2019 USACE GOES DCS User Report

LySanias Broyles

Water Control, Rock Island District

Rock Island, IL

05 May 2020

2020 DCS Technical Working Group Teleconference

US Army Corps of Engineers

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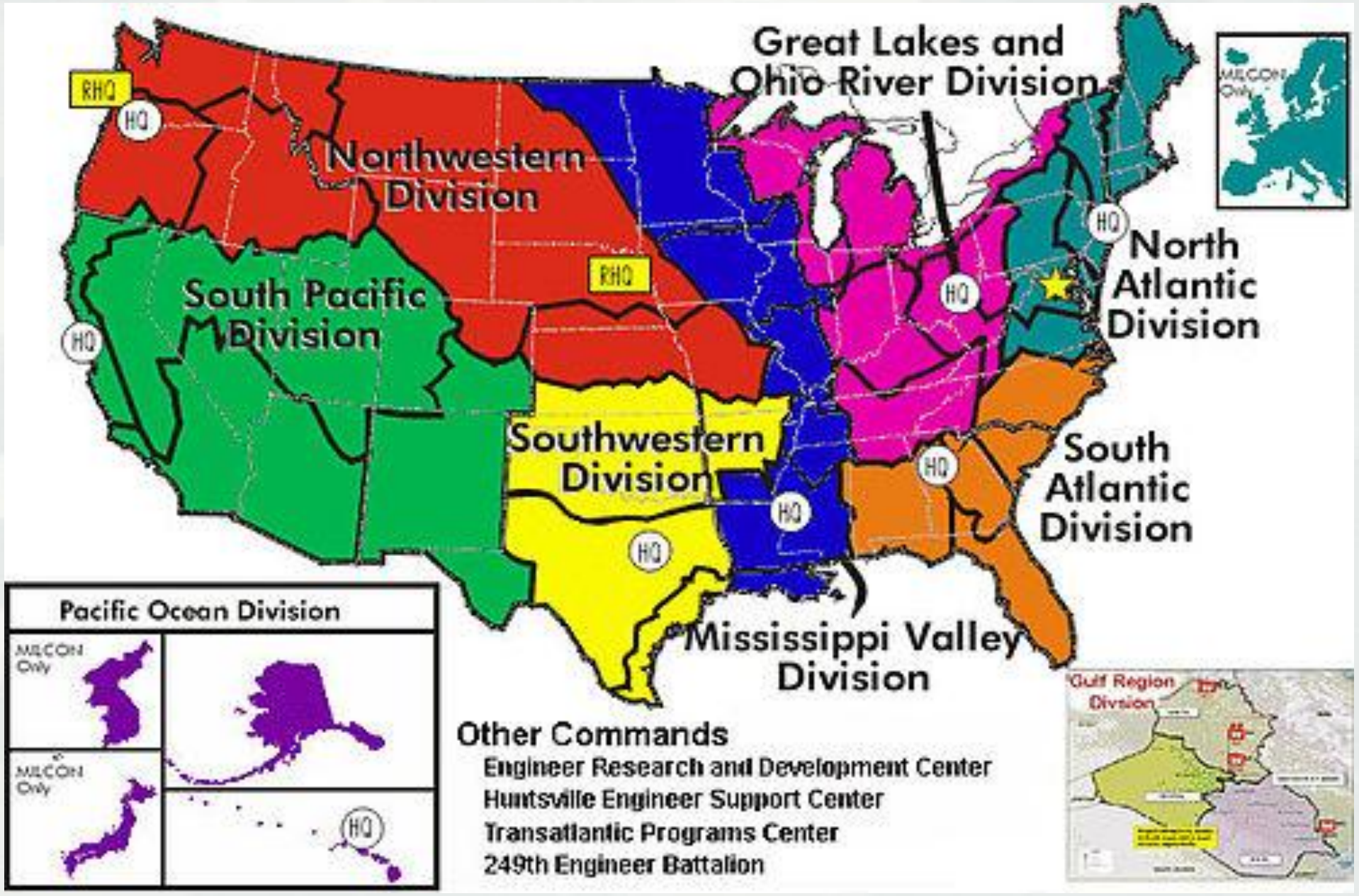
Great Lakes and Ohio River Division
RHQ
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Northwestern Division
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South Pacific Division
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North Atlantic Division
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Southwestern Division
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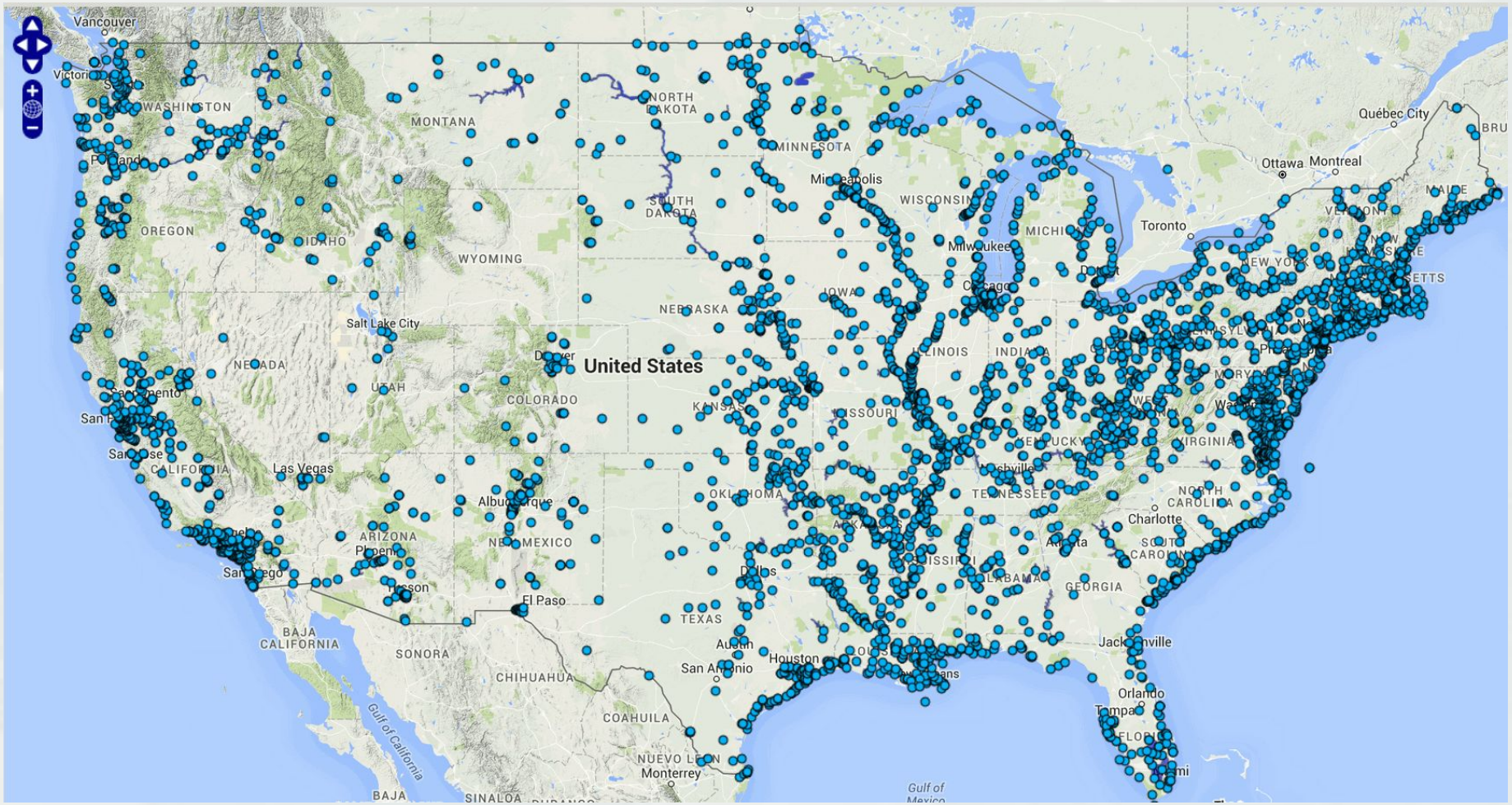
South Atlantic Division
Mississippi Valley Division
MILCON Only
Pacific Ocean Division
MILCON Only
MILCON Only
HQ
Gulf Region Division
Other Commands
Engineer Research and Development Center
Huntsville Engineer Support Center
Transatlantic Programs Center
249th Engineer Battalion

Deployed CONUS GOES DCP's



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USACE DRGS Modernization

- Contract awarded in 2018
- Objective: assure future viability of USACE DRGS network
  - Spectrum analysis shows interfering signals detected at USACE sites
  - Separate from NOAA SPRES contract scope of work
    - All USACE sites have been visited; awaiting final report
- Replacement of all USACE DRGS systems
  - Rock Island, IL – GOES East/West – Scheduled to begin ~Aug 2020
  - St. Louis, MO (East) – Site visit and EME analysis complete
  - Vicksburg, MS (East) – Site visit and EME analysis complete
  - Columbia, MS (East) – Site visit and EME analysis complete
  - Cincinnati, OH (East) – Site visit and EME analysis complete
  - Omaha, NE (East) – Phase 1 projected to begin ~Summer/Fall 2020
  - Sacramento, CA (West) – Phase 1 complete

USACE DRGS Modernization (cont'd)

- Site surveys
  - Radio frequency interference analysis - SPRES
  - Provide recommendations for mitigation, physical security, etc. - Alion
- Site/System upgrades
  - Some sites 30+ years old
  - Implementing recommendations at all USACE DRGS sites
    - New Microcom DRGS systems
    - Dish, cabling, interference mitigation, DRGS cages, DAMS-NT controllers/software, etc.
- Interference monitoring
  - Alerts and maintains record of occurrences

Rock Island District 2019 Flood Event

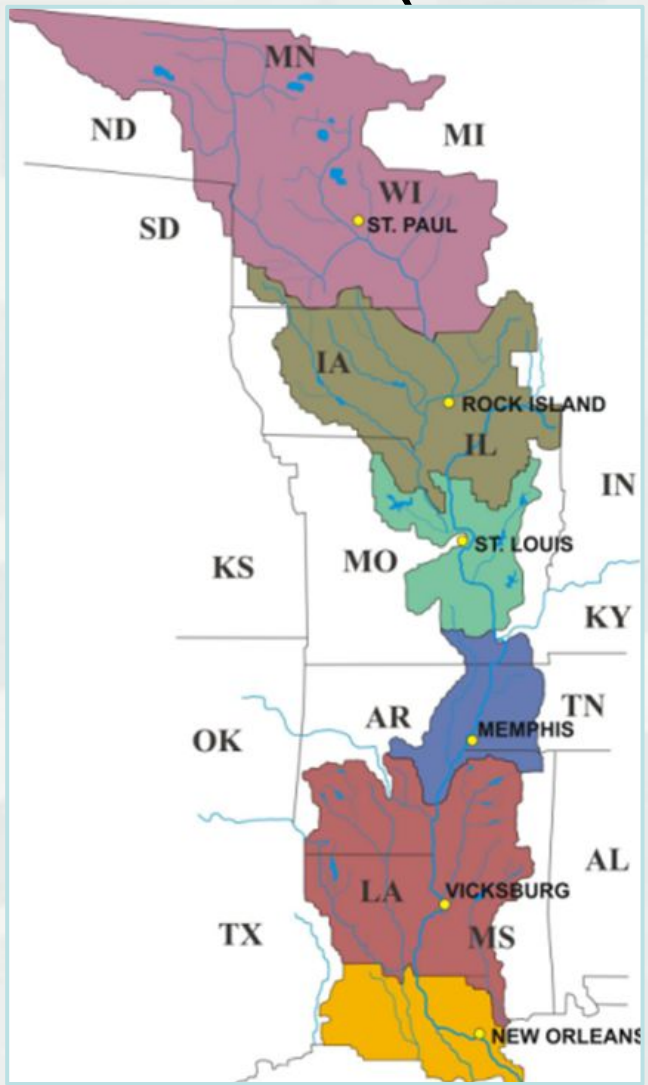
- Extremely abnormal winter
  - Several snow, melt, rain, freeze cycles in late winter months
  - Saturated soil worsened runoff from spring rain events
- Record flood duration
- Several Top 10 crests reported throughout district

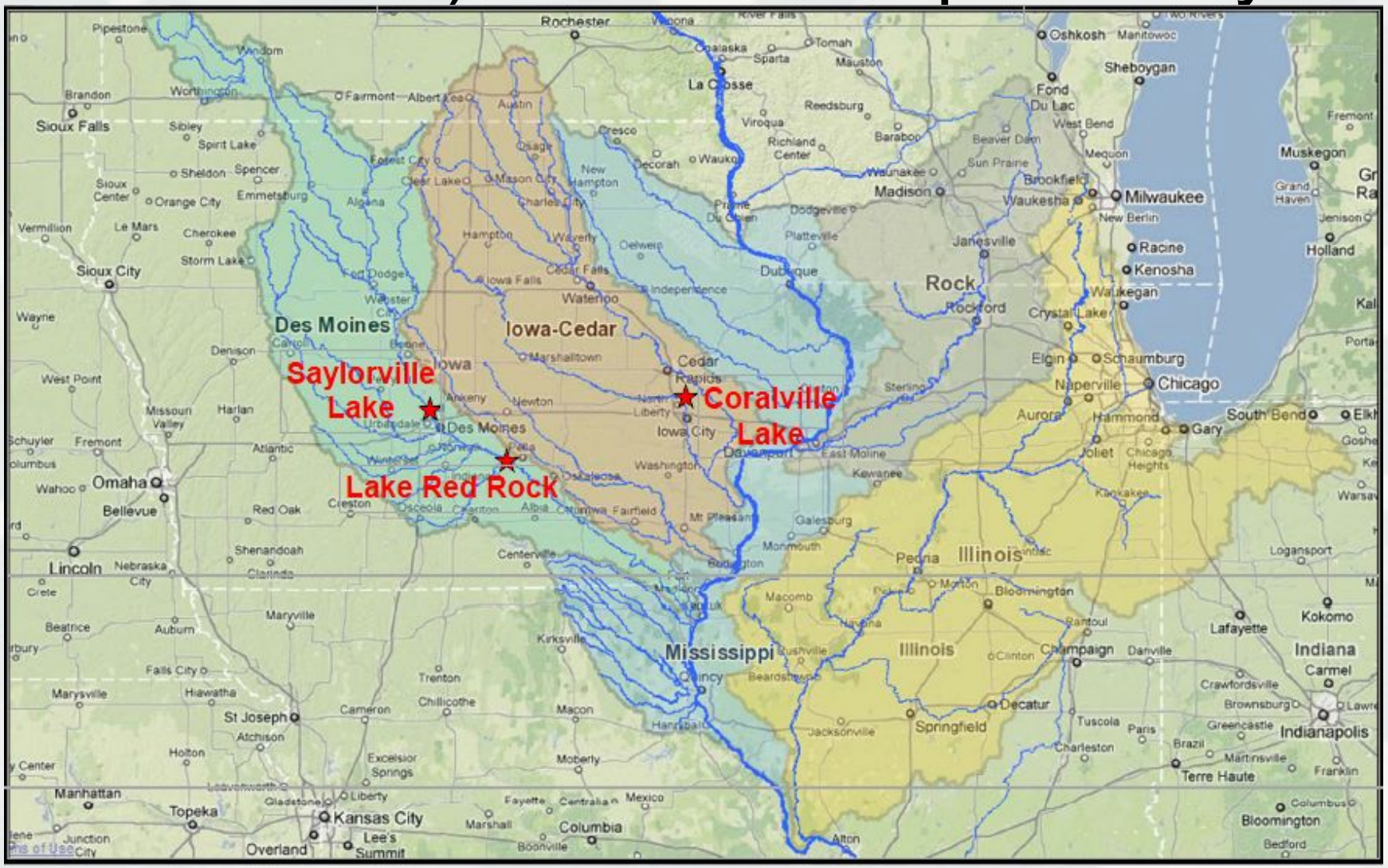
2019 Downtown Davenport, IA

25-Mar-2019

Gage Location: Mississippi River at Rock Island, IL (RCKI2: CE252210)

MVR (Rock Island District) - Area of Responsibility





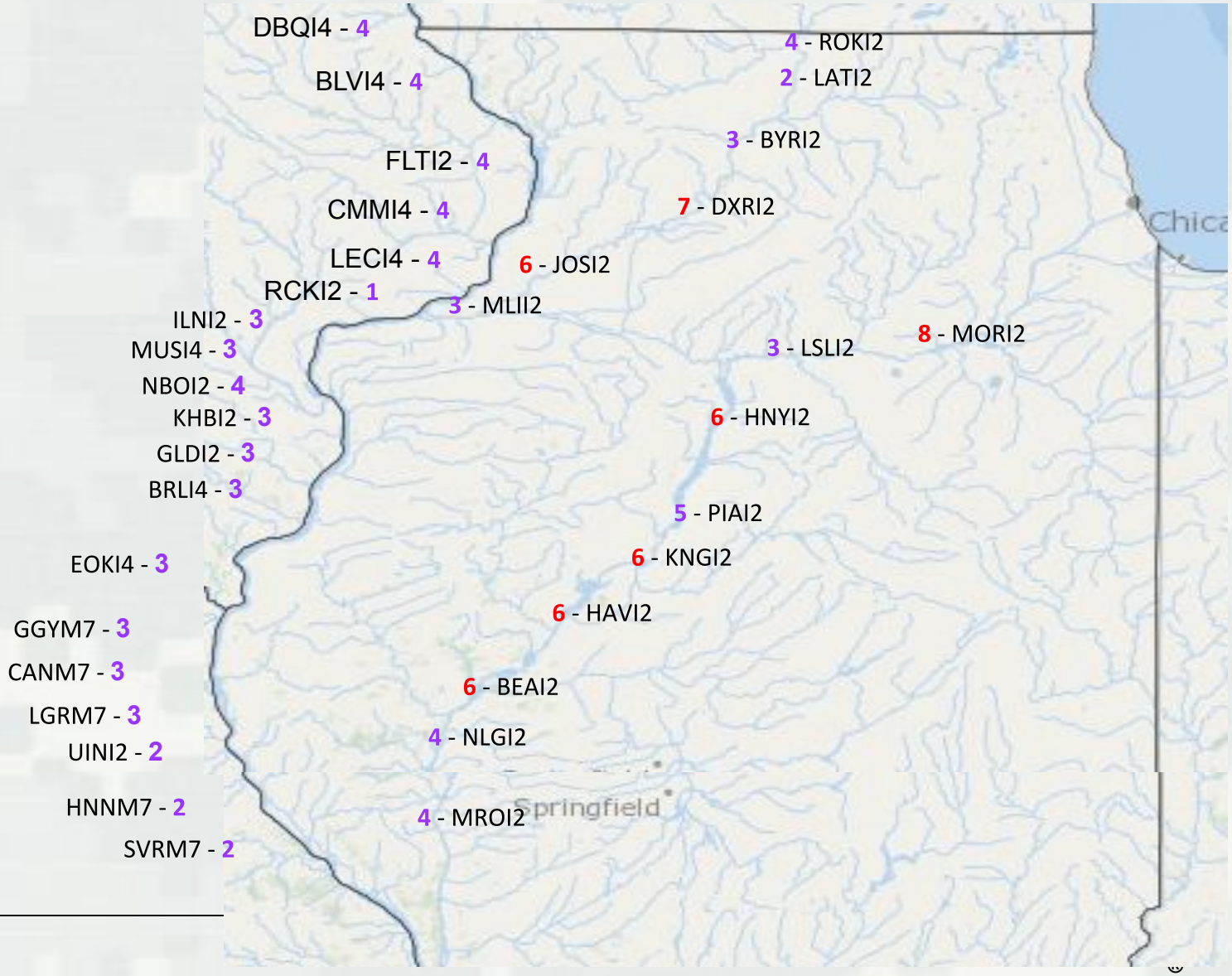
TOP 10 HISTORICAL CRESTS - 2019

Historic Crests along the Mississippi River - Spring Flood of 2019

Gage Location	Flood Stage	Beginning of Flood	March - April 2019 Crest	March - April 2019 Crest Date	April - May 2019 Crest	April - May 2019 Crest Date	May - June 2019 Crest	May - June 2019 Crest Date	Rank	Record
L&D 11 (Dubuque, IA)	16	3/22	21.22	4/6/2019	**21.77**	**4/28/2019**	19.19	5/31/2019	4	25.69 (4/26/1965)
Dubuque, IA	17	3/20	22.65	4/6/2019	**23.18**	**4/28/2019**	20.75	5/31/2019	4	26.81 (4/26/1965)
L&D 12 (Bellevue, IA)	17	3/29	20.36	4/6/2019	**20.87**	**4/29/2019**	18.91	6/5/2019	4	23.51 (4/26/1965)
L&D 13 (Fulton, IL)	16	3/22	20.91	4/8/2019	**21.77**	**4/30/2019**	19.83	6/5/2019	4	24.75 (4/28/1965)
Camanche, IA	17	3/21	21.91	4/6/2019	**22.77**	**5/1/2019**	21.23	6/1/2019	4	24.65 (4/28/1965)
L&D 14 (Le Claire, IA)	11	3/21	15.14	4/6/2019	**16.50**	**5/2/2019**	15.08	6/1/2019	4	17.75 (4/28/1965)
L&D 15 (Rock Island, IL)	15	3/15	20.68	4/8/2019	**22.70**	**5/2/2019**	21.68	6/1/2019	1	22.70 (5/2/2019)
Fairport, IA	14	3/14	21.25	4/9/2019	**23.63**	**5/3/2019**	23.03	6/2/2019	3	24.74 (7/9/1993)
L&D 16 (Illinois City, IL)	15	3/15	20.83	4/10/2019	**23.23**	**5/3/2019**	22.81	6/2/2019	3	24.10 (7/9/1993)
Muscatine, IA	16	3/15	21.95	4/10/2019	24.33	5/3/2019	**24.52**	6/2/2019	3	25.61 (7/9/1993)
L&D 17 (New Boston, IL)	15	3/16	21.05	4/10/2019	23.59	5/3/2019	**24.42**	6/2/2019	4	25.90 (7/9/1993)
Keithsburg, IL	14	3/15	19.17	4/10/2019	21.97	5/3/2019	**22.95**	6/2/2019	3	24.49 (6/17/2008)
L&D 18 (Gladstone, IL)	10	3/14	16.30	4/10/2019	19.67	5/3/2019	**20.62**	6/2/2019	3	22.46 (6/17/2008)
Burlington, IA	15	3/14	20.41	4/10/2019	23.54	5/3/2019	**24.48**	6/2/2019	3	25.73 (6/17/2008)
Fort Madison, IA	528	4/5	531.25	4/12/2019	533.37	5/3/2019	**534.30**	6/2/2019	-	-
L&D 19 (Keokuk, IA)	16	3/16	19.78	4/11/2019	23.50	5/2/2019	**25.60**	5/30/2019	3	27.58 (7/10/1993)
Gregory Landing, MO	15	3/15	20.92	4/11/2019	25.16	5/3/2019	**26.97**	6/2/2019	3	28.49 (7/9/1993)
L&D 20 (Canton, MO)	14	3/14	21.75	3/31/2019	24.85	5/3/2019	**27.11**	6/2/2019	3	27.88 (7/9/1993)
Quincy, IL	17	3/15	25.67	3/31/2019	28.78	5/3/2019	**31.16**	6/1/2019	2	32.13 (7/13/1993)
L&D 21 (Quincy, IL)	17	3/16	24.93	3/31/2019	27.81	5/3/2019	**30.15**	6/1/2019	2	31.30 (7/13/1993)
Hannibal, MO	16	3/15	25.83	3/31/2019	28.25	5/3/2019	**30.16**	6/2/2019	2	31.80 (7/15/1993)
L&D 22 (Saverton, MO)	16	3/15	24.91	3/31/2019	26.89	5/3/2019	**28.47**	6/2/2019	2	29.58 (7/25/1993)

Historic Crests along the Illinois River - Spring Flood of 2019

Gage	Flood Stage	May - June 2019 Crest	May - June 2019 Crest Date	Rank	Record
L&D 2 (Lockport)	541.0	542.72	5/1/2019	-	456.59 (12/4/1982)
L&D 3 (Brandon Road)	507.0	510.54	5/1/2019	-	513.30 (7/13/1957)
L&D 4 (Dresden Island)	491.5	504.46	5/2/2019	8	506.38 (4/19/2013)
Morris	16.0	23.04	5/2/2019	5	24.91 (4/19/2013)
L&D 5 (Marseilles)	467.0	474.18	5/2/2019	5	476.72 (4/19/2013)
Ottawa	463.0	470.83	5/2/2019	4	473.62 (4/19/2013)
L&D 6 (Starved Rock)	450.0	464.61	5/3/2019	4	467.81 (4/19/2013)
LaSalle	20.0	32.14	5/3/2019	3	34.44 (4/20/2013)
Henry	31.3	31.27	5/6/2019	6	32.94 (4/22/2013)
Peoria Boatyard	18.0	28.00	5/7/2019	5	29.35 (4/23/2013)
L&D 7 (Peoria)	446.4	455.04	5/7/2019	5	456.57 (4/23/2013)
*Copperas Creek	428.0	24.30	5/8/2019	4	25.52 (4/25/2013)
Havana	14.0	26.73	6/3/2019	6	27.78 (4/26/2013)
Beardstown	14.0	28.99	5/9/2019	6	29.81 (4/27/2013)
L&D 8 (La Grange)	23.0	33.89	6/4/2019	4	34.66 (7/2/2015)



Top 10 Crests Cont'd

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RECORDS FOR FLOOD DURATION- 2019

2019 Mississippi River Flooding Consecutive Days above Flood Stage Below are the top 2 records for Consecutive Days above Flood Stage at each gage.			
Dubuque L&D 11	**52 Days: 2019 - 3/22 to 5/12** 35 Days: 2001 - 4/14 to 5/18	**Keithsburg**	**105 Days: 2019 - 3/15 to 6/27** 63 Days: 1993 - 6/8 to 8/9
Dubuque RR Bridge	**86 Days: 2019 - 3/20 to 6/13** 37 Days: 2001 - 4/13 to 5/19	**Gladstone L&D 18**	**108 Days: 2019 - 3/14 to 6/29** 95 Days: 1993 - 6/8 to 9/10
Bellevue L&D 12	**43 Days: 2019 - 3/29 to 5/10** 31 Days: 2001 - 4/16 to 5/16	**Burlington**	**108 Days: 2019 - 3/14 to 6/29** 95 Days: 1993 - 6/8 to 9/10
Fulton L&D 13	**54 Days: 2019 - 3/22 to 5/14** 35 Days: 2001 - 4/16 to 5/20	**Keokuk L&D 19**	**99 Days: 2019 - 3/16 to 6/22** 81 Days: 1993 - 6/20 to 9/8
Camanche	**88 Days: 2019 - 3/21 to 6/16** 39 Days: 2011 - 3/31 to 5/8	**Gregory Landing**	**108 Days: 2019 - 3/15 to 6/30** 101 Days: 1993 - 6/5 to 9/13
Le Claire L&D 14	**56 Days: 2019 - 3/21 to 5/15** 35 Days: 2001 - 4/16 to 5/20	**Canton L&D 20**	**111 Days: 2019 - 3/14 to 7/2** 101 Days: 1993 - 6/9 to 9/17
Rock Island L&D 15	**96 Days: 2019 - 3/15 to 6/18** 43 Days: 2011 - 3/29 to 5/10	**Quincy**	**109 Days: 2019 - 3/15 to 7/1** 97 Days: 1993 - 6/9 to 9/13
Illinois City L&D 16	**96 Days: 2019 - 3/15 to 6/18** 44 Days: 1993 - 4/5 to 5/18	**Quincy L&D 21**	**106 Days: 2019 - 3/16 to 6/29** 95 Days: 1993 - 6/10 to 9/12
Muscatine	**99 Days: 2019 - 3/15 to 6/21** 56 Days: 1993 - 6/9 to 8/3	**Hannibal**	173 Days: 1993 - 4/1 to 9/20 **127 Days: 2019 - 3/14 to 7/18**
New Boston L&D 17	**103 Days: 2019 - 3/15 to 6/25** 60 Days: 1993 - 6/9 to 8/7	**Saverton L&D 22**	**110 Days: 2019 - 3/15 to 7/2** 102 Days: 1993 - 6/10 to 9/19

2019 USACE Summary

- ~2936 owned GOES Id's
- ~2527 active GOES platforms (all 300 baud)
- Channels: 17, 25, 31, 49, 58, 73, 88, 161, 162, 177
- Western districts converting Line of Site platforms to GOES (SPL completely converted)
- Of 38 districts, over ~90% have at least one local L/HRIT receive system
- Still a desire for more frequent transmissions at critical locations
  - Some also transmit on random channel while exceeding observation threshold
- Supplementing GOES DCP's with r/t DAMS-NT over LAN at some locks and dams, etc.
- "300 series" channels?
- 2-Way DCP's?
- Adding sensors sending add'l observations as necessary for MMC Modeling efforts
- USACE DRGS modernization

USACE GOES Usage by Division

- North Atlantic Division
  - New England, New York, Philadelphia, Baltimore and Norfolk Districts
- 225 Active GOES Platforms (300 Baud)
  - 235 total
- Channel 161
- 1-hour intervals
- 5, 10 and 15 second windows

USACE GOES Usage by Division

- North Atlantic Division (cont'd.)
  - New England District - NAE
    - 98 Active GOES DCP's (300 Baud on Channel 161)
      - 35 reservoirs, 3 hurricane barriers, 2 tidal stations and remaining are stream gages
      - Primarily 5-sec time windows with a few 10-sec
      - Most transmit 15-minute data hourly
      - 3 hurricane barriers transmit every 30 minutes

USACE GOES Usage by Division

- North Atlantic Division (cont'd.)
  - Baltimore District - NAB
    - Transmits 15 minute data hourly
    - 17 of 83 are reservoir and remaining are stream gages
    - 20 collect precip, 12 collect air temp and 10 collect water quality data
    - No new gages in the foreseeable future

USACE GOES Usage by Division

- South Atlantic Division
  - Charleston, Jacksonville, Mobile, Savannah, and Wilmington Districts
- ~230 GOES Platforms (300 Baud)
  - 131 active
- Channels 31 and 161
  - SAM completed vacating channel 41
- 1-hour intervals
- 5, 10 and 15 second windows

USACE GOES Usage by Division

- South Atlantic Division (cont'd.)
  - Wilmington District – SAW
    - 39 active GOES DCP's (300 Baud)
    - Channel 161
    - 10-minute samples
    - Hourly transmissions
    - Decodes 74 USGS GOES DCP's throughout North Carolina and Virginia

USACE GOES Usage by Division

- South Atlantic Division (cont'd.)
- Jacksonville District – SAJ
  - 46 active DCP's (89 total)
  - Recently received a new block of NESDIS Id's
  - Plans to deploy 25-30 new platforms (some currently under construction)
    - Culverts along Herbert Hoover Dike surrounding Lake Okeechobee
  - Sensors: Shaft encoders, wind sensors, barometers, pressure transducers, gate position indicators, temperature sensors, battery voltage and flow meters
  - Typical sites: locks and dams, spillways, culverts, stilling wells, etc.

USACE GOES Usage by Division

- Lakes and Rivers Division
  - Huntington, Detroit, Nashville, Pittsburgh, Cincinnati, Buffalo and Louisville Districts
- ~739 GOES Platforms (300 Baud)
  - 675 active
- Channels 17, 25, 88, 177
- 1-hour intervals
- 10 second windows

USACE GOES Usage by Division

- Lakes and Rivers Division (cont'd.)
  - Pittsburg District - LRP
    - 313 Platforms (260 USGS)
  - Huntington District - LRH
    - 262 Platforms (176 USGS)
  - Cincinnati District - LRC
    - 24 Platforms (24 USGS)
  - Buffalo District - LRB
    - 20 Platforms (24 USGS)
  - Louisville District - LRL
    - 124 Platforms (124 USGS)
  - Nashville District - LRN
    - 90 Platforms (47 USGS)
    - Precip, stage, air/water temp, pool, tail, pH, dissolved oxygen, pool/tail elevation, gate opening, etc.
  - Detroit District - LRE
    - 74 Platforms

USACE GOES Usage by Division

- Mississippi Valley Division
  - St. Paul, Rock Island, St. Louis, Memphis, New Orleans and Vicksburg Districts
- 798 GOES Platforms (300 Baud)
  - 710 active
- Channels 31, 49, 58, 73, 177
- 30-minute and 1-hour transmit intervals
- 5 and 10 second windows

USACE GOES Usage by Division

- Mississippi Valley Division (cont'd.)
  - St. Louis District - MVS
    - 122 PDT's (118 active)
      - 64 distributed throughout central and eastern Missouri
      - 54 sites in central and southern Illinois
      - Elevation, stage, precip, air/water temp, wind speed/direction, water quality, etc.
    - 10 major water resource projects (5 reservoirs, 5 locks and dams)
    - 100+ levee systems
    - 10 CS2 transmitters deployed, 30 on the shelf
    - Use DRGS and LRIT to receive data
    - Continuing to upgrade to CS2 (25-50 DCP's/year)
    - Will need 4-5 new DCP assignments per year for the next 5 years

USACE GOES Usage by Division

- Mississippi Valley Division (cont'd.)
  - Rock Island District - MVR
    - 155 active DCP's (161 total)
      - 22 CS2 Platforms
      - Contract with USGS to maintain 103 active MVR stations
      - Receive and decode 165 additional USGS gages
      - Fund 85 USGS gages
    - 23 Projects (20 Navigation Locks and Dams and 3 Multi-purpose Reservoirs)
      - MET Stations: Air/water temp, wind speed/direction, gate opening, pool/tail stage, precip, pool/tail elevation
      - Half-hourly transmissions
      - Send minute interval data using network DCP's
      - Display real-time data on homegrown web GUI served from Sutron DCP
      - Acquire data locally: monitoring includes all Corps GOES DCS channels
        - East and West DRGS cages with LRIT as secondary GOES downlink
        - Distribute data Corps-wide as Data Acquisition Center
        - Host Cove DCP-Monitor: decode and collect districts' GOES data and display performance stats
    - GOES East and West DRGS
    - HRIT Receiver

USACE GOES Usage by Division

- Mississippi Valley Division (cont'd.)
  - New Orleans District - MVN
    - Maintains 95 Data Collection Platforms
    - Allows District's Water Management Team to daily maintain 30/70 split between Atchafalaya River and the Mississippi River at the Old River Control Complex using near real-time water level data
    - Allows the district to provide the public with real-time water levels throughout SE Louisiana

USACE GOES Usage by Division

- Northwestern Division – Missouri River Region
  - Kansas City, Omaha District, NWD-MRR Division Office
  - ~391 owned NESDIS Id's (300 Baud)
    - 341 active owned platforms
      - NWO: 381, NWK: 186, NWDM: 119
    - 686 unique platforms decoded
      - Includes USACE, USGS, local gov't and municipality owned
  - Channels 58, 128
  - 1-hour intervals; 15-minute and hourly routing specs
  - 5, 10 and 20 second windows

USACE GOES Usage by Division

- Northwestern Division - MRR (cont'd.)
  - Kansas City District – NWK
    - decodes and collects180 (91 funded whole or in part)
    - Transmitting 15 minute data every hour
    - A few platforms log 5 minute data and transmit hourly
    - Typical configuration consists of a Sutron DCP with orifice lines and/or radar gages
    - Added new sensors for (MMC) modeling effort

USACE GOES Usage by Division

- Northwestern Division – Columbia River Region
  - Portland, Walla Walla and Seattle Districts
  - Walla Walla District – NWW
  - 18 platforms
    - Mostly elevation, weather, water temp and stage
  - 15 platforms are maintained by the USGS but owned and monitored by NWW
  - Plan to add 7 platforms in the next year for temp monitoring and elevation
  - Plan to add another 7 in the next 2-3 for project data, weather and water temp
  - Plan to add 6 platforms for fish passage purposes

USACE GOES Usage by Division

- Northwestern Division - CRR (Cont'd)
  - Seattle District – NWS
  - Receives GOES data from 183 DCP's located within the District's border, owned and operated by various Federal agencies
    - 5 minute, 15 minute and 1 hour data intervals
    - We use stream gage data, water quality data and weather data from these GOES DCP's
  - NWS owns 14 DCP's that currently transmit GOES data.
    - Transmit hourly data, once per hour
    - 5 second or 10 second transmission windows
    - We transmit stream gage data, water quality data and weather data
    - All transmit on primary channel 88
    - All transmitters we own are currently transmitting on 300 baud rate
    - 13 of 14 units are Satlink 2's; recently upgraded to latest firmware for GPS rollover in early April
  - GOES data provides a critical, primary and/or secondary data delivery mechanism that is crucial for Seattle District's decision-making process, regarding the safety of lives and property downstream of the District's locks and dams.

USACE GOES Usage by Division

- Southwestern Division
  - Tulsa, Fort Worth and Galveston Districts
    - Galveston transferred all DCP's to USGS
      - Funds equipment, operation and maintenance
- ~388 GOES Platforms (300 Baud)
  - 345 active
- Channels 31, 49, 88 and 162
- 1-hour intervals
- 5 and 10 second windows

USACE GOES Usage by Division

- South Pacific Division
  - Sacramento, San Francisco, Los Angeles and Albuquerque Districts
- ~263 GOES Platforms (300 Baud)
  - 221 active
- Channels 17, 31
- 1-hour intervals
- 5 and 10 second windows

USACE GOES Usage by Division

- South Pacific Division (cont'd.)
  - Los Angeles District - SPL
    - 30 GOES Platforms
    - Converted all LOS sites to GOES
    - 2 L/HRIT systems (LA and El Monte, CA)
  - Sacramento (SPK) and San Francisco (SPN) Districts
    - 125 GOES platforms
    - VHF/LOS and IP redundancy

End.