SWEETWATER LAKE DAM (7-10)

2023 Dam Safety Inspection Report

Brown County, IN | February 2024

Inspection Date: October 24, 2023

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FEBRUARY 2024
INSPECTION DATE: OCTOBER 24, 2023

Prepared for:

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DISCLAIMER

This report was prepared by Christopher B. Burke Engineering, LLC (Burke) for the Cordry-Sweetwater Conservancy District (CSCD) for the Sweetwater Lake Dam using available data and observed conditions. Burke is not responsible for any conditions that could not be inspected during the field examination due to excessive vegetation, inundation, or other visual obstructions.

Information describing possible solutions to problems and concerns, repairs, and emergency actions are intended for guidance only. The dam owner should obtain detailed design plans and specifications from a qualified professional engineer experienced in dam design and construction before performing any repairs or modifications to the dam or its appurtenant works. Only qualified contractors should be employed to install necessary measures.

Permits from federal, state or local agencies may be required to perform dam remedial work or repairs, depending on the magnitude of the repairs. The dam owner should seek assistance from a qualified professional in determining the need for permits.

EXECUTIVE SUMMARY

Sweetwater Lake Dam located approximately 6 miles south of the Town of Nineveh, in Brown County, Indiana in Section 19, Township 10N, Range 4E on the Nineveh and Bean Blossom USGS Quadrangles. The lake was formed by the construction of an earthen embankment across the East Branch of Sweetwater Creek. The dam is owned by the Cordry-Sweetwater Conservancy District (CSCD) and is currently classified as high hazard.

The embankment is approximately 121 feet high and 1,560 feet long, with a 23-foot-wide crest. The 275-acre lake collects runoff from an approximately 2.3 square mile watershed. The principal spillway is a 12-foot by 12-foot reinforced concrete box control structure with a 36-inch diameter high density polyethylene (HDPE) outlet pipe, located at the right abutment. The auxiliary spillway is a 150-foot-wide open channel located in natural ground to the left of the embankment. The dam was found to pass a "Maximum Probable Storm" through the auxiliary spillway in the 1978 Phase 1 Report. However, the methodology used for the spillway capacity analysis does currently meet the requirements outlined in the Indiana Department of Natural Resources (IDNR) *General Guidelines for New Dams and Improvements to Existing Dams in Indiana* with regard to the storm duration and rainfall depth. Dams classified as high hazard by IDNR are required to safely pass the rainfall runoff from the 100% Probable Maximum Precipitation (PMP) event without overtopping. There is no apparent lake drawdown capability.

The dam was originally designed by Hugh K. Dargitz, Greenwood Engineering Company in 1952 and was initially approved by the State of Indiana Flood Control and Water Resources Commission (predecessor to IDNR) in May 1958 (D-429) and again after design revisions in June 1965 (D-863). The dam was constructed in stages between 1957 and 1969 by C.R. Morris Construction Company. Dam files include the design plans, design survey, and as-built drawings.

Christopher B. Burke Engineering, LLC (Burke) performed a visual dam safety inspection of the Sweetwater Lake Dam on October 24, 2023. The inspection was performed by Jeffrey D. Fox, P.E., Aaron J. Fricke, P.E., and Joshua L. Erwood, P.E., who have experience in dam safety. Nick Johann of CSCD was present for portions of the inspection to discuss recent changes, maintenance, and repair items. The overall condition of the dam was considered to be "**Conditionally Poor**" based on IDNR rating criteria. This rating reflects the uncertainties related to the spillway capacity and embankment stability and the need for further analysis. **The risk of Type 1 component failure and Type 2 uncontrolled breach failure dam failure are considered to be low**. Maintenance, repairs, and engineering analyses are needed to achieve a "Satisfactory" overall conditions rating.

The component ratings, overall conditions rating, and recommendations to achieve a "Satisfactory" rating are summarized in the table on the next page.

Component	Rating	Recommendations	Schedule	Importance
Upstream Slope	Acceptable	• Spray/Remove weeds and woody vegetation in riprap • Remove trees within 25 feet of right abutment in accordance with the Indiana Dam Safety Inspection Manual • Supplement riprap slope protection at bare areas and at areas where riprap gradation is too small. Extend riprap at right abutment to provide protection from wave erosion. • Remove woody debris and logs from shoreline • Remove bird house at left abutment	• Ongoing • Within 2 years • Within 2 years • Ongoing • Within 2 years	• Low • Medium • Medium • Low • Low
Crest	Acceptable	• Monitor cracks in asphalt pavement and seal as needed	• Ongoing	• Low
Downstream Slope	Acceptable	• Fill and seed erosion gully at the far left abutment • Remove trees and brush within 25 feet of left abutment, right abutment, and toe of slope in accordance with the Indiana Dam Safety Inspection Manual • Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual • Repair/Replace damaged bench drain cleanouts and remove outlet obstructions. Install a marker post at each cleanout along the benches and at each outlet along the groins for easy identification	• Within 1 year • Within 2 years • Ongoing • Within 1 year	• Low • Medium • Low • Medium
Seepage	Acceptable	• Monitor large wet area at downstream toe near right side of embankment and notify professional engineer of observed changes	• Ongoing	• Low
Principal Spillway	Acceptable	• Monitor surface cracking and minor spalling on concrete inlet • Remove debris from concrete inlet trash rack and above inlet structure • Replace missing hardware for trash rack located on top of concrete inlet • Supplement riprap on concrete inlet side slopes at bare spots • Remove vegetation adjacent to and extending over concrete impact basin • Remove woody debris and fallen tree downstream of outlet	• Ongoing • Ongoing • Immediately • Immediately • Immediately • Within 2 years	• Low • Low • Low • Low • Low • Low
Auxiliary Spillway	Acceptable	• Relocate light pole and volleyball courts and replace sand with turf-building ground cover • Fill and seed bare areas in inlet section • Remove trees and brush from spillway channel side slopes and at outlet • Remove minor obstructions from outlet channel area	• Within 2 years • Within 1 year • Within 2 years • Within 2 years	• Low • Low • Medium • Low
Maintenance and Repairs	Acceptable	• Perform spillway capacity analysis in accordance with IDNR requirements • Retain a geotechnical engineer to perform an investigation to evaluate dam stability • Conduct a video inspection of the principal spillway outlet pipe; subsequent inspections should be performed every six years • Update Incident and Emergency Action Plan • Develop lake drawdown plan	• Within 2 years • Within 4 years • Within 2 years • Within 1 year • Within 1 year	• Medium • Medium • Medium • High • Low
Overall Conditions	**Conditionally Poor**	• **See above**	• **N/A**	• **N/A**

Notes:
1. Possible Component Ratings: Good, Acceptable, Deficient, Poor
2. Possible Overall Conditions Ratings: Satisfactory, Fair, Conditionally Poor, Poor, Unsatisfactory

1.0 BACKGROUND

1.1 PROJECT LOCATION

Sweetwater Lake Dam is an earthen embankment across the East Branch of Sweetwater Creek creating a lake utilized for recreational purposes. The dam is located approximately 6 miles south of the Town of Nineveh, in Brown County, Indiana. It is located in Section 19, Township 10N, Range 4E of the Public Land Survey System (PLSS) as shown on the Bean Blossom and Nineveh United States Geological Survey (USGS) Quadrangle Maps. The dam is owned by the Cordry-Sweetwater Conservancy District (CSCD) and currently classified as high hazard by the Indiana Department of Natural Resources (IDNR).

1.2 FILE REVIEW

Unless otherwise noted, information presented in this report is from the visual inspection, information obtained from the IDNR files for the dam, Burke's in-house file from previous work on the dam, and aerial photography, topographic information, and maps publicly available through the Indiana Spatial Data Portal and IndianaMap. An extensive review of IDNR's file was not considered necessary for this inspection due to Burke's previous research of the file and recent involvement with the dam. Primary sources of information include:

- Calculations, correspondence and permits prepared by IDNR from 1952 through 2017
- Dam construction and dam safety inspection reports prepared by IDNR from 1955 through 2000
- Sweetwater Lake Dam Phase 1 Inspection Report, prepared by Clyde E. Williams & Associates, Inc. for the United States Army Corps of Engineers (USACE) – Louisville District (1978)
- Dam safety inspection reports prepared by Fink, Roberts, & Petrie, Inc. from 2002 through 2011
- Ninevah and Bean Blossom 2022 7.5-minute USGS quadrangle maps
- Dam safety inspection reports prepared by Burke from 2012 through 2021
- "Wabash Valley Seismic Zone". Central United States Earthquake Consortium. Accessed 4 December 2023 <http://www.cusec.org/earthquake-information/wabash-valley-seismic-zone>.
- "1811-1812 New Madrid, Missouri Earthquakes". United States Geological Survey. Accessed 4 December 2023 <https://www.usgs.gov/natural-hazards/earthquake-hazards/science>.
- "Search Earthquake Archives". United States Geological Survey. Accessed 4 December 2023. <http://earthquake.usgs.gov/earthquakes/search/>.
- Gray, Walter E. and John C. Steinmetz. "Map of Indiana Showing Known Faults and Historic Earthquake Epicenters having Magnitude 3.0 and Larger". Indiana Geological Survey. Miscellaneous Map 84, revised 2015.
- "2018 National Seismic Hazard Model for the Conterminous United States, Peak Horizontal Acceleration with a 2% Probability of Exceedance in 50 Years". United States Geological Survey. Accessed 4 December 2023. <https://www.sciencebase.gov/catalog/item/5d5597d0e4b01d82ce8e3ff1>.

1.3 HISTORY OF THE DAM

Based on the Phase 1 report, the dam was first designed around 1952 by Hugh K. Dargitz, Greenwood Engineering Company for land developer Howard Prince of Prince's Lake Building Company. An application for approval from the State of Indiana Flood Control and Water Resources Commission (predecessor to IDNR) was submitted in October 1955, after construction had begun, but was never approved. Work apparently halted in July 1956 with the dam less than 20 feet high and the stream bypassing the embankment fill at the right abutment.

In 1957, Sweetwater Lakes, Inc. was formed and assumed ownership of the dam. Revised plans for finishing the dam were completed by Hilbert L. Hoffman, from Indianapolis. A new application was submitted to the Commission in October 1957, approval for which was issued in May 1958 under Docket No. D-429. Construction records show fill material was added to the upstream and downstream slopes of the dam between 1957 and 1959, but no increase in dam height occurred. In addition, the stream was still bypassing the embankment at the right abutment.

In June 1959, the CSCD was established to complete the dam. Fraps and Associates, Inc. (Fraps) prepared revised plans and received approval from the Commission in May 1960, under Docket No. D-863, for construction of the dam and a common auxiliary spillway with Cordry Lake Dam. In June 1965, a revised application for construction was approved by the Commission, under Docket No. D-863 (revised), for the construction of a separate auxiliary spillway for Sweetwater Lake Dam and construction of either a separate auxiliary spillway for Cordry Lake Dam or widening Sweetwater's auxiliary spillway and constructing a canal between the two lakes. C.R. Morris Construction Company raised the dam in three stages in 1962, 1964, and 1966, and constructed the spillways by 1969.

There have been two repairs/modifications to the dam since its completion in 1969. In 2003, R.W. Armstrong & Associates (RW) designed improvements to address the deteriorated principal spillway outlet pipe and erosion at the downstream end. The existing 48-inch diameter corrugated metal pipe (CMP) principal spillway outlet was slip lined with a 36-inch diameter high density polyethylene (HDPE) pipe, and a new principal spillway stilling basin was constructed. In 2008, the bench drains along the downstream slope and paved side ditches along the groins were replaced.

In September 2019, Burke completed preliminary calculations for armoring the outlet channel downstream of the principal spillway after significant erosion was observed along the right abutment. Conceptual layouts were developed for several hard armor solutions. CSCD plans to address and implement final design for this work in the future.

1.4 PREVIOUS INSPECTIONS

In accordance with Indiana Code 14-27-7.5-9, high hazard dam owners must have a licensed professional engineer inspect the dam at least once every two years and submit a report regarding the structure's condition. Prior to enactment of the code in 2002, Sweetwater Lake Dam was inspected by IDNR nearly every year from 1955 through 2000. Fink, Roberts, & Petrie, Inc. performed inspections from 2002 through 2011, and Burke inspected the dam from 2012 through 2021.

Table 1 is a summary of the inspection ratings from 2012 to 2021.

Table 1: Previous Inspection Ratings (2012 - 2021)

Component	Condition Ratings Per Inspection					
	2012	2013	2015	2017	2019	2021
Upstream Slope	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Crest	Good	Good	Good	Good	Acceptable	Acceptable
Downstream Slope	Acceptable	Acceptable	Deficient	Deficient	Acceptable	Acceptable
Seepage	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Principal Spillway	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Auxiliary Spillway	Good	Good	Good	Good	Acceptable	Acceptable
Maintenance and Repairs	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Overall Conditions	**Fair**	**Fair**	**Fair**	**Fair**	**Conditionally Poor**	**Conditionally Poor**

Notes:
1. Possible Component Ratings: Good, Acceptable, Deficient, Poor
2. Possible Overall Conditions Ratings: Satisfactory, Fair, Conditionally Poor, Poor, Unsatisfactory

1.5 HISTORICAL EVENTS

No major historical rainfall events were noted in IDNR's file. No gages or other instruments have been used to record peak water levels or discharges at the site. Based on discussions with CSCD, the auxiliary spillway has only engaged once since 1993. In 2008, the depth of flow through the auxiliary spillway was approximately 6 to 12 inches.

1.6 EMERGENCY PREPAREDNESS

Sweetwater Lake Dam is classified by IDNR as a high hazard structure. Starting in July 2022, Indiana Code 14-27-7.5-18 requires that the owner of a high hazard dam prepare and maintain an Incident and Emergency Action Plan (IEAP). An Incident and Emergency Action Plan for this dam, including an approximate dam failure flood inundation map, was completed in June 2013 through IDNR as part of a grant from the Federal Emergency Management Agency (FEMA). The dam has good dry weather access. Access from the northeast may be limited during activation of the auxiliary spillway. No auxiliary power is necessary because the dam and spillways do not have electronical components. There have been no updates to this document since its completion in 2013.

1.7 HYDROLOGY

According to the 1978 Phase 1 Inspection Report, Sweetwater Lake Dam has a surface area of approximately 275 acres at normal pool, at an elevation of 850.0 feet mean sea level (MSL), with a corresponding storage volume of 9,500 acre-feet. The contributing watershed is 2.29 square miles (1,466 acres), comprised primarily of steeply sloping forested land and low density seasonal and permanent residential development near the shores of the lake.

The lake is located in a relatively narrow and steep valley. The maximum pool elevation at the top of the dam is 857.7 feet MSL, resulting in a surface area of about 337 acres and a storage volume of 11,700 acre-feet. The principal and auxiliary spillways are located at elevations 850.0 feet MSL, and approximately 852.0 feet MSL, respectively.

According to the 1978 Phase 1 Inspection Report, Fraps routed a "Maximum Probable Storm" of 29.5 inches in 12 hours through the auxiliary spillway, resulting in a peak water surface elevation in the lake of 856.4 feet, 1.3 feet below the top of dam. The hydrologic and hydraulic analyses performed for the Phase 1 Report routed the "Probable Maximum Storm" through the lake and spillway system using a 24-hour duration, resulting in a peak water surface elevation in the lake of 855.9 feet, 1.8 feet below the top of dam. Both analyses were completed before the 48-inch diameter CMP principal spillway outlet pipe was lined with a 36-inch diameter HDPE pipe. However, according to the July 2002 *Sweetwater Lake Dam Spillway Improvement Project Design Report*, completed by RW, modifications to the spillway entrance and the smooth interior of the lining would mitigate for the smaller pipe size. Note that although pipe capacity calculations were included with the RW report, an updated hydrologic analysis of the watershed and hydraulic evaluation of the spillways was not performed. Further, the methodology used in the Phase 1 report does not currently meet the requirements outlined in IDNR's *General Guidelines for New Dams and Improvements to Existing Dams in Indiana* with regard to the storm duration and rainfall depth. More detailed and accurate topographic information is now available for computing the watershed area and lake storage.

Dams classified as high hazard by IDNR are required to safely pass the rainfall runoff from the 100% PMP event without overtopping. A PMP storm event is the Probable Maximum Precipitation that can be expected during specific storm durations. The design storm duration is generally dictated by the size of the dam's watershed. For the location and size of the Sweetwater Lake Dam watershed, the 6-hour Probable Maximum Precipitation (10 square mile basin) is 27.4 inches. The 6-hour storm duration required for analysis by IDNR would likely create a higher peak flow into the lake than the 12- and 24-hour storm durations previously analyzed.

1.8 GEOLOGIC, SEISMIC AND GEOTECHNICAL CONSIDERATIONS

According to the "Geotechnical Engineering Safety Inspection Sweetwater Lake Dam", completed by ATC Associates, Inc. for Fink, Roberts, & Petrie, Inc. and dated August 2, 2006:

"Sweetwater Lake Dam is located within the Norman Upland physiographic subdivision, which is part of the Southern Hills and Lowlands Region. The Norman Upland is characterized by rugged topography and high relief. The dam is south of the Wisconsin glacial boundary and near the southern extent of pre-Wisconsin glacial deposition in Indiana. The upper bedrock below the site belongs to the Mississippian Age Borden Group, which consists primarily of siltstone, shale and sandstone with thin limestone layers. It is likely that the depth to bedrock is less than about 20 feet in the general vicinity of the site."

The Phase 1 report references a simplistic geotechnical analysis that was performed in 1958 by G.D. Mann whereby a correlation was made between unconfined compressive test results for proposed fill materials and Taylor stability curves. However, this methodology used does not meet the following current guidelines outlined by IDNR and USACE:

- *General Guidelines for New Dams and Improvements to Existing Dams in Indiana, 2001 edition*
- *General Design and Construction Considerations for Earth and Rock-Fill Dams (U.S. Army Corps of Engineers, Engineering and Design Manual EM 1110-2-2300), dated July 30, 2004*

According to FEMA, the dam is within the limits of an area where seismic design category (SDC) "B" is applicable. This category is the second lowest risk and is described as an area that "could experience shaking of moderate intensity." The USGS has determined that the 50-year two-percent probability of exceedance peak ground acceleration near Sweetwater Lake Dam is approximately 0.14g, where "g" is standard gravity.

Although the perceived seismic risk is low, the dam is in an area that could be impacted by earthquakes from the Wabash Valley Seismic Zone in southwest Indiana and southeast Illinois and the New Madrid Seismic Zone

centered in southeast Missouri, according to information from the Central United States Earthquake Consortium and the USGS. Three earthquakes of magnitude 7.3 or greater occurred near New Madrid, Missouri in 1811 and 1812 which were undoubtedly felt in central Indiana. Indiana Geological Survey (IGS) records indicate that the closest earthquakes to the dam that occurred in Indiana with magnitude 3.0 or greater were:

- Magnitude 4.9 near Columbus in Bartholomew County on August 15, 1891
- Magnitude 3.2 near Shelbyville in Shelby County on May 8, 1906
- Magnitude 3.8 near Shelbyville in Shelby County on September 12, 2004

Several other earthquakes have occurred in Indiana and Illinois, many since the dam was constructed. A magnitude 3.8 occurred September 12, 2004 near Shelbyville, Indiana about 24 miles northeast of Sweetwater Lake Dam. The most notable is a magnitude 5.2 that occurred on April 18, 2008 near Mount Carmel, Illinois about 105 miles southwest of Sweetwater Lake Dam. Most recently, a magnitude 3.8 earthquake occurred northeast of Montezuma, Indiana on June 17, 2021 about 75 miles northwest of Cordry Lake Dam. All earthquakes noted were reported to the USGS as felt in Brown County. There has been no documented damage to Sweetwater Lake Dam because of earthquakes.

1.9 DAM AND LAKE CHARACTERISTICS

Sweetwater Lake Dam is an earthfill embankment approximately 121 feet high and 1,560 feet long, with an upstream slope of approximately 3(H):1(V) from the crest to the shoreline. The upstream slope is covered with riprap from below the normal pool to just below the embankment crest. Sweetwater Drive is located along the crest and is approximately 23 feet wide. The downstream slope is approximately 2.5(H):1(V) from the crest to the downstream toe of the dam and includes three drainage benches, each approximately 9 feet wide. Each bench has an underdrain system to facilitate drainage. The bench underdrains outlet to riprap ditches located along the groin on both sides of the embankment.

The Phase 1 report indicates that the dam was constructed of compacted fill with a clay core at the center. The clay core is 10 feet wide at the top of the dam, with side slopes of 0.5(H):1(V) to the base. Plans also show a core trench at the center of the dam, 130 feet wide and about 7 feet deep to shale bedrock. A key trench, 12 feet wide and 4 feet deep with vertical side slopes in bedrock, is shown at the center of the core trench. A 3-foot-thick filter blanket, extending under the toe of the dam for a maximum of 60 feet, was also designed.

The principal spillway is a 12-foot by 12-foot reinforced concrete box control structure located at the right abutment with a 48-inch diameter CMP outlet pipe slip lined with a 36-inch diameter HDPE pipe. A metal trash rack with 6-inch by 9-inch openings is attached to the face of the inlet. There is a concrete weir at the upstream end of the box structure that effectively sets the normal pool elevation of the lake. The outlet pipe discharges into a steep ravine through bedrock. Near the bottom of this ravine, a 48-inch diameter CMP was constructed through natural ground. At the upstream end, the pipe is flush with a 12-foot high by 10-foot wide concrete headwall. The pipe is equipped with a concrete end section at the downstream end and discharges into a riprap-lined pool near the toe of the right abutment. It should be noted that, in 2018, erosion along the right abutment occurred and this pipe failed beyond repair. This area is monitored regularly by CSCD while plans for the final design phase are implemented. The auxiliary spillway is an open channel located in natural ground to the left of the embankment. This spillway is 150 feet wide with 25(H):1(V) side slopes. There is no lake drawdown facility.

The following descriptions and summary of pertinent information regarding the dam, lake, and spillway system were compiled from the sources listed in Section 1.2 and by field investigation or calculations by Burke.

DAM HEIGHT	121 feet +/-
CREST LENGTH	1,560 feet +/-
CREST WIDTH	23 feet +/-
U/S SLOPE	3(H):1(V) +/-
D/S SLOPE	2.5(H):1(V) +/-
LAKE NORMAL POOL	850.0 feet (MSL)
LAKE AREA	275 acres (normal pool), 337 acres (top of dam)
STORAGE VOLUME	9,500 acre-ft (normal pool) 11,700 acre-ft (top of dam)
PRINCIPAL SPILLWAY CREST	850.0 feet (MSL)
AUXILIARY SPILLWAY CREST	852.0 feet (MSL)
DAM CREST	857.7 feet (MSL)

1.10 DRAWDOWN SYSTEM

The dam does not have permanent drawdown capability.

1.11 DOWNSTREAM FEATURES

The receiving stream for the principal spillway is the East Branch of Sweetwater Creek, located in a valley bottom approximately 500 feet wide at the toe of the dam. The receiving stream for the auxiliary spillway is an unnamed tributary to the East Branch of Sweetwater Creek. The confluence of these two receiving streams is located approximately 2,000 feet downstream of the dam. From there, the East Branch of Sweetwater Creek flows southwest, to its confluence with the North Fork Salt Creek.

The approximate dam failure flood inundation map extends approximately 19.1 miles downstream of Sweetwater Lake Dam along the East Branch of Sweetwater Creek and North Fork Salt Creek at a point roughly 4.5 miles downstream of the State Road 46 crossing of North Fork Salt Creek in Nashville. Downstream of this point, significant flooding is still possible for several miles. There are several structures and farmsteads located downstream of the dam that are within the dam breach inundation area which includes a significant portion of the Town of Nashville.

2.0 OBSERVED CONDITIONS

Burke personnel performed a visual dam safety inspection of Sweetwater Lake Dam on October 24, 2023. The inspection was performed by Jeffrey D. Fox, P.E., Aaron J. Fricke, P.E., and Joshua L. Erwood, P.E., who have experience in dam safety. The weather conditions were sunny with a temperature that ranged from approximately 51 degrees Fahrenheit at the beginning of the inspection to 74 degrees Fahrenheit at the end. The ground cover had some dew at the start of the inspection. The principal spillway was not engaged during the inspection with the lake level being approximately 9 inches below normal pool. For purposes of reference, the left and right sides of the dam are based on a view looking downstream. Thus, right is generally coincidental with west and left is coincidental with east. Narrative descriptions of the inspection findings are provided below. The IDNR Inspection Report Form summarizing the inspection findings and containing descriptions of the rating criteria can be found in **Appendix 1**. A copy of the 2021 IDNR Inspection Report Form is provided in **Appendix 2**. Refer to **Appendix 3** for photographs taken the day of the inspection. **Appendix 4** contains the

dam inspection checklist completed during the inspection. Refer to the **Exhibits** section of this report for a USGS quadrangle map, aerial photograph, and inspection summary map.

2.1 UPSTREAM SLOPE

The upstream slope is armored with riprap from below normal pool to just below the dam crest. Several areas were observed to have sparse and smaller gradation of riprap sizes. Two areas on the left side had sparse riprap extending 40 feet and 65 feet in length. A 45 foot long area on the right side had smaller gravel sized riprap. Most of the riprap is weathered with sporadic bare areas. A seven-foot-long area at the right abutment has wave erosion about five and a half inches deep with no riprap protection. Weeds and small woody vegetation growth were observed in the riprap, particularly along the waterline but most had been sprayed recently. Woody and leafy debris are along the entire shoreline. A large log is on the right-side shoreline. A few trees were also observed within 25 feet of the dam at the right abutment. A small bird house on a metal post is encroaching at the left abutment. It was noted that the guardrail at the interface with the crest was rusted on the upstream side. The slope was measured with an inspection rod and tape measure to be 3:1 (H:V). The upstream slope was considered "**Acceptable**" based on IDNR rating criteria.

2.2 CREST

Sweetwater Drive is an asphalt road along the crest with guardrail on both the upstream and downstream sides. The asphalt pavement surface exhibited transverse and longitudinal cracks which appeared to have been sealed, are consistent with the age of the asphalt, and do not appear to be indicative of embankment instability. The road appeared to have been constructed with a low point near the center of the dam. The crest was considered "**Acceptable**" according to IDNR rating criteria.

2.3 DOWNSTREAM SLOPE

The downstream slope was observed to have adequate grass cover at an appropriate height. Trees and brush were observed within 25 feet at the right abutment, left abutment, and toe of slope. Due to dense vegetation, the groin ditches could not be inspected thoroughly. In addition, some of the bench drain outlets at the groins were obstructed with leaves. The bench drain cleanouts located on the middle left bench, lower right bench, and lower left bench were broken with caps on the ground. A few of the bench drain cleanouts could not be inspected due to the caps being stuck and unable to be opened. Design plans of improvements to address the erosion and storm pipe failure near the right abutment are planned for the future. Shallow burrows and rodent runs were observed sporadically along the slope. The left valley side area had some bare areas with soft spots and a small divot. Trees and brush cover the toe of slope in this area towards the far left abutment. An erosion gully has formed at the far left abutment from surface runoff measuring about one foot wide and up to one foot deep. The slope was measured in the middle of each tier with an inspection rod and tape measure ranging from 3:1 to 4:1 (H:V). Small bird houses on a metal posts are encroaching near the top of slope. The downstream slope was considered "**Acceptable**" according to IDNR rating criteria.

2.4 SEEPAGE

A large wet area was observed at the downstream toe, near the right side of the embankment. This area has been noted in past inspection reports. Dense vegetation was present which prevented a thorough inspection of the area. Clear seepage last observed in 2010 at the left abutment or evidence thereof was not observed at the time of this inspection. Seepage was considered "**Acceptable**" according to IDNR rating criteria.

2.5 PRINCIPAL SPILLWAY

The visible portions of the concrete principal spillway inlet appeared to be in good condition and consistent with the age of the structure. Surface cracking and spalling were observed on both sides of the inlet near the metal trash rack bolts. Leaves and debris have accumulated near the bottom of the metal trash rack. Minor surface rust was observed near the bottom of the trashrack. Woody debris was also observed to be resting on the riprap above the concrete box inlet structure. The metal trash rack on the top of the concrete inlet appears to have bolts missing. Riprap around the exterior of the concrete inlet has been added but there is sparse area on the right sideslope. The interior of the outlet pipe, observed during previous inspections, appears to have a non-uniform slope. The exterior of the principal spillway concrete impact basin could not be inspected thoroughly due to the observed vegetation adjacent and extending over the side walls. The interior of the impact basin side walls appeared to be in good condition and consistent with the age of the structure. Several fallen trees and woody debris obstructions were observed downstream of the outlet. The principal spillway was considered "**Acceptable**" according to IDNR rating criteria.

2.6 AUXILIARY SPILLWAY

The auxiliary spillway open channel is in natural ground to the left of the embankment. Except for the light pole and volleyball net, the inlet is free from obstructions. Sporadic bare areas and sand covered volleyball courts could exhibit erosion during activation of the spillway. The spillway side slopes are covered with trees and brush as is the downstream portion of the channel prior to the outlet. Minor surficial pavement cracking along the roadway control was observed. Several minor obstructions are within the outlet gravel parking lot area including construction materials. As noted in Section 1.7, the methodologies used previously to evaluate the overall spillway capacity are different than that currently required by IDNR. The auxiliary spillway was considered "**Acceptable**" according to IDNR rating criteria.

2.7 MAINTENANCE AND REPAIRS

Sweetwater Lake Dam was considered to be maintained in "**Acceptable**" condition according to IDNR rating criteria. CSCD regularly monitors the dam components, mows, and has completed repairs such as the replacement of the principal spillway trash rack was noted in the 2021 inspection report. However, additional embankment and spillway improvements are needed. Further, critical analyses are needed to address uncertainties related to spillway capacity and embankment slope stability. Regular maintenance activities should include mowing, clearing trees and brush, monitoring the downstream toe for seepage, and removing trash and debris from the principal spillway inlet. It is important to note that the dam is not equipped with a drawdown valve or another means of lowering the lake for maintenance or emergency situations. Continued maintenance should be completed as discussed in Section 4.0.

2.8 OVERALL CONDITION

The overall condition of the Sweetwater Lake Dam was considered "**Conditionally Poor**" according to IDNR rating criteria. Based on IDNR guidelines, the potential overall condition ratings include, from worst to best, Unsatisfactory, Poor, Conditionally Poor, Fair, and Satisfactory. A "Conditionally Poor" dam is one that "a potential safety deficiency is recognized for unusual loading conditions which may realistically occur during the expected life of the structure. Conditionally Poor may also be used when uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency; further investigations and studies are necessary". This overall condition rating is primarily the result of the uncertainties related to the spillway and embankment analyses and the need for further investigation. A summary of inspection observations is provided in **Table 2**. Locations of observations are shown on **Exhibit 3**. Refer to **Appendix 3** for typical photographs.

Table 2: Inspection Observations Summary

Observation Number	Category	Component	Location	Observation
1	Vegetation	Upstream Slope	Right	Some vegetation growth above shoreline which has been sprayed
2	Encroachment	Upstream Slope	Right	Large log on shoreline
3	Surficial	Upstream Slope	Right	Wave erosion 5.5 inches deep and 7ft long at abutment within vegetation. Riprap does not extend along abutment shoreline.
4	Surficial	Upstream Slope	Right	Smaller riprap gradation in the upper portion of slope
5	Surficial	Upstream Slope	Right	Wave erosion within vegetation growth in bare spots with 7-inch depth
6	Vegetation	Upstream Slope	Right	Trees and brush on slope and within 25ft of right abutment
7	Note	Upstream Slope	Middle	3:1 slope measurement
8	Surficial	Upstream Slope	Middle	Typical smaller riprap size at shoreline
9	Encroachment	Upstream Slope	Left	Bird house encroaching near left abutment
10	Vegetation	Upstream Slope	Left	Vegetation growing in riprap
11	Vegetation	Upstream Slope	Left	Minor vegetation growth in upper riprap
12	Surficial	Upstream Slope	Left	Sparse riprap coverage with smaller rock sizes
13	Surficial	Upstream Slope	Left	Smaller sized riprap protection
14	Note	Upstream Slope	Entire Component	Rusted guardrail posts along entire top of slope
15	Surficial	Upstream Slope	Entire Component	Typical weathered riprap
16	Encroachment	Upstream Slope	Entire Component	Woody and leafy debris along shoreline typical throughout
17	Surficial	Crest	Right	3/4" wide pavement crack on downstream side of roadway surface
18	Surficial	Crest	Middle	Typical longitudinal pavement cracking on downstream side of roadway surface
19	Note	Crest	Middle	20ft crest width measurement
20	Surficial	Crest	Middle	Typical transverse pavement cracking patchwork every 20-50ft
21	Note	Crest	Left	22ft wide crest measurement near abutment
22	Surficial	Crest	Entire Component	Transverse pavement cracking patched every 20-50ft.
23	Drainage	Downstream Slope	Right	Upper bench right outlet 8" HDPE partially obstructed with leafy debris
24	Encroachment	Downstream Slope	Right	Bird house at top of slope
25	Note	Downstream Slope	Right	Keep off the dam sign at top of slope
26	Drainage	Downstream Slope	Right	Upper bench right bench drain cleanout
27	Drainage	Downstream Slope	Right	Middle bench drain cleanout could not remove cap
28	Drainage	Downstream Slope	Right	Middle right bench drain outlet
29	Drainage	Downstream Slope	Right	Lower right bench outlet could not be inspected due to vegetation
30	Drainage	Downstream Slope	Right	Lower right cleanout broken and missing cap

Observation Number	Category	Component	Location	Observation
31	Vegetation	Downstream Slope	Right	Trees and brush in groin ditch and within 25ft of dam
32	Surficial	Downstream Slope	Right	Rodent activity with shallow runs and small burrows. 2" diameter burrow and 5" deep
33	Surficial	Downstream Slope	Right	Shallow rodent run
34	Note	Downstream Slope	Middle	Approximate high point for upper bench drain
35	Note	Downstream Slope	Middle	3:1 upper tier slope measurement
36	Surficial	Downstream Slope	Middle	Rodent burrow activity in upper tier, mostly shallow
37	Encroachment	Downstream Slope	Middle	Bird house on upper tier near top
38	Surficial	Downstream Slope	Middle	Minor burrow activity in area
39	Note	Downstream Slope	Middle	Approximate middle bench drain high point
40	Note	Downstream Slope	Middle	4:1 slope measurement
41	Surficial	Downstream Slope	Middle	Middle bench downstream edge minor bare spots
42	Note	Downstream Slope	Middle	Approximately lower bench high point
43	Vegetation	Downstream Slope	Middle	Trees and brush at toe and within 25ft
44	Drainage	Downstream Slope	Left	Upper tier bench drain left clean out
45	Surficial	Downstream Slope	Left	Shallow burrow activity throughout area
46	Drainage	Downstream Slope	Left	Upper left bench drain outlet partially obstructed with leafy debris. 8" corrugated HDPE pipe
47	Note	Downstream Slope	Left	Earthen access ramp
48	Note	Downstream Slope	Left	Keep of the dam sign near top of slope
49	Surficial	Downstream Slope	Left	Burrow shallow depth
50	Surficial	Downstream Slope	Left	Shallow divot 6" deep by 8" diameter
51	Encroachment	Downstream Slope	Left	Bird house near top of slope
52	Drainage	Downstream Slope	Left	Middle left bench outlet
53	Drainage	Downstream Slope	Left	Middle bench left drain cleanout top segment broken off and cap off
54	Drainage	Downstream Slope	Left	Lower left drain cleanout broken and missing cap
55	Note	Downstream Slope	Left	4:1 slope measurement
56	Drainage	Downstream Slope	Left	Lower left bench drain outlet could not inspect thoroughly due to dense vegetation. Possibly obstructed with leaves.
57	Surficial	Downstream Slope	Left	Erosion on left valley side of left groin ditch. Could not inspect thoroughly due to dense vegetation.
58	Vegetation	Downstream Slope	Left	Trees and brush on and within 25ft of left groin ditch
59	Vegetation	Downstream Slope	Left	Tall grass, trees, and brush on toe and within 25ft
60	Surficial	Downstream Slope	Left	Rutting with some bare spots and soft areas
61	Surficial	Downstream Slope	Left	Erosion gully from surface runoff 1ft wide by 8" deep up to 12" deep
62	Surficial	Downstream Slope	Left	Shallow rodent run

Observation Number	Category	Component	Location	Observation
63	Drainage	Seepage	Toe of Slope	Damp and saturated area with drain channel along toe of the dam. Dense vegetation some aquatic could not inspect thoroughly
64	Encroachment	Principal Spillway	Inlet	Vegetation, woody and leafy debris around inlet
65	Structural	Principal Spillway	Inlet	Trashrack has minor rust on bottom, missing bolt on top. Openings 6" by 8". Metal grate on top has missing bolt. Grate opening 6" by 8". Minor chipping on left side of concrete. Concrete near pipe invert has appearance of honeycombing
66	Encroachment	Principal Spillway	Outlet	Downstream outlet channel culvert stilling basin has several obstructions from fallen trees and woody debris
67	Structural	Principal Spillway	Outlet	Stilling basin structure in good condition. Trees and brush around outlet but not obstructing. Pipe alignment does not appear to be straight.
68	Vegetation	Principal Spillway	Outlet	Fallen tree downstream of outlet
69	Note	Principal Spillway	Outlet	Significant erosion downstream of outlet
70	Encroachment	Auxiliary Spillway	Inlet	Several obstructions such as volleyball net, telephone pole, and signage.
71	Surficial	Auxiliary Spillway	Inlet	Sporadic bare areas and sand covered volleyball area
72	Surficial	Auxiliary Spillway	Control Section	Pavement cracking some patched
73	Vegetation	Auxiliary Spillway	Outlet	Vegetation blocking outlet and side slopes
74	Drainage	Auxiliary Spillway	Outlet	Drainage ditch culvert
75	Encroachment	Auxiliary Spillway	Outlet	Several minor obstructions including construction materials

3.0 RISK OF DAM FAILURE

Burke utilized the results of the dam inspection to evaluate the potential for dam failure at Sweetwater Lake Dam. There are typically two types of dam failures that could occur:

- Type 1 – component failure of a structure that does not result in a significant release from the lake
- Type 2 – uncontrolled breach failure of a structure that results in a significant release from the lake

Refer to **Appendix 5** for more details of types of failure and definitions of risk levels. Burke has evaluated the risk of failure for both types of failures.

3.1 RISK OF DAM COMPONENT FAILURE (TYPE 1)

Burke evaluated the risk for Type 1 component failure at Sweetwater Lake Dam after the inspection was completed by considering possible failure of each component. The components that were evaluated include the upstream embankment slope, downstream embankment slope, embankment crest, principal spillway, auxiliary spillway, and dam abutments. After considering the dam's current condition and the potential maximum loadings, Burke has estimated the risk of failure for each component as shown below. The estimated risk levels are based on Burke's visual observations during the inspection and do not necessarily account for uncertainties in critical analysis parameters which could impact the risk level.

Component	Risk Level
Upstream slope	Low
Downstream slope	Low
Embankment crest	Low
Principal spillway	Low
Auxiliary spillway	Low
Dam abutments	Medium

3.2 RISK OF UNCONTROLLED BREACH FAILURE (TYPE 2)

Burke evaluated the potential for uncontrolled breach failure of Sweetwater Lake Dam after the inspection was completed by considering possible failure modes. Embankment dams such as Sweetwater Lake Dam generally have three potential modes of uncontrolled breach failure: 1) hydraulic failure, 2) seepage failure, and 3) structural failure. The factors that pose a risk to embankment dams and can result in dam failure can be categorized into four groups: 1) structural factors, 2) natural factors, 3) human factors, and 4) operating factors. Refer to Appendix 5 for more information about failure modes and risk factors. **At the present time, Sweetwater Lake Dam appears to have a low risk for uncontrolled breach failure**. Structural factors are summarized below.

Structural factors	Risk Level	Failure Mode
Vegetation in riprap along upstream slope	Low	Seepage
Trees within 25 feet of abutments and toe	Low	Seepage
Rodent burrows	Low	Seepage
Broken bench drain cleanouts	Low	Structural
Sparse riprap on upstream slope and at principal spillway	Low	Structural
Erosion at far left abutment on downstream slope	Low	Hydraulic
Uncertainties in spillway and embankment analyses	Low	Hydraulic/Seepage
Lack of drawdown capability	Low	Hydraulic

Natural and human risk factors were also considered. Severe storms present a low risk to Sweetwater Lake Dam based on previously completed analyses, although an analysis has not been completed based on current standards. Earthquakes present a low risk but cannot be ignored due to the dam's proximity to the Wabash Valley and New Madrid Seismic Zones. **It should be noted that there is always some risk for dam failure at all dams, and that risk cannot be completely eliminated**.

Natural factors	Risk Level	Failure Mode
Severe storms	Low	Hydraulic
Earthquakes	Low	Structural

Human factors	Risk Level	Failure Mode
Vandalism	Low	Structural
Terrorism	Low	Structural

Operating factors	Risk Level	Failure Mode
Maintenance Practices	Low	Hydraulic/Structural
Access	Low	Hydraulic/Structural

4.0 RECOMMENDATIONS

This section presents Burke's recommendations for action based on the findings of the dam safety inspection, Burke's assessment of the risk of dam failure at Sweetwater Lake Dam, and Burke's assessment of the priority for repairs of each observed deficiency. The recommendations are summarized by dam feature, such as the upstream slope, crest, etc. Based on inspection findings, Sweetwater Lake Dam requires monitoring, maintenance, engineering analysis, and repairs to achieve IDNR's "Satisfactory" rating. A summary of the 2023 inspection ratings and recommendations are provided in **Table 3**. **Table 4** is a summary of inspection ratings from 2013-2023.

Table 3: Inspection Ratings and Recommendations

Component	Rating	Recommendations	Schedule	Importance
Upstream Slope	Acceptable	• Spray/Remove weeds and woody vegetation in riprap • Remove trees within 25 feet of right abutment in accordance with the Indiana Dam Safety Inspection Manual • Supplement riprap slope protection at bare areas and at areas where riprap gradation is too small. Extend riprap at right abutment to provide protection from wave erosion. • Remove woody debris and logs from shoreline • Remove bird house at left abutment	• Ongoing • Within 2 years • Within 2 years • Ongoing • Within 2 years	• Low • Medium • Medium • Low • Low
Crest	Acceptable	• Monitor cracks in asphalt pavement and seal as needed	• Ongoing	• Low
Downstream Slope	Acceptable	• Fill and seed erosion gully at the far left abutment • Remove trees and brush within 25 feet of left abutment, right abutment, and toe of slope in accordance with the Indiana Dam Safety Inspection Manual • Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual • Repair/Replace damaged bench drain cleanouts and remove outlet obstructions. Install a marker post at each cleanout along the benches and at each outlet along the groins for easy identification	• Within 1 year • Within 2 years • Ongoing • Within 1 year	• Low • Medium • Low • Medium
Seepage	Acceptable	• Monitor large wet area at downstream toe near right side of embankment and notify professional engineer of observed changes	• Ongoing	• Low
Principal Spillway	Acceptable	• Monitor surface cracking and minor spalling on concrete inlet • Remove debris from concrete inlet trash rack and above inlet structure • Replace missing hardware for trash rack located on top of concrete inlet • Supplement riprap on concrete inlet side slopes at bare spots • Remove vegetation adjacent to and extending over concrete impact basin • Remove woody debris and fallen tree downstream of outlet	• Ongoing • Ongoing • Immediately • Immediately • Immediately • Within 2 years	• Low • Low • Low • Low • Low • Low
Auxiliary Spillway	Acceptable	• Relocate light pole and volleyball courts and replace sand with turf-building ground cover • Fill and seed bare areas in inlet section • Remove trees and brush from spillway channel side slopes and at outlet • Remove minor obstructions from outlet channel area	• Within 2 years • Within 1 year • Within 2 years • Within 2 years	• Low • Low • Medium • Low
Maintenance and Repairs	Acceptable	• Perform spillway capacity analysis in accordance with IDNR requirements • Retain a geotechnical engineer to perform an investigation to evaluate dam stability • Conduct a video inspection of the principal spillway outlet pipe; subsequent inspections should be performed every six years • Update Incident and Emergency Action Plan • Develop lake drawdown plan	• Within 2 years • Within 4 years • Within 2 years • Within 1 year • Within 1 year	• Medium • Medium • Medium • High • Low
Overall Conditions	**Conditionally Poor**	• **See above**	• **N/A**	• **N/A**

Notes:
1. Possible Component Ratings: Good, Acceptable, Deficient, Poor
2. Possible Overall Conditions Ratings: Satisfactory, Fair, Conditionally Poor, Poor, Unsatisfactory

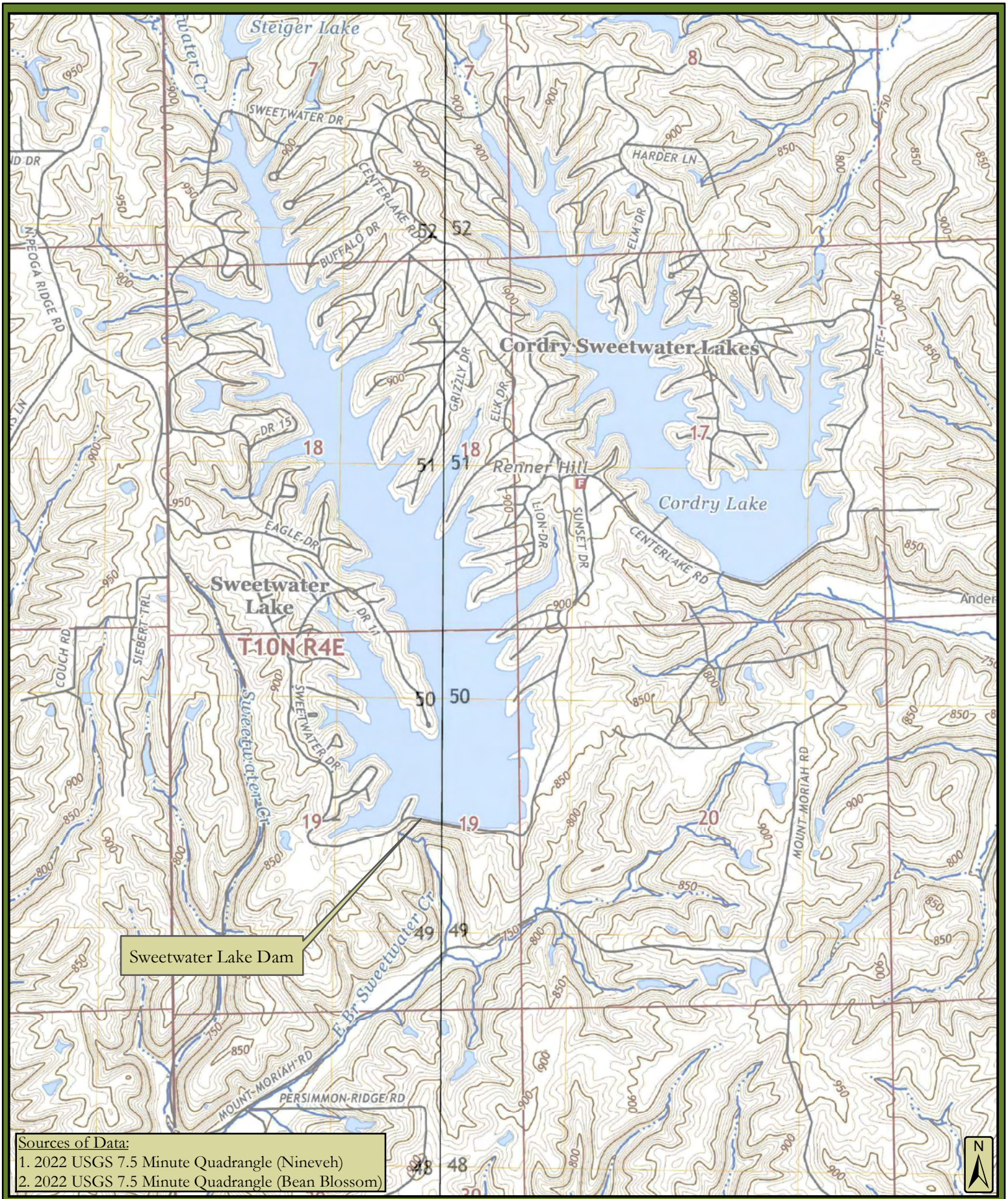
Table 4: Previous Inspection Ratings (2013 - 2023)

Component	Condition Ratings Per Inspection					
	2013	**2015**	**2017**	**2019**	**2021**	**2023**
Upstream Slope	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Crest	Good	Good	Good	Acceptable	Acceptable	Acceptable
Downstream Slope	Acceptable	Deficient	Deficient	Acceptable	Acceptable	Acceptable
Seepage	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Principal Spillway	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Auxiliary Spillway	Good	Good	Good	Acceptable	Acceptable	Acceptable
Maintenance and Repairs	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Overall Conditions	**Fair**	**Fair**	**Fair**	**Conditionally Poor**	**Conditionally Poor**	**Conditionally Poor**

Notes:

1. Possible Component Ratings: Good, Acceptable, Deficient, Poor
2. Possible Overall Conditions Ratings: Satisfactory, Fair, Conditionally Poor, Poor, Unsatisfactory

EXHIBITS



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Indianapolis, Indiana 46204
(t) 317.266.8000 (f) 317.632.3306

PROJECT: Sweetwater Lake Dam 2023 Dam Safety Inspection		PROJECT NO. 23-0291	APPROX. SCALE 1"=1,750'
TITLE: USGS Quadrangle Map			DATE: 02/2024
			EXHIBIT 1

Sources of Data:
1. Aerial Photography: 2021 Brown County, IndianaMap Framework Data (indianamap.org)

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PROJECT: **Sweetwater Lake Dam 2023 Dam Safety Inspection**	PROJECT NO. **23-0291**	APPROX. SCALE **1"=2,000'**
		DATE: **02/2024**
TITLE: **Aerial Photograph**		EXHIBIT **2**

Inspection Observations

Point Features

Category

- Drainage
- Encroachment
- Note
- Slope
- Structural
- Surficial
- Vegetation

Line Features

Category

- Encroachment
- Surficial
- Vegetation

Sweetwater Lake

Auxiliary Spillway

Principal Spillway Inlet

Crest

Upstream Slope

Sunset Drive

Sweetwater Drive

Downstream Slope

Principal Spillway Outlet

Upper Bench

Middle Bench

Lower Bench

Downstream Channel Culvert Outlet

East Branch Sweetwater Creek

Sources of Data:
1. Aerial Photography: 2021 Brown County, IndianaMap Framework Data (indianamap.org)

N

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PROJECT: Sweetwater Lake Dam 2023 Dam Safety Inspection		PROJECT NO. 23-0291	APPROX. SCALE 1"=150'
TITLE: Inspection Summary			DATE: 02/2024
			EXHIBIT 3

APPENDIX 1: **IDNR DAM INSPECTION REPORT FORM (OCTOBER 24, 2023)**

Print Form

SUGGESTED DAM INSPECTION REPORT (Refer to pages 5 and 6 for instructions.)

Name of Professional Conducting Inspection	Professional License No. (Indiana)
Jeffrey D. Fox, P.E./Aaron J. Fricke, P.E./Joshua L. Erwood, P.E.	PE11100632/PE11100305/PE12100846
Business Address 115 West Washington Street, Suite 1368 South, Indianapolis, IN 46204	**Phone:** (day) 317 - 266 - 8000 (evening) ___ - ___ - ___

Company Name: Christopher B. Burke Engineering, LLC

INSPECTION PREPARATION: Reviewed all pertinent technical documentation related to this dam and site in the State's and the Owner's files: Yes ☒ No ☐ Comment

MULTIDISCIPINARY:I am experienced in the technical disciplines or I am working with other professionals experienced in the technical disciplines to properly inspect this dam and appurtenant works. Technical disciplines, in additional to the general civil engineering, may include geotechnical, geological, hydrologic, structural, and mechanical. Yes ☒ No ☐ Comment

Dam Name	Quad.	Date of Inspection
Sweetwater Lake Dam	Nineveh	10 / 24 / 23

State Dam ID	Permit (if unapproved see pg. 6)	County	Sec.	T.	R.	Last Inspection
7-10	D-429, D-863	Brown	19	10 N	4 E	07 / 13 / 21

Owners Name	Owner's Phone
Cordry-Sweetwater Conservancy District	(317) 933-9858

Address/Zip Code: 8377 Cordry Drive, Nineveh, IN 46164

Contact's Name	Contact's Phone	Spillway Width	Ft. FBD.
Nick Johann	(day) 317 - 933 - 2893 (evening) 317 - 412 - 7052	Top Bot. 150 ft.	5.7

Hazard	Drainage Area	Surface Area	Height	Crest Length	Crest Width	Inlet Below Crest	Slope: Up / Down
High	2.29 MI^2	275 AC	121 FT	1560 FT	23 FT	7.7 FT	3:1 to 4:1 / 2.5:1

FIELD CONDITIONS OBSERVED

Water Level - Below Dam Crest 8.45 Ft.

Ground Moisture Condition: Dry ☒ Wet ☒ Snowcover ☐ Other ___

DRAWDOWN STRUCTURE

☐ Yes ☒ None

Comment ___

MONITORING ☐ Yes ☒ None [☐ Gage Rod ☐ Piezometers ☐ Seepage Weirs ☐ Survey Monuments ☐ Other]

Comments ___

A UPSTREAM SLOPE

GOOD	ACCEPTABLE	DEFICIENT	POOR
☐	☒	☐	☐

PROBLEMS NOTED: ☐ (A-1) None ☒ (A-2) Riprap - Missing, Sparse, Displaced, Weathered ☒ (A-3) Wave Erosion-with Scarps ☐ (A-4) Cracks-with Displacement ☐ (A-5) Sinkhole ☐ (A-6) Appears Too Steep ☐ (A-7) Depressions or Bulges ☐ (A-8) Slides ☐ (A-9) Animal Burrows ☒ (A-10) Trees, Brush, Briars ☒ (A-11) Other Vegetation in Riprap

Comments:

(A-2) Riprap weathered and variable gradation in several areas
(A-3) Right abutment beyond riprap has wave erosion up to 7 inches deep within vegetation
(A-10) Trees were observed within 25 feet of right abutment. Woody debris, leaves and a large log on shoreline.
(A-11) Grass and weeds were growing in riprap slope protection

B CREST

GOOD	ACCEPTABLE	DEFICIENT	POOR
☐	☒	☐	☐

PROBLEMS NOTED: ☐ (B-1) None ☐ (B-2) Ruts or Puddles ☐ (B-3) Erosion ☒ (B-4) Cracks with Displacement ☐ (B-5) Sinkholes ☐ (B-6) Not Wide Enough ☐ (B-7) Low Area ☐ (B-8) Misalignment ☐ (B-9) Inadequate Surface Drainage ☐ (B-10) Trees, Brush, Briars ☐ (B-11) Other ___

Comments:

(B-4) Transverse and longitudinal cracks were observed throughout the crest roadway pavement. Cracks appeared to have been sealed.

Spillway Width refers to the open channel (typically the emergency or auxiliary spillway) at the control section.
Ft. FBD. refers to the vertical distance from the emergency (auxiliary) spillway control section to the lowest point of the crest of the dam.
Inlet Below Crest refers to the vertical distance from the inlet of the principal spillway to the crest of the dam.

C DOWNSTREAM SLOPE

GOOD	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

PROBLEMS NOTED: ☐ (C-1) None ☐ (C-2) Livestock Damage ☐ (C-3) Erosion or Gullies ☐ (C-4) Cracks with Displacement ☐ (C-5) Sinkholes ☐ (C-6) Appears too Steep ☐ (C-7) Depression or Bulges ☐ (C-8) Slide ☐ (C-9) Soft Areas ☒ (C-10) Trees, Brush, Briars ☒ (C-11) Animal Burrows ☒ (C-12)Other Ruts; Bench Drain

Comments:

(C-10) Trees and brush were observed within 25 feet of right abutment, left abutment, and toe. Unable to thoroughly inspect left and right groin ditches or right abutment components.
(C-11) A few small animal burrows were observed along the slope
(C-12) Soft, bare and rutted areas were observed on the far left abutment; Bench drain cleanout pipes were damaged at the middle left, lower right, and lower left with caps on the ground.

D SEEPAGE

GOOD (NONE)	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

PROBLEMS NOTED: ☐ (D-1) None ☐ (D-2) Saturated Embankment Area ☐ (D-3) Seepage Exits on Embankment ☐ (D-4) Seepage Exits at Point Source ☒ (D-5) Seepage Area at Toe ☐ (D-6) Flow Adjacent to Outlet ☐ (D-7) Seepage Clear/Muddy

[**DRAIN OUTFALLS SEEN** ✗ No ___ Yes ☐ (D-8) Flow Clear/Muddy ☐ (D-9) Dry/Obstructed]

☐ (D-10) Other _____ Describe location of drains and indicate amount and quality of discharge.

Comments:

(D-5) Large wet area observed at downstream toe with dense vegetation some aquatic. Drainage channel appears to run along the toe of the dam.

E PRINCIPAL SPILLWAY

GOOD	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

DESCRIPTION: Reinforced concrete box control structure and a 36-inch diameter HDPE outlet pipe

PROBLEMS NOTED: ☐ (E-1) None ☒ (E-2) Deterioration ☐ (E-3) Separation ☐ (E-4) Cracking ☐ (E-5) Inlet, Outlet Deficiency ☐ (E-6) Stilling Basin Inadequacies ☒ (E-7) Trash Rack ☒ (E-8) Other Debris; Riprap; Vegetation

Comments:

(E-2) Concrete deterioration was observed on the inlet control structure, including cracking and spalling
(E-7) Accumulated debris near bottom of new trash rack; hardware missing on top trash rack
(E-8) Woody debris was observed above the inlet structure; steep side slopes at inlet with some missing riprap on right side; fallen tree downstream of outlet

F AUXILIARY SPILLWAY

GOOD	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

DESCRIPTION: 150' wide open channel with 25(H):1(V) side slopes; asphalt crest

PROBLEMS NOTED: ☐ (F-1) None ☐ (F-2) No Auxiliary Spillway Found ☐ (F-3) Erosion-with Backcutting ☐ (F-4) Crack with Displacement ☐ (F-5) Appears to be Structurally Inadequate ☐ (F-6) Appears too Small ☐ (F-7) Inadequate Freeboard ☒ (F-8) Flow Obstructed ☐ (F-9) Concrete Deteriorated/Undermined ☒ (F-10) Other Bare areas

Comments:

(F-8) Light pole and volleyball net at inlet of spillway. Trees and brush were observed along the spillway channel side slopes and the outlet. Construction materials in channel from ongoing lake maintenance work.
(F-10) Sporadic bare areas and sand covered volleyball area

G MAINTENANCE AND REPAIRS

GOOD	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

PROBLEMS NOTED: ☐ (G-1) None ☐ (G-2) Access Road Needs Maintenance ☐ (G-3) Cattle Damage ☒ (G-4) Spillway Obstruction ☒ (G-5) Brush, Weeds, Tall Grass, on Upstream Slope, Crest, Downstream Slope, Toe ☒ (G-6) Trees on Upstream Slope, Crest, Downstream Slope ☒ (G-7) Rodent Activity on Upstream Slope, Crest, Downstream Slope, Toe ☐ (G-8) Deteriorated Concrete-Facing, Outlet, Spillway ☐ (G-9) Gate and/or Drawdown Need Repair ☒ (G-10) Other Additional Investigations/Analyses

Comments:

The dam appears to receive regular maintenance but improvements are needed. See comments for individual components. Spillway capacity and embankment stability analyses are needed.

H OVERALL CONDITIONS

Based on this inspection and recent file review, the overall surficial condition is determined to be: ☐ (H-1) Satisfactory ☐ (H-2) Fair ☒ (H-3) Conditionally Poor ☐ (H-4) Poor ☐ (H-5) Unsatisfactory

IMPORTANT: IF THIS RATING IS DIFFERENT THAN PREVIOUS IDNR RATING, PLEASE ATTACH EXPLANATION AND REASONS FOR CHANGE ON PAGE 4.

DAM NAME Sweetwater Lake Dam STATE DAM I.D. 7-10 DATE 10 / 24 / 23

RECOMMENDATIONS AND ITEMS REQUIRING ACTION BY OWNER TO IMPROVE THE SAFETY OF THE DAM

MAINTENANCE-MINOR REPAIR-MONITORING

☒ (1) Provide Additional Erosion Protection: Add riprap on U/S slope sparse and smaller sized gradation areas

☐ (2) Mow: _____

☒ (3) Clear Trees and/or Brush From: Upstream slope right abutment; downstream slope right abutment, left abutment, and toe

☒ (4) Initiate Rodent Control Program and Properly Backfill Existing Holes: Downstream slope

☒ (5) Repair: Bench drain cleanouts; broken trash rack on inlet face; hardware on inlet top; ruts near right abutment

☐ (6) Provide Surface Drainage For: _____

☒ (7) Monitor: Asphalt cracking on embankment crest; wet area at downstream toe; cracking and spalling at principal spillway inlet

☒ (8) Other: Remove trees and brush in auxiliary spillway

☒ (9) Other: Remove debris from principal spillway inlet; relocate light pole and volleyball net

ENGINEERING-EMPLOY AN ENGINEER EXPERIENCED IN DESIGN AND CONSTRUCTION OF DAMS TO:

(Plans & Specifications must be approved by State prior to construction.)

☐ (10) Prepare Plans and Specifications for the Rehabilitation of the Dam: _____

☐ (11) Prepare As-Built Drawings of: _____

☒ (12) Perform a Geotechnical Investigation to Evaluate the Stability of the Dam: _____

☒ (13) Perform a Hydrologic Study to Determine Required Spillway Size: _____

☐ (14) Prepare Plans and Specifications for an Adequate Spillway: _____

☐ (15) Set up a Monitoring Program: _____

☐ (16) Refer to Unapproved Status of Dam: _____

☒ (17) Develop an Emergency Action Plan: Update IEAP and develop drawdown plan

☒ (18) Other: Prepare plans and specs to address erosion in right abutment (note, plans for final design are being implemented)

☒ (19) Other: Perform a video inspection of the principal spillway outlet pipe

Recommended schedule for upgrades/comments (Please prioritize and note importance of each item.)

See attached table of recommendations.

Photographs ☒ Attachments ☒

ENGINEER'S INSTRUCTION Instructed owner on the safety concerns with the structure and how to monitor and inspect the dam and appurtenant works in the interim period between the regulatory two-year inspections. Yes ☒ No ☐

Comment

Professional Engineer's Signature _____ Date 2/29/2024

Reviewed By Nicholas B. Brown Date 2/12/24

Owner/Owner's Representative

Component	Rating	Recommendations	Schedule	Importance
Upstream Slope	Acceptable	• Spray/Remove weeds and woody vegetation in riprap • Remove trees within 25 feet of right abutment in accordance with the Indiana Dam Safety Inspection Manual • Supplement riprap slope protection at bare areas and at areas where riprap gradation is too small. Extend riprap at right abutment to provide protection from wave erosion. • Remove woody debris and logs from shoreline • Remove bird house at left abutment	• Ongoing • Within 2 years • Within 2 years • Ongoing • Within 2 years	• Low • Medium • Medium • Low • Low
Crest	Acceptable	• Monitor cracks in asphalt pavement and seal as needed	• Ongoing	• Low
Downstream Slope	Acceptable	• Fill and seed erosion gully at the far left abutment • Remove trees and brush within 25 feet of left abutment, right abutment, and toe of slope in accordance with the Indiana Dam Safety Inspection Manual • Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual • Repair/Replace damaged bench drain cleanouts and remove outlet obstructions. Install a marker post at each cleanout along the benches and at each outlet along the groins for easy identification	• Within 1 year • Within 2 years • Ongoing • Within 1 year	• Low • Medium • Low • Medium
Seepage	Acceptable	• Monitor large wet area at downstream toe near right side of embankment and notify professional engineer of observed changes	• Ongoing	• Low
Principal Spillway	Acceptable	• Monitor surface cracking and minor spalling on concrete inlet • Remove debris from concrete inlet trash rack and above inlet structure • Replace missing hardware for trash rack located on top of concrete inlet • Supplement riprap on concrete inlet side slopes at bare spots • Remove vegetation adjacent to and extending over concrete impact basin • Remove woody debris and fallen tree downstream of outlet	• Ongoing • Ongoing • Immediately • Immediately • Immediately • Within 2 years	• Low • Low • Low • Low • Low • Low
Auxiliary Spillway	Acceptable	• Relocate light pole and volleyball courts and replace sand with turf-building ground cover • Fill and seed bare areas in inlet section • Remove trees and brush from spillway channel side slopes and at outlet • Remove minor obstructions from outlet channel area	• Within 2 years • Within 1 year • Within 2 years • Within 2 years	• Low • Low • Medium • Low
Maintenance and Repairs	Acceptable	• Perform spillway capacity analysis in accordance with IDNR requirements • Retain a geotechnical engineer to perform an investigation to evaluate dam stability • Conduct a video inspection of the principal spillway outlet pipe; subsequent inspections should be performed every six years • Update Incident and Emergency Action Plan • Develop lake drawdown plan	• Within 2 years • Within 4 years • Within 2 years • Within 1 year • Within 1 year	• Medium • Medium • Medium • High • Low
Overall Conditions	**Conditionally Poor**	• **See above**	• **N/A**	• **N/A**

Notes:

1. Possible Component Ratings: Good, Acceptable, Deficient, Poor
2. Possible Overall Conditions Ratings: Satisfactory, Fair, Conditionally Poor, Poor, Unsatisfactory

EXPLANATION FOR CHANGE IN RATINGS (Describe all repairs, upgrades or improvements made if dam conditions and rating have improved since the last inspection. Describe deteriorating conditions if ratings have worsened.)

REASONS FOR RATING CHANGE:

There are no rating changes.

PREVIOUS RECOMMENDATIONS FOR MAINTENANCE, REPAIRS, AND UPGRADES:

HAVE THEY BEEN PERFORMED ☒ YES ☒ NO (If no, please explain:)

Items that have been performed include the following:
- Riprap added at principal spillway inlet sideslopes

Items that have not been performed include the following:
- Add riprap on right side of principal spillway where bare
- Replace missing hardware on top principal spillway inlet trash rack
- Repair erosion on downstream groin ditches (not observed during 2023 inspection)
- Remove trees and brush within 25ft of embankment material
- Repair broken bench drain cleanouts

Supporting Documentation

Photographs ☒ Attachments ☒ Calculations ☐ Drawings ☐ Other ☐

Comments:

INSTRUCTIONS FOR COMPLETING DAM VISUAL INSPECTION REPORT

1. Complete all items that are applicable; if not applicable, write in "N/A". For concrete dams, complete all applicable items and use "comments" section to cover items not included in the check boxes. Also indicate that the dam is concrete in the comments section.

2. Use page 6 to determine ratings of each dam component (items A through G) and for Overall Conditions (Item H).

3. Please write legibly and concisely.

4. Inspector must be knowledgeable with the type of dam, materials, and components being inspected. If not, qualified assistance shall be engaged.

5. The inspector shall review the dam owner's and IDNR project files prior to the inspection. Previous inspection reports shall be closely reviewed for previous problems and deficiencies.

6. If the ratings of the components (items A through G) or the Overall Conditions (item H) of the dam have changed since the last inspection, please complete page 4. If a rating has improved, dam repairs, improvements, analyses, or maintenance must have been performed and documented on page 4.

7. For a dam to have a satisfactory "Overall Conditions" rating, it must have no existing or potential dam safety deficiencies recognized. Safe performance is expected under all anticipated loading conditions, including infrequent hydrologic events (PMP for high hazard dams) and seismic events. The dam owner's project files must contain hydrologic and hydraulic analyses of the dam and its spillways to verify performance. The files must also contain slope stability analyses to verify embankment stability under full reservoir conditions and rapid-draw down conditions. The dam and all of its components must meet current IDNR and design standards. "Normal" deficiencies such as minor erosion, minor seepage, or normal concrete aging may not make a dam unsatisfactory or unacceptable. For a satisfactory "Overall Conditions" rating to be assigned, items A through G generally should all have a "good" rating; however, in some cases an "acceptable" rating may be satisfactory if the "Problems Noted" are minor, or "normal" conditions, such as minor erosion rills, small puddles on crest, or if grass needs mowed, but is in good condition.

8. An inspection report form must be submitted to IDNR along with a formal technical inspection report as described in Chapter 4.0 of Part 3 of the Indiana Dam Safety Inspection Manual.

9. Please sign and date this page in the space below to verify that you have read and understand these instructions.

Inspector's Signature: _____ Date: 2/29/2024

GUIDELINES FOR DETERMINING CONDITIONS

CONDITIONS OBSERVED - APPLIES TO UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, PRINCIPAL SPILLWAY, AUXILIARY SPILLWAY

GOOD	ACCEPTABLE	DEFICIENT	POOR
In general, this part of the structure has a good appearance, and conditions observed in this area do not appear to threaten the safety of the dam.	Although general cross-section is maintained, surfaces may be irregular, eroded, rutted, spalled, or otherwise not in new condition. Conditions in this area do not currently appear to threaten the safety of the dam.	Continued deterioration and/or unusual loading may threaten the safety of the dam.	Conditions observed in this area appear to threaten the safety of the dam. Conditions observed in this area are unacceptable.

CONDITIONS OBSERVED - APPLIES TO SEEPAGE

GOOD (NONE)	ACCEPTABLE	DEFICIENT	POOR
No evidence of uncontrolled seepage. No unexplained increase in flows from designed drains. All seepage is clear. Seepage conditions do not appear to threaten the safety of the dam.	Some seepage exists at areas other than the drain outfalls, or other designed drains. No unexplained increase in flows from designed drains. All seepage is clear. Seepage conditions observed do not currently appear to threaten the safety of the dam.	Excessive seepage exists at areas other than drain outfalls and other designed drains. Seepage needs to be evaluated. Increased flow and/or continued deterioration in seepage conditions may threaten the safety of the dam.	Excessive seepage conditions observed appear to threaten the safety of the dam and is unacceptable. Examples: 1) Designed drain or seepage flows have increased without increase in reservoir level. 2) Drain or seepage flows contain sediment. i.e., muddy water or particles in jar samples. 3) Widespread seepage, concentrated seepage or ponding appears to threaten the safety of the dam.

CONDITIONS OBSERVED - APPLIES TO MAINTENANCE AND REPAIR

GOOD	ACCEPTABLE	DEFICIENT	POOR
Dam appears to receive effective on-going maintenance and repair, and only a few minor items may need to be addressed.	Dam appears to receive maintenance, but some maintenance items need to be addressed. No major repairs are required.	Level of maintenance of the dam needs significant improvement. Major repairs may be required. Continued neglect of maintenance may threaten the safety of the dam.	Dam does not receive adequate maintenance. One or more items needing maintenance or repair has begun to threaten the safety of the dam. Level of maintenance is unacceptable.

OVERALL CONDITIONS

SATISFACTORY - No existing or potential dam safety deficiencies recognized. Safe performance is expected under all anticipated loading conditions, including such events as infrequent hydrologic and/or seismic events. Project Files contain necessary hydrologic, and other engineering calculations to verify dam safety and performance.

FAIR - No existing dam safety deficiencies are recognized for normal loading conditions. Infrequent hydrologic and/or seismic events would probably result in a dam safety deficiency.

CONDITIONALLY POOR - A potential safety deficiency is recognized for unusual loading conditions which may realistically occur during the expected life of the structure. CONDITIONALLY POOR may also be used when uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency; further investigations and studies are necessary.

POOR - A potential dam safety deficiency is clearly recognized for normal loading conditions. Immediate actions to resolve the deficiency are recommended; reservoir restrictions may be necessary until problem resolution.

UNSATISFACTORY - A dam safety deficiency exists for normal conditions. Immediate remedial action is required for problem resolution.

HAZARD CLASSIFICATIONS OF DAMS (STRUCTURE)

LOW HAZARD- A structure the failure of which may damage farm buildings, agricultural land, or local roads

SIGNIFICANT HAZARD- A structure the failure of which may damage isolated homes and highways, or cause the temporary interruption of public utility services.

HIGH HAZARD-A structure the failure of which may cause the loss of life and serious damage to homes, industrial and commercial buildings, public utilities, major highways, or railroads.

UNAPPROVED STATUS OF DAM

A dam that has been given an unapproved status (see entry for permit) means that plans, construction specifications, hydraulic analyses, and/or a geotechnical investigation on your dam, proving the safety of the structure, have not been received and approved by the Indiana Department of Natural Resources (IDNR). IDNR records indicate that no progress has been made to secure this approval. The fact that the dam is inspected under the Regulation of Dams Act (IC 14-27-7.5) in no way alters the illegal status of the structures.

If your dam is indicated to be unapproved, it is requested that your engineer contact the Indiana Department of Natural Resources,

APPENDIX 2: **PREVIOUS IDNR DAM INSPECTION REPORT FORM (JULY 13, 2021)**

Print Form

SUGGESTED DAM INSPECTION REPORT (Refer to pages 5 and 6 for instructions.)

Name of Professional Conducting Inspection	Professional License No. (Indiana)
Jeffrey D. Fox, P.E./Aaron J. Fricke, P.E./Joshua L. Erwood, E.I.	PE11100632/PE11100305
Business Address 115 West Washington Street, Suite 1368 South, Indianapolis, IN 46204	Phone: (day) 317 - 266 - 8000 (evening) ___ - ___ - ___

Company Name: Christopher B. Burke Engineering, LLC

INSPECTION PREPARATION: Reviewed all pertinent technical documentation related to this dam and site in the State's and the Owner's files: Yes ☒ No ☐ Comment

MULTIDISCIPINARY:I am experienced in the technical disciplines or I am working with other professionals experienced in the technical disciplines to properly inspect this dam and appurtenant works. Technical disciplines, in additional to the general civil engineering, may include geotechnical, geological, hydrologic, structural, and mechanical. Yes ☒ No ☐ Comment

Dam Name	Quad.	Date of Inspection
Sweetwater Lake Dam	Nineveh	07 / 13 / 21

State Dam ID	Permit (if unapproved see pg. 6)	County	Sec.	T.	R.	Last Inspection
7-10	D-429, D-863	Brown	19	10 N	4 E	07 / 10 / 19

Owners Name	Owner's Phone
Cordry-Sweetwater Conservancy District	(317) 933-9858

Address/Zip Code: 8377 Cordry Drive, Nineveh, IN 46164

Contact's Name	Contact's Phone	Spillway Width	Ft. FBD.
Josh Bryant	(day) 317 - 306 - 8395 (evening) ___ - ___ - ___	Top Bot. 150 ft.	5.7 ft.

Hazard	Drainage Area	Surface Area	Height	Crest Length	Crest Width	Inlet Below Crest	Slope
High	2.29 MI^2	275 AC	121 FT	1560 FT	23 FT	7.7 FT	Up 3:1 Down 2.5:1

FIELD CONDITIONS OBSERVED

Water Level - Below Dam Crest 7.3 Ft.

Ground Moisture Condition: Dry ☐ Wet ☒ Snowcover ☐ Other ___

DRAWDOWN STRUCTURE

☐ Yes ☒ None

Comment ___

MONITORING ☐ Yes ☒ None [☐ Gage Rod ☐ Piezometers ☐ Seepage Weirs ☐ Survey Monuments ☐ Other]

Comments ___

A UPSTREAM SLOPE

GOOD	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

PROBLEMS NOTED: ☐ (A-1) None ☐ (A-2) Riprap - Missing, Sparse, Displaced, Weathered ☐ (A-3) Wave Erosion-with Scarps ☐ (A-4) Cracks-with Displacement ☐ (A-5) Sinkhole ☐ (A-6) Appears Too Steep ☐ (A-7) Depressions or Bulges ☐ (A-8) Slides ☐ (A-9) Animal Burrows ☒ (A-10) Trees, Brush, Briars ☒ (A-11) Other Vegetation in Riprap

Comments:

(A-10) Trees were observed within 25 feet of right abutment
(A-11) Grass and weeds were growing in riprap slope protection

B CREST

GOOD	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

PROBLEMS NOTED: ☐ (B-1) None ☐ (B-2) Ruts or Puddles ☐ (B-3) Erosion ☒ (B-4) Cracks with Displacement ☐ (B-5) Sinkholes ☐ (B-6) Not Wide Enough ☐ (B-7) Low Area ☐ (B-8) Misalignment ☐ (B-9) Inadequate Surface Drainage ☐ (B-10) Trees, Brush, Briars ☐ (B-11) Other ___

Comments:

(B-4) Transverse and longitudinal cracks were observed throughout the crest. Cracks appeared to have been sealed.

Spillway Width refers to the open channel (typically the emergency or auxiliary spillway) at the control section.
Ft. FBD. refers to the vertical distance from the emergency (auxiliary) spillway control section to the lowest point of the crest of the dam.
Inlet Below Crest refers to the vertical distance from the inlet of the principal spillway to the crest of the dam.

C DOWNSTREAM SLOPE

GOOD	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

PROBLEMS NOTED: ☐ (C-1) None ☐ (C-2) Livestock Damage ☐ (C-3) Erosion or Gullies ☐ (C-4) Cracks with Displacement ☐ (C-5) Sinkholes ☐ (C-6) Appears too Steep ☐ (C-7) Depression or Bulges ☐ (C-8) Slide ☐ (C-9) Soft Areas ☒ (C-10) Trees, Brush, Briars ☒ (C-11) Animal Burrows ☒ (C-12)Other Ruts; Bench Drain

Comments:

(C-10) Trees and brush were observed within 25 feet of right abutment, left abutment, and toe. Unable to thoroughly inspect left and right groin ditches or right abutment components.
(C-11) A few small animal burrows were observed in the upper left abutment of the embankment
(C-12) Poorly drained rutted areas were observed near right abutment; Left 3rd bench drain cleanout pipe was damaged

D SEEPAGE

GOOD (NONE)	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

PROBLEMS NOTED: ☐ (D-1) None ☐ (D-2) Saturated Embankment Area ☐ (D-3) Seepage Exits on Embankment ☐ (D-4) Seepage Exits at Point Source ☒ (D-5) Seepage Area at Toe ☐ (D-6) Flow Adjacent to Outlet ☐ (D-7) Seepage Clear/Muddy

[**DRAIN OUTFALLS SEEN** X No ___ Yes ☐ (D-8) Flow Clear/Muddy ☐ (D-9) Dry/Obstructed]

☐ (D-10) Other _____ Describe location of drains and indicate amount and quality of discharge.

Comments:

(D-5) Large wet area observed at downstream toe, near right side of embankment

E PRINCIPAL SPILLWAY

GOOD	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

DESCRIPTION: Reinforced concrete box control structure and a 36-inch diameter HDPE outlet pipe

PROBLEMS NOTED: ☐ (E-1) None ☒ (E-2) Deterioration ☐ (E-3) Separation ☐ (E-4) Cracking ☐ (E-5) Inlet, Outlet Deficiency ☐ (E-6) Stilling Basin Inadequacies ☒ (E-7) Trash Rack ☒ (E-8) Other Debris; Riprap; Vegetation

Comments:

(E-2) Concrete deterioration was observed on the inlet control structure, including cracking and spalling
(E-7) Accumulated debris near bottom of new trash rack; hardware missing on top trash rack
(E-8) Woody debris was observed above the inlet structure; sparse riprap along inlet side slopes; vegetation was observed adjacent to and extending over concrete impact basin

F AUXILIARY SPILLWAY

GOOD	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

DESCRIPTION: 150' wide open channel with 25(H):1(V) side slopes; asphalt crest

PROBLEMS NOTED: ☐ (F-1) None ☐ (F-2) No Auxiliary Spillway Found ☐ (F-3) Erosion-with Backcutting ☐ (F-4) Crack with Displacement ☐ (F-5) Appears to be Structurally Inadequate ☐ (F-6) Appears too Small ☐ (F-7) Inadequate Freeboard ☒ (F-8) Flow Obstructed ☐ (F-9) Concrete Deteriorated/Undermined ☒ (F-10) Other Ruts

Comments:

(F-8) Light pole and volleyball net at inlet of spillway. Trees and brush were observed along the spillway channel side slopes and at the outlet. A material spoil pile found in channel section.
(F-10) Two poorly drained ruts in inlet section

G MAINTENANCE AND REPAIRS

GOOD	☐
ACCEPTABLE	☒
DEFICIENT	☐
POOR	☐

PROBLEMS NOTED: ☐ (G-1) None ☐ (G-2) Access Road Needs Maintenance ☐ (G-3) Cattle Damage ☒ (G-4) Spillway Obstruction ☒ (G-5) Brush, Weeds, Tall Grass, on Upstream Slope, Crest, Downstream Slope, Toe ☒ (G-6) Trees on Upstream Slope, Crest, Downstream Slope ☒ (G-7) Rodent Activity on Upstream Slope, Crest, Downstream Slope, Toe ☐ (G-8) Deteriorated Concrete-Facing, Outlet, Spillway ☐ (G-9) Gate and/or Drawdown Need Repair ☒ (G-10) Other Additional Investigations/Analyses

Comments:

The dam appears to receive regular maintenance but improvements are needed. See comments for individual components. Spillway capacity and embankment stability analyses are needed.

H OVERALL CONDITIONS

Based on this inspection and recent file review, the overall surficial condition is determined to be: ☐ (H-1) Satisfactory ☐ (H-2) Fair ☒ (H-3) Conditionally Poor ☐ (H-4) Poor ☐ (H-5) Unsatisfactory

IMPORTANT: IF THIS RATING IS DIFFERENT THAN PREVIOUS IDNR RATING, PLEASE ATTACH EXPLANATION AND REASONS FOR CHANGE ON PAGE 4.

DAM NAME Sweetwater Lake Dam STATE DAM I.D. 7-10 DATE 07 / 13 / 21

RECOMMENDATIONS AND ITEMS REQUIRING ACTION BY OWNER TO IMPROVE THE SAFETY OF THE DAM

MAINTENANCE-MINOR REPAIR-MONITORING

☒ (1) Provide Additional Erosion Protection: Add riprap on both sides of principal spillway inlet structure

☐ (2) Mow: _____

☒ (3) Clear Trees and/or Brush From: Upstream slope right abutment; downstream slope right abutment, left abutment, and toe

☒ (4) Initiate Rodent Control Program and Properly Backfill Existing Holes: Downstream slope

☒ (5) Repair: Left 3rd bench drain cleanout; broken trash rack on inlet face; hardware on inlet top; ruts near right abutment

☐ (6) Provide Surface Drainage For: _____

☒ (7) Monitor: Asphalt cracking on embankment crest; wet area at downstream toe; cracking and spalling at principal spillway inlet

☒ (8) Other: Remove vegetation adjacent to principal spillway stilling basin; remove spoil pile, trees and brush in auxiliary spillway

☒ (9) Other: Remove debris from principal spillway inlet; relocate light pole and volleyball net

ENGINEERING-EMPLOY AN ENGINEER EXPERIENCED IN DESIGN AND CONSTRUCTION OF DAMS TO:

(Plans & Specifications must be approved by State prior to construction.)

☐ (10) Prepare Plans and Specifications for the Rehabilitation of the Dam: _____

☐ (11) Prepare As-Built Drawings of: _____

☒ (12) Perform a Geotechnical Investigation to Evaluate the Stability of the Dam: _____

☒ (13) Perform a Hydrologic Study to Determine Required Spillway Size: _____

☐ (14) Prepare Plans and Specifications for an Adequate Spillway: _____

☐ (15) Set up a Monitoring Program: _____

☐ (16) Refer to Unapproved Status of Dam: _____

☒ (17) Develop an Emergency Action Plan: Update IEAP and develop drawdown plan

☒ (18) Other: Prepare plans and specs to address erosion in right abutment (note, plans for final design are being implemented)

☒ (19) Other: Perform a video inspection of the principal spillway outlet pipe

Recommended schedule for upgrades/comments (Please prioritize and note importance of each item.)

See attached table of recommendations.

Photographs ☒ Attachments ☒

ENGINEER'S INSTRUCTION Instructed owner on the safety concerns with the structure and how to monitor and inspect the dam and appurtenant works in the interim period between the regulatory two-year inspections. Yes ☒ No ☐

Comment

Professional Engineer's Signature _____ Date 10/22/2021

Reviewed By _____ Date 10/22/2021

Owner/Owner's Representative

Component	Rating	Recommendations	Schedule	Importance
Upstream Slope	Acceptable	• Spray/Remove weeds and woody vegetation in riprap • Remove trees within 25 feet of right abutment in accordance with the Indiana Dam Safety Inspection Manual	• Ongoing • 1 year	• Low • Medium
Crest	Acceptable	• Monitor cracks in asphalt pavement	• Ongoing	• Low
Downstream Slope	Acceptable	• Fill and seed poorly drained rutted areas observed near right abutment; vary mowing patterns to reduce likelihood of additional rutting • Remove trees and brush within 25 feet of left abutment, right abutment, and toe of slope in accordance with the Indiana Dam Safety Inspection Manual • Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual; near upper left abutment • Repair/Replace damaged left 3rd bench drain cleanout	• 1 year • 1 year • Ongoing • 1 year	• Low • Medium • Low • Low
Seepage	Acceptable	• Monitor large wet area at downstream toe near right side of embankment and notify professional engineer for significant change	• Ongoing	• Low
Principal Spillway	Acceptable	• Monitor surface cracking and minor spalling on concrete inlet • Remove debris from concrete inlet trash rack and above inlet structure • Replace missing hardware for trash rack located on top of concrete inlet • Supplement riprap around concrete inlet side slopes • Remove vegetation adjacent to and extending over concrete impact basin	• Ongoing • Ongoing • 1 year • 1 year • 1 year	• Low • Low • Low • Low • Low
Auxiliary Spillway	Acceptable	• Relocate light pole and volleyball net • Fill and seed ruts in inlet section • Remove trees and brush from spillway channel side slopes and at outlet • Remove spoil pile material from outlet channel area	• Immediately • 1 year • 1 year • 1 year	• Low • Low • Medium • Medium
Maintenance and Repairs	Acceptable	• Perform spillway capacity analysis in accordance with IDNR requirements • Retain a geotechnical engineer to perform an investigation to evaluate dam stability • Conduct a video inspection of the principal spillway outlet pipe; subsequent inspections should be performed every six years • Update Incident and Emergency Action Plan • Develop reservoir drawdown plan	• 2 years • 2 years • 2 years • 1 year • 2 years	• Low • Medium • Low • Medium • Low
Overall Conditions	**Conditionally Poor**	• **See above**	• **N/A**	• **N/A**

Notes:

1. Possible Component Ratings: Good, Acceptable, Deficient, Poor
2. Possible Overall Conditions Ratings: Satisfactory, Fair, Conditionally Poor, Poor, Unsatisfactory

EXPLANATION FOR CHANGE IN RATINGS (Describe all repairs, upgrades or improvements made if dam conditions and rating have improved since the last inspection. Describe deteriorating conditions if ratings have worsened.)

REASONS FOR RATING CHANGE:

There are no rating changes.

PREVIOUS RECOMMENDATIONS FOR MAINTENANCE, REPAIRS, AND UPGRADES:

HAVE THEY BEEN PERFORMED ☒ YES ☒ NO (If no, please explain:)

Items that have been performed include the following:
- Replaced principal spillway trash rack

Items that have not been performed include the following:
- Add riprap to sides of principal spillway
- Repair erosion gully near guardrail at left groin (not observed during 2021 inspection)
- Repair erosion on downstream groin ditches (not observed during 2021 inspection)
- Remove trees and brush within 25ft of embankment material

Supporting Documentation

Photographs ☒ Attachments ☒ Calculations ❒ Drawings ❒ Other ❒

Comments:

INSTRUCTIONS FOR COMPLETING DAM VISUAL INSPECTION REPORT

1. Complete all items that are applicable; if not applicable, write in "N/A". For concrete dams, complete all applicable items and use "comments" section to cover items not included in the check boxes. Also indicate that the dam is concrete in the comments section.

2. Use page 6 to determine ratings of each dam component (items A through G) and for Overall Conditions (Item H).

3. Please write legibly and concisely.

4. Inspector must be knowledgeable with the type of dam, materials, and components being inspected. If not, qualified assistance shall be engaged.

5. The inspector shall review the dam owner's and IDNR project files prior to the inspection. Previous inspection reports shall be closely reviewed for previous problems and deficiencies.

6. If the ratings of the components (items A through G) or the Overall Conditions (item H) of the dam have changed since the last inspection, please complete page 4. If a rating has improved, dam repairs, improvements, analyses, or maintenance must have been performed and documented on page 4.

7. For a dam to have a satisfactory "Overall Conditions" rating, it must have no existing or potential dam safety deficiencies recognized. Safe performance is expected under all anticipated loading conditions, including infrequent hydrologic events (PMP for high hazard dams) and seismic events. The dam owner's project files must contain hydrologic and hydraulic analyses of the dam and its spillways to verify performance. The files must also contain slope stability analyses to verify embankment stability under full reservoir conditions and rapid-draw down conditions. The dam and all of its components must meet current IDNR and design standards. "Normal" deficiencies such as minor erosion, minor seepage, or normal concrete aging may not make a dam unsatisfactory or unacceptable. For a satisfactory "Overall Conditions" rating to be assigned, items A through G generally should all have a "good" rating; however, in some cases an "acceptable" rating may be satisfactory if the "Problems Noted" are minor, or "normal" conditions, such as minor erosion rills, small puddles on crest, or if grass needs mowed, but is in good condition.

8. An inspection report form must be submitted to IDNR along with a formal technical inspection report as described in Chapter 4.0 of Part 3 of the Indiana Dam Safety Inspection Manual.

9. Please sign and date this page in the space below to verify that you have read and understand these instructions.

Inspector's Signature:  Date: 10/22/2021

GUIDELINES FOR DETERMINING CONDITIONS

CONDITIONS OBSERVED - APPLIES TO UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, PRINCIPAL SPILLWAY, AUXILIARY SPILLWAY

GOOD	ACCEPTABLE	DEFICIENT	POOR
In general, this part of the structure has a good appearance, and conditions observed in this area do not appear to threaten the safety of the dam.	Although general cross-section is maintained, surfaces may be irregular, eroded, rutted, spalled, or otherwise not in new condition. Conditions in this area do not currently appear to threaten the safety of the dam.	Continued deterioration and/or unusual loading may threaten the safety of the dam.	Conditions observed in this area appear to threaten the safety of the dam. Conditions observed in this area are unacceptable.

CONDITIONS OBSERVED - APPLIES TO SEEPAGE

GOOD (NONE)	ACCEPTABLE	DEFICIENT	POOR
No evidence of uncontrolled seepage. No unexplained increase in flows from designed drains. All seepage is clear. Seepage conditions do not appear to threaten the safety of the dam.	Some seepage exists at areas other than the drain outfalls, or other designed drains. No unexplained increase in flows from designed drains. All seepage is clear. Seepage conditions observed do not currently appear to threaten the safety of the dam.	Excessive seepage exists at areas other than drain outfalls and other designed drains. Seepage needs to be evaluated. Increased flow and/or continued deterioration in seepage conditions may threaten the safety of the dam.	Excessive seepage conditions observed appear to threaten the safety of the dam and is unacceptable. Examples: 1) Designed drain or seepage flows have increased without increase in reservoir level. 2) Drain or seepage flows contain sediment. i.e., muddy water or particles in jar samples. 3) Widespread seepage, concentrated seepage or ponding appears to threaten the safety of the dam.

CONDITIONS OBSERVED - APPLIES TO MAINTENANCE AND REPAIR

GOOD	ACCEPTABLE	DEFICIENT	POOR
Dam appears to receive effective on-going maintenance and repair, and only a few minor items may need to be addressed.	Dam appears to receive maintenance, but some maintenance items need to be addressed. No major repairs are required.	Level of maintenance of the dam needs significant improvement. Major repairs may be required. Continued neglect of maintenance may threaten the safety of the dam.	Dam does not receive adequate maintenance. One or more items needing maintenance or repair has begun to threaten the safety of the dam. Level of maintenance is unacceptable.

OVERALL CONDITIONS

SATISFACTORY - No existing or potential dam safety deficiencies recognized. Safe performance is expected under all anticipated loading conditions, including such events as infrequent hydrologic and/or seismic events. Project Files contain necessary hydrologic, and other engineering calculations to verify dam safety and performance.

FAIR - No existing dam safety deficiencies are recognized for normal loading conditions. Infrequent hydrologic and/or seismic events would probably result in a dam safety deficiency.

CONDITIONALLY POOR - A potential safety deficiency is recognized for unusual loading conditions which may realistically occur during the expected life of the structure. CONDITIONALLY POOR may also be used when uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency; further investigations and studies are necessary.

POOR - A potential dam safety deficiency is clearly recognized for normal loading conditions. Immediate actions to resolve the deficiency are recommended; reservoir restrictions may be necessary until problem resolution.

UNSATISFACTORY - A dam safety deficiency exists for normal conditions. Immediate remedial action is required for problem resolution.

HAZARD CLASSIFICATIONS OF DAMS (STRUCTURE)

LOW HAZARD- A structure the failure of which may damage farm buildings, agricultural land, or local roads

SIGNIFICANT HAZARD- A structure the failure of which may damage isolated homes and highways, or cause the temporary interruption of public utility services.

HIGH HAZARD-A structure the failure of which may cause the loss of life and serious damage to homes, industrial and commercial buildings, public utilities, major highways, or railroads.

UNAPPROVED STATUS OF DAM

A dam that has been given an unapproved status (see entry for permit) means that plans, construction specifications, hydraulic analyses, and/or a geotechnical investigation on your dam, proving the safety of the structure, have not been received and approved by the Indiana Department of Natural Resources (IDNR). IDNR records indicate that no progress has been made to secure this approval. The fact that the dam is inspected under the Regulation of Dams Act (IC 14-27-7.5) in no way alters the illegal status of the structures.

If your dam is indicated to be unapproved, it is requested that your engineer contact the Indiana Department of Natural Resources,

APPENDIX 3: **INSPECTION PHOTOGRAPHS (OCTOBER 24, 2023)**

Top: Upstream slope from right side; note riprap slope protection with leafy debris along waterline

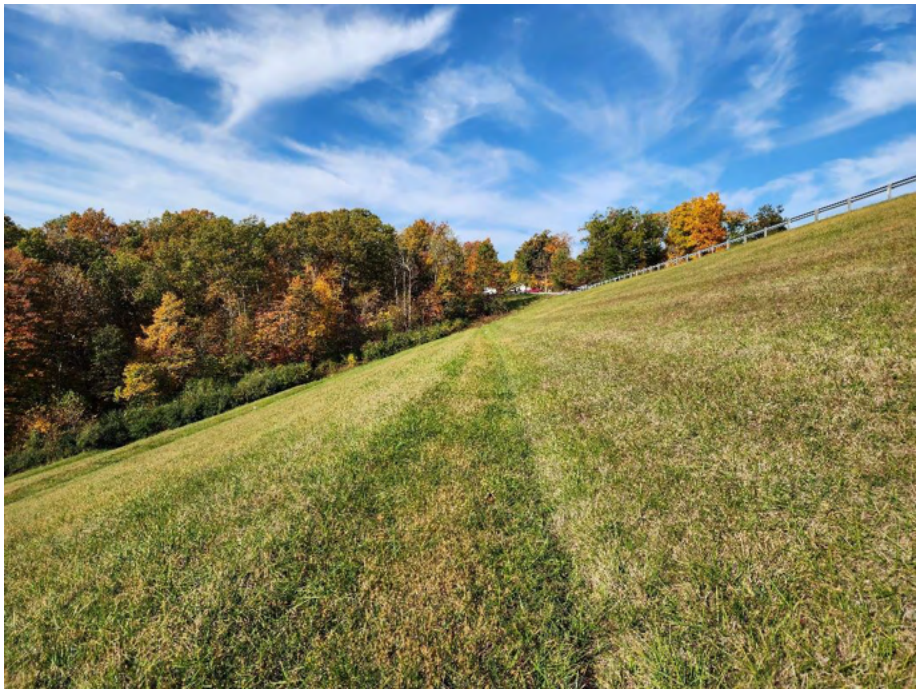
Bottom: Upstream slope from left side; note riprap slope protection with some grass and weeds near waterline

Top: Embankment crest from right side; note guardrail along edges

Bottom: Embankment crest from left side; note previously sealed transverse cracks

Top: Downstream slope at left abutment; note trees and brush within 25 feet

Bottom: Downstream slope near left side; note trees, brush and tall grass on toe within 25 feet



Top: Downstream slope looking left; note trees and brush within 25 feet of dam

Bottom: Downstream slope near left side; note adequate grass cover and generally uniform slope between benches

Top: Downstream slope drain cleanout; lower left bench drain cleanout appeared broken. Middle left and lower right cleanouts were also broken.

Bottom: Downstream near middle; typical minor burrow along slope.

Top: Downstream slope at right abutment; note trees and brush within 25 feet of dam

Bottom: Downstream slope at toe; note large wet area overgrown with vegetation

Top: Principal spillway inlet; note bottom portion of trash rack accumulated debris and some fallen riprap on the right sides

Bottom: Principal spillway inlet looking downstream of inlet; note woody debris and intruding vegetation within riprap

Top: Principal spillway inlet top; note trash rack on top of inlet has missing hardware

Bottom: Principal spillway pipe inlet

Top: Principal spillway outlet

Bottom: Principal spillway outfall looking downstream, not fallen tree and erosion downstream

Top: Auxiliary spillway inlet; note volleyball court, utility pole, and signage within upstream open channel portion with a few bare areas

Bottom: Auxiliary spillway inlet; note boat dock and ramp

Top: Auxiliary spillway left side; note trees and brush along side slopes of downstream open channel portion

Bottom: Auxiliary spillway outlet; note trees and brush along downstream spillway channel.

Top: Auxiliary spillway drainage ditch looking upstream

Bottom: Auxiliary spillway outlet looking right, note temporary construction materials in channel

APPENDIX 4: **DAM INSPECTION CHECKLIST (OCTOBER 24, 2023)**

Dam Safety Inspection Checklist

Complete All Portions of This Section (Pre-inspection)
Date of Inspection: October 24, 2023
Name of Dam: Sweetwater Lake Dam File Number: 7-1
EAP: (yes, no) OM&I: (yes, no)

Review Inventory - Highlight missing information (Pre -inspection)
Owner=s Name(s): Cordry Sweetwater Conservancy District
Address: 8377 Cordry Dr.
City: Nineveh State: IN Zip (+4): 46164

Telephone (Home): 317-412-7052 Telephone (Work): 317-933-2893
Contact Person: Nick Johann Telephone: 317-412-7057
Designed By: Dargitz / Fraps
Constructed By: Prince / CR Morris
Year Completed: 1969 Plans Available (Yes, No) (location): IDNR File
Purpose of dam: Recreation

Interview with Owner (at the site):
Owner/Representative present: (Yes, No) Name(s): Nick Johann

Double check address, telephone #, purpose (check ->) G
How long have you owned dam - previous name/owner?

EAP/OM&I: up-dated-(yes, no) & location: Some correspondence with Brown County EMA
Operate lake drain (times per year, accessibility): No drain - low flow takes a few days to return to normal pool

Mowing (times per year): 3x year
Prior problems (wet areas, erosion, slides):

Repair or modification (what & when): Principal spillway inlet riprap reestablished, late summer 2023 riprap treated. Some dredging projects in coves to remove silt.

Failure/Incident/Breach (max. pool): See inspection report

Downstream hazard status (recent changes): no change

Do you know the in-depth details of the construction of your dam? (If yes - ask next three questions, if no - go to Field Information Section)
Core trench material and location: see IDNR File
Volume of fill (earth or rock) in dam: "
Foundation (earth or rock) of dam: "

Field Information (while at site)
Pool Elevation (during inspection): 9" BELOW NORMAL POOL Time: 8:30 (a.m. p.m.)
Site Conditions(temp., weather, ground moisture): 51°F, Sunny, some dew AT START
74°F, CLOUDY, DRY AT END
Inspection Party: AARON J. FRICKE, P.E. ; JEFFREY D. FOX, P.E. ; JOSHUA L. ERWOOD, P.E.
Maximum Height: 121 FT (measured or inventory appears correct)
Normal Pool Surface Area: 275 Ac (measured or inventory appears correct)

SEE INSPECTION REPORT FOR RECOMMENDED ACTION

Required Action (None, Monitor, Maintenance, Engineer)

UPSTREAM SLOPE

Gradient: Horizontal: 3 Vertical: 1 (est, meas.)

☐ ***VEGETATION*** [no problem]

☐ Trees: Quantity: (<5, sparse, dense)
Diameter: (<6", 6-12", >12") VARIABLE
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg) ALONG RT. GROIN,
Notes:

☑ Brush: Quantity: (sparse, dense)
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes: • LT. ABUTMENT IN RIPRAP NEAR WATERLINE (GPS POINT);
• LT. SIDE NEAR CREST (GPS POINT); ALONG WATERLINE THROUGHOUT (APPEARS SPRAYED)

☑ Ground Cover: Type: (grass, crown vetch) Other: • RT. SIDE LOWER SLOPE (APPEARS SPRAYED)
Quantity: (bare, sparse, adequate, dense) • DENSE ALONG RT. GROIN
Appearance: (too tall, too short, good)
Notes: ~3'-WIDE GRASS STRIP NEAR CREST ALONG GUARDRAIL

☐ ***SLOPE PROTECTION*** [no problem, could not inspect thoroughly]

☐ None

☑ Riprap: Average Diameter: 6" +/- EXTENDS BELOW NORMAL POOL
(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no)
Notes: AREA OF SPARSE COVERAGE / SMALL ROCKS LT. SIDE (~40')
AREA OF SPARSE COVERAGE / SMALL ROCKS LT. SIDE (~45')

☐ Wave Berm: AREA OF SMALLER ROCK NEAR CREST RT. SIDE (~45')
Vegetation: (adequate, bare, sparse, improper vegetation)
Notes:

☐ Concrete Slabs: (cracked, settlement, undermined, voids, deteriorated, vegetation)
Notes:

☐ Other:
Notes:

☐ ***EROSION*** [no problem, could not inspect thoroughly]

☑ Wave Erosion (Beaching): Scarp: Length: 20' +/- Height: 7" +/- MEASURED
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes: NEAR WATERLINE AND LOCATION OF LARGE LOG
ALSO, AT RT. GROIN ~7' LONG, 5.5" DEEP WITH NO RIPRAP

☐ Runoff Erosion (Gullies): Quantity:
Depth: Width: Length:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

☐ ***INSTABILITIES*** [no problem, could not inspect thoroughly]

☐ Slides: Transverse Length: Longitudinal Length:
Scarp: Width: Length:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Crack: Width: Depth:
Notes/Causes:

☐ Cracks: ☐ Transverse ☐ Longitudinal ☐ Other
Quantity: Length: Width: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

Required Action (None, Monitor, Maintenance, Engineer)

Required Action

None | Monitor | Maintenance | Engineer

☐ Cracks: ☐ Transverse ☐ Longitudinal ☐ Other ☐ ☐ ☐ ☐
Quantity: _____ Length: _____ Width: _____ Depth: _____
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg) _____
Notes/Causes: _____

☐ Bulges ☐ Depressions ☐ Hummocky ☐ ☐ ☐ ☐
Size: _____ Height: _____ Depth: _____
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg) _____
Notes/Causes: _____

☐ Bulges ☐ Depressions ☐ Hummocky ☐ ☐ ☐ ☐
Size: _____ Height: _____ Depth: _____
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg) _____
Notes/Causes: _____

☐ ***OTHER*** [no problem, could not inspect thoroughly]

☐ Rodent Burrows: (few, numerous) _____ ☐ ☐ ☐ ☐
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg) _____
Notes: _____

☐ Ruts: ☐ ☐ ☐ ☐
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg) _____
Depth: _____ Width: _____ Length: _____
Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian) _____

☑ Other: SMALL BIRDHOUSE NEAR CROWN ON LT. SIDE ☐ ☐ ☐ ☐
Notes: GUARDRAIL NEAR CREST FOR ROADWAY SAFETY (POSTS RUSTED)
MINOR WOODY DRIFT/DEBRIS THROUGHOUT ALONG WATERLINE
LARGE LOG ON RT. SIDE AT WATERLINE

CREST Length: _____ Width: 20' +/- MEAS. CENTER 22' +/- MEAS. LT. SIDE (est, meas.)
NOTE: CREST CONSIDERED FROM EDGE OF PAVEMENT TO EDGE OF PAVEMENT

☐ ***VEGETATION*** [no problem] ☐ ☐ ☐ ☐

☐ Trees: Quantity: (<5, sparse, dense)
Diameter: (<6", 6-12", >12") _____
Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg) _____
Notes: _____

☐ Brush: Quantity: (sparse, dense) _____ ☐ ☐ ☐ ☐
Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg) _____
Notes: _____

☐ Ground Cover: Type: (grass, crown vetch) Other: _____ ☐ ☐ ☐ ☐
Quantity: (bare, sparse, adequate, dense) _____
Appearance: (too tall, too short, good) _____
Notes: _____

☐ ***EROSION*** [no problem] could not inspect thoroughly]

☐ Runoff Erosion (Gullies): Quantity: _____ Depth: _____ Width: _____ Length: _____ ☐ ☐ ☐ ☐
Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg)
Notes/Causes: _____

None | Monitor | Maintenance | Engineer

Required Action

Required Action

None | Monitor | Maintenance | Engineer

☐ ***ALIGNMENT*** [no problem, could not inspect thoroughly]

☐ Vertical: ☐ Low Area: ☐ ☐ ☐ ☐

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg) _____

Elevation Difference: _____ Length: _____

Notes/Causes: _____

_____ ☐ ☐ ☐ ☐

☐ Horizontal:

Notes/Causes: _____

☐ ***WIDTH*** [no problem]

☐ Too Narrow

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg) _____ ☐ ☐ ☐ ☐

Notes/Causes: _____

_____

☐ ***INSTABILITIES*** [no problem, could not inspect thoroughly]

☐ Cracks: ☐ Transverse ☐ Longitudinal ☐ Other ☐ ☐ ☐ ☐

Quantity: _____ Length: _____ Width: _____ Depth: _____

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg) _____

Notes/Causes: _____

_____

☐ Cracks: ☐ Transverse ☐ Longitudinal ☐ Other ☐ ☐ ☐ ☐

Quantity: _____ Length: _____ Width: _____ Depth: _____

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg) _____

Notes/Causes: _____

_____

☐ Bulges ☐ Depressions ☐ Hummocky ☐ ☐ ☐ ☐

Size: _____ Height: _____ Depth: _____

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg) _____

Notes/Causes: _____

_____

☐ Bulges ☐ Depressions ☐ Hummocky ☐ ☐ ☐ ☐

Size: _____ Height: _____ Depth: _____

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg) _____

Notes/Causes: _____

_____

☐ ***OTHER*** [no problem, could not inspect thoroughly]

☐ Rodent Burrows: (few, numerous) _____ ☐ ☐ ☐ ☐

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg) _____

Notes: _____

_____

☐ Ruts: ☐ ☐ ☐ ☐

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg) _____

Depth: _____ Width _____ Length: _____

Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian) _____

_____

☑ Other: MINOR PAVEMENT CRACKING THROUGHOUT (SURFICIAL) ☐ ☐ ☐ ☐

Notes: TRANSVERSE AND MAZE/MAP CRACKING APPEARS TO BE PAVEMENT DETERIORATION AND NOT EMBANKMENT INSTABILITY. MOST CRACKS HAVE BEEN SEALED. CRACKING APPEARED TO BE MORE PREVALENT ON DOWNSTREAM SIDE OF CENTERLINE

None | Monitor | Maintenance | Engineer

Required Action

D/S SLOPE OTHER:
- MIDDLE LEFT BENCH DRAIN OUTLET UNOBSTRUCTED
- MIDDLE LEFT BENCH DRAIN CLEANOUT CAP BROKEN AND NEEDS REPLACED
- MIDDLE RIGHT BENCH DRAIN CLEANOUT CANNOT OPEN BUT APPEARS SECURE
- MIDDLE RIGHT BENCH OUTLET UNOBSTRUCTED

DOWNSTREAM SLOPE Gradient: Horizontal: 3:1 (H:V) MEAS. UPPER TIER AT MIDDLE Vertical: 4:1 (H:V) MEAS. UPPER MIDDLE TIER, LOWER MIDDLE TIER (est, meas.)

Required Action — None / Monitor / Maintenance / Engineer

☐ ***VEGETATION*** [no problem]

☑ Trees: Quantity: (<5, sparse, (dense)) ☐ ☐ ☐ ☐
Diameter: (<6", 6-12", >12") VARIABLE
Location: (adj. to structure, entire slope, lt end, (rt end), middle, see dwg)
Notes: ALONG RT. GROIN AND WITHIN 25' OF DAM ALONG TOE LEFT OF VALLEY SECTION
ALONG LT. GROIN AND WITHIN 25' OF DAM AND ALONG TOE OF VALLEY SECTION

☑ Brush: Quantity: (sparse, (dense)) ☐ ☐ ☐ ☐
Location: (adj. to structure, entire slope, lt end, (rt end), middle, see dwg)
Notes: ALONG RT. GROIN AND WITHIN 25' OF DAM ALONG TOE LEFT OF VALLEY SECTION
ALONG LT. GROIN AND WITHIN 25' OF DAM AND ALONG TOE OF VALLEY SECTION

☑ Ground Cover: Type: (grass, crown vetch) Other: ☐ ☐ ☐ ☐
Quantity: (bare, sparse, adequate, (dense))
Appearance: (too tall, too short, (good))
Notes: DOWNSTREAM EDGE OF MIDDLE BENCH SPORADIC SMALL BARE SPOTS

NOTE: RIPRAP ALONG VALLEY SECTION GROINS

☐ ***EROSION*** [no problem, could not inspect thoroughly]

☑ Runoff Erosion (Gullies): Quantity: Depth: Width: Length: ☐ ☐ ☐ ☐
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes: LT. ABUTMENT SECTION GROIN, 35'+/- LONG, 1'+/- WIDE, 1'+/- DEEP
LT. VALLEY VALLEY SECTION GROIN @ LOWER BENCH EROSION AGAINST HILLSIDE
(COULD NOT ACCESS DUE TO VEGETATION)

☐ ***INSTABILITIES*** [no problem, could not inspect thoroughly]

☐ Slides: Transverse Length: Longitudinal Length: ☐ ☐ ☐ ☐
Scarp: Width: Length:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Crack: Width: Depth:
Notes/Causes:

☐ Cracks: ☐ Transverse ☐ Longitudinal ☐ Other ☐ ☐ ☐ ☐
Quantity: Length: Width: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

☐ Cracks: ☐ Transverse ☐ Longitudinal ☐ Other ☐ ☐ ☐ ☐
Quantity: Length: Width: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

☐ Bulges ☐ Depressions ☐ Hummocky ☐ ☐ ☐ ☐
Size: Height: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

☐ Bulges ☐ Depressions ☐ Hummocky ☐ ☐ ☐ ☐
Size: Height: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

Required Action — None / Monitor / Maintenance / Engineer

D/S SLOPE OTHER:
- LOWER LEFT BENCH DRAIN OUTLET COULD NOT ACCESS DUE TO VEGETATION
- LOWER RIGHT BENCH DRAIN OUTLET COULD NOT ACCESS DUE TO VEGETATION
- LOWER RIGHT BENCH DRAIN CLEANOUT OPEN / DAMAGED
- LOWER MIDDLE TIER, LT. SIDE, RILL FROM APPARENT ANIMAL ACTIVITY (GPS POINT)
- LOWER LEFT BENCH DRAIN CLEANOUT OPEN / DAMAGED

* 8"-DIA, 6" DEEP DIVOT NEAR LT. END
* UPPER TIER RT. BENCH DRAIN CLEANOUT STABLE AND DRY
* ~~UPPER~~ TIER RT. BENCH DRAIN CLEANOUT STABLE AND DRY
* UPPER TIER LT. BENCH DRAIN PARTIALLY OBSTRUCTED (8" CORRUGATED PLASTIC)
* LEFT OF VALLEY SECTION GENERALLY SOFTER

Required Action (None / Monitor / Maintenance / Engineer)

☐ ***OTHER*** [no problem, could not inspect thoroughly] ☐ ☐ ☐ ☐

☑ Rodent Burrows: (few, numerous) ☐ ☐ ☐ ☐
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes: RT SIDE, UPPER TIER, SHALLOW RODENT RUN WITH A FEW SHALLOW BURROWS
CENTER, UPPER TIER, RODENT ACTIVITY (SHALLOW)

☑ Ruts: SPORADIC THROUGHOUT (SEE GPS POINTS) ☐ ☐ ☐ ☐
Location: (adj. to structure, entire slope, (lt end), rt end, middle, see dwg)
Depth: SURFICIAL Width: ≈1 FT, Length: 105' +/-
Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian) MOWING

☑ Other: UPPER TIER RT. BENCH DRAIN PARTIALLY BLOCKED (8" CORRUGATED PLASTIC) ☐ ☐ ☐ ☐
Notes: GUARDRAIL NEAR CREST FOR ROADWAY SAFETY. BEAVER HOLES NEAR CREST
"KEEP OFF THE DAMS" SIGNS NEAR CREST

☐ ***SEEPAGE*** [no problem, (could not inspect thoroughly)]
☐ Wet Area ☐ Flow ☐ Boil ☐ Sinkhole ☐ ☐ ☐ ☐
Flow Rate Size:
Location:
☐ Aquatic Vegetation ☐ None
☐ Rust Colored Deposits ☐ None
☐ Sediment in Flow ☐ None
☐ Other:
Notes/Causes:

☐ Wet Area ☐ Flow ☐ Boil ☐ Sinkhole ☐ ☐ ☐ ☐
Flow Rate Size:
Location:
☐ Aquatic Vegetation ☐ None
☐ Rust Colored Deposits ☐ None
☐ Sediment in Flow ☐ None
☐ Other:
Notes/Causes:
AREAS BEYOND TOE OF VALLEY SECTION MAY BE DAMP, BUT IS THE PATH FOR DRAINAGE FROM LEFT GROIN

☐ ***EMBANKMENT DRAINS*** [(none), none found, no problem, could not inspect thoroughly] ☐ ☐ ☐ ☐
Type: ☐ Toe Drain ☐ Relief Wells ☐ Other:
Flow Rate: Size: Number:
Location:
Notes:

☐ ***MONITORING INSTRUMENTATION*** [(none), none found, no problem, could not inspect thoroughly] ☐ ☐ ☐ ☐
☐ None Found ☐ Piezometers ☐ Weirs/Flumes ☐ Other
☐ Periodic Inspections by:
Notes:

Required Action (None / Monitor / Maintenance / Engineer)

PRINCIPAL SPILLWAY

Required Action: None | Monitor | Maintenance | Engineer

☐ ***GENERAL INLET*** [no problem, could not inspect thoroughly] ☐ ☐ ☐ ☐

☐ Anti-Vortex Plate [None] Dimensions: _____ (adequate, too small,)

Type: (steel, concrete, aluminum, stainless steel, corrugated metal wood, other): _____

Deterioration: (missing sections, rusted, collapsed) _____

Notes: _____

☐ Flash Boards [None] ☐ ☐ ☐ ☐

Type: (metal, wood): _____

Deterioration: _____

Notes: _____

☑ Trashrack [None] Opening Size: 6"x8" (adequate, too small, too large) ☐ ☐ ☐ ☐

Type: (metal bars, fence, screen, concrete, baffle, other): _____

Deterioration: (broken bars, missing sections, rusted, collapsed) MINOR RUSTING OF BOTTOM

Notes: POTENTIAL MISSING BOLT AND NUT MIDDLE TOP

• TOP TRASH RACK (6"x8" OPENING) MISSING A BOLT/NUT

☐ ***INLET OBSTRUCTION*** [no problem, could not inspect thoroughly] ☐ ☐ ☐ ☐

☑ Debris: (leaves, trash, logs, branches, ice) IN FRONT OF WEIR ☐ ☐ ☐ ☐

☐ Trees: Quantity: (<5, sparse, dense)

Diameter: (<6", 6-12", >12")

Location: (entire inlet, lt side, rt side, middle, see dwg)

Notes: _____

☑ Brush: Quantity: (sparse, dense) ☐ ☐ ☐ ☐

Location: (entire inlet, lt side, rt side, middle, see dwg) AROUND SIDES AND TOP BUT NOT OBSTRUCTING OPENINGS

Notes: _____

☑ Other:(beaver activity, trashrack opening too small, partially/completely blocked, i.e.) ☐ ☐ ☐ ☐

Notes: LOG IN RIPRAP ABOVE STRUCTURE

☐ ***INLET MATERIALS*** [no problem, could not inspect thoroughly]

☐ Metal

(loss of coating/paint, surface rust, corrosion (pitting, scaling), rusted out, pipe deformation) ☐ ☐ ☐ ☐

Dimensions: _____

Location: _____

Notes/Causes: _____

☑ Concrete

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location: _____

Notes/Causes: NO SIGNIFICANT DETERIORATION VISIBLE. MINOR SPALL ON LEFT VERTICAL FACE AT TRASH RACK. HONEYCOMB APPEARANCE ON INTERIOR WALLS @ BOTTOM,

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location: _____

Notes/Causes: _____

☐ Plastic ☐ ☐ ☐ ☐

(deterioration, cracking, deformation) _____

Dimensions: _____

Location: _____

Notes/Causes: _____

Required Action: None | Monitor | Maintenance | Engineer

Required Action: None | Monitor | Maintenance | Engineer

☐ Earthen

☐ Ground Cover: Type: (grass, crown vetch) Other: _____ ☐ ☐ ☐ ☐
Quantity: (bare, sparse, adequate, dense) _____
Appearance: (too tall, too short, good) _____
Notes: _____

☐ Erosion: (wave, surface runoff) _____ ☐ ☐ ☐ ☐
Description (height/depth/length/etc): _____
Notes: _____

☐ Ruts: ☐ ☐ ☐ ☐
Location: (entire inlet, lt side, rt side, middle, see dwg) _____
Depth: _____ Width: _____ Length: _____
Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian) _____

☐ Riprap: Average Diameter: _____ ☐ ☐ ☐ ☐
(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no)
Notes: _____

☐ Rock-Cut (weathered, erosion) ☐ ☐ ☐ ☐
Description: _____
Notes: _____

☑ Other: _____ ☐ ☐ ☐ ☐

☐ ***OTHER INLET PROBLEMS*** [no problem, could not inspect thoroughly]

☐ Mis-Alignment: (pipe, chute, sidewall, headwall) ☐ Pipe Deformation _____ ☐ ☐ ☐ ☐
Location/Description: _____
Notes/Causes: _____

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐
Location/Description: _____
Notes/Causes: _____

☐ Undermining: ☐ ☐ ☐ ☐
Location/Description: _____
Notes/Causes: _____

☑ Other: STEEP SOIL FACE EXPOSED ON ADJACENT RIGHT HILLSIDE (NO RIPRAP COVERAGE) ☐ ☐ ☐ ☐

☐ ***OPEN CHANNEL CONTROL SECTION*** [no problem, could not inspect] **Width** _____ (est., ms.) **Brdth** _____ (est., ms.)
Notes: CONCRETE WEIR ☐ ☐ ☐ ☐

☐ ***OUTLET OBSTRUCTION*** [no problem, could not inspect thoroughly]

☐ Debris: (leaves, trash, logs, branches, ice) _____ ☐ ☐ ☐ ☐
☐ Trees: Quantity: (<5, sparse, dense) _____ ☐ ☐ ☐ ☐
Diameter: (<6", 6-12", >12") _____
Location: (entire outlet, lt side, rt side, middle, see dwg) _____
Notes: _____

☐ Brush: Quantity: (sparse, dense) ☐ ☐ ☐ ☐
Location: (entire outlet, lt side, rt side, middle, see dwg)
Notes: _____

Required Action: None | Monitor | Maintenance | Engineer

☑ Other: (beaver activity, partially/completely blocked, i.e.) _____ ☐ ☐ ☐ ☐
Notes: TREES AND BRUSH AROUND HEADWALL BUT NOT OBSTRUCTING PIPE

{Upstream Slope, Crest, Downstream Slope, Seepage, **Principal Spillway-Inlet/Outlet**, Emergency Spillway, Lake Drain}

Required Action (None | Monitor | Maintenance | Engineer)

☐ ***OUTLET MATERIALS*** [no problem, could not inspect thoroughly]

☐ Metal (loss of coating/paint, surface rust, corrosion (pitting, scaling), rusted out, pipe deformation) _____ ☐ ☐ ☐ ☐

Dimensions: _____

Location: _____

Notes/Causes: _____

_____

☐ Concrete

(bug holes, hairline crack, efflorescence) _____ ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) _____ ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) _____ ☐ ☐ ☐ ☐

Dimensions/Location: _____

Notes/Causes: _____

_____

(bug holes, hairline crack, efflorescence) _____ ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) _____ ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) _____ ☐ ☐ ☐ ☐

Dimensions/Location: _____

Notes/Causes: _____

_____

☑ Plastic (deterioration, cracking, deformation) DOWNSTREAM OUTLET PIPE W/ CONCRETE END SECTION ☐ ☐ ☐ ☐

Dimensions: _____

Location: _____

Notes/Causes: FALLEN TREE DIRECTLY ABOVE END SECTION

_____

☐ Earthen

☐ Ground Cover: Type: (grass, crown vetch) Other: _____ ☐ ☐ ☐ ☐

Quantity: (bare, sparse, adequate, dense) _____

Appearance: (too tall, too short, good) _____

Notes: _____

_____

☐ Erosion: (other, surface runoff) ☐ ☐ ☐ ☐

Description (width/depth/length/etc): _____

Notes: _____

_____

☐ Ruts: ☐ ☐ ☐ ☐

Location: (entire inlet, lt side, rt side, middle, see dwg) _____

Depth: _____ Width _____ Length: _____

Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian) _____

_____

☐ Riprap: Average Diameter: _____ ☐ ☐ ☐ ☐

(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no)

Notes: _____

_____

☐ Rock-Cut (weathered, erosion) _____

Description/Notes: _____ ☐ ☐ ☐ ☐

_____

☐ Other: _____ ☐ ☐ ☐ ☐

_____

☐ ***OTHER OUTLET PROBLEMS*** [no problem, could not inspect thoroughly]

☑ Mis-Alignment: (pipe, chute, sidewall, headwall) ☐ Pipe Deformation _____ ☐ ☐ ☐ ☐

Location/Description: _____

Notes/Causes: PIPE ALIGNMENT NOT STRAIGHT AS VIEWED FROM D/S END

_____

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐

Location/Description: _____

Notes/Causes: _____

_____

☐ Undermining: _____ ☐ ☐ ☐ ☐

Location/Description: _____

Notes/Causes: _____

_____

☐ Other: _____ ☐ ☐ ☐ ☐

{Upstream Slope, Crest, Downstream Slope, Seepage, **Principal Spillway-Outlet**, Emergency Spillway, Lake Drain}

Required Action (None | Monitor | Maintenance | Engineer)

Required Action: None | Monitor | Maintenance | Engineer

OUTLET EROSION CONTROL STRUCTURE (Stilling Basins)

☐ None
☑ (endwall/headwall, plunge pool, impact basin, flip bucket, USBR, baffled chute, rock lined channel)
Notes: WITH

Components (baffle blocks, chute blocks, endsill)

☐ ***MATERIAL*** [no problem, could not inspect thoroughly]
☑ Riprap: Average Diameter: VARIABLE SIZE
(adequate,
sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no)
Notes:

☑ Concrete
(bug holes, hairline crack, efflorescence)
(spalling, popouts, honeycombing, scaling, craze/map cracks)
(isolated crack, exposed rebar, disintegration, other)
Dimensions/Location:
Notes/Causes: NO SIGNIFICANT DETERIORATION VISIBLE

(bug holes, hairline crack, efflorescence)
(spalling, popouts, honeycombing, scaling, craze/map cracks)
(isolated crack, exposed rebar, disintegration, other)
Dimensions/Location:
Notes/Causes:

☐ ***OTHER*** [no problem, could not inspect thoroughly]
☐ Mis-Alignment:(sidewall, headwall, entire struct.)
Location:
Description:
Notes/Causes:

☐ Separated Joint ☐ Loss of Joint Material
Location:
Description:
Notes/Causes:

☐ Undermining:
Location:
Description:
Notes/Causes:

☑ Other: VINES ON CONCRETE
SIGNIFICANT EROSION D/S OF RIPRAP

☐ ***DRAINS*** [none, none found, no problem, could not inspect thoroughly] (See ***SEEPAGE*** Section for Toe Drains & Relief Wells)
Type: ☐ Weep Holes ☐ Relief Drains ☐ Other:
Flow Rate: Size: Number:
Location:
Notes:

Type: ☐ Weep Holes ☐ Relief Drains ☐ Other:
Flow Rate: Size: Number:
Location:
Notes:

None | Monitor | Maintenance | Engineer
Required Action

EMERGENCY SPILLWAY

Required Action: None | Monitor | Maint. | Engineer

☐ None Found ☐ ☐ ☐ ☐

☐ ***GENERAL INLET*** [no problem, could not inspect thoroughly]

☐ Anti-Vortex Plate [None] Dimensions:_____ (adequate, too small,) ☐ ☐ ☐ ☐

Type: (steel, concrete, aluminum, stainless steel, corrugated metal wood, other):_____

Deterioration: (missing sections, rusted, collapsed)_____

Notes:_____

_____ ☐ ☐ ☐ ☐

☐ Flash Boards [None]

Type: (metal, wood):_____

Deterioration:_____

Notes:_____

_____

☐ Trashrack [None] Opening Size:_____ (adequate, too small, too large) ☐ ☐ ☐ ☐

Type: (metal bars, fence, screen, concrete, baffle, other):_____

Deterioration: (broken bars, missing sections, rusted, collapsed)_____

Notes:_____

_____

☑ ***INLET OBSTRUCTION*** [no problem, could not inspect thoroughly]

☐ Debris: (leaves, trash, logs, branches, ice)_____ ☐ ☐ ☐ ☐

☐ Trees: Quantity: (<5, sparse, dense)_____ ☐ ☐ ☐ ☐

Diameter: (<6", 6-12", >12")_____

Location: (entire inlet, lt side, rt side, middle, see dwg)_____

Notes:_____

_____

☐ Brush: Quantity: (sparse, dense)_____ ☐ ☐ ☐ ☐

Location: (entire inlet, lt side, rt side, middle, see dwg)_____

Notes:_____

_____

☑ Other:(beaver activity, trashrack opening too small, partially/completely blocked, i.e.)_____ ☐ ☐ ☐ ☐

√VOLLEYBALL NET, SIGNAGE, UTILITY POLE

Notes:_____

_____

☐ ***INLET MATERIALS*** [no problem, could not inspect thoroughly]

☐ Metal

(loss of coating/paint, surface rust, corrosion (pitting, scaling), rusted out, pipe deformation)_____ ☐ ☐ ☐ ☐

_____

Dimensions/Location:_____

Notes/Causes:_____

_____

_____

☐ Concrete

(bug holes, hairline crack, efflorescence)_____ ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks)_____ ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other)_____ ☐ ☐ ☐ ☐

Dimensions/Location:_____

Notes/Causes:_____

_____

(bug holes, hairline crack, efflorescence)_____ ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks)_____ ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other)_____ ☐ ☐ ☐ ☐

Dimensions/Location:_____

Notes/Causes:_____

_____

☐ Plastic ☐ ☐ ☐ ☐

(deterioration, cracking, deformation)_____

Dimensions/Location:_____

Notes/Causes:_____

_____

None | Monitor | Maintenance | Engineer
Required Action

Required Action: None | Monitor | Maintenance | Engineer

☑ Earthen

☐ Ground Cover: Type: (grass, crown vetch) Other: ALSO SAND, GRAVEL, CONCRETE BLOCK ☐ ☐ ☐ ☐
Quantity: (bare, sparse, adequate, dense) SOME BARE SPOTS
Appearance: (too tall, too short, good)
Notes:

☐ Erosion: (wave, surface runoff) ☐ ☐ ☐ ☐
Description (height/depth/length/etc):
Notes:

☐ Ruts: ☐ ☐ ☐ ☐
Location: (entire inlet, lt side, rt side, middle, see dwg)
Depth: Width: Length:
Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian)

☐ Riprap: Average Diameter: ☐ ☐ ☐ ☐
(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no)
Notes:

☐ Rock-Cut (weathered, erosion) ☐ ☐ ☐ ☐
Description:
Notes:

☐ Other: ☐ ☐ ☐ ☐

☐ ***OTHER INLET PROBLEMS*** [no problem, could not inspect thoroughly]

☐ Mis-Alignment:(channel, chute, sidewall, headwall) ☐ Pipe Deformation ☐ ☐ ☐ ☐
Location/Description:
Notes/Causes:

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐
Location/Description:
Notes/Causes:

☐ Undermining: ☐ ☐ ☐ ☐
Location/Description:
Notes/Causes:

☐ Other: ☐ ☐ ☐ ☐

☐ ***OPEN CHANNEL CONTROL SECTION*** [no problem, could not inspect] **Width** (est., ms.) **Brdth** (est., ms.)
Notes: APPEARS TO BE ROAD ☐ ☐ ☐ ☐

☐ ***OUTLET OBSTRUCTION*** [no problem, could not inspect thoroughly]

☐ Debris: (leaves, trash, logs, branches, ice) ☐ ☐ ☐ ☐
☑ Trees: Quantity: (<5, sparse, dense) ☐ ☐ ☐ ☐
Diameter: (<6", 6-12", >12")
Location: (entire outlet, lt side, rt side, middle, see dwg)
Notes: DENSE, VARIABLE LT. SIDE AND DOWNSTREAM OF GRAVEL AND RT. SIDE
SPARSE, VARIABLE, RT. SIDE

☑ Brush: Quantity: (sparse, dense) ☐ ☐ ☐ ☐
Location:(entire outlet, lt side, rt side, middle, see dwg)
Notes: SAME LOCATIONS AND DENSITY AS TREES

Required Action: None | Monitor | Maintenance | Engineer

☑ Other:(beaver activity, partially/completely blocked, i.e.) ☐ ☐ ☐ ☐
PORT-O-LET, RETAINING WALL BLOCKS, PARKED VEHICLES, WOOD PARKING BUMPERS
Notes:

{Upstream Slope, Crest, Downstream Slope, Seepage, Principal Spillway, **Emergency Spillway-Inlet/Outlet**, Lake Drain}

Required Action (None | Monitor | Maint. | Engineer)

☐ ***OUTLET MATERIALS*** [no problem, could not inspect thoroughly]

☐ Metal (loss of coating/paint, surface rust, corrosion (pitting, scaling), rusted out, pipe deformation) ☐ ☐ ☐ ☐

Dimensions:

Location:

Notes/Causes:

☐ Concrete (bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location:

Notes/Causes:

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location:

Notes/Causes:

☐ Plastic (deterioration, cracking, deformation) ☐ ☐ ☐ ☐

Dimensions:

Location:

Notes/Causes:

☑ Earthen

☑ Ground Cover: Type: (grass, crown vetch) Other: GRAVEL ☐ ☐ ☐ ☐

Quantity: (bare, sparse, adequate, dense)

Appearance: (too tall, too short, good)

Notes: SOME BARE SPOTS

☐ Erosion: (other, surface runoff) ☐ ☐ ☐ ☐

Description (width/depth/length/etc):

Notes:

☐ Ruts: ☐ ☐ ☐ ☐

Location: (entire inlet, lt side, rt side, middle, see dwg)

Depth: Width: Length:

Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian)

☐ Riprap: Average Diameter: ☐ ☐ ☐ ☐

(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no)

Notes:

☐ Rock-Cut (weathered, erosion) ☐ ☐ ☐ ☐

Description:

Notes:

☐ Other: ☐ ☐ ☐ ☐

☐ ***OTHER OUTLET PROBLEMS*** [no problem, could not inspect thoroughly]

☐ Mis-Alignment:(channel, chute, sidewall, headwall) ☐ Pipe Deformation ☐ ☐ ☐ ☐

Location/Description:

Notes/Causes:

☐ Separated Joint ☐ Loss of Joint Material

Location/Description:

Notes/Causes:

☐ Undermining: ☐ ☐ ☐ ☐

Location/Description:

Notes/Causes:

☐ Other: ☐ ☐ ☐ ☐

{Upstream Slope, Crest, Downstream Slope, Seepage, Principal Spillway, **Emergency Spillway-Outlet**, Lake Drain}

Required Action (None | Monitor | Maintenance | Engineer)

Required Action

None | Monitor | Maint. | Engineer

OUTLET EROSION CONTROL STRUCTURE (Stilling Basins)

☐ None ☐ ☐ ☐ ☐

☐ (endwall/headwall, plunge pool, impact basin, flip bucket, USBR, baffled chute, rock lined channel) ☐ ☐ ☐ ☐

Notes:_____

_____

Components (baffle blocks, chute blocks, endsill)_____

☐ ***MATERIAL*** [no problem, could not inspect thoroughly]

☐ Riprap: Average Diameter: _____ ☐ ☐ ☐ ☐

(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no)

Notes:_____

_____

☐ Concrete

(bug holes, hairline crack, efflorescence) _____ ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks)_____ ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other)_____ ☐ ☐ ☐ ☐

Dimensions/Location:_____

Notes/Causes:_____

_____

(bug holes, hairline crack, efflorescence) _____ ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks)_____ ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other)_____ ☐ ☐ ☐ ☐

Dimensions/Location:_____

Notes/Causes:_____

_____

☐ ***OTHER*** [no problem, could not inspect thoroughly] ☐ ☐ ☐ ☐

☐ Mis-Alignment:(sidewall, headwall)_____

Location:_____

Description:_____

Notes/Causes:_____

_____

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐

Location:_____

Description:_____

Notes/Causes:_____

_____

_____

☐ Undermining: ☐ ☐ ☐ ☐

Location:_____

Description:_____

Notes/Causes:_____

_____

☐ Other:_____ ☐ ☐ ☐ ☐

_____

☐ ***DRAINS*** [none, none found, no problem, could not inspect thoroughly] (See ***SEEPAGE*** Section for Toe Drains & Relief Wells)

Type: ☐ Weep Holes ☐ Relief Drains ☐ Other:_____ ☐ ☐ ☐ ☐

Flow Rate:_____ Size:_____ Number:_____

Location:_____

Notes:_____

_____

_____

Type: ☐ Weep Holes ☐ Relief Drains ☐ Other:_____ ☐ ☐ ☐ ☐

Flow Rate:_____ Size:_____ Number:_____

Location:_____

Notes:_____

_____

_____

None | Monitor | Maintenance | Engineer

Required Action

{Upstream Slope, Crest, Downstream Slope, Seepage, Principal Spillway, **Emergency Spillway-Outlet Erosion Control Structure**, Lake Drain}

LAKE DRAIN

Required Action: None | Monitor | Maint. | Engineer

☐ ***GENERAL***

☐ None Found ☑ Does not have one — ☐ ☐ ☐ ☐

☐ Type of Lake Drain (isolated control/intake tower, valve vault w/ outlet conduit, valve in riser/drop inlet, siphon) — ☐ ☐ ☐ ☐

Notes: _____

_____

☐ Operated During Inspection (yes, no) _____ — ☐ ☐ ☐ ☐

Notes: _____

_____

☐ ***ACCESS TO VALVE/SLUICE GATE*** [no problem, could not inspect thoroughly] — ☐ ☐ ☐ ☐

☐ Type (not accessible, from shore, boat, walkway, other) _____

Notes: _____

_____

☐ Walkway/Platform: _____

☐ Concrete Deterioration ☐ Cracks (platform, piers, end supports, railing) — ☐ ☐ ☐ ☐

Location: _____

Notes: _____

_____

☐ Wood Deterioration — ☐ ☐ ☐ ☐

Notes: _____

_____

☐ Metal Deterioration — ☐ ☐ ☐ ☐

(minor, moderate, extensive, other) _____

Notes: _____

_____

☐ ***LAKE DRAIN COMPONENTS*** [no problem, could not inspect thoroughly]

☐ Concrete Structure — ☐ ☐ ☐ ☐

Location: _____

Description: (deterioration, misalignment, cracks): _____

Notes/Causes: _____

_____

☐ Valve Control (Operating Device)

☐ No Operating Device ☐ No Stem ☐ Bent/Broken Stem ☐ Other — ☐ ☐ ☐ ☐

Notes/Operability: _____

_____

☐ Valve / Sluice Gate — ☐ ☐ ☐ ☐

☐ Metal Deterioration: (surface rust, minor, moderate, extensive, other) _____

Location: _____

Flow Rate: _____

Notes/Causes: _____

_____

☐ Misalignment — ☐ ☐ ☐ ☐

Notes/Causes: _____

_____

☐ Leakage - Flow Rate: _____ — ☐ ☐ ☐ ☐

Notes/Causes: _____

_____

☐ Valve / Sluice Gate — ☐ ☐ ☐ ☐

☐ Metal Deterioration: (surface rust, minor, moderate, extensive, other) _____

Location: _____

Flow Rate: _____

Notes/Causes: _____

_____

☐ Misalignment - Notes/Causes: _____ — ☐ ☐ ☐ ☐

_____

Required Action: None | Monitor | Maintenance | Engineer

☐ Leakage - Flow Rate: _____ — ☐ ☐ ☐ ☐

Notes/Causes: _____

_____

Required Action

None | Monitor | Maintenance | Engineer

☐ Outlet Conduit

☐ Metal:(loss of coating/paint, surface rust, corrosion (pitting, scaling), rusted out) ☐ ☐ ☐ ☐

Location:_____

Notes/Causes:_____

_____

☐ Concrete (bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location:_____

Notes/Causes:_____

_____

☐ Plastic:(deterioration, cracking)_____ ☐ ☐ ☐ ☐

Location:_____

Notes/Causes:_____

_____

☐ Conduit Deformation ☐ Mis-Alignment: ☐ ☐ ☐ ☐

Location:_____

Notes/Causes:_____

_____

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐

Location/Description:_____

Notes/Causes:_____

_____

☐ Undermining: ☐ ☐ ☐ ☐

Location/Description:_____

Notes/Causes:_____

_____

☐ Vegetation (trees, brush)_____ ☐ ☐ ☐ ☐

Notes:_____

☐ Other:_____ ☐ ☐ ☐ ☐

Notes:_____

_____

☐ Energy Dissipator

☐ Type (endwall, plunge pool, impact basin, stilling basin, rock-lined channel, none) ☐ ☐ ☐ ☐

Notes:_____

_____

☐ Riprap: Average Diameter:_____ ☐ ☐ ☐ ☐

(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no))

Notes:_____

_____

☐ Concrete (bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location:_____

Notes/Causes:_____

_____

☐ Mis-Alignment:_____ ☐ ☐ ☐ ☐

Location/Description:_____

Notes/Causes:_____

_____

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐

Location/Description:_____

Notes/Causes:_____

_____

☐ Undermining: ☐ ☐ ☐ ☐

Location/Description:_____

Notes/Causes:_____

_____

Required Action

☐ Other:_____ ☐ ☐ ☐ ☐

Notes:_____

_____

None | Monitor | Maintenance | Engineer

APPENDIX 5: EMBANKMENT DAM FAILURE MODES AND RISK FACTORS

Failure Modes of Embankment Dams

IDNR classifies dam failures in two categories: Type 1, component failure of a structure that does not result in a significant reservoir release; and, Type 2, uncontrolled breach failure of a structure that results in a significant reservoir release.

Type 1 failures include localized seepage and structural failures of dam components that do not breach the dam into the reservoir. Type 1 failures are generally local failures of a dam feature, such as an embankment slide that does not breach the crest, a spillway structural failure, a piping condition in its early stage of formation, a trash rack failure, or settlement on an earth dam embankment that does not extend to the water level. Type 1 failures are critical, require immediate attention, and may lead to a Type 2 failure. However, they do not result in a significant release of reservoir water and generally do not pose an immediate dam safety risk.

Type 2 failures are failures that do result in a significant release of the reservoir and may eventually result in a dam breach with total release of the reservoir. There are three general categories of Type 2 failures: (1) hydraulic failures, (2) seepage failures, and (3) structural failures. Type 2 failures often result from Type 1 failures that were improperly corrected or were ignored.

Embankment dams have three potential modes for Type 2, uncontrolled breach failure:

1. hydraulic failure (dam overtopping, wave erosion, dam toe erosion, severe erosion)
2. seepage failure (pervious reservoir rim or bottom, pervious foundation, pervious dam, leaking conduits, cracks in dam, piping through dam or along conduits, inappropriate vegetation, windblown trees, animal burrows)
3. structural failure (dam and foundation slides, dam failure, dam settlement, spillway cracks or failure)

The presence of any of these conditions poses a degree of risk for dam failure, however, failure typically will not occur until the conditions become severe enough to allow water to flow out of the reservoir in an uncontrolled manner. Therefore, when the dam deficiencies are minor and do not threaten the stability or safety of the dam, the risk of dam failure is low. If the deficiencies are serious and do pose a likely threat to the dam safety, the risk of dam failure is high.

Risk Factors that can Cause Dam Failure

The factors that pose a risk to embankment dams can be categorized into four groups:

1. structural factors (design, construction, and condition of embankment, foundation, abutments, and spillways)
2. natural factors (earthquakes, storms, floods, landslides, sedimentation)
3. human factors (vandalism, terrorism, mistakes, operational mismanagement)
4. operating factors (poor maintenance practices, lack of operator training, poor access, lack of proper inspection program, reliability of electrical and mechanical equipment)

For purposes of this report, the potential risk of dam failure is defined as follows:

Low risk – the dam or its appurtenant works has a minor deficiency that does not pose an imminent threat to the dam safety. However, if left unattended, these deficiencies may progress and ultimately lead to a dam failure. Low risk conditions should be monitored and/or repaired within 4 years. If the deficiency is minor and is progressing very slowly, it may be appropriate to monitor the condition, and reassess it every year. In some cases, it may be appropriate to complete the repairs immediately and be done with it. If the dam is a high hazard dam, a shorter time limit for performing low risk repairs may be warranted to ensure that the work will be completed before the next formal technical safety inspection. Repairs or correction of low risk deficiencies are

typically a low priority. A minor deficiency with a low risk of dam failure may be assigned a medium priority repair schedule if the deficiency makes it impossible or difficult to perform a visual inspection. An example of this is excessive vegetation of the embankment; the excessive vegetation may present a low risk of dam failure, but because it prevents a proper visual inspection, removal of the brush may be assigned a medium or high priority.

Medium risk - the dam or its appurtenant works has a deficiency that lies between minor and serious. Medium risk conditions should be corrected as soon as possible, but no later than 3 years. Corrective repairs may need to be performed sooner if the deficiency is progressing rapidly. Repairs or correction of medium risk deficiencies are typically a medium priority.

High risk – the dam or its appurtenant works has a severe deficiency that poses an imminent threat to the dam safety. The dam will fail if the deficiency is not corrected. High risk conditions must be corrected within 1 year. Repairs or correction of high risk deficiencies are typically a high priority.

The risk assessment should always be tempered with the potential downstream safety hazards. A minor deficiency on a low hazard dam may have a lower priority for repair than the same deficiency on a high hazard dam.