J.T. Myers Dam Major Rehab

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Project Information
Operational in 1972
10 Tainter Gate Bays
110’ x 1200’ Main Lock Chamber
110’ x 600’ Auxiliary Lock Chamber
Highest Tonnage Lock on Ohio with Small Auxiliary Lock
Roughly 70 million tons annually

Indiana Shore
Kentucky Shore
Wabash Island
Fixed Crest Weir
Gate Bay #10
Ohio River
Lock Chambers
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John T. Myers Dam Rehab

Major Areas of Concern for J.T. Myers Dam

- **Erosion of dam gate stilling basin slab below dewatering bulkheads**
  - Potential for undermining of dam
  - Downstream of bulkhead slots where repairs can be made
  - Damage to end sill structure potential to scour below dam

- **Stability of dam pier structures due to seismic loads and erosion**
  - More detailed information regarding ground motions at site
  - More detailed mapping of faulting at site
  - More stringent criteria regarding uplift on structure

- **Other items (mechanical & electrical upgrades) will be evaluated since there are significant concerns regarding long-term condition**

- **Evaluation of bulkhead crane girder seats**
Erosion of Ohio River Stilling Basin Slabs

Widespread Problem Throughout Louisville District Ohio River Projects with J.T. Myers, Markland, Cannelton, and Newburgh Having the Most Significant Damage


Repairs Can Only Be Made During Low Water Periods

Some Small Repairs Made at Markland Site with a Dewatering Box

J.T. Myers Site First of Anticipated Follow-on Rehab Studies at Other Sites with Similar Problems

Potential for Catastrophic Outcomes without Future Repairs
Erosion Damage at J.T. Myers
J.T. Myers Dam Gate Bay #6 Damage
Erosion of Stilling Basin / End Sill Structure

End sill scour damage – 60 ft. wide, averages 12” into base of end sill structure and 6” deep into basin floor. Majority of the end sill structure destroyed in this area.

Smaller scour holes

Sonar camera view (next slide)

Large scour hole with 2 layers of exposed rebar noted

10” deep hole extends 12” outside bulkhead slot

Dam stilling basin end sill structure

Undermining of baffle blocks into stilling basin floor (typical)

9 baffle blocks to break up flow

Represents area of stilling basin slab which currently can not be dewatered for repairs

Flow

Dewatering bulkhead slot (typical)

Dam Pier 5 (IN Side)

Dam Pier 6 (KY Side)
J.T. Myers Dam Gate Bay #6 Scour Image
Erosion of Stilling Basin / End Sill Structure

Top of end sill at elev. 304

Scour hole 60-ft across, averages 12” deep into end sill/basin floor Interface and 6” in height

Scour hole with 2 layers of exposed rebar.

top of end sill at elev. 304

end sill

stilling basin slab

erosion damage

302

elev. 300

Flow
Fixed weir stub wall, top elevation 312.0

Stilling basin floor

J.T. Myers Dam Gate Stilling Basin Scour Damage
Plan View of Gate #10 Floor / Pier #11 Area

End sill structure

Flow

Dam gate ogee section

Sonar Camera View

(next slide)

Scour hole (36” dia. x 4” deep)

Scour hole (24” dia. x 14” deep) into basin floor/pier interface

Scour hole (48” wide x 24” deep) into floor/pier interface.
Both levels of end sill structure missing from damage. Exposed rebars.

Pier #11

Fixed weir stub wall, top elevation 312.0

Represents area that currently cannot be dewatered to make repairs
Interface between stilling basin floor and vertical face of Pier #11

Exposed 3" diameter conduit used during original concrete construction and left in place

Represents area where pier is being undercut with scour at basin floor & pier wall interface (roughly 24" into pier face)

Interface of stilling basin floor and fixed weir stub wall with top elev. 312

Exposed and damaged rebars (prevalent throughout scour hole)

Exposed 3" diameter conduit used during original concrete construction and left in place

Current limits of scour hole (roughly 48" in diameter by 24" to 30" deep)

J.T. Myers Dam Scour Images
Erosion Damage of Dam Gate #10
Stilling Basin Floor at Pier #11
Scour Damage and Repairs at Markland Dam

** Note: Markland Dam is a similar high-lift project on Ohio River very similar to J.T. Myers
Scour Damage Repairs at Markland Dam

Temporary dewatering box built by LRS to make limited scour repairs around piers at the Markland Project.

Only allows for limited area of damage to be repaired. Not applicable for many other sites and types of erosion damage.

Must be site adapted which is too costly and would not cover necessary areas.
Markland Scour Damage

Note depth of scour hole around pier

Note scour below baffle block & stilling
Basin floor interface, exposed rebar, limits of scour hole
Scour Damage Repairs at Markland

Note close-up of damage of exposed and worn rebar in scour hole prior to repairs.

Limits of scour hole and repair of missing and damaged rebar throughout entire area around nose pier.
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Failure Mechanisms and Potential Impacts

Critical Features in Need of Evaluation for Rehab Study

✓ Scouring of Dam Stilling Basin and Piers
✓ Stability of the Dam Piers due for Various Load Cases Combined with Scour, Foundation Faults, and Previous Cofferdam Failures
✓ Electrical and Mechanical Upgrades Required for Various Issues
✓ Bulkhead Crane Bridge Seats

Failure Mechanisms Associated with Various Features

✓ Dam Scour – inability to dewater for repairs, increased erosion rate through time, potential for undermining of dam with catastrophic failure
✓ Dam Stability – potential for deep-seated sliding failure of dam due for various load cases due to heavy faulting, pier failure due to reduced shear capacity at erosion areas, potential for catastrophic failure of dam
✓ Electrical & Mechanical Upgrades – inability to find replacement parts for repairs, uneven distribution of load on tainter gate cables, reduced capacity to operate dam properly, potential for increased O/M and inability to effectively control pools
J.T. Myers Dam Rehab
Impacts Associated with Failure Modes

✓ Duration of loss of pool depends upon level of failure and inflows at time of failure, but 30 to 60 days duration is considered reasonable to block flow and rebuild pool levels while permanent repairs are undertaken.

✓ Loss of navigation benefits alone would exceed $100 million not to mention pool loss impacts to industries and cities with water intakes:
  - Multiple power plants, industry, and municipal intakes in J.T. Myers pool
  - Major handling facilities for navigation traffic
  - Potential for other damages (bank erosion, highways, bridges)

✓ Repair costs would most likely exceed $50 million to build temporary cofferdam and make repairs to damaged gate bays.

✓ Expected overall costs would run into the hundreds of millions, if not billions of dollars, depending upon the severity of the failure.

✓ Navigation pool loss can occur within 3 days during low inflow periods.
Development of Engineering Reliability Models

- Scouring of Dam Stilling – Analytical reliability model based upon detailed F.E. analysis of scouring action calibrated with test data and 1:100 navigation model from J.T. Myers Locks Improvements Project.

- Stability of the Dam Piers – Analytical reliability model based upon wedge analysis and associated random variables for foundation strengths, passive resistance, lower pool fluctuations...

- Electrical and Mechanical Features – hazard rates to be developed by expert elicitation process.

- Bulkhead Bridge Bearing Seats – analytical model with variations in concrete parameters, loads, deterioration rates, etc...
J.T. Myers Dam Rehab
F.E. Analysis of Scouring Below Dam

- Global 3-D F.E. model of ½ stilling basin gate bay w/ baffle blocks and reinforcement features
- Refined local FE model evaluating concrete performance with continued scour
- FE model data output vs. field data and model tests
J.T. Myers Dam Rehab
Rehab Option to Improve Reliability

Anticipated Features of J.T. Myers Dam Rehabilitation

- Overall cost in the range of $25 to $35 million
- Specialized dewatering bulkhead and related equipment to make repairs to entire dam stilling basin - $12 to $15 million
- Anchoring of dam piers to improve stability - $8 to $10 million
- Mechanical and electrical upgrades as required - $3 to $8 million
- Repairs to bulkhead bridge bearing seats - $2 million +/-

Specialized Dewatering Bulkhead

- Consists of main bulkhead with site-specific end connectors
- Main bulkhead would be a regional asset that could be used at multiple projects throughout LRD
- Allows repairs to be made to areas of the dam currently not accessible for maintenance repairs
Functional Criteria for the Bulkhead

- **Allow for the Dewatering of an Entire Tainter Gate Dam Stilling Basin Bay**
- **Provides Unobstructed Access for Repair of Severe Scouring in the Stilling Basins**
- **Match Geometries of J.T. Myers, Markland, Cannelton and Newburgh Dams – Ohio River**
- **Be Adaptable for Use at Other Tainter Gate Dam Stilling Basin Bays**
Dewatering Bulkhead Installed

Main Bulkhead

Project Specific End Connectors
J.T. Myers Dam Rehab
Current Status and Schedule

✓ **Study Cost of Roughly $800k Over 3 Years. Three Years Required Due to Limited Funding Stream from Available O/M $$$. (could have been done in 2 years)**

✓ **Supporting Engineering Analysis Completed, Currently Developing Reliability Models**

✓ **Supporting Economic and Hydrologic Analysis Underway, as well as Environmental Review**

✓ **Report Planned for Completion in Spring 2006 Pending Available Funds**
Thank You

Questions???

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