FLOOD PLAIN INFORMATION

SOUTHWEST FOOTHILL STREAMS

(EVANS, THOMAS, AND WHITES CREEKS & SKYLINE WASH)

RENO, NEVADA

PREPARED FOR
THE REGIONAL PLANNING COMMISSION
OF RENO, SPARKS AND WASHOE COUNTY

BY THE

DEPARTMENT OF THE ARMY,
SACRAMENTO DISTRICT,
CORPS OF ENGINEERS,
SACRAMENTO, CALIFORNIA

JUNE 1974

Orientation Folder

FLOODS

ON THE
Southwest Foothill Streams

Flood plain areas of the Southwest Foothill Streams have suffered damage from large floods in the past. Studies made for a flood plain information (FPI) report show that floods of similar or larger magnitude can occur in the future.

The FPI Report presents facts on the flood potential and flood hazard along Evans, Dry, Thomas, and Whites Creeks, and Skyline Wash in the area generally south of Plumb Lane and west of Highway 395 in and in the vicinity of Reno. It includes maps, drawings, and photographs that illustrate the extent and severity of future floods that have been designated as the Intermediate Regional Flood (IRF) and Standard Project Flood (SPF). An IRF is a large flood expected to occur about once in 100 years on the average, although it could occur, and has a 1 percent probability of occurring, in any given year. An SPF would be greater than an IRF, but one that can reasonably be expected to occur in the future. It would occur less frequently than an IRF, but still could occur in any particular year.

Future flood heights along Evans Creek at U.S. 395.

The purpose of FPI reports is to provide a basis for managing the use of flood prone lands in such a way that flood hazards and damage during future floods are minimized or eliminated.

This folder has been prepared for Washoe County by the Sacramento District, U.S. Army Corps of Engineers. It is partially based on data in the report entitled "Flood Plain Information, Southwest Foothill Streams, Reno, Nevada." Copies of the report and this folder are available upon request from the Regional Planning Commission of Reno, Sparks and Washoe County.

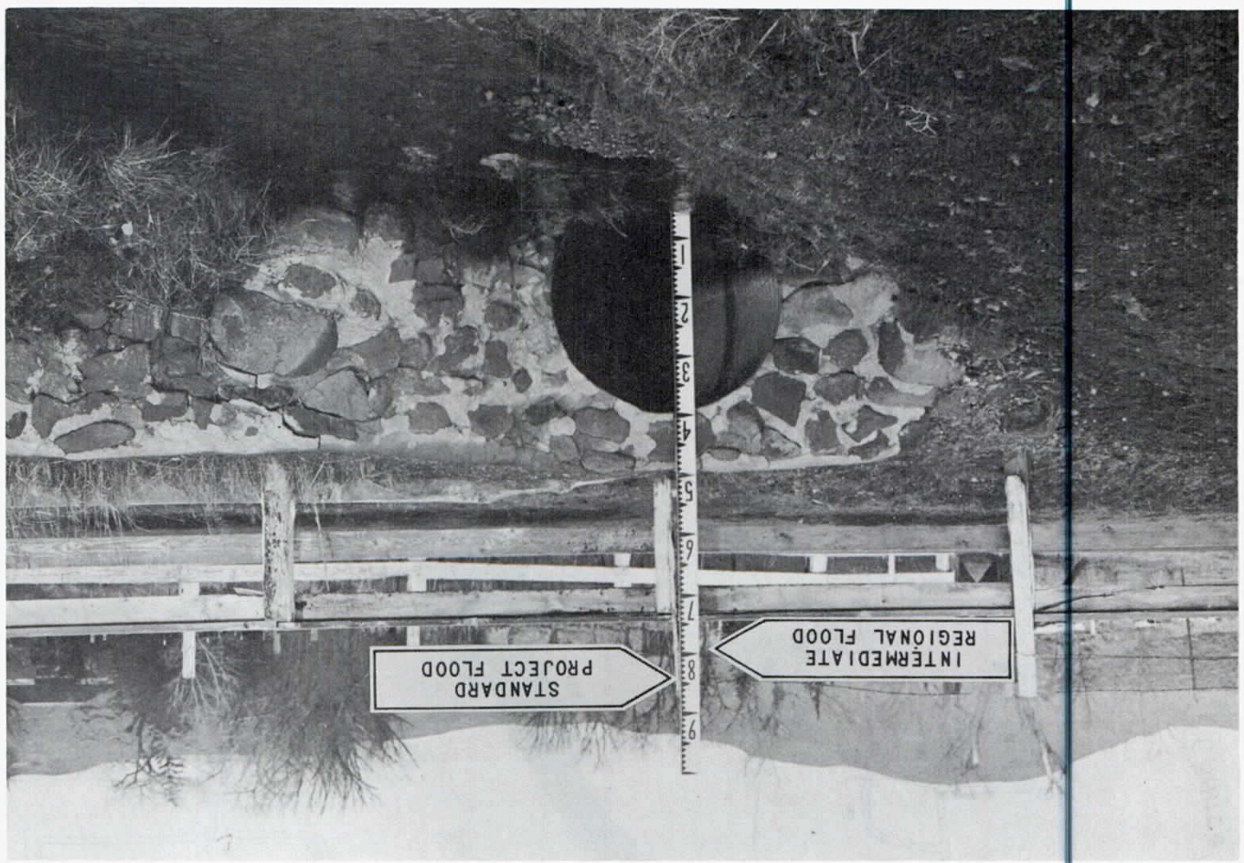
COVER PHOTOGRAPH:

Remains of Steamboat Ditch Flume crossing of Thomas Creek following the January-February 1963 floods. Rock debris from earlier cloudburst floods appear in the background (Soil Conservation Service photo).

Flood plains along the Southwest Foothill Streams south of Reno are being converted from their rural nature to residential, commercial, and recreational uses.

With continued community growth, greater pressure to utilize these flood prone areas will occur. Flood hazards and flood damage will increase unless some preventive or corrective action is taken.

Effective regulatory measures such as flood plain zoning, subdivision regulations, and building codes can be adopted to prevent or minimize the increase in flood damage. Flood insurance can help to compensate for flood losses. Flood proofing that prevents future damage to existing structures subject to flooding, and flood control works to modify flood patterns can also be a part of a long-range solution. Flood plain regulations, which are becoming more and more acceptable as a practical approach to flood damage reduction, encourage the highest and best use of flood prone areas.



Future flood heights along Thomas Creek at Sierra Manor Drive.

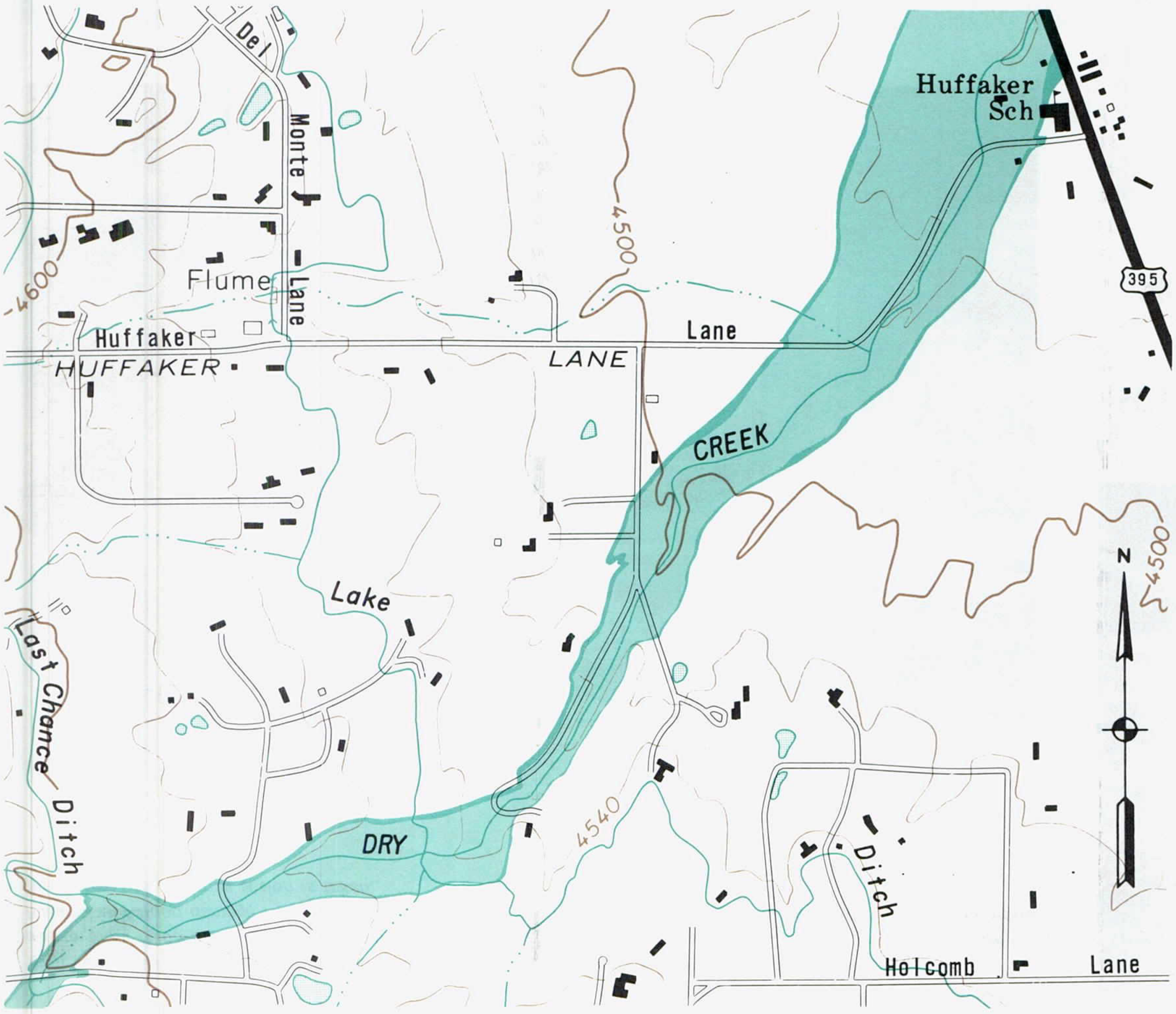
FLOODS

SOUTHWEST FOOTHILL STREAMS
(EVANS, DRY, THOMAS, AND WHITES CREEKS AND SKYLINE WASH)
RENO, NEVADA
JUNE 1974

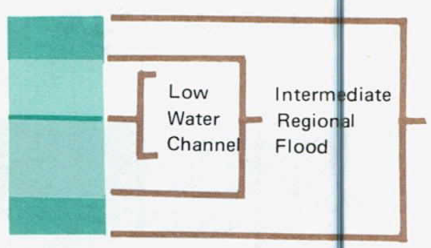
FLOOD PATTERNS

SOUTHWEST FOOTHILL STREAMS

RENO, NEVADA



OVERFLOW LIMITS



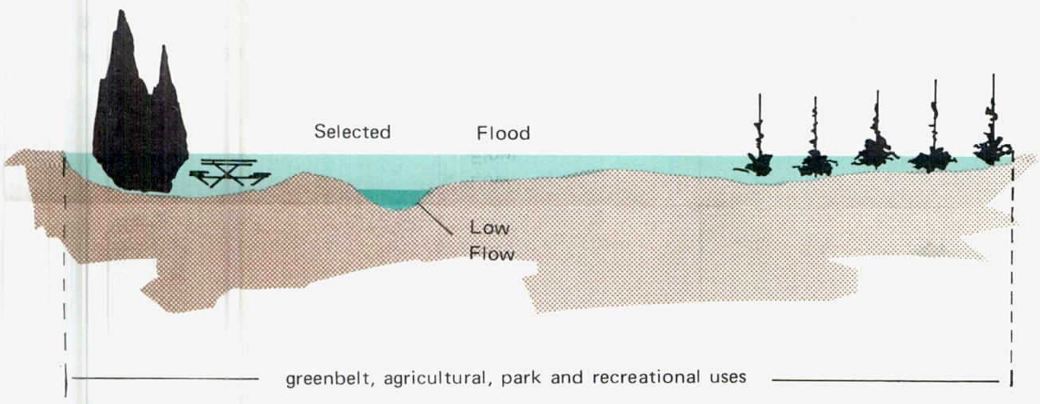
APPROXIMATE SCALE

Maps and other illustrations for the remainder of the study area (the flood plains and immediately adjacent areas along the lower reaches of Evans, Dry, Thomas, and Whites Creeks and Skyline Wash) are contained in the FPI Report.

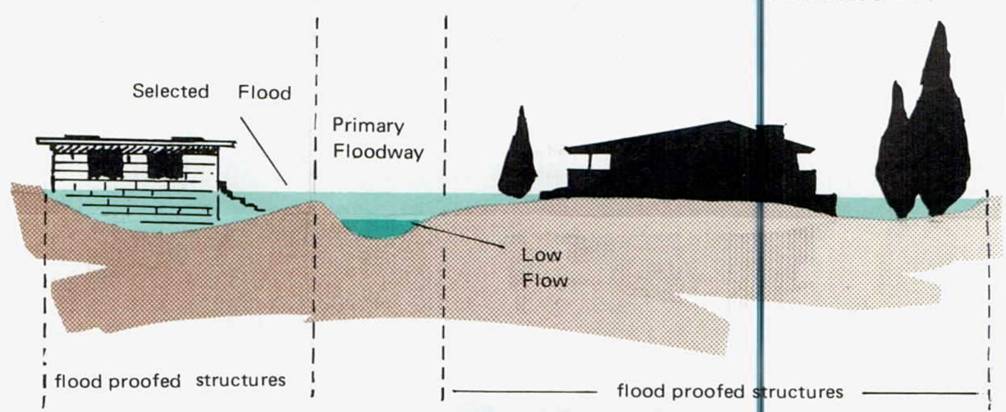
FLOOD PLAIN MANAGEMENT MEASURES USABLE FOR THE REDUCTION OF FLOOD DAMAGE

PREVENTIVE MEASURES

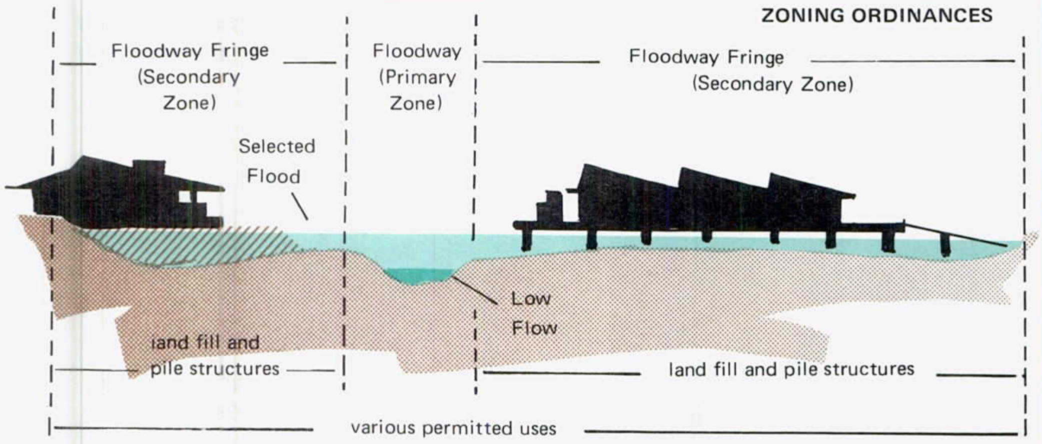
OPEN SPACE DEVELOPMENT



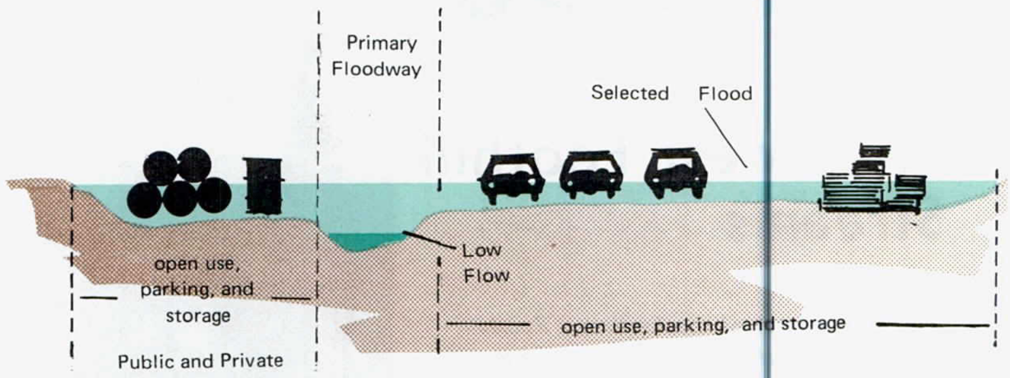
FLOOD PROOFING



ZONING ORDINANCES

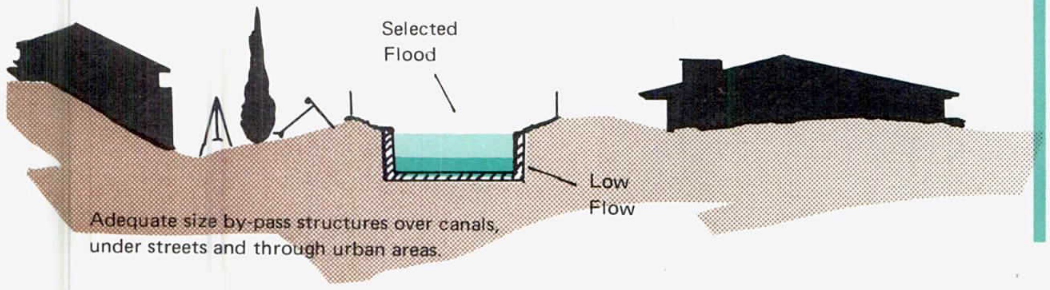


DEVELOPMENT POLICIES

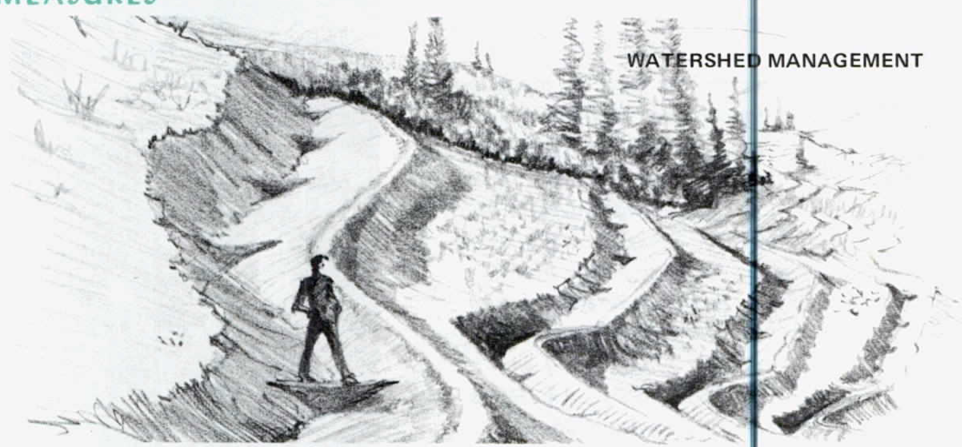


CORRECTIVE MEASURES

CHANNEL IMPROVEMENTS



WATERSHED MANAGEMENT



Preventive measures reduce vulnerability to flood damage and provide for greater flexibility in land use management, often at minor cost and with little adverse effect on the environment. Preventive measures other than those illustrated above include subdivision regulations, building codes, health regulations, tax adjustments, warning signs, and flood insurance. Corrective measures are often required to alleviate existing flood problems and forestall future problems.

Two types of corrective measures are illustrated above. Others include dams and reservoirs, flood plain evacuation, flood forecasting, and urban redevelopment. Preventive and corrective measures may be used by themselves or in varying combinations to meet the specific needs of a particular flood prone area. Public support is necessary to obtain needed flood damage reduction through flood plain management measures.

CONTENTS

CONTENTS (Continued)

TABLES

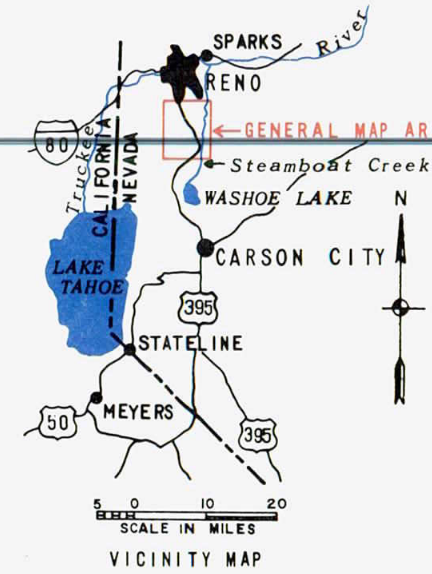
FIGURES

CONTENTS (Continued)

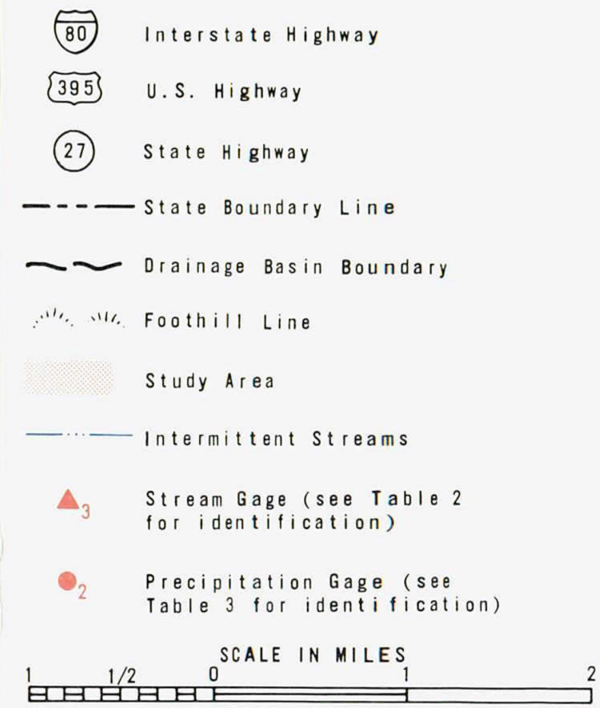
Cover Photographs: Typical scenes of flooding and flood damage likely to occur along the Southwest Foothill Streams. (Upper and lower photographs courtesy of the Soil Conservation Service. Center photograph courtesy of the Reno Evening Gazette.)

+ NOTE +

Unless otherwise indicated, photographs in this report were taken by Corps of Engineers personnel.



LEGEND



DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

FLOOD PLAIN INFORMATION
SOUTHWEST FOOTHILL STREAMS

RENO, NEVADA

GENERAL MAP
JUNE 1974

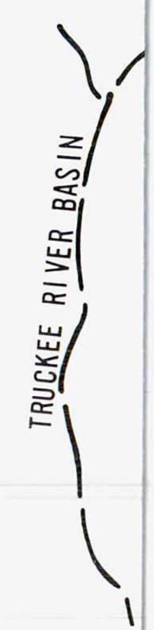
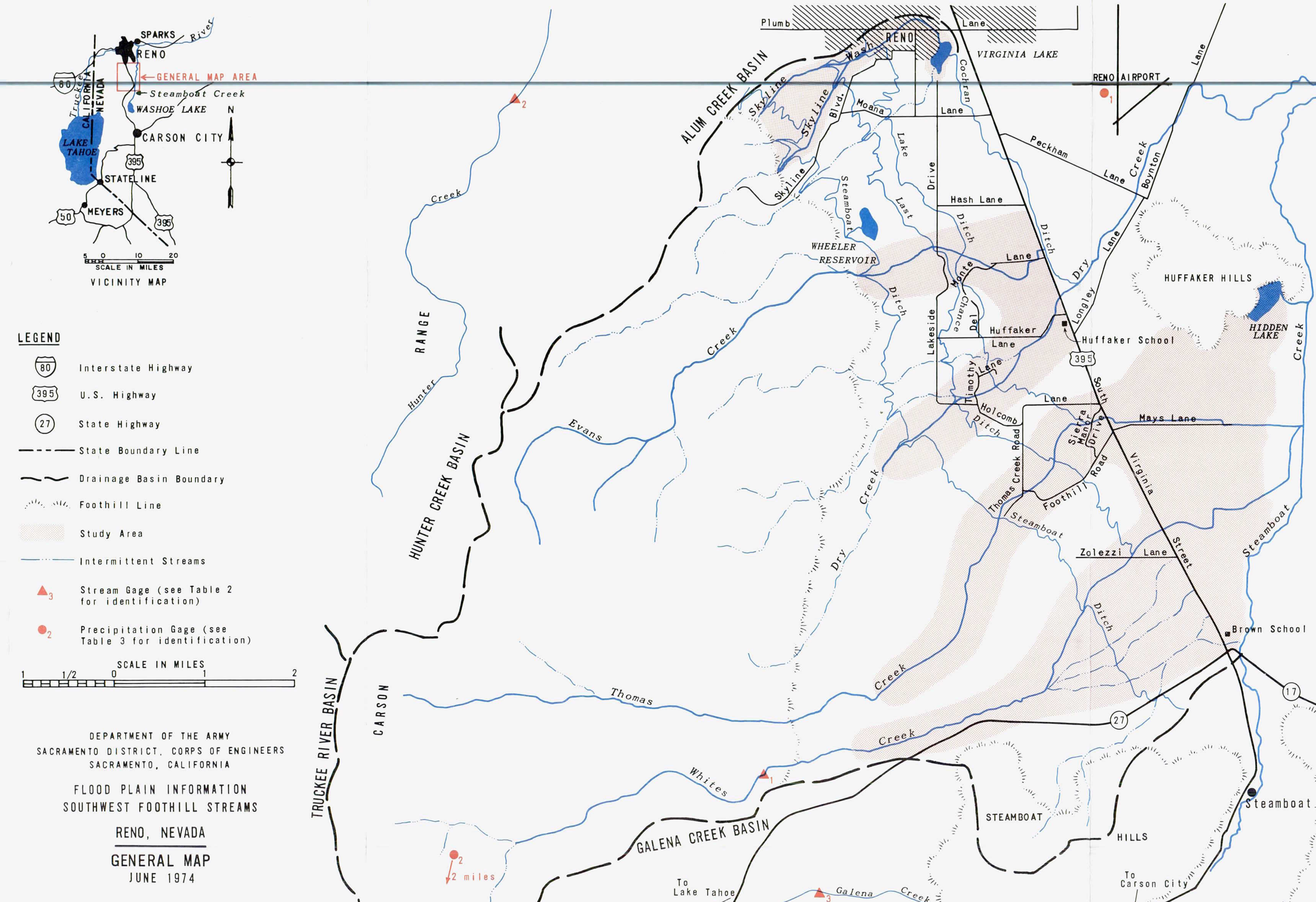


PLATE 1



SPARKS
RENO
River
Truckee
CALIFORNIA
NEVADA
GENERAL MAP AREA
Steamboat Creek
WASHOE LAKE
LAKE TAHOE
CARSON CITY
STATELINE
MEYERS
N
80
395
50
5 0 10 20
SCALE IN MILES
VICINITY MAP
LEGEND
80 Interstate Highway
395 U.S. Highway
27 State Highway
State Boundary Line
Drainage Basin Boundary
Foothill Line
Study Area
Intermittent Streams
Stream Gage (see Table 2 for identification)
Precipitation Gage (see Table 3 for identification)
SCALE IN MILES
1 1/2 0 1 2
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA
FLOOD PLAIN INFORMATION
SOUTHWEST FOOTHILL STREAMS
RENO, NEVADA
GENERAL MAP
JUNE 1974
TRUCKEE RIVER BASIN
CARSON
HUNTER CREEK BASIN
RANGE
Hunter
Creek
ALUM CREEK BASIN
GALENA CREEK BASIN
Evans
Creek
Thomas
Creek
Whites
Creek
Dry
Creek
Galena
Creek
2 miles
To Lake Tahoe
To Carson City
STEAMBOAT
HILLS
Steamboat
Plumb
Lane
RENO
VIRGINIA LAKE
RENO AIRPORT
Wash
Skyline
Skyline
Skyline Blvd.
Moana
Lane
Cochran
Lake
Last
Ditch
Drive
Hash Lane
Peckham
Lane
Creek
Boynton
Lane
WHEELER RESERVOIR
Steamboat
Ditch
Monte
Lane
Ditch
Chance
Del
Huffaker
Lane
Lakeside
Longley
Dry
Lane
HUFFAKER HILLS
HIDDEN LAKE
Creek
Huffaker School
395
Timothy
Lane
Lane
Holcomb
Ditch
South
Mays Lane
Sierra Manor Drive
Road
Thomas Creek Road
Foothill
Virginia
Steamboat
Zolezzi
Lane
Street
Steamboat
Ditch
Brown School
17
27

PLATE 1

PREFACE

The portions of Reno and adjoining areas in Washoe County covered by this report are subject to flooding from Evans, Dry, Thomas, and Whites Creeks and Skyline Wash, which are located generally in or in the vicinity of Reno, and south of Plumb Lane and west of U. S. Highway 395. For convenience of reference, the watercourses involved in the study have been designated as the "Southwest Foothill Streams." Properties along these watercourses are primarily agricultural and rural-residential, and have been moderately damaged by floods in the past. Floods larger than those that have occurred in the past can occur in the future. Accordingly, flooding and flood damage can still be expected.

This report was prepared because knowledge of potential flooding is important in the land-use planning of flood plains. It contains information on past floods, and maps, profiles, and cross sections that indicate the approximate extent and depth of inundation from large floods that can reasonably be expected to occur in the future.[a] For purposes of this report, these future floods have been designated as the Intermediate Regional and Standard Project Floods. The report provides the city and county a basis for study and planning for optimum use and development of flood prone areas through zoning and subdivision regulations, construction of flood control projects, or by a combination of these and other approaches to reducing flood hazards and flood damage. Information contained in the report would also be useful in programs

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(a) The maps showing areas flooded by Evans, Dry, Thomas, and Whites Creeks in this report join and extend upstream those contained in earlier reports entitled "Flood Plain Information, Truckee River, Reno-Sparks-Truckee Meadows, Nevada" (October 1970), and "Flood Plain Information, Steamboat Creek and Tributaries, Steamboat and Pleasant Valleys, Nevada" (June 1972).

dealing with ecological and environmental aspects of the study area and its land-use role as part of its surroundings. Recommendations or plans for solution of continuing flood problems in the study area are not included in this report. Neither does it extend any Federal authority over zoning or other regulation of flood plain use.

This report was prepared at the request of the Regional Planning Commission of Reno, Sparks and Washoe County, with the indorsement of the Nevada Department of Water Resources, under the continuing authority provided the Corps of Engineers in Section 206 of the 1960 Flood Control Act (Public Law 86-645), as amended.

The Sacramento District gratefully acknowledges the assistance and cooperation of the Reno City Engineer, the Washoe County Engineer, the Nevada Department of Highways, the Nevada Historical Society, the U. S. Soil Conservation Service, the Nevada State Journal, and individuals who directly or indirectly aided in the preparation of this report.

The Regional Planning Commission of Reno, Sparks and Washoe County will make the information in this report available to all interested agencies and individuals. Copies of the report and information on its use are available from that agency. The Sacramento District of the Corps of Engineers will, upon request, provide technical assistance to local, State, and Federal agencies in the interpretation and use of data presented herein, and will provide other available flood data related thereto.

BACKGROUND INFORMATION

SETTLEMENT

Permanent occupation of the study area was begun in the 1850's by settlers who cut wild hay or raised wheat to support immigration to the California gold fields, mining activity along the Comstock lode, and, in the 1860's to support construction of the Central Pacific Railroad east and west of Reno. Early development was based on livestock production and, with the introduction of irrigation in 1865, more varied agricultural activities that included production of barley, oats, and a variety of vegetables and fruit. Logging to supply timber for the Virginia City mines and firewood for Reno became important activities following completion of the now-abandoned Virginia and Truckee Railroad line between Reno and Virginia City.

In the early days, the railroad was very significant to the economy of the study area. Huffaker's Station became a shipment point for agricultural products and large amounts of timber and stovewood flumed down from the mountains to the west. With the decline of the Comstock, the importance of the railroad faded and the economy of the study area settled back on the true wealth of the region--the fertile meadowlands and abundant water supply. Farming and ranching continued as the principal economic activity of the area for many years. Following World War II, the need for housing and the proximity of the study area to Reno resulted in a trend to convert agricultural lands to subdivision and rural residential uses. With continued expansion of the Reno area due to its favorable business environment, its increasing popularity for year-round recreational activities, and the general need for people to work in a metropolitan area and their wish to live in scenic, pastoral settings, it is expected that the trend to develop agricultural land to urban uses will continue.

THE STREAMS AND THEIR VALLEYS

The study area for this report comprises the southwest sector of a large intermountain valley known as Truckee Meadows, and consists of the flood plains and immediately adjacent areas along the lower reaches of Evans, Dry, Thomas, and Whites Creeks and Skyline Wash. The creeks involved in the study are tributaries to Steamboat Creek. Skyline Wash is tributary to Virginia Lake, a recreation pond in the southern part of Reno. The stream reaches studied extend from Highway 395 west to about the foothill line on Evans and Dry Creeks (distances of 2.6 and 3.3 miles, respectively), and from the western limit of the Steamboat Creek Intermediate Regional Flood plain west to about the foothill line on Thomas and Whites Creeks (distances of 6.7 and 6.5 miles, respectively). The study reach along Skyline Wash extends from Virginia Lake west to the foothill line, a distance of about 3 miles. In general, the study area extends from the southern part of Reno on the north to Steamboat Hills on the south. (See Plate I.)

The Southwest Foothill Streams rise in the Carson Range and flow in northeasterly trending courses to the foothills and valley floor. About 2 miles west of Highway 395, Whites Creek divides into four distinct distributary channels, the northernmost of which is the main channel and carries most of the flow. Elevations in the watersheds range from about 4,400 feet in Truckee Meadows to about 10,800 feet in the highest headwater areas on Mount Rose. Vegetation in the higher elevations consists of second growth pine and fir; patches of manzanita, snowbrush, and bitterbrush; and isolated stands of mountain mahogany. In the middle elevations, vegetation consists of sagebrush, and bitterbrush, with a ground cover of hardy perennial and annual native grasses. The valley floor areas are mostly improved meadowlands used for pasture and production of hay.

In the headwater areas, the climate is classified as dry-subhumid and average annual precipitation is about 40 inches. Winter precipitation usually occurs as snow and a moderate snowpack accumulates.

Temperatures in the higher elevations range from average daily winter lows of 10 degrees to average daily summer highs of about 70 degrees.

The climate on the valley floor is classified as semiarid and average annual precipitation is about 8 inches. Wintertime precipitation frequently occurs as snow, but it seldom remains for more than 3 or 4 days. Temperatures range from average daily summer highs of about 80 degrees, with maximum daytime temperatures frequently exceeding 90 degrees, to average daily winter lows of about 20 degrees, with daytime temperatures frequently lower than 32 degrees. In the summer, cloudburst type storms frequently occur over the drainage basins of the streams under study.

In total, the Southwest Foothill Streams drain about 55 square miles upstream from Highway 395. Approximate drainage areas are shown in Table I.

TABLE I

DRAINAGE AREAS
(At Highway 395)

Stream	Drainage Area sq. mi.
Evans Creek	9.5
Dry Creek	14.1
Thomas Creek	11.3
Whites Creek	17.1
Skyline Wash	2.3

The streams flow in deep notches down the mountain slopes, emerging onto alluvial fans as they near the valley floor. The outwash fans are characterized by deposits of large boulders and rocks on the higher slopes. As the streams approach Highway 395 and gradients flatten, the debris becomes smaller in size. Stream channels are too small to carry any but minor floodflows and follow confusing courses across the outwash fans. Each stream has distributary channels that would seemingly pose severe flood threats, but are blocked near the present active channels by debris plugs. Extensive channel maintenance to remove debris is often required after heavy runoff to prevent the streams from changing course.

DEVELOPMENTS IN THE STUDY AREA

Livestock raising is the principal agricultural pursuit in the study area and it is generally centered south of Huffaker Hills and east of Highway 395. Developments include those associated with livestock production and consist of ranchhouses, barns, sheds, corrals, fences, and irrigation facilities. Lake, Last Chance, and Steamboat Ditches, the principal irrigation conveyance facilities, traverse the study area in a northwest-southeast direction. Ranches are also located in the southern part of the study area between Highway 395 and Steamboat Ditch, but this area is rapidly being converted to rural residential and suburban-estate type developments. Crop production is related to stock raising and includes feed and forage crops for cattle maintenance and winter subsistence. Large acreages are devoted to irrigated pasture. The northern sector of the study area includes a portion of the city of Reno and county areas being developed to suburban subdivisions. Commercial development includes shopping centers along Highway 395 in Reno, and many tourist-oriented facilities such as motels, service stations, and restaurants along that thoroughfare. The present population of the study area is estimated at about 18,000 and is expected to increase to about 45,000 by the year 2000.[a]

Surface transportation facilities in the study area consist of Highway 395, a network of county roads, and city streets in Reno. State Highways 17 and 27, which join Highway 395 at the southern limit of the study area, afford access to points east and west, respectively. Major airlines maintain scheduled flights to Reno Municipal Airport.

At present, the study area is not extensively urbanized, but a large area, about 30 percent of the land, is devoted to rural residential uses. About 10 percent of the area is residential, about 1-2 percent is commercial, and about 60 percent remains devoted to agriculture. It is expected that existing land-use patterns in the study area will undergo

(a) Based on projections made by the Bureau of Business and Economic Research, University of Nevada.

only minor changes in the next 25-30 years. Urbanization will continue at a fairly rapid rate in the northern sector, and more extensive conversion of agricultural land to rural subdivision and estate-type development is expected essentially throughout the study area. Commercial development will continue to the south and will become more dense, and some light industrial development may take place along Highway 395. By the year 2000, it is estimated that about 20 percent of the study area will be urbanized, 40 percent will be devoted to rural residential uses, 2-3 percent will be in commercial or light industrial use, and about 40 percent will be in agricultural uses.

FLOOD SITUATION

SOURCES OF DATA AND RECORDS

Information relative to past floods was developed from available streamflow and precipitation records, from interviews with local residents, from research of newspaper files and historical documents, and from reports of other agencies.[a] Basic hydrologic data were derived from streamflow records of the stations shown in Table 2.

TABLE 2

STREAM GAGING STATIONS[a]

Station Number (b)	Station Name	Period of Record	Maximum Recorded Peak Flow c.f.s.	Maximum Recorded Peak Flow date
1	Whites Creek near Steamboat, Nevada	1961-1966	2,280	Aug 15, 1965
2	Hunter Creek near Reno, Nevada	1961-1971	986	Jan 31, 1963
3	Galena Creek near Steamboat, Nevada	1961-present	3,670	Aug 15, 1965

(a) Stream gage data were extracted from U. S. Geological Survey surface water records for Nevada.
(b) As shown on Plate 1.

There are two precipitation stations near the study area, one on the mountain slopes immediately adjacent to the drainage basin of Whites Creek, and one at the Reno Airport on the valley floor. Records from these stations were used in the basic hydrology studies made for this report.

(a) Especially Southwest Reno Watershed Investigation Report jointly prepared by the Soil Conservation and Forest Services, U. S. Department of Agriculture.

information on the stations used and the precipitation recorded for selected major winter storms are shown in Table 3. Precipitation data on cloudburst events are not available.

TABLE 3

PRECIPITATION STATIONS

Station Number *(a)*	Station Name	Precipitation (inches) Average Annual	Dec 18-24 1955	Jan 29-Feb 1 1963	Dec 21-24 1964
1	Reno WB Airport	7.15	4.75	2.77	1.55
2	Mt. Rose-Christmas Tree *(b)*	32.24	*(c)*	13.58 *(d)*	15.58

(a) As shown on Plate 1.
(b) Formerly Mt. Rose Highway Station.
(c) Not yet installed.
(d) 7.13 inches recorded for the 24-hour period ending 4:30 pm, January 31.

Since streamflow and precipitation data on the study area are very limited, supplemental data were synthesized from records of other small drainage areas having similar hydrometeorological characteristics. Hydrologists familiar with the area made a detailed field inspection of the drainage basins to define their runoff characteristics.

The topographic maps prepared for this report to show areas that would be inundated by large future floods (Plates 7-14) were based on the U. S. Geological Survey 7.5 minute quadrangle sheets entitled "Reno", 1967, "Mt. Rose NE", 1969, and "Steamboat", 1967. Stream profiles and cross sections were developed from those quadrangles and supplemental survey data furnished by the Nevada Department of Highways and the Washoe County Engineer. In total, data for more than 200 cross sections were developed for use in preparing the report. Structural dimensions on bridges and culverts were furnished by the Nevada Department of Highways, or obtained by field investigation during the course of the study.

FLOOD SEASON AND FLOOD CHARACTERISTICS

Rainfloods can occur in the study area anytime during the period October through March. This type of flood results from prolonged heavy rainfall over the drainage areas and is characterized by high peak flows of moderate duration. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions, when the ground is frozen and infiltration is minimal, or when warm rain on snow in the higher elevations adds snowmelt to rainflood runoff. Severe but localized flooding may result from cloudburst storms centered over the stream basins. These storms may occur from late spring to early fall, but generally occur during the summer months of July and August. Runoff from cloudbursts is characterized by high peak flows, short duration, and small volume. Due to the small areal extent of the snowpack that accumulates in the high elevations, melting snow during the late spring and early summer months does not constitute a serious flood hazard in the study area. Winter rainfloods, sometimes augmented by melting snow, have occurred in the study area much more frequently than summer cloudburst floods, but cloudburst flooding would be the most severe due to high velocities and greater peak flows.

FACTORS AFFECTING FLOODING AND ITS IMPACT

Obstructions to Floodflows.

Natural obstructions to floodflow include brush and other vegetation growing along streambanks in floodway areas. During floods, brush growing in floodways impedes floodflows and results in backwater and increased flood heights. Brush washed out during floods and carried downstream may collect on bridges or plug culverts, thus creating a damming effect and overbank flow. As floodflow increases, masses of debris may break loose and a wall of water and debris may surge downstream until another obstruction is encountered.

Man-made obstructions to floodflow in the study area consist of a number of bridges, culverts, and irrigation flumes. Debris collecting on a bridge may increase to the point where its structural capability is exceeded and the bridge is destroyed, or may raise water levels to the extent that abutments are eroded and the overlying and approach roadbed flooded or damaged. Culverts in the study area are easily plugged, thus forcing floodwater out of the stream channel and onto the flood plain. Debris blocking the opening under an irrigation flume may dump storm runoff into the irrigation ditch and cause flooding along the ditch at locations remote from the stream. Debris may rupture the flume or plug the ditch. During the irrigation season, this aggravates the flood situation by adding irrigation water to floodflow.

In general, obstructions restrict floodflows and cause overbank flows, unpredictable areas of flooding, destruction of or damage to stream crossings, and increased velocity of flow immediately downstream. Representative obstructions in the study area are shown in Figures 1-6. Pertinent data on obstructions to floodflow are shown in Table 5, page 30.

Figure 1 - Culvert on Evans Creek at Highway 395.

Figure 2 - Culvert on Dry Creek at Huffaker Lane.

Figure 3 - Bridge over Dry Creek at Timothy Lane.

Figure 4 - Culvert on Thomas Creek at Sierra Manor Drive.

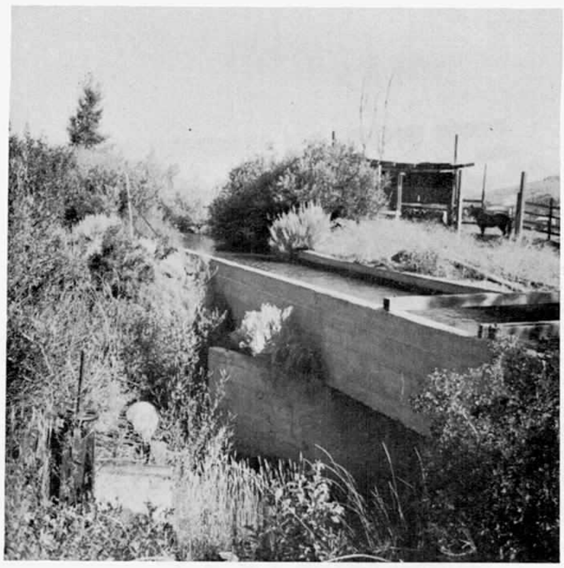

Figure 5 - Upstream view (left) and downstream view (right) of flume at Steamboat Ditch crossing of Thomas Creek. Upstream view shows flash boards used to divert Steamboat Ditch flows into Thomas Creek.

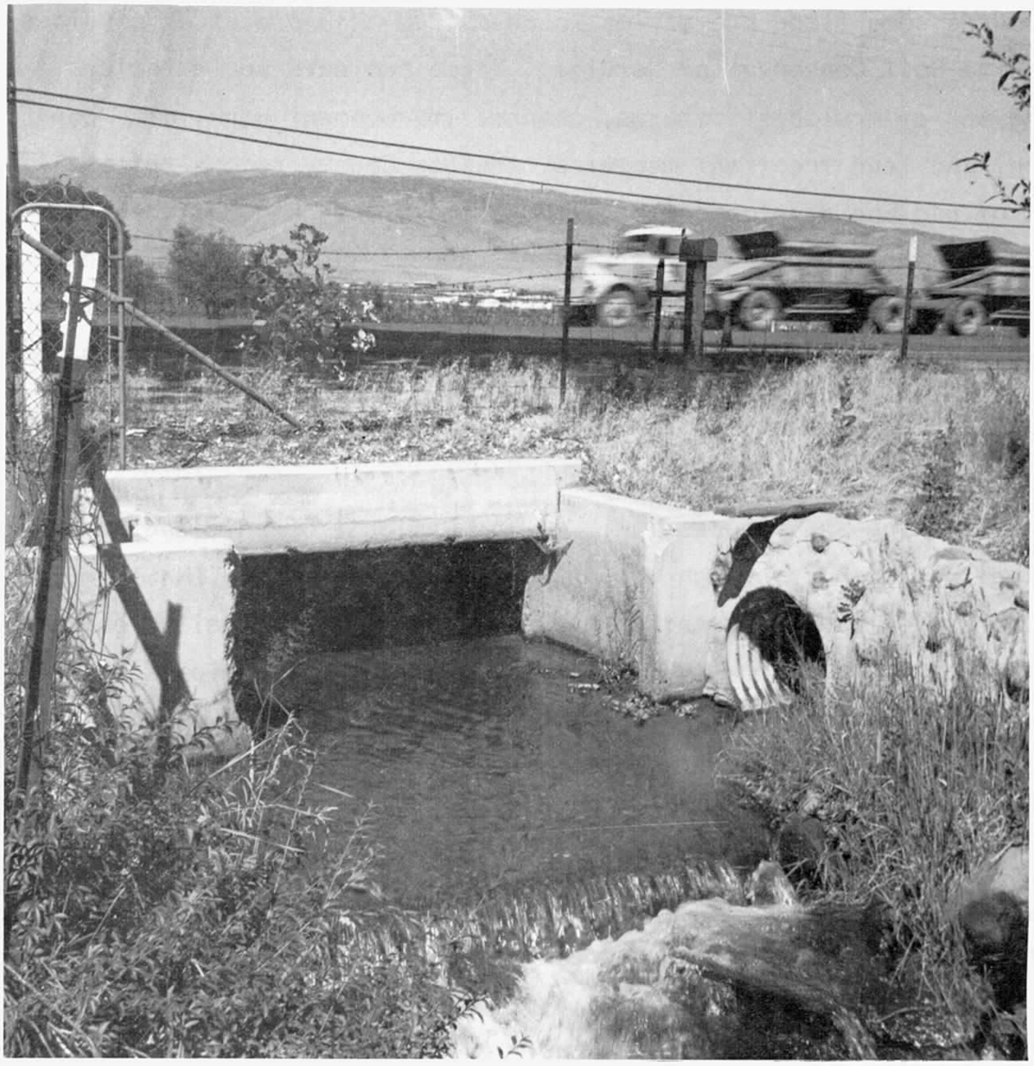

Figure 6 - Culvert on Whites Creek at Highway 395.

Flood Damage Reduction Measures.

There are no existing or authorized flood control structures that would reduce flood damage in the study area, and none are under investigation by the Corps of Engineers. As part of an investigation of providing flood protection in Truckee Meadows, the Corps of Engineers has proposed construction of a dam at Huffaker Hills to control Steamboat Creek, a channel to divert floodflows from Evans and Dry Creeks into the reservoir, and other project facilities. At present, the project is inactive due to lack of local support. Watershed protection projects that would provide some flood protection in the study area are under consideration by the Soil Conservation Service. These projects would include flood retarding and diversion structures, channel improvement work, dike construction, and land treatment measures. Washoe County recognizes the problems of use and development of flood-prone areas, and has adopted a building code that requires construction setbacks along streams. However, zoning or other land-use measures that would guide development of flood prone areas toward optimum uses commensurate with the flood hazard have not been adopted for the study area.

Other Factors and Their Impacts.

Flood warning and forecasting. - The National Oceanic and Atmospheric Administration (NOAA), through its National Weather Service (NWS), maintains year-round surveillance of weather and flood conditions. Daily weather forecasts that apply generally to watersheds draining the slopes of Mount Rose are issued by the NWS office in Reno, and disseminated by the local news media. Specific forecasts of flooding are not made for these watersheds. Thunderstorm activity leading to possible cloudburst situations in a general region can be forecast with a moderate degree of dependability. However, accurate prediction of flood-producing cloudbursts over specific small drainage basins such as those of the Southwest Foothill Streams is not possible and, in any event, would provide little advance warning of floodflows.

Flood fighting and emergency evacuation plans. - A coordinated plan for flood fighting and other flood emergencies has been developed by Washoe County in cooperation with the cities of Reno and Sparks. In general, the plan provides that the Directors of Public Works supervise flood emergency operations in their respective jurisdictions, and that the Civil Defense Agency for Washoe County coordinate activities in the three political entities involved, establish communications, disseminate weather and flood information, and request State and Federal assistance when the flood situation so warrants. Formal plans for emergency evacuation of people and property from flood prone areas have not been developed. The Corps of Engineers responds to requests for flood fighting and rescue work when the emergency is beyond the capabilities of State and local governmental agencies.

Storage of floatable materials in flood plain areas. - Floatable materials resulting from agricultural and commercial operations, or from other activities, may be picked up and carried away by floodwaters; thereby increasing flood losses. Flood hazards are intensified by such materials collecting against bridges or plugging culverts and obstructing the passage of floodflows.

The residential and commercial uses of flood plains in the study area do not result in the accumulation of significant amounts of floatable materials that could be carried away by floodwaters. Agricultural operations may result in the temporary storage of small amounts of baled hay possibly subject to flotation. Thus, the presence of floatable materials constitutes a negligible added flood hazard or potential flood loss.

Flood borne debris. - Trees and brush washed out by floods, deadwood lying along stream channels, and sand, silt, rocks, and boulders carried by floodflows aggravate the flood hazard in the study area by plugging culverts and collecting on or filling under bridges. This is particularly true in the higher portions of the study area where stream gradients are very steep. Debris can block small channels on the outwash fan, thus diverting floodflows into other distributaries and requiring extensive channel maintenance to avoid a permanent change in the stream course.

PAST FLOODS

SUMMARY OF HISTORICAL FLOODS

Truckee Meadows and the streams draining the foothill slopes of Mount Rose have a long history of winter rain-snowmelt and summer cloudburst floods. The earliest known wintertime flood occurred in December 1861-January 1862. Since that time, similar floods occurred in 1867-68, 1871, 1886, 1904, 1907, 1909, 1928, 1937, 1943, 1950, 1955, 1963, and 1964. The earliest known summer cloudburst flood occurred in July 1869. Similar flood events occurred in 1878 and 1965. Undoubtedly others have occurred on the Southwest Foothill Streams, but they have gone unrecorded.

FLOOD RECORDS

Specific information on past floods in the study area is very limited due to the lack of streamflow records and because its rural and relatively unpopulated nature usually precluded detailed news media reporting of flood events. Flood information in this report is based mainly on data contained in the joint Soil Conservation Service-Forest Service report referred to on page 6. That report reflects exhaustive research into the files of the Carson District Forest Ranger Office, the Toiyabe National Forest Supervisor's Office, the Soil Conservation Service State Office, and the Reno and Carson City newspapers.

FLOOD DESCRIPTIONS

Winter Rainfloods.

During the floods of December 1861-January 1862, Truckee Meadows became a vast lake of floodwater resulting from heavy rain and melting snow on the watersheds of the Southwest Foothill Streams and other tributaries to Steamboat Creek. Ranch buildings, pasture, and farm lands were damaged.

Another severe rain-snowmelt flood occurred in December 1867-January 1868. All of the Southwest Foothill Streams overflowed their banks and discharged floodwater into the Meadows area, which again became a large inland lake. The Meadows were again flooded as a result of prolonged rain in December 1871. The Southwest Foothill Streams were especially heavy flood producers during the storm period and, although the flood was judged less severe than earlier ones, every crossing on the newly constructed Virginia and Truckee Railroad between Reno and Steamboat and much of the roadbed itself was destroyed. Repair and restoration of the railroad required several weeks. Drenching rain on snow again resulted in flooding by the Southwest Foothill Streams in January 1886, but information on damage was unrecorded.

The winter rainfloods that occurred in February 1904, March 1907, January 1909, March 1928, December 1937, and January 1943 were all similar in magnitude and pattern of flooding, except that the 1907 inundation was the worst experienced between 1868 and 1950. In every flood, the Southwest Foothill Streams contributed to creation of a lake in the Meadows area and resultant semi-marsh conditions that persisted until late spring. Floods that occurred in November 1950, December 1955, January-February 1963, and December 1964 were also similar in magnitude. These were severe floods and the most damaging rainfloods known because they occurred after residential and business areas of Reno began to spread to the south and southwest. In each flood event, residential, business, and agricultural areas were flooded. Residential damage was minor but some residents were evacuated from their homes and some rural residences were isolated by floodwater and damaged roads. In agricultural areas, irrigation facilities were damaged; livestock was threatened; baled hay and haystacks were lost; and deposits of sand, silt, and other flood detritus were left on the land. Sections of Steamboat, Lake, and Last Chance Ditches were washed out and streambanks were eroded.

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Figure 7 - Remains of Steamboat Ditch Flume crossing of Thomas Creek following the January-February 1963 floods. Rock debris from earlier cloudburst floods appears in the background (Soil Conservation Service photo).

Summer Cloudburst Floods.

As previously indicated, three known cloudburst floods have occurred on streams of the Southwest Foothills group. Cloudburst floods have high peak but short duration flow, very high velocity flow, and can carry and deposit large volumes of boulders, rocks, sand, silt, and other flood detritus. They possess great destructive force and create extremely high hazards. An eye-witness to one such flood event said "it came in a wall, at least six feet high, carrying trees, brush, cattle, and horses with it."[a]

(a) *Nevada State Journal, June 12, 1917, p.1.*

Figure 8 - Typical cloudburst flood debris deposited near the Zolezzi Lane crossing of Whites Creek.

The July 1869 cloudburst resulted from probably the heaviest and most widespread convective-type storm known along the eastern escarpment of the Sierra Nevada. Intense rain accompanied by hail resulted in run-off that caused flooding 2 feet deep from about Browns School to Huffaker School. On August 15, 1878, torrential rain (described by the Reno newspaper as a "monster cloudburst") fell for 3 hours on the watersheds southwest of Reno. Thomas Creek became a raging torrent about 200 to 600 feet wide and from 2-4 feet deep, and gouged out its channel to bedrock in many locations. Over 250 cords of wood awaiting shipment to the Comstrock *via* V-flume in Thomas Creek Canyon was swept away or covered with mud and debris. About 1 mile of the flume was washed away or buried with mud, rock, logs, and other flood detritus, and large deposits of similar materials were carried well out onto the sloping benchlands to the east. In the lower part of the canyon, a 150-man logging camp was washed completely away. No lives were lost as the camp was warned of the onrushing floodflows and was hurriedly evacuated before the wall of water struck. An intense summer storm that caused severe flooding to the south of the study area on August 15, 1965 also produced floodflows on Whites Creek. The stream reached a peak flow of 2,280 cubic feet per second, but little damage occurred because there were few improvements in the path of the water.

FUTURE FLOODS

Although flood producing storms of the same magnitudes as those that have occurred in the past could recur in the future, discussion of future floods in this report is limited to those designated as the Intermediate Regional and Standard Project Floods. The Standard Project Flood would be larger and would occur less frequently than the Intermediate Regional Flood. A Standard Project Flood would be a rare event, but could reasonably be expected to occur. Selection of these floods was based on hydrologic computations, which include analysis of available records of past floods, and consideration of pertinent meteorologic and physiographic conditions. As previously indicated, cloudbursts would create the most severe flood conditions in the study area.

During floods, debris collecting against obstructions causes greater water depths (backwater effect) upstream. Since the occurrence and amount of debris are indeterminate factors, only the physical characteristics of the structures were considered in preparing the maps and other illustrations showing the Intermediate Regional and Standard Project Floods. These maps and illustrations reflect consideration of vegetation normally existing in floodways, and show the backwater effect of obstructive bridges and culverts, but do not reflect increased water surface elevations that could be caused by debris collecting against the structures, or by deposition of silt in the stream channel.

INTERMEDIATE REGIONAL FLOOD

The Intermediate Regional Flood is one that could occur about once in 100 years on the average, although it may occur in any year. Since streamflow and precipitation data for the Southwest Foothill Streams are extremely limited, the magnitudes of the Intermediate Regional Floods on these streams were synthesized from a characteristic cloudburst storm isohyetal developed for 100-year cloudburst storms over stream basins having hydrometeorological characteristics similar to those of the creek basins under study. The storm isohyetal was transposed to the Southwest Foothill Streams watersheds, the most critical areas of contribution and the rainfall over those areas were found, and the resultant peak flows computed. Peak flows thus developed for selected locations in the study area are shown in Table 4. Synthesized stage hydrographs of the Intermediate Regional Flood on Evans, Dry, Thomas, and Whites Creeks are shown on Plates 2, 3, 4, and 5, respectively. A hydrograph was not prepared for Skyline Wash because the drainage area is very small, contribution to flow is received all along its course rather than from an upstream drainage area, and flow through the study reach is essentially constant.

STANDARD PROJECT FLOOD

Standard Project Floods on the streams under study are those that can be expected from the most severe combination of meteorological conditions reasonably characteristic of the geographical region, excluding extremely rare combinations. Peak flows for Standard Project Floods were determined in the same manner as those for the Intermediate Regional Floods. Peak flows thus derived are also shown in Table 4.

FREQUENCY

Frequency curves of peak flows on streams in the study area were constructed on the basis of available precipitation records and computed peak flows of floods up to the magnitude of the Standard Project Flood. The frequency curves thus derived reflect the judgment of hydrologists familiar with the region. They show that the 2,280 cubic foot per second flow of Whites Creek on August 15, 1965 had a frequency of occurrence of about once in 50 years on the long-term average.

As previously indicated, an Intermediate Regional Flood has a frequency of occurrence of once in 100 years on the average, and a Standard Project Flood would occur less frequently than an Intermediate Regional Flood. Although the Standard Project Flood is a rare event, it can be

TABLE 4

PEAK FLOWS FOR INTERMEDIATE REGIONAL AND STANDARD PROJECT FLOODS

Location	Intermediate Regional Flood c.f.s.	Standard Project Flood c.f.s.
	EVANS CREEK	
At Steamboat Ditch	2,600	3,600
At Highway 395	2,600	3,600
	DRY CREEK	
At Last Chance Ditch	2,900	3,800
At Highway 395	4,300	5,700
	THOMAS CREEK	
At Canyon Mouth	3,200	4,200
At Steamboat Ditch	3,500	4,700
At Highway 395	3,900	5,200
	WHITES CREEK (Main Channel)	
At Canyon Mouth	3,000	4,000
At Divide (mile 4.99)	2,000	2,600
At Highway 395	2,300	3,000
	SKYLINE WASH	
At Plumb Lane	700	900

expected to occur in the future. Floods larger than the Standard Project Flood are possible; however, the combinations of events necessary to produce such large flows would be extremely rare.

HAZARDS OF LARGE FLOODS

The amount and extent of damage, and the attendant flood hazard, from any flood depends on the depth and duration of flooding, velocity of flow, rate of rise, and developments in the flood plain. An occurrence of an Intermediate Regional or Standard Project Flood on the streams in the study area under present conditions of development would cause inundation of residential areas, roads and streets, public utilities, and agricultural lands and appurtenant improvements. Large floods occurring during the irrigation season can plug irrigation ditches with debris or rupture them, thus adding irrigation water to the floodflow and aggravating flooding downstream.

Floodwater flowing at high velocity and carrying debris would create conditions hazardous to persons attempting to cross flooded areas on foot or in vehicles. In general, floodwater 3 or more feet deep and flowing at a velocity of 3 or more feet per second could easily sweep a person off his feet, thus creating a definite danger of injury or drowning.

Flood borne debris loads containing large boulders present a special hazard in the flood plains along the steeper portions of the creeks. Rapidly rising and swiftly flowing floodwater may trap persons in homes that are badly damaged, or in vehicles that could be stranded or trapped in debris. Sewage, garbage, and other organic materials carried or deposited by the flood could create health hazards. Disruption of communications facilities and isolation of areas by floodwater, damaged roads, or deposits of debris could create short term hazards in terms of medical, fire, or law enforcement emergencies. Cloudburst floodflows create severe hazards to livestock and wildlife, and result in serious ecological damage.

FLOODED AREAS AND FLOOD DAMAGES

The areas along the streams that would be inundated by a Standard Project Flood are shown on Plate 6, which is also an index to more detailed maps showing the areas that would be inundated by the Intermediate Regional and Standard Project Floods (Plates 7-14). As may be seen from these plates, flooding closely parallels the watercourses in the steep upper reaches, but spreads out in broadening fans as the stream approaches Highway 395. On the east side of the highway, flooding is typically shallow sheet flow that does not follow any defined stream channel, but flows along swales and low areas into Hidden Lake Irrigation Reservoir and Steamboat Creek.

The northern portion of the study area near Plumb Lane is subject to high velocity flows from Skyline Wash. Flows would not be deep, but could be expected to deposit debris and silt in and around residences, light commercial developments, and tourist facilities. The areas on the higher slopes of the Evans, Dry, Thomas, and Whites Creeks watersheds inundated by Intermediate Regional and Standard Project Floods include rural residential and estate-type developments, the associated roads, streets, and public utilities, and some pasture land. On the gentler slopes, near Highway 395, irrigation facilities, pastureland and hayfields, fences, the highway, commercial and tourist facilities, homes, and shopping centers would be flooded. Floodflows from Thomas and Whites Creeks would damage ranch buildings, roads, irrigation facilities, pasture, and hayfields east of Highway 395. Floodflows could carry vast amounts of sand, silt, rocks, and floatable debris that would be deposited on inundated areas, choke bridges and culverts, and clog drainage channels. Rocks several feet in diameter would be deposited on the steeper slopes. High velocity flows erode channel banks, overbank areas, and the abutments and road approaches to bridges. The area that would be inundated by an Intermediate Regional Flood totals about 1,700 acres, of which 1,100 acres are agricultural or open lands, 570 acres are rural residential, and 30 acres are urban. The Intermediate Regional Flood area taken up by streamway is negligible.

The area inundated by a Standard Project Flood will be slightly larger than that inundated by an Intermediate Regional Flood. However, the differences in depths and velocities are not significant, and damage caused by a Standard Project Flood would not be appreciably greater than that caused by an Intermediate Regional Flood. Plates 15-27 show water surface profiles of the Intermediate Regional and Standard Project Floods for Evans, Dry, Thomas, and Whites Creeks west of Highway 395. Depth of flow in the stream channels can be estimated from these illustrations. No attempt was made to plot flood profiles on Thomas and Whites Creeks east of the highway because the streams have been straightened, realigned, and converted into conveyances for irrigation and drainage water, and the pattern of flooding is controlled by terrain.[a] Typical cross sections of the flood plain at selected locations, together with the water surface elevation and lateral extent of the Intermediate Regional and Standard Project Floods, are shown on Plates 28-29.

The impact of flooding is not limited to areas actually flooded. For example, floodwaters may interrupt or contaminate domestic water supplies or disrupt sewer systems, thus creating inconvenience and potential hazards to health. Interruption of surface transportation or electrical and communication services may affect areas considerably removed from those actually flooded and result in personal inconvenience, cessation of commercial activities--and attendant loss of business and worker income--and in possible emergency situations very difficult to deal with due to lack of communication or transportation. Meeting the costs of emergency flood relief, flood fighting, other flood emergency activities, cleanup, and the repair and restoration of public facilities damaged or destroyed by floods has an impact that may far transcend the flooded areas because city, county, State, and Federal tax revenues must be used, thus reducing revenues available for other services, especially on the local level.

(a) Water surface profiles and cross sections for Skyline Wash would not be meaningful because overflow in the flood area is forced away from the defined channel and, within a short distance, loses any relationship to the water surface elevation in the channel.

OBSTRUCTIONS

As previously noted, there are numerous obstructions to floodflow in the study area. Pertinent data on obstructive bridges, culverts, and flumes are contained in Table 5, page 30. As may be seen from Plates 15-27, the effect of obstructions is to raise the water surface elevation upstream. In the upper reaches where stream gradients are very steep, the increase in the flooded area is slight, but the obstruction forces floodflows out of the channel. The flows then run down streets and across the outwash fans, often causing damage some distance from the streamcourse. The sudden damming of flow causes the streams to drop their sediment load, filling the channel and further aggravating the situation. Obstructive bridges are especially susceptible to damage from the forces of floodwater and flood borne debris.

VELOCITIES OF FLOW

Occurrence of the Intermediate Regional or Standard Project Flood would result in the flows shown in Table 4. During an Intermediate Regional Flood, the average velocity of main channel flow would be about 15-20 feet per second along the upper reaches of the creeks. Along the lower reaches, west of Highway 395, average channel velocities would be about 10-15 feet per second. Overbank velocities would be about 2-4 feet per second. The average velocity of sheet flow flooding from Thomas and Whites Creeks east of Highway 395 would be about 2-4 feet per second.

Water flowing at a rate of 7 feet per second or greater will cause severe erosion of streambanks. As flow velocity increases, the water is capable of transporting boulders and large rocks. Velocities in the range of 5 to 7 feet per second could erode fill around bridge abutments. Water flowing at about 2 feet per second or less will deposit debris and silt. It is expected that velocity of flow during a Standard Project Flood would be slightly higher than during an Intermediate Regional Flood.

TABLE 5

OBSTRUCTIVE BRIDGES, CULVERTS, AND FLUME CROSSINGS[(a)]

Identification	Location (c)	Elevation[(b)] Stream-bed	Top of Under-clearance	Road-way (d)	Inter-mediate Regional Flood (e)	Standard Project Flood (e)
EVANS CREEK						
Highway 395(f)	0.00	4,452	4,456	4,457	4,458	4,459
Del Monte Lane(f)	0.16	4,462	4,463	4,465	4,466	4,467
Bonde Lane(f)	0.67	4,496	4,499	4,500	4,500	4,501
Del Monte Lane	0.97	4,520	4,523	4,525	4,526	4,526
Lake Ditch Flume	1.25	4,551	4,553	4,555	4,556	4,557
Lakeside Drive	1.61	4,608	4,614	4,615	4,616	4,617
Steamboat Ditch Flume	2.60	4,808	4,813	4,816	4,816	4,817
DRY CREEK						
Highway 395	0.00	4,455	4,461	4,463	4,464	4,465
Huffaker Lane(f)	0.21	4,464	4,469	4,471	4,471	4,472
Panorama Lane(f)	0.96	4,502	4,508	4,510	4,511	4,511
Dieringer Lane	1.29	4,525	4,531	4,533	4,533	4,534
Timothy Lane	1.67	4,568	4,574	4,575	4,577	4,578
Holcomb Lane(f)	1.96	4,605	4,609	4,609	4,610	4,611
Steamboat Ditch Flume	2.82	4,801	4,804	4,806	4,806	4,807
THOMAS CREEK						
Highway 395(f)	2.29	4,502	4,505	4,507	4,508	4,508
Sierra Manor Drive(f)	2.46	4,514	4,518	4,520	4,522	4,523
Last Chance Ditch Flume	3.30	4,602	4,605	4,607	4,608	4,609
Foothill Road	3.71	4,659	4,666	4,668	4,669	4,670
Thomas Creek Road	3.81	4,685	4,689	4,691	4,691	4,692
Private Road(f)	4.12	4,762	4,766	4,768	4,768	4,769
Steamboat Ditch Flume	4.19	4,780	4,787	4,790	4,790	4,791
WHITES CREEK						
Highway 395(f)	2.57	4,530	4,532	4,533	4,533	4,534
Zolezzi Lane(f)	3.06	4,597	4,599	4,600	4,601	4,601
Steamboat Ditch Flume	3.97	4,774	4,777	4,780	4,780	4,781
Curtis Lane	6.22	5,347	5,354	5,355	5,357	5,358
Private Road	6.63	5,465	5,468	5,469	5,471	5,472

(a) *Crossings on Skyline Wash are omitted from the table because stream profiles were not prepared.*
(b) *All elevations are rounded to the nearest foot, mean sea level datum.*
(c) *Stream mile upstream from lower limit of study or from Steamboat Creek.*
(d) *Minimum elevation.*
(e) *Upstream side of obstruction.*
(f) *Culvert.*

RATES OF RISE AND DURATION OF FLOODING

Rainfall from cloudburst storms centered over watershed areas of the Southwest Foothill Streams would rapidly collect as runoff that reaches the study area soon after the storm begins. Stream channels are small in cross sectional area; consequently, flows from flood-producing cloudburst storms quickly fill the channel to capacity and spread overland. However, since the largest cloudbursts last only a few hours, the resultant volume of runoff is relatively small and overbank flow is of short duration. Table 6 (page 32), which was developed from the synthesized stage hydrographs shown on Plates 2-5, gives the maximum rate of rise, height of rise, time of rise, and duration above flood stage for the Intermediate Regional and Standard Project Floods at various locations in the study area. On the average, the water surface elevation of the Standard Project Flood would be less than 1 foot higher than the Intermediate Regional Flood.

PHOTOGRAPHS, FUTURE FLOOD HEIGHTS

The levels that the Intermediate Regional and Standard Project Floods are expected to reach at various locations in the study area are indicated in the series of photographs beginning on page 33.

TABLE 6

RATES OF RISE AND DURATION OF FLOODING[a]

Flood	Maximum Rate of Rise ft./hr.	Height of Rise[b] ft.	Time of Rise[c] hrs.	Duration above Flood Stage hrs.
	EVANS CREEK (At mile 0.15)			
Intermediate Regional	1.7	1.0	1	4
Standard Project	2.1	1.4	1	5
	DRY CREEK (At mile 0.02)			
Intermediate Regional	8.4	4.5	1	3
Standard Project	8.8	4.8	1	4
	THOMAS CREEK (At mile 2.45)			
Intermediate Regional	6.2	4.5	1½	6
Standard Project	6.5	5.0	2	6
	WHITES CREEK (At mile 2.59)			
Intermediate Regional	4.4	1.2	2	7
Standard Project	4.5	1.3	2	7

(a) Skyline Wash is omitted because hydrographs were not prepared.
(b) Flood stage to maximum flood level.
(c) Time period corresponding to height of rise, rounded to nearest half-hour.

Figure 9 - Future flood heights, Evans Creek at Highway 395.

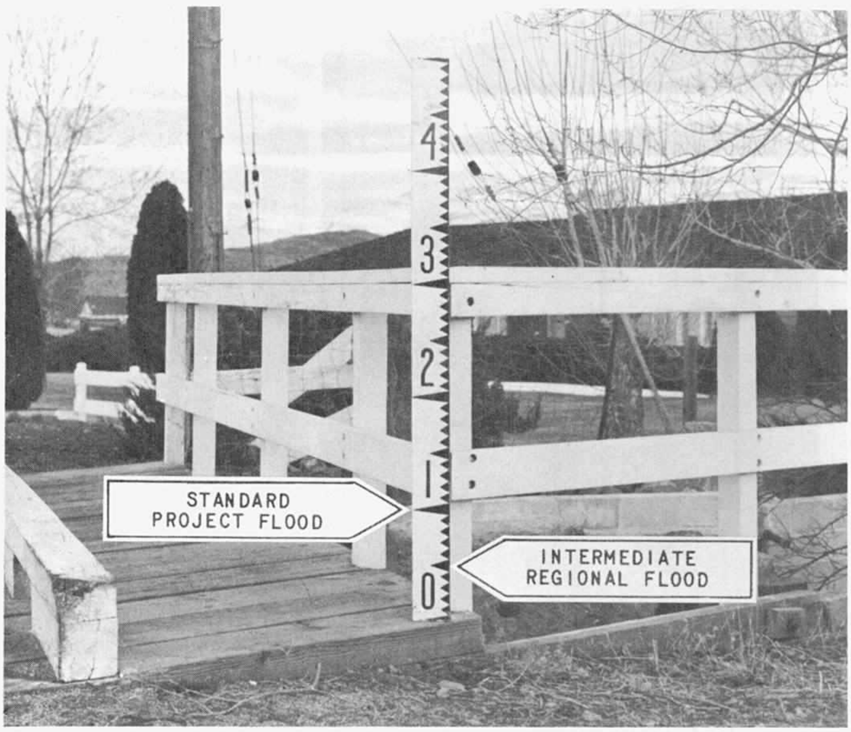


Figure 10 - Future flood heights, Evans Creek at Del Monte Lane.

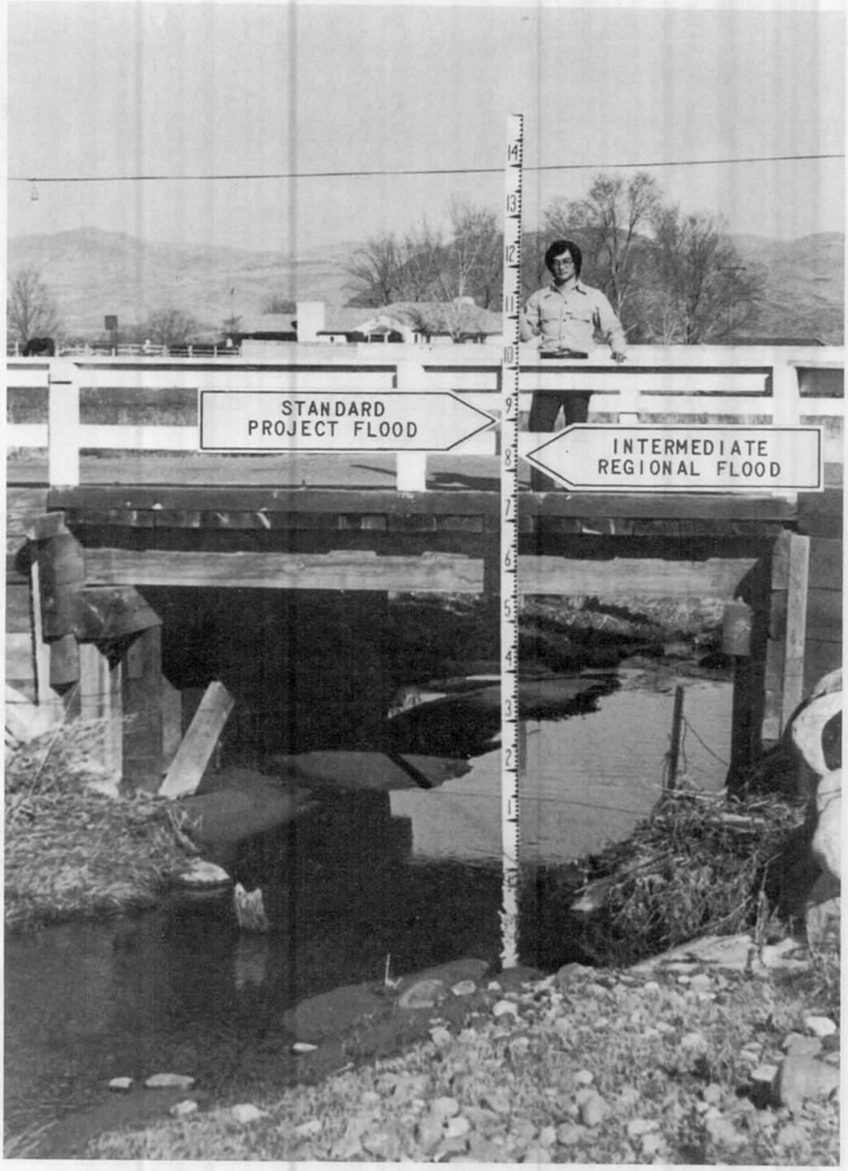


Figure 11 - Future flood heights, Dry Creek at Timothy Lane.

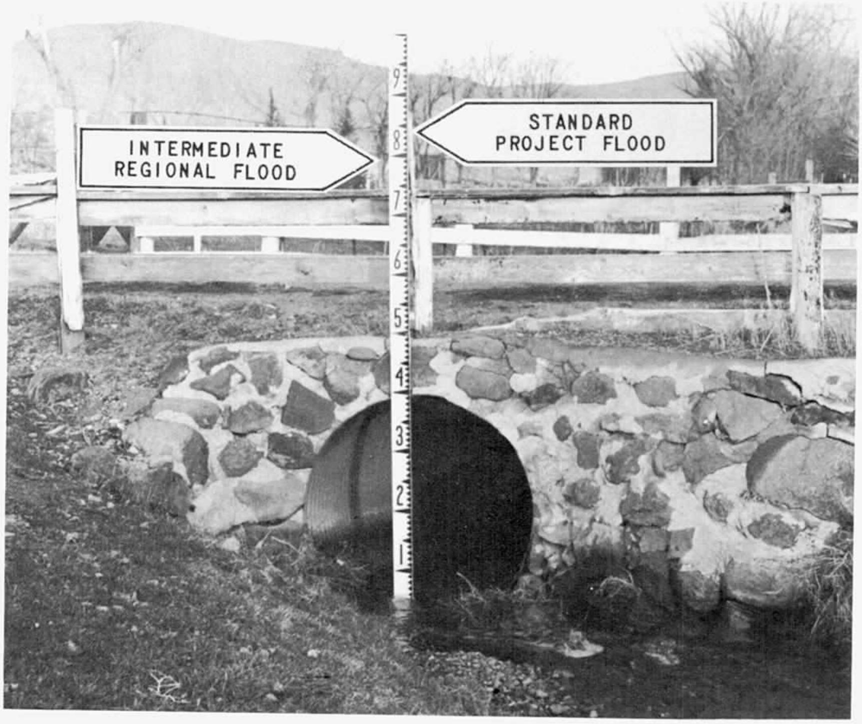


Figure 12 - Future flood heights, Thomas Creek at Sierra Manor Drive.

Figure 13 - Future flood heights, Whites Creek at Zolezzi Lane.

GLOSSARY

Backwater Effect. The rise in surface elevation of flowing water upstream from and as a result of an obstruction to flow.

Cloudburst. A sudden and extremely heavy downpour of rain that is small in areal extent; of short duration; and may be accompanied by lightning, thunder, and strong gusts of wind.

Flood. An overflow of water onto lands that are used or usable by man and not normally covered by water. Floods have two essential characteristics: The inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river, stream, lake, or ocean.

Normally, a "flood" is considered as any temporary rise in streamflow or stage (but not the ponding of surface water) that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow in land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, rise of groundwater coincident with increased streamflow, and other problems.

Flood Peak. The maximum instantaneous discharge of a flood at a given location. It usually occurs at or near the time of the flood crest, i.e., the maximum stage or elevation reached by the floodflow.

Flood Plain. The relatively flat area or lowlands adjoining a river, stream, watercourse, ocean, or lake, which have been or may be covered by floodwater.

Flood Profile. A graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above mouth for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage. The elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

Floodway. The channel of the stream and that portion of the flood plain that would be used to carry floodflows.

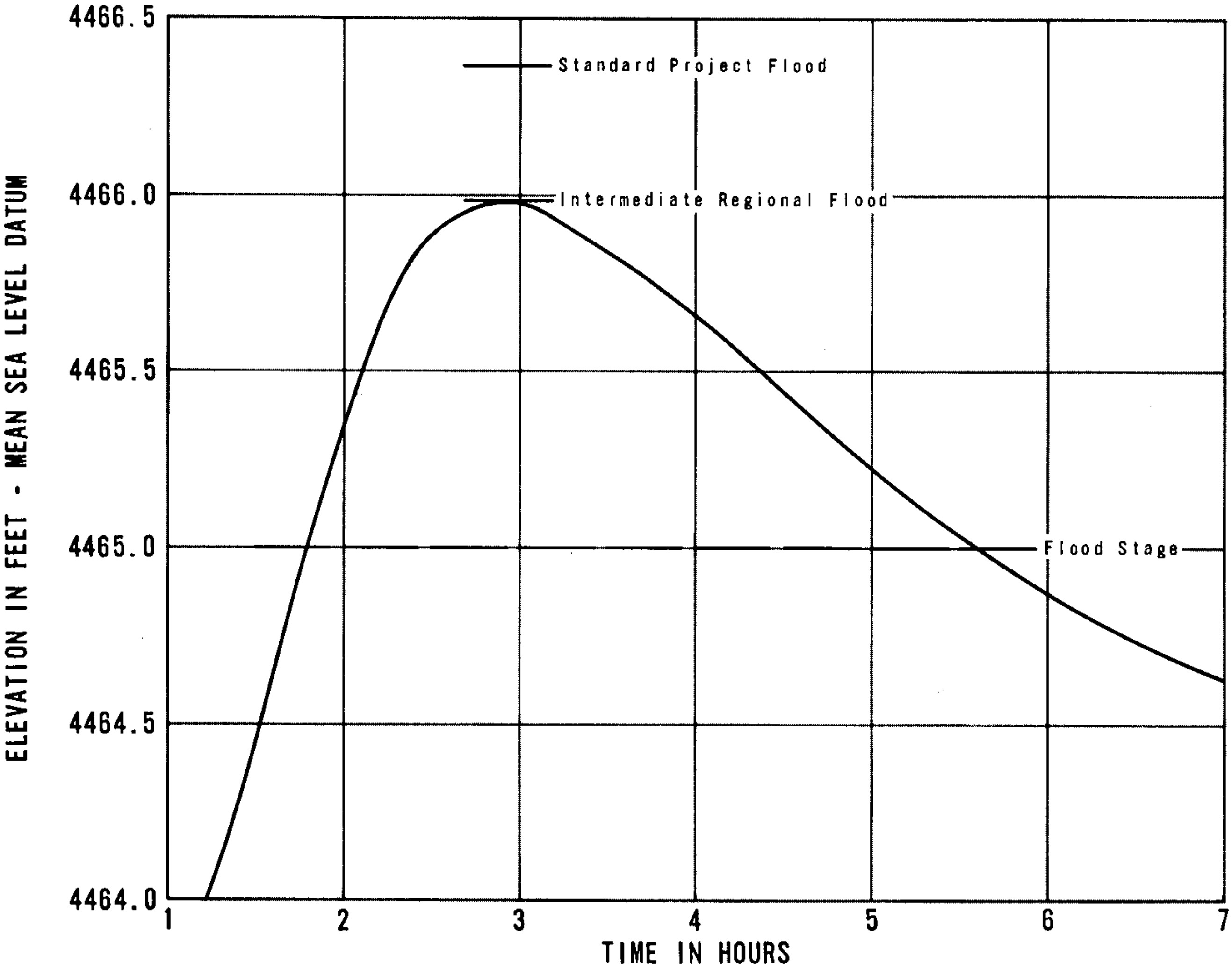
Hydrograph. A graph of time *vs* flow or stage at a given location along a stream.

Intermediate Regional Flood. A flood having an average frequency of occurrence in the order of once in 100 years although it may occur in any year.

Sheet Flow. Broad, shallow overland floodflows generally less than 2 feet deep.

Standard Project Flood. The flood that may be expected from the most severe combination of meteorological and hydrological conditions considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations.

Storm Isohyetal. Pattern or map of a storm as represented by lines (isohyets) connecting points having equal amounts of precipitation for a specific period.



NOTES

Stage Hydrograph at mile 0.15 on Evans Creek.

Hydrograph based on computed data.

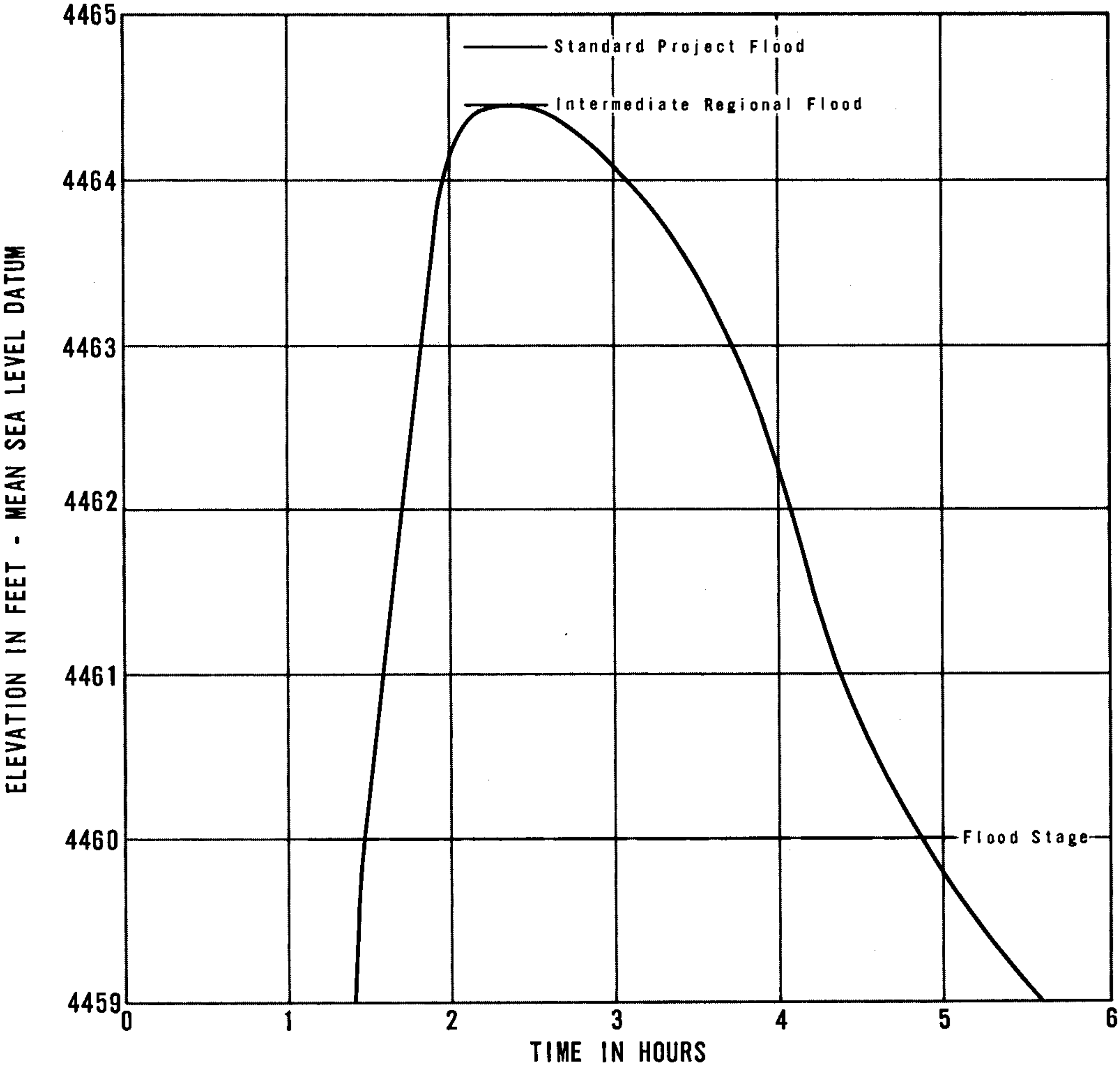
Flood Stage is beginning of overbank flow.

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

FLOOD PLAIN INFORMATION
SOUTHWEST FOOTHILL STREAMS

RENO, NEVADA

STAGE HYDROGRAPH
INTERMEDIATE REGIONAL FLOOD
EVANS CREEK
JUNE 1974



NOTES

Stage Hydrograph at mile 0.02 on Dry Creek.

Hydrograph based on computed data.

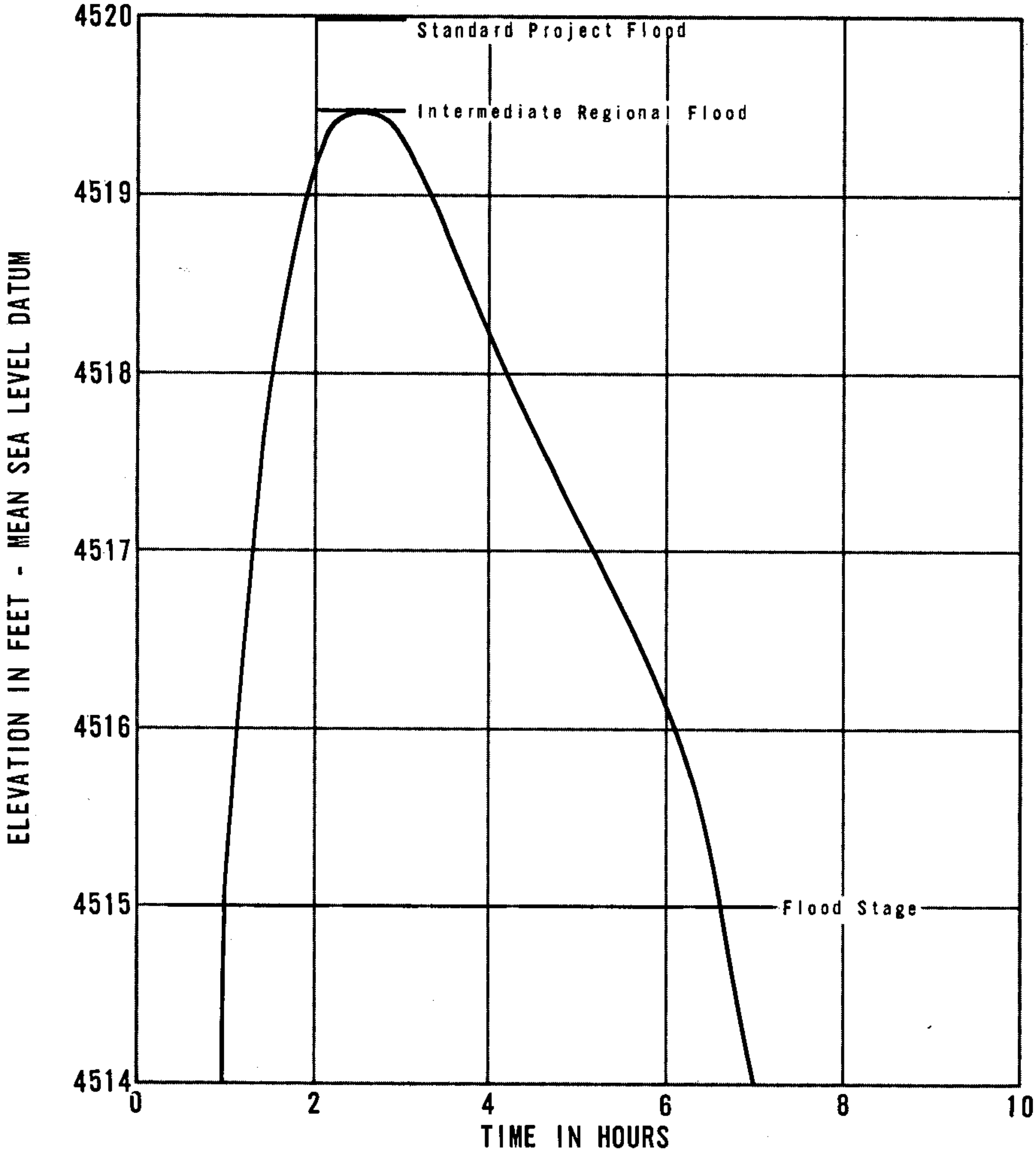
Flood Stage is beginning of overbank flow.

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

FLOOD PLAIN INFORMATION
SOUTHWEST FOOTHILL STREAMS

RENO, NEVADA

STAGE HYDROGRAPH
INTERMEDIATE REGIONAL FLOOD
DRY CREEK
JUNE 1974



NOTES

Stage Hydrograph at mile 2.45 on Thomas Creek.

Hydrograph based on computed data.

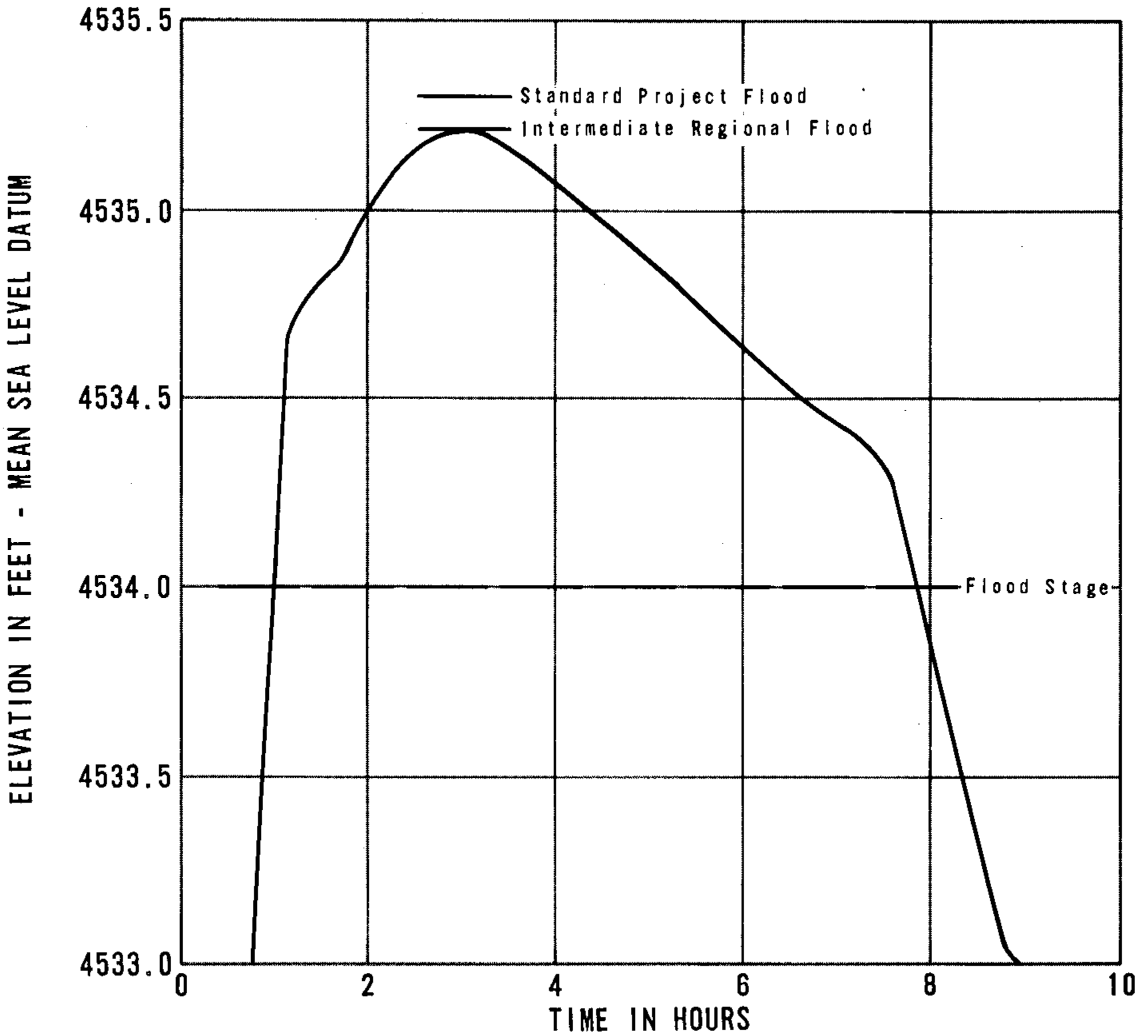
Flood Stage is beginning of overbank flow.

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

FLOOD PLAIN INFORMATION
SOUTHWEST FOOTHILL STREAMS

RENO, NEVADA

STAGE HYDROGRAPH
INTERMEDIATE REGIONAL FLOOD
THOMAS CREEK
JUNE 1974



NOTES

Stage Hydrograph at mile 2.59 on Whites Creek.

Hydrograph based on computed data.

Flood Stage is beginning of overbank flow.

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

FLOOD PLAIN INFORMATION
SOUTHWEST FOOTHILL STREAMS

RENO, NEVADA

STAGE HYDROGRAPH
INTERMEDIATE REGIONAL FLOOD
WHITES CREEK
JUNE 1974

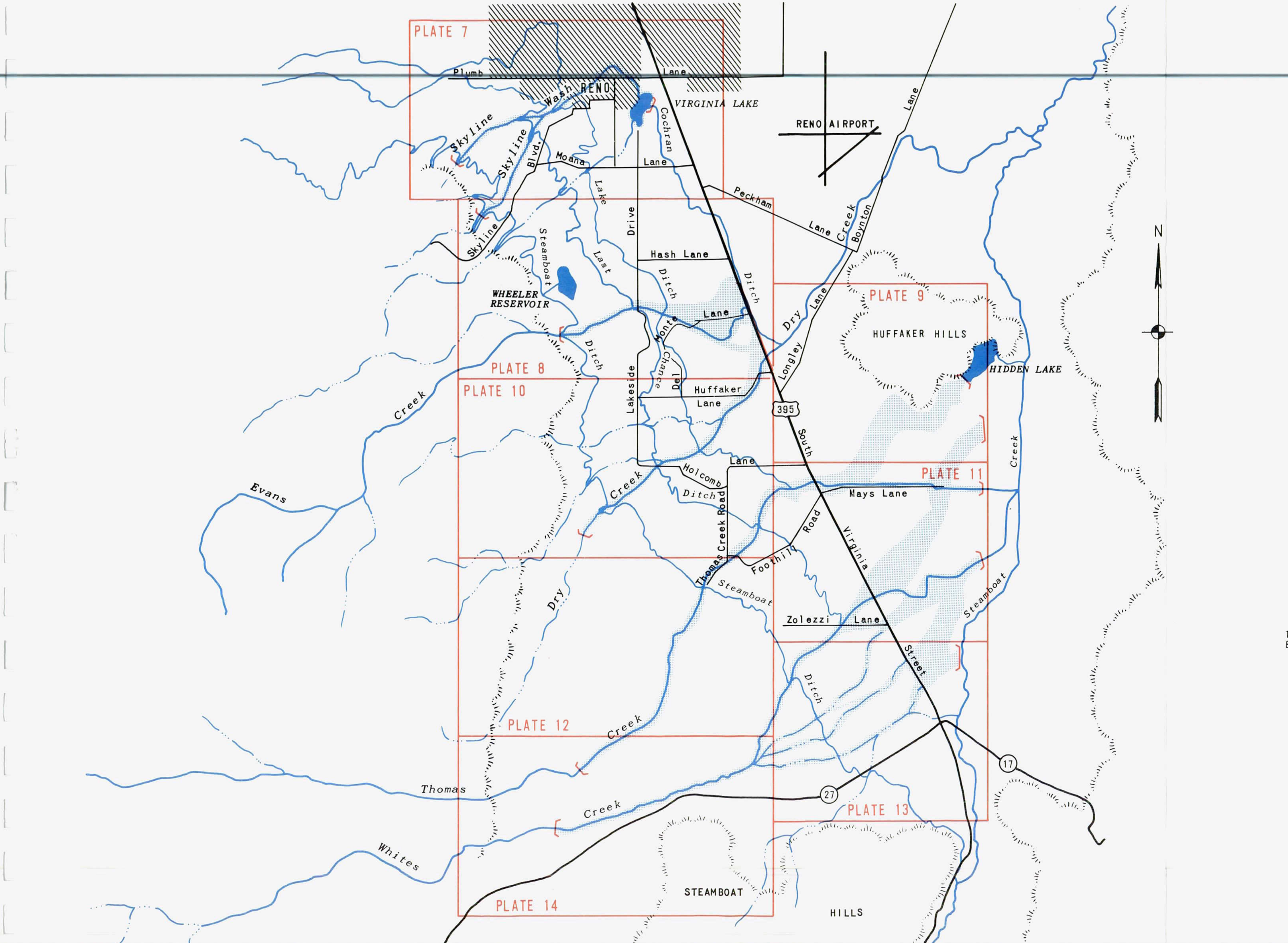


PLATE 7
PLATE 8
PLATE 9
PLATE 10
PLATE 11
PLATE 12
PLATE 13
PLATE 14
RENO
Plumb Lane
Wash
Skyline
Skyline Blvd.
Moana Lane
VIRGINIA LAKE
Cochran
RENO AIRPORT
Peckham Lane
Boynton Lane
Creek
Lake
Last
Drive
Hash Lane
Ditch
Steamboat
WHEELER RESERVOIR
Monte
Lane
Chance
Del
Lakeside
Huffaker Lane
395
South
Dry Lane
Longley
HUFFAKER HILLS
HIDDEN LAKE
Evans
Creek
Holcomb
Ditch
Thomas Creek Road
Foothill Road
Mays Lane
Virginia
Street
Zolezzi Lane
Steamboat
Dry
Thomas
Creek
Whites
27
17
STEAMBOAT
HILLS
N
LEGEND
395
27
1
1/2
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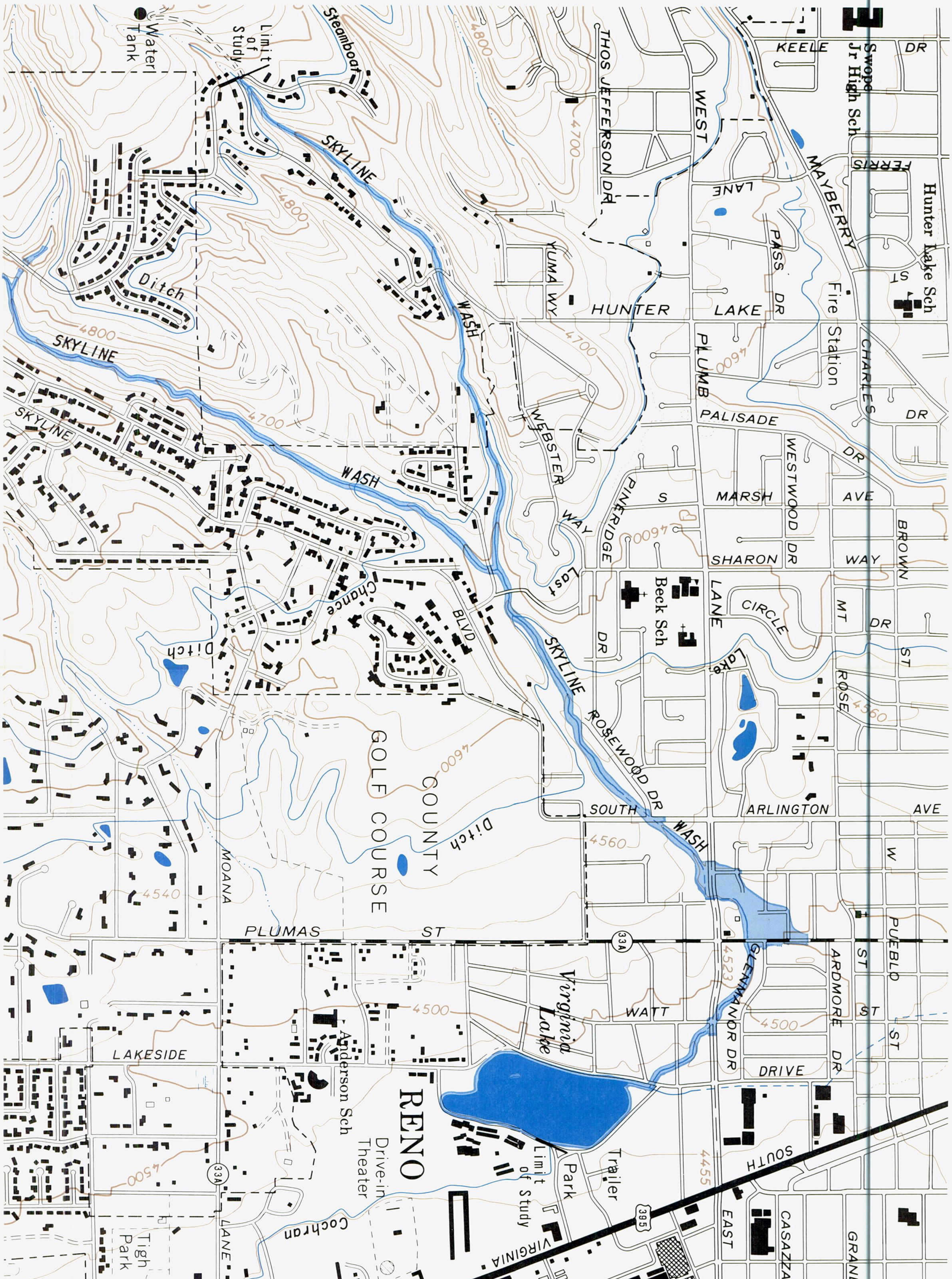
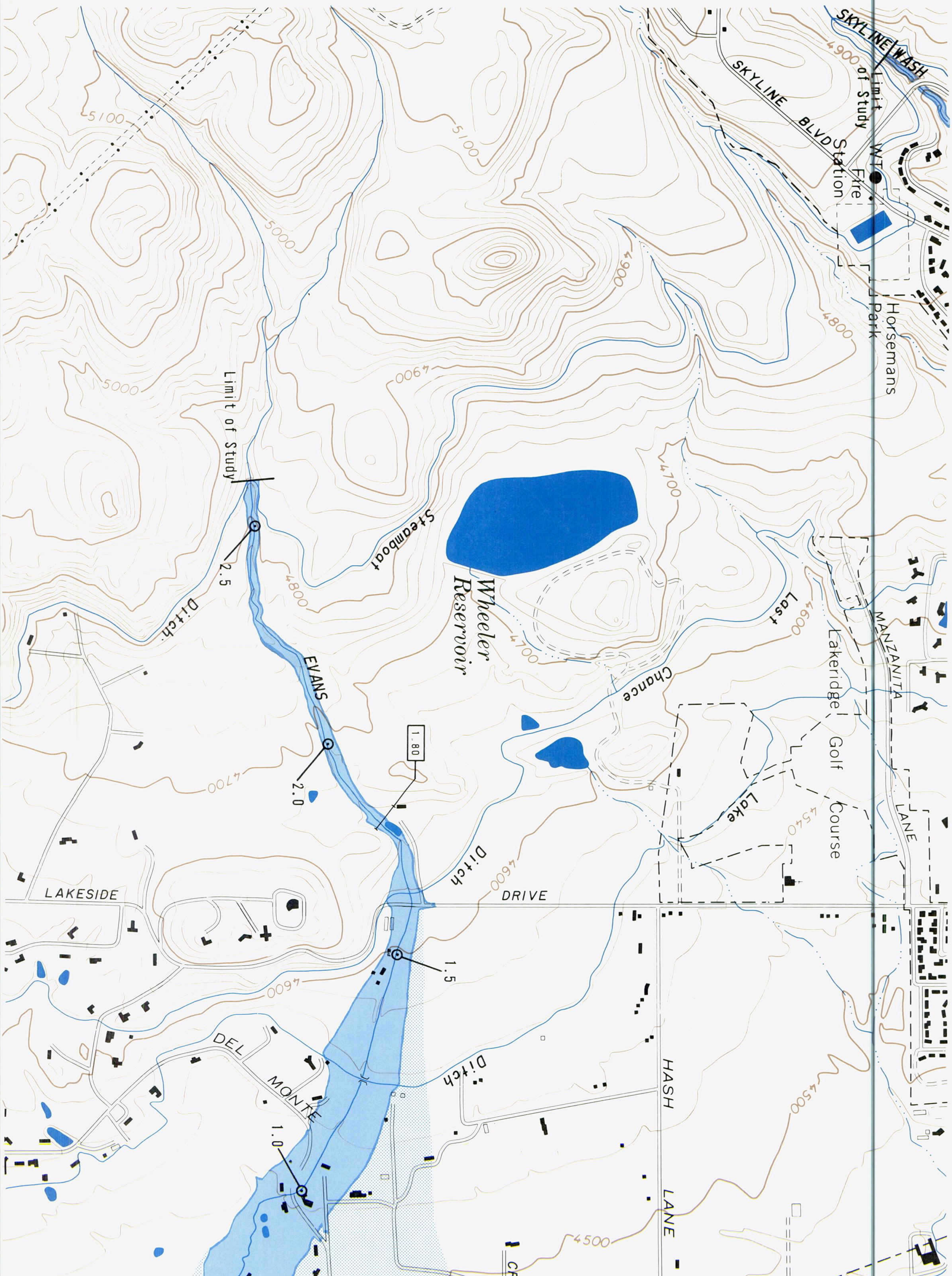
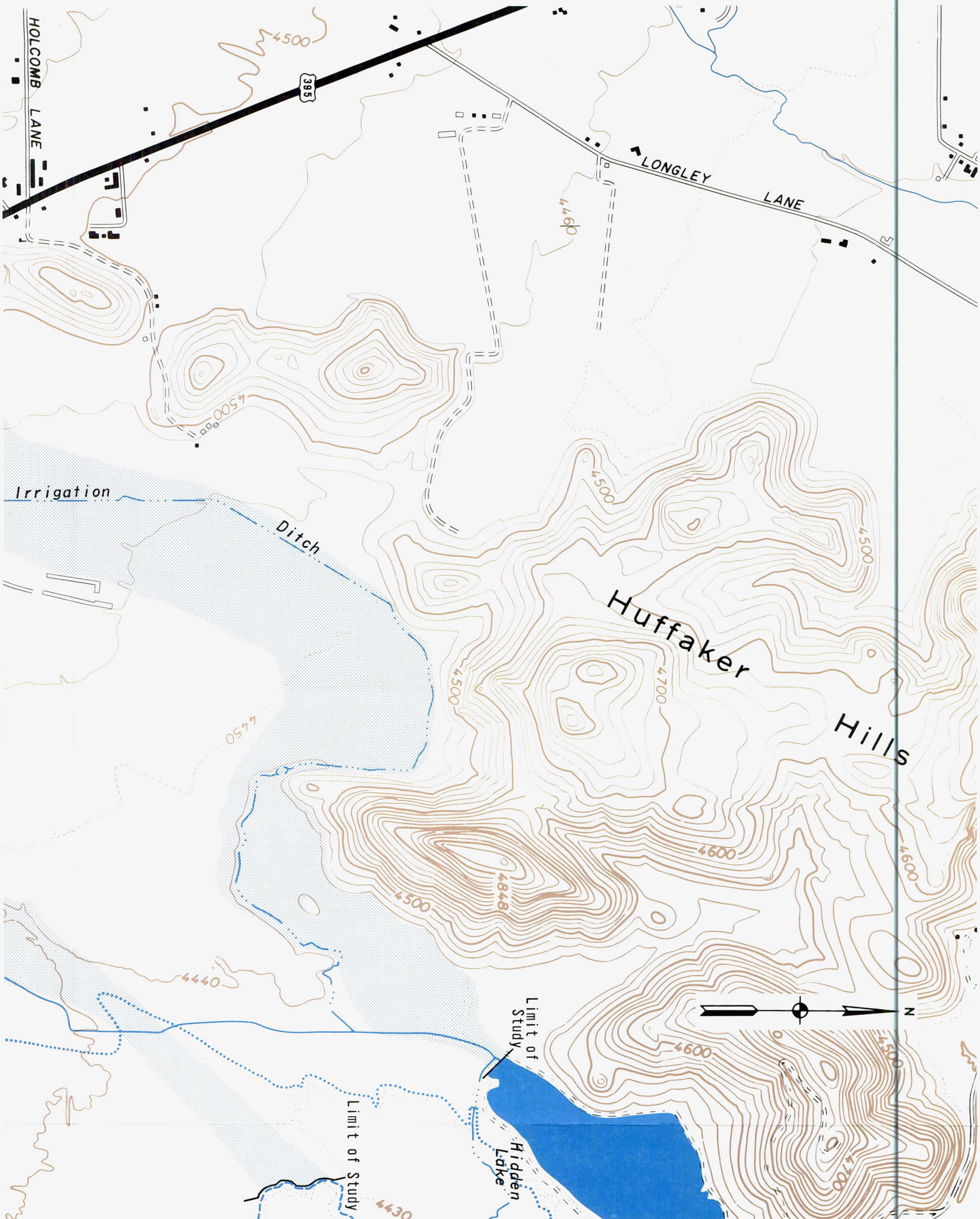

Water Tank
Limit of Study
Steamboat
SKYLINE WASH
4800
4700
THOS JEFFERSON DR
WEST
KEELE DR
Swope Jr High Sch
FERRIS
MAYBERRY
LANE
Hunter Lake Sch
PASS DR
YUMA WY
HUNTER LAKE
Fire Station
CHARLES DR
PLUMB LANE
4600
PALISADE DR
WEBSTER WAY
PINERIDGE DR
S MARSH AVE
WESTWOOD DR
BROWN ST
SHARON WAY
Ditch
Last Chance Ditch
Beck Sch
CIRCLE
MT ROSE ST
Lake
SKYLINE BLVD
ROSEWOOD DR
4560
SOUTH ARLINGTON AVE
COUNTY GOLF COURSE
4540
MOANA LANE
PLUMAS ST
33A
4523
GLENMANOR DR
ARDMORE DR
PUEBLO ST
W
WATT ST
Virginia Lake
4500
LAKESIDE DRIVE
Anderson Sch
RENO
Drive-in Theater
Limit of Study
Trailer Park
SOUTH VIRGINIA
395
4455
EAST
CASAZZA
GRAND
Cochran
Tigh Park


SKYLINE WASH
Limit of Study
SKYLINE BLVD
W.T.
Fire Station
Horsemans Park
5100
5000
4900
4800
4700
4600
4540
4500
Limit of Study
Steamboat
Ditch
Wheeler Reservoir
EVANS
2.5
2.0
1.80
1.5
1.0
Last Chance
Lake
Lakeridge Golf Course
MANZANITA LANE
LAKESIDE DRIVE
Ditch
DEL MONTE
Ditch
HASH LANE



LEGEND

395

(Refer to P
report enti
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NOTES

Map based o
sheets Stea
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by Corps of

Elevations
Level Datum

Limits of o
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Areas outsi
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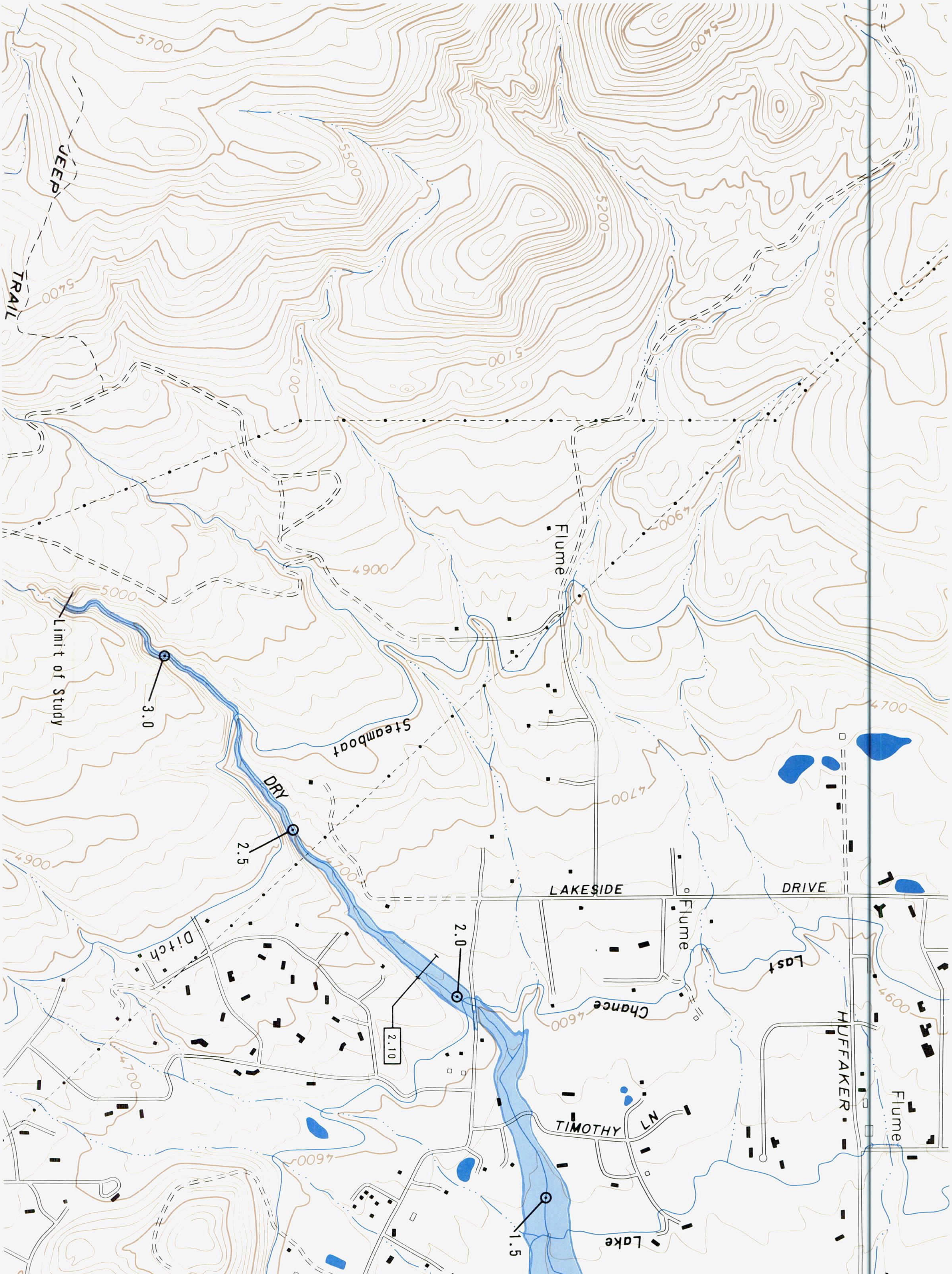
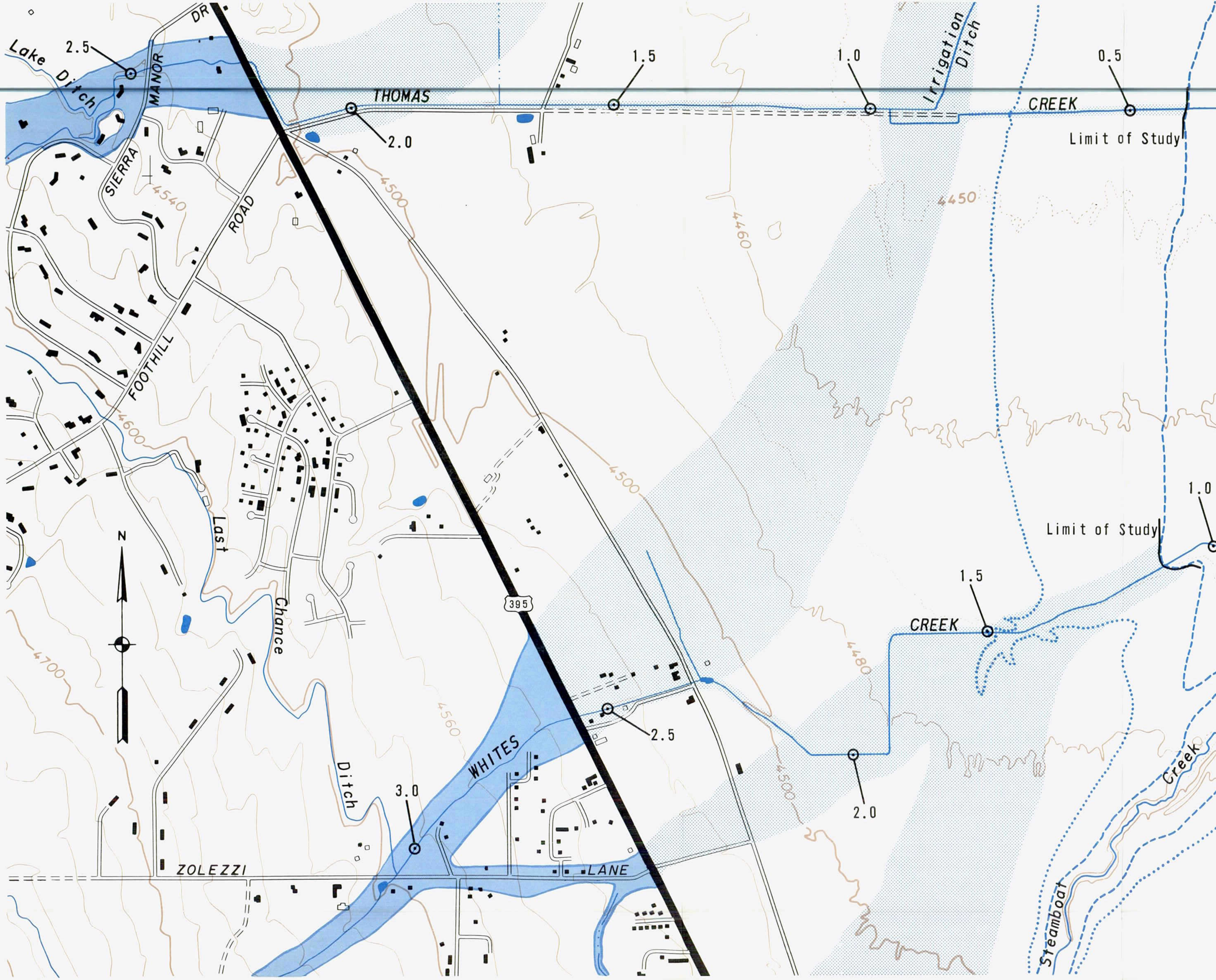


5700
5600
5500
5400
5200
5100
5000
4900
4700
4600
JEEP TRAIL
Flume
Limit of Study
3.0
Steamboat
DRY
2.5
LAKESIDE DRIVE
Ditch
2.0
2.10
Last
Chance
HUFFAKER
TIMOTHY LN
1.5
Lake



LEGEND

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395

(Refer to P
neers' repo
mation, Ste
Steamboat a
June 1972.)

NOTES

Map based o
sheets Stea
1969. Mino
by Corps of

Elevations
Level Datum

Limits of o
actual loca
accuracy of

Areas outsi
to flooding

500

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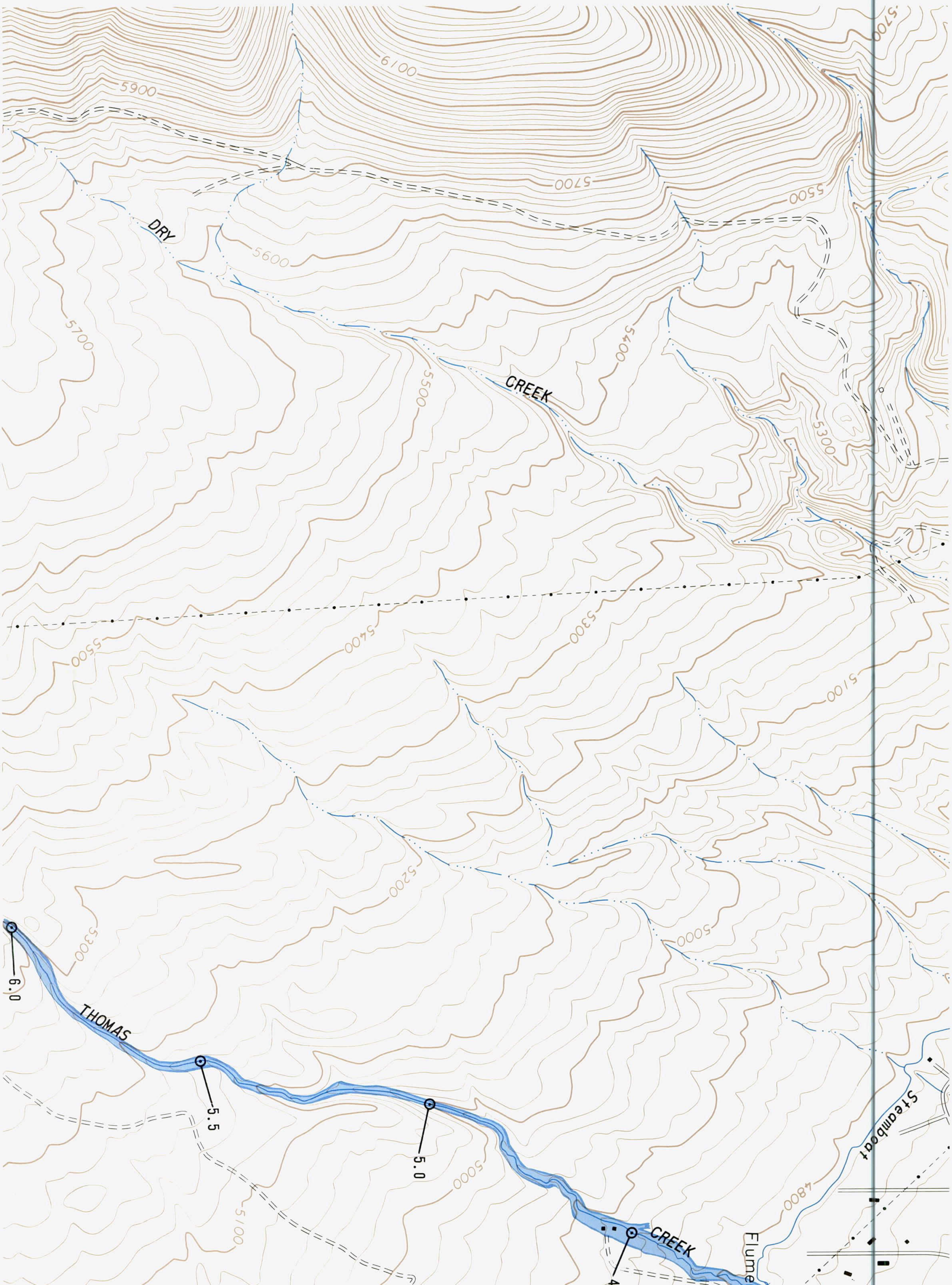
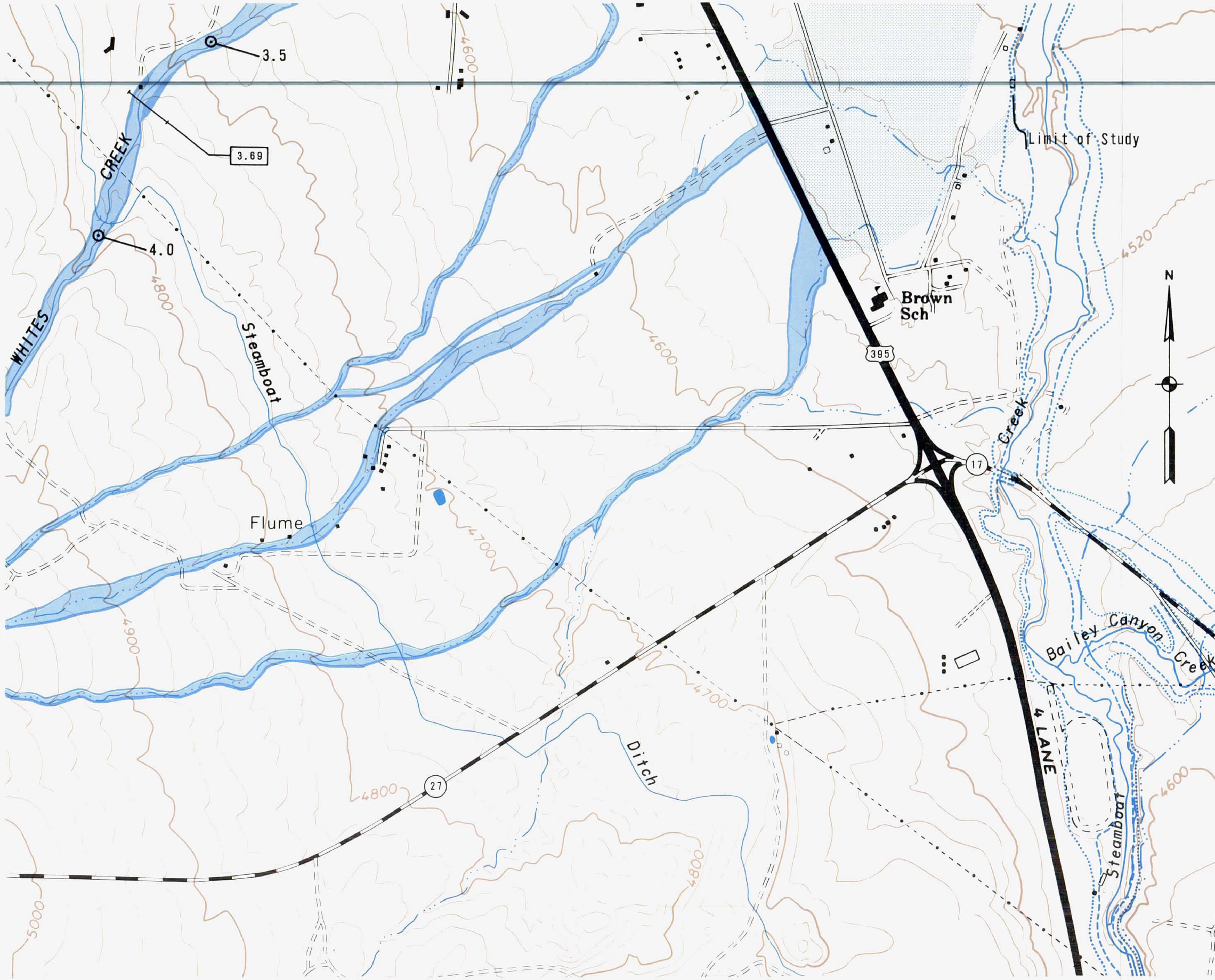
SACRAMENT
S

FLO
SOUT


6100
5900
5700
5600
5500
DRY
CREEK
5400
5300
5200
5100
5000
4800
THOMAS
CREEK
6.0
5.5
5.0
Steamboat
Flume



LEGEND

Lo
Wa
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395

17

(Refer to P
neers' repo
mation, Ste
Steamboat a
June 1972.)

NOTES

Map based o
sheets Stea
1969. Minc
by Corps of

Elevations
Level Datum

Limits of o
actual loca
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Areas outsi
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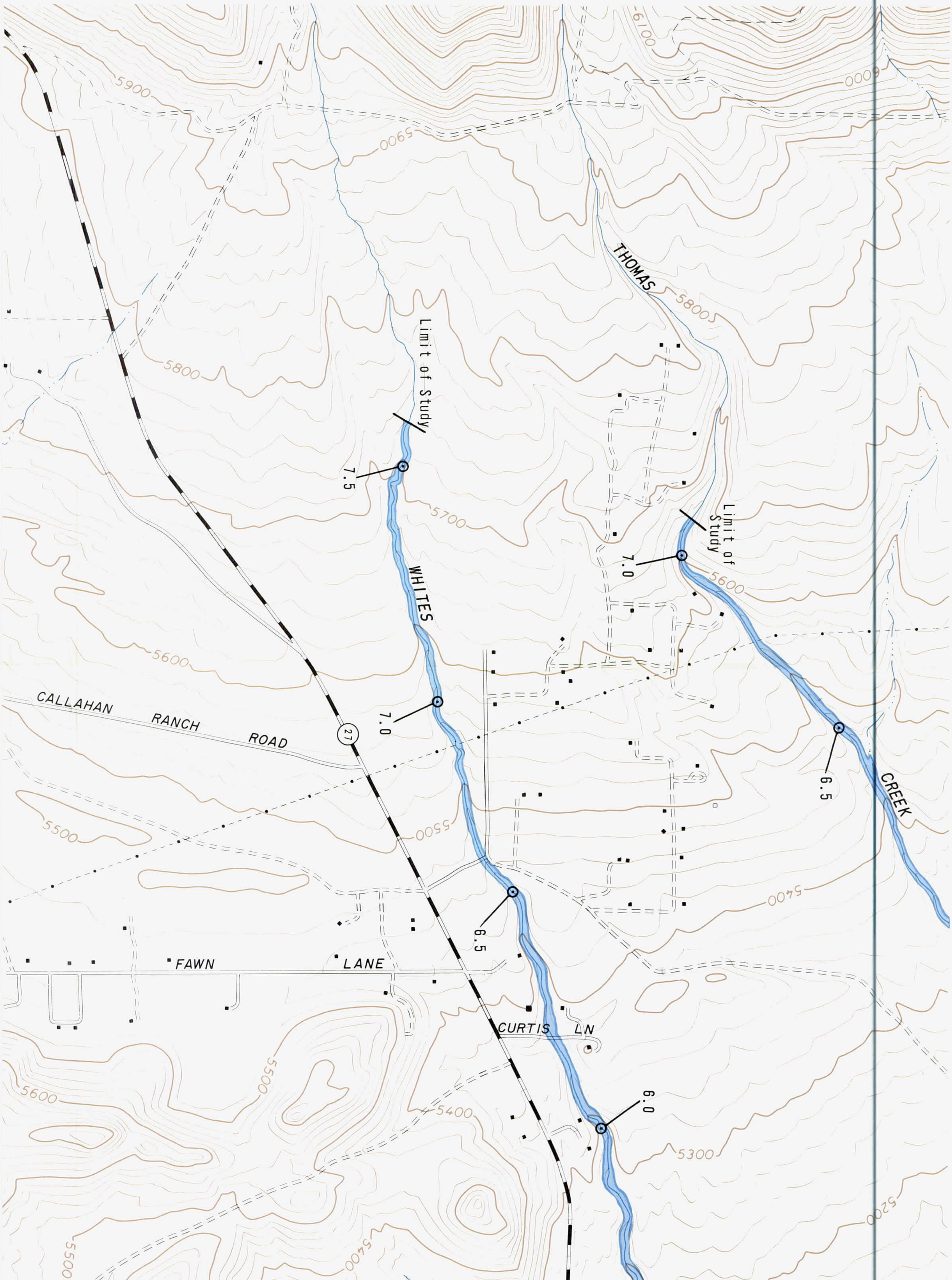
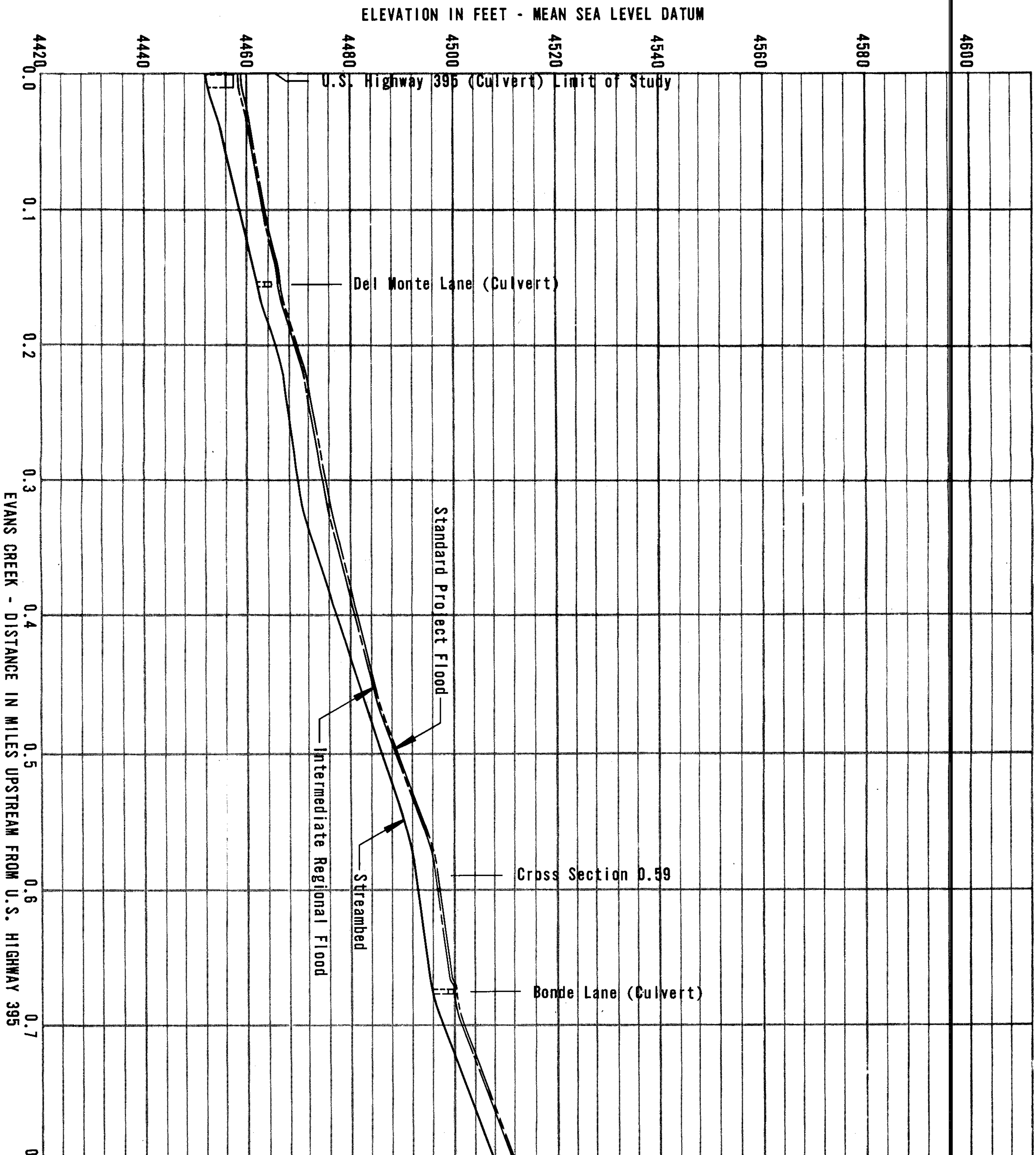
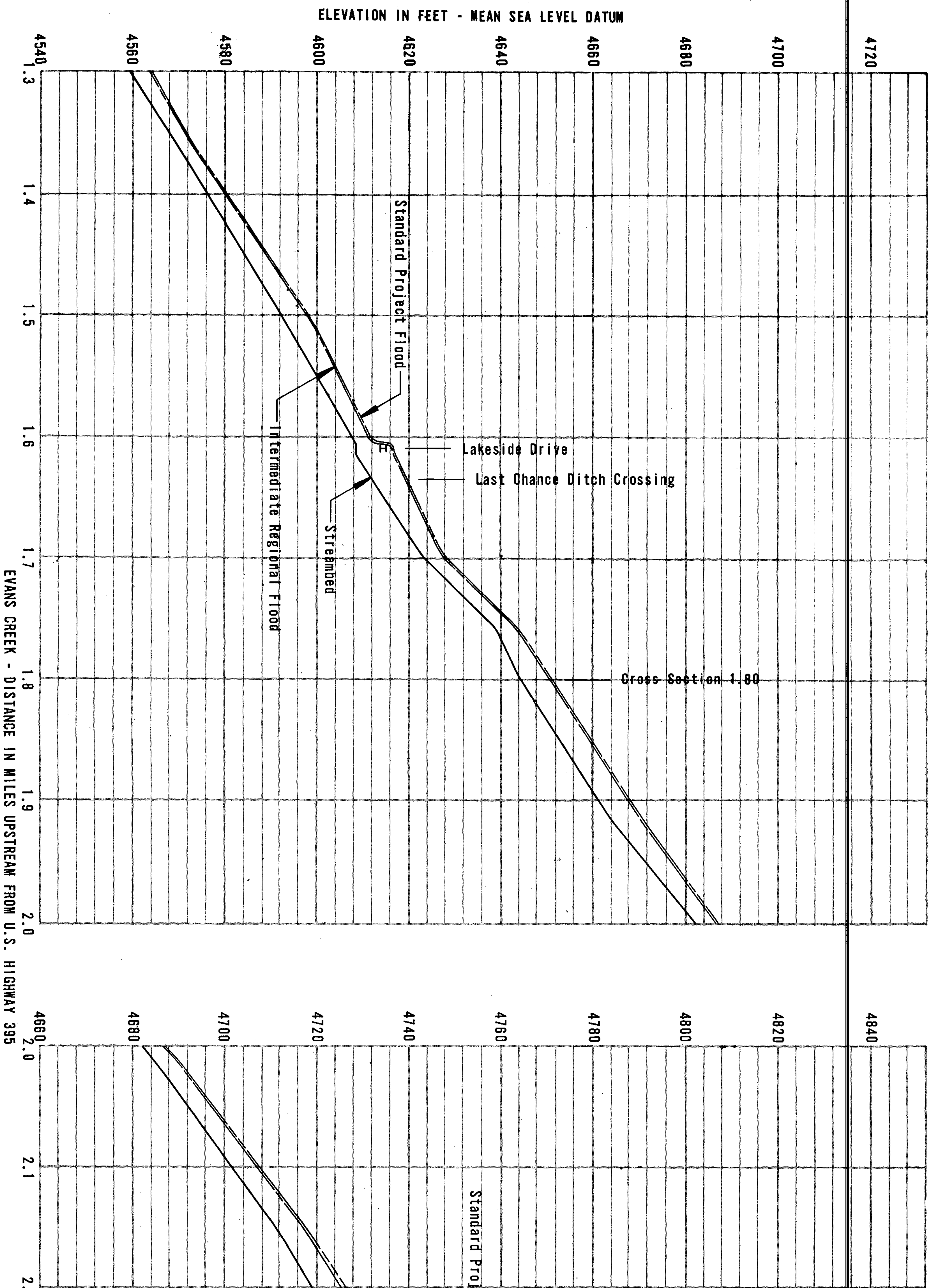


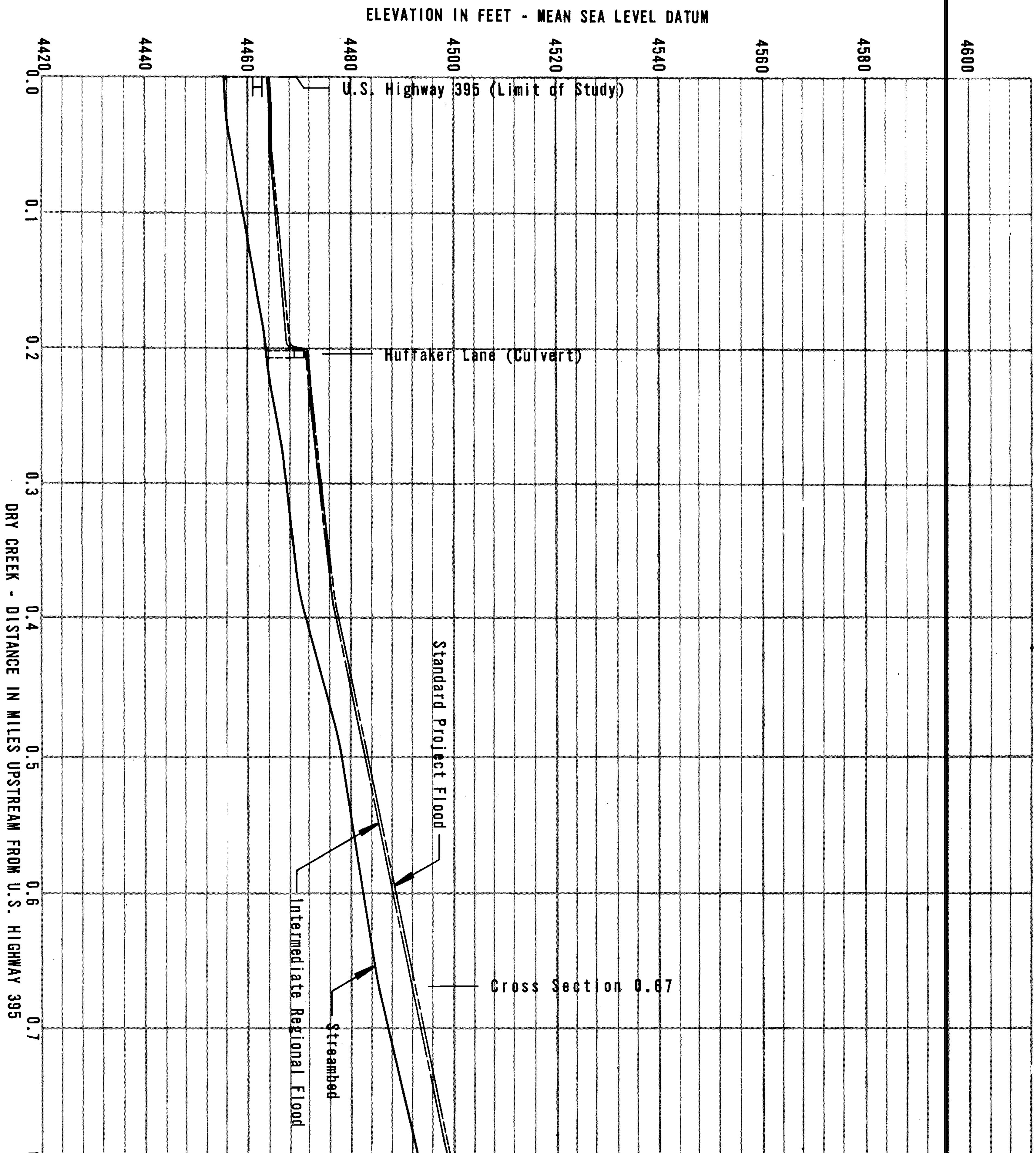
CALLAHAN RANCH ROAD
FAWN LANE
CURTIS LN
27
WHITES
THOMAS
CREEK
Limit of Study
Limit of Study
7.5
7.0
7.0
6.5
6.5
6.0
6100
6000
5900
5800
5700
5600
5500
5400
5300
5200

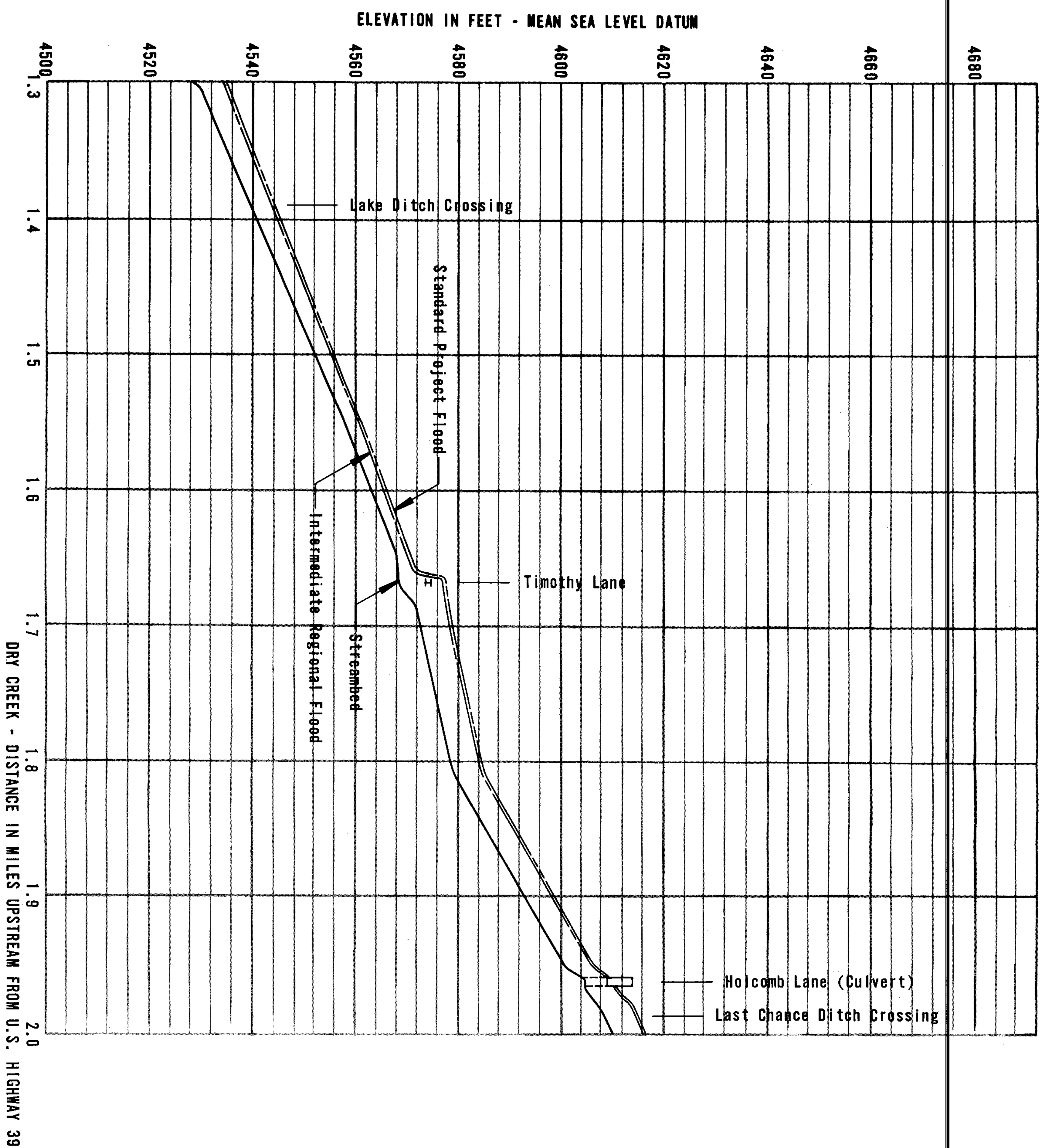
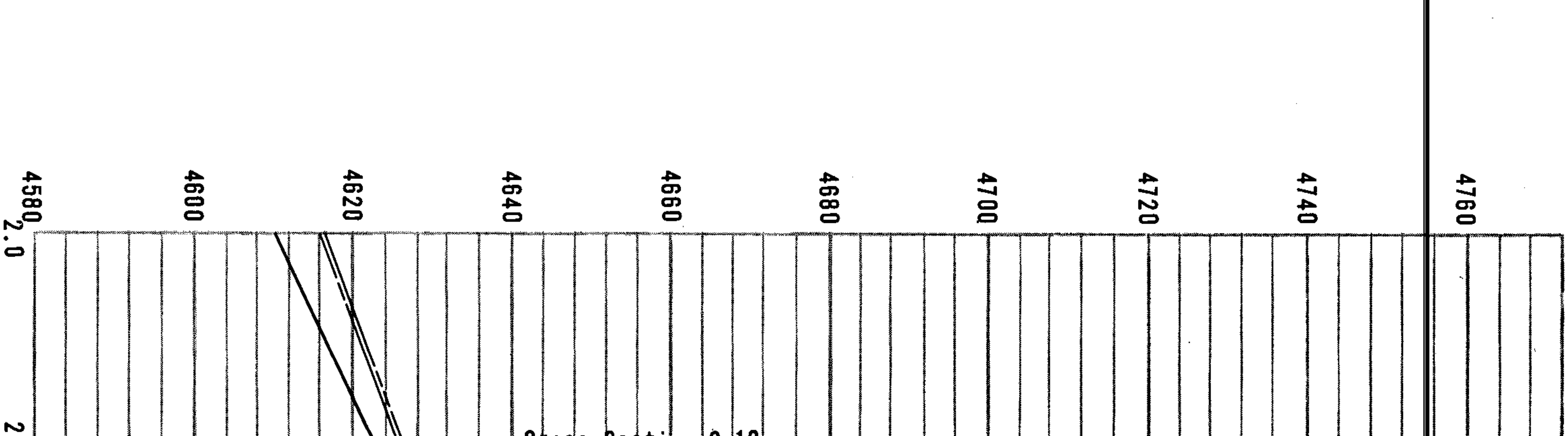


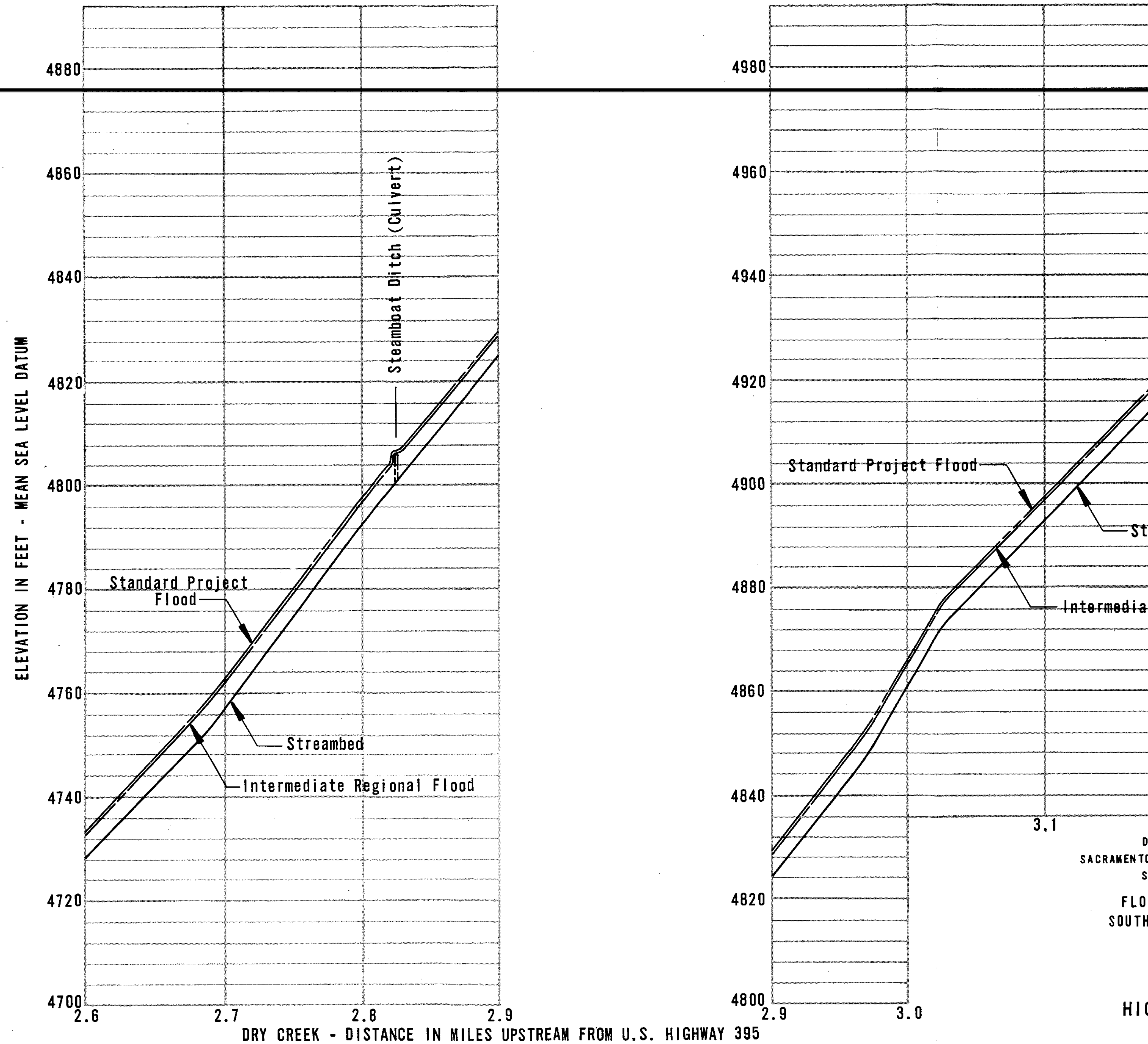
ELEVATION IN FEET - MEAN SEA LEVEL DATUM
4420
4440
4460
4480
4500
4520
4540
4560
4580
4600
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
U.S. Highway 395 (Culvert) Limit of Study
Del Monte Lane (Culvert)
Standard Project Flood
Intermediate Regional Flood
Streambed
Cross Section 0.59
Bonde Lane (Culvert)
EVANS CREEK - DISTANCE IN MILES UPSTREAM FROM U.S. HIGHWAY 395

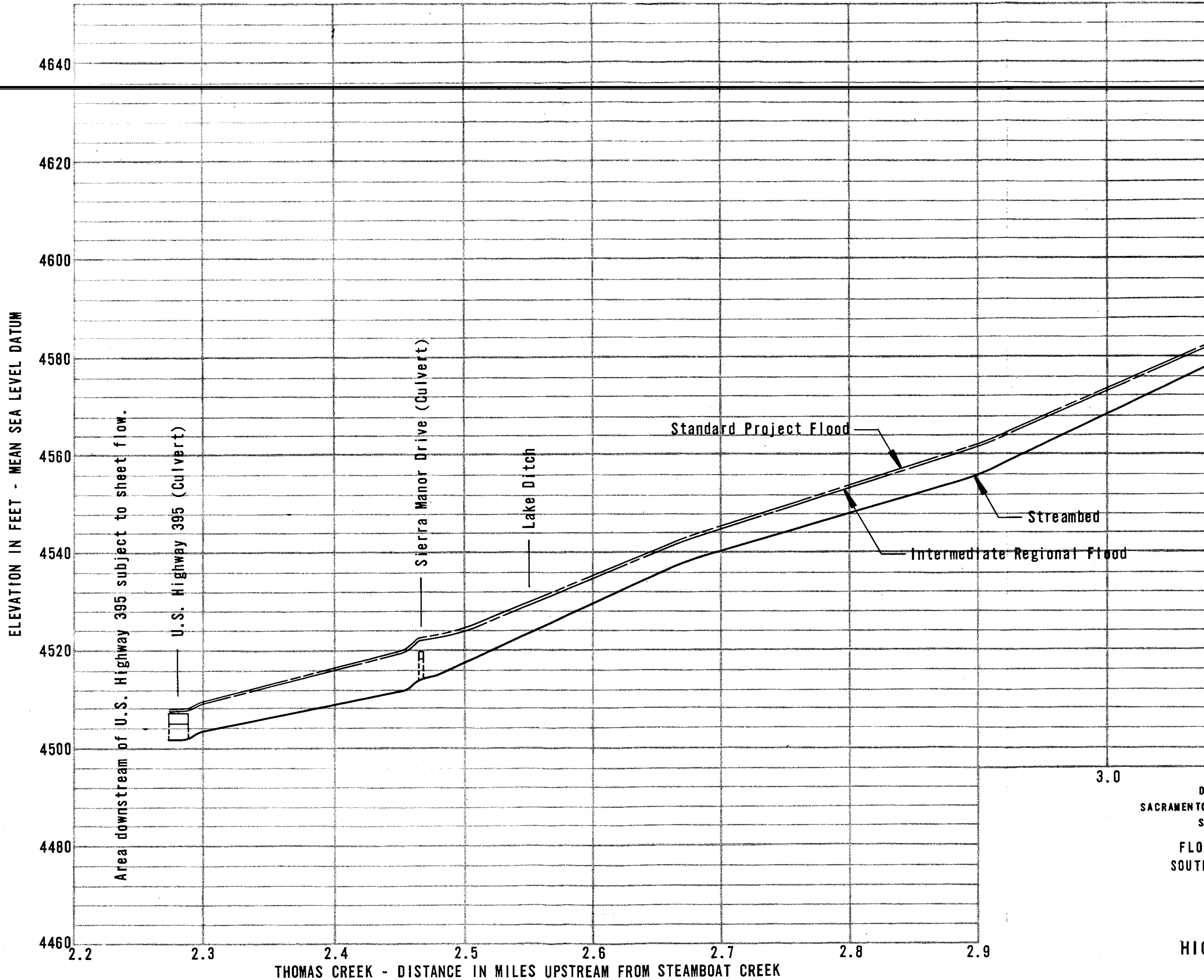


ELEVATION IN FEET - MEAN SEA LEVEL DATUM
4540
4560
4580
4600
4620
4640
4660
4680
4700
4720
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0
Standard Project Flood
Intermediate Regional Flood
Streambed
Lakeside Drive
Last Chance Ditch Crossing
Cross Section 1.80
EVANS CREEK - DISTANCE IN MILES UPSTREAM FROM U.S. HIGHWAY 395
4660
4680
4700
4720
4740
4760
4780
4800
4820
4840
2.0
2.1
Standard Pro

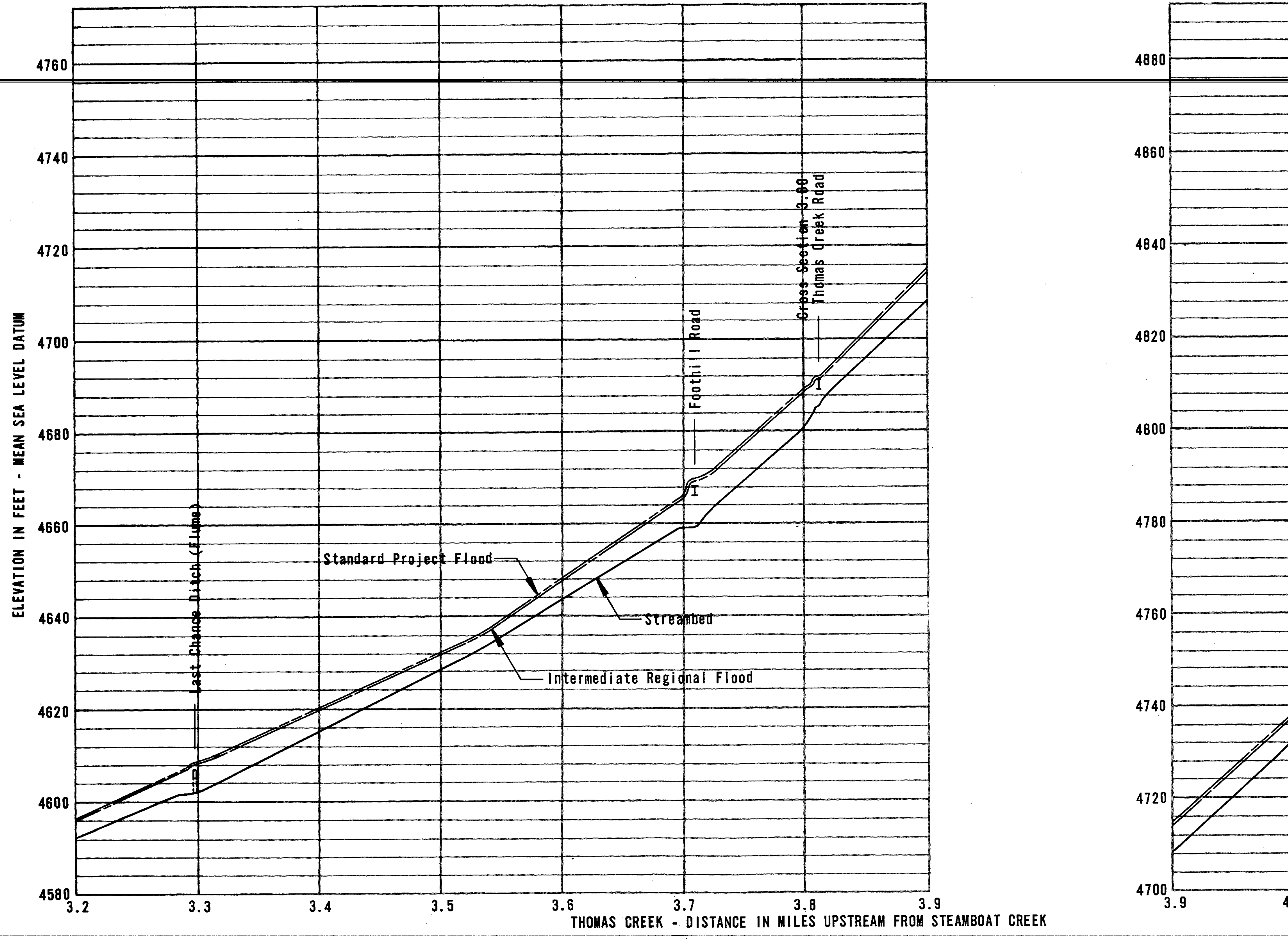

ELEVATION IN FEET - MEAN SEA LEVEL DATUM
4420
4440
4460
4480
4500
4520
4540
4560
4580
4600
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
U.S. Highway 395 (Limit of Study)
Huffaker Lane (Culvert)
Standard Project Flood
Intermediate Regional Flood
Streambed
Cross Section 0.67
DRY CREEK - DISTANCE IN MILES UPSTREAM FROM U.S. HIGHWAY 395


ELEVATION IN FEET - MEAN SEA LEVEL DATUM
4500
4520
4540
4560
4580
4600
4620
4640
4660
4680
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0
Lake Ditch Crossing
Standard Project Flood
Intermediate Regional Flood
Streambed
Timothy Lane
Holcomb Lane (Culvert)
Last Chance Ditch Crossing
DRY CREEK - DISTANCE IN MILES UPSTREAM FROM U.S. HIGHWAY 395

4580
4600
4620
4640
4660
4680
4700
4720
4740
4760
2.0

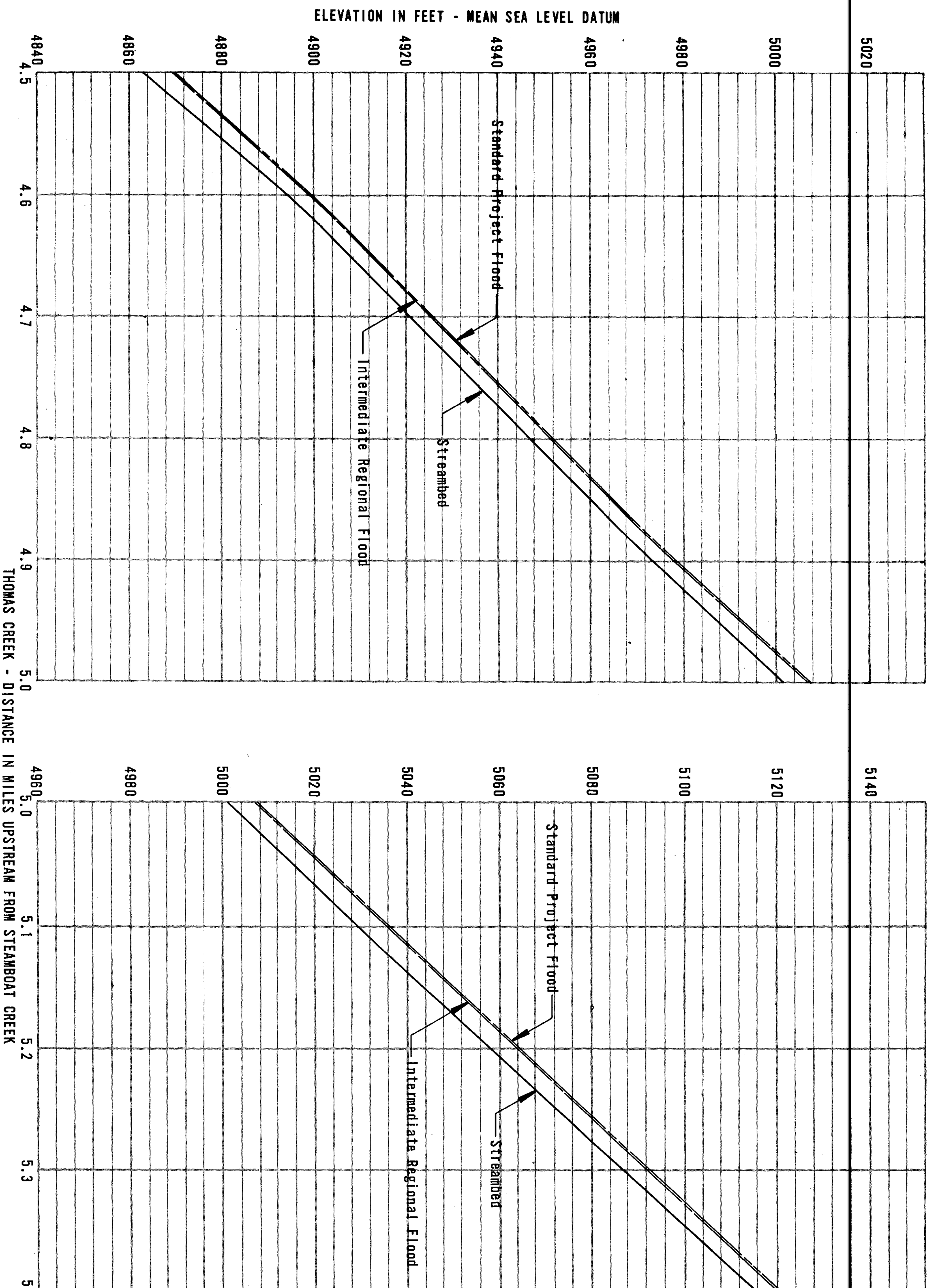

ELEVATION IN FEET - MEAN SEA LEVEL DATUM
4700
4720
4740
4760
4780
4800
4820
4840
4860
4880
2.6
2.7
2.8
2.9
Standard Project Flood
Streambed
Intermediate Regional Flood
Steamboat Ditch (Culvert)
4800
4820
4840
4860
4880
4900
4920
4940
4960
4980
2.9
3.0
3.1
Standard Project Flood
Intermedia
St
DRY CREEK - DISTANCE IN MILES UPSTREAM FROM U.S. HIGHWAY 395
D
SACRAMENTO
S
FLO
SOUTH
HIG

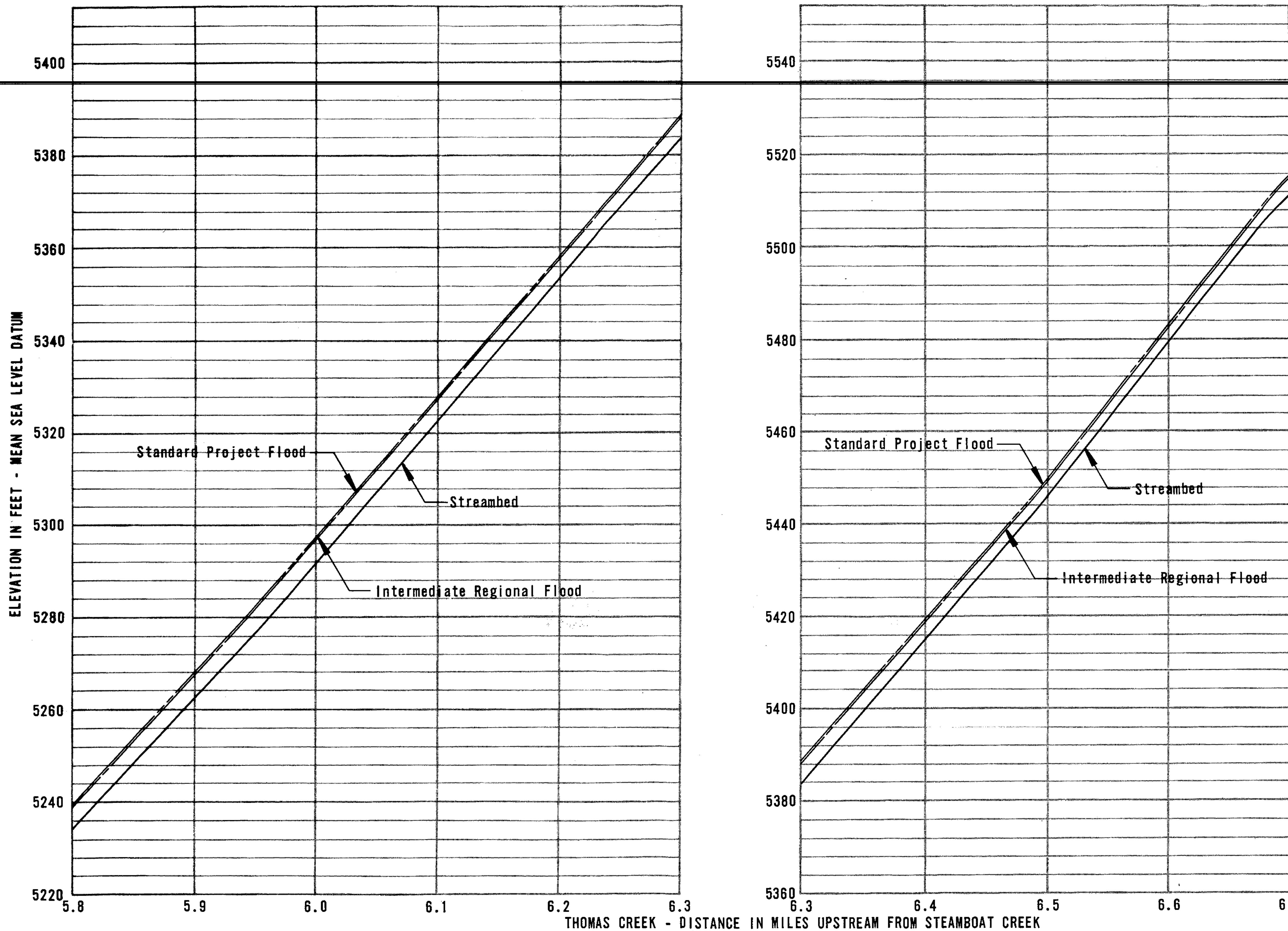


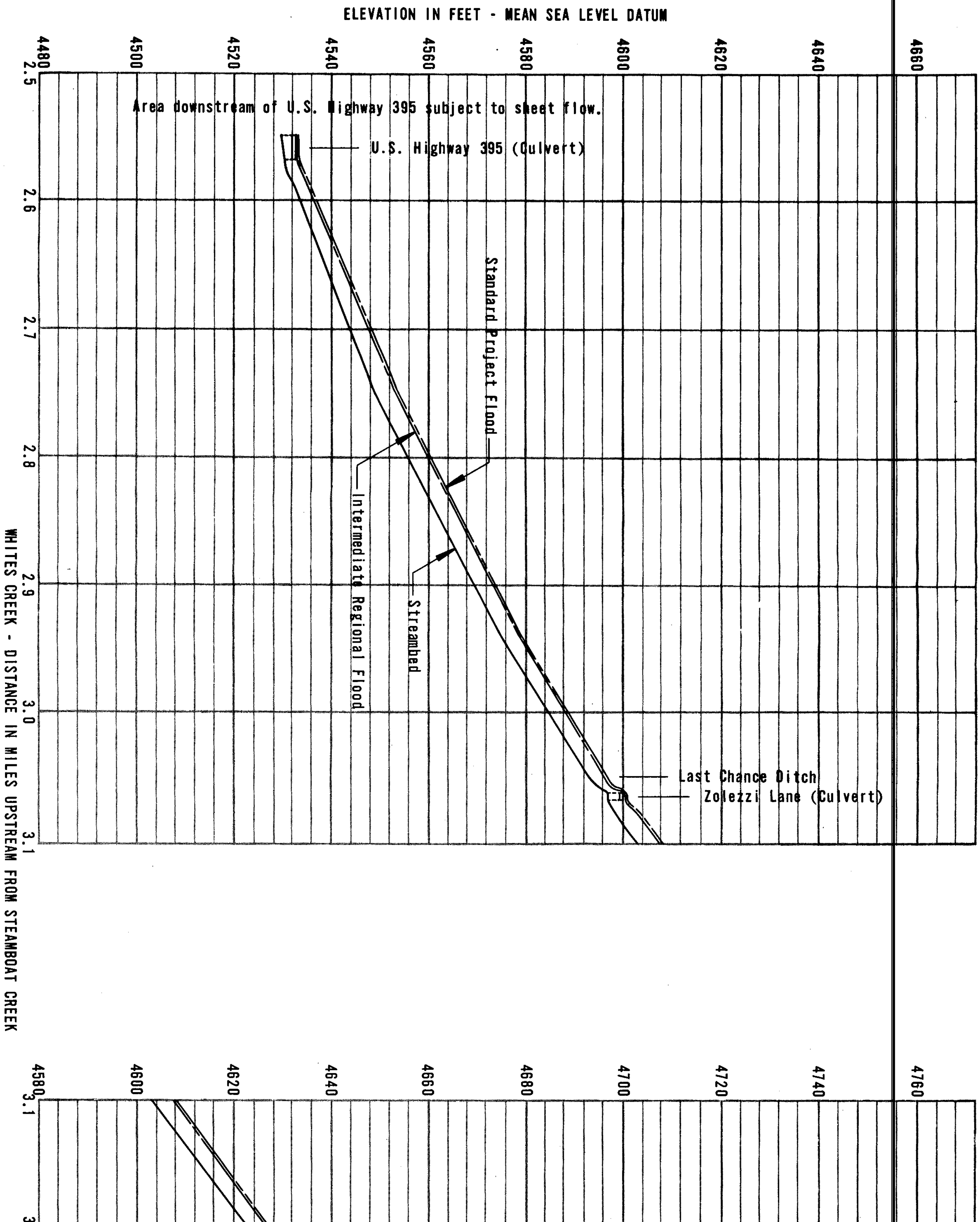
ELEVATION IN FEET - MEAN SEA LEVEL DATUM
4640
4620
4600
4580
4560
4540
4520
4500
4480
4460
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3.0
THOMAS CREEK - DISTANCE IN MILES UPSTREAM FROM STEAMBOAT CREEK
Area downstream of U.S. Highway 395 subject to sheet flow.
U.S. Highway 395 (Culvert)
Sierra Manor Drive (Culvert)
Lake Ditch
Standard Project Flood
Streambed
Intermediate Regional Flood



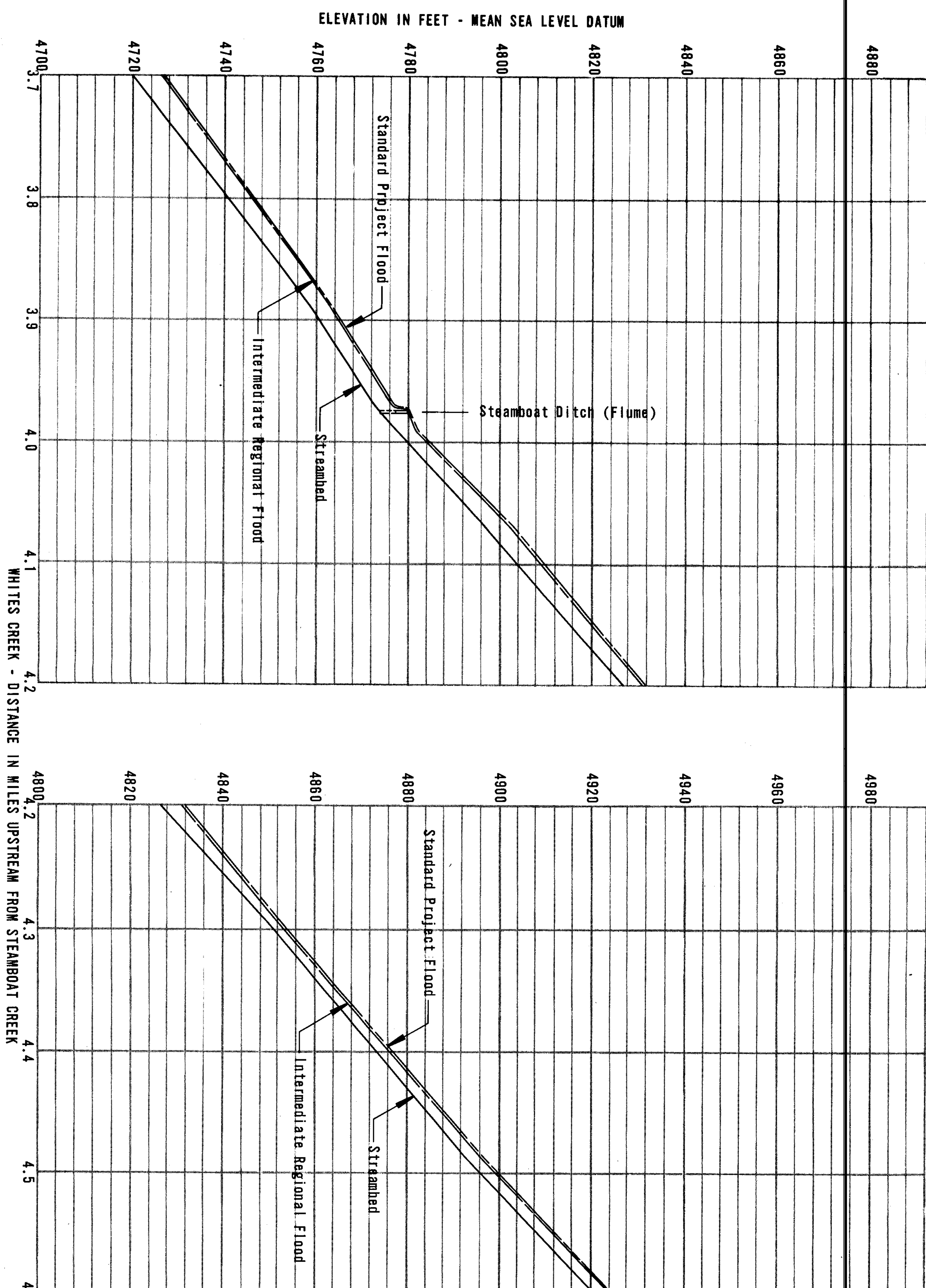
ELEVATION IN FEET - MEAN SEA LEVEL DATUM
4580
4600
4620
4640
4660
4680
4700
4720
4740
4760
4780
4800
4820
4840
4860
4880
3.2
3.3
3.4
3.5
3.6
3.7
3.8
3.9
THOMAS CREEK - DISTANCE IN MILES UPSTREAM FROM STEAMBOAT CREEK
Last Chance Ditch (Flume)
Standard Project Flood
Intermediate Regional Flood
Streambed
Foothill Road
Cross Section 3.80
Thomas Creek Road

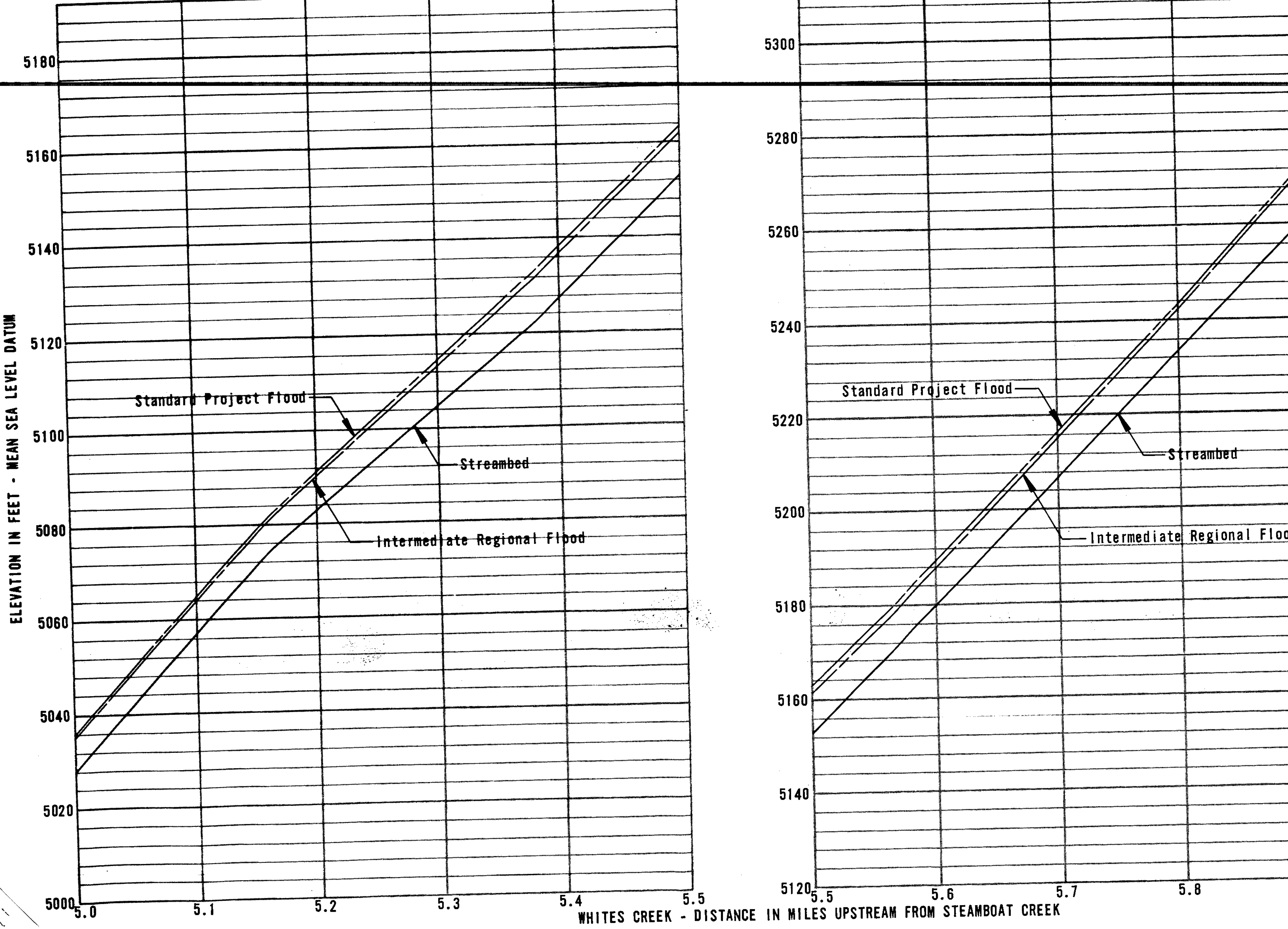

ELEVATION IN FEET - MEAN SEA LEVEL DATUM
4840
4860
4880
4900
4920
4940
4960
4980
5000
5020
4960
4980
5000
5020
5040
5060
5080
5100
5120
5140
4.5
4.6
4.7
4.8
4.9
5.0
5.1
5.2
5.3
Standard Project Flood
Intermediate Regional Flood
Streambed
THOMAS CREEK - DISTANCE IN MILES UPSTREAM FROM STEAMBOAT CREEK


ELEVATION IN FEET - MEAN SEA LEVEL DATUM
5220
5240
5260
5280
5300
5320
5340
5360
5380
5400
5.8
5.9
6.0
6.1
6.2
6.3
Standard Project Flood
Streambed
Intermediate Regional Flood
5360
5380
5400
5420
5440
5460
5480
5500
5520
5540
6.3
6.4
6.5
6.6
Standard Project Flood
Streambed
Intermediate Regional Flood
THOMAS CREEK - DISTANCE IN MILES UPSTREAM FROM STEAMBOAT CREEK

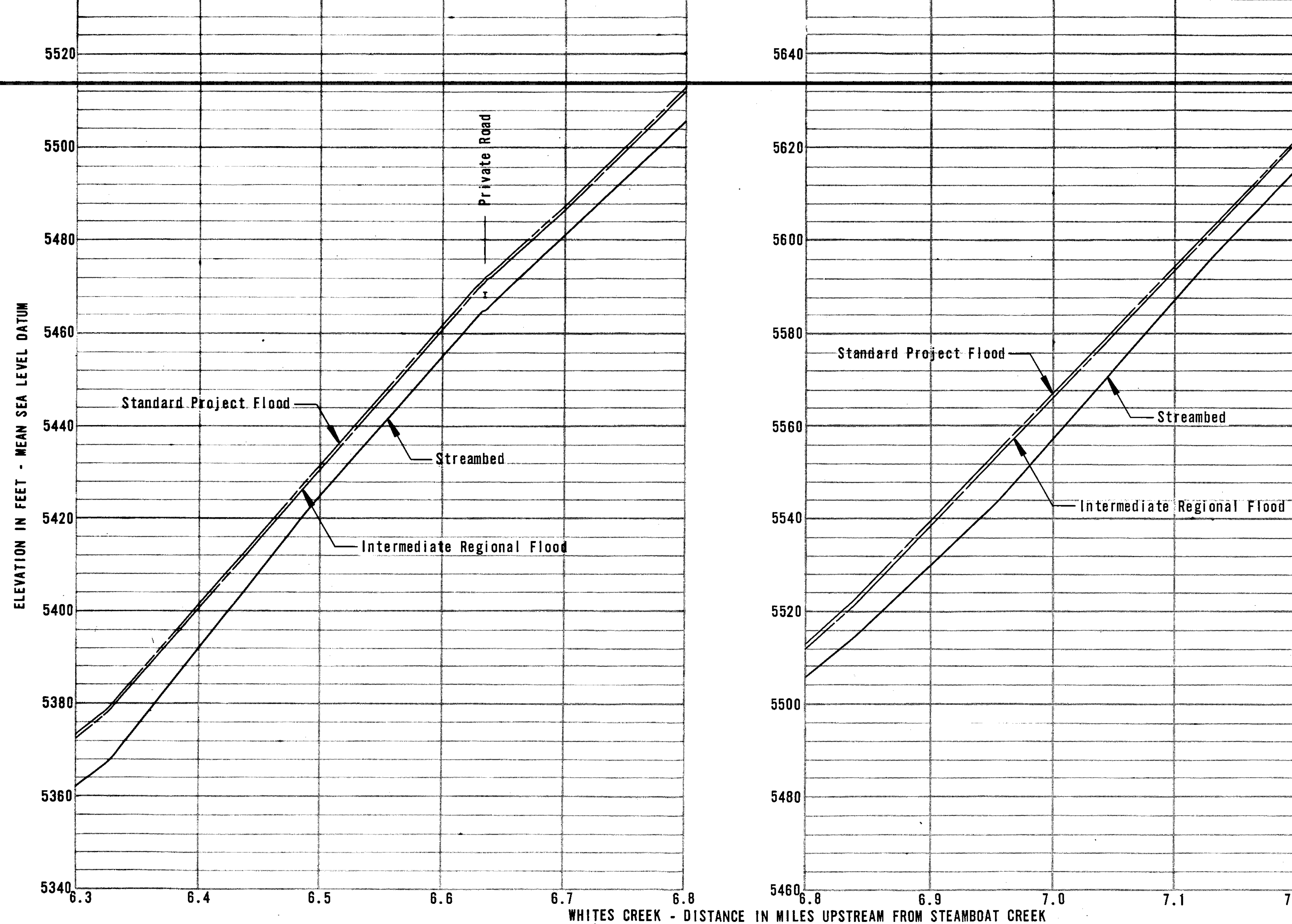


ELEVATION IN FEET - MEAN SEA LEVEL DATUM
4480
4500
4520
4540
4560
4580
4600
4620
4640
4660
2.5
2.6
2.7
2.8
2.9
3.0
3.1
Area downstream of U.S. Highway 395 subject to sheet flow.
U.S. Highway 395 (Culvert)
Standard Project Flood
Intermediate Regional Flood
Streambed
Last Chance Ditch
Zolezzi Lane (Culvert)
WHITES CREEK - DISTANCE IN MILES UPSTREAM FROM STEAMBOAT CREEK
4580
4600
4620
4640
4660
4680
4700
4720
4740
4760
3.1

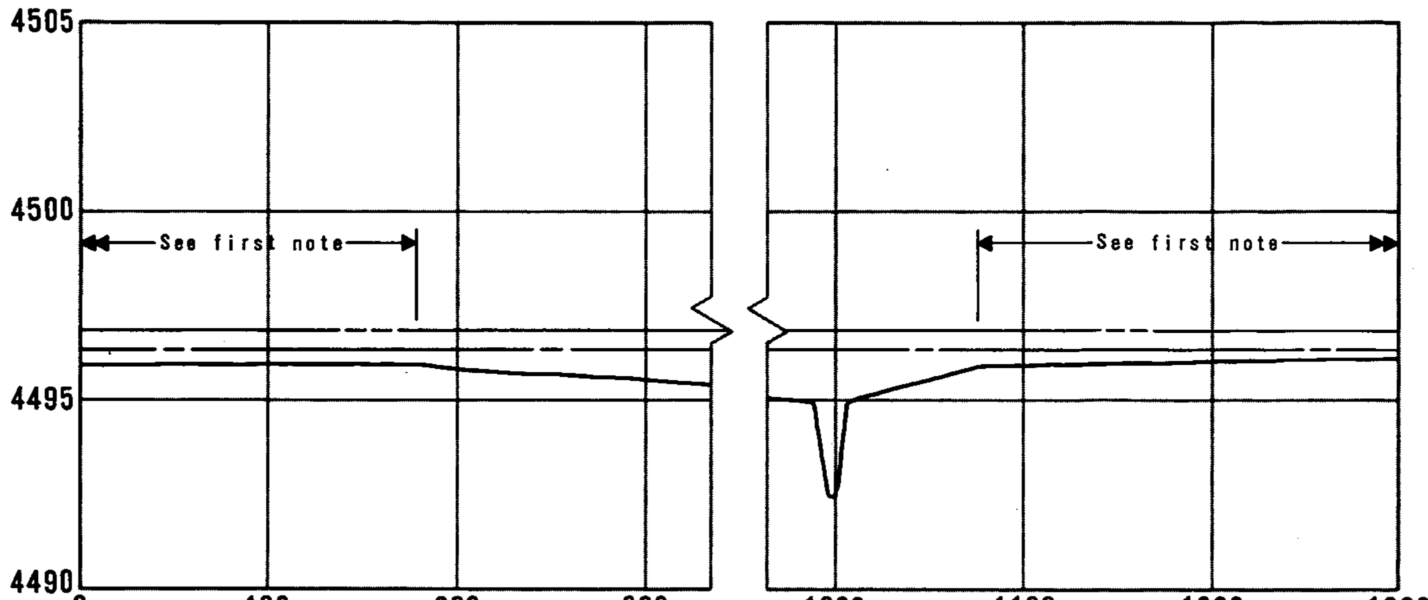

ELEVATION IN FEET - MEAN SEA LEVEL DATUM
4700
4720
4740
4760
4780
4800
4820
4840
4860
4880
4800
4820
4840
4860
4880
4900
4920
4940
4960
4980
3.7
3.8
3.9
4.0
4.1
4.2
4.2
4.3
4.4
4.5
Standard Project Flood
Intermediate Regional Flood
Streambed
Steamboat Ditch (Flume)
Standard Project Flood
Intermediate Regional Flood
Streambed
WHITES CREEK - DISTANCE IN MILES UPSTREAM FROM STEAMBOAT CREEK



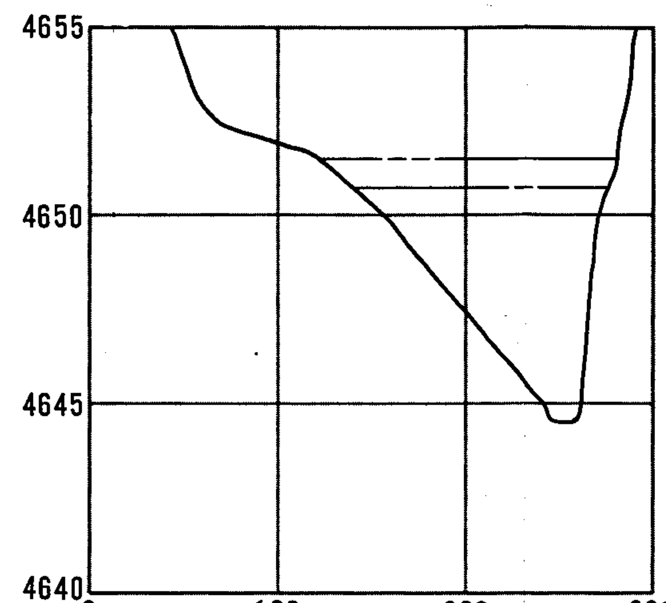
ELEVATION IN FEET - MEAN SEA LEVEL DATUM
5000
5020
5040
5060
5080
5100
5120
5140
5160
5180
5.0
5.1
5.2
5.3
5.4
5.5
Standard Project Flood
Streambed
Intermediate Regional Flood
5120
5140
5160
5180
5200
5220
5240
5260
5280
5300
5.5
5.6
5.7
5.8
Standard Project Flood
Streambed
WHITES CREEK - DISTANCE IN MILES UPSTREAM FROM STEAMBOAT CREEK


ELEVATION IN FEET - MEAN SEA LEVEL DATUM
5340
5360
5380
5400
5420
5440
5460
5480
5500
5520
6.3
6.4
6.5
6.6
6.7
6.8
Standard Project Flood
Streambed
Intermediate Regional Flood
Private Road
5460
5480
5500
5520
5540
5560
5580
5600
5620
5640
6.8
6.9
7.0
7.1
7
Standard Project Flood
Streambed
Intermediate Regional Flood
WHITES CREEK - DISTANCE IN MILES UPSTREAM FROM STEAMBOAT CREEK

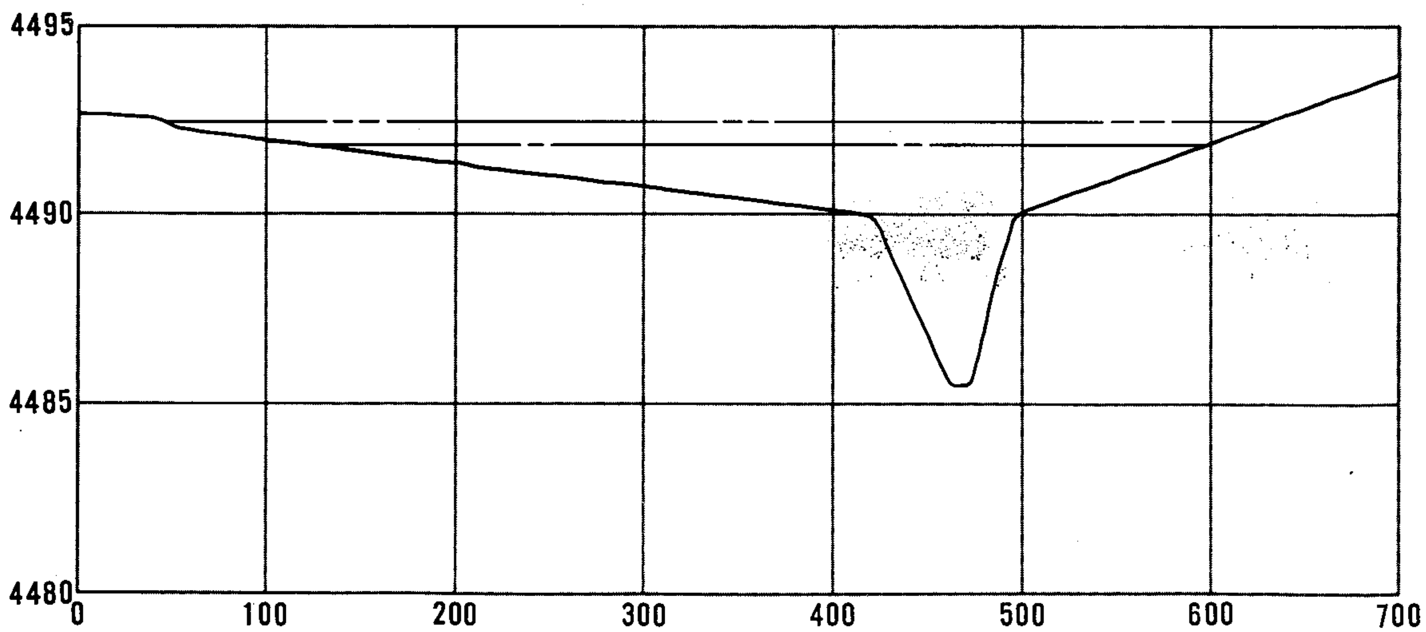
ELEVATION IN FEET - MEAN SEA LEVEL DATUM



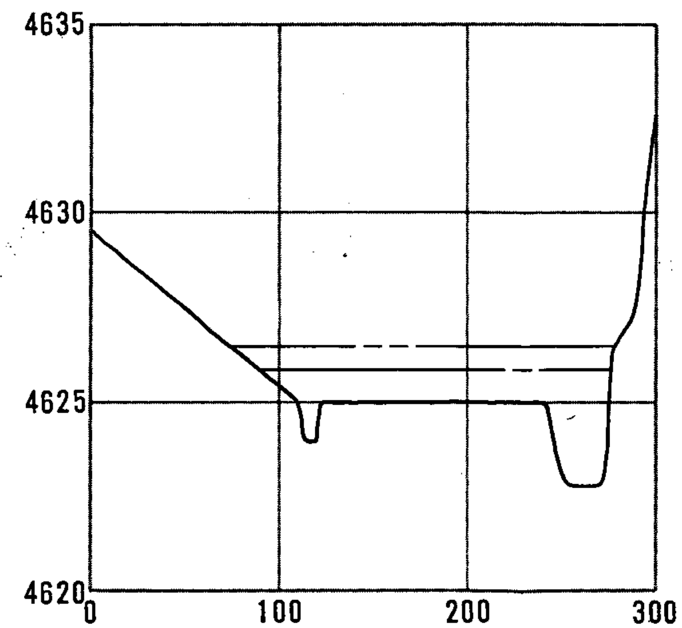
EVANS CREEK CROSS SECTION 0.59



EVANS CREEK CROSS SECTION 1.80



DRY CREEK CROSS SECTION 0.67



DRY CREEK CROSS SECTION 2.10

LEGEND

NOTES

Cross Sect
does not e
flooded ar
flow area

Cross Sect
of flow.

All horizo

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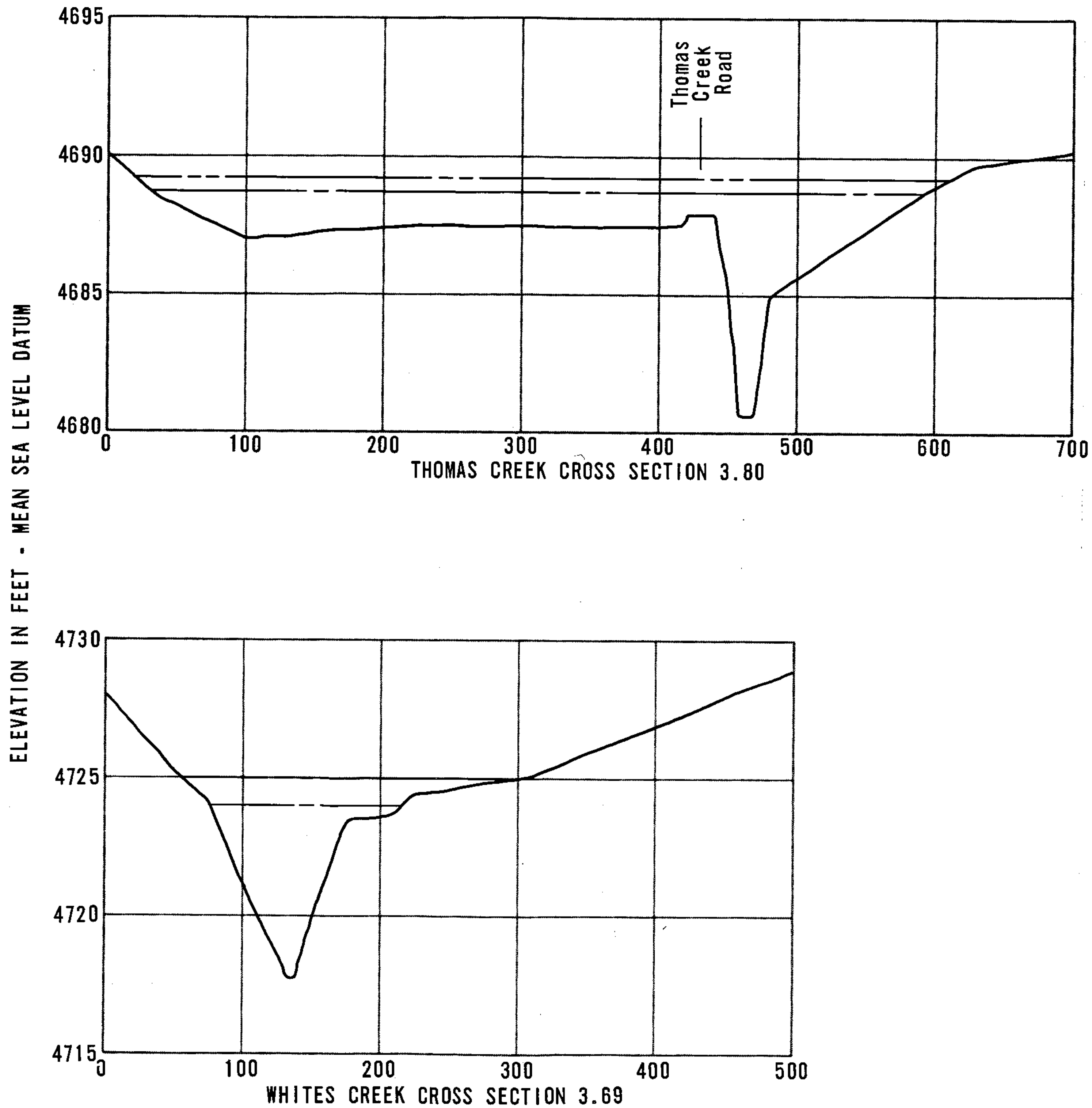
SOU



LEGEND

NOTES

Cross sectio
of flow.

All horizont

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SOUTHW

C
THOM