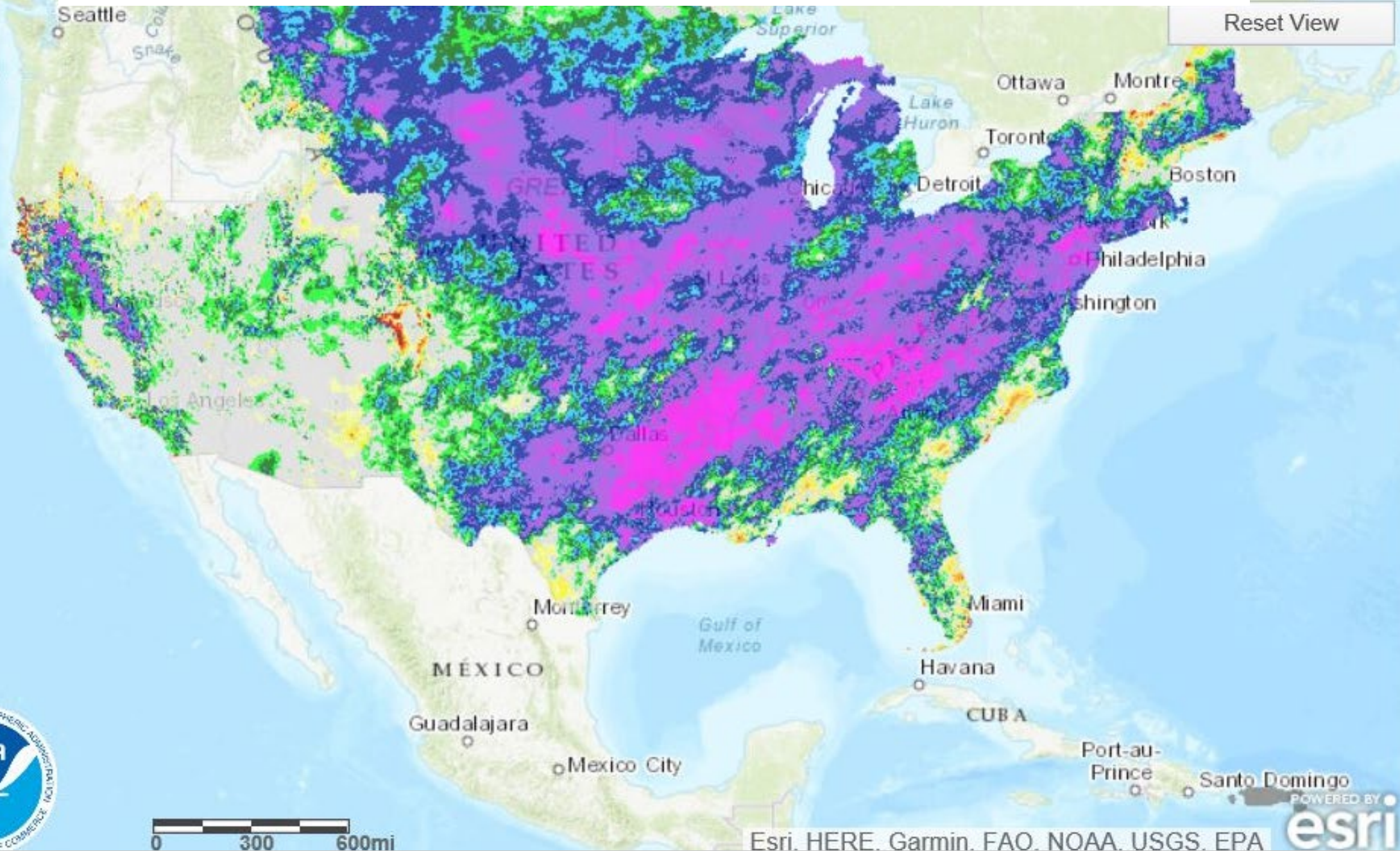
20
16
12
8
6
4
2
-2
-4
-6
-8
-12
-16
-20



0 300 600mi

Esri, HERE, Garmin, FAO, NOAA, USGS, EPA

POWERED BY
esri

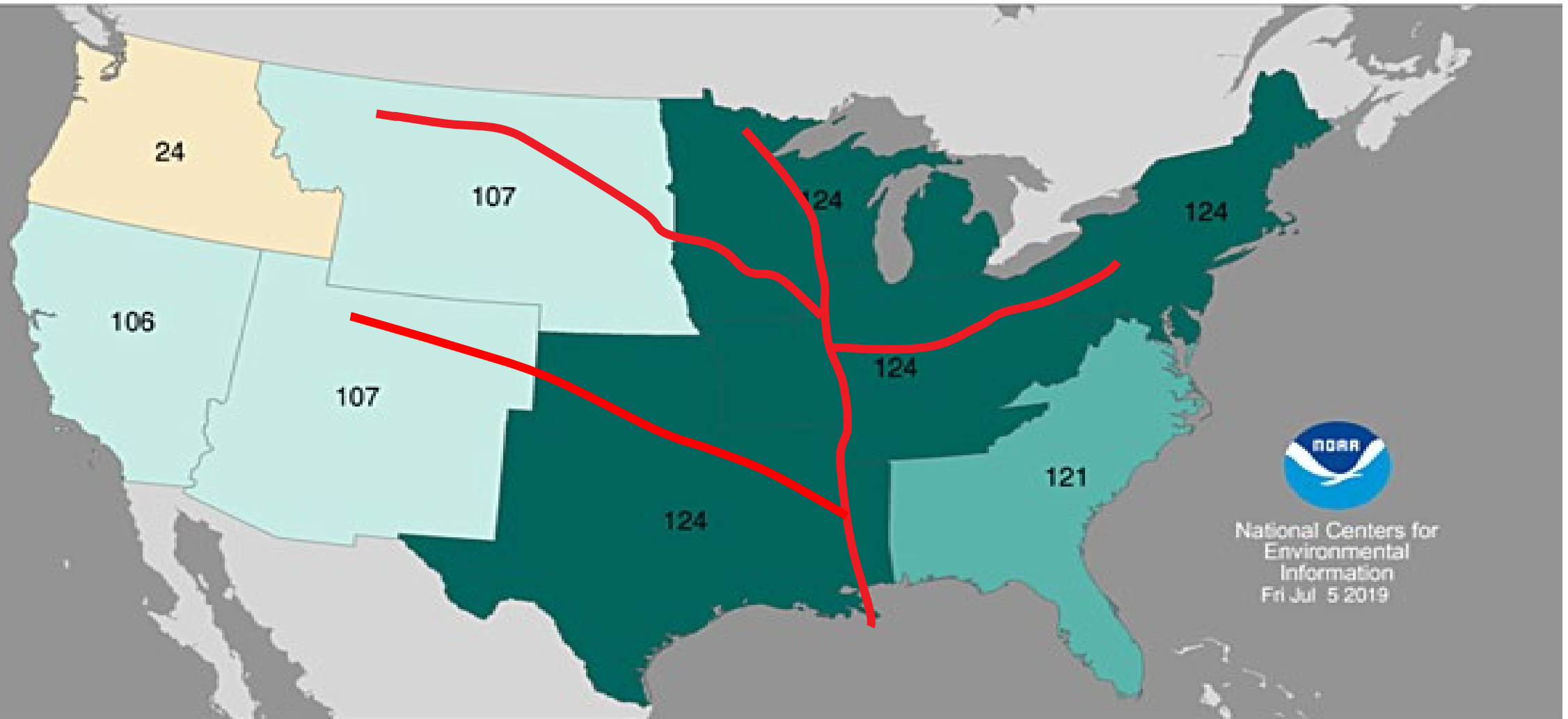


Regional Precipitation Ranks

July 2018–June 2019

Period: 1895–2019

®



Record
Driest
(1)

Much
Below
Average

Below
Average

Near
Average

Above
Average

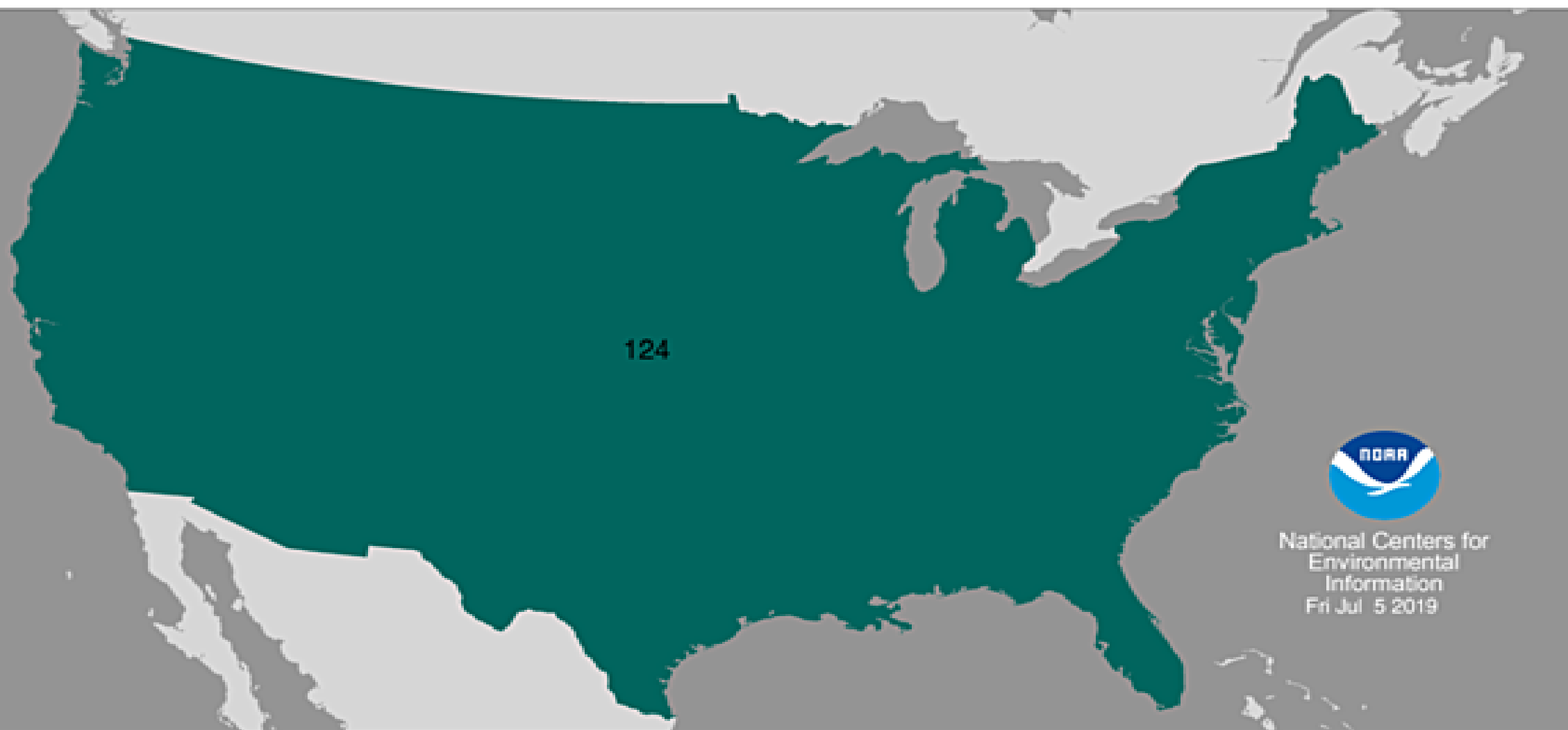
Much
Above
Average

Record
Wettest
(124)

National Precipitation Rank

July 2018–June 2019

Period: 1895–2019



National Centers for
Environmental
Information
Fri Jul 5 2019

Record
Driest
(1)

Much
Below
Average

Below
Average

Near
Average

Above
Average

Much
Above
Average

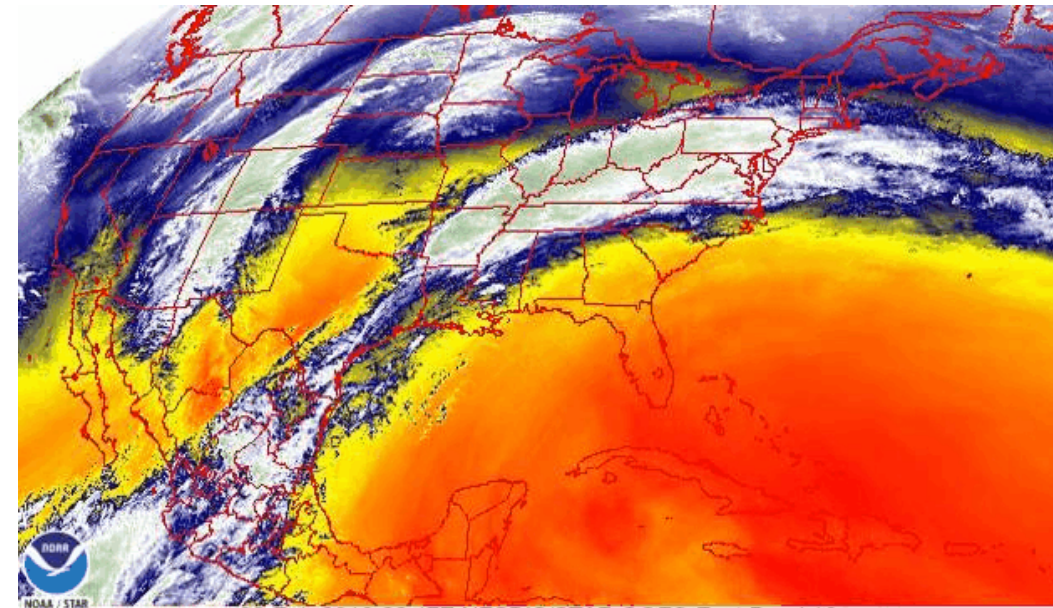
Record
Wettest
(124)



4 High Water Events



- Sep~Jan – Above normal rainfall over the entire watershed
- Feb~Mar – Heavy rains over the Ohio River and Tennessee/Cumberland
- May – Snow melt and heavy rains over the Missouri and Upper Mississippi Valleys
- June – Heavy rains over the Missouri and Upper Mississippi and Arkansas



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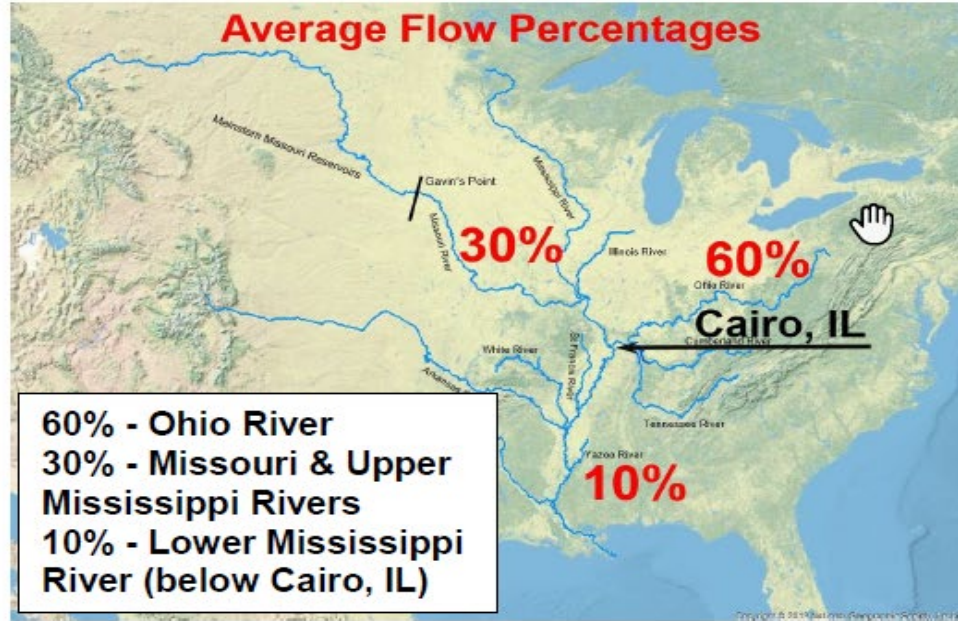


Mississippi River Watershed Flow Percentages

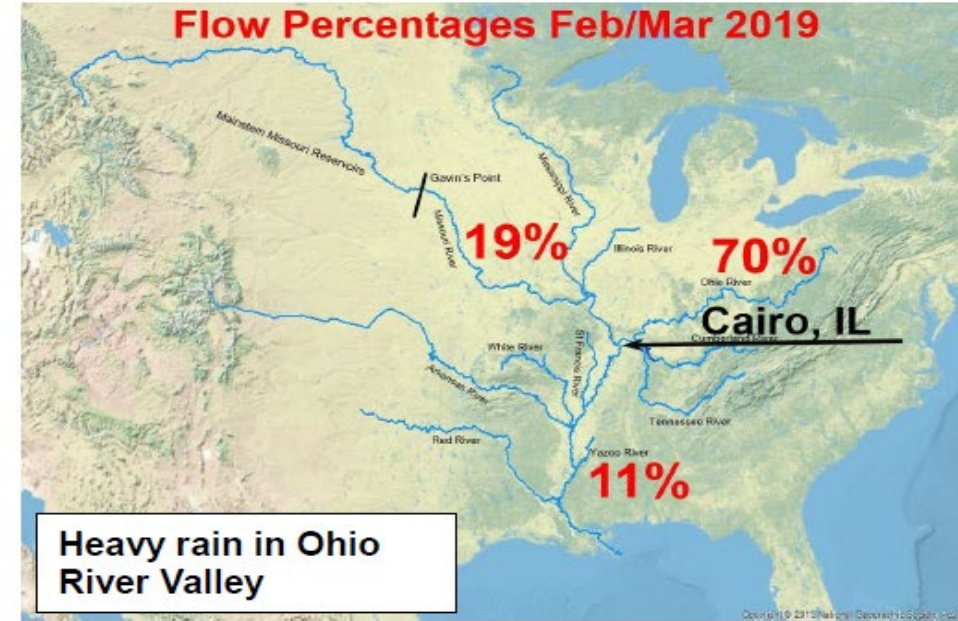
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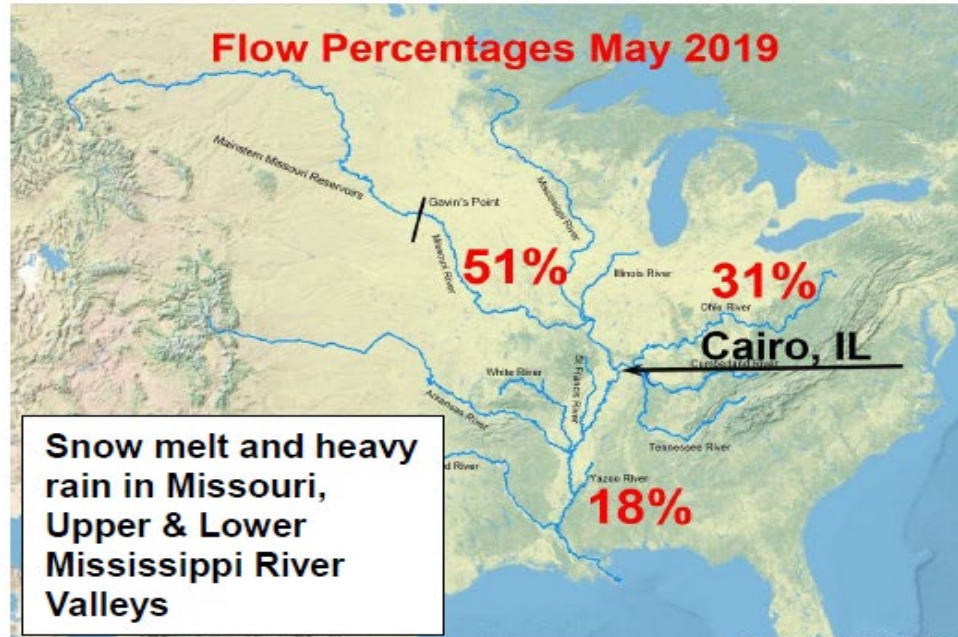
Average Flow Percentages



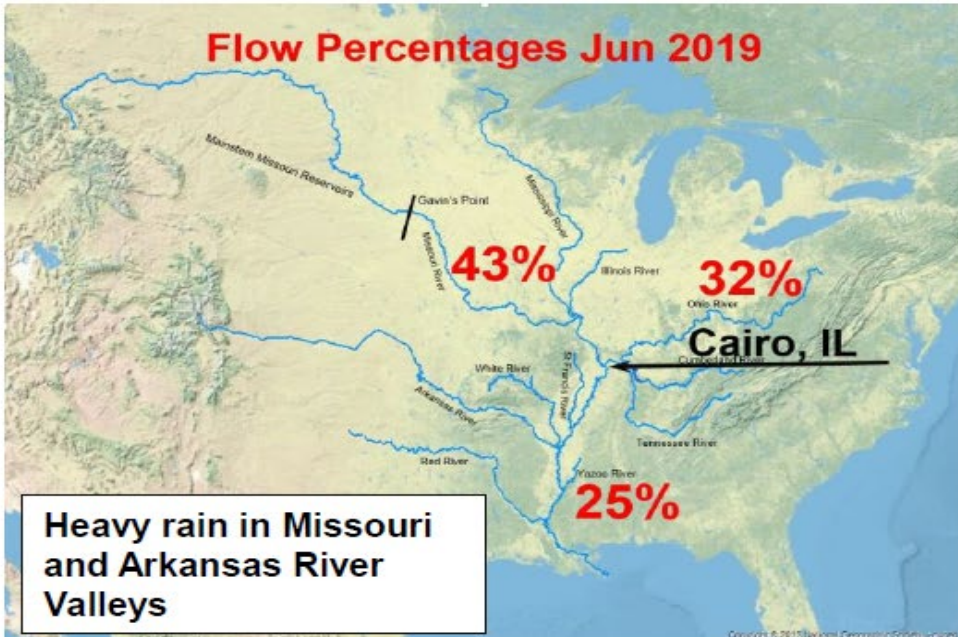
Flow Percentages Feb/Mar 2019



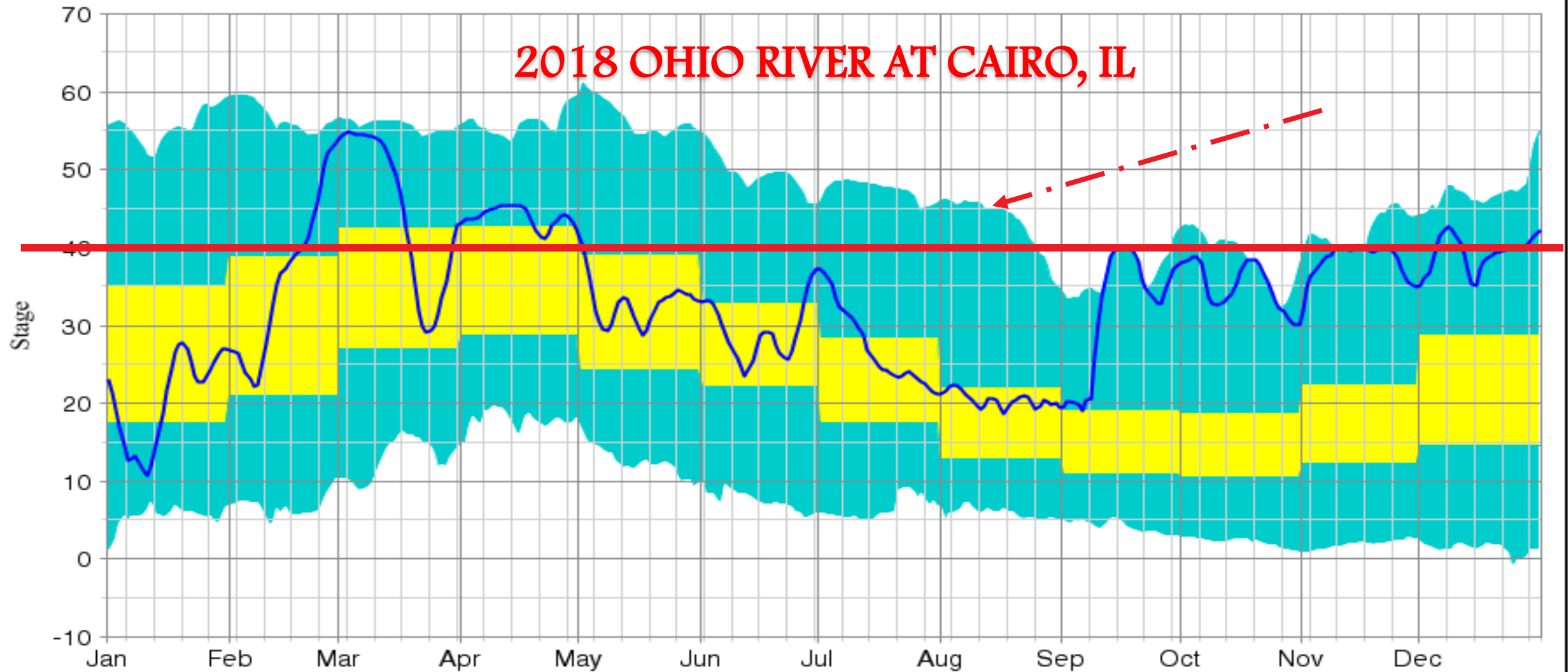
Flow Percentages May 2019



Flow Percentages Jun 2019



2018 OHIO RIVER AT CAIRO, IL



Maximum Limit



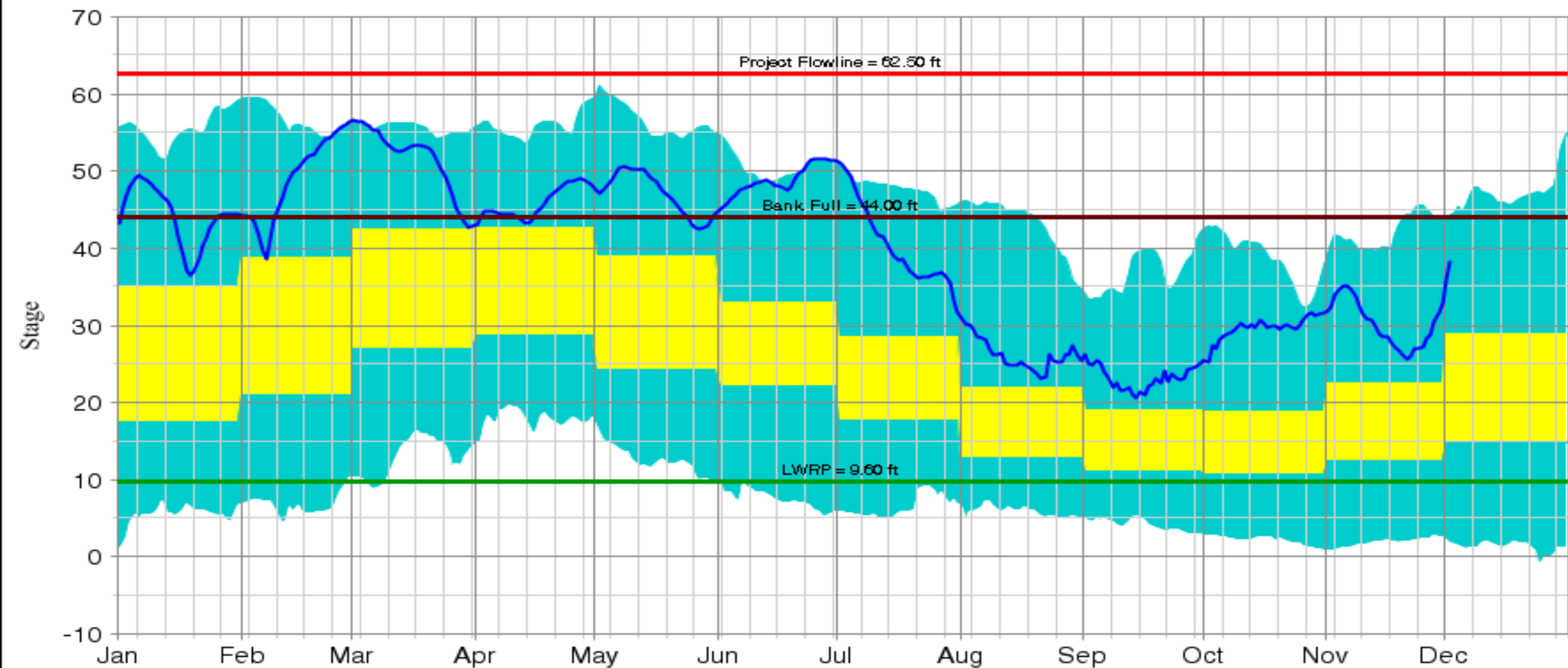
Maximum Monthly Mean
Grouped by Year
Minimum Monthly Mean
Grouped by Year

Minimum Limit

STATISTICAL RECORD: 1858 - 2019

Time

— 2018



Maximum Limit



Maximum Monthly Mean
Grouped by Year

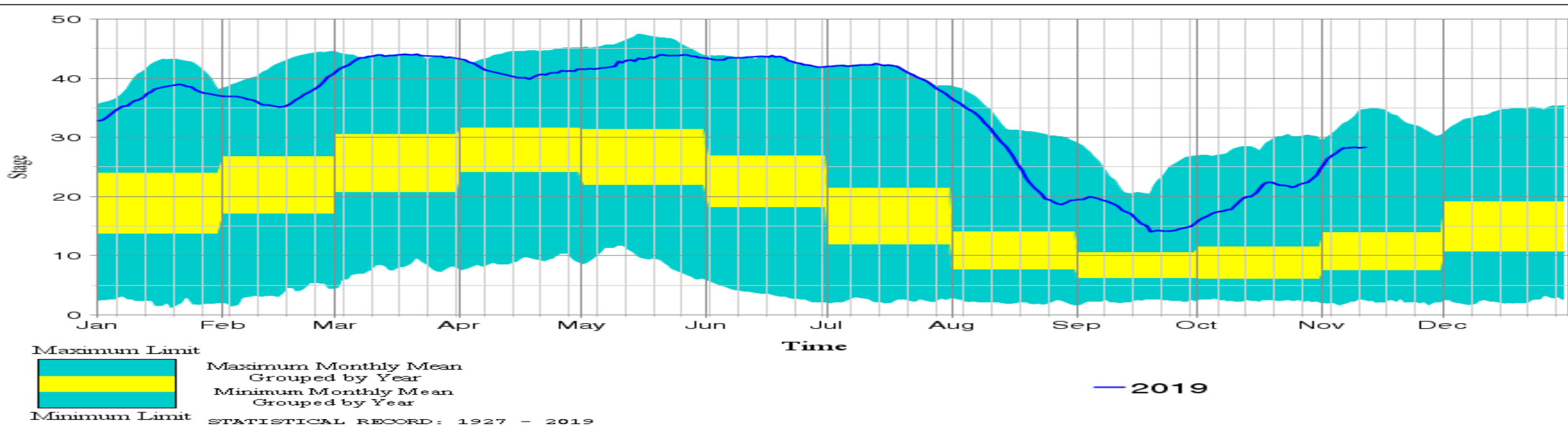
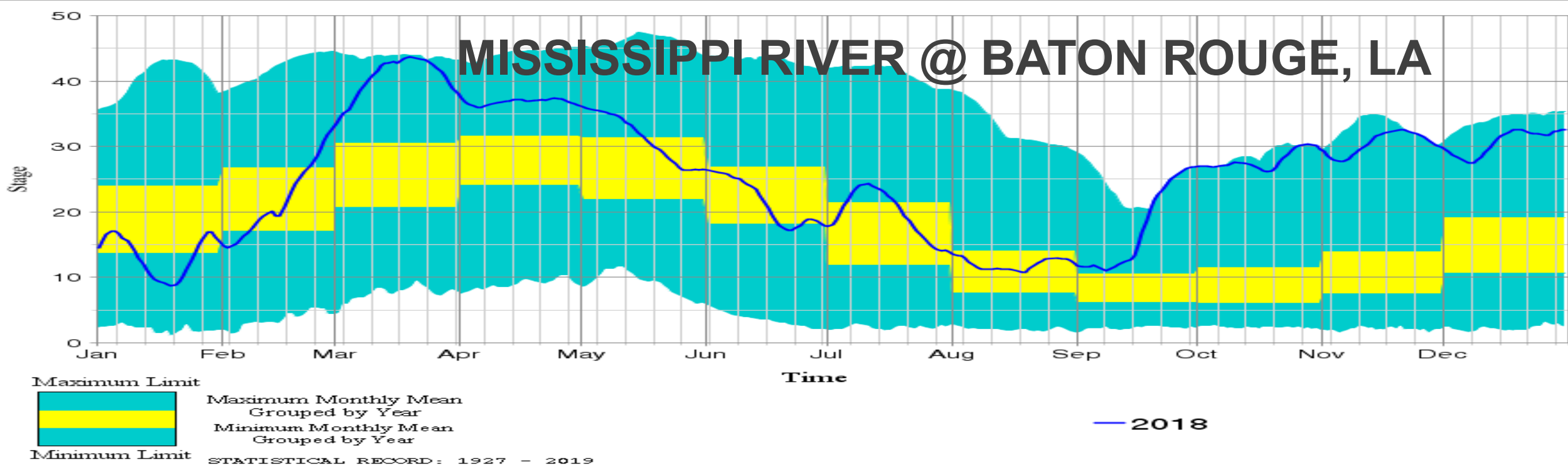
Minimum Monthly Mean
Grouped by Year

Minimum Limit

STATISTICAL RECORD: 1858 - 2019

— 2019

MISSISSIPPI RIVER @ BATON ROUGE, LA





MISSOURI RIVER & TRIBUTARIES



IMPACTS

- 1.4+ million acres flooded
- 5,000+ structures inundated
- Significant trafficability issues in the Missouri River floodplain (I-29, state and local highways)

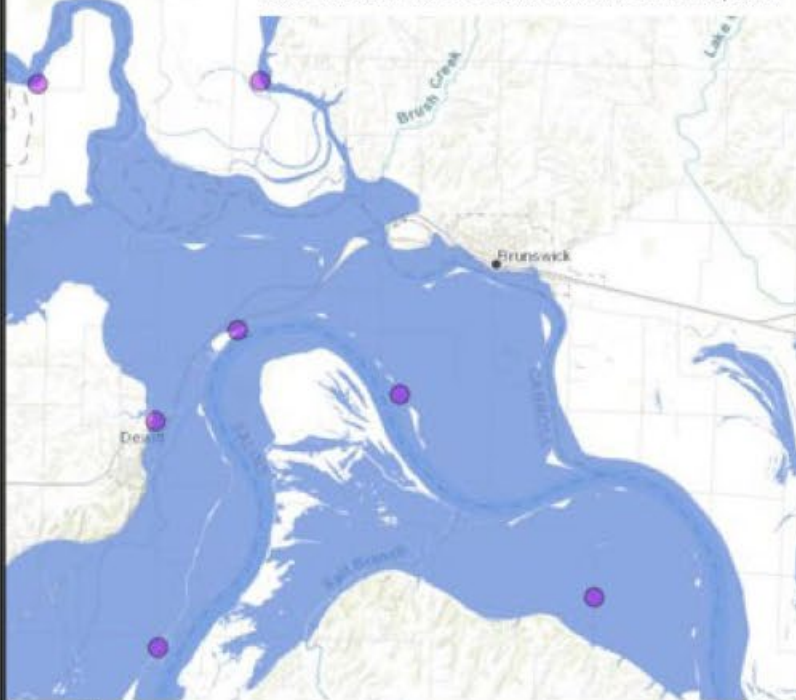
LEVEES OVERTOPPED/BREACHED

- 17 Federal Constructed/Sponsor Maintained
PL 84-99 Status: 12 Active; 5 Inactive
- 53 Non-Federal Constructed/Sponsor Maintained
PL 84-99 Status: 53 Active
- 9 Private Levees
PL 84-99 Status: Not in program

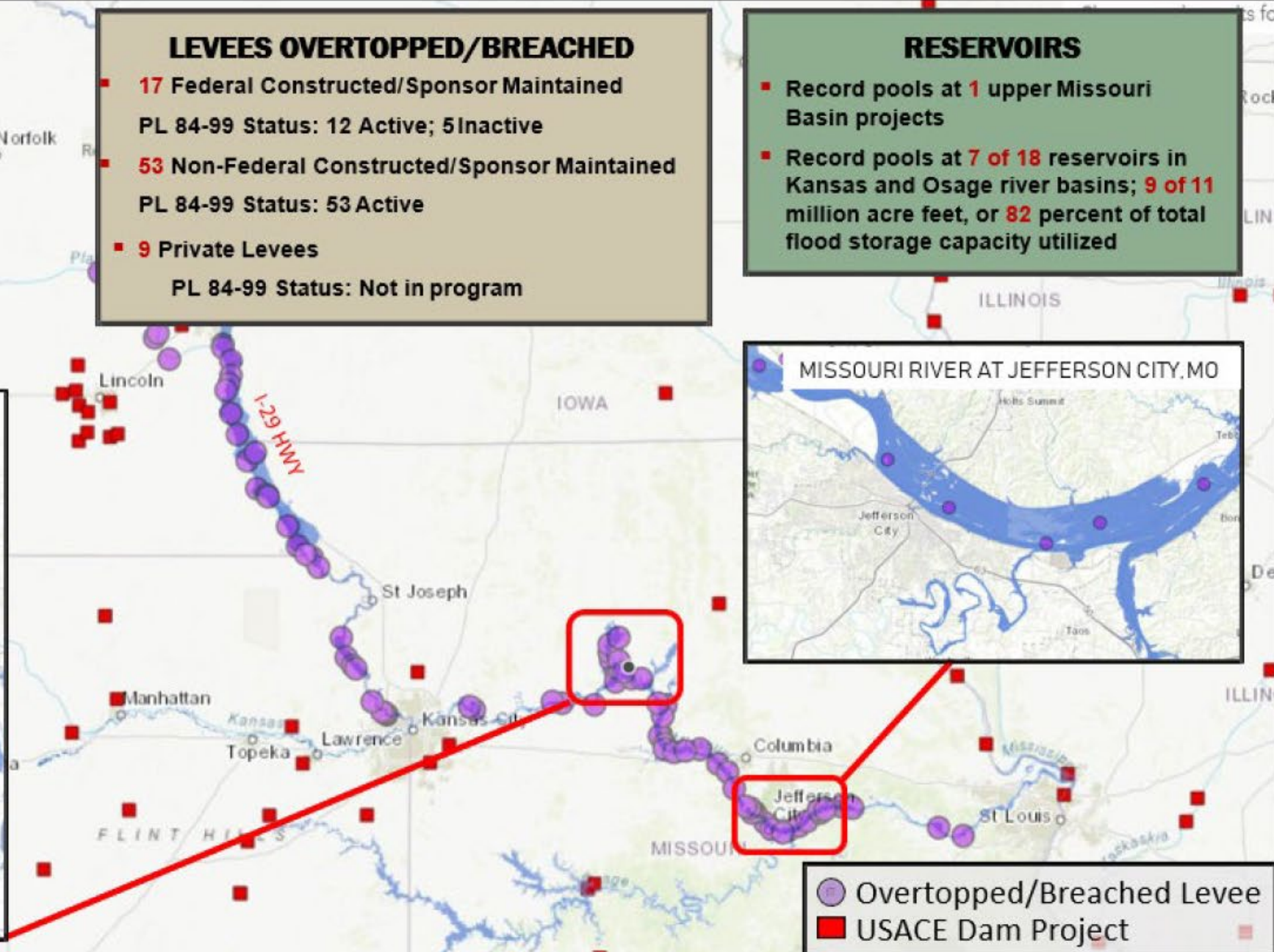
RESERVOIRS

- Record pools at 1 upper Missouri Basin projects
- Record pools at 7 of 18 reservoirs in Kansas and Osage river basins; 9 of 11 million acre feet, or 82 percent of total flood storage capacity utilized

MISSOURI RIVER AT BRUNSWICK, MO



MISSOURI RIVER AT JEFFERSON CITY, MO





UPPER MISSISSIPPI RIVER



IMPACTS

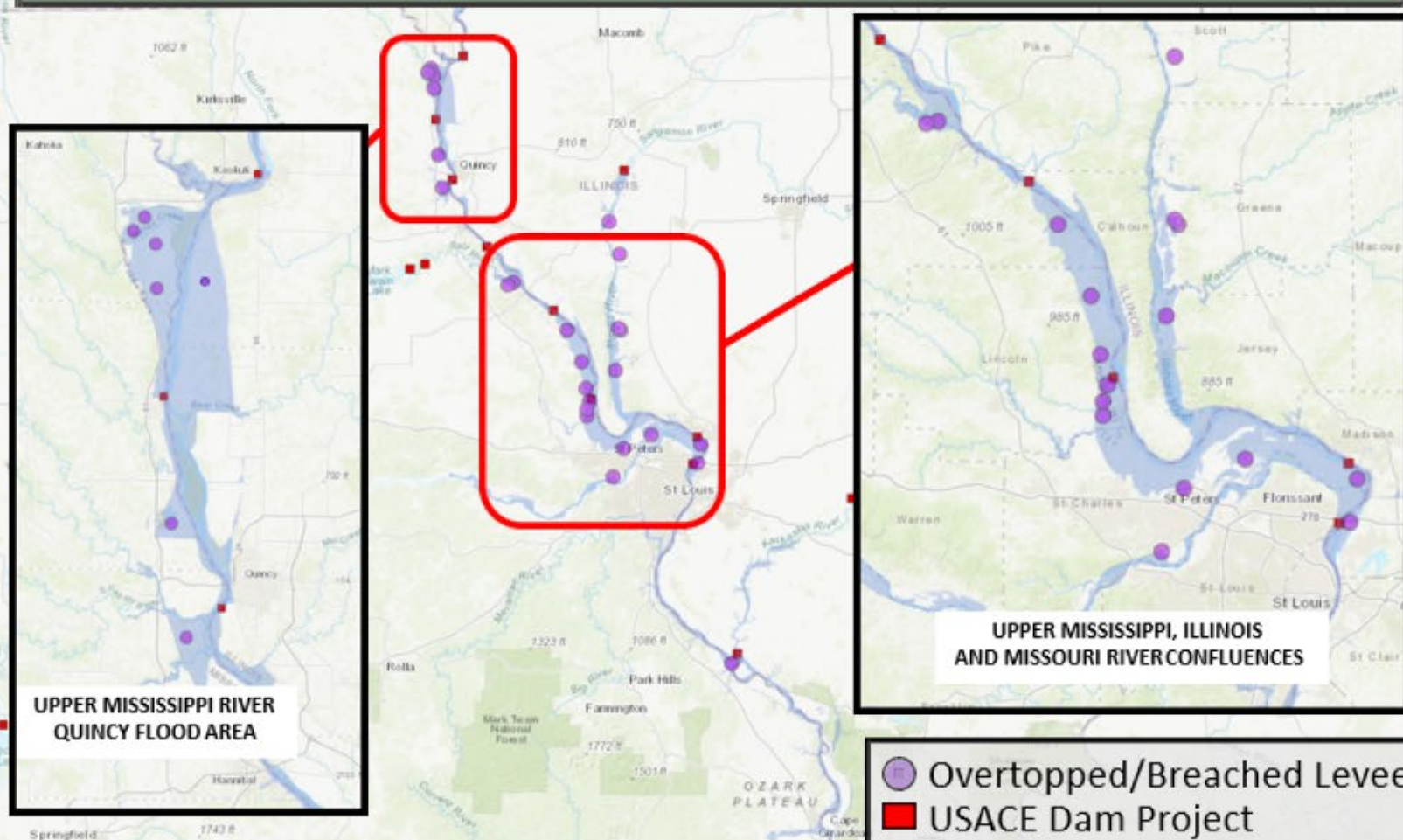
- **682,000** acres flooded
295,000 ACRES Agricultural
- **8,000+** structures inundated
- Overtopping/breach of temporary protective measures (HESCO) in Davenport, IA, and Burlington, IA, flooding downtown businesses, bridge access, and major transportation routes.
- Record crest in Rock Island, IL
- **2nd** highest crest from Quincy, IL, to Chester, IL

LEVEES OVERTOPPED/BREACHED

- **6** Federal Constructed/Sponsor Maintained
PL 84-99 Status: 5 Active, 1 Inactive
- **16** Non-Federal Constructed/Sponsor Maintained
PL 84-99 Status: 13 Active, 3 Inactive
- **2** Private Levees
PL 84-99 Status: Not in program

RESERVOIRS (Peak Inflow, Peak Outflow & Percent Reduction):

- | | |
|--|---|
| ■ Lake Red Rock – 97,000 CFS, 43,000 CFS, 56% | ■ Lake Shelbyville 5,600 CFS, 900 CFS, 84% |
| ■ Saylorville Lake – 44,000 CFS, 20,000 CFS, 55% | ■ Carlyle Lake – 22,000 CFS, 5,000 CFS, 77% |
| ■ Coralville Lake – 30,000 CFS, 10,000 CFS, 67% | ■ Rend Lake – 7,300 CFS, 3,000 CFS, 59% |
| ■ Mark Twain Lake– 35,000 CFS, 12,000 CFS, 66% | |





ILLINOIS RIVER

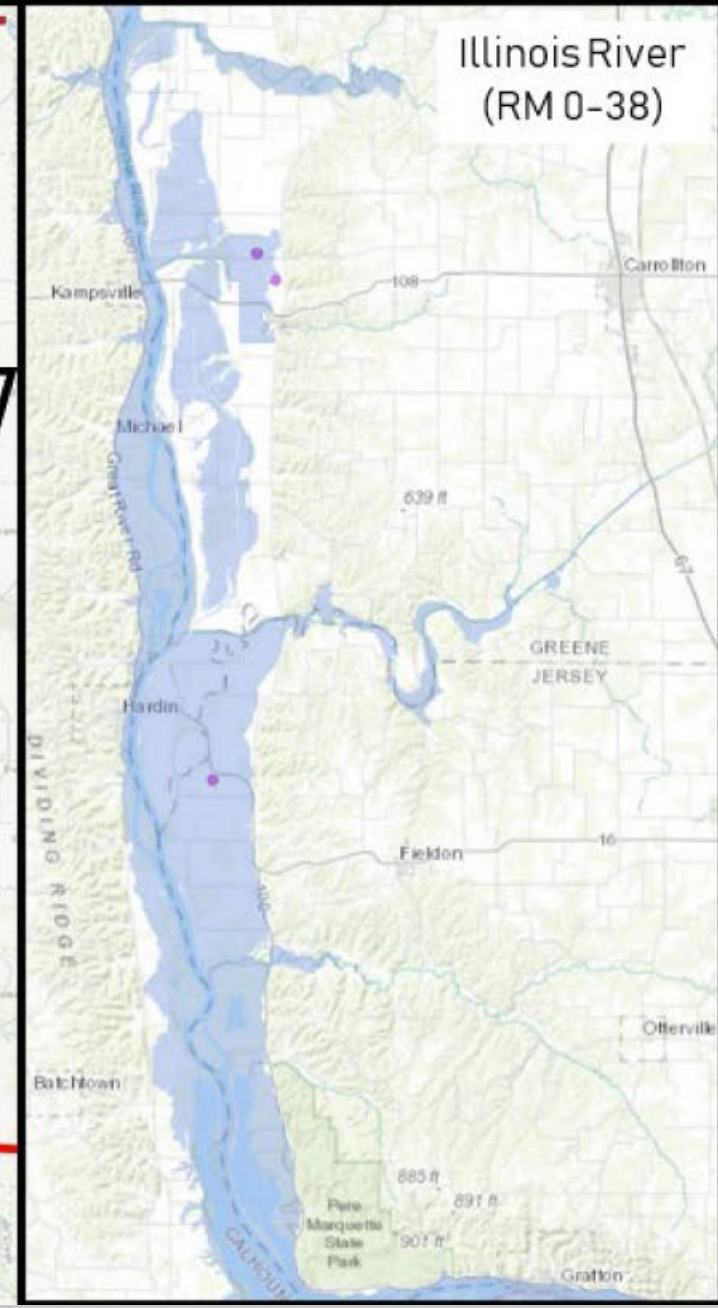
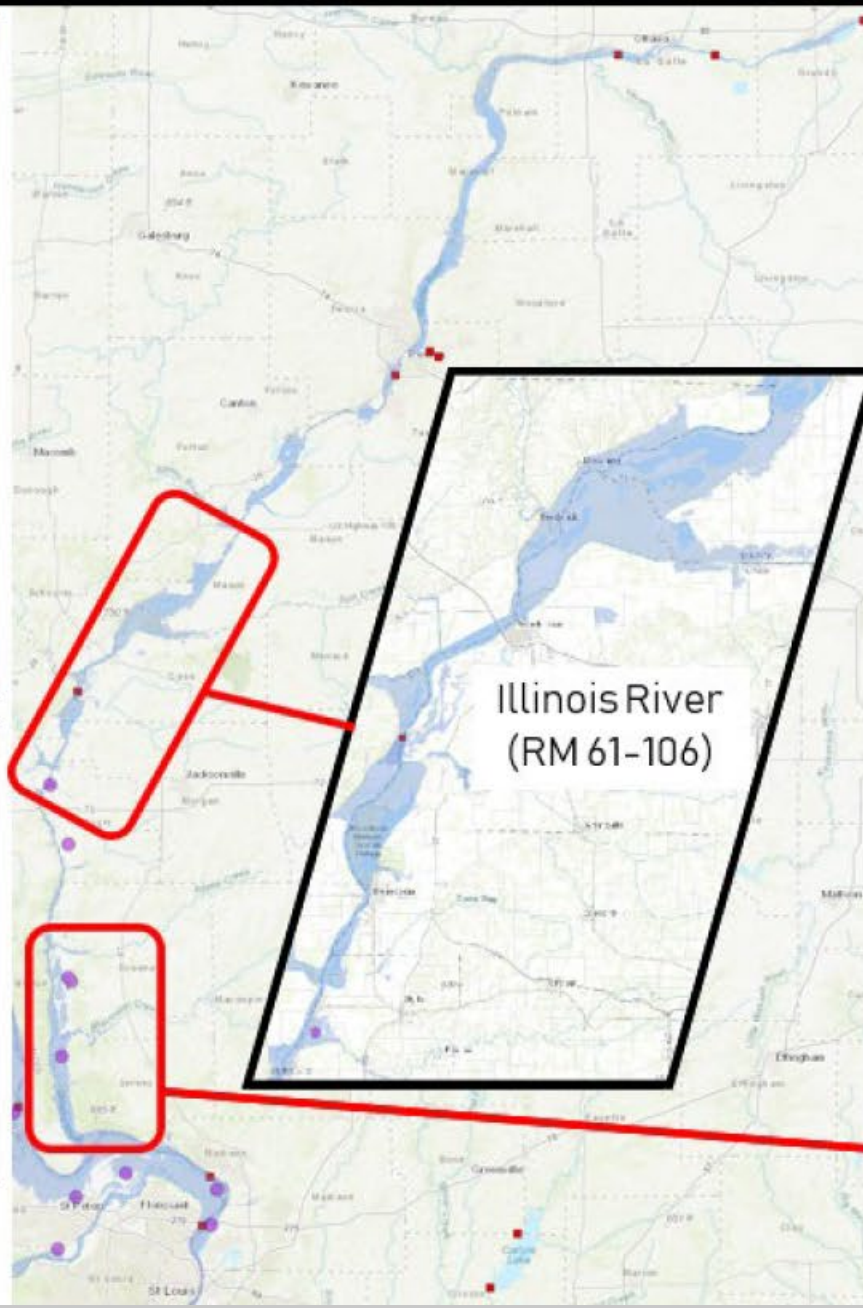


IMPACTS

- **190,000** acres flooded
- **1,082+** structures inundated
- Hardin isolated (5 hour drive) for at least a month until lower Illinois River recedes due to Nutwood levee overtopping/breach
- Un-leveed communities of Hardin, Kampsville, Pearl, and Florence are partially to fully inundated
- **2nd** highest crest at Valley City and Hardin
- Navigation on the Illinois is projected to be closed for **3** weeks

LEVEES OVERTOPPED/BREACHED

- **4** Federal Constructed/Sponsor Maintained
PL 84-99 Status: 4 Active
- **2** Non-Federal Constructed/Sponsor Maintained
PL 84-99 Status: 2 Active
- **1** Private Levee
PL 84-99 Status: Not in program





ARKANSAS RIVER BASIN



LEVEES OVERTOPPED/BREACHED

LITTLE ROCK

- 2 Federal Constructed/Sponsor Maintained
PL 84-99 Status: 1 Active, 1 Inactive
- 1 Non-Federal Constructed/Sponsor Maintained
PL 84-99 Status: 1 Inactive

TULSA

- Federal assistance prevented breaches in Coffeyville, KS and Tulsa, OK

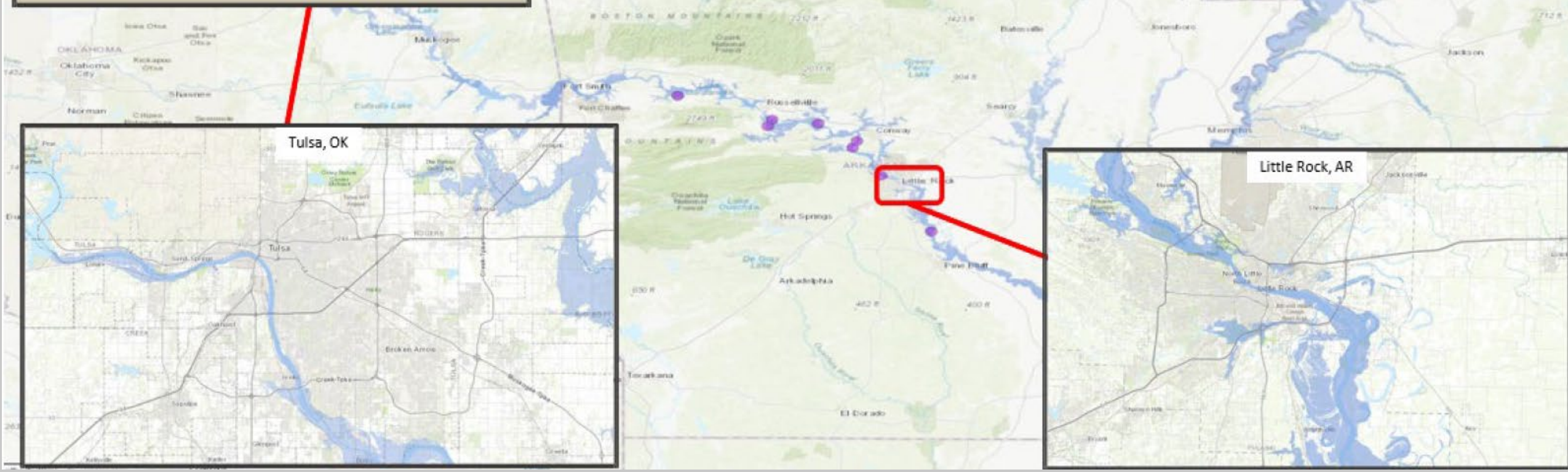
IMPACTS

- 1.1+ million acres flooded
- 3,748 structures inundated
- 4 gages on the Little Rock portion of Arkansas River set all-time records
- Enough flow has passed the Arkansas River at Dardanelle gage to flood the state of Arkansas 6 inches deep

RESERVOIRS

TULSA

- 105 percent storage used in Tulsa system-wide
- 19 spillways activated
- 11 pools of record set
- Total combined release exceeded 500,000 cfs





YAZOO RIVER BASIN

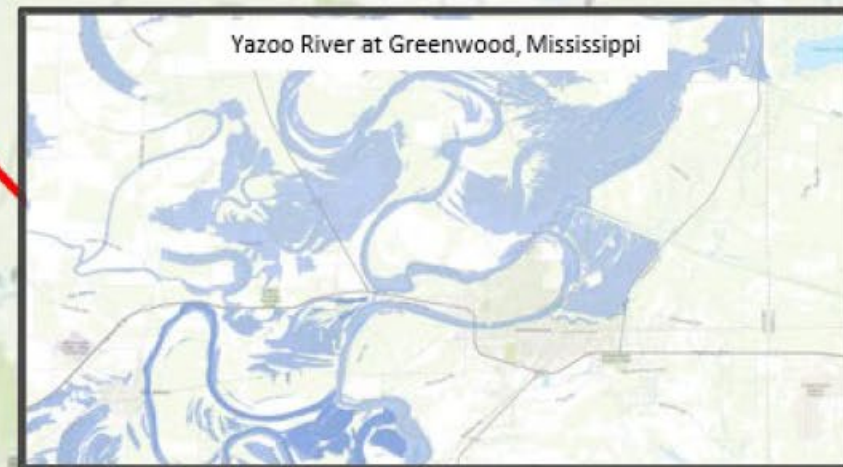
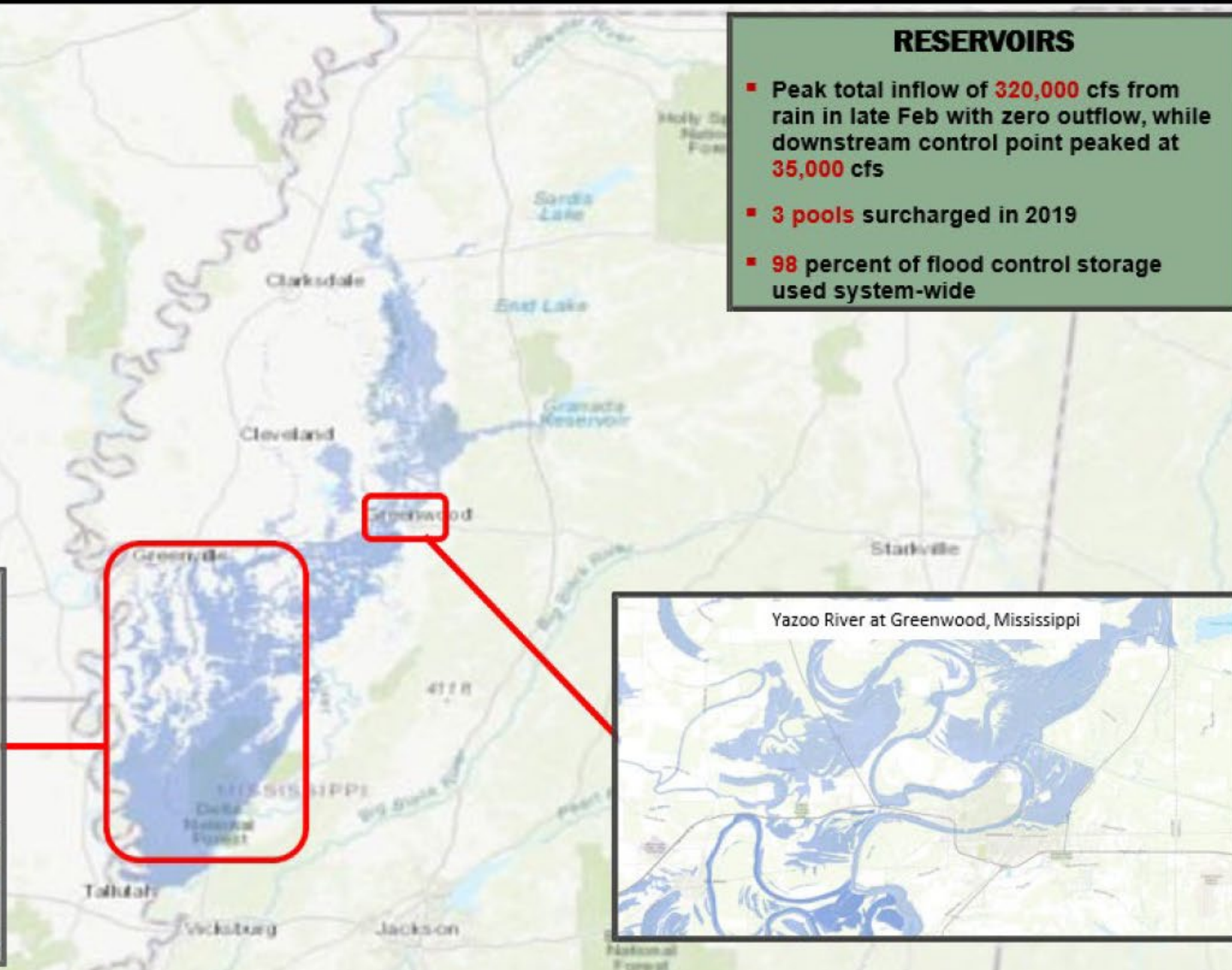


IMPACTS

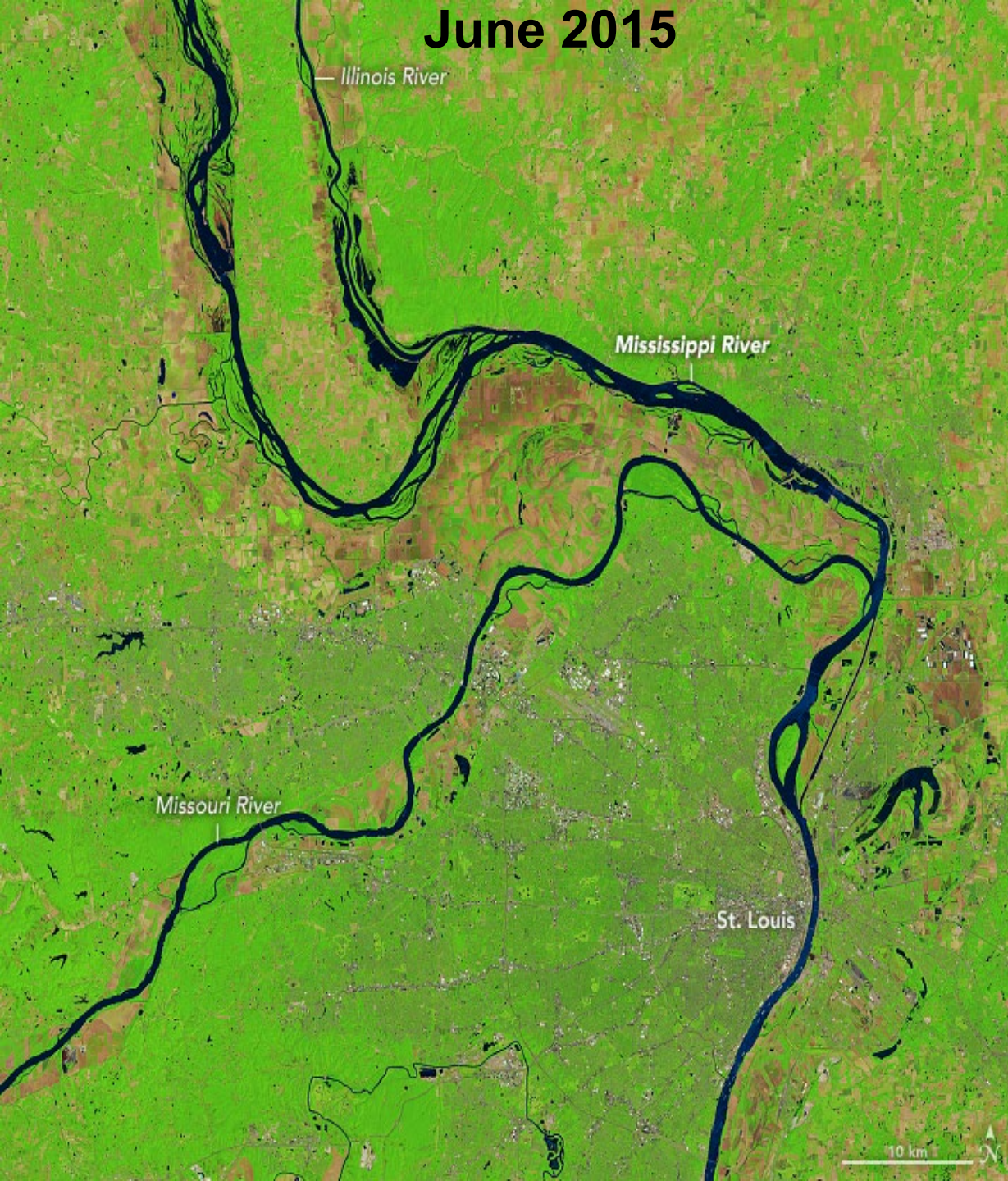
- **550,000** acres flooded in Yazoo Backwater
- **1,000+** structures inundated
- Eagle Lake flooded from Yazoo Backwater flooding
- **3** state highways and numerous county roads closed for months

RESERVOIRS

- Peak total inflow of **320,000** cfs from rain in late Feb with zero outflow, while downstream control point peaked at **35,000** cfs
- **3** pools surcharged in 2019
- **98** percent of flood control storage used system-wide

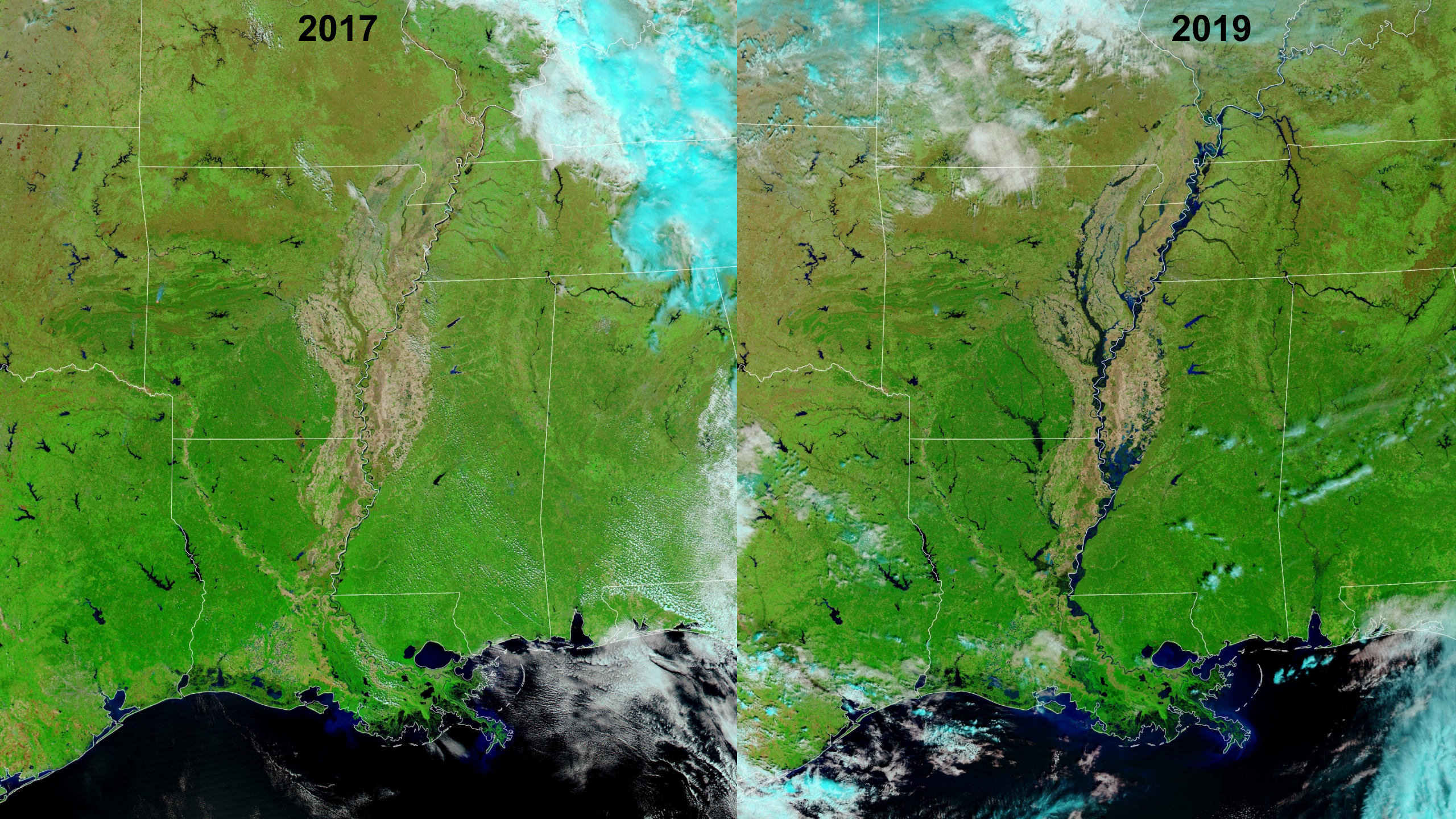


June 2015



May 2019







Consecutive Days Above Flood Stage

Lower Mississippi River Forecast Center

Current data as of August 12th 2019

| Forecast Location | Record (Days/Year) | 2019 (Days/Period) | 2011 (Days) | 1973 (Days) | 1927 (Days) |
|-----------------------|-----------------------|--|----------------|-----------------|----------------|
| Cairo, IL | 156 2019 | 156 Feb 8 th – Jul 13 th | 59 | 97 | 76 |
| Memphis, TN | 65 1927 | 39 Feb 19 th – Mar 29 th | 35 | 64 | 65 |
| Arkansas City, AR | 197 1927 | 94 Apr 16 th – Jul 19 th | 44 | 72 | 197 |
| Greenville, MS | 155 2019 | 155 Feb 17 th – Jul 21 st | 46 | 71 | 115 |
| Vicksburg, MS | 185 1927 | 162 Feb 17 th – July 28 th | 48 | 83 | 185 |
| Natchez, MS | 215 2019 | 215 Jan 4 th – August 6 th | 53 | 90 | 77 |
| Red River Landing, LA | 227 2019 | 227 Dec 27 th – August 10 th | 59 | 95 | 152 |
| Baton Rouge, LA | 211 2019 | 211 Jan 6 th – August 4 th | 79 | 99 [±] | 135 |

Numbers in Red are records for this year

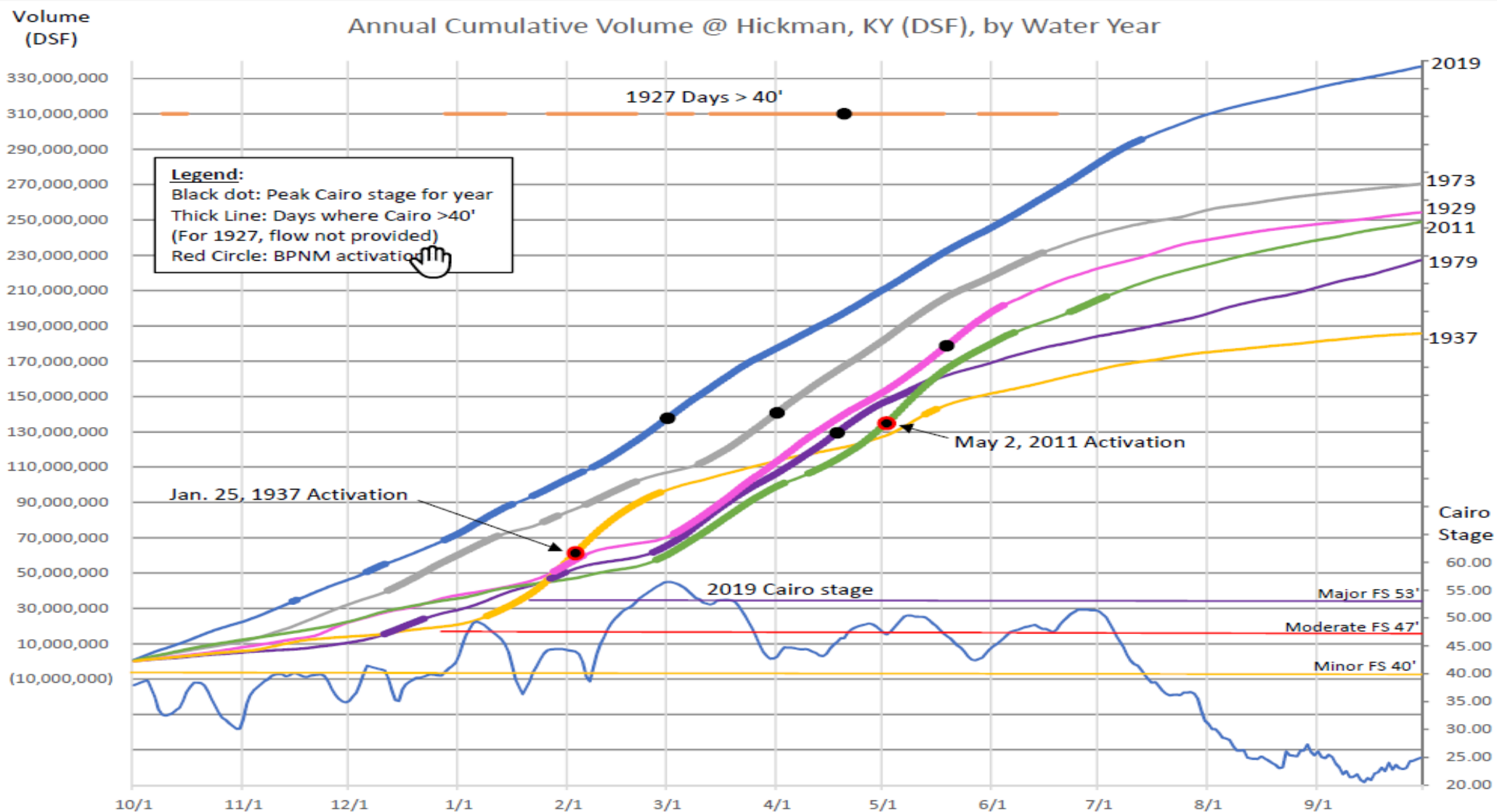
Data provided by U.S. Army Corps of Engineers



HISTORICAL DISCHARGES

| Station | 2011 | 1927 | 1937 | 2019 | PDF |
|-----------------------|-----------|-----------|-----------|-----------|-----------|
| Cairo, IL | 2,100,000 | 1,626,000 | 2,010,000 | 1,600,000 | 2,360,000 |
| Memphis, TN | 2,136,000 | N/A | 2,020,000 | 1,668,000 | 2,410,000 |
| Helena, AR | 2,130,000 | 1,756,000 | 1,968,000 | 1,622,000 | 2,490,000 |
| Arkansas City, AR | 2,293,000 | 1,712,000 | 2,159,000 | N/A | 2,890,000 |
| Vicksburg, MS | 2,272,000 | 1,806,000 | 2,060,000 | 1,820,000 | 2,710,000 |
| Natchez, MS | 2,227,000 | N/A | 2,046,000 | 1,850,000 | 2,720,000 |
| Red River Landing, LA | 1,641,000 | 1,461,000 | 1,467,000 | 1,445,000 | 2,100,000 |
| Baton Rouge, LA | 1,440,000 | N/A | 1,400,000 | 1,380,000 | 1,500,000 |
| New Orleans, LA | 1,190,000 | 1,360,000 | 1,342,000 | 1,250,000 | 1,250,000 |
| Morgan City, LA | 478,000 | 741,000 | 493,000 | 390,000 | 920,000 |
| Wax Lake Outlet, LA | 309,000 | N/A | N/A | 263,000 | 580,000 |





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THE MISSISSIPPI RIVER AND TRIBUTARIES PROJECT WAS AUTHORIZED BY THE 1928 FLOOD CONTROL ACT

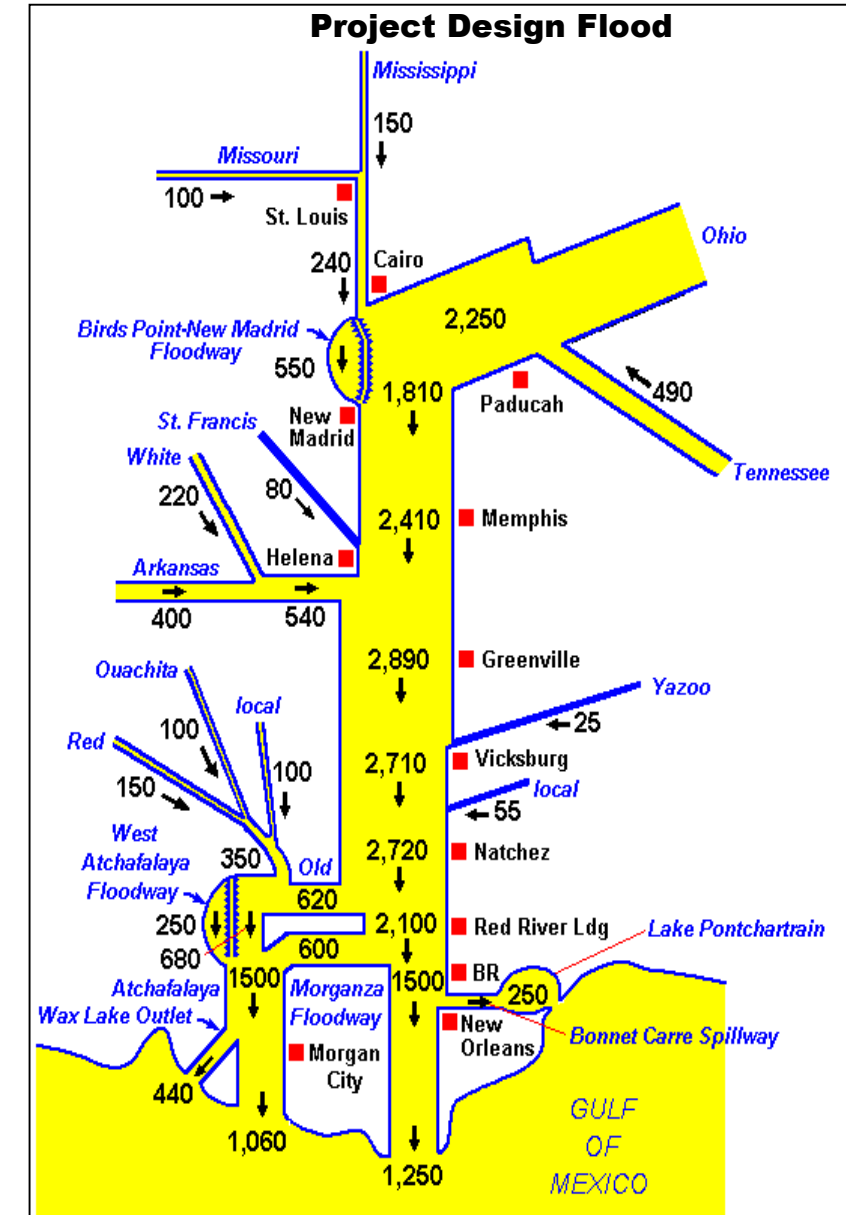
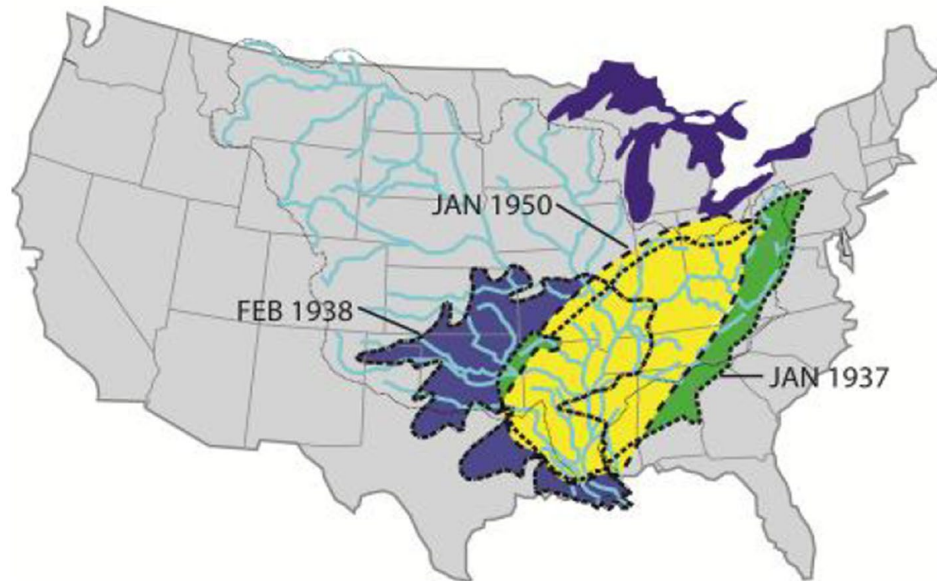


The MR&T project has four major features:

1. Levees / Floodwalls
2. Floodways / Backwater Areas
3. Channel improvement and stabilization
4. Tributary basin improvements

These features work together to provide risk reduction from floods, efficient navigation, and environmental protection and enhancement.

HYPO--FLOOD 58A STORMS



Flood Storage

Floodway

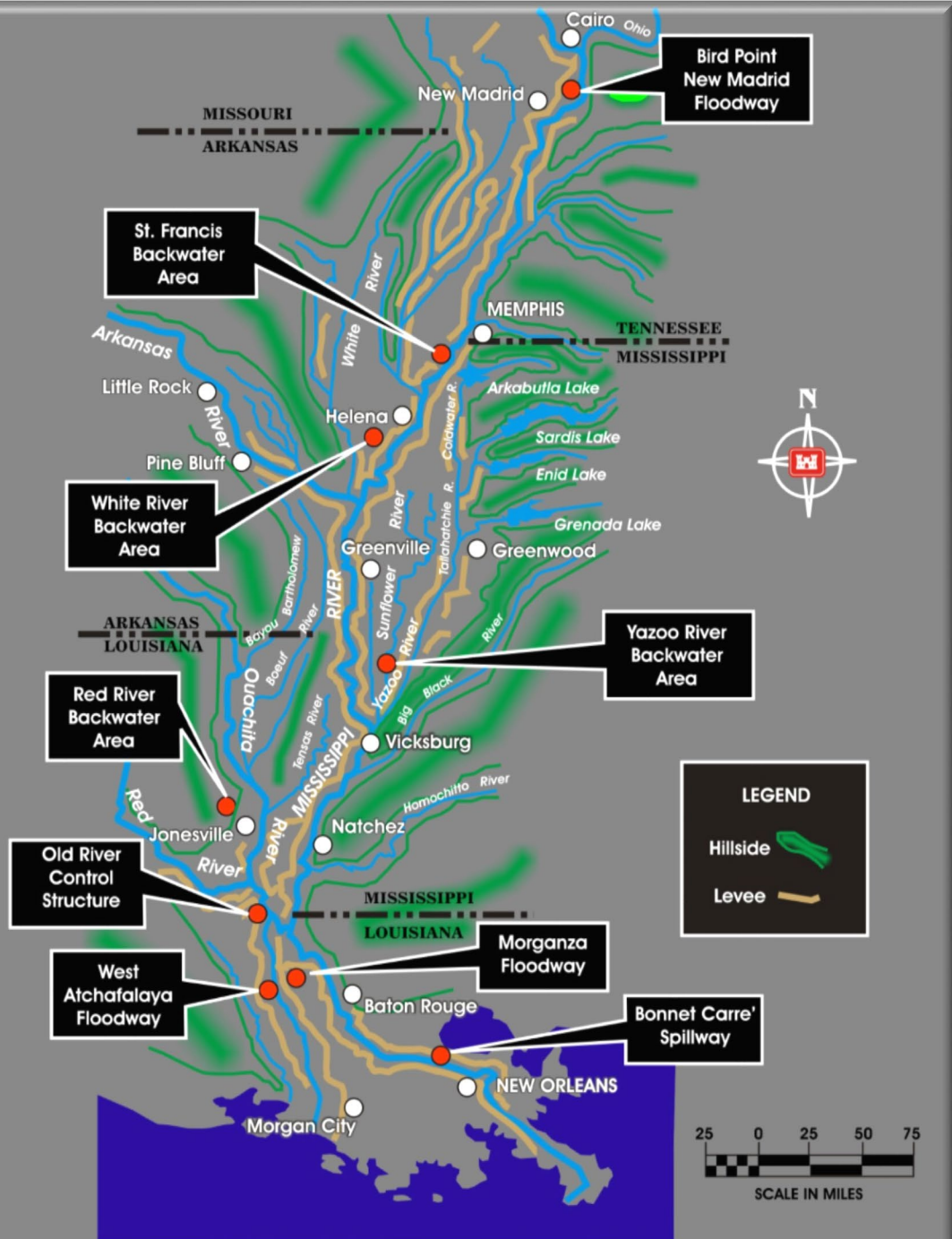
Birds Point – New Madrid =
133,000 acres; (550 kcfs)

Backwater Areas

- St. Francis = 500,000 acres
- White River = 145,000 acres
- Yazoo = 634,000 acres
- Red River = 373,000 acres

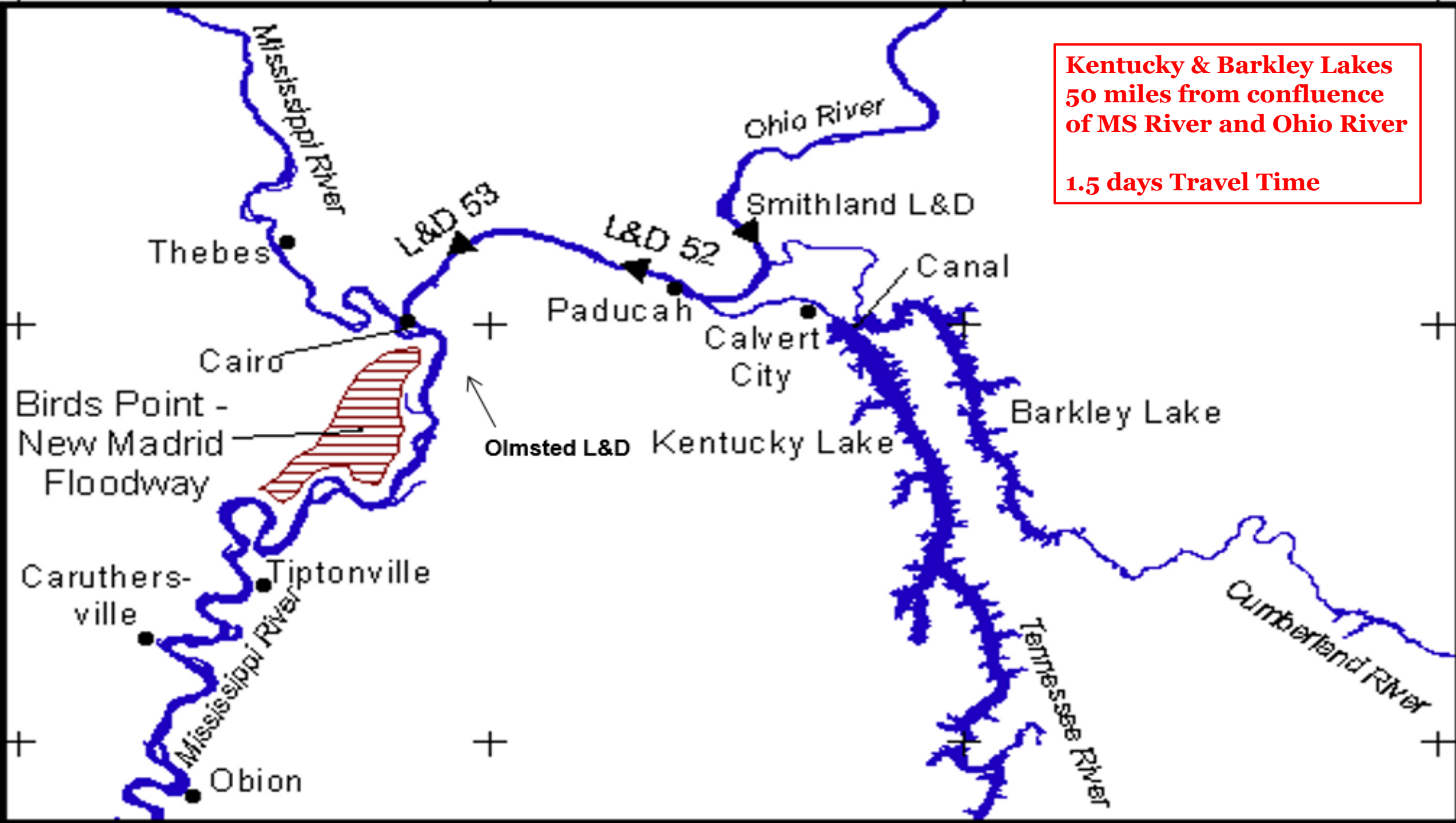
Floodways

- Morganza Floodway = 71,500 acres
- Bonnet Carré Spillway = 7,600 acres
- West Atchafalaya Floodway = 154,000 acres



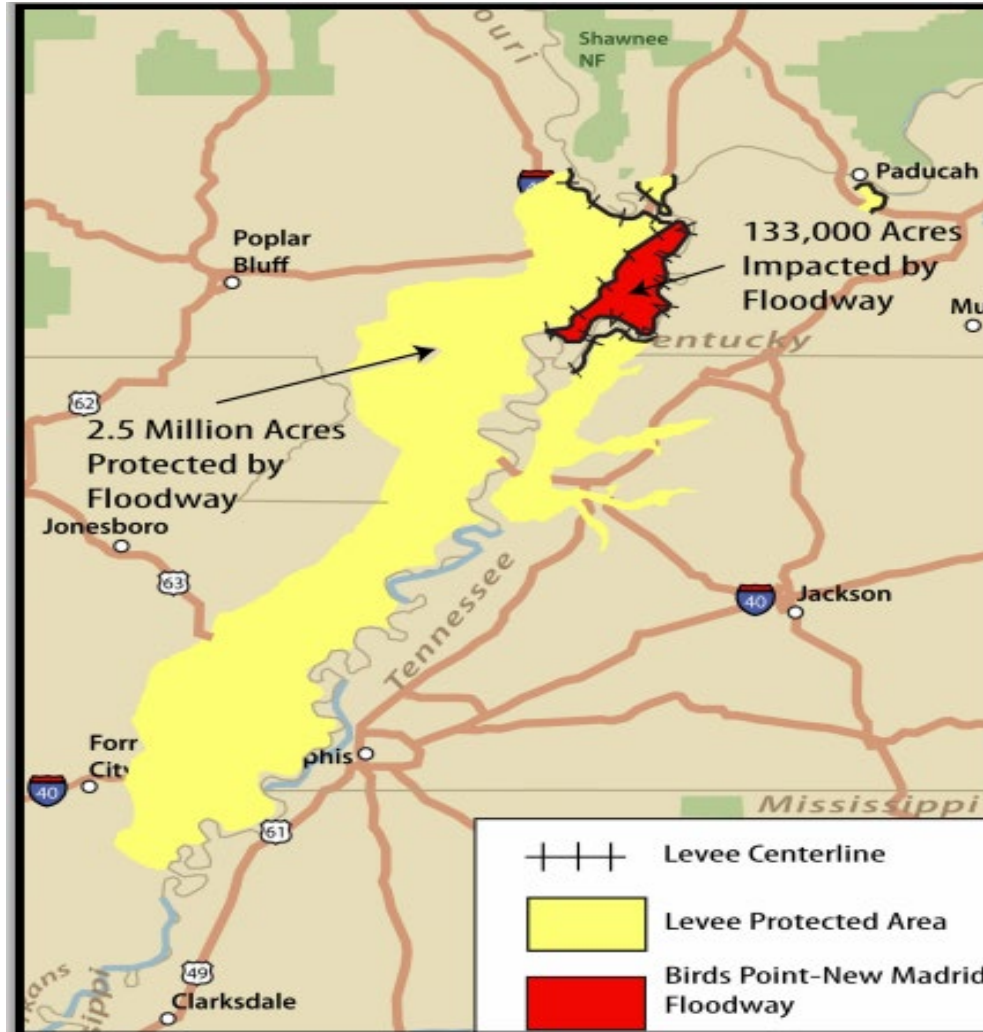
Kentucky & Barkley Lakes
50 miles from confluence
of MS River and Ohio River

1.5 days Travel Time

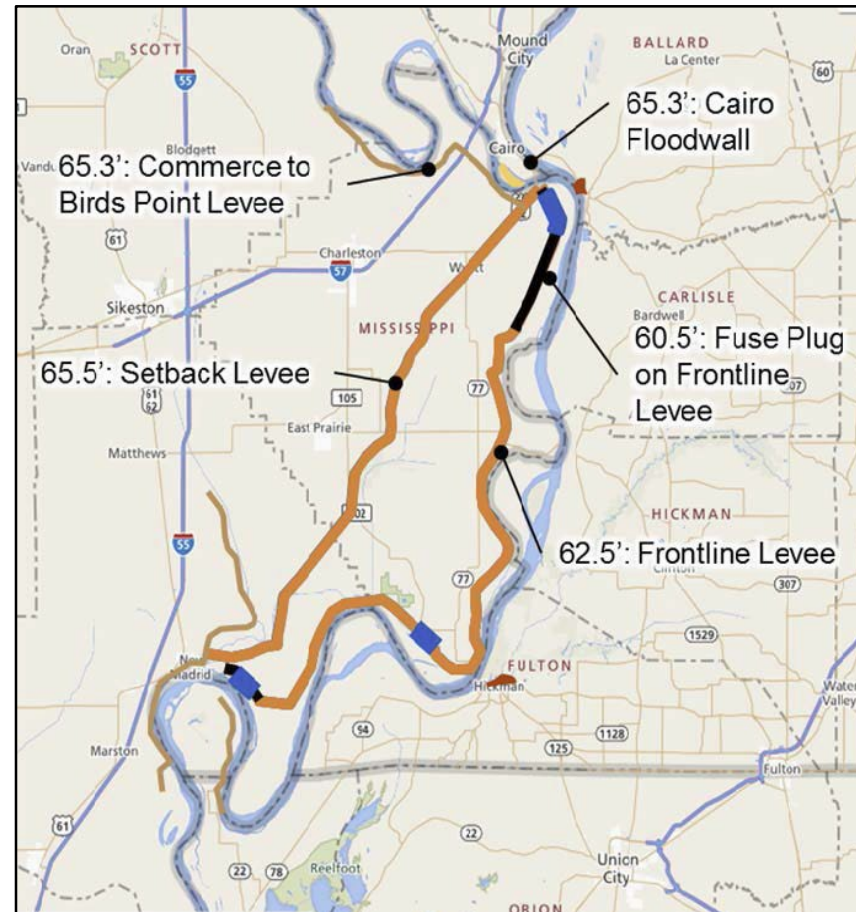




Operating the Birds Point-New Madrid Floodway PROTECTING A BROAD RANGE OF LAND USES



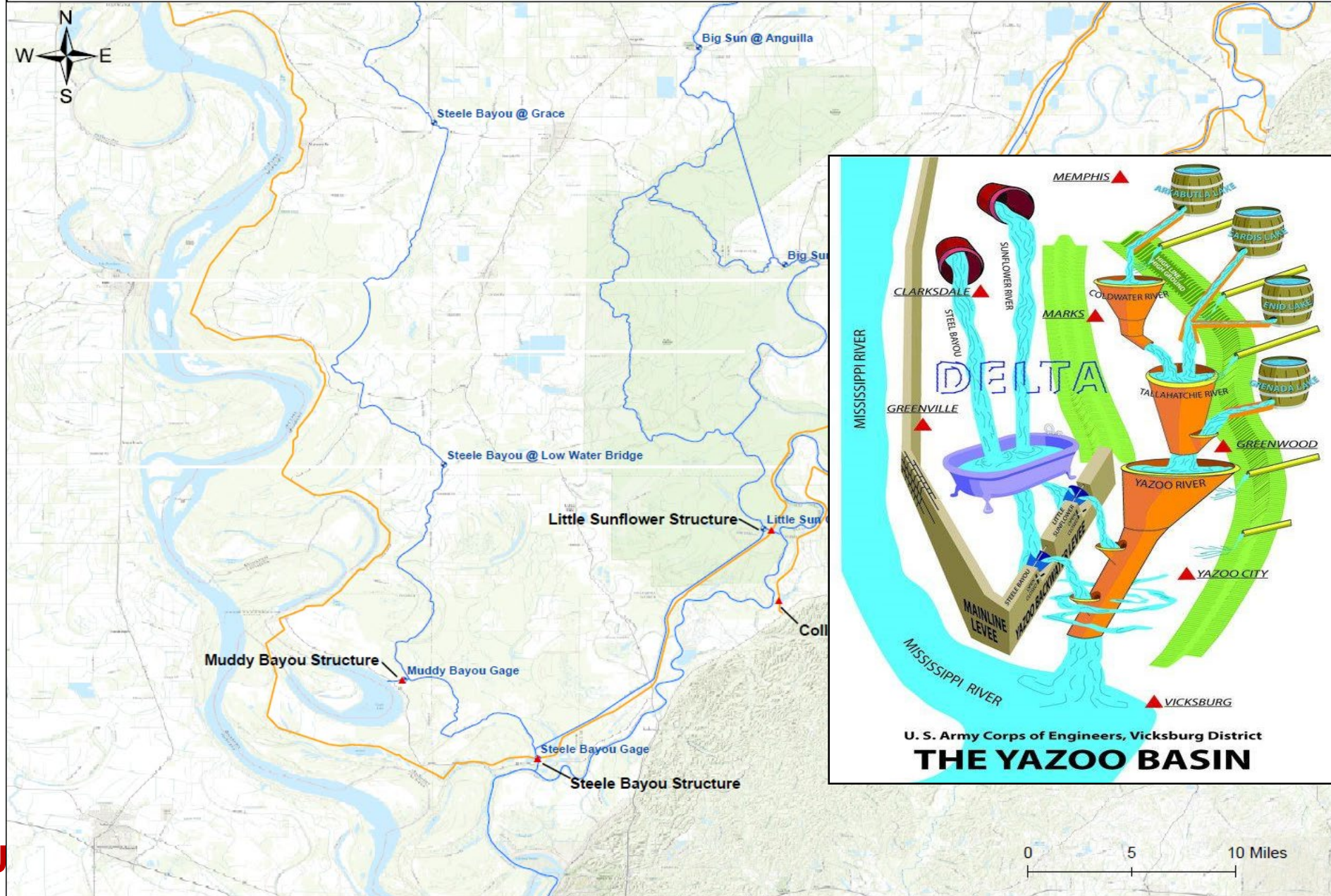
- Completed in 1932
- 133,000 acre floodway – completely flooded in 2011
- Operated (levees breached) in 1937 and 2011
- Design flow of 550,000 cfs



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Lower Yazoo Basin



BU



Yazoo Backwater Levee 0.3ft Freeboard

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Mississippi River & Tributaries Project

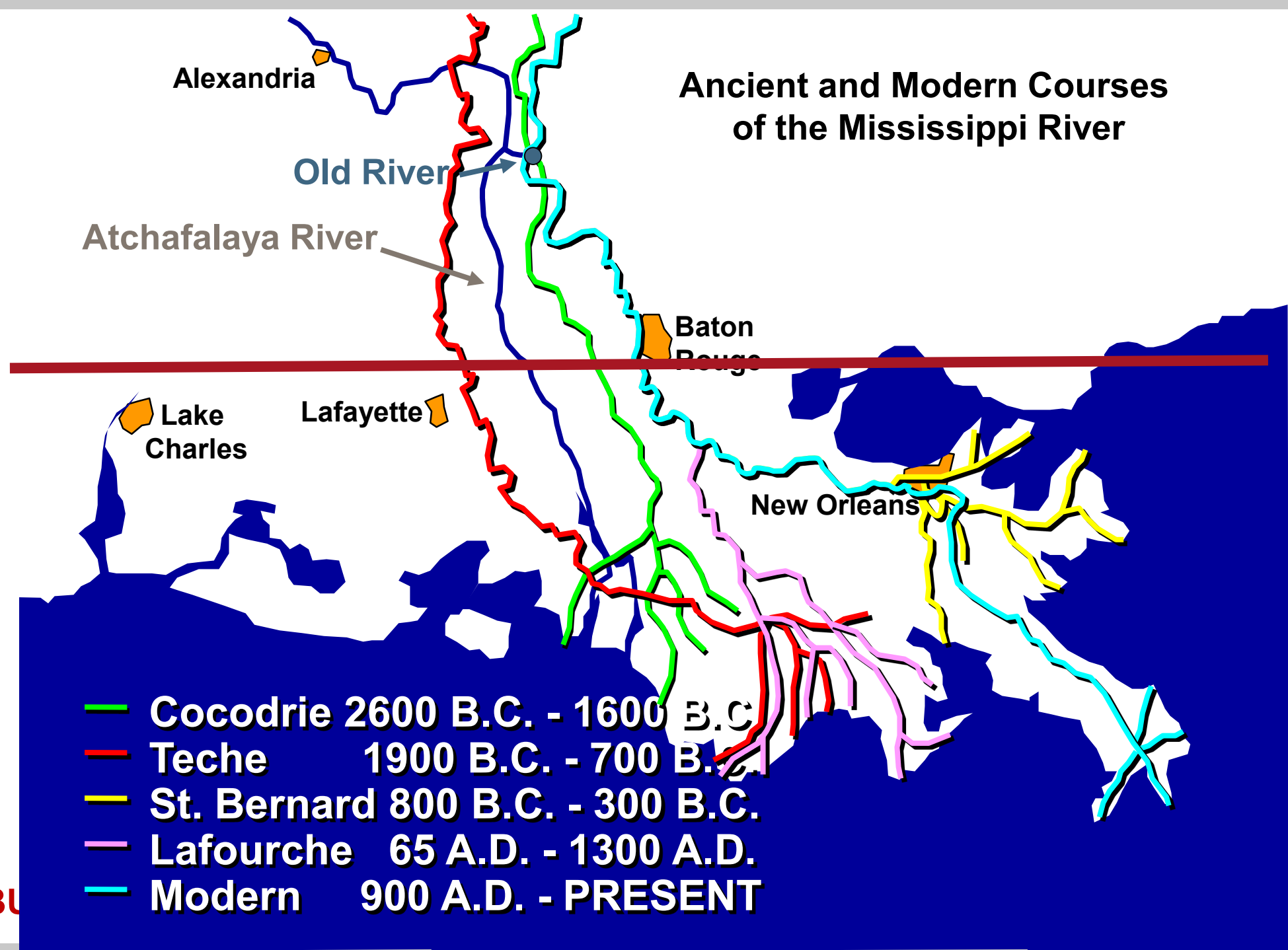
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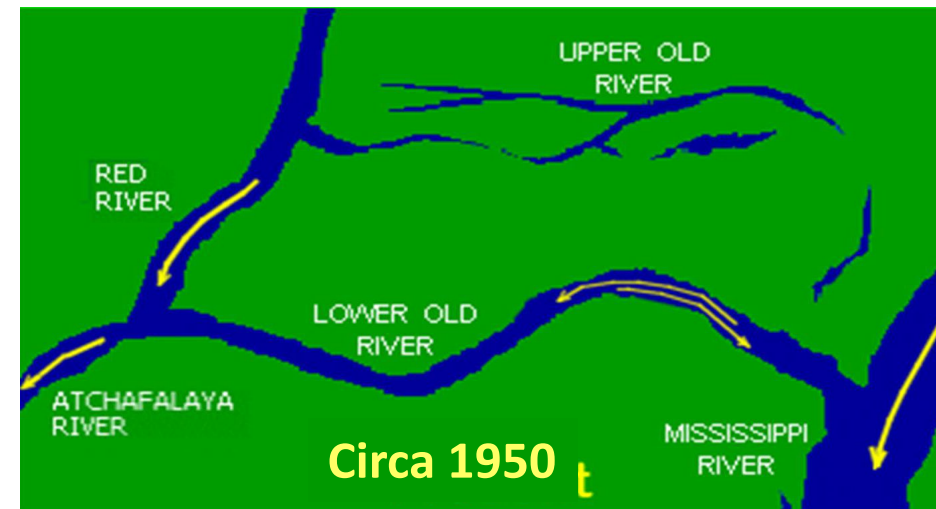
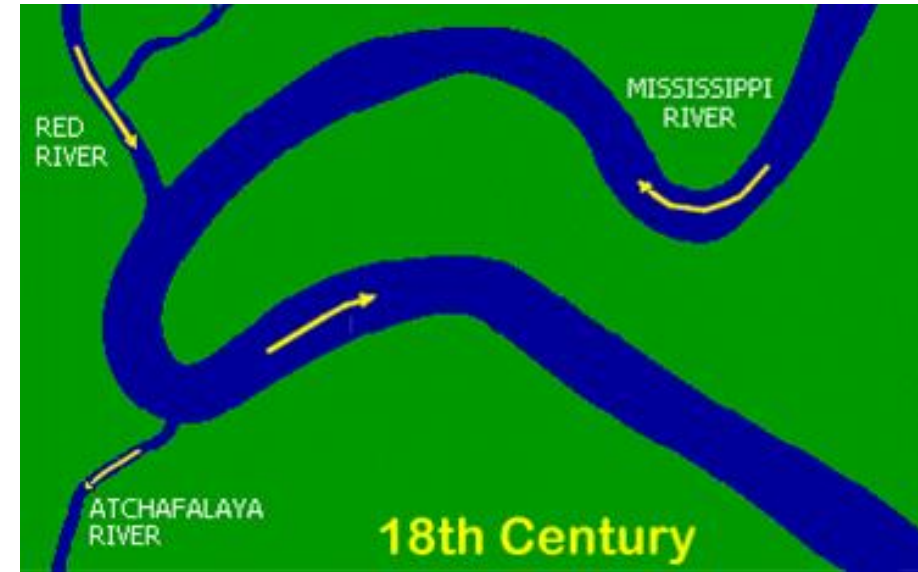
Ancient and Modern Courses of the Mississippi River





History of Old River

32



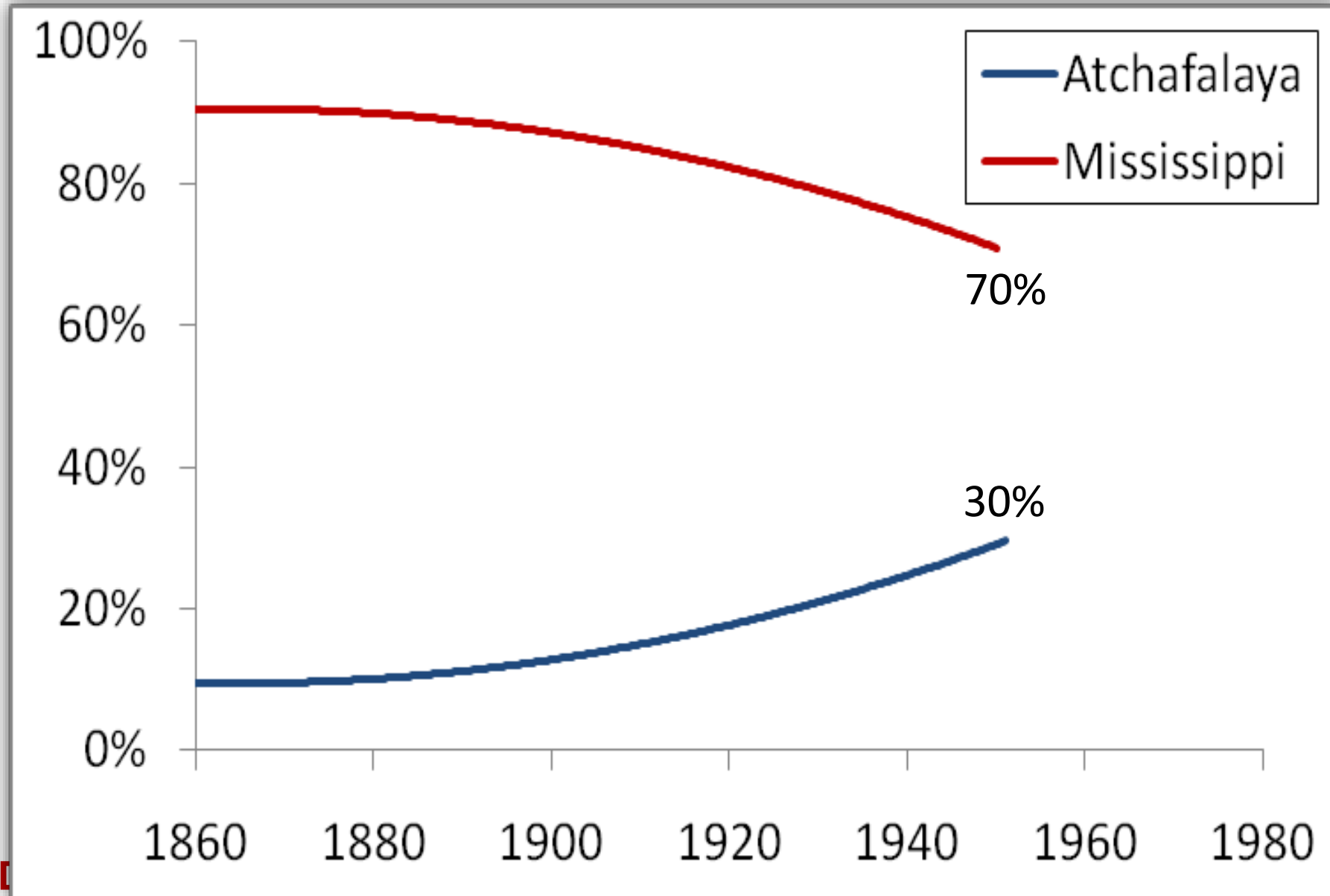
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Flow Distribution After Shreve's Cutoff

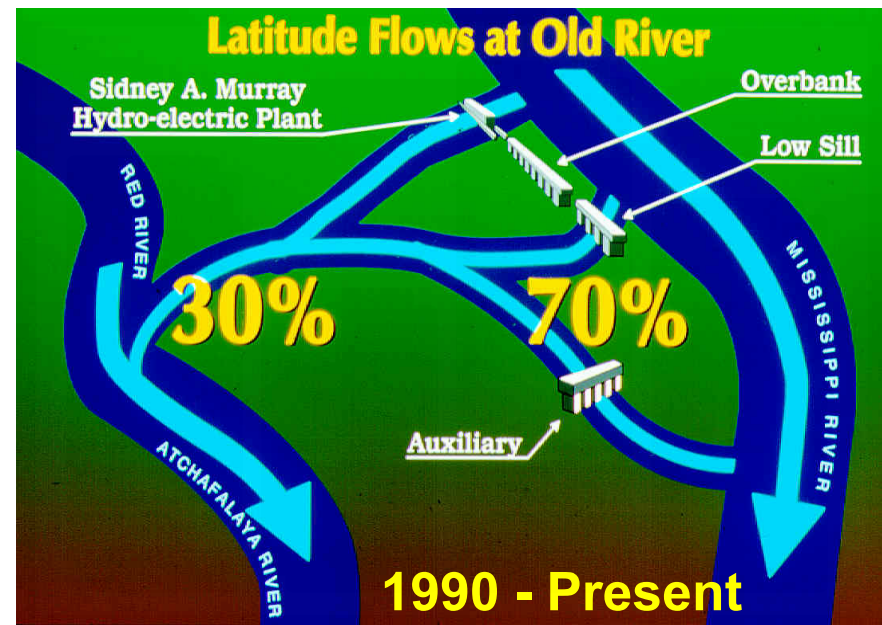
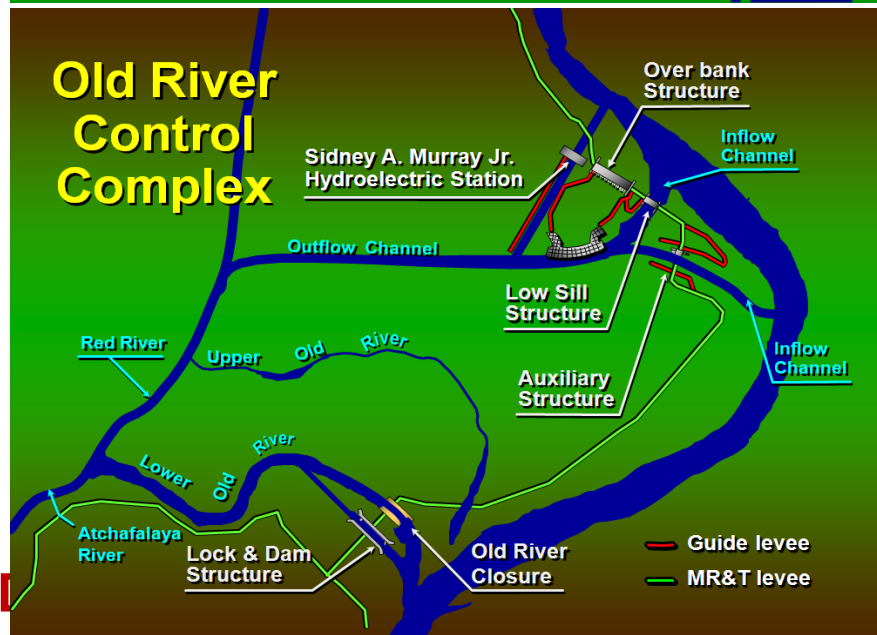
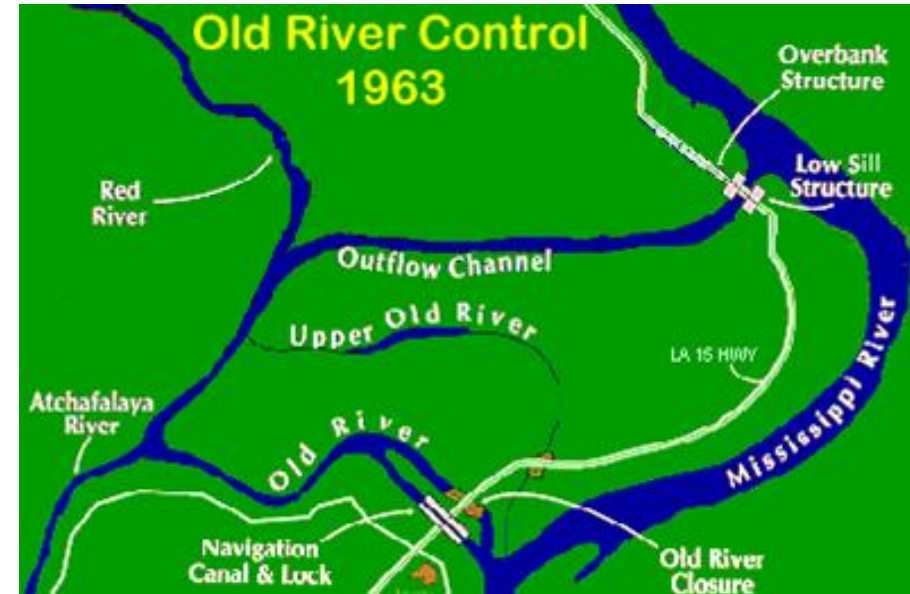
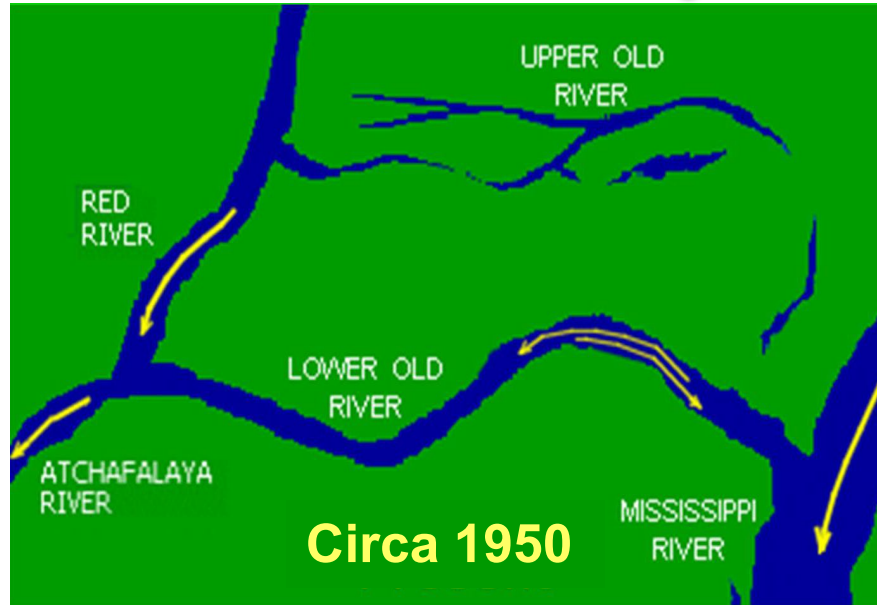
33



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History of Old River

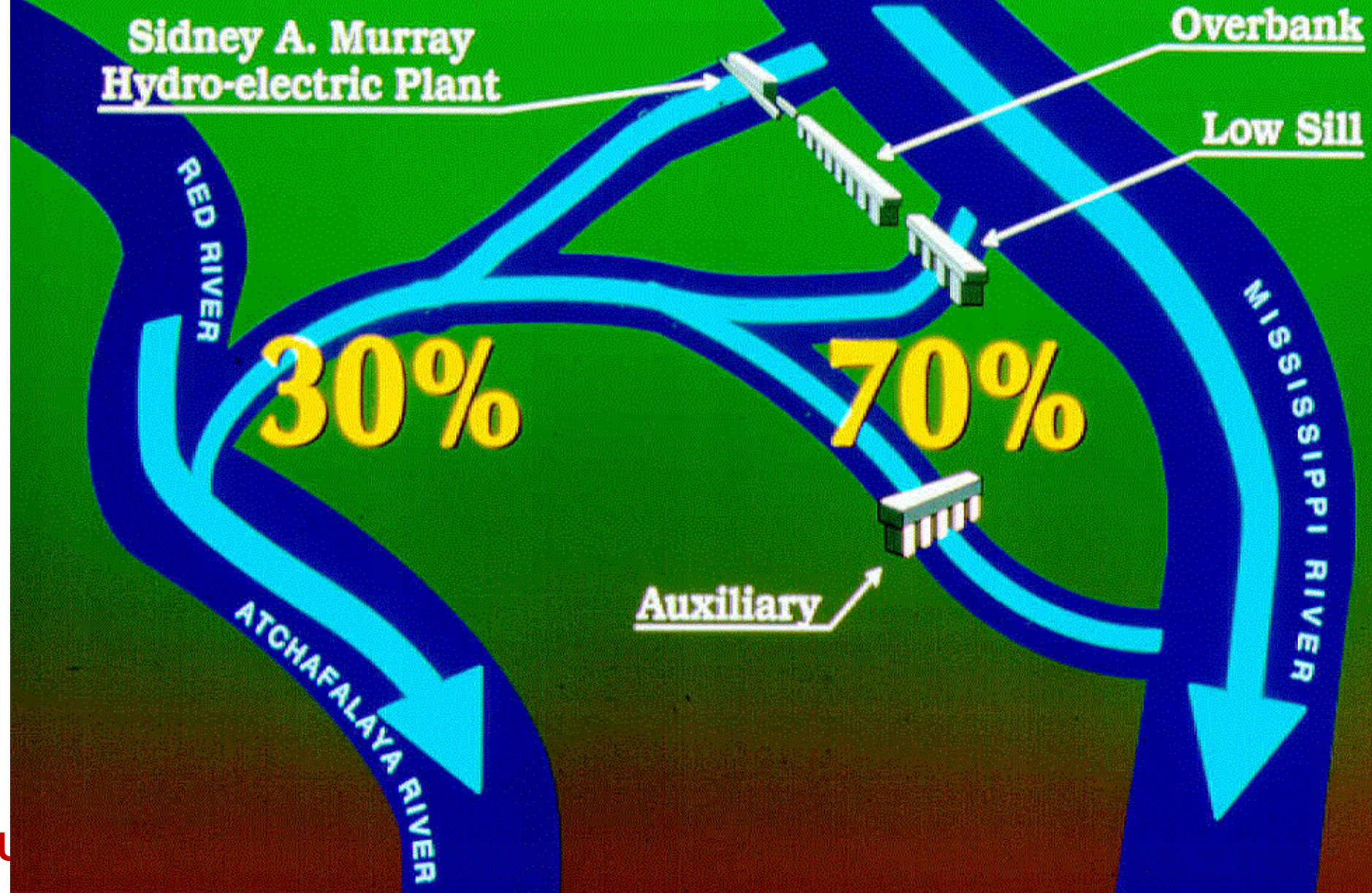




Old River Control Structure

Latitude Flows at Old River

35



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Mississippi River & Tributaries Project

36

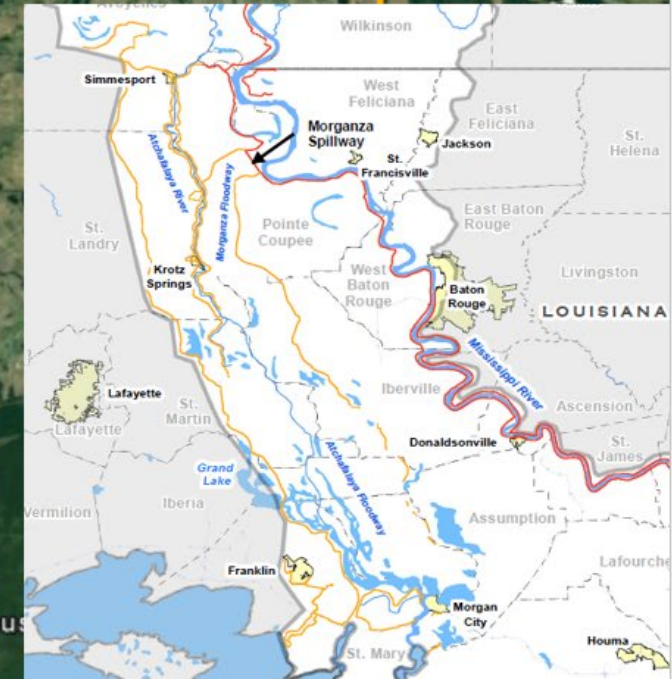
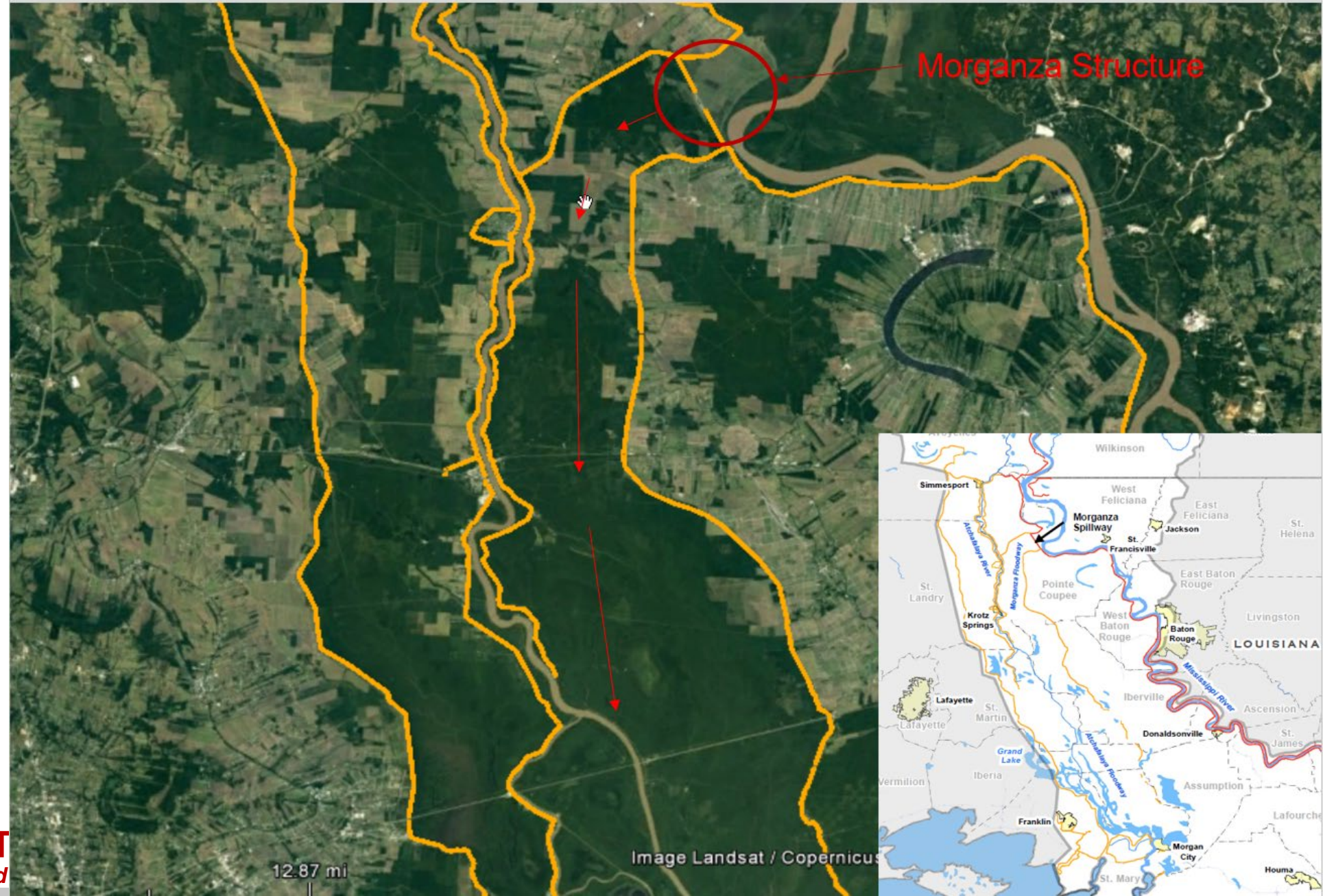


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MORGANZA STRUCTURE/FLOODWAY

Completed 1954
Operated in 1973 & 2011
1973 42 bays = 194 KCFS
2011 17 bays = 170 KCFS
PDF Capacity = 600 KCFS

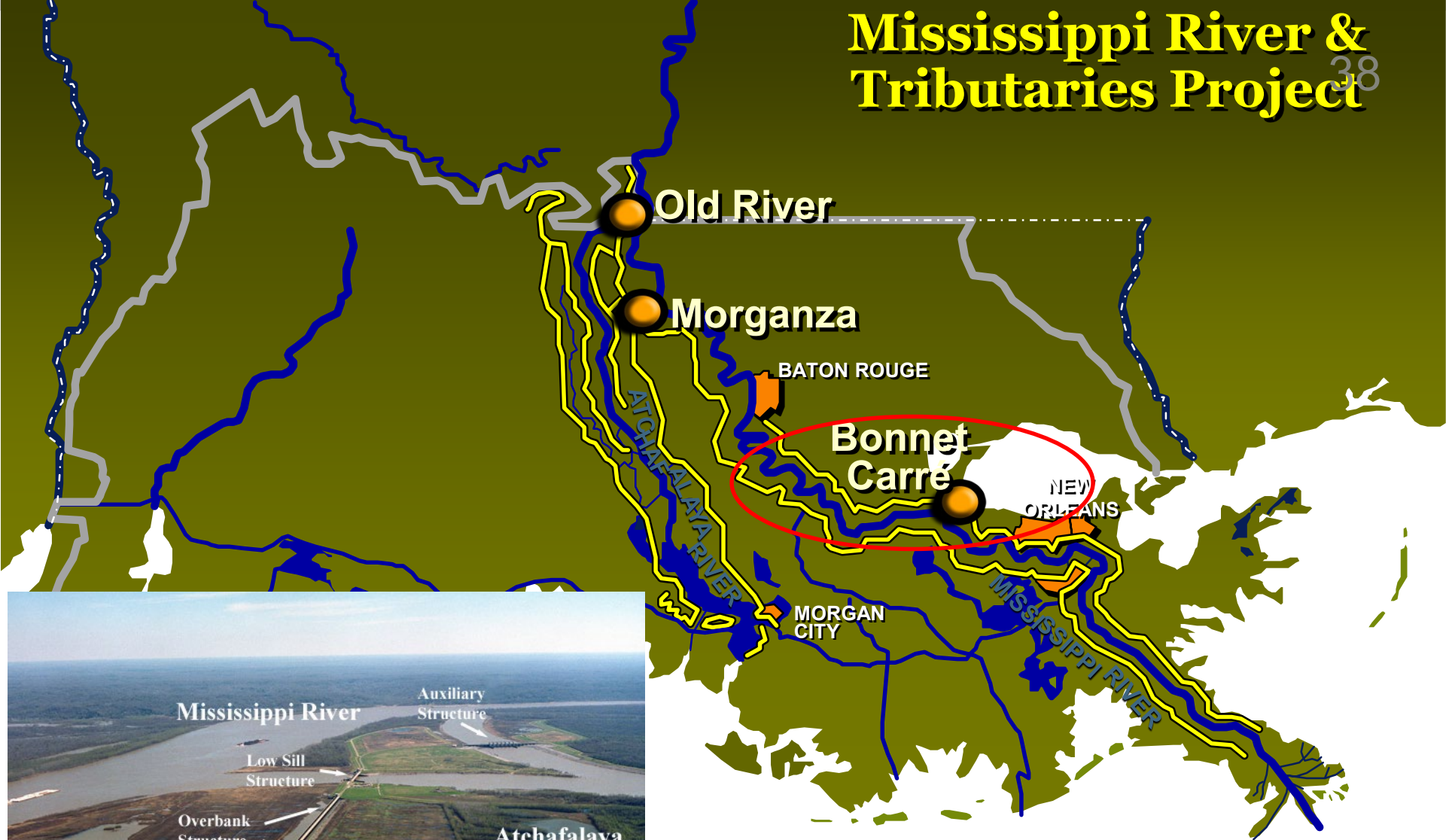


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Mississippi River & Tributaries Project³⁸

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Bonne Carre' Spillway

Lake
Pontchartrain

Upper Guide Levee

Spillway

Lower Guide Levee

Bonne Carre'
Structure

Forebay



Bonnet Carre' Opened for the 1st time this year on February 27, 2019

- Open for 44 days
- Peak Discharge 213,000 cfs
- Total Gates Opened: 206

Bonnet Carre' Opened for the 2nd time this year on May 10, 2019

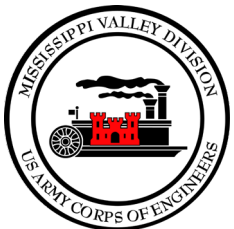
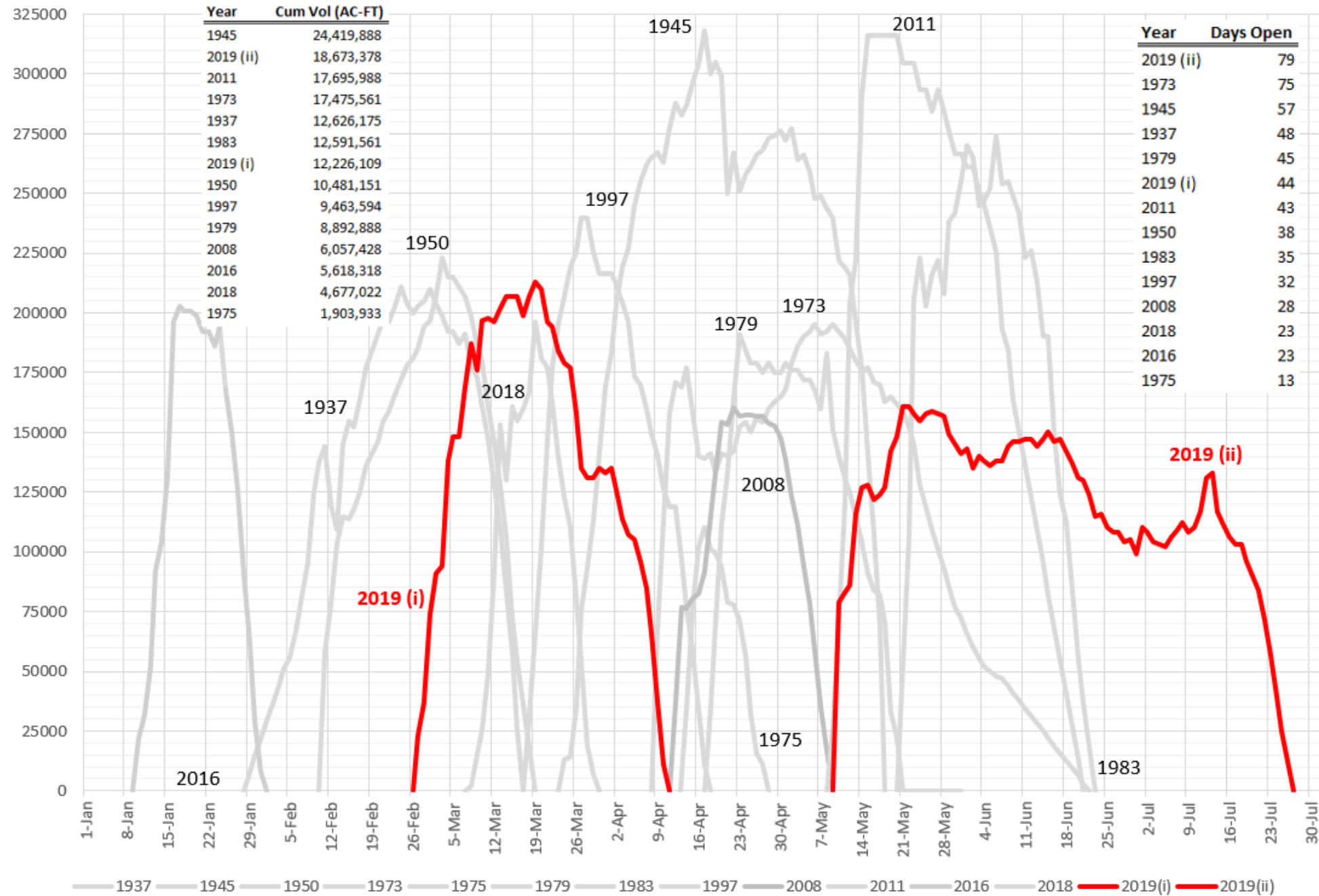
- Open for 79 days
- Peak Discharge 161,000 cfs
- Total Gates Opened: 168



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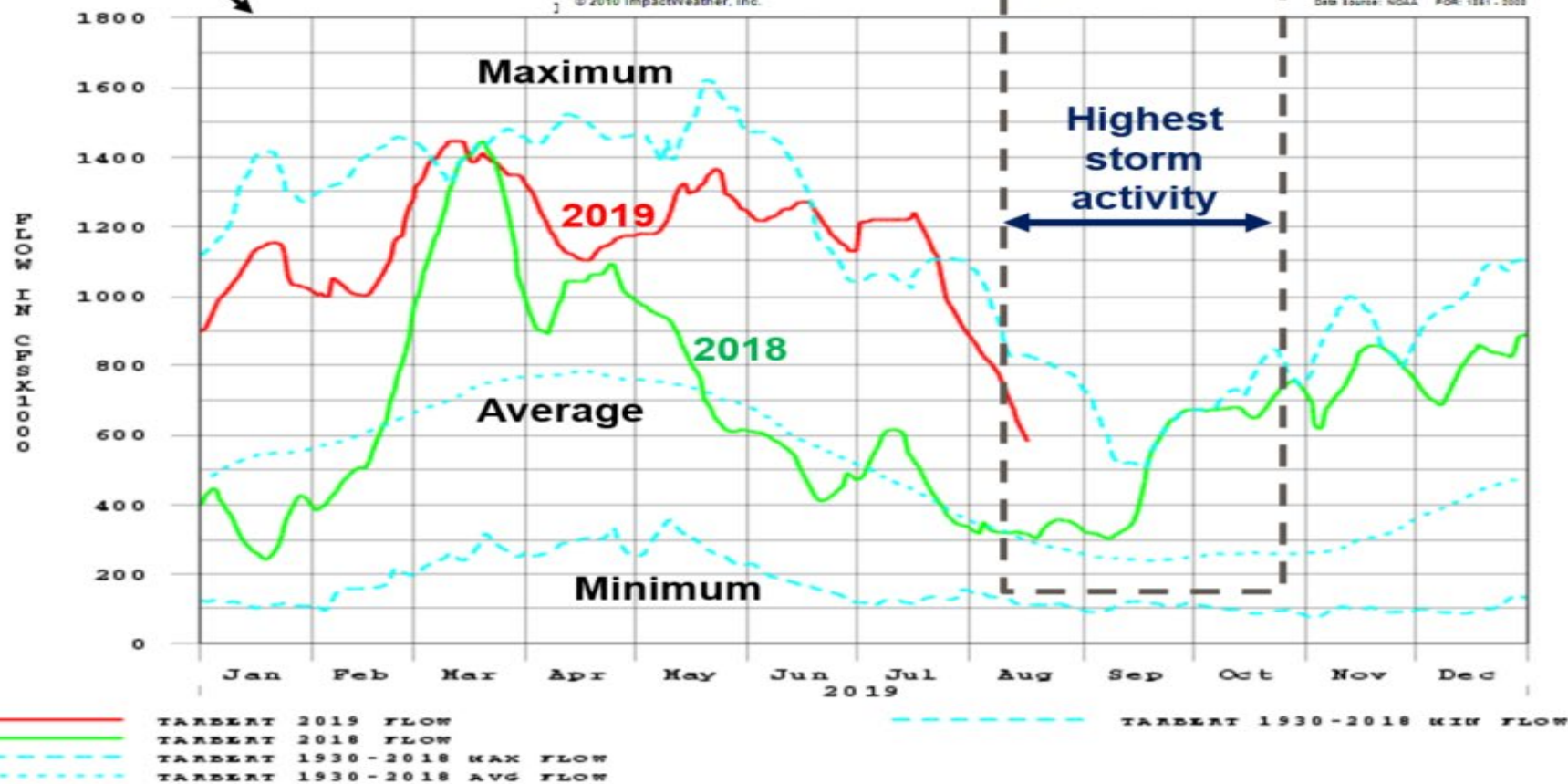
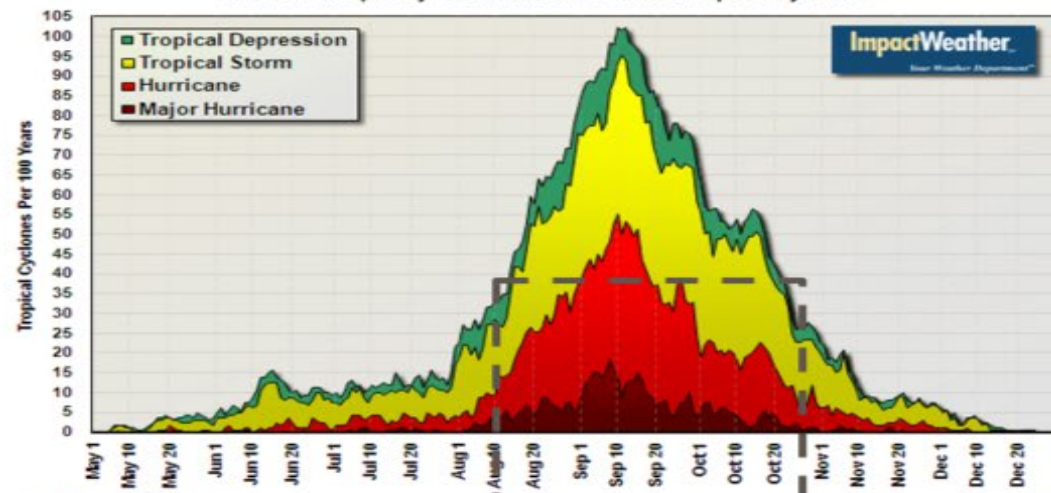


Bonnet Carré Historic Openings



Hurricane Frequency vs. River Discharge

100-Year Frequency of North Atlantic Basin Tropical Cyclones





Five-Day Graphical Tropical Weather Outlook

National Hurricane Center Miami, Florida



www.hurricanes.gov

All Disturbances

SAT JULY 6TH

2:00 pm EDT
Sat Jul 6 2019

100W 90W 80W 70W 60W 50W 40W 30W 20W

45N

35N

25N

15N

5N

Current Disturbances and Five-Day Cyclone Formation Chance:

✕ < 40%

✕ 40-60%

✕ > 60%

Tropical or Sub-Tropical Cyclone:

○ Depression

⬮ Storm

⬮ Hurricane

⊗ Post-Tropical Cyclone or Remnants



Five-Day Graphical Tropical Weather Outlook

National Hurricane Center Miami, Florida



www.hurricanes.gov

All Disturbances

BARRY
TUE JULY 9TH



8:00 am EDT
Tue Jul 9 2019

100W

90W

80W

70W

60W

50W

40W

30W

20W

5N

15N

25N

35N

45N

Current Disturbances and Five-Day Cyclone Formation Chance:

✕ < 40%

✕ 40-60%

✕ > 60%

Tropical or Sub-Tropical Cyclone:

○ Depression

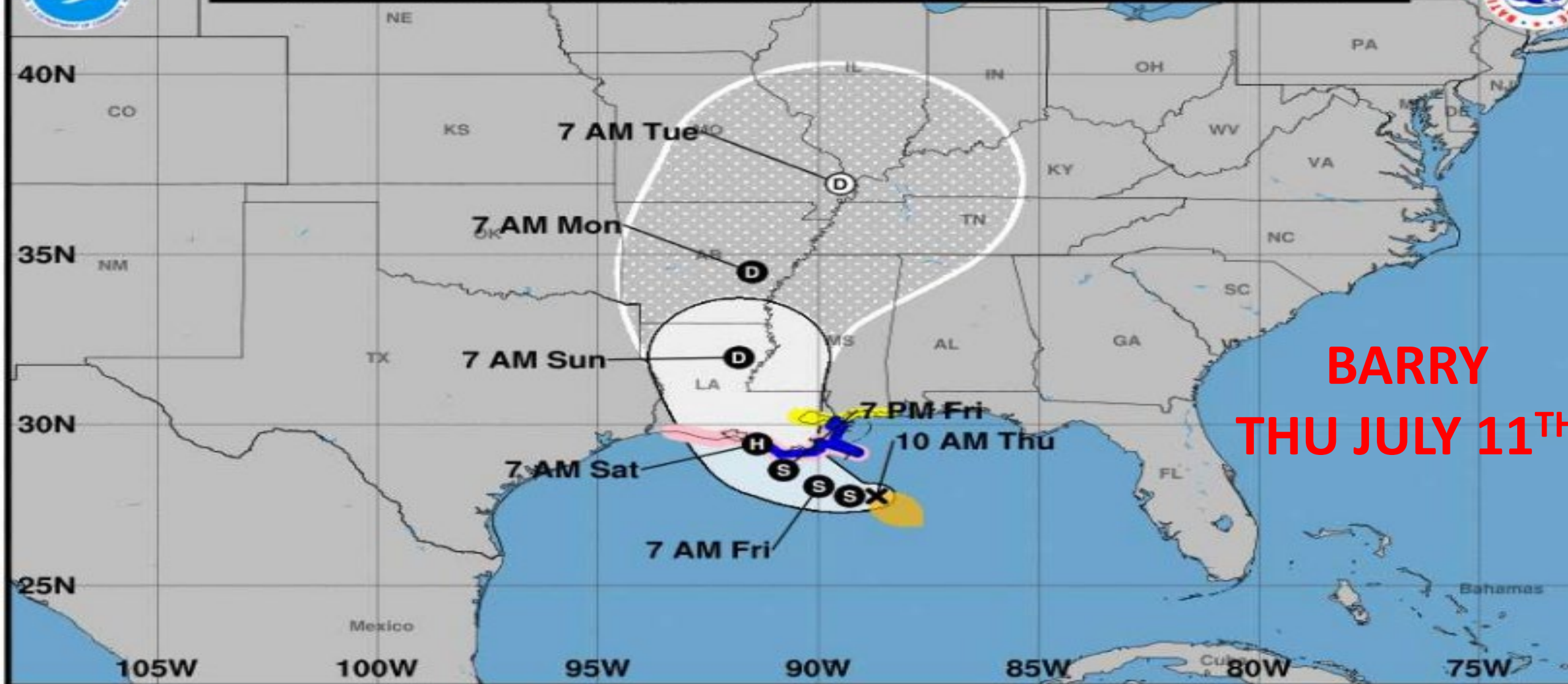
⚡ Storm

⚡ Hurricane

⊗ Post-Tropical Cyclone or Remnants



Note: The cone contains the probable path of the storm center but does not show the size of the storm. Hazardous conditions can occur outside of the cone.



BARRY
THU JULY 11TH

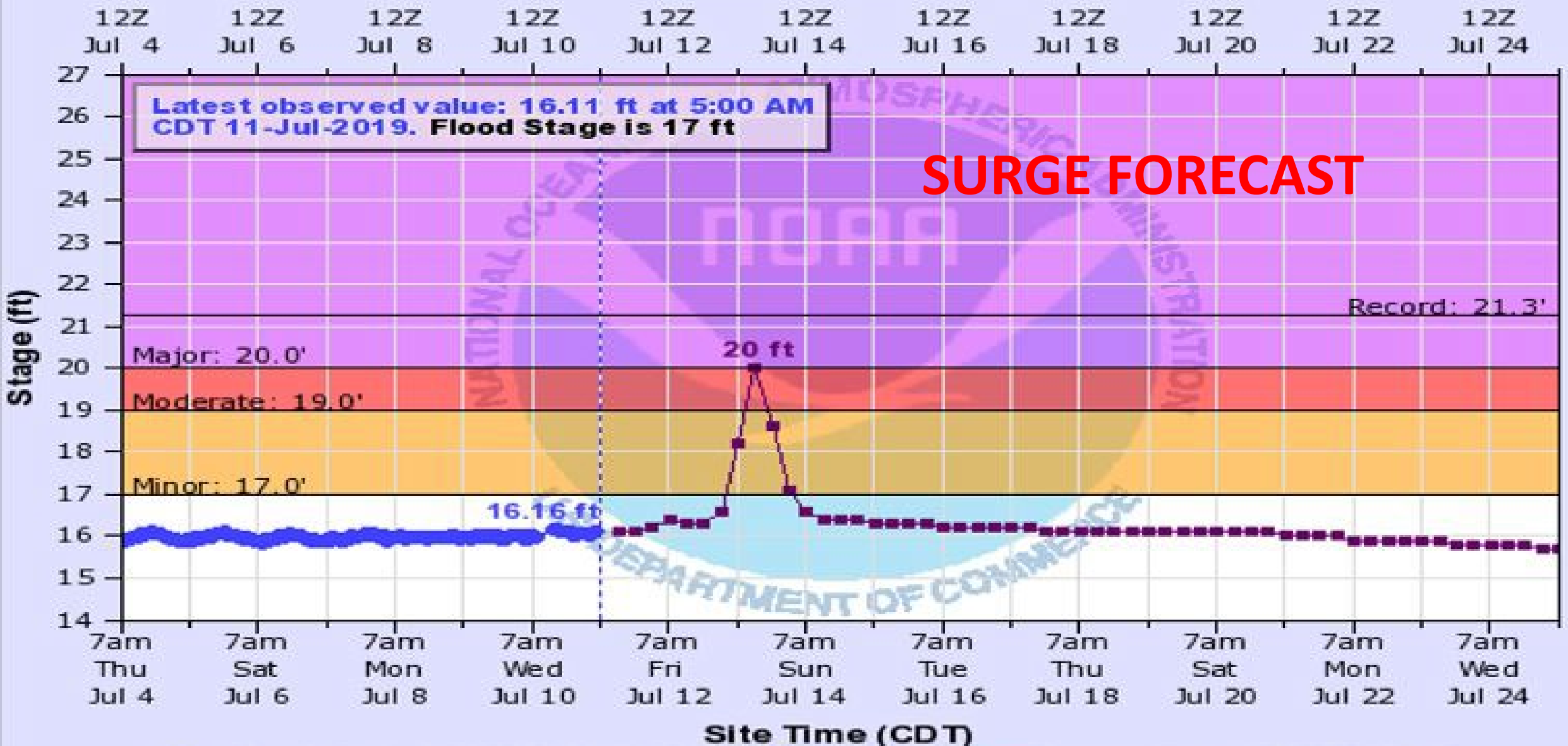
Tropical Storm Barry
Thursday July 11, 2019
10 AM CDT Advisory 5
NWS National Hurricane Center


Current information: x
Center location 27.8 N 88.7 W
Maximum sustained wind 40 mph
Movement W at 5 mph

Forecast positions:
● Tropical Cyclone ○ Post/Potential T
Sustained winds: D < 39 mph
S 39-73 mph H 74-110 mph M > 110 mph

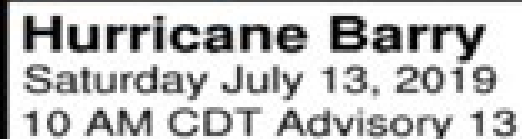
MISSISSIPPI RIVER AT NEW ORLEANS

Universal Time (UTC)





BARRY
SATURDAY JULY 13TH

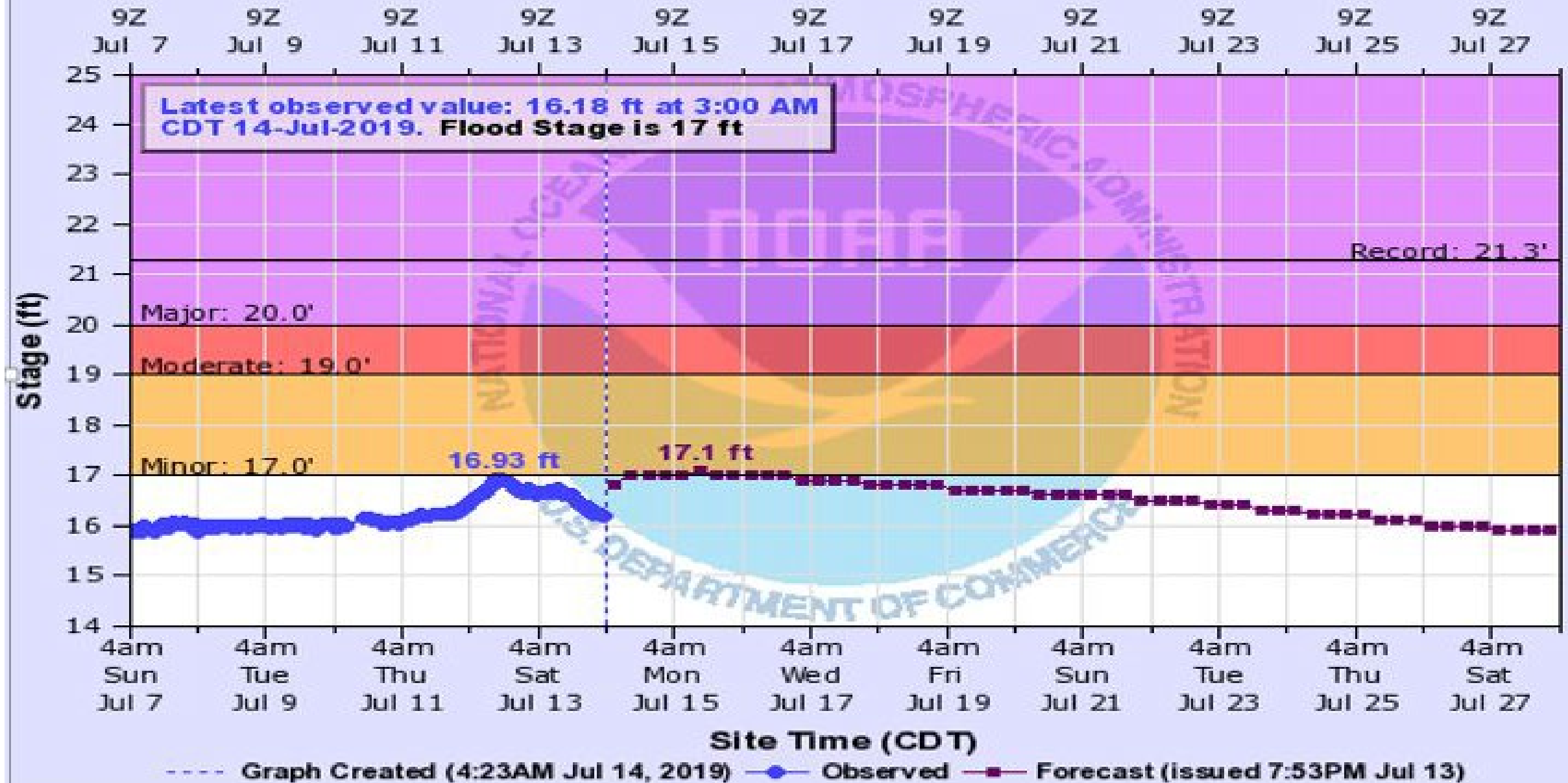


Current information: ☉
Center location 29.6 N 92.0 W
Maximum sustained wind 75 mph

Forecast positions:
 ● Tropical Cyclone ○ Post/Potential TC
 Sustained winds: D < 39 mph

MISSISSIPPI RIVER AT NEW ORLEANS

Universal Time (UTC)

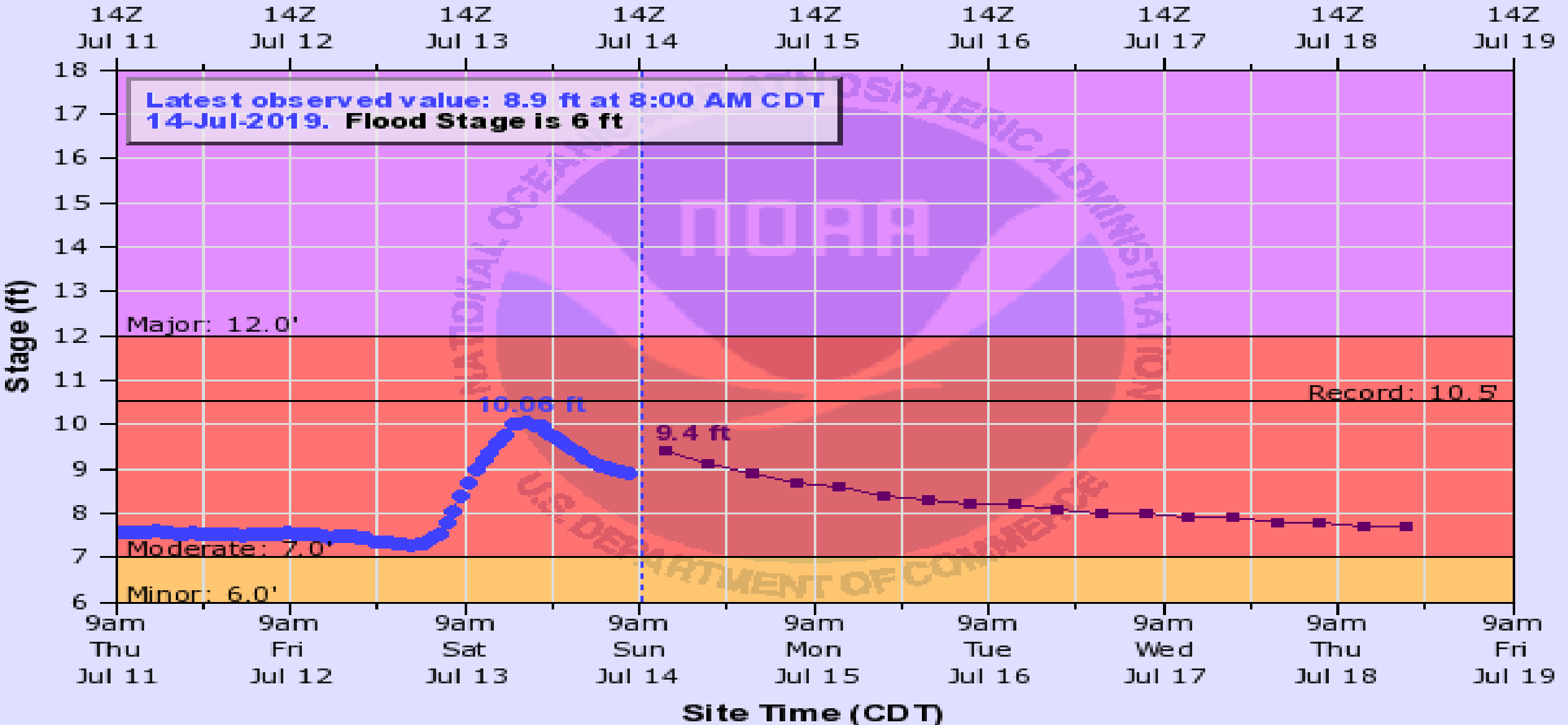


NORL1(plotting HGIRG) "Gage 0" Datum: 0'

Observations courtesy of U.S. Army Corps of Engineers

ATCHAFALAYA RIVER AT MORGAN CITY

Universal Time (UTC)





Questions?



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