Executive Summary

At 8:00 p.m. on December 31, 1987, when the National Weather Service (NWS) issued a flood warning for the eastern part of Oahu, Hawaii, few New Year's Eve revelers in the area imagined that nearly $34 million in flood damages would occur before torrential rains subsided the next morning. Although no lives were lost and the amount of damages might not be considered severe by some standards, the flooding proved significant because it occurred without warning and affected densely populated urban watershed areas.

The severe weather that caused the News Year's Eve flooding culminated an unusually wet December that had already seen more than five times the average rainfall expected for the month. Minor damage and disruption to telephone and power services had already occurred as a result of the earlier rains.

The drenching rains responsible for the New Year's Eve flood commenced about 3:00 p.m. on Thursday, New Year's Eve, but rain had fallen throughout the day. The forecast called for continued thundershower activity, with heavy downpours expected; however, the torrential rainfall and resulting floods were not anticipated even as late as 4:40 p.m., when NWS forecasters told officials of the Oahu Civil Defense Agency that there were no data to indicate an imminent threat of flooding.

The flood rains were produced by a cold front that had weakened into a shear line, a significant cloud and rain producer that acted as a center of strong low-level convergence between weak east-southeasterly winds to the south of the flood zone and fresh north or northeast winds to the north. When lifted along the southern rampart of the Koolau Mountains, this shear line produced steady rains of 2 to 4 inches per hour over the already saturated watersheds of southeastern Oahu.

Forecasting of the torrential rains was made difficult by the unavailability of adequate weather radar in the region. In addition, high clouds masked the actual rain clouds, limiting the effectiveness of satellite imagery in depicting local weather. For this reason, a flood warning was not issued until flooding had already commenced in some regions.

Rainfall totals were impressive. In the region immediately windward of the Koolau Mountains, the precipitation was in excess of that expected for a 100-year storm (a storm of an intensity expected to recur only once every 100 years) and was probably as much as would occur in a 200-year storm. Rainfall measured more than 20 inches in many mountain locations over a 24-hour period. In many cases, accurate totals were not available, since some raingauges malfunctioned or their capacity was overwhelmed.

Two types of flooding resulted from these rains. Flash flooding occurred in the Hawaii Kai area and in Waimanalo, a relatively low-lying region. Farther north in the Kailua region, overtopping of a flood control levee produced comparatively slower but more pervasive flooding.

Reports of property damage, household evacuations, and transportation disruptions were already being fielded by police in the Hawaii Kai and Waimanalo areas by 8:00 p.m., when the NWS issued its first flash flood warning. Because of the holiday, locating emergency response personnel was difficult, but by 9:00 p.m. authorities of the Oahu Civil Defense Agency had activated their emergency operations center, had begun to respond to distress calls, and had authorized the opening of the first emergency shelter in Hawaii Kai.

Major flooding and accompanying debris flows in Hawaii Kai commenced by 9:00 p.m. Blockage of drainage systems by rocks and debris caused unanticipated diversions of floodwaters, resulting in extensive damage to many upland neighborhoods not accustomed to flooding. Meanwhile, in Waimanalo, a low-lying region, floodwaters inundated homes with up to 5 feet of swirling water at the peak of the runoff.

Flooding in Kailua began around midnight, as the levee protecting the region from the Kawainui Marsh was overtopped and canals draining the area were overwhelmed. Residents had no warning that flooding was imminent, since flash flood warnings extended only to Waimanalo, not farther up the coast, and media attention and emergency response efforts up to that time were focused on the Hawaii Kai area.

As the evening proceeded and the flooding began to displace some residents and cut transportation routes, preventing others from returning home after the evening's festivities, the Red Cross opened several shelters, eventually serving almost 1,100 people on New Year's Eve and New Year's Day.

In all, more than 1,250 homes sustained some form of damage, with over 300 homes receiving major structural damage. Unfortunately, only about a tenth of these residences were covered by flood insurance through the National Flood Insurance Program. Only those homeowners whose mortgages are secured through a federal loan program (e.g., the Federal Housing Administration) or through a federally insured bank or savings and loan are required to purchase such insurance in specified flood zones; most other residents of Oahu chose not to buy flood insurance.