

SNOW AVALANCHES IN PROVO CANYON, UTAH

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This paper discusses the Utah Department of Transportation's (UDOT) implementation of an avalanche forecasting and explosive control program for the avalanche paths that threaten US Highway 189. This section of US Highway 189 is located in Utah's Wasatch Mountains between the of city Orem and Deer Creek Reservoir. UDOT Region Three's jurisdiction also includes the avalanche paths in American Fork Canyon and Daniels Canyon although they will not be discussed in this paper.

Until January 1994 UDOT did not have a full-time program to control avalanches on US Highway 189. UDOT instead relied upon its avalanche forecasters located in Little and Big Cottonwood Canyons. These canyons are located approximately 29 km (18 miles) to the north by air. Highway travel distance is approximately 65 km (40 miles). Because these UDOT forecasters spent a considerable amount of time (often twenty-four hours a day) controlling the frequent avalanches that cross Utah State Road 210 in Little Cottonwood Canyon and Utah State Road 190 in Big Cottonwood Canyon, they were only able to perform sporadic avalanche forecasting and control in Provo Canyon. The geography and weather in the northern Utah mountains often prevented these forecasters from traveling to Provo Canyon since storm and avalanche cycles often make mountain travel nearly impossible.

UDOT Snow and Avalanche Atlas for Provo Canyon (US 189) describes Provo Canyon as follows:

Provo Canyon is a southwest to northeast running corridor cut through the central Wasatch Mountains by the Provo River. The elevation at the canyon mouth is 1472 meters (4830 feet) and rises to 1651 meters (5417 feet) at the Deer Creek Dam where the highway leaves the canyon. The north side of the canyon consists of the south flank of Mt. Timpanogos and rises to 3245 meters (10645 feet). The south side of the canyon rises to 3023 meters (9917 feet) and consists of the north end of Cascade Mountain.

Slide Canyon, Bridal Veil Falls, and Lost Creek are the three largest slide paths in the state of Utah that threaten a year-round highway. Fortunately, they only cross the highway on an infrequent basis, but when they do they can cause

severe damage. The Dam Chute, insignificant by comparison, can hit the highway three to four times a year.

Since the publication of the above mentioned atlas, US Highway 189 has been relocated slightly to the north and widened from two lanes to four lanes in the runout zones of Slide Canyon, Bridal Veil Falls, and Lost Creek. Planning is currently underway to widen the existing two lanes to four lanes for the rest of Provo Canyon. Design and location of this highway expansion is not yet complete so the affect on the avalanche control program is unknown. Avalanche activity at the Dam Chute will require changes to be included in the updated atlas, with avalanches hitting the highway seven times during the winter of 1992-1993. (One caught an eighteen wheel truck weighing 20,500 kilograms (45,000 pounds) sweeping it partially off the highway.) The same avalanche path did not cross the highway once the next winter.

In January 1994, UDOT hired an avalanche forecaster for Provo, Daniels, and American Fork Canyons. Avalanche forecasting and control here requires winter access to the starting zones of Slide Canyon, Lost Creek, Bridal Veil Falls, the Dam Chute, and numerous others. Access is often difficult, always time consuming, and is described below.

If weather and avalanche conditions permit, access to Slide Canyon and Lost Creek starting zones can begin by driving up Provo Canyon 8.9 kilometers (5.5 miles) then 4.8 km (3 miles) up the North Fork of Provo Canyon on Utah State Road 92 (SR 92) to the base of Sundance Ski Area. Of course this route travels across numerous avalanche paths. After riding two chair lifts from the base of Sundance Ski Area, access on foot commences at 2500 meters (8200 feet). From this point, the main starting zone for Slide Canyon is 2.4 km (1.5 miles) to the west at 3230 meters (10,600 feet); the main starting zone for Lost Creek is 0.8 km (0.5 miles) farther west at the same elevation. This route is the fastest access to these starting zones, and has become the most frequently used for snowpack and weather observations, as well as explosive avalanche control with hand charges.

Access to the Dam Chute is by foot from the southeast end of Deer Dreek Dam (on US Highway 189) ascending from 1651 meters (5417 feet) to 2012 meters (6600 feet) in a distance of 0.6 km (0.4 miles).

Access to the starting zones of Bridal Veil Falls, like all the avalanche paths on the south side of Provo Canyon is by foot from the canyon floor. Forecasts relied upon the following avalanche forecasting methods: Snowpack and weather data was obtained during field trips to starting zones and study plots. This was supplemented with data from UDOT's avalanche forecasters in Little and Big Cottonwood canyons, avalanche forecasters at the Sundance Ski Area, and UDOT maintenance personnel working in snow removal operations. Snow study plots were implemented at the following locations: (1) Aspen grove, follow SR 92 9.6 km (6 miles) from Provo canyon, elevation 2100 meters (6900 feet); (2) Dam Chute, follow US Highway 189 0.3 km (2000 feet) north from the southeast end of deer creek Dam, elevation 1676 meters (5500 feet); and (3) three study plots at Sundance Ski Area, elevations at 1859 meters (6100 feet), 2134 meters (7000 feet), 2438 meters (8000 feet).

Snowpit and weather data collected during field trips provides the only local data available with the exception of that supplied by Sundance Ski Area and UDOT maintenance personnel on the highway. The information that Sundance provides is valuable, but has limited value for avalanche hazard evaluation in Provo Canyon.

Avalanche forecasting in Provo Canyon requires daily field observations at a variety of locations especially at higher elevations due to the absence of any remote weather stations. This necessitates explosive control work by field observers for safe access to starting zones. The large expanse of terrain in the Provo Canyon mandates the use of helicopters for explosive avalanche control to reduce the chances of avalanches striking US Highway 189.

The following is an example of a typical storm and avalanche cycle in Provo Canyon. Snowfall began February 17, 1994 with 24 cm (9.5 in) snow, 3.18 cm (1.25 in. H₂O) by the morning of the 18th. Snowfall continued with additional accumulation of 37 cm (14.5 in.) snow, 3.96 cm (1.56 in.) H₂O by the morning of the 20th. By this point in time numerous spontaneous avalanches had run with starting zone elevations as low as 2620 meters (8500 feet) and debris in Slide Canyon down to 1950 meters (6400 feet). This meant that approximately 1.5 km (4000 feet) horizontally and 300 meters (1000 feet) vertically of the track and runout zone remained dry to absorb additional activity before an avalanche could reach the highway. By 5:30 am on the 21st additional precipitation at Aspen Grove was 23 cm (9 in.) snow, 1.63 cm (0.61 in.) H₂O. About an hour later a spontaneous avalanche released depositing debris 15 meters (50 feet) deep within 60 meters (200 feet) of the highway. Weather did not permit aerial bombing until the 23rd; although this produced spectacular results none of the resulting avalanches hit the highway.

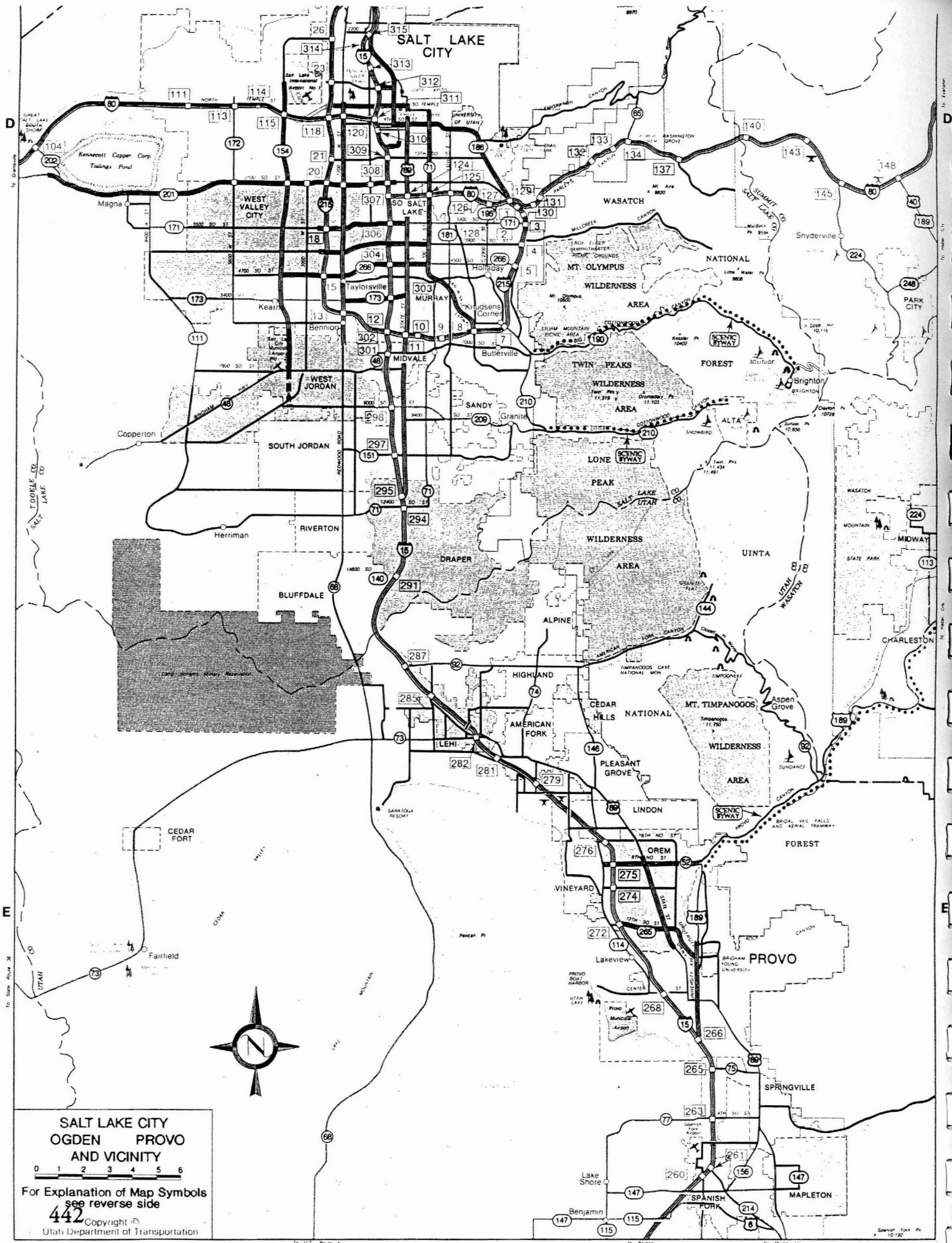
REFERENCES

Snow Avalanche Atlas Provo Canyon
Compiled and edited by Dan Judd

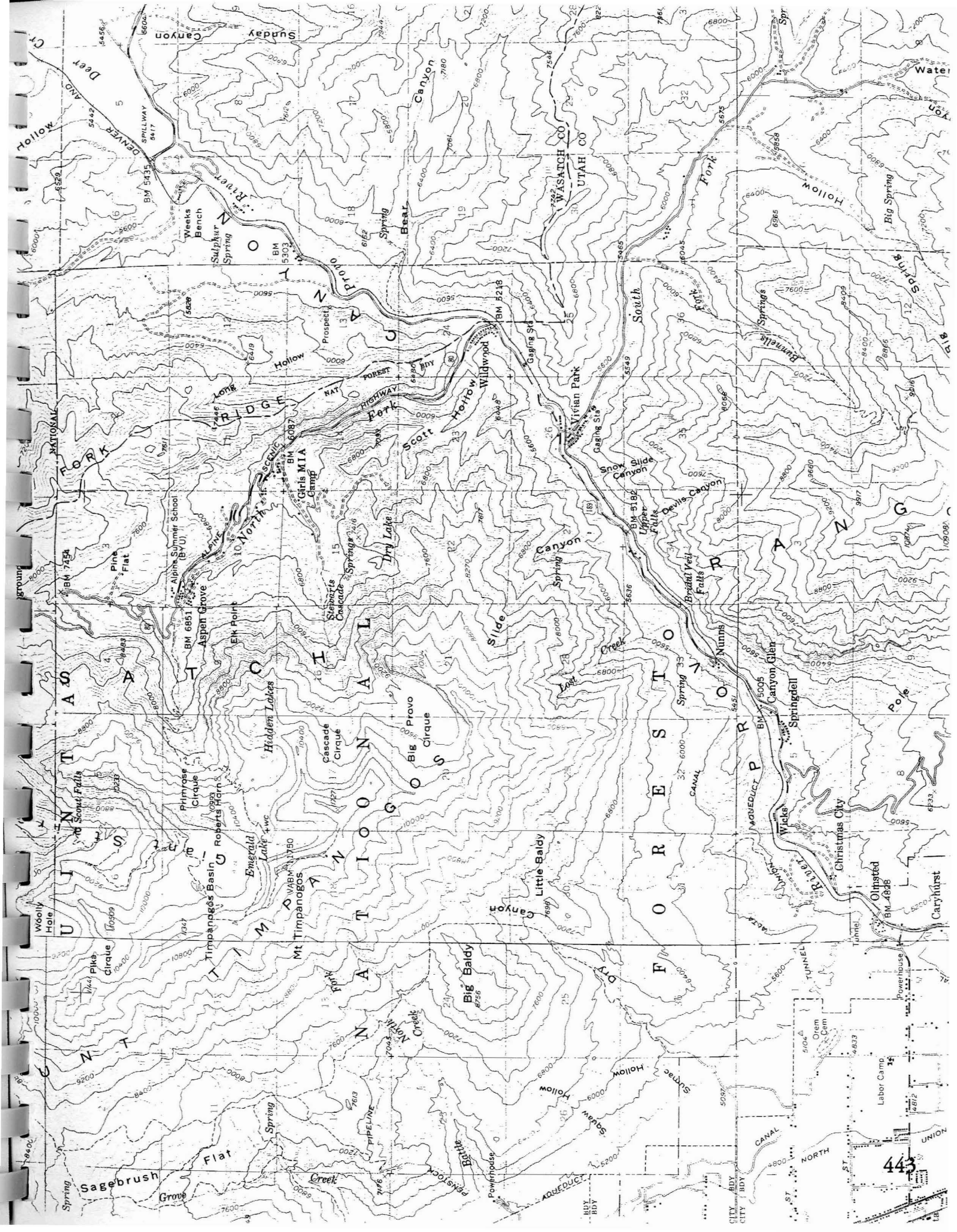
Photography
Snow Avalanche Atlas Provo Canyon
Dan Judd, Darwin Stoneman, & Rick Wyatt

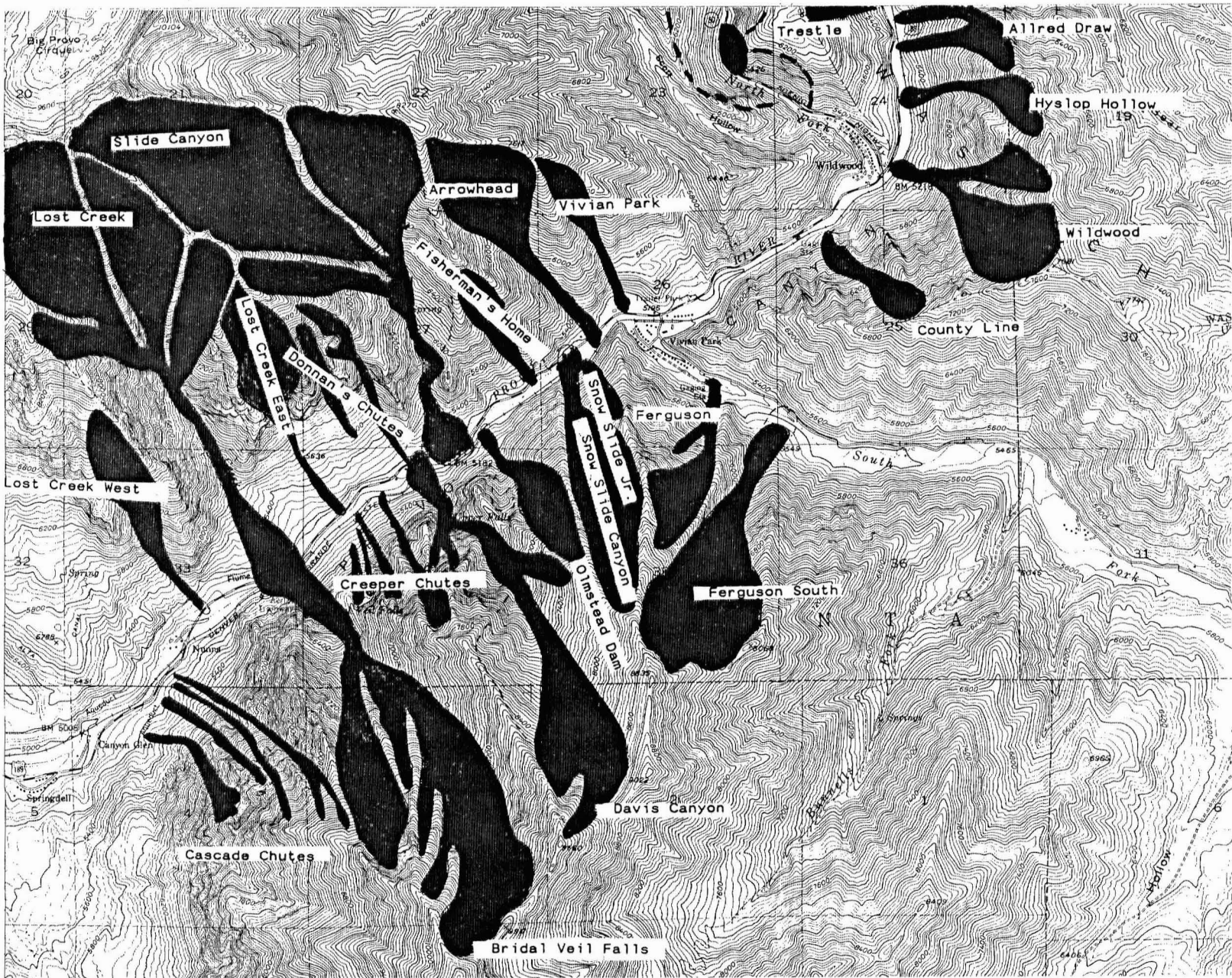
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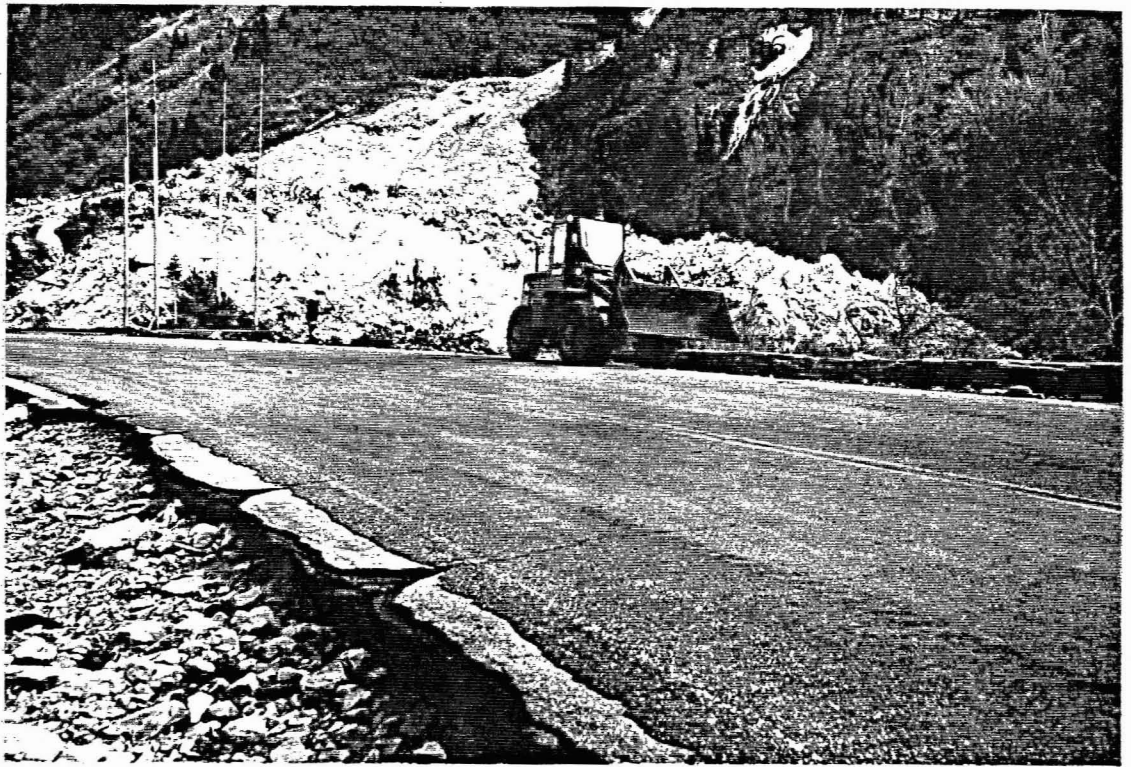
Photographs Included
Gerald Peterson-UDOT Photographer



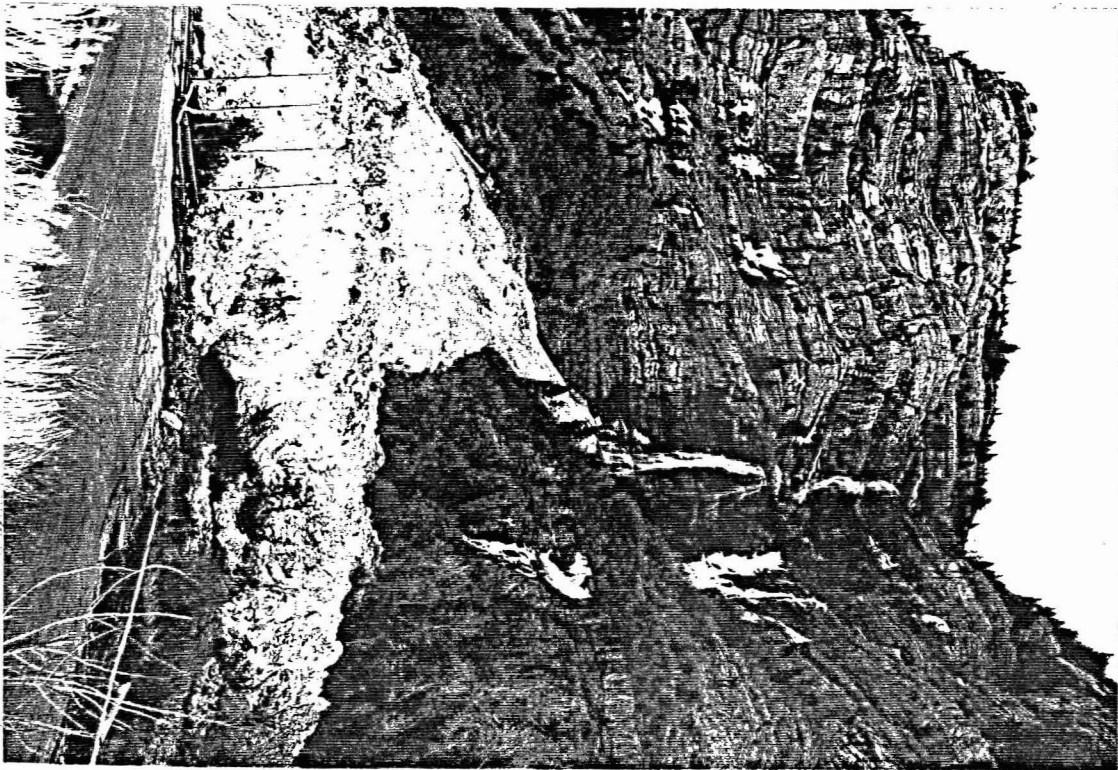
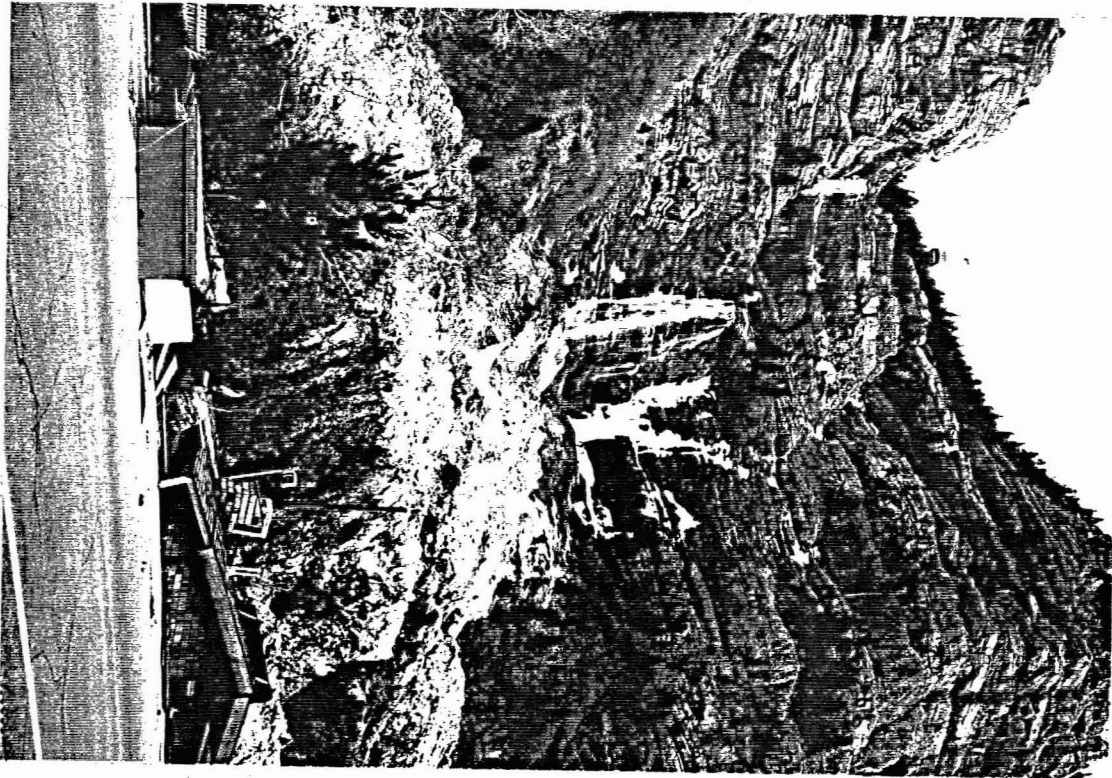
**SALT LAKE CITY
 OGDEN PROVO
 AND VICINITY**
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 For Explanation of Map Symbols
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BRIDAL VEIL FALLS, SPRING 1986



BRIDAL VEIL FALLS, SPRING 1986

