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FLOOD INSURANCE STUDY



TOWN OF
ELSINORE,
UTAH
 SEVIER COUNTY

APRIL 6, 1998



Federal Emergency Management Agency

COMMUNITY NUMBER 490125

SA 98-015762

**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
TOWN OF ELSINORE, SEVIER COUNTY, UTAH**

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Elsinore, Sevier County, Utah, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

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 Foothill Engineering Consultants, Inc. (the study contractor), for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-93-C-4150. This study was completed in December 1996.

1.3 Coordination

An initial Consultation Coordination Officer meeting for this study was held on August 10, 1993, and attended by representatives of FEMA, the Town of Elsinore, and the study contractor.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the Town of Elsinore, Sevier 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 1996.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards.

2.2 Community Description

The Town of Elsinore is located in Sevier County, in the south-central portion of Utah, approximately 175 miles south of Salt Lake City. Sevier County is bordered by Emery County to the east, Sanpete County to the north, Piute County to the south and Millard and Beaver Counties to the west. According to the U.S. Census, the population of the Town of Elsinore was 608 in 1996 (Reference 1). The Town is served by Interstate Highway 70, U.S. Highway 89, and the Denver and Rio Grande Western Railroad.

2.3 Principal Flood Problems

The Sevier River in the southern part of the Town is the principal flooding source affecting the Town of Elsinore. As a result of the construction of Interstate Highway 70, flooding from Albinus and Raphaelsen Canyons affecting the Town has been minimized and/or eliminated.

2.4 Flood Protection Measures

Two detention ponds at the mouths of Albinus and Raphaelsen Canyons have been constructed to intercept and convey flood flows from these streams.

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 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 10-, 2-, 1-, and 0.2-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 exceedence) 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.

Hydrologic calculations prepared during the Interstate Highway 70 design were obtained from the Utah Department of Transportation (UDOT) and reviewed. A number of discrepancies were noted between the as-built construction drawings and the UDOT calculations, such as tributary basin areas, sizes and types of outlet pipes in the detention ponds, and elevations of detention-pond embankments and spillways. It was decided that an independent hydrologic analysis would be completed. Initially, only Raphaelsen Canyon would be modeled. As a

result of a review of the drainage patterns and flow diversions into the Sevier Valley Canal and the estimated canal capacity, the hydrology for Albinus Canyon to the south also needed modeled.

Unit hydrographs were derived for both basins in accordance with the procedure outlined in Chapter 4 of the Bureau of Reclamation "Flood Hydrology Manual" (Reference 2). The thunderstorm dimensionless unit hydrograph for the Rocky Mountains was obtained from Table 4-11 of that publication to develop the basin unit hydrographs. The unit hydrographs developed for both basins had unit durations of 10 minutes each.

To estimate losses, a Natural Resources Conservation Service (NRCS) (formerly the Soil Conservation Service) curve number (CN) was estimated for both basins based on discussions with NRCS personnel. Soils for the Town of Elsinore area have been sampled and catalogued, but no report has been published. According to the NRCS, both basins consist of approximately 80 percent Type D soils (high runoff potential) and approximately 20 percent Type B soils (moderate runoff potential). The land use is primarily open-range land in poor condition with sparse vegetation. As such, a CN of 87 has been estimated for both basins.

Rainfall depth data for the 100-year storm were obtained from UDOT hydrologic calculations for 1- and 6-hour durations (Reference 3). Intermediate depths were obtained from a semi-log plot of the 1- and 6-hour values, and 5- and 15-minute depths were obtained in accordance with Weather Bureau Technical Paper No. 40, "Rainfall Frequency Atlas of the United States" (Reference 4). Other hydrologic modeling parameters, such as basin area and slope and detention-pond storage and outflow characteristics, were obtained from U.S. Geological Survey 7.5-minute series topographic maps (Reference 5) or UDOT as-built drawings.

A model was set up using the U.S. Army Corps of Engineers HEC-1 computer program (Reference 6) to compute runoff from both basins. The hydrographs generated for Albinus and Raphaelsen Canyons were routed through the detention ponds at the canyon mouths and downstream into the Sevier Valley Canal. No other drainage basins upstream of Albinus Canyon were considered because no major creeks are diverted into the Sevier Valley Canal and any upstream flows intercepted by the canal are delayed sufficiently to prevent substantially increasing the downstream flows.

Peak discharge-drainage area relationships for Albinus and Raphaelsen Canyons are shown in Table 1, "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.

During a May 30, 1996, site visit, it was acknowledged that an analytical evaluation of flooding would be difficult given the complexity of the hydraulics and limitations of the topographic and geotechnical data. For those reasons, judgment and reasonably conservative assumptions were necessary to complete the evaluation.

Table 1. Summary of Discharges

<u>Flooding Source and Location</u>	<u>Drainage Area (Square Miles)</u>	<u>Peak Discharges (Cubic Feet Per Second)</u>			
		<u>10-Year</u>	<u>50-Year</u>	<u>100-Year</u>	<u>500-Year</u>
Albinas Canyon	2.46	-- ¹	-- ¹	720	-- ¹
Raphaelsen Canyon	1.11	-- ¹	-- ¹	400	-- ¹

¹Data not computed

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Albinus Canyon

The spillway of the Albinus Canyon detention pond discharges into an unimproved section of the Sevier Valley Canal. The peak discharge from the Albinus Canyon detention pond spillway is 690 cubic feet per second (cfs). According to the Sevier Valley Canal Company, the bankfull capacity of the Sevier Valley Canal is approximately 400 cfs.

Based on field observations and discharge characteristics, three possible flooding scenarios were considered. One case was determined during the site visit to be the scenario appropriate for analysis. The following is a reasonable sequence of events that would occur during a 100-year flood on the Albinus Canyon drainageway.

- The 690-cfs pond outflow would discharge into the unimproved canal flowing bankfull at 400 cfs. The discharge from the spillway would surcharge the canal and split with approximately 250 cfs overflowing the downslope bank and 440 cfs entering the improved canal section immediately downstream. It should be noted that the values assumed above are arbitrary and have been selected based on engineering judgment. They were estimated by observations of the existing conditions and agreed upon in the field by FEMA and the study contractor as reasonable yet conservative estimates. A hydraulic analysis of the actual flow split would be extremely complex and thus could not be performed with the limited topographic information available or within the current scope of this study.
- The 250 cfs that breaches the unimproved canal flows approximately 300 feet to the southeast to the inlet of the 36-inch pipe culvert under Interstate Highway 70. The culvert flared end section shown on the highway construction plans could not be located. Regardless, the discharge would overtop the dike and enter the highway roadside swale and flow southeasterly away from the corporate limits. Some of the flow would enter small inlets along the roadside swale, pass under the highway, and discharge to the east outside of the Town of Elsinore corporate limits.
- The remaining 440 cfs would be carried by the improved canal section a distance of approximately 1,800 feet to where the improved canal section ends. At that point, the 440 cfs would spill over the canal downslope bank (without breaching) and flow overland eastward to a dike penetrated by a 48-inch pipe culvert. Approximately 105 cfs would enter the pipe, pass under the highway, and discharge to the east within the corporate limits. It appears from the available mapping that discharge would enter an improved section of the Elsinore Canal. It was judged in the field that the limited capacity of the pipes crossing under Interstate Highway 70 and the flat topography to the east are such that the small discharges from the pipes are too shallow and dispersed to constitute a flooding hazard.
- The remaining 335 cfs would flow northerly along the toe of slope of the entrance ramp to westbound Interstate Highway 70. Approximately 13 cfs would be intercepted by each of two 24-inch pipe culverts located approximately 250 and 750 feet to the north (13 cfs determined assuming inlet control). The remaining 309 cfs would reach the bottom of the entrance ramp at the west end of Main Street where there are two 24-inch pipe culverts located at the bottom of the entrance ramp. It is estimated that these inlets would intercept 13 cfs each.

- Approximately 283 cfs pass under Interstate Highway 70 via the Main Street underpass, resulting in a flow depth of 0.5 foot. That depth was determined by calculating normal depth for the trapezoidal channel formed by the underpass, with a bottom width of 50 feet, 1:1 side slopes, 5.5-percent channel slope, and a Manning's "n" value of 0.02 for concrete/asphalt. These assumptions were based on available mapping and the Interstate Highway 70 construction plans.

Raphaelsen Canyon

It was assumed that the Sevier Valley Canal is back to a bankfull condition of 400 cfs, and that any surcharge in the canal from Albinus Canyon has exited before reaching the Raphaelsen Canyon pond outlet.

The routed outflow from the pond of 180 cfs is discharged directly into an improved segment of the Sevier Valley Canal. The improved canal in that vicinity has a bankfull capacity of approximately 1,225 cfs. The improved canal section ends approximately 2,000 feet downstream of the detention pond, but the existing canal would have a considerably greater capacity than 1,225 cfs because the Interstate Highway 70 embankment downslope of the canal is approximately 12 feet higher than the canal invert. Thus, a huge cross-sectional area is created inadvertently by the highway embankment to the east and the upslope hillside to the west. However, the canal passes back under Interstate Highway 70 through an 8-foot-high by 18-foot-wide concrete box culvert approximately 3,000 feet downstream of the pond. That culvert has a capacity of approximately 860 cfs, and that value is used conservatively as the capacity of the canal in the vicinity of Raphaelsen Canyon. It was concluded that the 180-cfs routed outflow from the Raphaelsen Canyon detention pond is easily intercepted and conveyed by the Sevier Valley Canal, and thus would eliminate any concentrated flooding through the Town of Elsinore from that source.

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 National Geodetic Vertical Datum of 1929. Elevation reference marks and their descriptions are shown on the maps.

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 topographic maps at a scale of 1:1,200, with a contour interval of 2 feet (Reference 3).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit I). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zone A), 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 I).

Approximate 100-year floodplain boundaries in some portions of the study area were taken directly from the previous Flood Insurance Rate Map for the Town of Elsinore (Reference 7).

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.

No floodways were computed for Albinus and Raphaelsen Canyons because of the complexity of the hydraulics and limitations of available topographic data.

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 X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No BFEs or depths are shown 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 studies have been prepared for the Town of Elsinore.

Flood Insurance Rate Maps have been prepared for the Town of Elsinore and Sevier County (References 7 and 8). This study supersedes the information contained on those maps.

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 80225-0267.

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