

Environmental Defense Institute

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by Dave McCoy and Chuck Broschious

Complaint to ID Governor on Mackay Dam Hazards Ignored

EDI's March 2017 request to Governor Otter to take preventative action to protect the towns of Mackay, Leslie, Darlington, Moore, Arco and Butte City Idaho from the collapse of Mackay Dam has been ignored. Pursuant to Idaho Code Title 42 Chapters 1701-1721, we are again requesting that an inspection and administrative enforcement action be commenced for Mackay Dam.

Mackay Dam is in poor condition, in an unsafe location and is a clear and present danger to the town of Mackay, Leslie, Darlington, Moore, Arco and Idaho National Laboratory. At risk are more than 600 residents and their property that is in close downstream proximity to the dam. Mackay residents will have no advanced warning of an imminent dam collapse; even with warning evacuation could be difficult or impossible. At this time, there is no electronic or human warning system in place to allow evacuation.

We haven't seen anything to indicate that Mackay Dam management corrected the earlier inspection problems that EDI identified.¹ And additionally, if that dam can have 7 times its capacity flowing through, as IDWR indicates below, it would seem advisable to inspect that dam every month during the flood season, not every year.

Idaho Department of Water Resources Denies Access to Crucial Mackay Dam Inspection Reports

The Environmental Defense Institute filed a Public Records Request to the Idaho Department of Water Resources (IDWR) 12/12/17 under Idaho Code Title §74-102 that included:

- 1) All MacKay Dam Inspection/Dam Safety Reports post 8/11/15.
- 2) The current MacKay Dam Operation/Emergency Plans.
- 3) All communications post 8/11/15 between IDWR (including John Falk) and the MacKay Dam management regarding MacKay Dam.

IDWR response/denial stated: "A portion of your request is denied under Idaho Code § 74-105(4) (b) which exempts from disclosure IDWR records related to existing critical infrastructure. Dam Inspection/Safety Reports and Operation/Emergency Plans are considered critical infrastructure records and are therefore exempt from disclosure." "The Office of the Attorney General reviewed your request. Pursuant to Idaho Code § 74-115, you have 180 days to appeal this decision by filing a petition in the state district court of the county where all or part of the records are located."² IDWR further states: "As explained in the original email sent with the instructions for the document some documents are exempt from disclosure and have been withheld under § 74-105(4)(b). The inspection report falls under this exemption."³

¹ Environmental Defense Institute 3/14/17 letter to Governor Otter and Gary Spackman acting Director ID Department of Water Resources "Mackay Dam: A Preventable Disaster. <http://environmental-defense-institute.org/publications/MackayDam2017.pdf>

² Rosemary DeMond, Administrative Assistant to the Director, Idaho Dept. of Water Resources, email to C. Broschious, EDI,12/28/17

³ Rosemary DeMond, email to C. Broschious, EDI, 12/29/17.

After reading one of the released documents that discussed IDWR John Falk's 10/10/17 letters to the Big Lost River Irrigation District (owner of Mackay Dam) acknowledging the 10/4/17 Dam inspection, EDI challenged IDWR for excluding Mackay Dam inspection report. These inspection reports are crucial for the public to understand the current condition and hazard risk the dam poses only to receive the following:

"The inflow design flood for High Hazard dams is the Probable Maximum Flood (PMF). The existing spillway at Mackay Dam is understood to contain this large flow.

Consequently, when the reservoir is operated at full pool (spillway crest) neither does the dam have enough freeboard to contain the peak flow, nor does the reservoir have sufficient storage capacity to route the inflow without overtopping the dam. This is a scenario that is unacceptable for any high hazard dam. Therefore, IDWR recommends the water level in the reservoir gradually be lowered in the autumn to a relative elevation equal to approximately 50% of total storage volume (i.e., +/- 18' below spillway crest), and the held at said elevation until the beginning of the New Year (2018). This procedure will improve the response time for managing the pool level via a controlled release of water through the outlet conduit until better information has been collected about the upcoming winter's snow depth (snow water equivalent) and the resultant projections for next spring's runoff.

"The snow showers on the day of the inspection restricted to some degree our visual observations, however we did note the following:

* Your efforts to address the dense undergrowth at the downstream toe of the dam have greatly improved pedestrian access. We understand that additional efforts will continue to enable a clear view and unrestricted access to areas that exhibit seepage;

* **The broken gate stem bracket (Gate #4) has not been repaired, but we understand it will be repaired or replaced when the pool level is again low enough to safely access;**

* **Flow water was observed leaking through the concrete joints in the emergency spillway. This appears to occur primarily when the reservoir surface approaches a level near the base of the concrete overflow sill. Flowing water beneath concrete slabs can result in uplift forces that may damage the concrete channel especially when flow within the channel is high."** ⁴

"Enclosed please find a copy of the recent inspection report that describes the above-bulleted items in greater detail. Included is also is the Certificate of Approval which authorizes reservoir storage until the end of the 2019 calendar year. Prior to expiration of the Certificate, IDWR will schedule a return visit to evaluate the physical condition of the dam and its appurtenant works to determine whether or not the project can be approved for the continued impoundment of water. **Please note that authorization to impound water behind the dam may be jeopardized if we determine the structure is not being properly maintained, operated and/or repaired as needed to ensure public safety.**" ⁵

[emphasis added]

Gary Sparkman, Director of IDWR wrote in a letter to Big Lost River Irrigation District:

"Unlike the past several years, however, all water data for 2017 strongly suggest there is currently enough snow in the Big Lost River watershed above Mackay dam to completely fill the reservoir with water many times over.

⁴ Letter to Big Lost River Irrigation District from John Falk, Dam Safety Program Manager Idaho Dept. of Water Resources, 10/10/17, pg. 1.

⁵ Letter to Big Lost River Irrigation District from John Falk, Dam Safety Program Manager Idaho Dept. of Water Resources, 10/10/17, pg.2.

“The purpose for this letter is to encourage you to release as much water as possible from Mackay Reservoir without flooding downstream properties. **The reason for my concern is that the runoff forecast volume of 350,000 acre-feet (NRCS-30%) is more than seven times the entire capacity of the reservoir and the current rate of release (+/- 400 cfs) is too small to prevent the emergency overflow spillway from discharging uncontrollably to pass all of this expected runoff.** This year, the near record volume of water that presently exists in the snow pack may combine later with the unseasonably warm temperatures to create near record maximum flow through the spillway.

“As you are aware, the maximum spillway capacity is approximately 4,370 cfs measured at the top of the concrete training wall. Exceeding this rate of flow may result in severe erosion of adjacent fill materials. Consequently, the sooner you are able to controllably release the maximum quantity of water from the reservoir, the more likely you will be able to reduce peak discharges through the spillway. I am aware that you intend to increase releases from the outlet as soon as the Big Lost River channel downstream from the dam is clear of ice and other potential obstruction.”⁶

In spite of the above warnings Big Lost River Irrigation District (BLRID) wrote in an email to IDWR that they are still “storing water in the dam because we have a river breach at Leslie. I had to reduce the flow in the river significantly to stop water from going over the highway there and flooding houses. We are in the process of repairing a dike that was put there in the 60s. I have no choice in the matter because it cannot be fixed with 1000 cfs in the river. If we don’t fix this leak now then all hell will break lose when we get more water later and then there is no way to fix it.”⁷

Matthew Anders, Idaho Dept. of Water Resources emailed a response to Jim Rindfleisch BLRID:

“IDWR is concerned that unseasonably warm temperatures may rapidly melt the near record snowpack, resulting in near record maximum flow through the spillway. Based on conversations with your May 5th and 9th, IDWR understanding was that BLRID’s reservoir operations would not increase the contents of the reservoir. However despite BLRID having increased outflows, the reservoir contents are continuing to increase.”⁸

“Summary of Mackay Reservoir:

- * Capacity 45,000 AF [acre feet]
- * Spillway Capacity: 3,250 cfs [cubic feet per second]
- * Outlet Capacity: 3,000 cfs
- * Maximum Recorded Release: 2,990 cfs (6/10/1921)

“The outlet works consist of five (5), 4’W x 8’H slide gates. Three gates sit at the bottom of the tower, and two are set about 20’ higher elevation. Based on the Phase I Inspection Report, the maximum outlet release through all five gates at full pool is ~3000 cfs, but I don’t believe this has ever been verified/confirmed. Similar to Oakley, I think the limiting factor is not the gates but may be the tunnel size/configuration (500’ length, 10’W x 10’H).

“The emergency overflow spillway is 24’ wide at maximum width and 8.2’ deep, and is estimated to have a **discharge capacity of 7000 cfs w/ the pool level at the top of dam. But I think that’s pure estimate as there is nothing that I can find that would provide any sort of a rating curve. The estimated “normal” maximum spillway capacity is reported to be 3250 cfs w/ four feet of freeboard.** [free board is the distance between water level and the top of the spillway wall]

⁶ Gary Sparkman, Director of IDWR letter to Big Lost River Irrigation District Manager, Jim Rindfleisch, 3/14/17:

⁷ Jim Rindfleisch Big Lost River Irrigation District email to Matthew Anders, Idaho Dept. of Water Resources, 5/17/17.

⁸ Matthew Anders, Idaho Dept. of Water Resources emailed a response to Jim Rindfleisch, 5/16/17 :

“So.....total discharge capacity from Mackay Dam without infringing on the freeboard *could* be considered to be the sum of the outlet gates and the spillway (~6250 cfs). At the time of the 1978 Report, the maximum recorded reservoir inflow was 2760 cfs on 6/12/1921; the maximum outflow at the dam (assumed gates *and* spillway) was 2990 on 6/10/1921. The drainage area is listed as 788 square miles: PMF from the “old” HMR is 41,000 cfs peak inflow with a 5-day volume of 100,000 acre-feet.”⁹

In a June 2017 email titled **“Mackay Reservoir Update--Flooding Imminent”** from David Hoekema, IDWR to the Big Lost River Irrigation District, he states:

“I’ve attached the Department’s latest Mackay Reservoir Update report, which I prepared today. It appears the reservoir will fill sometime tonight, at which time reservoir releases will start to approach reservoir inflows. We anticipate this will result in a spill between 2,400 and 3,100 cfs. Reservoir releases at these flow rates will approach maximum rates of anything seen in recent times. There is some risk that reservoir releases could exceed the maximum historic record which was set on June 10, 1921 and June 6, 1986. BLRID has exercised significant flood control efforts as can be seen graphically in the attached report, but the reservoir is filling fast.

“The county emergency coordinators attended the May Water District meeting and seemed to be making preparations for a flood event. Maureen O’Shea the Coordinator for Idaho’s Floodplain Management Program will contact the local emergency coordinators today regarding Mackay Reservoir releases.”¹⁰

Mackay Dam was built nearly a century ago without any thought given "to conform to seismic or hydrologic design criteria." The Utah Construction Co. had no previous experience in reservoir construction. No one knows how safe the dam will be during the next earthquake or major flood. Mackay Dam lies 11 miles from the Borah earthquake fault that caused a 7.3 earthquake (1983).

The State of Idaho classifies Mackay Dam as a Category 1 "high hazard." The dam receives safety inspections every two years. Since the last inspection was in 2009, the Idaho Department of Water Resources report does not reflect that Mackay Dam was overtopped in 2010 and 2011 from high run-off. (See photos of Mackay Dam Running Over Spillway on April 26 2010 and on June 26, 2011.

The 2009 recommendation of the dam inspector annual inspections to be made has **not** been followed. Other recommendations have been ignored for years by the Mackay Dam owner, the Big Lost River Irrigation District. These include failure to:

- Maintain a record of the amount of flowing water through the base of the dam.
- Issue storage authorization for one-year intervals
- Update emergency action/operation plan to keep it current
- Monitor all leaking water through the base of the dam, and to keep a comprehensive record of flow quantities for future reference and evaluation

⁹ Matthew Anders, Response from John Falk: Idaho Dept. of Water Resources emailed a response to Jim Rindfleisch, 5/12/17

¹⁰ David Hoekema, *Hydrologist, Technical Hydrology Section, Idaho Department of Water Resources email* Big Lost River Irrigation District, 6/9/17

- Install a log-boom or similar floating barrier at the entrance to the emergency spillway to help prevent boaters from accidental entry when reservoir is experiencing full-pool runoff conditions.

The Idaho 2009 dam inspection report states:

“Much about this dam is not known due to poor documentation during initial construction and subsequent modifications. The amount of leakage observed at the right-center toe of the dam is cause for concern despite claims by the owner that ‘it has always leaked like that’.”

The flow of water from the base of the middle of the dam is now leaking at a rate greater than 1 cu ft. per second, enough water to fill a backyard swimming pool about every 30 minutes.

Mackay Dam, should it not hold, threatens to send an 80 ft. wall of water towards the town of Mackay within 6 minutes. The dam face is 67 ft. high and the reservoir covers 1392 acres with a storage capacity of approximately 45,000 acre feet of water.

On the west side of the dam, the emergency spillway lies beneath a large mass of rock with a continuous crack from top to bottom. This area is susceptible to massive rock movement should an earthquake occur. The steep cliff above the spillway constantly sheds rock into the spillway channel. There is no abutment on the east side of the dam. The concrete spillway channel has numerous cracks throughout.

The State of Idaho has a history of ignoring potential disasters. In 1976, the earthen Teton Dam began eroding due to a leak at its base, then burst, resulting in 11 deaths and over a billion dollars in property damage.¹¹ Teton Dam, built during the same era and of similar design, was only 125 miles away from Mackay Dam.

Dam failures can result from any one, or a combination, of the following causes:

- Earthquakes, which typically cause longitudinal cracks at the tops of the embankments, leading to structural failure.
- Prolonged periods of rainfall and flooding, which cause most failures;
- Inadequate spillway capacity, resulting in excess overtopping of the embankment;
- Internal erosion caused by embankment or foundation leakage or piping;
- Improper maintenance, including failure to remove trees, repair internal seepage problems, or maintain gates, valves, and other operational components;
- Improper design or use of improper construction materials;
- Landslides into reservoirs, which cause surges that result in overtopping;
- Freezing and thawing causing changes in soil density and shrinkage of embankments in contact with bedrock abutments that might adversely affect the safety of earth dams.

¹¹ The hydroelectric industry is not generally held financially liable for catastrophic incidents such as dam failure or resultant flooding. For example, dam operators were not held liable for the 1977 failure of the [Teton Dam](#) in Idaho that caused approximately \$500 million in property damage.^[2] Meehan, Taylor. "Lessons from the Price-Anderson nuclear industry indemnity act for future clean energy compensatory models." Conn. Ins. LJ 18 (2011): 339. Reported in: https://en.wikipedia.org/wiki/Price%E2%80%93Anderson_Nuclear_Industries_Indemnity_Act#cite_note-cilj-12

- High winds, which can cause significant wave action and result in substantial erosion; and,
- Destructive acts of terrorists; (NOTE: In the spring of 1933, during a drought, farmers desperate for water to irrigate their crops, dynamited the head house tower at the dam releasing all impounded waters, and destroyed diversion equipment at the Blaine Diversion. A week later they also blew up the diversion gates at Darlington. More threats of dynamiting caused the Utah Construction Co. to considerably reduce the asking price for its interest.)

All of the above causes for potential dam failure exist at Mackay Dam.

Can a similar occurrence be prevented? Recommendations to consider are:

- Install an electronic warning system and 24 hour monitoring
- Create an emergency plan for evacuation
- Make annual or monthly as needed inspections and an action plan to correct deficiencies
- Repair leakage
- Spillway repairs
- The federal government should take over ownership of Mackay Dam due to national security issues,
- The current owner must carry adequate liability insurance for loss of life and property damage
- Access to the dam should be blocked to prevent sabotage.

The above 9/14/11 Complaint to ID Governor Otter and Gary Spackman acting Director ID Department of Water Resources was submitted by David B. McCoy, Esq., Chuck Broschious on behalf of Environmental Defense Institute.

It must also be noted here as to the possibility of a Mackay dam break compromising safety at the INL due to INL estimates of potential floodwater height. The alarm system, while not necessarily allowing local residents to evacuate could provide many hours for INL facilities to be put into a safer reactor shutdown configuration before flood waters reached INL. This is in addition to the flood inundating buried radioactive waste and causing more contaminate migration into the Snake River Plain aquifer.

Given the high level of danger the restrictions currently imposed are inadequate to ensure safe operation for the Mackay dam. Also there has been past non-compliance with restrictions that have been imposed for Mackay Dam therefore the Certificate of Approval should be denied.¹²

“1976 Teton Dam Collapse” by Idaho Department of Water Resources

“Official investigations into building a dam on the Teton River date back to 1932, and in 1962, after three decades of failed proposals, the Bureau of Reclamation recommended construction of the Teton Dam. In 1964, the U.S. Congress authorized the construction of the Teton Dam which commenced eight years later in February 1972 and was completed in November 1975. Operators began filling the reservoir

¹² <https://legislature.idaho.gov/statutesrules/idstat/Title42/T42CH17/SECT42-1711/>

on October 3, 1975. Regulations restricted the infill rate to 1 foot per day; however, on March 23, 1976, officials authorized a reservoir filling rate of 2 feet per day. After April 10, spring runoff from snowmelt caused the reservoir to fill at an even faster rate. On May 13, the infill rate was increased again and the water rose at an average rate of 3 feet per day with the maximum rate reaching 4.3 feet per day. After the dam collapsed, many argued that officials filled the reservoir too quickly, but after exhaustive research, investigators found that the rapid filling rate did not cause the collapse.

“The Teton Dam appear to be progressing perfectly without any major problems, but trouble approached as the water neared the spillway. On June 3, an inspection team downstream of the dam found clear water seeping from the ground at two locations: one at 1300 feet and another at 1500 feet downstream. By next day another seep had formed 150 to 200 feet downstream. All three seeps formed downstream of the north side of the dam, but none were considered serious hazards.

“The final report to the Department of the Interior (DOI) entitled Failure of Teton Dam: A report of findings,¹³ noted that geologists “recognized early that the reservoir rim could transmit water in large quantities and that seepage from the reservoir could occur.” The rock walls surrounding the dam formed from hot ash that fell and melted together after Yellowstone’s Huckleberry Ridge supereruption 2.1 million years ago. As the welded ash cooled, the rocks fractured extensively, forming large open voids that would allow water seepage around the dam. Construction crews planned to fill in these fractures with grout, but as work continued, crews continually discovered larger and larger fractures. Original projections significantly underestimated the just over half a million cubic feet of grout needed for the fractures (Idaho Daily Statesman reports by Jerry Gilliland and Rod Cramer). Additionally, geologists noted that earthquakes might occur in the area given low levels of seismicity present in the past. In response, equipment was installed to monitor seismicity during construction of the dam and filling of the reservoir. Monitors showed that the collapse was not initiated by an earthquake.

“Engineers recalled hearing a loud noise and rushing water at 10:30 a.m. Project Construction Engineer Robert Robison stated, “This leak developed almost instantaneous at about 10:30 a.m. and let loose with a loud roar” (DOI, 36). Within 10 to 15 minutes, two dozers began attempting to plug the hole and the County Sheriff was alerted to start downstream evacuations.”¹⁴

References:

Below are video and internet links about Mackay and Teton Dams

¹³ Independent Panel Review Teton Dam Failure, <https://www.usbr.gov/pn/snakeriver/dams/upperSnake/teton/1976failure.pdf>

¹⁴ “1976 Teton Dam Collapse” by Idaho Department of Water Resources, <https://ioem.idaho.gov/Pages/History/DamCollapse.aspx>

Video Shows Dam discharge outlet pipes and degraded condition of dam base in the Spring 2017 at low water.

<https://www.youtube.com/watch?v=jK7MgAszYZs>

Arial Video of Mackay Dam 6/11/17 that shows full reservoir and out flow and spillway flow.

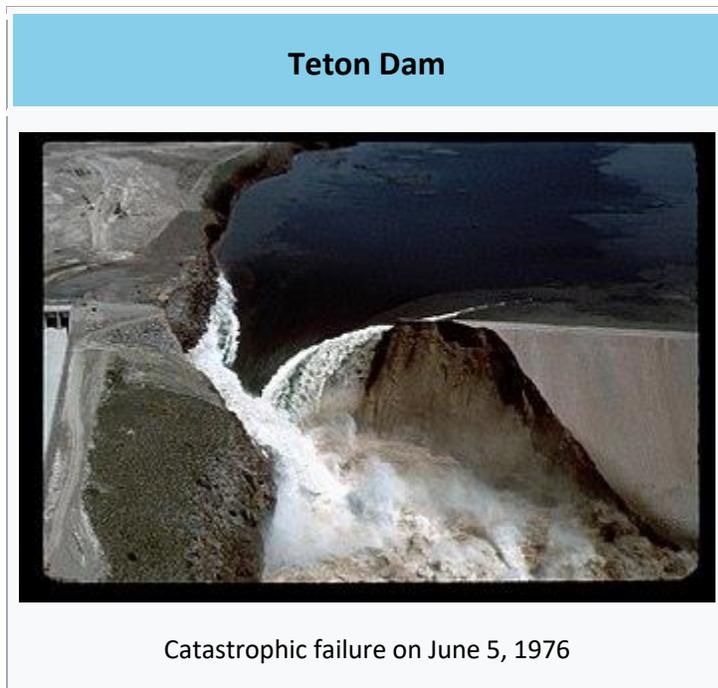
<https://www.youtube.com/watch?v=-eBsDe7x4ww>

“Deadliest Catch” on Mackay Reservoir shows danger high winds w/small boat on reservoir on 7/30/2016. Wave action can be a factor in dam failures

<https://www.youtube.com/watch?v=dmR5N0I026I&feature=youtu.be>

This link from Wikipedia shows pictures of various stages of the Teton Dam Failure

https://en.wikipedia.org/wiki/Teton_Dam#mw-head



“The **Teton Dam** was an [earthen dam](#) on the [Teton River](#) in [Idaho](#), United States. It was built by the [Bureau of Reclamation](#), one of eight [federal agencies](#) authorized to construct dams.^[3] Located in the [eastern part](#) of the state, between [Fremont](#) and [Madison](#) counties, it suffered a catastrophic failure on June 5, 1976, as it was filling for the first time.

“The collapse of the dam resulted in the deaths of 11 people^[4] and 13,000 cattle. The dam cost about \$100 million to build and the federal government paid over \$300 million in claims related to its failure. Total damage estimates have ranged up to \$2 billion.^[5] The dam has not been rebuilt.” https://en.wikipedia.org/wiki/Teton_Dam#cite_note-bor-4