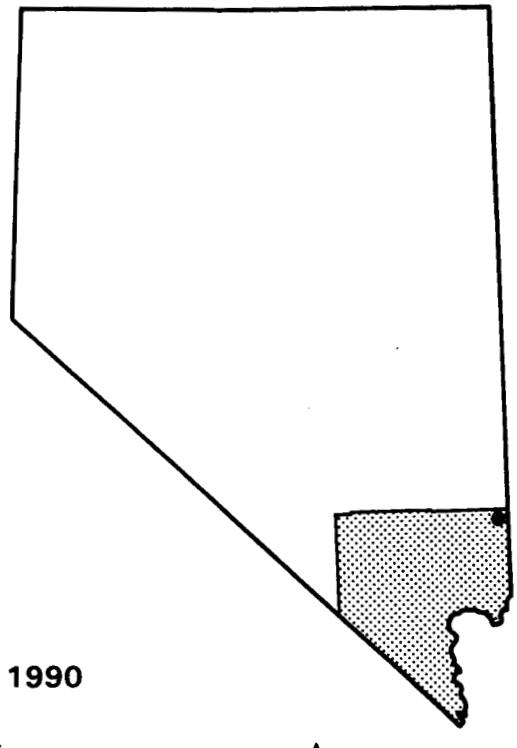
FLOOD INSURANCE STUDY

CITY OF MESQUITE, NEVADA
CLARK COUNTY



SEPTEMBER 28, 1990

Federal Emergency Management Agency

COMMUNITY NUMBER - 320035

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.

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Mesquite, Clark County, Nevada, 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 James M. Montgomery, Consulting Engineers, Inc. (the study contractor), for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-83-C-1197. This study was completed in May 1986.

1.3 Coordination

Flooding sources requiring detailed study were identified at an initial Consultation and Coordination Officer's (CCO) meeting attended by representatives of the study contractor, FEMA, and Clark County on April 14, 1983. Results of the hydrologic analyses were coordinated with the U.S. Soil Conservation Service (SCS), Clark County Department of Comprehensive Planning, U.S. Army Corps of Engineers (COE), State of Nevada Division of Emergency Management, and the U.S. Geological Survey (USGS).

On July 17, 1986, the results of this study were reviewed at an intermediate/final CCO meeting attended by representatives of FEMA, the study contractor, and the City of Mesquite.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the City of Mesquite, Clark County, Nevada. The area of study is shown on the Vicinity Map (Figure 1).

Flooding caused by the overflow of Pulsipher Wash was studied by detailed methods. Flooding on Abbott Wash and Town Wash was studied by approximate methods. Study limits for each of the flooding sources begin at the edge of the Virgin River floodplain and end just above Interstate Highway 15. 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 May 1992.

2.2 Community Description

The City of Mesquite is located in southeastern Nevada near the Nevada-Arizona state border. It is a recently incorporated community (March 1984) in the northeastern corner of Clark County, and is situated in the Virgin Valley approximately 80 miles northeast of the City of Las Vegas. It lies immediately north of the Virgin River.

The City of Mesquite has an area of approximately 11.3 square miles. Most of this area is undeveloped, including open land in the foothills north of the city and the Virgin River floodplain south of the city. Most development in Mesquite is related to agricultural or residential uses. Agricultural land use predominates in the area between Mesquite Boulevard and the Virgin River. Residential development is primarily confined to the area within 2 or 3 blocks north and south of Mesquite Boulevard. Commercial development is focused along Mesquite Boulevard.

The weather in the area is arid, characterized by sparse rainfall, low humidity, and wide extremes in daily temperatures. The average annual precipitation is approximately 3.95 inches. The average annual temperature is approximately 66°F, with average daily maximums in the high 70s and average daily minimums in the mid 50s. Daily maximum temperatures in summer usually exceed 100°F (Reference 1).

Winter storms in the area are regional. These storms are associated with broad low-pressure systems that develop over the Pacific Ocean and move easterly. Precipitation from these storms in generally widespread and is intense only on rare occasions. Summer storms, however, occur as localized thunderstorms and can be intense. These local convective storms are associated with moisture from the Gulf of California and the southern Pacific Ocean that move northeasterly. Floods occurring in the area near Mesquite are generally associated with precipitation from the summer convective thunderstorms in the mountains, occurring

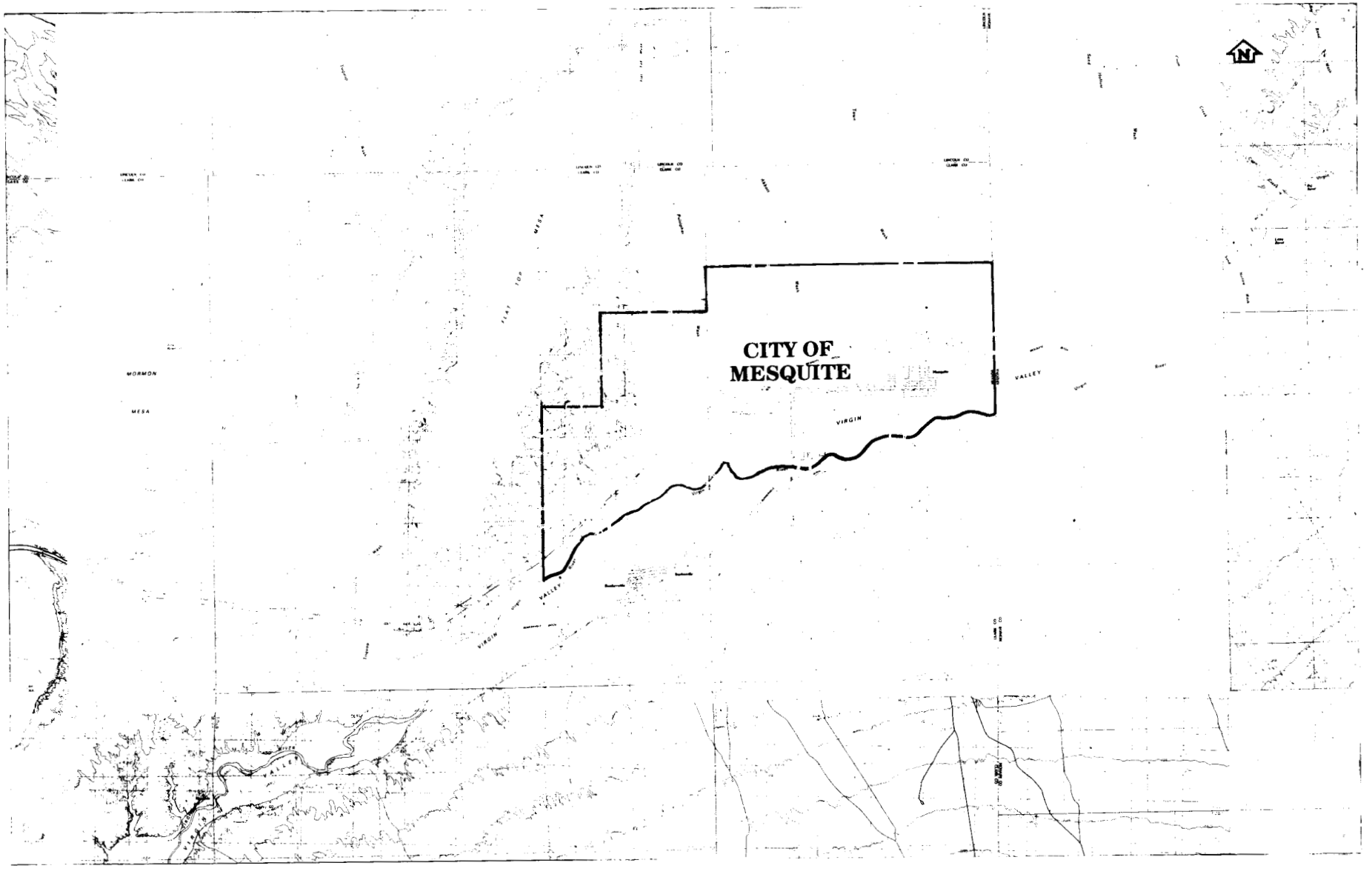


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MESQUITE, NV
(CLARK CO.)

APPROXIMATE SCALE

1.7 0 1.7 3.4 5.1 MILES

VICINITY MAP

primarily during the hotter months (July through September) (References 2 and 3).

Due to the arid nature of the desert, where Mesquite is located, the area is dry except during, and shortly after, a storm. When a major storm does move into the area, water collects rapidly as surface runoff concentrates in a short period of time. Consequently, resultant floodflows are flash floods, having sharp peaks and short durations.

The City of Mesquite is situated at an elevation of approximately 1,600 feet. There are three distinct topographic regions within the city. The northernmost region is composed of steep, barren, foothills from which many dry washes originate and flow southerly into the city. The central region is a broad, flat plain between the foothills and the Virgin River. This is part of the historical Virgin River floodplain, and has gently sloping topography to the south and west. This central region supports essentially all of the existing Virgin River channel and floodplain, and must be kept free of development.

Natural vegetation in the area around Mesquite is typical of the Mojave Basin desert region and includes creosote brush, a variety of yuccas, mesquite, and sagebrush. Soils are coarse and rocky in the foothill areas, allowing rapid runoff. Soils on the plain are more porous, particularly where modified for agricultural uses.

The City of Mesquite had a population of 1,108 in 1984 and 1,273 in 1985. Population data are not available from the 1980 Census because this precedes the community's incorporation. Agriculture represents the primary economic activity in the city. It is expected that the gaming and tourism industries may further develop as facilities are expanded to attract visitors from nearby Arizona and Utah (Reference 4). The primary transportation artery serving Mesquite is Interstate Highway 15, which connects major population centers in Nevada and Utah.

2.3 Principal Flood Problems

Principal flood problems in the City of Mesquite are associated with a series of washes that originate in the mountains to the north of the city and flow southerly to the Virgin River. The three washes of major concern are Pulsipher, Abbott, and Town. Flows from these washes concentrate at the mouths, then spread out across the broad area between the foothills and the Virgin River. The channels for the washes have a limited capacity, and are only capable of containing approximately a 10-year floodflow. In addition, the channels are unlined, and are susceptible to erosion and sediment deposition problems, particularly at bridge and unimproved road crossings.

Recent major flood events have occurred in August 1981 and July 1984. The 1984 flood reportedly caused flow to overtop Mesquite Boulevard on Abbott Wash by approximately 0.5 foot, and led to

extensive erosion and sediment deposition throughout all of the channels. Local residents claimed that the worst flood event on Town Wash in the past 40 years caused water to overtop Mesquite Boulevard by approximately 1.0 foot. There are no available estimates of flow rates or frequencies for any past floods on any of the three dry washes.

The Virgin River causes frequent flooding problems in the Mesquite area. The largest peak flow of record at the gage at Bunkerville bridge (downstream of the confluence of Abbott Wash) was 35,200 cubic feet per second (cfs) on December 6, 1966 (Reference 5). This flow has an estimated return period of approximately 98 years. Damage from flooding of this nature generally consists of erosion, sedimentation, inundation of crop land, and road and bridge washouts. Vegetation in the floodplain (natural and agricultural) becomes uprooted and obstructs downstream bridges.

2.4 Flood Protection Measures

There are no major flood protection measures associated with the three dry washes affecting the City of Mesquite. Aside from typical bridge and culvert crossings, the only flood-control facility is an unlined levee on Town Wash, immediately downstream of Interstate Highway 15. This is intended to prevent channel breakouts at a bend in the channel above a portion of the developed area of the city. In June 1987, the Nevada Department of Transportation completed a project that has eliminated erosion problems on this levee. Channel maintenance consisting of sediment removal from the dry washes is conducted by County and State agencies only after major storm events. Interstate Highway 15 has a substantial embankment through the study area, and acts as a dike, which provides some protection from flooding from the washes to the north.

There are two irrigation structures located on the Virgin River in the study area. These essentially offer no protection from large floods. There are no major flood protection measures on the Virgin River upstream of Mesquite.

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 which 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 which 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 the peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

Peak discharges for the desired recurrence intervals were computed for flooding sources in the City of Mesquite using the TR-20 Project Formulation - Hydrology computer program (Reference 6). This program was developed by the SCS to implement the SCS unit hydrograph procedures. TR-20 models were prepared for Pulsipher, Abbott, and Town Washes upstream of their respective crossings of Interstate Highway 15. The watershed area downstream of Interstate Highway 15 is insignificant, and much of it does not drain to any of the three washes.

Topographic information used to delineate watershed boundaries and estimate times of concentration was taken from a USGS 15-minute topographic map of the study area (Reference 7). Pulsipher Wash and Abbott Wash have small drainage areas (4.9 and 7.1 square miles, respectively) and were modeled with only a single subarea. Town Wash (20.7 square miles) was modeled with three subareas. Subbasin times of concentration ranged from 0.91 to 1.59 hours. SCS curve numbers, which relate to soil type, land use, and vegetative cover, were estimated to be 86 to 88, based on SCS soils maps and field reconnaissance.

As part of the analysis conducted for Flood Insurance Studies for other portions of Clark County, Nevada, an investigation of flood-producing storms typical of Southern Nevada was performed. It was determined, based on a review of published historical storm events, that thunderstorms in the study areas are generally of a 3-hour duration, and cover, at most, 150 to 200 square miles. Qualitative descriptions of historical events were used to develop a synthetic cumulative-time distribution for a 3-hour thunderstorm in Southern Nevada. This distribution was adopted instead of the SCS standard dimensionless storm patterns.

Point precipitation values for the 10-, 50-, and 100-year, 3-hour storms were obtained from the National Oceanic and Atmospheric Administration's Precipitation-Frequency Atlas for the State of Nevada (Reference 8). Depth-area reduction factors from a COE study for storms in Central Arizona (Reference 9) were used to estimate average rainfall over each of the study watersheds.

Depth-area reduction factors were 0.96 for Pulsipher Wash, 0.95 for Abbott Wash, and 0.88 for Town Wash. Adjusted 10-, 50-, and 100-year, 3-hour storm depths used in the TR-20 model are given below.

Return Period (years)	Adjusted Precipitation Depth (inches) Pulsipher Wash	Abbott Wash	Town Wash
10	1.25	1.24	1.14
25	1.73	1.71	1.58
100	1.92	1.90	1.76

Because the drainage basins are smaller than 150 square miles, critical peak flows were calculated assuming that separate storms were centered over each of the three watersheds.

Peak 500-year floodflows for the three dry washes were estimated by extrapolating graphically from the 10-, 50-, and 100-year discharges.

Peak discharge-drainage area relationships for Pulsipher Wash, Abbott Wash, and Town Wash are shown in Table 1.

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.

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).

Water-surface elevations of floods of the selected recurrence intervals were computed through the use of the COE HEC-2 step-backwater computer program (Reference 10). Cross sections for the backwater analysis of Pulsipher Wash were obtained from an aerial survey conducted in May 1984. This information was augmented by relative channel sections obtained by field measurement. All bridges and culverts were field surveyed to obtain elevation data and structural geometry.

Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. The starting water-surface elevations for Pulsipher Wash were calculated using the slope-area method. This starting method assumed that floods on Pulsipher Wash are independent of floods on the Virgin River. The large difference in watershed areas between the wash and the river makes it very unlikely that concurrent floods would occur on both sources.

TABLE 1. SUMMARY OF DISCHARGES

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Pulsipher Wash At Interstate Highway 15	4.9	930	1,730	2,070	3,230
Abbott Wash At Interstate Highway 15	7.1	1,050	1,940	2,340	3,690
Town Wash At Interstate Highway 15	20.7	2,810	5,260	6,350	9,890

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the stream and floodplain areas. Roughness values for Pulsipher Wash varied from 0.030 to 0.050 in the channel and from 0.030 to 0.047 in the overbanks.

In evaluating the floodplain for Pulsipher Wash, it was found that channel overflows occurred at or downstream of Mesquite Boulevard for the more infrequent flood events. These overflows leave the channel and do not return to it, due in part to the slope of the floodplain away from the channel, and to the presence of levees on the channel banks. At the locations on the wash, the main floodplain is separated from the overflow areas only by a slight topographic ridge. Overflow magnitudes were determined by modeling the full flow over the entire floodplain (including the overflow area), and using the flow distribution routine of HEC-2 to estimate the percentage of flow occurring in the overbanks. For determination of natural profiles, the overflow was subtracted from the full flow, and the cross sections were modified to show effective flow areas only in the main floodplain (excluding the overflow areas). Flows in the HEC-2 model decrease in a downstream direction as overflows are progressively subtracted from the main flow area at subsequent cross sections.

Average 100-year flow depths in overflow areas for Pulsipher Wash were determined using normal-depth calculations. In all cases average depths were less than 1.0 foot. Boundaries of the shallow flooding overflow areas could be determined only by approximate methods due to the general lack of topography on the broad Virgin River historical floodplain.

Shallow flooding is often characterized by highly unpredictable flow directions, caused by low relief or shifting channels and high debris loads. Where such conditions exist, the entire area susceptible to this unpredictable flow was delineated as a zone of equal risk. Small-scale topographic variations were averaged across inundated areas to determine flood depths.

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 (NGVD) of 1929. Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

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 rectified photo-topographic maps at a scale of 1:4,800, with a contour interval of 4 feet (Reference 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, AE, and AO); 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.

Approximate 100-year floodplain boundaries in some portions of the study area were taken directly from the Flood Hazard Boundary Map for the City of Mesquite (Reference 12).

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 1.0 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 (Table 2). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The 100-year overflows could be contained in the lower channel area of Pulsipher Wash without more than a 1.0-foot rise in the 100-year water-surface elevation, and thus, a floodway has been developed for the entire study reach.

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 by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

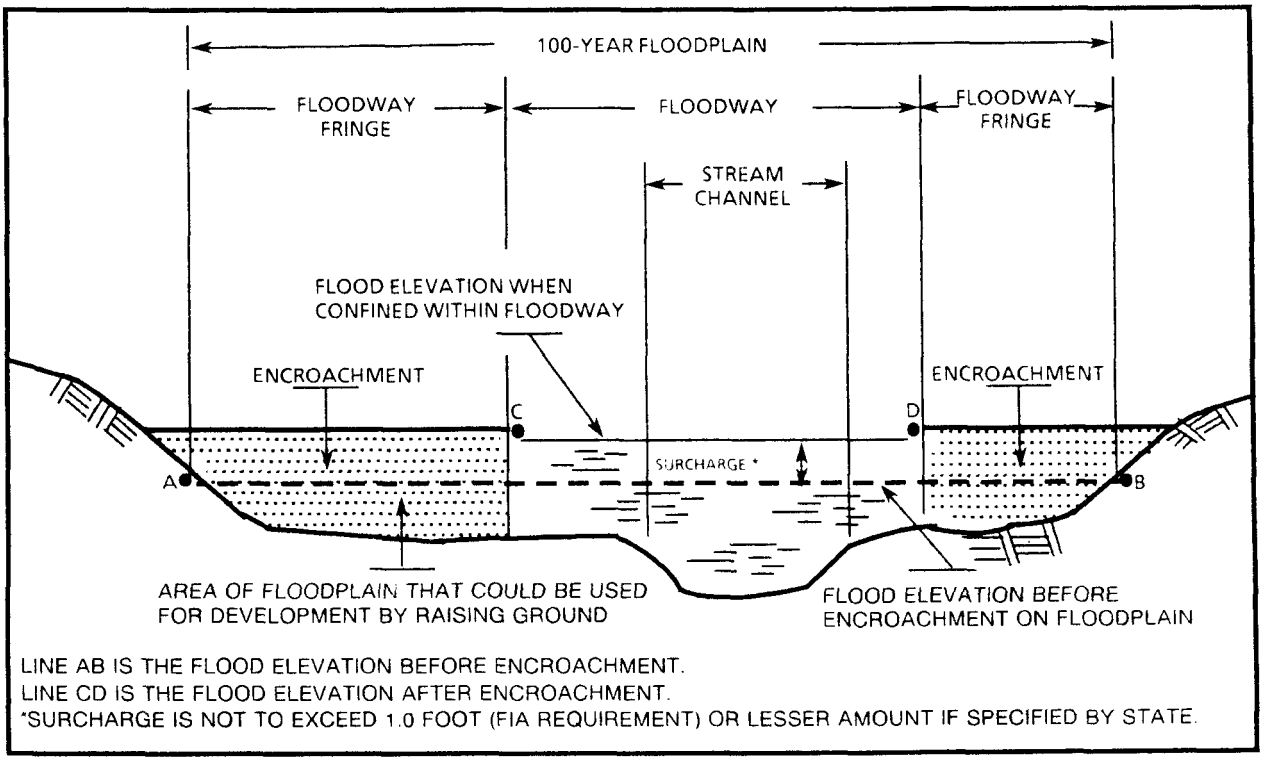


Figure 2. Floodway Schematic

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Pulsipher Wash								
A	490	800	557	3.7	1,538.8	1,538.8	1,538.8	0.0
B	880	222	311	6.7	1,546.3	1,546.3	1,547.0	0.7
C	1,210	165	398	5.2	1,550.9	1,550.9	1,551.6	0.7
D	2,400	336	819	2.5	1,573.9	1,573.9	1,574.9	1.0
E	3,350	52	194	10.7	1,580.0	1,580.0	1,580.1	0.1
F	4,020	65	210	9.9	1,588.2	1,588.2	1,589.0	0.8
G	4,870	200	1,213	1.7	1,603.4	1,603.4	1,603.5	0.1

[1] Feet Upstream of Confluence with Virgin River

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MESQUITE, NV
(CLARK CO.)

FLOODWAY DATA

PULSIPHER WASH

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 flood elevations 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 base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheetflow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses 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 base flood elevations 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 base flood elevations or average depths. Insurance agents use the zones and base flood elevations 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

Due to its more detailed hydraulic analyses, this Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for the City of Mesquite (Reference 12).

A Flood Insurance Study has been prepared for the unincorporated areas of Clark County, Nevada (Reference 13). This study was prepared concurrently with the county study, and incorporates many of the same assumptions regarding the hydrologic and hydraulic analyses. The results of this study are in agreement with the results of the Clark County study.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Presidio of San Francisco, Building 105, San Francisco, California 94129.

9.0 BIBLIOGRAPHY AND REFERENCES

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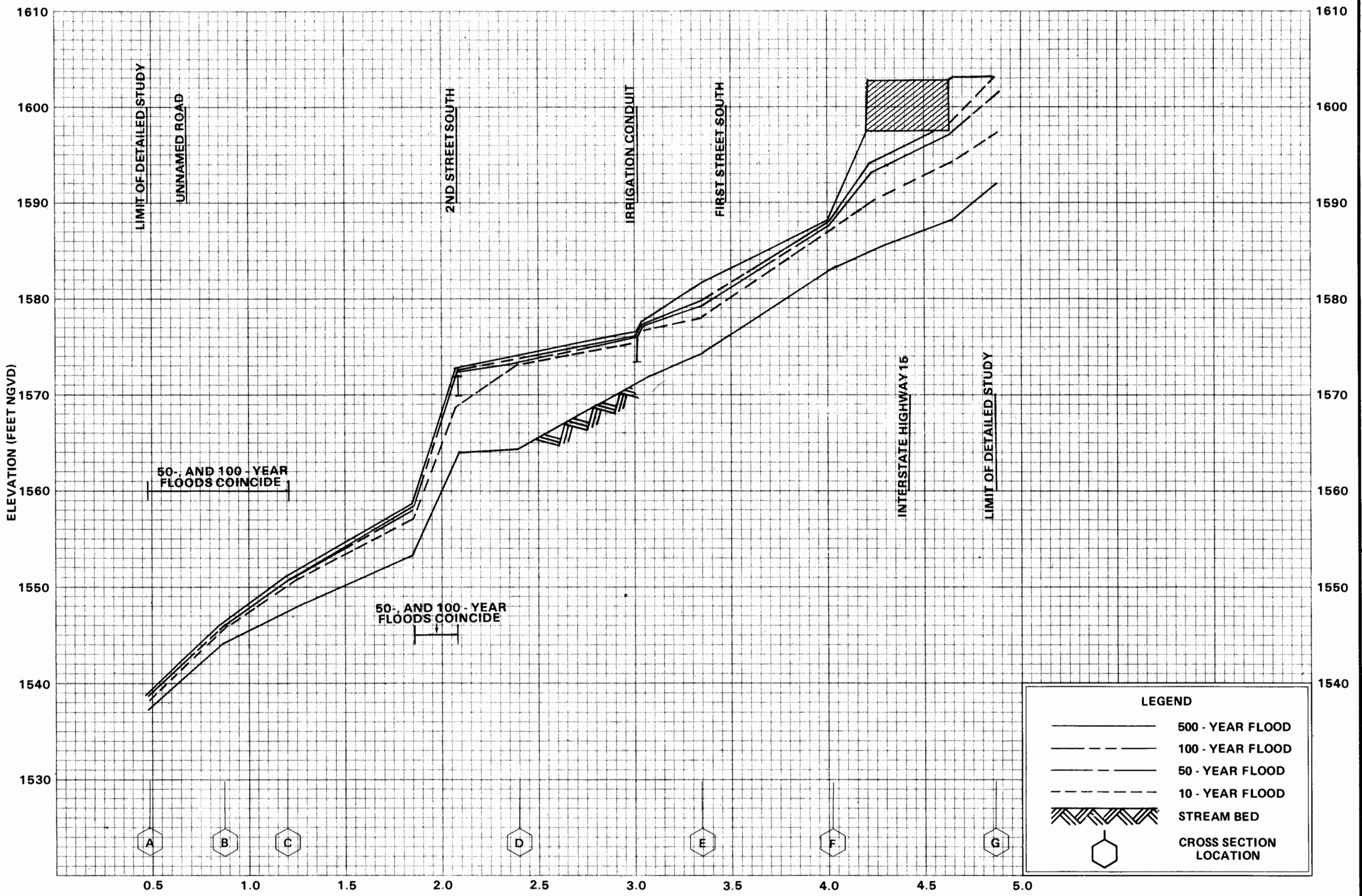

FLOOD PROFILES

PULSIPHER WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MESQUITE, NV
(CLARK CO.)

01P

EXHIBIT 3 - ELEVATION REFERENCE MARKS

Reference Mark	Elevation (Feet NGVD)	Description of Location
RM 1	1632.33	Clark County Survey Marker Station 2115.RLS 2050.
RM 2	1628.91	South 1/4 Corner Sections 9 and 16. GLO Brass Cap.
RM 3	1645.76	Aluminum Cap. Station 2115 "Katie." RSL 2050.