

# Presentation To Inland Waterways Users Board

## OLMSTED LOCKS & DAM – Construction Status, L/Ds 52/53 Risk Assessment, Benefits, PACR, Construction Methodology, Funding Alternatives

**MR. RICHARD HANCOCK, P.E.**

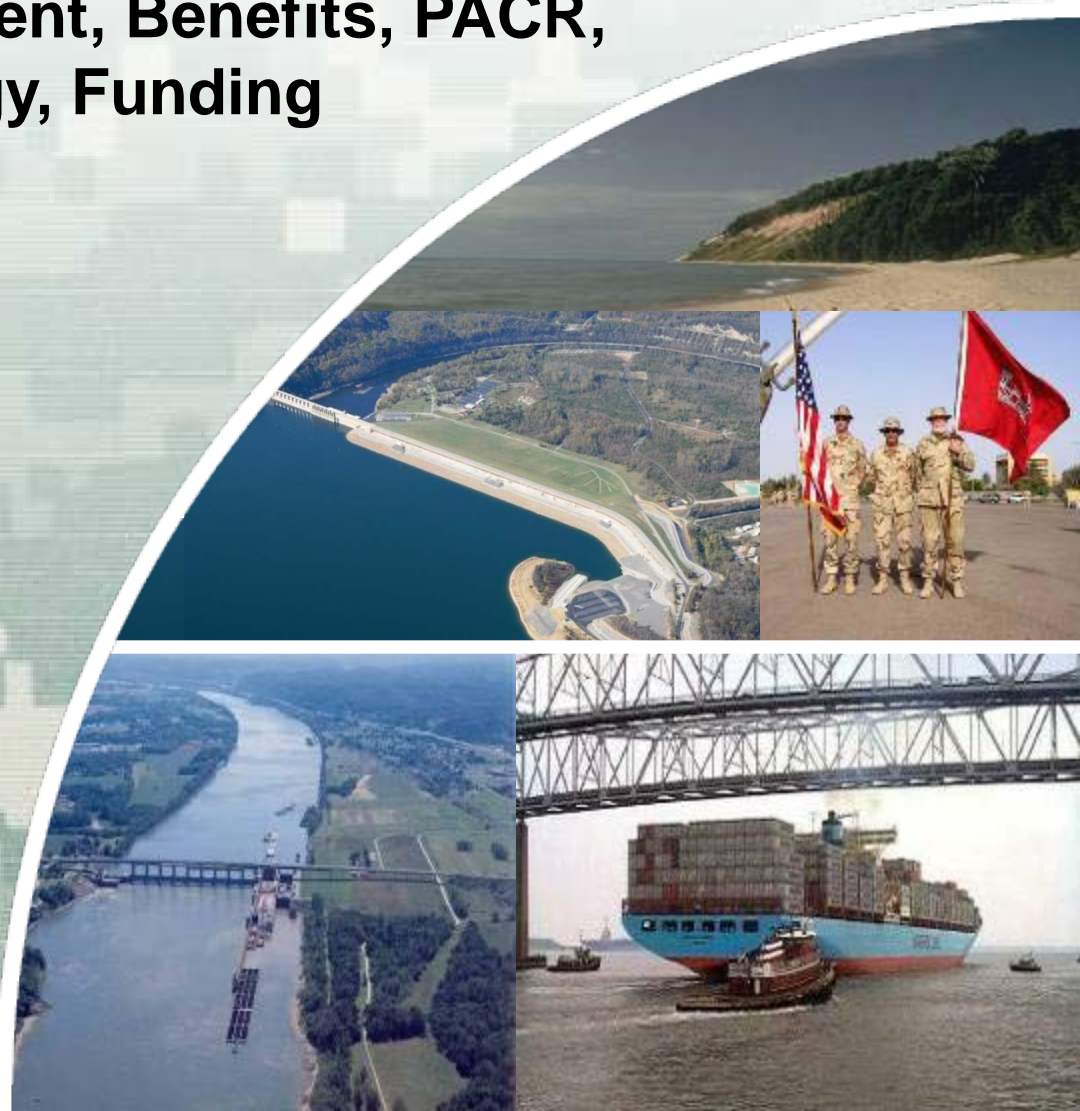
**DIRECTOR, Regional Business Directorate**

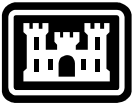
**Great Lakes & Ohio River Division**

**29 Aug 2012**



**US Army Corps of Engineers**  
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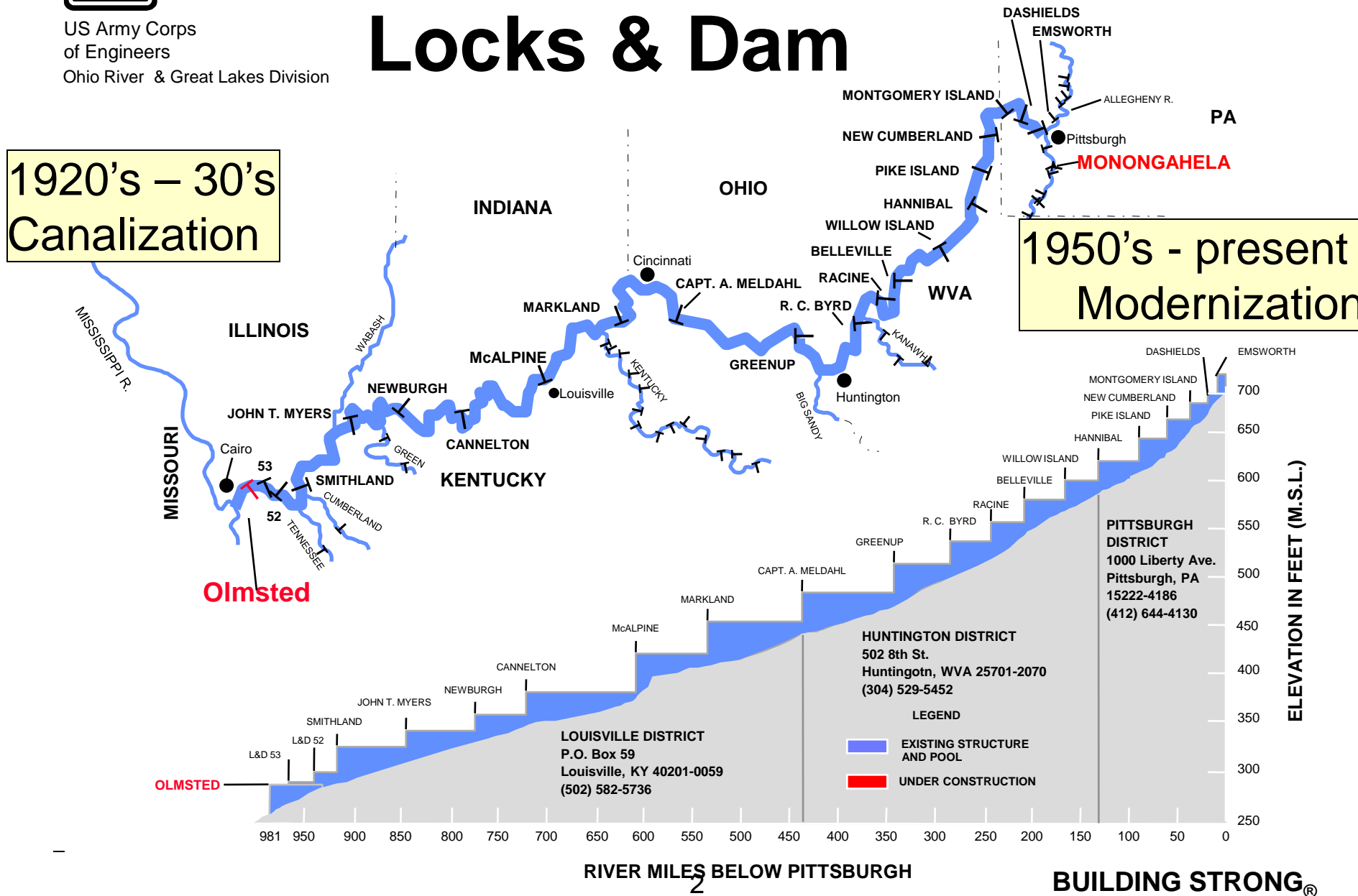


US Army Corps  
of Engineers  
Ohio River & Great Lakes Division

# Ohio River Main Stem Locks & Dam

1920's - 30's  
Canalization

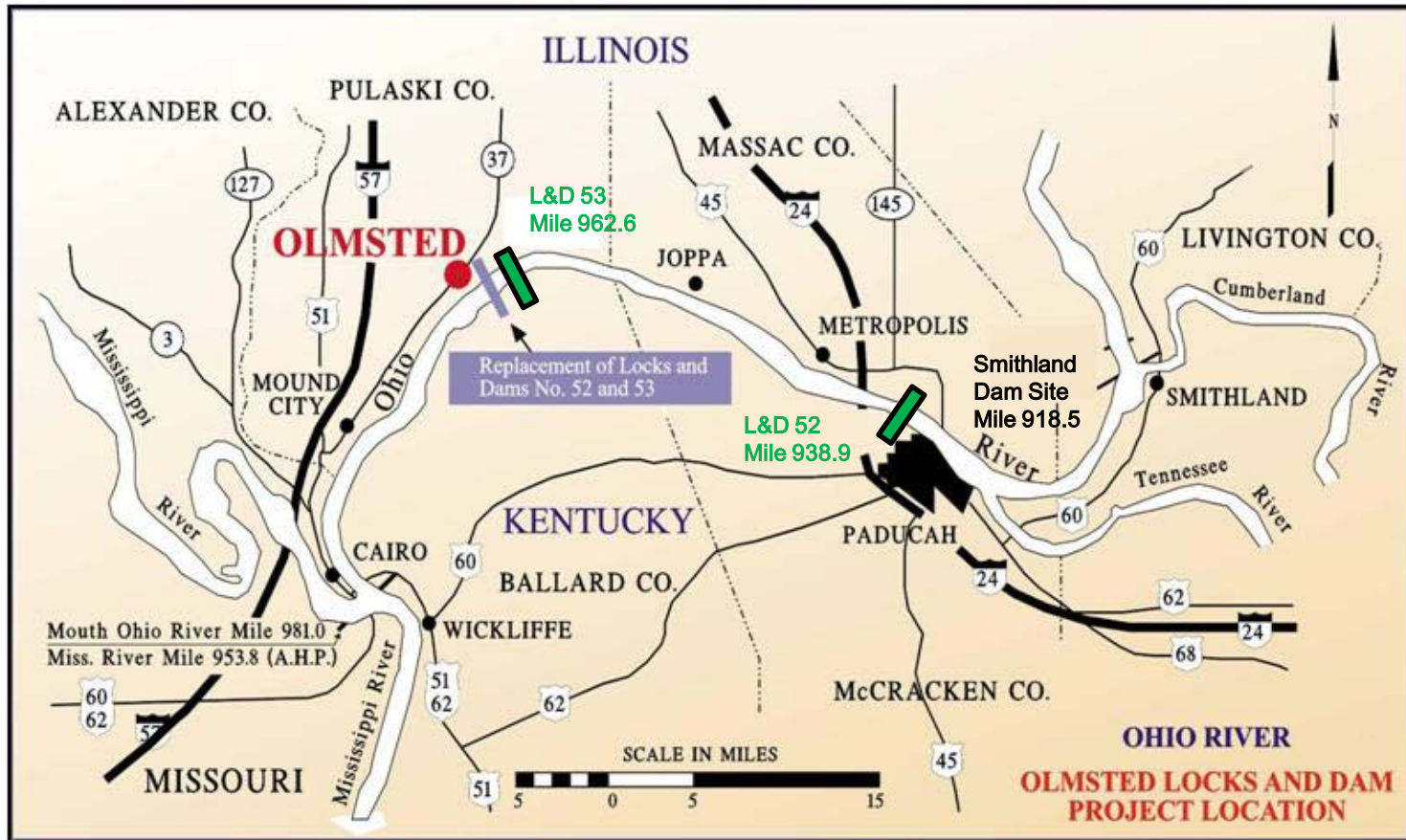
1950's - present  
Modernization



RIVER MILES BELOW PITTSBURGH

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# Olmsted Locks & Dam Project



- 1928/1929: L&D 52 & 53 in service
- 1949-1957: Miscellaneous studies
- 1969: L&D 52 1,200-ft Chamber operational (temporary chamber)
- 1977: Recon Report for Major Rehab L&D 52 & 53
- 1980: L&D 53 1,200-ft Chamber operational (temporary chamber)
- 1985: Feasibility Report
- 1988: Authorization

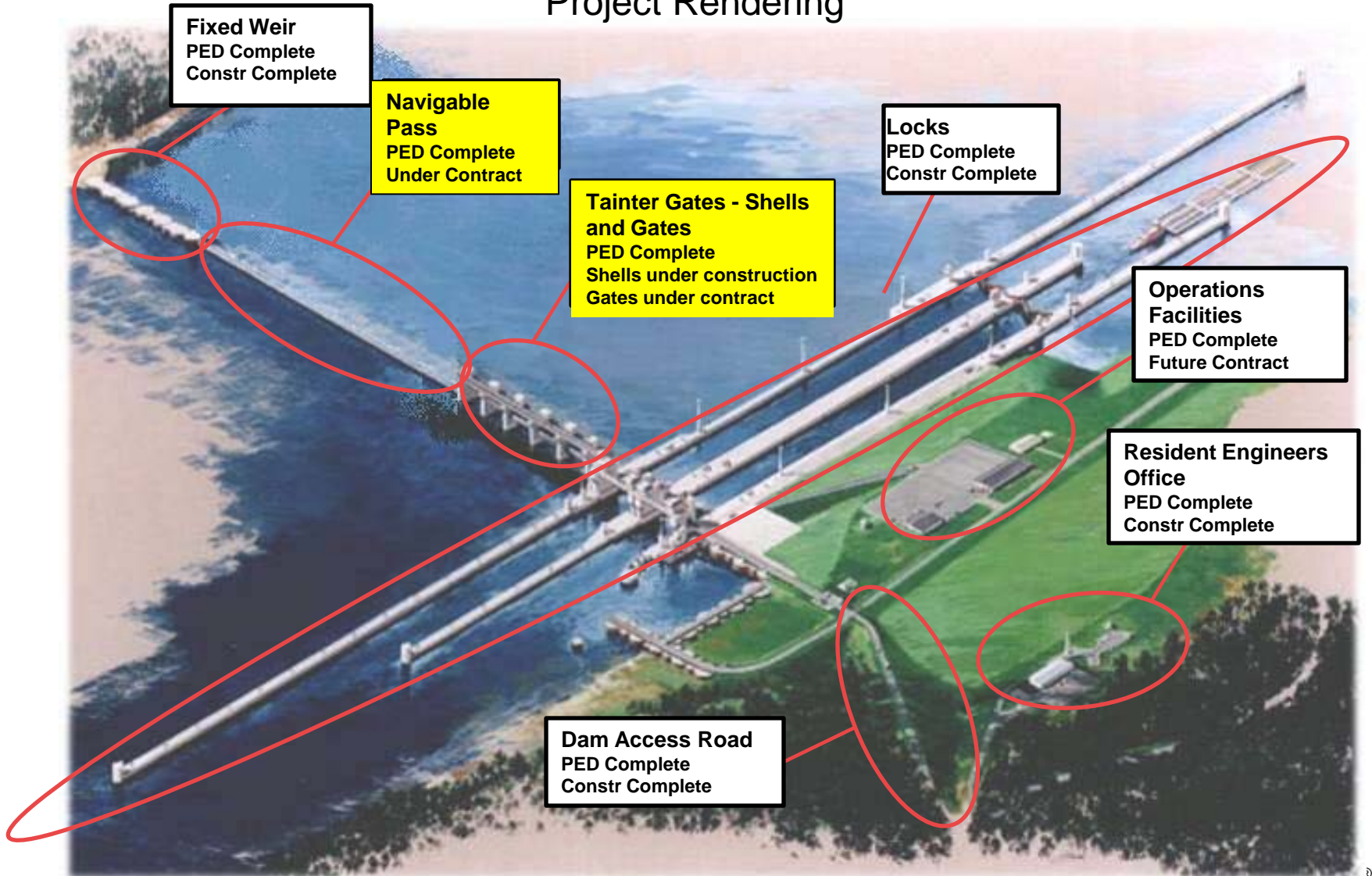


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# Olmsted Locks & Dam Project

## Project Rendering



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# IWUB Actions - BLUF

1. Current Action: Endorse increase to 902 limit
2. Current Action: Make recommendation for ITD vs. ITW construction
3. Current Action: Offer opinion on Olmsted Slow-Down plan vs. continuing at the current pace
4. Future Action: Help LRD prioritize our O&M investments to pay for addressing failure modes on L/D 52/53 (what will not get done?)
5. Future Action: Develop Long Term sustainable strategy for the IWTF



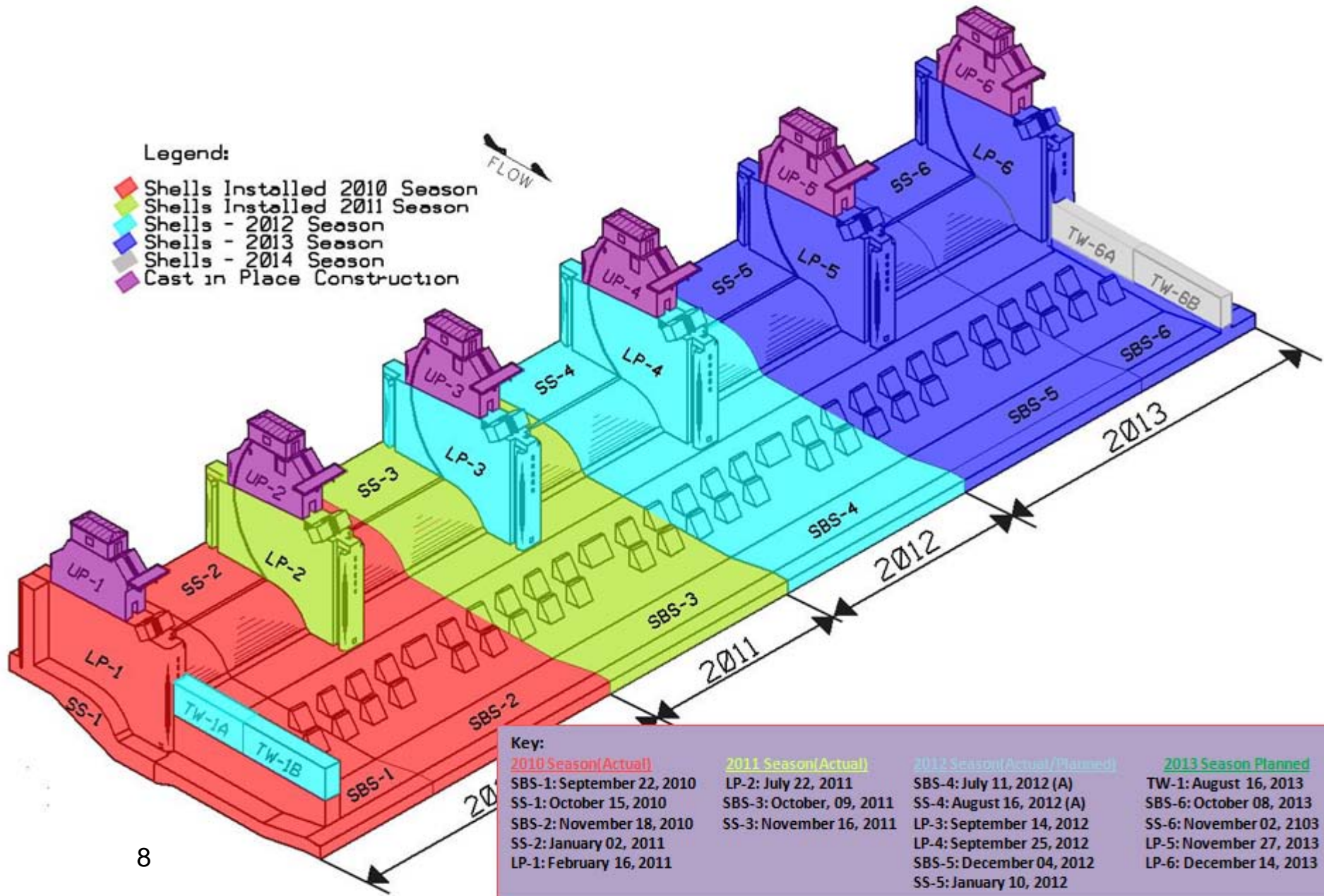
# Construction Status

- Constructing Tainter Gate section of Dam. Components include 18 concrete shells, 5 gates.
- Total of 8 shells placed in 2010 and 2011.
- Four shells scheduled for 2012. Six in 2013.
- Two placed to date in 2012 (SBS4 and SS4). LP3 scheduled for 14 Sep. LP4 for 28 Sep.
- Stretch goal - place 6 shells in the 2012, on schedule.





# Current Plan for Tainter Gate

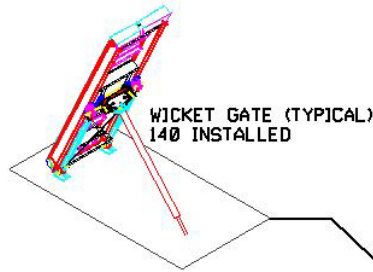




# Current Plan for Nav Pass

Legend:

- Shells Installed 2014 Season
- Shells Installed 2015 Season
- Shells Installed 2016 Season
- Shells Installed 2017 Season
- Shells Installed 2018 Season

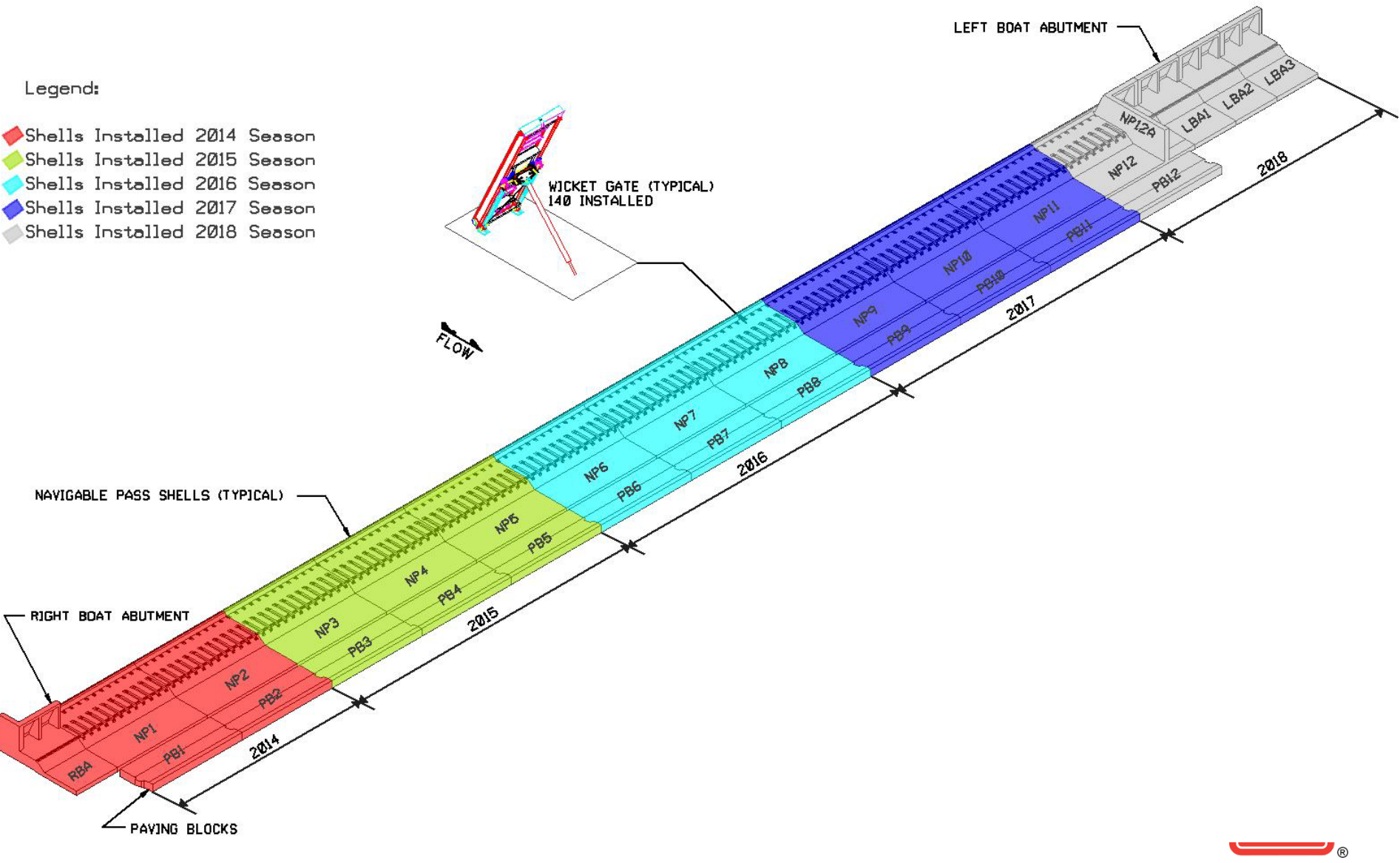
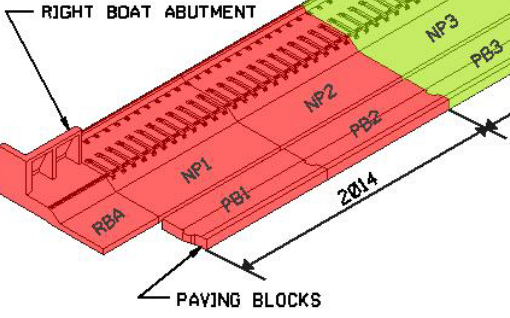


FLOW

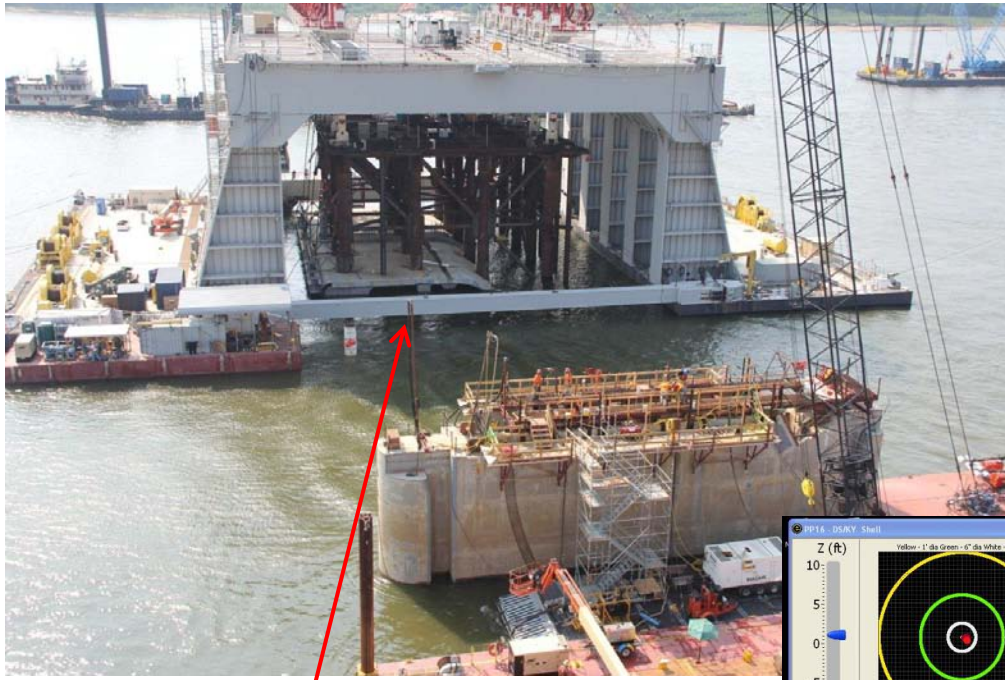
NAVIGABLE PASS SHELLS (TYPICAL)

RIGHT BOAT ABUTMENT

LEFT BOAT ABUTMENT



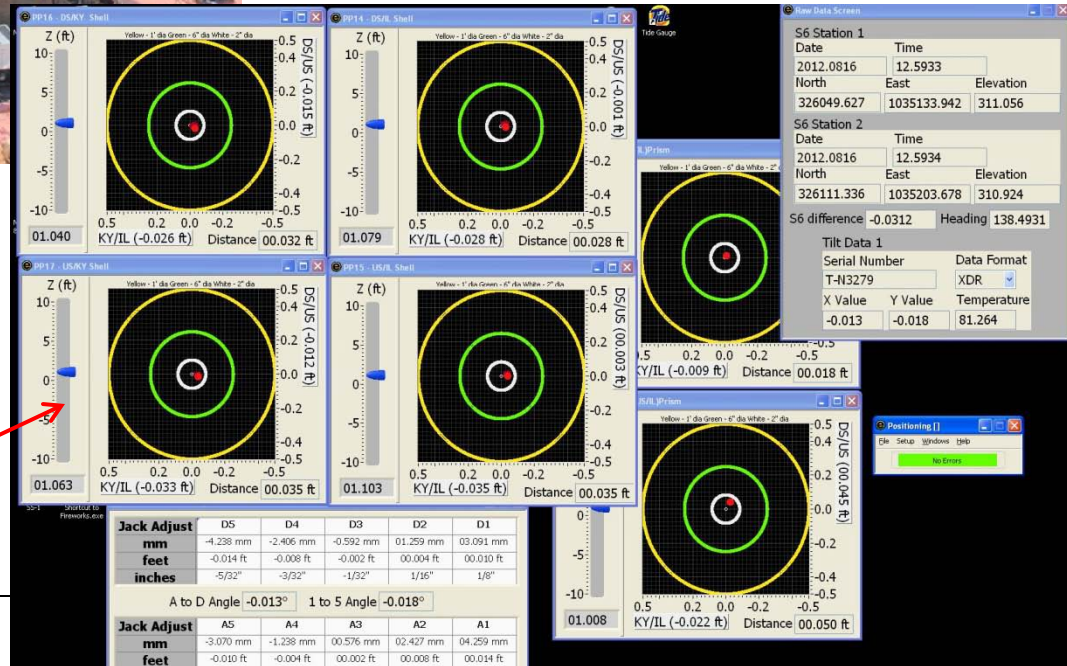
# Shell Placement & Positioning



- Normal duration takes approximately 15-16 hours.
- Must be level within 1 inch

## SS-4 Placement

- 16 August 2012
- 10.5 hours
- Level within  $\frac{1}{4}$ "





# 2012 Shells SBS5, SS5 & LP6 Under Construction



# Duration of Shell Movement

- It takes approximately a 3 week duration to:
  - ▶ Set shell onto the Cradle
  - ▶ Lift with the Cat Barge
  - ▶ Haul and Set at It's Final Position
  - ▶ Fill with Tremie Concrete
  - ▶ Return to Pick another Shell







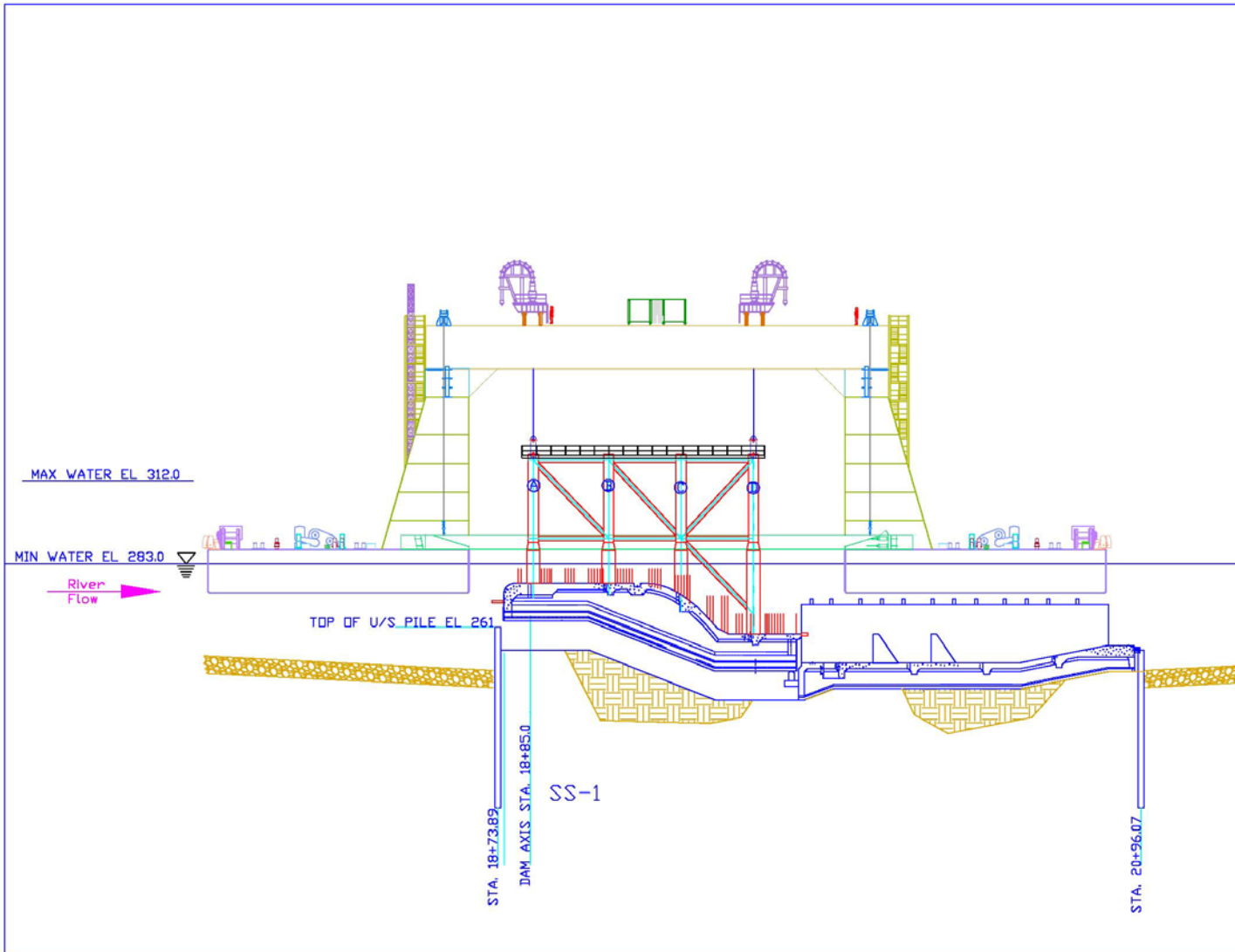
5304 TON  
CAPACITY

EDERER  
SCHAFFHAUSEN

EDERER  
SCHAFFHAUSEN

Movement of SS3 Shell to Cradle

# Cat Barge Setting Shell into Final Position at Bottom of River



# L/Ds 52/53 Qualitative Risk Assessment - Summary

- A Risk Assessment was performed using Expert Elicitation to determine credible Failure Modes (FMs) and ROM cost estimates to address the credible (or likely) FMs in a 10, 20, and 30 year timeframe.
- The team defined “Failure” as an event that caused delays to navigation of more than 24 hours, loss of 2(+) feet of pool, or loss of life.
- 39 Potential failure modes were identified based on expert judgment and review of the original feasibility investigation, Operational Condition Assessment inspections, Periodic Inspection Reports, SPRA inspections, etc...



# L/Ds 52/53 Qualitative Risk Assessment - Summary (cont)

- Of the 39 potential FMs, 11 were identified as significant for L/D 52 and 12 for L/D 53 in a 10 year period.
- A rough order of magnitude (ROM) estimate was prepared to “band-aide” the FMs. The technical team was very clear that these measures do not “correct” the issue, just mitigate risk.
- The cost to proactively address these FMs in a 10 year period is ~\$96 million (\$53 m for 52 and \$43 m for 53). We would like to perform the work to address this right now but funding is not available. Therefore, the work will be planned/executed over the next 4 or 5 years.





# L/Ds 52/53 Qualitative Risk Assessment - Summary (cont)

- For a 20 year period, the total cost is estimated at \$169 million. If a decision were made to address these significant FMs, the work would be spaced over the next 8 – 10 years due to funding constraints.
- For a 30 year period, the total cost is estimated at \$247 million. If a decision were made to address these significant FMs, the work would be spaced over the next 12 – 15 years due to funding constraints.
- Olmsted funds cannot be for work on 52/53 and O&M funds are already very limited. Will need the IWUB to help us prioritize what maintenance does not get accomplished elsewhere in LRD.



# Locks & Dams 52 & 53

## Qualitative Risk Assessment

- Purpose and Scope
  - Identify project components that pose high risk to safety and economic benefits
  - Develop a repair strategy to allow for continued operation
  - Consider 10, 20 and 30 year time periods
  - Assess all components of the dams, auxiliary locks and main locks of both projects, as well as critical operational equipment



# Locks & Dams 52 & 53

## Qualitative Risk Assessment

- Assessment Methodology
  - Utilized a team of experienced engineers from LRD, MVS and the RMC
  - Engineering judgment based (qualitative) versus probabilistic numerical analysis and economic formulation (quantitative)
  - Relied on existing data, past study reports, a cursory field inspection and discussions with project personnel
  - No physical testing or calculations done to fill data gaps



# Locks & Dams 52 & 53

## Qualitative Risk Assessment

- Assessment Methodology (continued)
  - Utilized the Potential Failure Mode Analysis (PFMA) technique common to most COE risk assessments
  - Brainstormed a listing of all Potential Failure Modes
  - Trimmed out Non-Credible Failure Modes through consideration of probability of occurrence and the agreed to definition of failure
  - Identified the Significant Failure Modes (high risks drivers) through consideration of probability of failure and level of failure consequence





# Locks & Dams 52 & 53

## Qualitative Risk Assessment

- L&D 52 Project Information
  - Aux Lock and Dam built on timber piles in 1925-1928.
  - Main Lock built of sand filled circular sheet pile cells in 1968-1969. Designed to be a temporary structure.
  - A portion of rock filled timber crib downstream of Dam washed out in 1929 and a 200-ft length of Dam Sill was severely undermined. The area was stabilized with sand.
  - Many of the Dam Wickets are very old and in poor condition.
  - Sheet piles of main lock cells have significant section loss due to corrosion and barge abrasion. Many cells contain holes and continually experience loss of fill.



# Locks & Dams 52 & 53

## Qualitative Risk Assessment

- L&D 52 Assessment Results
  - The team defined failure as an event that would close the main lock for over 24 hours, allow a 2-ft or more loss of pool, or cause loss of life
  - A Credible failure mode was defined as one that could reasonably be expected to occur and would yield consequences significant enough to meet the definition of failure
  - The assessment team identified 25 Credible failure modes for L&D 52



# Locks & Dams 52 & 53

## Qualitative Risk Assessment

- Examples of L&D 52 Credible Failure Modes
  - Failure of pile foundation for dam due to earthquake
  - Failure of wickets due to barge impact
  - Failure of pile foundation for dam due to piping
  - Failure of miter gate anchorage
  - Cell failure due to loss of structural integrity
  - Failure of wicket dam causing loss of maneuver boat while dam is being set



# Locks & Dams 52 & 53

## Qualitative Risk Assessment

- L&D 52 Credible and Significant Failure Modes
  - Considering things such as available workarounds, impacts to navigation, impacts to the community, cost to repair and life safety, the team applied engineering judgment and trimmed the Credible list down to a list of Significant failure modes.
  - The Significant failure modes were those considered necessary to address in a repair strategy to allow for continued operation of the locks and dam
  - The team identified 11 Significant failure modes for L&D 52
  - The team determined best repair alternatives, repair costs and impacts to navigation in terms of days of lock closure



# Locks & Dams 52 & 53

## Qualitative Risk Assessment

### L&D 52 REPAIR STRATEGY 10 YEAR TIME PERIOD

PFM#	PFM Description	Repair Cost	Impacts to Nav (days) Scheduled
22/28/31	Wicket Failure	\$10,400,000	0
29	Wicket Embedded Hardware	\$13,000,000	0
1/3/5	Chamber Cell Failure	\$11,000,000	14 day closure
6	Miter Gate Anchorage	\$4,000,000	12 day closure
9A	Failure of Pile Foundation (Scour)	\$2,000,000	0
9B	Failure of Pile Foundation (Piping)	\$5,000,000	0
25	Guide Wall Failure	\$8,000,000	Three 7 day closures





# Locks & Dams 52 & 53

## Qualitative Risk Assessment

### L&D 53 REPAIR STRATEGY 10 YEAR TIME PERIOD

PFM#	PFM Description	Repair Cost	Impacts to Nav (days) Scheduled
22/28/31	Wicket Failure	\$14,000,000	0
29	Wicket Embedded Hardware	\$10,000,000	0
1/3/5	Chamber Cell Failure	\$5,000,000	14 day closure
6	Miter Gate Anchorage	\$4,000,000	12 day closure
9A	Failure of Pile Foundation (Scour)	\$2,000,000	0
9B	Failure of Pile Foundation (Piping)	\$5,000,000	0
25	Guide Wall Failure	\$3,000,000	7 day closure
26	Guide Wall Beam Failure	\$250,000	3 day closure



# Locks & Dams 52 & 53

## Qualitative Risk Assessment

### ■ KEY POINTS / SUMMARY

- Both projects contain numerous critical components that are likely to fail without investment beyond normal O&M.
- Eleven failure modes at L&D 52 and twelve at L&D 53 were identified that represent significant risk to property and economic benefit.
- Some failure modes represent risk to life and limb.
- The assessment team has laid out a repair strategy that if implement should allow for continued operation.
- Current conditions represent a high level of risk.
- From an overall project standpoint, the investment strategy will not appreciably reduce the level of risk.



# Locks & Dams 52 & 53

## Qualitative Risk Assessment

- KEY POINTS / SUMMARY (cont)
  - Regardless of the approach to constructing the Olmsted Nav Pass (ITW or ITD), LRD is recommending that proactive measures be taken to address the credible and significant failure modes at L/D 52/53 over the next 10 year period. Cost is ~\$96 million. QUESTION: What options are available to get these additional funds? Project funds from Olmsted cannot be used and our O&M funds are already very limited. Will need the IWUB to help us prioritize what maintenance does not get accomplished elsewhere in LRD.



# Annual Benefits vs. Net Annual Benefits

- Stream of future benefits/costs discounted to present value, amortized to generate “Annual” estimates
- Discounting approximates “time value” of costs/benefits
  - A dollar today worth more than one 50 years from now
  - Performed using multiple “discount rates”
- Annual Benefits – Annual Costs = Net Annual Benefits

## Cost/Benefit Analysis – 7.0% Discount Rate

Annualized Benefits	
Transportation Benefits	\$823,272,341
Fuel Tax Revenues	\$19,976,006
Less WOPC Normal O&M	\$7,664,548
Less LD 52 Repairs	\$12,291,092
Less LD 53 Repairs	\$11,860,808
Incremental Annual Benefits	\$875,064,795
Annualized Costs	
Construction	\$211,450,732
Interest During Construction	\$19,093,734
Normal O&M	\$3,832,274
Main Chamber Maintenance	\$277,669
Aux Chamber Maintenance	\$314,605
Dam Maintenance	\$60,200
Incremental Annual Costs	\$235,029,214
Net Annual Project Benefits	\$640,035,580
<b>BENEFIT - COST RATIO</b>	<b>3.7</b>



# Benefit/Cost Categories

- Primary benefit categories:
  - Transportation rate savings
  - Locks and Dams 52 and 53 repair avoidance
  - O&M reductions
  - Fuel tax revenues
- Primary cost categories:
  - Construction cost (w/ IDC)
  - Olmsted future maintenance/repair cost





# Computation of Benefits

## Two New Scenarios

- Failure assumptions for L/Ds 52/53 were questioned. Therefore, alternate benefit calculation scenarios with different assumptions for L/Ds 52/53 were developed.
- Slipping the failure assumptions for L/Ds 52/53 in years 2021 thru 2026 by 20 years, and assuming no delays to navigation from 2021 thru 2026, the annual benefits reduce from \$875 million to \$513 million. This produces a BCR of 2.2 (based on total project cost)
- In another scenario, we removed the major failure assumptions in years 2021 thru 2026 completely and annual benefits dropped to \$445 million. This produces a BCR of 1.9 (based on total project cost)



Division	District	Project	Benefits	
			Average Annual	Source
LRD	LRL	Olmsted L/D Construction	\$ 875,064,795	Report
LRD	LRH	Greenup Dam Rehab PED and Const	\$ 18,960,343	Estimated
LRD	LRH	Meldahl Dam Rehab	\$ 18,960,343	Estimated
LRD	LRH	Willow Island Dam Rehab PED and Const	\$ 11,886,264	Estimated
LRD	LRH	Marmet Dam Rehab	\$ 11,344,108	Estimated
LRD	LRL	JT Myers Dam Major Rehab	\$ 9,142,532	Est*
LRD	LRN	Kentucky Lock Addition	\$ 66,057,052	Report
LRD	LRN	Chickamauga Replacement Lock	\$ 93,288,706	Est*
LRD	LRP	Lower Mon 2,3, & 4 Replacement **	\$ 220,032,000	Report
LRD	LRP	Montgomery Major Rehab	\$ 24,887,347	Estimated
MVD	MVN	Inner Harbor Lock Replacement	\$ 160,056,231	Est*
MVD	MVR	Lagrange 1200' Lock Addition	\$ 53,060,000	Report
MVD	MVR	L/D 22 Upper MS 1200' Lock Addition	\$ 45,799,413	Est*
MVD	MVR	Lagrange Major Rehab	\$ 10,178,239	Estimated
MVD	MVR	ILL WW Thomas O'Brien L/D Major Rehab	\$ 4,875,803	Estimated
MVD	MVS	L/D 25 Upper MS 1200' Lock Addition	\$ 54,854,226	Est*
MVD	MVS	L/D 24 Upper MS 1200' Lock Addition	\$ 49,869,093	Est*
MVD	MVS	L/D 25 Upper MS Dam Major Rehab	\$ 9,634,988	Estimated
MVD	MVS	Mel Price Upper MS Major Rehab	\$ 7,596,594	Estimated
NWD	NWW	Lower Monumental Major Rehab	\$ 3,304,068	Est*
SWD	SWG	High Island to Brazos River, TX	\$ 5,666,000	Report
SWD	SWL	No. 2 Lock AR Lock Wall/Bank Slope Rehab	\$ 22,685,480	Estimated

\* An analysis has been completed for this project, however, the benefit estimating procedure (3 x Av. Annual Equivalent Capability Cost) produced a higher value.

\*\* Lower Monongahela replacement benefits are phased.



# Post Authorization Change Report (PACR)

- Recommend Authorization Increase to: \$2.918 B
- Current Section 902b Limit: \$1.7 B (will hit in 2014)
- BCR for authorization at 4% discount rate: 9.9
- BCR for budget development at 7% discount (OMB): 3.7
- Estimated Lock and Dam Operational: FY 2020
- Estimated Dam Construction Complete: FY 2021
- Estimated Contract Complete: FY 2024



# PACR Recommendation

- Olmsted is the #1 priority project in the IMTS inventory, producing significantly more benefits than the #2 priority, even if optimistic assumptions are made concerning the reliability of L/Ds 52 and 53.
- A slowdown of Olmsted is being discussed as early as the first quarter of FY13. It may be too late to prevent impacts to the schedule and cost of constructing Olmsted. QUESTION: What are the chances of getting an authorization increase by mid-year, 2013?
- Recommend the IWUB vote to endorse an Authorization Increase to \$2.918 B



# In-The-Dry Alternative

- Developed design basis for constructing the Olmsted Dam Navigable Pass In-The-Dry
- Utilizes conventional construction techniques within two-phases of cofferdam construction
- Similar but less detailed than a Feasibility Study
- Prepared a cost estimate for the In-The-Dry construction
- Prepare a cost estimate for the current contract with the Navigable Pass work deleted
- Prepare a construction schedule
- Determine economic benefits based on schedule





# Key Assumptions

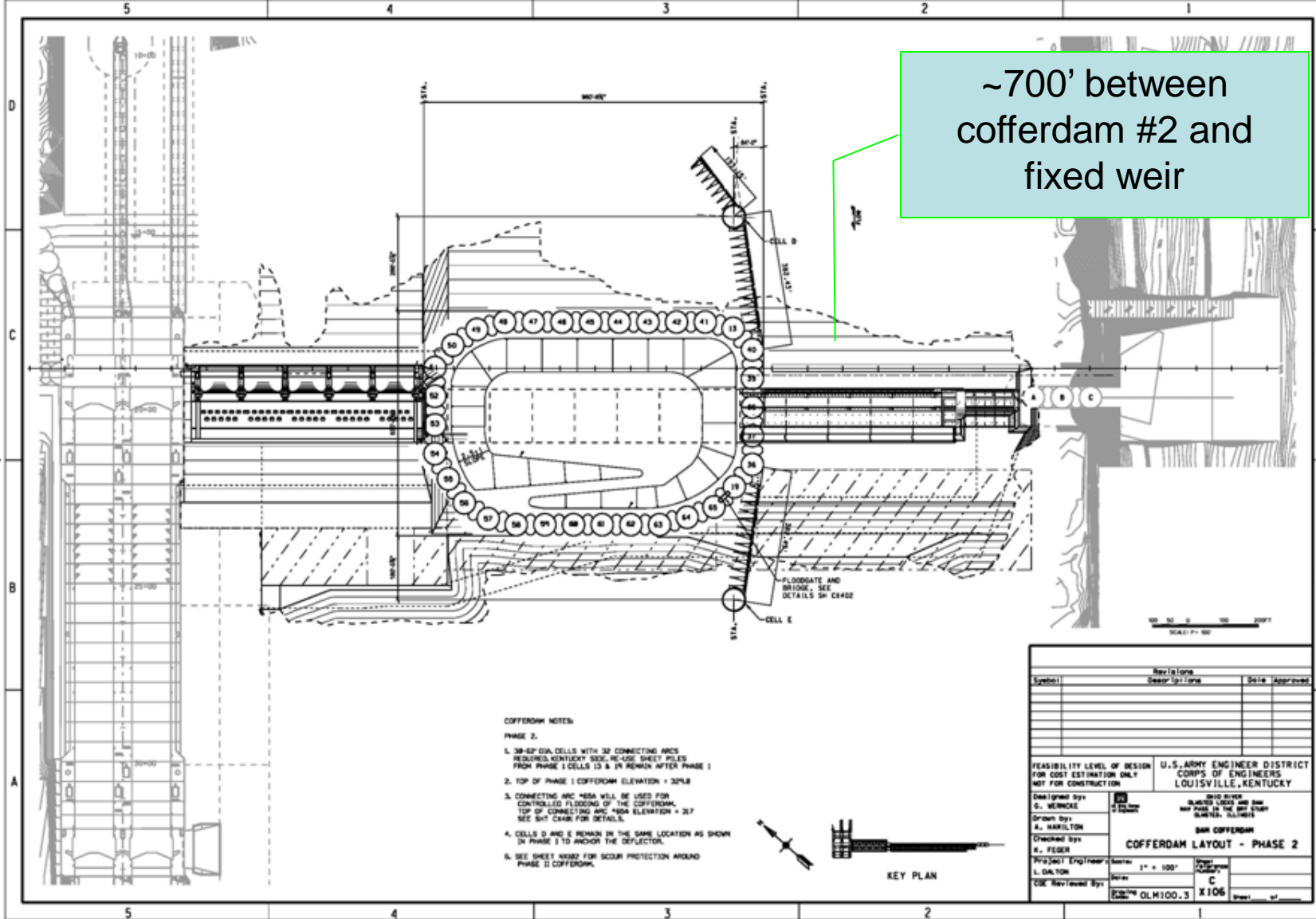
- No significant change in configuration of navigable pass
- Did not constrain the alternative study based on acquisition method or Incremental funding restrictions (this could be a significant issue)
- Assume continued funding at \$150 million per year
- Tainter Gate portion of Dam to be completed In-The-Wet
- Decision on In-The-Wet vs. In-The-Dry approach must be made by 1 Oct 2012.





\*\*\* SAFETY PAYS \*\*\*

~700' between  
cofferdam #2 and  
fixed weir



- COFFERDAM NOTES:  
PHASE 2.
1. 38'-02" DIA. CELLS WITH 32 CONNECTING ARCS REQUIRED. KENTUCKY SIDE, RE-USE SHEET PILES FROM PHASE I CELLS 13 & 14 REMAIN AFTER PHASE I.
  2. TOP OF PHASE I COFFERDAM ELEVATION = 324.8
  3. CONNECTING ARC WISA WILL BE USED FOR CONTROLLED FLOODING OF THE COFFERDAM. TOP OF CONNECTING ARC WISA ELEVATION = 317. SEE SH1 C248 FOR DETAILS.
  4. CELLS D AND E REMAIN IN THE SAME LOCATION AS SHOWN IN PHASE I TO ANCHOR THE DEFLECTOR.
  5. SEE SHEET 3030 FOR SCOUR PROTECTION AROUND PHASE II COFFERDAM.

Revisions		Designation	Date	Approval
Symbol				

DESIGNED BY S. WERNICK	DESIGNED BY D. D. BROWN	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS LOUISVILLE, KENTUCKY
DRAWN BY A. HAMILTON	CHECKED BY K. FESER	BAR COFFERDAM COFFERDAM LAYOUT - PHASE 2
PROJECT ENGINEER L. DALTON	DATE 11/11/03	SCALE 1" = 100'
DATE 11/11/03	SCALE 1" = 100'	PROJECT NO. OLM100.3
DESIGNED BY S. WERNICK	DESIGNED BY D. D. BROWN	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS LOUISVILLE, KENTUCKY

\*\*\* SUPPORT VALUE ENGINEERING - IT PAYS \*\*\*

# ITD Findings and Considerations

- Cost for ITD Construction using traditional cofferdams is estimated to be \$109 M less than ITW costs assuming no delays are experienced due to a supplemental EIS, acquisition changes, or Incremental funding restrictions.
- The Schedule for ITD Construction will cause an estimated delay of 2 years in completion of the Dam portion of the contract and realization of project benefits. The calculated benefits are \$875 million per year (over the 50-year period). However, actual benefits could range from less than \$30 million per year to well over \$1 billion, depending on the actual transportation impacts.



# ITD Findings and Considerations (cont)

- ITW construction did not meet the desired schedule in 2010 or 2011. However, we are looking good in 2012 and have reason to be confident we can complete the project on or ahead of schedule and within budget. We have incorporated learned lessons into our ITW construction method and have decreased man-hours required to fabricate the shells by over 30% since 2010. The new estimate was risk-based. Shell placement will get easier as we continue across the river. The nav pass shells are in shallower water, are slightly lighter, have smaller dimensions (less impacted by current) and only need to be aligned on one end. Based on these considerations, LRD supports ITW construction.





## BENEFIT BY PROJECT FUNDING SCENARIO Alt. 4C – 6 Year Pause

- **Alternative 4C (pause 6yrs), Option 1 (divert funds to construction) would allow 1 construction project to be completed sooner.**
  - *Lower Monongahela phase 1 advanced 10 yrs from 2027 to 2017 operational (\$187.0M annual benefit).*
  
- **Alternative 4C (pause 6yrs), Option 2 (divert funds to rehabs) would allow 1 construction and 9 major rehab projects to be completed sooner.**
  - *High Island advanced 38 years from 2053 to 2015 operational (\$5.7M annual benefit).*
  - *LD 25 Upper MS rehab advanced 38 yrs from 2053 to 2015 operational (\$9.6M annual benefit).*
  - *Lagrange rehab advanced 49 yrs from 2064 to 2015 operational (\$10.2M annual benefit).*
  - *Lower Monumental rehab advanced 46 yrs from 2065 to 2019 operational (\$3.3M annual benefit).*
  - *O'Brien L/D rehab advanced 50 yrs from 2065 to 2015 operational (\$4.9M annual benefit).*
  - *Greenup L/D rehab advanced 60 yrs from 2079 to 2019 operational (\$19.0M annual benefit).*
  - *Myers rehab advanced 64 yrs from 2081 to 2017 operational (\$9.1M annual benefit).*
  - *Meldahl Dam rehab advanced 60 years from 2079 to 2019 operational (\$19.0M annual benefit)*
  - *Mel Price rehab advanced 69 yrs from 2086 to 2017 operational (\$7.6M annual benefit).*
  - *Marmet dam rehab advanced 71 yrs from 2090 to 2019 operational (\$11.3 annual benefit).*
  
- **Alternative 4C (pause 6yrs), Option 3 (divert to priority list) would allow 1 construction and 5 major rehab projects to be completed sooner.**
  - *Kentucky Lock addition advanced 22 years from 2041 to 2019 operational (\$66.1M annual benefit).*
  - *LD 25 Upper MS rehab advanced 38 yrs from 2053 to 2015 operational (\$9.6M annual benefit).*
  - *Lagrange rehab advanced 50 yrs from 2064 to 2014 operational (\$10.2M annual benefit).*
  - *Lower Monumental rehab advanced 46 yrs from 2065 to 2019 operational (\$3.3M annual benefit).*
  - *O'Brien L/D rehab advanced 50 yrs from 2065 to 2015 operational (\$4.9M annual benefit).*
  - *Myers rehab advanced 64 yrs from 2081 to 2017 operational (\$9.1M annual benefit).*



# Funding Alternatives and Discussion

- In addition to the 4 funding scenarios previously developed, we are developing 3 additional scenarios. One assumes full funding is available for Olmsted. The second is a “slow-down” of Olmsted. The third is proceeding with the current construction schedule and then stopping Olmsted.
- Full Funding Scenario: Removing the funding constraint of \$150 million per year would allow the existing contractor to increase the pace of construction and make more efficient material purchases (such as buying all 5 tainter gates in a single purchase instead of one per year). This would allow for completion of the dam 2 to 3 years earlier than in the current schedule and completion of the total project 4 years earlier (2020). The cost savings would be in approximately \$200 million, assuming full funding is received in mid FY13.



# Funding Alternatives and Discussion

## (cont)

- **Slow-Down Scenario:** In this scenario, construction expenditures in 2013 and 2014 would be reduced to ~\$70 million per year. This would allow us to remain below the 902 limit into FY15 and still maintain capability and progress on the project. The overall completion date would slip depending on when the 902 is increased. However, delays could be mitigated by “banking” the excess IWTF funds and then moving out at a more efficient pace when the 902 limit is increased. Another option is to divert the excess \$80+ million per year to other projects in FY13 and 14. If the 902 limit is not increased by FY15, the contract would be suspended or terminated. A Super Slow-Down variation to this option is also being considered to get thru FY15.



# Funding Alternatives and Discussion

## (cont)

- Continue At Current Pace And Then Stop Scenario: Construction would continue at \$150 million per year in anticipation of an increase to the 902 limit. If no increase is received in FY13, construction activity would stop early in the 4<sup>th</sup> quarter of FY13 and the contract would be suspended or terminated. Enough funds would need to be retained to maintain the project in caretaker status until a future date when the project can proceed or a new contract awarded. The PRO of this scenario is no impact to the schedule or cost IF the 902 is increased by the 3<sup>rd</sup> quarter of FY13. The CON is direct impacts to cost and schedule if the 902 is not increased before the project is shut down.



# IWUB Key Messages

- Recommend the IWUB vote to endorse an increase to the 902 limit to avoid project cost increases and non-value added cost to IWTF. Our intent is to slow Olmsted down significantly in FY13 and/or FY14 to allow time for a 902 fix.
- L/Ds 52 and 53 require significant proactive maintenance to address significant credible failure modes in the next 10, 20, or 30 years. Our recommendation is to address the 10 year failure modes, at a cost of \$96 million, and to finish Olmsted as fast as possible.



# IWUB Key Messages (cont)

- The benefits of finishing Olmsted are compelling and make it the top priority in the IMTS even if we remove the assumption of a major failure early in the 50 year period for calculation of benefits.
- We need a fix to the IWTF as soon as possible. The current model is not sustainable and projects and national benefits are being impacted right now. A sustainable number for construction and rehabilitation is \$380 million per year.





# IWUB Key Messages (cont)

- ITD Construction offers the benefits of a traditional construction method and potential savings of \$100+ million. However, it will add 2 years to completion of the Dam, delay project benefits, and the savings from ITD will be reduced by the cost of settling a T4C and procuring a new contract. Also, we would either need full funding or approval from Congress to use the Continuing Contracts Clause before we could award a new contract, both of which are risky. Based on this and the lessons learned and success we are having with ITW this season, LRD is recommending we stay with ITW construction.



# IWUB Key Messages (cont)

- Full funding of Olmsted would save 2 to 3 years and ~\$200 million, if received by mid FY13. This can be done thru creative financing options (such as public-private partnerships) or thru a political fix. In the meantime, we are proceeding with construction in a manner that will complete the project and provide benefits to the nation asap given the current situation.



# BACK UP SLIDES



# Total Project Cost vs. “Fully-Funded” Cost

- Total Project Cost at 1 Oct 2011 price level:
  - \$2,918,000,00
- “Fully-Funded” Cost with projected future inflation (through 2024):
  - \$3,099,000,000



# PACR Facts & Assumptions

Fact – No scope change from the original authorization in 1988

Fact – Dam estimate is based on 2011 re-baseline and productivity from 1<sup>st</sup> year shells (2010)

Fact - A CSRA established an 80% confidence level for the Certified Cost Estimate. The 80% confidence level is the recommended level for USACE cost estimates

Fact - Sunk cost as of 30 Sep 2011 is \$1,358M

Assumption - Funding stream limited to \$150M per year

Assumption - OMB will submit for authorization in the FY13 President's budget

Assumption - Dam contract, including navigable pass, will continue “in-the-wet”

Assumption - Dam contract will continue to perform under a cost reimbursement contract



# Olmsted Funding Alternatives

## ■ Key Assumptions

- ▶ Priorities were based on updated priorities from IMTS Capital Projects Business Model
- ▶ Based on current (in-the-wet) construction
- ▶ Based on current contract type/method
- ▶ A continuous funding mechanism will exist in the future for the alternatives considered
- ▶ Olmsted 902 limit (authorization) increased
- ▶ Locks and Dam 52 & 53 will continue to operate



# Olmsted Funding Alternatives

## **Alternative 1: Olmsted Status Quo (per PACR)**

- ▶ Estimated Project Cost \$2.9B (FY12 price level)
- ▶ Remaining Project Cost \$1.5B (FY12 price level)
- ▶ \$150M/year Funding Stream
- ▶ Assumes \$75M/yr from IWTF
- ▶ \$875M Annual Benefits (\$640M Net Benefits)
- ▶ Olmsted – (Operational 2020/Complete 2024)
- ▶ Lower Mon - Complete 2033 (Phase 1 operational 2027 – 85% of annual benefits achieved)
- ▶ Kentucky Lock – Complete 2040





# Olmsted Funding Alternatives

## Alternative 2: Optimal Funding Stream

- ▶ \$215M/yr for 6 years (Capability-level funding)
- ▶ Saves \$250M
- ▶ Operational 2018 / Complete 2020
- ▶ Advancing project schedule 2 years generates \$1.7B of Annual Benefits
- ▶ Assumes availability of IWTF funds
- ▶ No adverse impacts to other projects



# Olmsted Funding Alternatives

## **Alternative 3: Olmsted Slowdown**

- ▶ 2, 4 and 6 years evaluated
- ▶ Assume \$50M/year to Olmsted
- ▶ 3 Options (\$100M diverted to other projects)

**Option 1:** Focus on New Construction in CPBM priority order

**Option 2:** Focus on Major Rehabs in CPBM priority order

**Option 3:** Focus on mix of Major Rehab and New Construction in CPBM priority order



# Olmsted Funding Alternatives

## **Alternative 4: Olmsted Pause**

- ▶ 2, 4 and 6 years evaluated
- ▶ Assume \$10M/year to Olmsted for “caretaker” status
- ▶ 3 Options (\$140M diverted to other projects)

**Option 1:** Focus on New Construction in CPBM priority order

**Option 2:** Focus on Major Rehabs in CPBM priority order

**Option 3:** Focus on mix of Major Rehab and New Construction in CPBM priority order



# COST ANALYSIS ASSUMPTIONS

- If Alternative Project estimate had a Risk Based Cost Estimate – No adjustment to estimate
- If Alternative Project had a Detailed Cost Estimate (MCACES) - Estimate Increased by 15%
- If Alternative Project had a Rough Order of Magnitude Cost Estimate – Estimate increased by 25%
- Note: Emsworth was not included In the analysis because it is scheduled to complete in FY14



# IMTS CPBM Priority Lists

Rank	All Projects	Construction	Rehabilitation
1	Olmsted L/D Construction	Olmsted L/D Construction	Emsworth Major Rehab (dam safety)
2	Lower Mon 2,3, & 4 Replacement	Lower Mon 2,3, & 4 Replacement	L/D 25 Upper MS Dam Major Rehab
3	Emsworth Major Rehab (dam safety)	Kentucky Lock Addition	Lagrange Major Rehab
4	Kentucky Lock Addition	Chickamauga Replacement Lock	Lower Monumental Major Rehab
5	Chickamauga Replacement Lock	L/D 25 Upper MS 1200' Lock Addition	ILL WW Thomas O'Brien L/D Major Rehab
6	L/D 25 Upper MS Dam Major Rehab	High Island to Brazos River, TX	Greenup Dam Rehab PED and Const
7	L/D 25 Upper MS 1200' Lock Addition	Lagrange 1200' Lock Addition	JT Myers Dam Major Rehab
8	High Island to Brazos River, TX	Inner Harbor Lock Replacement	Meldahl Dam Rehab
9	Lagrange 1200' Lock Addition	L/D 22 Upper MS 1200' Lock Addition	Montgomery Major Rehab
10	Inner Harbor Lock Replacement	L/D 24 Upper MS 1200' Lock Addition	Mel Price Upper MS Major Rehab
11	L/D 22 Upper MS 1200' Lock Addition		No. 2 Lock AR Lock Wall/Bank Slope Rehab
12	L/D 24 Upper MS 1200' Lock Addition		Willow Island Dam Rehab PED and Const
13	Lagrange Major Rehab		Marmet Dam Rehab
14	Lower Monumental Major Rehab		
15	ILL WW Thomas O'Brien L/D Major Rehab		
16	Greenup Dam Rehab PED and Const		
17	JT Myers Dam Major Rehab		
18	Meldahl Dam Rehab		
19	Montgomery Major Rehab		
20	Mel Price Upper MS Major Rehab		
21	No. 2 Lock AR Lock Wall/Bank Slope Rehab		
22	Willow Island Dam Rehab PED and Const		
23	Marmet Dam Rehab		

SOURCE: IMTS CPBM: Updated as of Mar 2012



# BENEFIT BY PROJECT FUNDING SCENARIO Alt. 4A – 2 Year Pause

- **Alternative 4A (pause 2yrs), Option 1 (divert funds to construction) would allow no construction or rehabilitations to be completed sooner.**
  
- **Alternative 4A (pause 2yrs), Option 2 (divert funds to rehabs) would allow 1 construction and 5 major rehab projects to be completed sooner.**
  - *High Island advanced 38 years from 2053 to 2015 operational (\$5.7M annual benefit).*
  - *LD 25 Upper MS rehab advanced 38 yrs from 2053 to 2015 operational (\$9.6M annual benefit).*
  - *Lagrange rehab advanced 50 yrs from 2064 to 2014 operational (\$10.2M annual benefit).*
  - *Lower Monumental rehab advanced 50 yrs from 2065 to 2015 operational (\$3.3M annual benefit).*
  - *O'Brien L/D rehab advanced 51 yrs from 2065 to 2014 operational (\$4.9M annual benefit).*
  - *Myers rehab advanced 66 yrs from 2081 to 2015 operational (\$9.2M annual benefit).*



# BENEFIT BY PROJECT FUNDING SCENARIO Alt. 4B – 4 Year Pause

- **Alternative 4B (pause 4yrs), Option 1 (divert funds to construction) would allow 1 construction project to be completed sooner.**
  - *Lower Monongahela phase 1 advanced 10 yrs from 2027 to 2017 operational (\$187.0M annual benefit).*
  
- **Alternative 4B (pause 4yrs), Option 2 (divert funds to rehabs) would allow 1 construction and 7 major rehab projects to be completed sooner.**
  - *High Island advanced 38 years from 2053 to 2015 operational (\$5.7M annual benefit).*
  - *LD 25 Upper MS rehab advanced 38 yrs from 2053 to 2015 operational (\$9.6M annual benefit).*
  - *Lagrange rehab advanced 50 yrs from 2064 to 2014 operational (\$10.2M annual benefit).*
  - *Lower Monumental rehab advanced 50 yrs from 2065 to 2015 operational (\$3.3M annual benefit).*
  - *O'Brien L/D rehab advanced 50 yrs from 2065 to 2015 operational (\$4.9M annual benefit).*
  - *Greenup L/D rehab advanced 62 yrs from 2079 to 2017 operational (\$19.0M annual benefit).*
  - *Myers rehab advanced 66 yrs from 2081 to 2015 operational (\$9.1M annual benefit).*
  - *Mel Price rehab advanced 69 yrs from 2086 to 2017 operational (\$7.6M annual benefit).*
  
- **Alternative 4B (pause 4yrs), Option 3 (divert to priority list) would allow 2 construction and 1 major rehab projects to be completed sooner.**
  - *L/D 25 Upper MS 1200' Lock addition advanced 47 years from 2064 to 2017 operational (\$54.9M annual benefit).*
  - *High Island advanced 38 years from 2053 to 2015 operational (\$5.7M annual benefit).*
  - *Lagrange rehab advanced 50 yrs from 2064 to 2014 operational (\$53.1M annual benefit).*





# BENEFIT BY PROJECT FUNDING SCENARIO Alt. 4C – 6 Year Pause

- **Alternative 4C (pause 6yrs), Option 1 (divert funds to construction) would allow 1 construction project to be completed sooner.**
  - *Lower Monongahela phase 1 advanced 10 yrs from 2027 to 2017 operational (\$187.0M annual benefit).*
  
- **Alternative 4C (pause 6yrs), Option 2 (divert funds to rehabs) would allow 1 construction and 9 major rehab projects to be completed sooner.**
  - *High Island advanced 38 years from 2053 to 2015 operational (\$5.7M annual benefit).*
  - *LD 25 Upper MS rehab advanced 38 yrs from 2053 to 2015 operational (\$9.6M annual benefit).*
  - *Lagrange rehab advanced 49 yrs from 2064 to 2015 operational (\$10.2M annual benefit).*
  - *Lower Monumental rehab advanced 46 yrs from 2065 to 2019 operational (\$3.3M annual benefit).*
  - *O'Brien L/D rehab advanced 50 yrs from 2065 to 2015 operational (\$4.9M annual benefit).*
  - *Greenup L/D rehab advanced 60 yrs from 2079 to 2019 operational (\$19.0M annual benefit).*
  - *Myers rehab advanced 64 yrs from 2081 to 2017 operational (\$9.1M annual benefit).*
  - *Meldahl Dam rehab advanced 60 years from 2079 to 2019 operational (\$19.0M annual benefit)*
  - *Mel Price rehab advanced 69 yrs from 2086 to 2017 operational (\$7.6M annual benefit).*
  - *Marmet dam rehab advanced 71 yrs from 2090 to 2019 operational (\$11.3 annual benefit).*
  
- **Alternative 4C (pause 6yrs), Option 3 (divert to priority list) would allow 1 construction and 5 major rehab projects to be completed sooner.**
  - *Kentucky Lock addition advanced 22 years from 2041 to 2019 operational (\$66.1M annual benefit).*
  - *LD 25 Upper MS rehab advanced 38 yrs from 2053 to 2015 operational (\$9.6M annual benefit).*
  - *Lagrange rehab advanced 50 yrs from 2064 to 2014 operational (\$10.2M annual benefit).*
  - *Lower Monumental rehab advanced 46 yrs from 2065 to 2019 operational (\$3.3M annual benefit).*
  - *O'Brien L/D rehab advanced 50 yrs from 2065 to 2015 operational (\$4.9M annual benefit).*
  - *Myers rehab advanced 64 yrs from 2081 to 2017 operational (\$9.1M annual benefit).*



# Cofferdam Height Determination

- Insufficient time to do a complete economic assessment
- Cofferdam Height Study of 1989 concluded Nav Pass cofferdam top should be at El. 327
- Successful lock cofferdam built with top at El. 329
- Cofferdam Height Study of 1997 concluded Nav Pass cofferdam should be at El. 329
- Water elevation-frequency curves are now higher than those used in 1989 or 1997 studies
- Cost of added cofferdam height would be limited by cost of cofferdam flooding and clean up



# Beyond Olmsted– Alternatives and Impacts to Long Term Investment


- At the current funding level of \$150 million per year, it will take until 2024 to finish Olmsted L/D, 2033 to finish Lower Mon L/D, and 2040 to finish Kentucky L/D. This is assuming that no significant failure of the system occurs in the next 28 years – a bad assumption.
- The Top 23 projects in the IMTS Inventory will not be completed in well over the next 100 years with status quo funding.
- **CONCLUSION:** The System is not sustainable.



# Inland Navigation's Future...

	Annual Program	Total Proj	Total Cost	Funded, FY2012-32	Total Not Funded
CPBM, 2010	\$380M	110	\$18B	27 @ \$7.6B	83 @ \$10.4B
IWTF, 2010	\$170M	110	\$18B	6 @ \$3.4B	104 @ \$14.6B
CPBM, 2012	\$380M	110	\$19B	17 @ \$7.6B	93 @ \$11.4B
IWTF, 2012	\$170M	110	\$19B	2 @ \$3.4B	108 @ \$15.6B

ASSUMPTION: 110 urgent maintenance needs continue to serve without catastrophic failure for the next 20 years. Is this a reasonable expectation? If not, what should we do? Examples:

<u>Unfunded Projects</u>	<u>Risk</u>	<u>Consequences</u>
New Upper Miss Lock 21	Aging single 600-ft lock at risk of failure	Traffic delays mechanical failures
Calcasieu Lock	62-yr old lock Traffic Congestion	Continued traffic delays
Bayou Sorrel Lock	Traffic Congestion	Continued 
traffic delays		

# Beyond Olmsted– Alternatives and Impacts to Long Term Investment

- OPTIONS - Changing the Model
  - ▶ Must generate a sustainable funding stream. Fix the IWTF or somehow change the funding mechanism.
  - ▶ \$380 million a year according to the IMTS CPBM. \$445 million per year to cover the CPBM projects plus finishing Olmsted 2 years early.
  - ▶ Explore Public/Private Partnerships
  - ▶ The Panama Canal Authority generates nearly \$1 billion per year via transit fees.
  - ▶ Consider the Private development model for funding with reimbursement thru operations (Military Model)

