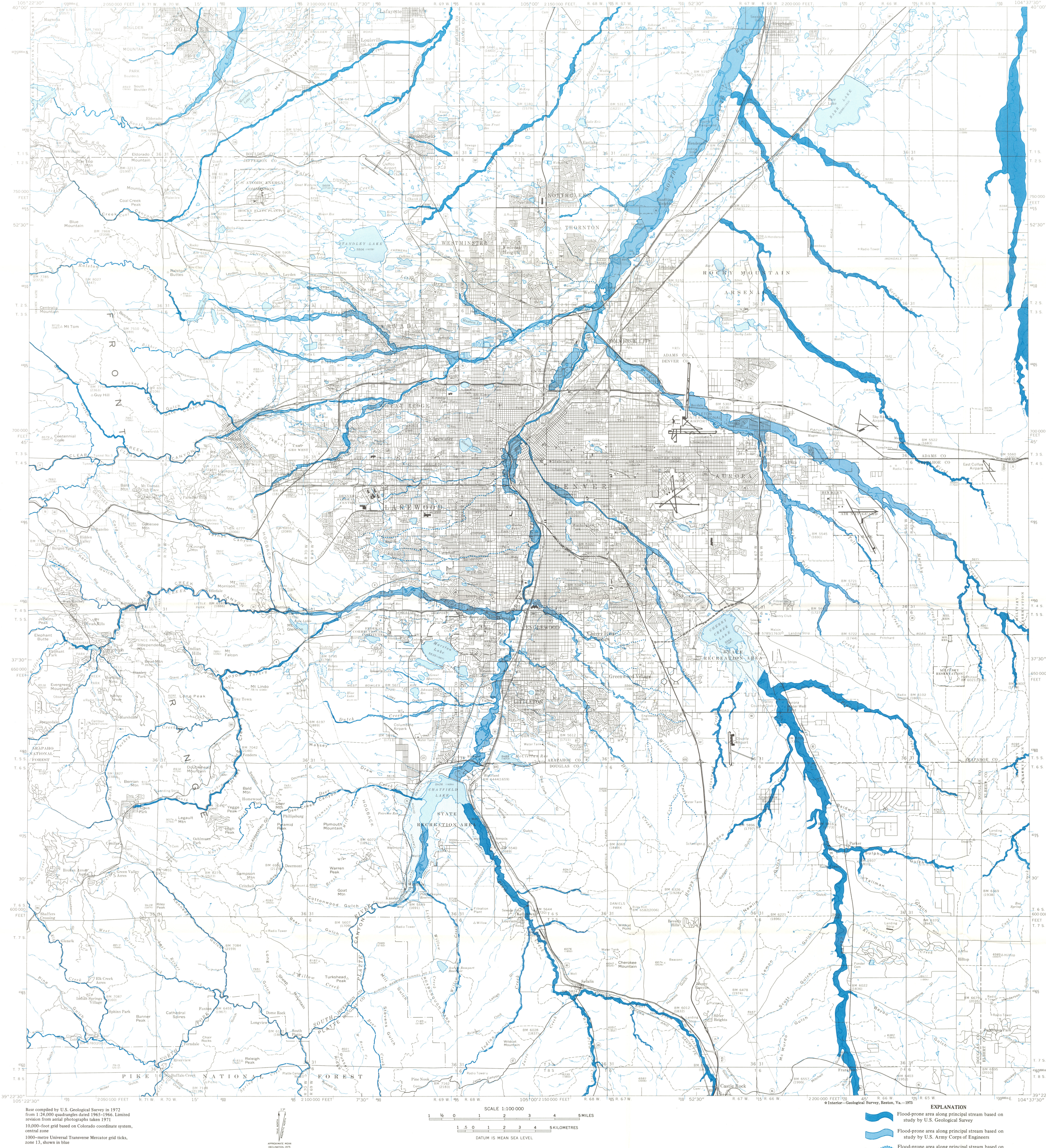
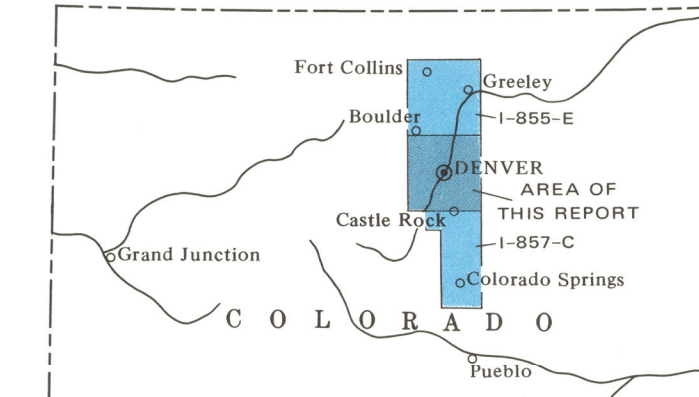




MAP SHOWING FLOOD-PRONE AREAS, GREATER DENVER AREA, FRONT RANGE URBAN CORRIDOR, COLORADO

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- EXPLANATION**
- Flood-prone area along principal stream based on study by U.S. Geological Survey
 - Flood-prone area along principal stream based on study by U.S. Army Corps of Engineers
 - Flood-prone area along principal stream based on studies by private firms for Urban Drainage and Flood Control District
 - Flood-prone area delineated on 7 1/2-minute topographic quadrangle-width not shown because of small map scale
 - Flood-prone area not delineated on 7 1/2-minute topographic quadrangle because of narrow canyon reach



MAP SHOWING AREA OF FRONT RANGE URBAN CORRIDOR

The rapid growth of population in the Front Range Urban Corridor of Colorado is causing intense competition for available land resources. One form of competition posing serious problems is indiscriminate development on flood plains along creeks and rivers. Flood plains are natural features of the landscape developed by streams to carry water in excess of channel capacity. Although not used as often by the stream, flood plains are as much a part of the stream system as is the channel. Whenever man competes with this natural function of the flood plain he must inevitably pay the price through property damage and varying degrees of human suffering. Flood damages in the United States have been estimated to average about \$1 billion annually (American Public Works Association, 1966). This tremendous waste of national resources is borne not only by those citizens in direct contact with floods but also to a lesser degree by all citizens through increased cost of public services. Thus, floods are of concern to the entire community, and solutions to existing or potential problems should be a community effort.

Flood plain inundation can be regarded as a temporary use of the land by a stream; therefore, effective management of flood plains is an integral objective of good land planning. Common procedures of flood plain management are land-use regulation, flood-control facilities, and flood-proofing of buildings. A combination of these procedures may alleviate or minimize flood damage in many flood-prone areas, but for others a single procedure may suffice. Regardless of the procedure used, flood plain management in an urbanizing area is a complex but necessary endeavor requiring adequate and current identification of areas subject to flooding.

This map depicts a broad-scale view of flood-prone areas along principal streams in the Greater Denver area of the urban corridor. Because of its small scale, the map is primarily an index to more detailed sources of flood plain information. Planners, designers, and developers should consult the reference material for detailed flood information in their particular area of interest. This map is presented as an aid to those authorities in whom the responsibility for flood plain zoning and regulation is vested.

Flood-prone areas identified on this map are subject to inundation by the 100-year flood—a flood having a 1 percent chance of being equaled or exceeded in any given year. The magnitude of stream flow for this reference flood were derived for streams in the study area from streamflow records and reports of the U.S. Geological Survey, reports of the U.S. Army Corps of Engineers, and from reports prepared by various consulting engineering firms for the Urban Drainage and Flood Control District. Reports of the Geological Survey include a series of 7 1/2-minute topographic quadrangles showing areas along principal streams that are subject to inundation by the 100-year flood. These maps were prepared under a project with the Federal Insurance Administration of the U.S. Department of Housing and Urban Development to meet provisions of the National Flood Insurance Act of 1968. These reconnaissance-type maps are prepared from information available in office files and in previously published reports. Upon completion, these maps are published and are available for distribution to the public. The U.S. Army Corps of Engineers reports contain detailed flood plain information for selected streams, including maps of inundated areas, flood and streambed profiles, and stream cross sections. Flood plain information for the South Platte River downstream from Commerce Reservoir is based on conditions existing before construction. Future studies of this reach may result in modified flood-prone area boundaries. The reports prepared for the Urban Drainage and Flood Control District contain detailed drainage planning for selected streams throughout the Denver metropolitan area. These reports show the 100-year flood limits for both existing and projected future conditions of basin development. Current status of flood plain studies for the study area is indicated in the diagram near the lower right corner of this map. The studies are referenced elsewhere in this report.

The flood information utilized for this study represents unobstructed conditions of existing channels and drainage structures. Alteration of the existing conditions by man or by debris accumulation can change the flood boundaries and cause damage to adjacent property. Also, the magnitude and depth of the reference flood are subject to change as the upstream parts of a basin are converted to more intensive land uses; therefore, future basin development should be considered in flood plain management studies. Flood-prone areas are shown on the map as blue pattern along the principal streams. The areas based on U.S. Geological Survey studies are shown as dark-blue pattern, those based on U.S. Army Corps of Engineers studies are shown as medium-blue pattern, and those studies prepared for the Urban Drainage and Flood Control District are shown as light-blue pattern. The limits of individual studies overlap in some instances; thus, the user should consult the referenced material to determine the availability of flood information in these areas. Because of the small map scale, areas subject to flooding along some streams could not be shown. A solid blue line along a stream indicates the core detailed flood information available in referenced reports.

Streams in the western part of the study area are confined to narrow canyon that have steep streambed slopes. Limits of flood-prone areas along these streams roughly coincide with the channel banks except in areas upstream from bridges or other constrictions in the channel. Many of these structures would be overtopped by the 100-year flood, and the depth of flooding upstream would be slightly higher than the maximum height of the structures. Depths of the 100-year flood along the unobstructed canyon reaches would average above 6 feet (1.8 meter) above the streambed based on an analysis of streamflow records at 19 gauging stations in the area. The 100-year flood depths generally range from 3 feet (0.9 meter) for a 10-square-mile (26-square-kilometer) basin to 9 feet (2.7 meter) for a 1,000-square-mile (2,590-square-kilometer) basin. Although flood depths are generally shallow, stream velocities would be fast and could damage structures close to the stream banks. Streams along the canyon reaches for which the above information applies are shown by dashed blue lines on the map.

In addition to the areas subject to inundation along principal streams, other areas are also subject to periodic flooding. These areas include numerous ravines that experience shallow flows during extraordinary runoff events and many flat, low-lying areas where water is ponded during periods of rainfall or snowmelt. Also, during flood periods, debris may accumulate upstream from drainage structures causing a reduction in flow capacity of the waterway. Such debris can cause increased upstream flood depths and extremely swift velocities near the streambed. In extreme cases, drainage structures can be severely damaged or destroyed. Another destructive process that commonly accompanies rare floods in mass wastage, such as landsliding and mudflow along steeply sloping terrain. These processes are often triggered by excessive wetting of the ground and by scour of stabilizing material from the base of slopes. The report by Hansen (1973) describes scour and mass wastage processes during the May 1973 flood in the Denver metropolitan area. Identification of areas where the above-described flood-related processes occur is beyond the scope of this report. Nonetheless, a detailed analysis of each process should be an integral part of any plans for extensive development of the land resources of the area.

SELECTED REFERENCES

- American Public Works Association, 1966, Urban drainage practices, procedures, and needs: Chicago, Ill., Am. Public Works Assoc. Research Found. Special Rept. No. 31.
- Ducett, G. L., Jr., and Hansen, W. R., 1973, Storm of May 5-6, 1973, in the Denver metro area, frequency and effect: Denver, Colo., Urban Drainage and Flood Control District, p. 2, app. 6, figs.
- Ducett, G. L., Jr., and Hodges, H. E., 1972, Rainfall-runoff data from small watersheds in Colorado, June 1968 through September 1971: Colorado Water Conservation Board, Water-Resources Basic-Data Release 27, 301 p.
- Follansbee, Robert, and Sawyer, L. R., 1948, Floods in Colorado: U.S. Geol. Survey Water-Supply Paper 997, 151 p.
- Hampton, E. R., 1974, Map showing availability of hydrologic data published by the U.S. Environmental Data Service, and by the U.S. Geological Survey and cooperating agencies, Greater Denver area, Front Range Urban Corridor, Colorado: U.S. Geol. Survey Misc. Inv. Series Map I-856-C. [In press.]
- Hansen, W. R., 1973, Effects of the May 5-6, 1973 storm in the Greater Denver Area, Colorado: U.S. Geol. Survey Circ. 689, 20 p., 19 figs.
- Martini, H. F., 1968, Magnitude and frequency of floods in the United States; Part 6-8, Missouri River basin below Sioux City, Iowa: U.S. Geol. Survey Water-Supply Paper 1680, 491 p., 15 figs., 1 pl.
- 1969, Floods of June 1965 in South Platte River basin, Colorado: U.S. Geol. Survey Water-Supply Paper 1850-B, 64 p., 34 figs., 4 pls.
- U.S. Army Corps of Engineers, 1963, Flood plain information, v. I, summary report, South Platte River, Waterton to Brighton, Colorado: U.S. Army Corps Engrs., Omaha, Neb., 11 p., 6 figs., 15 pls.
- 1966, Flood plain information, v. III, summary report, Bear and Clear Creeks, South Platte River Basin: U.S. Army Corps Engrs., Omaha, Neb., 14 p., 5 figs., 7 pls.
- 1968, Flood plain information, Big Dry Creek, Little Dry Creek (Arapahoe County), Greenwood Gulch, West Gulch, Lakewood Gulch, South Lakewood Gulch, McIntyre Gulch, Little Dry Creek (Adams County), Grange Hall Creek, v. IV, Denver Metropolitan Region, Colorado: U.S. Army Corps Engrs., Omaha, Neb., 62 p., 12 figs., 32 pls.
- 1969, Flood plain information, Boulder Creek and South Boulder Creek, v. I Boulder Metropolitan Region, Colorado: U.S. Army Corps Engrs., Omaha, Neb., 34 p., 4 figs., 13 pls.
- 1970, Flood plain information, Ralston Creek, Leyden Creek, Van Bibber Creek, Lena Gulch, Sanderson Gulch, and North Sanderson Gulch, v. V, Denver Metropolitan Region, Colorado: U.S. Army Corps Engrs., Omaha, Neb., 11 figs., 32 pls.
- 1971a, Special flood hazard report to revise flood plain information metropolitan region Denver, Colorado, v. II, Sand, Toll Gate, and Lower Cherry Creeks, South Platte River Basin: U.S. Army Corps Engrs., Omaha, Neb., 8 figs., 7 pls.
- 1971b, Flood plain information, Bear Creek and Mt. Vernon Creek, Morrison, Colorado: U.S. Army Corps Engrs., Omaha, Neb., 27 p., 5 figs., 9 pls.
- U.S. Army Corps of Engineers, 1971c, Flood plain information, Coldsmith Gulch, Dutch Creek, Lilley Gulch, and Coon Creek, v. VI, Denver Metropolitan Region, Colorado: U.S. Army Corps Engrs., Omaha, Neb., 50 p., 11 figs., 21 pls.
- 1972, Special flood hazard information report, Bear Creek, Denver Metropolitan Area: U.S. Army Corps Engrs., Omaha, Neb., 17 p., 4 figs., 10 pls.
- 1973, Special flood hazard information report, Upper Toll Gate Creek and tributaries, Aurora, Colorado: U.S. Army Corps Engrs., 33 p., 11 figs., 17 pls.
- U.S. Geological Survey, 1973, Map of flood-prone area [Colorado]: U.S. Geol. Survey open-file maps, Box Elder School quadrangle, Adams County; Brighton quadrangle, Adams County; Castle Rock North quadrangle, Douglas County; Coal Creek quadrangle, Adams County; Conifer Conifer quadrangle, Jefferson County; Eldorado Springs quadrangle, Boulder and Jefferson Counties; Evergreen quadrangle, Jefferson County; Indian Hills quadrangle, Jefferson County; Lafayette quadrangle, Adams, Boulder and Jefferson Counties; Louisville quadrangle, Boulder and Jefferson Counties; Mile-High Lakes quadrangle, Boulder and Jefferson Counties; Parker quadrangle, Arapahoe and Douglas Counties; Piney Creek quadrangle, Arapahoe and Douglas Counties; Ralston Buttes quadrangle, Jefferson County; Sable quadrangle, Adams County; Sable quadrangle, Douglas County; Sable quadrangle, Adams County; Sable quadrangle, Douglas County.
- 1973, Master plan, major drainage planning, Big Dry Creek (Adams-Jefferson Counties), v. 1, 2 Denver, Colo., Wright-McLaughlin Engineers.
- 1973, Major drainage planning, South Boulder Creek, v. 1, 2 Denver, Colo., R. W. Beck and Associates.
- 1974, Major drainage planning, Little Dry Creek, v. 1, 2 Denver, Colo., McCall-Edgington and Morrill, Inc.
- 1974, Water and drainage at River Creek, phase B report, Denver, Colo., Engineering Consultants, Inc.

Flood-prone areas are mapped on the U.S. Geological Survey 7 1/2-minute quadrangles indicated above.

A. Map of flood-prone area published by U.S. Geological Survey in 1973.

B. Flood-prone areas not delineated because of large map contour intervals and locations of streams in narrow canyon reaches.

C. Major drainage planning report published by Urban Drainage and Flood Control District (1972, 1973, 1974) available for selected streams on map.

D. Flood plain information report by U.S. Army Corps of Engineers available for selected streams on map.