UTAH GEOLOGICAL AND MINERAL SURVEY

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June 1, 1981

MEMORANDUM

TO: Zella Rasmussen, Councilwoman, Town of Santa Clara

FROM: William Lund, Utah Geological and Mineral Survey

SUBJECT: Landslide affecting Truman Drive, Santa Clara, Washington County, Utah

In response to a request from the Santa Clara City Council, a geologic reconnaissance was made on May 13, 1981, of a small landslide that has developed within the town limits. The failure is located along the bluffs that form the eastern boundary of the Santa Clara River flood plain. Movement of the slide has disrupted Truman Drive causing the pavement to drop and buckle in several places. In addition, the toe of the failure is beginning to impinge on the Santa Clara Field and Canal Company canal. Water is seeping from the slide, and residents in the area have complained of smelling a strong unpleasant odor. Of specific concern during this investigation was the possibility advanced by some council members that irrigation water and sewage effluent migrating in the subsurface from the town of Ivins, 1½ miles to the northwest, might be causing the ground to fail.

SCOPE OF WORK

The scope of this investigation included the following:

- A review of geologic, hydrologic, and soils information available on the study area.
- A field reconnaissance of the landslide and its surroundings made in the company of Mr. Reed Wittwer, Santa Clara Town Councilman.
- Examination of stereo aerial photographs covering the slide area.
- A detailed inspection and mapping of the slide.
- Making arrangements with the Southwestern Utah District Health Department to collect water samples for laboratory analysis.
- Preparation of this memorandum and accompanying attachments.

SETTING

The landslide is located in the NW¼ sec. 16, T. 42 S., R. 16 W., Salt Lake Base Line and Meridian (Attachment 1). The failure occurred where Truman Drive

ascends the 80-foot high river bluff that marks the western edge of the Santa Clara Bench. A small irrigation canal parallels the base of the bluff and a new subdivision is being built on the flat bench surface which lies further to the east. A gravelled subdivision road intersects Truman Drive a short distance up-slope from, and northwest of, the slide area. The homes in the subdivision will be connected to the city sewer system, but an older home and a small manufacturing facility/work shop located near the edge of the bluff (about 300 feet from the landslide) utilize septic tanks and drain fields for fluid waste disposal. The town of Ivins (population 600, 1980 Census Bureau advance count) is located on top of the bench about 1½ miles northwest of the slope failure. A well developed dry wash lies between the landslide and Ivins.

LANDSLIDE DESCRIPTION

This slope failure can be classified as a small rotational slump type feature (Figure 1). Maximum dimensions of length and width are approximately 150 and 80 feet respectively. A small ground water seep, making at most two to three gallons per minute at the time of the reconnaissance, is located near the toe of the slide. Nowhere within the landslide do vertical offsets exceed 3 feet and seldom are they greater than 1.5 feet.

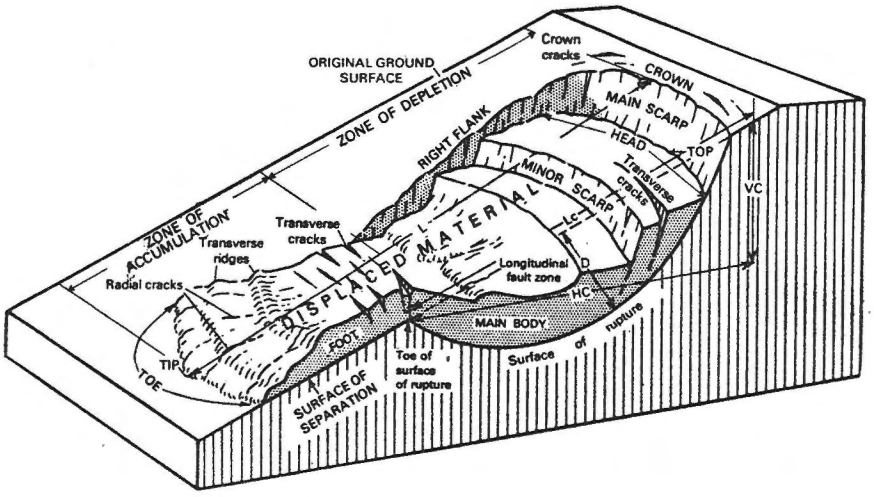


Figure 1. Representative diagram of a typical rotational slump landslide (after Varnes, 1978).

The main scarp and at least two interior scarps intersect Truman Drive causing the roadbed to be down dropped to the west; the road has remained open, however. Material in the zone of accumulation at the toe of the failure is threatening to block the Santa Clara Field and Canal Company canal. Movement of the landslide is very slow and it may in fact be inactive during a portion of the year. Considerable evidence exists to indicate that other slope failures have taken place here in the past, and Mr. Wittwer could recall at least one such event occurring in the 1930's. He also indicated that the present slide has become more active over the past 12 to 18 months and that the flow from the seep has increased.

GEOLOGY/HYDROLOGY

Three types of material are exposed in the side of the bluff at the point where the slope failed. They are from youngest to oldest (top to bottom): a thin

layer of loose, red-brown, fine, silty sand of probable eolian origin; a moderately-to well-cemented coarse sand and gravel deposit of variable thickness which is undoubtedly of fluvial origin; and the gently north to northeast dipping, purple-gray Chinle Shale that comprises approximately the lower 2/3 of the bluff. The slope failure is confined almost entirely to the shale, the overlying materials becoming involved only when support from below is removed by slippage in the shale unit.

Subsurface hydrologic information on the Santa Clara Bench is limited and generally of poor quality. Wells drilled in T. 42 S., R. 16 W., sections 5, 6, 9, and 16 have encountered water at depths ranging from 9 to 174 feet. The aquifers reported to be supplying those wells include the Kayenta, Moenave, and Chinle Formations, as well as unconsolidated sand and gravel deposits. The few wells that have been drilled through the unconsolidated deposits indicate that these materials differ in thickness from place to place. These differences, especially when they occur over what amounts to relatively short distances (1000-2000 feet) suggest that erosional depressions, perhaps old stream channels, lie buried beneath the surface. What affect those buried features have on the collection and channeling of subsurface waters beneath the bench is not known and could only be determined by test drilling or geophysical studies.

The seep observed near the toe of the landslide issues from disturbed Chinle Shale material. A positive identification on the source of its water cannot be made with the data presently available. However, it appears more likely that the water originates from within the near-site vicinity rather than migrating all the way from Ivins. This conclusion is based upon topographic considerations, the fact that the bedrock beneath the bench dips to the north away from the landslide, and indications that a considerable volume of surface runoff collected and channelized by Truman Drive and the gravelled subdivision road has been diverted onto the slide area. It seems probable that this runoff infiltrating into the plastic shales and clay of the Chinle Formation either triggered or aggravated the slope failure. How much, if any, water is contributed to the seep from the septic system drain fields located a few hundred feet northwest of the slide is not known. Water samples have been collected and tests will be run on the water from the landslide to determine both total water chemistry and if sewage is present. Chemical analyses will also be made on water samples taken from the Ivins irrigation system for comparison with the water draining from the slide. The results of those tests will be forwarded to the town as they become available.

CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of this study, the following conclusions and recommendations are made:

1. This landslide is a small rotational slump-type feature that has developed primarily in the Chinle Shale, a rock formation noted for its high shrink/swell and plasticity characteristics.

2. It was not possible during the field reconnaissance to determine the source of the water draining from the landslide, but indications are that it originates from within the near slide vicinity.

3. Chemical analyses of water samples collected from the landslide and the Ivins irrigation system are being made in an attempt to pinpoint the water source. The results of those tests will be forwarded to the city as they become available.

4. Immediate steps that could be taken to help stabilize the landslide include:

   - Divert the drainage along Truman Drive and the gravelled subdivision road in such a way that surface runoff is no longer directed onto the landslide.

   - Limit road repairs to the grading of rough spots; imported material should not be used to build up low areas because the additional weight of the fill could cause the slide to move.

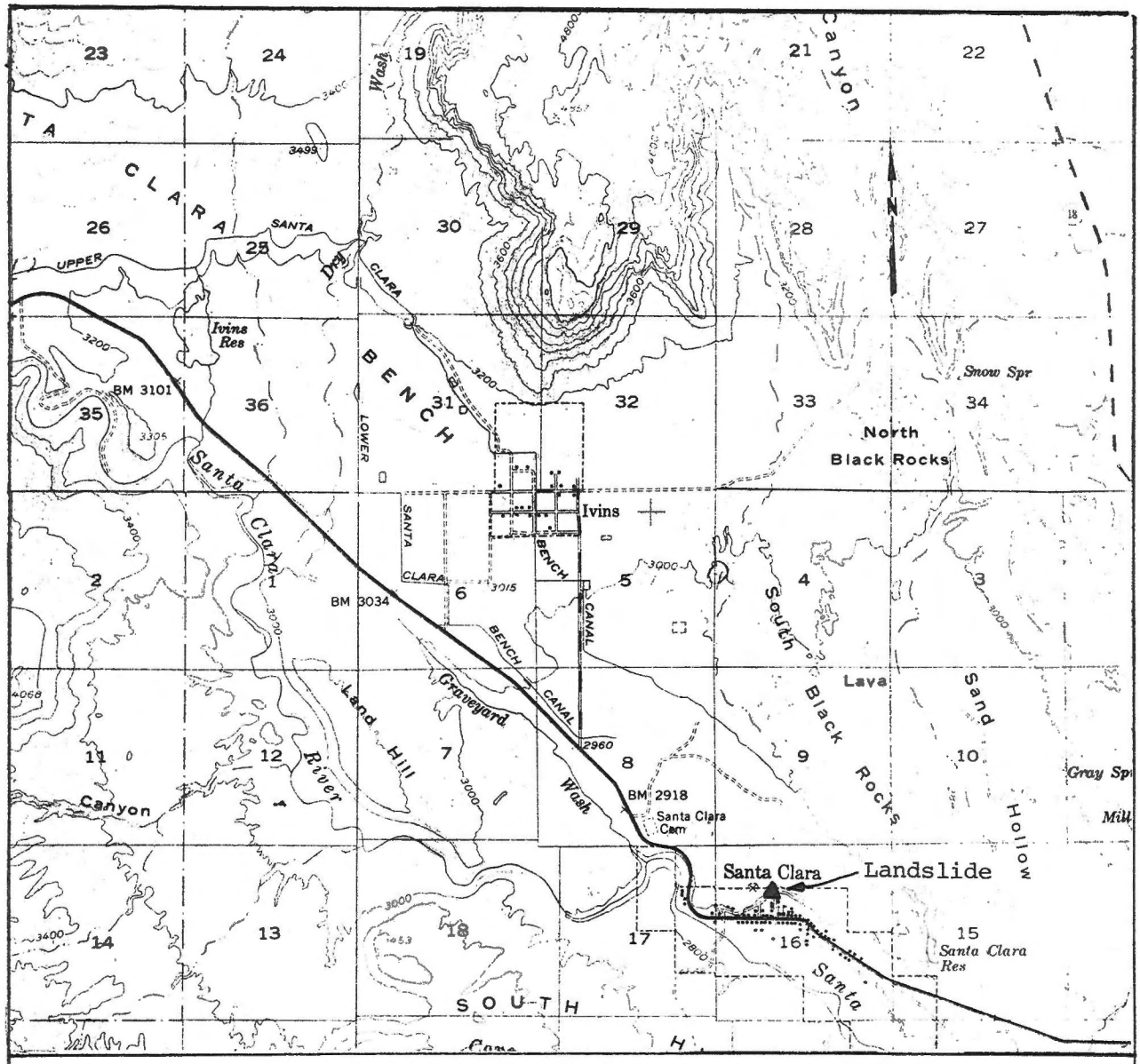
   - Heavy truck traffic should be restricted from using Truman Drive where it crosses the landslide.

5. Major improvements to Truman Drive (paving, widening, etc.) or the installation of underground utilities along the roadway should be preceded by a thorough engineering study so that further slope stability problems may either be avoided or properly mitigated.

William R. Lund

WILLIAM R. LUND
Site Investigations Section

WRL/co
Attachment
cc: Steve Labrum, Southwestern Utah District Health Department
Five County Association of Governments



General location map showing position of landslide and the relationship of Ivins to Santa Clara. Scale 1" = 2000'