2019 FLOOD EVENT SUMMARY

What led to the flood event?
- High soil moisture last Fall leading into winter
- Extremely cold temperatures in February and early March
  - Significant frost depths limiting infiltration
  - Above normal, and in some cases, record snowfall
- Bomb cyclone dumped 2.25 inches of warm rain on frozen soil and heavy, wet snowpack (March 12-14)
- Rain and melting snow on frozen ground led to significant runoff across southeastern SD, eastern NE, and western IA

March 2019 unregulated flood event is unprecedented in the region.
- 45 river gages set new records
- MO River (5); South Dakota (8); Iowa (8); Nebraska (24)

OVERVIEW – THE FLOOD

Peak Flows – March 2019
- Missouri River
  - Sioux City – 159,000 CFS
  - Plattsmouth – 428,000 CFS
  - Nebraska City – 342,000 CFS
- Big Sioux River
  - Hawarden, IA – 58,100 CFS
  - Waterloo, NE – 132,000 CFS
- Platte River
  - Louisville, NE – 252,000 CFS
- Gavins Point Dam Releases
  - Max 2011 – 160,000 CFS
  - Max 2019 – 100,200 CFS

USACE RESERVOIR STORAGE

Height indicates relative volume (acre-feet)
New Record Stages Observed 12-16 September 2019

- Red circles indicate river gage has set a new record stage (preliminary)
- Purple circle indicates river gage has tied previous record stage (1)
- 19 total gages have observed new records (as of 0800 16 September 2019)

FLOOD DURATION (~270 DAYS)

- 3 events
  - March
  - May/June
  - September
- ~9 months above flood stage
  - 163 days in 2011
  - 25 days in 2003

FLOOD IMPACTS - MISSOURI RIVER LEVEE SYSTEM

- Widespread, unprecedented damage
  - Nearly 50 breaches
  - 32 on systems active in PL 84-99
- Request for assistance on levee systems active in PL 84-99
  - 60 levee & channel systems
  - 352 miles of levees

LEVEE SYSTEM DAMAGES

- 49 levee systems damaged

PAST BASIN FLOODS (DAMAGES AND REPAIR COST)

1993
- 12 damaged levees (NWO)
  - L-550 overtopped (inlet and outlet breaches)
  - Damage primarily from overtopping
  - SHAM Rehab Cost (NWO & NWI combined)

1997
- No breaches

2011
- 5 breaches
  - Failure mode primarily foundation failure
  - Long duration event
  - $250M rehab cost

2019
- Over 50 breaches (widespread, unprecedented damage)
  - 17 breaches on systems inactive in PL 84-99
  - Failure mode primarily overtopping
  - Short duration events
  - Reloading of levees on Memorial Day
  - Requests for assistance on levee systems active in PL 84-99
  - 60 levee and channel systems (45 completed Project Information Reports)
  - 352 miles of levees
  - Rehab cost much greater
OVERTOPPING

R-616 on March 17th

The levee system did not breach.

OVERTOPPING

L-611-614 on March 16th

INLET BREACHES ON L-611-614
ON MARCH 17TH

BREACH ON L-611-614

Max. scour depth ~72 ft
below top of levee (rel. 904)

Scour depth ~125 ft
downstream ~20 ft below pre-
flood ground elevation (rel. 939)

FLOW

SET BACK LEVEE ON L-611-614 AND CROSS SECTION ON 18 APRIL 2019

450 feet

L-550 on March 16th
Rebuilding After A Historical Flood 2/21/2020

L-575_A_I INLET BREACH DIMENSIONS

Max. scour hole depth ~ 50 ft below levee crest (elev. 895 ft)

BREACH AT L-575_B_I

L-575_B_I INLET BREACH ON MARCH 16TH

INITIAL CLOSURE OF L-575_A_I AND CROSS SECTION

L-575_A_I INITIAL REPAIR

Photos from around June 13

L-575_A_I INITIAL BREACH REPAIR CLOSURE ON JUNE 20TH
L-575_A_I INITIAL BREACH REPAIR CLOSURE ON JUNE 24TH

BREACH AT L-575_B_I ON MAY 1ST

BREACH AT L-575_B_I ON JULY 9TH

BREACH AT L-575_B_I ON JULY 25TH

BREACH AT L-575_B_I ON MAY 29TH

BREACH AT L-575_B_I ON JUNE 29TH

BREACH AT L-575_B_I ON JULY 20TH
BREACH AT L-575_B_I ON SEPT 10TH

BREACH AT L-575_B_I SEPTEMBER HIGH WATER

BREACH AT L-575_B_I ON OCT 10TH

BREACH AT L-575_B_I ON FEB 11TH

BREACH AT L-550_A_I ON MARCH 19TH

BREACH AT L-550_A_I ON MARCH 27TH

Max scour depth ~40ft below levee top ~23ft below natural ground

At ~300ft upstream of breach, scour depth ~20ft below natural ground

Narrows At River Flow Breach Flow

~1000 ft
BREACH CLOSURE AT L-550_B_I ON SEPT 12

BREACH AT L-550_B_I ON SEPT 22

DOWNSTREAM END OF L-550 ON MAR 27

CREST DAMAGE

CREST DAMAGE
L-611-614 CRITICAL LOSS OF SECTION

ON-GOING CONSTRUCTION

R-616-613 Final Repairs

CONSTRUCTION STATUS:
- SYSTEM RESTORED TO FULL HEIGHT
  - Relieved well work to be complete in late February with contract final inspection and turnover targeted for early March

L-611-614 Interim Repairs

CONSTRUCTION STATUS:
- ENTIRE LEVEE SYSTEM HAS BEEN RESTORED TO FULL HEIGHT (11 FEB 2020)
  - Relief work is on-going
  - Work on-going at inlet breach tie-in locations (rip rap and clay placement)
  - Levee surfacing placement on-going on crest repair areas

L-611-614 Outlet breach (2/7)
L-611-614 Inlet Breach Tie-Ins (2/17)
L-611-614 Inlet Breach Tie-In Armoring (2/17)

L-594 Final Repairs

CONSTRUCTION STATUS:
- Sheetpile – 3,155 LF of 5,575 LF Installed (57%)
  - (~35K CY of sand placed per day)
  - All but one breach (Breach “G”) closed
  - “G” breach milestones:
    - Sand pad 90% complete
    - Sand levee complete target prior to 1 MAR

L-575 Final Repairs

CONSTRUCTION STATUS:
- All breaches have been closed.
  - 91% of sand and 26% of clay placed to date
  - Continuing repairs at outlet breach locations

L-575_G Upper Nish Borrow Site
L-575_G (2/12)
L-575_G (2/13)
L-575_B (2/13)

L-575_D (2/13)
TRIBUTARY CONSTRUCTION PROJECTS

L550 Final Repairs

- All breaches have been closed.
- Clay placement underway to raise levee from "C" to "F" breaches.
- Continuing repairs at outlet breach locations.

CONSTRUCTION STATUS:

- CV: $1,255,879 | PoP: 180 | CCD: 19MAY20
- Base contract repairs are substantially complete.

ONAWA – MISSOURI RIVER RB (95%) [8%]

- CV: $9,199,325 | PoP: 270 | CCD: 17OCT20
- Excavation at Camp Ashland began 14FEB.
- Primary effort: bring initial levee breach repair (DA #7) to design elevation using material from Camp Ashland and complete final repairs NLT 01MAR.
- Secondary effort: repair scour on the Platte River and stabilize the bank with 20,000+ tons of riprap near Thomas Lakes (DA #12).

TRIBUTARY CONSTRUCTION PROJECTS

WYOMING – SHOSHONE RIVER RB (95%) [55%]

- CV: $4,235,783 | PoP: 120 | CCD: 06FEB20
- Construction Status:
  - Contractor scheduled to mobilize the week of 02MAR.

OMAHA – MISSOURI RIVER RB (95%) [55%]

- CV: $1,255,879 | PoP: 180 | CCD: 19MAY20
- All earthwork repairs completed and scheduling a pre-final inspection for all earthwork repairs the week of 02MAR.

TRIBUTARY CONSTRUCTION PROJECTS

WESTERN SARPY – PLATTE RIVER RB (99%) [99%]

- CV: $9,199,325 | PoP: 270 | CCD: 19MAY20
- Construction Status:
  - Contractor scheduled to mobilize the week of 02MAR.

CONSTRUCTION COMPLETE PROJECTS

- Pierce – North Branch Elkhorn River RB (100%) [100%]
  - CV: $183,000 | PoP: 60 | CCD: 15OCT19
  - Final inspection conducted 01OCT19.
  - Final close-out packet being submitted.

- Broken Bow – Mud Creek (100%) [100%]
  - CV: $165,000 | PoP: 60 | CCD: 07DEC19
  - Final inspection conducted 17OCT19.
  - Close-out documents received. Compiling final packet.

- Ida Grove – Odebolt Creek (100%) [100%]
  - CV: $359,000 | PoP: 90 | CCD: 13JAN20
  - Final inspection conducted 04NOV19.
  - Close-out documents received. Compiling final packet.

- Scribner – Pebble Creek LB and Elkhorn River RB (100%) [100%]
  - CV: $93,500 | PoP: 60 | CCD: 01DEC19
  - Final inspection conducted 05NOV19.
  - Close-out documents received. Compiling final packet.

- Cedar Creek – Omaha Fish and Wildlife (100%) [100%]
  - CV: $1,343,200 | PoP: 180 | CCD: 13APR20
  - Final inspection conducted 12DEC19.
  - Close-out documents under review.

- Columbus – Loup River (100%) [100%]
  - CV: $2,223,000 | PoP: 90 | CCD: 09JAN20
  - Final inspection scheduled for 30JAN20.
  - Waiting for final topographic surveys of underwater features and spring establishment period to complete seeding.
  - Close-out documents under review.

PATH FORWARD

- All construction projects completed and scheduling a pre-final inspection for all earthwork repairs the week of 02MAR.

- Final inspection conducted 01OCT19.
- Final close-out packet being submitted.

- Contractor scheduled to mobilize the week of 02MAR.

- CV: $9,199,325 | PoP: 270 | CCD: 19MAY20
- Excavation at Camp Ashland began 14FEB.
- Primary effort: bring initial levee breach repair (DA #7) to design elevation using material from Camp Ashland and complete final repairs NLT 01MAR.
- Secondary effort: repair scour on the Platte River and stabilize the bank with 20,000+ tons of riprap near Thomas Lakes (DA #12).
PATH FORWARD

- Continue repairs along the Missouri River Levees. Continue to complete the design as repairs are being made.

- Complete Engineering & Design and award construction contracts on Tributaries by Spring for the vast majority of projects.
  - The first construction contracts have been completed.

❖ All work is subject to availability of funding which is determined by Congress and HQUSACE.