

## Mississippi River & Tributaries Project

### Overview, Historic Perspectives and Statistics

**Scott Whitney**  
MVD REGIONAL FLOOD RISK MANAGER  
IRTF Meeting, Pearl MS  
23 Aug 2011

US Army Corps of Engineers  
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## Mississippi River Watershed

### World's 3rd Largest

Drainage basin for 41% of the United States

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## 1927 Flood

**Legend**  
1927 Flooded Area

26,000 Square Miles Flooded  
500 People Killed  
325,000 Refugees

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## Mississippi River & Tributaries Project

- Largest and most comprehensive FRM in the world.
- Comprised of Levees, Channel Stabilization, Tributary improvements and Floodways
- 35,000-square-mile flood plain
- \$13.9 billion invested
- \$478.3 billion in flood damages prevented
- 34 to 1 return on investment
- 4.5 million people protected
- MR&T Project Currently 89% Complete

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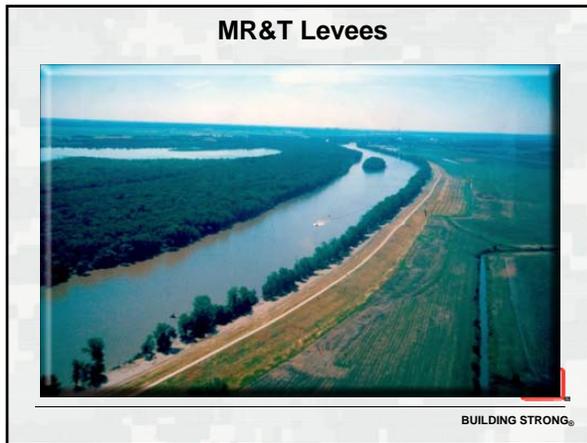
## HYPO - FLOOD 58A STORMS

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## Mississippi River & Tributaries Project

### Project Design Flood

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### Floodways and Backwater Areas

- Floodways
  - Birds Point - New Madrid = 133,000 acres
  - Morganza Floodway = 71,500 acres
  - Bonnet Carré Spillway = 7,600 acres
  - West Atchafalaya Floodway = 154,000 acres
- Backwater Areas
  - St. Francis Backwater Area = 500,000 acres
  - White River Backwater Area = 145,000 acres
  - Yazoo Backwater Area = 634,000 acres
  - Red River Backwater Area = 373,000 acres

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### Birds Point-New Madrid Floodway

- 133,000 Acres Impacted by Floodway
- 2.5 Million Acres Protected by Floodway

Legend:  
 +++ Levee Centerline  
 Yellow Levee Protected Area  
 Red Birds Point - New Madrid Floodway

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### Bonnet Carré Spillway

- ▶ Completed 1932
- ▶ 7,600 acre Floodway – Completely flooded in 2011
- ▶ Operated (Structure Opened) 10 times
- ▶ Note that in non-operation years, river stages in most years get high enough to result in leakage through the structure needles resulting in 1,000 cfs or more passing into the spillway and into Lake Pontchartrain
- ▶ Design Flow of 250,000 cfs
- ▶ 2011 Flows of 316,000 cfs

### Morganza Floodway

- ▶ Completed in 1954
- ▶ 71,500 acre Floodway – Completely flooded in 2011
- ▶ Operated in 1973 and 2011
- ▶ Design Flow of 600,000 cfs
- ▶ 2011 Peak Flows of 186,000 cfs

### “CRITICAL LESSONS LEARNED AND APPLIED” Room for the River Concept

- 1927 Flood
  - Flooded 26,000 square miles = 16,800,000 acres

**“The MR&T flood control system was designed to conform to the natural tendencies of the river, it is not forced or driven.”**

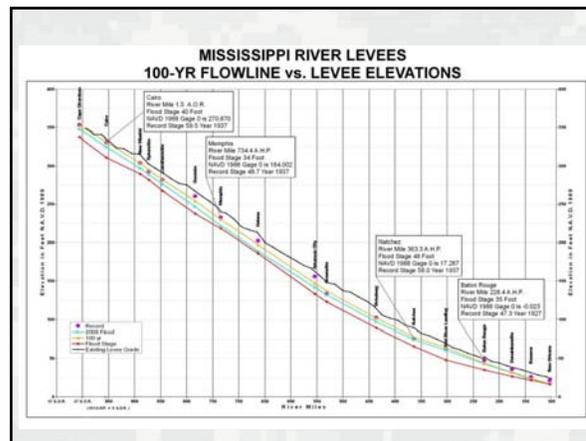
**– 1927 Jadwin Plan**

- ▶ Total used during 2011 Flood = 335,000 acres (interior flooding)
- Over 1.5 million acres of floodways and backwater areas were not inundated during the 2011 Flood
- While the 2011 Flood is not as large as the Project Design Flood, there is still **Room for Larger Floods**

### Mississippi & Atchafalaya STAGES – 29 July 2011 – 0600 CDT

Station	Flood Stage	Current Stage	Actual/Forecasted Crest Stage	Date	Record Stage	Record Year
Cairo, IL	40.0	28.49	61.72****	2 May	59.51	1937
New Madrid, MO	34.0	17.91	48.35	6 May	47.97	1937
Caruthersville, MO	32.0	19.51	47.61	7 May	46.00	1937
Memphis, TN	34.0	12.84	47.87	10 May	48.70	1937
Helena, AR	44.0	19.98	56.59	12 May	60.21	1937
Arkansas City, AR	37.0	18.38	53.14	16 May	59.20	1927
Greenville, MS	48.0	29.87	64.22	17 May	65.4*****	1927
Vicksburg, MS	43.0	25.50	57.1	19 May	56.20*	1927
Natchez, MS	48.0	34.57	61.95	19 May	58.04	1937
Red River Lndg, LA	48.0	37.32	65.5*** (63.09***)	21 May	61.61	1997
Baton Rouge, LA	35.0	21.33	47.5*** (45.01***)	18 May	47.28	1927
New Orleans, LA	17.0**	7.13	19.5*** (17.0***)	14 May	21.27	1922
Simmesport, LA	47.0	15.15	44.94	23 May	59.13	1927
Butte LaRose, LA	25.0	8.06	23.15	26 May	27.28	1973
Morgan City, LA	4.0	3.78	9.5*** [10.35***)	30 May	10.53	1973

\*62.2' If Levees Held  
 \*\*Levees Protect New Orleans to 20.0' Stage  
 \*\*\*w/o Morganza Operation  
 \*\*\*\*w/Morganza Operation  
 \*\*\*\*\*NWIS Crest of 63.0' on 5 May w/o BPNM Operation – Actual Stage of 59.7' on 5 May w/BPNM Operation  
 \*\*\*)Adjusted to Current Stage Location - Prior to 1940 stages were taken at City Front or Warfield Point  
 Note: With Morganza Operation, Baton Rouge to N. Orleans crests will occur before upstream locations and will remain steady during the floodway operations.



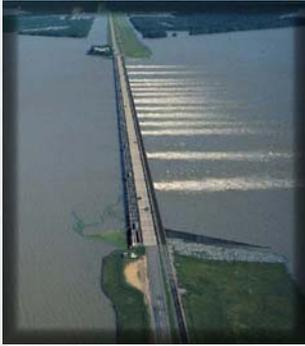
### Historical Discharges

Station	2011	1927 <sup>1/2</sup> Actual	1927 <sup>3/4</sup> Confined	1937 <sup>5/4</sup>	1973	PDF <sup>4/</sup>
Cairo, IL <sup>1/2</sup>	1,936,000 <sup>C/2/</sup>	1,626,000	1,765,000	2,010,000 <sup>4/</sup>	1,536,000	2,360,000
Memphis, TN	2,136,000 <sup>C</sup>	N/A	1,744,000	2,020,000	1,633,000	2,410,000
Helena, AR	2,130,000 <sup>C</sup>	1,756,000	N/A	1,968,000	1,627,000	2,490,000
Arkansas City, AR	2,293,000 <sup>C</sup>	1,712,000	2,472,000	2,159,000	1,879,000	2,890,000
Vicksburg, MS	2,272,000 <sup>C</sup>	1,806,000	2,278,000	2,060,000	1,962,000	2,710,000
Natchez, MS	2,227,000 <sup>C</sup>	N/A	N/A	2,046,000	2,024,000	2,720,000
Red River Landing, LA	1,641,000 <sup>C</sup>	1,461,000	1,779,000	1,467,000	1,498,000	2,100,000

C - Peak Discharge, Provisional  
 1/ Discharge Range at Hickman, KY  
 2/ Approximate mile 950.8 at 1400 CDT 5/02/2011 near Wickliffe, KY, prior to operation of Birds Point-New Madrid Floodway  
 3/ Project Design Flood (PDF) provides design flows for MR&T project - currently estimated to be complete in 2032 at the average rate of funding over the last 10 years  
 4/ Includes flow through Birds Point-New Madrid Floodway  
 5/ Reference - "Annual Maximum, Minimum, and Mean Discharges of the Mississippi River and its Outlets and Tributaries to 1963"  
 Revised 22 June 11

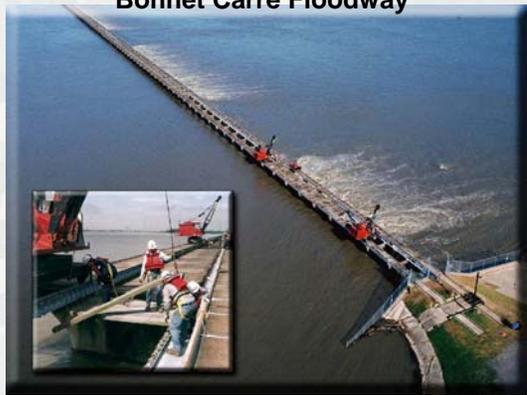


**Morganza Floodway**



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**Bonnet Carré Floodway**



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## Operation Watershed Responding to the Historic Mississippi River Flood of 2011

**RECOVERY OPERATIONS**

**Scott Whitney**  
MVD REGIONAL FLOOD RISK MANAGER  
IRTF Meeting , Pearl MS  
23 Aug 2011

US Army Corps of Engineers  
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## Agenda

1. Establishing Repair/Restore Priorities-  
Timeline and Process
2. Risk Based Prioritization Criteria
3. Phase I Summary
4. Pictures

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## PHASE I: PRELIMINARY ASSESSMENT CRITICAL REPAIRS

- ✓ 3 Aug - DST Preliminary Ranking
- ✓ 4-9 Aug – Review by DPMs, E & C Chiefs, Ops Chiefs
- ✓ 9-10 Aug – St. Louis face to face E & C Chiefs/Ops Chiefs
- ✓ 10 Aug – Final Review by ESOC
- ✓ 15 Aug – Final Reset/Restore Priorities presented to MRC
- ✓ 22 Aug – MVD Commander certifies life safety priorities per OPORD
- ✓ 23 Aug – Preliminary Phase I Briefing to Interagency Recovery Task Force
- 24 Aug – MVD submittal of MR&T system life safety repairs to USACE for funding.
- 31 Aug – Initiation of Phase I repairs pending receipt of funding

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## Operation Watershed Responding to the Historic Mississippi River Flood of 2011

### RECOVERY

```

graph TD
    ESC[EXECUTIVE STEERING OVERSIGHT COMMITTEE] --> DAT[DAMAGE ASSESSMENT TEAM]
    ESC --> SPT[SYSTEM PERFORMANCE TEAM]
    ESC --> IRTF[INTERAGENCY RECOVERY TASK FORCE]
    
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## Operation Watershed Responding to the Historic Mississippi River Flood of 2011

### DAMAGE ASSESSMENTS

- (1) Physical data collection
- (2) Historic perspective analysis
- (3) Repair options
- (4) District QA review
- (5) ROM Repair Cost

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## Operation Watershed Responding to the Historic Mississippi River Flood of 2011

### MR&T DAMAGE ASSESSMENTS

```

graph TD
    MRAT[MR&T DAMAGE ASSESSMENTS] --> MRL[MRL & TRIBS  
Kent Parrish]
    MRAT --> CI[CHANNEL IMPROVEMENT  
Carol Jones]
    MRAT --> STR[STRUCTURES  
Kerry Lowman]
    MRAT --> DRED[DREDGING  
Don Mayer]
    
```

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## Criteria

- **FRAGO 1** (USACE Guidance for Emergency Repairs) to OPORD 2011-50 2011 Greater Mississippi Basin Flood Repairs and Post-Flood Assessment of Response Operations
- **Commander's Intent**-USACE will develop, validate and prioritize the requirements to provide critical interim repairs to protect life and ensure public safety prior to the start of the next flood event or season.



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## Criteria Classifications

### Classifications

**Class I:** High Potential for Loss of Life. Only critical repairs for breached or severely damaged Civil Works Projects where the probability of inundation combined with a probable loss of life results in **extremely high risk**.

**Class II:** Significant Potential for Loss of Life and Significant Economic Damage. Only critical repairs for damaged Civil Works Projects where the probability of failure during the next high water event combined with the probability for loss of life and significant economic damages results in **very high risk**.



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## Criteria Classifications

### Classifications

**Class III:** High Impact to Navigation or Indirect Potential for Loss of Life or critical repairs for damaged Civil Works Projects where failure during the next high water event could potentially disrupt essential lifeline services or access to these services

**Class IV:** Other Risk and Impact Reduction Measures. Any critical repairs for damages not described in Classes I-III.



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## Risk Matrix Failure Likelihood Categories

- **High** – Direct evidence or substantial indirect evidence to suggest failure has already occurred and/or is likely to occur during a flood
- **Moderate** – The fundamental condition or defect is known to exist, indirect evidence suggests it is plausible, and key evidence is weighted more heavily toward likely than unlikely to occur during a flood



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## Risk Matrix (cont) Failure Likelihood Categories

- **Low** – The possibility cannot be ruled out, but there is no compelling evidence to suggest it has occurred or that a condition or flaw exists that could lead to its development during a flood
- **Remote** – Several events must occur concurrently or in series to trigger failure. Most, if not all of the events are very unlikely to occur during a flood



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## Consequences Categories

**Level 0** – No significant impacts to the effected population. Relatively minor impact to navigation for high-use projects (over 10M tons at ports and 2.5B ton-mile for inland waterways projects).

**Level 1** – Although people are at risk, there is only an indirect potential for loss of life. Transportation links are damaged that could disrupt lifeline services; OR Safe navigation for high-use projects (over 10M tons at ports and 2.5B ton-mile for inland waterways projects) is directly impaired.

**Level 2** – Significant potential for loss of life and economic damage due to impaired navigation and property damage.

**Level 3** – High potential for loss of life and economic damage due to impaired navigation and damage to critical infrastructure.



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### Failure Likelihood vs Consequences

		Class III	Class II	Class II	Class I
High		Class IV	Class III	Class II	Class II
Moderate		Class IV	Class III	Class III	Class II
Low		Class IV	Class IV	Class IV	Class III
Remote		Level 0	Level 1	Level 2	Level 3
	Failure Likelihood	Consequences			

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### Phase I Summary

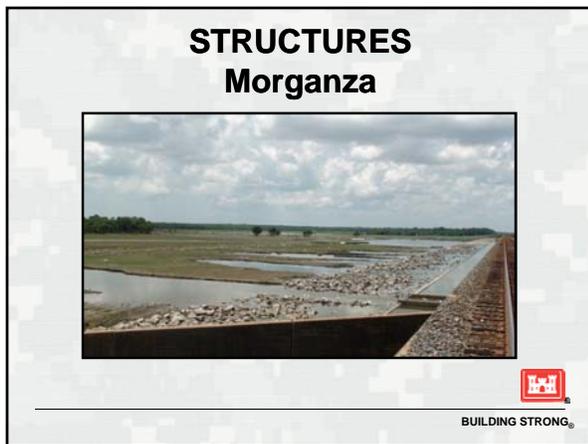
*As of 23 August 2011*

- 93 Items identified
- \$778 million total (By FRAGO Class)
  - 12 - Class I \$ 85 million
  - 43 - Class II \$549 million
  - 37 - Class III \$144 million
  - 1 - Class IV \$ 1 million
- \$778 million total (By MR&T Component)
  - 32 – Miss River Levee \$327.7 million
  - 22 – Channel Improvements \$222.5 million
  - 25 – Dredging \$157.4 million
  - 13 – Structures \$ 70.6 million

**\*\* See Handouts for Phase I listing of 93 identified critical repair areas\*\***

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**Operation Watershed**  
*Responding to the Historic Mississippi River Flood of 2011*  
**RESTORE RECOVERY**

**QUESTIONS?**



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**Interagency Recovery Task Force**

## Operation Watershed Recovery System Performance Evaluation

David R. Busse, P.E.  
Chief, Engineering and Construction, St. Louis District  
Technical Lead for the System Performance Evaluation

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**System Performance Evaluation**

### Agenda

- OW-R Management Structure
- Purpose/Scope
- Team Composition
- Schedule/Deliverables
- Post Flood Data
- Progress to Date
- Initial Thoughts

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**System Performance Evaluation**

### Management Structure

```

graph TD
    A[EXECUTIVE STEERING OVERSIGHT COMMITTEE] --> B[DAMAGE ASSESSMENT TEAM]
    A --> C[SYSTEM PERFORMANCE TEAM]
    A --> D[INTERAGENCY RECOVERY TASK FORCE]
    
```

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**System Performance Evaluation**

### Purpose

- (1) Objectively evaluate and document the performance of the MR&T System and how the entire watershed was managed during the 2011 Flood.
- (2) Identify and prioritize recapitalization requirements to prepare the system for future events
- (3) Identify opportunities to improve the systems performance and reliability.

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**System Performance Evaluation**

### Scope

The evaluation to be conducted by the internal team will focus primarily on the performance and contributions from the following major structural & relational items:

1. Reservoirs
2. Levees/Floodwalls
3. Floodways and Backwater Areas
4. Channel Improvements
5. Outlet Structures (e.g. Old River...etc)
6. Operational Decisions
7. Collaboration
8. Communication

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**System Performance Evaluation**

### Team Composition

- Leadership of the team will be by a senior leader from within MVD
- All six MVD districts will be represented with a cross section of disciplines
- Expertise will also be drawn from across USACE, to include RMC, ERDC, IWR, LRD, NWD, SWD, and HQUSACE
- The Fusion Team (i.e., USACE, USGS and NWS) will be utilized in evaluation of river forecasting
- Review of this evaluation will be accomplished by MVD headquarters and technical experts from other Divisions
- Experts from outside the Corps

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**System Performance Evaluation**

**Team Effort**

- Fusion Team
- Silver Jackets
- USGS
- NWS
- ERDC
- RMC
- IWR/HEC
- LDWF
- LSU
- University of Texas
- United States Navy
- .....

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**System Performance Evaluation**

**Team Effort**  
Fusion Team

- Created by MG Walsh as a result of concerns from stakeholders after the 2008 flood.
- USCAE, NWS, USGS
- Has been identified as a key part of the improved river forecasting during the 2011 event.
- Played a key role in data consistency in this event
- Tasked with evaluating the value of the forecast products to decision makers

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**System Performance Evaluation**

**Team Effort**  
Silver Jackets

- Utilizing as a means of engaging Local, State Federal representatives.
- Setting up meetings with state agencies in September to understand their perspective

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**System Performance Evaluation**

**Team Effort**  
USGS

- Fusion Team
- Need to understand flow situation around Morganza
  - Critical to understand before next large event
- Collecting environmental data

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**System Performance Evaluation**

**Team Effort**  
United States Navy

- Remote sensing of turbidity

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**System Performance Evaluation**

**Draft Schedule and Deliverables**

Data Inventory	Aug 2011
Submit Project Management Plan	Sep 2011
Complete Interviews	Dec 2011
Develop System HECRAS Model	Dec 2011
Submit Interim Report	Feb 2012
Develop Draft Report	Jun 2012
Submit Final Report	July 2012

Agency Technical Reviews to be conducted in Oct/Jan/Apr

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**System Performance Evaluation**

**Post Flood Data**

**COLLECTION:**

- ✓ Much of the post flood data has already been collected by the Corps or our many partners
- ✓ Make inventory of what data is available, how to secure and who is currently in control of data
- ✓ Gap analysis and acquisition strategy
- ✓ System Performance Evaluation team to review data needs and work to ensure all relevant post flood data is being collected or preserved.
- ✓ District Damage Assessment Teams will be collecting considerable post flood physical data
- ✓ IRTF can serve a valuable function in cross-agency awareness of data needs and inventories

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**System Performance Evaluation**

**Post Flood Data**

**EXAMPLES:**

- ✓ Performance levels of FRM and Navigation structures (e.g. Design Capacity, endurance, elasticity)
- ✓ High Water Marks
- ✓ Water Control Structure Activation Sequence and Trigger Points
- ✓ Operational Decisions (MSC, District, State, Local and Fed Agencies)
- ✓ Operational Communications (internal and external, modes...etc)
- ✓ Media communications, coverage and characterizations
- ✓ Risk Communication and Community Response
- ✓ Inundation maps
- ✓ Environmental condition and impact data (Corps, States, USGS, EPA...etc)
- ✓ Physical Assessments of Areas of Concern (Seeps, Boils, Slides, dredging areas, revetments, navigation structures, water control structures)
- ✓ Reservoir Event Logs and consequences of operation
- ✓ Multimedia including Photos, video, facebook, emails, press releases...etc

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**System Performance Evaluation**

**Progress to Date**

- Team formation
- Scope/Schedule/Budget
- Data gathering
  - Cost saving measures

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**System Performance Evaluation**

**Initial Thoughts?**

- The MR&T system performed well
- The MR&T system was truly operated as a system
- Lessons learned from this event will reduce risk for future events.

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**System Performance Evaluation**

**Initial Thoughts?**

- To what extent is the Corps' ability to operate as a system during a historic event?
  - We have projects that are capable of operating a system.
  - Our current processes as demonstrated in 2011 produce system wide benefits but are not operated as a system rather as several systems.
- Can we withstand the design flood?
  - We have work to do to reset/restore the system before it could with a high degree of confidence withstand another historic event.
  - This flood has exposed some vulnerabilities that need to be addressed before the next historic event.

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**System Performance Evaluation**

**Questions?**



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