Flood Risks or Dam Failure Inundation

Floods are one of the most common and widespread natural disasters, second only to fire. At risk communities are those located in low-lying areas, near water, or downstream from a dam. Dam failures are potentially the worst flood events. A dam failure is usually the result of neglect, poor design, or structural damage caused by a major event such as an earthquake. Flash flooding occurs when an intense storm drops large amounts of rain in a brief period, with little or no warning. “The flood hazard areas of Trinity County are subject to periodic inundation, which can result in loss of life and property, health and safety hazards, disruption of commerce and governmental services, extraordinary public expenditures for flood protection and relief, and impairment of the tax base, all of which adversely affect the public health, safety and general welfare” (Trinity County Zoning Ordinance Sec. 29.4, Flood Hazard).

In 1968, the United States Congress passed the National Flood Insurance Act, and in doing so, created the National Flood Insurance Program (NFIP). The Flood Disaster Protection Act of 1973, which also amended the 1968 Act, required that flood-prone communities be notified of their flood hazards to encourage program participation. This act also required the purchase of flood insurance by property owners who were being assisted by Federal programs, or by Federally supervised, regulated, or insured agencies or institutions, in the acquisition or improvement of land or facilities located, or to be located in special flood hazard areas. This act also severely limited Federal financial assistance in the flood hazard areas of communities that did not join NFIP.

The primary requirement for community participation in the NFIP is the adoption and enforcement of floodplain management regulations that meet the minimum standards of the NFIP regulations in Title 44 of the Code of Federal Regulations, Section 60.3.

Trinity County has chosen to participate in this program. In 1988, Trinity County adopted its first floodplain ordinance. The ordinance was revised in 1993 and a major amendment was done in 2000 to address growing concerns of development within mapped floodplain areas. This most recent floodplain management ordinance has been included in the Trinity County Zoning Ordinance as Section 29.4.
**Dam Failure**

Located within Trinity County are five managed dams: Lewiston, Trinity, Buckhorn, Ewing, and Matthews Dam.

**Lewiston Dam**

The Bureau of Reclamation owns and operates Lewiston Dam located seven miles below Trinity Dam. The dam is part of the Central Valley Project. Lewiston Dam creates an after bay for Trinity Power Plant and diverts water by means of Clear Creek tunnel to Whiskeytown Lake. The water in turn is then released to the Sacramento River Basin Project. Lewiston Dam also provides correct tail-water elevations for Trinity Dam power plant.

A Probable Maximum Flood (PMF) study dated 1996 and prepared by the Technical Services Center, Denver, Colorado, uses a PMF resulting in a general storm that includes the concurrent precipitation for Lewiston Dam. The study is located in the U.S Bureau of Reclamation Emergency Action Plan for Trinity and Lewiston Dams (BAS-19).

The study uses a peak inflow of 19,100 cubic feet/second and a 3-day volume of 35,000 acre-feet. Lewiston Dam PMF was routed through most of the appurtenant structures of Trinity Dam and over Trinity Dam, assuming no failure of the dam. Both Trinity Lake and Lewiston Lake are assumed to be at the top of active conservation for the purposes of the study. Lewiston Dam uses Clear Creek Power Conduit, river outlet works and the spillway for releases during a flood. Assuming no failure, Lewiston Dam is overtopped 15.8 feet during the general storm PMF. Floods greater than 62 percent of the general storm PMF will overtop the dam, and a minimum freeboard of 3.0 feet occurs during a flood equal to 60.5 percent of the general storm PMF. The report shows that the local Lewiston PMF can be safely controlled.

A study, the *Performance Parameters Input to Updating of the Emergency Action Plan (EAP)*, dated 1999, indicated that extensive rapid landsliding in the Baker Gulch slide complex can generate large waves threatening the lives of individuals using the Cooper Gulch Campground (EAP Lewiston and Trinity Lakes: BAS-22). The slide does not threaten the safety of the dam.

While Bureau of Reclamation is responsible for timely and effective notification of emergency events, warning and evacuation planning and implementation are the responsibility of the city, county, state, or federal authorities having jurisdiction in areas that will be inundated by releases or impacted by other events related to Trinity or Lewiston Dams, or in other events that could present a hazard.

Control operators, who are stationed at the Powerplant, perform routine inspections at Lewiston Dam, approximately three times per week, and a specific dam inspection is completed once a week. Communication capabilities include commercial telephones, two-way radios, cellular telephones, and pagers.
Trinity Dam

Trinity Dam is located nine miles from Lewiston. The Bureau of Reclamation manages and operates Trinity Dam. It was constructed between 1957 and 1962 as part of the Central Valley Project. It is a zoned earth-fill structure, containing about 29,251,000 cubic yards of earth, sand, gravel, and rock. This dam was originally constructed primarily for regulation of flows and storage of water for irrigation. The lake also serves as a water source for hydroelectric energy generated at the Trinity Powerplant, which is located at the toe of Trinity Dam. The power that is generated is dedicated first to meeting the requirements of the project facilities, with the remaining energy marketed to various preference customers (Trinity County has first preference) in Northern California.

The spillway, located on the left abutment, consists of a 54-foot diameter uncontrolled glory-hole concrete crest structure, a concrete-lined 20-foot diameter inclined shaft and tunnel, a concrete chute, and a concrete flip bucket. The tunnel exits to the concrete chute that ends at the concrete flip bucket at the Trinity River. The auxiliary outlet works discharges into the spillway tunnel approximately 1,000 feet upstream from the lower portal of the spillway tunnel. The spillway has a design capacity of 22,400 cubic feet at elevation 2387.0 feet. Downstream, on the left abutment of the dam a large landslide had been reactivated by gold dredging and borrows operations.

Buckhorn Dam

Buckhorn Dam is located on Grass Valley Creek, 20 miles west of Redding and is part of the Central Valley Project. It is managed and operated by the Bureau of Reclamation. The primary responsibility for the operation, maintenance, and safety of Buckhorn Dam rests with the Area Manager, Northern California Area Office. Construction began in 1988 and was completed in 1991. The dam is a part of the Trinity River Restoration Program, which was developed for restoration of the Trinity River to the quality prior to the construction of Trinity Dam. It is designed to trap decomposed granite from Buckhorn Mountain before it enters Grass Valley Creek, which eventually flows to the Trinity River. If Buckhorn Dam were to fail or make unusually high discharges, human lives and/or property downstream would be endangered.

There are year-round occupants in the I.O.O.F. Camp, 3.5 miles downstream, and a California Division of Forestry and Fire Protection (CDF) Station occupied during the forest fire season, 6.1 miles downstream. According the Bureau of Reclamation Emergency Action Plan for Buckhorn Dam, Probable Maximum Flood (PMF), would

(a) Endanger any people involved in fishing, picnicking, and hiking along Grass Valley Creek downstream from the dam

(b) Flood the I.O.O.F. Camp (8 full-time residents, considerably more people during the summer months) 3.5 miles downstream to a maximum depth along the channel of 31 feet within 21 minutes, washing away two vehicle bridges, a foot bridge, and several houses. Sewage or hazardous material present on site, including household propane tanks, would potentially mix with the floodwaters and debris.
(c) Inundate State Highway 299 from a point 4.5 miles to 6.5 miles downstream from the dam, within 25 minutes. Highway 299 is the main artery that connects Trinity County to Communities and resources in Shasta County and the rest of California.

(d) Inundate CDF Station #61 (Fawn Lodge) and other residential dwellings located in close proximity to the station, 6.1 miles downstream, within 30 minutes, to a maximum depth of 15 to 20 feet.

(e) Reach the Trinity River nine miles downstream within 45 minutes, bringing tons of sediment and other debris into the river, which would have at least a short-term severe negative impact on fisheries and other aquatic life.

(f) Pose a potential threat to low-lying areas of the floodplain along the Trinity River for approximately 10 miles downstream from its confluence with Grass Valley Creek.

(g) Pose a potential threat to any house situated within the floodplain of Grass Valley Creek.

Equally important are trigger points of high releases from the outlet/spillway that would affect downstream populations and are of interest to downstream jurisdictions, high-risk populated areas, and response agencies.

(a) Releases from the outlet/spillway exceeding 800 to 1000 cubic feet per second would begin to inundate some I.O.O.F. Camp buildings and access bridges.

(b) Releases from the outlet/spillway at or above 5000 cubic feet per second would begin to flood CDF Station #61. Considerably smaller releases would have similar impact if substantial flows were coming down Little Grass Valley Creek.

(c) Releases at or above 7000 cubic feet per second would inundate State Highway 299 where it runs along Grass Valley Creek, approximately five to seven miles downstream from the dam.

In the event of Probable Maximum Flood failure and maximum possible releases, a copy of the Emergency Action Plan is located at the Office of Emergency Services (OES) in Weaverville. This documents all procedures that will help minimize damage resulting from dam failure and large water releases from Buckhorn Dam.

Matthews Dam

Construction on Matthews Dam ended in 1962, providing a water supply for the Humboldt Bay and Eureka area. Humboldt Bay Municipal Water District (HBMWD) owns and operates Matthews Dam and the hydroelectric plant. The dam is located on the Mad River approximately 80 miles upstream from the mouth of the river (Sect. 19, T. 1 S, R 7 E, H. B. & M.). R.W. Matthews Dam is a zoned, earthfill dam, with an ungated spillway, and a maximum height above
the streambed of approximately 150 feet. On the basis of the dam’s height, reservoir capacity and downstream damage potential, the dam would be rated "large" in size and "high" in hazard potential, according to the "Recommended Guidelines for Safety Inspection of Dams" (HBMWD 1990: 2-1). The dam is rated high-hazard, not because it is at risk for failing, but because of the number of people that could be impacted downstream in the event of failure (HBMWD 1990:2-1). Emergency Action Plans (EAPs) for dam failure are maintained at the County of Emergency Services, Trinity County Sheriff’s Office, Southern Trinity Area Rescue, USFS Mad River Ranger District, Ruth Lake Community Services District, and the Humboldt Bay Municipal water District.

If R.W. Matthews Dam were to fail, it would most likely be caused by:

(a) Flooding which exceeds the capability of the spillway which then causes overtopping and subsequent erosion and failure of the dam

(b) Earthquake, which could cause immediate failure of the dam through slumping, sliding or shear, or which could cause sufficient damage to some part of the dam, or its spillway or outlet works, to subsequently lead to failure.

(c) Foundation or embankment failure caused by uneven or excessive settlement, internal erosion, or other unknown internal condition

(d) Penstock rupture caused by critical surges or waterhammer due to failure of hydraulic systems/penstock valves and surge relief mechanisms

(e) Criminal or terrorist acts.

Ewing Reservoir

Ewing Reservoir is located in Hayfork (Sect. 1, T. 31 N., R. 11 W. MD. B. & M.). Prior to the construction of the dam, an inundation study and map were prepared for Ewing Reservoir.

Even in the event of complete dam failure at Ewing Reservoir (i.e. a 45 degree breach of both sides of the dam) the volume and velocity of floodwaters will not pose a significant threat to people or property (Hayfork Community Plan 1996:7.12).

Griffith and Associates: Surveyors and Engineers prepared the inundation study and map. The Map was reviewed and approved by the Office of Emergency Services in February, 1976. Trinity County Waterworks District #1 has an evacuation plan on file that outlines: (1) responsibilities of various personnel in the event of dam failure; (2) the location of temporary gathering points for food and shelter, and; (3) sources of emergency food, water and other assistance. Their office is located on Reservoir Road in Hayfork. A copy is also located at the Office of Emergency Services in Weaverville.