1999

Flood Insurance Study, City of Santa Clara, Utah, Washington County

Federal Emergency Management Agency

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FLOOD INSURANCE STUDY

CITY OF
SANTA CLARA, UTAH
WASHINGTON COUNTY

REVISED: DECEMBER 6, 1999

Federal Emergency Management Agency
COMMUNITY NUMBER - 490178
BEST COPY AVAILABLE
NOTICE TO FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY  
CITY OF SANTA CLARA, WASHINGTON COUNTY, UTAH

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study revises and updates a previous Flood Insurance Rate Map for the City of Santa Clara, Washington County, Utah. This information will be used by the City of Santa Clara to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP). The information will also be used by local and regional planners to further promote sound land use and floodplain development.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by J.F. Sato and Associates, for the Federal Emergency Management Agency (FEMA), under Contract No. EMD-96-CO-0020. This work was completed in December 1997. This study also incorporates the results of hydrologic and hydraulic analyses for Tucalna and Lava Flow Washes, performed by Bush and Gudgel Engineering, Inc., in April 1998, for the City of Santa Clara.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the City of Santa Clara, Washington County, Utah.

The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction through December 1997.
Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon, by FEMA, J.F. Sisto and Associates, and the City of Santa Clara.

2.2 Community Description

The City of Santa Clara is located in southern Washington County, in the southwestern corner of Utah. Neighboring communities are the Cities of St. George to the east and Ivins to the north. Washington County is approximately 120 miles northeast of Las Vegas, Nevada, on Interstate Highway 15. According to the U.S. Bureau of the Census, the City of Santa Clara had a 1990 population of 2,122 (Reference 1).

The Pine Valley Mountains are to the north. The Santa Clara River drains both the Pine Valley and Bull Valley Mountains to the north and northwest of the City. The Santa Clara River flows southeasternly along the western corporate limits. Tuscalo and Level Flow Washes flow southeasternly through the upper-middle portion of the City of Santa Clara.

Initial development occurred during the Civil War, when Brigham Young summoned Mormon families from central Utah to settle in southwestern Utah. The Mormons built a self-sufficient economy to support their ecclesiastical goals to provide cotton supplies that had been cut off because of the Civil War.

The climate in the City of Santa Clara is arid, characterized by long, hot summers; short, mild winters; and infrequent rainfall. The mean annual temperature is 61°F, with a January average of approximately 39°F and a July average of approximately 84°F. The mean annual precipitation is approximately 8 inches, 4 inches of which occur in the higher mountain areas that feed the major watercourses.

2.3 Principal Flood Problems

Stream channels in the City of Santa Clara area are largely ephemeral, however, much of the Santa Clara River Basin contains spectacular formations of rock that shed nearly all precipitation that occurs. This fact, coupled with relatively sparse vegetation and high-intensity summer thunderstorms, is the cause of the high flash flood potential that exists in the Santa Clara area.

For the larger perennial streams in the basin, such as the Santa Clara River, the potential for flooding as a result of large general storms from the Pacific Ocean also exists. Large general storms that melt the snowpack in the upper mountain elevations can cause swelling of these rivers, and serious flooding may result.

From the earliest days of settlement of the City of Santa Clara area, the Santa Clara River has subjected residents to periodic floods that have resulted in heavy property damage and loss of life. In December and January 1862, heavy rains caused extensive flooding and damage to the farmlands and the farm industry associated with the original mission of the Mormon settlers of the area.

2.4 Flood Protection Measures

Very limited measures have been taken to provide flood protection along the major flooding sources that affect the community. The U.S. Bureau of Reclamation considered the construction of two reservoirs as part of the Dixie Project during the 1950s. One of those reservoirs, Gunlock Reservoir, located on the Santa Clara River near Gunlock, Utah, was completed in 1971; however, it provides only limited flood control for the City of St. George area due to its small size. The floodplain of the Santa Clara River is nearly unregulated by any structural flood protection improvement.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period recurrence interval have all been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 1.00, 0.20, 0.10, and 0.02 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood 1 percent chance of annual exceedance in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community. The Santa Clara River had stream-gaging records available. The stream-gaging sites yielding important information for this study are listed in Table 1, Summary of Gaging Stations.

Flow-frequency analyses were conducted in accordance with U.S. Water Resources Council Bulletin 17A, "Guidelines for Determining Flood Flow Frequencies" (Reference 2). The log-Pearson Type III probability distribution was assumed and a regional skew of 0.0 was used. The flood frequency curves obtained from the gaging record analyses on each stream were supplemented with flood-frequency estimates resulting from two U.S. Geological Survey regional methods for frequency estimation (References 3 and 4). The effects of Gunlock Reservoir on the flooding potential of the Santa Clara River were evaluated through reservoir routing techniques, and the flood frequency curves for this stream were modified to incorporate this information.
<table>
<thead>
<tr>
<th>Gage No.</th>
<th>Station</th>
<th>Drainage Area (Square Miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0941.3000</td>
<td>Santa Clara River at St. George</td>
<td>541</td>
</tr>
<tr>
<td>0941.0400</td>
<td>Santa Clara River near Santa Clara</td>
<td>410</td>
</tr>
<tr>
<td>09409980</td>
<td>Santa Clara River at Guinlock</td>
<td>271</td>
</tr>
</tbody>
</table>
The discharges for Tucahn and Lava Flow Washes in the City of Santa Clara were calculated using the Natural Resources Conservation Service (NRCS) (formerly the Soil Conservation Service) method for computing peak rates of discharge for small watersheds (Reference 5).

Because no stream-gaging records are available, the drainage areas for Sand Hollow Wash were considered small enough to render it inappropriate to use available regional methods for flood frequency estimation. The NRCS curve-number method (Reference 6) was used to estimate the 10-, 50-, and 100-year floods on these streams. These estimates were plotted on log-normal probability paper, and a frequency curve was drawn (assuming a regional skew of 0.0) for extrapolation to the 500-year flood. Precipitation-frequency estimates were obtained from a precipitation-frequency atlas (Reference 7).

Peak discharge-drainage area relationships for the streams studied by detailed methods are shown in Table 2, "Summary of Discharges."

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Water-surface profiles for all streams studied in detail were developed using the U.S. Army Corps of Engineers HEC-2 computer program (Reference 8).

Cross-section data were obtained from a digital terrain map developed by Bush and Gudgell Engineering, Inc. (Reference 9), for the City of Santa Clara by field measurements. Cross sections for Sand Hollow Wash were taken from topographic maps furnished by the City of St. George (Reference 10). All bridges and culverts were field inspected and photographed to obtain elevation data and structural geometry.

Roughness coefficients (Manning's "n" values) for the detailed study streams were estimated by field inspection and engineering judgment. A roughness value of 0.035 was used for the main channel and 0.050 for the overbank areas for Tucahn and Lava Flow Washes and the Santa Clara River. For Sand Hollow Wash, roughness values ranging from 0.018 to 0.035 for the main channel and 0.05 for the overbank areas were used.

Starting water-surface elevations were developed using the slope-area method.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the Flood Insurance Rate Map (Exhibit 2).

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the North American Vertical Datum of 1988 (NAVD). Elevation reference marks and their descriptions are shown on the maps.
Table 2. Summary of Discharges

<table>
<thead>
<tr>
<th>Flooding Source and Location</th>
<th>Drainage Area (Square Miles)</th>
<th>10-Year</th>
<th>50-Year</th>
<th>100-Year</th>
<th>500-Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Clara River</td>
<td>425</td>
<td>3,000</td>
<td>7,100</td>
<td>9,800</td>
<td>18,000</td>
</tr>
<tr>
<td>Above confluence with Sand Hollow Wash</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tucacahn Wash</td>
<td>5.5</td>
<td>...</td>
<td>...</td>
<td>2,200</td>
<td>...</td>
</tr>
<tr>
<td>At Santa Clara Dike</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above confluence with Lava Flow Wash</td>
<td>2.8</td>
<td>...</td>
<td>...</td>
<td>1,700</td>
<td>...</td>
</tr>
<tr>
<td>Lava Flow Wash</td>
<td>2.2</td>
<td>...</td>
<td>...</td>
<td>500</td>
<td>...</td>
</tr>
<tr>
<td>Above confluence with Lava Flow Wash</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand Hollow Wash</td>
<td>50.1</td>
<td>2,800</td>
<td>5,200</td>
<td>6,600</td>
<td>10,200</td>
</tr>
<tr>
<td>Above confluence with Halfway Wash</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1Data not available
4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:2,400, with a contour interval of 2 feet (Reference 9), and 1:1,200, with a contour interval of 2 feet (References 10 and 11).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal-conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (see Table 3, "Floodway Data"). In cases where the floodway and 100-year
<table>
<thead>
<tr>
<th>CROSS SECTION</th>
<th>WIDTH (FEET)</th>
<th>SECTION AREA (SQUARE FEET)</th>
<th>MEAN VELOCITY (FEET PER SECOND)</th>
<th>REGULATORY FLOODWAY ELEVATION (FEET NAVD)</th>
<th>WITHOUT FLOODWAY</th>
<th>WITH FLOODWAY</th>
<th>INCREASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand Hollow Wash A</td>
<td>6,290</td>
<td>347/180</td>
<td>1,173</td>
<td>5.6</td>
<td>2,720.6</td>
<td>2,720.6</td>
<td>2,721.6</td>
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<tr>
<td>Santa Clara River A</td>
<td>2,613</td>
<td>248/90</td>
<td>1,244</td>
<td>7.9</td>
<td>2,685.5</td>
<td>2,685.5</td>
<td>2,685.5</td>
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<tr>
<td>B</td>
<td>3,609</td>
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<td>1,781</td>
<td>5.5</td>
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<td>667</td>
<td>14.7</td>
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<td>D</td>
<td>6,593</td>
<td>125</td>
<td>759</td>
<td>13.8</td>
<td>2,711.7</td>
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<tr>
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<td>164</td>
<td>839</td>
<td>11.7</td>
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<td>F</td>
<td>9,109</td>
<td>211</td>
<td>1,212</td>
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<td>321</td>
<td>1,305</td>
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<td>12,156</td>
<td>230</td>
<td>980</td>
<td>12.6</td>
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<tr>
<td>I</td>
<td>13,276</td>
<td>328</td>
<td>1,723</td>
<td>8.8</td>
<td>2,764.8</td>
<td>2,764.8</td>
<td>2,765.3</td>
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<tr>
<td>J</td>
<td>14,737</td>
<td>334</td>
<td>1,762</td>
<td>5.6</td>
<td>2,772.6</td>
<td>2,772.6</td>
<td>2,773.5</td>
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<tr>
<td>K</td>
<td>16,758</td>
<td>162</td>
<td>844</td>
<td>13.7</td>
<td>2,783.0</td>
<td>2,783.0</td>
<td>2,783.1</td>
</tr>
</tbody>
</table>

1 Foot above Levee Flow Divert bridge  
2 Width within the corporate limits

---

**FLOODWAY DATA**

FEDERAL EMERGENCY MANAGEMENT AGENCY  
CITY OF SANTA CLARA, UT  
(WASHINGTON COUNTY)

SAND HOLLOW WASH - SANTA CLARA RIVER
floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1.

![Figure 1. Floodway Schematic](image)

No floodways were computed for Tuacahn and Lava Flow Washes because it was not within the scope of the study.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

**Zone A**

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base (100-year) flood elevations (BFEs) or depths are shown within this zone.

**Zone AE**

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use the zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

No previous detailed studies have been prepared for the City of Santa Clara.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA, Mitigation Division, Denver Federal Center, Building 710, Box 25267, Denver, Colorado 80225-4267.

9.0 BIBLIOGRAPHY AND REFERENCES


