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Managing Water in the West

A Synopsis of Notable U.S. Dam Failures

1874 to present

U.S. Department of the Interior
Bureau of Reclamation

Dams Included:

Dam	Dam Height	Year of Failure	Loss of Life
Mill River, MA	43	1874	138
Walnut Grove, AZ	110	1890	70 to 100
Swift, MT	157	1964	19
Buffalo Creek Coal Waste, WV	46	1972	125
Canyon Lake, SD	20	1972	<165
Teton, ID	305	1976	11
Kelly Barnes, GA	40	1977	39
Timber Lake, VA	33	1995	2
Big Bay Lake, MS	57	2004	0
Ka Loko, HI	44	2006	7

Mill River Dam
(Williamsburg Dam)
Located in western Massachusetts

- 43 Feet High
- Earthfill
- Failed May 16, 1874 at 7:20 a.m.
- Failed due to piping, embankment slide and then collapse of core wall.
- No warnings were issued before dam failure.
- 138 Fatalities

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Factors Affecting Loss of Life Mill River Dam

Positive Factors

- Daytime
- No flooding before failure
- Short walk to safety
- No people at risk in first 3 miles
- Gatekeeper lived at dam and observed dam deterioration

Negative Factors

- Steep channel, flood depths of 20 to 40 ft.
- No method for communicating from dam to below.
- No warning plan
- Many received no warning or only a few minutes of warning

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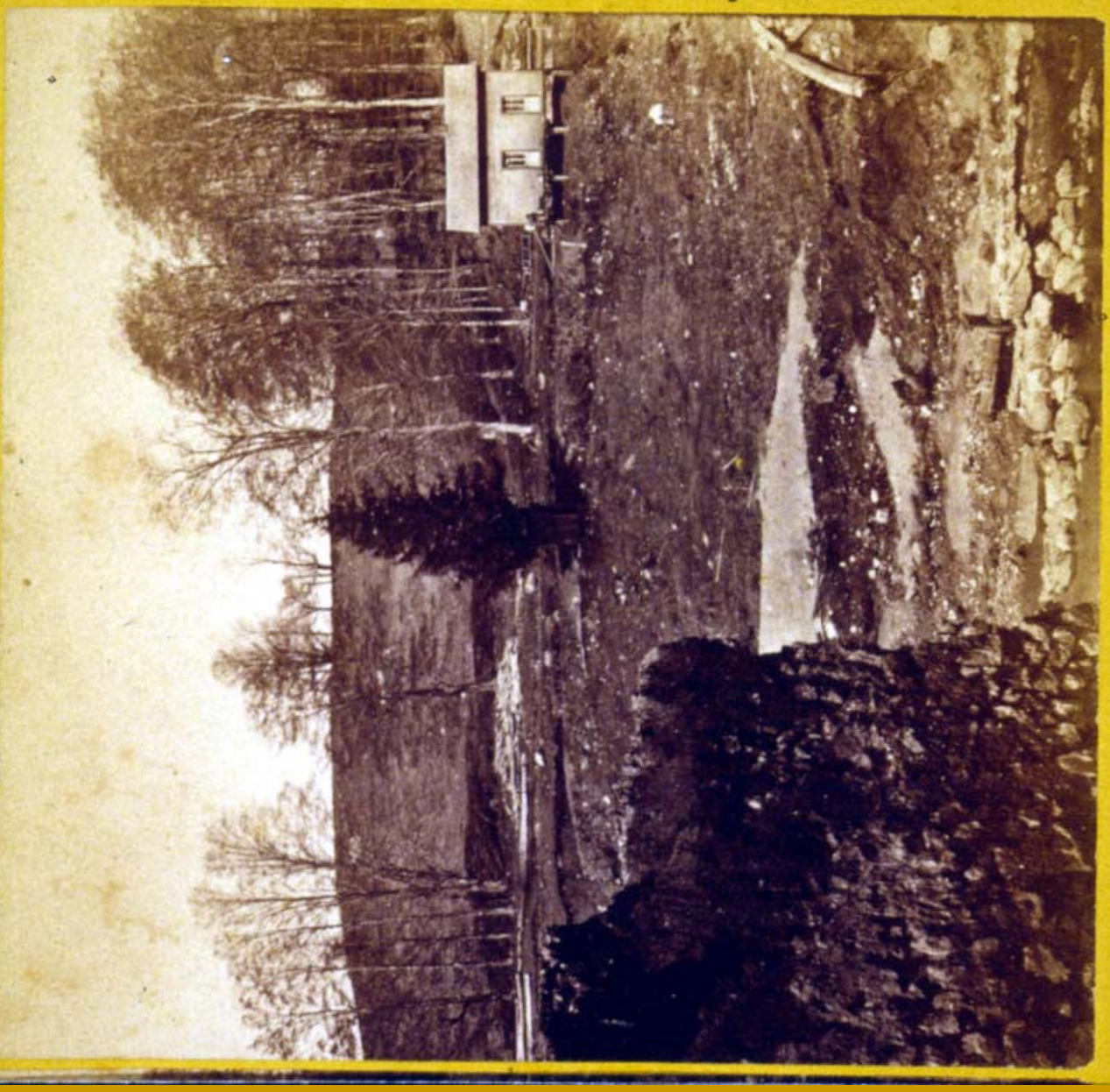
Views of the Flood in Mill River Valley.

View at Williamsburgh Reservoir. (Descriptive List the other side.)

Views in Mill River Valley

After the Great Flood of May 16, 1874.

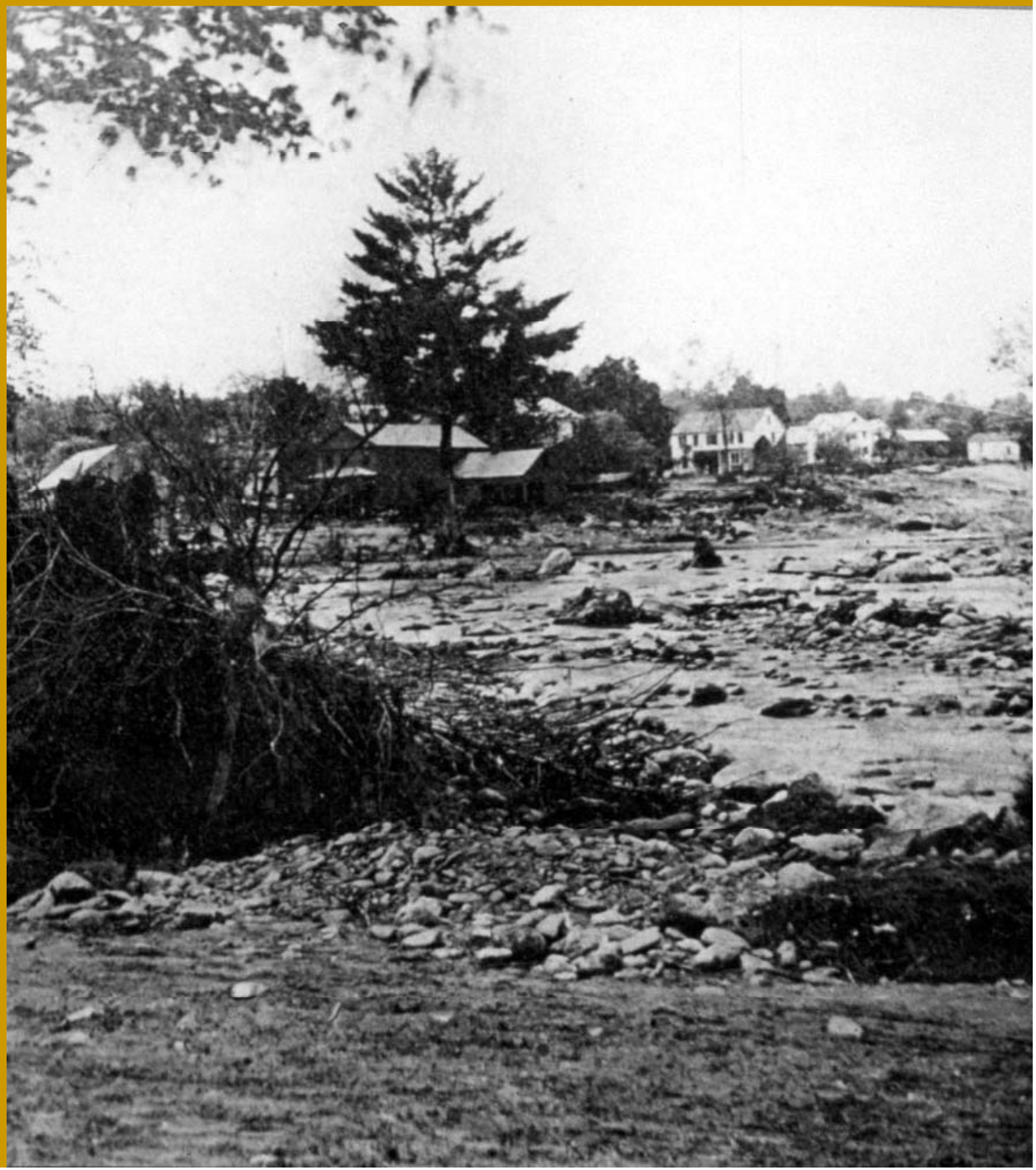


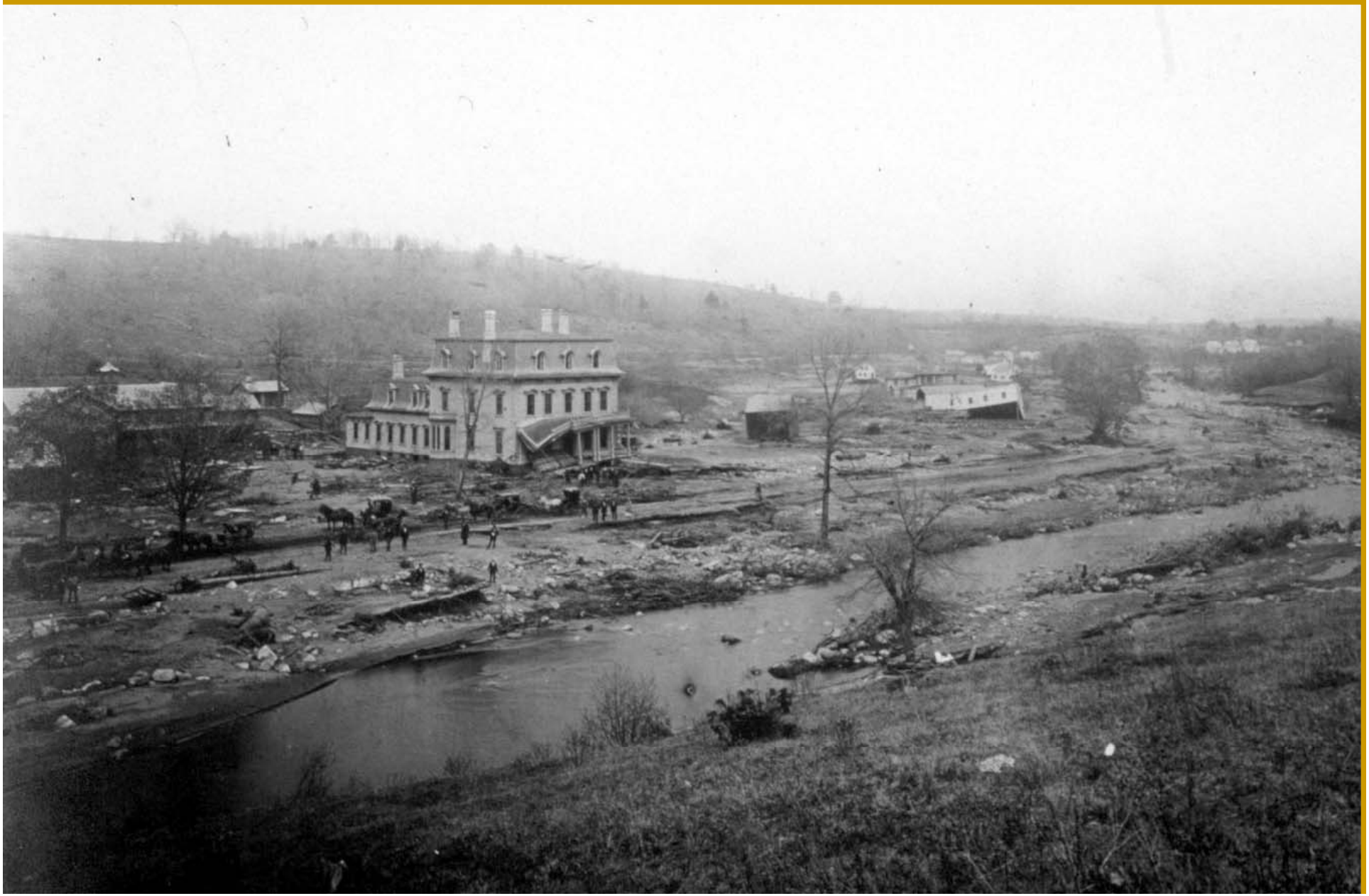
Bed of Williamsburgh Reservoir, showing east wall.

Views in Mill River Valley

After the Great Flood of May 16, 1874.

Geo. Cheney, gate-keeper at Williamsburgh Reservoir.





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Walnut Grove Dam, Arizona

- 110 feet high
- Rockfill
- Failed February 22, 1890 at 2:00 a.m.
- Failed due to overtopping
- No warnings issued before dam failure
- 70 to 100 fatalities

Factors Affecting Loss of Life Walnut Grove Dam

Positive Factors

- Few at risk in first 14 miles
- Some people awakened by roar and scrambled to safety
- Employee sent on horseback to warn people, 11 hours before failure

Negative Factors

- Night
- Flood depths of 60 to 80 feet
- People in flimsy structures
- Employee on horseback never reached people at risk

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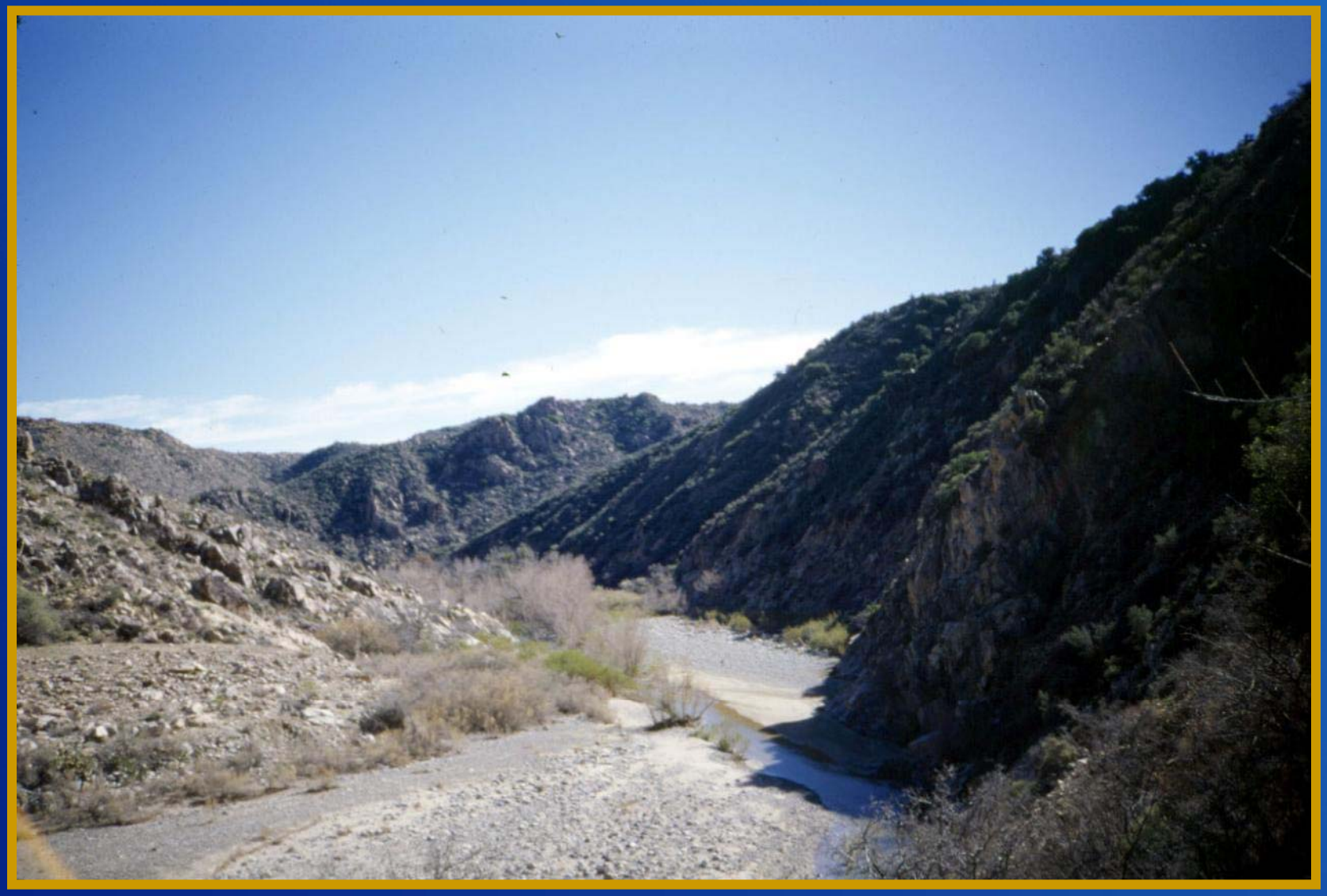

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Swift Dam, northwestern Montana

- 157 feet high
- Rock fill
- Failed June 8, 1964 at 10 a.m.
- Structural failure during major flood
- No warnings were issued prior to dam failure.
- 19 fatalities including 8 members of one family.

Factors Affecting Loss of Life Swift Dam

Positive Factors

- Daytime
- Area downstream sparsely populated

Negative Factors

- No one at dam to observe
- Weather (flood conditions) hindered communication and travel
- Great Falls media lacked reporting for this remote area

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FIGURE 27.—Remains of Swift Dam looking downstream from the reservoir area. Arrow points to a part of the right end of the upstream face of the dam.

Picture No. P1054-D-45266. Emergency-type spillway on the north abutment of Swift Dam. The flood plain immediately below Swift Dam is several hundred feet wide. Pieces of large rock and debris carried out of Swift Dam at the time of failure are scattered downstream for a mile or more.

July 14, 1964

Picture No. P1054-D-45267. Picture taken looking at the abutments of Swift Dam, from a point below the dam.

July 14, 1964

Picture No. P1054-D-45268. Looking across Birch Creek to the north abutment where Swift Dam used to be.
July 14, 1964

Picture No. P1054-D-45269. Taken from same location as P1054-D-45268, looking downstream showing the debris that has been spread out over the flood plain as a result of the failure of Swift Dam. The dam failed at 10:10 a.m. on June 8, 1964. Practically all the water was released within a matter of minutes.

July 14, 1964

Picture No. P1054-D-45265. Picture taken of Birch Creek at U.S. Highway 89 crossing, looking to the east and showing the debris and trees that have been knocked down from the recent flood. Part of the flood flow was caused by the failure of Swift Dam.

July 14, 1964

Buffalo Creek Coal Waste Dam in the mountains of West Virginia

- 46 feet high
- Dam formed with waste material from coal mining.
- Failed February 26, 1972 at 8 a.m.
- Failed from slumping of dam face during a 2-year rain.
- No warnings issued before dam failure.
- 125 fatalities

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Factors Affecting Loss of Life Buffalo Creek Coal Waste Dam

Positive Factors

- Daytime
- Some people in upper valley evacuated based on rumors
- Safe areas reached in few minutes on foot
- Dam being monitored by coal company officials

Negative Factors

- Dam failed suddenly resulting in rapid increase in flooding
- Steep gradient – high velocity floodwater
- False alarms prevalent
- Owner reps did not recognize that failure was imminent and did not enlist the aid of sheriff deputies who were on site, ready to help with evacuation

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Canyon Lake Dam at Rapid City (2nd Largest City in South Dakota)

- 20 feet high
- Earthfill
- Failed June 9, 1972 between 10:45 and 11:30 p.m.
- Failed due to overtopping.
- No concerted effort to warn of dam failure prior to failure.
- Approximately 165 fatalities downstream from the dam; contribution resulting from dam failure not known.

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Factors Affecting Loss of Life Canyon Lake Dam

Positive Factors

- Dam could be seen from nearby homes
- Easy access to dam by vehicle for confirmation of danger
- Dam located near city with wealth of resources

Negative Factors

- Night
- Heavy rain
- Flooding in large area took attention away from dam
- Many residences impacted
- Magnitude and seriousness of event not well understood
- “low-lying areas urged to evacuate” Dam failure not incorporated into message

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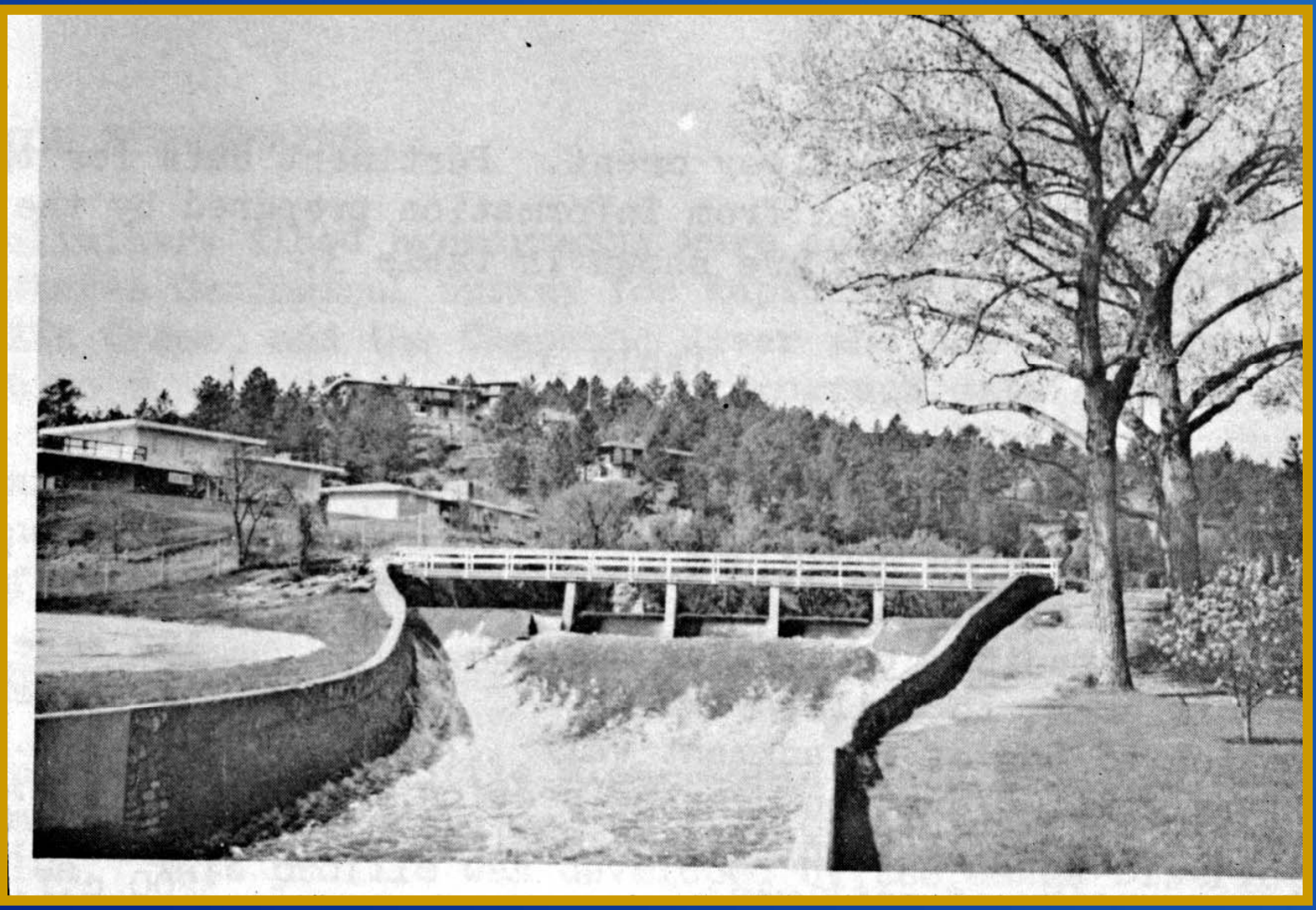

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Teton Dam, Idaho

- 305 Feet High
- Earthfill
- Failed June 5, 1976 at 11:57 a.m.
- Failed due to piping during initial filling.
- Warnings WERE issued prior to dam failure.
- 11 fatalities
  - 10 of these people had been warned.
  - 6 fatalities from drowning, 5 from other causes.

Factors Affecting Loss of Life Teton Dam

Positive Factors

- Daytime
- Saturday, families together
- Clear, warm weather
- Tight-knit communities
- Easy access to dam
- Problems discovered 5 hours before failure
- On-site radio broadcast – dam failure described with clarity and urgency

Negative Factors

- Massive damage, 771 homes destroyed
- Some people unaware of large volume of water in reservoir
- Inadequate warning in Teton Canyon

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AFTER VAINLY TRYING TO FILL BREAK IN EMBANKMENT OF TETON DAM, TWO "CAT" OPERATORS BACK TOWARD SAFETY AS THEIR BULLDOZERS SLIDE INTO THE WIDENING GAP

PHOTOGRAPHED BY DALE HOWARD

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Kelly Barnes Dam near Toccoa, Georgia

- 40 Feet High
- Earthfill
- Failed on November 6, 1977 at 1:20 a.m.
- Failed due to downstream slope failure during heavy rains (and a 10-year flood?)
- No warnings were issued before dam failure
- 39 fatalities

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Factors Affecting Loss of Life Kelly Barnes Dam

Positive Factors

- No development in first 0.5 mile below dam
- As flood swept through area, a few people made last minute attempts to warn people by word-of-mouth

Negative Factors

- Night
- No observers at dam
- Flood caused power outage making it harder to see
- Structures located close to creek
- Trailer village (flimsy structures) in flood path
- Some people alerted to high water, but not dam failure

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FIGURE 2. – *Lakebed and remains of Kelly Barnes Dam. (View downstream)*


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Timberlake Dam
near Lynchburg, Virginia

- 33 Feet High
- Earthfill
- Failed June 22, 1995 at 11 p.m.
- Failed due to overtopping
- No warnings were issued before dam failure.
- 2 Fatalities

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Factors Affecting Loss of Life Timberlake Dam

Positive Factors

- Only 1 residence destroyed
- Emergency Action Plan (with maps)was available for dam
- Dam tender was aware of heavy rainfall and threat to dam

Negative Factors

- Night
- Dam tender had to be rescued after he drove along lake shoreline enroute to dam
- Heavy rain hindered visibility
- Busy 4-lane highway about 1 mile downstream from dam
- Highway users not aware of dam failure

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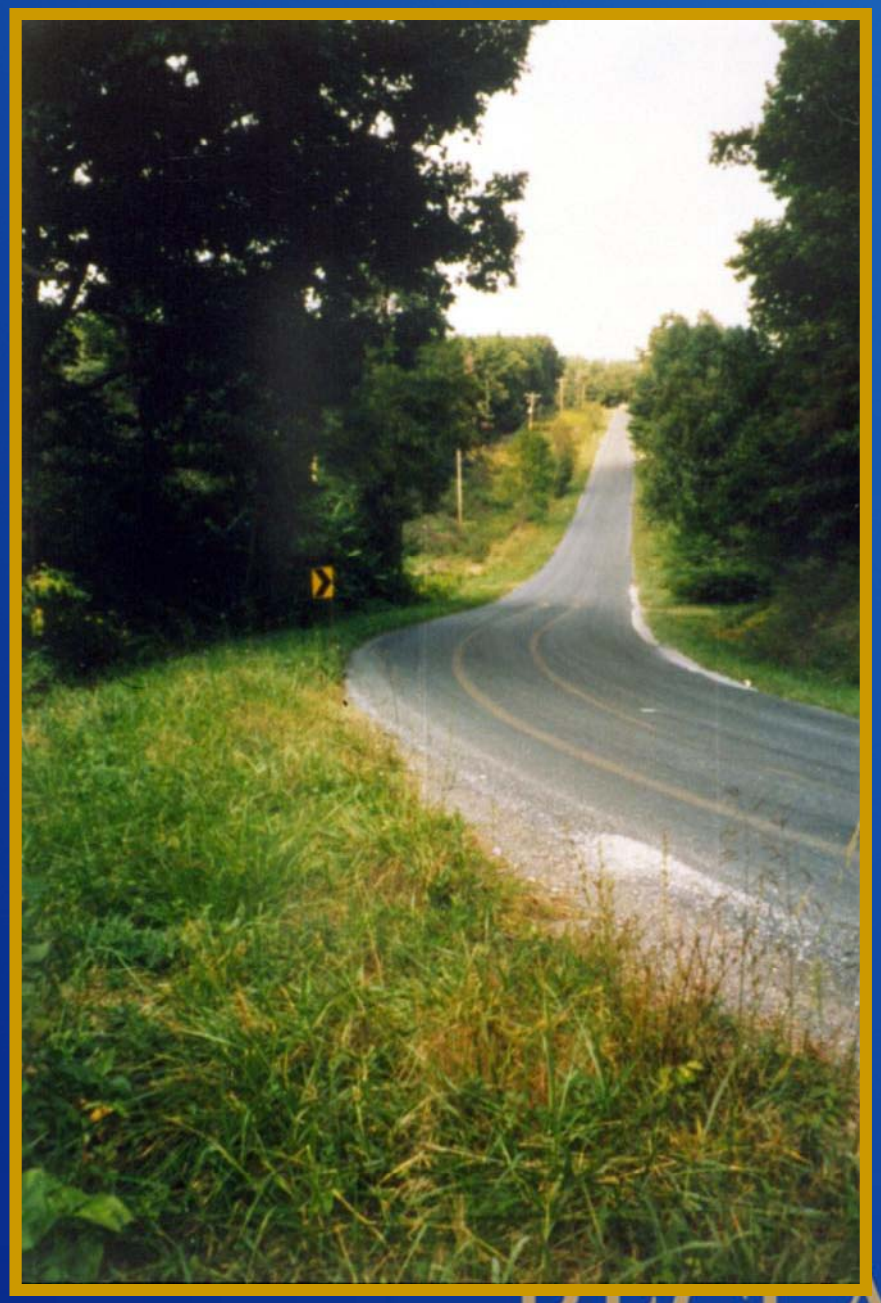

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Big Bay Lake Dam
Mississippi

- 57 Feet High
- Earthfill
- Failed March 12, 2004 at 12:20 p.m.
- Failed due to piping during normal weather
- Warnings were issued simultaneously with breach formation
- Destructive flood with no fatalities

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Factors Affecting Loss of Life
Big Bay Lake Dam

Positive Factors

- Daytime
- Clear weather
- Emergency Action Plan activated at same time breach began
- Warning spread by word-of-mouth
- Some homes not occupied with people away for school break

Negative Factors

- Large peak outflow
- Flood depths up to 20 feet
- 52 homes or businesses destroyed, 69 damaged

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2004 3 16

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Many vehicles were swept one-quarter mile into the woods


2004 3 16


2004 3 16


2004 3 16

Many homes on Robbins Road Were Severely Damaged or Washed Away


2004 3 16


2004 3 16

Ka Loko Dam
Island of Kauai, Hawaii

- 44 Feet High
- Earthfill
- Failed March 14, 2006 at 5:30 a.m.
- Failed due to probable overtopping
- No warnings were issued before dam failure.
- 7 Fatalities

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Factors Affecting Loss of Life
Ka Loko Dam

Positive Factors

- Minimal development in flooded area
- Some alerted to the danger by tremendous noise
- Downstream dam overtopped, but did not fail

Negative Factors

- Night
- No one lived near dam
- No dam monitoring
- Destroyed structure(s) very close to stream
- Steep gradient with high velocity floodwater
- No plans for warning or evacuation

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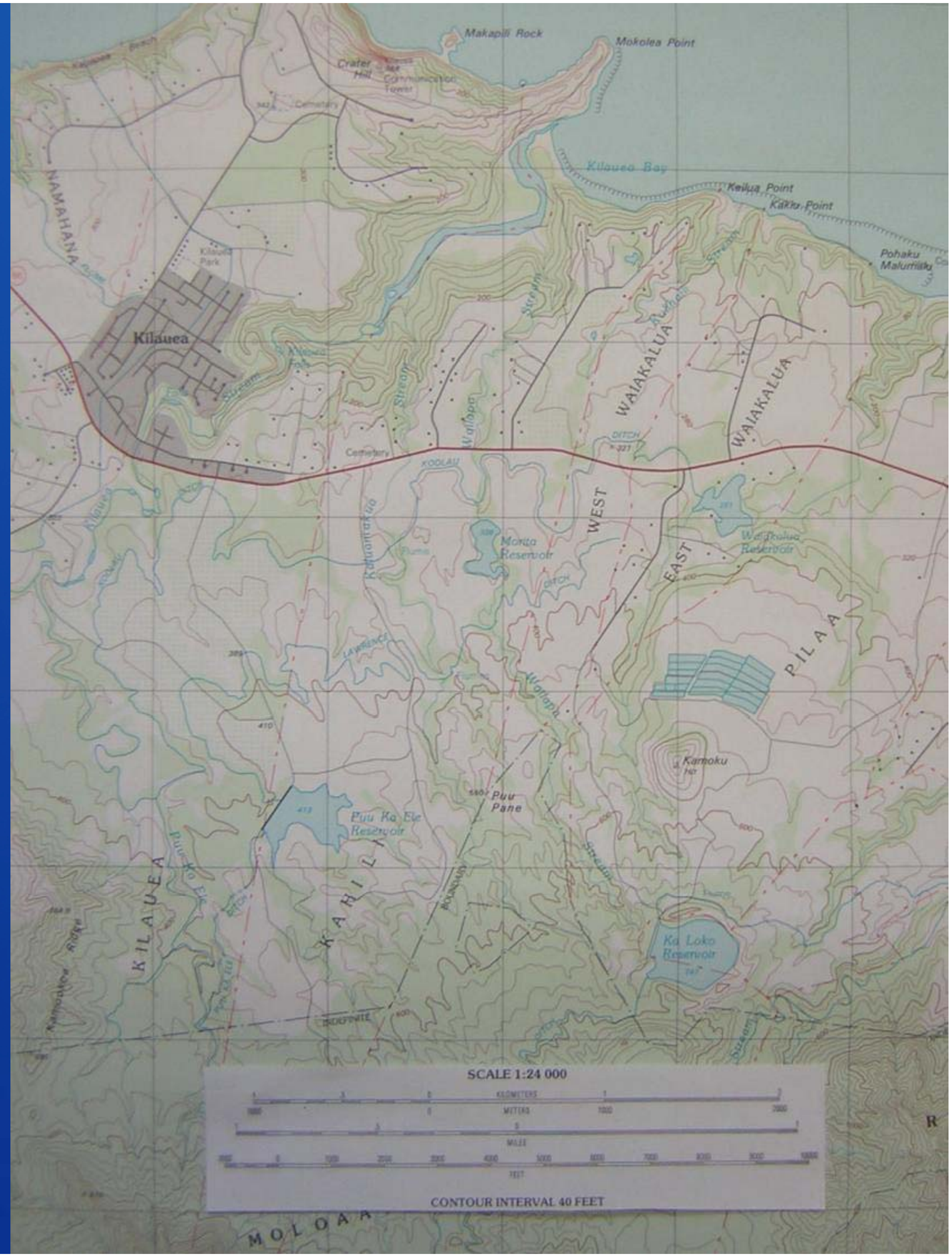

Makapili Rock
Mokolea Point
Crater Hill
Kilauea Bay
Kilauea
NAMAHANA
Cemetery
WAIAKALUA
WAIAKALUA
WEST
EAST
DITCH
Morita Reservoir
PILAA
Kamoku
Puu Pane
Puu Ka Ele Reservoir
Ka Loko Reservoir
KILAUEA
KAHILI
BOUNDARY
INDEFINITE
MOLOAA
SCALE 1:24 000
KILOMETERS
METERS
MILES
FEET
CONTOUR INTERVAL 40 FEET

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Summary of Factors Affecting Loss of Life

Positive Factors

- Daytime
- Observers at dam
- Emergency plan available
- Warning issued
- Dry weather
- Small flood, rises slowly
- Residences not destroyed
- Few people at risk
- No people immediately downstream from dam
- Escape/evacuation possible

Negative Factors

- Nighttime
- No observers at dam
- No emergency plan
- No warning issued
- Rainy or flooding
- Large flood, rises rapidly
- Residences destroyed
- Many people at risk
- Many people immediately downstream from dam
- Escape/evacuation not possible

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