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**LAKE SHELOOLE  
(SULLIVAN DAM AND COWPATH DAM)  
ENGINEER'S REPORT OF SAFETY  
INSPECTION AND HAZARD ASSESSMENT**

Prepared For:  
City of  
Shelby by  
Triple Tree Engineering, Inc.



**June 2021**

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City of Shelby

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LAKE SHELOOLE  
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ENGINEER'S REPORT OF SAFETY INSPECTION  
AND HAZARD ASSESSMENT

1.0 INTRODUCTION

This inspection report has been prepared in accordance with the Montana Department of Natural Resources (DNRC) Water Resources Division Dam Safety Rules (ARM 36.14.603) to ensure the safe operation of Sullivan and Cowpath Dams. The combined reservoirs are known as Lake Sheloole. As shown in Figure I-1, Lake Sheloole is located in the SW1/4 of Section 15 and NE1/4 of Section 22 of Township 32 north and Range 2 west and between the latitude 48.528°N, longitude 111.855°W and latitude 48.517°N, longitude 111.842°W in Toole County. Sullivan Dam is 49 feet high and provides impoundment for 360 acre-feet below the principal spillway crest (normal pool). Cowpath Dam is 49 feet high and provides normal pool impoundment of 190 acre-feet. One principal spillway and one emergency spillway serve both dams through a connecting channel (Cowpath spillway). Combined storage capacity at crest elevations is almost 2500 acre-feet. Lake Sheloole has been classified as having high downstream hazard potential (CSS, 1980).

This inspection report for Lake Sheloole addresses the following items required by Administrative Rules of Montana (ARM) 36.14.603:

1. An assessment of conditions of the dams and reservoirs based on available data on the design, construction and other inspections (*Section 2*).
2. Findings and assessment of conditions of the dams and reservoirs based on visual observation, including condition of surfaces, vegetation, spillways, and outlets (*Section 3*).
3. An assessment of conditions of the dams and reservoirs based on hydrologic, hydraulic, stability, and other evaluations (*Sections 4 through 7*).

4. An evaluation of the operation, maintenance, emergency, and inspection procedures being used for the dam (*Section 8*).
5. An analysis of piezometric levels or other monitoring data and of seepage conditions (*Section 6*).
6. Recommendations for (*Sections 8 and 9*).
  - Any critical or emergency measures or actions;
  - Corrective measures or actions relating to design, construction, operation, maintenance, and inspection of the structures;
  - Time periods appropriate for implementing any necessary emergency or corrective measures or actions to improve the safety of the dams to an acceptable level;
  - Additional detailed studies, investigations, and analyses;
  - The safe storage level of the dams or reservoirs; and
  - The time of the next inspection by an engineer.



## LAKE SHELOOLE

CITY OF SHELBY  
SHELBY, MT

DAM LOCATION

EXHIBIT

A

## 2.0 DESIGN, CONSTRUCTION, AND INSPECTION HISTORY

References to sources for the following information regarding design, construction, and inspection of Lake Sheloole Dams are Located in Section 10 at the end of this report.

### 2.1 DESIGN AND CONSTRUCTION

Sullivan and Cowpath Dams are rolled earth embankment dams constructed in 1966-1967 as part of a project by the City of Shelby with multiple purposes including flood prevention, fish and wildlife storage, and recreation. The embankments were constructed primarily with glacial till from the surrounding area. Impoundments formed by Sullivan Dam and Cowpath Dam are located on adjacent drainages separated by a high natural ridge. A controlled principal spillway located near the center of Sullivan Dam serves both dams through a connecting channel (Cowpath reservoir spillway channel). An emergency spillway is located approximately 1400 feet north of the right abutment of Sullivan Dam. A trailer park, campground, recreation facilities, and the City of Shelby are located downstream from the dams. The U.S. Army Corps of Engineers Phase I Inspection Report (CSS, 1980) contains a more complete description of the project, design and construction history, regional and site geology, and seismicity of the project area.

Sullivan Dam is located on Sullivan Draw. The crest length is approximately 750 feet long. Cowpath Dam is located on Cowpath Draw. The crest consists of two segments approximately 1425 feet in total length. Both dams have a crest width of 18 feet and height from the crest to the bottom of the outlet channel of 49 feet. The upstream slopes are 1 vertical to 3 horizontal (1V to 3H) and downstream slopes are (1V to 2H). A 10-foot-wide berm is located at the height of the principal spillway crest along both dams (CSS, 1980).

### 2.2 PREVIOUS INSPECTIONS

The City of Shelby has been conducting operations and maintenance inspections or periodic inspections since 1989 (CSS, 1980; HKM, 2002; Hydrometrics, 2011). Dam safety rules contained in ARM Section 36.14.601 require inspections at least once every five years. Inspections were completed in 1991, 1996, 2001, 2006, 2011, and 2016. Copies of inspection reports were submitted to the Montana Dam Safety Program as required to maintain an operating permit for Sullivan and Cowpath Dams.

1. The inspection in June of 2011 included a visual inspection of Cowpath and Sullivan Dams. No recommendations for critical or emergency measures were made. Minor recommendations included periodic operation of the principal spillway outlet gate and grease for the stem of the primary closure mechanism. The need for ongoing maintenance to remove trash and sediment from the spillway and channel was also noted and will continue to be a recommended maintenance item.
2. The last inspection in June of 2016 included visual inspection of the Cowpath and Sullivan Dams. No recommendations for critical or emergency measures were made. Minor recommendations included routine maintenance activities including lubrication and operation of the primary spillway outlet gate, periodic removal of debris from the spillway drop structure, and regular monitoring of erosion areas noted in previous report and will continue to be a recommended maintenance item.
3. The conduit was last inspected in 2016, and no major obstructions or defects were identified. The next conduit inspection is scheduled for 2026.



### 3.0 FIELD INSPECTION FOR 2021

Brad Koon, P.E. and Anthony Moritz (DNRC) conducted a detailed field inspection of Sullivan and Cowpath Dams for the City of Shelby on June 8, 2021. Documentation of this inspection is contained in Appendices A and B. Access to both dams is good by way of a road across each crest. There is a gate across the Sullivan dam at the end of the road, but there are other access roads into the area.

#### Sullivan Dam

The condition of Sullivan Dam's crest is good (Photos 1, 2, 4, and 26). The horizontal alignment appears for the most part to be straight with only minor ruts (~2") caused by vehicles. Vegetation on the crest is fair, with a wide dirt path running along center and 8' of vegetation on the sides. 19 animal burrows were observed along the crest as well as 3 on the upstream slope and 28 on the downstream slope (Photo 3). A large badger hole is shown in photo 17.

The upstream slope is well protected with rock (6" to 3' in size) at the elevation of maximum normal pool and with good vegetative cover higher on the slope (Photos 6, 7, and 8). Vegetative cover is providing good erosion protection between the embankment and abutment in most areas; however, some erosion was observed on the left upstream groin (Photo 16). The right-side contact between embankment and abutment on the downstream slope is covered with riprap. There are 3 trees to be removed. Vegetative cover across the downstream slope is in good condition (Photo 19).

The intake and protective cover on the principal spillway are both in good condition (Photo 5) and the cover is kept locked. The principal spillway outlet gate should be periodically opened and closed to ensure proper operation. The stem of the primary closure mechanism appeared clean but should be greased as well as a cap installed to cover the threads (Photo 25). There is no secondary closure mechanism. The outlet pipe was clear, but some corrosion and cracked concrete were evident on the bottom (Photos 13). The stilling basin has good vegetation surrounding it and is in good condition (Photo 15). However, since the spillway rarely if ever flows, a marshy area along the downstream outlet channel (Photos 15 and 16) indicates some foundation seepage is occurring. The pipe from the principal spillway discharges to a canal, which discharges to a drainage through a drop structure. The drop structure is in good condition. Some minor excavation was observed near the outlet structure. Based on conversations with the City, the excavation was performed to determine the location of the underdrain outlet (Picture 19).

### Cowpath Dam

The horizontal alignment of Cowpath Dam crest is good (Photos 46 and 50). There are two segments at slightly different alignments and the left end curves into the abutment contact. A very small amount of erosion is apparent on the right upstream groin. Vegetation is generally good along the crest with some bare spots (Photo 50). The upstream and downstream slopes have good vegetation (Photos 44 and 78). A few animal burrows were observed, 4 on the crest and 1 on the upstream slope. 3 small trees are growing on the upstream slope (Photos 28 and 29).

No sliding, sloughing, scarping, or unusual soil movement was observed on the upstream slope of Cowpath Dam. A very small amount of erosion was observed on the right groin (Photo 45). Rock is located on the upstream slope at the maximum normal pool elevation to protect against wave action. The slope is also well protected with vegetation above this level. No seepage was observed on the downstream slope, along abutments or in the downstream area. Two drains serve Cowpath Dam, one located on each dam segment (Photos 43 and 52). No signs of recent flow or seepage were observed.

A channel connecting the Sullivan impoundment with the Cowpath impoundment serves as the Cowpath spillway. The Cowpath spillway channel shows evidence of erosion, particularly near the north end (Photo 28) where vegetation is sparse. Most of the channel has very good vegetation. No flow was observed in the Cowpath spillway channel.

#### 4.0 HAZARD CLASSIFICATION

Lake Sheloole is classified as having high-downstream hazard potential as evaluated against the Corps of Engineers Recommended Guidelines for Safety Inspection of Dams (COE, 1975). Both dams are intermediate in size; Sullivan Dam impounds approximately 360 acre-feet and Cowpath Dam impounds approximately 190 acre-feet at normal pool elevation. Failure of either dam would cause property damage and endanger lives in the downstream Hazard Area (Photo 10), which includes recreational and residential facilities, infrastructure, and the City of Shelby (located 2 mile south) (CSS, 1980).

## 5.0 SPILLWAY CAPACITY

The 1980 Phase I Inspection Report (CSS) discusses hydrologic investigations in detail including the estimation of Probable Maximum Flood (PMF). Montana dam safety personnel have performed additional investigations to determine that the principal and emergency spillways have sufficient capacity (HKM, 2002). However, these have not been revised to reflect current Dam Safety program requirements. Additionally, HDR was contracted by the USDA Natural Resources Conservation Service (NRCS) Dam Breach and Auxiliary Spillway Flow Analysis Supporting Inundation Mapping and Emergency Action Plan (HDR, 2019). In this study, the dam outlet capacity is 102 cfs, and the auxiliary spillway is 14,400 cfs.

## 6.0 SEEPAGE

No seepage, wet areas, or evidence of movement were observed on Sullivan or Cowpath dams. No flow was observed in the drain located in Sullivan Dam or in the two drains at the toe of Cowpath Dam. A wet, marshy area was observed below the spillway pipe on Sullivan Dam, indicating some foundation seepage is occurring. However, because the pool levels behind Sullivan and Cowpath Dams remain very low, seepage is not a significant concern for these dams at this time.

## 7.0 EMBANKMENT STABILITY

As reported in the Phase I Inspection Report (CSS, 1980), both Cowpath and Sullivan Dams appear to be stable under current operating conditions.

The crest width of 18 feet meets standards for single purpose flood retention structures presented in TR60 (SCS, 1985). The upstream slopes of 3:1 meet design standards (USBR, 1987) for the sandy, silty clay from which the dams are reported to be constructed (CSS, 1980). However, the downstream slope of 2:1 may not meet this standard if the embankment materials trend more towards clay (CL) than clayey sand (SC). However, as long as the dams continue to be routinely inspected and are checked after large precipitation events, additional stability analysis is not warranted.

## 8.0 OPERATION, MAINTENANCE, AND EMERGENCY PROCEDURES

The Operation Plan, Maintenance Plan, and Emergency Action Plan are on hand with the City of Shelby. At the time of inspection, emergency procedures were last updated on March 16, 2011. The EAP has been updated as of October 2021 and included as Appendix C. A copy of each plan and a brief summary of procedures described in the Plans are contained in the Engineer's Report of Periodic Inspection for Cowpath Dam and Sullivan Dam Shelby, Montana (HKM, 2002). Although some maintenance items from the previous inspection have not been addressed, from the condition of the two dams, it appears that maintenance has been adequate to prevent safety concerns for the dams.

## 9.0 SUMMARY AND RECOMMENDATIONS

This investigation has shown the Sullivan and Cowpath Dams (Lake Sheloole) are being well maintained and appear to be adequately protected from overtopping, seepage erosion, and structural instability, as required by the Montana Dam Safety Act. No emergency or critical actions are necessary at this time. Routine maintenance should include monitoring of erosion areas noted in this report, periodic removal of debris from the spillway drop structure, monitoring water levels below primary outlet structure, clearing vegetation away from toe drains, and annual lubrication and operation of the principal spillway outlet gate. Trees smaller than 6" in diameter should be removed from the spillway channel and upstream slope of Cowpath Dam, and maintenance is recommended to prevent further corrosion on the principal spillway outlet pipe. Additionally, rodent control is needed.



## 10.0 REFERENCES

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