

RECLAMATION

Managing Water in the West

The Teton Dam Failure- An Effective Warning and Evacuation



**By Wayne J.
Graham, P.E.**

**For Presentation at the Association of State Dam
Safety Officials 25th Anniversary Conference,
Indian Wells, California, September 7-11, 2008**



**U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Denver, Colorado**

July 30, 2008

Introduction

This story could start with, “It was a dark and stormy night,” or “Under a night sky, the wind blew the snow into five foot drifts,” but the story starts differently. It begins with “It was that beautiful kind of June morning that is just right for working in the garden and yard.”

On Saturday, June 5, 1976, at 11:57 a.m., on a bright and sunny day, Teton Dam failed. Measured in terms of either dam height or volume of water released, the failure was the worst in U.S. history. More than 180 square miles were inundated, 771 homes were destroyed, 3,002 homes were damaged, 16,650 livestock were lost, and 11 people lost their lives directly or indirectly from the flood. (Report No. 94-963, Teton Dam Disaster Assistance Act of 1976)

Several forensic studies were conducted to determine the cause of failure. Analyses of the warning and evacuation received cursory treatment in these studies. This paper examines the Teton Dam failure, specifically the discovery of the problem at the dam, attempts to fix the problem, decision to notify local public safety authorities, disseminating the warning, and public response to the warning. The success of the warning and evacuation is evaluated and factors that operated for and against the success of the evacuation are discussed. Finally, a discussion of how the Teton Dam failure experience may be used to reduce the impacts of future dam failures is given.

I start by briefly describing the physical setting of Teton Dam, the locations of populations at risk in this setting, the sequence of flood events, and the damages resulting from the flood. This is followed by a description and evaluation of the flood warning and public response.

Cover Photos:

Teton Dam. Photo taken from the left abutment 1000 feet downstream looking toward the right abutment of the dam. Approximate time: 11:52 a.m. on June 5, 1976. Photo by Jerry Dursteler (Gibbons and Reed).

West Rexburg not far from the South Fork of the Teton River, showing flood damage following the break in Teton Dam. Photo taken June 17, 1976. Photo by Glade Walker (U.S. Bureau of Reclamation).

Setting

Teton Dam was located in southeastern Idaho. The Teton River drains the western slopes of the Teton Mountains and the northeastern slopes of the Big Hole Mountains located along the Idaho-Wyoming border. The Teton Dam was located in a steep-walled canyon incised by the Teton River. The Teton Canyon ends approximately 5 miles downstream from the dam. The river meanders through a relatively flat plain and divides into two forks about 4 miles downstream from the end of the canyon. Both forks, which meander broadly through the alluvial deposits, flow into Henry's Fork several miles further downstream. Henry's Fork enters the Snake River about 11 miles downstream from the mouth of the South Fork Teton River. American Falls Dam is located on the Snake River 123 miles downstream from the mouth of Henry's Fork. The flatlands in the Teton River, Henry's Fork and Snake River basins were (and continue to be) used extensively for agriculture.

Construction of the dam began in February 1972 and was substantially completed in November 1975. The 305-foot-high zoned earth fill structure was to store water for supplemental and primary irrigation water, power production, flood control, and enhancement of fish and wildlife and recreation. The drainage area at the dam was 853 square miles.

On October 3, 1975, reservoir filling began; the reservoir was then at elevation 5060 feet. (IRG, p. 35). From January 1, 1976 to April 5, 1976 the reservoir rose from elevation 5146 feet to elevation 5174 feet, or about 0.3 feet per day. From April 5 to June 1 the reservoir rose 118 feet or about 1.9 feet per day. During the first 5 days of June, the reservoir level was increasing at an average rate of 2.3 feet per day. The dam failed with the reservoir at elevation 5301.7 feet, 30.3 feet below the dam crest. At the time of failure, the reservoir contained about 251,700 acre-feet of water. A total of 240,000 acre-feet of water drained from the reservoir within about 6 hours.

Flooding Sequence

Table 1 summarizes significant events at the dam from June 3 to June 5, 1976.

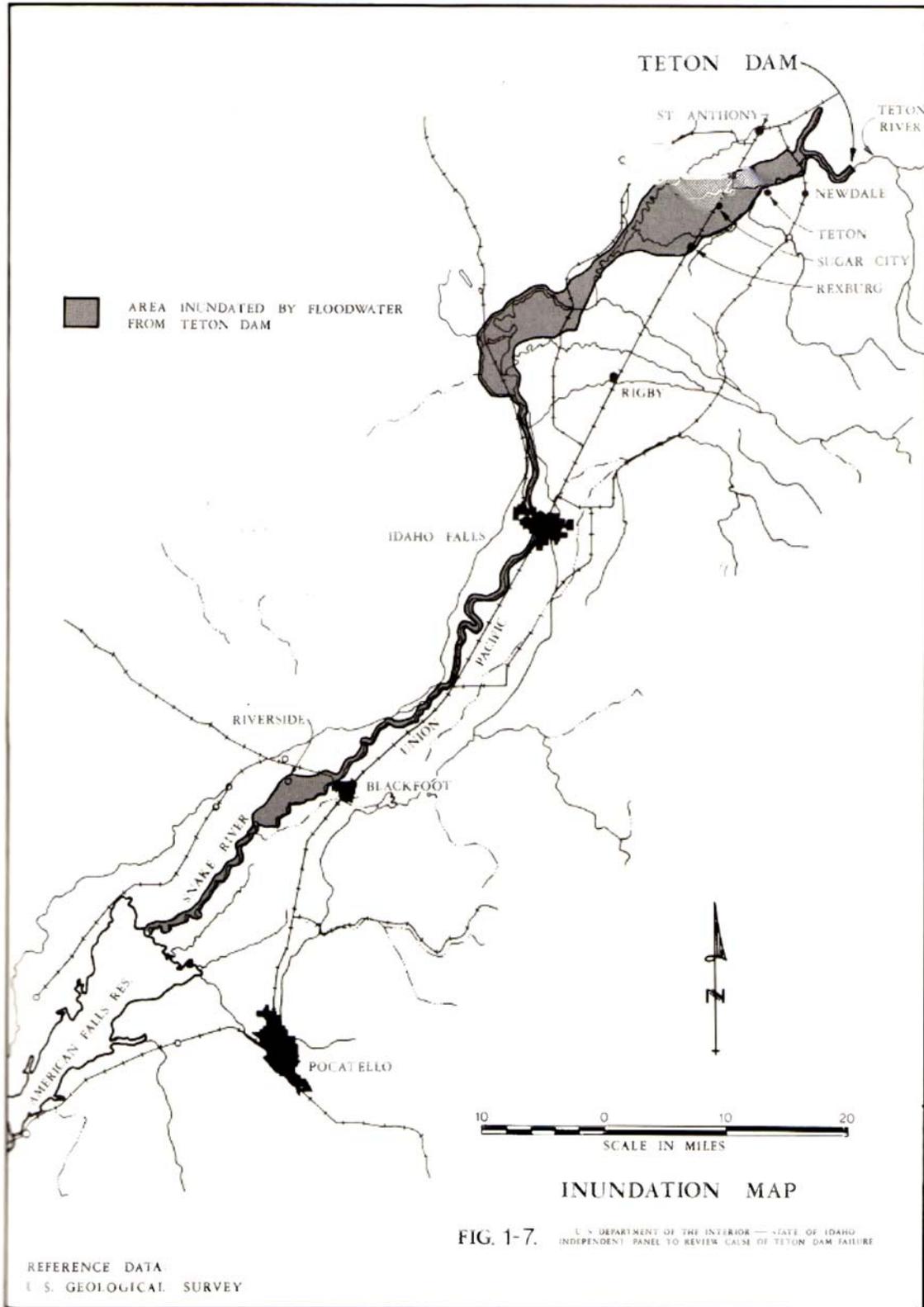
Table 1 Significant Events at Teton Dam from June 3 to June 5, 1976 (primary source, IRG, page 47)		
Date	Time	Event
June 3		Two small seeps noted 1,300 and 1,500 feet downstream from toe of dam on right abutment flowing 40 and 60 gallons per minute, respectively
June 4		One small seep note 160 to 200 feet downstream from toe on right abutment flowing 20 gallons per minute
June 4	9:05 p.m.	Sunset
June 5	12:30 a.m. to 7:00 a.m.	No Reclamation or contractor employees at dam (IRG, p. 35)
June 5	5:46 a.m.	Sunrise
June 5	7:00 a.m.	Slightly turbid leakage first noted at El. 5200 coming from right abutment
June 5	7:30 - 8:30	Turbid leakage first noted at El. 5045
June 5	8:30	Leakage at El. 5045 examined and estimated to be 20 to 30 cfs
June 5	9:10	Leakage at El. 5000 examined and estimated at 2 cfs
June 5	9:20	Leakage at El. 5045 examined and estimated at 40 to 50 cfs
June 5	9:30 – 10:00	Project Construction Engineer (PCE) considered alerting area residents, but decided that an emergency situation was not imminent and did not want to cause a panic
June 5	10:15	Wet spot at El. 5000 formed rapidly and began to leak and erode embankment
June 5	10:30	Loud noise heard by several people
June 5	10:40	Two dozers begin to push materials into hole at El. 5200
June 5	10:43	PCE notifies sheriff's offices in Madison and Fremont Counties and advised them to alert citizens of potential flooding and to be prepared to evacuate the area downstream
June 5	11:00	Whirlpool develops in reservoir
June 5	11:00 – 11:30	Additional notification given to Madison and Fremont County sheriff's offices to evacuate areas below the dam (source: Chronicle-News)
June 5	11:00 -11:10	Efforts initiated to fill whirlpool
June 5	11:30	Dozers slide into downstream hole – operators rescued
June 5	11:45	Sinkhole forms at El. 5315 on downstream face of dam
June 5	11:45	Dozers attempting to fill whirlpool were removed from top of dam
June 5	11:55	Dam crest collapses
June 5	11:57	Embankment breached
June 5	12:30 – 1:30 p.m.	Peak dam failure outflow of 2,300,000 cfs (source: U.S.G.S. Open-File Report 77-765)
June 5	5 to 6 p.m.	Teton Reservoir essentially empty

The flood was contained in a 1,200-foot-wide canyon, from the dam to the canyon mouth, 5 miles downstream. There were groups of people rafting and fishing in the canyon on this beautiful spring day. A group of five people paddling a raft through the canyon observed the river flow getting higher and muddier and soon after observed a wall-of-water 50 feet high. (These people were warned by a relative firing a .45 pistol; they scampered out of the canyon and all survived). (Idaho East, p.78). Two men were fishing on an island. The water rose about 6 feet and the two became caught in the water. They decided to swim to shore at which time they could see a 30 foot wall-of-water

coming at them. (Both were swept away in the log-infested torrent; one died and the other survived after a 10-day hospital stay) (Teton OHP, Grigg).

A dairy farmer at the mouth of the canyon made the following observation at about 12:20 p.m. with the water about one-half mile upstream: “The canyon was just straight up and down with water, just level full, but it was like it was just straight up and down in front of it. The water was hitting these big cottonwood trees, and the canyon was clear full of those trees. They were going down as soon as the water hit them and break them. They were gone that quick.” (Teton OHP, Bischoff).

Upon exiting Teton Canyon, a 15-foot wall-of-water flooded the farming community of Wilford and the denser and more heavily populated farming community of Sugar City. In the vicinity of Sugar City, the flood was about 4 miles wide and would be up to about 7 miles wide near Rexburg where flood depths were approximately 6 to 8 feet. The wide flood plain near Rexburg caused a significant decrease in both flood peaks and forward movement of the flood. Figure 1 shows the dam failure inundated area from Teton Dam to the head of the American Falls Reservoir. Figure 2 shows the dam failure inundated area in more detail from Teton Dam to Idaho Falls. Table 2 summarizes flooding resulting from the Teton Dam failure.



1-8

Figure 1 – Teton Dam Failure Inundation Map

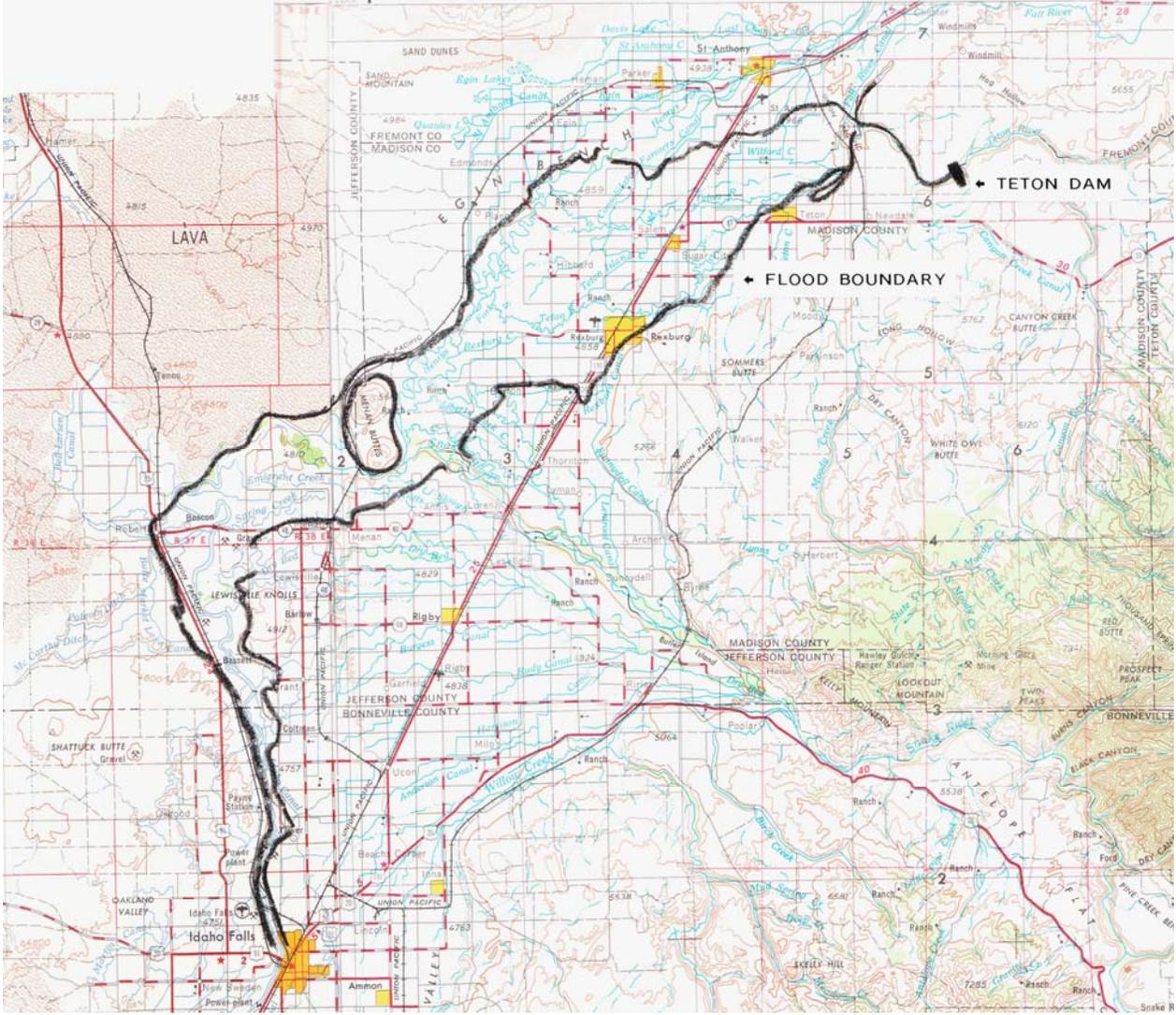


Figure 2 – Teton Dam Failure Inundation Map from Teton Dam to Idaho Falls

Table 2 Teton Dam Failure Summary Flood Data (Primary source: USGS Open-File Report 77-765)					
Location	Miles from Dam	Flood Arrival Time	Flood Arrival Travel Time (time from embankment breach)	Peak Flow (cubic feet per second)	Flood Description
Teton Canyon	2.5	12:05 p.m. June 5	8 minutes	2,300,000	50 to 75 ft wall-of-water
Near mouth of Teton Canyon	5.0	12:20 p.m.	23 minutes		
Wilford	8.4				120 of the 154 homes “completely swept away”
Town of Teton	8.8	12:30 p.m.	33 minutes	1,060,000	Only tiny fraction flooded
Sugar City	12.3	About 1:30 p.m.	1.5 hours		15-foot wall-of-water
Rexburg	15.3	About 2:30 p.m.	2.5 hours		6 to 8 feet in a few minutes
Roberts	43.1	9:00 p.m.	9 hours		
Idaho Falls	63.0	1 a.m. June 6	13 hours	90,500	
Shelley	71.2	2 a.m.	14 hours	67,300	Peak 21 hours after arrival. 0.5 feet per hour average rate of rise.
Blackfoot	112.1	10 a.m.	22 hours	53,500	Peak 35 hours after arrival. 0.3 feet per hour average rate of rise.
American Falls Reservoir	155.9	0:30 a.m. June 7	36.5 hours		Easily accommodated the flood volume

Losses Resulting from the Flood

Five counties were impacted by the flooding. Loss estimates provided below were obtained from the June 13, 1976 issue of the Idaho Statesman as summarized in the Teton Dam Disaster Assistance Act of 1976. Estimates may vary in other portions of this report.

The Teton River formed the boundary of Fremont and Madison Counties. It was these two counties that experienced the most dangerous flood conditions.

Fremont County contained the farming community of Wilford. Fremont County had 134 homes destroyed, 14 homes damaged, and 4,300 livestock were lost. All six drownings occurred in Fremont County.

Madison County contained much larger communities than Fremont's Wilford. The largest community in Madison County was Rexburg, followed by Sugar City. Several small communities were in Madison County. Countywide, 493 homes were destroyed, 2,211 homes damaged, and 10,600 livestock were lost.

Continuing downstream, Jefferson County contained Rigby. Jefferson County had 45 homes (mobile homes) destroyed, 285 homes damaged, and 1,450 livestock were lost.

Bonneville County contained Idaho Falls, the largest community impacted by dam failure. Flooding in Idaho Falls did not begin until 13 hours after Teton Dam failed, providing ample opportunity to take actions to protect life and property. No homes were destroyed, 38 homes were damaged, and no livestock were reported lost.

Bingham County contained Firth and the partially flooded Blackfoot. Floodwaters in these areas began more than 12 hours after the failure and water rose gradually, with average rates of less one-half foot, or less, per hour. Countywide, 99 homes were destroyed, 454 homes were damaged, and 300 livestock were lost.

In total, 771 homes or mobile homes were destroyed, 3,002 homes were damaged, and 16,650 livestock were lost.

The failure of Teton Dam caused the loss of 11 human lives, 6 from drowning. Table 3 provides summary information on the loss of life.

Table 3 Fatalities Caused Directly or Indirectly by the Failure of Teton Dam (Primary Source: "Idaho East, The Teton Dam Flood," Winter 1977)			
Name, Age, Hometown	Location	Distance from Teton Dam (miles)	Circumstances
David Benson, 21, Teton City	Teton Canyon	2 or 3	Fishing on Teton River. Only drowning victim not warned.
Florence Daw, 76, Wilford	Wilford	8.5	Received in-person warning by grandson. Apparently did not leave residence before flood wave hit house. Drowned.
Clarence Daw, 79, Wilford	Wilford	8.5	Clarence and Florence were in same house and received same warning message.
Glen Bedford, 30, Parker	Wilford	8.5	Was trying to help remove household items from wife's parent's house in Wilford. Remained in house too long and then unable to escape. Drowned.
James Bedford, 33, Parker	Wilford	8.5	Was with Glen Bedford.
Charles McRae, 55, Parker	Wilford	8.5	Was with Glen Bedford.
Stanley Peterson, 51, Rexburg	Rexburg	15.3	Accidental gunshot wound sustained when removing a gun from his vehicle, June 5.
John Heyrend, 72, Idaho Falls	Idaho Falls	63	Heart attack suffered while loading valuables and emergency supplies into his vehicle in anticipation of order to evacuate, June 5
Natalee Pendrey, 62, Rexburg	Rexburg	15.3	Heart attack. Had previous heart condition. Evacuation contributed to death, June 6.
Mary Gillette, 94, Teton City	Teton City	8.5	Oldest resident of Teton City, died after being evacuated, June 6.
Karen Virgin, 29, St. Anthony	St. Anthony	7.5	Self-inflicted gunshot wound, June 10. Authorities attributed her death to psychological problems resulting from the Teton Dam flood.

The Warning Process

Reclamation and contractor staff were scheduled to work Saturday, June 5 at the dam site. Workers started arriving at about 7:00 a.m. Reclamation's Jan Ringel telephoned Reclamation's Pete Aberle at about 8:20 a.m. and notified him of the leakage. Aberle left

for the dam and his wife called Reclamation's Project Construction Engineer (PCE) Robert Robison. Aberle and Robison both departed their Rexburg residences by vehicle and arrived at the dam at about 9:00 a.m.

The PCE, along with other personnel, observed the leakage and discussed measures to control the leakage. Between 9:30 and 10:00 a.m. the PCE "considered the matter of alerting area residents at this time, but decided that an emergency situation was not imminent and he did not want to cause a panic." (IRG, p. F-32)

At 10:43 a.m. the PCE notified the sheriff's offices in Fremont and Madison Counties (the first two counties that would be impacted by dam failure flooding) advising them to alert citizens of potential flooding and to be prepared to evacuate the area downstream. Between 11 a.m. and 11:30 a.m., the PCE requested the Fremont and Madison County Sheriff's to call for a complete evacuation of all low-lying areas below Teton Dam. (Busch, August 2002) and (Chronicle-News, p9)

Sheriff Stegelmeier of Fremont County (County Seat – St. Anthony) logged a warning from the dam of pending collapse as of 10:43 a.m. He immediately telephoned the PCE at the dam. The PCE told the sheriff that there was a "possibility the dam might go but it would 'go slowly.'" (Chronicle-News, p5) The sheriff "did not sense the urgency of the situation based on the PCE's comments that the dam was not in immediate danger, and that if a failure occurred, it would probably be a slow process." The sheriff said "immediate action was not initiated to warn people." (GAO, p67) The sheriff telephoned Ted Austin of St. Anthony radio station KIGO who also placed a call to the PCE. Austin and Deputy Sheriff Rhinehart then left in the same vehicle for the dam. (IRG, p. F-82) Rhinehart and Austin stayed at the dam making telephone calls until the telephone lines were dead. They then sped to Teton City and drove up and down the streets warning people through the police loudspeaker system. (Chronicle-News, p5) Sheriff Stegelmeier did not realize the urgency of the situation until Rhinehart called from the dam to notify him that the dam had failed. Sheriff Stegelmeier commented, "County officials simply did not have enough time to explain the situation, and many people failed to understand the seriousness of a dam failure in relation to other floods they had lived through." (GAO, p67)

Sheriff Smith of Madison County (County Seat – Rexburg) was advised by his dispatcher of the threatened dam collapse at about 10:50 a.m. The Sheriff did not immediately accept the warning as valid, but he decided that the matter was too serious not to act on the call and he began telephoning everyone he knew in the potential flood path, starting with a citizen residing one and one-half miles from the dam. None of his officers reached the dam site prior to the collapse. (IRG, p. F-82)

Radio and television broadcasts spread the word of the dam failure quickly and effectively. Some broadcasts were better than others, based on the information they received from officials and on what the broadcasting staff was observing.

Ted Austin of St. Anthony radio station KIGO was contacted by Fremont Sheriff Stegelmeier. Austin contacted the PCE who asked Austin to “broadcast a public service message to alert people below the dam that the structure had sprung a leak. He said to tell them that crews were working on the leak and would open a diversion tunnel and area residents should be prepared for a rise in the level of the Teton River.” (Chronicle-News, p5) The radio station, however, allowed its taped programming to continue before broadcasting a warning because of the apparent lack of urgency of the situation. (GAO, p67) Upon reaching the damsite with Deputy Sheriff Rhinehart, Austin broadcast from the site announcing that the dam was breaking up. Austin then traveled to Teton City with Rhinehart and then caught rides with different people and traveled a circuitous route to St. Anthony, stopping at Teton Dam enroute and at the community of Tetonia where Austin made another telephone broadcast over KIGO. Sheriff Stegelmeier said, “his broadcasts did the trick in alerting people to evacuate,” and that his broadcasts “could be attributed with saving many lives.” (Chronicle-News, p5). Not everyone was pleased with KIGO broadcasting. The Bischoff’s, owner of a dairy farm near the mouth of the Teton Canyon were asked, “Did you ever hear the radio announcer sound excited about the flood?” Mrs. Bischoff’s response was, “No. We were listening to KIGO...but on KIGO, they didn’t sound too excited.” (OHP, Bischoff)

Many of the people living in flooded areas were thankful for (and survived) due to the spirited reporting of Don Ellis of radio station KRXX in Rexburg. The sheriff’s office called the station at about 11:08 a.m. and spoke with Don’s son Mitch who was announcing and working the board shift that morning. The sheriff’s office told Mitch that the Bureau of Reclamation had called the sheriff’s office and said there was leak in the dam and that the people downstream should prepare to evacuate if necessary. For several months before this, every once in a while Don would hear people talking about leaks in the dam. Don and others would ignore these statements. However, because this particular phone message originated with the Bureau, and was passed through the sheriff’s office, Don thought, “Well, maybe I’d better go up and see what was going on.”

Don Ellis got in his car, stopped at his home to pick up his 18-year-old daughter and drove to the dam site. While driving to the dam, Don communicated with his son by two-way radio. (Teton OHP, Ellis)

Recognizing that this might be serious, Don asked Mitch to begin tape recording the broadcast. Don restated this request after they arrived at the dam.

While Don and his daughter drove to the dam (from about 11:10 to 11:30), Mitch began to announce on the air, many times, that they had received a message from the Bureau through the sheriff’s office that people directly below the dam along the river should probably make preparations to evacuate if necessary. Not everyone took this seriously, not even Mitch who was joking about it. (That Day in June, p. 32)

Don and his daughter arrived at the dam at about 11:30 a.m. He drove to the visitor’s outlook and he knew immediately there were problems “because it was beginning to develop a pretty good sized hole right at the base of the dam.” Don and his daughter

watched the two bulldozers fall into the hole. They could see the hole enlarge. They recognized that this was something quite serious. Don talked to Mitch and said, “You better put me on the air right quick, because we have a real problem!”

Don began broadcasting live from the dam. He began telling people that “we were having a difficult problem with the dam.” “The dam is slowly beginning to crumble, it would appear! There is a lot of water coming through and there is going to be some problems downstream!”

Don soon saw the whole downstream face of the north side of the dam crumble. The volume was suddenly so tremendous and immediately he knew, “everyone standing there knew, a real disaster was in the making.” He began broadcasting continually from that point on. **“People downstream, evacuate quickly! Hurry! Hurry!”**

In Don’s words:

On my tape, when I listened back to it, it was simply repetitious of, “People downstream, people in the way of these floodwaters, there is going to be a tremendous flood! The volume of water coming through will be tremendous! The people downstream should evacuate quickly! The water is coming!” Repetitious, on and on and on, through the entire tape. I would talk for a short time from up there, with the two-way radio and Mitch, at the studio, would take it back down there.

It was soon instant madhouse at the radio studio. Mitch was by himself. State police, law enforcement sheriff officers, and people started to run into the radio station. Civil defense people and average citizens would run in and wonder what was going on. The state police and others began running in with messages to put over the air, such as the areas that should evacuate – “The floodwaters will reach Sugar City in 20 minutes! People get out of the way! Cannot save anything! Hurry! Hurry! Hurry!”

Power was lost to the transmitter at 2:40 p.m. and the station went off the air and remained off the air for several days. (Teton OHP, Ellis)

Richard Howe, a reporter for KID Radio AM and Television Station in Idaho Falls learned at about 11:45 a.m. that a warning had been given that Teton Dam was in danger of collapse. He immediately went to the airport at Rexburg and flew to the dam with a cameraman, arriving within minutes after actual collapse of the dam. He began broadcasting an account of the flood as visible by air. TV film footage was seen on CBS Network Television that evening. (IRG, p. F-77)

The Idaho State Police were actively involved in warning people. Information from Officer David Neal provides an overview of the state police involvement. He was on routine patrol near Rigby, about 30 highway miles from Teton Dam, when he was notified by police radio to proceed to the Rexburg area to assist local authorities with evacuation due to a break of Teton Dam. “Two of us” were assigned to go the Fremont

County Sheriff's office and two to the Madison County Sheriff's office. Before arriving at Rexburg the state police were reassigned the responsibility of proceeding east of Sugar City and on to the county roads to advise people in the area that the dam had broke and to evacuate the area. When asked about the reaction of the people to the dam failure message the officer said, "Well, most of them couldn't really realize it then others would over react, a few out there driving kind of wild." The officers could see some people loading furniture and others trying to free their livestock. They also observed people coming into the area to see the flood. The officer mentioned two planes that were following the crest down, providing spot reports of where the flooding was. [It is not known if this information was conveyed to the state police officers]. Upstream from Sugar City the wall of water appeared to be 15 to 20 feet high. There were times when the officers were only 200 yards ahead of the wall of water. (KID Radio Reports, Tape 5, Interview #1).

The following stories describe how officials learned about the dam failure, traveled by ground or air to observe the dam failure and flooding, and did all they could to get people out of harms way:

Keith Walker, Chairman, Madison County Commissioners, was cleaning corrals when his older boy rode up in a motorcycle and about the same time his father drove up in a pick-up truck with the message that Sheriff Smith was trying to get in contact with him. All three got into a vehicle, Walker drove. Upon arriving at the town of Teton, the radio announcer had stated that the dam was going, that it had broken. Walker stated in an interview on April 1, 1981, that he told his father, "With all the decisions that are going to have to be made, I'd better see for myself." They continued to the dam, saw "hunks of dirt coming out of the face of the dam" and then drove toward Rexburg. (Many people were driving to the dam to witness the event). Passing through Sugar City on their way to Rexburg, they saw Idaho State Police starting to go door-to-door and down side roads to evacuate people. Walker dropped his son and father off, instructing them to gather respective families and evacuate while he (Walker) went straight to the Madison County Courthouse in Rexburg. (Clements)

Ronnie Moss, Civil Defense Director, Madison County learned about the failure as someone ran out of a store as he pulled into Rexburg Mighty Mite. Kent Marlor, Operations Director, Madison County Civil Defense, learned about the failure when a next door neighbor rushed over and told him. Moss and Marlor were at the courthouse when Walker arrived. Before arriving at the courthouse, Moss had been on his amateur radio, heard airplane owners talking, and asked them to meet him at the Rexburg airport for a flyover. While Marlor remained at the courthouse, Walker and Moss were driven to the airport, became airborne as passengers "to see how far the waters had come and how bad the flood was. We needed to see if it was starting to spread out and lose some of its velocity and force." Walker and Moss remained in direct radio communication with the operations director, other commissioners and county police when they were traveling to the airport and when air born. Walker was hoping that with the big and wide valley, the water would spread out and lose its force. When they flew over the wall of water, it was just going over the roof of the Wilford Church. They could see trailer houses and homes

floating in the water. Moss said, "It was a sickening feeling" [to see only a part of the top of the church roof]. Walker radioed back to Marlor that it was worse than he thought it would be and that the water looked 30 feet deep and from 3 to 4 miles wide. Moss was "really concerned how we're going to get everybody warned." Moss radioed back to the command post, talked with Marlor, and said, "It's bad, move the people." They returned to the Rexburg airport and reconvened with others who had moved out of the courthouse to the Army reserve building near Ricks College. (Clements) (OHP, Moss)

The following is a direct quote from Moss's oral history interview:

And from that time [flying over Wilford Church] the evacuation directly progressed. There had been some evacuation before that time, the state police were out working from house to house. We had people warning neighbors, neighbor warning neighbor. The siren was going and we also had the Bonneville Jeep Patrol out, getting people out. I found out later there were stake presidents, bishops, and everybody, but at that time I wasn't aware of it.

When asked if they flew all the way to the dam, the response was:

No, we never went clear to the dam. When we saw what had happened we knew our responsibilities. We'd better be back at the command post directing affairs. We wanted to see what we actually had, we needed that type of information. There was a lot of talk, you were listening on the radios and different things, but you need to assess some of those things sometimes yourself and take a look at it. (Teton OHP, Moss)

After receiving the flood report from the air born Walker and Moss, Marlor initiated a move out of the courthouse to Rexburg Hill. Marlor and others implemented a three stage evacuation plan in Rexburg. In Marlor's words:

We still didn't know exactly how far that water was going to come into Rexburg, so we looked at a three stage evacuation. First, from the South Fork of the Teton River to First North in Rexburg. Then from First North, south in two stages. Actually, we evacuated to what is really the foot of the campus on an east-west basis. We received water in some areas within a half a block and in other areas right up to that particular point. That is as far south as we attempted the evacuation within Rexburg itself.

Sirens were sounded, but effort was required. Again, in Marlor's words:

The first thought that occurred to me as I got to the courthouse, before really we had the other two commissioner's, was that we have got to alert the people and we, at that time, asked the sheriff's office to sound the civil defense sirens in both Sugar City and Rexburg. The sirens sounded and I walked out the door to grab our communications man and they shut off the sirens after about a minute. It really bothered me because at that point I thought if I can't depend on them to

leave those sirens on, I can't depend on them for anything. I physically had to grab the one deputy and told him to leave those sirens on until I ordered him to turn them off. You can imagine at that point that they were flustered. (Teton OHP, Marlor)

Warning was spread quickly through word-of-mouth. The seed for this warning likely originated with Don Ellis's on-site reporting from the Teton Dam. Based on interviews held primarily with residents of Rexburg and Sugar City, only 7% of people learned that the dam failed from police. The vast majority of people (79%) first learned of the failure from the radio, a neighbor or telephone. The remaining 14% first learned of the failure from TV, neighborhood runners, and people making contact in person or by phone. Sirens were sounded but people did not mention this as the way in which they learned of the failure. (Idaho East, Winter 1977).

Typical Response to the Warnings

Far from causing a panic, the warnings issued were received by many with an initial state of denial. Many people didn't believe the dam failure information that they first received. The following is a typical response upon first learning of the dam failure:

And then, when I heard of the dam breaking (I think I heard it first on the radio) they first said the dam was leaking and then they announced if you live below the dam you should prepare to evacuate. Well, I thought they meant everyone who lived right underneath the dam. We had been up to visit the dam a couple of months ago and it was quite a drive [from Rexburg] and I thought, "My goodness it's far away. It wouldn't affect us." They repeated the announcement several times and I thought well, surely they would say specifically Rexburg if they meant Rexburg should evacuate. My neighbor was out working in her yard. ...I asked her if she'd heard and she said, "Yes." And I said, "Do you think that we ought to evacuate?" and she said, "Oh no, it's never flooded this high before." About that time one of my neighbors came in tears and in hysterics and said, "Have you heard? The dam's broken!" I thought "Oh my goodness, you silly girl. You're kind of overacting." So, my first thought was not to take it seriously. I think that I remember thinking that this is 1976; dams don't break. (Teton OHP, Bake)

Most people eventually evacuated, but only after receiving several warning messages from various sources. Some people evacuated more promptly than others. The following story of a Wilford family, similarly duplicated thousands of times during this dam failure event, show how people went through a social psychological process of hearing the warning, understanding what was meant by the warning, believing the warning, personalizing the warning, i.e., that it was meant for them, and responding by moving to a safer location. This example also demonstrate that the "single most important factor that influences public response to warnings is confirming risk information through interacting with others and searching for additional confirmatory information." (Mileti, 1995, p 4)

It was that beautiful kind of June morning that is just right for working in the garden and yard. My husband, Warren, and I had just finished putting the final touches to our work and sat down in the lawn chairs admiring our accomplishment. It was about 12:15, and we were almost ready to eat lunch when I heard someone pounding on our front door. It was so loud and hard that I ran to open it to find a man with a serious, stern, red face and bulging eyes. He commanded me in a loud voice, "Get out! Get out! Get out of your house! The Teton Dam has burst! The flood is coming! Don't stop to get food or clothes or anything. Get to high ground. It means your life!" He slammed the door and ran.

My husband came in just then to see what the yelling was about. I was frightened and until the man said the dam had burst, I thought he was crazy. Now I knew he was serious.

"What shall we do? I asked. Warren said "Grab an armload of your best clothes, and I'll do the same, then I'll get the cars out of the garage. I'll drive one and you take the other." By this time, I had an armload of clothes and a container of cookies that I had baked the evening before. Warren said that I should gather up the family pictures from the piano and put them on the bed upstairs. I took them and a favorite vase upstairs, snatched the sleeping bag from the closet, ran downstairs, picked up what clothes I could carry and my favorite Bible and Book of Remembrance.

The telephone rang twice, and each time I answered it. Once it was my niece, who works at KID-TV in Idaho Falls. "Aunt Martha, do you know about the Teton Dam? Are you getting out?" she asked. The other call was from a friend in Newdale warning me just in case we didn't know. I guess I sounded very excited to my niece because she said, "Aunt Martha, hurry, hurry, goodbye." I found out later that she was very upset for she thought she may have delayed me. But I was happy for her warning, and also grateful to the man who had come to warn us and impressed upon me the seriousness of the situation.

I could hardly see to drive and keep an eye in the rearview mirror to be sure that Warren was behind me. Warren was really quite calm, but I knew that he had been praying for guidance, as I was.

While waiting for gas, I mentioned to Warren that we had forgotten his heart medicine. This was just the excuse he was waiting for. He had decided, and probably been prompted to go back and get our camping trailer. He said he would be careful and watchful. I wanted to go with him, but he said no with such a finality and authority that I said no more. We changed cars, and I watched him drive out of sight. I proceeded to do as I was told, drive through St. Anthony and up the highway to wait for him praying and listening all the way.

It seemed like a long time, and then a voice came over the radio saying that Wilford Ward Latter Day Saints chapel had been destroyed. In a few minutes here came Warren with the trailer.

We went back to Wilford Sunday afternoon, and I thought I was prepared for what had happened. I was not! I could not even tell where I was until I saw a part of our house that was still standing – one of the very few. Out of 150 homes in Wilford, 133 were gone (That Day in June, p5)

Some People Didn't Evacuate and Some People Entered Areas to Help

Some people did not evacuate even though they had varying degrees of knowledge of the dam failure and/or approaching floodwater. Table 3 provides the names of people who failed to evacuate and perished in the flood. Others remained in or near their homes. Most survived, some did not. Some people entered dangerous areas to help move furniture and other possessions. Information is available on the circumstances associated with some of the people who remained in the flood path as the floodwaters arrived.

Harold Bischoff operated a dairy farm near the mouth of Teton Canyon. He and his 3 boys were at the farm branding cattle when his wife, Sharon, and 2 girls arrived back at the farm after being in town. A neighbor came over and told Sharon that “They’re having trouble at the dam and they’re going to turn some water out.” Sharon relayed this information to Harold and she began listening to the radio. She was listening to radio station KIGO from St. Anthony. The announcer on KIGO didn’t sound too excited. Sharon said, “I have wished a dozen times, after I heard what Don Ellis said on KRXX, about ‘there it goes’ [that I had been listening to that station].” Family members watched nearby houses being destroyed and big grain combines floating through a field. Eventually the wife drove to safety with all five children. Harold remained at the farm to tend to his cows, continually moving to unflooded portions of his farm. Their house was not washed away, but the flood tore three sides of it off the foundation. Sharon stated during the oral interview: “As we look at it now, we realize how foolish it was to stay here.” (Teton OHP, Bischoff)

Leah Weston of Sugar City was staying at a sister’s house, also in Sugar City, and received minimal warning. The power went off. An alarm, that she described as a “fire alarm” went off. She looked for a fire and didn’t see one. The alarm went off again; she went outside; a man said, “There’s not a fire,” but he said nothing else. He soon came back, told her the dam had broken and that he would be back to help after going to city hall. He did not come back. Leah remained in her house which flooded but remained intact. She spent 19 hours in the house. (Blackfoot News and Standard Journal).

Verl Bird of Sugar City lived with his wife and three young children. His father-in-law, Leon, was also at the house. A neighbor came running over and said, “The dam has broken. You better get out.” Verl said, “No, go back home. The dam hasn’t broken. There is no problem.” Verl and Leon continued building a motor home. Verl needed more nails and drove his motorcycle to Rexburg where he observed everyone in a “panic”

at the Boise Cascade store. Verl went around a roadblock (set up to prevent people from traveling into the danger area) on his return trip to Sugar City. Upon returning to his house, the family, except for Verl and Leon, departed for Rexburg Hill. Verl had been to the dam two weeks earlier and didn't think too much water was in it. He didn't think too much water would be in Sugar City. Verl and Leon soon observed, one block away, a "solid mass of junk moving, standing up like a wall...two feet in front it was bone dry." Verl and Leon climbed onto and remained on a playground slide in Verl's yard. They watched as trailers and houses floated by. They worried as power lines started leaning from all the floating debris. They remained on the slide from about 1:30 p.m. until 8:00 p.m. (Teton OHP, Bird and May 31, 1977 Rexburg Standard).

Nile Boyle, a pharmacist in Rexburg, was at the pharmacy when his daughter came to the pharmacy and said, "The dam has broken." He didn't believe it until he turned the radio on. Expecting only a foot or so of water, he spent the next couple of hours moving items out of the pharmacy basement and moving things up on high shelves. He and his family went to Rexburg Hill. On the hill he could see floodwater approaching Rexburg – he could see how severe it was. He decided to go to his house (which he had not been to since receiving the warning) to turn off the electricity and move a few things. He went with his wife and six-month old baby (other children must have remained somewhere on Rexburg Hill). They stayed a couple of minutes too long at the house; tried to drive to high ground; exit roads were flooded; and they returned to their house. They went up on their sundeck with 2 other men who were trapped in their area. The water around their house was 4.5 feet deep. They watched houses float away out of the Ricks-Wade Addition. (Teton OHP, Boyle)

A story from the book, "That Day in June," tells of a tragic ending associated with the response to the warnings that were issued when Teton Dam failed. The following, condensed from the book, was written by Vernon Mortensen of Salem and tells of people who lived in Wilford, the first community flooded and people who lived in Parker, a community that was not flooded:

When the very shocking report came over the radio that the Teton Dam had burst, all of the residents living in the valley below the dam were told to prepare to evacuate immediately.

This message was especially frightening to Clara Lieding as she sat in the radio station in Rexburg receiving and conveying messages. Clara's parents, the Lieding's, lived and owned a farm in Wilford, close to the river. Clara, afraid that her parents would be out in the yard working this beautiful morning and not listening to the radio, gave them a telephone call, advising them of what had happened and urged them to evacuate immediately.

The Lieding's went out of their house and looked to the east in the direction of the dam, but because of the large trees and foliage growing in that direction could see nothing to give them much alarm. They did heed the warning advice given to them by their daughter and began loading their personal property onto their

pickup to haul to St. Anthony [a town a few miles away that was not flooded from the failure]. They succeeded in getting two pickup loads hauled to safety.

In the meantime, another daughter of the Lieding's, Colleen, and her husband Glen Bedford, of the town of Parker, had received the message and naturally had an immediate urge to do something about it. Colleen said to Glen, "We've just got to go out to Wilford and help Dad and Mother," but Glen said, "You stay here with the children, and I'll drive over and get Jim (his brother) and Charles McCrea (Jim's father-in-law) and we'll take the pickup and go out and help."

Glen immediately went to his two neighbor's homes, first that of his brother's and then to Jim's father-in-law and started for Wilford. As they passed through St. Anthony, they stopped momentarily at Clara's home where the Lieding's were finishing unloading their second pickup load of belongings. Being unable to see Mr. Lieding because of his position back of the house, Glen said to Mrs. Lieding, "We'll go right out there and see what we can do," and away they drove. When Mrs. Lieding told her husband what had happened, he said, "I've got to stop them. It's too late to do anything now." He started driving back alone towards Wilford in pursuit of his friends and relatives.

As Mr. Lieding was nearing his home in Wilford, he saw the three men busying themselves taking things out of the house and putting them into their pickup. Then as he looked to the east he saw the huge bank of water rushing towards him. He says now, "That bank of rolling water coming towards me looked like it was fifty feet high!"

Rushing to the house where the three men now were, he hollered, "Get out of here before it's too late!" Then he hurriedly went to the cabinet, took out some pills, and left, thinking the others would follow him. Apparently, Glen and the other two just did not sense the danger because when Mr. Lieding hollered, one of them answered, "We have time." But Mr. Lieding had seen the rushing torrent of water and left the premises in his pickup just in time to save his own life. The other three, brave as they were, evidently couldn't imagine the magnitude of the flood, stayed just one minute too long, and were caught by the roaring mass of water and carried away. [The three men died]. (That Day in June, p9)

Tradeoffs Were Made Between Saving Lives and Property

Knowingly or unknowingly, tradeoffs were made between saving property, livestock and human lives. A typed transcript of a KID radio report (tape 1) from Sunday June 6 of the newsman (N) and resident of and business manager in Rexburg (R) is as follows:

N: Now when did you hear about it and what was coming?

R: We heard just before 12:00, I imagine about a quarter to twelve that the dam had broken.

N: How much warning did you have?

R: Let's see, it didn't hit for about three hours, but we sure never believed it would be that bad.

N: I know they'd predicted about 10 minutes. Had you known you had three hours, could you have made quite a bit of saving?

R: Well, we could have, we didn't even take the money out of the cash registers or the checks or the money from the whole week, the charge accounts. Things like that we could have grabbed easily, but we didn't.

N: This seems to be the complaint of most of the people we've talked to. If they'd only known how much time they really had. They could have made a tremendous amount of saving.

R: Well, I'm sure we could've. We prepared a blockade out here of up to about two feet, which is what we thought it would be, course the force that came, didn't do a thing. [The flood overwhelmed their hastily built defense].

N: Oh wow, the wonderful thing is, you know, maybe people left a lot of property they could have saved, but with the warning the lives that have been saved is a big thing.

Author's Evaluation of the Warning Process

The failure of Teton Dam could not have come at a more optimal time of day and season. Early detection of the dam failure, recognition of the need to alert and warn the public by Reclamation staff at the dam, excellent on-site reporting by radio broadcaster Don Ellis of Rexburg's KRXX, warnings and evacuation orders issued by local and state law enforcement officials, and word-of-mouth warning between neighbors, relatives and friends, provided the opportunity for people to move from harms way before the flood arrived. Of the 11 people who died, only one was not warned (he did not realize that a plane flying overhead was attempting to warn him of danger).

Factors Affecting the Success of Warning

Many factors affected the outcome of the Teton Dam failure flood. Some factors promoted chances for a successful outcome, while others hindered success. Some of the factors are beyond the control of public safety officials while others can be influenced to a greater or lesser degree.

Positive factors: Not controllable. The success of the warning and evacuation was promoted by a number of factors not generally under public management. These might be thought of as "chance" factors. It is important to appreciate the contribution of these factors to avoid overestimating the chances for similar success in other dam failure situations.

- Time of day. – Significant problems with the dam were observed soon after workers arrived at the dam on Saturday morning. Daylight allowed these workers to observe the leakage and dam deterioration, recognize that dam failure was imminent and decide to warn the public. Systems and resources for warning the public are better-functioning in the day. Failure during daylight hours allowed media and public safety officials to observe the failure take place and daylight

allowed people exposed to the flooding to see the flood bearing down on them. Many people in the Snake River Valley were afraid to think of the outcome if the dam had failed during the night.

- Time of week. – The failure occurred on Saturday. Most families were together. Spouses were not at work (although some of the farmers were in agricultural fields that day) and children were not at school. As most groups make decisions as families, and evacuate as family groups, having everyone together from the start sped things up.
- Weather. – The weather at the dam and in nearby communities was beautiful on Saturday, June 5, 1976. Pictures taken of the dam failure in progress and of Wilford, Sugar City and Rexburg as the flood passed through, show a mostly clear sky. Visibility was perfect. The high temperature Saturday afternoon in St. Anthony, representative of Wilford, Sugar City and Rexburg was 79 degrees Fahrenheit (26 degrees Celsius). This pleasant temperature brought many people out of their homes to do planting or yard work. At many of these homes, people indoors heard about the flood from the radio or from people phoning and then warned people outdoors while in other cases people outdoors learned about the flood from other people outdoors and then shared the information with people indoors.
- Confirmation of dam failure/flood danger readily available. – Access to the dam by vehicle and air allowed for much stronger warning messages to be issued. People sought confirmation of the danger and the need to take action. This is true for both those issuing the warnings and those for whom the warning was issued.
- Land use patterns. – The areas exposed to the most severe flooding, and flooded soon after the dam break, were sparsely developed. The 5-mile long Teton Canyon did not have riverfront cabins or houses, although there were houses at the rim of the canyon. In the farming community of Wilford, there were 154 homes spread out over a section of Fremont County about 4 miles wide, from north to south, and 6 miles long, from east to west. (Chronicle-News, p3) With an average of about 6 homes per square mile, this is far less than found in typical suburban or urban areas. Roadways and highways had sufficient capacity to convey vehicles out of the flood path without causing backups.
- Communications. – There were not many radio stations near the areas that were flooded in the first few hours after dam failure. There was one AM station in St. Anthony, KIGO, and two AM stations in Rexburg KRXX and KADQ. Radio station KRXX was the most listened to during the dam failure event, possibly because of the on-site broadcasting from the dam. While KRXX was urging people to safety, KADQ "...was playing nice, tranquil music. Finally, it did come on that we should evacuate." (Teton OHP, Case)
- Culture, Religion and strong tight knit communities. – Nearly 95 percent of the people living in Wilford, Sugar City and Rexburg belonged to the Church of the Latter Day Saints, the Mormons. The organizational and social networks brought about by the church facilitated in the dissemination of warning. (Sunstone magazine, March-April 1980, "The LDS Response to the Teton Dam Disaster in Idaho)

- Airport. – Rexburg had a municipal airport located less than 2 road miles from the center of town. Public safety officials and others wanted to see the events at the dam with their own eyes to help them understand the events that were taking place. Many jumped into planes and flew to the vicinity of Teton Dam.
- Access to dam. – The road(s) leading to the dam from Sugar City and Rexburg did not go through Teton Canyon, but rather were located on high ground that was not flooded. This allowed people to travel to and from the dam to observe and monitor the dam failure and the flood that it was creating. Travel time by vehicle from Rexburg to the dam was approximately 20 minutes.
- Telephone and power remained on. – Power and telephone remained functional until utility poles or lines were destroyed nearby. This enabled people to provide telephone warnings effectively.
- Citizen Band Radios (CB). – Several people mentioned using CB radio, short wave radio, or two-way radio to convey information or to hear updated reports. This event occurred before the advent of cell phones and the internet.
- Comfortable evacuation destination. – Ricks College (now Brigham Young University- Idaho), located on Rexburg Hill, provided a safe, comfortable and logical place for people to use as a meeting place after evacuating from areas expected to be flooded. The college provided housing and meals for people displaced by the flood.

Positive factors: Controllable.

- Early detection. – Contractor and Reclamation staff arrived at Teton Dam at about 7 a.m. Saturday morning. As conditions deteriorated, additional staff was called to the dam site to monitor the situation.
- Decision to warn. – Reclamation’s PCE placed a call to the sheriff’s offices in Madison and Fremont Counties at about 10:43 a.m. advising them to alert citizens of potential flooding.
- On-Site reporting by commercial radio. – Don Ellis’s descriptive reporting from Teton Dam over Rexburg’s KRXXK was singled out by Fremont and Madison County officials as being the greatest reason for the low number of fatalities (McDonald, p 87). Ellis was not asked to be on-site; he drove to the dam on his own volition to provide accurate news reporting. He received a plaque from Idaho Governor Andrus recognizing him for his work in warning people that the floodwaters were coming.
- Multiple warnings. – Many people received warnings from several sources - from the radio, from friends, from neighbors, etc.
- Requirement for dam monitoring. – Reclamation’s “Design Considerations for Teton Dam,” October 1971, stated the following: “During the initial filling for periods when the reservoir surface is either rising or falling more than 1 foot per day, and for a least the first year of reservoir operation, frequent inspections of the embankment, of the abutments, and of foundation areas should be made to check for seepage or for significant rises in the water table downstream from the dam.” (Independent Panel, p 10-6)

- Emergency notification strategy outlined. – “The project staff prepared a document entitled ‘Teton Emergency Notifications.’ It contained available Bureau instructions and memorandums covering internal reporting procedures when unusual or serious conditions arise...” However, “it did not contain procedures for notifying and evacuating residents downstream in case of a dam failure.” (GAO, p71)
- There were many aircraft flying. – There were so many planes in the air that at least one pilot stated, “I had quite a bit of altitude [when flying over the dam], but there were numerous planes in the area and I was a little concerned about the traffic” (Teton OHP, Porter). Pilots and passengers were in airplanes to observe, sightsee, report, take pictures, and move planes out of the Rexburg Airport (which did get flooded). These airborne observers, with the messages that they conveyed, provided message recipients with a clear understanding of the seriousness of the flood.

Negative factors: Not controllable.

- Flood awareness. – Flooding occurred in portions of Fremont and Madison Counties in February 1962. The flood caused minor damage. Many people expected the same type of flooding from the failure of Teton Dam.

Negative factors: Controllable.

- Unattended dam site. – Although the time when the dam failed avoided the problem that lack of attendance would have caused, there was no one at the dam site from 12:30 a.m. to 7:00 a.m. the day of the failure. Reclamation should have learned of the need for 24-hour-a-day visual observations during the critical reservoir filling stage from the near failure in September 1965 of Fontenelle Dam in Wyoming. (GAO, p60)
- New dam and reservoir. – The reservoir was being filled for the first time during the spring of 1976. Most people, not having been to the dam or reservoir site during the spring, were unaware of the large quantity of water stored in the reservoir when the dam failed. While generally not surprised by the horizontal boundaries of the flood, most people did not expect the flooding to be as devastating as it was.
- Inability to lower reservoir. – When evidence of the leak in the dam was discovered, Reclamation’s staff at Teton Dam could not immediately open the main river outlet drain to lower the reservoir level because a contractor was behind schedule in completing work on this structure. (GAO, p60)
- Fear about panic caused delay in initiating warning. – Reclamation’s PCE delayed the issuance of a warning to public safety officials or the public partially due to concern over causing a panic. This concern was unwarranted. “The fact persons spend so much time checking out warnings and the fact some refuse to go even when warnings are crystal clear shows panic is not a problem in disasters.” (Scanlon) In the case of the Teton Dam failure, “According to officer Rhinehart [Fremont County Deputy Sheriff], there was no panic in the evacuating areas.

- ‘Everybody really cooperated. It was an orderly evacuation.’” (Chronicle-News, p5)
- No staged evacuation. – Evacuation orders could have proceeded in stages. For example, Teton Canyon and Wilford could have been warned of the potential danger and evacuated while people in Sugar City, Rexburg and other downstream areas were alerted to the danger and told to be ready to evacuate.
 - Inadequate warning in Teton Canyon. – Warnings issued to people in Teton Canyon were inadequate. One group of rafters made a last minute escape when a relative shot a pistol to get their attention. An airplane flying over head tried to warn two men fishing in the canyon. The two men misunderstood the message that the pilot was trying to convey.
 - No inundation map available. – There were no dam failure inundation maps available for Teton Dam the day the dam failed. Some areas were evacuated that did not get flooded. There were no areas that flooded that were not evacuated. In Sugar City and Rexburg, the flood depths were greater than people initially anticipated.
 - No Emergency Action Plan for Teton Dam. – Teton Dam failed before EAP’s were prepared for Reclamation dams. This may have resulted in a less than optimal response to the event. “Sheriffs in both counties [Fremont and Madison] told us that the Bureau made no attempt before the failure to assist the counties in developing an evacuation plan or to discuss any other matters pertaining to a dam failure.” (GAO, p71)
 - Emergency notification strategy not outlined. – The PCE was a speaker at a Kiwanis luncheon about a year before the failure. Michael Kennedy, Prosecuting Attorney for Madison County (Rexburg), raised his hand and asked the question, “What type of danger factor are we dealing with in the event of an earthquake, or some calamity if that dam were to break? What would happen to the people below? What sort of civil defense mechanism do you have to warn them, or to become aware of that possibility?” Kennedy, in his own words: “And he answered my question in a way that made me feel as though it was a radical, doomsday type question. He simply said, ‘If we had to worry about the ultimate hazard with every dam, we would never build one, so we don’t. We just realize it’s a very minor risk and accept it academically but then we don’t worry about it after that.’” (Teton OHP, Kennedy)
 - No emergency operations plan by communities. – Sheriffs in Fremont and Madison counties had not established an emergency plan in case of dam failure because no one thought that the dam would ever fail. (GAO, p67)

Criticism of the warning

Most people providing oral history interviews appeared to be satisfied with the warning. Those people closest to the dam received the least adequate warning and did express criticism. The man whose fishing partner was swept to his death stated: “I don’t know why in hell they even let anyone go on the river. I don’t think that would put everyone to panic, but, you know, “Don’t go fishing on the river.” (OHP, Grigg).

Even if an emergency action plan and inundation maps had existed for the dam, there would have been difficulties. Inundation maps, which display flooded area and sometimes flood depths and travel times, are subject to uncertainty and error. Even with perfect maps, it is difficult to quickly and accurately convey the technical information specific to each of the thousands of residences that were flooded. Today, emergency action plans and inundation maps are generally not released to the public because of security concerns, so the people who need to move out of harm's way are totally in the dark about possible flood impacts.

An editorial, published in the Salt Lake Tribune on June 9, 1976, titled, “[The wolf] Was Licking His Chops,” suggested that the warning should have been issued earlier than it was. The PCE at Teton Dam, responding to criticism suggesting that warning should have been issued earlier stated, “We did not feel it (the situation) was critical until the time we gave the notice.” (Blackfoot News and Standard Journal).

What would have happened if the dam had failed, say, at 3:00 a.m.?

The first response is, “Let's not think about that.” The dam could have failed at 3:00 a.m. just as easily as it did at noon. Perhaps people would have observed leakage at the dam on the prior evening, and initiated 24-hour-a-day surveillance at the dam. The failure initiation process could have developed immediately after sunset which would have made it more difficult to observe the changing conditions at the dam. Warning may not have preceded dam failure. Most people living in areas closest to the dam would have been asleep. They would not have been listening to the radio, watching television, not in the yard or fields conversing with neighbors and those awake would have been hesitant to telephone others at that time of night unless they were somewhat certain of what was happening. Even if awake, the cues of the approaching wall-of-water would be difficult to observe. Moonset on June 5, 1976 was 1:29 a.m.

Wilford residents may have received no warning. Residents of Sugar City and Rexburg likely would have received some warning (although not as good as the warning they actually received). Fatality rates in Wilford would be higher than in downstream areas. With 120 of the 154 Wilford homes completely swept away [Stone, July 6, 1976], miles-wide flooding, deep and turbulent flooding, and lack of daylight to help people cling to floating objects, it is reasonable to assume that more than half of the people in the Wilford homes would have perished in the flood. This equates to loss of life in the hundreds. Loss of life would have also been likely in Sugar City and Rexburg.

Kent Marlor, Operations Director, Madison County Civil Defense stated: “If this had happened in the middle of the night, or if it had happened in the middle of January, our loss of life would have been just terrible. There really would have been no way to prevent that kind of thing.” (Teton OHP, Marlor).

An editorial published Tuesday, June 8, 1976 in the Deseret News (Salt Lake City), titled, “Who's at fault in failure of Idaho's Teton Dam,” reads:

And lest anyone tend to shrug it off as just one of those things, let's remember that we were just plain lucky that this wasn't one of the nation's worst disasters in terms of human casualties. Had the break occurred undetected during hours of darkness, the loss of life could have been overwhelming.

Thoughts and Observations

Many things went right when Teton Dam failed, either by chance or due to the responsiveness of Teton Dam personnel, news media, public safety officials, and citizens. There is relatively little that could have been done on that Saturday to reduce the loss of life that occurred. Based on the events taking place Saturday morning, Reclamation staff acted appropriately in trying to prevent the dam from failing and alerting local officials when failure became foreseeable and likely.

With the benefit of hindsight, I offer the following thoughts and observations:

- It would have been advantageous to notify public safety officials earlier. Today, an emergency action plan with different response levels likely would have achieved this.
- Due to remoteness and difficult access, warnings could not easily be issued to people located in the 5-mile-long Teton Canyon downstream from Teton Dam. While still contemplating whether a warning should be issued for areas further downstream, attempts should have been made to close the canyon to recreation and evacuate people already in the canyon when dam failure became a possibility.
- People were reluctant or hesitant to take action before confirming the validity of the information that they initially received. Some local officials or their staff, as well as news media personnel, traveled to the dam by vehicle or aircraft to obtain confirmation of the danger. Some residents who had been warned of the dam failure did not evacuate until they could see the flood water approaching. The best coverage of the event and the most effective warning originated from a radio reporter from Rexburg who arrived at the dam about 30 minutes before it failed. Residents obtained some confirmation of the danger in their mind's eye by listening to his authoritative radio broadcast. In future disasters, it appears that having some public safety officials and media representatives situated in (safe) areas within sight of the causative event will result in improved decision making and more effective warnings being issued to people at risk. Live television coverage from key locations would provide public safety officials and residents with real-time information on the event.
- The dam owner should provide information to public safety officials and the media. The dam owner should understand the consequences that can occur without adequate warning and should provide public safety officials and the media with a clear description of the flooding that is anticipated. Reclamation addresses this during EAP exercises which occur on a 3-year cycle.
- Warn people repeatedly using as many different means as possible. This will help ensure that people receive at least one message, and people are more likely to take

- recommended actions when they are bombarded with forceful messages from reliable and respected sources.
- For dams that can cause many fatalities if they fail, 24-hour-a-day surveillance may be prudent during initial filling or refilling after any significant modification. This is now done by Reclamation.

References

This analysis of the Teton Dam failure warning, 32 years after the event, was made possible by a rich information base. Primary sources included:

The book, “That Day in June,” published in 1977, based on the stories of nearly 300 individuals who lived in the Upper Snake River Valley and were impacted by the Teton Dam flood.

Newspaper accounts from Rexburg, Idaho Falls, other Idaho locations as well as the major newspapers in Salt Lake City, Utah.

The Teton Dam Oral History Program of the History Departments of Utah State University, Ricks College, and the Idaho State Historical Society. The purpose of the program was to gather and preserve information for historical and scholarly use concerning the Teton Dam Disaster.

Bureau of Reclamation witness statements. These sworn statements were made by most of the Reclamation and contractor personnel who were at Teton Dam on the day of the failure.

References include the following:

Blackfoot News and Standard Journal, “Tragedy: A Chronology of the Teton Dam Disaster Compiled by the Staff of the Blackfoot News and Standard Journal,” undated.

Blumell, Bruce D., “The LDS Response to the Teton Dam Disaster in Idaho,” Sunstone magazine, March-April 1980.

Busch, Leo A., “Experiencing the Teton dam failure,” in *International Water Power and Dam Construction*,” August 2002.

Clements, Louis J., “Teton Dam – June 5, 1976 – Revisited,” A Publication of the Upper Snake River Valley Historical Society, January 1991. [This contains information from an interview with Keith Walker conducted April 1, 1981]

Chronicle-News, “Teton Dam Tragedy – An Account of the Teton Dam disaster in Fremont County Idaho as compiled from the pages of the Chronicle-News,” (booklet).

Deseret News, (Salt Lake City), “Who’s at fault in failure of Idaho’s Teton Dam,” editorial published June 8, 1976.

(GAO), Report of the Comptroller General of the United States, “Actions Needed to Increase the Safety of Dams Built by the Bureau of Reclamation and the Corps of Engineers,” June 3, 1977.

Idaho East, Greater Idaho Falls Chamber of Commerce, “The Teton Dam Flood,” Winter 1977.

Independent Panel to Review Cause of Teton Dam Failure, “Report to U.S. Department of the Interior and State of Idaho on Failure of Teton Dam,” December 1976.

(IRG), U.S. Department of the Interior Teton Dam Failure Review Group, “Failure of Teton Dam, A Report of Findings,” April 1977.

McDonald, Dylan J., “The Teton Dam Disaster (Idaho) – Images of America,” Arcadia Publishing, 2006.

Mileti, Dennis S., “Factors Related to Flood Warning Response,” in *U.S.-Italy Research Workshop on the Hydrometeorology, Impacts, and Management of Extreme Floods*, Perugia (Italy), November 1995.

Ninety-fourth Congress, 2nd Session, “Teton Dam Disaster Assistance Act of 1976,” Senate Report No. 94-963, June 21, 1976.

Rexburg Standard, “They used a slide for a high perch,” May 31, 1977.

Salt Lake Tribune, “Was Licking his Chops,” editorial published June 9, 1976.

Scanlon, T.J., “What the Research Shows, Part 2, Leaving, Waiting and Coming Back: Evacuation as a Strategy in Emergency Management,” in *Conference: Problems with Large Scale Evacuations, Easingwold Papers No. 5*, The Emergency Planning College, 1994.

Stone, George L., Transcript from the James Moyle Oral History Program, Historical Department, The Church of Jesus Christ of Latter-Day Saints, SLC, Utah, July 6, 1976.

Teton Dam Oral History Program Transcripts (including, but not limited to, the following):

Bake, Margaret; Rexburg

Bird, Verl; Sugar City

Bischoff, Harold and Sharon; St. Anthony (near mouth of Teton Canyon)

Boyle, Nile; Pharmacist in Rexburg

Case, Garrett; Rexburg

Ellis, Don; Owner of Rexburg Radio Station KRXX

Grigg, Daryl; Fishing in Teton Canyon, companion drowned
Kennedy, Michael; Prosecuting Attorney for Madison County
Moss, Ronnie; Director, Madison County Civil Defense
Marlor, Kent; Operations Director, Madison County Civil Defense Office
Porter, Arthur; Owner of printing business in Rexburg

Teton Dam Special Collection (from Utah State University Library)
KID Radio Reports, Tape 5, Interview #1

Thomas, Janet, et.al. (Editors), "That Day in June: Reflections on the Teton Dam Disaster," Ricks College Press, 1977.

U.S. Geological Survey, "The Flood in Southeastern Idaho from the Teton Dam Failure of June 5, 1976 – With Sections on Ground Water Fluctuations and on Quality of Surface and Ground Water," Open-File Report 77-765, 1978.

Acknowledgements

Special thanks go the following:

Louis Clements of the Teton Dam Museum. He reviewed an early draft of the report and provided me with his insights of the failure. He also provided a cassette tape with the KRXX radio Teton Dam failure broadcast. It was fascinating listening to Don Ellis and his son Mitch.

Liz Kline with the Special Collections and Archives group, Merrill-Cazier Library, Utah State University. She provided copies of documents from the Teton Dam Flood Collection.

John Powell with the Special Collections and Archives group, David O. McKay Library, Brigham Young University – Idaho. He provided copies of documents from the Teton Dam Flood Collection and copies of slides showing the failure of Teton Dam and flooding in downstream areas.

Several people reviewed and provided comments on a draft of this report. Thanks go to:

Pete Aberle, retired from Reclamation and present at Teton Dam on the day it failed.
Mark Baker, Brian Becker, Tim Randle and Larry Wolf of Reclamation.
Audrey Karper of the Fish and Wildlife Service.