# MCNARY SPILLWAY STATUS

FPOM
January 2023

U.S. ARMY

US Army Corps of Engineers®

# MCNARY SPILLWAY

- Operational in 1954
- 22 Spillbays with double leaf vertical lift gates
- 2 Cranes (#6, #7) only initially,
  200 ton (400,000 lbs) capacity.
  Routinely operated gates in split leaf

# MCNARY CRANES 6 & 7

- Overloaded by estimated 20% according to BDI tests in 2003/05- not counting for lifting beam or frictional losses. – Violation of American Society of Mechanical Engineers (ASME) and Engineer Manual (EM) 385.
- Gantry crane frames do not comply with current American Institute of Steel Construction (AISC) codes - Under breakdown torque simulations, the downstream legs fail.
- The electrical system is outdated. Asbestos. DC hoist controls at risk of failure. Obsolete component replacement is becoming more challenging.
- Frequently down for weeks or months at a time – most recently a gantry drive gearbox failure required bearings that are no longer readily available.
- Recently had a main hoist gearbox replacement to address severe vibration issues, with mixed results.
- January 2023, Cranes 6 & 7 were limited to two engineered lifts (250 tons) per year.
    - Lifts that do not overload crane capacity are not limited

# MCNARY HOISTS

- 1976, 16 Ederer hoists added, 175 tons (350,000 lbs) capacity
  - Flow deflectors added
  - Spillway predominately operated as full gates
- 2002/2003, Four Transco hoists added.
  - 350,000 lbs capacity
- 2002, Failure of hoist gearbox coupler
- 2003-2005, Testing indicated all hoists were overloaded, 13 were > 125% overloaded
  - Up to 480,000 lbs of load. Did not include sheave friction.
- 2004-2009, Rehab of some gates wheel bearings, guide slots, guide shoes, replaced seals
  - Minor improvement only
- 2007, Hoist replacement project initiated
- 2020, Work restriction while hoists were under load implemented to reduce risk to health and human safety
- 2021, Load cell data collected on four hoists for prototype hoist project showed overload condition
- 2022, Hoist #6 failed, gears showed severe pitting due to material fatigue from high contact stresses, replaced with hoist from bay #16. Bay #16 RTS after about three month outage.
  - Hoist #15 OOS for one week for repairs
  - Hoist #20 taken OOS for repairs
  - Hoist #21 gearbox coupler failed and brakes failed during closure causing gate to fall on sill
- October 2023, Hoist operations were limited to either no (13) or two (7) overload lifts per year

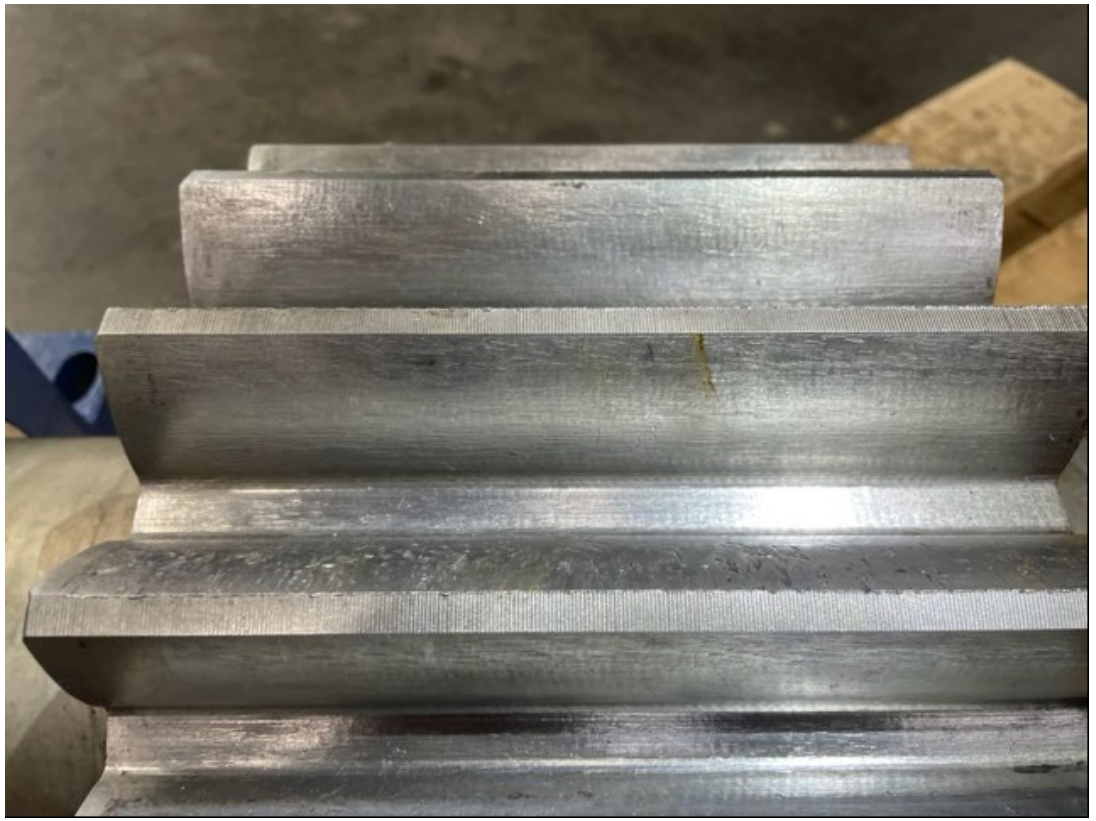
# MCNARY HOISTS

Pitted north drum gear

Unworn gear

# MCNARY HOISTS

Pitting on south pinion gear



Unworn pinion gear

# MCNARY SPILL GATES

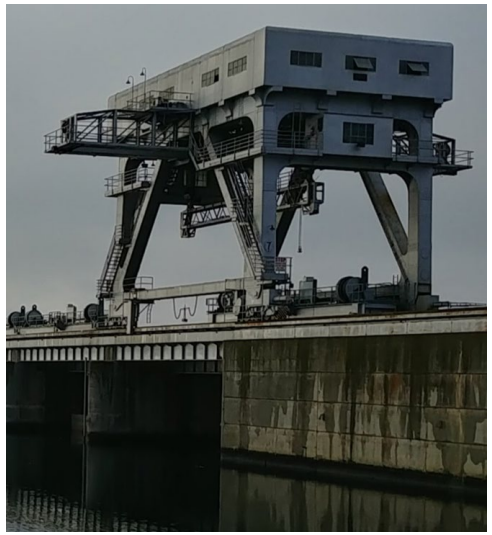
- 2022, Testing of lifting eyes showed deterioration and overload of design capacity
  Gate girders; several were close to failure for normal operations, and many did not meet criteria for emergency operation

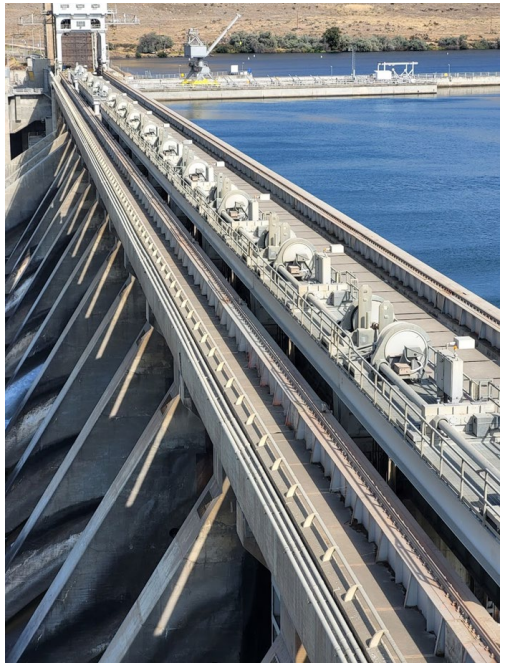
- 2023, Spillbay #16 closed to repair cracks in dogs and dog mounting points
  Bays #1, #3, #21 taken OOS to repairs dogs. Other bays to follow over the next year

- Result of structural analysis is that all 22 (+2 spares) spill gates should be replaced

# MCNARY SPILLWAY UPGRADE STATUS

## SCOPE OF SPILLWAY UPGRADES





Spillway Gate Dogging Mechanism Repairs (NREX):

- Repair and restore dogging mechanisms to allow safe dogging of gates.

Replace Spillway Cranes 6 & 7 (BPA Joint Capital):

- Replace spillway gantry cranes with uprated (350 ton) cranes (**PRIORITY**)
- Replace spillway gate lifting beams with uprated lifting beams

Gate Hoist Replacements (BPA Joint Capital):

- Replace all 20 gate hoists (**PRIORITY**). **Add 2 new gate hoists** so each spill bay has a hoist. 350 ton capacity

Spillway Gate Replacement (BPA Joint Capital):

- Based on 2023 structural analysis, we must replace all spillway gates with uprated capacity for sheave friction and hydraulic down-pull forces.

Spillway Gate Repair Pit Upgrade (BPA Joint Capital):

- Remove lead and asbestos.
- Add explosion-proof lighting, ventilation, doorways, electrical, pedestal upgrades, deck slab repairs and handrail upgrades, and fire protection.

# MCNARY SPILLWAY UPGRADE STATUS

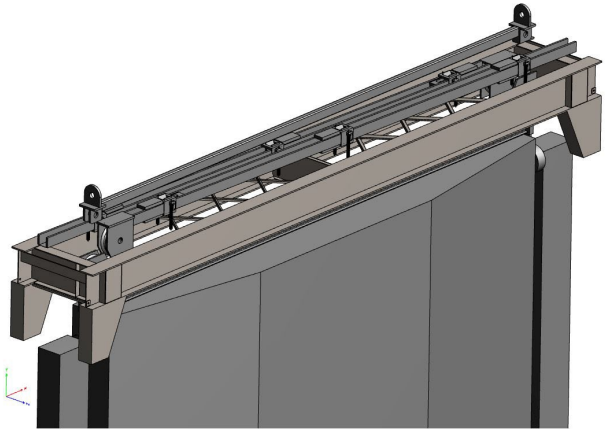
## SCOPE OF SPILLWAY UPGRADES

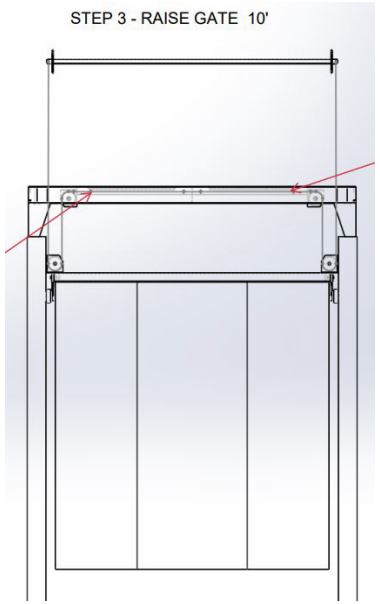

Spillway Deck Safety Handrail (NREX):

- Procure 21 new sets of handrail for the upstream spillway gate slots
- Move spillway gates and spillway gate hoists to upstream slots
- Operate spillway in upstream, split-leaf configuration for spill and fish passage requirements (**PRIORITY**)

Spillway Lifting Auxiliary Beams (SLABs) (BPA Joint Capital):

- Purchase new SLABs to allow use of spillway cranes without overloading (**PRIORITY**)
- Reduces spillway gate load from the spillway cranes and allows spillway crane operation within acceptable load limits





- **McNary Spillway Working Schedule**
  - MCN Replace Spillway Cranes 6 & 7
    - Phase 1a approved. FY23-24 Funding in place.
    - Design FY24-25? (pending appropriated $$s)
    - Award 1 crane (pending appropriated $$s):
    - Start fabrication crane 1 in FY26
    - Award 2nd crane (pending appropriated $$s):
  - MCN Spillway Major Rehab Evaluation Report (MRER)
    - Creating new project for FY24-25 budget request
  - MCN Spillway Hoist Replacements
    - First hoist in final design
    - Award prototype early FY24. Install FY24-Early FY25
    - Award follow-on contract for remaining hoists FY26: three per year?
    - Safety handrails – Pending Phase 1&2 Approval: Construction FY24
    - SLABS – Pending 1&2 Approval. Construction FY24-FY25
  - MCN Spillway Gate Replacements
    - Phase 1a pending Deb 2024 Capital Work Group Meeting
    - Phase 1 design in FY24-25
    - Award:
    - New spillway gates delivered FY26?: Three per year?
  - MCN Spillway Gate Dogging Mechanism Repair underway with FY23 NREX funds.
    - Funded. Repairs to occur in FY25 and complete in FY26
  - MCN Spillway Gate Repair PIT Upgrade
    - Phase 1a has been approved, but no appropriated match
    - Lower priority since gates are to be replaced
    - Repair pit will likely be used for storage when new spillway gates start to be delivered.
  - Modeling – Latest estimate, $1.5M to create new model
    - Initial funding from CRFM allotment has been sent to ERDC to initiate construction

# MCNARY SPILLWAY CRANE MILESTONES

| | |
|---|---|
| Kick off | August 2023 |
| Phase 1 Approval | April 2024 |
| Ready to Advertise | September 2024 |
| Award | March 2025 |
| Onsite Construction | Summer 2027 |

# SPILLWAY GATE HOIST REPLACEMENTS

## MILESTONES

| | |
|---|---|
| Kick off | Dec 2014 |
| ***Phase 1 Approval*** | Nov 2019 |
| Phase 2a Approval | Jul 2022 |
| Contract Award | Apr 2024 |
| Onsite Construction | Apr 2025 |
| Phase 2b Approval | Jun 2024 |
| Contract Award | Nov 2024 |
| Onsite Construction | Sep 2025 – 2032 (~Three per year) |

Phase 2a = Prototype Spillway Gate Hoist (1 hoist)
Phase 2b = Remaining Spillway Gate Hoists (21 hoists)

# SPILLWAY GATE HOIST REPLACEMENTS

**McNary Spillway Hoist Phase 1:**

- prepare plans and specifications based on recommended alternatives, including a "prototype" rehabilitation of one gate and uprate of one hoist
- prepare contract documents to BCOES level
- prepare total project cost estimate
- advertise contract and pre-award acquisition actions

Operational requirements for the new spillway gate hoist:

| | |
|---|---|
| Hoist Designation | Gate hoist |
| Rated Capacity | 400 tons (800,000 lbs) |
| Lift Speed | 1 ft/min |
| Motor Power | 40 HP max |
| Picking Distance | 20 ft(Gate Opening) |
| Over Travel | 1 ft |
| Rated Voltage | 480 V |

New hoist motor capable of 200 percent overload torque for one minute from zero speed to base speed.

Include a new gate lifting beam rated to match 400 ton capacity.

Use commercially available off-the-shelf components as much as is feasible

# SPILLWAY GATE HOIST REPLACEMENTS

**McNary Spillway Hoist Phase 1 (continued):**

Equipment such as motors, reducers, gearboxes, etc. shall allow for easy extraction and installation.

Use Environmentally Acceptable Lubricant (EAL) for components not permanently sealed.

Include a load-limit visual/audible system for when the load-limit has been exceeded. The load-limit system shall include load-sensing electronics and an alarm light. The alarm setpoint shall be adjustable.

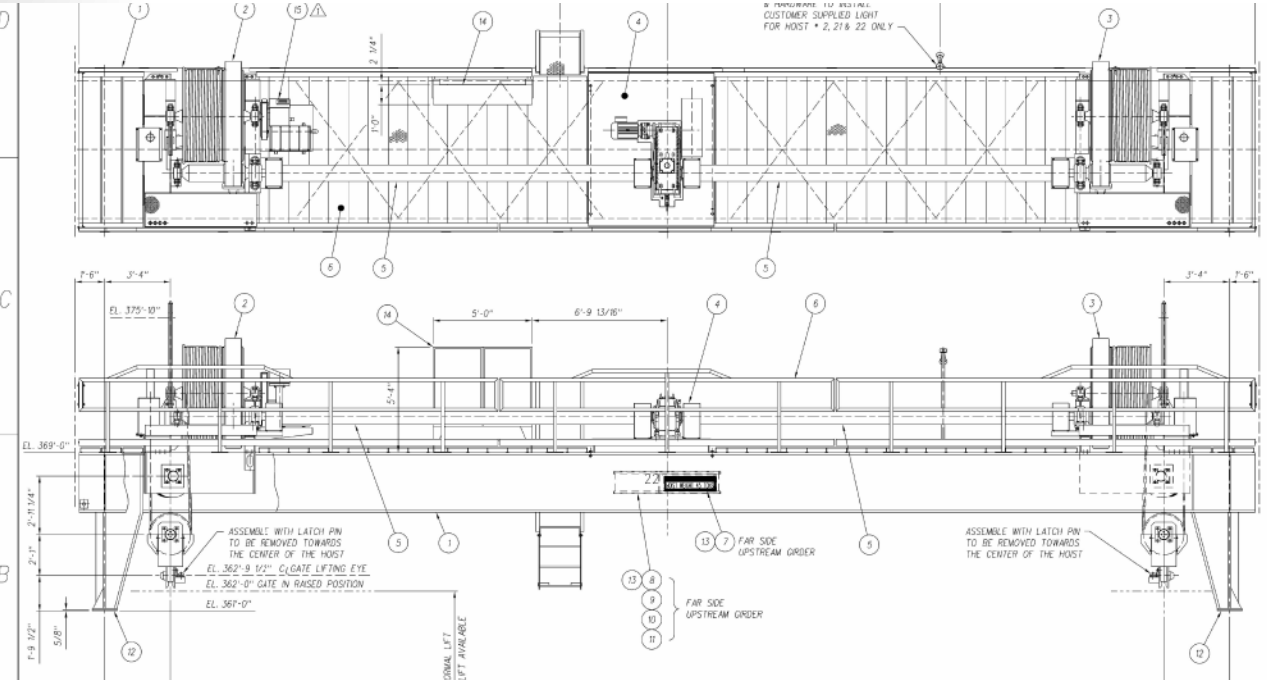
Include load cells to provide continual load measurement signals with an emergency stop pushbutton.

One of each item, rating and type of equipment furnished as selected by the Contracting Officer, shall be given a complete test witnessed by the Contracting Officer. No equipment shall be shipped until it has been approved for shipment by the Contracting Officer.

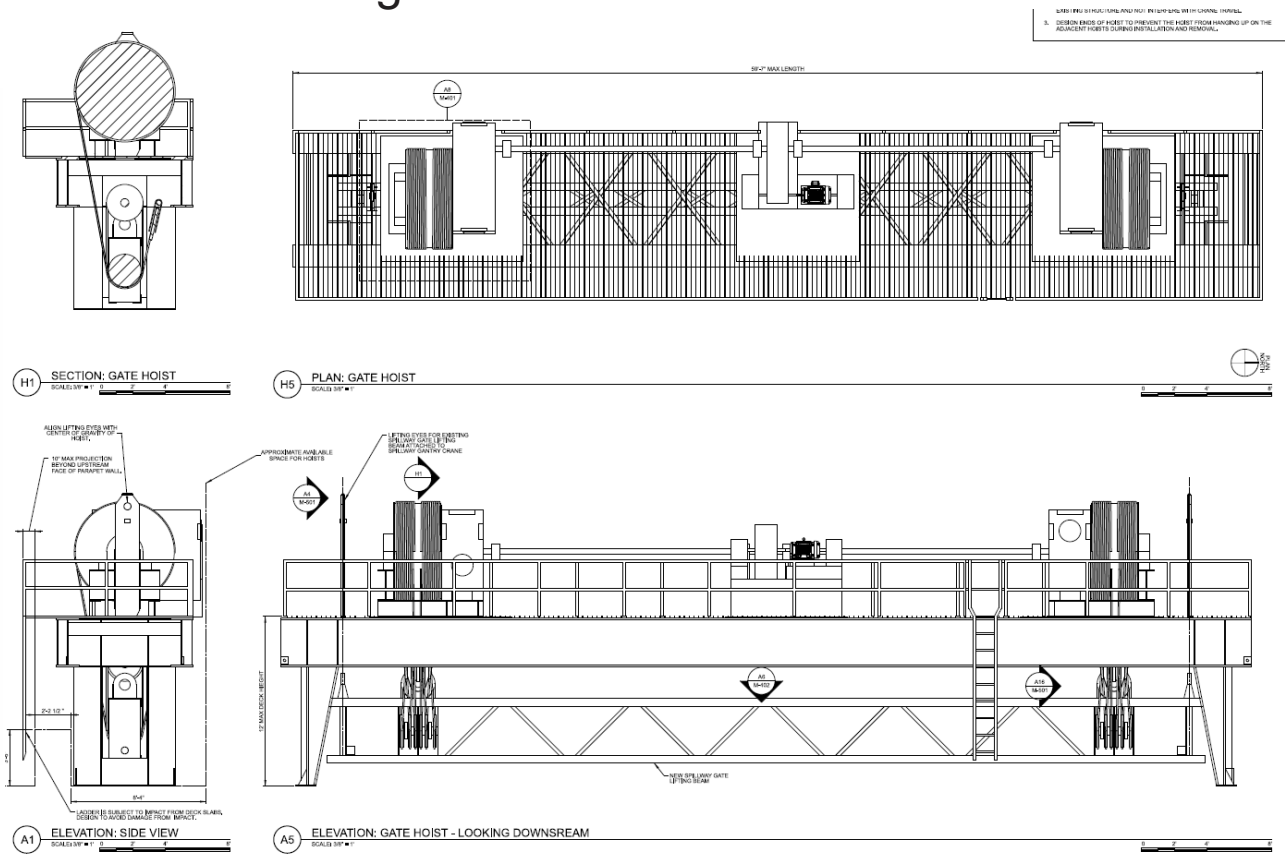
Each hoist shall be given a complete functional test after installation with the gate attached.

# SPILLWAY GATE HOIST REPLACEMENTS

## Old Hoist Design

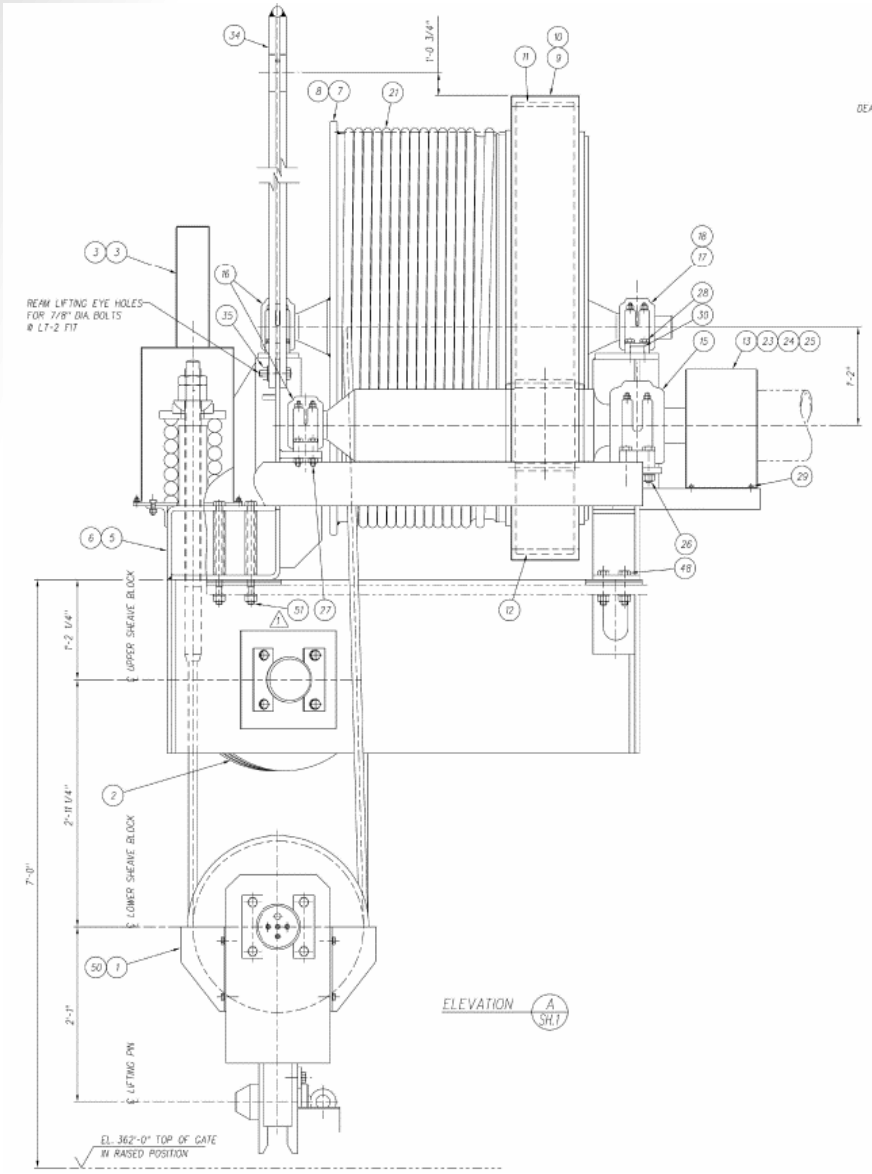


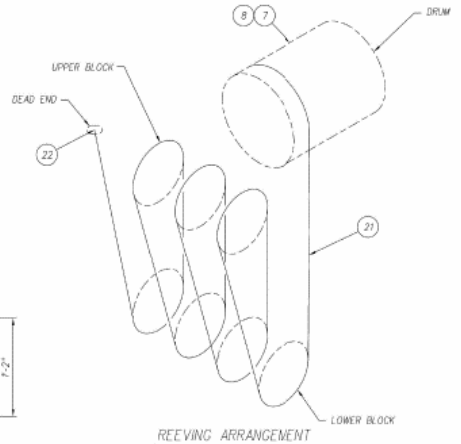

## New Hoist Design



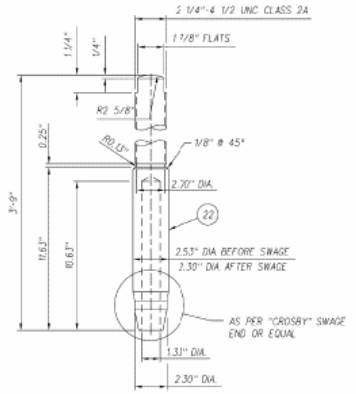
# SPILLWAY GATE HOIST REPLACEMENTS

## Old Hoist Design



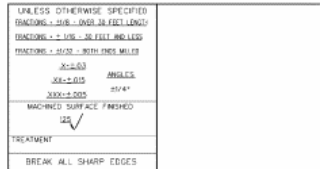




REEVING ARRANGEMENT

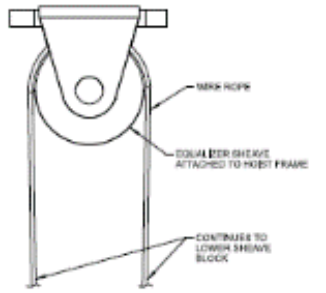



DEAD END SWAGED WIRE ROPE FITTING

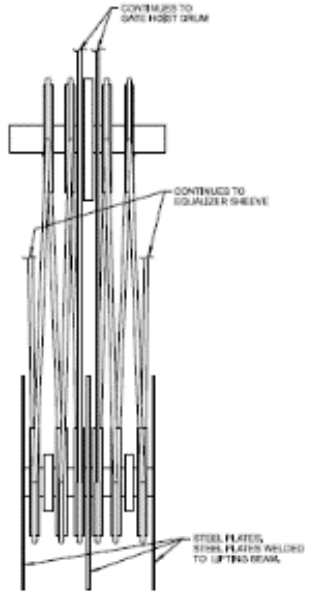
CUSTOM MADE BY "CROSBY" OR EQUAL FORGED FROM SPECIAL BAR QUALITY CARBON STEEL, SUITABLE FOR COLD FORMING. HARDNESS CONTROLLED BY SPHEROIDIZE ANNEALING. EFFICIENCY RATING TO BE 100% BASED ON THE CATALOG STRENGTH OF THE WIRE ROPE PROOF LOAD IN ACCORDANCE WITH ANSI B30.9



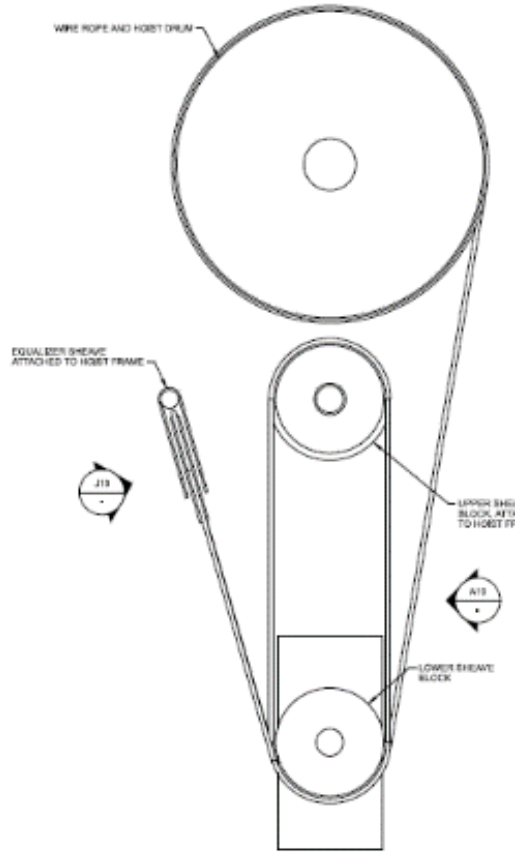

## New Hoist Design




J10 DETAIL; EQUALIZING SHEAVE

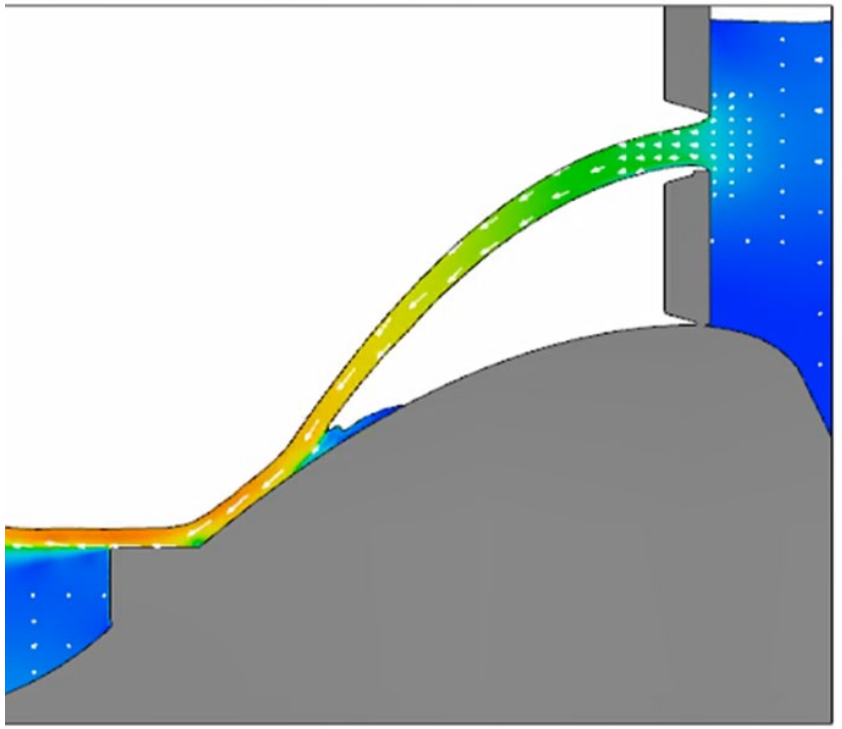



A10 DETAIL: UPPER AND LOWER SHEAVES




A16 DETAIL: SHEAVE ASSEMBLY

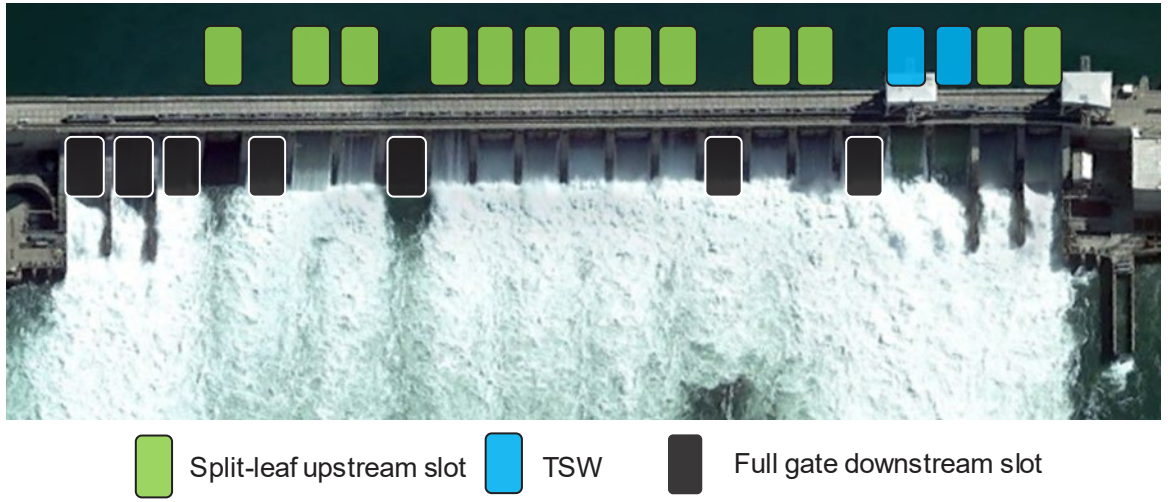
# PROPOSED SPILL OPERATIONS



Retain two TSW's in normal location

Move 13 hoists to upstream slot and use in split leaf configuration
- Construct new control cables
- Procure materials for handrails with Small Cap
  - Assemble handrails in-house

Retain 7 gates in downstream slot closed in full gate configuration
- Needed to maintain Standard Project Flood (SPF) capacity
- Adaptively manage operations once risk for spring floods are better understood
- Incorporate use of SLAB's when available



# SPILLWAY OPERATION EVALUATIONS

SRWG has meet several times to discuss evaluation plans

Research Summary was distributed 18 December. Comments due 31 December

**FY24 DIRECT INJURY STUDY OBJECTIVES:**

1. Estimate direct injury and survival of yearling Chinook salmon passing through a McNary Spillbay after being set in the upstream slot in split-leaf operation by direct releases of fish equipped with balloon tags at two different elevations. (Sample sizes sufficient to estimate with a precision of ±5% @ 95% Confidence Interval [CI]).
2. Estimate direct injury and survival of yearling Chinook salmon passing through McNary Dam TSW by direct releases of fish equipped with balloon tags at two different elevations. (Sample sizes sufficient to estimate with a precision of ±5% @ 95% CI).

**FY24 ACTIVE TAG STUDY OBJECTIVES:**

1. Estimate spillway survival of out-migrating juvenile salmonids passing through McNary Dam with split-leaf spillway operations from dam face detections to outside of project influence downstream.
2. Estimate survival of out-migrating juvenile salmonids passing through all passage routes at McNary Dam with split-leaf spillway operations.
    a. Estimate tailrace egress time for juvenile salmonids downstream of McNary Dam.
    b. Estimate spillway passage efficiency (SPE) for split-leaf spillway operations at McNary Dam.
    c. Estimate forebay survival and forebay residence time for split-leaf spillway operations at McNary Dam.

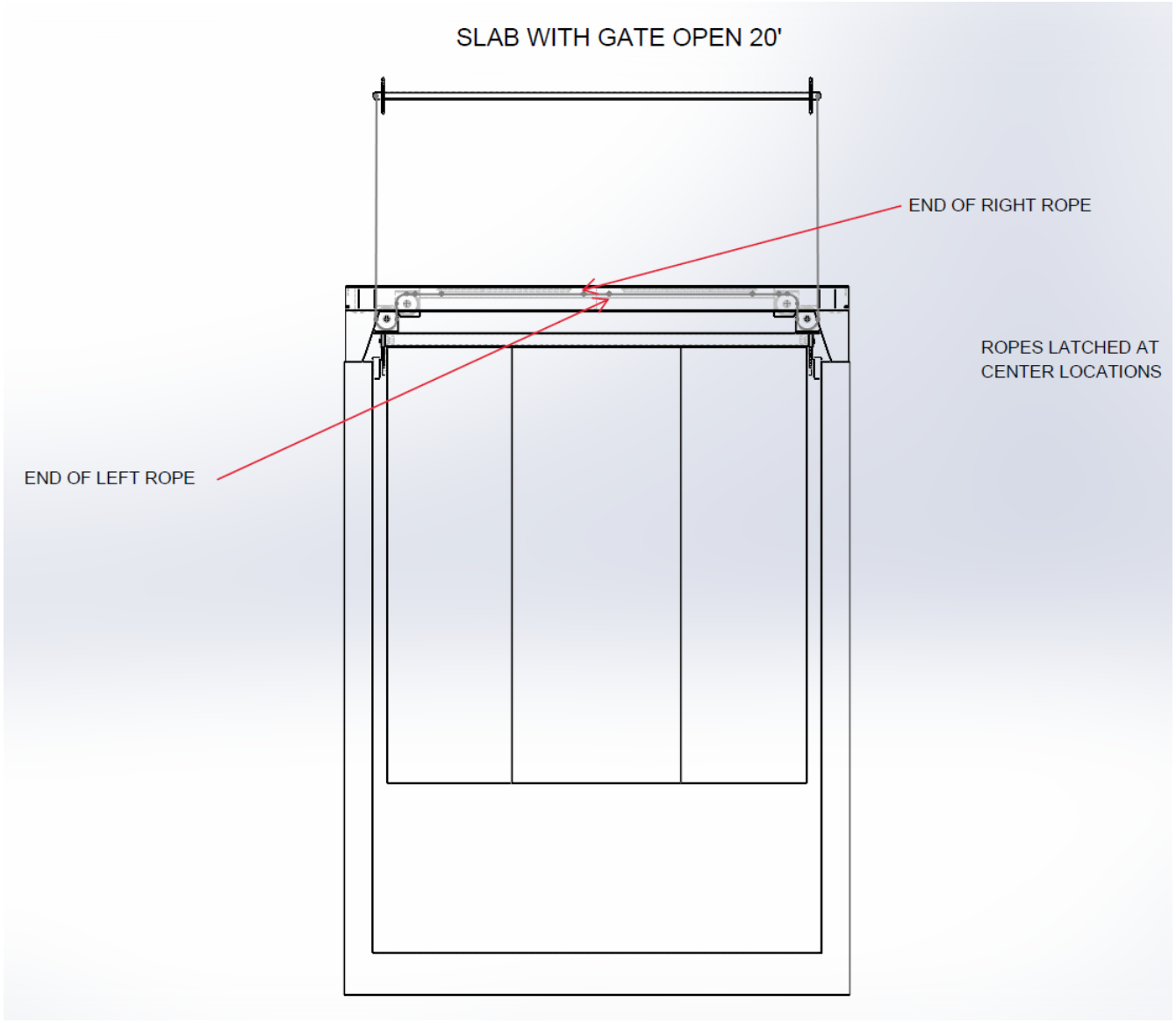
Evaluations are intended to be early spring. Before April spill season if possible.

Funding available is still TBD

# SPILLWAY OPERATIONS MODELING


6
STOP
PROCEED WITH CAUTION WHEN RED LIGHT IS FLASHING
06/11/2023


06/11/2023 10:55


SLAB WITH GATE OPEN 20'
END OF RIGHT ROPE
ROPES LATCHED AT
CENTER LOCATIONS
END OF LEFT ROPE