

KEYSTONE WOODS LAKE DAM (29-5)

2025 Dam Safety Inspection Report

Hamilton County, IN | November 2025

Inspection Date: July 25, 2025



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DISCLAIMER

This report was prepared by Christopher B. Burke Engineering, LLC (Burke) for the Woodlands Home Owners Association, Inc. (WHOA) for Keystone Woods 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

Keystone Woods Lake Dam (State ID 29-5), also referred to as Woodland Addition Lake Dam, is located half a mile east of Keystone Parkway between East 106th Street and East 116th Street in Carmel, Indiana. It is located in Section 5, Township 17N, Range 4E of the Public Land Survey System (PLSS) as shown on the Fishers United States Geological Survey (USGS) Quadrangle Map. The dam is an earthen embankment constructed across a tributary to Blue Woods Creek. The dam is collectively owned by Woodland Home Owners Association, Inc (WHOA) and adjacent private properties as referenced in a letter from the Indiana Department of Natural Resources (IDNR) dated July 31, 2020. See **Appendix 1**.

According to Indiana Department of Natural Resources (IDNR) records, Keystone Woods Lake Dam was constructed immediately downstream of Lake Woodland Dam, an unpermitted structure constructed in the late 1960's, for recreation and residential aesthetics. Records indicate that the embankment is approximately 14 feet high and 420 feet long, not including the auxiliary spillway. The crest is approximately 10 feet wide. The total surface area is about 53 acres which includes the upstream lake. For the purpose of this inspection report, overall spillway capacity, and recommendations, it is the opinion of Burke that the two lakes be considered one. The principal spillway is comprised of a 2.5-foot by 5-foot reinforced concrete drop inlet box with a 24-inch diameter discharge pipe. The auxiliary spillway is a 108-foot-wide open channel constructed on fill and lined with gravel and riprap.

Burke personnel performed a visual dam safety inspection of Keystone Woods Lake Dam on July 25, 2025. The inspection was performed by Joshua L. Erwood, P.E. and Cassidy G. Hoback, E.I. both having dam safety experience. The July 25, 2025, dam safety inspection revealed that the overall condition of the dam is considered "**Conditionally Poor**" based on IDNR rating criteria. This rating is primarily driven by the spillway capacity uncertainties for a dam with high hazard classification and lack of a geotechnical engineering investigation. High hazard dams in Indiana must safely pass runoff from the 100% PMP storm event. There are no records of a geotechnical investigation that includes subsurface soil testing, slope stability calculations, and seepage analysis.

Further analysis and rehabilitation of the dam is needed to address surficial deficiencies and apparent lack of spillway capacity. Monitoring, maintenance, repairs, engineering analyses, and improvements are required to achieve an overall "Satisfactory" rating and improve the safety and performance of the dam. The risk of Type 1 and Type 2 dam failure is considered low to medium. The component ratings, overall conditions rating, and recommendations to achieve a "Satisfactory" rating are summarized in the table on the next page. **Appendix 2** contains the IDNR Dam Inspection Report Form completed by Burke for the 2025 safety inspection.



| Component | Rating | Recommendations | Schedule | Importance |
|--------------------|------------|--|----------------|------------|
| Upstream Slope | Deficient | Remove trees and brush from the slope and within 25 feet of the slope and abutments in accordance with the Indiana Dam Safety Inspection Manual | Within 1 year | Medium |
| | | Replace gravel covered slope with grass, riprap or other erosion resistant material | Within 1 year | Medium |
| | | Relocate watercraft, docks, and furniture off the dam embankment and onto natural ground | Immediately | Low |
| | | Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual | Ongoing | Low |
| | | Monitor right side wooden seawall for deflection and deterioration; notify a registered professional engineer of observed changes | Ongoing | Low |
| | | Seed bare areas and repair divots along slope | Within 2 years | Low |
| | | Restabilize and armor scarp forming in bush on left side | Within 1 year | Medium |
| Crest | Deficient | Remove trees and brush from the crest in accordance with the Indiana Dam Safety Inspection Manual | Within 1 year | Medium |
| | | Remove concrete patio in its entirety and reestablish dam crest elevation by backfilling with appropriate embankment fill or perform an engineering evaluation to confirm structural integrity of feature and potential impact on the embankment | Within 1 year | High |
| | | Remove encroaching fire pits, debris piles, garden bed and landscaping from dam crest. | Within 2 years | Low |
| Downstream Slope | Deficient | Remove trees and brush from the slope and within 25 feet of the slope and abutments in accordance with the Indiana Dam Safety Inspection Manual | Within 1 year | Medium |
| | | Remove landscaping, decks, steps, and other encroachments and backfill as necessary with appropriate embankment fill or perform an engineering evaluation to confirm structural integrity of feature and potential impact on the embankment | Within 2 years | Medium |
| | | Seed sporadic bare areas along slope | Within 2 years | Low |
| Seepage | Good | Monitor downstream slope and around concrete patio, steps, and decks for evidence of seepage; notify a registered professional engineer of observed changes | Ongoing | Low |
| | | Monitor backyards of properties on right side of dam and avoid over irrigation creating saturated ponding areas. | Ongoing | Low |
| Principal Spillway | Acceptable | Clean and paint metal trash rack | Immediately | Low |
| | | Keep inlet trashrack clear of debris and remove debris accumulation as needed | Ongoing | Low |
| | | Remove tree stumps around outlet | Within 1 year | Low |
| | | Cover exposed geotextile at outlet | Within 1 year | Low |
| | | Remove and replace metal end section at outlet | Within 2 years | Low |

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| Component | Rating | Recommendations | Schedule | Importance |
|-------------------------|--------------------|--|----------------|------------|
| Auxiliary Spillway | Deficient | Retain a qualified professional engineer to appropriately size riprap or other armoring to the spillway inlet section for installation of erosion protection and to establish a uniform crest elevation | Within 1 year | High |
| | | Seed bare spots on left side | Within 2 years | Low |
| | | Evaluate options for removal of the large tree stump on left side and other tree stumps on right side in riprap; monitor areas adjacent to the stumps for seepage or other surficial deficiency monthly and/or after large rain events and notify a registered professional engineer of observed changes | Within 1 year | Low |
| | | Monitor start of headcut in the middle of the spillway and any overflow until inlet riprap installation is completed | Ongoing | Low |
| | | Spray and remove vegetation growing within spillway | Within 1 year | Low |
| Maintenance and Repairs | Deficient | Perform spillway capacity analysis in accordance with current IDNR requirements | Immediately | High |
| | | Retain a geotechnical engineer to evaluate the stability of the dam under various loading conditions | Within 2 years | High |
| | | Develop an Incident and Emergency Action Plan per Indiana Code 14-27-7.5-18 and update the plan on an annual bases | Immediately | High |
| | | Conduct a video inspection of the principal spillway outlet pipe; subsequent inspections should be performed every six years | Immediately | Low |
| | | Multiple owners to work to resolve dam inspection recommendations | Ongoing | High |
| 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

Keystone Woods Lake Dam (29-5) also referred to as Woodland Addition Lake Dam, is an earthen embankment across a tributary to Blue Woods Creek constructed for aesthetic and recreational purposes. The dam is located in Carmel, Indiana about a half mile east of Keystone Parkway between East 106th Street and East 116th Street. It is located in Section 5, Township 17N, Range 4E of the Public Land Survey System (PLSS) as shown on the Fishers USGS Quadrangle Map. The dam is collectively owned by Woodland Home Owners Association, Inc (WHOA) and adjacent private properties as referenced in a letter from the Indiana Department of Natural Resources (IDNR) dated July 31, 2020. See **Appendix 1**. The dam is classified as high hazard by IDNR.

1.2 FILE REVIEW

Unless otherwise noted, information presented in this report is from the visual inspection, a review of information contained in IDNR files, Burke's files, aerial photography, topographic information, and maps publicly available through the Indiana Spatial Data Portal or Indiana Map. 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:

- *Woodland Addition Lake Dam Phase I Inspection Report*, prepared by GRW Engineers, Inc. for the United States Army Corps of Engineers (USACE) - Louisville District (1980)
- *Hydraulics and Hydrology for Woodland Addition Lake Dam*, prepared by Clyde E. Williams and Associates, Inc. (1983)
- High Hazard Dam Inspection Report Keystone Woods Lake Dam, prepared by Cosmopolitan Consulting Engineers, Inc. (2004)
- Keystone Woods Lake Dam Inspection Biennial Inspection Report, prepared by Fink Roberts & Petrie, Inc. (FRP) (2009, 2011)
- Dam Inspection Report Keystone Woods Lake Dam, prepared by VHW Engineering Company (2016)
- Dam inspection reports and correspondence prepared by IDNR from 1981 to 2015.
- High hazard dam inspections performed by Burke (2019, 2021, and 2023)
- "Wabash Valley Seismic Zone". Central United States Earthquake Consortium. Accessed 13 August 2025 <<https://cusec.org/wabash-valley-seismic-zone/>>.
- 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, NEHRP Site Class D". United States Geological Survey. Accessed 13 August 2025 <<https://www.sciencebase.gov/catalog>>.
- "Earthquake Hazard Maps". Federal Emergency Management Agency. Accessed 13 August 2025. <<https://www.fema.gov/earthquake-hazard-maps>>.

1.3 HISTORY OF THE DAM

According to IDNR records, Lake Woodland Dam, located upstream of Keystone Woods Lake Dam, was constructed without permit approval in the late 1960's by developer Ralf Wolfong and his engineer Ken Thompson. Shortly after the construction of Lake Woodland Dam, Ken Thompson formed a partnership with John Schutz called Schutz & Thompson, Inc. Schutz & Thompson purchased the land south of Lake Woodland Dam to develop The Woodlands subdivision. In July 1972, Schutz & Thompson received approval from IDNR, under Docket No. D-3086, for construction of Keystone Woods Lake Dam, referred to at that time as Woodlands Addition Lake Dam. The engineer of record was Clyde E. Williams &



Associates, Inc. (CW). The dam was reportedly constructed between 1973 and 1974 without supervision from the design engineer. The contractor who constructed the dam is unknown.

The 1980 Phase 1 report outlined discrepancies between their measurements and the documents of record. The report indicated that the as-built dam crest was 1.8 feet lower than the approved design plans and that the spillways would only be able to safely pass 38% of the Probable Maximum Flood (PMF). In 1983, CW completed a hydrologic and hydraulic evaluation for modifications to the dam and spillway to address the inadequate spillway capacity noted in the Phase 1 report. Plans and technical specifications for raising the embankment crest, lowering the principal spillway crest, widening the auxiliary spillway, and lowering the auxiliary spillway crest were prepared by CW. Approval for construction of these modifications was issued by IDNR in March 1984 under Docket No. D-3086 (revised I). Construction of these modifications was apparently completed in November 1984 by an unknown contractor.

The 2003 Labor Day flood event resulted in significant erosion from activation of the auxiliary spillway. Following the event, the erosion in the auxiliary spillway was backfilled with clay and armored with riprap. In a June 2005 letter to WHOA in response to receiving the 2004 biennial inspection report which documented the 2003 Labor Day flood, IDNR recommended that a new hydrologic and hydraulic analysis be performed to address variations in drainage area previously determined as well as evaluate the anticipated performance of erosion protection through the auxiliary spillway during maximum discharge. No records of these evaluations were found.

In April 2015, a sinkhole formed above the principal spillway. A subsequent video inspection of the principal spillway outlet pipe revealed a hole in the bottom of the pipe likely to have contributed to the sinkhole. Due to the emergency nature of this condition, Burke submitted a letter request to IDNR on April 10, 2015, for Construction in a Floodway Permit approval in lieu of the formal permit application. Approval from IDNR was issued on April 15, 2015, referencing CTS-3965-Basin 14-Hamilton County Unnamed Tributary Blue Woods Creek. Midwest Mole, Inc. slip-lined the 42-inch diameter corrugated metal pipe (CMP) with a 24-inch diameter HOBAS centrifugally cast fiberglass reinforced polymer mortar (CCFRPM) pipe and backfilled the sinkhole. The work was considered substantially complete on October 8, 2015.

Following the 2019 dam safety inspection, WHOA facilitated several meetings with the other dam owners to review the recommendations from the 2019 dam safety inspection. WHOA prepared a drawdown plan for the lake, which was reportedly kept on file in the clubhouse. WHOA also significantly improved the areas around the principal spillway outlet and auxiliary spillway channel in November 2019 and April 2020, removing trees, brush, and unwanted vegetation encroachments. In addition, watercraft previously stored with the auxiliary spillway channel were removed. In July 2020, Wharff Excavating, LLC installed geotextile blankets and riprap armoring to the spillway channel and side slopes. At the principal spillway outlet, the deteriorated concrete outlet channel was replaced with riprap armoring and adjacent eroded areas were repaired.

In August 2020, a portion of the timber seawall along the right side of the dam deteriorated and sloughed into the lake. The property owner, in conjunction with WHOA, contacted IDNR with their plan to replace approximately 24 feet of the seawall with new 6-inch by 6-inch treated posts similar in nature to the original wall. Due to the urgency of the repair, IDNR did not require a formal permit submittal. The work was completed by Outdoor Designs, Inc. shortly thereafter.

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 one (1) time every two (2) years and submit a report regarding the structure's condition. Prior to enactment of the code in 2002, Keystone Woods Lake Dam was inspected by IDNR nearly every year from 1984 through 1991. IDNR then performed inspections in 1995, 1997, and 2000. The dam was inspected by Cosmopolitan Consulting Engineers, Inc. in 2004.



Fink Roberts and Petrie, Inc. inspected the dam in both 2009 and 2011. VHW Engineering Company inspected the dam in 2016. Burke performed the inspections in 2019, 2021, and most recently in 2023.

Table 1 is a summary of the component ratings and overall condition ratings from the most recent dam inspections based on IDNR criteria.

Table 1: Previous Inspection Ratings (2004 - 2023)

| Component | Condition Ratings Per Inspection | | | | | | |
|---------------------------|----------------------------------|-------------|-------------|-------------|-------------|---------------------------|---------------------------|
| | 2004 | 2009 | 2011 | 2016 | 2019 | 2021 | 2023 |
| Upstream Slope | Acceptable | Acceptable | Acceptable | Good | Deficient | Deficient | Deficient |
| Crest | Acceptable | Acceptable | Acceptable | Deficient | Deficient | Deficient | Deficient |
| Downstream Slope | Acceptable | Acceptable | Acceptable | Acceptable | Deficient | Deficient | Deficient |
| Seepage | Good | Acceptable | Acceptable | Acceptable | Good | Good | Good |
| Principal Spillway | Good | Acceptable | Acceptable | Acceptable | Deficient | Acceptable | Acceptable |
| Auxiliary Spillway | Good | Deficient | Deficient | Deficient | Deficient | Deficient | Deficient |
| Maintenance and Repairs | Acceptable | Acceptable | Acceptable | Acceptable | Deficient | Deficient | Deficient |
| Overall Conditions | Satisfactory | Fair | Fair | Fair | 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

1.5 HISTORICAL EVENTS

The 2003 Labor Day event resulted in activation of the auxiliary spillway and erosion damage downstream. There were no other major historical events or records of peak water levels or discharges at the site noted in IDNR's file.

1.6 EMERGENCY PREPAREDNESS

Keystone Woods Lake Dam is classified 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). Although there is mention in the 2009 inspection report by FRP of an Emergency Action Plan having been prepared, no document was found in either IDNR's file or the owner's file. An approximate dam failure flood inundation map was prepared in December 2020 by Burke as part of the IDNR initiated 2019 Dam Safety Grant Program. The dam is accessed by foot since there are no roads leading to the dam. No auxiliary power is necessary because the dam and spillways do not have electrical components. In 2019, the owner reportedly prepared a drawdown plan that is kept in the clubhouse, however this document has not been reviewed by Burke.

1.7 HYDROLOGY

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 Keystone Woods Lake Dam watershed, the 6-hour PMP (10 square mile basin) is 26.9 inches. Several hydrologic and hydraulic analyses have been performed with varying results due to differences in watershed size, top of dam and spillway elevations, and rainfall depths. A summary of these analyses is provided below.

The 1972 Engineer's Report for Keystone Woods Lake Dam, prepared by CW, recorded a surface area of approximately 7 acres at normal pool, at an elevation of 774.5 feet mean sea level (MSL), with a corresponding storage volume of 19.2 acre-feet. The contributing watershed was 0.76-square mile (485 acres). Flood routing calculations, performed using a 6-hour rainfall depth of 25.5 inches, resulted in a maximum pool elevation of 779.85 feet (MSL) which is 0.15-foot below the top of dam.

The 1980 Phase 1 report noted a few differences from the original design based on measurements and calculations. The Phase 1 report found the top of dam elevation to be 778.2 feet (MSL), the auxiliary spillway crest to be 774.8 feet (MSL), and the contributing drainage area to be 1.1 square miles. In addition, the Phase 1 report noted that the flood routing should have been evaluated based on a 6-hour rainfall depth of 27 inches. As a result of these differences, the Phase 1 report determined that the overall spillway capacity was inadequate, passing only 38% of the recommended design flood.

In order to address the inadequate spillway capacity determined in the Phase 1 report, CW designed modifications in 1983 that included raising the dam crest to 778.7 feet (MSL), lowering the principal spillway crest to 774.2 feet (MSL), widening the auxiliary spillway eight feet, and lowering the auxiliary spillway crest to 774.6 feet (MSL). CW used a drainage area of 0.67-square mile and a 6-hour rainfall depth of 26.9 inches to determine that the dam could pass 100% of the recommended design flood without overtopping.

It should be noted that the 2015 principal spillway repair work included slip-lining the existing 42-inch diameter CMP with a 24-inch diameter CCFRPM pipe though no hydraulic analysis appears to have been completed.

1.8 GEOLOGIC, SEISMIC AND GEOTECHNICAL CONSIDERATIONS

The following paragraph describing geologic features is from the Phase 1 report:

"The site is located within the limits of the glacial till deposited when the various ice sheets receded. In this area, these glaciers left unconsolidated deposits of granular materials up to 150-ft. thick. The deposits are mostly loam till and are part of the Trafalgar formation. The site is underlain by bedrock of the Devonian period and consists mostly of limestone and dolomite of middle Devonian age. The Fortville Fault is located approximately ten miles to the southeast and extends in the southwesterly-northeasterly direction. The dam is within Seismic Zone 2 according to the Seismic Zone Map of contiguous States. Zone 2 indicates that moderate damage may result from the expected seismic activity."

Original construction drawings for the Keystone Woods Lake Dam include five soil borings that appear to have been taken in the vicinity of the embankment as well as in the lake area. However, no geotechnical engineering evaluation of the structure's stability is known to exist. Geotechnical engineering considerations should be made in accordance with the following 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 the Federal Emergency Management Agency (FEMA), the dam is within the limits of an area where seismic design category (SDC) "A" is applicable. This category is the lowest risk and is described as an area that "very small probability of experiencing damaging earthquake effects." The USGS has determined that the 50-year two-percent probability of exceedance peak ground acceleration



near Keystone Woods Lake Dam is approximately 0.1g, 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 3.2 near Shelbyville in Shelby County on May 8, 1906
- Magnitude 3.8 near Shelbyville in Shelby County on September 12, 2004
- Magnitude 3.8 near Greentown in Howard County on December 30, 2010

Several other earthquakes have occurred in Indiana and Illinois, many since the dam was constructed. The most notable is a magnitude 5.2 that occurred on April 18, 2008, near Mount Carmel, Illinois about 138 miles southwest of Keystone Woods Lake Dam. A magnitude 3.8 earthquake occurred northeast of Montezuma, Indiana on June 17, 2021 about 68 miles southwest of Keystone Woods Lake Dam. Most recently, a magnitude 3.3 earthquake occurred near Lerna, Illinois on May 13, 2025 which is about 120 miles southwest of the dam. All earthquakes noted were reported to the USGS as felt in Hamilton County. There has been no documented damage to Keystone Woods Lake Dam because of earthquakes.

1.9 DAM AND LAKE CHARACTERISTICS

Keystone Woods Lake Dam is an approximately 14-foot-tall earthen embankment that is approximately 420 feet long, not including the auxiliary spillway, and has a crest width of 10 feet. The upstream and downstream slopes are approximately 3:1 (H:V). Although original construction drawings appear to show a toe drain, no outlet was observed in the field. For reference, left and right are based on a view looking downstream. For Keystone Woods Lake Dam, left and right correspond to east and west, respectively.

The principal spillway is comprised of a 2.5-foot by 5-foot reinforced concrete drop inlet box with an approximately 70-foot long, 24-inch diameter CCFRPM outlet pipe located near the center of the dam. The 24-inch CCFRPM pipe is slip lined within the original 42-inch CMP. Four anti-seep collars were constructed along the pipe with 10-foot spacing downstream of the drop inlet structure. The outlet pipe discharges into an armored channel consisting of a short CMP section at the upstream end followed by gabion mattresses. The auxiliary spillway is a 108-foot-wide open channel constructed on fill and lined with gravel and riprap located adjacent and to the left of the principal spillway.

The total surface area of the lake is about 53 acres which includes the upstream impoundment. For the purpose of this inspection report, overall spillway capacity, and recommendations, it is the opinion of Burke that the two lakes be considered one due to the uncertainties associated with current condition of the upstream embankment as well as the hydraulic connectivity between the lakes.

1.10 DRAWDOWN SYSTEM

The dam does not have permanent drawdown capability.



1.11 DOWNSTREAM FEATURES

The valley downstream of the dam is relatively broad and flat. The channel downstream known as Blue Woods Creek goes through a wooded area between tennis courts and a community swimming pool before it is piped under Lakeshore Drive East. The creek continues through residential and industrial areas for approximately 2.7-miles until its confluence with White River. Several houses located along Blue Woods Creek are likely within the dam breach inundation area.

2.0 OBSERVED CONDITIONS

Burke personnel performed a visual dam safety inspection of Keystone Woods Lake Dam on July 25, 2025. The inspection was performed by Joshua L. Erwood, P.E. and Cassidy G. Hoback, E.I., both having dam safety experience. The weather conditions during the inspection were cloudy with occasional light rain with a temperature of approximately 80 degrees Fahrenheit. The principal spillway was engaged at the time of the inspection with the lake level being about 1-inch above normal pool. The auxiliary spillway had trickle flow going through it at the time of the inspection.

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 2**. A copy of the IDNR Inspection Report Form from the previous biennial inspection (2023) is provided in **Appendix 3**. Refer to **Appendix 4** for photographs taken the day of the inspection. **Appendix 5** contains the dam inspection checklist completed during the inspection. Refer to the **Exhibits** section of this report for a USGS quadrangle map, aerial photograph site location map, and a summary map with table showing observations from the inspection.

2.1 UPSTREAM SLOPE

The upstream slope is generally grass-covered but has a large area on the left side of the dam that is covered with gravel and weedy vegetation to the shoreline. There is a timber seawall along the upstream slope right of the principal spillway that extends roughly 4 feet above the normal pool elevation. The timber seawall appeared to have a slight deflection toward the lakeside and has weedy vegetation growing through the wall. The left side of the timber seawall is deteriorating and the entire sea wall appears to be rotting below normal pool but could not be inspected thoroughly. A rock seawall, approximately 2.5 feet above the normal pool elevation, is located near the left abutment area with granular rock cover at the base.

There were several encroachments throughout the upstream slope such as a gazebo, docks, fences, watercraft, and patio furniture. In addition, a concrete patio was cut into the embankment near the principal spillway on the right side. The concrete patio had a longitudinal crack across it showing slight settlement into the lakeside of the embankment. The patio crack appears to have been patched since the previous inspection. Trees, brush, and residential landscaped areas were observed sporadically along property lines of owners along the embankment. There are two large diameter trees in the gravel area on the left side of the embankment and another tree on the right side of the dam above the timber seawall.

There is a large bush on the left side near the waterline and one on the right side of the dam. A large bare area and scarp was observed inside of the bush on the left side of the dam which is next to an old irrigation spigot. Burrow holes are also around this bush. A small surficial divot was found adjacent to the bush on the left side. On the left side are two sections of a wooden dock that prevented a thorough inspection with tall grass growth within shoreline riprap. A few animal burrows about 1-inch in diameter were noted near the fence on the left side of the dam and behind the timber seawall on the right side. A slope measurement was taken on the right side using an inspection rod and tape to be 3:5:1 (H:V). "No Trespassing" signage was posted on the slope near left side of the auxiliary spillway channel. The upstream slope was considered "**Deficient**" according to IDNR rating criteria.



2.2 CREST

Grass cover on the crest was generally adequate. The crest width was measured by tape to be 22 feet wide on the left side and 18 feet wide on the right side. Several fence lines traverse the dam between property limits. A garden bed encroaching near the right abutment. There are two fire pits encroaching on both sides of the dam. A woody debris pile was located next to the left side fire pit. There are trees and bushes near both right and left abutments along fences. A landscaped area and a stored watercraft were observed near the fence on the left side of the embankment. The concrete patio built into the embankment right of the principal spillway has resulted in a loss of crest width and freeboard. The loss of freeboard was estimated to be about 6 to 12 inches. The crest was considered **"Deficient"** according to IDNR rating criteria.

2.3 DOWNSTREAM SLOPE

The downstream slope was adequately covered with grass except for a few minor bare spots. One bare area was next to the raised garden bed at the right abutment and another on the right side near the toe of slope in an area of poor surface drainage. The property on the right side had several saturated areas along the slope and at the toe. The wet areas are likely due to yard irrigation and poorly drained areas. Trees and brush were observed growing on and within 25 feet of the downstream slope at two areas on the middle-left embankment. Trees and brush were also observed near the left and right abutments. Brush was observed along the property line near the principal spillway outlet. Several encroachments were observed on the right side of the dam including landscaping, fencing, stone stairway, and a wooden deck. A landscaped area with trees and bushes was observed near the fence on the left end. Several of the landscaped features have been excavated into the slope removing embankment fill in some areas. Slope measurements were taken on the right and left sides using an inspection rod and tape to be 3:5:1 and 4:1 (H:V) respectively. The downstream slope was considered **"Deficient"** according to IDNR rating criteria.

2.4 SEEPAGE

The right side of the dam had multiple areas of dampness and standing water in the backyards of some houses likely caused by recent rainfall and over irrigation. It appears that the natural ground in many of the wet areas was above normal pool. Seepage was considered **"Good"** according to IDNR rating criteria.

2.5 PRINCIPAL SPILLWAY

The visible portions of the principal spillway concrete riser structure showed minor surface deterioration, consistent with its age, with a thin layer of dried film from operation. A smaller diameter pipe was observed directly across from the outlet pipe, near the bottom of the riser, though it appears to have been capped and no longer operational. Minor surface rust was observed on the inlet's metal trash rack. Very minor leafy debris has accumulated on the inlet trash rack. The metal end section at the outlet has a rusted invert and holes on the side with some vegetation growing through. The outlet was observed to have tree stumps around it and areas of exposed geotextile fabric. The interior of the outlet pipe itself could not be thoroughly, though, it should be noted that the reduction in cross sectional area of the pipe during the 2015 slip-lining work has likely reduced its capacity. The principal spillway was considered **"Acceptable"** according to IDNR rating criteria.

2.6 AUXILIARY SPILLWAY

The open channel auxiliary spillway is located near the center of dam and appears to have been constructed on fill. The surface of the channel is covered in gravel and riprap which was observed to be very sparse at the inlet section. Aquatic vegetation is growing along the inlet section of the spillway. There was a large tree stump left over from tree removal on the left side and a few smaller tree stumps



within the riprap on the right side. A few small bare spots were observed on the left side slope at the interface with the downstream slope. A tree stump with woody debris is surrounded by tall grass growth on the left side. A headcut noted previously in the middle of the auxiliary spillway due to periodic flow has continued to propagate. Trickle flow was going through this low headcut area over the spillway crest at the time of the inspection. Significant weedy vegetation growth has developed within the riprap of the entire spillway channel. Signage has been posted along the spillway to deter those using the lake recreationally from moving the riprap. As noted previously, there is uncertainty with the spillway system's (principal spillway and auxiliary spillway) ability to safely pass the runoff from the 100% PMP storm event without overtopping the embankment. The auxiliary spillway was considered "**Deficient**" according to IDNR rating criteria.

2.7 MAINTENANCE AND REPAIRS

Although Keystone Woods Lake Dam has seen recent improvement regarding maintenance and repairs, vegetation is starting to encroach on some of the previously completed repairs. Several natural and manmade encroachments remain that will require enhanced monitoring, additional studies, removal and/or rehabilitation. In particular, trees, brush, and landscaping located on several portions of the dam. The concrete patio cut into the embankment effectively lowers the crest elevation of the dam. Further, critical analyses are needed to determine the actual spillway capacity and factors of safety for embankment slope stability in accordance with IDNR guidelines.

Based on the 2019 dam safety inspection review letter from IDNR dated July 31, 2020, multiple properties have been identified as owning parts of the dam. When there are multiple owners of a dam, no one party has authority to conduct work, limiting the dam from receiving proper maintenance. Thus, all owners have to work together to remedy dam safety issues. Keystone Woods Lake Dam was considered to be maintained in "**Deficient**" condition according to IDNR rating criteria.

2.8 OVERALL CONDITION

The overall condition of Keystone Woods 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 dam 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 with uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency; further investigations and studies are necessary". This rating primarily reflects uncertainties in spillway capacity and embankment stability as well as encroachments, both manmade and natural.

3.0 RISK OF DAM FAILURE

Burke utilized the results of the dam inspection to evaluate the potential for failure of Keystone Woods 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 6** for more details of types of failure and definitions of risk levels. Burke evaluated the risk for both types of failures.

3.1 RISK OF DAM COMPONENT FAILURE (TYPE 1)

Burke evaluated the risk for Type 1 component failure at Keystone Woods 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 | Medium |
| Downstream slope | Medium |
| Embankment crest | Medium |
| Principal spillway | Low |
| Auxiliary spillway | Medium |
| Dam abutments | Low |

3.2 RISK OF UNCONTROLLED BREACH FAILURE (TYPE 2)

Burke evaluated the potential for an uncontrolled breach failure of Keystone Woods Lake Dam after the inspection was completed by considering possible failure modes. Embankment dams such as Keystone Woods 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 6 for more information about failure modes and risk factors. **At the present time, Keystone Woods Lake Dam appears to have a low to medium risk for uncontrolled breach failure.**

Structural deficiencies were observed during the inspection that pose a low to medium risk of Type 2 failure of Keystone Woods Lake Dam. Structural factors are summarized below.

| Structural factors | Risk Level | Failure Mode |
|---|-------------------|----------------------|
| Vegetation on embankment crest and slopes | Low | Structural/Seepage |
| Manmade encroachments on embankment | Medium | Hydraulic/Structural |
| Small animal burrows | Low | Seepage |

Natural, human, and operating risk factors were also considered. Severe storms present a medium risk to Keystone Woods Lake Dam due to the perceived capacity of the lake and spillway system. Earthquakes present a low risk, but the dam's proximity to the Wabash Valley and New Madrid Seismic Zones should not be ignored. **It should be noted that there is always some risk for failure at all dams and that risk cannot be completely eliminated.**

| Natural factors | Risk Level | Failure Mode |
|--------------------------|-------------------|----------------------|
| Severe storms | Medium | 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 Keystone Woods Lake Dam, and Burke's assessment of the priority for repairs of each observed deficiency. Based on inspection findings, Keystone Woods Lake Dam requires monitoring, maintenance, engineering analysis, and improvements to achieve IDNR's "Satisfactory" overall conditions rating. Burke's objective is to make engineering recommendations that minimize the risk of failure to an acceptable level. A summary of the 2025 inspection ratings and recommendations are provided in **Table 2** on the next two pages. **Table 3** on the subsequent page is a summary of inspection ratings from 2009-2025.

The dam owner should consult with a registered professional engineer experienced in dam safety and, if necessary, IDNR, to determine which recommendations require detailed design plans and specifications prepared by a qualified registered professional engineer. Permits from federal, state, or local agencies may be required to perform dam remedial work or repairs, depending on the magnitude of the repairs. In general, routine monitoring and surficial maintenance such as seeding and debris removal do not require plans or permits. Tree and stump removals should be conducted under the supervision of a registered professional engineer due to the importance of proper backfill and compaction. Only qualified contractors should be employed to install necessary measures.



Table 2: Inspection Ratings and Recommendations

| Component | Rating | Recommendations | Schedule | Importance |
|--------------------|------------|--|----------------|------------|
| Upstream Slope | Deficient | Remove trees and brush from the slope and within 25 feet of the slope and abutments in accordance with the Indiana Dam Safety Inspection Manual | Within 1 year | Medium |
| | | Replace gravel covered slope with grass, riprap or other erosion resistant material | Within 1 year | Medium |
| | | Relocate watercraft, docks, and furniture off the dam embankment and onto natural ground | Immediately | Low |
| | | Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual | Ongoing | Low |
| | | Monitor right side wooden seawall for deflection and deterioration; notify a registered professional engineer of observed changes | Ongoing | Low |
| | | Seed bare areas and repair divots along slope | Within 2 years | Low |
| | | Restabilize and armor scarp forming in bush on left side | Within 1 year | Medium |
| Crest | Deficient | Remove trees and brush from the crest in accordance with the Indiana Dam Safety Inspection Manual | Within 1 year | Medium |
| | | Remove concrete patio in its entirety and reestablish dam crest elevation by backfilling with appropriate embankment fill or perform an engineering evaluation to confirm structural integrity of feature and potential impact on the embankment | Within 1 year | High |
| | | Remove encroaching fire pits, debris piles, garden bed and landscaping from dam crest. | Within 2 years | Low |
| Downstream Slope | Deficient | Remove trees and brush from the slope and within 25 feet of the slope and abutments in accordance with the Indiana Dam Safety Inspection Manual | Within 1 year | Medium |
| | | Remove landscaping, decks, steps, and other encroachments and backfill as necessary with appropriate embankment fill or perform an engineering evaluation to confirm structural integrity of feature and potential impact on the embankment | Within 2 years | Medium |
| | | Seed sporadic bare areas along slope | Within 2 years | Low |
| Seepage | Good | Monitor downstream slope and around concrete patio, steps, and decks for evidence of seepage; notify a registered professional engineer of observed changes | Ongoing | Low |
| | | Monitor backyards of properties on right side of dam and avoid over irrigation creating saturated ponding areas. | Ongoing | Low |
| Principal Spillway | Acceptable | Clean and paint metal trash rack | Immediately | Low |
| | | Keep inlet trashrack clear of debris and remove debris accumulation as needed | Ongoing | Low |
| | | Remove tree stumps around outlet | Within 1 year | Low |
| | | Cover exposed geotextile at outlet | Within 1 year | Low |
| | | Remove and replace metal end section at outlet | Within 2 years | Low |

Table Continued on Next Page

Table Continued from Previous Page

| Component | Rating | Recommendations | Schedule | Importance |
|-------------------------|--------------------|--|----------------|------------|
| Auxiliary Spillway | Deficient | Retain a qualified professional engineer to appropriately size riprap or other armoring to the spillway inlet section for installation of erosion protection and to establish a uniform crest elevation | Within 1 year | High |
| | | Seed bare spots on left side | Within 2 years | Low |
| | | Evaluate options for removal of the large tree stump on left side and other tree stumps on right side in riprap; monitor areas adjacent to the stumps for seepage or other surficial deficiency monthly and/or after large rain events and notify a registered professional engineer of observed changes | Within 1 year | Low |
| | | Monitor start of headcut in the middle of the spillway and any overflow until inlet riprap installation is completed | Ongoing | Low |
| | | Spray and remove vegetation growing within spillway | Within 1 year | Low |
| Maintenance and Repairs | Deficient | Perform spillway capacity analysis in accordance with current IDNR requirements | Immediately | High |
| | | Retain a geotechnical engineer to evaluate the stability of the dam under various loading conditions | Within 2 years | High |
| | | Develop an Incident and Emergency Action Plan per Indiana Code 14-27-7.5-18 and update the plan on an annual bases | Immediately | High |
| | | Conduct a video inspection of the principal spillway outlet pipe; subsequent inspections should be performed every six years | Immediately | Low |
| | | Multiple owners to work to resolve dam inspection recommendations | Ongoing | High |
| 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

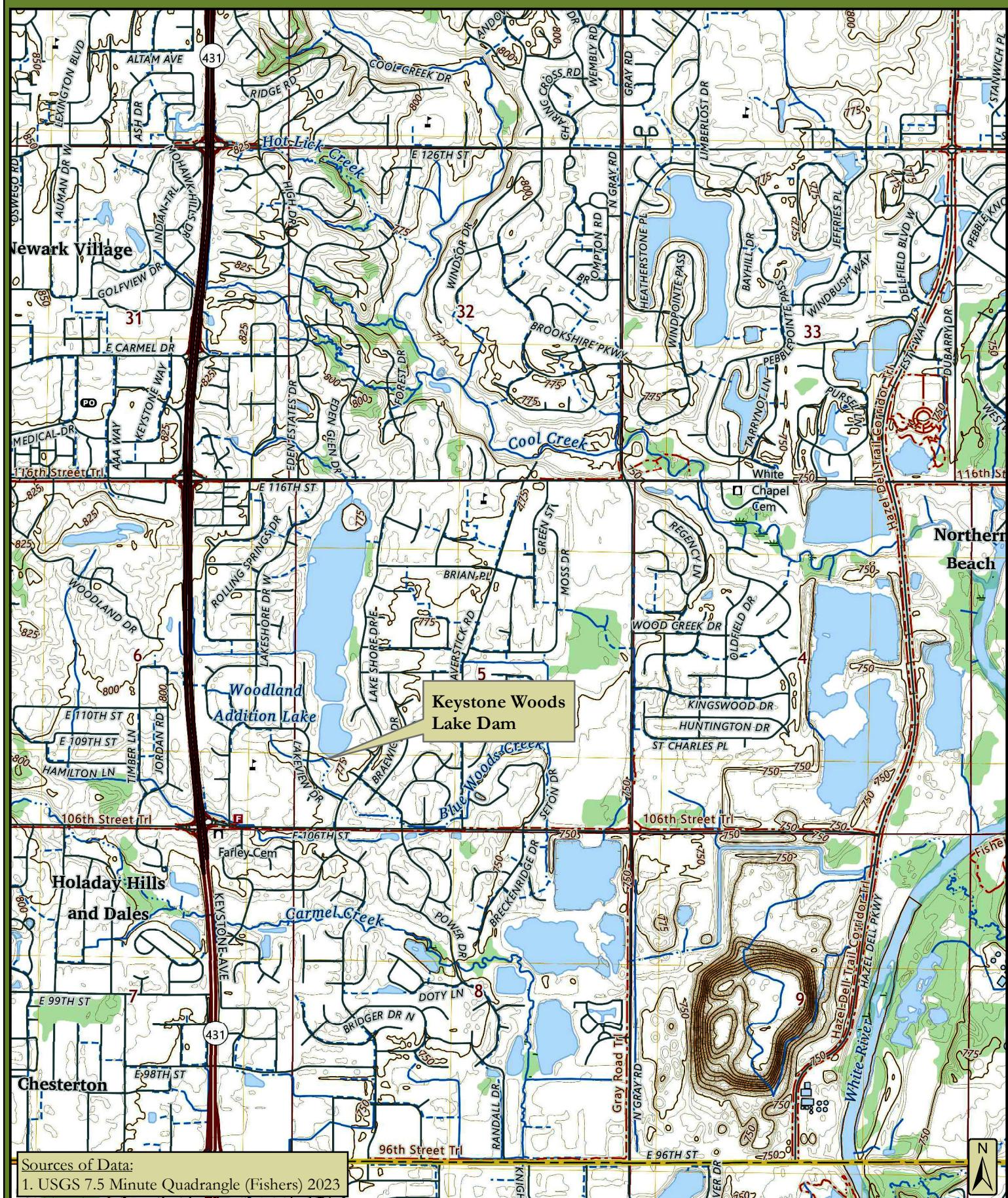
Table 3: Previous Inspection Ratings (2009 - 2025)

| Component | Condition Ratings Per Inspection | | | | | | |
|---------------------------|----------------------------------|-------------|-------------|-------------|---------------------------|---------------------------|---------------------------|
| | 2009 | 2011 | 2016 | 2019 | 2021 | 2023 | 2025 |
| Upstream Slope | Acceptable | Acceptable | Good | Deficient | Deficient | Deficient | Deficient |
| Crest | Acceptable | Acceptable | Deficient | Deficient | Deficient | Deficient | Deficient |
| Downstream Slope | Acceptable | Acceptable | Acceptable | Deficient | Deficient | Deficient | Deficient |
| Seepage | Acceptable | Acceptable | Acceptable | Good | Good | Good | Good |
| Principal Spillway | Acceptable | Acceptable | Acceptable | Deficient | Acceptable | Acceptable | Acceptable |
| Auxiliary Spillway | Deficient | Deficient | Deficient | Deficient | Deficient | Deficient | Deficient |
| Maintenance and Repairs | Acceptable | Acceptable | Acceptable | Deficient | Deficient | Deficient | Deficient |
| Overall Conditions | Fair | Fair | Fair | Poor | 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



Christopher B. Burke Engineering, LLC
 111 Monument Circle, Suite 3500
 Indianapolis, Indiana 46204
 (t) 317.266.8000 (f) 317.632.3306

PROJECT: Keystone Woods Lake Dam
 2025 Safety Inspection

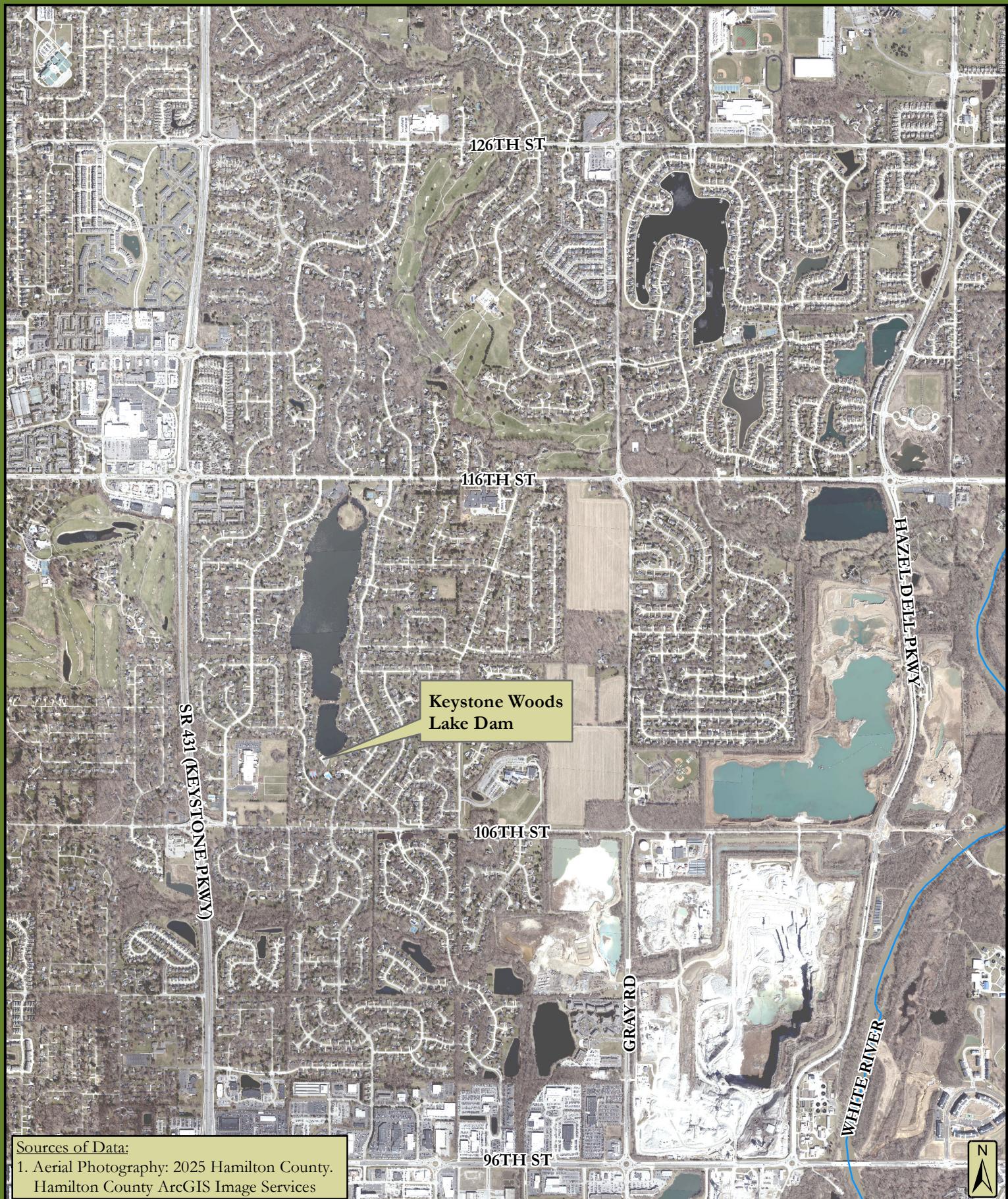
TITLE: USGS Fishers Quadrangle Map

PROJECT NO.
 15-0171

APPROX. SCALE
 1"=2,000'

DATE: 11/2025

EXHIBIT 1



Sources of Data:

1. Aerial Photography: 2025 Hamilton County.
Hamilton County ArcGIS Image Services

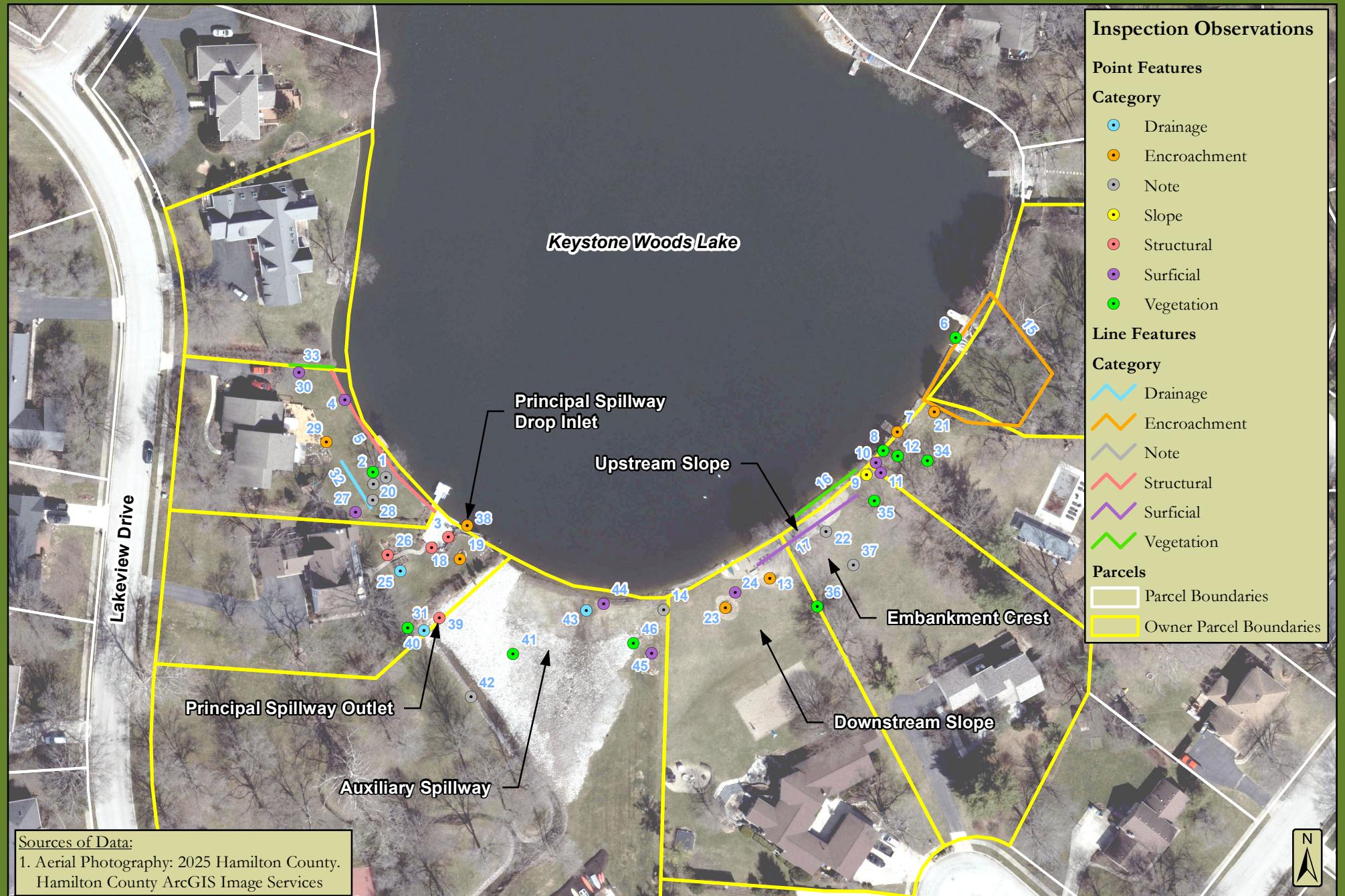


Christopher B. Burke Engineering, LLC
111 Monument Circle, Suite 3500
Indianapolis, Indiana 46204
(t) 317.266.8000 (f) 317.632.3306

| | | | |
|----------|---|------------------------|----------------------------|
| PROJECT: | Keystone Woods Lake Dam 2025 Safety Inspection | PROJECT NO. 15-0171 | APPROX. SCALE 1"=2,000' |
| TITLE: | Aerial Photograph | | |

DATE: 11/2025

EXHIBIT 2



Christopher B. Burke Engineering, LLC
 111 Monument Circle, Suite 3500
 Indianapolis, Indiana 46204
 (t) 317.266.8000 (f) 317.632.3306

PROJECT: Keystone Woods Lake Dam
 2025 Safety Inspection

PROJECT NO.
 15-0171

APPROX. SCALE
 1 " = 100 '

DATE: 11/2025

TITLE:
 Inspection Summary

EXHIBIT 3

| Observation Number | Category | Component | Location | Observation |
|--------------------|--------------|--------------------|------------------|---|
| 1 | Note | Upstream Slope | Right | 3.5:1 slope measurement |
| 2 | Vegetation | Upstream Slope | Right | Tree encroaching |
| 3 | Structural | Upstream Slope | Right | Concrete crack has been patched; concrete patio slab sloped towards lake |
| 4 | Surficial | Upstream Slope | Right | Several 1" diameter burrows behind wall |
| 5 | Structural | Upstream Slope | Right | Tilted wooden seawall with vegetation growing through wall. Wooden sections rotting near water level. |
| 6 | Encroachment | Upstream Slope | Left | Landscaped trees and brush |
| 7 | Encroachment | Upstream Slope | Left | Weathered wooden dock sections with riprap |
| 8 | Vegetation | Upstream Slope | Left | Large bush with irrigation spigot |
| 9 | Slope | Upstream Slope | Left | Bare area eroded and scarped area hidden by large bush. Small burrow holes around bush. |
| 10 | Surficial | Upstream Slope | Left | Surficial divot next to bush |
| 11 | Surficial | Upstream Slope | Left | 4" deep 1" diameter burrow |
| 12 | Vegetation | Upstream Slope | Left | Tall grass around wooden dock |
| 13 | Encroachment | Upstream Slope | Left | Patio furniture, flag pole, and recreational equipment |
| 14 | Note | Upstream Slope | Left | Signage |
| 15 | Encroachment | Upstream Slope | Left | Landscaping; 2' stone sea wall, fenceline, watercraft. |
| 16 | Vegetation | Upstream Slope | Left | Vegetation along shoreline and trees in gravel area |
| 17 | Surficial | Upstream Slope | Left | Gravel cover along shoreline with weeds growing through |
| 18 | Structural | Crest | Right | Patio built into dam |
| 19 | Encroachment | Crest | Right | Fire pit |
| 20 | Note | Crest | Right | 18' width measurement |
| 21 | Encroachment | Crest | Left | Fence line |
| 22 | Note | Crest | Left | 22' width measurement |
| 23 | Encroachment | Crest | Left | Fire pit |
| 24 | Surficial | Crest | Left | Vegetation debris next to fire pit |
| 25 | Drainage | Downstream Slope | Right | Wet spot likely from poor irrigation surface drainage |
| 26 | Structural | Downstream Slope | Right | Stairs and garden bed cut into slope |
| 27 | Surficial | Downstream Slope | Right | Bare spots at toe of slope |
| 28 | Note | Downstream Slope | Right | 3.5:1 slope measurement |
| 29 | Encroachment | Downstream Slope | Right | Landscaping and deck on slope; could not inspect thoroughly |
| 30 | Surficial | Downstream Slope | Right | Bare area by raised bed garden on right abutment |
| 31 | Vegetation | Downstream Slope | Right | Brush around fenceline near principal spillway outlet |
| 32 | Drainage | Downstream Slope | Right | Bare areas and ponding |
| 33 | Vegetation | Downstream Slope | Right | Vegetation along property line |
| 34 | Vegetation | Downstream Slope | Left | Tree and brush within 25' |
| 35 | Vegetation | Downstream Slope | Left | Tree within 25' |
| 36 | Vegetation | Downstream Slope | Left | Tree on toe of slope |
| 37 | Note | Downstream Slope | Left | 4:1 slope measurement |
| 38 | Encroachment | Principal Spillway | Inlet | Principal spillway inlet; light debris in trash rack. Minor surface rust on the inlet trash rack. |
| 39 | Structural | Principal Spillway | Outlet | Outlet pipe, previously sliplined; slight surface rust on metal end section |
| 40 | Drainage | Principal Spillway | Outlet | Outlet; exposed geotextile; tree stumps; vegetation around; 6" standing water; trickle flow |
| 41 | Vegetation | Auxiliary Spillway | Entire Component | Weedy vegetation growing throughout riprap spillway |
| 42 | Note | Auxiliary Spillway | Right | Signage |
| 43 | Drainage | Auxiliary Spillway | Middle | Trickle flow over spillway crest |
| 44 | Surficial | Auxiliary Spillway | Middle | Slight headcut erosion with some bare areas where there is sparse riprap. |
| 45 | Surficial | Auxiliary Spillway | Left | Sporadic bare spots |
| 46 | Vegetation | Auxiliary Spillway | Left | Woody debris and tall grass growth |

APPENDIX 1: 2020 IDNR LETTER TO OWNERS

July 31, 2020

Judith Rouhselang
Woodland Home Owners Association, Inc.
10700 Lakeshore Drive East
Carmel, IN 46033

Jane B & George P Sweet
10807 Lakeview Dr
Carmel, IN 46033

Bree E & Nathan E Simmons
10803 Lakeview Dr
Carmel, IN 46033

Hassan & Christine Kassebnia,
10801 Lakeview Dr
Carmel, IN 46033

Jeffrey R & Gwen V Kempson
45 Stratford Pl
Carmel, IN 46033

Kathryn Kempson
46 Stratford Pl
Carmel, IN 46033

Christopher Lee & Carajane D Moore
50 Beechwood Ct
Carmel, IN 46033

Lynn D & Beth A Eikenberry
51 Beechwood CT
Carmel, IN 46033

Re: High Hazard Dam - 2019 Biennial Inspection Report
Keystone Woods Lake Dam
Dam ID # 29-5 - Hamilton County

Dear Dam Owners,

Over the years, Woodlands Home Owners Association (HOA), Inc. has acted much like an owner of the Keystone Woods Lake Dam's principle spillway system, and have coordinated maintenance and repairs, etc. However, based on a review of the online Hamilton County GIS parcel information, confirmation from the HOA and the engineer involved in inspection, it appears that there are multiple owners of the entirety of the dam embankment and spillway. Please see the attached aerial imagery, available at Hamilton County GIS site that shows the footprint of the dam in black line and the multiple ownership parcels. This letter is being sent to all of you as it appears you each own parts of

Keystone Woods Lake Dam (#29-5)

July 31, 2020

this dam. If you feel that you are not an owner of the dam, you may want to hire a surveyor or an engineer to perform a detailed investigation of your property's title.

Keystone Woods Lake Dam is a **high hazard** dam.

- A high hazard dam is a structure that may cause the loss of life, serious damage to homes, industrial and commercial buildings, or public utilities, or interruption of service to main highways, or railroads.
- Indiana Code 14-27-7.5-9, requires the owner(s) of a high hazard structure to have a licensed professional engineer make an engineering inspection of the high hazard structure at least one (1) time every two (2) years and submit a report of the inspection to IDNR.
- Indiana Code 14-27-7.5-7, requires the owner(s) to maintain and keep the structure in the state of repair and operating condition required by the following: the exercise of prudence; due regard for life and property; and the application of sound and accepted technical principles.
- Indiana Code 14-27-7.5-7, also requires the owner(s) to notify the department in writing of the sale or other transfer of ownership of the structure. The notice must include the name and address of the new owner(s) of the structure.

When there are multiple owners of a dam, often no one party has authority to conduct work, or remove / correct dam safety issues on all the properties that make up the dam and its footprint. All owners then have to figure out how to work together towards the resolution of all dam safety deficiencies.

The electronic report of the biennial inspection for the high hazard rated Keystone Woods Lake Dam was received in this office on November 6, 2019. Jeffrey D. Fox, P.E. – PE11100632 along with Aaron J. Fricke, P.E. – PE11100305 of Christopher B. Burke Engineering, LLC - Indianapolis, performed this biennial inspection on August 5, 2019. Your engineer rated the overall condition of the dam as “Poor CR”.

The “Poor” rating for overall condition means that a potential dam safety deficiency is clearly recognized for normal loading conditions. Immediate actions to resolve the deficiency are recommended. Reservoir restrictions (such as lowered pool and other restrictions) may be necessary until the problem deficiencies are resolved.

In your report, your engineer has expressed the steps needed to correct the conditions needed to bring your overall rating to Satisfactory. Monitoring, maintenance, repairs, engineering analyses, and improvements will help to improve your rating in the future. Please refer specifically to "4.0 Recommendations" on page 9 in the report to review those recommendations. Page 3 of 6 of the Inspection Report Form included in the report also describes and explains the engineer’s recommendations in more detail. We hope that you all have reviewed the document and discussed the results with your engineer. Guidance and advice given by your consulting professional engineer (firm) is most important and valuable.

As per your engineer, the level of maintenance of the dam needs significant improvement. In addition, significant rehabilitation of the dam is needed to address surficial deficiencies and apparent lack of spillway capacity. Continued neglect of maintenance and improvements may threaten the safety of the dam and safety of individuals and properties located below the dam. The next biennial inspection report should include a detailed report of the status of each of engineer recommended tasks, including the dates of completion and detailed description of work performed.

Please take necessary action to remove all manmade encroachments (concrete patio, steps, decks etc.) and also relocate watercraft, equipment and furniture from the dam and spillway.

Keystone Woods Lake Dam (#29-5)

July 31, 2020

Please note the Dam Safety Act, and particularly part (I.C. 14-27-7.5-9) requires a dam owner(s) to perform the recommended maintenance, repairs, or alterations that are necessary to remedy deficiencies in the structure or to maintain the safety of the dam. The attachment to this letter explains the importance of the recommendations and schedules presented by your engineer and the "Overall Condition Rating" system.

Please feel free to send me an e-mail at mmukherjee@dnr.in.gov if you have any questions regarding your dam or this inspection report. Your next biennial inspection is expected to be performed on or before August 5, 2021, and the electronic formal report in bookmarked PDF format should be submitted to this office within 60 days of the actual field inspection date.

Respectfully,

Moumita Mukherjee

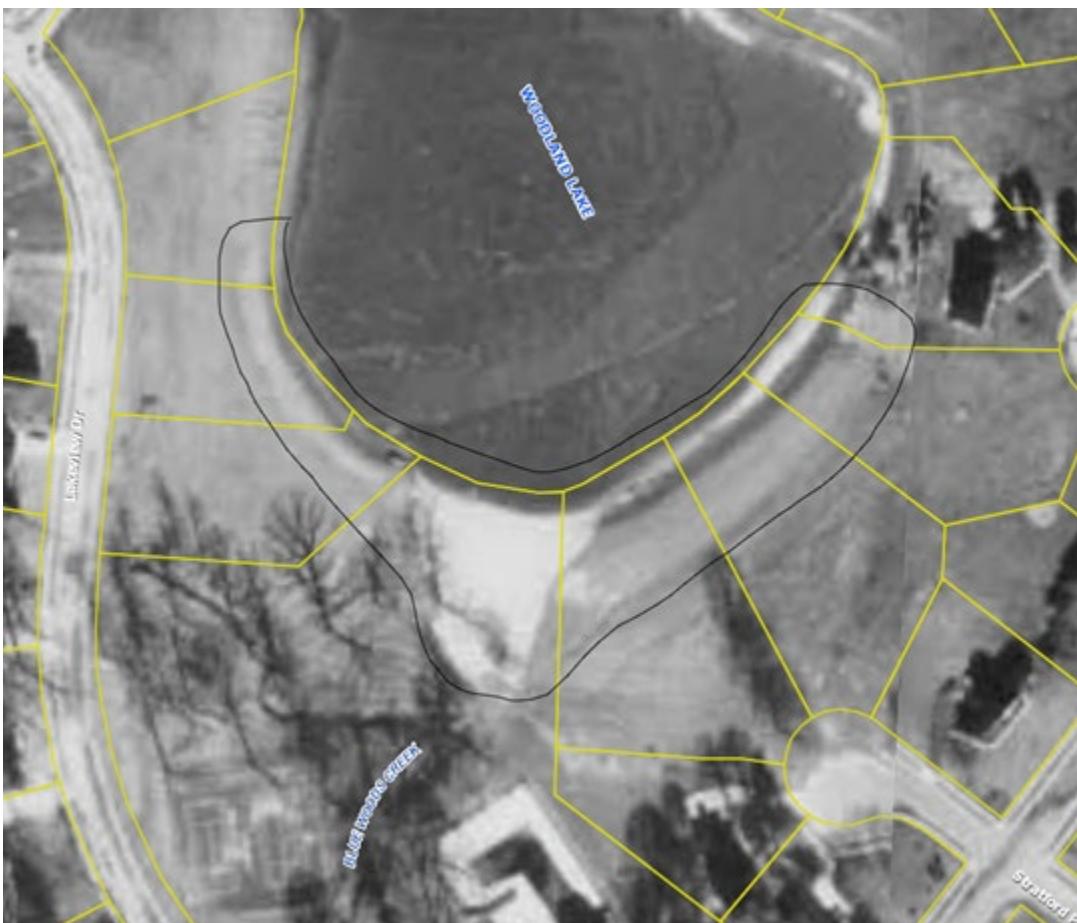
Moumita Mukherjee, Ph.D., P.E.
Manager, Dams & Levee Safety Section
mmukherjee@dnr.in.gov

Attachment: General Information and Guidance

Cc: Christopher B. Burke Engineering Ltd - Indianapolis, IN

Mr. Jon Eggen, Manager, Compliance and Enforcement Section, Division of Water, DNR

Shane Booker, Director, Hamilton County Emergency Management, 18100 Cumberland Rd., Noblesville, Indiana 46060



General Information and Guidance

(A letter attachment)

The Dam Safety Act, and particularly part (I.C. 14-27-7.5-9) places requirements on a dam owner.

IC 14-27-7.5-9 - High hazard structures; inspections; report; duty to make repairs or alterations; notice of violation

Sec. 9. (a) The owner of a high hazard structure shall:

- (1) Have a professional engineer licensed under IC 25-31 make an engineering inspection of the high hazard structure at least one (1) time every two (2) years;*
- (2) Submit a report of the inspection in a form approved by the department to the department. The report must include at least the following information:*
 - (A) An evaluation of the structure's condition, spillway capacity, operational adequacy, and structural integrity.*
 - (B) A determination of whether deficiencies exist that could lead to the failure of the structure, and recommendations for maintenance, repairs, and alterations to the structure to eliminate deficiencies, including a recommended schedule for necessary upgrades to the structure.*

(b) If after an inspection under subsection (a) the licensed professional engineer who conducted the inspection determines that maintenance, repairs, or alterations to a high hazard structure are necessary to remedy deficiencies in the structure, the owner shall perform the recommended maintenance, repairs, or alterations.

Guidance and Considerations - for Scheduled Recommended Tasks

Remember that all recommendations made by your engineer that require ***a change in the characteristics*** of the dam must be performed under the direction of the engineer and only after a Permit for Construction in a Floodway has been obtained from IDNR. Work requiring ***a change in the characteristics*** of the dam is generally, but not all inclusively, those that, (1) alter the hydraulic capacity of the spillway system, or (2) modify the stability characteristics of the embankment, or (3) lessen the safety of the dam temporarily during construction.

Normal maintenance work does not require a permit. If you feel the work recommended by your engineer may need a permit or are unsure of the need for a permit, it is suggested that you consult with this office before beginning any work

IDNR would like to follow your progress in meeting the recommended tasks and schedules. The next inspection report should discuss the status of these recommendations so that we may better understand and follow your progress.

Overall Condition Rating System – Explained:

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.

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 deficiency. Further investigations will be necessary.

POOR · A potential dam safety deficiency is clearly recognized for normal loading conditions. Immediate actions to resolve the deficiency are recommended. Reservoir restrictions (such as lowered pool and other restrictions) may be necessary until the problem deficiencies are resolved.

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

A "CR" after the rating explains that the rating was determined by the professional engineer consultant that performed the inspection and is not a rating determined by the Indiana DNR.

APPENDIX 2: IDNR DAM INSPECTION REPORT FORM

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

| | |
|---|--|
| Name of Professional Conducting Inspection Joshua L. Erwood, PE, Cassidy G. Hoback, EI | Professional License No. (Indiana) PE12100846 |
| Business Address 111 Monument Circle, Suite 3500, Indianapolis, IN | 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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Comment _____ |
| MULTIDISCIPLINARY: 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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Comment _____ |

| | | | | | | | |
|---|--|---|-------------------------|--|----------------------|-----------------------------|---------------------------------------|
| Dam Name Keystone Woods Lake Dam | | | Quad. Fishers | Date of Inspection 7 / 25 / 25 | | | |
| State Dam ID 29-5 | Permit (if unapproved see pg. 6) D-6308 | County Hamilton | Sec. 5, T. 17 N, R. 4 E | Last Inspection 8 / 2 / 23 | | | |
| Owners Name Woodlands Homeowners Association, Inc. | | | Owner's Phone () | | | | |
| Address/Zip Code 10700 Lakeshore Drive East, Carmel, Indiana 46033 | | | | | | | |
| Contact's Name Neil Metzger | | Contact's Phone (day) 317 - 564 - 4297 (evening) - - - | | Spillway Width Top 108ft Bot. 108ft | | | |
| Hazard High | Drainage Area 1.1 MI ² | Surface Area 53 AC | Height 14 FT | Crest Length 420 FT | Crest Width 10 FT | Inlet Below Crest 4.5 FT | Slope: Up 3:1 (H:V) Down 3:1 (H:V) |

| | | | | | | | |
|--|--|--|--|---|--|--|--|
| FIELD CONDITIONS OBSERVED | | | | DRAWDOWN STRUCTURE | | | |
| Water Level - Below Dam Crest 4.5 Ft. | | | | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> None | | | |
| Ground Moisture Condition: Dry <input checked="" type="checkbox"/> Wet <input type="checkbox"/> Snowcover <input type="checkbox"/> Other _____ | | | | Comment Abandoned | | | |

| | | | | | | | |
|---|--|--|--|--|--|--|--|
| MONITORING <input type="checkbox"/> Yes <input checked="" type="checkbox"/> None <input type="checkbox"/> Gage Rod <input type="checkbox"/> Piezometers <input type="checkbox"/> Seepage Weirs <input type="checkbox"/> Survey Monuments <input type="checkbox"/> Other] | | | | | | | |
| Comments _____ | | | | | | | |

| | |
|---|---|
| A UPSTREAM SLOPE | PROBLEMS NOTED: <input type="checkbox"/> (A-1) None <input checked="" type="checkbox"/> (A-2) Riprap - Missing, Sparse, Displaced, Weathered <input checked="" type="checkbox"/> (A-3) Wave Erosion-with Scarp <input type="checkbox"/> (A-4) Cracks-with Displacement <input type="checkbox"/> (A-5) Sinkhole <input type="checkbox"/> (A-6) Appears Too Steep <input type="checkbox"/> (A-7) Depressions or Bulges <input type="checkbox"/> (A-8) Slides <input checked="" type="checkbox"/> (A-9) Animal Burrows <input checked="" type="checkbox"/> (A-10) Trees, Brush, Briars <input checked="" type="checkbox"/> (A-11) Other <u>Encroachment / Surface Cover</u> |
| GOOD <input type="checkbox"/> | Comments: _____ |
| ACCEPTABLE <input type="checkbox"/> | _____ |
| DEFICIENT <input checked="" type="checkbox"/> | (A-2) Nonuniform riprap along slope; wooden seawall on right side rotting at water level, deteriorated on leftside |
| POOR <input type="checkbox"/> | (A-3) Scarp observed on left side with bare areas and burrows but hidden by a large bush. (A-9) Few animal burrows observed along slope (A-10) Trees and brush on slope and within 25 feet of toe and abutments (A-11) Concrete patio constructed into embankment slope; watercraft, docks, and furniture on dam; portion of slope covered in small gravel; Bare area near wooden deck on left side |

| | |
|---|---|
| B CREST | PROBLEMS NOTED: <input type="checkbox"/> (B-1) None <input type="checkbox"/> (B-2) Ruts or Puddles <input type="checkbox"/> (B-3) Erosion <input type="checkbox"/> (B-4) Cracks with Displacement <input type="checkbox"/> (B-5) Sinkholes <input type="checkbox"/> (B-6) Not Wide Enough <input checked="" type="checkbox"/> (B-7) Low Area <input type="checkbox"/> (B-8) Misalignment <input type="checkbox"/> (B-9) Inadequate Surface Drainage <input checked="" type="checkbox"/> (B-10) Trees, Brush, Briars <input checked="" type="checkbox"/> (B-11) Other <u>Bare Spots</u> |
| GOOD <input type="checkbox"/> | Comments: _____ |
| ACCEPTABLE <input type="checkbox"/> | _____ |
| DEFICIENT <input checked="" type="checkbox"/> | (B-7) Concrete patio and stairs constructed into embankment slope has resulted in a loss of crest width and freeboard. Concrete patio also has cracking, settlement, and hairline cracks (B-10) Trees, brush, woody debris pile and landscaping on crest (B-11) Garden bed near right abutment with surrounding bare spots |
| POOR <input type="checkbox"/> | |

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 | <input type="checkbox"/> |
| ACCEPTABLE | <input checked="" type="checkbox"/> |
| DEFICIENT | <input checked="" type="checkbox"/> |
| POOR | <input type="checkbox"/> |

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 Encroachment/Bare Area

Comments:

(C-9) Damp areas on right property back yard
(C-10) Trees and brush on slope and within 25-feet of toe and abutments
(C-12) Landscaping, fencing, wood deck and deck construction, and steps along slope on right side; bare areas on right side

D SEEPAGE

| | |
|-------------|-------------------------------------|
| GOOD (NONE) | <input checked="" type="checkbox"/> |
| ACCEPTABLE | <input type="checkbox"/> |
| DEFICIENT | <input type="checkbox"/> |
| POOR | <input type="checkbox"/> |

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-2) Damp areas with soft ground on right side by fence property line, possible yard irrigation

E PRINCIPAL SPILLWAY

| | |
|------------|-------------------------------------|
| GOOD | <input type="checkbox"/> |
| ACCEPTABLE | <input checked="" type="checkbox"/> |
| DEFICIENT | <input type="checkbox"/> |
| POOR | <input type="checkbox"/> |

DESCRIPTION: 5'x2.5' Concrete Riser Inlet with a 24" CCFRPM 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 Decreased Pipe Capacity, Debris

Comments:

(E-2) Metal end section at outlet has rusted invert and small holes on side

(E-7) Minor surface rust observed on metal trash rack

(E-8) Slip-lining work reduced outlet pipe from a 42" CMP to a 24" CCFRPM; Wood debris at inlet; Tree stumps and vegetation around outlet; exposed geotextile at outlet.

F AUXILIARY SPILLWAY

| | |
|------------|-------------------------------------|
| GOOD | <input type="checkbox"/> |
| ACCEPTABLE | <input type="checkbox"/> |
| DEFICIENT | <input checked="" type="checkbox"/> |
| POOR | <input type="checkbox"/> |

DESCRIPTION: 108' Wide Open Channel in Fill and Lined with Riprap

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 Riprap sizes, weeds, stump, debris

Comments:

(F-3) Start of headcut in middle, (F-6) Uncertain spillway capacity, with lowered crest section and slip-lined principal spillway outlet, (F-10) Riprap is sparse and appears too small along inlet section; weedy vegetation growth throughout; few bare spots on left side; large tree stump on left side and a few in riprap on right side; bare area around stump with woody debris.

G MAINTENANCE AND REPAIRS

| | |
|------------|-------------------------------------|
| GOOD | <input type="checkbox"/> |
| ACCEPTABLE | <input type="checkbox"/> |
| DEFICIENT | <input checked="" type="checkbox"/> |
| POOR | <input type="checkbox"/> |

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:

Although recent maintenance and repair activities have increased in the auxiliary spillway and principal spillway outlet areas, the remaining portions of the dam need improvement. 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.

**RECOMMENDATIONS AND ITEMS REQUIRING ACTION BY OWNER
TO IMPROVE THE SAFETY OF THE DAM****MAINTENANCE-MINOR REPAIR-MONITORING**

- (1) Provide Additional Erosion Protection: Auxiliary spillway inlet section and upstream slope
- (2) Mow: Continue regular mowing; vary mowing pattern to avoid rutting; mow during dry conditions
- (3) Clear Trees and/or Brush From: Upstream and downstream slopes, crest, and within 25' of toe and abutments
- (4) Initiate Rodent Control Program and Properly Backfill Existing Holes: Upstream slope
- (5) Repair: Seed bare areas; scarping on left side of upstream slope. Auxiliary spillway headcut and sparse riprap at inlet.
- (6) Provide Surface Drainage For: Pooley drained areas on right side toe
- (7) Monitor: Wooden seawall on right side for deflection and deterioration; downstream slope for seepage
- (8) Other: Relocate watercraft, furniture, and other equipment off of embankment; clean and paint metal trash rack
- (9) Other: Remove manmade encroachments or provide engineering evaluation of structure and potential impact

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: No record of detailed analysis
- (13) Perform a Hydrologic Study to Determine Required Spillway Size: Uncertainties in past analyses and modifications to dam
- (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: Needs to be completed and delivered to IDNR
- (18) Other: Perform a video inspection of the principal spillway outlet pipe as part of next biennial dam safety inspection
- (19) Other: Multiple owners to work to resolve dam inspection recommendations

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 11/3/2025

Reviewed By



Owner/Owner's Representative

Date 10/30/2025

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:

PREVIOUS RECOMMENDATIONS FOR MAINTENANCE, REPAIRS, AND UPGRADES:

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

See inspection report recommendations. Concrete patio crack has been patched.

Supporting Documentation

Photographs Attachments Calculations Drawings Other

Comments:

Keystone Woods Lake Dam 2025 Dam Safety Inspection Report

| Component | Rating | Recommendations | Schedule | Importance |
|--------------------|------------|--|----------------|------------|
| Upstream Slope | Deficient | Remove trees and brush from the slope and within 25 feet of the slope and abutments in accordance with the Indiana Dam Safety Inspection Manual | Within 1 year | Medium |
| | | Replace gravel covered slope with grass, riprap or other erosion resistant material | Within 1 year | Medium |
| | | Relocate watercraft, docks, and furniture off the dam embankment and onto natural ground | Immediately | Low |
| | | Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual | Ongoing | Low |
| | | Monitor right side wooden seawall for deflection and deterioration; notify a registered professional engineer of observed changes | Ongoing | Low |
| | | Seed bare areas and repair divots along slope | Within 2 years | Low |
| Crest | Deficient | Restabilize and armor scarp forming in bush on left side | Within 1 year | Medium |
| | | Remove trees and brush from the crest in accordance with the Indiana Dam Safety Inspection Manual | Within 1 year | Medium |
| | | Remove concrete patio in its entirety and reestablish dam crest elevation by backfilling with appropriate embankment fill or perform an engineering evaluation to confirm structural integrity of feature and potential impact on the embankment | Within 1 year | High |
| Downstream Slope | Deficient | Remove encroaching fire pits, debris piles, garden bed and landscaping from dam crest. | Within 2 years | Low |
| | | Remove trees and brush from the slope and within 25 feet of the slope and abutments in accordance with the Indiana Dam Safety Inspection Manual | Within 1 year | Medium |
| | | Remove landscaping, decks, steps, and other encroachments and backfill as necessary with appropriate embankment fill or perform an engineering evaluation to confirm structural integrity of feature and potential impact on the embankment | Within 2 years | Medium |
| Seepage | Good | Seed sporadic bare areas along slope | Within 2 years | Low |
| | | Monitor downstream slope and around concrete patio, steps, and decks for evidence of seepage; notify a registered professional engineer of observed changes | Ongoing | Low |
| Principal Spillway | Acceptable | Monitor backyards of properties on right side of dam and avoid over irrigation creating saturated ponding areas. | Ongoing | Low |
| | | Clean and paint metal trash rack | Immediately | Low |
| | | Keep inlet trashrack clear of debris and remove debris accumulation as needed | Ongoing | Low |
| | | Remove tree stumps around outlet | Within 1 year | Low |
| | | Cover exposed geotextile at outlet | Within 1 year | Low |
| | | Remove and replace metal end section at outlet | Within 2 years | Low |

Table Continued on Next Page

Table Continued from Previous Page

| Component | Rating | Recommendations | Schedule | Importance |
|-------------------------|--------------------|--|----------------|------------|
| Auxiliary Spillway | Deficient | Retain a qualified professional engineer to appropriately size riprap or other armoring to the spillway inlet section for installation of erosion protection and to establish a uniform crest elevation | Within 1 year | High |
| | | Seed bare spots on left side | Within 2 years | Low |
| | | Evaluate options for removal of the large tree stump on left side and other tree stumps on right side in riprap; monitor areas adjacent to the stumps for seepage or other surficial deficiency monthly and/or after large rain events and notify a registered professional engineer of observed changes | Within 1 year | Low |
| | | Monitor start of headcut in the middle of the spillway and any overflow until inlet riprap installation is completed | Ongoing | Low |
| | | Spray and remove vegetation growing within spillway | Within 1 year | Low |
| Maintenance and Repairs | Deficient | Perform spillway capacity analysis in accordance with current IDNR requirements | Immediately | High |
| | | Retain a geotechnical engineer to evaluate the stability of the dam under various loading conditions | Within 2 years | High |
| | | Develop an Incident and Emergency Action Plan per Indiana Code 14-27-7.5-18 and update the plan on an annual bases | Immediately | High |
| | | Conduct a video inspection of the principal spillway outlet pipe; subsequent inspections should be performed every six years | Immediately | Low |
| | | Multiple owners to work to resolve dam inspection recommendations | Ongoing | High |
| 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

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: 11/3/2025

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. | seismic events would probably result in a dam safety deficiency. | 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. |
| FAIR - No existing dam safety deficiencies are recognized for normal loading conditions. Infrequent hydrologic and/or | 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. | 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: PREVIOUS IDNR DAM INSPECTION REPORT FORM

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

| | |
|--|---|
| Name of Professional Conducting Inspection Joshua L. Erwood, PE, Maxwell V. Runningen, EI | Professional License No. (Indiana) PE12100846 |
| Business Address 115 West Washington Street, Suite 1368 South, Indianapolis, IN 46204 | Phone: (day) <u>317</u> - <u>266</u> - <u>8000</u> (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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Comment _____ |
| MULTIDISCIPLINARY: 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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Comment _____ |

| | | | | | | | |
|---|--|--|---|--|----------------------|-----------------------------|---------------------------------------|
| Dam Name Keystone Woods Lake Dam | | | Quad. Fishers | Date of Inspection <u>8</u> / <u>2</u> / <u>23</u> | | | |
| State Dam ID 29-5 | Permit (if unapproved see pg. 6) D-6308 | County Hamilton | Sec. <u>5</u> , T. <u>17</u> N, R. <u>4</u> E | Last Inspection <u>8</u> / <u>3</u> / <u>21</u> | | | |
| Owners Name Woodlands Homeowners Association, Inc. | | | Owner's Phone () | | | | |
| Address/Zip Code 10700 Lakeshore Drive East, Carmel, Indiana 46033 | | | | | | | |
| Contact's Name Grant Morris | | Contact's Phone (day) <u>765</u> - <u>412</u> - <u>2307</u> (evening) - - - | | Spillway Width Top <u>108ft</u> Bot. <u>108ft</u> Ft. FBD. <u>4.1 FT</u> | | | |
| Hazard High | Drainage Area 1.1 Mi ² | Surface Area 53 AC | Height 14 FT | Crest Length 420 FT | Crest Width 10 FT | Inlet Below Crest 4.5 FT | Slope: Up 3:1 (H:V) Down 3:1 (H:V) |

| | | | | | | | |
|--|--|--|--|--|---|--|--|
| FIELD CONDITIONS OBSERVED | | | | | DRAWDOWN STRUCTURE | | |
| Water Level - Below Dam Crest <u>4.5</u> Ft. | | | | | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> None | | |
| Ground Moisture Condition: Dry <input checked="" type="checkbox"/> Wet <input type="checkbox"/> Snowcover <input type="checkbox"/> Other _____ | | | | | Comment <u>Abandoned</u> | | |

| | | | | | | | |
|---|--|--|--|--|--|--|--|
| MONITORING <input type="checkbox"/> Yes <input checked="" type="checkbox"/> None <input type="checkbox"/> Gage Rod <input type="checkbox"/> Piezometers <input type="checkbox"/> Seepage Weirs <input type="checkbox"/> Survey Monuments <input type="checkbox"/> Other] | | | | | | | |
| Comments _____ | | | | | | | |

| | | | | | | | | |
|---|---|--|--|--|--|--|--|--|
| A UPSTREAM SLOPE | PROBLEMS NOTED: <input type="checkbox"/> (A-1) None <input checked="" type="checkbox"/> (A-2) Riprap - Missing, Sparse, Displaced, Weathered <input checked="" type="checkbox"/> (A-3) Wave Erosion-with Scarp <input type="checkbox"/> (A-4) Cracks-with Displacement <input type="checkbox"/> (A-5) Sinkhole <input type="checkbox"/> (A-6) Appears Too Steep <input type="checkbox"/> (A-7) Depressions or Bulges <input type="checkbox"/> (A-8) Slides <input checked="" type="checkbox"/> (A-9) Animal Burrows <input checked="" type="checkbox"/> (A-10) Trees, Brush, Briars <input checked="" type="checkbox"/> (A-11) Other <u>Encroachment / Surface Cover</u> | | | | | | | |
| GOOD <input type="checkbox"/> | Comments: _____ | | | | | | | |
| ACCEPTABLE <input type="checkbox"/> | | | | | | | | |
| DEFICIENT <input checked="" type="checkbox"/> | (A-2) Nonuniform riprap along slope; wooden seawall on right side rotting at water level, deteriorated on left side | | | | | | | |
| POOR <input type="checkbox"/> | (A-3) Scarp 10" deep by 10ft long, observed on left side but partially hidden by a large bush (A-9) Few animal burrows observed along slope (A-10) Trees and brush on slope and within 25 feet of toe and abutments (A-11) Concrete patio constructed into embankment slope; watercraft, docks, and furniture on dam; portion of slope covered in small gravel; Bare area near wooden deck on left side | | | | | | | |

| | | | | | | | | |
|---|---|--|--|--|--|--|--|--|
| B CREST | PROBLEMS NOTED: <input type="checkbox"/> (B-1) None <input type="checkbox"/> (B-2) Ruts or Puddles <input type="checkbox"/> (B-3) Erosion <input type="checkbox"/> (B-4) Cracks with Displacement <input type="checkbox"/> (B-5) Sinkholes <input type="checkbox"/> (B-6) Not Wide Enough <input checked="" type="checkbox"/> (B-7) Low Area <input type="checkbox"/> (B-8) Misalignment <input type="checkbox"/> (B-9) Inadequate Surface Drainage <input checked="" type="checkbox"/> (B-10) Trees, Brush, Briars <input checked="" type="checkbox"/> (B-11) Other <u>Bare Area, soft spot</u> | | | | | | | |
| GOOD <input type="checkbox"/> | Comments: _____ | | | | | | | |
| ACCEPTABLE <input type="checkbox"/> | | | | | | | | |
| DEFICIENT <input checked="" type="checkbox"/> | (B-7) Concrete patio and stairs constructed into embankment slope has resulted in a loss of crest width and freeboard. Concrete patio also has cracking, settlement, and hairline cracks (B-10) Trees, brush and landscaping on crest (B-11) Bare area near left abutment; soft area with tree roots on left side of crest; garden bed near right abutment with surrounding bare spots | | | | | | | |

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 | PROBLEMS NOTED: |
| GOOD | <input type="checkbox"/> | <input type="checkbox"/> (C-1) None <input type="checkbox"/> (C-2) Livestock Damage <input type="checkbox"/> (C-3) Erosion or Gullies <input type="checkbox"/> (C-4) Cracks with Displacement <input type="checkbox"/> (C-5) Sinkholes <input type="checkbox"/> (C-6) Appears too Steep <input type="checkbox"/> (C-7) Depression or Bulges <input type="checkbox"/> (C-8) Slide |
| ACCEPTABLE | <input type="checkbox"/> | <input checked="" type="checkbox"/> (C-9) Soft Areas <input checked="" type="checkbox"/> (C-10) Trees, Brush, Briars <input type="checkbox"/> (C-11) Animal Burrows <input checked="" type="checkbox"/> (C-12) Other <u>Encroachment/Bare Area</u> |
| DEFICIENT | <input checked="" type="checkbox"/> | Comments: |
| POOR | <input type="checkbox"/> | (C-9) Damp areas on right property back yard (C-10) Trees and brush on slope and within 25-feet of toe and abutments (C-12) Landscaping, fencing, wood deck and deck construction, and steps along slope on right side; 3'x3' bare areas on right side |

| | | |
|--|-------------------------------------|---|
| D | SEEPAGE | PROBLEMS NOTED: |
| GOOD (NONE) | <input checked="" type="checkbox"/> | <input type="checkbox"/> (D-1) None <input checked="" type="checkbox"/> (D-2) Saturated Embankment Area <input type="checkbox"/> (D-3) Seepage Exits on Embankment |
| ACCEPTABLE | <input type="checkbox"/> | <input type="checkbox"/> (D-4) Seepage Exits at Point Source <input type="checkbox"/> (D-5) Seepage Area at Toe <input type="checkbox"/> (D-6) Flow Adjacent to Outlet |
| DEFICIENT | <input type="checkbox"/> | <input checked="" type="checkbox"/> (D-7) Seepage Clear/Muddy |
| POOR | <input type="checkbox"/> | [DRAIN OUTFALLS SEEN <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> (D-8) Flow Clear/Muddy <input type="checkbox"/> (D-9) Dry/Obstructed] <input type="checkbox"/> (D-10) Other _____ Describe location of drains and indicate amount and quality of discharge. |
| Comments: | | |
| (D-2) Damp areas with soft ground on right side by fence property line, possible yard irrigation | | |

| | | |
|------------|-------------------------------------|--|
| E | PRINCIPAL SPILLWAY | DESCRIPTION: 5'x2.5' Concrete Riser Inlet with a 24" CCFRPM Outlet Pipe |
| GOOD | <input type="checkbox"/> | PROBLEMS NOTED: <input type="checkbox"/> (E-1) None <input checked="" type="checkbox"/> (E-2) Deterioration <input type="checkbox"/> (E-3) Separation <input type="checkbox"/> (E-4) Cracking <input checked="" type="checkbox"/> (E-5) Inlet, Outlet Deficiency <input type="checkbox"/> (E-6) Stilling Basin Inadequacies <input checked="" type="checkbox"/> (E-7) Trash Rack <input checked="" type="checkbox"/> (E-8) Other <u>Decreased Pipe Capacity, Debris</u> |
| ACCEPTABLE | <input checked="" type="checkbox"/> | Comments: |
| DEFICIENT | <input type="checkbox"/> | (E-2) Metal end section at outlet has rusted invert and small holes on side |
| POOR | <input type="checkbox"/> | (E-5) Possible seepage observed in joints of concrete inlet riser (E-7) Minor surface rust observed on metal trash rack (E-8) Slip-lining work reduced outlet pipe from a 42" CMP to a 24" CCFRPM; Wood debris at inlet; Tree stumps around outlet; exposed geotextile at outlet; some riprap had fallen into the pipe outlet invert |

| | | |
|---|-------------------------------------|---|
| F | AUXILIARY SPILLWAY | DESCRIPTION: 108' Wide Open Channel in Fill and Lined with Riprap |
| GOOD | <input type="checkbox"/> | PROBLEMS NOTED: <input type="checkbox"/> (F-1) None <input type="checkbox"/> (F-2) No Auxiliary Spillway Found <input type="checkbox"/> (F-3) Erosion-with Backcutting |
| ACCEPTABLE | <input type="checkbox"/> | <input type="checkbox"/> (F-4) Crack with Displacement <input type="checkbox"/> (F-5) Appears to be Structurally Inadequate <input checked="" type="checkbox"/> (F-6) Appears too Small |
| DEFICIENT | <input checked="" type="checkbox"/> | <input type="checkbox"/> (F-7) Inadequate Freeboard <input type="checkbox"/> (F-8) Flow Obstructed <input type="checkbox"/> (F-9) Concrete Deteriorated/Undermined |
| POOR | <input type="checkbox"/> | <input checked="" type="checkbox"/> (F-10) Other <u>Riprap Size at Inlet, bare spots, stump</u> |
| Comments: | | |
| (F-3) Start of headcut in middle, (F-6) Uncertain spillway capacity, with lowered crest section and slip-lined principal spillway outlet, (F-10) Riprap is sparse and appears too small along inlet section; few bare spots on left side; large tree stump on left side and a few in riprap on right side; bare area around stump with dry cracking | | |

| | | |
|--|-------------------------------------|--|
| G | MAINTENANCE AND REPAIRS | PROBLEMS NOTED: |
| GOOD | <input type="checkbox"/> | <input type="checkbox"/> (G-1) None <input type="checkbox"/> (G-2) Access Road Needs Maintenance <input type="checkbox"/> (G-3) Cattle Damage |
| ACCEPTABLE | <input type="checkbox"/> | <input checked="" type="checkbox"/> (G-4) Spillway Obstruction <input checked="" type="checkbox"/> (G-5) Brush, Weeds, Tall Grass, on Upstream Slope, Crest, Downstream Slope, Toe |
| DEFICIENT | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> (G-6) Trees on Upstream Slope, Crest, Downstream Slope <input checked="" type="checkbox"/> (G-7) Rodent Activity on Upstream Slope, Crest, Downstream Slope, Toe <input type="checkbox"/> (G-8) Deteriorated Concrete-Facing, Outlet, Spillway <input type="checkbox"/> (G-9) Gate and/or Drawdown Need Repair |
| POOR | <input type="checkbox"/> | <input checked="" type="checkbox"/> (G-10) Other <u>Additional Investigations/Analyses</u> |
| Comments: | | |
| Although maintenance and repair activities have increased in the auxiliary spillway and principal spillway outlet areas, the remaining portions of the dam need improvement. 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.

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

MAINTENANCE-MINOR REPAIR-MONITORING

(1) Provide Additional Erosion Protection: Auxiliary spillway inlet section and upstream slope

(2) Mow: Continue regular mowing; vary mowing pattern to avoid rutting; mow during dry conditions

(3) Clear Trees and/or Brush From: Upstream and downstream slopes, crest, and within 25' of toe and abutments

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

(5) Repair: Seal joints in concrete riser; seed bare areas

(6) Provide Surface Drainage For: _____

(7) Monitor: Wooden seawall on right side for deflection and deterioration; downstream slope for seepage

(8) Other: Relocate watercraft, furniture, and other equipment off of embankment; clean and paint metal trash rack

(9) Other: Remove manmade encroachments or provide engineering evaluation of structure and potential impact

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: No record of detailed analysis

(13) Perform a Hydrologic Study to Determine Required Spillway Size: Uncertainties in past analyses and modifications to dam

(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: To be completed in 2024

(18) Other: Perform a video inspection of the principal spillway outlet pipe as part of next biennial dam safety inspection

(19) Other: Multiple owners to work to resolve dam inspection recommendations

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 12/21/2023

Reviewed By




Owner/Owner's Representative

Date 12/21/2023

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:

PREVIOUS RECOMMENDATIONS FOR MAINTENANCE, REPAIRS, AND UPGRADES:

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

See inspection report recommendations.

Supporting Documentation

Photographs Attachments Calculations Drawings Other

Comments:

Keystone Woods Lake Dam 2023 Dam Safety Inspection Report

| Component | Rating | Recommendations | Schedule | Importance |
|-------------------------|--------------------|--|---|--|
| Upstream Slope | Deficient | <ul style="list-style-type: none"> Remove trees and brush from the slope and within 25 feet of the slope and abutments in accordance with the Indiana Dam Safety Inspection Manual Replace gravel covered slope with grass, riprap or other erosion resistant material Relocate watercraft, docks, and furniture off the dam embankment and onto natural ground Initiate rodent control program, backfilling burrows in accordance with the Indiana Dam Safety Inspection Manual Monitor right side wooden seawall for deflection and deterioration; notify a registered professional engineer of observed changes Seed bare areas along slope Restabilize and armor scarp forming in bush on left side | <ul style="list-style-type: none"> Within 1 year Within 1 year Immediately Ongoing Ongoing Within 2 years Within 2 years | <ul style="list-style-type: none"> Medium Medium Low Low Low Low Medium |
| Crest | Deficient | <ul style="list-style-type: none"> Remove trees and brush from the crest in accordance with the Indiana Dam Safety Inspection Manual Remove concrete patio in its entirety and reestablish dam crest elevation by backfilling with appropriate embankment fill or perform an engineering evaluation to confirm structural integrity of feature and potential impact on the embankment Seed bare areas on crest Monitor soft area with roots on left side of crest | <ul style="list-style-type: none"> Within 1 year Within 2 years Within 2 years Ongoing | <ul style="list-style-type: none"> Medium High Low Low |
| Downstream Slope | Deficient | <ul style="list-style-type: none"> Remove trees and brush from the slope and within 25 feet of the slope and abutments in accordance with the Indiana Dam Safety Inspection Manual Remove landscaping, decks, steps, and other encroachments and backfill as necessary with appropriate embankment fill or perform an engineering evaluation to confirm structural integrity of feature and potential impact on the embankment Seed sporadic bare areas on right and left sides | <ul style="list-style-type: none"> Within 1 year Within 2 years Within 2 years | <ul style="list-style-type: none"> Medium Medium Low |
| Seepage | Good | <ul style="list-style-type: none"> Monitor downstream slope and around concrete patio, steps, and decks for evidence of seepage; notify a registered professional engineer of observed changes Monitor backyards of properties on right side of dam | <ul style="list-style-type: none"> Ongoing Ongoing | <ul style="list-style-type: none"> Low Low |
| Principal Spillway | Acceptable | <ul style="list-style-type: none"> Seal leaking joints in concrete inlet riser Clean and paint metal trash rack Remove tree stumps around outlet Clear debris in outlet channel Cover exposed geotextile at outlet Remove and replace metal end section at outlet | <ul style="list-style-type: none"> Within 1 year Within 1 year Within 2 years Within 2 years Within 2 years 2-4 years | <ul style="list-style-type: none"> Low Low Low Low Low Low |
| Auxiliary Spillway | Deficient | <ul style="list-style-type: none"> Add appropriately sized riprap or other armoring to the spillway inlet section for erosion protection Seed bare spots on left side Evaluate options for removal of the large tree stump on left side and other tree stumps on right side in riprap; monitor areas adjacent to the stumps for seepage or other surficial deficiency monthly and/or after large rain events and notify a registered professional engineer of observed changes Monitor start of headcut in the middle of the spillway Spray and remove vegetation growing within spillway | <ul style="list-style-type: none"> Within 2 years Within 2 years Within 1 year Ongoing Within 2 years | <ul style="list-style-type: none"> Low Low Low Low Low |
| Maintenance and Repairs | Deficient | <ul style="list-style-type: none"> Perform spillway capacity analysis in accordance with current IDNR requirements Retain a geotechnical engineer to evaluate the stability of the dam under various loading conditions Conduct a video inspection of the principal spillway outlet pipe; subsequent inspections should be performed every six years Multiple owners to work to resolve dam inspection recommendations | <ul style="list-style-type: none"> Within 1 year Within 2 years Within 1 year Ongoing | <ul style="list-style-type: none"> High High Low High |
| Overall Conditions | Conditionally Poor | <ul style="list-style-type: none"> See above | <ul style="list-style-type: none"> N/A | <ul style="list-style-type: none"> N/A |

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

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: 12/21/2023

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. | seismic events would probably result in a dam safety deficiency. | 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. |
| FAIR - No existing dam safety deficiencies are recognized for normal loading conditions. Infrequent hydrologic and/or | 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. | UNSATISFACTORY - A dam safety deficiency exists for normal conditions. Immediate remedial action is required for problem resolution. |

HAZARD CLASSIFICATIONS OF DAMS (STRUCTURE)

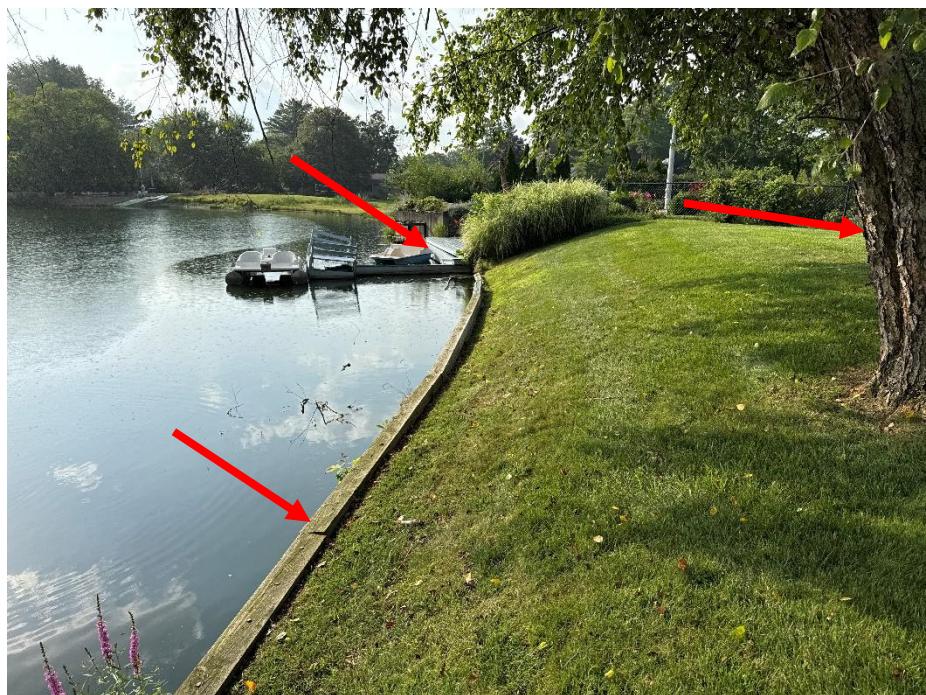
| | | |
|---|--|--|
| LOW HAZARD- A structure the failure of which may damage farm buildings, agricultural land, or local roads | SIGNIFICANT HAZARD- A structure the failure of which may damage isolated homes and highways, or cause the temporary interruption of public utility services. | HIGH HAZARD- 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 4: INSPECTION PHOTOGRAPHS



Top: Upstream slope right side. Note timber seawall protection on this section with slight deflection towards lake. Also note several encroachments of fences, trees, and bushes.

Bottom: Upstream slope right side. Note timber seawall protection on this section with slight deflection towards lake. Also note several encroachments of docks, fences, landscaping, trees, and bushes.



Top: Upstream slope right side. Note typical small diameter burrow holes behind wooden seawall.

Bottom: Upstream slope right side. Note deteriorated wooden seawall with weedy vegetation growing through.



Top: Upstream slope left side. Note inadequate slope cover in gravel area with trees, weedy vegetation, and patio furniture encroaching.

Bottom: Upstream slope left side. Note tall grass and weedy vegetation growth along shoreline.



Top: Upstream slope left side. Note inadequate slope cover in gravel area with trees, weedy vegetation, and patio furniture encroaching.

Bottom: Upstream slope left side. Note tall grass and weedy vegetation growth within riprap near wooden dock.



Top: Upstream slope left side. Note large bush on slope by irrigation spigot.

Bottom: Upstream slope left side. Note large bush hides bare and eroded area at shoreline. Burrow holes found around bush.



Top: Embankment crest on left abutment looking left. Note trees, brush, landscaping, and watercraft.

Bottom: Embankment crest on left abutment looking right. Note trees, brush, landscaping, and watercraft.



Top: Embankment crest left side. Note fence lines typical at property boundaries.

Bottom: Embankment crest left side. Note firepit and woody debris pile.



Top: Embankment crest right side. Note firepit encroachment.

Bottom: Embankment crest right side. Note landscaping and brush encroaching near patio cut into the embankment. Crack in concrete patio has been patched.



Top: Embankment crest right side. Note watercraft, landscaping, and brush encroaching around patio cut into the embankment. Crack in concrete patio has been patched.

Bottom: Embankment crest right side. Note fencing and brush across embankment typical at each property boundary.



Top: Downstream slope from right side. Note typical damp bare area found at toe of slope likely from irrigation and poor surface drainage.

Bottom: Downstream slope from right side. Note extended decking on embankment with landscaping.



Top: Downstream slope right side. Note landscaping and stairs cut into embankment slope.

Bottom: Downstream slope right side. Note bare area next to raised garden bed at right abutment and fenceline. Note dense brush along the fenceline prevented a thorough inspection of the area.



Top: Downstream slope left side. Note trees and bushes growing on and within 25 feet of embankment.

Bottom: Downstream slope from left side. Note trees and bushes growing on and within 25 feet of embankment.



Top: Principal spillway drop inlet riser with trashrack near dock.

Bottom: Principal spillway drop inlet riser with trashrack near dock. Note minor debris accumulation around inlet and slight surface rust on trashrack.



Top: Principal spillway outlet channel. Note tree stumps and surrounding vegetation growth.

Bottom: Principal spillway outlet and interior of 24-inch CCFRPM discharge pipe outlet. Note exposed geotextile and surrounding vegetation growth.



Top: Principal spillway outlet. Note metal end section rust and hole on side.

Bottom: Principal spillway concrete outlet channel looking downstream where it joins the auxiliary spillway open channel.



Top: Auxiliary spillway open channel. Note smaller riprap at inlet section with weedy vegetation growth throughout.

Bottom: Auxiliary spillway open channel. Note start of headcut at shoreline within sparse riprap.



Top: Auxiliary spillway open channel. Note variable riprap sizes and weedy vegetation growth.

Bottom: Auxiliary spillway open channel with weedy vegetation growth throughout.



Top: Auxiliary spillway open channel. Looking downstream, note weedy vegetation growth within riprap.

Bottom: Auxiliary spillway open channel. Looking downstream, note weedy vegetation growth within riprap.



Top: Auxiliary spillway left side. Note tree stump and woody debris surrounded by tall grass.

Bottom: Auxiliary spillway left side. Note sporadic bare areas next to channel.

APPENDIX 5: DAM INSPECTION CHECKLIST

Dam Safety Inspection Checklist

Complete All Portions of This Section (Pre-inspection)

Date of Inspection: July 25, 2025

Name of Dam: Keystone Woods Lake Dam File Number: 29-5

EAP: (yes, no) no OM&I: (yes, no)

Review Inventory - Highlight missing information (Pre -inspection)

Owner=s Name(s): Woodlarch Homeowners Association, Inc.

Address: 10700 Lakeshore Dr. E.

City: Carmel State: IN Zip (+4): 46033

Telephone (Home):

Telephone (Work):

Contact Person:

Telephone:

Designed By:

Constructed By:

Year Completed: Plans Available (Yes, No) (location):

Purpose of dam:

Interview with Owner (at the site):

Owner/Representative present: (Yes, No) Name(s): Neil Metzger

Double check address, telephone #, purpose (check ->) G

How long have you owned dam - previous name/owner? since constructed

EAP/OM&I: up-dated-(yes, no) & location:

Operate lake drain (times per year, accessibility):

Mowing (times per year): Weekly Mowing

Prior problems (wet areas, erosion, slides): None

Repair or modification (what & when): None

Failure/Incident/Breach (max. pool): None

Downstream hazard status (recent changes): None

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:

Volume of fill (earth or rock) in dam:

Foundation (earth or rock) of dam:

Field Information (while at site)

Pool Elevation (during inspection): Just above N.P. Time: 8:00 (a.m. p.m.)

Site Conditions(temp., weather, ground moisture):

80°F, Cloudy, Dry - some light rain

Inspection Party: Josh Edwards, P.E., Bassidy Hoback

Maximum Height: (measured or inventory appears correct)

Normal Pool Surface Area: (measured or inventory appears correct)

SEE INSPECTION REPORT FOR
RECOMMENDATIONS

| | | | |
|------|---------|-------------|----------|
| None | Monitor | Maintenance | Engineer |
|------|---------|-------------|----------|

UPSTREAM SLOPE

Gradient: Horizontal: 3.5 Vertical: 1

(est, meas) RT Side

VEGETATION [no problem]

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

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

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

Notes:

Lawn/scrub area at property line, a few in gravel area. Right side by wooden seawall.

Brush: Quantity: (sparse, dense)

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

Notes:

At fence lines, few at shore line left side

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

Quantity: (bare, sparse, adequate, dense)

Appearance: (too tall, too short, good)

Notes: LT. Gravel area

left side slightly tall by wooden docks

SLOPE PROTECTION [no problem, could not inspect thoroughly]

None

Riprap: Average Diameter:

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

Notes: Some by wooden docks on left side

Wave Berm:

Vegetation: (adequate, bare, sparse, improper vegetation)

Notes:

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

Notes:

Other:

LT side 2ft stone seawall, right side pavers area with built in concrete steps with patched cracks. Right side wooden seawall angled into lake with broken section.

Notes:

EROSION [no problem, could not inspect thoroughly]

Wave Erosion (Beaching): Scarp: Length:

Height: 1 - 2ft (could not inspect)

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

Notes: Under bush with bare area

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: Patched concrete crack in pavers next to principal spillway tube. Slabs slightly angled into lake.

| 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: *1" dia, 4" deep LT side, several - Rt side*

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

Notes: *several behind wooden screen RT side*

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:

Patios, Furniture, docks, watercraft, fire pits

Notes:

CREST

Length: Width: *22 ft (LT), 18 ft (RT) best, meas.*

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: *LT. side fence area / landscaping, few in gravel area*

Brush: Quantity: (*sparse, dense*)

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

Notes: *At property fence lines*

Ground Cover: Type: (*grass, crown vetch*) Other: *few bare areas in gravel*

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

Appearance: (*too tall, too short, good*) *left property with taller grass*

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 |
|-----------------|
|-----------------|

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:Notes: *Patios on right side, cut into embankment lower freeboard. Landscaping features and encroachments throughout. Depth with brush pile on left side, fire pit on right side.*

| | | | | Required Action |
|---|--|--|--|--|
| | | | | None |
| | | | | Monitor |
| | | | | Maintenance |
| | | | | Engineer |
| DOWNSTREAM SLOPE Gradient: Horizontal: 4 Vertical: 1 (LT) (est, meas.) 1 (RT) | | | | |
| <input checked="" type="checkbox"/> VEGETATION [no problem] | | | | |
| Trees: Quantity: (<5, sparse, dense) Diameter: (<6", 6-12", 12+) Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg) Notes: | | | | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| <input checked="" type="checkbox"/> Brush: Quantity: (sparse, dense) Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg) Notes: At property line along fences | | | | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| <input checked="" type="checkbox"/> Ground Cover: Type: (grass, crown vetch) Other: Quantity: (bare, sparse, adequate, dense) Appearance: (too tall, too short, good) Notes: Bare areas at base of right slope, with irrigation runoff ponding. Bare area by raised garden at RT embankment. | | | | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| <input checked="" type="checkbox"/> 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: | | | | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| <input checked="" type="checkbox"/> 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: | | | | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| Cracks: <input type="checkbox"/> Transverse <input type="checkbox"/> Longitudinal <input type="checkbox"/> Other Quantity: Length: Width: Depth: Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg) Notes/Causes: | | | | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| Cracks: <input type="checkbox"/> Transverse <input type="checkbox"/> Longitudinal <input type="checkbox"/> Other Quantity: Length: Width: Depth: Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg) Notes/Causes: | | | | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| Bulges <input type="checkbox"/> Depressions <input type="checkbox"/> Hummocky Size: Height: Depth: Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg) Notes/Causes: | | | | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| Bulges <input type="checkbox"/> Depressions <input type="checkbox"/> Hummocky Size: Height: Depth: Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg) Notes/Causes: | | | | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |

| Required Action |
|--------------------------------------|
| <input type="checkbox"/> None |
| <input type="checkbox"/> Monitor |
| <input type="checkbox"/> Maintenance |
| <input type="checkbox"/> 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:

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:

Notes: *Stairs built into slope right side, deck built into slope on right side - could not inspect thoroughly.*

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:

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:

None

Monitor

Maintenance

Engineer

Required Action

PRINCIPAL SPILLWAY

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: _____

Required Action
 None Monitor Maintenance Engineer

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) *some rusted on bars*

Notes: *some small branches & leaves in trashrack*

INLET OBSTRUCTION [no problem, could not inspect thoroughly]

Debris: (leaves, trash, logs, branches, ice) *some light leafy debris, some branches*

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.) _____

Notes: _____

INLET MATERIALS [no problem, could not inspect thoroughly]

Metal

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

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 | | | |
|--|---|---|---------|-------------|----------|
| | | None | Monitor | Maintenance | Engineer |
| <input type="checkbox"/> Earthen | □ Ground Cover: Type: (grass, crown vetch) Other: _____ Quantity: (bare, sparse, adequate, dense) Appearance: (too tall, too short, good) Notes: _____ | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | | | |
| <input type="checkbox"/> Erosion: (wave, surface runoff) | Description (height/depth/length/etc): _____ Notes: _____ | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | | | |
| <input type="checkbox"/> Ruts: | Location: (entire inlet, lt side, rt side, middle, see dwg) Depth: _____ Width: _____ Length: _____ Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian): _____ | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | | | |
| <input type="checkbox"/> Riprap: Average Diameter: | (adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no) Notes: _____ | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | | | |
| <input type="checkbox"/> Rock-Cut (weathered, erosion) | Description: _____ Notes: _____ | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | | | |
| <input type="checkbox"/> Other: _____ | | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | | | |

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

| | | | | | |
|---|---|---|--|--|--|
| <input type="checkbox"/> Mis-Alignment: (pipe, chute, sidewall, headwall) | <input type="checkbox"/> Pipe Deformation | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | | | |
| Location/Description: _____ | | | | | |
| Notes/Causes: _____ | | | | | |
| <input type="checkbox"/> Separated Joint | <input type="checkbox"/> Loss of Joint Material | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | | | |
| Location/Description: _____ | | | | | |
| Notes/Causes: _____ | | | | | |
| <input type="checkbox"/> Undermining: | | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | | | |
| Location/Description: _____ | | | | | |
| Notes/Causes: _____ | | | | | |
| <input type="checkbox"/> Other: _____ | | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | | | |

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

Notes: _____

OUTLET OBSTRUCTION [no problem, could not inspect thoroughly]

| | | | | |
|---|---|--|--|--|
| <input type="checkbox"/> Debris: (leaves, trash, logs, branches, ice) | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | | | |
| <input type="checkbox"/> Trees: Quantity: (<5, sparse, dense) Diameter: (<6", 6-12", >12") Location: (entire outlet, lt side, rt side, middle, see dwg) Notes: _____ | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | | | |
| <input type="checkbox"/> Brush: Quantity: (sparse, dense) Location: (entire outlet, lt side, rt side, middle, see dwg) Notes: _____ | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | | | |
| <input type="checkbox"/> Other: (beaver activity, partially/completely blocked, i.e.) Notes: _____ | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | | | |

Required Action
None Monitor Maintenance Engineer

IV 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:

| Required Action | None | Monitor | Maintenance | Engineer |
|-----------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Concrete

(bug holes, hairline crack, efflorescence)

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

(isolated crack, exposed rebar, disintegration, other)

Dimensions/Location:

Notes/Causes: weathered

| | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

(bug holes, hairline crack, efflorescence)

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

(isolated crack, exposed rebar, disintegration, other)

Dimensions/Location:

Notes/Causes:

| | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Plastic (deterioration, cracking, deformation)

Dimensions:

Location:

Notes/Causes:

| | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|

Earthen

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

Quantity: (bare, sparse, adequate, dense)

Appearance: (too tall, too short, good)

Notes:

| | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|

Erosion: (other, surface runoff)

Description (width/depth/length/etc):

Notes:

| | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|

Ruts:

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

Depth: _____ Width: _____ Length: _____

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

| | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|

Riprap: Average Diameter: 9"

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

Notes: some exposed fabric above inlet

| | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|

Rock-Cut (weathered, erosion)

Description/Notes:

| | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|

Other:

| | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|

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

Mis-Alignment:(pipe, chute, sidewall, headwall)

Pipe Deformation

| | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|

Location/Description:

Notes/Causes:

| | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Separated Joint Loss of Joint Material

Location/Description:

Notes/Causes:

| | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|

Undermining:

Location/Description:

Notes/Causes:

| | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|

Other: 6" standing water on top of floor

(Upstream Slope, Crest, Downstream Slope, Seepage, Principal Spillway-Outlet, Emergency Spillway, Lake Drain)

| | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Required Action

OUTLET EROSION CONTROL STRUCTURE (Stilling Basins)

None

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

Notes: *Riprap lined channel with stone mesh*

| | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|
| None | Monitor | Maintenance | Engineer |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Components (baffle blocks, chute blocks, endsill)

MATERIAL [no problem, could not inspect thoroughly]

Riprap: Average Diameter: *3"*

(adequate)

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

Notes: *Some riprap fallen leaving exposed geotextile blanket*

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, entire struct.)

Location:

Description:

Notes/Causes:

Separated Joint

Loss of Joint Material

Location:

Description:

Notes/Causes:

Undermining:

Location:

Description:

Notes/Causes:

Other: *Tree stumps and vegetation next to outlet*

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:

<input type="

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) *Some woody debris*

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: *Weed vegetation growth.*

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

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:

(Upstream Slope, Crest, Downstream Slope, Seepage, Principal Spillway, Emergency Spillway-Inlet, Lake Drain)

None Monitor Maintenance Required Engineer Action

| | Required Action |
|---|---|
| <input type="checkbox"/> Earthen | <input type="checkbox"/> None <input type="checkbox"/> Monitor <input type="checkbox"/> Maintenance <input type="checkbox"/> Engineer |
| <input type="checkbox"/> Ground Cover: Type: (grass, crown vetch) Other: _____ | _____ |
| Quantity: (bare, sparse, adequate, dense) _____ | _____ |
| Appearance: (too tall, too short, good) _____ | _____ |
| Notes: _____ | _____ |
| <input type="checkbox"/> Erosion: (wave, surface runoff) _____ | _____ |
| Description (height/depth/length/etc): _____ | _____ |
| Notes: _____ | _____ |
| <input type="checkbox"/> Ruts: | _____ |
| Location: (entire inlet, lt side, rt side, middle, see dwg) _____ | _____ |
| Depth: _____ Width: _____ Length: _____ | _____ |
| Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian) _____ | _____ |
| <input checked="" type="checkbox"/> Riprap: Average Diameter: <i>Gravel</i> _____ | _____ |
| (adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no) _____ | _____ |
| Notes: <i>Some sparse coverage, too small rock & rebar at shoreline</i> | _____ |
| <input type="checkbox"/> Rock-Cut (weathered, erosion) | _____ |
| Description: _____ | _____ |
| Notes: _____ | _____ |
| <input type="checkbox"/> Other: _____ | _____ |

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

| | |
|---|---|
| <input type="checkbox"/> Mis-Alignment: (channel, chute, sidewall, headwall) | <input type="checkbox"/> Pipe Deformation _____ |
| Location/Description: _____ | _____ |
| Notes/Causes: _____ | _____ |
| <input type="checkbox"/> Separated Joint | <input type="checkbox"/> Loss of Joint Material _____ |
| Location/Description: _____ | _____ |
| Notes/Causes: _____ | _____ |
| <input type="checkbox"/> Undermining: | _____ |
| Location/Description: _____ | _____ |
| Notes/Causes: _____ | _____ |
| <input checked="" type="checkbox"/> Other: <i>Erosion at middle, start of headcut</i> | _____ |

OPEN CHANNEL CONTROL SECTION [no problem, could not inspect]

Width (est., ms.) Brdth (est., ms.) Notes: *Weedy vegetation*

OUTLET OBSTRUCTION [no problem, could not inspect thoroughly]

| | | |
|---|---------------------------|---|
| <input checked="" type="checkbox"/> Debris: (leaves, trash, logs, branches, ice) | <i>left side</i> | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| <input checked="" type="checkbox"/> Trees: Quantity: (<i><5</i> sparse, dense) | <i>stump on left side</i> | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| Diameter: (<6", 6" <i>>12"</i>) | _____ | _____ |
| Location: (entire outlet, lt side, rt side, middle, see dwg) | _____ | _____ |
| Notes: _____ | _____ | _____ |
| <input checked="" type="checkbox"/> Brush: Quantity: (<i>sparse</i> , dense) | _____ | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| Location: (entire outlet, lt side, rt side, middle, see dwg) | _____ | _____ |
| Notes: <i>Weedy vegetation</i> | _____ | _____ |
| <input type="checkbox"/> Other: (beaver activity, partially/completely blocked, i.e.) | _____ | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| Notes: _____ | _____ | _____ |

Notes: _____

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

None Monitor Maintenance Engineer

| 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:

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: *2"*

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

Notes: *weedy vegetation within riprap*

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

OUTLET EROSION CONTROL STRUCTURE (Stilling Basins)

None

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

Notes: _____

| Required Action | None | Monitor | Maint. | Engineer |
|-----------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Components (baffle blocks, chute blocks, endsill) _____

MATERIAL [no problem, could not inspect thoroughly]

Riprap: Average Diameter: 9"

(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: Some erosion from low flow near midlife

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: _____

LAKE DRAIN

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:

Required Action
None Monitor Maint. Engineer

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 Maint. Engineer

Leakage - Flow Rate:

Notes/Causes:

| | | Required Action | | | |
|---|--|--------------------------|--------------------------|--------------------------|--------------------------|
| | | None | Monitor | Maintenance | Engineer |
| <input type="checkbox"/> Outlet Conduit | <input type="checkbox"/> Metal: (loss of coating/paint, surface rust, corrosion (pitting, scaling), rusted out) | | | | |
| Location: | | | | | <input type="checkbox"/> |
| Notes/Causes: | | | | | <input type="checkbox"/> |
| <input type="checkbox"/> Concrete | (bug holes, hairline crack, efflorescence) (spalling, popouts, honeycombing, scaling, craze/map cracks) (isolated crack, exposed rebar, disintegration, other) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Dimensions/Location: | | | | | <input type="checkbox"/> |
| Notes/Causes: | | | | | <input type="checkbox"/> |
| <input type="checkbox"/> Plastic: | (deterioration, cracking) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Location: | | | | | <input type="checkbox"/> |
| Notes/Causes: | | | | | <input type="checkbox"/> |
| <input type="checkbox"/> Conduit Deformation | <input type="checkbox"/> Mis-Alignment: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Location: | | | | | <input type="checkbox"/> |
| Notes/Causes: | | | | | <input type="checkbox"/> |
| <input type="checkbox"/> Separated Joint | <input type="checkbox"/> Loss of Joint Material | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Location/Description: | | | | | <input type="checkbox"/> |
| Notes/Causes: | | | | | <input type="checkbox"/> |
| <input type="checkbox"/> Undermining: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Location/Description: | | | | | <input type="checkbox"/> |
| Notes/Causes: | | | | | <input type="checkbox"/> |
| <input type="checkbox"/> Vegetation | (trees, brush) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Notes: | | | | | <input type="checkbox"/> |
| <input type="checkbox"/> Other: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Notes: | | | | | <input type="checkbox"/> |
| <input type="checkbox"/> Energy Dissipator | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> Type | (endwall, plunge pool, impact basin, stilling basin, rock-lined channel, none) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Notes: | | | | | <input type="checkbox"/> |
| <input type="checkbox"/> Riprap: Average Diameter: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no) | | | | | <input type="checkbox"/> |
| Notes: | | | | | <input type="checkbox"/> |
| <input type="checkbox"/> Concrete | (bug holes, hairline crack, efflorescence) (spalling, popouts, honeycombing, scaling, craze/map cracks) (isolated crack, exposed rebar, disintegration, other) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Dimensions/Location: | | | | | <input type="checkbox"/> |
| Notes/Causes: | | | | | <input type="checkbox"/> |
| <input type="checkbox"/> Mis-Alignment: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Location/Description: | | | | | <input type="checkbox"/> |
| Notes/Causes: | | | | | <input type="checkbox"/> |
| <input type="checkbox"/> Separated Joint | <input type="checkbox"/> Loss of Joint Material | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Location/Description: | | | | | <input type="checkbox"/> |
| Notes/Causes: | | | | | <input type="checkbox"/> |
| <input type="checkbox"/> Undermining: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Location/Description: | | | | | <input type="checkbox"/> |
| Notes/Causes: | | | | | <input type="checkbox"/> |
| <input type="checkbox"/> Other: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Notes: | | | | | <input type="checkbox"/> |

**APPENDIX 6: 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