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U.S. ARMY CORPS OF ENGINEERS, WALLA WALLA DISTRICT
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CENWW-EC (1130)

29 September 2023

MEMORANDUM FOR Chief of Operations Division

SUBJECT: McNary Lock and Dam, Spillway Hoist Restrictions

1. Purpose: Outline the engineering, limitations, and restrictions of the spillway hoist at McNary Dam in consideration of operational, dam safety, life safety mission requirements.
2. References.
 - a. American Society of Mechanical Engineers (ASME) B30.16-2020, Overhead Underhung and Stationary Hoists
 - b. Engineering Manual (EM) 385-1-1, Safety and Health Requirements
 - c. U.S. Army Corps of Engineers (USACE) Walla Walla District, McNary Dam Spillway Flow Deflectors, Hydraulic Model Study, Sept 2001
3. Summary. 20 of the 22 Spillways at McNary have spillway hoists and all 20 are overloaded, per data collected between 2003 and 2022. In the full gate (double leaf) configuration, 13 of the gates are loaded more than 125% of rated capacity, which is prohibited per EM 385-1-1. The remaining seven hoists are loaded between 100% and 125% of rated capacity, which is classified as an ENGINEERED LIFT per ASME B30.16-2020. Only two ENGINEERED LIFTS are allowed for each of these hoists in a consecutive 12-month period. As a result, the spillway hoists are limited to split leaf operations, with limited full gate operations with the seven (7) hoists within the 100-125% of capacity until capacity issues are resolved. Engineering is analyzing options to mitigate impacts given these limitations and will provide instructions and recommendations by follow-on correspondence. It should be noted that both spillway cranes require ENGINEERED LIFTS to open spillway gates in full gate configuration as well, see enclosed memos.

4. Background.

a. McNary spillway has a total of 22 spillway gates which were originally designed to operate with two cranes to pass involuntary spill (inflow that exceeds powerhouse capacity). Voluntary spill for fish passage first started in 1995 for spring spill, and summer spill was added in 2006, which required the use of the cranes/hoists/gates multiple times per day depending on the time of year.

b. The spillway gates are vertical lift gates with an upper and lower leaf that can be separated to operate in split leaf configuration. In split leaf operation, just the top leaf is lifted, and water passes between the two leaves. In full gate configuration both leaves are lifted, and water passes underneath the gate, clearly requiring a larger lifting capacity.

c. In 1976, dedicated hoists were installed on 16 of the spillway gates and the gates were only operated in full gate configuration. Six of the gates were still operated by the cranes. Flow deflectors were also added to the downstream face of the spill bays to minimize dissolved gases that are caused by plunging flow into the stilling basin.

d. In 2002, four additional hoists were installed with the same capacity as the ones installed in 1976.

e. From 2002 to 2005 various analysis, testing, rehab, and retrofit efforts were unsuccessful in reducing loads resulting in a recommendation to replace the 20 hoists. From this, the MNA Spillways hoist replacement project was started in 2007.

f. In 2021, additional load cell data was collected on four of the gates to validate load for new prototype spillway hoist. Load data from a fifth gate was subsequently acquired by one of the spillway cranes in 2022. Load data collected showed hoists are still overloaded to the same level if not higher, in some cases, when compared to 2005 load data.

g. In the past five years, the hoists have experienced multiple failures due to their overloaded condition. Failures include load block failure, pillow block bearing failure, coupling failure and brake failure. As a result of the failures, three spillway gates have been dropped.

h. The McNary Modernization project is currently underway and plans for 2-5 turbine units out over the next 15-years which affects overall project discharge capacity.

i. Wholistically, there are 2 efforts in place to replace the spillway hoists and cranes. One effort is for one prototype spillway hoist replacement currently in the final stages of design and a Phase 1A scoping for crane replacements that began 30 August 2023.

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5. Discussion.

a. Currently 13 of the hoists cannot lift the full gates without violating EM 385-1-1, which explicitly states no equipment may be loaded above 125% rated capacity. The remaining seven hoists, upon load cell verification, may be able to lift the full gate two times in a consecutive 12-month period in accordance with ASME B30.16-2020 with ENGINEERED LIFTS.

b. All hoists can raise and lower the top leaf, which weighs 132,000lbs, within their rated capacity of 350,000lbs.

c. The McNary project flow capacity with this restriction is less than the standard project flood (SPF) of 810,000 cfs mission requirement.

(1) Without engineered lifts: The maximum capacity of McNary project is approximately 604,000 cfs. This assumes 10 powerhouse units in service at generator limit and all spill bays in single leaf configuration.

(2) With engineered lifts: the maximum capacity of McNary project is approximately 774,000 cfs which still does not meet SPF. This assumes 10 powerhouse units in service at generator limit, two bays with cranes gates removed in free flow, 7 bays in full gate configuration, and 13 bays in single leaf configuration. Further adjustments of spill due to operational impacts in the free flow and full gate spill bays would not be possible as both engineered lifts are used when setting this configuration.

d. Operating the spillway in spilt leaf configuration will result in operational and environmental impacts. Further modeling is underway to assess the extent of these impacts and develop mitigation options.

e. Other options involving extensive physical changes to the hoists or cranes were considered; however, due to new cranes and hoists being procured and the time to implement such changes these options were not deemed feasible.

f. Utilizing the spillway cranes to regularly lift all gates was ruled out due to crane restrictions, see enclosed memos. Temporary mobile cranes were also considered but were ruled out because the spillway bridges cannot support loads.

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6. Restrictions & Recommendations. The list below must be followed to reduce safely risk to operate the spillway until new cranes or hoists are procured and installed.

a. RESTRICTION – Spillway gates 4, 6, 7, 9, 10, 11, 12, 13, 14, 16, 17, 19, 20, 21 and 22 are loaded above 125% may only be operated by the hoists in split leaf configuration, lifting only the top leaf for spill.

b. RESTRICTION – Spillway gates 1, 2, 3, 5, 8, 15 and 18 are loaded between 100-125% and must be operated by the hoists in split leaf configuration as well but may also be hoisted in full gate configuration only 2 times in a consecutive 12-month period per ASME B30.16-2020 ENGINEERED LIFT and should be reserved for high flow event until further analysis can be completed. Continued rehabilitation efforts on gate dogging devices is critical to engineered lifts for these gates.

c. RESTRICTION - Load cells must be installed on gates prior to ENGINEERED LIFTS to monitor loads during operation. Installation of load cells is recommended for all gates given current load data is nearly 20 years old.

d. Recommendation – Full replacement of 22 hoist and/or cranes with adequate capacities to lift full gates in two leaf operation as soon as possible to meet spillway mission requirements safely.

e. Recommendation – Assuming the restrictions above, continue to analyze operational configurations and evaluate spill patterns to minimize environmental impacts until new cranes or hoists are installed.

f. This memo does NOT cover Dam Safety emergency operation of the spillway in which the restrictions and recommendations within this memo prevent passing the flow needed to prevent overtopping of McNary Dam. Refer to Emergency Action Plans where applicable.

7. Point of Contact. The technical point of contact for this memorandum is Caleb Willard, P.E. at (509) 527-7622.

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