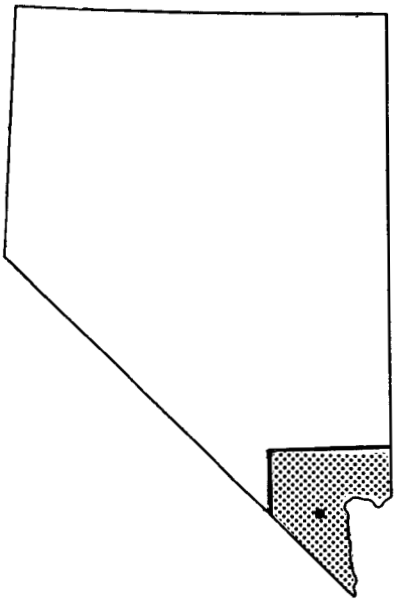
FLOOD INSURANCE STUDY

CITY OF HENDERSON, NEVADA
CLARK COUNTY



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Federal Emergency Management Agency

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1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this Flood Insurance Study is to investigate the existence and severity of flood hazards in the City of Henderson, Clark County, Nevada, and to aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of this information will be to convert Henderson to the regular program of flood insurance by the Federal Emergency Management Agency. Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain development.

1.2 Coordination

This Flood Insurance Study evolved from the Clark County Flood Insurance Study (Reference 1), which started in January 1975. In April 1976, it was divided into five principal areas, including the City of Henderson.

The initial coordination meeting for the study was held in June 1975. It was attended by representatives of the local communities, the county, and the study contractor.

The limits of detailed and approximate study in Henderson were determined by the Federal Emergency Management Agency, with community and study contractor consultation, at a meeting held in Las Vegas on January 8, 1976, and in subsequent meetings and communications.

The U.S. Army Corps of Engineers, the U.S. Geological Survey, and the U.S. Bureau of Reclamation were asked to review the hydrologic analyses prepared for the area.

A final community coordination meeting was held on October 7, 1980, and was attended by representatives of the Federal Emergency Management Agency, the study contractor, and the city. Pertinent problems raised at the meeting have been resolved.

1.3 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Soil Conservation Service, for the Federal Emergency Management Agency, under Inter-Agency Agreement No. IAA-H-8-77, Project Order No. 1, Amendment 9. This work, which was completed in November 1978, covered all significant flooding sources affecting the City of Henderson.

2.0 AREA STUDIED

2.1 Scope of Study

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

The areas of Clark County located within the corporate limits of Henderson were not included in this study.

Within the City of Henderson only alluvial fan flooding was studied by detailed methods.

The areas and initial methods of study were agreed to jointly by the Federal Emergency Management Agency, the city, and study contractor representatives, in June 1975 at the initial community coordination study meeting. During the course of the study, the Federal Emergency Management Agency developed guidelines for alluvial fan flooding. Dames & Moore reevaluated the flooding situation in Henderson according to these guidelines. All hydrologic and hydraulic computations were based upon present conditions.

Those areas studied by detailed methods were chosen with consideration given to all proposed construction and forecasted development through 1983.

2.2 Community Description

The City of Henderson is located in central Clark County, in southeastern Nevada. It is near the center of a broad desert valley surrounded by mountains ranging from 2,000 to 10,000 feet above the valley. Las Vegas is approximately 10 miles north of Henderson.

The total land area within the city is approximately 64 square miles. According to U.S. Census Bureau figures, the population increased from 12,525 in 1960 to 16,395 in 1970 (Reference 2).

Approximately 25 percent of the city has been developed, with the remainder of land being vacant. Within the flood plains studied, development primarily consists of single-family residences, a few private businesses, and some heavy industry.

The City of Henderson is situated in the Las Vegas Valley drainage basin at the northern end of the McCullough Mountain range.

The Las Vegas basin is made up of three types of land forms: mountains, alluvial fans and valley lowlands. The rugged topography of the mountainous areas is characterized by sharp peaks and ridges, steep slopes and deep, steepside canyons.

Many large alluvial fans exist around the perimeter of the valley. All fans are dissected by gullies. These gullies exhibit a dendritic drainage pattern throughout the intermediate and lower parts of the watershed (Reference 3).

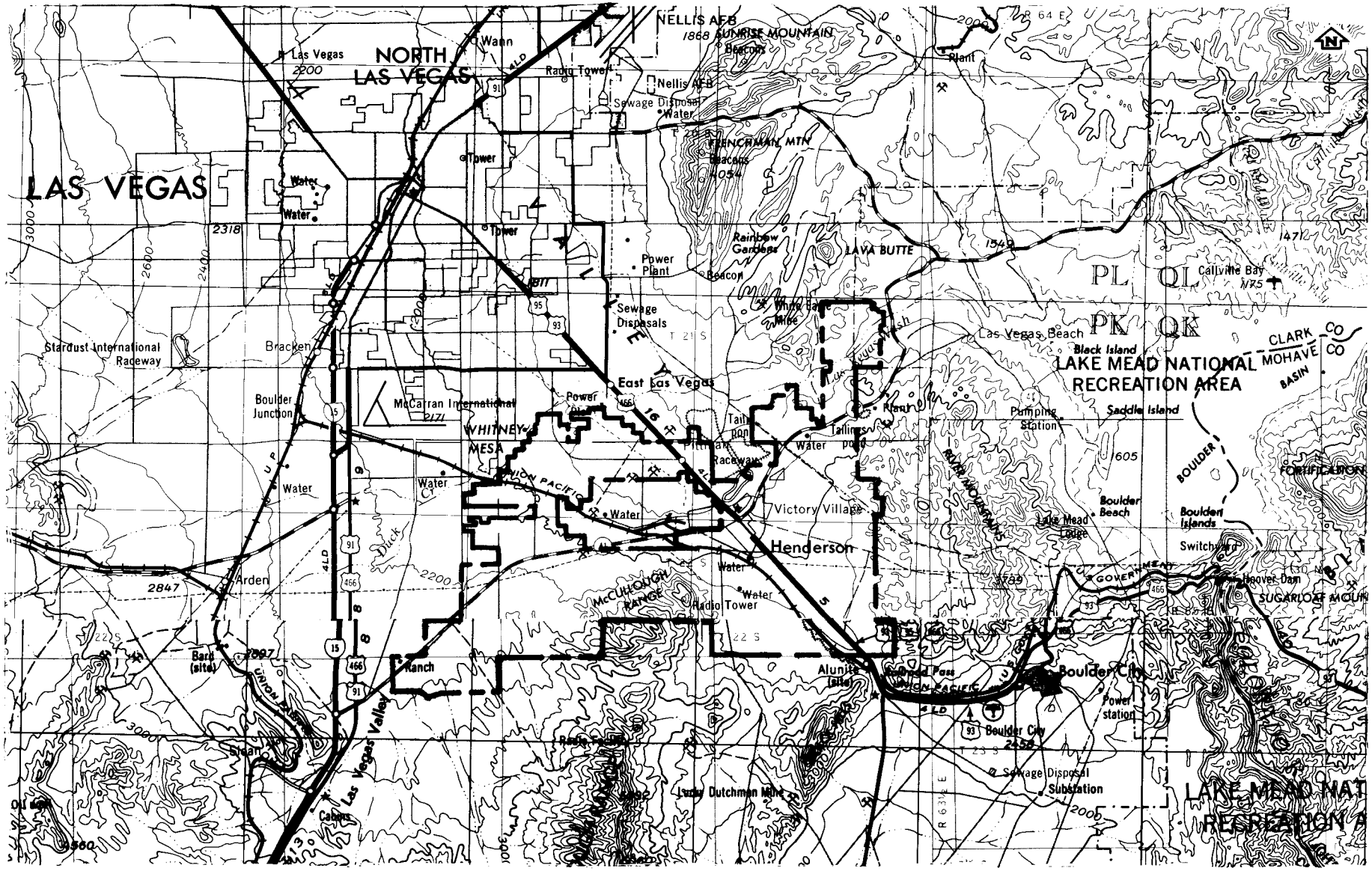

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF HENDERSON, NV

(CLARK CO.)

APPROXIMATE SCALE

1 0 1 2 3 MILES

VICINITY MAP

The climate for the area is classified as arid, which is characterized by warm summers and winters. The average annual precipitation is 3.76 inches.

The four seasons are well defined. Summers are typically hot and dry with maximum temperatures often over 100°F. The nights are generally cooler, due to the nearby mountains and their descending cool air. During almost every summer, there is a period of approximately 2 weeks when warm, moist, tropical air moves into the valley with resultant frequent thunderstorms and associated flash flooding. Winters are usually mild and pleasant, with daytime temperatures averaging near 60°F. The fall and spring seasons are ideal, with few days inappropriate for outdoor activities (Reference 4).

Typical soils types include the Delnorte-Nickel family, the Bodlard-Bracken-McCarran association, and the Nickel-Arizo-Delnorte family. The Bodlard-Bracken-MacCarran association consists of a gravelly fine sandy loam and fine sandy loam, with slopes of 0 to 8 percent. The two other soil types are gravelly loams to very gravelly sandy loams formed on alluvial fans from mixed rock sources, with slopes of 2 to 15 percent.

Native vegetation consists primarily of shrubs and grasses. Several trees, shrubs, and grass species can be adapted to the area if irrigation practices are used.

2.3 Principal Flood Problems

The past history of flooding sources within the city indicates that flooding may occur during any season of the year. The majority of major floods have occured during February, March, April, and May and are usually the result of thunderstorms.

There have been a number of major floods in Henderson. In September 1952, a storm blackened Henderson; power poles were downed and rains were torrential. In June 1954, homes on the north side of Henderson were ravaged by high waters. Several homeowners were forced to knock out walls to allow mud and water to pass through. In July 1974, severe flooding forced Henderson Police to close Sunset Road due to flooding (Reference 5). Conclusions drawn from limited data are that these three floods were smaller than the 10-year recurrence interval flood. The July 1974 flood was the most recent as well as the most severe flood of record.

A flood occured in Henderson on July 24, 1955, resulting from an intense storm centered over Henderson. The greatest amount of rainfall observed was 1.75 inches approximately 8 miles southeast of the city along U.S. Highway 95. Rainfall measurements in other parts of Henderson ranged from 0.6 to 1.5 inches. Floodwater swept down on Henderson, swamping hundreds of homes and stopping traffic.

Residents tried to slow down the rising tide by throwing up wooden barricades. Water as high as four feet deep flooded homes, leaving deposits of silt throughout the tract (Reference 5).

The recurrence interval for this flood is estimated to be 25 years.

The flow characteristics of several stream sources have been altered by joining several upstream channels and routing them through a large common highway culvert. This will tend to flatten the peak flows by lengthening the distance the stream must flow and increasing channel storage. However, this may tend to increase peaks immediately adjacent to large culverts.

2.4 Flood Protection Measures

There are no flood detention structures within the study area. The City of Henderson has altered low flow characteristics through numerous channel relocations, enlargements, and linings. These modifications have no appreciable effect on the large flows associated with infrequent storms. One notable exception to this is the Henderson Lateral which is located adjacent to Pueblo Boulevard. This lateral collects additional runoff from adjacent areas and directs it towards the Las Vegas Wash. This lateral protects downstream areas from more frequent floods, but is expected to be overtopped by the 100-year event. In addition to a slight flooding hazard presented by overtopping in the event of failure (breaching) of the downstream embankment on the lateral, there could be significant damage to areas immediately downstream adjacent to the breach.

The City of Henderson does not have a flood plain ordinance at this time. A grading ordinance that controls changes in drainage patterns is in force.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail 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 equalled 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 flood plain management and for flood insurance premium 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 equalled 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 occurrence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported here 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 floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

Estimates of flood discharges for the alluvial fan analysis were based on published U.S. Geological Survey data (Reference 6).

Peak discharge-drainage area relationships for the alluvial fans in Henderson are shown in Table 1.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flooding sources.

Statistical analyses were used to compute flood depths and velocities for those areas which are subject to alluvial fan flooding. Channel systems on alluvial fans are unstable, and flow may occur on separate parts of an alluvial fan during sequent flood events. The depths of flooding on alluvial fans presented in this report were computed according to the guidelines issued by the Federal Emergency Management Agency (Reference 7).

The hydraulic analyses for this study were based on unobstructed flow. The flooding depths 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 (NGVD). Elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
Alluvial Fan In Eastern Henderson	5.54	370	2,200	3,600	---[1]
Alluvial Fan In Western Henderson	76	1,490	13,300	23,370	---[1]

[1]Discharge Not Available

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Emergency Management Agency as the base flood for purposes of flood plain management measures.

Alluvial fan boundaries were delineated using topographic maps at a scale of 1:24,000 with a contour interval of 20 feet (Reference 8).

Approximate flood boundaries were delineated using topographic maps at a scale of 1:24,000 with a contour interval of 20 feet and at a scale of 1:2,400 with a contour interval of 5 feet (References 8 and 9).

Approximate flood boundaries in some portions of the study area were taken from the Flood Hazard Boundary Map (Reference 10).

Flood boundaries are indicated on the Flood Insurance Rate Map (Exhibit 1). On this map, the 100-year flood boundary corresponds to the boundary of the areas of special flood hazards (Zones A and A0). Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

4.2 Floodways

The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment in order that the 100-year flood be carried without substantial increases in flood heights.

The concept of a floodway does not apply to shallow flooding on alluvial fans; therefore, no floodway was determined for this study.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the Federal Emergency Management Agency has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each flooding source studied in detail affecting the City of Henderson.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods.

This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

Reach determinations do not apply to shallow alluvial fan flooding; therefore, no reaches have been determined for the flooding sources in the City of Henderson. Applicable flood insurance zone data are shown in Table 2.

5.2 Flood Hazard Factors

The FHF is the Federal Emergency Management Agency device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

Flood Hazard Factors are based on standard reach determinations and, therefore, do not apply to the flooding in the City of Henderson.

5.3 Flood Insurance Zones

The entire incorporated area of Henderson was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A: Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.

Zone AO: Special Flood Hazard Areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Shallow Flooding	0010,0015, 0020	Alluvial Fan Flooding				A0	Varies[4]

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot
[4]Depth and Velocity Values

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF HENDERSON, NV
(CLARK CO.)

FLOOD INSURANCE ZONE DATA

SHALLOW FLOODING

feet; depths are shown, or areas of 100-year alluvial fan flooding, depths and velocities shown, but no Flood Hazard Factors are determined.

Zone B: Areas between the Special Flood Hazard Areas and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C: Areas of minimal flooding.

Alluvial-fan flood hazard areas are shown on the Flood Insurance Rate Map (published separately) as AO zones, with average depths and velocities of flow given. In these areas, depths of the 100-year flood may exceed 3 feet. Development on alluvial fans is subject to a more severe flood hazard than would normally be encountered in an AO zone due to high velocities and unpredictability of the location of the stream channel across the width of the fan.

The flood elevation differences, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community are summarized in Table 2.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Henderson is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the Federal Emergency Management Agency.

6.0 OTHER STUDIES

A Flood Hazard Boundary Map for Henderson was published in January 1977 (Reference 10); this study represents a more detailed analysis and, therefore, supersedes that map.

This study is authoritative for the purposes of the National Flood Insurance Program; data presented herein either supersede or are compatible with all previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 211 Main Street, Room 220, San Francisco, California 94105.

8.0 BIBLIOGRAPHY AND REFERENCES

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6. U.S. Department of the Interior, Geological Survey, Water Resources Investigation, 77-21, Magnitude and Frequency of Floods in California, A.O. Waananen and J.R. Crippen, June 1977

7. Federal Emergency Management Agency, Alluvial Fan Special Flood Hazard Zone Mapping, July 19, 1979

8. U.S. Department of the Interior, Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 feet: Henderson, Nevada (1970); Las Vegas SE, Nevada (1967), Photorevised (1973); Boulder Beach, Nevada (1970); Boulder City NW, Nevada (1958), Photorevised (1973); Boulder City, Nevada (1958), Photorevised

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10. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, City of Henderson, Nevada, Scale 1:24,000, January 1977