2019 USACE GOES DCS User Report

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Water Control, Rock Island District

Rock Island, IL

24 April 2019

2019 DCS Technical Working Group Meeting

USACE Western Division Risk Management Center

Denver, CO

US Army Corps of Engineers

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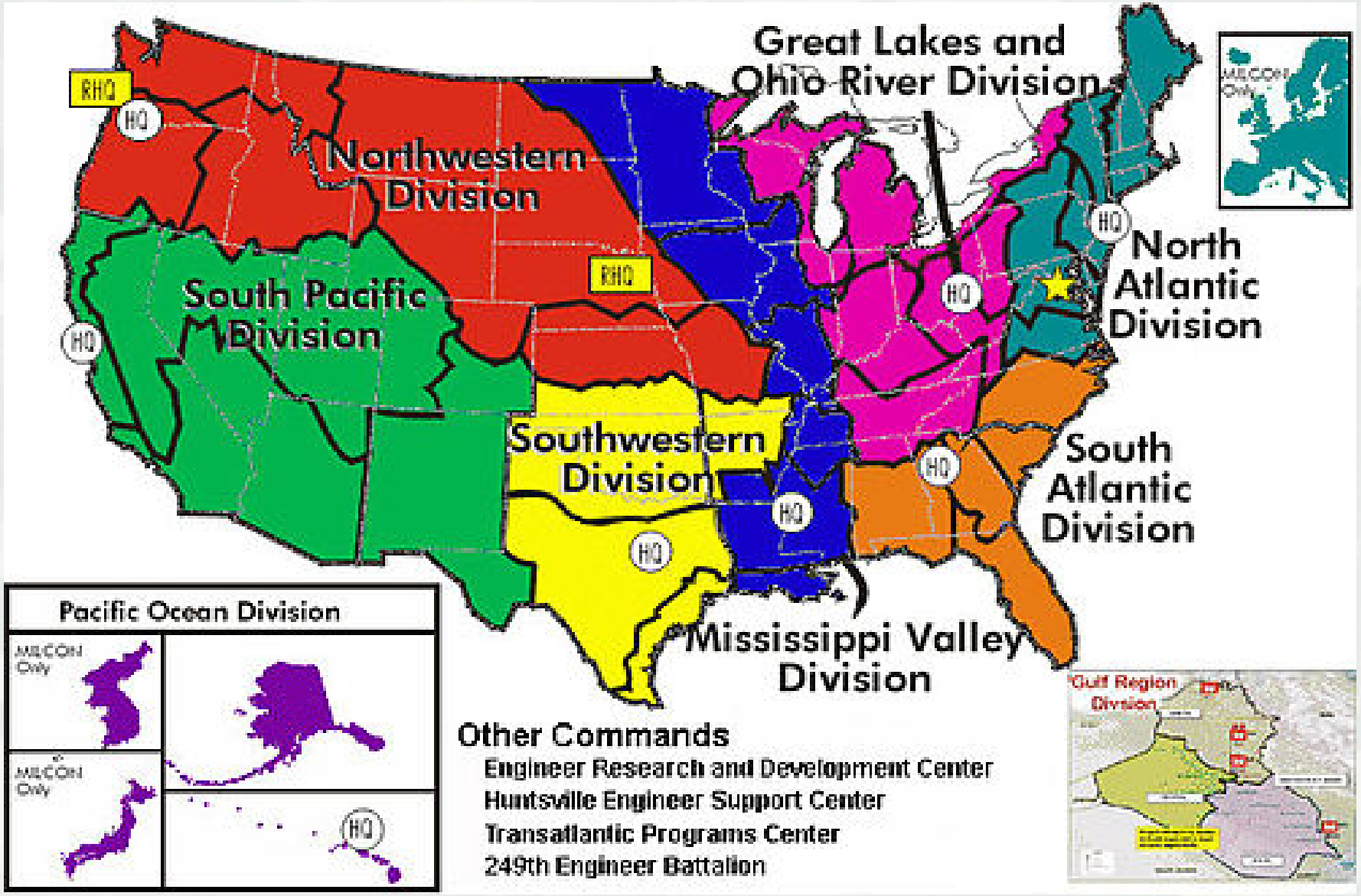
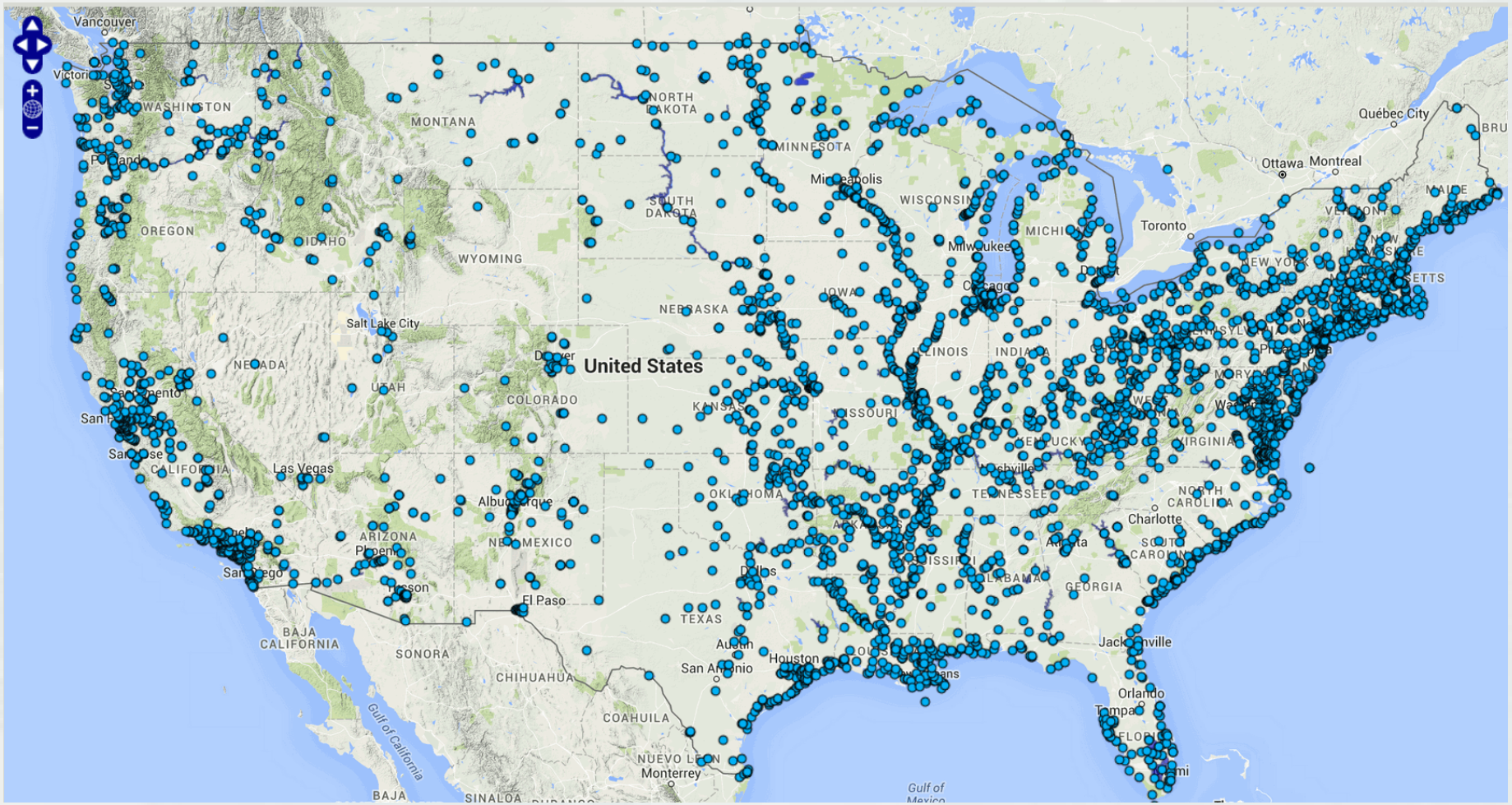


257 USACE Navigation Projects
- $250B/yr Benefit
- 12,000 miles of navigable channel
- 50% oil imports
- 67% of US consumer goods

400 USACE Reservoir Projects
- 132 multi-use water resource projects
- Avg. $90B/yr flood damage reduction
- 75 hydro-electric plants
- 24% of US hydro-power generation
- 9M ac/ft of water storage
- Recreation, water supply, fish, etc.
- 4B gal/day used from USACE projects

Deployed CONUS GOES DCP's



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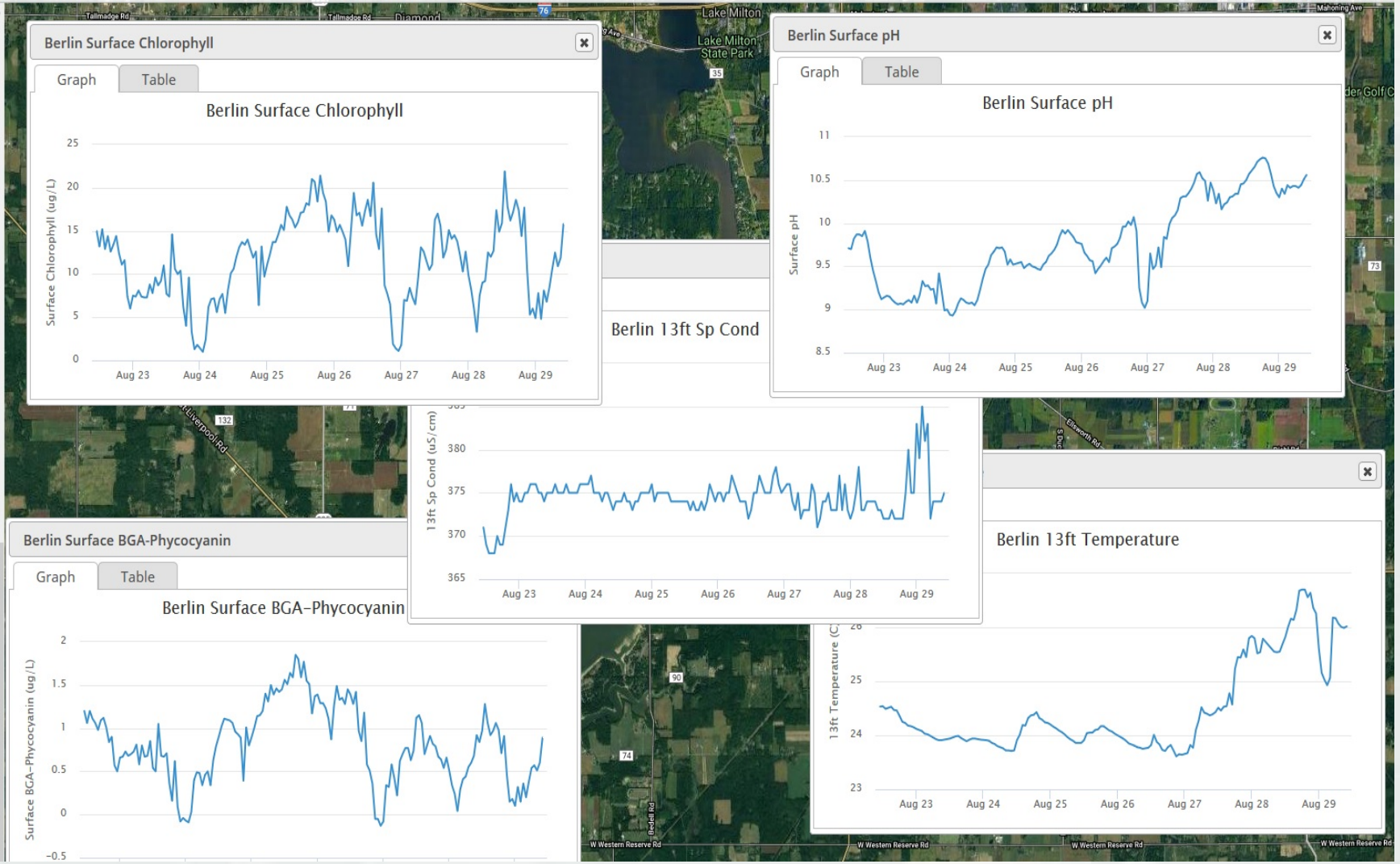
Pittsburgh District Reservoir Temperature Monitoring Network

Wednesday, August 29th, 2018

Surface Sonde Depth (ft)	1.46
Surface pH	10.56
Surface pH mV	-242.8
Surface ORP (mV)	146
Surface Turbidity (NTU)	4.29
Surface Chlorophyll (ug/L)	15.8
Surface Chlorophyll RFU (RFU)	3.9
Surface BGA-Phycocyanin (ug/L)	0.890
Surface BGA-Phycocyanin RFU (RFU)	0.9
Surface ODOSat (%)	121.3
Surface ODO (mg/L)	9.63
13ft Temperature (C)	26.02
13ft Sp Cond (uS/cm)	375
13ft Depth (ft)	9.833
13ft pH	9.03
13ft pH mV	-135.1
13ft ORP (mV)	219
13ft Turbidity (NTU)	173.36
13ft Chlorophyll (ug/L)	23.1
13ft Chlorophyll RFU (RFU)	5.7
13ft BGA-Phycocyanin (ug/L)	1.270
13ft BGA-Phycocyanin RFU (RFU)	1.3
13ft ODOSat (%)	134.3



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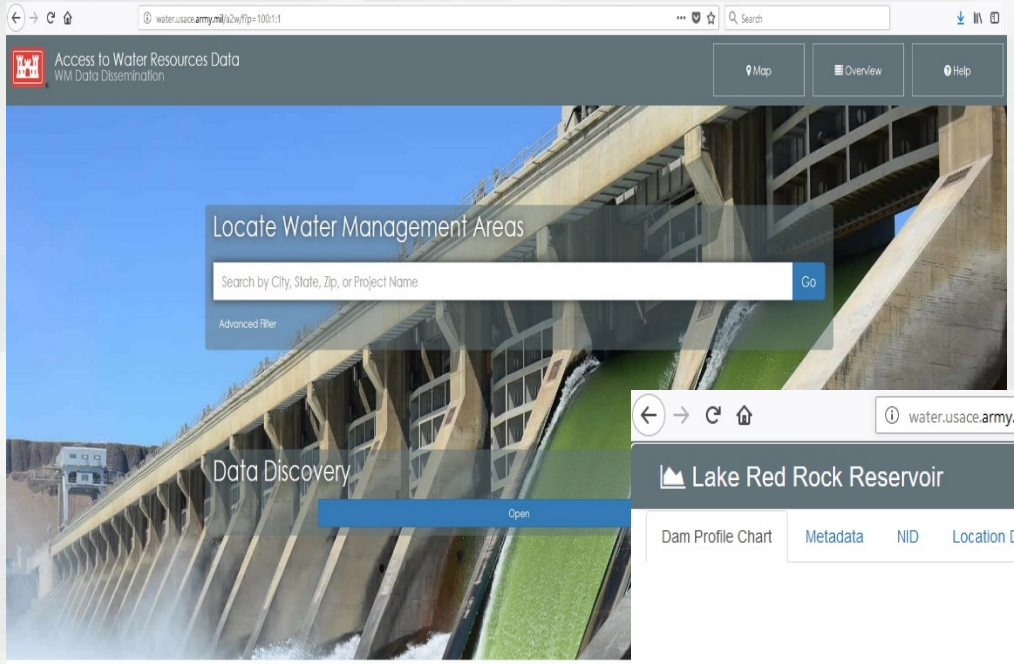
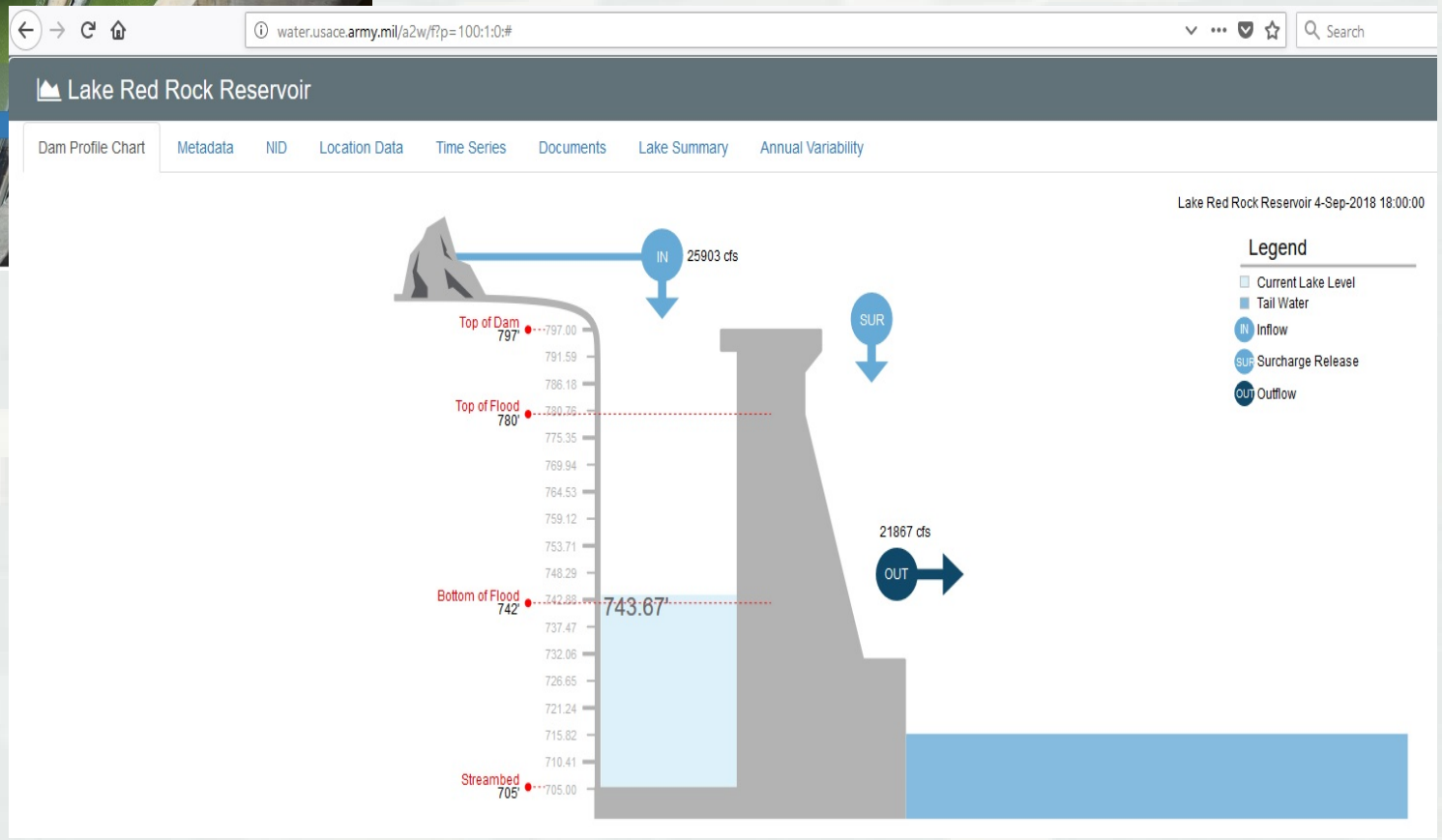
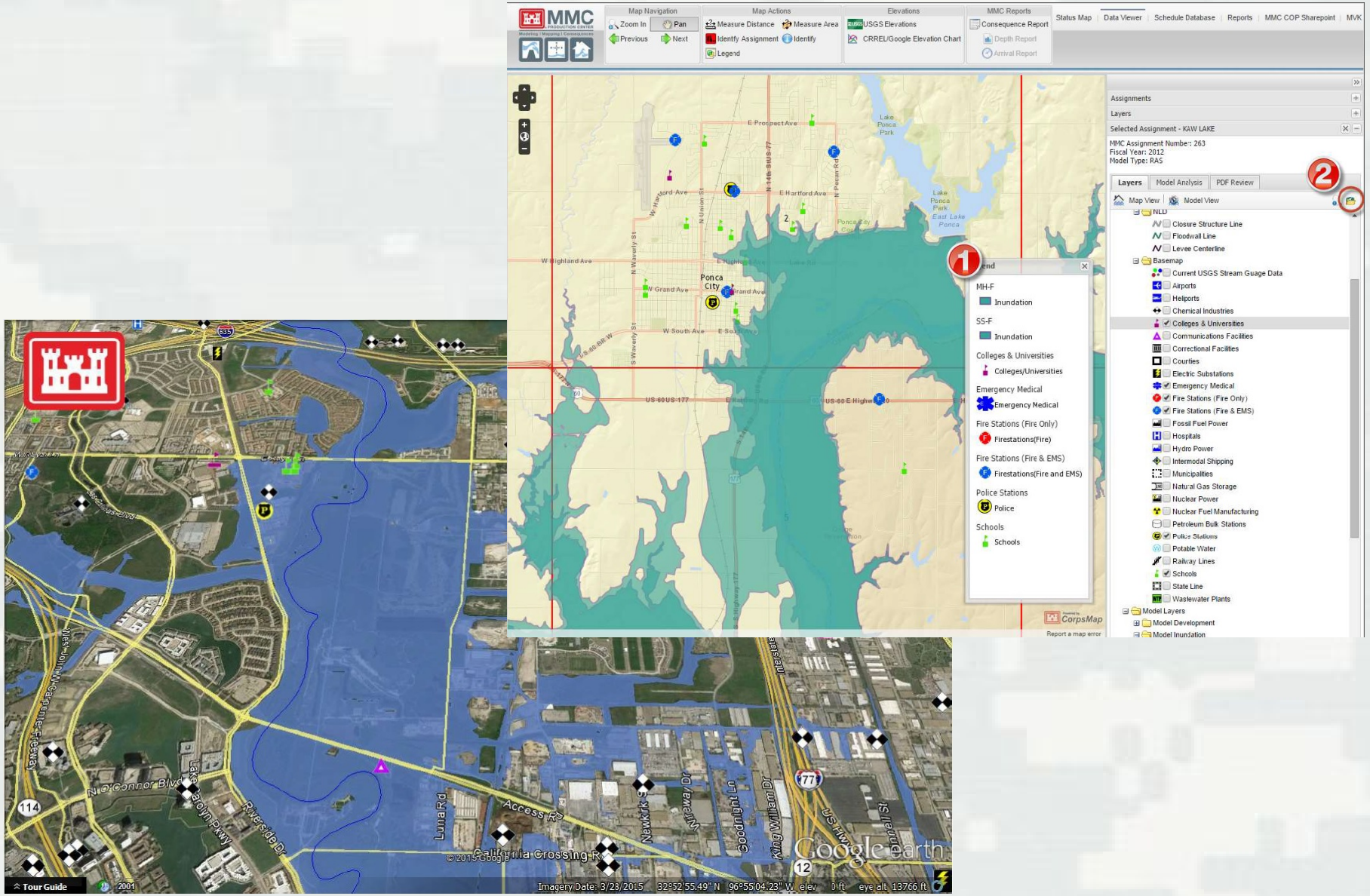

Access to Water Resources Data
WM Data Dissemination
Map
Overview
Help
Locate Water Management Areas
Search by City, State, Zip, or Project Name
Go
Advanced Filter
Data Discovery
Open


water.usace.army.mil/a2w/f?p=100:1:0:#
Search
Lake Red Rock Reservoir
Dam Profile Chart
Metadata
NID
Location Data
Time Series
Documents
Lake Summary
Annual Variability
Lake Red Rock Reservoir 4-Sep-2018 18:00:00
IN
25903 cfs
SUR
Top of Dam
797'
Top of Flood
780'
Bottom of Flood
742'
Streambed
705'
797.00
791.59
786.18
780.76
775.35
769.94
764.53
759.12
753.71
748.29
742.88
737.47
732.06
726.65
721.24
715.82
710.41
705.00
743.67'
21867 cfs
OUT
Legend
Current Lake Level
Tail Water
Inflow
Surcharge Release
Outflow



USACE Modeling Mapping and Consequences Production Center creates inundation maps by incorporating real-time GOES hydro-met observations. FIM is combined with economic, land use and other information for analysis to estimate consequences/losses; fatality rates, critical infrastructure, real-estate, etc.

RIVERGAGES.COM

Water Levels of Rivers and Lakes

US Army Corps of Engineers

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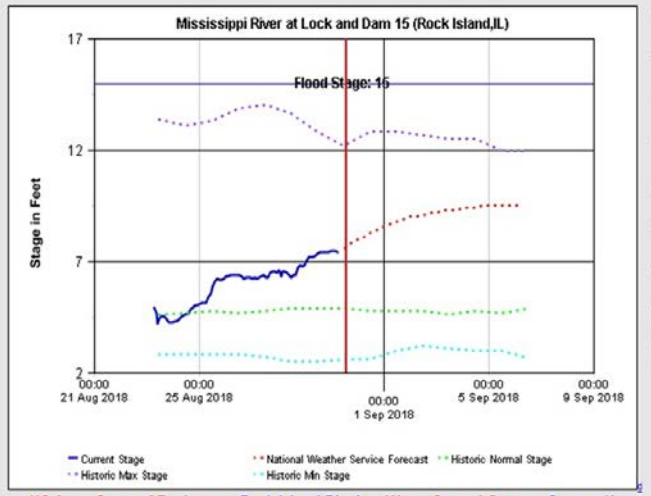
Mississippi River at Lock and Dam 15 (Rock Island,IL) - National Weather Service Forecast
(Central Time Zone)



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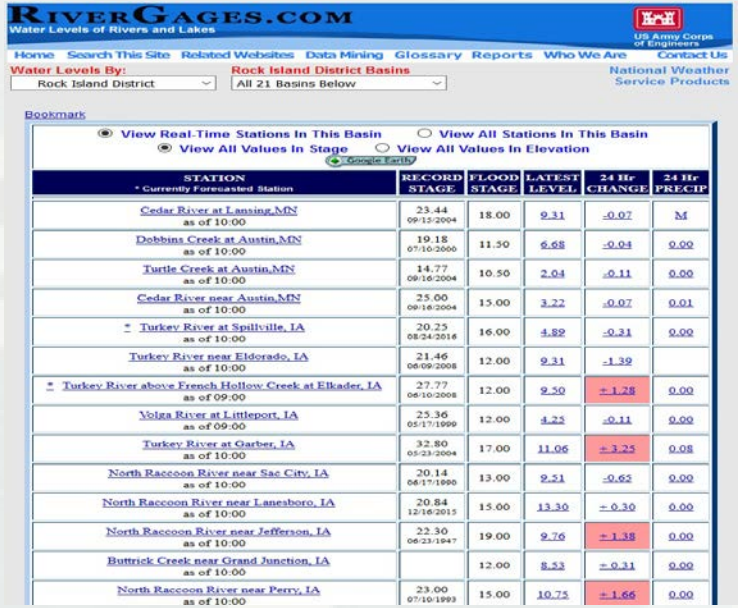
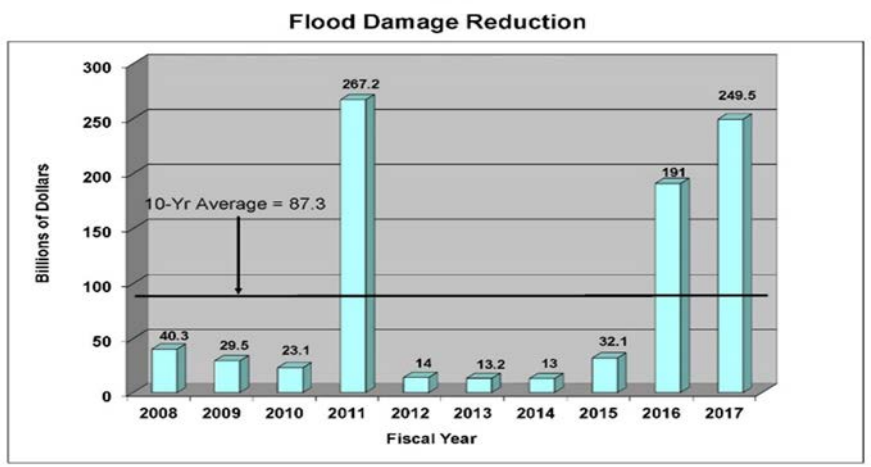


STATION * Currently Forecasted Station	RECORD STAGE	FLOOD STAGE	LATEST LEVEL	24 Hr CHANGE	24 Hr PRECIP
Cedar River at Lansing,MN as of 10:00	23.44 09/15/2004	18.00	9.31	-0.07	M
Dobbins Creek at Austin,MN as of 10:00	19.18 07/10/2000	11.50	6.68	-0.04	0.00
Turtle Creek at Austin,MN as of 10:00	14.77 09/16/2004	10.50	2.04	-0.11	0.00
Cedar River near Austin,MN as of 10:00	25.00 09/16/2004	15.00	3.22	-0.07	0.01
* Turkey River at Spillville, IA as of 10:00	20.25 08/24/2016	16.00	4.89	-0.31	0.00
Turkey River near Eldorado, IA as of 10:00	21.46 08/09/2008	12.00	9.31	-1.39	
* Turkey River above French Hollow Creek at Elkader, IA as of 09:00	27.77 08/10/2008	12.00	9.50	+ 1.28	0.00
Volga River at Littleport, IA as of 09:00	25.36 05/17/1999	12.00	4.25	-0.11	0.00
Turkey River at Garber, IA as of 10:00	32.80 05/23/2004	17.00	11.06	+ 3.25	0.08
North Raccoon River near Sac City, IA as of 10:00	20.14 06/17/1990	13.00	9.51	-0.62	0.00
North Raccoon River near Lanesboro, IA as of 10:00	20.84 12/16/2015	15.00	13.30	+ 0.30	0.00
North Raccoon River near Jefferson, IA as of 10:00	22.30 06/23/1947	19.00	9.76	+ 1.38	0.00
Buttrick Creek near Grand Junction, IA as of 10:00		12.00	8.53	+ 0.31	0.00
North Raccoon River near Perry, IA as of 10:00	23.00 07/10/1993	15.00	10.75	+ 1.66	0.00

FIGURE 1



Flood Damages Prevented in the U.S.A. by the U.S. Army Corps of Engineers

G-3

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
  - Add'l Chans:16, 20, 24, 28, 29, 30, 32, 36, 38, 54, 66, 70, 77, 80, 83, 88, 89, 90, 94, 102, 105, 109, 122, 124, 126, 128, 129, 138, 142, 144, 152, 153, 154, 156, 164, 170, 172, 202, 208
- 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

- 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

- Mobile District - SAM
  - 30 District maintained Data Collection Platforms (300 baud, Channel 31)
  - Decode 271 USGS GOES DCP's throughout Mississippi, Alabama, Georgia, and Florida
  - Hourly transmissions
    - 5 ,10 and 15 second windows
  - Sensors: Shaft Encoders, wind sensors, barometers, pressure transducers, gate position indicators, temperature sensors, flow meters, battery voltage, pH, DO, and turbity
  - Typical sites: Locks and dams, spillways, river gauges, tidal platforms

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)
    - Precip, stage, air/water temp, pool, tail, pH, dissolved oxygen, pool/tail elevation, gate opening, etc.
  - 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)
  - Vicksburg District
    - 187 PDT's
      - 42 sites throughout MS, AR, LA in the USGS Co-Op Program
      - 145 sites in MS, AR, LA maintained by MVK
        - Elevation, stage, precip, air/water temp
        - 7 major river basins
        - 19 major water resources projects (10 reservoirs, 9 lock and dams)
        - 16 pump stations/gated structures
        - 75% are CS2 compliant
      - Use DRGS and HRIT to receive data
      - Continuing migration to CS2 (25 – 50 DCP's/year)
        - Will need 4 – 5 new DCP assignments/year for next 5 years

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
  - Kansas City, Omaha, Walla Walla, Seattle and Portland Districts
- ~391 GOES Platforms (300 Baud)
  - 341 active
- Channels 58, 88
- 1-hour intervals
- 5, 10 and 20 second windows

USACE GOES Usage by Division

- Northwestern Division (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

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

USACE GOES Usage by Division

- South Pacific Division (cont'd)
  - ▶ Sacramento District (SPK)
  - ▶ ~125 Active GOES Platforms
    - Channels:16, 20, 24, 28, 29, 30, 32, 36, 38, 54, 66, 70, 77, 80, 83, 88, 89, 90, 94, 102, 105, 109, 122, 124, 126, 128, 129, 138, 142, 144, 152, 153, 154, 156, 161, 164, 170, 172, 202, 208

DCP Outages

- Design Analysis H-2221: ~200 sites impacted
  - ▶ Able to deploy firmware update quickly once made available
  - ▶ Daily meetings with Xylem were appreciated to keep users informed
- Multi-Manufacturer GPS Roll-Over Outage
  - ▶ Communication lapse and unavailability of firmware fix affected 100+ USACE platforms; ~2,000 nation-wide
    - Coincided with extensive flood event
    - Requesting more communication and engagement from manufacturers to avert these disruptive outages
    - Districts still working to resolve the issue

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 and West
  - St. Louis, MO
  - Vicksburg, MS
  - Columbia, MS
  - Cincinnati, OH
  - Omaha, NE
  - Sacramento, CA

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

End.